TRANSACTIONS

OF THE

ENTOMOLOGICAL SOCIETY

OF

LONDON.
THE

TRANSACTIONS

OF THE

ENTOMOLOGICAL SOCIETY

OF

LONDON

FOR THE YEAR

1906.

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# List of Fellows

## of the

**ENTOMOLOGICAL SOCIETY OF LONDON.**

Marked * have died during the year.

### HONORARY FELLOWS.

<table>
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<tr>
<th>Date of Election</th>
<th>Member</th>
<th>Location</th>
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<tr>
<td>1900</td>
<td>Aurivillius, Professor Christopher</td>
<td>Stockholm</td>
</tr>
<tr>
<td>1905</td>
<td>Bolivar, Don Ignacio, Pasco de Recoletos Bajo</td>
<td>20, Madrid</td>
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<tr>
<td>1901</td>
<td>Fabre, J. H., Sérignan, Vauchue, France</td>
<td></td>
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<tr>
<td>1894</td>
<td>Forel, Professor Auguste, M.D., Chigny, près Morges, Switzerland</td>
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<td>1906</td>
<td>Ganglbauer, Professor Ludwig von, Hof Museum, Vienna</td>
<td></td>
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<td>1898</td>
<td>Grassi, Professor Battista, The University, Rome</td>
<td></td>
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<td>1884</td>
<td>Osten Sacken, Baron C. R., Bunsenstrasse 8, Heidelberg</td>
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<tr>
<td>1906</td>
<td>Reuter, Professor Odo Morannal, The University, Helsingfors, Finland</td>
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<td>1895</td>
<td>Scudder, Samuel Hubbard, Cambridge, Mass., U.S.A.</td>
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<td>1885</td>
<td>Snellen, P. C. T., Rotterdam</td>
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<td>1893</td>
<td>Wattenwyl, Hofrath Dr. Carl Brunner Von, Lerchenfeldstrasse 28, Vienna</td>
<td></td>
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<tr>
<td>1898</td>
<td>Weismann, Dr. August, Freiburg, Baden</td>
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### FELLOWS.

Marked † have compounded for their Annual Subscriptions.

<table>
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<tr>
<th>Date of Election</th>
<th>Member</th>
<th>Location</th>
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<tr>
<td>1901 † Adair, Sir Frederick E. S., Bart., Flixton Hall, Bungay</td>
<td></td>
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<tr>
<td>1877</td>
<td>Adams, Frederick Charlstrom, F.Z.S., 50, Ashley-gardens, Victoria-street, S.W.</td>
<td></td>
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<tr>
<td>1877</td>
<td>Adams, Herbert J., Roseneath, London-road, Enfield, N.</td>
<td></td>
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<tr>
<td>1902</td>
<td>Adkin, Benaiah Whitley, Trenoweth, Hope-park, Bromley, Kent.</td>
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<tr>
<td>1885</td>
<td>Adkin, Robert, Wellfield, Lingards-road, Lewisham, S.E.</td>
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<tr>
<td>1904</td>
<td>Agar, E. A., La Haut, Dominica, B. W. Indies</td>
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<tr>
<td>1904</td>
<td>Alderson, Miss E. Maude, Park House, Worksp, Notts.</td>
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<tr>
<td>1899</td>
<td>Andrews, Henry W., Shirley, Welling, S.O., Kent.</td>
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<tr>
<td>1901</td>
<td>ANNING, William, 39, Lime Street, E.C.</td>
<td></td>
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<tr>
<td>1899 † Arrow, Gilbert J., 87, Union-grove, Clapham, S.W.; and British Museum (Natural History), Cromwell-road, S.W.</td>
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</table>
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1892 Carpenter, The Honble. Mrs. Beatrice, 22, Grosvenor-road, S.W.
1895 Carpenter, G. H., 45, Porii-sireef, S.W.
1880 Capper, Samuel James (President of the Lancashire and Cheshire Entomological Society), Hayton Park, Liverpool.
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1880 Capper, Samuel James (President of the Lancashire and Cheshire Entomological Society), Hayton Park, Liverpool.
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1901 † Gardner, Willoughby, F.L.S., Degannwy, N. Wales.
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1904 Gilliat, Francis, B.A., Forest Dene, Worth, Sussex.
1865 † Godman, Frederick Du Cane, D.C.L., F.R.S., F.L.S., F.Z.S., South Lodge, Lower Beeding, Horsham; 7, Carlos-place, Grosvenor-square; and 45, Pont-street, S.W.
1890 Goldthwait, Oliver C., 5, Queen's-road, South Norwood, S.E.
1886 † Goodrich, Captain Arthur Mainwaring, Lemoz Lodge, Malvern Link, Malvern.
1904 Goodwin, Edward, Canon Court, Wateringbury, Kent.
1898 Gordon, R. S. G. McH., Corsemalzie, Whauphill, R.S.O., Wigtownshire.
1874 Goss, Herbert, F.L.S., Vice-President, The Avenue, Surbiton-hill, Surrey.
1891 † Green, E. Ernest, Government Entomologist, Royal Botanic Gardens, Peradeniya, Ceylon.
1894 Green, J. F., F.Z.S., West Lodge, Blackheath, S.E.
1898 Greenshields, Alexander, 38, Blenheim-gardens, Willesden, N.W.
1899 Greenwood, Edgar, 49, Melrose-avenue, Cricklewood, N.W.
1893 † Greenwood, Henry Powys, F.L.S., Whitsbury House, Salisbury.
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1897 † Harrison, Albert, F.L.S., F.C.S., Delamere, Grove-road, South Woodford, Essex.
1881 Henry, George, Ivy Bank, 112, London-road, St. Leonards-on-Sea.
1903 Herrod, William, W.B.C. Apiary, Old Bedford-road, Luton, Beds.
1898 Heron, Francis A., B.A., British Museum (Natural History), Cromwell-road, S.W.
1876 † Hillman, Thomas Stanton, Eastgate-street, Lewes.
1902 Hole, R. S., The Rectory, North Taunton, Devon.
1898 Holman-Hunt, C. B., Talawakelle, Ceylon.
1897 Horne, Arthur, 60, Gladstone-place, Aberdeen.
1876 Horniman, F. J., F.L.S., F.Z.S., etc., Forest Hill, S.E.
1903 Houghton, J. T., 1, Portland-place, Workop.
1900 Howe, George H., Box 180, Dunedin, New Zealand.
1865 † Hudd, A. E., 108, Pembroke-road, Clifton, Bristol.
1897 Image, Selwyn, M.A., 20, Fitzroy-street, Fitzroy-square, W.
1891 Isabell, The Rev. John, Sunnycraft, St. Semen, R.S.O., Cornwall.
1886 Jacoby, Martin, 1, The Mansions, Hillfield-road, West Hampstead, N.W.
1869 Janson, Oliver E., Cestria, Claremont-road, Highgate, N.; and 44, Great Russell-street, Bloomsbury, W.C.
1898 Janson, Oliver J., Cestria, Claremont-road, Highgate, N.
1886 Jenner, James Herbert Augustus, 209, School Hill, Lewes.
1899 Jennings, F. B., 152, Silver-street, Upper Edmonton, N.
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<td>1886</td>
<td>John, Evan</td>
<td>Llantrisant, R.S.O., Glamorganshire</td>
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<td>Johnson, The Rev. W. F.</td>
<td>Acton Rectory, Poyntz Pass, Co. Armagh</td>
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<td>Jones, Albert H.</td>
<td>Treasurer, Shrublands, Eltham, Kent</td>
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<td>Jordan, Dr. K.</td>
<td>The Museum, Tring</td>
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<td>Joy, Norman H.</td>
<td>M.R.C.S., L.R.C.P., Bradfield, Reading</td>
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<td>Kane, W. F. de Vismes</td>
<td>Drumleaske House, Monaghan</td>
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<td>Kappel, A. W.</td>
<td>Linnean Society, Burlington House, S.W.</td>
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<td>Kay, John Dunning</td>
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<td>Kaye, William James</td>
<td>Caracas, Ditton Hill, Surbiton</td>
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<td>Kemp, Stanley W.</td>
<td>Upper Fitzwilliam-street, Dublin</td>
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<td>1890</td>
<td>Kenrick, G. H.</td>
<td>Whetstone, Somerset-road, Edgbaston, Birmingham</td>
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<td>Kershaw, G. Bertram</td>
<td>Ingleside, West Wickham, Kent</td>
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<td>1898</td>
<td>Kershaw, J. A.</td>
<td>Morton Banks, Lewisham-road, Windsor, Melbourne, Victoria</td>
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<td>1901</td>
<td>Kershaw, John C. W.</td>
<td>Macao, China</td>
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<td>1906</td>
<td>Keynes, John Neville</td>
<td>Harvey-road, Cambridge</td>
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<td>1900</td>
<td>Keys, James H.</td>
<td>Morwell, Freedom-villas, Lipson-road, Plymouth</td>
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<td>1889</td>
<td>King, J. J. F. X.</td>
<td>Lecturer on Economic Entomology at the West of Scotland Agricultural College, 1 Athole Gardens-terrace, Kelvinside, Glasgow</td>
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<td>1861</td>
<td>Kirby, William F.</td>
<td>Hidden, 18, Sutton Court-road, Chiswick, W.</td>
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<td>1893</td>
<td>Kirkaldy, George Willis</td>
<td>Honolulu, Hawaii</td>
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<td>1905</td>
<td>Kitchen, Vernon Party</td>
<td>The Priory, Watford</td>
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<td>Klapálek, Professor Franz</td>
<td>Karlín 263, Prague, Bohemia</td>
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<td>Klein, Sydney T.</td>
<td>Hatherlow, Raglan-road, Reigate</td>
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<td>Kraatz, Dr. G.</td>
<td>Link-strasse, Berlin</td>
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<td>Lane, E. W.</td>
<td>Parkholme, 40, Fletching-road, Clapton, N.E.</td>
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<td>1868</td>
<td>Lang, Colonel A. M.</td>
<td>Box Grove Lodge, Guildford</td>
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<td>1900</td>
<td>Lang, The Rev. H. C.</td>
<td>All Saints' Vicarage, Southend-on-Sea</td>
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<td>Lathy, Percy I.</td>
<td>Penton House, Cheshunt</td>
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<td>1895</td>
<td>Latter, Oswald H.</td>
<td>Charterhouse, Godalming</td>
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<td>Lea, Arthur M.</td>
<td>Government Entomologist, Hobart, Tasmania</td>
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<td>Leigh, George F.</td>
<td>Cuthbert's Buildings, West-street, Durban, Natal</td>
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<td>1883</td>
<td>Lemann, Fredk. Charles</td>
<td>Blackfriars House, Plymouth</td>
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<td>1898</td>
<td>Lethbridge, Ambrose G.</td>
<td>Nordrach-on-Dee, Banchory, N.B.; Guards Club, Pall Mall, S.W.</td>
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<td>1898</td>
<td>Lewis, E. J., F.L.S.</td>
<td>Victoria Cottage, Little Common, Bexhill-on-Sea</td>
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<td>1876</td>
<td>Lewis, George, F.L.S.</td>
<td>Frant-road, Tanbridge Wells</td>
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<td>Lewis, J. H.</td>
<td>Ophir, Otago, New Zealand</td>
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<td>Lightfoot, R. M.</td>
<td>Bree-st, Cape Town, Cape of Good Hope</td>
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1903 Littler, Frank M., Althorne, High-street, Launceston, Tasmania.
1881 † Lloyd, Alfred, F.C.S., The Dome, Bognor.
1885 † Lloyd, Robert Wylie, 1, 5 and 6, The Albany, Piccadilly, W.
1903 Lofthouse, Thomas Ashton, The Croft, Linthorpe, Middlesbrough.
1904 Longstaff, George Blundell, M.D., Highlands, Putney Heath, S.W.
1899 Lounsbury, Charles P., B.Sc., Government Entomologist, Cape Town, S. Africa.
1893 Lower, Oswald B., St. Oswalds, Bartley Crescent, Wayville, South Australia.
1901 Lower, Rupert S., Davonport-terrace, Wayville, South Australia.
1898 Lucas, William John, B.A., 28, Knight's Park, Kingston-on-Thames.
1904 Luff, W. A., La Chaumière, Brock-road, Guernsey.
1903 Lyell, G., June, Gisborne, Victoria, Australia.
1901 Lyman, Henry H., M.A., F.R.G.S., 74, McTavish-street, Montreal, Canada.
1906 McCarrison, D. L., Indian Police Forces, Madras Club, Madras.
1887 M'Doougall, James Thomas, Dunolly, Morden-road, Blackheath, S.E.
1888 Mackinnon, P. W., Lyndale, Mussoorie, N.W.P., India.
1898 Maddison, T., South Bailey, Durham.
1899 † Main, Hugh, B.Sc., Almondale, Buckingham-road, South Woodford, N.E.
1905 Mally, Charles Wm., M.Sc., Nacogdoches, Texas, U.S.A.
1887 Manders, Lieut.-Colonel Neville, R.A.M.C., Curepipe, Mauritius.
1892 Mansbridge, William, 27, Ebenezer-road, Sefton-park, Liverpool.
1894 † Marshall, Alick, Auchinraith, Bexley, S.O., Kent.
1895 Marshall, Guy Anstruther Knox, 6, Chester-place, Hyde Park-terrace, W.
1897 Martineau, Alfred H., Solihull, Birmingham.
1895 Massey, Herbert, Ivy-Lea, Burnage, Withington, Manchester.
1887 Matthews, Coryndon, Stentaway, Plymstock, Plymouth.
1900 Maxwell-Lefroy, H., Entomologist to the Government of India, Agricultural Institute, Pusa, Bengal.
1899 May, Harry Haden, 12, Windsor Terrace, Plymouth.
1904 Meade-Waldo, Geoffrey, Stonewall Park, Edenbridge, Kent.
1872 † Meldola, Professor Raphael, F.R.S., F.C.S., 6, Brunswick-square, W.C.
1885 Melville, James Cosmo, M.A., F.L.S., Steele Brace Hall, Shrewsbury.
1887 Merrifield, Frederic, President, 14, Clifton-terrace, Brighton.
1906 Merriman, Gordon, 96, Finchley-road, Hampstead, N.W.
1905 Merry, Rev. W. Mansell, M.A., St. Michael's, Oxford.
1888 Meyer-Darcis, G., c/o Sogin ami Meyer, Wohlen, Switzerland.
1887 Mell, Professor Louis Compton, F.R.S., 1, Richmond Mount, Headingley, Leeds.
1906 Mitchell-Hedges, Frederic Albert, 42, Kensington Park Gardens, W.
1905 Mofford, Robert Sidney, C.B., 35, Redcliffe Square, S.W.
1879 Monteiro, Dr. Antonio Augusto de Carvalho, 70, Rua do Alecrinar, Lisbon.
1902 Montgomery, Arthur Meadows, 34, Shalimar Gardens, Penbridge-road, North Acton, N.
1853 Moore, Frederic, D.Sc., A.L.S., F.Z.S., 17, Maple-road, Penge, S.E.
1899 Moore, Harry, 12, Lower-road, Rotherhithe.
1886 Morgan, A. C. F., F.L.S., 135, Oakwood-court, Kensington, W.
1895 † Morley, Claude, The Hill House, Monk's Soham, Suffolk.
1900 Moser, Julius, 60, Bulow-strasse, Berlin.
1901 † Muir, Frederick, H.S.P.A. Experiment Station, Honolulu, Oahu, H.T.
1869 † Müller, Albert, F.R.G.S., c/o Herr A. Müller-Mechel, Grenzacherstrasse, 60, Basle, Switzerland.
1904 Mumford, Frank S., 10, Mountfield Gardens, Tunbridge Wells.
1872 † Murray, Lieut.-Col. H., 43, Cromwell Houses, Cromwell-road, S.W.
1896 Nesham, Robert, Utrecht House, Queen's-road, Clapham Park, S.W.
1889 Nevinson, Basil George, M.A., F.Z.S., 3, Tedworth-square, Chelsea, S.W.
1901 Nevinson, E. G. B., Morland, Cobham, Surrey.
1890 Newstead, R., Johnston Tropical Laboratory, University, Liverpool.
1900 Nicholl, Mrs. M. De la B., Merthyr Mawr, Bridgend, Glamorganshire.
1904 Nicholson, W. A., 36, Promenade, Portobello, N.B.
1886 Nicholson, William E., School Hill, Lewes.
1906 Nix, John Ashburner, Tilgate, Crawley, Sussex.
1893 Nonfried, A. F., Rakonitz, Bohemia.
1878 Nottidge, Thomas, Ashford, Kent.
1895 Nurse, Lt.-Colonel C. G., 33rd Punjabis, Jubbulpore, Central Provinces, India.
1869 Oberthür, Charles, Rennes (Ille-et-Vilaine), France.
1877 Oberthür, René, Rennes (Ille-et-Vilaine), France.
1893 Ogé, Bertram S., Steeple Aston, Oxfordshire.
1895 Oliver, John Baxter, 22, Ranelagh Villas, Hove, Brighton.
1873 Olivier, Ernest, Ramillons, près Moulins (Allier), France.
1895 Page, Herbert E., Bertrose, Gellatly-road, St. Catherine's Park, S.E.
1901 Pickett, C. P., 39, Dawlish-road, Leyton, Essex.
1891 Pierce, Frank Nelson, 1, The Elms, Dingle, Liverpool.
1901 Piffard, Albert, Felden, Boxmoor, Hemel Hempstead.
1903 Pilcher, Colonel Jesse George, I.M.S., F.R.C.S., 133, Gloucester-road, Kensington, S.W.
1885 Poll, J. R. H. Neerwort van de, Driebergen, Netherlands.
1905 Powell, Harold, 7, Rue Mireille, Hyères (Var), France.
1878 Price, David, 48, West-street, Horsham.
1904 Priske, Richard A. R., 9, Melbourne Avenue, West Ealing.
1893 Prout, Louis Beethoven, 246, Richmond-road, Dalston, N.E.
1900 Rainbow, William J., The Australian Museum, Sydney, N.S.W.
1874 Reed, E. C., Director del Museo de Concepcion, Concepcion, Chile.
1893 Reid, Captain Savile G., late R.E., The Elms, Yalding, Maidstone.
1898 Relton, R. H., c/o Perkins and Co., Ltd., Brisbane, Queensland.
1898 Reuter, Professor Enzio, Helsingfors, Finland.
1901 Skertchly, Ethelbert Forbes, c/o 'Penang Gazette,' Penang, Straits Settlements.
1906 Smallman, Raleigh S., Wressil Lodge, Wimbledon Common, S.W.
1901 Smith, Arthur, County Museum, Lincoln.
1902 Smith, W. G., Mount Side, Bushey Park, Bristol.
1895 Smith, W. W., 96, Drakefield-road, Upper Tooting, S.W.
1889 Standen, Richard, 92, Gap, Lancaster County, Penn., U.S.A.
1893 Taylor, Charles B., Gap, Lancaster County, Penn., U.S.A.
1901 Thompson, Matthew Lawson, 20, Emerald-street, Saltburn-by-the-Sea.
1897 Tomlin, J. R. le B., M.A., Stoneley, Alexandra-road, Reading.
1906 Tryhane, George E., St. Ann's, Trinidad, British West Indies.
1906 Tulloch, Captain James Bruce Gregorie, The King's Own Yorkshire Light Infantry; c/o Messrs. Cox & Co., 16, Charing Cross, S.W.
1895 Tunaley, Henry, 13, Beemead-avenue, Streatham, S.W.
1897 Tunstall, Wilmot, Cuerleon, Greenlaw Drive, Paisley.
1898 Turner, A. J., M.D., Widsham Terrace, Brisbane, Australia.
1893 Turner, Henry Jerome, 98, Drakefell-road, St. Catherine's Park, Hutham, S.E.
1906 Turner, Roland E., 21, Emperor's Gate, S.W.
1894 Turner, Thomas, Cullompton, Devon.
1886 Tutt, James W., Rayleigh Villa, Westcombe Hill, S.E.
1893 Urich, Frederick William, C.M.L.S., Port of Spain, Trinidad, British West Indies.
1904 Vaughan, W., Cocogalla, Madulsima, Ceylon.
1866 Verral, George Henry, Sussex Lodge, Newmarket.
1897 Vice, William A., M.B., 19, Belvoir-street, Leicester.
1895 Wacher, Sidney, F.R.C.S., Dane John, Canterbury.
1899 Wade, Albert, 52, Frenchwood-street, Preston, Lancashire.
1897 Wainwright, Colbran J., 45, Handssworth Wood-road, Handsworth, Birmingham.
1886 Warren, Wm., M.A., 33, Western-road, Tring, Herts.
1869 Waterhouse, Charles O., Vice-President, Ingleside, Avenue-gardens, Acton, W.; and British Museum (Natural History), Cromwell-road, S.W.
1901 Waterhouse, Gustavus A., B.Sc., F.C.S., Royal Mint, Sydney, New South Wales, Australia.
1904 Watson, Rev. W. Beresford, St. Martin's Vicarage, St. Philip Barbados, W. Indies.
1893 Webb, John Cooper, 218, Upland-road, Dulwich, S.E.
1876 Western, E. Young, 36, Lancaster Gate, Hyde Park, W.
1886 Wheeler, Francis D., M.A., LL.D., Paragon House School, Norwich.
1884 White, William, 75, Thurlow Park-road, West Dulwich, S.E.
1906 Wickar, Oswin S., Crescent Cottage, Cambridge Place, Colombo, Ceylon.
1896  Wileman, A. E., c/o H.B.M.'s Consul, Anping, Formosa.
1894  Wolley-Dod, F. H., Millarville P. O., Alberta, N.W.T., Canada.
1900  Wood, H., 9, Church-road, Ashford, Kent.
1905  Woodbridge, Francis Charles, Northcroft, Cornwall-road, Uxbridge.
1901  Woodforde, F. C., Market Drayton.
1899  Woolley, H. S., 7, Park-row, Greenwich, S.E.; and P. O. Box 1047, Waterbury, Conn., U.S.A.
1891  Wroughton, R. C., Inspector General of Forests, Indian Forest Service, c/o Army and Navy Co-operative Society, Ltd., 105, Victoria-street, S.W.

1888  Yerbury, Colonel John W., late R.A., F.Z.S., Army and Navy Club, Pall Mall, S.W.
1892  Youldale, William Henry, F.R.M.S., Daltonleigh, Cockermouth.
ADDITIONS TO THE LIBRARY

DURING THE YEAR 1906.†

ΑΔΛΕΡΖ (Γοττφριδ). Lefnadsförhållanden och Instinkter inom Familjerna Pompilidae och Sphégidae.
[Kungl. Svenska Vetenskaps-Akademiens Handlingar, Band 37, No. 5, 1903.]
Lefnadsförhållanden och Instinkter inom Familjerna Pompilidae och Sphégidae. II.
[Kungl. Svenska Vetenskaps-Akademiens Handlingar, Band 42, No. 1, 1906.]

*ΑΛΤΜΑΝ (Λ.). Kurzer Abriss der Entomologie mit besonderer Rücksicht aus Deutschlands Käfer nach den neueren Benennungen geordnet. Leipsiz, 1897.

ΑΝΝΑΝΔΕΛ (Ν.). The Fauna of a Desert Tract in Southern India.
I. Batrachians and Reptiles.
II. Insects and Arachnida.


The Authors.

ΑΣΗΜΕΑΝ (Ωμ. Η.). Descriptions of new Hymenoptera from Japan.
[U. S. Nat. Mus.]

ΛΥΡΙΒΙΛΙΟΥ (Χρ.). Results of the Swedish Zoological Expedition to Egypt and the White Nile, 1901. Lepidoptera.
O. Standinger und H. Rebel, Catalog der Lepidopteren des Paläarktischen Faunengebietes (Review).
[Ent. Tidskr. 1901.]
Zwei Neue Afrikanische Heteroceren.
[Ent. Tidskr. 1903.]
The Author.

ΑΥΣΤΕΝ (Ε. Ε.). [See Βαλφουρ (Ανδρέω) .]

ΒΑΧΗΡ (Καρλ Φ.). A Revision of American Siphonaptera, or Fleas, together with a complete list and bibliography of the Group.
[U. S. Nat. Mus.]

[Including papers by E. E. Austen and F. V. Theobald.]
A. Balfour.

ΒΑΝΚΣ (Νάθαν). A Revision of the Tyroglyphidae of the United States.
[U. S. Dept. of Agric., Bureau of Entom., Techn. Ser., No. 13.]
[U. S. Dept. Agric.]
† Including certain works not previously catalogued, those marked with an asterisk being from the Stainton Library.

BELL (R. G.). [See Kellogg (V. L.).]


BOFILL y PICHOT (D. J. M.). [See Antiga y Sunyer (D. Perc.).]


[See GODMAN (F. D.), Biologia Centrali-Americana.]

BURGESS (A. F.). [See Howard (L. O.).]


Una especie nueva de Opisthocosmia (Dermopterous). [Boletín de la Real Soc. de Historia Natural de España, Dic. 1905.] The Author.

BUSCK (August). A review of the American Moths of the Genus Cos- 


U. S. Nat. Museum.


[See GODMAN (F. D.), Biologia Centrali-Americana.]


Carpenter (G. H.).—(continued).
Injurious Insects and other Animals observed in Ireland during the year 1903.

Caterpillars on Fruit-trees.

Caudell (Andrew Nelson). The Locustidae and Gryllidae (Katydids and Crickets) collected by W. T. Foster in Paraguay.

Champion (G. C.). [See Godman (F. D.), Biologia Centrali-Americana.]

Chapman (B. L.). [See Kellogg (V. L.).]

Chaster (G. W.) and Tomlin (J. R. le Brockton). Coleoptera from Ballycastle, Co. Antrim.
[Irish Nat., Vol. XI, No. 3, 1902.] The Authors.

Chittenden (F. H.). Harvest Mites or "Chiggers."
[U. S. Dept. of Agric., Circular No. 77, 1906.] The Authors.

Clavareau (H.). [See Jacoby (M.). Coleoptera Phytophaga.]

Cockerell (T. D. A.). Two Plant Bugs.
[New Mexico Entomologist, No. 2, May 25, 1894.]
Contributions to the Natural History of the Rocky Mountains (Arachnida, Coleoptera, Coccidae and Hymenoptera).
Some Coccidae from the Philippine Islands.
A new Scale Insect (Fam. Coccidae) on the Rose.
[Zool. Anzeiger, Bd. XXIX, 1905.]
The Bees of Florissant, Colorado.
Fossil Saw-flies from Florissant, Colorado.
A Fossil Cicada from Florissant, Colorado.
New American Bees.
——— (T. D. A.) and Gill (Marie). Tricorythus, a genus of May-flies.
[Psyche, X, 1903.] The Author.

Cotes (E. C.). The Experimental Introduction of Insecticides into India, with a short account of modern insecticides and methods of applying them.
[Notes on Economic Entomology, No. 2, 1888.] The India Office.

*Cristofori (Joseph de) et Jan (George). Conspectus Methodicus Insectorum. Milan, 1832.

Distant (W. L.). Insecta Transvaaliensia. Part VII. Purchased.


Druce (Hamilton H.). Descriptions of Lycænidae and Hesperiidae collected by Mr. Harold Cookson in Northern Rhodesia in 1903-1904. [Trans. Ent. Soc. Loud., 1905, Part II.]


Descriptions of some New Species of Diurnal Lepidoptera collected by Mr. Harold Cookson in Northern Rhodesia in 1903 and 1904. [Trans. Ent. Soc. Loud., 1905, Part II.]


F. D. Godman.


Felt (Dr. E. Porter). Diversities among New York Mosquitoes. [Proc. of Second Anti-Mosquito Convention, N. York, 1906.]


U. S. Nat. Mus.


Description d'une espèce nouvelle de *Lebidoderus* de Sumatra. [Notes Leyden Mus., XXIII, 1901.]


Gestro (R.)—(continued).
Sopra alcune forme di Acanthocerini.
Osservazioni intorno al genere Bolhotritus, Bates.
Un cenno sul genere Stiptopodius, Harokl.
Le Specie del Sottogenere Micriska.
Materiali per lo studio delle Hispidae.
Viaggio di Leonardo Fea in Birmania e regione vicine. Enumerazione delle Hispidae.
Alcune osservazioni intorno al genere Chalcosoma.
Nuove forme del gruppo delle Platypria.
Gli Anofthalmi trovati finora nel Veneto.
Materiali per lo studio delle Hispidae.
A proposito di un recente articolo intorno alla fauna entomologica dell' Eritrea.
Catalogo sistematico dei Paussidi.
Contribution à l’étude de la Faune de Sumatra. Relevé des Hispidae.

Gill (Marie). [See Cockerell (T. D. A.).]


[Proc. Royal Soc., No. 216, 1881.]

Green (Ernest E.). Formalin as a reagent in the Preparation of some soft-bodied Coccidae.

Greene (Edward L.). The Genus Ptitea in the Western and South-Western United States and Mexico.

A Study of North American Noctuidae.
Descriptions of Noctuidae, principally from California.
GROTE (A. R.)—(continued).
Kleiner Beitrag zur Kenntniss einiger Nordamerikanischer Lepidoptera.

Description of the genera Argyrophyes and Condylomia and of a species of Deuterodyta.

Description of a Butterfly new to the Lower Lake Region.

Description of three new genera of Noctuidae.

On Wallengren’s “Lepidoptera Scandinavise Heterocera disposita et descripta.”

[Mém. du Musée Royal d’Hist. Nat. de Belgique, T. III, 1904.]
The Musée Royal de Belgique.

HAROLD (E. v.). Coleopterologische Hefte. Heft. I and XIV—XVI (completing the series).
Purchased.

HINDS (W. E.). Proliferation as a Factor in the Control of the Mexican Cotton Boll Weevil,
[U. S. Dept. of Agriculture, Bureau of Entom., Bull. 59.]
*U. S. Dept. Agric.*

HINE (James S.). Tabanidae of the Western United States and Canada,
[Bull. Ohio State Univ., series 8, No. 35, 1904.]
*The Author.*

HOPKINS (A. D.). Notes on Some Mexican Scolytidae, with descriptions of some New Species,
The Black Hills Beetle, with further notes on its distribution, life history, and methods of control.
The Locust-Borer,
*U. S. Dept. Agric.*

HOWARD (L. O.). The Brown-Tail Moth and how to control it.
*U. S. Dept. Agric.*

——— and BURGESS (A. F.). The Laws in force against Injurious Insects and foul brood in the United States.
[U. S. Dept. of Agric., Bureau of Entom., Bull. No. 61, 1906.]
*U. S. Dept. Agric.*

JACOBY (M.). Description of New Species of Phytophagous Coleoptera of the Genera Homopheta, Asphæra, and Eédionychis.

——— and CLAVAREAU (H.). Coleoptera Phytophaga, Donacidæ, Criotceridæ, and Clytrinæ.

JAN (George). [See CRISTOFORI (Joseph de).]

JORDAN (Karl). [See GODMAN (F. D.).] Biologia Centrali-Americana.
[See ROTHSCCHILD (Hon. Walter).]
Kaye (W. J.). New Species of Guiana and Jamaican Butterflies. [Entomologist, March 1906.]

Transparency in wings of Lepidoptera (with plates). [Reprinted from Entomologists' Record, Vol. XVII, No. 45.]


and Bell (R. G.). Variations induced in Larval, Pupal, and Imaginal States of Bombyx mori by Controlled, Varying Food Supply. [Science, Dec. 11th, 1903.]


Kershaw (J. C.). Butterflies of Hong Kong and South-East China. Parts I to III. Purchased.


Kraatz (G.). Ueber die Verwandten der Boekkäfer-Arten Pachyta interrogans, L., and variabilis, Gebh. [Deutsche Ent. Zeitschr, XXIII, Heft 1, 1879.]

Ueber die Boekkäfer Ost-Sibiriens. [Deutsche Ent. Zeitschr., XXIII, Heft. 1–2, 1879.]


Kuwana (S. J.). [See Kellog (V. L.).]


Insect Pests of Coffee. [Dept. of Agric. in India, Bull. No. 2, 1903.] 


Lubbock (Sir John). On Two Aquatic Hymenoptera, one of which uses its Wings in Swimming. [Trans. Linn. Soc., Vol. XXIV, 1863.]

Lubitz (Adolpho). Beiträge zur Kenntniss der Brasilianischen Tabaniden. [Revista da Sociedade Scient. de São Paulo, No. 1, Junho, 1905.]


Meyerick (E.)—continued.
Supplement to a Monograph of the New Zealand Geometrina.
Descriptions of New Zealand Micro-Lepidoptera.
[Trans. New Zealand Institute, 1884.]
Descriptions of Australian Micro-Lepidoptera, LXII.
Supplement to a Monograph of New Zealand Noctuina.
Notes on New Zealand Geometrina.
Notes on New Zealand Pyralidina.
Notes on New Zealand Tortricina.
Descriptions of New Zealand Tineina.
[Trans. New Zealand Institute, Vol. XX, 1887.]
Descriptions of Australian Micro-Lepidoptera, Part I.

Navas (S. J., R. P. Longinos). Notáis Neuropterológicas; VI. Neurópteros de Montserrat.

Newstead (R.). On the Life History of Stomoxys calcitrans, Linn.
General Entomology.

Oestlund (O. W.). On the Reproduction of lost or mutilated limbs of Insects.

Osborn (Herbert). Aradidse of Ohio.
A subterranean root-infesting Fulgorid (Myndus radicis, n. sp.).
New Species of Ohio Fulgoride.


The Author.


Panton (E. Stuart). The Life History of some Jamaica Hesperiidæ.

Pascoe (F. P.). On New Genera and Species of Longicorn Coleoptera, Pt. II.


Für die finnlandische Fauna Schmetterlinge. [Meld. af Soc. pro Fauna et Flora Fennica, 1903.]

Bidrag till en statistisk utredning angående orsakerna till "Hvitax" på ångsgräsen i Finland. [Ent. Tidsskr. xxiv, 1903.]

Rothschild (Hon. Walter) and Jordan (Karl). A Revision of the American Papilios. [Novitates Zoologicae, Vol. XIII.] The Authors.


The Gypsy Moth in New Hampshire. [New Hampshire College Agric. Exp. Station, Bull. 121.]

Schæffer (Chas.). Some additional New Genera and Species of Coleoptera found within the limit of the United States.

List of Bombycine Moths belonging to the families Lithosidae, Nolidae, etc., collected on the Museum Expedition of 1905 in the Huacheca Mountains.

On New and Known Genera and Species of the Family Chrysomelidae.

The Author.

Schaus (Wm.). Descriptions of New South American Moths.

U. S. Nat. Mus.

Scudder (Samuel H.). Adephagous and Clavicorn Coleoptera from the Tertiary Deposits at Florissant, Colorado. Also contains a systematic list of the non-Rhynchophorous Tertiary Coleoptera of North America.

Schneider (J. Sparre). Coleoptera og Lepidoptera ved Bergen og i nærmeste omegn.
[Bergens Museums Aarbog. 1901, No. 1.] The Author.

Sharp (W. E.). The Occasional Phenomenal Abundance of certain forms of Insect life, with special reference to Deilephila galiit.

Some speculations on the derivation of our British Coleoptera.

Insects of Lancashire.

Schilsky (J.). [See Küster (H. C.).]

Shipley (A. E.). The Orders of Insects.


Söestedt (Yngve). Monographie des Termiten Afrikas.


Sopp (E. J. B.). The Birth and Infancy of Dytiscus punctulatus, Fab.

Theobald (F. V.). A New Culicid genus from Uganda. [Journ. Tropical Medicine, Jan. 15th, 1904.]

New Culicidae from the Federated Malay States (two papers). [Entom., January and February, 1904.]


[See Balfour (Andrew).] The Author.

Tomlin (J. R. le Brockton). [See Chaster (G. W.).]

Tower (Wm. Lawrence). Colours and Colour Patterns of Coleoptera. Chicago, 1903. The Author.


[Ann. Queensland Mus., No. 2, 1892.]


Periodicals and Publications of Societies.

AFRICA.


AMERICA (NORTH).

Canada.


United States.


Entomological Student, Vol. II, Nos. 2 and 4, 1901.


Proceedings of the 18th Annual Meeting of the Association of Economic Entomologists. 1906.
AMERICA (SOUTH).


WEST INDIES.


The Journal of the Imperial Agricultural Department for the West Indies. The Agricultural Department.


ASIA.

INDIA.


The Agricultural Ledger, Entomological Series, Nos. 1–8 and 11. The India Office.


JAPAN.

TOKIO. Bulletin of the Imperial Central Agricultural Experiment Station, Japan. Vol. I, No. 1, 1905. The Agricultural Station.

AUSTRALASIA.


PERTH. Journal Agricultural Department of West Australia. 1906. The Society.


By Exchange.

By Purchase.

Belgium.

DENMARK.

FRANCE.


GERMANY.


Monatliche Mittheilungen aus dem Gesammtgebiete der Naturwissenschaften. Vierter Band. 1887.


Jahresbericht für 1905.


GREAT BRITAIN AND IRELAND.


LONDON. Annals and Magazine of Natural History. 1906. By Purchase.


City of London Entomological and Natural History Society. Transactions. 1905. The Society.

Entomologist (The). 1906. R. South.


( xli )


MIDDLESBOROUGH. Cleveland Naturalist’s Field Club. Record of Proceedings, 1902-3-4.

SOUTHPORT. Lancashire and Cheshire Entomological Society. 27th, 28th, and 29th Annual Reports and Proceedings. 1903-5.

HOLLAND.


ITALY.


RUSSIA.


SWEDEN.


SWITZERLAND.

ERRATA.

TRANSACTIONS.

Page 106, line 12 from bottom, for Forström read Forsström.
Page 125, line 6 from bottom, for cæruleascens read cæuleus.
Page 134, line 13 from top, for these read three.
Page 137, last line, for five read fine.
Page 141, line 19 from bottom, for July 15th read June 17th.
Page 141, line 12 from bottom, delete July 25th.
Page 362, line 10 from bottom, for Rynchota read Rhynchota.
Page 446, line 16 from top for Aurikulus read Auritulus.
Page 453, line 9 from top, for Quezaltenango read Quezaltenango.
Page 467, line 3 from bottom, for assymetrical read asymmetrical.
Page 468, line 14 from top, for rühi read rülli.
Page 477, line 3 from top for andreniformis read andreniformis.
Page 478, line 20 from top for andreniformis read andreniformis.
Page 533, line 2 from top, and throughout the paper, for Dracenta read Draconia.

PROCEEDINGS.

Page lxxviii, line 5 from top, for Monyonchus read Mononychus.
Page lxxviii, line 17 from top, for Dracenta read Draconia.
Page xc, line 2 from top, for andreniformis read andreniformis.
Wednesday, February 7th, 1906.

Mr. F. Merrifield, President, in the Chair.

Nomination of Vice-Presidents.

The President announced that he had nominated Mr. Herbert Goss, F.L.S., Mr. Edward Saunders, F.R.S., F.L.S., and Mr. Charles Owen Waterhouse, as Vice-Presidents for the Session 1906-1907.

Election of Fellows.

Mr. H. J. Carter, B.A., of "Ascham," Darling Point, Sydney, New South Wales, and the Rev. William Henry Heale, of Wolstanton Vicarage, Stoke-on-Trent, were elected Fellows of the Society.

Obituary.

The decease of the Rev. Joseph Greene, M.A., was announced.

Exhibitions.

Mr. W. E. Sharp exhibited a specimen of *Lathrobium levipenne*, Heer, a beetle new to the British list, taken by him in a sandpit near Oxted, Surrey, in August, 1905, and for comparison therewith the nearest members of the group to which it belongs, *L. boreale*, Hoch., *L. fulvipenne*, Grav., and *L. angustatum*, Lac.
Dr. F. A. Dixey exhibited specimens of South African butterflies captured by himself and Dr. Longstaff, and remarked upon them as follows:

"It may be remembered that at a recent meeting of the Society (Proc. Ent. Soc. Lond., 1905, pp. liv–lix), I gave some account of the scents observed by us in South African Pierines, calling attention to the fact that they were practically without exception of an agreeable character and confined to the male sex. On the present occasion I wish to speak of the perfumes detected by us in butterflies belonging to other groups; some of these odours having a similar character to those of the Pierines, while others belong to a different category.

"Mycalesis safitza, Hew. ♂. On separating the fore- and hind-wings, so as to expose the well-known ‘tufts,’ I at once perceived a strong odour of chocolate, perhaps combined with a trace of vanilla. This I noted at the time as ‘one of the strongest butterfly scents known to me.’ I found no odour in the female. Dr. Longstaff also detected a ‘chocolate scent, not strong,’ in the tufts of the male.

"Two males of Mycalesis perspiciens, Trim., examined by Dr. Longstaff, emitted a ‘very strong treacly odour—quite distinct from the scent of M. safitza.’ To my perception the scent was rather of the chrysippus order, with a suggestion of burnt sugar or treacle. We had no opportunity of testing the female.

"Two male specimens of Ypthima itonia, Hew., and three of Pseudonympha cassius were tested by me with a negative result.

"The males of Byblia goetzius, Herbst, yielded a very distinct and agreeable odour of sweet chocolate, mingled, as in Mycalesis safitza, with a suggestion of vanilla. Dr. Longstaff reports a chocolate scent in the only specimen examined by him—a female.

"I found a similar chocolate scent in a specimen of Geyenes oculata, Trim. ♂. Geyenes zetterstedti, Wallgrn. ♀, was odourless, as also was a specimen (not yet determined) of Pterygospidea flexus, Fabr.

"Planema aganice, Hew., has been stated by Mr. Marshall (Trans. Ent. Soc. Lond., 1902, p. 413) to have no smell. The
green juice exuded from a male specimen appeared to me to have an odour like that of a crushed cabbage leaf, which was by no means unpleasant.

"Both sexes of Acreea alboradiata, Auriv., have a distinct odour which is described by Dr. Longstaff as 'musty' and 'like old hay.' The female was independently noted by me as smelling like musty straw.

"The scent of Acreea anemosa, Hew., seems to vary greatly in strength in different individuals. One of the males tested by me had no apparent odour. Another male and a female both smelt strongly of damp, fusty straw. Dr. Longstaff's specimens, all males, gave a 'musty' odour of varying intensity. Mr. Marshall (loc. cit.) states that A. anemosa 'emits a very strong smell when pinched, being the only Acreea in which I have noticed this, though possibly acreea does the same.'

"No odour was perceptible in the wings or crushed thorax of Acreea cahira, Hopff. $\ddagger$. Mr. Marshall (ibid.) reports that he was unable to detect any trace of bitterness or acridity in this species.

"Dr. Longstaff found a slight snuff'y scent in the male of Acreea encedon, Linn., and an evanescent disagreeable odour, not very strong, in the female when crushed. The yellow juice of this species is said by Mr. Marshall to be slightly bitter, but not very markedly so.

"Acreea doubledayi, Guér. $\ddagger$, emits a yellow juice which on one occasion seemed to me to be scentless. In another male I detected a slight fusty odour. Dr. Longstaff reports an 'old hay' scent on crushing, in both male and female.

"Both sexes of Acreea atollmis, Westw., were found by Dr. Longstaff to possess a faint odour, which, however, he does not describe. I did not examine the female, but a male specimen appeared to me to be scentless.

"The smell of musty straw was very distinct in a female specimen of Acreea caldarena, Hew. It was only slightly apparent in a male examined by Dr. Longstaff.

"In Acreea atergatis, Westw., I found that the same musty odour was accompanied by a strong ammoniacal scent, like that of stable-litter.

"Both sexes of Amauris echeria, Boisd. (form albimaculata,
Butt.), yielded a similar smell of musty straw, accompanied in this case by an evanescent sharp or pungent scent like that of vinegar. A considerable amount of yellow juice, which seemed to be tasteless, was exuded by one male specimen. The characteristic smell adhered to the fingers after crushing a female specimen, though in this instance no fluid was seen. In regard to A. echeria, Mr. Marshall remarks that in the few specimens that he tried, no juice was emitted; but they had a nauseous taste and a strong smell which reminded him somewhat of that emitted by many Coccinellidae. Dr. Longstaff observed the musty smell and the transient pungent odour in both sexes; the latter he compares to acetylene. One female was noted by him as possessing 'a disagreeable odour like some animal.'

"The scent in both sexes of Limnas chrysippus, Linn., invariably appeared to me to be of a strong and disagreeable nature, like that of cockroaches, often stronger in the female. The odour of the male seemed to contain an additional constituent, which I am inclined to compare to the perfume of burnt almonds. I found no increase of the scent when the glands of the hind-wing were crushed with the forceps. Dr. Longstaff noted a disagreeable odour in both sexes—stronger in the female—which he likens to that of musk-rats or cockroaches. The excised glands of the male yielded on pressure a yellow or brown juice, without perceptible taste or odour. (For his impressions of L. chrysippus in India see Trans. Ent. Soc. Lond., 1905, pp. 87, 89, 108, 137.) That great individual differences exist in the appreciation of these scents appears from Mr. Marshall's statement that in his experience L. chrysippus emits no smell.

"A specimen of Charaxes varanes, Cram. ♂, on being squeezed, emitted an odourless yellow juice. Another was noted by Dr. Longstaff as having a 'treacly' odour. A female was thought by him to have a smell like cowdung. To me the scent of the same specimen recalled that of L. chrysippus.

"Salamis anacardii, Linn., has an animal-like scent which to Dr. Longstaff suggests the odour of rabbit-hutches. It appears to be stronger in the female. This may be compared with Wood-Mason's statement that the females of Papilio
dasarada, Moore, 'had the strong scent of caged porcupines with a touch of musk' (Journ. Asiat. Soc. Bengal, 1886, Vol. LV, Part II, No. 4, p. 374).

"Three specimens of Neptis agatha, Cram., captured by me in Natal, emitted a strong and very disagreeable scent, much like that of L. chrysippus, but more intense. Two specimens from the Zambesi, however, are reported by Dr. Longstaff as having a 'slight sweet scent,' and 'slight scent' respectively. The Natal and Zambesi forms of this species certainly differ in aspect, and it may be that a corresponding difference exists in their scent-producing capacity. All five specimens seem to be males.

"I found no smell in Neptis marpessa, Hopff. ♂.

"A male specimen of Hypolimnas misippus, Linn., had a smell like coffee; not very strong.

"The male of Humanamida dealalus, Fabr., was found by me to smell like burnt sugar, or caramel toffee. A similar scent of burnt treacle, accompanied by a 'fairly strong animal scent,' was noted in another male specimen by Dr. Longstaff. In two others, when dead, he detected a 'mousy' odour.

"I could find no scent in Eurytela hiarbasa, Drury, ♂. Dr. Longstaff records of two specimens (sex undetermined) 'snuffy scent.'

"Precis clelia, Cram. ♂, is said by Dr. Longstaff to have a treacly scent.

"The smell ofusty packing-straw, so common among the Acres, is also found in Papilio demodocus, Esp. It is sometimes combined with a smell that suggests cabbage-water, or a kitchen sink, and was found by Dr. Longstaff to be stronger in the female than in the male.

"Papilio cenea, Stoll, ♂, has a similar odour; less 'musty,' according to Dr. Longstaff, than that of P. demodocus.

"Papilio lyxus, Doubl. ♂, is occasionally scentless. A few specimens were found by Dr. Longstaff to have an odour, more or less pronounced, which he describes as 'sweet, luscious, flowery.'

"A specimen of Papilio leonidas, Fabr. ♂, had a scent which to my mind seemed like that of L. chrysippus. Other specimens, however, all males, were described by Dr. Longstaff
as having a 'strong, sweet, "white flower"' scent, followed by something more spicy.'

"Lastly, it may be mentioned that the Geometrid Cartuletis libyssa, Hopff., which no doubt belongs to the synaposematic group headed by L. chrysippus, exuded when pinched a yellowish juice like that of an Acraea. This juice was scentless.

"It will be observed that in some of these cases, e.g. in Mycalesis safitza, the fragrance resembles that of the Pierines mentioned on a former occasion in being agreeable in character and confined to the male sex. The inference seems fair that odours of this kind are employed as a means of sexual attraction and perhaps of recognition. Mr. Wood-Mason (Journ, Asiat. Soc. Bengal, 1886, Vol. LV, Part II, No. 4, pp. 343-393) found many years ago that the males of several Indian butterflies belonging to the genera Danisepa, Mycalesis, Lethe and Thanumantis, exhaled a pleasant fragrance of vanilla, the corresponding females being scentless; one species of Mycalesis indeed received from Wood-Mason and de Nicéville the name of suaveolens on this account. These instances clearly belong to the same category.

"The case is different with the odours of several Acraea and some Papilios, in which the scent has been found to be disagreeable or even disgusting. The possessors of such malodorous perfumes are generally such as we should on other grounds suppose to be distasteful; and it is significant in this connection that these unpleasant scents are as a rule shared by both sexes, and indeed often show a marked tendency towards greater intensity in the female. This is of course precisely what we should expect on the hypothesis of their value as a means of protection.

"In a former communication (Proc. Ent. Soc. Lond., 1905, p. lv), I mentioned the possibility that both kinds of scent may occur in the same species; I have some reason to think that this is the case with L. chrysippus. The males of three common species of Mylothris, viz., M. agathina, M. ruppellii and M. trimenia, possess a well-marked and very agreeable odour of which the females show no trace (Proc. Ent. Soc. Lond., 1905, p. lvii). There are, as is well known, strong
grounds for believing this to be a distasteful genus, and it is noticeable that both sexes emit on pressure a yellow or greenish juice like that of an Acron. I was never able to convince myself that any odour attached to this juice, or, except in one case (a female) to the crushed body. But it is quite possible that an observer with a more acute sense of smell than I possess might arrive at a different result. The disagreeable odours of the Euplœca group are well known, but Wood-Mason (loc. cit.) records that in Euplœca (Daniele) rhadamantus, Fabr., 'the eversible caudal rosettes of the males are finely vanilla-scented.' A still more conclusive instance, also noted by Wood-Mason, is as follows:—'The gland covered by a patch of modified scales and by an erectile wisp of hairs on each hind-wing in the male (of Stichophthalma camadeva, Westw.) secretes a fluid that gives out a pleasant odour distinct from, but so faint as to be barely perceptible in the presence of, a much stronger odour (resembling that of sable fresh from the furrier's shop), which is common to the two sexes.'

"A point of much interest in connection with these scents, their diverse characteristics and presumably diverse significance, is the probability thus suggested of a certain correspondence between human aesthetic preferences and those of some at least of the lower animals."

The general character—agreeable or the reverse—of the odours emitted by the various species shown, as also the property belonging to some of them of exuding a yellowish or greenish fluid on pressure, was indicated in the exhibit by means of coloured labels.

The Rev. A. E. Eaton inquired whether the coloured juice was exuded from any particular pore, and suggested that when crushed it would be worth while to put the specimen into a solution of formaline, as he had noticed that in some species under this treatment certain pores of the antennae were extruded, and that the liquid came, not from the air tubes, but from some special processes.

Mr. G. C. Champion mentioned that he had observed a fluid exuding from the thorax of many Anthrocerids, and Dr. G. B. Longstaff said that he had found the expression of
fluid from the antennae so usual in collecting that he shifted
his specimens in papers after a short time to prevent them
adhering to the envelopes.

A discussion followed on the organs and uses of scent for
purposes of attraction and defence in insects generally, Mr.
J. W. Tutt drawing attention to the fact that there are two
glandular scents in Lepidoptera: the one emanating from the
androconia; and the other from the body, and that in determin-
ing the scent peculiar to the various species they must be
distinguished.

Professor Poulton, in congratulating Dr. Dixey and Dr.
Longstaff upon the interesting results of their careful observa-
tions in the field, referred to the fact that the scents observed
in the males alone, and presumably epigamic in significance,
were pleasing to the human sense, whereas those common to
both sexes, and presumably aposematic, were unpleasing to
man. *Ex hypothesi*, the first set appealed to the sense of the
female insect, the second to that of insect-eating vertebrates.
That the former should be agreeable to man appeared to be
a far more astonishing result than that he should find the
aposematic scents unpleasant. Professor Poulton also
mentioned having seen in a dissection of the larva of
*Cosmis*, prepared by Mr. O. H. Latter, a long tubular
gland emitting the odour peculiar to that species. The
President, Dr. T. A. Chapman, Mr. G. Bethune-Baker,
Mr. M. Burr, Mr. G. J. Arrow and other Fellows continued
the discussion, at the close of which Dr. Dixey replied,
reminding Mr. Tutt that he had already dealt with "andro-
conial" scents on two former occasions. It was of course
true, as he had previously stated (Proc. Ent. Soc. Lond. 1904,
p. lviii) that the sexual scent in many Pierines, Lycænids,
Satyrids and Nymphalids was distributed, though not manu-
factured, by specialised scales either scattered over the wings
or collected into patches. At the same time it was worth
noticing that in some species, e.g. *Ganoris brassica*, which
were plentifully supplied with "androconia," the scent was
barely or not at all perceptible; while in *Gonepteryx rhamni*
and *G. cleopatra*, both of which, and especially the latter, had
been found to possess a flower-like odour, he had been unable
to detect any scales specialised for scent distribution. He was not at present prepared to assert, from his observations in the field, that the repulsive odours were in all cases confined to the tissues and juices of the body; though in some instances the intensity of such odours was certainly increased when the thorax was crushed.

Mr. W. G. Sheldon exhibited a collection of Rhopalocera made by him in Spain during July and August, 1905, including *Argynnis adippe*, var. *chlorodippe* and *cleodippe*, together with typical European specimens, and var. *cleodoxa*, for comparison; an aberration of *A. aglaia*, with the black blotches on the superior wings enlarged and banded, and with dark suffused ground colour on all wings; *Melanargia lachesis*, with var. *canigulensis*, and ab. *catalena*, * Erebia stygna*, var. *penalarae*, with Swiss type for comparison; *Brenthis hecate*; *Chrysophanus virgaurex*, var. *miegii*, with French typical specimens for comparison; and *Lasopis roboris*, all from La Granja, in the Guadarrama mountains; *Satyrus priewri* and *? var. uhagoni*, and intermediates, *Epinephele lycaon*, *? Melita didyma*, *Erebia zapateri*, with French specimens for comparison; and *Lasopis hylas*, var. *nivescens*, with type for comparison; and *L. corydon* and vars. *hispana* and *polonus* with intermediates between all these forms, and also British, French, and Swiss typical specimens for comparison. The last-named species were collected in the Albarracin Sierra in Arragon.

Commenting on these exhibits, Mr. Sheldon said:—“The *E. zapateri* show considerable variation in the spot markings of the inferior wings, sometimes without any red and thus typical; whereas others have single red spots, and others a small red band, inclining towards the French forms of the nearly allied species *E. neoridas*.

“The *Epinephele lycaon*, female, are striking, the anal ocellus which in European specimens is usually slightly smaller than the costal ocellus in the Spanish specimens, is distinctly larger, and in one or two it shows a strong tendency to invade the surrounding light area, suffusing it with the black of the ocellus.

“The *Lycaena corydon* taken and exhibited are very interest-
The usual form in Central Spain of this species is with the almost white male, known as var. _hispana_, in the Albarracin Sierra, however, it has been known for some time; a second form occurs with males of a deep violet-blue colour, and which have been called var. _corydonius_ of Herrich-Schaffer, described from specimens from Asia Minor.

"Dr. Chapman on his visit to Albarracin in 1901 found both these forms, but could not ascertain any evidence of interbreeding, or any intermediate specimens, and he states in 'The Entomologists' Record,' Vol. XIV, p. 119, that 'it was difficult to say why they are not entitled to specific rank.' Whilst I was staying at Albarracin I was fortunate in obtaining through the kindness of Miss Fountaine, who was also collecting there, a copy of Zapater and Korbs' 'Catalog de los Lepidópteros de la Provincia de Teruel,' Albarracin being of course in this Province.

"These authors have the following observations on the various forms of the species occurring in the district. _Corydon_ generally distributed; var. _albicans_, rare; var. _corydonius_, not rare, locally; var. _hispana_, not abundant. My observations lead me to agree with Dr. Chapman that the form _hispana_ and the violet-blue form are geological varieties, or at any rate that they occur on different formations, _hispana_ being confined to limestone, whilst I only observed the violet-blue forms on metamorphic strata in the neighbourhood of the village of Noguera, some fifteen miles from Albarracin, with the exception of a single somewhat worn specimen, captured flying wildly in the Guadalavier Gorge, some two miles below Albarracin.

"The hills immediately in the vicinity of the town are limestone, and here, except for the before-mentioned violet-blue example, the _corydon_ netted, probably some two hundred in number, were var. _hispana_, with one or two per cent. of the type form.

"There is a path leading up the hills to the south of the town, towards a farm known as Losillo; here the rock formation is a deep red sandstone, but there is here also in places an outcrop of limestone.

"The _corydon_ were still var. _hispana_ with type specimens,
but the latter here were considerably more abundant than near Albarracín, and probably equalled eight or ten per cent. of the total number examined, and of the remainder a considerable number were intermediate between the typical form and var. hispana; some of these I exhibit; curiously enough I did not myself, nor did my companions so far as I know, meet with a single example of the violet-blue form here, although Dr. Chapman seems to have found it frequent in this locality.

"At Noguera only the violet-blue forms, some of which are exhibited, and a form in which the blue is equally strong, but in which the violet is missing, occurred. I also exhibit this form. These were exceedingly abundant, but unfortunately I could only spend an hour or so amongst them, and as during this time I was unwell, my observation here could hardly be called exhaustive.

"From the above observations and on examination of the specimens exhibited, I think it therefore is most probable that the light and dark forms do cross freely when they meet, and that the various forms of intermediate shade are the results.

"I have abstained from using the name corydonius for any of the Spanish forms taken by myself, because I doubt whether it should be so used.

"On referring to the examples of this species in the National Collection, I find that the blue Asia Minor forms are well represented; there are three of these in the series:—

"1. A light violet form, much lighter, and with the violet more pronounced than in any of my Spanish examples, and with narrower darkening of the hind margins of the wings. This is labelled corydonius, H.-S.

"2. A form with ground colour violet-blue, with very narrow dark margins to the wings. The colour of these specimens is almost identical with the violet-blue examples exhibited, and they agree very well with them in all respects, except that they are somewhat larger, and the darkening of the hind margins is much narrower. They are named caucasica, Lederer.

"3. A form in which the ground colour is deep blue, without any violet, and with the hind margins deeply shaded with black. The colour of these is similar to the deep blue
specimens exhibited, but the black margins are deeper. They are labelled *polonus*, Zeller.

"The *polonus* of Zeller has been considered by some to be a variety of *L. bellargus*, and it is included with that species by Staudinger in the last edition of his Catalogue, but I think there is no doubt that it is a form of *L. corydon*. I take it that as *L. bellargus* in Aragon is very typical, and Staudinger does not give any form of *L. corydon* except the type and var. *hispana* and *albicans* as occurring there, he refers to forms exhibited to-night.

"That they are not a form of *L. bellargus* is I think evident from the specimens I exhibit of both species, neither the upper nor under sides having any resemblance to that species.

"*L. bellargus*, very typical in form and worn to rags, was abundant in the Guadarrama Gorge, near Albarracin, about July 20th, whereas the blue *corydon* were in good condition some fifteen miles away, and at about the same altitude, on August 7th."

Dr. G. B. Longstaff exhibited four species of *Acruxa* taken in South Africa during the visit of the British Association, viz.:


2. *A. alboradiata*, Auriv., previously known to Mr. Roland Trimen by two females only, and considered by him as a variety of *anemosa*. This species was abundant near the hotel at the Victoria Falls, flying about the tops of trees, late into the afternoon, or even at dusk. The females were in far better condition than the males. After examining a long series Mr. Trimen is disposed to think it a distinct species, which should bear the name given by Aurivillius to Mr. Trimen's original specimen when believed to be merely a variety of *anemosa*.

3. *A. atolmis*, Westw. In the Hope Collection are Westwood's types of two forms of this, to which he gave the names of *atolmis* and *acontius*. There seems no doubt they are one species. They were taken by F. Oates near the Victoria Falls in January, 1875. Mr. Trimen has specimens from Damaraland. Some of the specimens exhibited retain much
of the brilliant red colouring which is so striking in fresh specimens during life. The darker specimens resemble Prof. Westwood's acontias. Occasionally seen flying high, atolmis is more common nearer the ground, being much addicted to drinking from wet mud on the banks of the Zambesi, or at patches of irrigation in the hotel garden.

4. *A. aleryatis*, Westw. The two types of this are in the Hope Collection at Oxford, having been taken by F. Oates near the Victoria Falls in January, 1875. There are also two specimens in the National collection. Dr. Dixey took four specimens near the Falls.

The other three species exhibited were commoner and fell to the nets of Dr. Dixey, Professor Poulton, and the exhibitor.

Professor E. B. Poulton, F.R.S., exhibited two Diptera, which had been observed following the bee, *Andrena labialis*, Kirb., by Mr. A. H. Hamm, assistant in the Hope Department, Oxford University Museum. The specimens have been compared with Mr. G. H. Verrall's collection and identified as *Chortophila unilateralis*, Ztt., by Mr. J. E. Collin. Mr. Hamm's notes were as follows:

"During the afternoon of May 27th, 1900, I was sitting watching a fairly numerous colony of *Andrena labialis*, nidificating on the sloping side of a small clay pit, near Bagley Wood, Oxford. My attention was arrested by the surprising behaviour of a fly, which kept following up a ? bee in the most persistent manner. The bee seemed conscious of the attention of the fly, and instead of making direct for the burrow, it zigzagged about and sometimes alighted on the ground, as if endeavouring to get rid of its pursuer; but the fly was not to be shaken off; for it followed the bee in all its movements, settling on the ground and resuming its flight at the same time as the Aculeate. Throughout this persistent pursuit the fly kept at a fairly uniform distance of about six inches behind the bee. I saw about six of these flies altogether, but no single bee was followed by more than a single fly. I netted the two flies exhibited by Professor Poulton, in one case capturing pursuer and pursued at a single sweep."

Professor Poulton stated that new and interesting light
had been thrown on the observation by Col. Yerbury, who pointed out that both flies were males. At first sight it seemed astonishing that the bees should be pursued by the males of inquilíne flies; but Professor Poulton suggested the males in this way find their way to the burrows, where they meet the females which have also reached them in the same manner, or where more probably they lie in wait for the freshly emerging females.

The Rev. A. E. Eaton doubted that the object of the male flies following the bees was to be guided to where the female flies were likely to be found. He remarked that these Diptera frequent the Andrena colonies and have no need to be guided to them. And might not these males have chased the bees just as Vanessa and Hesperi dæ dart at and pursue any Bombus or Pieris that happens to fly past their resort?

Professor Poulton considered that the cautious and persistent tracking described by Mr. Hamm was inconsistent with Mr. Eaton's suggestion.*

Papers.

Dr. G. B. Longstaff, M.D., read a paper "On some Bionomic Points in certain South African Lamellicorns."

Mr. Roland Trimen, F.R.S., communicated a paper "On some new or hitherto unfigured species of South African Butterflies."


* Since the meeting of the Society on February 7th, the two flies have been further examined by Mr. J. E. Collin, who writes, Feb. 19th, 1906:— "After a microscopical examination I consider them undoubtedly females: all Mr. Verrall's are females, but there is a male among the specimens in his European collection from Kowarz." The two specimens had been previously studied with the lens, but not the compound microscope, by Col. Yerbury, Mr. E. E. Austen, and Mr. Collin himself; and all three Dipterists had then considered them to be males. It is fortunately possible to correct the mistake on the very page in which it is printed. The story enforces Darwin's conclusion that errors of fact are more dangerous than errors of hypothesis.

The eyes of these female flies are of a size and relative position which seem to imply the male sex. The eyes of male flies in general are probably chiefly developed for the pursuit of the female, and it may well be that they are similarly formed in these females in order to aid in the pursuit of the Hymenopterous host. [E. B. P.]
Wednesday, March 7th, 1906.

Mr. F. Merrifield, President, in the Chair.

_Election of a Fellow._

The Rev. George Wheeler, M.A., of Les Tourelles, Territet, Switzerland, was elected a Fellow of the Society.

_Obituary._

The decease of the following Fellows was announced—Mr. W. P. Blackburne-Maze, Mr. C. W. Dale, and Mr. F. J. Horniman, F.L.S., F.Z.S., etc.

_Exhibitions._

Mr. H. W. Andrews exhibited two specimens of _Microdon latifrons_, Lw., a rare dipteron taken in the New Forest in June, 1905.

Mr. H. M. Edelsten showed examples of _Nonagria neurica_, Hb., and _N. dissoluta_, var. _arundineta_, Schmidt, from Germany, with (?) var. _arundineta_ from Central Asia, for comparison with _N. dissoluta_ and _N. var. arundineta_ from Kent, Cambridge and Norfolk. He said that for many years _N. neurica_, Hb., had been confounded with the species occurring in Britain, viz.:—_N. dissoluta_, Tr., and its variety _arundineta_, Schmidt; but _N. neurica_, Hb., is a distinct species and does not occur in Britain, the type of our British species being the _N. dissoluta_, Tr., and (_= hessii_, Bdr.), and of which _arundineta_, Schmidt, is the variety. _N. neurica_, Hb., differs from _arundineta_ by its white collar; the central streak has three whitish dots in it, and the under-side is unmarked: while _arundineta_ has no white collar, the central streak also is dark and ends in a black central spot, and the markings show through on the under-side. Further, it is quite different in its earlier stages.

Mr. L. B. Prout exhibited a variable series of _Gynopteryx gladiaria_, Guen., and its varieties, and made the following remarks upon it:—

"I believe it has long been suspected by the few who work at South American Geometrids that Guenée's _seriaria_ and _rhombaria_ were merely forms of this, but I do not think any
'synepigonic' evidence has heretofore been adduced. My friend Mr. A. F. Bayne and his brother have, however, now furnished this, as my material will demonstrate. Besides two rows of captured specimens, I am showing: 'brood 1,' bred November, 1903, from a ♀ taken at La Paz, Mendoza, July, 1903, and consisting of _gladiaria_ (6♂, 3♀), _seriaria_ (2♂, Guenée's var. A), _rhombaria_ (1♀); 'brood 4,' bred about the same date from a ♀ taken at Palmira, Mendoza, September, 1903, and consisting of three specimens only, more or less typical; 'brood 8,' one ♂, bred January, 1904, from a pairing obtained in brood 4, this specimen being intermediate between _gladiaria_ and _seriaria_, while Mr. Bayne writes me that others of the same brood follow each of those forms; and a series of 9♂ and 10♀ bred end of July and throughout August, 1903, from a Mendoza (La Paz?) ♀ which seems to have been yellow, though there is some uncertainty; the progeny are nearly all brown and I identify as 'Apicia' _maldama_, Schaus, yet one ♂ is purely _gladiaria_ (though with brownish costa) and two others intermediate. Perhaps _maldama_ is a seasonal form of _gladiaria_. I know of no other July or August examples of the species excepting the parent of brood 1, and this Mr. W. M. Bayne says was 'yellow-brown with broad violet margin.' Three ♀'s captured at San Juan, Argentina, April 16th, 1904 (by Mr. A. F. Bayne), were also brownish, with the lines rather distinct, much like a few of the extremer examples of the variable 'maldama' brood. I may add that a fifth name (_Apicia nazadaria_, Walk.) will probably also have to sink to _gladiaria_.

Mr. A. J. Chitty exhibited combs of the honey bee formed on a branch of nut tree, the bees having swarmed late in the year. After July they deserted the combs, and having consumed all the honey contained in them, again swarmed on a neighbouring tree.

Prof. R. Meldola, F.R.S., exhibited on behalf of Major R. B. Robertson a specimen of _Prodenia littoralis_, Boisd., which had emerged in a breeding cage kept, with many others, by the Major at Boscombe, Hants, for the reception of caterpillars found in that district. The moth emerged on July 16th, 1905. The species, which is figured in Hampson's "Moths of India,"
is said to have a distribution extending from the Mediterranean subregion throughout the tropical and subtropical zones of the Old World. Specimens from Madeira (Wollaston collection) are in the British Museum. The food-plant is stated to be Lantana, and the larva is the “cotton worm” of Egypt. Previous records of the appearance of this moth in England are in existence, one specimen having been exhibited at a meeting of the City of London Entomological Society in August, 1891 (Ent. Record, vol. ii., p. 167), by Mr. Boden, who had found the larva feeding on an imported tomato. Another specimen was exhibited by Mr. Gregson at a meeting of the Lancashire and Cheshire Entomological Society in 1893, the larva in this case having been found in the market-place at Barnsley (Entom. Record, vol. iv., p. 20). There is no information in the case of the specimen now exhibited where the larva came from, beyond the fact that it must have been found at large in Boscombe or the neighbourhood, as Major Robertson has no communication with professional dealers, and no larvae are put into his breeding cages excepting those found in his own district.

Commander J. J. Walker said he had taken the larva in the Central Pacific Islands feeding on the tobacco plant. It was remarkable that the imago was so much smaller comparatively with the larva.

Mr. O. E. Janson exhibited a Mantis on a portion of the bark of a tree as found by Mr. F. Birch in Trinidad, who stated that its close resemblance to a withered leaf was evidently a protection for aggressive purposes.

Mr. M. Burr exhibited a series of Callimenidae, a small family of Orthoptera, consisting of two genera, Dinarchus, with the single species D. dasypus, Illig., and Callimenus, of which all the known species were included, with the exception of C. inflatus, Br., from Asia Minor. Callimenus ferdinandi, Bol. (unpublished name), is a new species recently discovered in Persia by the Spanish traveller Señor Escalera; C. montandoni, Burr, was discovered near Bucarest in 1898, and has since been rediscovered in the same locality, and its position, which was somewhat doubtful, definitely established; C. oniscus, Charp., is fairly common in Greece and Southern
Turkey; Callimenum pancei, Br., is a rarer species only known from Servia; Callimenum macrogaster, Lefeb., is fairly widely distributed in South Russia; it was long regarded as synonymous with C. oniscus and later with C. montandoni, but it is now clear that it is a distinct species. All these insects are confined to the countries bordering on the Black Sea; they are sluggish and inactive creatures, living among thorns and shrubs; they are entirely vegetable feeders; individuals appear to be nowhere numerous; in Russia they are popularly known as "ground hogs" (zemlyannaya svinka) or "fat fellows" (tolstun). The rudimentary elytra can be just seen in the females, but in the males they are entirely hidden. Brunner has observed that in July the males chirp all day long, sitting immovably in the corner of a branch, with the head downwards.

Mr. H. Rowland-Brown exhibited specimens of Argyminis niobe, var. eris, ♀, from the Pyrenees, Cevennes, and South Tyrolean mountains. He drew attention to the remarkable form of the example taken at Gavarnie, in July 1905, of which the coloration of the upper-side of all the wings was ruddy-copper red shot with blue upon the nervures. He also remarked that whereas specimens of eris and other Argynmids from the mountainous regions of Central France showed a tendency to maintain constant pale forms, those from the Pyrenees are generally more highly coloured, while the high Alpine forms of Central Europe inclined to melanism.

Mr. H. Rowland-Brown, at the request of Mr. C. O. Waterhouse, also read the following note on the migration of Lepidoptera extracted from a report on "The Pearl Oyster of the Gulf of Manaar—Avicula (meleagrina) fusata," by Henry Sulli- van Thomas, F.L.S., F.Z.S., etc., extracted from the "Madras Journal of Literature and Science" for the session 1886–87:—

"Butterflies can in an astonishing manner fly against a very strong wind. That butterflies can so fly is a fact in natural history which is doubtless well known, for as my memory serves me it is mentioned by Darwin; and I have myself repeatedly seen butterflies crossing the Red Sea with considerable rapidity in the very teeth of a decidedly stiff breeze—I think, from memory without notes, that I may call it a reef
topsail breeze, a breeze such that one expected every moment to see a form like a butterfly's carried away helplessly before it. And yet the butterflies had evidently started on their migration with a consciousness of power to battle with the opposing breeze, had already accomplished two-thirds or more of their journey, and were continuing their course with no uncertain rate of progress from the east to the west shores of the Red Sea. Taken in this connection the fact kindly shown me in the British Museum that certain patches on the east and west shores of the Red Sea are the habitat of the same butterfly is noteworthy. The structure of the butterfly prepares us to expect that it would be liable to be tossed about by any wind that blows, rather than that it would be able confidently to adventure a passage of several miles in the very face of it, and across a sea where it could never alight to rest."

A discussion followed, Colonel C. T. Bingham saying that he had encountered a similar migration in the Red Sea. Mr. Champion having suggested that apparent migrations against the wind might be due to diverse air currents at higher and lower levels, Colonel Bingham said that in this case there could be no mistake as the butterflies were flying on a level with the ship in which he was at the time.

Professor E. B. Poulton exhibited the original African Journal written by W. J. Burchell, between May 24 and September 2, 1812, both days inclusive. The account of this part of his journey occupied the whole of a small notebook bound in sheep-skin, and still in the most beautiful condition. In a lecture before the British Association at Cape Town, on August 17 of last year, Professor Poulton had mentioned the unfortunate loss of the journals in which Burchell recorded a general account of his doings during the five years (1810-15) in Southern Africa and the five (1825-30) in Brazil. His classical work, "Travels in the Interior of Southern Africa," does indeed give a complete record between November 26, 1810, and August 3, 1812,—the day on which he brought to a conclusion his first visit to Litakun, the capital of the Bachapins, in what is now British Bechuanaland. Mr. Mason, head-master of the Boys' High School at Ronde-
bosch, near Cape Town, who was present at the lecture, told Professor Poulton that a former pupil of his, named Burchell, had brought to school a diary written by an ancestor in St. Helena. Through Mr. Mason's kind help Professor Poulton was put into communication with Mr. Francis A. Burchell, a grand-nephew of the great explorer, who has most kindly lent the deeply interesting note-book now exhibited to the Society. At the place where Burchell's second volume comes to an end, the words "end of the 2nd volume" are written in pencil in the margin. Beyond this point one month of the lost records are here restored to us, from August 3 to September 2, 1812. Furthermore even in the period covered by the published work there are many statements of the deepest interest to us which Burchell withheld. For the first time we are made acquainted with the day and month of his birth. It is believed—but there is no certainty—that he was born in the year 1782. July 23, 1812, was a day of great anxiety and trouble. Among his attendants was a man named Cornelis, of Hottentot and Dutch parentage. Cornelis had been unsatisfactory and useless from the day of his engagement when he presented himself "in a state of complete intoxication," and now in the midst of the Bachapin capital, Litakun, then visited for the first time by a European, he broke out into open rebellion, and Burchell was compelled, buckling on his pistols and cutlass, personally to enforce obedience. The published account ends with the words:—"Thus ended one of the most turbulent days which I had experienced since the commencement of my journey." ("Travels," vol. ii, London, 1824, p. 462.) The manuscript journal, however, concludes the day with the following personal details omitted from the second volume:—

"I continued in the waggon all the evening, and to divert my mind from the past, I spent the remaining time with my flute."

"It thus has unfortunately happened that I have been prevented joining my family in their remembrances of me on this day: and that my birthday should be marked as one of the most turbulent days I have passed since landing on Africa. From the little dependance I can place on my own people my situation now begins to grow critical, and calls for the most resolute but prudent measures."
Another record of great interest to the Society is found under the date May 29, 1812, when Burchell was at Klaarwater (Griquatown) making arrangements for his journey to Litakun. It is contained in these words:—"The Sphinx Atropos is called by Colonists the Bye-mot or Duyvel-bye, and is firmly believed to be poisonous."

This sentence appears to have been written later than the brief record of the day, the writing being in a darker ink and compressed into the narrow space between the entries for May 29 and 30.

Mr. Roland Trimen's observation of the superstitious dread of this species in South Africa is thus both confirmed and carried back to a much earlier date. (Trans. Ent. Soc. Lond. 1902, p. 402.)

Professor Poulton exhibited a specimen of the large Melolonthid beetle *Lepidiota bimaculata*, Saunders, and directed attention to the two white eye-like spots on the elytra, and to the tapering posterior abdominal segments which suggested the appearance of the snout of a small mammal. The relative position of the eye-like spots and apparent snout was such as to promote the deceptive resemblance, which was also strongly assisted by the regular shape of the white spots, the direction of their long axes, and the fact that they lay in the shadow of a low but distinct ridge. Similar appearances were to be seen in several allied species, and Professor Poulton suggested that there were conditions during life in which the anterior part of these beetles was concealed, as it might be by foliage or by burrowing, and that the appearance of the exposed posterior part then acted as a defence. Professor Poulton had been led to draw attention to this example, which had been long known to him, because of the obvious and interesting analogy with the interpretation of the powerful posterior legs of the male *Heterochelus*, sp., offered by Dr. G. B. Longstaff at the last meeting of the Society (p. 93).

Delia, Cram., Xanthidia nicippe, Cram., and Pyrisitia proterpia, Fabr. (America). The under surfaces of the "wet" and "dry" phases were in each case shown side by side, in order to illustrate the very general tendency in these and other species to assume a reddish coloration beneath in the dry season. This tendency was most marked in the American forms shown, and least marked in the Indian; but was clearly seen to be common to all three Continents. The reds varied in character—sandy-orange, terra-cotta, Indian red and brick-purple being all represented; and the contrast with the usually pale appearance of the under surface in the wet season was in every case very distinct.

Dr. Dixey remarked that it could hardly be doubted that this infusion of red in the "dry-season" forms had a cryptic significance, and stood in relation with the very general prevalence of a reddish coloration, mostly due to the presence of iron, in the sandy wastes and bare patches of soil which formed a prominent feature in the tropical and sub-tropical regions inhabited by these and kindred species. He had himself observed that when the dry-season form of Teracolus speciosus settled on the red sandy soil of the "Bluff" at Durban, and then closed its wings so as to conceal the whole of the fore-wing except the tip, the uniform red of the under surface as then displayed made the insect very difficult of detection. A general redness of soil, recalling that of parts of the Devonian system in England, was characteristic of large areas of the African Continent; and Dr. Longstaff had informed him that similar conditions prevailed in India and China. The species exhibited were generally ground-hunting; and in all cases the reddish tinge of the under surface extended to the tip of the fore-wing as well as to the entire hind-wing, thus involving just so much of the wings as was exposed during rest. He considered that the present series of specimens tended to illustrate and confirm Professor Poulton's view of the generally cryptic character of "dry-season" phases.

Papers, etc.

Dr. T. A. Chapman read a paper entitled "Observations on the Life History of Trichoptilus paludum, Zell."
Professor E. B. Poulton, F.R.S., read a paper entitled "Notes upon some remarkable parasitic insects from North Queensland" by F. P. Dodd, F.E.S., and exhibited the fine and carefully labelled material sent by the author. This material consisted of a series of Braconidae bred from Lepidopterous hosts, Chalcididae from Lepidopterous and Hymenopterous hosts, and a new Cyrtid fly of the genus Oycodes, bred from the Attid spider, Cosmophasis hitaeiata, Keys. The accurate observations upon these parasitic species render the paper of much value. Thus the host of the extraordinary and beautiful Chalcidid genus Schizaspidea of Westwood has never before been observed; but Mr. Dodd records that the specimen obtained by him—an example of a new species—was bred from the pupa of a large ant of the genus Camponotus. Professor Poulton desired to express his warm thanks for the kind and cordial help he had received from distinguished naturalists, in naming and describing the material, communicated to him by Mr. Dodd. In an Appendix to the paper the new forms of Braconidae and Chalcididae were described by Colonel C. T. Bingham, and the new Cyrtid fly by Dr. Benno Wandolleck of Dresden. The ants had been kindly named by Professor Auguste Forel of Morges, and the Attid spider by Dr. G. W. Peckham of Milwaukee.

Colonel C. T. Bingham read the following note on "A Plague of Ants in the Observatory district, Cape Town, South Africa," and illustrated his remarks with specimens of the insects referred to by him.

"The remarkable occurrence to which this note refers was communicated to me by G. A. James Rothney, a Fellow of this Society. With his letter telling me of it, Mr. Rothney forwarded to me some correspondence and a cutting from a local paper at Cape Town, also specimens of the ants. In his letter Mr. Rothney says: 'The head manager of our South African business has been writing me at different times about a plague of ants which has attacked a suburb of Cape Town known as the Observatory district. I asked him to send me a short report, accompanied with specimens of the ant, and these have now come to hand.' He goes on to say: "There has also been a good deal of correspondence in local papers, with hot
discussions at municipal meetings, and a good deal of money seems to have been spent on attempted remedies. So far, the most successful antidote seems to have been a sheep dip.' The report and correspondence referred to above do not, I regret to say, give sufficient details, but I gather that this plague of ants has been going on for a couple of years at least. It must have been in full swing, so to speak, during the autumn months of last year, when the meetings of the British Association were being held in South Africa. Some of the Fellows of the Entomological Society present here to-night had the good fortune to be present also at those meetings, and I should like to ask them whether the occurrence of a plague of ants in the Observatory district of Cape Town came to their knowledge, for it seems to have been a serious, I may say a very serious, matter. To us here in England it would appear almost absurd that a mere increase in insect life should cause any great trouble, but any one who has lived in the tropics, or in any country where insects are numerous, or apt under certain conditions to become so, will bear me out in the statement, that they are a very real and grave cause of trouble and annoyance. It would seem that the nuisance caused by this plague of ants in the district mentioned has led to the appointment of a special Ant Committee, whose business it is to consider ways and means of dealing with it. Mr. Rothney's correspondent, Mr. Timberlake, writes: 'Mr. Hartley, who is a friend of mine, and the chairman on the Ant Committee, is in the office, and I am now dictating this letter. I told him I would like to send home some specimens, and with great difficulty he has managed to get hold of the queen, the big one in the phial which we sent you last mail. The crowds of little ones are, of course, the scourge. £300 was spent last year in attempts to destroy, but without success. The house, garden, and the whole place is overrun with them; trees, beds, and everything. Numbers of people have left the locality, and it has been very difficult to locate the queen. The ants are traced to a saucer-like cavity just below the surface not deeper than an inch, where there are hundreds of eggs, but no sign of the queen. I do not know whether you can suggest anything or give any advice as to the destruction of this fearful plague, but if so you
would be conferring an invaluable boon on the community. The ants come into the houses in a thick black stream an inch wide, marching over everything and into everything, and in one case, a very sad instance—the case of a corpse—people had to really sit up with it to prevent the ants molesting the body.

"The newspaper cutting referred to above has the following short report: 'The Public Works Committee reported that the complaints of the prevalence of ants had been received from 57 properties in Observatory district, and that a supply of disinfectants had been sent to Mr. J. H. Hartley, from whom residents could obtain free supplies of disinfectants. Mr. Hartley said something must be done on similar lines as last year. Numbers of people were leaving the district. They must try to do away with this pest, which penetrated even into the houses of the most respectable people. Some people had to spend from 5s. to 7s. 6d. weekly on disinfectants. Mr. Carey moved that the matter be referred to the Sanitary Committee, adding that the Sanitary Superintendent was doing what he could to have the district cleared. Mr. Searle said they spent last year £300 of the ratepayers' money for this item of disinfectants. They might as well buy up the properties affected.'

"With regard to the specimens of ants sent, some of them, which I have had mounted on card for examination, including the only ♂ and ♀ sent, form the subject of the exhibit that I have here. The little ones are the ♀ of an *Iridomyrmex*, subfamily *Dolichoderinae*. The species is closely allied to, if not identical with, *Iridomyrmex anceps*, Mayr, found almost throughout the Indo-Malayan region. It had not, so far as I know, been recorded from any part of Africa. The ♂ ♀ sent belong to an entirely different subfamily, the *Myrmicinae*, and I identify them as *Aphexogaster barbara*, Linn., race capensis, Mayr.

"The inevitable conclusion, therefore, is that there has been faulty (but, considering the little there is known, except to professed entomologists, of the different species of ants, quite excusable) observation in tracing the ants to their nests.

"With *I. anceps*, Mayr, in life I am well acquainted, and so
far as my observations go it is essentially a tree ant. In fact, I cannot call to mind any instance of finding it on the ground, and certainly I have never seen nor heard of its intruding into human habitations. It is not carnivorous, has no functional sting, and its jaws are so feeble that its bite is not perceptible on the naked hand. Aphanogaster barbara, again, is, so far as I know, a strict vegetarian, and I presume its subspecies or race capensis is so also. Reverting to the correspondence, there is some mention made of the ants causing the plague being identified by some entomologist as termites. It is evident that the specimens sent to Mr. Rothney and those declared to be Termites could not have been the same. No entomologist could confound a true ant with a Termite, unless, indeed, on a hasty glance in perhaps a bad light he mistook the ♀ of Dorylus for a Termite, which it somewhat superficially resembles. Dorylus helvolus, Linn., is, I am informed, exceedingly common in the vicinity of Cape Town; it is a carnivorous species, and the ♂ I know have a habit of "marching in a thick black stream," as mentioned in Mr. Timberlake's letter.

"To sum up, I am of opinion that, owing to causes which to us are still very obscure, there may have been during the last two years a phenomenal increase of ant life in the vicinity of Cape Town, and that the so-called plague is caused by not one but by several species of ants.

"I have ventured to bring this remarkable occurrence to the notice of the Society at the special request of Mr. Rothney. In more than one letter to me Mr. Rothney has expressed the hope that some of the members of the Society will take the matter up, and make suggestions as to the best means of combating what is no doubt a very great infliction to the inhabitants of Cape Town."

Dr. G. B. Longstaff read a paper "On some Rest Attitudes in Butterflies," illustrated by numerous specimens arranged upon backgrounds of specially-prepared sand-paper approximating to the natural surroundings of the insects in their various habitats.

Dr. T. A. Chapman understood that Dr. Longstaff's remarks referred chiefly to resting attitudes during quiescence, when
invisibility was desired, but the heliotropic attitude with tail to the sun, was familiar to observers of Vanessas and other Nymphalids—and some other butterflies of the European fauna. During their active period, when, settling, usually on the ground, they assumed that orientation, and spread their wings flat on the ground with the head a little raised, making the greatest display of their colours, but chiefly appearing to desire to secure as vertical a sun as circumstances allowed; this might be different in the tropics. He wished to ask how and how far these two phases of a similar orientation were related.

Professor E. B. Poulton congratulated the author on the many interesting facts and observations contained in his memoir. There was neither time nor opportunity to consider these in detail; but the speaker felt that he must express his deep interest in the principle suggested by Dr. Longstaff at the conclusion of his account:—that in the tropics there were many hours of daylight during which insects were at rest and their enemies active. It was clearly a principle of the utmost importance, which must be seriously taken into account in observing and recording bionomic data.*

Upon Dr. Chapman’s suggestion that butterflies assume a

* Since the meeting of the Society on March 7, I have remembered the very interesting observations published in 1900 by Mr. N. Annandale, of the Indian Museum, Calcutta. The author, observing the habits of certain Phasmites and of a beetle larva, is led to conclusions very similar to those reached by Dr. Longstaff from the habits of Lepidoptera. ("Notes on the Habits of Malayan Phasmitae, and of a Flower-like Beetle larva," by Nelson Annandale, B.A., Proc. Roy. Phys. Soc. Edinb. 1900, No. xxix, pp. 439-444.) In this communication Mr. Annandale describes a dull-red species of Phasmid, Lonchotes, sp., nearly four inches long, which, in the full blaze of the mid-day sun, is freely exposed on "the upper surface of certain broad leaves such as abound in neglected hill clearings." Even from below "its shadow was perfectly visible through the translucent tissues of the leaf."

"I was quite unable to discover what became of them at night, for I never found them on the leaves either late in the afternoon or early in the morning. Most probably they remained concealed among the undergrowth except during the heat of the day.

"The Phasmid . . . is only conspicuous at certain times of day, when the sun is at its hottest and brightest. . . . At mid-day, the mammals, birds and amphibians of the jungle are at rest. They are not asleep, but they do not search actively for food, nor come out of the wood into the clearings. . . . Lizards, of course, are generally most active when the sun is hottest; but in these hill-clearings reptiles of all sorts are rare. . . . I have a certain amount of negative evidence that the majority of Malayan Phasmites are most active in the middle of the day, being inclined to remain concealed in the early morning and late afternoon.
position with their heads directly away from the sun in order to receive as much heat as possible, the speaker wished to point out, that when the wings are raised over the back, this was the very position which insured a minimum of heat. The size of the shadow cast is a criterion of the amount of heat intercepted and in this position with the wings upright the shadow becomes a mere line. When the wings of a butterfly resting in this position on the ground are fully opened, there is, it is true, some very slight compensating gain of heat, wherever the sun's rays strike the earth obliquely. The head of the butterfly being turned from the sun, the raised costal margins of its fore-wings insure that the heat rays strike the plane of the wings with slightly less obliquity and therefore with more thermal effect than they do the ground.

Referring to the "list" of butterflies in the resting position Professor Poulton said that, on one occasion many years ago, he had observed this movement in a pronounced degree in the Green Hairstreak (*Thecla rubi*). The butterfly was observed at rest on the flat surface of a leaf at Birdlip, Gloucestershire, and it let itself down on one side so completely that it seemed to lie flat on the leaf. The obliteration of shadow was very marked and had at the time forced itself upon the speaker's mind as the significance of the attitude.

Dr. F. A. Dixey said that he was much struck with the fact pointed out by Dr. Longstaff, that there were several hours of daylight during which most butterflies were inactive, and were

. . . Too late or too early in the day, it was impossible to see a single stick-insect in the clearing; and during my six months' stay in Lower Siam, I never was able to discover any Phasmide of any species late in the afternoon." Mr. Annandale however found a single specimen in the early morning clinging motionless, like an enormous Geometrid larva, to a blade of grass, and remaining "absolutely still while the grass was broken off." Towards the end of the paper Mr. Annandale describes the habits of a flower-like beetle-larva (apparently an Endomychid), which, "early in the morning, as late as two hours after sunrise (which occurs in Patalung between five and six o'clock)," rests "motionless in the angle formed by the leaves with the stem" of its favourite plant. These same larvae are, he states, extremely active during the heat of the day. As possibly bearing upon these habits the author remarks that "The hour immediately preceding and following upon sunrise is the time of the greatest activity of many Malayan animals, for both nocturnal and diurnal species are often then at work." At the same time, Mr. Annandale is careful to point out that nothing is "known as to the enemies and dangers to which this particular insect is exposed." [E. B. P.]
therefore fully exposed in the resting position to the attacks of insectivorous enemies. This could hardly fail to have an important influence on their postures and colouring. To the evidence lately adduced in favour of the selection by butterflies of appropriate surroundings for their concealment during repose, he might add the testimony of Mr. R. M. Christy, who observed a black and yellow *Papilio* choosing, after much fluttering, to settle on a twig of *Betula glandulosa* bearing withered leaves of a similar yellow colour. (Proc. Ent. Soc. Lond., 1885, p. ix.) There were some interesting records by Captain Clements, R.A.M.C., who observed that "*Papilio merope* ♂ almost invariably selects a broad-bladed grass, striped with brown and yellow, and, hanging pendent from its extremity with the wings folded, the upper ones being covered over and concealed by the lower, it cannot be seen until it is again startled into flight. Another butterfly, in this case the female, which selects a resting-place which effectually conceals it, is *Catopsilia florella*; this yellow insect has small round silvery spots surrounded by a narrow brown margin on its wings. When near a mango-tree, of which some few of the leaves are of a bright yellow colour, dotted with spots identical in colour, shape, and disposition with those above described, it invariably selects these leaves for settling on, and is then very difficult to detect." ("On a Collection of Sierra Leone Lepidoptera," by W. Schaus and W. G. Clements, London, 1893.) The last observation, he thought, afforded a very complete parallel with the case of *Eronia cleodora*; and the evidence collected from so many quarters appeared to be conclusive as to the prevalence, throughout a wide range of species, of this habit or faculty of selection.

The President, Mr. H. Rowland-Brown, Mr. G. C. Champion and other Fellows joined in the discussion.
Wednesday, March 21st, 1906.

Mr. F. Merrifield, President, in the Chair.

Election of Fellows.

The Rev. George A. Crawshay, M.A., of "Lowlands," Leighton-Buzzard; Mr. Hereward Dollman, of Hove House, Newton Grove, Bedford Park, W.; Mr. Edward Dukinfield Jones, of "Castro," Reigate; Dr. John Neville Keynes, M.A., D.Sc., of 6, Harvey Road, Cambridge; Mr. D. L. McCarrison, Indian Police Forces, Madras Club, Madras; and Mr. George E. Tryhane, of St. Ann’s, Trinidad, B.W.I., were elected Fellows of this Society.

Exhibits.

Dr. Dixey exhibited male and female examples of Pierines belonging to the genus *Eronia* with the closely-allied genera (or subgenera) *Nepheronia* and *Leuconeria*. He drew attention to the great diversity of aspect that obtained between different members of this group, especially the females, and showed that in many instances this was due to the fact that one or both sexes of the *Eronia* had been assimilated in aspect to a form or group of forms either known or suspected to be distasteful. He believed the association to be in most cases synaposematic (Müllerian) rather than pseudaposematic (Batesian); but it was perhaps possible that in *Eronia leda*, which possessed a cryptic under-side, we had a case of true mimicry. *Eronia cleodora*, Hüb., which was more closely related to *E. leda* than were any of the forms shown, was not a mimic; its sexes were similar to each other, and both male and female appeared to trust for protection to their cryptic under surface. The same was probably the case with the female of *E. leda*, which also seemed not to be a mimic; but the male in this instance, though to some extent cryptic beneath, was an excellent copy of another Pierine, viz. *Teracolus auxo*, Lac., or of its northern form *T. incredus*, Butl. On these grounds the presumption was that both *E. cleodora* and its congener *E. leda* were less distasteful than other members of the *Eronia* group, and it
seemed therefore possible that the mimicry by *E. leda* ♂ was Batesian, the female finding perhaps a more effective defence in the cryptic colouring of its under surface. In the remaining cases there was less reason to presume edibility, and the females had become powerfully affected by other protected forms of various affinities.

With respect to some of the "models," the evidence of the distasteful quality of the groups represented by *Tirumala limniace* and the two species of *Mylothris* was generally admitted to be strong. There appeared to be no direct evidence as to *Nyctitona medusa*, but it had the habits of a protected form; while *Huphina phryne* (nerissa) was found by Mr. Finn, as a result of many experiments, to be disliked by several insectivorous birds.

The species shown were as follows, a specimen of the "model" being in each case placed beside the form which resembled it:

  (♀ with brown upper wings.)

Mr. R. Adkin showed two specimens of *Emmelesia unifasciata* which had emerged in August last from pupae which had lain over since the autumn of 1900, thus having passed five seasons in the pupal stage. Some fifty larvae went to earth in the autumn of 1900, from which ten moths emerged in 1901, eleven in 1902, two in 1903, five in 1904, and the two examples exhibited in 1905.

Commenting on Mr. Adkin's remarks, Mr. A. H. Jones mentioned that he had observed in this species a three years' retardation.

*Paper.*

Dr. T. A. Chapman, M.D., exhibited a number of specimens from the Riviera, Sicily, etc., and read a paper on the "Progressive Melanism in the Riviera of *Hastula hyerana*."
A discussion followed on melanism and its causes, Mr. G. T. Porritt pointing out that in this case the tendency could hardly be attributed to carbon deposited from a smoky atmosphere, while it was a well-known fact that in some of the most marked cases of melanism observed in Yorkshire, that the dark forms of species such as *Acronycta mennyanthidis* were found in localities unaffected by smoke. Dr. F. A. Dixey suggested that melanism undoubtedly occurs as a “sport” in some creatures, and may under certain circumstances be selected. The President took the view that there are probably several entirely different and at present undetermined causes at work to produce the effect in question.

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**Wednesday, April 4th, 1906.**

Mr. C. O. Waterhouse, Vice-President, in the Chair.

**Election of Fellows.**

Mr. Leonard Doncaster, M.A., King's College, Cambridge; Major F. Winns Sampson, H.M. Travelling Commissioner; Senior Officers’ Mess, Old Calabar, Southern Nigeria; and Mr. Raleigh S. Smallman, Wressil Lodge, Wimbledon Common, S.W., were elected Fellows of the Society.

**Exhibits.**

Mr. H. St. J. Donisthorpe exhibited a specimen of the very rare ant *Formicoxenus nitidulus*, a ♀, found in a nest of *Formica rufa* at Weybridge during the present month. Mr. A. J. Chitty said he had taken a single ♀ of the species in the Blean Woods, Kent, and the Rev. F. D. Morice reported it common in Switzerland, where he had taken examples of all three sexes abundantly.

Mr. G. C. Champion showed a specimen of *Platypsyllus castoris*, Ritsema, a Coleopterous parasite of the beaver, from France, and suggested that perhaps it might be found on the beavers in the London gardens of the Zoological Society.
Mr. W. G. Sheldon exhibited several specimens of a Noctuid moth, described by Dr. H. Guard Knaggs, as *Agrotis helvetina* (Entomologist's Annual, 1872, p. 115). He had purchased them at the sale of the late Dr. Mason's collection, in which they were labelled as light varieties of *Noctua augur*, to which species he thought in fact that they should be referred.

Mr. A. H. Jones exhibited examples of butterflies taken by him last year in Majorca showing injury to the wings, caused in his opinion by the attacks of lizards. He remarked that a large proportion of the few butterflies met with in the island were mutilated, especially at the posterior part of the hind-wings. A *Gonepteryx cleopatra* and a *Pararge megara* had semicircular pieces removed, while another specimen of the latter showed that quite half the hind-wings had been removed as though cut by a pair of scissors.

Dr. G. B. Longstaff observed that these butterflies appeared to be much more irregularly treated than the species he had noticed to be similarly attacked in India, and Mr. W. G. Sheldon agreed with the exhibitor as to the cause of the damage, observing that it was unusual where he had collected to find insects attacked in this peculiar way where lizards did not exist.

The Rev. F. D. Morice mentioned that remarkable and apparently constant characters, both generic and specific, were to be found in the calcaria of Hymenoptera; and asked if any use was made of the corresponding structures for classifying and diagnosing insects of other Orders. He also referred to the theories of various writers on the functions of calcaria—*e.g.* Kirby and Spence regarded them as assisting insects to walk and climb, but he did not think that this was mainly, if at all, their function in the Hymenoptera, and had only actually seen them used for toilet purposes, *i.e.* to remove dust, pollen, etc. from other parts of the insects' bodies. It was well known that bees and wasps cleaned their antennae with the calcaria attached to their front tibiae. Females of many species belonging to almost every group of Hymenoptera possessed remarkably pectinated (interior) calcaria on the hind-legs. The development of this structure differed greatly in

different groups, but it did not seem to stand in any obvious relation to the habits of the insects (whether predaceous, pollen-gathering, parasitic, etc.). It was found alike in Bees, Wasps, Fossors, Chrysids, Saw-flies, and other groups; the common Hive-bee, which has no "calcaria" on the hind-legs, but in their place the well-known "pollen-basket," being a curious exception to the rule. He invited any information from the students of other Orders, as to the development of "calcaria," or analogous structures, among insects generally; and especially asked if any one present had noticed anything which could throw light on the question as to their functions.

Mr. C. O. Waterhouse said that similar spurs existed in the Trichoptera, though they did not assume such beautiful forms as in the Hymenoptera; but as to their uses, he was not aware that any observations had been published or made on the subject. Mr. G. C. Champion remarked that they were also well developed on the hind-legs of some Coleoptera, such as the Melandryadw of the genera Orchesia and Anisoxya. Commander J. J. Walker suggested that they are probably connected with the well-known jumping power of these beetles.

Wednesday, May 2nd, 1906.

Mr. F. Merrifield, President, in the Chair.

Obituary.

The decease was announced of M. Leon Fairmaire, the distinguished French entomologist, who died on April 1st, 1906, aged eighty-six years.

Exhibits.

Commander J. J. Walker showed fourteen examples of both sexes of Hystrichopsylla talpa, Curtis, the largest of the British fleas, taken in the nest of a field-mouse in a tuft of grass at Grange, near Gosport, Hants., on March 28th, last.

Mr. G. C. Champion exhibited living specimens of Apatc capucina, Deilus fugax, a Cryptocephalus (rugicollis), two species
of Anthaxia, etc., forwarded by Dr. T. A. Chapman from Ste. Maxime, South France.

Mr. F. B. Jennings brought for exhibition an example of the weevil Procas armillatus, F., taken near Dartford, Kent, on April 13th, last. This species appears to be extremely scarce in Britain, and with the exception of a single specimen taken near Chatham by Commander Walker, and exhibited by him at the meeting of the Society held March 18th, 1896, has not been recorded from this country for a considerable period.

Mr. M. Jacoby exhibited a box of beetles from New Guinea, including Aesernia meeki, Jac., A. costata, Jac., A. gestroi, Jac., and Cetonidae and Lucanidae from South Africa and Borneo.

Mr. H. St. J. Donisthorpe exhibited specimens of Hydrochus nitidicollias, Muls., a beetle not hitherto recorded in Britain, taken in the River Meavy at Yelverton, Devon, in April.

The Rev. F. D. Morice exhibited lantern-slide photographs (from nature) of the Q calcaria postica in Hymenoptera belonging to divers groups, mostly Aculeates, but including also representatives of the Chrysids, Ichneumonids, and Sawflies.

He submitted that, in all the examples shown, the structure of the calcaria themselves (and also of the parts adjacent to them) clearly indicated that their main function was that of an elaborately-constructed instrument for toilet purposes. It was well known that the anterior calcare was used as a sort of strigil to clean the antennae; but little attention seemed to have been paid to the question how the other calcaria were used, though various suggestions had been offered, e.g. that they assisted the insects in progression, or in "climbing" (Burmeister), or in "digging their burrows" (Kirby and Spence). He did not think that the structure and position of the calcaria made any of these suggestions probable; and added that climbing was seldom if ever practised by Hymenoptera, and that parasitic Aculeates, Ichneumonids, Sawflies, etc., did not dig. Practically all the Hymenoptera, however, visited flowers; and might thus become dusted with the pollen, which would require to be removed from time to time; and the theory that this was the real function of the calcaria in all cases, seemed to explain satisfactorily all the
structural phenomena presented by them (e. g. serrated inner margins, pectiniform rows of spines and bristles, brush-like pilose fascicules, etc.). He should be glad to hear of any observations that might have been made as to the structure and functions of calcaria in insects of other orders, having examined them himself only in the Hymenoptera.

Dr. F. A. Dixey exhibited male and female specimens of the African Pierines Belenois thysa, Hopff, and Mylothris agathina, Cram. He drew special attention to the fact that the resemblance between these two species, which Mr. Trimen speaks of as “deceptively close in both sexes,” applies mainly to the dry-season phase of the Belenois and not to the wet. This, he observed, was well illustrated by the exhibit, which included wet and dry-season examples of both sexes of B. thysa; M. agathina showing no seasonal change. The resemblance borne by the male Belenois to the male Mylothris was much more striking in the dry-season specimen of the former than in the wet; and while the dry-season female B. thysa was an excellent copy of the female M. agathina, it was seen that the usual wet-season form of the same sex did not mimic the Mylothris at all. These facts appeared to be significant in relation to the comparative scarcity of insect food during the dry or winter months, and the consequent greater liability of dry-season forms to the attacks of enemies. The higher need for protection thus experienced by the dry-season forms had been clearly shown by Professor Poulton, who had found in the principle referred to an explanation of the cryptic garb assumed in the dry season by several species of Precis (Trans. Ent. Soc. Lond., 1902, pp. 432–443). Other examples of the same phenomenon had been subsequently adduced by the speaker, who had also brought evidence to show that it was especially characteristic of the female sex (Ibid., 1903, pp. 155–158, Pl. vii.). But the present instance differed from all these in the fact that the protection enjoyed by the dry-season phase took the form not of cryptic coloration but of mimicry. The species of Mylothris were held on good grounds to be distasteful, and Mr. G. A. K. Marshall had expressed the opinion that B. thysa was a Batesian mimic. This might be so, but the speaker rather inclined to the view
that the resemblance was synaposematic. In either case the difference between the seasonal phases with respect to their approach to the distasteful model was undoubtedly significant, and he thought it would not be easy to find an explanation better fitting the facts than that just offered.

Papers.

Mr. Edward Meyrick, B.A., F.R.S., contributed a paper 'On the Genus Imma, Walk. (= Tortricomorpha, Feld.).'

Mr. H. Eltringham, M.A., F.Z.S., contributed the following paper on "The Late Professor Packard's Paper on the Markings of Organisms." In the absence of the author, Professor E. B. Poulton, F.R.S., explained the drift of the paper, and expressed his agreement with the main lines of argument:—

The late Professor A. T. Packard read a paper before the American Philosophical Society on December 2nd, 1904, in which he criticised at some length the Bates-Müller hypothesis of mimicry. The paper is the more welcome owing to the comparative scarcity of literature dealing with the subject from an antagonistic point of view. Since the promulgation of the presently accepted theories of mimicry and protective resemblance the subject has made very considerable progress. Whilst, however, the strongest supporters of the Bates-Müller theories have lost no opportunity of publishing facts corroborative of the general principles which they uphold, the opponents of these views have for the most part contented themselves with a kind of passive disagreement, usually treating the whole subject with a species of airy contempt, sometimes putting forward somewhat vaguely formulated objections, but in no case, so far as I have been able to ascertain, bringing forward any really satisfactory hypothesis on which to base an explanation of those phenomena for which the Bates-Müller theories seek to account. Nor does the paper in question remove this latter defect. The main conclusion is that the instances of resemblance which have been noted amongst organisms are due, not to any tendency of an unprotected species to resemble for its own benefit, a protected form, but to the biological environment of the species concerned. "Sunlight or excessive contrasts of light and shade
combined, moisture and dryness, differences in environment or other climatic causes as affecting the amount and distribution of pigment." It is as a student of the so-called mimicry in butterflies endeavouring to be as impartial as a deep interest in the subject will allow, that I wish to deal with Professor Packard's paper, and the object of the following remarks is to show that the difficulties in the way of accepting that author's arguments against the Bates-Müller theories are at least as great as those which beset their would-be upholders, and that whilst the paper is deserving of the greatest attention as being one of the few lengthy and carefully compiled criticisms of what Dr. Sharp describes as the "fashionable theories," it at the same time falls short of the one essential of providing a really satisfactory alternative.

In his introductory remarks Professor Packard compares the observed cases of mimicry between butterflies with the resemblance of a zebra to an antelope or that of the "spotted leopard of the Old World" to the "jaguar and ocelot of the New World, their habits and environment being the same." But surely the cases are not analogous. No one has ever attributed the resemblance between a leopard and a jaguar to the pattern of either animal being protective by reason of its resemblance to the other. The spotted appearance of a leopard and an ocelot is no doubt a case of what Professor Poulton has described as "syncryptic" coloration, each animal being concealed by resembling the same thing, and such a case is of the same nature as the remarkable resemblance of the under-side of many butterflies to dead leaves. The only difference being that in the case of the butterflies the syncryptic coloration is protective, whereas in the leopard and similar animals it is probably aggressive. Neither form of coloration comes under the head of Batesian or Müllerian resemblance. Following on these remarks, we are told that "what has been understood as protective mimicry, in the sense of Bates and of Müller and their followers, has a precarious basis." But the resemblance of an animal to its inanimate surroundings is not at all "what has been understood as protective mimicry, in the sense of Bates and of Müller and their followers." Professor Packard further
maintains that the Bates-Müller hypotheses are seriously undermined by the fact that the wings of insects were, as early as the Carboniferous period, striped or barred and spotted long before birds ever appeared." I cannot however see that this affects the Bates-Müller hypotheses at all. Such stripes, bars and spots may for all we know, have been cryptic or epigamic, but this would not preclude the ultimate development either of sematic or pseudosematic coloration.

It will be as well here to recall the fact that Professor Packard entirely misunderstood what is generally known as "Müller's hypothesis." Put very shortly, Müller's suggestion was that butterflies belonging to different genera, both distasteful, might come to resemble one another so that the general sacrifice to the inexperience of insectivorous enemies would be divided between them.

This theory was published in 1879. Nine years previously Müller had made a tentative suggestion that the resemblance between protected genera had been brought about by sexual selection. It is this theory which Darwin described as "rather too speculative to be introduced into my book," and it is also the theory which Professor Packard regarded as the accepted Mullerian hypothesis. The error has been very fully pointed out by Professor Meldola in a letter to "Nature" published in November 1905, and materially affects the value of Professor Packard's criticisms.

Mr. Abbot H. Thayer's view that the colours of animals are such as to cause the creature to cease to appear at all, appears to be merely a universal application of the theory of cryptic coloration. Instances of cryptic coloration are too common to admit of any doubt whatever, but to maintain that every animal is coloured for concealment appears to me to be too much of a generalization. Probably few would deny that warning colours are exhibited by many stinging insects, distasteful caterpillars and other offensive creatures, to take only the insects alone. Mammals and reptiles, however, are also known to exhibit warning colours, as for instance the skunk with its white tail, the coral snake, and certain brightly coloured frogs described in Mr. Belt's "Naturalist in Nicaragua." The warning colours exhibited by certain caterpillars have
formed the subject of much experiment by well-known investigators, and all are agreed that insect-eating animals refuse those larvae which possess conspicuous coloration.

Professor Packard next proceeds to emphasize the paucity of evidence on which rests the theory that insectivorous birds are the principal agents of natural selection in Lepidoptera. Here I feel myself bound to agree that the recorded instances of butterflies forming the staple food of birds are few and far between. It would at first sight appear that if birds are really the principal cause of modification in the markings of butterflies' wings there ought to be no necessity for the supporters of the Bates-Müller theories to be obliged to seek out instances of birds eating butterflies. It should be generally recognized that birds do actually destroy butterflies in large numbers, but on the other hand most experienced collectors seem agreed that the sight of a bird even chasing a butterfly is of rare occurrence. One point, however, is frequently overlooked alike by the supporters and opponents of the Bates-Müller theories, viz:—that it is not to be expected that any of the full-grown and experienced birds will be frequently observed catching butterflies, since they have already learned to avoid the distasteful species and incidentally their imitators. Only the young birds will attack and experiment with distasteful and edible kinds alike, and since on the one hand, young birds are notably retiring and inconspicuous and furthermore will speedily learn that butterflies are unprofitable prey, it is not to be wondered at that birds are not universally observed to be butterfly eaters.

Many common occurrences in nature are exceedingly difficult to observe, and it would seem at least possible that the destruction of butterflies by young birds is carried on to a far greater extent than would appear from casual observation. The evidence adduced by Professor Packard is to some extent contradictory, and whilst some of the observers assert that they have never seen butterflies attacked by birds, others again mention numerous cases of this form of destruction. Instances are given by butterflies being eaten by birds in North America, India, Ceylon, Burmah, Natal, etc., but it must be acknowledged that the evidence on this head, and
upon which undoubtedly rest, to a great extent, the Bates-Müller theories, is by no means so complete as is desirable for their thorough establishment.

Professor Packard then proceeds to discuss the case of *Anosia plexippus*, which is usually considered to be a distasteful species mimicked by *Limenitis disippus*. Evidence of the edibility or otherwise of *Limenitis* is wanting, but judging by the abundance of individuals and slow flight, it may be regarded as a protected genus. As regards *Anosia plexippus*, the evidence adduced certainly goes to show that the insect is distasteful, since in one case the insect was caught but not eaten, and in the second was refused with apparent signs of disgust after close inspection. The statement further adduced that *Limenitis disippus* has never been seen to be attacked, goes to confirm the conclusion that it is also inedible.

Professor Packard then proceeds to give the observations of Mr. Finn given in his "Contributions to the Theory of Warning Colours and Mimicry." Little need be said here on the subject of these experiments, except to quote Mr. Finn's final conclusions: "That many, probably most, species (of birds) dislike, if not intensely, at any rate in comparison with other butterflies the 'warningly coloured' *Danainx, Acrax violx, Delias eucharis* and *Papilio aristolochia*; of these the last being the most distasteful, and the *Danainx* the least so."

In the paper under discussion considerable space is devoted to enumerating instances of birds eating butterflies both under natural conditions and in captivity, and the general impression to be gained from the expressed opinions of the various authorities quoted may be summed up in the statement that whilst some birds in the wild state, and many in captivity, show a marked appetite for butterflies, observations of instances of the destruction of the latter by the former are of rare occurrence.

It should not be however forgotten that where evidence of such destruction has been systematically sought it has been found to be plentiful, and I would refer those interested to the very extensive work in this direction which has been carried out by Mr. G. A. K. Marshall in South Africa, a full description of which has been given in the joint communic-
tion of that author and Professor Poulton, and published in the Transactions of this Society for 1902.

There is, however, one aspect of the matter which the writer does not remember to have been previously put forward, and that is the possible value of the force of example amongst birds. It is well known that young birds are to some extent trained by the example of their parents in many matters which make for their ultimate success in the battle for existence. They may and probably do indulge in much experimental tasting, but the extent of such action may to a great extent be curtailed by the example of the parents in selecting more satisfactory food than butterflies in their present condition afford. Such a state of affairs would minimize the present, or in some cases the local destruction of butterflies by birds, and consequently also the number of observed cases of such destruction, but it would not preclude the possibility that a much more extensive process of selection took place amongst butterflies in earlier times. In other words the balance of nature is now maintained by other and various agencies acting in concert with the now much-reduced influence of insectivorous birds, and we are present now only to see a state of affairs brought about by agencies which have become considerably modified in their relative influences.

It will probably be immediately pointed out that if the selective influence of birds is not as great as ever it was the well-known tendency of reversion to ancestral forms would tend to do away with mimicry, and that only by constant pressure of selective forces can mimetic resemblance be maintained. But is there any evidence that mimicry amongst butterflies is at present more extensive and complete than it has ever been before? Have we any right to say that all cases of imperfect mimicry are in process of being perfected and not undergoing reversion? I have never been satisfied that the white-winged form of Hypolimnas misippus is really a mimic of the alcippus variety of Danais chrysippus, extremely attractive as the suggestion undoubtedly is. One cannot forget that the male misippus has large white patches, and the lack of geographical coincidence between alcippus and misippus is much against the mimetic theory. The alcippus
form may be also a reversion, or it may be, as suggested by Professor Poulton, an effort towards more conspicuous coloration. If such be the case, we have here an instance of accidental resemblance, a phenomenon which I cannot but believe does occasionally occur. Such a suggestion will probably be looked upon with disfavour by keen supporters of Bates's hypothesis, but I do not see that that hypothesis loses anything by the admission that every case of resemblance is not necessarily true mimicry. Many other cases of imperfect resemblance might be cited which can just as easily be regarded as instances of partial reversion as of incomplete development. I do not necessarily insist on the theory that birds have partially ceased to be a selective force acting on butterflies, but I do suggest that even if it be proved that they are not so now, it by no means follows that they never were.

It may be further objected that if the selective force of birds is no longer as strong as it was, what influence maintains those accurate cases of mimicry with which we are all familiar? To this one may reply that we are ignorant of the relative power of the forces which guide development. So long as existence depended upon favourable variation, sexual selection may have been too weak to prevent such variation. Sexual selection may, however, be sufficient in some species to maintain facies which have been perfected through long periods of evolution. Such suggestions are merely speculative, but they may serve to remind those who would lay down laws for mimetic development, how complicated both in their nature and in their effect, are the influences which guide the course of evolution.

In discussing the Batesian and Müllerian theories, Prof. Packard's paper lays much stress on the explanation that resemblance between butterflies is due to convergence brought about by similarity in their surroundings. Thus we read—"From the facts regarding these local varieties thus stated by Bates, we seem warranted in ascribing the mimetic resemblance to convergence, or exposure to the same conditions of light, heat, moisture, etc., affecting all the individuals of a variety simultaneously rather than to what is vaguely called
(

And

natural selection."

xliv

)

again — " The colour and markings

of animals in general are primarily due to the action of light

and the colour

To

environment or background.

of the

sup-

pose that in the case of butterflies alone the colours of the

mimics are due to the attacks of bii'ds, whereas remarkably
few butterflies, as we have seen, are ever eaten by them, is a
cause so inadequate, so limited in its scope and so one-sided,
that it is no wonder the hypothesis has so many opponents."
In these observations, we seem again to have the idea of

and

climatic influence,
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Poulton in his paper read

March 1898

— " There

is

something attractive and plausible in the suggestion that the
strong mutual resemblance within a group of butterflies of
different genera

and sub-families, inhabiting a single

are due to the direct

action

of peculiar

local

locality,

physical

or

chemical influences
iveness

when

it is

but the suggestion loses all its attract;
applied to the resemblance between a spider

and an ant or a moth and a wasp, and yet few could bring
themselves to believe that the resemblances which are here
contrasted have been built up by two entirely different sets
of forces."
In another part of the same paper, Professor
Poulton points out the very difl^erent conditions under which
the larval stages of mimetic insects undergo their develop-

ment. Thus the larva of the drone fly lives on putrefying
animal matter, " a food as different as possible from that provided for the larval bee," and

we

are reminded that "

the imago emerges from the pupa and

when

expanded wings
have dried, nothing that it will eat or endure henceforward
produces any further effect upon its colours or patterns.
Hence identity of food and condition during the final stage
its

cannot be of any assistance to the interpretation of mimicry."
Pi'ofessor

Packard further proceeds to point out that bright

colours are not invariably associated with a nauseous taste or
smell, but surely a negative fact of this

way

kind does not in any

invalidate the theory of warning colours.

The

fact that

certain nauseous insects have not developed warning colours

does not appear to show that the bright colours of other

nauseous insects are not of a warning nature, neither does the


fact that certain inedible moths have no mimics materially affect the question.

There is fairly conclusive evidence that inedible species of butterflies adopt for the most part a slow, negligent form of flight. This habit, which has probably arisen through immunity from pursuit, also serves to display those colours which are supposed to be of a warning nature. It is a remarkable fact that mimetic species, though belonging to genera which ordinarily fly quickly, also exhibit the same carelessness of pursuit. This latter fact is referred to in Professor Packard's paper, and it is even suggested that climatic or local causes may be sufficient to account for a change in the mode of flight. I cannot but think that such a suggestion is carrying the climatic theory to a somewhat unwarrantable length. We are next reminded of Eisig's suggestion that "those bright colours of animals which have hitherto been regarded as of warning significance, are merely the substance or secretions which confer the unpleasant taste, and that therefore Wallace's older interpretation is unnecessary and, in fact, erroneous." Now we have already been told that the existence of very inconspicuous animals of a highly distasteful nature is an argument against the theory of warning colours, and yet in the next breath a theory is quoted which to be adequately supported would require that these highly distasteful insects should also be highly coloured.

At the end of the next section the author discusses the case of the brightly coloured Nicaraguan frog which I mentioned in the earlier portion of my remarks. Whilst allowing that the frog is inedible and that its gay colours have taught the birds to avoid it, it is maintained that the cause of the bright colours has been exposure to the bright sunlight and consequent excessive pigmentation. On this supposition the bright colours would have been developed just the same had the creature been of an edible species, except that such colours would have soon resulted in the animal's entire extinction. It is therefore merely accident that the bright colours and inedible qualities co-exist. I am prepared to submit that in one or two isolated cases such an accident might be possible; for the sake of argument I would even go so far as to allow that in the case of
the frog, the co-existence of bright colours and inedibility is accidental, or the result of climatic conditions, or even that the inedible qualities are the *sources* of the bright colouring. Then for the sake of further argument let us suppose that all such cases have arisen from one of these causes, and we are faced with the difficulty that *Papilio meropae*, for instance, can produce from one batch of eggs the typical male, and the *trophonius*, *cenea*, and the black and white forms of female, all entirely different in appearance, the females not resembling the males in the least, and each closely resembling a common inedible Danaid, all of which surprising and varied results are achieved by either accident, similar climatic conditions, or distasteful pigments of the existence of which there is no evidence. I must confess that I find it harder to believe all this than that birds either do or once did exercise a powerful selective influence over butterflies. The question of snakes is next considered. In Brazil, we are told that eight species of harmless snakes mimic the same number of species of *Elaps*. Then, as if to counterbalance this unfortunate evidence, it is pointed out that three harmless genera mimic the poisonous genera and *the latter prey on the former*, so that they are not protected except from birds. But surely whilst being protected from birds and mammals, they are protected from their poisonous enemies by their resemblance to them, unless the poisonous ones prey on each other. The case is a complicated one, and appears to exhibit protective and aggressive resemblance respectively in the two genera, but brought about by the same means. The balance of nature has been reduced to a fine point.

In the next section the author cites a case in which a brown *Empusa*, a *Danais*, and a *Hypolimnas*, all much alike, are observed to fly together. Mr. G. F. Mathew maintains that all these three genera are avoided by birds, and the case is given as one to which the Müllerian theory is therefore inapplicable. I cannot help thinking, however, that the case is one to which the Müllerian theory precisely applies, and the paragraph only goes to confirm Professor Meldola's contention that Professor Packard did not understand the Müllerian hypothesis at all,
The remainder of the paper is devoted to an able and interesting discussion on the origin of the markings of mammals, the effect of the blending of colours when the animals are in motion, and other matters. Deeply interesting as this portion is, it hardly bears on the case of butterfly mimicry. Animals which develop their external attributes of colour and markings under the life-long influence of light and shade, colours which are for the most part cryptic, though presumably developed by natural selection, cannot be compared to creatures which reach full colour and pattern development in an hour or so after emerging from the pupa, and which moreover can produce such diverse forms, as for instance the male and female Hypolimnas misippus, from the same batch of larvae fed and pupated under the same physical conditions.

In conclusion, I trust it will not appear to be an act of presumption on my part to attempt to criticise the work of the eminent naturalist whose loss we must all deplore. I am well aware that an amateur naturalist like myself has not the opportunity of making the extensive and careful researches which have made the writings of our prominent scientists such magnificent records of devotion to their work.

The remarks I have here ventured to make are merely the expression of the thoughts which have occurred to me in a humble endeavour to arrive at sound conclusions on a most complicated, difficult, and deeply interesting subject.

For some years I have been making a special study of the most interesting forms of mimetic resemblance, more particularly amongst the African Rhopalocera, and I have invariably been much touched by the ready assistance which has been afforded me even by those prominent workers with whom I am acquainted only by correspondence, and it will always be my desire to reciprocate in every way which lies in my power. It is therefore with these thoughts in my mind that I should wish my remarks on Professor Packard's paper to be regarded in the light of a friendly discussion on a subject of mutual interest, and not in any way a criticism of the personal views of a naturalist whose work must ever command the respect, both of those whose attainments entitle them to rank with him in eminence, and also of those who, like
myself, are of the humbler, though I trust not less faithful workers.

Finally, I would gratefully acknowledge the help I have received from Professor Poulton, who has very kindly furnished me with references and data which have been of great assistance in the preparation of the foregoing remarks.

Wednesday, June 6th, 1906.

Mr. F. Merrifield, President, in the chair.

Obituary.
The decease of Mrs. Elizabeth Brightwen was announced.

Exhibitions.
Mr. H. St. J. Donisthorpe exhibited specimens of Lomechusa strumosa, F., taken with Formica sanguinea at Woking on May 26 and 29 last. Only two other British examples are known, one taken by Sir Hans Sloane on Hampstead Heath in 1710, the other found by Dr. Leach while travelling in the mail-coach between Gloucester and Cheltenham, and these are included in the Natural History Museum collection. Since 1866 it has been omitted from our lists, where it was last included by Crotch among the doubtful species.

Dr. K. Jordan said that the species was not uncommon in Central Germany, and that he had met with it in some numbers at Hildesheim.

Mr. H. J. Turner showed a case containing a large number of the life-histories of Coleophorids, notes on which had appeared in the Society’s “Proceedings,” or in the “Entomological Record.” He also showed: — (a) Coleophora fusceolinella. Birch leaf showing (1) larval mines, (2) a wintering curved larval case (dark) with early spring addition (light), (3) the newly-cut case not yet completed and still attached to the mine, (4) a completed new case on a fresh mine. (b) C. alticolella. Cases, partly of white secreted substance and partly of the seed-husks of Juncus tamprocarpus. (c) C. cespititella. Cases on Juncus conglomeratus, the smaller white cases autumn, the larger stained cases the winter cases.
Mr. A. H. Jones showed on behalf of Mr. Henry Lupton a few butterflies from Majorca, captured between April 8 and April 20 last. Comparing the specimens with those of the same species from Corsica, also exhibited, they appeared to be smaller; the Pararge mejorena approached the form tigelius, the Ceneonympha pamphilus differed somewhat in the under-side being darker. Only one moth was seen, MacroGLOSSA stellatarum. So far under twenty species of butterflies have been recorded from the Balearic Islands.

Mr. Selwyn Image showed:— (a) A specimen of Crambus ericellus, Hb., taken at Loughton, Essex, August 8, 1899. Not previously recorded from further south than Cumberland; (b) two specimens of Vola confusalis, H.S. ab. columbina, Image, taken in Epping Forest, May 22, 1906. The first examples of this aberration were taken by him at the same locality May 22, 1905, and recorded in the Ent. Rec. July 1905, p. 188; and (c) a specimen of Peronea cristana, F., the ground colour of upper-wings abnormally black, even more intensely black than in the ab. nigrana, Clark. Taken in Epping Forest August 19, 1905.

Mr. J. H. Keys sent for exhibition the type of Spathorhamphus corsicus, Marshall (described and figured in the "Bull. Soc. Ent. Franc., 1902," pp. 210–212), from Vizzavona, Corsica. This fine Anthribid was supposed by some Coleopterists to have been an accidental importation into the mountainous regions of the island, but was no doubt endemic.

Mr. G. C. Champion remarked that he had taken Platyrhinus latirostris in numbers at the same locality, in the beech and pine forests (Pinus laricio) along the line of railway, above the tunnel. Dr. Karl Jordan, of Tring, the principal authority on the Anthribidae at the present time, reports on the genus as follows:—

Spathorhamphus, Marshall (1902).

♀. Close to Eurymycter, Leconte (1876), from North America. Antenna as thick as in that genus, but shorter, the club longer and more compressed, segment 8 less than half the length of 9, 10 one-third shorter than 11, being longer than in Eurymycter. Rostrum broader at apex, less distinctly grooved longitudinally on upper-side, the mesial carina more elevate.
There are several Old World species (Africa and Japan) standing under Tropideres which come also close to Spalthor-rhamphus, but have thinner antennae.

Dr. F. A. Dixey exhibited specimens of eight species of Pierine butterflies, and remarked on them as follows:—

"It is well known that many kinds of butterflies, especially Pierines, are in the habit of congregating in large numbers on damp patches of soil for the sake of absorbing the moisture. This phenomenon occurs to some extent in temperate regions, but it is in tropical and sub-tropical districts of both the old and the new world that the size and frequency of such assemblages have attracted most attention. Mr. Distant ('Rhopalocera Malayana,' 1882–1886, pp. 284, 285) has brought together several instances from the experience of various travellers, and many others are on record. By the kindness of Professor Poulton I am able to show representative examples of 153 specimens captured under these conditions by Mr. C. A. Wiggins, a well-known official of the British East African Protectorate, to whom Science is indebted for the fine collection of Rhopalocera from Uganda lately described by Mr. Neave ('Novitat. Zoolog.,' vol. XI, 1904). Mr. Wiggins's note to the series represented by the exhibit is as follows:—

"'All these (over 150) were caught in one sweep of the net over a pool within a few yards of the Ripon Falls, Jinja, Lake Victoria Nyanza, by C. A. Wiggins, on Feb. 2, 1906.'"

"The catch consists entirely of Pierines of the two genera Pinacopteryx and Belenois. Eight species are represented, the numbers being as follows:—

<table>
<thead>
<tr>
<th>Species</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pinacopteryx vidua,</td>
<td>104</td>
</tr>
<tr>
<td>Butl.</td>
<td></td>
</tr>
<tr>
<td>&quot; piga, Boisd. (northern form)</td>
<td>17</td>
</tr>
<tr>
<td>&quot; liliana, Grose Smith</td>
<td></td>
</tr>
<tr>
<td>Belenois solitarius,</td>
<td>1</td>
</tr>
<tr>
<td>Butl.</td>
<td></td>
</tr>
<tr>
<td>&quot; subida, Feld. (form instabilis Butl.)</td>
<td>8</td>
</tr>
<tr>
<td>&quot; formosa, Butl.</td>
<td>12</td>
</tr>
<tr>
<td>&quot; gidica, Godt.</td>
<td>1</td>
</tr>
<tr>
<td>&quot; severina, Cram. (form boquensis, Feld.)</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>153</td>
</tr>
</tbody>
</table>

"Every one of the 153 specimens is a male. The B. gidica is of the 'wet-season' form, the others are all more or less 'dry.'
The great preponderance of *P. vidua* is noticeable, as is also the generally good condition of most of the specimens making up the somewhat significant figure of the total."

In answer to questions, Dr. Dixey said that he had no further information from Mr. Wiggins than that which he had already given. He should be disposed to infer from the words, "caught in one sweep of the net over a pool," that the butterflies were disturbed while drinking, and the net dashed among them just as they were taking wing.*

Professor E. B. Poulton, F.R.S., communicated some notes on Natal butterflies which he had received from Mr. Geo. H. Burn, of Weenen. This naturalist, writing January 19, 1905, stated that he had that week returned from a trip down the Tugela Valley, during which he had spent about ten days in the valley of its tributary, the Umhlungane River, about thirty-five miles from Weenen. "While there," he wrote, "I obtained many good specimens, amongst others, *Iolus pallene, aphnoides, bowkeri* and *sidus; Aphnus [Spindasis] masilikazi, ella, phanes* and *[Choroselas] pseudozeritis; Caenpra hebe* and *Aciocerces amanga.* I was particularly pleased to get *aphnoides,* which is very rare. About ten years ago I captured a few about thirty miles higher up the Tugela. This is the first time I have seen *C. hebe* in life. I fancy it must be very local. All the species I have mentioned, and many other butterflies, were taken off the flowers of the Umechehau tree or shrub, growing along the banks of the spruit. These flowers seem to attract insects of all descriptions, as well as butterflies and moths. Among Coleoptera, the *Lycidae* were very numerous on it. The flowers of the Umandane tree similarly attract all sorts of insects in this neighbourhood during September and October. *Aphnoides* would seem to differ from others of its group, inasmuch as it appears always to settle on a flower.

* The following passages show the possibility of such an explanation:—
"Large numbers of white butterflies may be seen quenching their thirst on the damp ground, and flying up when disturbed, in quite a startling cloud" (MS. note by Dr. Thwaites in Moore's "Lepidoptera of Ceylon," vol. I, 1880–81, p. 117). Mr. E. L. Arnold (quoted in Distant, *loc. cit.*) describes a "countless host of thirsty butterflies, collected from the forest all round to drink . . ., crowded so close by the water that the sand could scarcely be seen," and when disturbed, "springing into the air in a huge cloud." [F. A. D.]
in the middle and most inaccessible part of the bush, whereas *pallene* and other species apparently prefer the outer branches.

"I am inclined to think, from a good many years of observation, that the anal appendages (at any rate in the case of the *Iolaeus* and *Aphænæus* groups) of many butterflies are intended to deceive their enemies by resembling antennæ. I have repeatedly come across fresh specimens with that part of the hind-wings injured, in many cases apparently bitten completely out, and I incline to the belief that *Mantidae* are the chief enemies of butterflies in the imago stage. A few days ago I noticed a very large green *Mantis* 'stalking' an *I. pallene*. The *Mantis* apparently was trying to edge round to the part where the tails were. I watched it for some time, when unfortunately a wasp settled on the flower and frightened the *pallene* away.'"

Professor Poulton observed that it was extremely interesting thus to gain further independent evidence in favour of the interpretation of the "tails" of *Lycaenidae* as antennalike directive structures adapted to divert the attacks of an enemy from a vital to a non-vital part of their prey. It is difficult to resist the conclusion that this interpretation is correct when it has been independently reached by so many naturalists:—Dr. Arnold and Dr. Forsström (quoted by Kirby and Spence in 1817 as Dr. G. B. Longstaff has recently pointed out*), Dr. R. C. L. Perkins, Dr. Richard Evans, Mr. Champion B. Russell, Mr. E. A. Floyer, Dr. Longstaff, and lastly by the excellent observer who is quoted on the present occasion. (See Trans. Ent. Soc., Lond., 1902, pp. 373, 374; 1906, pp. 106, 107.)

Professor E. B. Poulton also exhibited the four individuals of *Euralia mima*, Trim., and the four of *E. wahlbergi*, Wallgr., captured by Mr. G. A. K. Marshall on the Umbilo River, near Malvern, Natal, on June 28, 1897, as described in Trans. Ent. Soc. Lond., 1902, pp. 491, 492. He showed their respective

* Dr. Longstaff's recent note (Trans. Ent. Soc. Lond., 1906, pp. 106, 107) referring to my discussion of the tails of *Lycaenids* (l. c., 1902, p. 374), supplies a good example of the liability to error in quoting an unusual name. In my account the name Forsström is rendered Forströma, in Dr. Longstaff's Forström. The generic name *Hesperia*, which at first puzzled Dr. Longstaff in the first edition of Kirby and Spence (1817) is replaced by *Thecla* in the fifth (1828, vol. ii, p. 251). *Hesperia* persists in the third edition (1823, vol. ii, p. 254). I have not seen the fourth. [E.B.P.]
Danaine models *Amauris echeria*, Boisd., and *A. niavius*, L., form *dominicanus*, Trim., and explained the reasons why Mr. Marshall considered the mimics to be two forms of a single species (*l.c.* p. 491). Professor Poulton had written to Mr. G. F. Leigh, advising him to make the attempt to breed from one form or the other, and thus settle the question. Mr. Leigh had done his best but failed in this attempt. He had however made special observations on the two forms which are an interesting addition to our knowledge of them. The differences revealed in the course of this inquiry had convinced Mr. Leigh that the two forms are entirely distinct species. Professor Poulton was by no means convinced of the soundness of this conclusion. The extraordinary facts now recognized in the genus *Precis* show us that differences of instinctive behaviour are not necessarily evidence of specific distinction. Indeed every difference relied upon by Mr. Leigh breaks down when tried by the test of this searching comparison. Professor Poulton much hoped that the food-plant would be discovered, eggs obtained, and the only convincing evidence made available. The following paper shows that Mr. Leigh is intimately acquainted with these forms in Natal, and the Society may anticipate that his energy and powers of observation will ultimately lead to success in the decision of this difficult and interesting question.

**Notes on Euralia wahlbergi**, Wallgr., and *E. mima*, Trim.,

by G. F. Leigh, F.E.S.

Having read (Trans. Ent. Soc. Lond. 1902, pp. 491, 492) that these two butterflies are thought to form but a single species, I have during this season (1904-5) been closely observing their habits. I now offer full particulars of what I have seen,—particulars which in my opinion support the conclusion that the two forms are entirely distinct species.

It has been inferred that they are probably the same species because "they have been taken *in coitu* several times" (*l.c.*, p. 491). This I do not regard as very strong evidence; for I have taken *Eromia cleodora* and *E. leda, in coitu*, also *Neptis agatha* and *Eurytela hiarbas*. The only intermediate specimen I know of here may well be a hybrid result of such pairing;
for the characters of both *mima* and *wahlbergi* are represented upon it. The other reason given is “that the two forms are always found together wherever they are met with in any number” (*l.c.*, p. 491). This may be a fact, but it is also true that they fly just as often with *Planema esbria*, *Planema aganice*, *Amauris echeria*, and *Papilio brasidas*, *E. mima* very much resembling the latter when on the wing. I give below a summary of the habits of these two forms so far as I have observed them in Natal. It will be seen at a glance that they are widely different.

### *E. wahlbergi.*

To be found from middle of December and during January and part of February.*

Imago emerges from pupa between 9.30 and 11.30 a.m.

Always rests upon upper surface of leaves or the ground with wings folded except when drying after emergence, when they are continually opened and shut like those of a Saturnid moth.

Flight slow and hovering, and when disturbed the insect usually returns after a time to the same spot, often to the same leaf.

Very much commoner than *E. mima*: at least ten of *wahlbergi* may be seen to one of *mima*.

### *E. mima.*

To be found about first week in January and during February.

Emerges between 2 and 4 p.m., never in the morning.

Always rests upon the underside of the leaf with wings shut and hanging down, except when drying which usually occurs upon the sand or very low herbage.

Flight very much quicker than *E. wahlbergi*, and if disturbed or missed the butterfly flies high and does not return to the same place.

One of the rare species here. I should consider ten to twelve a probable estimate of the number which might be seen in an average season.

I think there is sufficient difference in the habits set forth above to indicate that we are dealing with distinct species, but a few additional remarks may not be out of place. I have

* Mr. Leigh writes on May 26, 1906:—“I have seen two or three *Euralia wahlbergi* this month; last year I saw none after February and early March. The specimens now seen are very much larger than the earlier brood, but not so common.” [E. B. P.]
often seen and captured specimens of *wahlbergi* no larger than *E. mima*, but I have never seen, or heard of any of the latter that in any way approach the size of a very large proportion of the former. *Wahlbergi* may also be seen in gardens and sometimes even in the public roads, while *mima* is very rarely found except in shady glades in the bush.

The following is a precise record of the examples of both species I have seen, captured, or heard of during December 1904 and January 1905, in Stella Bush, Durban.

1904.
December 16 Morning: captured 1 *E. wahlbergi*.
   " 17 " " 1 and saw 2 ditto.
   " 18 " " pair *wahlbergi* in cop.*
   " 19 " " 2. Afternoon saw one.
   " 20 " " 1. Heard of 3 specimens being captured in garden in Musgrave Road, Durban.

December 21 Saw 3 specimens in morning.
   " 22 Captured 2 specimens in morning just emerged.
   " 23 " " 1 specimen in afternoon, damaged.
   " 24, 25, 26, 27. Not in Durban.
   " 28 Saw 3 specimens in morning.
   " 29 Morning: captured 2 specimens, 1 perfect and 1 ♀ with three wings.†
   " 30 Saw 2 specimens in morning, 1 in afternoon.
   " 31 January 1 and 2. Not in Durban,

January 3 Captured 1 in morning and 1 in afternoon, saw 2 others.
   " 4 " " 2 " (raining in afternoon).
   " 5 " " 3 " and 2 in afternoon.
   " 6 " " 1 " saw 4 others, 2 damaged.
   " 7 and 8. Not in Durban,
   " 9 Captured 3 in morning, saw 1 *mima* in afternoon.
   " 10 " " 5 *wahlbergi* in morning, saw 2 in afternoon.
   " 11 " " 2 " " " " " 3 others, captured 2 freshly emerged *mima* in afternoon.
   " 12 Captured 6 *wahlbergi* in morning and 2 in afternoon: also captured 1 *mima* and saw 2 others, all 3 freshly emerged, and going to rest early, as a bad storm commenced about 4 p.m.
   " 13 Captured 2 *wahlbergi* in morning, saw 2 others, heard of 1 *mima* being captured on the Bluff, Durban.

* The ♀ was kept alive for over a week, but no ova were laid.
† Kept alive for three days, but no ova laid.
1905.
January 14 and 15. Not in Durban.
" 16 Captured 1 wahlbergi and 1 mima, and saw another of the latter, all in the afternoon.
" 17 Captured 3 wahlbergi in morning and 2 in the afternoon, and 1 mima going to rest as late as 5.30.
" 18 Not out in morning, captured 1 mima in afternoon.
" 19 Morning: captured 10 wahlbergi and saw 3 others, 1 badly crippled. Afternoon: saw 2 more wahlbergi, no mima, but had 2 perfect specimens of latter given me, captured about 3 p.m. in another part of Stella Bush. They had only just emerged, and the wings were hardly dry.
" 20 Captured 3 wahlbergi and saw 1 mima in morning.
" 21 and 22. Not in Durban.
" 23 Captured 2 wahlbergi in morning and 2 in afternoon; saw 4 others, including a pair in coitu; captured 1 mima just out and saw another in afternoon.
" 24 Captured 5 wahlbergi and saw 4 others in morning, raining all afternoon.
" 25 Captured 2 wahlbergi and saw 1 other in morning; saw 1 mima in afternoon. A dull damp day.
" 26 Captured 1 wahlbergi* and saw another in morning; captured 1 freshly emerged mima in afternoon. Raining nearly all day.
" 27 Afternoon: captured 3 wahlbergi and saw 1 other; saw 2 mima in coitu. Wet, dull morning.

At this point the observations ceased, as I was unable to continue my regular visits to the locality in which the above recorded notes were made.

To sum up:—Between December 16, 1904, and January 27, 1905, I captured, saw, or heard of being captured just 121 E. wahlbergi, and between January 9 and 27, 1905, I captured, saw, or heard of being captured just 20 mima.

These numbers, especially of mima, are greatly in excess of anything that I have before observed in this locality. The mima captured in the season 1904–5 indeed exceed the total that I have been able to obtain in the five previous seasons together, that is during the whole of my experience of this locality. This remarkable abundance I attribute to the fact

* A crippled ♀ kept alive for ova without success.
that the glade had only been made about three and a half months, and was therefore practically virgin ground.

Although I saw wahlbergi in coitu on several occasions and mina once, I never saw the two forms pairing together, and not very frequently flying together, except on the afternoon of January 12, when there was a very bad storm with hail, and all species of butterflies were going to rest unusually early. It is very unfortunate I have not been successful in getting any ova from the ♀'s kept for this purpose, but even had I done so, I am not at all sure that I know the food plant. Roland Trimen, F.R.S., in his work suggests a tree, but I think that the Buck Weed is far more probable, as nearly all the recorded specimens were settling on or flying over this plant. I several times searched unsuccessfully for the pupa-cases, although a great many of the wahlbergi had scarcely dried their wings when captured, and in several cases I observed on the leaves beneath the spot where a butterfly had been resting the excretory fluid which is ejected shortly after emergence.

Professor Poulton also exhibited Mr. Guy A. K. Marshall's latest demonstration of seasonal phases in South African species of the genus Precis—the proof, by actual breeding, that P. tukuoa, Wallgr., is the dry season phase of P. ceryne, Boisd.

The female parent of the wet phase was captured April 2, 1905, at Salisbury, Mashonaland (5000 ft.). The eggs were laid on the following day, and all hatched April 13. The eight offspring were treated, and went through their transformations as follows:

<table>
<thead>
<tr>
<th>1905.</th>
<th>1905.</th>
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<tbody>
<tr>
<td>1. Pupated May 9.</td>
<td>Emerged May 27, as a dry phase ♀</td>
</tr>
<tr>
<td>2. &quot; 12. &quot; 31, &quot; &quot;</td>
<td>&quot;</td>
</tr>
<tr>
<td>3. &quot; 12. &quot; 31, &quot; &quot;</td>
<td>&quot; ♀</td>
</tr>
<tr>
<td>4. &quot; 12. &quot; June 1, &quot; &quot;</td>
<td>&quot; ♀</td>
</tr>
<tr>
<td>5. &quot; 13. &quot; 1, &quot; &quot;</td>
<td>&quot; ♀</td>
</tr>
<tr>
<td>6. &quot; 15. &quot; 2, &quot; &quot;</td>
<td>&quot; ♀</td>
</tr>
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Pupated and subjected to damp heat, May 15, 1905.
Emerged May 23, 1905, as a dry phase ♀

8. Pupated and subjected to damp heat, May 15, 1905.
Emerged May 23, 1905, as a dry phase ♀
The whole of the offspring are marked examples of the tukuoa or dry phase. The damp heat to which Nos. 7 and 8 were subjected hurried the transformation in a remarkable manner, the pupal period only enduring for eight days, instead of from eighteen to twenty days, as in Nos. 1–6. But with all this hardly any effect, if any, has been wrought upon the pigments. The upper-side colouring of Nos. 7 and 8 is very slightly lighter than that of two out of the three other males (Nos. 2, 5, and 6), but is about the same as the third. Upon the under-side, where the essential distinction between the phases is manifest, no difference can be detected.

Professor E. B. Poulton exhibited ten specimens of *Precis sesamus*, captured at a height of about 5000 ft. on the S.E. slopes of Kilimanjaro by the Rev. K. St. Aubyn Rogers. The dates, seasonal phases and condition of the specimens are shown below:

**Mamba state,**

1905.

Sept. 19, 1 *Precis sesamus*, ⊙ (dry season phase), not much worn.  
22, 1 " " ⊙ " " nearly perfect.  
22, 1 " " ⊙ " " rather worn.  
22, 1 " " ⊙ slight tendency towards intermediate; worn.  
22, 1 " " ⊙ very much worn and very ragged.

The symmetrical injuries suggest the attack of a bird or lizard.

22, 1 *Precis sesamus*, ⊗ (wet season phase), quite fresh.  
22, 1 ⊗ " " ⊗ slight tendency towards intermediate. Slightly worn and very badly notched and torn, probably by enemies.

25, 1 *Precis sesamus*, ⊙ worn and much notched.

25, 1 " " ⊙ (intermediate.) On dry side of intermediate. Much worn and a great part of both hind-wings shorn away.

**Marang state,**

1905.

Sept. 25, 1 " " ⊙ very slight tendency towards intermediate. Worn and notched.
Concerning these specimens Mr. St. Aubyn Rogers wrote on September 29, 1905:—

"I was very interested to meet with Precis sesamus for the first time. All the specimens except one were of the winter form, and were more or less worn. The one exception was a beautiful fresh natalensis which was taken in coitu with sesamus. One sesamus has the red spots considerably elongated, thus showing some approach to natalensis.

"During the whole time I was on the mountain the weather was for the most part cloudy and showery, so that I was unable to go up to the higher levels as I had hoped. I did go as far as the forest which extends upwards for about 6000 ft., but everything was dripping, though it was one of the finest days we had, and no butterflies came within reach, in fact only two or three were seen. In the forest there are ferns and mosses everywhere carpeting the ground and hanging in festoons from every branch, and the begonias form great bushes 20 ft. high."

Still more recently the following interesting notes on the subject have been received from the same keen and observant naturalist:—

"I saw one other natalensis which was also quite fresh, so it is fairly certain that I was on Kilimanjaro just at the time when the wet-season phase was appearing.

"I fear I have no first-hand knowledge of the seasons on Kilimanjaro except what I can assume from living well within sight of it, and being able to tell from the amount of cloud what the weather is like. (We are not more than ten or twelve miles from the mountain, which rises from the plain on which we live, and probably not more than five or six from the nearest foot-hills.) I have, however, inquired diligently, and I am informed that the wet season lasts with short breaks from the middle of March till the end of November, so that I was there towards the end of the wet season, when one would expect the dry phase to be beginning to show up, and the wet phase to be still predominant though somewhat worn, whereas the facts were exactly opposite to this. Possibly the explanation is that during the wet season, or at any rate a good part of it, the clouds hang so heavily over the mountain,
even at 5000 ft., that butterfly life is reduced to a minimum
from want of sunshine, not from want of moisture, and I am
told that during this season for weeks at a time the sun is
scarcely seen at all. The period of the year when butterflies
are most abundant is during the dry season, if it may be
so called where the country never dries up at all. During the
wet season it is so wet and cold that very few insects are on
the wing, but during the months of December—February
there is plenty of sunshine and quite sufficient moisture
for all needs of insects. It is curious that the seasons at
which the wet and dry phases are found do not vary much
from those further south, where the seasons are so very
different."

Professor Poulton observed that the facts were extremely
remarkable, and must be taken into account in the attempt to
interpret the nature of the change from the one form into the
other. By themselves they seemed to suggest temperature
and not degree of moisture as the controlling factor. The
facts were, however, equally in accordance with the hypothesis
that the changes are due to internal causes and merely more or
less parallel with the seasons without being caused by them,
so that local reversal of the wet or dry periods is unaccom-
panied by a corresponding reversal in the phases of the insect.
But the problem is too difficult and complex to be solved by
these observations alone, interesting and suggestive as they
are.

Professor Poulton exhibited 325 butterflies captured on one
day by Mr. C. B. Roberts, between the eighth and tenth mile
from the Potaro River on the road to the gold-mines. The
road starts from the Potaro 30 miles above its confluence with
the Essequibo. The capture was effected February 23, 1904,
and may be compared with that of August 28, 1903, exhibited
to the Society on November 4 of the same year. The follow-
ing statement sets forth the constitution of the two sets of
butterflies:—
<table>
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<tr>
<td></td>
<td>Mid short dry season.</td>
<td>Mid long dry season.</td>
</tr>
<tr>
<td>Melinae muneme</td>
<td>250♂ 3♀</td>
<td>220♂</td>
</tr>
<tr>
<td>,, crameri</td>
<td>8♂</td>
<td>7♂</td>
</tr>
<tr>
<td>,, egina</td>
<td>9♂</td>
<td>21♂</td>
</tr>
<tr>
<td>Mechanitis pannifera</td>
<td>10♂</td>
<td>4♂</td>
</tr>
<tr>
<td>,, polyminia</td>
<td>9♂</td>
<td>3♂</td>
</tr>
<tr>
<td>Lycoea cerea</td>
<td>1♂</td>
<td>0</td>
</tr>
<tr>
<td>,, pasimunia</td>
<td>3♂</td>
<td>7♂</td>
</tr>
<tr>
<td>Heliconius ceycticus</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Eueides nigrofusci</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Ceratinia callonia</td>
<td>15♂ 1♀</td>
<td>58♂</td>
</tr>
<tr>
<td>Napoegenes phrasthes</td>
<td>1♂</td>
<td>0</td>
</tr>
<tr>
<td>Ceratinia barii</td>
<td>4♂</td>
<td>0</td>
</tr>
<tr>
<td>Ithomia zarepha</td>
<td>1♂</td>
<td>0</td>
</tr>
<tr>
<td>Scada thephria</td>
<td>5♂</td>
<td>5♂</td>
</tr>
<tr>
<td>Hesperia syrithus</td>
<td>1</td>
<td>0</td>
</tr>
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</table>

**Totals**: 323 (Aug. 28, 1903) 325 (Feb. 23, 1904)

* Three specimens have been mislaid. It is almost certain that they are males.
The extraordinary predominance of the Ithomiine-centred groups, especially the first, is well shown in Mr. Roberts' captures on these two days. Of course, an essential consideration is the nature of the locality in which he collected, viz., the clearing in the forest made and kept open for establishing and maintaining the road to the gold-mines. The butterflies were all captured upon the white flowers of *Eupatorium macrophyllum* which springs up wherever the forest is cleared. On these flowers in this situation the almost exclusive predominance of the Ithomiine-centred groups is proved by the whole results of collecting on two typical days, one (August 28) in the middle of the short, the other (February 23) in the middle of the long dry season. The extraordinary preponderance of males is also remarkable, and may be compared with the exhibit made by Dr. F. A. Dixey, in which the 153 *Pierine*—all males—were captured on wet mud. It is probable that these and other observations showing that the male is compelled to seek moisture, are to be explained by the fact that this sex flies in the sun far more freely than the comparatively retiring female.

Professor E. B. Poulton exhibited specimens referred to in the following notes by his assistant, Mr. W. Holland, of the Hope Department:

"Whilst sweeping in Stowe Wood, near Oxford, August 28, 1904, I brushed up a good many specimens of the little Halticid beetle, *Apteropeda orbiculata*, Mar., from the patches of *Ajuga reptans*, and with them at the same time the little Hemipteron, *Halticus apterus*, L., the last-named being most plentiful, and closely resembling the beetles with which they were mixed in the sweeping-net.

"On August 18, 1904, in searching at the roots of plants near Ascot-under-Wychwood, I found the same two insects in company, and experienced the same difficulty in picking out the beetles from the bugs.

"On April 13, 1905, when shaking some heaps of cut herbage lying beside the path from S. Hincksey to Chilswell Farm, near Oxford, a number of the little Staphylinid, *Myrmédonia canalliculata*, F., tumbled out on to the paper, together with many *Myrmica rubra*, race *ruginodis*, Nyl., the
beetle looking extremely like the ant. The same occurred in each heap which I searched. I then remembered having often seen the beetle and ant together under the large stones which lie by the path side in the walk to Henwood, on another part of the same hill. This latter observation is of course well known, but the former, seeming to show that the Staphylinids accompany the ants outside the nest, was new to me.”

Professor Poulton observed that it was of great interest to obtain all possible evidence of association between mimic and model in the living state.

Mr. R. Shelford communicated the following “Note on a feeding experiment on the spider *Nephila maculata*.”

Conclusions as to the relative tastefulness or distastefulness of insects derived from feeding experiments that are carried out with captive spiders or predatory insects must always be unsatisfactory; for the captives rendered ultra-ferocious by a new-found imprisonment will seize and devour almost everything in the nature of food that is offered to them, or else, wearied with a long imprisonment, become too languid to eat anything. I welcomed therefore an opportunity, that offered some little time ago, to test the predilections of a large spider living under perfectly natural conditions. In July 1902 I encountered the web of *Nephila maculata* stretched across a jungle path on Mt. Matang, in Sarawak, Borneo; occupying the centre of the web was a fine female specimen of this spider, and I employed two hours in catching examples of the insects flying about near the web, in placing my captures in the web and in noting down the behaviour of the spider. A heavy thunderstorm then drove me to shelter and in a short time totally wrecked the spider’s web, so that the experiments are by no means as complete as I could wish. However, so far as they go, they are of some interest and appear worthy of a permanent record; they are set forth in tabular form here-with, the numbers in brackets referring to the numbers of specimens offered as food.
Insect offered as food. | Treatment by spider.
--- | ---
**Hymenoptera** | 
Trigona apicalis (5)  
Trigona lacteifascia (2)  
Thrown out of the web.  
One tasted, but then rejected; one thrown out of the web.

**Coleoptera** | 
Antipha sp. (1)  
Tasted, and reserved for future consumption.

**Hemiptera** | 
Riptortus pedestris (2)  
Cosmolestes picticeps (4)  
Velinus nigrigenu (1)  
Thrown out of the web.  
Thrown out of the web; great caution exercised.

**Diptera** | 
Musca sp. (1)  
Instantly devoured.

**Lepidoptera** | 
Ypthima pandocus (7)  
Cynitia diardi (1)  
Terias hecabe (4)  
Instantly devoured.  
One devoured, rest reserved for future consumption.

In these experiments one feature was plain, viz. that the spider exhibited its likes and dislikes in the most unmistakable manner, and I am positive that its appetite was by no means sated by the time that the experiments had come to an untimely end. When the butterflies, *Ypthima pandocus* were thrown into the web the spider made a rapid rush at them, and in a moment the victims were engulfed. The Phytophagous beetle, a reddish-yellow species of *Antipha*, was instantly seized when it fell into the web, but the spider, after driving her falces into the body of her prey, then paused and appeared to find the copious yellow fluid which exuded from the body of the beetle highly distasteful; at any rate the beetle was not bitten again, but was spun up in a silken shroud and was suspended by a single strand of silk from the web. The method by which this beetle was ensnared was interesting to watch. The spider held it by her front pair of legs and caused it to revolve by the help of her mouth parts,
whilst her hind pair of legs were applied one at a time to her spinnerets, bringing away at each movement a strand of silk which was then applied to the revolving beetle; the operation was carried out with great rapidity, and I could almost persuade myself that I was watching the movements of some ingenious silk-winding machine. When the beetle had become an amorphous bundle, one long strand was attached to it, the other end of the strand being held by one of the hind-legs; the spider then rapidly scaled its huge web, the silken bundle dangling from one leg, and attached the strand to one of the strands of the web. When my experiments came to an end four of the bundles were hanging from the web, one containing the beetle, the others specimens of the Pierine butterfly Terias hecabe. The first specimen of Terias put into the web was quickly eaten, but the other three were bitten and then wound up into bundles. If an insect was distasteful to the spider the strands in which it was entangled were cut, one of these strands was then caught up by one of the hind-legs of the spider, and after a few vigorous jerks of this leg the offensive insect was thrown clear of the web. The Reduviid bug Cosmolestes picticeps, a conspicuous black and yellow species, was thus treated; Velinus nigrigenu, another, but larger, yellow and black Reduviid, was approached with great caution, the spider just touched it with her palpi and started back as if alarmed, the strands of the web were cut in a wide circle round the prisoner so that a large hole was made, and the bug was jerked for some little distance away from the web; both these bugs were quite uninjured by their temporary imprisonment and soon managed to free themselves of the sticky silk in which they had been enmeshed. The small black bee with white-tipped wings, Trigona apicalis, was always thrown out of the web instantly, whereas the reddish species T. lacteifascia was in one case seized by the spider, but after it had been mouthed considerably was dropped in favour of a Muscid fly which then flew of its own accord into the web; a second specimen was rejected. It should be mentioned in this connection that the black and white species of bee is much more common than the reddish species and is mimicked very widely by Diptera, Coleoptera, other Hymenoptera and a

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moth; the type of coloration is as typical a warning coloration as the red and black of the Lycidae and the yellow bands of wasps; it was of interest then to note that the spider rejected the black and white bee without the slightest hesitation, whereas it tasted the less conspicuous red species. The common black and white moth *Deilemera coleta* was also thrown out of the web almost as soon as it was put in; this species is the only lepidopterous insect that I have ever found to be refused invariably by Mantidae; it is an extremely common and conspicuous day-flying moth, and it was always a matter of surprise to me that it was not mimicked by species of other families of Lepidoptera.

The only other records of feeding experiments carried out with spiders that I am acquainted with, are those made by Mr. G. A. K. Marshall on *Nephilengys malabarensis*, Walck., in S. Africa; these are described in the Transactions for 1902 in Mr. Marshall’s great paper on the bionomics of South African insects, and it is not necessary for me to quote them at length. The experimenter offered to five spiders various butterflies, some of which were denuded of their wing-scales, whilst others had their wings amputated. Mr. Marshall from his series of experiments concludes that spiders do not appreciate warning colours, and believes “that the toughness of inedible insects has been primarily developed to counteract the injuries from invertebrate foes (which are incapable of reasoning as to whether an insect is edible or not), and that therein lies its chief utility, though it may prove useful incidentally in other cases.” My one experiment, if it does not show that *Nephila maculate* is capable of appreciating warning colours, does at least show that this species can recognize without preliminary tasting some of the insects distasteful to it; absolutely no hesitation was shown in rejecting five examples of *Trigona apicalis*, one of *Deilemera coleta* and four of *Cosmolestes picticeps*, but whether the colouring of these insects or their form was the feature determining their rejection by the spider is quite uncertain.

It is much to be desired that further feeding experiments on spiders be carried out, for they are almost the only insect enemies that can be experimented on under natural conditions
Papers.

The following papers were read:—“Some Bionomic notes on Butterflies from the Victoria Nyanza Region,” with exhibits from the Oxford University Museum, by S. A. Neave, B.A.

“On the habits of a Species of Ptyelus in British East Africa,” by S. L. Hinde, illustrated by drawings by Mrs. Hinde, communicated by Professor E. B. Poulton.

“Mimetic forms of Papilio dardanus (merope) and Acræa johnstoni,” by Professor E. B. Poulton, D.Sc., F.R.S., Fellow of Jesus College, Oxford.

“Predaceous Insects and their Prey,” by Professor E. B. Poulton, F.R.S.

“Studies on the Orthoptera in the Hope Department, Oxford University Museum. I. Blattidæ,” by R. Shelford, M.A., F.L.S.

Wednesday, October 3rd, 1906.

Mr. F. Merrifield, President, in the Chair.

Election of Fellows.

Mr. Arthur Hall, of 16, Park Hill Rise, Croydon, and Mr. E. E. Bentall, of The Towers, Heybridge, Essex, were elected Fellows of the Society.

Exhibitions.

Commander J. J. Walker exhibited (1) a specimen of Calosoma sycophanta taken in Denny Wood, New Forest, June 16th; (2) Lygus equestris, L., found in the Isle of Sheppey by Lieut. Jacobs, R.E., on September 22nd; (3) Sitars muralis, taken near Oxford in August by Mr. A. H. Hamm; (4) two varieties of Vanessa urtica, with a strong black ligament connecting the second costal and dorsal spot on the forewings, from the Isle of Sheppey, August; (5) a variety of Argynnis adippe, caught at Tubney, Berks., on July 7th; (6) a slate-coloured variety of Lyceæa icarus, taken near Chatham, August 24th; and (7) examples of an almost entirely black form of Strenia clathrata occurring at Streatley, Berks., in August—all taken this year.
Mr. G. T. Porritt showed a series of *Abraxas grossulariata*, var. *varleyata*, bred this year from a pairing of the variety obtained from wild larvae the previous season at Huddersfield. All the brood were of the variety, none showing the least tendency to revert to the ordinary form.

Mr. C. P. Pickett brought for exhibition a remarkable gynandromorphic specimen of *Angerona prunaria* bred by him, of which the right-hand fore-wing was ♂, and the hind-wing ♀, while the left fore-wing was ♀, the hind-wing showing a mixed tendency to ♀ and ♂. He also showed a ♀ specimen of *Fidonia atomaria*, caught at Folkestone, with six wings. The two extra wings, which were placed with the left hind-wing, though rudimentary, displayed perfect fringes.

Professor Charles Stewart, F.R.S., exhibited a remarkable unnamed exotic larva found in a collection of specimens received at the College of Surgeons. It displayed a series of iridescent spots about the spiracles, this iridescence being in his experience unique in the larval stage of Lepidoptera.

Mr. W. J. Lucas exhibited, on behalf of Mr. F. W. Campion and Mr. H. Campion, specimens of *Sympetrum flaveolum*, and read the following note by those gentlemen:

"A male specimen of this species was taken and another seen among some rush-beds a little to the north of Epping on 8th August. On 12th August, when the sky was so overcast that not a single *S. striolatum*, or hardly anything else, was on the wing, we met with a good number of *S. flaveolum* resting upon the rushes in an old gravel-pit, then nearly dry, near Chingford. Not a solitary example, however, was seen in a neighbouring pit, still fairly well filled with water but almost bare of rushes, until 2nd September, when a male was taken. On 12th August we noticed that at our approach the insects started up with a sudden and peculiarly disconcerting bound, and, although their flight was neither very rapid nor prolonged, we found it difficult to follow them, not only by reason of the general agreement of their coloration with that of the rush-flowers, but also on account of their habit, whenever the pursuit became at all hot, of taking refuge in the tops of tall trees. However, we succeeded in taking four males and, what was still more important, a female. The female
measured, in the fresh state, 33 mm. in length and 57 mm. across the fore-wings, the dimensions thus practically agreeing with those taken from two continental specimens as given in Mr. Lucas' "British Dragonflies," p. 82. The face was greenish-white, and in both fore- and hind-wings the saffron patch near the cubital point was connected with the basal saffron patch. Eight more specimens, all males, were secured at the same place on 19th August, when the weather was very bright, and it was observed that the behaviour of the insects was the same then as it was during the dull weather of 12th August, with the exception that they showed no disposition to resort to the trees. We usually found the saffron colour sufficiently conspicuous to render the species determinable at sight; it was most noticeable when the insect rose to a level with our eyes, when it was seen that the light in passing through the wings had acquired a remarkable ruddy glare. The colour of the thorax in the male has been stated to be deep red, but we saw it as a brownish colour, in strong contrast with the red of the abdomen. It is doubtful whether these insects were native to the localities where they were found, for nothing was seen of them at the most prolific site, which had been visited regularly, prior to 12th August, when all the specimens examined presented the mature coloration and several of them were damaged in respect of wings and legs.

Dr. F. A. Dixey exhibited specimens of *Nychitona medusa*, Cram., *Pseudopontia paradoxa*, Feld., *Terias senegalensis*, Boisd., *Leuceronia pharis*, Boisd., and *L. argia*, Fabr., remarking upon them as follows:—

"Though there does not exist, so far as I am aware, any direct evidence that the members of the genus *Nychitona* are distasteful, their habits are such as to suggest this mode of protection; and there is, I think, little doubt that they have served as models for other insects. We find, for instance, a striking resemblance between the West African form of *N. medusa* called by Aurivillius *immaculata*, and the remarkable insect *Pseudopontia paradoxa*, Feld., as to whose affinities

* I employ Dr. A. G. Butler's name for a genus which has been variously known as *Pontia* and *Leplosia* by different authors.
I will not venture to offer an opinion. Both forms are inhabitants of the same tropical coast region, and it may well be anticipated that future observation will show their likeness in appearance to have a mimetic significance. I would suggest also that the white form of the female *Terias senegalensis*, Boisd., which occurs not uncommonly in some parts of Africa, may owe its peculiar aspect to a similar cause. Specimens of this form of the female from the Victoria Nyanza, together with an ordinary yellow male from the same district, are here exhibited.

"But probably the most remarkable and unmistakable case of mimetic approach to the *Nychitona* as a model is that afforded by *Leuceronia pharis*, Boisd., to which I incidentally drew attention in reference to an exhibit recorded in our Proceedings" for 1906, p. xxi. As I remarked on that occasion, the genus *Eronia* (including *Nepheronia* and *Leuceronia*) has been so strongly affected by mimetic transformation that it can scarcely be said to have an aspect of its own. The male, however, of *L. argia*, Fabr., is probably as characteristic of the genus as any other form, and a specimen has accordingly been placed by the side of *L. pharis*, to which it is closely related. Few observers will, it is believed, remain unconvinced that *L. pharis* represents a departure, of mimetic significance, in the direction of *Nychitona*. That the latter genus rather than the former has served as the model might be expected from its very wide range and generally uniform characteristics. This is no doubt really the case, but with a qualification.

"Several years ago I tried to explain certain curious phenomena of mimicry in South American butterflies, by supposing that a mutual interchange of features was liable to take place between distasteful forms—a give-and-take arrangement which I then called 'reciprocal mimicry,' and for which Prof. Poulton has since proposed the more accurate term 'diaposematism' (Trans. Ent. Soc. Lond., 1894, pp. 296–298; *ibid.* 1896, pp. 72–75; *ibid.* 1897, pp. 324–331. See also Presidential Address by Mr. Trimen, Proc. Ent. Soc. Lond., 1897, pp. lxxx, lxxxii). The principle thus suggested has since been found by Mr. G. A. K. Marshall, Prof. Poulton, Mr. Neave and others to be applicable in many other cases than those which first led me to its formulation, and I venture to
think that it may now be taken as a well-established law (Trans. Ent. Soc. Lond. 1902, pp. 296, 489, 490; ibid. 1906, pp. 216–218, 292–3). It will be seen from what follows that the present exhibit probably furnishes a fresh instance of its operation.

"The resemblance of L. pharis to the ordinary African forms of Nychitona, though striking, is not exact. The Leuceronia has no dark discal spot, the outline of the dark apical border of the fore-wing is more regular, and the texture of the wings is more solid-looking and opaque than in the prevailing forms of the model. But among the specimens of Nychitona collected by Mr. Wiggins in the neighbourhood of the Victoria Nyanza and worked out by Mr. Neave in 'Novit. Zool.,' Vol. XI, 1904, p. 324, there occur some forms which in all these respects correspond with the mimic rather than with the usual type of the model. The inference seems clear that although the part played by the Leuceronia has been chiefly that of a borrower, it has in return bestowed certain features of its own upon this particular race of its model. The form of Nychitona in question, a specimen of which is included in the exhibit, may possibly deserve to rank as a distinct sub-species.

"Whether the aspect of the purely white specimens of Nychitona from West Africa here shown in connection with Pseudopontia affords another instance of reciprocal change, I am not prepared to say, especially as similar forms occur in districts where Pseudopontia is not met with. But on looking at the genus as a whole, it would appear to be significant that whereas in India, where, so far as we know, Nychitona is not mimicked, its forms present a very uniform appearance with the characteristic discal spot and irregular apical border conspicuously present, in Africa we find variations of Nychitona each of which tends to bring it into more or less close correspondence with a probable mimic. On these grounds it seems not unreasonable to seek for an explanation of the facts in the direction of diaposematic change."

Mr. H. St. J. Donisthorpe exhibited examples of Dinarda pygmaea, Wasm., with our other three species, D. hagensi, Wasm., D. dentata, Gr., and D. mürkeli, Kies., with their respective hosts, and read the following note:—
“Dinarida pygnea, Wasm., was first taken in this country by Mr. J. H. Keys of Plymouth in Cornwall several years ago. It was wrongly named for him *D. dentata*, and its host *Formica fusca*. I this year sent it to Father Wasmann who returned it as *D. pygnea*. It is the smallest of the genus, and the thorax is much less broad in proportion to the elytra than in the others. Father Wasmann stated after he had seen the beetle that the ants it was found with must be *Formica rufibarbis, v. fuscorufibarbis*. This turns out to be the case. I have just been down to Cornwall, and Mr. Keys and I took over a dozen of the beetle. We examined a great number of nests and all the ants were this form. They make their nests under stones, and we found them from the Rame Head to Tregantle.

“Dinarid hagensi, Wasm., was first taken in this country by me last year at Bournemouth with the rare ant *Formica exsecta*. It is a little larger than *D. pygnea*, but not so large as *dentata*, it is narrower and always of a lighter yellow colour. I have taken over fifty specimens now and they are all the same. Its hosts make nests about the size of a football, and smaller, of grass and ling in open spaces among fir-trees.

“Dinarida dentata, Gr., is only found with *Formica sanguinea*. It is a broader, darker and more robust species than *hagensi*. Its hosts make nests either in the turf above which it raises a very low cover of cut grass as at Woking, or in fir-stumps as at Wellington College. It will also build under any object, like an old boot or kettle.

“Dinarida märkeli, Kies., is only found with *Formica rufa*, which builds large hillocks of pine needles in fir-woods. It is the largest species of the genus and the most well-known.”

Mr. Donisthorpe also exhibited a larva of *D. dentata* sent to him by Father Wasmann, and a larva of *D. pygnea* taken by him in Cornwall.

Mr. Norman Joy showed the following species of Coleoptera first recognized as British in 1906:—(a) *Laccobius sinuatus*, Mots., from Lundy Island (Tomlin and Joy) and Cambridgeshire (Gorham), distinguished by its smaller size and more parallel form from *L. nigriceps*, Thoms.; (b) *Homalota para- doxa*, Rey, taken in moles' nests in Berkshire and Devon;
(c) *Quedius vexans*, Epp., and its larva, from moles' nests in Berkshire; (d) *Euplectus tomlini*, Joy, from a starling's nest at Bradfield, Berkshire; (e) *Corticaria crenicollis*, Mannh., from under bark at Basildon, Berkshire, and at Epping (Pool); (f) *Cardiophorus erichsoni*, Buys., taken on Lundy Island by Mr. Tomlin and himself. He also exhibited:—

(a) a variety of *Lathrobium elongatum*, L., from South Devon, with entirely black elytra, and which he proposed to call var. nigrum; (b) a curious dull aberration of *Apteropeda globosa*, Ill.; (c) *Heterothops nigra*, Kr., taken in moles' nests from various parts of the country; (d) a species of *Gnathoncus* differing in certain characters from *G. rotundatus*, Kugel, and which occurs almost exclusively in birds' nests. With regard to the last two he made the following remarks:

"*Heterothops nigra* is regarded on the continent as a variety of *H. prævia*, Er.; with which it seems to correspond in structure, but differs from it in colour. However, there is a marked difference in habitat, and therefore habits, of the two forms. *H. prævia* is taken in rotting straw, etc., whereas *H. nigra* is confined to the nests of moles, and a few other mammals. This difference in habits is considered of no importance by many collectors, yet surely is it not of as great importance as a difference in punctuation, and has it not as much right to be regarded as a specific character as a difference in structure? Indeed, there must be a constant minute difference in the structure of the central nervous system. Among the birds there is a beautiful example of two very closely allied species being far more easily differentiated by their habits and life history than by their structure or colour. These are the March Warbler (*Acrocephalus palustris*) and Reed Warbler (*A. streperus*), skins of which I exhibit. You will notice that there is only a slight difference in the shade of the colour of the back and breast, and in the colour of the legs, and the wing formulae differ in a small degree. These differences would certainly only be regarded as varietal by most coleopterists, yet the two birds differ markedly in distribution, habits, habitat, eggs, nest and song. I maintain that *H. nigra* is, as far as possible, a parallel case. I see in Trans. Ent. Soc. 1906, part II, p. liii, that Mr. G. F. Leigh
separates two closely allied forms of butterflies on account of differences in the habits of the two forms; and I have myself brought forward the same arguments ('Ent. Mo. Mag.,' Jan. 1905) when describing *Rhizotrogus ochraceus*, Knoch., as a good species.

"The *Gnathoncus* is another case in point. Mr. G. Lewis has pronounced that we only possess one species of this genus as British. I found however that in a long series in my and other collections there were two quite constant and distinct forms: (a) with shining and diffusely punctured apex of elytra, and large teeth to the front tibiae; (b) with dull and closely punctured (the punctures often running into lines) apex of elytra, and much smaller teeth to the front tibiae. I could not find, and have not seen since, any intermediate forms. I then discovered that all my specimens of form a were taken in carrion, and those of form b in birds' nests. This, to my mind, conclusively separates them as distinct species. I sent my two series to Mr. Lewis pointing out these differences, and he still maintains that they both belong to the same species because the form of the sternum is the same in both, and completely ignores the biological distinction. This, I am afraid, is the attitude of a great many coleopterists, who seem to forget that their cabinet specimens were ever alive and had distinctive life histories and habits."

The President said he thought they could appreciate the force of the argument of Mr. Norman Joy and Mr. Donisthorpe that, where morphological differences between two kinds of insects were not great, but a difference of such a remarkable character as they had described existed in habit, this difference of habit might properly be taken into account in forming a judgment whether the two should be considered specifically distinct. But whether they accepted this or not, he thought they could agree that it was highly useful that the special habits of an insect, as an important part of its life, should be observed and recorded.

Mr. L. B. Prout showed on behalf of Mr. G. B. Oliver, of Tettenhall, Wolverhampton, a melanic ♀ of *Acidalia marginopunctata*, Goeze, and a melanic ♂ of *A. subsericeata*, Haw., both taken in North Cornwall this summer, together
with the typical forms for comparison; also a dark aberration of *Coenonympha pamphilus*, Linn., taken in the same district in 1903. The district is on the whole noted for light and brightly-marked forms, and the exhibitor said that he did not pretend to offer any explanation of these casual aberrations, one at least of which—the *A. subsericeata*—seemed to be absolutely unique, so far as is at present known. A very few eggs, only eight, he believed, were obtained from the *A. marginapunctata*, and three of the larvae fed up rapidly, and produced moths on September 5th and 6th, the remaining five hibernating. The three were exhibited with the parent, and though slightly darker than normal, are by no means extreme forms.

Mr. H. W. Southcombe communicated a note on the formation of a new nest by *Lasius niger*, the common black garden ant, as follows:—

"A number of fertile queens were captured on the 28th July, 1905. They were running about in a large open space in front of a railway-station, and both there and in other places were hurriedly searching for some crevice in which to hide, and as hurriedly scurrying out again.

"I afterwards enclosed some of these queens in a perforated box having holes of a size which permitted the small ants to pass through and offered them to some wild nests, and also to a captive colony which possessed no queen. In each case they were torn to pieces, the members of the captive nest showing remarkable fury in attacking the offered queen.

"It would thus appear that the queens which fall a prey to the birds, sometimes in vast numbers, stand in danger if they escape the birds of meeting a worse fate at the hands of their own kind.

"The remaining captive queens were kept in a box with glass top, perforated sides for ventilation, and a porcelain bottom, being at first supplied with a wet sponge under which they congregated during the hot weather. Food was supplied, but I never at any time saw them feeding; although they may have done so. Afterwards they were supplied with damp earth, in which they burrowed and spent the winter.

"In the middle of May 1906 the little colony began to die
without apparent cause, until only two survivors remained, but as these were in excellent condition and extremely active, it may have been that they attacked one another. The two survivors were transferred to a flower-pot, 31st May, 1906, where they made a new hole and lived in it until the 12th June, during which time they were taken a long railway journey. During this time they certainly did not come out to feed as the shaking caused the hole to become stopped up. On the 12th June, 1906, the pot was turned out and the ants found at some depth and in good condition. It is to be noted that the black queens if supplied with damp earth and a flat potsherd or two, will always burrow out hiding-places, turning out the earth in little pellets as the working ants do, and sometimes carrying some of it a little distance away.

"On 12th June, 1906, I arranged a thin layer of earth covered by two bits of broken flower-pot a few inches square in the box they formerly occupied, and under this they at once made a new nest. The little mound of earth was kept damp from time to time.

"The nest was left alone and seldom looked into, until 11th September, 1906, when on taking off the cover I saw at least two workers had been born.

"On the following day two ants were out thoroughly examining every part of the box. They did not appear very anxious for food, but attacked a newly killed fly and dragged it towards the nest, and have since (14th Sept.) spent a good deal of time round it.

"From the foregoing it is clear that a fertile black queen is able to start a new nest of her own without the assistance of other ants, and that she will do so under favourable circumstances about the end of the first year after flight.

"The difficulty a wild queen would find in discovering a hiding-place not too wet or too dry, and not already tenanted by hostile ants, is much greater than might be supposed, because the runs of each existing nest are very extensive.

"In one country house at least three-quarters of the whole area of about an acre I found to be occupied by three nests, and in a town house with not much garden three separate nests occupied the sides of the house, and still another hostile
nest had its boundary at a corner a few yards away. In neither of these gardens would a new queen find a corner that was not well patrolled by ants in quest of food.

"The new queen's chance of life is still further limited by the fact that she cannot stand too much wet, while dust and dryness is almost immediately fatal to her.

"It may be worth observing that if a lot of black ants are feeding together some will be found quite large and others very much smaller. The difference in size is obvious to the naked eye, and is confirmed by a measurement of the width of heads, etc., under the microscope, and that these two newly hatched ants are both of the very smallest size."

The President, exhibiting a series of *Selenia bilunaria*, said that he had seen no notice of a form that is met with of this species, and not observed by him in any other insect, viz. that with the fore-wings very much broadened, so that a line drawn from the apex to the anal angle nearly equals the length, and if the insect is set with the inner edges of the fore-wings at right angles with the body, the costal edges would be at an angle of about 90° to each other. The exhibit included specimens many years old from the President's cabinet, of the particulars of which he had no record: also ten examples out of many hundreds bred this year from several dozen different broods, only one of which broods, comprising about sixty individuals, included the abnormal ones. There was nothing very special in their treatment. Mr. Barrett describes one aberration of the kind in *Nenia typica* as "most extraordinary."

**Papers.**

Mr. W. J. Kaye read "Some Notes on the Dominant Müllerian Group of Butterflies from the Potaro River District of British Guiana."

Mr. G. J. Arrow read "A Contribution to the Classification of the Coleopterous Family *Passalidae.*"
Wednesday, October 17th, 1906.

Mr. F. Merrifield, President, in the Chair.

Exhibitions.

Mr. H. St. J. Donisthorpe showed living examples of the beetle Monyconchus pseudacori, and seed capsules of Iris fictidissima which contained more specimens, found at Niton, Isle of Wight, where the species occurs in numbers.

Mr. A. H. Jones exhibited a species of Pieris napi, var. bryonix, Argynnis thore, Erebia glacialis, ab. pluto, a small form of Lyceuna arion from Arosa, Switzerland, at 6000 ft.; a variety of Melanargia galatea in which the dark patch on the under-side of the hind-wings was much enlarged, and two varieties of Argynnis niobe ♀, one very pale, the other of a bluish copper colour taken on the Splügen Pass in July last; also specimens from other localities for comparison.

Mr. W. J. Kaye exhibited a fine example of the remarkable moth Dracenta rusina, Druce, from Trinidad. The species bears a wonderful resemblance to a decayed dead leaf, the patches on the wings also suggesting the work of some leaf-mining insect. The margins of the wings were so deeply indented as to make it appear that the specimen was greatly damaged. The species was originally described by Druce from Guatemala in the "Biol. Cent. Am. Heterocera," p. 188, and was figured on Plate IX, fig. 9. There it was placed in the Siculodidae, a small family created to include a few allied species, but was put into the Thyrididae by Hampson, the family embracing the Siculodidae. On imaginal characters the insect was undoubtedly a Thyridid, although in general appearance wholly different from the two European Thyridids. The specimen exhibited, and also figured for the Society (Plate XXXII), had been found at rest on the ground. But it was probably a night flyer as the exhibitor had taken one or two other related species in British Guiana at night.

Mr. E. M. Dadd showed a number of Noctuids common to the British Isles and Germany, and read the following observations on the insular racial characters of some British Lepidoptera as compared with the predominant form occurring on the continent of Europe.
"In his 'Island Life,' when dealing with the British Isles, Dr. A. R. Wallace designates, amongst others, 179 forms of Lepidoptera as being peculiar to the British Isles. This list of species was compiled for Dr. Wallace by Mr. Tutt, and the latter gentleman has supplemented it by a much extended list in his articles on this subject in Vol. XIV of the 'Entomologist's Record.'

"As Mr. Tutt himself remarks, many of the forms enumerated will have to be erased from the list, as soon as continental entomologists commence to study variation more than is the case at present. The object of the present paper however is not to determine what is and what is not a peculiar British form, but to call attention to constant differences between the prevalent form occurring in England and the prevailing form of the same species from the continent.

"Having collected formerly for years in England the writer has been a resident in Germany for the last five years, and during this time has had many hundreds of the species mentioned through his hands. Very shortly after his removal over here he was struck by the differences between Mamestra dissimilis (suasa), Pachnobia rubricosa, Orthosia litura, Xylina ornithopus and the forms of these insects as he had known them in England.

"England is the home of many dark races, Polia chi, var. olivacea, Amphidasys betularia, var. doubledayaria, the dark forms of II. abruptaria, L. multistrigaria, P. pedaria, O. bidentata, etc., and it is therefore all the more curious that in the 22 species of Noctua enumerated the tendency is always for the English form to be lighter and the continental darker.

"It does not appear to me that the colour of the soil is here a determining factor, as were this the case one would expect Berlin insects to be the lighter, the soil round Berlin being for the greater part a fine yellow sand. Compare this with the London clay on which most of my English captures were made.

"It is more probable that climatic conditions are the determining factor, possibly the proximity of the sea. I have unfortunately not had an opportunity of collecting on
the European coast so cannot say whether lighter forms are there prevalent.

"At present I have distinguished 22 species which show more or less constant differences, and no doubt this number could very largely be added to. I should like at this point to again observe that I am not questioning the occurrence of these darker forms in England, but only pointing out that they constitute the type found on the continent as against the paler type from England.

"Agrotis exclamationis.—The English form is more yellow-brown than the continental. I have this species from various London localities, Mucking (Essex), Deal, Sandown, New Forest, Sussex Coast, Devonshire and Cambridge, and German specimens from many Berlin localities, East Prussia, Saxon Erzgebirge and Switzerland. The distinction though not very great seems to be fairly general.

"Agrotis tritici.—English specimens paler yellow-brown with distincter paler markings. I have only Deal tritici from England; German from Berlin, Plauen and East Prussia. Some of the English specimens are almost as dark as the continental, but no continental are as pale as the English.

"Agrotis nigricans.—English specimens are reddish-brown, varying in depth of colour; continental almost black.

"Agrotis vestigialis.—English specimens paler and yellower.

"Mamestra dissimilis (suasa).—English specimens always yellow-brown with darker markings; continental generally almost unicolorous dark brown with a more or less reddish tinge. I have long series of English specimens from Essex and Sussex coast localities; continental from Berlin and other German localities, Denmark and Sweden. The English form occurs at Berlin as a rare aberration.

"Mamestra genistæ.—The English form has the pale markings nearly white; these are always darker in continental specimens, frequently being hardly distinguishable from the ground colour.

"Mamestra albicolon.—The English form is yellowish-brown; the continental much darker, being in fact as dark as M. brassicae, the hind-wings are also much more suffused.

"Hadena sordida.—The English form of this species is
yellowish, the continental much darker. This is a species of
which I have had large numbers, both in England and
Germany. In Berlin it is one of our commonest Hadenas,
and I have seen many hundreds on a single night. Although
this was one of the first insects in which I observed the
difference between the English and continental form, and I
have been constantly on the look out for light forms, the
fifth specimen in the continental row is the lightest observed.
As will be seen it is a good deal darker than the darkest
English form. During the last five years I have certainly
seen many hundreds of this species on sugar here.

"*Hadena lithoxylea.*—The English form is very pale with
very indistinct markings, the continental have a greyer tinge,
owing to a general diffusion of the wings with whitish-grey
scales; the markings are also large and more distinct, the
hind-wings much more suffused. This is also a common
insect both in England and Germany.

"*Hadena basilinea.*—The English form is almost unicolorous
pale fawn; the continental much more richly marked and
altogether a handsomer insect. I have never taken this
species commonly although it seems to occur everywhere.

"*Miselia oxyacanthae.*—Here we are confronted with a
double problem. Of the typical form, the continental tends to
be somewhat darker than the English, the paler markings
being more distinct, but curiously enough the dark English
variety *capucina* does not occur on the continent as far as
my experience goes. Further testimony to this effect is
afforded by the fact that all German entomologists when
looking over my collection have always called attention to it
as something new to them.

"*Dryobota protea.*—Continental specimens are much darker
and dingier than English. The pretty English forms with
white and rosy patches are quite unknown.

"*Pachnobia rubricosa.*—The English form of this insect is
so distinct that it is known as var. *rufa* on the continent.
I have taken large numbers of this insect both in England
and Germany, and have bred both forms on two occasions.
Although I have had occasional dark specimens in England,
I have never seen a red form on the continent. The result
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of breeding in Berlin from dark females was always the typical continental form.

"Toniocampa gracilis.—The continental form is always much darker than English specimens.

"Orthosia pistacina.—This common English insect does not occur at Berlin, its place being taken by the smaller and darker nitida. I however took it in large numbers at Leudelange, Luxemburg, last September, and have seen series from other parts of Germany. It varies just as much as it does in England with one notable exception: the bright red forms, which in England form the majority, are entirely wanting.

"Orthosia litura.—This insect is a reddish insect in England, on the continent it is always a dark blueish-grey, some insects having a tinge of red; even these forms are however much darker than any I have ever seen in England.

"Onrhodia vaccinii.—This insect is very variable both in England and on the continent. Whereas however the English specimens only seem to vary in the intensity of the red and have a more or less suffusion of yellow markings, the continental vary from red to almost black. The pale English forms with a large amount of yellow markings are absent on the continent.

"Scopelosoma satellitia.—The English forms are generally speaking lighter red than the continental. Dark brown and almost black forms are by no means rare on the continent, though I do not remember seeing such forms in England and if they occur are only aberrations.

"Xylina semibrunnnea.—Continental specimens are much darker than English.

"Xylina ornithopus.—The ground colour of the English form is almost pure white; that of the continental grey. I have taken this species at Berlin, Plauen (Saxony), and Leudelange, Luxemburg, always in plenty, but have never taken a specimen in any way approaching the English form (New Forest) for whiteness.

"Asphalia flavicorns.—The continental form is much darker than the English; it more nearly resembles C. or, and is by no means such a handsome insect as the English. The frosted yellowish-green scaling is almost entirely absent.
"Asphalia ridens.—The continental form is generally almost unicolorous; the conspicuous frosted markings of the English form are nearly always absent."

Dr. F. A. Dixey exhibited specimens of Ixias baliensis, Fruhst., and Huphina corea, Wallace, remarking upon them as follows:

"Some short while since, a few Pierine butterflies from the Island of Bali, which formed part of a collection kindly presented to the Hope Department by their captor, Mr. E. Shelford, were put into my hands for incorporation with the general series. The butterflies when they reached me had been set up, and, as was supposed, had been sorted into species. Among a somewhat worn series of the Malayan form (H. corea, Wallace), of Huphina nemissa, Fabr., one female caught my eye as being in rather better condition than the rest. On being examined more closely, it was seen to be not a Huphina at all, but an Ixias; a genus, as I need hardly say, of very different affinities. The specimen is, in fact, a female of the Bali form of Ixias reinwardtii, Voll.; the form which has been called baliensis by Fruhstorfer. It is quite near enough in appearance to the Huphinias with which it was caught to pass muster easily on a casual view; and, as has been seen, it did actually delude one human observer.

"There can, I think, be little doubt that this resemblance is significant. The usual aspect of Ixias is rather widely departed from by both sexes of I. reinwardtii and its immediate allies, but, as so often is the case, the mimetic approach to another genus is confined to the female. Through the kindness of Professor Poulton I am able to exhibit a male example of Ixias baliensis which is especially interesting as being one of the actual specimens caught by Mr. Wallace during his memorable visit to the Malay Archipelago. It will be seen that the male has no share in the mimetic garb of his mate.

"It is noticeable that the appearance of these specimens of H. corea from Bali differs from that of ordinary examples of H. nemissa in the fact that the hind-wing of both sexes shows a rather pronounced dark border; this in the female being brought about by an almost complete fusion of the submarginal row of dark spots, commonly found in that sex of the species,
with the dark margin itself. This brings the hind-wing of the model into close correspondence with that of the mimic, a correspondence which does not exist in the case of the usual form of the model. It is of course conceivable that this special feature in the *Huphina* is merely accidental; but in view of the fact that a similar condition is usual in *Ixias*, whereas in *H. nerissa* it is practically confined to the particular form that is mimicked by *Ixias*, it seems more explicable as a case of diaposematism—a principle which experience is continually showing to be very widely prevalent.

"In this instance the *Huphina* has on the whole acted as the model, under whose influence the *Ixias* has drifted some distance away from the usual aspect of its genus. But in the particular case of the hind-wing the process is reversed; the *Ixias* has been the model, and has in its turn been mimicked by the *Huphina*.

"We have some direct evidence that *H. nerissa* is disliked by insectivorous birds. I am not aware of any such evidence in the case of *Ixias*. But if the foregoing conclusions are well founded, the association between the two must necessarily be Müllerian and not Batesian."

Mr. S. A. Neave exhibited a number of Lepidoptera selected from the collection made by him in N.-E. Rhodesia, in 1904 and 1905, comprising the following rare and remarkable species:

*Melanitis libya*, Distant; *Liptena homeyeri*, Dewitz; *Pentila pencetia*, Hew.; *Catochrysops gigantea*, Trim.; *Crenis pechueli*, Dewitz, and *Crenis rosa*, Hew., which are evidently two distinct species; and *Crenidomimas concordia*, Hopff., the mimic of the last two species. Also two remarkable species of the genus *Aphonax*—including a female, so rarely taken in this genus—*Acraxa natalica*, Boisd., and *Acraxa anemosa*, Hew., with two remarkable moths showing a close mimetic resemblance to them.

The exhibitor further stated that his collection would, he thought, prove exceedingly interesting as regards seasonal forms especially in the Acræinæ and Pierine, of which he showed examples.

(a) *Acraxa acrita*, Hew.—Dry, intermediate and wet phases
of both sexes; the wet-season specimens were highly remarkable, being, especially in the females, nearly black.

(b) *Acrxia chevribula*, Oberth., taken in the height of the dry season; remarking that:

"Dr. Butler * has suggested that *chevribula* with its heavy black apex may be the wet-season form of *acrita*. The specimens shown seemed to demonstrate fairly certainly that this is not the case. At the same time, an examination of the series in the British Museum left it doubtful whether the specimens there recorded by him under that name are the true *chevribula* of Oberthühr. They appear to be only variations of *acrita* which, apart from its seasonal phases, is undoubtedly a highly variable species."

(c) *Acrxia natalica*, Boisd.—Dry and wet phases of both sexes; the dry specimens being characterized by their smaller size and slightly brighter colour.

(d) *Acrxia induna*, Trim.

\[\text{Dry and wet phases of both sexes, all exhibiting a tendency, especially the females, to a darker colour in the wet season.}\]

A. *dubledayi onexa*, Hopff.

A. *caldarena*, Hew.

Commenting on these species Mr. Neave said that he had found the above change of colour in the seasonal phases, which is common to all the above species, but is most marked in *acrita*, exceedingly difficult to account for. The very strongly aposematic coloration of this species in the dry season when the struggle for existence is keenest is most notable. It was, he thought, at this time of year, the most brilliant insect on the wing that he knew. The change of colour is also accompanied to some extent by change of habit, dry-season specimens being much more restless and hard to capture than wet ones. It seemed therefore difficult to account for these facts without supposing that the brilliant dry-season phases have been evolved, by stress of circumstance at that time of year, from a duller coloured phase such as, in this region, we still find in the wet season when the struggle is not so keen.

Seasonal forms in the Pierinae were represented by:

(e) A long series of *Teracolus regina*, Trim., of both sexes and

* P. Z. S. 1894, p. 566.
of *Teracolus phlegyas*, Butler. "The dry season ♀ ♀ of *regina* remarkable for having the brilliant purple apical tip of the ♂ much more strongly represented in dry-season specimens than in wet."

The distribution of these two species in this particular region was of interest, inasmuch as the exhibitor had never taken both in the same locality. *T. phlegyas* appeared to be entirely confined to the hot dry river valleys and low country up to 2000 feet, whilst he took *regina* commonly in the more hilly uplands from 2000 feet upwards.

(f) *Teriomima hildegarda*, Kirby, dry, intermediate and wet phases. A rare phenomenon in African Lycaenidae.

Mr. G. A. K. Marshall, with reference to the seasonal changes in *Acrsea*, expressed the opinion that the increase of the blackish markings, which is so usual a feature in the summer ♀ ♀, tended to make the insects less conspicuous on the wing and probably had a procryptic significance. This might be due to the fact that that was the season of oviposition when the ♀ ♀ might require special protection, even in the case of distasteful species. With regard to Mr. Neave's remarks on the brilliant colouring of *A. acrita* in the dry season he pointed out that in Rhodesia the species of *Acrsea* fall roughly into two groups in this respect, namely: (1) the larger or more high-flying species, such as *acrita*, *anemosa*, *atolmis*, etc., which presented a more brilliant appearance in winter; this being probably due to their greater unpalatability, which had been to some extent shown by experiments, and which would render a bright aposematic coloration of considerable utility at this season of greater stress; and (2) the smaller, low-flying, and less unpalatable species, such as *axina*, *asema*, etc., which could not afford to make themselves too conspicuous at such a time and whose colouring therefore tended more to harmonise with the dull reds and yellows of the withered grasses among which they flew.

The question however of the significance of the black markings in *Acrsea* was complicated by the fact that in several widely-distributed species there was a progressive local increase in the black from south to north, irrespective of season.

Professor E. B. Poulton, F.R.S., congratulated Mr. Neave
upon his interesting exhibition. He made a few remarks upon the melanic forms of the wet season, but expressed himself unable at present to understand the full significance of the changes. In conclusion, Professor Poulton asked Dr. F. A. Dixey whether it was likely that the females of Teracolus regina exhibited in one season a synaposematic approach to the females of other and very distinct species of the same genus; in the other season a similar approach to Pierinex of a remote genus.

Dr. F. A. Dixey said that he was not at present prepared to give a complete answer to the question put to him by Professor Poulton. The seasonal changes of Teracolus regina, in relation to the sexual dimorphism of that species, were very remarkable and required further investigation. He had, however, no doubt that both in this species and in T. phlegyas the dry-season form of both sexes had a cryptic character, at any rate in the resting position of the insect. He was quite convinced of this in the case of the last-named butterfly and of its congener, T. speciosus, from having watched both species under natural conditions.

Wednesday, November 7th, 1906.

Mr. F. Merrifield, President, in the chair.

Election of Fellows.

Mr. Gerard H. Gurney, Keswick Hall, Norwich; Mr. Harold Armstrong Fry, P.O. Box 46, Johannesburg, Transvaal Colony; Mr. Frederick Albert Mitchell-Hedges, 42, Kensington Park Gardens, London, W.; Mr. Gordon Merriman, Trinity Hall, Cambridge; Mr. Percy A. H. Muschamp, 20, Chemin des Asters, Geneva; and Mr. Oswin S. Wickar, Crescent Cottage, Cambridge Place, Colombo, Ceylon, were elected Fellows of the Society.

Exhibitions.

Mr. H. J. Lucas exhibited a photograph of Panorpa germanica, practically immaculate, taken by Mr. E. A
Cockayne, a Fellow of the Society, at Tongue, Sutherlandshire, now in the Hope Museum, and a typical form for comparison, corresponding apparently to the *borealis* of Stephens. He also showed a series of *P. germanica* to illustrate the range of spotting on the wings of both sexes, with two ♂♂ and two ♀♀ of *P. communis*; and a pair of a third species, *P. cognata*. The first two species are common; the third scarce.

Mr. G. C. Champion showed a long series of a *Hemicopus* (probably *H. spiniger*, Duval), taken by himself at El Barco, Galicia, Spain, last July, to demonstrate the dimorphism of the females: one form having wholly black hairs, and the other wholly white (sometimes with a few black ones intermixed), the males showing no variation in this respect. Bourgeois, in his Monograph, noted the variability of the colour of the hairs in various species of this genus, but makes no mention of dimorphism in the females.

Mr. H. St. J. Donisthorpe exhibited seven specimens of *Prionocyphon serricornis*, Müll., bred from larvæ taken in the New Forest in July, living larvæ, and a larva and pupa figured, of the same, and made the following remarks on the species:

"The life history of *Prionocyphon* was unknown to science. Last year I took some larvæ in water in a hole in a felled oak in the New Forest, which I thought might be the larvæ of *Prionocyphon*. They all unfortunately escaped or died, but my friend, Mr. Hereward Dollman, figured one of the larvæ for me, and this I exhibited at one of the meetings of our Society.

"This year, on July 17, I took some more of these larvæ out of the same tree in the Forest, and have succeeded in rearing seven perfect insects so far. I placed the larvæ in a bowl, with dead leaves, wood mould, and water out of the tree itself, and a piece of the fresh bark on the top. Perfect insects appeared on July 28, 29, 30, 31, and August 1. Some of the larvæ crawled on to the bark, and hid under the moss on it, to pupate. A larva was observed to pupate on July 29; I took it to the Museum and got it figured, and returned it to the bowl, and it hatched on August 1, only three days being passed in the pupal state. Eggs must have been deposited
in the bowl, as besides many nearly full-grown larvæ, a number of very young ones are now present. I hope to carry them all safely through the winter."

Dr. T. A. Chapman brought for exhibition a collection of butterflies, made by himself in Galicia (lat. 42° 16' N., long. 6° 44' W.) last July, including (a) specimens of *Lycena idas*, hitherto reported only from the Sierra Nevada and district in the extreme south-east of Spain. It came rather as a surprise therefore in the extreme north-west, where it occurred at an elevation of 4500 to 5000 feet, and only where there grew a species of *Erodium*, with extremely large handsome flowers. On this it was seen to lay its eggs, and on one little patch of about 50 square yards, practically carpeted with the plant, a good many butterflies were observed, and eggs were found, where they were seen being laid on the leaves; and, as is so common in the *Lycena*, as near the ground as the butterfly could get.

(b) Specimens of *L. astrarche*, one from practically the same ground as the *L. idas*, for comparison.

(c) Specimens of *L. argus* (*agony*) from the same district. These, while very close to the vars. hypochiona and bejarensis, differ in a certain proportion of the specimens presenting the red of the marginal "peacock eyes" on the upper surface of the hind-wings of the males. Dr. Chapman said that such a coloration occurs in Asiatic specimens, that differ otherwise from these, but he had not heard of any European forms possessing it. These specimens, also, differed amongst themselves in the tint of the blue; some being greenish, others full lilac—an amount of variation unusual amongst specimens all from one locality.

(d) Examples of all the other *Lycenae* met with; otherwise not remarkable. *L. boricus* and *L. telicanus* were almost everywhere abundant in all stages, except the pupa, which seemed to be hidden tolerably effectually.

The species met with and shown included also, *Thecla ilicis*, *T. spini*, *Zephyrus quercus*, *Chrysophanus virgauve*, *C. hippothoii*, *C. philax*, *Lycena argyolus*, *L. melanops*, *L. amanda*, *L. icarus*, *L. baton*, and *L. arivon.*

The Hon. N. CHARLES ROTHSCILD exhibited branches of
Viburnum lantana showing the mines of Sesia (Aegeria) andreniformis, now discovered by him as the food-plant of the species in Britain for the first time. He said that, in the Ent. Verein Zeit. Wien, the mine, which is unlike that of any other species of the genus, had been reported in Viburnum opulus (the Garden Snowball Tree).

Mr. E. Dukinfield Jones exhibited two species of Molippa from Parana, South East Brazil, which had been considered to be both M. sabina, Walk. The two species were so closely allied that the only way to distinguish them was by comparing the genitalia, dissections of which were shown. Photographs of the larvae of both accompanied the exhibit.

The President mentioned a bug which Mr. Cecil Floersheim had found very destructive to the eggs of Papilio machaon and P. asterias in his open-air butterfly house. It pierces the ovum and feeds on the contents, leaving only the iridescent shell, from May to August, being most abundant in June and July. Its attacks are made in the penultimate stage, but mostly in the winged stage, in which it is very agile. The eggs of P. philenor do not seem attacked by it. Mr. E. Saunders, F.R.S., who kindly allowed the insect to be sent to him for identification, says it is one of the Capsidae, Heterotoma merioptera, Scop., found on nettles and other plants, and apparently common all over Europe; but he had not heard of its being predaceous on eggs. Though Reuter speaks of the Capsidae as sucking the juices of Podurids and Aphides as well as of plants, Mr. Saunders thinks there is no doubt that most of them are vegetable feeders, probably not averse to a little change of diet as opportunity offers, but he would certainly never have thought of Heterotoma as a carnivorous species.

Dr. F. A. Dixey exhibited several specimens of Pierine butterflies in illustration of melanism, and made the following remarks:—

“At the recent meeting of the British Association in York, much interest was aroused by Mr. Porritt’s paper and exhibit on the subject of melanism. It has occurred to me that an illustration of some of the general conditions under which white and other kinds of pigment may be replaced by black might possibly aid in the consideration of the more special
question as it affects the insect-fauna of these islands. With this view I have brought some selected specimens here to-night, and propose, while enlarging the scope of inquiry in one way, to narrow it in another by confining my illustrations to the group of Pierinae.

"A substitution of dark pigment for light may take place—
"(1) Between allied species, as Belenois mesentina, Cram., and B. raffrayi, Oberth.

"(2) Between nearly-related forms of the same species, as Eronia cleodora, Hüb., from East London, and E. cleodora, f. dilatata, Butl., from Mombasa.

"(3) Between the sexes of the same species, as Delias inferna, Butl., ♂ and ♀.

"(4) Between individuals of the same sex of the same species, as the ordinary and 'white' form of Colias electra, Linn., ♀.

"It is often possible to trace a connection between dark pigmentation and certain external or internal conditions, such as horizontal or vertical distribution, season and sex. Can any of these conditions be regarded as a direct cause of melanism?

"(1) As instances of the influence of horizontal distribution, or locality, we have Eronia cleodora as above; Belenois mesentina of Africa and India with its Australian representative B. teutonia, Fabr.; and B. severina, Cram., ♀ from Natal compared with B. severina ♀ from the Victoria Nyanza.

"(2) As examples of the influence of vertical distribution we may take Tatochila artodice, Hüb., ♀ from Buenos Ayres, and T. stigmadice, Std., ♀ from the Andes of Ecuador. A familiar case of the same kind is the ordinary Ganoris napi, Linn., ♀ of Switzerland compared with G. bryonia, Ochs., of the high Alps.

"(3) To illustrate seasonal influence we may compare the dry- and wet-season forms of Teracolus anna, Wallgr., T. antigone, Boisd., T. omphale, Godt., Glutophrissa saba, Fabr., Appias libythea, Fabr., Tachyris hippo, Cram., Huphina nadina, Luc., H. nerissa, Fabr., and Ixias evippe, Drury. In all these the tendency towards melanism in the rains shown by the females is well marked. The corresponding males are also affected, though in less degree.
“(4) As exemplifying the influence of sex, we have *Delias inferna* ♂ and ♀ as above, *D. descombesi*, Boisd., *D. eucharis*, Drury, *Terias tominia*, Voll., and *T. zita*, Feld.

“It seems obvious that in all these cases there must be some relation or other between the increase of dark pigment and the conditions that have been named. But is the bond between them one of direct causation? It will be found that the attempt to rank any one of these conditions as an actual and immediate cause of melanism is attended with great difficulty.

“(1) Melanism cannot be purely a matter of different climatic conditions dependent on horizontal distribution, because in any given region it often happens that only one sex shows a tendency towards melanism, the other sex remaining unaffected. Moreover, as in the case of *Belenois mesentina* and *B. raffrayi*, we may have two closely allied butterflies from the same locality, one nearly white and the other almost black.

“(2) Nor is it easy to consider melanism as a direct consequence of high altitude, for here again it is often only the one sex that is affected, as in *G. bryonix*. Besides this, female *G. napi* of the ordinary kind may be found in the same localities as *G. bryonix*; and ‘white’ butterflies which are met with at enormously high altitudes, such as *Baltia shawii*, Bates, ♂ in Central Asia and *Phulia nymphula*, Blanch., in the Andes, are by no means melanic. Again, the female of *Tatochila demodice*, Blanch., shows dark pigmentation whether taken at high altitudes or at the sea-level.

“(3) There is obviously a strong connection between seasonal conditions and melanism. This is clearly shown by the series of seasonal forms in the present exhibit. As a rule, the deeply-pigmented form belongs to the wet season, and the paler form to the dry. But here again, if we attempt to make wet-season conditions a direct cause of melanism, we are met by the fact that sometimes the same conditions are associated with an exactly opposite result. The instance of *Precis octavia natalensis* and *sesamus* will occur to every one as a case in point; but without travelling beyond the *Pierinx* we have only to compare the under-sides of, say, *Ixias pyrene*, Linn., ♂,
wet and dry, or of *Terias senegalensis*, Boisd., ♂ wet and dry, to see that an increase of dark pigmentation, whether in a diffused or concentrated form, may characterize a dry-season phase as opposed to a wet one. A further difficulty is that dark pigmentation appears in some instances (as in *Polyommatus phlavinus*, var. *eleus*) to be an accompaniment of heat, in others (as in *Vanessa urticae*, var. *polaris*) of cold.

“(4) Lastly, with regard to sex. It is no doubt true that in the majority of instances the female shows a darker coloration than the male. This comes out well in many of the specimens exhibited. But it is not difficult to find examples of the reverse condition, where the female possesses less dark pigment than her mate. This is the case, for instance, with some forms of *Colias eurytheme*, Boisd., and with *Dismorphia thermesia*, Godt.

“It seems therefore difficult to attribute melanism, or the tendency towards that condition, to the immediate action of either geographical or seasonal conditions or to the direct influence of sex. What explanation remains? I am strongly disposed to think that in the vast majority of cases the prevalence of dark pigmentation is adaptive, and that although melanism in its various degrees may certainly originate as a variation or a sport, its increase and establishment are to be attributed to some form of selection. Any one of the conditions mentioned may by itself, or in combination with others, favour melanism; not however by direct causation, but by indirectly leading to the selection of melanic individuals. Thus, there is little doubt that the dark pigmentation is in many cases of advantage as aiding concealment. This is probably the explanation of many instances of dull or dark coloration in the female sex not only of insects but of other animals, it being well known that the female sex stands in special need of protection (Wallace). The writer has observed that the darkly-pigmented female of *Belenois severina*, a common African form, is far less conspicuous on the wing than the lighter-coloured male. The dark border indeed of the former sex is often hardly visible, and the general impression given is that of a much dwarfed specimen, though the average female is not really smaller than her mate. An enemy attack-
ing such forms on the wing might, it is believed, avoid the apparently dwarfed specimens, either because they afforded less prospect of a sufficient meal, or (in accordance with a suggestion of Mr. F. A. Heron) because, apparent size being a correlative of distance, the attacker might be deluded into supposing the black-bordered forms to be further away and so less easily reached than the rest.

"It is noticeable that in some cases of heavily-pigmented wet-season forms, the under-side shows no corresponding melanism, being often in fact far lighter in colour than the under-side of the same species in the dry season. This exact reversal of effect on the two surfaces is of itself a strong argument against the supposed direct operation of meteorological conditions in producing melanism. Such conditions, as I have elsewhere urged, and as has been amply proved by experiment, may act as a liberating stimulus; but only rarely, if at all, can they be looked upon as a direct cause of darkened pigmentation. I would not entirely deny their direct effect upon the individual, nor even that such direct effect may under some circumstances reappear in the offspring. Weismann's results with P. phloxus, Fischer's with Arctia caja, and others on record (see Schneider, "Einführung in die Deszendenz-theorie," 1906, p. 113, etc.) seem to demonstrate the possibility of such apparent transmission. But this phenomenon of the diverse effect upon the two surfaces, together with the other considerations already brought forward, appears to make strongly against the hypothesis of a direct effect; and to favour, as far as it goes, the view that such changes as these are adaptive.

"A further point of interest arises in connection with the common absence of dark pigmentation on the under-side of wet-season forms, even when the upper surface is strongly melanic. It is this: that on comparing the seasonal phases of such forms we are often led to the conclusion that so far as the upper-side is concerned the wet-season form is better protected, but with regard to the lower-side the corresponding dry-season phase, being cryptically coloured, has the advantage. This may mean that the wet-season form requires more protection during flight, and the dry-season form during repose; and this again may
point to the fact that it is such enemies as attack butterflies at rest (for example, lizards) that are especially dangerous during the drier part of the year.

"Whether the duskiness so often met with in arctic and mountain forms can at present be explained as an adaptation, is perhaps doubtful; though there seems to be no reason why Lord Walsingham's suggestion of its relation to the power of heat-absorption should not be correct. In such cases of the development of dark pigment as we see in females of Mylothris larena, Hew., M. pyrrha, Fabr., Pieris demophile, Clerck., P. viardi, Boisd., P. locusta, Feld., P. tithoreides, Butl., etc., to which may probably be added the wet-season Glutophrissa saba ♀ (see Trimen, Proc. Ent. Soc. Lond., 1881, p. viii), the influence at work is that of mimicry, and the result clearly takes rank as an adaptation.

"The occasional predominance of dark pigment in the males as compared with their mates is apt to show itself in the form of distinct and definite areas—not in that of suffusion. A common effect therefore on the male is to make that sex not less, but more conspicuous. Hence the pigmental areas may possibly in these cases serve as recognition-marks.

"This last, however, is but a suggestion. I am far from saying that the advantage of a melanic tendency to its possessor is in every instance demonstrable. I only submit that our present knowledge, so far as it goes, points to selective adaptation as the principle which seems likely to cover most if not all of the diverse conditions now grouped together under the comprehensive head of melanism."

The President said he thought there was no doubt that temperature had, what appeared to be, a direct effect in the case of many Lepidoptera. For example, on many of the common Geometrid moths, if the pupae were exposed, some to a temperature of 40° to 50°, others to one of 70° to 80°, those at the lower temperature were darker.

Professor E. B. Poulton, Dr. T. A. Chapman, Mr. W. E. Sharp, Mr. W. J. Lucas, and other Fellows joined in a discussion of the spread of melanism in various districts of Britain and elsewhere.
Wednesday, November 21st, 1906.

Mr. F. Merrifield, President, in the Chair.

Nomination of Council and Officers.

The following Fellows were nominated to serve as Officers and other members of the Council for the session of 1907–8:—

President, Mr. Charles Owen Waterhouse; Treasurer, Mr. Albert Hugh Jones; Secretaries, Mr. Henry Rowland-Brown and Commander James J. Walker; Librarian, Mr. George C. Champion. Other members of the Council:—Mr. Gilbert John Arrow, Mr. Arthur John Chitty, Dr. Thomas Algernon Chapman, Mr. William James Kaye, Dr. George Blundell Longstaff, Professor Raphael Meldola, F.R.S., Mr. Frederic Merrifield, Mr. Guy A. K. Marshall, Mr. Louis Beethoven Prout, Mr. Edward Saunders, F.R.S., Mr. Robert Shelford, Mr. George Henry Verrall.

Election of Fellows.

Mr. Walter E. Collinge, M.Sc., of the Department of Economic Geology in the University of Birmingham, 55 Newhall Street, Birmingham, and Mr. H. S. A. Guinness, of Balliol College, Oxford, and Chesterfield, Blackrock, co. Dublin, were elected Fellows of the Society.

Exhibitions.

Mr. H. W. Andrews exhibited specimens of Odontomyia angulata, Pz., from the Norfolk Broads, of which species few captures have been recorded of recent years, and Icterica westermannii, Mg., a rare Trypetid, taken by him in the New Forest district in August of this year.

Dr. F. A. Dixey exhibited dry- and wet-season forms of both sexes of Teracolus regina, Trim., together with specimens of Belenois calypso, Drury, B. thysa, Hopff., Mylothris agathina, Cram., and two unnamed forms of Belenois from Rhodesia.

The exhibit was designed to show the strong resemblance
between the under-side of the wet-season phase of *Teracolus regina* and that of certain forms of *Belenois* from the same region of Africa—a resemblance believed by the exhibitor to be of mimetic significance. He pointed out that between *B. calypso* and *B. thysa*, which latter was an acknowledged mimic of the distasteful *Mylothris agathina*, there existed a fairly complete series of transitional forms, one of which at least showed on the under-side a striking resemblance to the under-side of the wet-season *T. regina*. It seemed as if *M. agathina* had exercised a strong influence on this group of *Belenois*, and that in the progress of these *Belenois*-forms towards the final mimetic pattern shown by *B. thysa*, one of them had, as it were, taken up *T. regina* in its course. The association between the *Belenois* and the *Teracolus* was probably Müllerian, the *Belenois* being in most respects the model; but it was perhaps not improbable that the *Teracolus* had to some extent influenced the *Belenois*. These specimens seemed to favour the view that *B. thysa* was a Müllerian rather than a Batesian mimic. It was an interesting fact that the cryptic character of the dry-season form, as well as the mimetic appearance of the wet-season phase of the *Teracolus*, was confined to the under surface; being presumably in both instances intended for use during rest rather than in flight. As in other cases, the dry-season form was probably the more efficiently protected. It might be taken as a general rule that in cases of seasonal dimorphism, if one phase only were protected, that phase would be the dry-season one; if both adopted means of defence differing in degree or in kind, the dry-season phase would be the better protected of the two.

Mr. W. J. Lucas showed on behalf of Messrs. H. and F. Campion a male specimen of *Sympetrum vulgatum* taken in Epping Forest on the 4th September last. The only other authentic British specimens are: (1) a male in the collection of Mr. C. A. Briggs, taken at Bookham Common in 1891; (2) a male in his own collection taken 11th September, 1898, in Richmond Park; and (3) a male taken by Mr. A. H. Hamm at Torquay, 15th August, 1899, which he cannot now trace; but it was carefully examined at the time by the late Mr. McLachlan. Dr. Hagen mentions in the "Entomologist's
Annual," for 1857, a ♀ taken near Hull, on the authority of Mr. J. C. Dale.

Genitalia on ventral surface of segment 2 of the abdomen of the ♂ of:

1. Sympetrum vulgatum. 2. S. striolatum.

Mr. Lucas said that in his book on British Dragonflies he had noted several points of distinction, but he would add the shape of the abdomen (more constricted near the base in *S. vulgatum*), and the form of the genitalia (as shown in an accompanying drawing), absence of yellow dots on abdomen in *S. vulgatum*, judging by Mr. Campion’s specimen, did not hold good and must be erased from his list of differences and that of De Selys’.

Mr. R. Adkin exhibited a short series of *Tortrix pronubana*, Hb., including both sexes, which he had reared from larvæ and pupæ collected from *Euonymus* at Eastbourne in September last. The only previous records for the species in Britain were single male examples captured at Eastbourne ("Proc. Ent. Soc. Lond.,” 1905, lxiii), and at Bognor ("Ent. Mo. Mag." xli, 276) respectively in the autumn of 1905. The series exhibited therefore represented the first specimens reared in this country, and it was interesting to know that a species so recently taken for the first time in Britain was not a mere casual visitor, but that it had gained a footing on our shores and that there appeared good prospect of it becoming permanently established.
Dr. T. A. Chapman exhibited a long series of *Caenonympha mathewi*, Tutt ("Ent. Rec." xvi, p. 308), from different places in the north-west corner of Spain (Galicia), and read the following note:

"Showing much variation within certain limits, these specimens raise the question whether they belong to a species distinct from *C. dorus*. They come from an area whose limits are 30 miles from north to south and 140 from east to west, and throughout this area are fairly uniform, i.e. the variation in the direction of *dorus* is not greater in the most eastern specimens than in the others. They are smaller than *dorus*, and all show the difference that most characteristically separates them from *dorus*, viz. in *dorus* the white band on the under-side, common to so many *Caenonymphas*, extends to the margin and includes the eye-spots: in *mathewi* it does not pass the eye-spots, the remainder of the wing to the margin being of the same ground colour as the rest of the wing, in this respect it is nearer the generic type than *dorus*, in many specimens however this area contains a pale patch. The generally darker upper-side and the want of the silver line beneath, are also marked differences. At Bejar, 180 miles south, I found fairly typical *dorus*. In the Cantabrian region neither form was seen.

"*Mathewi* is a coast and mountain species. *Dorus* is not a low level insect so far as I have met with it.

"It would follow therefore that the area of distribution of *mathewi* is continuous with that of *dorus* if at all, only through central Portugal.

"Portugal has a special form of *dorus* mentioned by Staudinger under the name of *bieli*. I have not seen this form, but Staudinger's note shows that it differs from *dorus* in the direction of *mathewi*.

"An examination of the ancillary appendages shows them to be practically identical in form, but that those of *mathewi* are nearly 20% smaller than those of *dorus*.

"In conclusion, though I doubt the possibility of *dorus* and *mathewi* being directly syngamic did occasion offer, I think it very probable, that they are so by the mediation of transition forms in the regions connecting their proper areas"
of distribution, and if this is so, it is necessary to regard mathewi as a geographical or subspecific variety of dorus and not as a fully established species."

Mr. Hubert W. Simmonds contributed some "Notes on an Unusual Emergence of Chrysophanus salustius in New Zealand," as follows:—

"A few notes on the very unusual appearance of our New Zealand Chrysophanus salustius this winter may be of interest to Fellows of the Entomological Society. This butterfly generally appears about the beginning of November, the males first and the females becoming common a few weeks later. There seem to be a series of emergences throughout the summer, for fresh specimens are frequently taken up to the end of March, and it lingers on well into April on the sea-coast and other favoured spots. I was therefore very much surprised to find a perfect newly emerged ♀ at rest on a blade of grass under the cliff at Titahi Bay early in July, and still more so when on the 29th of that month (which was after a bright sunny week but with cold nights) I again visited that locality and found C. salustius almost common flying in bright sunshine. Nearly all the specimens were in perfect condition, and of the four I caught (I had no net with me) all were ♀s and two more of the variety having the blue hind-marginal spots well developed. Several others that I got close to were ♀s and I did not observe a single ♂. The locality was at the base of some sloping cliffs sheltered from the south winds and getting the sun all day. I have not since visited this spot, and although I have been in several similar localities in the neighbourhood, I have not seen a single specimen.

"The variety of the ♀ having the blue spots in the black hind-marginal spots seems peculiar to the sea-coast, for all that I have taken of this variety have been on the sandy cliffs that form the coast-line in this district."

Professor E. B. Poulton, F.R.S., communicated some "further notes on the choice of a resting site by Pieris rapae," by Mr. A. H. Hamm, as follows:—

"On July 10th this year I observed a male of this species at rest on the under-side of a dahlia leaf in my garden, 22 Southfield Road, Oxford. In no case had the dahlias bloomed
by this date. The *Pieris*, although it had not chosen the best possible site in the garden, was fairly well hidden amid the thick foliage. The only other occasion on which this species was seen at rest in 1906 was on August 4th, when my friends, Mr. Holdaway and Mr. Constance, and I were sugaring in the "Decoy," Newton Abbot, S. Devon. During the rounds many trees, bushes, &c. were searched with the aid of our lanterns for any strange insects at rest upon the foliage. My attention was first directed by Mr. Constance to a specimen of *P. rajae* at rest upon the whitish under-side of a leaf of the broad-leaved sallow (probably *Salix caprea*). After this we all three began a more systematic search, and succeeded in finding four additional individuals of the species. The five butterflies were distributed as follows:—Two were on the under-sides of leaves of the broad-leaved sallow; two on bramble leaves (one hanging from the under-side, and the other sitting on an under-side which happened to be turned uppermost); the fifth was found hanging from the under-side of a leaf on a birch bush. The under surface of all these leaves is very pale as compared with the upper surface. These facts seem to me to strengthen the opinion expressed in my former notes (vide "Proc. Ent. Soc. Lond." 1904, p. lxxv and 1905, pp. lxxiii, lxxiv.) that *Pieris rajae* does select for prolonged rest a site adapted to promote concealment."

*Papers.*

"A Permanent Record of British Moths in their Natural Attitudes of Rest," by Mr. A. H. Hamm, Assistant in the Hope Department of Zoology in the Oxford University Museum, communicated by Professor E. B. Poulton, F.R.S.


"Notes on the Life History of *Sesia andreanæformis*, Lasp.,” by the Hon. N. Charles Rothschild, M.A., F.L.S., F.Z.S.

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**Wednesday, December 5th, 1906.**

Mr. F. Merrifield, President, in the Chair.

*Donations, etc.*

The Hon. Secretary, reading out the list of Donations to the Library since the last meeting, made special reference to
the Haliday correspondence, now presented to the Society by Dr. E. Percival Wright, of Trinity College, Dublin, to whom a unanimous vote of thanks was given.

Nomination of Auditors, Officers, and Council for 1907.

Commander J. J. Walker, one of the Secretaries, again read the list of Fellows nominated to act as Officers, and as other Members of the Council for 1907.

The President announced that the following Fellows had been nominated as Auditors:—Mr. W. J. Kaye, Mr. A. J. Chitty, Mr. L. B. Prout, Mr. R. Adkin, Dr. T. A. Chapman and Mr. R. Wylie Lloyd.

Election of Fellows.

Mr. H. C. Pratt, Government Entomologist, Federated Malay States, Kuala Lumpur; Capt. H. J. Walton, M.B., F.R.C.S., Indian Medical Service; Mr. Arthur Ernest Gibbs, F.L.S., Kitchener’s Meads, St. Albans; Capt. James Bruce Gregorie-Tulloch, King’s Own Yorkshire Light Infantry, Strensall Camp, York; Mr. John Ashburner Nix, Tilgate, Sussex; Mr. Herbert W. Southcombe, J.P., 16 Stanford Avenue, Brighton, and Mr. Roland E. Turner, 21 Emperor’s-Gate, S.W., were elected Fellows of the Society.

Exhibitions.

Mr. A. W. Bacot exhibited a specimen of Catocala nupta, taken at rest at Hackney, November 9th, 1906, remarkable for having two well-developed tarsi on the left fore-leg. Also three ♀ specimens of Lasiocampa quercus, L., bred from larvae from Cornwall in 1906. One of these larvae had been submitted to a pressure of from 27 to 30 atmospheres (405 to 450 lbs. per square inch) on two occasions.

Dr. M. Greenwood commenting on the effects of rapid decompression on larvae, said that the lesions produced in Vertebrata by sudden decompression were known to be due to the liberation of nitrogen bubbles from the blood and tissue fluids. Accordingly decompression should be innocuous in animals, such as lepidopterous larvae, in which the respired gases are conveyed directly to the cells without the intervention of a circulating medium.
Larvae of the following species, *Cossus cossus*, *Lasiocampa rubi*, *L. quercus* and *Smerinthus populi*, had been submitted to air pressures of from 10 to 30 atmospheres for periods up to 2 hours and 40 minutes. In all the experiments decompression was effected in a few seconds. No ill effects resulted and two specimens, which were kept under observation, pupated and emerged normally. The fatal effect of such exposure upon *Vertebrata* was demonstrated on frogs used as controls.

Although, therefore, larvae were immune from decompression lesions they appeared to be nearly as susceptible to oxygen poisoning as frogs. Two larvae of *Smerinthus populi* were affected by exposure to 16 atmospheres of pure oxygen in the same time as a control frog.

If larvae were allowed to feed while under pressure, the air swallowed with the food plant would produce fatal lesions on decompression. A larva of *L. quercus*, placed in the pressure chamber at 11.25 a.m., together with some food plant, much of which was consumed, appeared to be killed instantly by decompression at 11.40; the gut being enormously distended with semi-digested leaves and air-bubbles.

A discussion followed in which Dr. F. A. Dixey and other Fellows joined.

Dr. T. A. Chapman exhibited a long series of *Hasula hyerana*, Mill., bred this year from larvae collected at Hyères; and a diagrammatic map of the neighbourhood to explain the distribution of the moth in that area. The moths consisted of about two hundred and fifty specimens from "Les Maures," the low hills behind Hyères, nearly 50 per cent. of which were melanics; and about a hundred and seventy from "La Plage," the coast nearest to Hyères; but these contained only about 14 per cent. of melanic forms.

"The former area (Les Maures)," said the Exhibitor, "would appear to have been searched in vain fifty years ago by Millière, who found the insect, however, at the Hermitage (= Costebelle), an area cut off from Les Maures by perhaps a mile and a half of country not habitable by *H. hyerana*, but probably continuous with the La Plage habitat. Hence it is not improbable that the insect had at that date recently
reached La Plage and Hermitage, but that it had not yet succeeded in advancing to Les Maures. At Les Maures the forces producing (i.e. selecting) melanism came into action, and now there is sufficient interchange of individuals between La Plage and Les Maures to prevent the dark from exceeding 50 per cent. at the latter locality and to supply the dark strain in sufficient numbers to La Plage to keep a small proportion of melanic specimens at that station.

"At any rate it is certain that we have at present at Hyères two colonies of H. hyerana, in one of which the melanic specimens are three times as numerous as in the other. These two colonies are separated by only a mile and a half of impassable country, which may however present some stepping-stones, in a direct line, and may be in closer connection by some more lengthy route.

"It is obvious, therefore, that the melanic tendency is much stronger in the one area than in the other, and it is difficult to believe, that, though sufficiently segregated to show this difference, they are not nevertheless capable of crossing with each other to an extent that makes the difference observed much less than it would be if segregation were complete. Possibly even to the extent of making the Les Maures race entirely dark and the La Plage colony entirely of the type form.

"I use the word melanism as indicating the presence of dark as contracted with lighter normal forms. Literally, however, these dark forms (marginata) are not black, but deep purple, almost leaden, when intense enough; it is, perhaps, desirable to note this, since the typical form presents specimens with an excess of black (not purple) pigment. The most marked of these are, however, far from being black, and even so are rare. They are, no doubt, indications of a melanic tendency acting on a different pigmentary variability to that which yields the purple specimens, and would literally be more entitled to be called melanic than the leaden-coloured ones. (See Ent. Trans. 1906, p. 155. E. M. M. 1906-1907)."

Dr. F. A. Dixey exhibited specimens of Teracolus omphale, Godt., bred and captured at Salisbury, Mashonaland, by Mr. G. A. K. Marshall, F.Z.S. The exhibit was intended to show
the effect of subjecting the insects during their immature stages to abnormal conditions of temperature and humidity.

He pointed out that the members of a brood which had been reared under ordinary conditions as larvae, but had been exposed as pupae to damp heat, showed on emergence little or no difference from those examples that had been reared under normal conditions throughout. The emergences took place in June 1905, and the resulting butterflies were of the usual dry-season phase, though less markedly dry-season than a pair captured in the field at the same date.

On the other hand, several examples, belonging to one brood, had been brought up as larvae in an atmosphere of damp heat, from which they were removed on pupation into natural conditions. The resulting butterflies, emerging in July during the height of the dry-season, were on the upper-side almost of the wet-season phase, while others of the same brood which had been kept in damp heat throughout both the larval and pupal stages went still further in the same direction. Some of these latter indeed, especially the females, showed on the upper surface the wet-season pattern fully developed. On the under surface the approximation to the wet-season phase was somewhat less complete; the most advanced examples of the effect of exposure to damp heat during both preliminary stages still exhibiting beneath some slight trace of the dry-season mottling. On the whole, however, very little difference was apparent between these artificially-produced wet-season forms and specimens which were shown of the normal wet-season phase captured in the open before the cessation of the rains.

Dr. Dixey further remarked that Mr. Marshall was to be congratulated on having been the first to produce, in tropical species of *Pierinae*, results as definite and unequivocal as any of those obtained by the President, Staudfuss, Fischer and others in European lepidoptera. Mr. Marshall had conclusively shown in the case of the present species that the natural stimulus for the assumption of the wet-season phase could be successfully imitated under artificial conditions; he had also proved experimentally that while both preliminary stages were to some extent capable of reacting to external conditions, by for the most susceptible period must be contained within the
larval stage of growth. The conclusions foreshadowed by Mr. Marshall's earlier experiments with *T. omphale* (Trans. Ent. Soc. Lond., 1902, pp. 211–213) were thus fully confirmed and amplified. These facts appeared to be of so much interest as to justify their immediate communication to the Society; he hoped before long to be in a position to present the results of a further examination of Mr. Marshall's valuable material.

Mr. G. A. K. Marshall said that his experiments showed that the larval period, especially in its later stages, was in *Teracolus* the period in which the insect was most sensitive to the above influence; the pupa stage, which was the most sensitive stage in *Precis*, being almost insensitive.

The President drew attention to the extreme interest of these experiments, and congratulated Mr. Marshall on the success which had attended his researches, conducted as they were under great difficulties in Central South Africa.

**Papers.**

Mr. Louis Beethoven Prout read a paper entitled "*Xanthorhoe ferrugata*, Clerck, and the Mendelian Hypothesis."

Dr. Frederick Augustus Dixey, M.A., M.D., communicated a paper "On the Diaposematic Resemblance between *Hyphina corea*, Wallace, and *Ixius baliensis*, Fruhst."
ANNUAL MEETING.

January 23rd, 1907.

Mr. F. Merrifield, President, in the Chair.

Mr. R. Wylie Lloyd, one of the Auditors, read the Treasurer's Balance Sheet, showing a balance £53 18s. 2d. in the Society's favour.

Mr. H. Rowland-Brown, one of the Secretaries, then read the following


During the Session 1906–1907 one Honorary Fellow, Baron C. R. Osten-Sacken, and six Ordinary Fellows, Mr. W. P. Blackburne-Maze, Mrs. Elizabeth Brightwen, Mr. C. W. Dale, the Rev. Joseph Greene, Mr. F. J. Horniman and Mr. E. W. Lane have died; four Fellows have resigned, or have been taken off the list, and twenty-nine new Fellows have been elected, with one Honorary Fellow.

The number of Fellows deceased is below the average, nor is the number of those who have resigned, or for other causes been removed from the list, excessive. While we are glad to report that the number of Fellows elected is a considerable improvement on the previous year, and with those nominated during the past three months, and still awaiting election, represents one of the largest accessions to the Society for many years: the returns showing especially, a notable increase of interest on the part of Fellows who are permanent residents outside the United Kingdom. The improved attendance at the Ordinary Meetings also indicates a much more active participation of other Fellows, the average being unusually high this year.

At present the Society consists of twelve Honorary Fellows, and four hundred and ninety-seven Life and Subscribing Fellows, making a total of five hundred and nine. Notwithstanding the rigid application of the new Bye-law relating to the removal of Fellows from the list for non-payment of subscriptions—a regulation which has saved the Hon.
Treasurer much time and trouble in the collection of arrears—the total, if slightly less than that of last year, still shows that the Society has by no means reached a stationary limit, and that we may rely confidently and still further on the assistance and support of many entomologists who have not yet joined our ranks. Indeed it is very satisfactory to note that in the last ten years the Society has increased to the extent of no less than one hundred and twenty-five.

The Transactions for the year 1906 form a volume of five hundred and thirty-nine pages, containing twenty-four Memoirs by the following authors: Mr. Gilbert J. Arrow, F.E.S., Dr. T. A. Chapman, M.D., F.E.S. (two), Dr. F. A. Dixey, M.A., M.D., F.E.S., Mr. Frank P. Dodd, F.E.S. (with an appendix by Col. C. T. Bingham, F.Z.S., F.E.S., and Dr. Benno Wandolleck), Mr. A. H. Hamm, Mr. C. Gordon Hewitt, B.Sc., Mr. S. L. Hinde, Mr. Martin Jacoby, F.E.S., Mr. W. J. Kaye, F.E.S., Mr. Percy I. Lathy, F.Z.S., F.E.S., Dr. G. B. Longstaff, M.D., F.E.S. (two), Mr. W. J. Lucas, B.A., F.E.S., Mr. E. Meyrick, B.A., F.R.S., F.E.S., Mr. S. A. Neave, M.A., B.Sc., F.E.S., Professor E. B. Poulton, D.Sc., F.R.S., F.E.S. (three), Mr. L. B. Prout, F.E.S., the Hon. N. Charles Rothschild, M.A., F.L.S., F.E.S. (with appendices by Mr. E. R. Bankes, M.A., F.E.S., and Dr. T. A. Chapman, M.D., F.Z.S., F.E.S.), Mr. R. Shelford, M.A., F.E.S. (two), and Mr. Roland Trimen, M.A., F.R.S., F.E.S.

Of these twenty-four papers, fourteen relate to Lepidoptera, three to Coleoptera, two to Rhynchota, two to Orthoptera, one to Hymenoptera, one to Neuroptera, and one, Professor Poulton's "Predaceous Insects and their Prey," refers to insects of all these orders except Lepidoptera, and includes observations also on Diptera.

The Memoirs referred to are illustrated by thirty-two plates, of which thirteen are coloured. Professor Poulton has defrayed the cost of Plate XXIX, and half the cost of Plates IX, X, XVI–XXII, XXIII, and XXXI, sharing also with Mr. W. J. Kaye the cost of Plates XXIV–XXVII, and with Mr. S. A. Neave half the cost of Plates XI, XII; the Hon. N. Charles Rothschild has given the entire cost of Plate XXVIII; Dr. T. A. Chapman has paid half the cost of Plate VIII, and the
whole cost of Plate VII; Mr. W. J. Kaye the cost of Plate XXXII; while to the production of Plates I and II, Mr. H. J. Adams, through Mr. P. I. Lathy, has contributed £16; and to the expenses of Plates IV, V, VI, Mr. H. H. Feltham, through Mr. Roland Trimen, has contributed £20.

The Proceedings, a limited number of which it is proposed for the first time to publish for exchange purposes in separate form, amount to one hundred and six pages: a sure testimony that the exhibitions and the discussions at the Meetings maintain a high level of interest.

By the suggestion, and at the expense of the President, the Society has been able to make a travel grant for the purpose of entomological study abroad in the summer months. Availing themselves of this opportunity Mr. A. W. Bacot, and Mr. J. H. Butterfield, B.Sc., worked for some weeks in the Rhone Valley of Switzerland. It is much to be desired that this grant should be continued by the Society and made permanent, as an encouragement to Fellows and others who would not otherwise extend their entomological investigations beyond the limits of the United Kingdom to localities on the Continent more favourable to their special branch of science. As it is, Mr. Merrifield has offered to repeat his donation for next year; and the Society owes him a deep debt of gratitude for his kindness and liberality.

Largely also on account of the generosity of so many Fellows in contributing to the expenses of the plates for the Transactions, the Treasurer is able to report that, after paying off all accounts rendered to the Society to the close of the year, there is a balance on the credit side of £53 18s. 2d. as against £50 3s. 5d. last year. A considerable saving of office expenses has assisted this satisfactory state of things, which is a certain assurance that the financial affairs of the Society are now in a thoroughly healthy condition.

The Assistant Librarian reports that Fellows have appreciated the extension of hours in the Library; and that there has been a large increase of readers. The number of volumes issued for outside reference is also encouraging, amounting to a total of 287 as against 208 for the previous twelve months: during which period the additions to the Library consist of
forty-four volumes, and one hundred pamphlets, in addition to the usual periodicals.

Entomological Society of London,
11, Chandos Street, Cavendish Square, W.
23rd January, 1907.


The following are also elected as officers:—President, Charles Owen Waterhouse; Treasurer, Albert Hugh Jones; Secretaries, Henry Rowland-Brown, M.A., and Commander James J. Walker, M.A., R.N., F.L.S.; Librarian, George C. Champion, F.Z.S.

The Balance Sheet and Report having been adopted, Mr. Frederic Merrifield, the President, delivered an Address. A vote of thanks to the President for his Address, and for his services as President during the past year, was proposed by Professor E. B. Poulton, F.R.S., seconded by Mr. G. H. Verrall, and carried unanimously. The President then proposed a vote of thanks to the other officers of the Society, which was seconded by Dr. T. A. Chapman, and carried unanimously. Mr. A. H. Jones, Mr. H. Rowland-Brown, and Commander J. J. Walker replied.
ENTOMOLOGICAL SOCIETY OF LONDON.

Balance Sheet for the Year 1906.

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No Ascertained Liabilities.

Additional Assets.

Contents of Library and unsold Publications.

Audited, compared with vouchers and found correct.

A. Hugh Jones, Treasurer.
11th January, 1907.

T. A. Chapman,
R. W. Lloyd,
Robert Adkin.
THE PRESIDENT'S ADDRESS.

LADIES AND GENTLEMEN,

I have the pleasing duty of congratulating the Society on its present aspect as disclosed by the Report just presented, not omitting the satisfactory balance sheet. The papers embraced in its Transactions maintain their high character, and the discussions recorded in its Proceedings are full of interest.

The losses among the Fellows of the Society during the closing months of 1905 and the year just past include several names around which many interesting recollections gather.

The Rev. Joseph Greene will long be remembered with gratitude by those whom he taught nearly half a century since how they might profitably spend the winter months in digging insects out of their pupal retreats. His paper on pupa-digging, afterwards expanded into "The Insect-hunter's Companion," is a valuable aid to field naturalists, and in many ways he contributed usefully to entomological literature. Mr. Greene died at his residence in Bristol at the age of eighty-two.

Captain Frederick Wollaston Hutton, F.R.S., died on the 27th October, 1905, in his sixty-ninth year. After retiring from the army in 1866 he emigrated to New Zealand, where he was occupied for some years in the Geological Survey. For some years he occupied the Chair of Zoology in Christ Church University. He made many contributions on the geology and natural history of New Zealand to various scientific publications, including those devoted to entomology. Captain Hutton was elected a Fellow of the Royal Society in 1892, and joined our Society in 1902.
Mr. Charles William Dale died in February last at the age of fifty-four, at Glanville's Wootton Manor House, Sherborne, where most of his life was passed. Among other works he wrote "The History of Glanville's Wootton, including its Zoology and Botany" (1878), "The Lepidoptera of Dorsetshire" (1886), with a second edition (1891). The fine collection of British insects made by his father, James C. Dale, passed to him, and, with many additions made by himself, was bequeathed to the Hope Museum at Oxford, where it arrived last summer.

A very eminent foreign entomologist, one of our Honorary Fellows, Baron C. R. v. d. Osten-Sacken, died at Heidelberg in May last, aged seventy-eight. The first of his writings, on the Tipulidae, published in 1854, showed the attraction which the Diptera had for him, and this was the Order of insects to which the principal part of his entomological work was devoted. But he was distinguished in many other ways. Twenty-one years of his life were spent as Secretary to the Russian Legation at Washington, and he presented his great American collection to the Museum of Comparative Zoology at Cambridge, Massachusetts. Knowledge of the Diptera was greatly advanced by his numerous contributions. His wide accomplishments and engaging personality added deep regret to the sense of the loss sustained by science in his death.

I proceed to the subject of my address.

I propose this evening to inquire into some of the causes of the persistent abundance or scarcity, generally and locally, of species and varieties of insects, and the relative importance, in this connexion, of their consumption of food and the attacks of their enemies. I shall have to refer to the large number of striking characters that appear to be of no biological importance; to the desirability also of observing and recording habits and activities—including those not directly concerned with nutrition or reproduction—not disregarding the psychical element which controls and guides action in these highly-organised animals. I propose also to call attention to the manner in which their activities and the motive-springs of them are affected by external conditions, and to the structure
and fixed habits indicating their ancestral history and affecting their present capabilities.

Darwin, in some of the earliest pages of his famous work on "The Origin of Species," remarks on our profound ignorance in regard to the mutual relation of the many beings which live around us, and asks who can explain why one species ranges widely and is very numerous, and why another allied species has a narrow range and is rare.

Notwithstanding the great advances made since those words were written we must admit that in the vast majority of cases, if our explanation is to be founded on actual knowledge of facts as distinguished from more or less well-founded conjecture, these questions are rather to be echoed than answered.

We may accept Darwin's position that, in the form a living creature presents, with certain important exceptions† "its structure either now is or was formerly of some direct or indirect use to its possessor," or, as the position is stated by Wallace, that every "truly specific character is or has been useful or is strictly correlated with such a character;" † but what we know of the actual processes by which these general causes have produced that which we see around us is recognised as exceedingly small in comparison with what we do not know.

The capacity for adding materially to the splendid generalisations of Darwin and Wallace, and of their distinguished successors in several departments of natural history, is not given to many, but the field of unexplored observation is almost infinite in extent and variety, so that many of us can gather facts that may help to solve some of the problems that exist.

Except in certain very limited investigations, there is probably nothing I can place before you that is not already known. But it has seemed to me that, without hoping to add

† Such as are caused by the definite action of external conditions, so-called spontaneous variations, and the complex laws of growth—"Origin of Species," p. 254.
‡ "Darwinism," and Journ. Linn. Soc., Dec. 1896, vol. xxv, p. 496, as cited by Professor Meldola in his Presidential Address to this Society in 1896, Proceedings, p. lxix, the correlation, as explained, p. lxx not being limited to such characters as are structural.
anything material to existing knowledge, still less to offer, except tentatively, any explanatory hypothesis, I could usefully avail myself of the opportunity you have given me—and which I feel as implying an obligation—by endeavouring to indicate some points to which the extensive opportunities for observation and research presented to this Society of more than 500 Fellows may with advantage be directed. I do so with unfeigned diffidence, for I know that I am addressing some who have devoted to the subject a capacity and an amount of thought far in excess of anything I can bring to bear upon it.

The questions which have been mentioned stand out as of interest and importance and such as we must often be asking ourselves. They may perhaps be followed out in this more detailed form: Why are the individuals of a well-established species fairly constant in number? Why is this number so much less in some species than in others? and especially, Why are some species so rare, and yet so persistent in the numbers of their individuals?

In inviting researches on these and cognate questions my data must mostly be supplied by observations made in the British Islands. This is so, partly because among countries of considerable and varied area and possessing a large number of organisms, belonging to widely different types and placed amidst diversified surroundings, there is none which has been more thoroughly searched, I may almost say ransacked, by entomologists, and none whose insects have been more studied by highly-qualified investigators, and therefore in reference to many particulars of which so much information of a fairly complete character is available; and partly because this information is that which has been most accessible to me. For somewhat similar reasons my illustrations must be drawn mainly from the Lepidoptera, with the additional reason that this is the only Order to which I have given any study. These are serious deficiencies, but I would plead that they are not an entire disqualification for the task set before me.

Productive and destructive forces—Productive.

It is by the conflict between the forces of production and
destruction that the organic world as we see it is maintained. Production of new beings is, of course, the necessary material for destruction to work on, but it need not here detain us long. Only let me offer the practical remark that the life history of a species cannot be considered complete unless it records such an important factor as the limits of the number of young that proceed from a single female parent, a number among some Lepidoptera far surpassing a thousand, among others much less than a hundred. Moreover, as effective production requires that there should be surrounding conditions which afford opportunities for the previous union of the parents, and admit of the disposition to use those opportunities, such as appropriate temperature and the right degree of light or obscurity, particulars of these conditions should be recorded.*

_Destructive forces._

The forces of destruction will occupy us much longer. Individuals are always being produced in abundance, their numbers being kept down by wholesale slaughter, a term in which I include starvation by the consumption of their food. Fully 99 per cent. of the offspring of an ordinarily prolific year-lived species are annually slain before their lives have become sufficiently complete to leave posterity, so that an investigation into the reason why their numbers persist involves an inquiry into the fatalities which they suffer, and it is to these fatalities consequently that it is of cardinal importance that attention should be directed. To complete their life history there must thus be added a detailed death history.

_Want of food._

The first of the causes of fatality that will be noticed is

* A few famous words, used in a very different sense, happen so concisely to sum up these requirements that I venture to re-quote them from a little paper published more than forty years since, humbly praying the forgiveness of all Dante scholars:

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di lor parenti
    . . .
    il luogo, il tempo e il seme
    Di lor senenza e di lor nascimenti.```

want of food. By analogy to the Malthusian doctrine that human population tends to increase faster than the means of subsistence, one is apt to think of the using up of the food of a species as the cause that usually prevents an inordinate increase of its numbers. But this cannot be so. It seems clear that the land does not in general bear the full complement of insects that the food it supplies is able to maintain, or anything approaching to that complement,* and there may be advantages in working this out from our own personal experience as entomologists, in order that we may realise its significance. I therefore offer some observations on the subject.

Consumption of food by herbivorous insects.

Considering these, in the first instance, in the mass,† we meet with much food destruction of a wholesale kind. Aphides, by attacking young shoots and leaves, and birds and molluscs by destroying seeds and seedlings, cut off an immense quantity of vegetable growth in its prime; but with all this and other wholesale destruction the amount of vegetation that attains full maturity and then falls to the ground, without having been consumed in supporting the life of herbivorous insects, appears to be very great in proportion to that which they consume, thus leaving a very large surplus fit for their consumption, but not, in fact, consumed by them.

Let me proceed to some familiar instances, where it is plainly impossible to say that the number of individuals of any species has been kept down by the exhaustion of their food supply. Look at a common rough untrimmed country hedge or ordinary wood. As we hunt along its borders for the imago, or it may be for the larva of common leaf-eating

* See accordingly Weismann's "Evolution Theory," English translation by Mr. and Mrs. Thomson, vol. i, p. 45 et seq.
† I have no personal acquaintance with those equatorial or tropical regions where there are no marked seasons, and where growth, multiplication, and destruction are rapid, simultaneous, and uninterrupted. But I have seen no reason to suppose that the general state of things is, in this respect, other than in seasonal regions, which, with their larger area, do not seem second in importance, and in which it does not appear likely that the relation between the growing vegetation and the insects that prey on it, though it may be less intense in degree, can be essentially different in kind.
species not limited to some particular kind of tree, how few are the insects that we can beat out, in comparison with the abundant leaves that fulfil their functions, reach maturity, and then fall off in such numbers as to form a dense carpet in the autumn!

Consumption by particular species.

Take a specific case, for example that of the common Gonepteryx rhamni, feeding exclusively in this country on the Rhamnus catharticus, scattered through our upland shaws, or the Rhamnus frangula, frequent in our lowland woods. How slight are its ravages, aided as they are by several other species! How rarely, indeed, do we find any tree or any hedge or wood so eaten down that either the plant itself has been killed or its summer outburst of leaves so consumed as to cause the starvation of nearly all the larvae, or even of a very large proportion of them!

Let me, before passing on, refer to some species famous for their destructive ravages. We have all seen oak trees with their spring crop of leaves cleared off by the larvae of the little green Tortrix viridana, or a field of cabbages reduced to skeletons by hordes of the gregarious larvae of Pieris brassicae; but enormous numbers of each species still reach the pupal stage. We have often seen a hawthorn hedge or several neighbouring hedges nearly cleared of leaves by the gregarious web-spinning larvae of Yponomeuta padella, to such an extent that probably many were starved, but a vast number must have eaten their fill. Nor is the productive capacity of the hedge, limited as hedges always are in extent of area, materially affected in the future, for next year the hedge presents an abundant repast.

There are countries in which doubtless the destruction is greater than in our own. We in England have no experience of the ravages of Ocneria dispar, of Psilura monacha, or of the dreaded “army worm,” such as they have in Germany or the United States, but, however great the destruction may be in particular years, the food supply left is so great on the whole as to leave enough to perpetuate these as veritable plagues.*

* Such outbreaks where they occur seem to be sometimes “countered” as regards further destruction in the same area by the habit of emigration,
The ravages of locusts are proverbial, yet in spite of their enormous consumption of green food there is still enough of it left in the countries they frequent to maintain them in countless millions.*

On the whole I think it would be difficult to show that any species of vegetable-feeding insect was ever wiped out or turned from a common kind to a rare one as a consequence merely of its food plant having been all—or nearly all—eaten down by itself or its congener; so that, whatever may be the cause of the remarkable numerical constancy we find in the individuals of different species, this persistence cannot be sufficiently accounted for by the relation between the food supply and its insect consumers.†

Climate and disease.

Extreme climatic variations are often very destructive, but these climatic causes can hardly be accountable for destruction of such a continuous or frequently recurrent nature as to produce a permanent reduction in numbers, an established species having become fairly adapted to its climate.

There is another source of destruction—that which is classed under the general name of "diseases"—and this, though especially rife when insects are bred under artificial conditions, certainly also operates in a state of nature, but not, I think, frequently to any very great extent. Observations by naturalists on this subject, however, are certainly desirable, though probably it is only with the assistance of those trained in the study of some of the lower forms of life that the nature of these diseases can be investigated with precision.

I conclude, therefore, that we must look to something more than failure or consumption of food-supply, climate or disease,

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* In Cyprus more than five thousand millions of egg cases gathered after several years of British occupation.—Sharp, "Camb. Nat. Hist.,” Pt. i, p. 292.
† I suggest that this conclusion may be important, as tending to exclude from a large field of operation what would otherwise be the powerful influence of direct mutual competition for food between herbivorous insects.
for the reason why herbivorous insects are not much more numerous than they are. We must turn to some other de-
structive influence of a kind constantly operating, in other words, to their active enemies, and with reference to this influence, I plead for all practicable additions to the informa-
tion that we possess.

_Destruction by active enemies._

I have enumerated in a note some of their chief enemies, which are of a most varied description, attacking them in all stages.* The elaborate contrivances for protection of Lepidoo-
tera in all stages are in themselves more than suggestive of the extent to which they suffer, or have in the past suffered, from enemies; but much observation is wanted if we are really to know instead of to conjecture the means by which the destruction is effected. Examination of the crops, castings and stomachs of birds and other insectivorous animals† afford valuable help in this direction. A scrutiny of the rejected wings, often found in plenty beneath the habitual resting-places of birds, often leads to useful results. Evidences of the amount of protection afforded by nauseousness or irritating hairs is accumulating, but there is room for much inquiry as to the actual operation of the horns, erectile tentacles, and apparatus for ejecting offensive or corrosive fluids with which so many larvae are provided, especially whether and to what extent these drive off or frighten away those terribly destructive foes, the ichneumon flies and the parasitic diptera.‡

* _Enemies._ In imago stage: Birds, especially in tropical and semi-tropical countries, lizards, night-jars, owls, bats, spiders, dragon-flies, mantids, ants, wasps, carnivorous beetles (see Mr. Floersheim’s careful description of the great extent to which beetles attack and kill sleeping butterflies, Tutt, Ent. Record, vol. xviii (1906), pp. 36-9). In pupal stage: Besides many of the enemies of the imago, mice and shrews, some ichneumon flies, especially while the pupe are soft; pupa diggers are recorded as finding many more pupe in October or November than in late autumn or winter. In larval stage, in addition to many of those above specified, the vast tribe of parasites, hymenopterous and dipterous, and bugs. In the egg stage, birds, ants, spiders, predaceous insects (Mr. Floersheim finds many eggs of _P. machaon_ and other Papilios sucked dry by a small bug. Ent. Proc. 1906).

† Such as those made by Mr. Guy Marshall, Trans. Ent. Soc. Lond. for 1902, p. 348 et seq.

‡ Scudder, as cited by Wallace ("Darwinism," p. 238), thinks nine-tenths of the North American butterflies are killed by parasites before they reach maturity.
Mainly it would appear, from the operation of the destructive forces above referred to, the number of individuals of most species—though but for these forces the possible increase in numbers is so immense—remains, taking one year with another, substantially the same.

**Maintenance of existing “balance.”**

The theoretical explanation is that the world is fully stocked, that all places are filled up, so that the competition of species prevents any permanent increase in the numbers of any one of them, except at the expense of some other or others, all the forces being thus balanced. This is a conclusion which seems almost to follow logically from the known and admitted facts, but the “how,” the process in detail, by which the normal number*—i.e. on the average of years—whether of a common or a rare species, is maintained, the various agencies by which it is brought about, are admittedly difficult to realise. Darwin tells us that the checks on increase and the relations between organic beings which have to struggle together are recognised to be extraordinarily complex. “Battle within battle must be continually recurring with varying success; and yet in the long run these forces are so nicely balanced that the face of nature remains for long periods of time uniform, though assuredly the merest trifle would give victory to one organic being over another.”†

The forces whose interaction results in this delicate balance and the methods of the interaction are so complex that proof from observation must always be defective, except in some

* Weismann, vol. i, pp. 46-95.
† “Origin of Species,” pp. 87, 89, 133. Though a balance is maintained it is not the balance, as the organisms between which it subsists are in a state of change, generally a slow one, but at times rapid, sometimes from causes which can be explained, such as human agency, as in the case of the introduction of rabbits into Australia or sparrows into New York. The causes are recognised to be generally obscure, and are considered by some to be chiefly internal. An endeavour, attended with some success, has been made to ascertain the causes of the rapid spread of melanism in parts of England and North-Western Germany; the results are summarised by Mr. L. Doucaster in the “Entomologist’s Record” for 1906, pp. 165-8, 206-8, 222-6, 248-54. The very diverse surrounding conditions under which melanism spreads (or fails to spread) show that there is much to learn before its causes can be treated as ascertained. See further on this subject Mr. Porritt’s paper, read before the British Association for the Advancement of Science in 1906.
relatively simple cases, like Darwin’s famous example of the way in which the fertility of red clover may depend, through the agency of humble-bees and field-mice, on cats. To supply such proof in general would seem as difficult as it would be to trace the paths of the particles in a storm-tossed sea, which, while in perpetual movement under the influence of the flowing and ebbing tides, and of the waves raised by the gusts of wind that sweep over its surface, aided by the fluctuating contributions from the river-mouths and rare upheavals from the “abyssal depths,” yet maintains an equable general level; even more difficult, because the influences that vary the face of organic nature are infinitely more complex than those which perturb the surface of the stormiest sea.

Great, however, as are the difficulties of proof, that is no reason why as much evidence as may be should not be obtained, thus conforming, so far as possible, to the demand—always a reasonable one—for evidence to support inference.* And the endeavour to obtain it, however imperfect the result, cannot fail to supply a fund of interesting and useful knowledge.

**Persistent variability.**

Let us now give some attention to the persistence of variability in the forms of established species. Looking to the excessive keenness of the competition that exists for vacant places, it does not seem easy to realise how some one of the “merest trifles” before adverted to can fail to give an advantage over the others, and therefore to see why the variety which possesses that character does not wholly supplant the others. Without disputing the proposition that there are cases in which what seems to us the “merest trifle,” or really is so, *may* be of selection value, the position that it *is* always so selected, *i.e.* is always practically of selection value, appears untenable. Such a position would be hardly consistent with the almost universally persistent prevalence of variability as an attribute of species which yet preserve general stability as such. And it

* Observations showing, in any case, how the different places in nature are filled up, notwithstanding that in many cases there appears to be room for a larger number of individuals of a species than permanently exists would be valuable.

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would be opposed to the views generally accepted that there are variations that "do not count,"* or, to use Weismann's term, are "biologically indifferent." † But there are many species which exhibit variations that, so far from being trifles, are of a very striking character, such as would challenge selection if it took that direction.

**Striking differences in facies.**

Among these striking characters, the facies presented to vision, including colour and design or pattern in conspicuous markings, at once suggests itself as probably the most effective, it being so extensively made use of for concealment and other vital purposes. Its usefulness for any such purposes is of course limited by the necessity for a sufficiency of light to show it, and of suitable seeing capacity on the part of the interested observer. Absolute darkness generally reduces insects to quiescence, but absolute darkness is rare during the active life of insects; it is practically limited to the few hours out of the twenty-four in which there is neither daylight, twilight, moonlight nor starlight, and, in the higher latitudes, during the summer months, when insects are most active, there is either no night at all or a very brief one. Moreover, a large minority of species of Lepidoptera are active in broad daylight only, and of the remainder that are only active in obscurity, a very large number are, while in a state of rest, fully exposed by day to observation and consequent destruction, so that even to human eyes, ill adapted as they are to pierce obscurity, the colours and patterns of these insects are more or less conspicuous, and may therefore be important characters.‡

* Thus Darwin speaks of "variations which are of no service or disservice to the species, and which consequently have not been seized on and rendered definite by natural selection."—"Origin of Species," p. 55. We are much too ignorant of the whole economy of any one organic being to say what slight modifications would be of importance or not.—Ib. p. 245. (Organs in process of extinction disappear so slowly that they must long be cumbrous.) See also Mr. Bateson's observations on the excessive variation of *Coccinella decempunctata* side by side with the invariability of *C. septem-punctata*, "Materials for the Study of Variation," pp. 572–3.


‡ Many species of predaceous beetles, bugs and other carnivorous insects hunt by night, and insects which, like butterflies, rest by night must be much at their mercy; moths that move about actively by night must have better chances of escape from them. As to the seeing powers of insects,
Among the Heterocera that fly in more or less of obscurity I think it may be said that the majority of species exhibit variation in colour and pattern of a kind and degree sufficient to arrest the attention of any observer duly endowed with sight. The range of variation in the numerous polymorphic species which, for a reason subsequently given, I call indiscriminately polymorphic, is enormous, and fully justifies the remark frequently met with in the books that, "take them where you may, there are scarcely two alike." I give some examples in a note.*

I think it will be found that the indiscriminately polymorphic Noctuae usually conceal themselves by day in grass and low herbage or in thatch, faggot stacks, ivy, &c., and do not rest by day, on palings, &c., where, indeed, many of them would be quite conspicuous. Still, they fly long before it is very dark, and the whitish underwings with which many are furnished, and which are displayed in flying, greatly add to their conspicuousness. And there must be some eyes capable of stealing upon them in their daytime retreats.

*Discriminate polymorphism.*

There are two classes of cases in which polymorphism would appear to be distinctly advantageous. The first consists of what, see Packard's "Text Book of Entomology," pp. 249-64; also Dr. Sharp's Presidential Address, Proc. Ent. Soc. Lond. 1888, pp. 1-lxvi, and his paper, Trans. Ent. Soc. Lond. 1889, pp. 393-405. Many perceive light beyond the violet rays which bound our vision. As to the capacity of moths for seeing in obscurity, every moth-collector must have observed the glowing eyes of

"... the filmy shapes
That haunt the dusk, with ermine capes
And woolly breasts and beaded eyes."*

As regards vertebrate enemies there is no doubt of the keen seeing power of these, many of them, such as owls and some other birds and other nocturnal animals, possessing special adaptations for use in obscurity.

* _Apamea didyma (oculea)_ exhibits any shade of ground colour from pale whitish grey to black; of the pale ones some have a dark costa, others a conspicuous dark central band; none are described as restricted to any particular locality. Thirty forms are enumerated and described in Tutt's "British Noctue," vol. i, pp. 91-94. _Mima strigilis, Agrotis trilinea, Agrotis coelamantis, Noctua festiva_ ("I have at times possessed hundreds of specimens, of which I can truly say that no two were alike."—Humphrey and Westwood's "British Moths," p. 124). _Triphana pronuba_, and among Geometrid moths _Hypsipetes elutata_, of which Barrett writes: "Excessively variable, the colour ranging from green to brown and endless variety in the marking."
by way of distinction, may be designated as discriminate polymorphism, when, for example, a species exists in widely different surroundings, and its different varieties are allocated, and, if one may say so, attuned, to fitting localities or, it may be, seasons, as in the case of some local or seasonal variety, or the many species which rest by day on objects of varied aspect, the colours or markings of which resemble their own, and often in attitudes adapted to increase the illusion. *

*Indiscriminate polymorphism.*

There is another class of cases to which I do not know that a better name can be applied than that of indiscriminate polymorphism, consisting of such as do not fit their variations to appropriate localities, seasons, resting places or resting attitudes. To these polymorphism may be advantageous on the principle that as every different colour or marking has its own special chance of escape from enemies, the more colours or markings its different individuals present the more chances of escape they would have; just as if one could conceive a billiard table to be fitted up with many holes of different shapes and a number of balls of different shapes to be scattered over it, more balls would find places than if all the balls were of one size.

Characters "biologically indifferent."

But I do not think these explanations can be considered to cover the whole ground. The only explanation that seems to me possible in the vast majority of cases is that many characters, even striking ones, are, as previously stated, "biologically indifferent.† Nature, it may be said, is more tolerant than is sometimes supposed, when, for example, it is said that the slightest difference in conspicuousness must tend

* Such as *Hibernia leucophoraria* resting on oak trunks.—Proc. Ent. Soc. Lond. 1903, p. ix. This resting situation and position is one of the points on which more observation is wanted. Some moths strongly variable in appearance are notorious for not resting on surfaces suitable for concealment, as *Polia chi*.—Barrett's "British Lepidoptera," vol. iv, p. 307. Can these be shown to be nauseous or in some other way exempt from attack? As bearing on this, see Mr. Porritt's paper before referred to.

† Weismann is of opinion that where species are variable in a high degree their variations possess no biological importance, or the less valuable among them would be gradually removed by selection.—"Evolution Theory," vol. ii, p. 135.
towards and ultimately lead to exclusive selection for survival or extinction. When Nature intervenes it is indeed often, perhaps generally, with a sentence of death—sometimes, as applied to the extinction of a species, a lingering one—but with a very large number of conspicuous characters she does not appear to intervene at all, thus leaving very considerable parts of the organic life we see around us as spheres in which natural selection does not for the time being practically operate. May I put it in this way?—that there is selection between competing classes of variation, those which are of the greatest biological importance, often not conspicuous ones, or, it may be, altogether hidden from our observation, coming to the front. Just as, if I may be pardoned for an illustration drawn from familiar human history—we all belong to the Animal Kingdom—it was rivalry between courtly and social qualities which led to and maintained eminence in France under the Monarchy, but all this ceased to operate during the grim struggles of the great revolution there.

Habits.

But without discussing this question any further I proceed now to call attention to a set of characters which have no place in merely diagnostic works, and often receive scant mention in descriptive works of larger scope—as characters which may possibly explain, in some cases in which this suggested tolerance cannot be invoked, why some of the conspicuous differences I have dwelt on may be of practical unimportance. The set of characters to which I would thus draw attention is that which may be summed up for the present in the word "habits." In the habits of a species, taking the word in a wide and comprehensive sense, we may sometimes find a uniformity missing in its facies, and possibly important enough to enable a species possessing these habits to find and hold a place for itself, with all its diversely-coloured forms; the habits, or the internal qualities they connote, being perhaps the important attribute possessed by them all, and binding all together in a common situation.

Before proceeding further let me acknowledge my deep indebtedness to Professor Meldola's Presidential Address to this Society in 1896. A part of what follows is nothing more
than an endeavour, an imperfect one, to follow out thoughts suggested in that address, and to test or illustrate their application to some of the questions which arise.

Professor Meldola asks these questions— "Are the external, visible, appreciable, measurable characters alone to be regarded as of selection value? May not some at least of the minor more or less constant specific characters be the outward expression of some constitutional or physiological differences at present beyond the power of our methods of discrimination?" Among the qualities or characters which may thus be of selection value Professor Meldola proceeds to mention habits, of which he says that "they are not and cannot be taken into consideration in ordinary diagnostic work. Nevertheless, such habits are as truly specific as the form, colour, and pattern with which they are associated." *

Examples of marked differences of habit.

We may conveniently enumerate here some habits and actions of insects that are special to certain groups of them, large or small, including such as are characteristic of the individuals of a species or even variety, and, in connexion with this subject, we may perhaps usefully consider whether they or some of them may not be of biological importance.

First let me give a few examples of differences of habit which fall under the observation of every field naturalist, some of them being of a very marked character.†

Modes of flight.

There is the slow heavy flight of the burnets (Anthrocerids) and of some nocturnal moths, especially their females; these become easy victims to their pursuers, but are often protected by nauseousness from pursuit. Few Lepidoptera have a straight flight, most have a more or less jerky one, some in long curves, some in shorter ones, and many have the zigzag flight of the common white butterflies, including females of some species, the males of which fly with more rapidity and directness, this

† There is a great fund of information on this subject in the "British Lepidoptera" of that excellent field observer, the late Charles Barrett, also in Mr. Tutt's "Practical Hints for Field Lepidopterists." In these works a great variety of habits will be found recorded. Many pages are also devoted to them in Scudder's "Butterflies of North America."
zigzag flight being admirably elusive, for no collector, whether human or avian, can tell whether the next flit will be right or left, above or below.*

Habits of display.

On a very hot day last August I watched for an hour the evolutions of butterflies in a flowery field at Glengarriff in Kerry. Vanessa io was plentiful—I counted at one time seven within a space of ten feet square, chiefly settling on thistles, and making short flights from one flower to another, with frequent visits to scabious and rare visits to ragwort. There were also a few Pyrameis alatala and P. cardui, with an occasional Argynnis paphia, and a fair number of Lyceenids and Satyrids. There was not one of the species observed whose attitude or position when settled on a flower or mode of flight was not quite distinctive. V. io especially always had its wings at an angle towards each other of a few degrees on either side of 90°. These insects were extraordinarily conspicuous, much more so than they would have been with their wings closed, as they would have been when at rest, or with wings outspread, as they were when on a cloudier day they settled on roads or stones. They were very bold, not moving when my shadow fell across them or when my fingers approached to touching distance. I will not pretend to say that they were in high animal spirits and were proud of the figure they cut, but they certainly looked as if they were so.

Times of flight.

Time of flight is a habit that varies greatly.† Much the larger number of our Lepidoptera, as we all know, do not take to flight in full daylight, and in their hours of flight there is great variation. Let me mention a few of these variations.

* Differences in modes of flight are of course often associated with peculiar forms of wing.
† We are apt to speak of day fliers and night fliers, but this is a very rough classification. As a rule, brightly-coloured Lepidoptera no doubt fly only in strong daylight, many only when the sun is shining. There are exceptions on both sides; Arctia caja and Euchelia jacobaeae sometimes fly by night, the former indeed scarcely ever by day; it flies about conspicuously by day, and is probably protected by the powerful odour it can emit. Its near relatives, Callimorpha dominula and Nemophila plantaginis, appear to fly only, or almost only, by day; many moths of no brilliancy of colour fly by day, and preferably in sunshine, often only during certain hours. These include the large full-bodied moths, the Lasiocampids, Endromis versicolor and Agyia tau.
The ordinary Noctuæ mostly fly by night or in the dusk, but they include species such as the *Ternicampas* and the *Triphænas*, which fly also in broad daylight and in strong sunshine. Some Eupithecia have the same habit, and a large number of Geometræ and Pyrales fly by day; of *Chæres graminis* the males are stated to fly from 8 to 11 in the morning, the females after 11, and again later at night. Other moths fly in full daylight, but only begin a little before sunset, like *Angerona prunaria* and *Cidaria fulvata*. *Epione adversaria* is said to fly only from 7 to 9 in the morning. Most Geometrids fly in the evening, at or soon after dusk, but many begin long before dusk, and some fly at different periods in the afternoon, others in the dead of night. Many of the smaller moths, especially the Tortricids, have their special hours of the day for flight.*

*Attractiveness of light, sugar, etc.*

Some night-flying species are strongly attracted by light, others, closely resembling them in many respects, are absolutely indifferent to it; of the species attracted, in some both sexes are so, in others the females rarely or never. Some species come freely to flowers only, some to sugar only, some to both; some are little endowed with scent, others so largely that male moths have been attracted from vast distances. These are all differences of habit of a kind we "higher vertebrates" can appreciate, but there must be many more that are doubtless beyond our ken.

*Postures and rest attitudes.*

Many rest on objects they resemble, as some Cucullias do on sticks, or roll themselves up so as to look like bits of stick as *Phalera bucephala* does; some select rocks of their own colour, others expose themselves conspicuously on objects of any colour.

* It would seem probable that moisture may have much to do with some of the times of flight, promoting their activity, when the air is saturated or nearly saturated as it commonly is towards evening, when the warmth of the day is declining, or during the night, or morning when the grass is still reeking with dew. Many Lepidoptera certainly require moisture. Butterflies get it by drinking at puddles or sucking moist objects, and the lives of captured moths are prolonged by keeping them out of a dry atmosphere. Moisture also intensifies scent and softens honey dew. But no one has fully explained why sugar or flowers are so much more attractive on some nights than on others.—Tutt's "Practical Hints," part i, p. 10.
Then there are great differences in the mode of holding themselves when at rest, some few Geometrids closing their wings as a butterfly does, e.g. *Selenia bilunaria, Eupisteria heparata, Cidaria dotata,* and *C. pyraliata,* others adopting an intermediate position like those of the genus *Ennomos,* and *Selenia lunaria* and *S. tetralunaria,* which assume the form of a concave scalloped shell.* The abdomen of many when at rest is peculiarly curved upwards.†

**Habits as to local haunts.**

Local haunts may be classed among the varied habits of some species, including some that in the larval condition feed promiscuously on grass. Thus *Epinephele tithonus* loves to flit in numbers about hedges, *E. hyperanthus* is practically limited to woods; of the two *Parargys, megyra* flies rather rapidly along the dusty roadsides, *eugenia* flitting about in woodland glades. *Botys prunalis,* an abundant species, its larva found "on anything but blackthorn," is rarely beaten out of anything but blackthorn.‡ *Asthena luteata* feeds on maple in the south, on alder in the north.§

**Habits as to modes and places of concealment.**

Modes of concealment are also often characteristic; as already mentioned, a large number hide in grass and herbage, some in ivy or in woodstacks or faggots, others in houses and cellars. Many of the habits are highly distinctive of large groups as a whole, but others, as we have seen, are distinctive of smaller groups, even so small a group as that comprised in a single genus or species, and striking differences of habit between local and seasonal varieties of the same species are recorded.

**Recent attention given to habits.**

The habits of insects are in an increasing degree occupying the attention of biologists. Professor Poulton's papers on the courtship of grasshoppers and of *V. urticae,* those of Dr. Longstaff on the orientation of butterflies, of Mr. Guy

* See especially the rest attitude of *H. leucophthora* referred to in a former note.
† Some of these rest attitudes are so fixed as apparently to be connected with structure.
Marshall on the marked difference in habit of the seasonal forms of *Precis sesamus* and *octavia-natalensis*, and those of Dr. Chapman, Commander J. J. Walker, and Mr. Tutt, in their numerous writings, add much to our conceptions of insect life, and similar observations of the same nature can hardly fail to throw light on some of the problems which that life presents, including those of structure, with which habits and functions are so closely allied.

*Relations between habits and structure.*

Special habits may derive much importance from this close connection with structure. It is of no protective use for a moth to be whitish grey if its habit is to rest on a dark brown tree trunk or indiscriminately on objects of any colour, but its colour may be of the greatest use if its habit is to rest on light grey stones. It may be urged that it is the structure which dictates the habit. So it does in the main; an Anthrocerid cannot hover like a hawk moth, or soar and glide like an Apaturid. But when structure was in the making, the habits, taken in connection with natural selection, must have had much to do with that making, and, so far as structure is being now made, present habits must have much to do with future shaping.

At the same time, the importance of habits (or even of facies) must not be exaggerated. The former are necessarily less rigid and more easily adaptable to temporary surroundings than structure can be. Colour, as shown by experiments (including my own), can in individuals be altered by moderate differences in temperature, well within the compass of what they would encounter under natural conditions, directly applied in the pupal stage, and seasonal forms often show immense differences not only in colour, but in pattern, shape, and size. In some local or seasonal forms the difference in facies, in others the difference in habits, seems to be the greater.*

* Some larvae of *Cucullia lucifuga*, of which I took a few near Dissentis early one September, afforded a remarkable example of community of habits in two different stages presenting a vast divergence in appearance. They lay about motionless, but, if touched, ran away at racing speed. They were of a light chocolate colour with several conspicuous bright yellow longitudinal stripes. When I opened the box a day or two afterwards I found three sooty black larvae with rows of small deep orange spots. They were so dissimilar to what I had found that I thought I must have made some mistake. But their habits showed at once what they were. When one was touched it rushed about at amazing speed ("*vera incessa* patuit").
Activities in "spare time."

I suggest that general activity itself, or the internal conditions which lead to it and influence its varied manifestations, may be of great significance and import, that there is in many insects a large part of the life not directed to the functions of nutrition or reproduction, but affording scope for what may be called their general activities. We find this activity to be exercised for many purposes, and so that there is in the case of many species much more time allowed for it than would be necessary for the primary functions I have named, or is, in fact, devoted to those functions. With many there is a long period of activity, of movement, before they settle down to the business of continuing their species, or to its preparatory courtship, and we can hardly suppose that so widely diffused a habit is of no biological importance. Some species, it is recorded,* refuse to pair until some days after emergence. Many live and disport themselves for days before they settle down, the males often flying about several days before the females appear;† and M. Fabre has told us how a fossorial wasp spends a month among the flowers before she obeys the marvellous parental instincts which his brilliant pages have made famous.

Sportiveness.

How do insects occupy their spare time? Part of it in what may be brought under the comprehensive name of "play" or "sportiveness." Lord Avebury ‡ in speaking of ants quotes Huber, Gould, and Bates as to their "exercises," Gould describing them as "amusements" and "sportive," and Forel as saying he is convinced that in the actions he is describing "l'attrait des sexes" could not have been the cause.

Pugnacity.

Part of the time is occupied by butterflies in fighting. One of their leading characteristics is pugnacity. Not that of the bull in asserting his lordship over a herd of cows, or that of the essentially solitary insect—it may be one of the Diptera §

† ib. pp. 82, 113-1.
or a dragon-fly—treating itself as entitled to a certain beat and driving off all intruders, but what appears to be the sheer love of a tussle. How often a collector, after carefully stalking down a butterfly, finds all his plans defeated because some other butterfly passes near the object of pursuit, which cannot resist the temptation of dashing at the passing stranger—it may be one of a quite different species—and then ensues a mutual buffeting, the two insects rising out of sight. Sexual attraction does not come in here; nor can the end be physical training, such as results from the “play” of higher animals, for a new-born butterfly inherits instincts which enable it to fly perfectly as soon as its wings are dry. There are doubtless many moths, especially females, to which these remarks about activity do not apply, but they are applicable to a very large number of Lepidoptera, perhaps to most.

*General activities influenced by conditions.*

A consideration of the general activities of insects may possibly bring us nearer to answering the question why Lepidoptera are more abundant in some countries, especially the warmer ones, than in England. All will agree that a full measure of health and vigour is a necessary condition for enabling a species in the competition that exists to hold its own with complete success, the measure of this success greatly depending on the extent to which those conditions are adapted to promote its health and vigour.

*Influences of temperature on activities.*

We must all have observed the immense difference which temperature makes in the activity of most of our Lepidoptera, how cold paralyses their energies so that they can hardly be provoked into movement; in hot weather, on the contrary, the lightest tap on a tree, or the gentlest touch on a hedge, will cause them to fly out in numbers. Many butterflies are absolutely inactive whenever the sun is behind a cloud, and I suggest that the necessity to these of sunshine for flight is caused by their readiness to respond rather to a high temperature than to intensity of light.* We warm-blooded creatures

* Though I think it deserves observation whether brightness alone as compared with gloominess may not influence the movement of some
possess an automatic apparatus for equalising bodily temperature, so that it only varies by a few degrees, whatever the external conditions, but an insect must rapidly acquire the temperature of its surroundings. The ordinary returns of temperature as published give us only that of the shade, and therefore fall short of indicating the heat which objects attain. For example, the average amount of sunshine in France has recently been stated to be about 30 per cent. more than in England, and therefore its crops and its insects must get much more heat than the difference of the mean temperatures in the two countries indicates. But sunshine may mean much more than this to the many insects whose activity is confined to the periods of sunshine, the difference between the temperature of objects "in the sun" and those "in the shade" being enormous, often 20°-30° F. (say 11°-16° C.), equal, while it lasts, to the difference between the mean shade temperatures of England in January and in July. Moreover it is quite conceivable that heat, intermittent and at the same time intense, especially when associated, as it often is, with dryness, may suit many insects much better than equable heat, though the average degree of the two may be nearly the same. The direct heat from the sun is especially great in mountain regions * and others where the air is very dry, and its effect on insects is increased by their habit of basking, especially if on a heat-reflecting surface. This habit is frequent with larvae, so that some species cannot be reared without exposure to sunshine; and many butterflies will not pair or lay eggs in the shade.

In some countries the excessive abundance of insect life is doubtless to be accounted for by the shortness of the summer season. This is the case in many of the higher elevations in mountain regions, where only a very few hot months separate the spring snows from those of autumn.

Temperature has obviously much to do with geographical

insects; the perception of a bright light, as we know, has an effect of marvellous power on many. Cebuna haworthii is an example of a species that flies by day in warm overcast weather, not on a clear sunny afternoon.—Tutt's "Hints," vol. i, p. 89.

* See Hann's "Handbook of Climatology," translated by Ward, chap. xii. Dr. Hunter Workman, addressing the Royal Geographical Society, 21st November, 1904, referring to altitudes of from 21,500 to 23,394 feet in the Himalayas, speaks of the intense heat at noon.
distribution. The preponderant opinion appears to be that most of our species or their near ancestors came from tropical or subtropical regions or descended to us from periods when similar high temperatures prevailed, rendering production more rapid and activity greater, and the opinion is supported by the abundant evidence we have in England of repeated invasions by overflow from the continent of Europe, successful for a brief time, during which climatic conditions approach more nearly to those of a warmer country.

We find that, as a rule, a species has its metropolitan centres—it may be covering, continuously or discontinuously, a large geographical region,—from which centres it thins off in various directions. To take a familiar example, we see a very large number of species abundant in many of the various parts of Europe become scarcer as we proceed northwards, for example within our islands, in the northern parts of which they die out. A smaller number have their metropolis in the north, and become rarer as we proceed southwards till they disappear. When plants thin off in this way we attribute the reduction to the direct effect of climate, and this doubtless has its effect on insects. But in their case it is much more limited in its operation. Insects can move and in various ways protect themselves, and therefore the element of their personal habits comes in, and the efficiency of these depends on health and vigour. I suggest that, apart from the fact, referred to later, that a cold climate will not admit of such a wealth of organisms as a warm climate will, the thinning off I have referred to may indicate, not so much the direct effect of the climate and other surroundings in killing off, as their operation in diminishing health and vigour, and in this manner affecting the activities of insects. Many of these activities are of course connected with the pairing instincts, such as the courtship of butterflies and grasshoppers, or with the procuring of food. But, as stated, many cannot be brought under either of these heads.

Motives springs of activity—Emotions.

As to the varied activities of insects, I think we cannot properly appreciate what they may mean without referring to
the motive springs of many of them, that is, to the emotions which undoubtedly prompt or accompany them. The differences in their habits and actions may or may not belong to the class on which the issues of life and death depend, but must be materially influenced by the conditions which affect vigour and energy, and the emotions which may prompt and regulate action cannot, I think, be passed over in a paper referring to habits.

Lord Avebury * and Dr. Sharp,† who have given thought to the subject, are among those who have shown that insects are not to be treated as insentient machines, but that they have what we know by the general name of emotions.

Many of these emotions, doubtless, are of the simple elementary kind which seem common to all animals that have to strive for their living or for their race preservation—such as anger in combat, ardour in pursuit, fear in flight, resentment at disturbance—emotions which we human beings can hardly do without when we engage in action, for they supply such an almost necessary stimulus that apathy is nearly synonymous with inaction. There are many insects indeed to which we should begrudge such a word as emotion, unless we are to include in it impulses of the lowest order. It is difficult to suppose that the worm-like female Psychid—blind, legless, wingless, can be anything more than a machine for continuing her species, incapable herself of any but the most rudimentary impulses, however capable of inspiring emotion in her ardent and restless pursuers of the opposite sex. But many, nay most, insects seem to perform actions and display habits

* "Even we, far removed as we are in organisation, habits, and sentiments from a fly or bee, can yet feel the difference between a contented hum and an angry buzz."—"Senses of Animals," International Scientific Series, vol. lxxv, pp. 71–2. Elsewhere he mentions that flies and gnats produce sounds through the spiracles, Eristalis and Syrphus doing so while sitting quietly, and refers to the hum of an angry bee as proverbial; in the Diptera and Libellula the thoracic spiracles produce sounds, the voice appears to some extent to be under the control of the will.—ib. p. 68.

† "A company of gnats dancing in the rays glinting through the bushes on a summer evening or in the afternoon of an autumnal day may by means of acute perceptions of lights and shades be enjoying an ocular treat as varied and as exhilarating to them as the prospect we enjoy from the summit of Rigi or Pilatus, while at the same moment by means of an extreme sensitiveness to movement and its direction they may be taking part in a rhythmical concert of no mean order of excellence."—Dr. Sharp, Presidential Address to this Society, 1888, p. lxi.
which manifest that they partake of some of the more complex emotions whose presence in animals framed on a different model, the vertebrates, we recognise. Insects have this in common with the vertebrates that their actions are certainly controlled by something in the nature of mind. In all of them resides some particle of that specialised substance known as "nervous matter" or "neuroplasm" which has dominion over all else and is endowed with such great and varied potentialities. Many of them are largely provided with this matter, having an elaborate nervous system, and a complex brain to control their actions,* and it seems unreasonable to refuse to recognise in them emotions of a complex kind, such as those we recognise in other animals whose differences of habit have much that correspond with theirs,—to deny any such emotions to Apaturid butterflies towering above the tall oak trees, to Vanessids displaying their gorgeous colouring on flowers or sailing like sea-gulls on the wing, to Diptera chasing each other beneath the ceiling of a room, to shining beetles gyrating on a pond, or to gnats dancing in the evening light.

**Biological value of activities.**

It would seem that the activities, whether general or of the special kinds which I have mentioned, looking to the length of time given to them, to their variety and the emotions which prompt or accompany them, should be of biological value. As bearing on this subject, let me place before you what Mr. Lloyd Morgan says†—"It is probable that all the situations with which pleasure and satisfaction are in a high degree associated are in primary origin closely connected with behaviour directed through natural or sexual selection to some definite biological end, or in brief with behaviour of biological value"; and again ‡—"In general we may say that emotional states are, under natural conditions, closely associated with behaviour of biological value,—with tendencies which are beneficial in self-preservation or in race preservation—with actions that promote survival."

* "Effective consciousness is associated with a nervous system. Its fundamental characteristic is control over the actions." Lloyd Morgan on "Animal Behaviour," p. 43. See also pp. 48 and 52.
‡ lb. p. 293.
To what extent the emotions I have referred to as springs of action may be within the compass of our apprehension, whether and how far they may affect the distribution of insects, their presence here, their absence there, their abundance or their rarity, are further questions. Only it may be suggested generally that where actions controlled by mind, whatever its quality, are concerned, conditions such as are adapted to exalt or depress emotions, to stimulate or deaden them, have their influence; and that those conditions which conduce to the free, healthy, and vigorous exercise of this controlling power, and to the habits and actions which are its manifestation, may have some influence in promoting the success of the organism, its vitality and its abundance.

Psychical element important.

I would point out also that, granted the existence of the psychical element, it should be more important and more likely to be persistent than the habit, the director being of greater consequence than the directed, and this not only in the species but in the individual. As I believe others have remarked, though I cannot lay my hand on the reference, an organism is something more than an individual, it is a person. Those who have observed insects in large numbers must have noted differential qualities which may be called personal.* And there must be many more of these qualities than we can perceive.

Numerical persistence of abundant and rare species.

Let me now advert again to my earlier questions, relating to the abundance and the rarity of species, and to their numerical persistence.

I would suggest that where warmth is combined with moisture and other suitable conditions a given piece of land

* At one time I was keeping some 50 or 60 S. tetralunaria, offspring of a single pair, in darkness, that they might not move and spoil themselves. Whenever I lifted the cover so that they were exposed to the light there were some few that immediately moved, one or two actively. In Tutt's "British Butterflies," now in course of publication, p. 458, mention is made of three bred Chrysophanus dispar, all of which showed very different dispositions. The various fights one sees between insects show "personal" differences in courage and endurance. There is possibly an analogy between the operation of this variability of disposition and the operation of physical variability (polymorphism, etc.).

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will support a very dense population of animal as well as vegetable organisms. The whole organic output is larger than that of other places, and the floating population for the time being of which the locality can bear the burden of maintenance is greater. "Tropical luxuriance" and "arctic sterility" are proverbial, and the day-flying Lepidoptera will certainly be more abundant, if only because warm climates are plainly more suitable than cold ones to the great majority of them.

Doubtless there is ground for the prevailing opinion that a rare species is often one that is on the road to extinction, but this does not account for the cases in which a species is persistently rare though not on the whole increasing or diminishing in numbers. Prof. Weismann * says it is a mistake to suppose that every rare species is already in process of disappearing, and expresses the opinion that a change in surrounding circumstances may cause an improvement exemplified by an increase in numbers, quite independently of whether this improvement is absolutely necessary to its preservation or not.

I doubt if we have the materials yet for successfully answering the questions. As a possible contribution towards their solution, may we entertain the thought that, like the morphological features before referred to, there are many actions and habits of organisms that are not subjected to the Draconic code summed up in the theory of the "survival of the fittest"? —that there are extensive departments of life in which a milder code prevails and where many habits and many activities may be indulged, ministering in various degrees to the enjoyments that accompany the free and healthy exercise of the natural impulses—to what we know as the "joy of life."

Scarcity may be advantageous.

I venture, however, to call attention to a case in which, paradoxical as it may appear, scarcity may itself be an advantage. The object of the enemies that prey upon insects is to obtain food, and it must suit their enemies better to devote themselves to the pursuit of such as are plentiful. Consequently when a species is rare, and the places it haunts,

its time or mode of flight, or its other characteristics, are in any way different from those of an abundant species equally suitable for food, it is not likely to be so much harassed as these are. Creatures which are hunting for necessary food do not spend their time, as "collectors" do, in quest of rarities.

Fitness of the Imago stage for observation.

I am well aware that most of my illustrations are taken from the imago state, and that a far greater destruction of life takes place in the earlier stages, and especially in that of the larva. But in the last and most perfect stage of the life of a lepidopterous insect a heavy toll is taken, sufficient in the competition that exists to affect materially its power to hold its own. Moreover it is the stage which admits of and is usually associated with infinitely greater variations in facies and habits than do any,—I think I may say all—of the others, and it is that stage alone in which the senses and the nervous matter which controls and directs habits have the widest scope for effective action. It is therefore the stage in which the materials exist in the greatest quantity for testing by actual observation and experiment many of the questions that have been discussed.

Summary of propositions.

Let me sum up briefly some of the propositions—I do not put any of them forward as if they originated with me—which I have submitted for your consideration.

1. That in the life history of a species the number of its offspring should be observed and recorded.
2. That the consumption by herbivorous insects of their food supply is not, except under special circumstances, a cause of the extinction or permanent reduction in numbers of a species.
3. That mutual competition is not usually of primary importance in keeping down the numbers of a herbivorous species of insect.
4. That the chief factors in keeping down the numbers of herbivorous insects are their active enemies.
5. That insects, being endowed with nervous matter controlling or guiding their movements, the psychic element should be taken into account in considering their habits and activities.

6. That insect activities not directly concerned with nutrition or reproduction are an important part of the lives of many of them.

7. That external circumstances promoting or checking the energetic exercise of these activities may affect numbers, and account in many cases for abundance or sparseness.

8. That observation and record of the abundance or scarcity of a species or variety, either generally or in any locality, and of any permanent change in these respects, and inquiry into its causes, is very desirable.

9. That evidence of the processes by which the balance of organisms as it applies to herbivorous insects is maintained is desirable.

10. That polymorphism, discriminate or indiscriminate (i.e. the forms not appropriated to special situations in reference to time, space, or other circumstances), may be of selection value.

11. That under certain circumstances scarcity may be of selection value.

12. That a large number of conspicuous features sufficient in themselves for selection are not in fact selected, but persist irrespectively of it.

13. That habits may be of selection value.

Importance of field observations.

This brings me to the practical end and object of my address, which is to invite attention to the great aid which may be given towards the solution of problems presented to naturalists, by extensive and systematic observation in the field and the laboratory on living creatures. Apart from all the specific questions which have been considered, we can hardly do wrong in devoting attention to the observation and record of the special habits of living things. It is life that gives its surpassing interest to this insect world that we study,
the present life as manifested in the habits they display, the past life as shown in the structure moulded by their ancestral vicissitudes; and it is the view of their life in this twofold aspect that enables us best to appreciate the marvelous variety in form, and splendour in colour, of the objects that adorn our cabinets—decorative corpses, alas, as we see them there,

Void of the little living will
That made [them] stir . . . .

—in their hour.

I hope the time may arrive when our books, if the scale and plan on which they are designed allow sufficient space, will give us, besides the structural details which show the systematic place that the insects under description occupy, particulars of all their actions of a distinctive kind as living things, not confined to such as are known to lead to self-preservation or race preservation; a statement also of the enemies that assail them and lessen their numbers, and of all factors of a noteworthy character that enter into the great gift which invests them with an interest far transcending all that belongs to the choicest products of inanimate nature, the gift which, however differing in its manifestations, they share in full measure with our lordly selves—their life.

A remarkably interesting and detailed account of predaceous insects and their prey, by Prof. Poulton in Parts III and IV of the Trans. Ent. Soc. Lond. 1906, unfortunately appeared too late to be noticed in this address. Particulars are there given of several hundred cases, the chief destroyers being Diptera, especially Asilidae and Empidæ. Insects specially protected by stings, nauseousness, etc., from many enemies seem to find little protection from attacks by other insects.
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March 27th, 1907.
I. A Contribution towards the knowledge of African Rhopalocera. By Percy I. Lathy, F.Z.S., F.E.S.

[Read November 1st, 1905.]

Plates I, II.

For some time past I have been receiving collections of Lepidoptera from various parts of Africa, and though none of them have been sufficiently interesting to be treated separately, yet taken together they contain several new species and some extremely interesting aberrations which I propose to describe and in some cases figure in this paper.

All the types of the new species here described are in the collection of Mr. Herbert J. Adams.

*Henotesia ochracea*, sp. nov. (Plate I, fig. 1.)

♂. Upper-side. Fore wing ochreous-yellow, basal area fuscous, apical area and outer margin blackish-brown; two small black-white centred spots in apical area, the upper of these being the larger; a large black-white centred spot between second and lower median nervules. Hind wing dull ochreous-yellow basal area, inner and outer margins fuscous.

Under-side. Fore wing as above but with the dark area replaced.
by fuscous irroration with dark grey and the ocelli not so distinct. Hind wing fuscous irroration with dark grey, traces of an irregular waved median line, beyond which the ground colour is slightly ochreous, and a submarginal row of obscure ocelli.

Exp. 50 millim.

_Hab._ Bihé District, Angola.
I received a single specimen of this striking species. It is allied to _H. simonsi_, Butl., but may at once be distinguished by the much darker and wider apical area of fore wing, both above and below, and by absence of postmedian line of fore wing below.

**Acrea mirifica**, sp. nov. (Plate I, fig. 2.)

♂. Upper-side. Fore wing blackish-brown with quadrate black spot at upper end of cell; a wide semihyaline whitish band from costa beyond cell to anal angle. Hind wing blackish-brown, with three minute submarginal white spots.

Under-side. Fore wing; inner marginal area widely blackish, upper part of cell and apical area olivaceous-white, a black spot at end of cell as above and a smaller black spot within cell. Hind wing olivaceous-white, base black, and containing two red spots of which the upper is much the larger, a black patch at end of, one crossing centre of cell and another below cell extending to inner margin, an irregular greatly curved series of black spots around cell, a submarginal row of seven red spots outwardly edged with black and between each of these spots on the nervule a black dash.

Exp. 46 millim.

_Hab._ Bihé District, Angola.
A single specimen of this wonderfully striking _Acrea_ was obtained. I cannot compare it with any other species in the genus.

**Acrea acutipennis**, sp. nov. (Plate I, fig. 3.)

♂. Upper-side. Fore wing red, apex blackish-brown, a black spot within, one at end of, and two below cell; an irregular black bar beyond cell extending from costa to second median nervule. Hind wing red, outer margin black containing small red lunules which become obsolete towards anal angle, base of and area below cell black, a black spot in centre of and another at upper end of cell, a greatly curved and irregular series of eight black spots around cell.

Under-side. Fore wing as above, but apical area paler. Hind
towards the knowledge of *African Rhopalocera.*

wing as above but basal black area broken up into distinct black spots, two additional spots to outer series on inner margin; the red lunules of outer marginal border replaced by distinct olivaceous lunules; the neuration olivaceous, widely so on basal half of median nervure.

Exp. 62 millim.

**Hab. North-Eastern Rhodesia.**

This species appears to be near *A. periphanes,* Oberth., and its allies; it can however be distinguished by its more pointed wings, and the peculiar olivaceous colouring of the neuration of hind wings below.

**Acrea angolanus,** sp. nov. (Plate I, figs. 4, 5.)

♂. Upper-side. Fore wing black, a quadrate hyaline-white patch beyond middle of cell; two round patches below, of which the upper is the larger, three similar subapical patches, of which the upper two are quadrate, the lower round and nearer outer margin. Hind wing black, cell and area round, except below third median nervure yellow.

Under-side. Fore wing paler than above, apical area olivaceous with nervures and dashes between blackish; median nervure and nervules olivaceous, an elongated reddish-brown mark on costa at base; hyaline markings as above. Hind wing, yellow area as above, the black replaced by olivaceous with nervules and dashes between black, basal black area replaced by reddish-brown; the following black spots in basal area: two at base, one in costal lobe, one in cell, and three within and three at lower edge of basal red area; anal angle reddish-brown.

♀. Similar to male but slightly larger and paler and with outer margin of hind wing not so concave.

Exp. ♀ 56–61 millim.; ♀ 62–66 millim.

**Hab. Bihé District,** Angola.

A long series of both sexes of this new form was obtained. It is closely allied to *A. orcas,* Sharpe, but may be separated by its greater size, the markings of fore wing being large and hyaline instead of small and yellow, the greater extent of yellow area of hind wing and the much paler ground colour below. I also figure a very beautiful aberration of the female in which markings of fore wing are hyaline-yellow and the yellow area of hind wing is extended in rays to outer margin.
Byblia goetzius, Herbst. (Plate I, fig. 6.)

Ab. ♀. Upper-side. Fore wing normal. Hind wing with inner half of submarginal orange markings irrorated with blackish.

Under-side. Fore wing with subapical whitish spots entirely absent. Hind wing with ground colour as in form acheloia, Wallengr., faint traces of the dark marking of that form, all the whitish markings totally absent.

Exp. 5 millim.

Hab. Bihé District, Angola.

A single female of this remarkable aberration was sent from Angola together with a great number of the normal form.

Pseudacræa albostriata, sp. nov. (Plate I, fig. 7.)

♂. Upper-side. Fore wing blackish-brown with large dull red patch on inner margin occupying about one-third of wing area; beyond cell a series of long white stria between nervules, the lower ones being shorter and broader; three black spots within, one at end, and one below cell. Hind wing blackish-brown, discal area dull red paler towards inner margin; nervules towards outer margin heavily bordered with black and wide black stria between them; three black spots within, one at end, three above and one below cell. Under-side. Fore wing paler than above, white stria much more distinct, a basal black spot within cell, and the cellular spots, excepting lower middle one edged with white. Hind wing whitish, basal half olivaceous, outer margin narrowly blackish-brown, nervules and stria towards outer margin as above but paler, a Z-shaped black mark on precostal nervure; other black markings as above.

♀. Upper-side. Fore wing similar to male but red patch reduced and darker, white stria less distinct and black spots outlined with olivaceous. Hind wing as in male but discal area paler. Under-side similar to male but less red in fore wing, and ground colour of hind-wing totally olivaceous.

Exp. ♂ 66 millim.; ♀ 68 millim.

Hab. Entebbe, Uganda.

Allied to P. dolomcna, Hew., and P. pharsa, Fruhs., but may at once be distinguished from the former by white striae of fore wing and the latter by darker outer margin to hind wing and different ground colour of hind wing below; also in pharsa, Fruhs., the striae coalesce and form an indistinct band.
Euphedra peculiari\(s\), sp. nov.  (Plate I, figs. 8, 9.)

♂. Upper-side. Fore wing dull green with narrow golden-yellow subapical band inwardly bordered, two obscure dark spots within and one at end of cell, widely with dark green, apex tipped with white. Hind wing dull green. Under-side. Fore wing yellowish-green, inner margin dark grey, three distinct black spots within cell and a small obscure one at upper end; apical band represented by three small whitish spots, apex tipped with white. Hind wing yellowish-green, two black spots within cell and four obscure whitish spots beyond on upper half of wing.

♀. Upper-side. Fore wing dull olive-brown, apical half black, a golden-yellow subapical band and white spot at apex. Hind wing dull olive-brown. Under-side. Fore wing green, inner margin grey, two minute black spots within cell, subapical band represented by four whitish spots, apex as above, an obscure submarginal dark band. Hind wing green, a black spot within cell, a narrow broken white band beyond extending from costal nervure to below upper median nervule, an obscure submarginal band as in fore wing.

Exp. ♂ 66–74 millim.; ♀ 88 millim.

Hab. Entebbe, Uganda.
The male of this interesting species resembles E. medon, Linn., from which it may be separated by the extremely narrow subapical band, while the female has the appearance of E. losinga, Hew.; here again the narrow subapical band serves as a distinguishing character, also the ground colour of the under-side of E. losinga, Hew., is a greyish-green and the cellular spots are more distinct.

Euryphene entebbe\(æ\), sp. nov.  (Plate II, fig. 1.)

♂. Upper-side. Fore wing dark olivaceous-brown, costa dull greenish; two yellowish-brown bars edged with blackish within and a yellowish-brown bar below cell, an irregular median and two irregular postmedian bands of same colour. Hind wing dark olivaceous brown, yellowish-brown at base and four irregular yellowish-brown bands beyond cell. Under-side. Fore wing pale brown; a black spot within cell near base and a black figure of 8 in centre of, a dark line closing and another beyond cell, an irregular dark median line outwardly bordered with dull yellowish-white, a very faint highly indented submarginal dark line and a row of faint postmedian black spots. Hind wing pale brown, two black rings and a black spot within cell, a highly irregular dark median line; postmedian marking as in fore wing.
♀. Upper-side. Fore wing as in male but larger, the pale markings ochre and more conspicuous, especially on nervures. Hind wing paler than in male and with a broad discal ochreous fascia. Under-side with markings of both wings similar to male but ground colour much paler.

Exp. ♂ 60-63 millim.; ♀ 78 millim.

Hab. Entebbe, Uganda.

Allied to E. lentyris, Hew., and mandinga, Feld.; the male may be separated from both by its different colour which is the same as in E. latitia, Plotz. The female has a much wider yellow fascia on hind wing than lentyris, Hew., and this fascia does not approach so near the hind margin as in mandinga, Feld.

Spindasis tavetensis, sp. nov. (Plate I, fig. 10.)

♂. Upper-side. Fore wing blackish-brown, inner marginal area shining violet-blue; an obscure orange spot at end of and band of similar colour beyond cell, and a subapical spot. Hind wing shining violet-blue, costa and apex blackish.

Under-side. Fore wing pale yellow with the following brown, silver centred, black-edged markings: two spots near base, a band crossing centre of cell and one beyond, a spot on costa and irregular postmedian and submarginal bands. Hind wings pale yellow, markings of similar colour to fore wing as follows: large diffused spot about base, and beyond three irregular bands merging together at anal angle where they are sharply angled.

♀. Upper-side. Fore wing similar to male but blue without lustre and orange markings larger and paler, the subapical spot being replaced by a band. Hind wing as in male but blue without lustre, and traces of a pale postmedian band.

Under-side. Both wings as in male but paler.

Exp. ♂ 30-34 millim.; 35 ♀ millim.

Hab. Taveta, British E. Africa.

Very closely allied to S. ella, Hew., but the orange markings of fore wings above are much more obscure, and markings of both wings below darker.

Mylothris similis, sp. nov. (Plate II, figs. 2, 3.)

♂. Upper-side. Fore wing white slightly tinged with orange at base, apex black; black spots on outer margin at termination of nervules, excepting submedian. Hind wing white, base of costa orange, a faint tinge of yellowish at base above cell; black spots on outer margin at termination of nervules excepting costal. Under-side.
Towards the knowledge of African Rhopalocera.

Fore wing white, basal third orange, black spots on outer margin and apex at termination of nervules. Hind wing as above.

♀. Upper-side of both wings as in male, but basal orange and yellow area more diffused, especially in hind wing. Under-side as in male.

Exp. ♀ 60 millim.; ♂ 63-66 millim.

Hab. Malanje, British Central Africa.
Very closely allied to M. ruppellii, Koch, and M. yulci, Butl. The male may easily be distinguished from the former by the much smaller basal orange patch; this patch is also smaller than in yulci, Butl.; other respects in which it differs from Butler's species are the pure white of the wings below and more distinct submarginal spots. The female differs in much the same way but in a less degree. The upper discocellular of the fore wing is more oblique in the new species than in ruppellii, Koch.

Pieris pigaea, Boisd. (Plate II, fig. 4.)

Ab. ♀. Upper-side. Fore wing orange with dark scaling along costa and an outer margin at termination of nervules, a round dark spot between upper and middle median nervules. Hind wing orange with minute black spots as above, but less distinct.

Under-side. Fore wing orange-yellow, basal third orange discal dark spot as above, but less distinct. Hind wing orange-yellow.

Exp. 46 millim.

Hab. Mt. Kilimanjaro, British East Africa.
A single female of this fine aberration was obtained together with seven females belonging to the form rubrobasalis, Lanz.

Pieris liliana, Gr. Sm. (Plate II, fig. 5.)

Ab. ♂. Upper-side. Fore wing smoky grey with traces of a discal spot between upper and middle median nervules. Hind wing smoky grey with trace of submarginal pale patches.

Under-side. Fore wing dull cream, discal spot more distinct than above and another spot below lower median nervule. Hind wing greyish white costa narrowly orange at base, a postmedian series of dark spots.

Exp. 52 millim.

Hab. Taveta, British East Africa.
A single example of this peculiar form among a large number of typical females.
Mr. P. I. Lathby's *Contribution*

**Teracolus castalis**, Stgr. (Plate II, fig. 6.)

Ab. ♀. Upper-side. Fore wing pale orange-yellow, base costa and outer margin dark brown, the latter widely so; a dark brown spot at end of cell, a series of pale orange-yellow spots within marginal border and minute spots of same colour on outer margin between nervules. Hind wing pale orange-yellow, base dark, marginal border as in fore wing but with yellow markings larger.

Under-side. Fore wing paler than above, dark brown markings mostly replaced by dull orange-yellow irrorated with reddish towards apex, a blackish spot at end of cell, and two blackish spots between upper and lower median nervules. Hind wing dull orange-yellow irrorated with dark scales, a minute dark spot at end of cell, and a submarginal broken ferruginous band.

Exp. 50 millim.

_Hab._ Taveta, British East Africa.

I received a large number of this *Teracolus*, but only one specimen of this striking form of the female; two other females have the wings suffused with primrose-yellow, especially in the hind wing.

**Teracolus bacchus**, Butl. (Plate II, figs. 7, 8.)

Ab. Upper-side. Left fore wing, normal female. Right fore wing normal male with exception of base being somewhat darker, a whitish spot on upper inner edge of violet patch, and a black patch between upper and middle median nervules. Left hind wing normal female. Right hind wing normal female excepting apical third, which is normal male.

Under-side. Left fore wing normal male with exception of larger cellular spot and traces of female markings on discoidal nervules. Right hind wing normal male with exception of brown patch on costa not far from apex and female markings below lower discoidal and an obscure dark spot below lower median nervule. Left hind wing normal female. Right hind wing normal male with exception of orange cellular spot, ground colour mostly tinged with yellowish and dark brown bar from costa half way across wing.

Exp. 62 millim.

_Hab._ Taveta, British East Africa.

This is the most remarkable gynandromorphous specimen I have ever seen, each wing with the exception of the left hind wing being a curious jumble of the characteristic markings of both sexes.
TETACOLUS EUPOMPE, Klug. (Plate II, figs. 9, 10.)

Ab. a. ♂. Upper-side. Fore wing as in typical specimens but with the apex bright primrose-yellow instead of red. Hind wing typical.

Under-side. Fore wing normal, but with apex pale primrose-yellow. Hind wing normal but with cellular spot centred with yellow.

Exp. 54 millim.

Hab. Taveta, British East Africa.

Only one specimen of this lovely aberration among many hundred typical specimens.

Ab. b. ♂. Upper-side. Fore wing with black band on inner edge of apical red patch twice the usual width. Hind wing with marginal black spot larger.

Under-side. Fore wing with apical portion of nervules more heavily bordered with black. Hind wing with all the nervules heavily bordered with black especially towards outer margin, area below cell irrorated with blackish.

Exp. 54 millim.

Hab. Taveta, British East Africa.

One specimen of this rather peculiar aberration.

PAPILIO UGANDA, sp. nov. (Plate II, fig. 11.)

♂. Upper-side. Fore wing blackish-brown with the following whitish markings: three small patches within, and three beyond cell and two beyond these, a patch above second median nervule and two large patches on inner margin, one above and one below sub-median, three sub-marginal spots towards anal angle. Hind wing blackish-brown with wide antemedian whitish band a row of sub-marginal whitish twin spots fringe on inner margin yellowish.

Under-side. Fore wing paler than above and reddish at base, pale markings rather more obscure. Hind wing pale brown, paler markings much more obscure than above, base reddish, a white spot on base, outwardly edged with black, a black spot on outer edge of præcostal.

Exp. ♂ 74—83 millim.

Hab. Entebbe, Uganda.

Closely allied to P. eurchedonis, Karsch, but may be distinguished by the greatly reduced pale markings of both wings. In one specimen the pale markings of hind wing and patches on inner margin of fore wing are inclined to be ochreous.
EXPLANATION OF PLATES.

PLATE I.

Fig. 1. Henotesia ochracea, sp. nov., p. 1.
2. Acria mirifica, sp. nov., p. 2.
3. " acutipennis, sp. nov., p. 2.
4. " angolanus, sp. nov. ♂, p. 3.
5. " " " " ab. ♀, p. 3.
7. Pseudacraea albostriata, sp. nov., p. 4.
8. Euphadra peculiaris, sp. nov. ♂, p. 5.
9. " " " " ♀, p. 5.
10. Spindasis taretensis, sp. nov. ♂, p. 6.

PLATE II.

Fig. 1. Euryphene entebbia, sp. nov., p. 5.
3. " " " " ♀, p. 7.
5. " liliana, Gr. Sm., ab. ♀, p. 7.
7. " bacchus, Butl., upper ♀ gynandromorphous
8. " " " " under ♀ specimen, p. 8.
10. " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " " 

Papilio uganda, sp. nov., p. 9.
II. Descriptions of new genera and species of African Halticinae and Galerucinae. By Martin Jacoby, F.E.S.

[Read December 6th, 1905.]

PLATE III.

The present paper deals with those species of Halticinae and Galerucinae which I have received from time to time from various parts of Africa and are contained in my collection. Although we are only at the commencement of our knowledge of the African fauna, every contribution helps to extend it, and a considerable amount of material has already accumulated and been worked out. It has been found that the African species are by no means so universally distributed in that great continent as was at first supposed; on the contrary, they seem to be confined to certain areas, each having its special fauna, although of course there are exceptions; the West African fauna is quite distinct from that of the other portions as is also the South from the Central portion. German East Africa has furnished a large number of new species, well worked out by Herr Weise as far as the Phytophaga are concerned.

HALTICINÆ.

*Aphthona marshalli*, sp. n.

Testaceous, the terminal joints of the antennæ and the scutellum black, the under-side and the posterior femora piceous, head impunctate, thorax transverse, extremely minutely punctured, elytra very finely and closely punctate. Length 2 millim.

Head impunctate, of a more fulvous tint than the thorax, with narrow, oblique grooves from the eyes to the clypeus, the latter broad and flat, the labrum black, antennæ rather short, the four or five lower joints flavous, the others black, the second joint thicker and slightly longer than the third and following joint, terminal ones slightly thickened; thorax about one-half broader than long, the lateral margins nearly straight, forming an oblique angle towards the apex, the disc impunctate, flavous, very shining, scutellum black,
Mr. M. Jacoby's Descriptions of New Genera and

elytra rather elongate, scarcely widened at the middle, testaceous, very closely and finely punctured, legs testaceous, the breast, abdomen and the posterior femora blackish; metatarsus of the hind-legs as long as the following two joints together.

Hab. ESTCOURT, Natal (G. Marshall).
A small species, allied to A. ovatipennis, Jac., likewise from Africa but of more elongate and parallel shape, the thorax impunctate, with less distinct oblique anterior angles, the elytral punctuation irregular and very close.

 Aphthona dilutipes, sp. n.

Winged, above flavous, below and the legs nearly black, the basal four joints of the antennae flavous, the others black, thorax subquadrate, impunctate, elytra scarcely perceptibly punctured, the knees and the base of the tibiae dark fulvous. Length 3 millim.

Of rather broad and convex shape, the head impunctate, the frontal tubercles small but strongly raised, the labrum black, antennae rather long, the second and third joint equal, the fourth slightly longer, the terminal joints slightly thickened; thorax subquadrate, scarcely one-half broader than long, the sides feebly and evenly rounded, the surface flavous, impunctate, rather convex; scutellum broader than long; elytra convex and subcylindrical, widest at the middle, the shoulders not much produced, the apex broadly rounded, the surface with some minute punctures, only visible under a very strong lens; under-side and legs nearly black, the extreme apex of the femora and the base of the tibiae more or less fulvous, posterior tibiae deeply sulcate, their metatarsus as long as the following two joints together, the terminal spur of the tibiae short and stout.

Hab. ESTCOURT, Natal.
A. usambarica, Weise, seems somewhat closely allied but in the present species, in which the frontal tubercles are very distinct also, the legs are black and the scutellum is flavous.

 Longitarsus amabilis, sp. n.

Winged, the head and thorax fulvous, antennae flavous, the terminal joints black, thorax very minutely punctured, elytra regularly punctate-striate, black, shining, the interstices sparingly punctured, legs flavous, the posterior femora and the breast and abdomen black. Length 2 millim.

Head impunctate, fulvous, the frontal tubercles very distinct, transverse, clypeus triangular, antennae slender, extending to about
the middle of the elytra, flavous, the last three or four joints more or less blackish, second joint thicker but not longer than the third, the following joints more elongate; thorax subquadrate, convex, about one-half broader than long, the sides nearly straight, anterior angles oblique to a slight extent, the surface extremely minutely punctured, pale fulvous, scutellum black, elytra slightly wider at the shoulders than the thorax, convex, nearly subcylindrical, regularly and strongly punctate-striate, the interstices with a few very fine punctures, black, legs flavous, the first joint of the posterior tarsi as long as the following joints together; breast and abdomen black.

_Hab. Dunbrody_, Cape Colony (*Rev. O'Neil*), on _Euphorbiaceae_.

This small species is well distinguished by its system of coloration, the distinct frontal tubercles and the nearly regularly punctate-striate elytra.

**Longitarsus braunsi**, sp. n.

Winged, black, the basal joints of the antennae, the head and thorax reddish-fulvous, elytra metallic dark blue, very closely punctured, thorax impunctate, subquadrate. Length 2½–3 millim.

Head smooth, impunctate, the frontal elevations just indicated, flat and broad, no oblique grooves, clypeus broad, impunctate, labrum and palpi black, antennae extending to the middle of the elytra, black, the lower four and the base of the fifth joint, flavous, third and fourth joint equal, longer than the second one, the fifth the longest, terminal joints thickened; thorax subquadrate, one-half broader than long, the lateral margins nearly straight, the anterior angles oblique, forming another angle before the middle, the surface impunctate, fulvous, scutellum broadly triangular, black; elytra scarcely widened at the middle, broadly rounded at the apex, very convex, dark blue, the punctuation very fine and arranged in indistinct very closely approached rows; under-side and legs black, very shining, metatarsus of posterior legs longer than the following two joints together.

_Hab. Willowmore_, Cape Colony (*Dr. Brauns*).

The black under-side and similarly coloured legs in connection with the general system of coloration distinguishes this species (I received three specimens from Dr. Brauns) from its African allies.

**Phyllotetra weisci**, sp. n. (Plate III, fig. 3.)

Black, the basal two or three joints of the antennae, the base of the tibiae and the tarsi, more or less flavous, head finely, thorax strongly
and closely punctured, elytra flavous, very closely and irregularly punctured, a narrow sutural and a still more narrow lateral and apical margin, greenish-black. Length 2 millim.

Head closely and finely punctured, with small and smooth frontal elevations, clypeus rather convex, widened in front, impunctate, antennæ robust, black, the lower three (sometimes two) joints flavous, the second, third and fourth joint equal, the fifth slightly longer in the male, terminal joints thickened; thorax one-half broader than long, greenish-black, strongly and closely punctured; elytra slightly wider at the base than the thorax and of similar punctuation, the dark sutural band narrowed at the base and apex, the lateral bands of about half the width, the shoulders sometimes likewise with a small spot; the male organ is of slender, parallel and slightly curved shape, broadly rounded at the apex, the latter ending in a small point at the middle.

Hub, Dunbrody, Cape Colony (Rev. O'Neil).

This species is perhaps more nearly allied to *P. parallela*, Boisd., than to any others, it is of the same size and coloration but the sutural band is not so broad and much narrower at the base and apex; the shoulders have only a very small spot occasionally and the male organ is pointed at the middle instead of broadly rounded.

*Crepidodera (Derocrepis) acuminata*, sp. n.

Narrowly elongate, pointed posteriorly, apterous; lower joints of the antennæ, the head and thorax fulvous, elytra bark blue, strongly punctate-striate, the interstices minutely punctured, anterior and intermediate legs fulvous, posterior ones and the breast and abdomen black. Length 2 millim.

Of posteriorly pointed shape, the head impunctate, rufous or fulvous, obliquely grooved between the eyes, frontal elevations rather small, trigonate, labrum piceous, antennæ about half the length of the body (taken as a whole), the lower seven joints flavous, the others blackish, the second to the fourth joint of equal length, fifth joint slightly longer, penultimate three joints short and thicker, apical joint more elongate; thorax about one-half broader than long, the sides rather strongly deflexed anteriorly, the lateral margins feebly rounded, the angles not very marked, basal sulcus straight and deep, bounded at the sides by an equally deep perpendicular groove with high lateral ridges, the disc only perceptibly punctured when seen under a strong lens, scutellum black, broader than long; elytra scarcely widened at the middle, pointed at the apex, metallic-blue, closely and strongly punctate-striate, the interstices very finely and
Species of African Halticinæ and Galerucinæ.

indistinctly punctured; thorax below and the anterior and intermediate legs fulvous, rest of the under-side and the posterior femora black, breast and abdomen nearly smooth.


Much smaller than C. peringueyi, apterous, the elytra pointed, the antennæ with the terminal four joints dark only.

Crepidodera malvernensis, sp. n. (Plate III, fig. 1.)

Below black, above dark metallic-blue, the basal joints of the antennæ and the legs fulvous, thorax strongly punctured, with oblique projecting anterior angles, deeply sulcate; elytra closely and strongly geminate punctate-striate. Length 3 millim.

Head impunctate, the vertex black, frontal elevations strongly raised, rounded, fulvous like the clypeus and the labrum, antennæ long and slender, black, the lower three joints fulvous, basal joint robust, second, one-half shorter than the third joint, fourth and following joints elongate; thorax transversely subquadrate, the lateral margins rounded at the middle, the anterior angles strongly produced outwards and pointed, the base with a deep sinuate sulcus bounded at the sides by an equally deep perpendicular groove, the surface very strongly but irregularly punctured, the space below the sulcus nearly impunctate, scutellum impunctate; elytra with a rather deep depression below the base, closely and strongly punctured in double rows; the interstices at the sides longitudinally costate; breast and abdomen purplish-black, legs fulvous.

Hab. Malvern, Natal (C. Barker); also Upper Tongaat (C. Barker).

A well-distinguished species on account of the metallic-blue upper surface, the produced anterior angles of the thorax, and the geminate punctuation of the elytra. The species differs from Deroecrips, Weise, in its non-narrowed anterior and posterior shape of the elytra, and in having the thoracic sulcus placed at some distance from the base, which is not narrowly raised as in the last-named genus.

Crepidodera usambarica, Weise (Deutsche Ent. Zeitg. 1902).

A comparison of this species of which Weise kindly has sent me some specimens proves its identity with my C. peringueyi (Trans. Ent. Soc., 1905), the insect seems to vary enormously in size, some specimens being twice as
large as others, but I am quite unable to find other differences.

*Crepidodera nigripes*, sp. n.

Black, the basal joints of the antennæ, the head and the thorax flavous, the latter finely and sparingly punctured, elytra deeply and closely punctate-striate, the interstices acutely longitudinally costate. Length 2½ millim.

Head impunctate at the vertex, flavous or pale fulvous, near the eyes with a few punctures, frontal elevations narrowly oblique, labrum black, antennæ slender, black, the lower two or three joints flavous, second joint slightly shorter than the third, this and the following joints nearly equal; thorax about one-half broader than long, the margins nearly straight, the angles not very acute, the disc with some fine and sparingly distributed punctures, flavous, the basal sulcus deep and straight, bounded laterally by a short perpendicular groove; scutellum broadly triangular, black; elytra slightly wider at the base than the thorax, elongate and parallel, sub-cylindrical, the punctures deep, closely placed and somewhat transverse, the interstices forming numerous acute longitudinal costæ; below and the legs black.

*Hab. Umhlali (C. Barker).*

*Cercyonia nigricollis*, sp. n.

Subelongate and subcylindrical, black, the basal joints of the antennæ flavous, thorax very closely and finely punctured, elytra fulvous, finely punctate-striate, the interstices very closely and finely punctured.

Head minutely granulate and finely punctured, black, with a slight bluish tint, with a shallow transverse groove between the eyes, clypeus transverse, finely punctured, antennæ widely separated, black, the lower four joints flavous, third joint slender and longer than the others, terminal joints triangularly widened from the fifth; thorax twice as broad as long, the sides obliquely narrowed towards the apex, the anterior angles acute, posterior margin slightly bisinuate, broadly produced at the middle, the surface extremely closely and finely punctured, with still more minute punctures at the interstices, black, scutellum triangular, piceous; elytra sub-cylindrical, slightly narrowed posteriorly, pale fulvous, finely punctured in rows, ten in number, the interstices very closely and finely punctured; under-side and legs black, posterior femora incrassate,
their tibiae widened at the apex, carinate but not sulcate; proter-
num narrow, anterior cotyloid cavities closed.

_Hab. Malvern, Natal (C. Barker)._ On account of the structure of the antennae which have their outer joints triangularly widened, the acute anterior thoracic angles, non-sulcate tibiae and generally elongate shape of the insect, this species agrees with Weise's genus better than with _Amphimela_ to which it is allied by the well-separated bases of the antennae.

_Ochrosis natalensis, sp. n._

Ovate, black, head, the antennæ, thorax, and the legs fulvous, thorax impunctate, elytra black, punctate-striate, the interstices finely punctured. Length 2½ millim.

Head impunctate, fulvous, the frontal elevations both broad and indistinct, labrum piceous, antennæ with short and rather robust joints, the third more slender and slightly longer than the others, terminal joints slightly stained with fuscus; thorax transversely convex, not much more than one-half broader than long, the sides strongly rounded at the middle, the disc convex, entirely impunctate, fulvous, at the base a very shallow transverse sulcus is placed (only seen in certain positions) which gradually curves downwards at the sides to the basal margin, scutellum black: elytra subcylindrical, black, rather shining, strongly and regularly punctate-striate, the interstices flat, sparingly and very finely punctured, legs robust, fulvous, the metatarsus of the posterior legs as long as the following joints together, tibiae with a very small spine; breast and abdomen black, the posternum narrow, the anterior cavities closed.

_Hab. Ifafa Mts., Malvern, Natal (C. Barker)._ _Ochrosis,_ Foud., appears to be the only possible genus for the reception of this species, agreeing as it does with the European representatives of the genus in the structure of the thorax and its shallow sulcus which gradually joins the base. It is the first recorded species from Africa.

_Cheirocnesia dunbrodensis, sp. n._

Dark aeneous, very shining, the antennæ (the apical joints excepted) and the legs flavous, posterior femora aeneous, head and thorax strongly punctured, elytra pointed posteriorly, strongly punctate-striate, the interstices impunctate. Length 2½ millim.

Head broad, without oblique grooves, deeply but not very closely
punctured, the elytra separated from the face by an obsolete transverse strongly punctured groove, antennæ with the lower six joints flavous, the rest black, the second joint scarcely shorter than the third, the terminal joints distinctly shorter and thicker, thorax about twice as broad as long, the sides nearly straight, the base without an impressed line, the disc with deep but not very closely placed punctures, of even size, the intervals much wider than the punctures themselves; elytra subcylindrical, but slightly narrowed at the apex, not more strongly punctured than the thorax, the interstices flat and impunctate; under-side and the posterior femora ãeneous, the rest of the legs flavous, sometimes stained with ãeneous, metasternum strongly transversely rugose, the first tarsal joint strongly dilated in the male.

_Hab. Dunbrody, Cape Colony (Rev. O'Neil)._ Of this species I received two specimens from the Rev. O'Neil, which may be known from other African forms by the metallic ãeneous, not dull, coloration and the strongly punctured head and thorax, the absence of lateral grooves from the face, and the want of a basal impressed thoracic line, also by the flat and impunctate elytral interstices. The specimens were obtained under dead reeds.

_Chatocnema barkeri, sp. n._

Dark ãeneous, the antennæ and the tibiae and tarsi fulvous, head nearly impunctate, with a deep curved groove in front of the eyes, thorax extremely minutely and closely punctured, elytra pointed, very deeply and strongly punctate-striate, the interstices strongly costate. Length 2 millim.

Of robust and broad shape, the elytra strongly pointed at the apex, the head very broad, impunctate, with two very deep grooves at a little distance from the eyes which commence above the latter in shape of foveæ and extend down to the sides of the elytra; eyes very large and slightly sinuate, antennæ entirely fulvous, the third joint distinctly longer and thinner than the others, terminal joints gradually thickened but longer than broad; thorax about twice as broad as long, convex, the sides straight, strongly deflexed, the lateral margins nearly straight, the anterior angles broadly oblique and thickened, furnished with a fovea, the surface extremely minutely punctured, when seen under a strong lens, the basal margin with a short row of deeper punctures at the sides only, scutellum very small; elytra convex, deeply punctate-striate, the interstices strongly longitudinally costate except at the base, under-side nearly black, the posterior femora ãeneous, very strongly thickened, the
Species of African Halticinae and Galerucinae.

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tibiae fulvous, the posterior ones with a strong tooth at the middle, tarsi fulvous, the first joint strongly dilated; prosternum very narrow.

**Hab. Malvern, Natal** (*C. Barker*).

This is a very characteristic species on account of the deep frontal sulci of the head, unique amongst the other members of the genus with which I am acquainted; this character, the colour of the antennae and legs and the costate elytra will at once distinguish the species, of which I received a single specimen from Mr. C. Barker.

**Chretoenema purpurea, sp. n.**

Elongate, parallel, below seneous, above, reddish-cupreous, the basal joints of the antennae and the legs reddish-fulvous, thorax closely and strongly punctured, elytra strongly and closely rugose-punctate, the interstices longitudinally costate. Length 2½ millim.

Head impunctate, reddish-cupreous, deeply obliquely grooved at the sides, clypeus convex between the antennae, dark seneous, antennae fulvous, the terminal joints more or less blackish, basal joint elongate, the third, fourth and fifth joint slightly shorter, much longer than the second one, terminal joints shorter and thicker; thorax transversely subquadrate, quite twice as broad as long, the lateral margins feebly rounded, the surface crowded with round, deep punctures, scutellum transverse; elytra subcylindrical, parallel, very closely impressed with transverse punctures, the interstices closely and acutely longitudinally costate throughout; legs dark red, the posterior tibiae with a strong tooth at the middle.

**Hab. Grahamstown** (*Rev. O'Neil*).

A robust species of purplish-cupreous coloration with dark reddish legs, well distinguished on that account and by the closely punctured and costate elytra, the impunctate head, etc. Two specimens have been kindly sent by the Rev. O'Neil.

**Dunbrodya, gen. n.**

Body oblong, smooth, antennae filiform, the third and following joints nearly equal, eyes moderately large, thorax subquadrate, slightly broader than long, the anterior angles oblique, posterior femora strongly incrassate, their tibiae widened at the apex, deeply longitudinally sulcate, armed at the apex with a long narrow spur, emarginate at the posterior margin, metatarsus of the hind-legs longer than the following joints together, claws appendiculate, prosternum narrow and convex, the anterior cotyloid cavities open.
This genus has much the general appearance of *Jamesonia*, Jac. (*Thrymnes*, Weise), but has filiform antennae and an elongate third joint, the eyes are much smaller and the frontal elevations nearly obsolete; still greater difference is to be found in the emarginate spur at the apex of the posterior tibia which resembles somewhat that of *Dibolia* but is narrower and less deeply bifid, the metatarsus is likewise much more elongate than in *Jamesonia*.

*Dunbrodya nitida*, sp. n. (Plate III, fig. 5.)

Black, very shining, the basal joints of the antennae (the first excepted) flavous, thorax broader than long, impunctate, elytra microscopically punctured. Length 3\(\frac{1}{2}\)-4 millim.

Of oblong-ovate shape, entirely black and very shining, the head impunctate, the frontal elevations obsolete and transverse, the carina very elongate and acutely raised, antennae slender and elongate, black, the second and the following three joints as well as the base of the sixth one, flavous, all the joints cylindrical, the fifth slightly longer than the preceding two joints, the second about one-third shorter than the third one; thorax about one-half broader than long, the sides very feebly rounded at the middle, the anterior angles oblique and forming a slight tooth before the middle, the surface but little convex, entirely impunctate, scutellum broad, scarcely longer than broad; elytra wider at the base than the thorax, convex and narrowed at the apex, the punctuation extremely minute, deep black, posterior femora strongly thickened their tibiae deeply sulate, the margins finely serrate, the apex with a long spur, the metatarsus very elongate, longer than the following joints together, the coxae flavous, the rest of the legs and the under-side black.

_Hab._ Dunbrody, Cape Colony, on wild *Asparagus* (Rev. O'Neil).

There seems to be but little differences in the sexes except that the thorax in the male is less transversely shaped, the penis is slender, strongly curved, its apex truncate and slightly emarginate.

*Jamesonia shepperdi*, sp. n.

Fulvous, the antennae (the basal joints excepted) the extreme apex of the tibiae and the tarsi black, thorax minutely punctured, elytral punctuation semi-regularly arranged. Length 4 millim.

Head impunctate, frontal elevations broad and transverse, carina acute, short, antennae black, the lower three joints fulvous, second and third joint small, terminal joints widened and short; thorax subquadrate, slightly broader than long, the sides feebly rounded, anterior
Species of African Halticinæ and Galcrucinæ.

angles slightly oblique, posterior ones obliquely rounded, the disc rather convex, extremely minutely punctured, elytra widened towards the middle, finely punctured in closely approached, semi-regular rows, under-side and legs fulvous like the upper surface, the extreme apex of the tibiae and the tarsi black; prosternum extremely narrow.

_Hab. Beira, East Africa (P. A. Sheppard)._ Of this species, which differs from all its allies in the colour of the antennæ and legs, and in the semi-regular elytral punctuation, I received two specimens from Mr. Sheppard; they seem to represent the female sex, in the other the eyes are probably more developed; the tibial spur agrees in length with that of the other species of the genus, but the prosternum is scarcely visible.

_Nisotra weisci, sp. n._ (Plate III, fig. 2.) Oblong, subcylindrical, obscure fulvous, the terminal seven joints of the antennæ black, thorax minutely punctured, the anterior and posterior depressions punctiform, elytra punctured in obsolete double rows, the interstices with finer punctures. Length 3½ millim. Head impunctate, without frontal tubercles, clypeus with a few punctures, eyes prominent, antennæ about half the length of the body, black, the lower four joints fulvous, the basal joint curved, the second one nearly as long as the third but thicker, terminal joints distinctly thickened; thorax transverse, nearly twice as broad as long, the sides strongly rounded, the anterior and posterior margin with a punctiform depression at each side, very feebly rounded or produced, very finely and closely punctured, elytra subcylindrical, finely punctured in double rows, very obsoletely so near the apex, the interstices still more finely punctured; below coloured like the upper surface, terminal spine at the posterior tibiae distinct; prosternum narrow and elongate.

_Hab. Beira (P. A. Sheppard)._ Smaller than the species I refer to _N. spadicea_, Dalm., and at once distinguished from this and other species with nearly similar coloration by the obsolete and punctiform depressions of the thorax in place of grooves; in _N. unifor- ma_, Jac., the latter are very distinct and elongate.

_Nisotra o'neili, sp. n._ Pale testaceous, the basal joints of the antennæ, the head, thorax and legs pale fulvous, terminal joints of the antennæ black, thorax nearly impunctate, the posterior perpendicular grooves distinct,
elytra with regular rows of fine punctures, the interstices extremely minutely punctured. Length 3 millim.

Head impunctate, reddish fulvous, the clypeus very broad, antennæ extending a little beyond the base of the elytra, robust, the second, third and fourth joint small, equal, the following ones strongly thickened, blackish (sometimes fulvous) thorax twice as broad as long, the sides rather strongly rounded before the middle, rather constricted at the base, the disc not perceptibly punctured, the base with a short but distinct perpendicular groove at each side; elytra paler than the thorax, with very fine but regular rows of punctures, about 10 on each elytron, under-side and legs fulvous.

*Hab. DUNEROODY, Cape Colony (Rev. O'Neil)*, also GRAHAMSTOWN.

In all the specimens before me, the head and thorax is of darker colour than the elytra; this character and their fine and regular punctuation in connection with the nearly impunctate thorax will help in the recognition of the species.

**Euplecnema, gen. n.**

Subelongate apterous, antennæ filiform, head with oblique grooves, frontal elevations absent, thorax transversely subquadrate, the lateral margins feebly but regularly rounded, the anterior angles slightly oblique, scutellum broader than long; elytra rather depressed, punctate-striate and finely pubescent; posterior femora strongly incrassate, the tibiae non emarginate at apex but sulcate, with a small spine, anterior tibiae likewise armed with a very small tooth, the metatarsus of the posterior legs as long as the following joints together, claws appendiculate, metasternum very elongate, prosternum narrow and elongate, the anterior coxal cavities closed.

The small species for which this genus is proposed is closely allied to *Chactocnema* in which it cannot be included on account of the absence of wings and the simple non-emarginate tibiae; the sculpture and the very fine elytral pubescence resemble that of the genus *Epitrix*, the first abdominal segment is not longer than the others and not united to the second as in *Chactocnema*.

**Euplecnema nigrita, sp. n.** (Plate III, fig. 4.)

Black, the antennæ (the last joints excepted) and the legs flavous, posterior femora black, thorax very closely and strongly punctured, elytra closely punctate-striate, the interstices finely pubescent. Length 1-1½ millim.
Species of African Halticinae and Galerucinae.

Head minutely granulate, opaque, without frontal elevations and with an oblique ridge from the eyes to the clypeus, the latter broad, separating the antennae rather widely, antennae with scarcely thickened terminal joints, flavous, the last two or three joints blackish, the second and third joint equal, slightly smaller than the following joints; thorax rather more than one-half broader than long, the angles distinct, the sides very narrowly margined, posterior margin not accompanied by an impressed line, the surface dull, opaque, black, very closely and strongly punctured, the punctures round and deep; elytra not transversely depressed below the base, somewhat flattened, the punctuation a little stronger than that of the thorax and arranged in very close rows, the interstices furnished with very short grey hairs, only visible under a powerful lens; metasternum very long, finely punctured.

*Hob. Dunbrody,* Cape Colony (*Rev. O'Neil*).

In the male insect the posterior femora are much more strongly incrassate than in the other sex.

**Weiseana**, gen. n.

Elongate, finely pubescent, antennae with short joints; thorax transverse and short, the sides and the posterior angles rounded, the disc with several depressions, scutellum broad, elytra finely pubescent, the epipleura indistinct below the middle, legs robust, the tibiae unarmed, the metatarsus of the posterior legs as long as the following two joints together, claws appendiculate, the inner tooth acute; prosternum nearly invisible between the highly raised coxae, the anterior cavities closed.


By an unfortunate oversight, the description of the genus in which I have placed this species was omitted at the time; the insect has entirely the appearance and coloration of a species of *Galerucella* with which it has also most of the structural characters in common, but the distinctly thickened posterior femora compels the inclusion of the species in the *Halticinae*. The colour of the upper surface is a dull and opaque testaceous, the elytra have the margins narrowly black and the thorax shows three more or less fuscous spots placed within an equal number of depressions. I would have referred this species without much doubt to Weise's genus *Homicloda*, Wiegm. Arch. 1902, p. 165), but I cannot see the structure of the elytral
epipleuræ in the way the author demands it for his genus, as these parts are concave anteriorly and do not gradually recede within, nor are the claws divided at the point only.

*Phygasia barkeri*, sp. n.

Oblong-ovate, flavous, the head fulvous, antennæ (the basal joints excepted) and legs black, extreme base of the femora flavous, thorax impunctate, with deep basal sulcus; elytra finely and irregularly punctured. Length 3 millim.

Head impunctate, pale fulvous, frontal tubercles broad and well developed, labrum piceous, antennæ rather short and robust, the lower three or four joints flavous, basal joint generally black above, the fourth and following joints entirely of that colour, somewhat triangularly widened and of equal length, not longer than the basal joint; thorax nearly twice as broad as long, the lateral margins strongly rounded at the middle, the disc convex, with a deep basal sulcus bounded at the sides by a perpendicular groove, impunctate, flavous; elytra oblong, very finely and closely punctured, flavous; the apical two-thirds of the femora and the legs black.

**Hab. Upper Tongaat (C. Barker).**

Allied to *P. brunnea*, Jac., from Africa, but smaller and less convex, pale flavous and the legs of different coloration.

*Phygasia bicolorata*, sp. n.

Black, the basal joints of the antennæ flavous, thorax minutely punctured, elytra flavous, very finely and closely punctate, the suture and the apex black. Length 3½ millim.

Head impunctate, black, frontal tubercles broad, strongly raised, antennæ long and rather slender, black, the lower five joints and the base of the sixth, flavous, basal joint black above, third and following joints equal, widened at the apex; thorax about one-half broader than long, the sides strongly rounded, the surface convex, very minutely punctured, black, shining, basal sulcus deep, scutellum broadly rounded at the apex, black; elytra elongate, pointed, very closely, rather strongly and irregularly punctured, dark flavous, the sutural margins, in shape of a gradually narrowed band and the extreme apex of each elytron, black; below and the legs of the latter colour.

**Hab. Ifafa Mts., Natal (C. Barker).**

Of this very distinct little species I received three specimens from Mr. Barker.
Physonychis beiraensis, sp. n. (Plate III, fig. 6.)

Testaceous, the head strongly, the thorax finely punctured, elytra purplish or bluish on a testaceous ground, very closely punctured, the punctures of the same size as those of the thorax, tibiae and tarsi more or less fuscous. Length $5\frac{1}{2}$ millim.

Elongate and parallel, the head very strongly and closely punctured, antennae rather long, the terminal joints gradually thickened, basal joint rather thicker in the male than in the female, second joint short, third and fourth equal, terminal joints rather strongly thickened, thorax of usual shape, the sides broadly flattened, nearly straight, the surface transversely sulcate near the base, rather closely and finely punctured, testaceous, scutellum subquadrate, testaceous, impunctate; elytra longitudinally depressed within the shoulders and near the lateral margins at the middle, purplish, with the testaceous ground colour showing through, very closely and finely but very distinctly punctured, under-side and legs rather darker than the thorax, finely pubescent, the posterior femora strongly incrassate, their tibiae entire, clawjoint strongly swollen.

Hab. Beira (P. A. Sheppard).

Of this species, which seems closely allied to P. wismanni, Weise, I have received three specimens from Mr. Sheppard; the differences are to be found in the distinctly punctured thorax and the colour of the elytra in the present species, the sculpturing of the head is also much stronger than in Weise’s insect. P. dohrni, Jac., is much larger and has green and rugosely punctured elytra.


There is not much doubt that my Amphimela ornata (Trans. Ent. Soc. Lond. 1895) is identical with Weise’s species. The author describes the anterior coxal cavities as open, but errs in this respect, they are certainly closed in my specimen, and there is I think no reason to separate the genus from Amphimela on the strength of this species, the description of which as given by Weise agrees in every detail with my type.

Torodera 8-maculata, Weise.

I possess this species from Tsipango and Malvern in Natal, and formerly looked upon it as a variety of Amphimela ornata; I find however that in this species, at
all events (*Torodera*), the anterior coxal cavities are open as Weise states of his genus, which can therefore be retained; it proves again how easily one insect may be confounded with another if all structural characters are not carefully examined. In regard to my specimens, they vary in not having a black mark at the vertex, in the absence, in some cases, of the small black spot near the scutellum and in the colour of the legs, the posterior femora of which varies from flavous to black.

**GALERUCINÆ.**

*Oides sheppardi*, sp. n.

Black, above dark fulvous, thorax very finely punctured, elytra strongly widened at the middle, semi-rugosely punctured, with several obsolete, raised, longitudinal lines, sides and apex of the abdomen fulvous. Length 13 millim.  

Head fulvous, impunctate, with the exception of a few punctures near the eyes, labrum and palpi black, antennae rather short and stout, the third joint shorter than the fourth, this and the following joints nearly equal, terminal joint elongate; thorax about twice and a half broader than long, the sides rounded, the angles rather blunt, the surface with an obsolete groove near the lateral margins, finely punctured with some still finer punctures at the interstices, scutellum triangular, with some punctures; elytra much more strongly punctured than the thorax with the interstices finely rugose with obsolete raised longitudinal lines, distantly placed; breast, abdomen and legs black, the sides and the apex of the last abdominal segment fulvous.

**Hab. Amatongas, Portuguese East Africa (P. A. Sheppard).**

This is another species allied to *O. ferruginea*, Fab., *O. assimilis*, Gah., and *O. conradti*, Weise, in coloration but differing in the much more strongly punctured and semi-rugose elytra, in which character it resembles *O. palliata*, Gerst., but that insect is of different colour and has a black head, the coloration of the under-side also in the present species differs from any of its allies. I have received two exactly similar specimens from Mr. Sheppard.

*Hyperacanthia silvana*, sp. n. (Plate III, fig. 11.)

Flavous, the vertex, antennae (the basal joints excepted) the apex of the tibiae and the tarsi black, elytra metallic blue or cupreous,
each with two deep depressions, and finely punctured within the latter.

Mas. Elytra near the apex with an elongate, highly raised tubercle, its apex obliquely truncate. Length 6½ millim.

Head impunctate, the vertex black, the lower portion flavous, labrum black, antennæ very slender, black, the lower two joints flavous, third and fourth joint equal; thorax nearly twice as broad as long, impunctate, flavous, with a deep transverse sulcus at the middle, scutellum flavous; elytra deeply depressed below the base at the suture and with another fovea near the lateral margins below the middle, finely punctured at the basal portion, the rest nearly impunctate, legs flavous, the lower portion of the tibiae and the tarsi black, claws appendiculate.


Almost identically coloured as D. nigricornis, Weise, but of much broader shape, the basal joints of the antennæ flavous, the elytra with two depressions and the tubercles of the male not pointed but elongate, hollowed within, and abruptly truncate at the apex; the last abdominal segment of the female slightly semicircularly concave, its apex entire.

Hyperaeantha obesa, sp. n. (Plate III, fig. 8.)

Broadly ovate, short and very convex, testaceous, antennæ (the basal joints excepted), the apex of the tibiae and the tarsi black, thorax deeply sulcate, impunctate, elytra very finely punctured, a narrow band at the base, connected at the shoulders with another curved transverse band before the middle and the suture anteriorly, black.

var. a. The elytral basal margin narrowly black as well as a small spot before the middle.

var. b. Elytra entirely testaceous. Length 5½ millim.

Female. More than usually convex and short, the head impunctate, frontal elevations broad and transverse, clypeus with a highly raised, broad, central ridge, labrum black, antennæ with very slender, elongate joints, extending to about two-thirds the length of the elytra, black, the lower two joints and sometimes the third one flavous, second joint very short; thorax more than twice as broad as long, the sides straight at the base, rounded before the middle, the disc impunctate, with a deep transverse sulcus, the anterior portion near the angles, with a few fine punctures, elytra extremely closely and finely punctured, testaceous, the base with a narrow, transverse black band, extending downwards at the shoulders to about one-third the
length of the elytra, where it curves inwards and forms another band which does not extend to the suture, this band is of irregular shape and suddenly strongly narrowed below the shoulders; the last abdominal segment trilobate, the median lobe broader than long, flat; tibiae all armed with a small spine, their lower half and the tarsi black, claws appendiculate.

_Hab. Umhlali Beach_ (C. Barker). _Umkomaas Mounts, Natal (G. Marshall)._ Of this species there are four female specimens before me, which cannot be mistaken for any other of the genus, on account of their short and convex shape in connection with the pattern of the elytra; this comes more near _H. abdominalis, Jac._ (was Duvivier) (a species not mentioned in Weise's list Deut. E. Zeit. 1903, and described in the Entomologist for 1891) than any other; but that species is of larger size, broader and less convex, the elytra are fulvous and entirely margined with black, the transverse band is of regular shape and extends to the suture, and the last abdominal segment of the female is entire (the male is likewise unknown). Of the present insect, probably more varieties will become known in time; in a single specimen, the breast and the abdomen are more or less black; in the var. _a._ the extreme basal margin of the elytra is black only, the lower band is absent and replaced by a small spot, while in var. _b._ the elytra are entirely without markings.

_Hyperacantha flavodorsata_, Fairm.

Weise looks upon this species as a variety of _H. flavonigra_, Thoms. (Deut. E. Zeit. 1903, 37), which does not seem to me to be correct, since Thomson’s species has deep black elytral markings and has been described from the interior of Africa, while Fairmaire says that his species has the elytra, "atro-cæruleis" with the markings different, and that it is found in Madagascar; this island has very few species indeed in common with Africa.

_Hyper, fenestrata_, Chap. The male of this species has near the suture below the middle of each elytron a whitish tubercle, as Weise has rightly presumed, this tubercle is of conical shape and its base is deeply hollowed out.

_H. adusta_, Weise. The author now looks upon his species as a variety of _H. bivestris_, Fab. (Deut. E. Zeit. 1903), but all the specimens I have seen of Fabricius' insect have
testaceous elytra with the base and lateral margins more or less rufous and no traces of any transverse black bands. I therefore think that Weise's species must be distinct from that of Fabricius.

*Leptaulaca maculicollis*, sp. n. (Plate III, fig. 7.)

Oblong-ovate, convex, black, abdomen more or less testaceous, head and thorax flavous, each with a small black spot at middle, elytra fulvous, minutely punctured, antenne pale. Length 7 millim.

Head impunctate, flavous, the vertex with a small black spot, antennae long and slender, flavous, the apex of each joint slightly darker, third joint scarcely shorter than the following joints; thorax scarcely twice as broad as long, constricted at the base, the anterior angles slightly pointed outwards, the disc with a transverse, medially interrupted sulcus at the middle, impunctate, flavous, with a small black spot near the base at the middle, scutellum black; elytra much wider at the base than the thorax, convex, gradually widened posteriorly, very minutely and closely punctured, fulvous, their epipleuræ broad at the base, but entirely obsolete below the middle, breast and part of the abdomen as well as the legs black, the last two or three abdominal segments and sometimes the under portion of the femora flavous; metatarsus of the posterior legs as long as the following joints together, claws bifid.

**Mas.** Last abdominal segment incised at each side, the median lobe longitudinally sulcate.

**Fem.** The corresponding segment truncate at the apex, with a fringe of short hairs.

*Hab.* Umhlali Riv. and Malvern, Natal (C. Barker).

This species agrees in almost every structural character with Weise's genus *Leptaulaca* except that the thoracic sulcus is not continuous but interrupted, which is however not of much importance; *Rhaphidopalpa africana*, Weise, seems a closely allied species but differs much in the structure of the antenne; the female before me has entirely black legs.

*Leptaulaca labiata*, sp. n.

Elongate, nearly parallel, entirely pale testaceous, labrum black, thoracic sulcus straight, disc finely and sparingly punctured, elytra closely and very finely punctured, tibiae all mucronate, claws bifid. Length 7 millim.

♀. Head impunctate, deeply foveolate between the eyes, clypeus triangular, raised at the middle, labrum black, antennæ long and
slender, testaceous, the terminal joints slightly stained at the apex with piceous, third joint slender, slightly curved and widened at the apex; thorax about twice as broad as long, slightly constricted at the base, the transverse sulcus deep and nearly straight, the surface with a few fine punctures, elytra wider at the base than the thorax, nearly parallel, extremely closely and finely punctured, their epipleura broad at the base but nearly disappearing below the middle, legs slender, the metatarsus of the posterior ones as long as the following three joints together, claws bifid.

_Hab._ GERMAN EAST AFRICA.

I only know the female sex of this species, in which the last abdominal segment has a small triangular emargination at the middle; the shape of the third joint of the antennae, identical in the two specimens I possess, is another characteristic mark of the insect as well as the black labrum.

_Ecosoma (Malacosoma) sheppardi_, sp. n.

Black, head and thorax fulvous, the latter subquadrate, finely punctured, elytra subcylindrical, black or dark fuscous, punctured in very closely approximate, semi-regular rows. Length 6 millim.

Head broad, impunctate, the frontal tubercles broadly, transversely trigonate, clypeus triangular, antennae with somewhat short, sub-triangular joints, black, the second and third joint short, subequal; thorax subquadrate, scarcely one-half broader than long, all the margins feebly rounded, the angles distinct but not produced, the disc convex, fulvous, very minutely and closely punctured, scutellum small, black; elytra of a dull fuscous black colour, sometimes with a pale ground colour shining through, more strongly punctured than the thorax, the punctures at the base somewhat regularly arranged in closely approached rows; under-side and legs black, clothed with fine yellowish pubescence, all the tibiae distinctly mucronate.

_Hab._ MATOPAS, Rhodesia (_P. A. Sheppard_).

A rather large-sized species and quite typical of the genus, the prosternum extremely narrow and convex, all the tibiae mucronate and the anterior cotyloid cavities open.

_Ecosoma (Malacosoma) sturmi_, sp. n.

Narrowly elongate, black, the clypeus, femora and tibiae fulvous, thorax impunctate, fulvous, elytra finely punctured and wrinkled, flavous, a sutural band at the base and another broader band at the
Species of African Halticinæ and Galericinæ.

Sides, constricted below the shoulders as well as the tarsi black. Length 4 millim.

Head black at the vertex, impunctate, minutely granulate, the frontal tubercles very prominent, elongate and pyriform, fulvous as well as the clypeus, antennæ rather long, black, the second and third joint small, equal, the following joints slightly widened; thorax but slightly broader than long, all the margins nearly straight, the surface rather convex, flavous, minutely granulate and finely and sparingly punctured, scutellum black; elytra distinctly and moderately closely punctured, with the interstices finely wrinkled here and there, flavous, the greater part of the disc occupied by a black longitudinal band which embraces the shoulders and extends to the base but not to the apex; in front of the shoulders, it is greatly constricted, another short sutural stripe extends from the scutellum to the middle; legs fulvous, the breast, abdomen and the tarsi black; metatarsus of the posterior legs as long as the following two joints together, tibiae with a small spine.

_Hab._ Lesapi River, Mashonaland.

A well-marked species of which I received a single specimen.

_Exosoma (Malacosoma) tongaatensis_, sp. n.

Flavous, thorax subquadrate, impunctate, elytra black, the base with a few punctures, the lower portion impunctate, breast black, abdomen fulvous. Length 3½ millim.

Elongate and subcylindrical, the head impunctate, flavous, frontal elevations broadly transverse, well developed and separated, carina lanceolate, clypeus narrowly transverse, antennæ slender, flavous, third joint double the length of the second and as long as the fourth joint, terminal joints slightly thickened, extending to about the middle of the elytra; thorax about one-half broader than long, subquadrate, convex, the sides rounded at the middle, the disc impunctate, flavous and very shining, scutellum flavous; elytra wider at the base than the thorax, subcylindrical, slightly depressed below the base, the latter with a few fine punctures, the rest of the surface nearly impunctate, black, legs flavous, tibiae mucronate, the metatarsus of the posterior legs as long as the following two joints together, breast black, abdomen fulvous; prosternum very narrow, convex.

_Hab._ Upper Tongaat (C. Barker).

_Exosoma (Malacosoma) apiepennæ_, Jac. (Plate III, fig. 10.)

This species has already been described and figured in the _Proc. Zool. Soc.,_ 1899, which I have unfortunately overlooked.
Mr. M. Jacoby's Descriptions of New Genera and

*Luperus thomsoni*, sp. n.

Fulvous, the intermediate joints of the antennae black, thorax obsoletely sulcate, impunctate, elytra very finely punctured, elongate. Length 5½ millim.

Of elongate, parallel shape, entirely fulvous, the head impunctate, eyes very large, frontal elevations transverse, strongly marked, eyes large, antennae extending beyond the middle of the elytra fulvous, the fourth to the eighth joint black, basal joint elongate and rather slender, second one about one-third shorter than the third joint, fourth and following joints elongate, nearly equal; thorax transversely subquadrate, the lateral margins feebly rounded and slightly constricted at the base, the surface with a broad transverse depression, more deeply marked at the sides than at the middle, entirely impunctate, scutellum smooth, triangular; elytra wider at the base than the thorax, the surface very finely and closely punctured, their epipleurae rather broad at the base, gradually greatly narrowed towards the apex, legs slender, the metatarsus of the posterior ones very elongate; all the tibiae mucronate, the anterior coxal cavities open.

*Hab. Sierra Leone.*

The colour of the antennae and the entirely impunctate and sulcate thorax characterise this species, which has also the metatarsus more than usually elongate, resembling the genus *Monolepta*, from which the open anterior coxal cavities and prolonged elytra epipleurae separate it.

*Luperus semifoveolatus*, sp. n.

Below black, above testaceous, head dark fulvous, antennae long, fulvous, thorax subquadrate, narrowed at base, obsoletely bifoveolate, impunctate, elytra not perceptibly punctured. Length 3½ millim.

Elongate, the head impunctate, dark fulvous, frontal elevations broadly trigonate, clypeus rather wide and broad between the antennae, eyes large, labrum at the apex and the palpi piceous, antennae slender, the second joint one-half shorter than the third, the fourth and following joints elongate and cylindrical, the apical joint extending to about half the length of the elytra; thorax subquadrate, distinctly constricted at the base, the lateral margins rounded before the middle, the disc with an obsolete transverse depression, subfoveolate at the sides, impunctate, testaceous; elytra wider at the base than the thorax, extremely finely wrinkled, nearly impunctate, some extremely fine punctures visible only near the base when seen under a powerful lens, legs slender, testaceous, the tibiae finely
pubescent, with a small spine, the metatarsus of the posterior legs as long as the following three joints together; breast and abdomen black.

_Hab._ Dunbrody, Cape Colony (_Rev. O'Neil_).

There seem to be a good many small and similarly coloured species of _Luperus_ and _Malacosoma_ inhabiting Africa, all more or less closely allied; in the present insect, the head is of darker colour than the rest of the upper surface, the thorax is proportionately long and is obsoletely transversely depressed (more distinctly foveolate at the sides in one specimen), this character and the black underside will assist in distinguishing the species, of which I received two specimens from the _Rev. O'Neil_ which were obtained on _Senecio juniperinus_.

_Luperus incertus_, sp. n. (Plate III, fig. 20.)

Black, the antennæ fulvous, head impunctate, fulvous, thorax minutely punctured, flavous; the basal margin more or less black, elytra finely punctured and wrinkled, black, the base and the apex sometimes obscure flavous. Length 3 millim.

Head fulvous, impunctate, frontal elevations strongly raised, transverse, the clypeus broad, with an acutely raised central ridge, flavous, antennæ slender, extending to about the middle of the elytra, fulvous, the third joint slightly longer than the second, the following more elongate; thorax about one-half broader than long, the sides slightly constricted at the base, the surface very minutely punctured, flavous, the basal margin more or less black, elytra very minutely punctured and finely wrinkled, black, the apex very indistinctly flavous; legs pale fulvous, the metatarsus as long as the following joints together, tibial spine very short.

_Hab._ Dunbrody, Cape Colony, on willows (_Rev. O'Neil_).

_L. apicalis_, Weise (_Wiegmann. Arch. 1902_), is evidently a closely allied species but is described with black antennæ and legs, and of larger size; in one specimen of the present insect, the elytra are marked with obscure flavous near the shoulders and at the apex, while the latter portion in the other specimen are scarcely so marked and the elytra are entirely black at the base.

_Stictocema_, gen. n.

Elongate, parallel and finely pubescent, antennæ filiform, the terminal joints shorter and wider, thorax transverse, the sides straight and narrowed anteriorly, the surface finely rugose and pubescent,
scutellum broad, elytra finely pubescent, their epipleurae very narrow and disappearing below the middle, legs slender, all the tibiae mucronate, the metatarsus of the posterior legs longer than the following joints together, claws bifid, prosternum invisible between the coxae, the anterior coxal cavities open. The very narrow elytral epipleurae, the mucronate tibiae, elongate metatarsus as well as the bifid claws and the finely pubescent upper surface of this genus present a number of characters not found in any of the numerous genera of Galerucinae in the same proportion; the true place of the species is therefore somewhat problematical, but in Schematizella, Jac., it has perhaps its nearest ally; both genera inhabit the same locality, have the antenna? shape of the thorax, the narrow elytral epipleurae and the bifid claws of similar structure, but the tibiae in the present genus have a long spur, in Schematizella even with the strongest lens I cannot find any mucro.

*Stictocoma maculicollis*, sp. n.

Testaceous, the antenna?, the upper edge of the femora and the tibiae and tarsi black, vertex with one, thorax with three black spots, elytra finely rugose, and closely pubescent, metallic green, the lateral margins testaceous. Length 7 millim.

Head closely rugose, the vertex and the labrum black, the clypeus testaceous, antenna with the lower eight joints black (the rest wanting), third joint shorter than the fourth, both joints elongate, the others shorter; thorax transverse, but scarcely one-half broader than long, the sides straight, obliquely narrowed towards the apex, the entire surface finely rugose and pubescent, testaceous, the sides with a small spot or a narrow stripe, the middle with a larger black spot, scutellum broad, testaceous or fusceous; elytra elongate, slightly widened posteriorly, finely rugose or wrinkled throughout and clothed with rather long grey pubescence, the extreme lateral margins and the epipleurae testaceous, legs long and slender, the femora testaceous, the upper edge black, the tibiae and tarsi entirely of that colour, posterior first tarsal joint as long as half the tibiae.

**Hub.** LOLODORF, Cameroons.

In this species, the metatarsus of the posterior legs is extremely elongate, much longer than in the following insect which prevents its being considered an unicolorous variety of that species, with which it otherwise agrees in structure.

*Stictocoma fasciata*, sp. n. (Plate III, fig. 9.)

Testaceous, the apical joints of the antennae black, head and thorax finely rugose, the first-named with one, the latter with three
blackish spots; elytra finely pubescent, a broad longitudinal band near the suture and another one near the lateral margins, violaceous blue. Length 7 millim.

Head scarcely longer than broad, finely rugose and pubescent, testaceous, with an elongate central spot at the vertex, eyes prominent, labrum black, antennæ with the lower six joints testaceous, the rest black, first joint slender and elongate, second short, third and fourth joint as long as the first, the following joints gradually shorter and thicker; thorax obliquely narrowed from base to apex, the sides perfectly straight, the angles acute, the posterior ones obliquely shaped, the surface finely rugose and pubescent, testaceous, the sides with a narrow blackish stripe, the middle of the base with a rounded spot, scutellum broad at the base, truncate at the apex; elytra clothed with short yellowish pubescence, finely rugose throughout, with two metallic violaceous bands, the first close to the suture not quite reaching to the apex, the second parallel with the lateral margins but extending to the suture and apex, both bands are of equal width and are interrupted by a narrower testaceous stripe of the ground colour, the extreme lateral margins and epipleure as well as the under-side and legs are likewise testaceous.

_Hab._ Cameroons.

There is only a single specimen (apparently a female) before me, in which the last abdominal segment is entire.

_Platyxantha_ (Haplotes) _bicolor_, sp. n.

Fulvous, the antennæ and legs flavous, head and thorax with slight purplish gloss, the latter bifoveolate, elytra metallic-green, finely punctured and granulate, very obsolesly sulcate.

♂. Antennæ with all the joints strongly curved and with a fringe of hairs. Length 5½ millim.

Head impunctate, fulvous, with a pronounced purplish gloss, frontal elevations narrow and transverse, strongly pointed anteriorly, eyes large, labrum and palpi flavous, antennæ flavous (the last joint wanting), basal joint strongly thickened at the apex, second one small, third and following joints elongate, nearly equal, strongly curved, with a fringe of hairs at the lower edge; thorax about one-half broader than long, the sides straight at the base, widened before the middle, the lateral margins with some long black pubescence, the disc with two deep depressions, impunctate, with the exception of a few fine punctures near the anterior angles, coloured like the head, scutellum fulvous; elytra parallel, without trace of a basal depression, metallic-green, minutely granulate and very finely and sparingly
punctured in obsolete rows, with traces of sulci, very feebly indicated, legs flavous.

_Hab._ W. _Africa._

The single male specimen contained in my collection has the joints of the antennæ much more strongly curved than in _P. currucornis_, Jac., and metallic elytra; there is also a fringe of hairs at the lower edge of each of the antennæ as well as on the lateral thoracic margins.

_Platyxantha_ (Haplotes) occipitalis, _sp. n._ (Plate III, fig. 14.)

Testaceous, the vertex of the head and the antennæ black, thorax flavous, deeply bifoveolate, impunctate, elytra finely punctured, all the margins narrowly, the lateral ones more broadly black, legs flavous, the tibias (excepting the base) and the tarsi black. Length 5 millim.

Head impunctate, the lower portion flavous, the vertex black, frontal elevations transverse, narrow, strongly raised, clypeus with an acute central ridge, antennæ with slightly curved and somewhat triangularly widened joints, black, the basal joint moderately long, thickened at the apex, second joint very short, moniliform, the following joints about as long as the first, all of nearly equal length; thorax about one-half broader than long, subquadrat, deeply transversely sulcate, the sulcus interrupted at the middle, the surface impunctate, flavous, scutellum flavous, elytra testaceous, finely punctured, the lateral margins, epipleura more broadly, the other margins very narrowly black, metatarsus of the hind legs elongate, tibiae simple.

_Hab._ Lower Tugela, Natal (_C. Barker)._ I only know a single specimen of this species, apparently a female, which differs from its allies in its system of coloration; in the male, the antennæ have probably some joint or other distorted as in most members of the genus.

_Haplotes bifasciata_, _sp. n._ (Plate III, fig. 13.)

Fulvous; thorax transversely sulcate, impunctate; elytra extremely minutely granulate, not perceptibly punctured, the basal half and a narrow transverse band below the middle, blackish. Length 6 millim.

Head impunctate, deeply transversely grooved between the eyes, frontal elevations narrowly transverse, eyes large and round, labrum fuscos, antennæ slender, filiform, fulvous, the intermediate joints more or less fuscos above, basal joint long and curved, second,
very short, moniliform, third and following joints very elongate, rather longer than the basal joint; thorax broader than long, the lateral margins rounded at the middle, narrowed at the base, the surface with a broad transverse sulcus at the middle, entirely impunctate; scutellum fulvous; elytra much broader at the base than the thorax, entirely impunctate, fulvous, the entire anterior half black, the posterior portion with a transverse narrow black band below the middle extending to both margins; under-side and legs fulvous.

Hab. Ogowé. (Collect. H. Clavareau and my own.)

In the apparently female specimens before me, the last abdominal segment is nearly entire or slightly sinuate; the species is well distinguished by the impunctate elytra and their coloration.

_Hemixantha subrugosa_, sp. n. (Plate III, fig. 18.)

Testaceous, the antennæ, the femora above and the tibiae and tarsi black; thorax finely and irregularly punctured, the lateral margins black, scutellum black, elytra deeply and strongly punctured, semirugose, a sutural band of varying width and the margins narrowly black.

var. Elytra with the margins black only, the sutural band absent. Length 5½–6 millim.

Head impunctate, broadly impressed between the eyes, the vertex pale fulvous, lower portion testaceous, the palpi black, frontal elevations broadly trigonate, antennæ filiform, black, the apical joint fulvous, the third joint twice as long as the second one in the male, shorter in the female, the fourth and following joints more elongate and equal; thorax less than twice as broad as long, the sides feebly rounded anteriorly, with narrow margins, anterior angles slightly thickened but not produced, the surface rather convex, with some shallow irregular depressions at the sides, closely impressed with larger and smaller punctures, the extreme lateral margins more or less black, scutellum broadly rounded at the apex, finely granulate, black; elytra wider than the thorax at the base, subcylindrical, closely and very strongly punctured, the interstices partly rugose, all the margins and the epipleurae black, the suture sometimes with another more or less strongly-marked broad black band, generally ill-defined at the sides, sometimes entirely absent; under-side and legs testaceous, the upper edge of the femora and the tibiae and tarsi black.

_Hab. Malvern_, Natal (C. Barker).

The sculpturing and coloration of the elytra in this
species differs from any of the others placed in this genus; the male has the last abdominal segment deeply longitudinally sulcate; in the female, this segment is simple and pointed.

*Hemixantha subconnectens*, sp. n. (Plate III, fig. 16.)

Testaceous, antennæ (the basal joints excepted) black, thorax finely punctured, with five black spots, elytra punctured like the thorax, the margins testaceous, the disc piceous in shape of two longitudinal, posteriorly more or less connected bands, legs testaceous, tarsi black. Length 4½ millim.

Head testaceous, the vertex impunctate, frontal elevations very highly raised, subquadrate, bounded by a deep transverse groove behind, piceous, lower portion of the face testaceous, eyes very large and coarsely granulate or faceted, antennæ robust, black, the basal two joints more or less testaceous, second joint very small, third, trigonate, the following joints scarcely larger, somewhat subquadrate widened; thorax one-half broader than long, or slightly broader, the sides rounded at the middle, the anterior angles thickened and slightly produced outwards, the surface rather closely and finely punctured, the punctures somewhat deeply impressed, testaceous, with three or five piceous spots, placed transversely, the middle ones often united into a triangular larger spot, the middle of the base with a shallow, more or less distinct fovea, scutellum black; elytra extremely finely and closely punctured, the apex nearly impunctate, the entire disc occupied by a broad piceous band, which is divided anteriorly by a more or less elongate stripe of the testaceous ground colour, the sutural and lateral margins as well as the apex more broadly, likewise testaceous; below and the legs testaceous, the knees sometimes stained with piceous, the tarsi entirely of that colour or black.

*Hab. Beira (P. A. Sheppard).*

In the male of this species, the eyes are particularly large and prominent, and the antennæ are more robust and longer than in the female; the elytral dark band is very variable in the amount of the anterior division which in some specimens extends much further downwards than in others, in which it assumes the shape of a flavous spot only.

*Hemixantha dilaticornis*, sp. n. (Plate III, fig. 15.)

Fulvous, the apical joints of the antennæ black, strongly thickened, thorax transverse, minutely punctured, elytra punctured like the
Species of African Halticinæ and Galerucinæ.

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thorax, testaceous, a transverse band at the base and a subtriangular spot near the apex of elytron, greenish-black. Length 5 millim.

♂. Head fulvous, impunctate, the vertex with a small central spot, eyes very large and prominent, each wider than the dividing space, frontal elevations strongly raised, subquadrate, antennæ robust, the basal joint short, curved, as long as the third one, fourth and following joints slightly triangularly widened, scarcely longer than the third, terminal three joints dilated, black, the others fulvous; thorax about one-half broader than long, subquadrate, the sides rounded, the anterior angles slightly produced and oblique, the anterior ones more rounded, the disc rather convex, fulvous, closely and finely punctured, with a small depression near the basal margin at the middle, scutellum fulvous; elytra scarcely perceptibly punctured, testaceous, the base with a narrow transverse, greenish band which is rather deeply indented below the shoulders, this band does not quite extend to the lateral margins, near the apex is another spot of somewhat triangular shape which does not extend to either margin, legs fulvous, all the tibiae unarmed, the anterior coxal cavities closed.

Hab. Beira (P. A. Sheppard).

Both sexes of this species agree in the structure of the antennæ, but the latter are shorter in the female; the eyes in this sex are also much smaller and more widely separated. H. bifasciata, Jac., is a closely allied species, but has simple antennæ and broader elytral bands.

Hemixantha dilutipes, sp. n. (Plate III, fig. 17.)

Metallic-green, the antennæ (the basal joints excepted) and the tarsi blackish, legs fulvous, thorax very finely punctured and granulate, with some irregular depressions, elytra finely transversely wrinkled, with a longitudinal sulcus at the sides. Length 4–4½ millim.

Head bright metallic-green, very finely granulate, impunctate, with a central fovea, labrum fulvous, antennæ very long and slender, black, the lower three or four joints testaceous, all the joints, with the exception of the second one, very elongate and nearly equal; thorax transverse, quite twice as broad as long, slightly constricted at the base, the sides feebly rounded before the middle, the disc with a shallow fovea at each side and another at the base, finely granulate and punctured, metallic-green, scutellum dark blue; elytra elongate and parallel, with a narrow sutural depression below the base, where the suture is somewhat thickened, the entire surface finely trans-
versely rugose, the interstices minutely granulate and finely punctured, legs fulvous, the tarsi black.

*Hab. Ifafa Mountains and Malvern, Natal (C. Barker).*

Closely allied to *H. natalensis*, Jac., but the thorax shorter and much more transverse, the antennae longer, and the legs fulvous, not black. The antennae in the female are much shorter, and both the second and third joint are short and equal.

*Monolepta cameruncensis*, sp. n.

Elongate, subcylindrical, fulvous, thorax subquadrate, strongly punctured, elytra punctured like the thorax, in closely approached irregular lines, the interstices slightly longitudinally raised. Length 6 millim.

Head sparingly but strongly punctured, with a short central groove, frontonal elevations strongly raised, trigonate, lower portion of face flavous, antennae extending nearly to the apex of the elytra, fulvous, the second and third joint very small, equal, the others very elongate with the exception of the fifth joint which is shorter; thorax about one-half broader than long, all the margins rounded, the disc, rather convex, closely and strongly punctured at the sides, much more sparingly so at the middle where there are two smooth and impunctate small spaces, scutellum smooth, elytra very elongate and subcylindrical, as strongly punctured as the thorax, with traces of longitudinal, raised lines; under-side paler than the upper-side, the terminal tibial spur very long, metatarsus longer than the following joints together.

*Hab. Cameroons.*

I only know of a single specimen of this rather large-sized species, contained in my collection; the entirely fulvous colour and the strongly punctured upper surface well distinguish it.

*Monolepta violaceipennis*, sp. n.

Flavous, the antennae, breast, tibia, and tarsi black, thorax strongly transverse, sparingly punctured, elytra dark violaceous, closely and finely punctured. Length 3½ millim.

Of posteriorly widened shape, the head impunctate, flavous, frontal elevations narrow, transverse, clypeus with an acute central ridge, apex of the labrum and the palpi black, antennae nearly extending to the apex of the elytra, the basal joint flavous, the others black,
third joint twice as long as the second, the others very slender and
elongate; thorax short, more than twice as broad as long, slightly
narrowed anteriorly, the sides nearly straight, the lateral margins
with a single long black hair before and below the middle, the
surface with a few fine punctures, scutellum black; elytra closely
punctured, violaceous-blue, below and the femora flavous, tibiae, tarsi
and the breast black; metatarsus of hind-legs very long.

**Hab. Old Calabar (Dr. Brown).**

*Monolepta pygidialis*, sp. n.

Head and under side ferrugineous, thorax and legs flavous, elytra
extremely minutely punctured, flavous, a narrow, transverse, angulate
band at the base and another near the apex, black, pygidium black.
Length 4 millim.

Head impunctate, ferrugineous or rufous, the frontal elevations
rather broad and flat, eyes large, antennae flavous, slender, the second
and third joint small, the fourth as long as the preceding two together,
terminal joints slightly shorter and thicker; thorax one-half broader
than long, the sides nearly straight, not narrowed in front, anterior
angles thickened, the surface extremely minutely punctured, flavous,
scutellum fulvous; elytra punctured like the thorax, yellowish-white,
the black bands narrow, the basal one angulate at the shoulders and
extending downwards at the lateral margins to about one-third the
length of the elytra, the second band slightly oblique, near the apex
and generally not quite touching the lateral margins, the pygidium
black.

**Hab. Malvern, Estcourt, Natal (C. Barker).**

This species must not be confounded with *M. bifasciata*,
Fab., or any of the other banded forms of *Monolepta*, from
which it is at once distinguished by the black pygidium,
entirely flavous antennae, which have the last joint sometimes
piceous, and the narrow elytral bands; all the specimens before me belong to the female sex; *M. bifas-
ciata* is a rather larger species in which the second elytral
band is not placed quite so low as in the present insect;
the pygidium also is flavous.

*Monolepta zambesiana*, sp. n.

Fulvous, the legs flavous, femora marked with black, thorax and
elytra finely punctured; the latter with an oblique flavous patch
from the base to the middle and another angulate band near the apex,
both margined with black. Length 5 millim.
Of broadly ovate shape, the head rather elongate, impunctate, frontal elevations trigonate, well defined, antennæ with the lower three joints flavous, the following four joints piceous, the rest broken off, third joint one-half longer than the second; thorax transversely subquadrate, of usual shape, the disc very finely and closely punctured, dark fulvous; elytra widened towards the middle, broad, punctured like the thorax, fulvous, an oblique, elongate flavous patch extends from the base towards the suture as far as the middle, this patch is narrowed in front of the shoulders and at the apex, another strongly angulate transverse band is placed near the apex of the elytra, the outer and narrower portion running parallel with the lateral margin without quite extending to it nor to the suture, both bands are margined with black; under-side fulvous, the legs flavous, the greater portion of the femora black; metatarsus very elongate.

_Hab. Zambesi._

Of this very distinct species, a single specimen is contained in my collection.

_Monolepta selecta_, sp. n.

Narrow and elongate, black, above testaceous, thorax transversely depressed, elytra opaque, nearly impunctate, testaceous, narrowly margined with black. Length 3½ millim.

Head impunctate, rather darker than the thorax, frontal tubercles strongly raised, trigonate, antennæ long and slender, flavous, the terminal joints stained with fuscous at the apex, second and third joint small, equal; thorax twice as broad as long, of equal width, the sides nearly straight, very slightly constricted at the base, the surface with a well-marked transverse depression, not extending to the lateral margins, not perceptibly punctured, pale testaceous, scutellum black; elytra parallel, with a few very fine punctures at the base, testaceous, opaque, the suture narrowly and the lateral margins rather more broadly black, this colour does however not extend to the apical margins of the elytra; below black, legs testaceous, metatarsus very elongate.

_Hab. Beira (P. A. Sheppard)._ Much narrower and more elongate than _M. nigrocincta_, Jac., the thorax with a sulcus, and the elytral margins more broadly black.

_Monolepta nigricornis_, Weise (Wiegm. Arch. 1903).

This name having already been used by the Rev. Blackburn for an Australian species (Tr. Lin. Soc. N.S.W., 1890), I alter the name to _M. atricornis_.

Mr. M. Jacoby's _Descriptions of New Genera and_
**Monolepta beirensis**, sp. n.

Narrowly elongate, rufous, thorax strongly transverse, finely punctured, elytra dark metallic-blue, extremely closely and more strongly punctured than the thorax. Length 5 millim.

Head finely strigose at the vertex, rufous, frontal elevations broadly transverse, nearly contiguous, eyes very large, the lower six joints of the antennæ flavous, the others wanting, the second and third joint short; thorax more than twice as broad as long, the sides rather strongly rounded, with a narrow margin, the anterior angles slightly thickened, the surface very minutely and superficially punctured, rufous, scutellum triangular, rufous; elytra more distinctly punctured than the thorax; the punctures very closely placed, metallic-blue, under-side and legs rufous; metatarsus of the posterior legs very long.

_Hab._ Beira, East Africa (P. A. Sheppard).

An elongate and narrow species with dark blue elytra, of which I received two specimens.

**Candecza congener**, sp. n.

Rufous, antennæ (the last two joints excepted) and the tibiae flavous, tarsi infuscate, thorax minutely punctured, elytra black with a bluish gloss, extremely finely punctured. Length 5 millim.

Smaller than _Monolepta apicalis_, Sahli., and without red apex of the elytra, the latter with a bluish, fatty gloss and microscopically finely punctured, their epipleura narrowly continued below the middle; head finely granulate and minutely punctured, frontal elevations rather feeble, trigonate, eyes very large, antennæ long, flavous, the second and third joint short, the terminal two joints black; thorax twice as broad as long, the sides slightly rounded, with a single seta near the anterior angles, the disc very finely and closely punctured, rufous, scutellum fulvous, tibiae flavous, the posterior ones with a long terminal spine, metatarsus very elongate, tarsi obscure fuscos.

_Hab._ Dunbrody, Grahamstown, S. Africa (Rev O'Neil).

I have received two exactly similar specimens from the Rev. O'Neil. _Monolepta famularis_, Weise, resembles also this species, but is described as having an elongate third joint of the antennæ, and a more strongly punctured thorax; the first-named organs are also unicolorous.

**Candecza parvicollis**, sp. n.

Ovate, convex, antennæ (the basal joints excepted), the tibiae and tarsi black, thorax short, with an obsolete transverse lateral sulcus,
Mr. M. Jacoby's Descriptions of New Genera and

finely punctured and wrinkled, elytra sculptured in the same way. Length 4½ millim.

Closely allied to _C. nigrotibialis_, Jac., and _C. mashuana_, Jac., but much smaller than either, the thorax shorter, not subquadrate and like the elytra finely rugosely punctured, the antennae, with the exception of the basal three joints which are flavous, black; the frontal elevations are strongly developed, the second and third joint of the antennae is short and equal, but not so short as in some species of the genus, the elytra are finely but distinctly punctured and finely wrinkled and distinctly wider at the base than the thorax.

_Hab. Malvern, Natal_ (C. Barker).

_Candezea annulicornis_, sp. n. (Plate III, fig. 12.)

Elongate, convex, flavous, the apex of the joints of the antennæ and the tibiae and tarsi black, thorax scarcely perceptibly, elytra extremely minutely and closely punctured. Length 5½ millim.

Head impunctate, with very feebly raised frontal elevations, obliquely grooved behind, the front with a narrow, impressed central line, clypeus convex, antennæ extending to about the middle of the elytra, flavous, the fourth to the ninth joint tipped with black at the apex (the last two joints wanting), third joint double the length of the second one; thorax rather long, scarcely one-half broader, subquadrate, the sides nearly straight, very slightly narrowed anteriorly, the anterior angles thickened, the surface only perceptibly punctured, when seen under a powerful lens, with a short transverse depression of each side; elytra extremely closely and scarcely more distinctly punctured than the thorax, their epipleura very broad and continued nearly to the apex; below flavous, the tibiae and tarsi black, metatarsus of the posterior legs half the length of the tibiae.

_Hab. Zambesi._

Allied to _C. (Monolepta) hematura_, Fairm., but flavous below instead of black, and with the scutellum likewise flavous, the tibiae and tarsi black. I know of only a single female specimen, contained in my collection.

_Candezea morio_, sp. n.

Convex and dilated posteriorly, deep black, the vertex of the head, the antennæ and legs fulvous, thorax narrowed in front, finely punctured, elytra very convex, strongly and closely punctured. Length 3½ millim.

Head finely punctured and minutely granulate, the vertex and the labrum fulvous, frontal elevations transverse, but extending
Species of African Halticinæ and Galcrucinæ.

downwards in a narrow ridge at the sides of the clypeus, the latter likewise narrowly elongate, eyes large, antennæ rather short, pale fulvous, the first joint very slender, elongate and curved, the second one-half shorter than the third, the latter and the following joints gradually elongated, more or less stained with piceous at the base; thorax transverse, the sides straight and obliquely narrowed anteriorly, the anterior angles slightly obliquely thickened, posterior margin rounded and rather strongly produced at the middle, the disc finely and rather closely punctured, scutellum transverse, piceous, the apex rounded; elytra gradually widened towards the apex, more strongly punctured than the thorax, their epipleura continued below the middle; under-side black like the upper surface, legs slender, fulvous, metatarsus of the posterior legs more than half the length of the tibiae, the latter with a long spine; anterior cotyloid cavities closed.

**Hab. Mt. Gamo, South Ogowe.**

This species, of which I received two specimens from M. Clavareau at Brussels, is a rather aberrant one, on account of its short and convex shape, and the structure of its head and clypeus; it is further distinguished by the black upper- and under-side.

*Candezea pygidiatis*, sp. n.

 Oblong-ovate, testaceous, thorax strongly transverse, minutely granulate, elytra with deep black lateral margins and epipleura, very finely punctured and granulate, pygidium black. Length 6 millim.

Head minutely punctured and granulate, eyes large and prominent, clypeus convex, triangular, antennæ with the lower four joints and the base of the fifth flavous, the following two joints darker, the rest broken off, third joint twice as long as the second one, the others elongate; thorax twice as broad as long, narrowed from base to apex, the sides straight, posterior margin broadly rounded, sinuate near the angles, the disc sculptured like the head, scutellum triangular; elytra gradually widened posteriorly, very minutely transversely wrinkled and punctured, testaceous, the lateral and apical margins as well as the epipleura and extreme base, deep black, this colour is in shape of a narrow band, which gradually and slightly widens towards the apex, elytral epipleura narrowly continued below the middle, under-side and legs testaceous, the metatarsus very long, pygidium black.

**Hab. W. Africa.**

A well-marked species which cannot be mistaken for
any other, also distinguished by the elytral sculpture. I possess a single specimen without detailed locality.

*Megalognatha sheppardi*, sp. n.

Fulvous, antennae flavous, the last two joints black, thorax with three depressions, elytra minutely and not very closely punctured, black, a subquadrate patch at the middle flavous.

*Var.* Elytra entirely black or fulvous. Length 4 millim.

Head impunctate, fulvous, frontal elevations very highly raised, trigonate, bounded behind by a deep transverse groove, anterior margin of the clypeus straight, labrum and palpi flavous, eyes prominent, antennae slender, the third and following joints elongately subquadrate; the last two joints black, terminal one elongate and slender, thorax about one half broader than long, slightly constricted at the base, the disc with a small triangular depression at the middle near the anterior margin and a large deep fovea at each side, fulvous, impunctate, with the exception of a few punctures which surround the anterior fovea, scutellum fulvous; elytra with very fine but rather remotely-placed punctures, the basal portion raised, depressed at the suture, black, this colour interrupted by an elongate subquadrate, flavous patch at the middle, extending across the suture, under-side and the femora fulvous, the tibiae and tarsi flavous, last joint of the latter, fuscous, tibiae unarmed, the metasternum of the posterior legs as long as the following joints together, claws appendiculate, anterior cotyloid cavities open.

*Hab. Beira (P. A. Sheppard).*

Although this species is less typical of the genus than most of its congeners, since the thorax is of rather more transverse shape, and the sutural margins are not thickened, yet the thoracic depressions and the open coxal cavities and unarmed tibiae agree better with *Megalognatha* than with any other genus of *Galcrucinae*. The specimen, which seems to be of the male sex on account of the long antennæ and their widened joints, which are very similar to those of several species of the genus *Platyxantha*, has a deep cavity in the first abdominal segments, but whether this is accidental or normal I am unable to say. The elytral coloration seems very variable.

*Megalognatha inconspicua*, sp. n.

Testaceous, the antennæ, tibiae and tarsi black, head, thorax and femora fulvous, the thorax finely and sparingly punctured with an
obscure piceous patch, elytra very finely rugosely punctured, testaceous. Length 5–7 millim.

Head flattened and rather long, impunctate, obscure fulvous, clypeus with an acute central ridge, antennae extending below the middle of the elytra (♂), the intermediate joints moderately widened, terminal ones tapering, third joint slightly shorter than the fourth; thorax subquadrate, the sides strongly rounded at the middle and widened, the disc very finely punctured, with a short obsolete, triangular depression near the anterior margin and stained with an obsolete, piceous patch at the middle, scutellum broad, pale piceous, elytra of paler colour than the thorax, finely rugosely punctured, legs rather robust, the femora fulvous, the tibiae and tarsi black, the breast and abdomen testaceous, the edge of the abdominal segments black.

_Hab._ BREDERSDORP, E. Africa.

Principally distinguished by the widened and rounded sides of the thorax, which resembles that of _M. bohemani_, Baly, from which the colour of the antennae and legs further separate the species; the female has much shorter antennae and the depression of the thorax is deeper.

*Megalognatha weisi*, sp. n.

Very elongate and robust, obscure dark testaceous, the antennae, legs and the coxae black, thorax subquadrate, strongly and closely punctured, elytra finely rugose and punctured. Length 11 millim.

Head rugose at the vertex, frontal elevations highly raised, trigonate, clypeus triangular, smooth, deflexed, antennae extending to the end of the elytra in the male, black, all the joints elongate, the third more than twice as long as the second; thorax subquadrate, one-half broader than long, the sides very feebly rounded at the middle, the angles acute, the disc strongly and almost rugosely punctured, slightly depressed anteriorly at each side, with a narrow, less closely punctured short space, scutellum broad, with some fine punctures; elytra wider at the base than the thorax, parallel, very closely and finely rugose and punctured, the sutural margins narrowly raised, legs black, very elongate, the first joint of the tarsi broadly widened, the anterior ones much more elongate than the others.

_Hab._ USAMBARA, Nguelo.

I only know of a single specimen of this species, one of the largest of the genus, and resembling in that respect _M. usambarica_, Weise, but with testaceous (not black) under-
side; the head likewise testaceous, and the antennae with cylindrical, not widened joints, the thorax strongly punctured.

_Eryana bicolor_, sp. n.

Black, the basal joints of the antennae flavous, thorax subquadrate, impunctate, elytra flavous, scarcely perceptibly punctured. Length 5 millim.

Head impunctate, black, deeply transversely grooved between the eyes, the frontal tubercles very strongly developed, triconate, clypeus triangular, rather broad between the antennae, the latter robust, black, the lower five joints flavous, third joint more than twice the length of the second, all the joints thickened at the apex; thorax subquadrate, scarcely broader than long, the margins rounded, posterior angles obsolete, the surface rather convex, impunctate, black, scutellum black; elytra elongate, flavous, the punctures only visible under a strong lens, their epipleurce indistinct below the middle, legs black as well as the under-side, the knees and tibia slightly stained with flavous, the latter macronate, anterior coxal cavities closed.

_Hab. Tanga, E. Africa (Dr. Brauns)._ The nearly impunctate upper surface and the coloration distinguish this species from its allies.

_Spilocephalus apicalis_, sp. n.

Fulvous, the last joint of the antennae black, thorax impunctate, with a deep curved depression, bounded by a ridge above (\(\xi\)), elytra violaceous-blue, the apex fulvous, finely punctured near the suture, with a deep basal depression. Length 4 millim.

Head impunctate, fulvous, deeply transversely grooved between the eyes, frontal elevations strongly raised, transverse, palpi dilated at the penultimate joint, antennae robust, extending beyond the middle of the elytra, fulvous, the second joint extremely small, the following four joints widened and subtriangularly compressed, terminal joints smaller, of similar shape, the last one elongate and black; thorax about one-half broader than long, subquadrate, the middle of the disc with an angular depression at each side which is bounded by a strong ridge above, rest of the surface impunctate, fulvous, very shining, scutellum very broad; elytra with a deep depression below the base, the shoulders and the basal portion prominent, dark violaceous-blue, with some fine punctures anteriorly near the suture, rest of the disc impunctate, the apex in shape of a
large triangular patch extending narrowly upwards at the suture, fulvous; under-side and legs fulvous, clothed with fine yellow pubescence, tibiae unarmed, anterior coxal cavities closed; last abdominal segment of the male deeply incised at the sides.

_Hab. Zambesi._

_Spilocephalus_, Jac. (Trans. Ent. Soc. Lond., 1888), is well distinguished by the structure of the antennæ and the shape of the thoracic depression, in connection with the unarmed tibiae and closed coxal cavities. _S. distantii_, Gab., and _S. metallica_, Jac., have filiform antennæ and a different thoracic sulcus and are better placed in _Platyxantha_. In the female of _S. apicalis_ the antennæ have the joints less widened and nearly equal, and the last abdominal segment is simple.

_Aulamorphus pictus_, sp. n.

Oblong, black, sides of the head flavous, thorax closely punctured, deeply transversely sulcate at the sides, elytra strongly and closely punctured, black, the shoulders and a strongly dentate and semicrescent shaped band at the middle, flavous. Length 6 millim.

Head impunctate, with a deep longitudinal central groove, the sides of the vertex and the frontal elevations flavous, clypeus and labrum black, antennæ slender, extending to the middle of the elytra, black, the third and the following two joints elongate, equal, the terminal joints slightly thickened and shorter, thorax about twice and a half broader than long, the sides straight, the anterior and posterior margins curved, the anterior angles oblique, the surface irregularly punctured with a very deep transverse sulcus at the sides, less deep at the middle, another small depression is placed at the base near the middle, scutellum smooth; elytra slightly wider at the base than the thorax, with a depression below the base, very strongly and closely punctured, black, the shoulders with a subquadrate flavous spot, another transverse and medially constricted mark is placed at the middle, not extending to the suture but connected near the lateral margin by a narrow stripe with another transverse dentate band near the apex, forming a semicrescent, under-side and legs black, the abdominal segments narrowly margined with flavous, tibiae unarmed, metatarsus of hind-legs as long as the following joint, together, anterior coxal cavities closed.

_Hab. German East Africa._

Of this, the second species of the genus, I only possess a single female specimen, it is however sufficiently distinguished by its coloration, although the latter is probably subject to variation.
Beiratia, gen. n.

Elongate, subcylindrical, antennæ filiform, the fourth joint longer than the third, thorax transversely subquadrate, with rounded sides and posterior angles, the disc convex, without depressions, elytral epipleura broad at the base, disappearing below the middle, legs rather short, all the tibiae mucronate, the metatarsus of the posterior legs about as long as the following joints together, claws appendiculate, prosternum extremely narrow, the anterior cotyloid cavities closed.

This genus will enter the Monoleptinae on account of the closed coxal cavities and the mucronate tibiae, it differs from Monolepta in the general robust and subcylindrical shape and the much shorter metatarsus of the hind-legs which are altogether more robust. Ergana, Chap., has the elytral epipleura continued and the metatarsus short. In Barombia, Jac., the second and third joint of the antennæ are short and the metatarsus is very elongate; the thorax also is strongly transverse.

Beiratia inornata, sp. n. (Plate III, fig. 19.)

Of a uniform testaceous colour, the antennæ (the basal joints excepted) and the tibiae and tarsi black, thorax impunctate, elytra extremely finely and closely punctured, the interstices still more finely punctate. Length 7 millim.

Head broad, impunctate, the frontal elevations subtuberculiform, bounded by a deep transverse groove behind, clypeus with an acute central ridge, mandibles strongly curved and pointed, the apex black, antennæ extending beyond the middle of the elytra, very slender, black, the lower two or three joints testaceous, fourth joint one-half longer than the third, the following of nearly similar length, apical joints not thickened; thorax transversely subquadrate, slightly narrowed in front, the lateral and the posterior margin rounded, the anterior angles blunt and oblique, the disc rather convex, extremely minutely granulate when seen under a strong lens, without any larger punctures, elytra not wider at the base than the thorax, very finely and closely punctured, with very minute other punctures at the interstices, tibiae and tarsi blackish; the male organ short and stout, terminating into an acute point, the cavity closed by an elongate lid having a central furrow, female with the last abdominal segment broadly produced at the middle.

Hab. BEIRA (P. A. Sheppard).
Species of African Halticinae and Galerucinae. 51

Hystaspes, Jac. (Stettin, Zeit., 1903).

I now find, to my dismay, that this genus and the species H. dohrni is identical with my genus Schematizella and with the type S. viridis (Trans. Ent. Soc., 1888), the first-named genus and species must therefore be entirely omitted.

Ootheca bennigseni, Weise (Deut. Ent. Zeit., 1900).

Of this species I have received several specimens from Beira obtained by Mr. P. A. Sheppard, amongst which are some with entirely fulvous upper-side; the insect is probably subject to the same amount of colour variation as the type O. mutabilis, Sahlb. The structure of the male organ agrees entirely with the description given by the author; another specimen is also contained in my collection from Natal.


This species, with metallic-green and rugose elytra, ought, I think, to find its place in Haplotes, Weise, as at present understood; the apex of the tibiae, if looked at sideways, seems produced into a point as in Duviciera, Weise, but this is caused by long stiff hairs only, which project in a close set beyond the apex.

Explanation of Plate III.

Fig. 1. *Crepidodera malvernensis.*
2. *Nisotra weisei.*
3. *Phyllotetra weisei.*
5. *Dunbrody nitida.*
7. *Leptaulaca maculicollis.*
8. *Hyperacantha obesa.*
10. *Exosoma apicipenne.*
11. *Hyperacantha silvana.*
12. *Candeza annulicornis.*
14. ″ *occipitalis.*
15. *Hemixantha dilaticornis.*
16. ″ *subconnectens.*
17. ″ *dilutipes.*
18. ″ *subrugosa.*
19. *Beiratia inornata.*
20. *Luperus incertus.*
III. On the emergence of Myrmeleon formicarius from the 
pupa. By W. J. Lucas, B.A., F.E.S.

[Read December 6th, 1905.]

In this species, striking changes take place in the structure 
of the mandibles as the insect passes from the larval to 
the imaginal stage. The object of this paper is to call 
attention to these changes, and especially to the modifica-
tions of the pupal mandible to fit it for cutting open the 
cocoon—an operation not, however, performed by the pupa 
(strictly speaking) but by the imago, immediately before 
it sheds the pupal skin. A few notes are added on the 
larval habits as observed by Dr. Chapman and myself. 
Though these probably contain nothing new, they may 
interest English entomologists who have few opportunities 
of seeing these curious larvae.

[Notes on the larvae made by T. A. Chapman, M.D., 
before they passed into my possession.—"I brought home 
several of these Ant-lion larvae on Aug. 10th, 1904, having 
found them a week or so earlier at La Granja (Spain). 
They were there very abundant amongst what was rather 
dry dusty earth—scarcely sand—in the pine forest, where 
the trees were even somewhat densely placed. They 
were quite under the trees, most abundant in fact close to 
their roots, so that it may well be, that they preferred such 
places as being less exposed to rain. They were sometimes 
so abundant that a square foot was occupied by eight or 
ten of them of various sizes. During the six weeks I 
had them at home before passing them on to Mr. Lucas 
they ate a good many larvae, chiefly of small Lepidoptera. 
If the larva was too large, they avoided it and were with 
difficulty got to seize it. In this they were well-advised, 
since the result was either that the larva jerked itself 
loose, or jerked the ant-lion out of the sand, into what 
would naturally be a position of much danger. A small 
larva, when once seized had no chance of escape, and after 
a few spasmodic twists, became passive and was soon 
dead. When hungry, the ant-lion sucked the larva very 
dry, so that a minute shred only remained, if the larva 

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given was a small one. When too well supplied, however, larvae were left only half emptied. They grew consider-
able whilst I had them, not however moulting, but chiefly filling out after the starvation incurred through being brought here. They made typical pits several times. I saw them not infrequently throwing out sand by the backward jerk of the head. This was done either in making a pit or in repairing it. Roesel, I think, says they also did this by way of artillery, to bring an insect at the edge of the pit, down within their reach. In a broad sense I think this is true; an insect at the edge of the pit may cause some sand to fall on the ant-lion at the bottom, in cases where it does not itself first reach that position, and the ant-lion at once ejects the sand in order to make his trap perfect as soon as possible. The move-
ment in the walls of the pit so caused would probably often precipitate to the bottom an insect that would other-
wise have escaped. I several times saw sand so ejected on disturbance of the pit, but in no case was there any-
thing like aiming the shower of sand at the insect. The eyes are so placed that the insect has probably a fair view of the field of operations; on the other hand, its artillery only commands a section of the circle, and it cannot turn itself round very quickly should the insect be on the opposite side. The larva appears always to travel back-
wards, and always under the sand, often, when replete, going to some depth to rest. On the surface it is not very helpful, except that it can bury itself with great rapidity; it moves to some distance under the sand very quickly."

Two living larvae were passed on to me at the end of September. Judging of the food from the common and scientific names that the insect bears, I supplied them with living specimens of the red ant of the fir-woods (Formica rufa). They would, however, have none of these, and indeed appeared unwilling to accept anything I gave them. Possibly they do not feed during the winter; at any rate they ate little or nothing till well on into the spring of the next year. One of the two could have been none the worse for its long fast, since it produced an imago of good size about midsummer (1905). Before pupating it ate one or two caterpillars. These, when seized, struggled violently at first. The ant-lion then rapidly buried itself as mentioned in Dr. Chapman's note when, suddenly as it seemed, the caterpillar became still,
Myrmeloon formicarius from the Pupa.

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giving one the impression that it had been stung and paralysed at this juncture. Only once did I notice sand being thrown about by the larva, and even on that occasion I could not see for what purpose this was done. It should be stated that a trap was never well formed—possibly because the sand supplied was too mobile for the purpose. Often the larvae would wander about during the night and make circular furrows in the sand, which were, there is little doubt, intended for traps. While in my possession the larvae seemed to be usually buried well beneath the surface of the sand.

At length one day threads of a gummy nature were noticed along the sand and across the box containing the larvae—this waste of material seeming to be ill able to be spared by so small an insect which had to produce so large an imago. Gradually there arose from the surface of the sand a spherical cocoon consisting of grains of sand cemented together by this gummy material (liquid silk). This cocoon was formed from below, a small section of a sphere first appearing, the sphere itself taking shape as the work progressed, and being when completed about nine-sixteenths of an inch in diameter. Having but the one cocoon, it was not possible for me to examine the pupa within. When a little later the emergence took place I was pleased to find that the imago was of good size, not having suffered apparently from the long fast in the larval stage.

In the case of the Chrysopas (Green Lace-wing Flies), which are near relatives of the ant-lions, we have a tiny spherical cocoon, quite ethereal in appearance and evidently made of silk alone. Before disclosing the imago the pupa of Chrysopa neatly cuts for itself a circular door. It then leaves the cocoon entirely and afterwards the disclosure of the imago takes place outside. The pupa of Myrmeloon formicarius does not do this, but after making an aperture at the top of the cocoon, protrudes the fore part of its body only, somewhat in the same way as the pupa of the Burnet-moth (Zygyna trifoli) does. Emergence of the imago then takes place from a dorsal slit, the delicate pupal skin remaining half-projecting from the orifice in the cocoon.

As previously mentioned interesting changes take place in the mandibles as the ant-lion proceeds from stage to stage of its life-cycle. These I have illustrated by means
of the accompanying figures, which are magnified about 23 times. It will be at once seen how admirably the formidable larval mandibles are formed to serve as a trap to catch the prey in that stage. The pupal jaws are used in the insect's life for a single operation—the cutting of an opening in the cocoon. They are much reduced in size, and the slender hairs are perhaps vestigial only.

The sharp points are well adapted for piercing the cocoon and the saw-like edges are equally well suited for enlarging the opening. In the imago the mandibles have become quite simple in form and the hairs have disappeared. Of two species of *Chrysopa* (*C. septempunctata* and *C. clathrata*) whose pupal skins I possess, the jaws in that stage are similar to those of the pupa of *M. formicarius*, and
judging by the clean manner in which *C. clathrata* had opened its cocoon by a circular lid, these jaws must be very efficient instruments for effecting this operation.

[Note on the pupal mandibles by Dr. Chapman.—"In the three stages of *M. formicarius* the mandibles are of interest to me in connection with the ancestry of the Lepidoptera, in view of the considerations I advanced in Trans. Ent. Soc. 1896, p. 568. No doubt any common *Chrysopa* or *Hemerobius* would afford a similar series, but I am not aware of such a series being figured, certainly not in any English medium I have come across. The pupal jaws are modified so as to be specially suited for opening the cocoon. The pupa throughout its whole existence is absolutely quiescent, and these jaws rest unused. It is when the insect is no longer a pupa, but an imago within the pupal skin, that it becomes active and uses these jaws to open the cocoon. It is not the pupa, but the imago that does this, these pupal jaws being merely a sort of glove to the marginal jaws, now fully developed, but no doubt like the wings requiring a few minutes' adjustment to the new conditions, when the pupal skin has been cast off. Mr. Lucas' specimen shows the pupal skin left in the grip of the opening made in the cocoon, the imago leaving it as soon as the anterior portion is outside the cocoon. It is easy to understand how these pupal jaws are moved by the imago, since it has its own jaws inside them; but how the similar jaws that are used for the same purpose by the *Trichoptera* and the *Eriocraniidae*, which have no imaginal jaws at all, are energised by the imago, remains as difficult to understand as I found it ten years ago."]
IV. On some new or hitherto unfigured forms of South-African Butterflies. By Roland Trimen, M.A., F.R.S., etc.

[Read February 7th, 1906.]

Plates IV, V, VI.

I have to thank once more the constant kindness of my friends and correspondents, Mr. H. L. Langley Feltham, F.E.S., of Johannesburg, and Mr. A. D. Millar of Durban, for bringing to my notice several of the interesting forms here dealt with. I would especially call attention to the new Transvaalian Coenyra, brought home on behalf of the captor, Mr. H. Livingstone, by Mr. Feltham, and to the highly remarkable new Deloneura discovered at Port Natal by Mr. Millar.

In view of the considerable number of species among the smaller South-African butterflies—especially among the Lycaenidae—remaining unfigured altogether or very imperfectly delineated, I have gladly adopted Mr. Feltham’s suggestion to devote two plates to the group mentioned, and especially to the genus Lycemna, many of the nearly-allied forms of which are most difficult of determination from descriptions alone.

The types of Coenyra rufiplaga, and the singular melanic aberration of Acræa aglaonice, have been respectively presented to the British Museum by Mr. H. Livingstone and Mr. G. T. Weeks.

Family NYMPHALIDÆ.

Subfamily SATYRINÆ.

Genus Coenyra, Hewits.

Coenyra rufiplaga, n. sp. (Plate IV, fig. 1.)

Closely allied to C. hebe (Trim.).

Exp. al., 1 in. 4 lin.

♂. Rather dark-brown, the hind-margins slightly paler; fore-wing with two sub-apical black, silvery-centred dull-ochreous-yellow-ringed ocelli, and a large discal pale-rufous patch which partly encloses the
upper ocellus and wholly encloses the lower one; hind-wing with two similar but smaller ocelli near hind-margin. Fore-wing: rufous patch large, wider superiorly, encircling lower half of upper ocellus, its inner edge irregular, its outer edge bounded by the inner of two indistinct parallel scarcely sinuated dark-brown sub-marginal streaks; this patch extends inwardly up to lower disco-cellular nervule, and inferiorly (much narrowed) to sub-median nervure; two ocelli placed a little obliquely, the lower one being rather nearer to hind-margin,—the third median nervure passes between them touching the lower one. Hind-wing: two ocelli divided by second median nervure, their ochreous-yellow rings with a slight rufous tinge; two darker brown sub-marginal streaks as in fore-wing, but closer together. Under-side.—Pale-yellowish, finely but closely irrorated with fuscous; ocelli better defined than on upper-side (and in hind-wing six in number), their rings of a bright pale-yellow in an outermost fine circle of fuscous; in both wings, a premedian and a median irregular transverse rufous streak, and also a short terminal disco-cellular rufous streak which unites with median streak on 3rd median nervure. Fore-wing: rufous patch paler, and wider inferiorly, where it more or less merges with median darker rufous streak; swollen basal portion of costal nervure rufous superiorly; two parallel sub-marginal fuscous streaks thin but sharply defined. Hind-wing: 4 additional ocelli, of which the first, on sub-costal nervules, is the largest, and the second third and sixth (in the whole series of six) are smaller than the fourth and fifth; two rufous streaks completely cross wing from costa to inner-margin, the outer or median one more angulated than the other; two small traces of a basal rufous streak; sub-marginal fuscous streaks as in fore-wing, but rather more sinuated.

This remarkable form of Conyra is distinguished from both the typical C. hebe and its "Variety A" on the upper-side by a much darker brown, but especially by the presence in the fore-wing of a large and conspicuous discal rufous patch. These features give the upper-side quite the aspect of a Pseudonympha,—and especially of P. naryana, Wallengr. The dark-brown ground-colour quite obliterates any trace of the transverse striae of the fore-wing, which in typical hebe are indistinct and ferruginous and in Variety A conspicuous and red. The rufous patch looks like a development and expansion of the ferruginous-red rings (usually thin and ill-defined, but in the female sometimes diffusely widened) which characterize typical hebe. It is notable that in the Variety A, in which the enlargement and redness of the transverse striae are so conspicuous,
Forms of South-African Butterflies.

there is no trace on either upper or under-side of the fore-wing of any rufous immediately encircling the ocelli, the outermost rings being dusky-brown; and thus, as regards this particular red marking, C. rufiplaga is nearer than the Variety A to typical hebe. In both examples of the new form only the two lower of the hind-wing ocelli are represented on the upper-side; I have noted the same feature in a King William's Town ♂ and a Bashee River ♀ of the Variety A. As regards the under-side, the rufous strie in C. rufiplaga are thinner and redder than in typical hebe, and there are only fragmentary and obsolescent traces of the two sub-basal ones present in the latter; in the fore-wing the outermost stria is inferiorly merged with inner edge of the rufous patch. In respect of these under-side striae, the new form is at the opposite extreme from the Variety A, which presents them in a very highly-developed condition.

The two examples here described are closely alike, and give the impression of representing a distinct local race; but this view cannot be definitely affirmed until specimens of the ♀ are forthcoming from the same district. Mr. Feltham received these ♂ ♀ from Mr. H. Livingstone, who notes that they were "caught on the top of Buiskop, near Warm Baths, Transvaal, on 2nd January, 1905." This, I learn from Mr. Feltham, is an elevation of some extent situated about 50 miles N. of Pretoria and half-way between that town and Nylstroom.

Genus Pseudonympha, Wallengr.

Pseudonympha duplex (Butl.)—Var. major. (Plate IV, fig. 2.)


This species was founded by Mr. Butler on a single ♂ from Somali-land,* and was made the type of his new

* The ♀ associated with this ♂ was subsequently recognized by Mr. Butler as distinct, and described by him (Proc. Zool. Soc. Lond., 1894, p. 559) as N. rufilineata. It differs in having on under-side of hind-wing three red transverse streaks—of which two, ante-median and post-median, are not present in the N. duplex, ♀. This ♀ does not appear to me to be separable from P. natalii, Boisd.
genus *Neocemyra*. I published (*l.c.* 1891) my view that the characters specified, while separating the proposed new genus from *Cemyra*, Hewits., seemed identical with those presented by *Pseudonympha*, and this view was confirmed on my examination of the type specimen of *duplex* in 1892. At the same time I found, on inspecting the type of *Ypthima bera*, Hewits.,—which I only knew previously from Hewitson’s description—that *duplex* was quite a distinct species; *bera*, though very nearly allied, being at once recognized by its total lack of rufous marking on both the upper and under surfaces.

Several other species have since been described and placed in *Neocemyra* by Mr. Butler; but Prof. Aurivillius (Rhop. *Æthiop.*, 1899, p. 72)—though he adds to these *Pseudonympha natalii* (Boisd.)—remarks that it is doubtful, looking to species so intermediate as regards the form of the antennal club as *P. cassius* (Godt.), whether *Pseudonympha* and *Neocemyra* can be distinctly separated.

Of late years, numerous examples of typical *P. duplex* have been received from British East Africa; there are eight (5 ♂♂ and 3 ♀♀) in the National Collection from various localities, and seven (6 ♂♂ and 1 ♀) in Mr. F. J. Jackson’s collection from Gulu-Gulu and Kibwezi. All these are of the same limited size, not exceeding about 1½ in. across the expanded wings.

The large Variety here figured had been long known to me as occurring in tropical South Africa, Mr. F. C. Selous having sent examples from Matabeleland in 1882, and Mr. A. W. Eriksson a good series from the same country in 1885, but it was not included in my “South African Butterflies” (1887-89) because I had no evidence of its having been met with in any extra-tropical *habitat*. I referred to its existence, however (in vol. i, p. 82 note, and vol. iii, p. 395), mentioning its relationship to *P. natalii*, Boisd., its distinguishing features, and its probable identity with *duplex*, Butler; and in 1891 (*l.c. supra*) I recorded its capture—in a somewhat modified form—by Mr. Eriksson on the Okavango River in 1887-88, and described the characters in which it differs from *P. neita*, Wallengr. Not until July last had I the pleasure of seeing specimens from an extra-tropical station, which were kindly presented to me by the captor, Mr. Alfred T. Cooke, of Johannesburg. These examples were taken in November and December 1903, at White River, 15 miles from Nelspruit (a station
on the Pretoria and Delagoa Bay Railway, about 30 miles from Barberton), Transvaal, where Mr. Cooke found the butterfly extremely abundant on a wide treeless grassy plateau roughly about 10 miles in diameter, but only a few stragglers of it in the bushy and rocky surrounding country.

The size of this form presents some variation, the ♂ ranging from 1 in. 7–9 lin., and the ♀ from 1 in. 9 lin. to 2 in., but it seems always to very considerably exceed that of the typical form. Some approach to a corresponding discrepancy is found in the allied P. neita, Wallengr., seven ♂ specimens of which, taken by Mr. C. N. Barker at Kwamakwaza in Zululand expand 2 in. 1–3 lin., in contrast with all I have seen from other parts of South Africa, which range in size from (♂) 1 in. 7 lin. to (♀) 2 in.

**Pseudonympha natalii** (Boisd.). (Plate IV, fig. 3.)


As only the ♀ of this species appears to have been described, I give here particulars of the slight differences which the ♂ exhibits.

♂. Smaller; exp. al., 1 in. 5–6 lin. A little darker; rufous-ochreous discal patch in both wings smaller and narrower. Hind-wing: obsolescent sub-apical ocellus very faint (in one example absent); other ocelli usually less distinct,—but in one example more developed than in ♀, especially the third inferior small one near anal angle. Underside,—Hind-wing: in one example each loop of submarginal ferruginous stria encloses a very small ocellus, the lower one very faint, but in five other examples there is no trace of these additional ocelli, and in three of them the looping of the stria is itself interrupted or incomplete.

I cannot find any published figure of this long-known but somewhat rare species, and the accompanying illustration will prove serviceable in determining the closely-related forms of this group. It is worth noting that, although *P. natalii* in its colouring and marking comes so
very near to *P. duplex*, yet in the remarkable feature of the double looping of the stria just beyond the ocelli on the under-side of the hind-wing* it finds its ally in *P. bera*, Hewits,—a butterfly without any rufous-ochreous colouring whatever, and so strongly resembling an *Ypthima*.†

Originally recorded by Boisduval from Zululand, the range of *P. natalii* has since been shown to extend to the northern Transvaal, Bechuanaland, Matabeleland, and Damaraland. Its distribution thus coincides largely with that of *P. duplex*, var. major; and the two forms came together in the collections made in Matabeleland by Mr. F. C. Selous, Mr. A. W. Eriksson, and the late Mr. F. Oates.

Subfamily ACRÆINÆ.

Genus Acræa, Fab.

*Acræa aglaonice* (Westw.). (Plate IV, fig. 4.)


Aberration (Melanic).—♀. Smoky-black: fore-wing with a moderately-wide rufous-fulvous costal border from base to a little beyond middle, a wider rufous-fulvous inner-marginal border from rather before middle to posterior angle, and an apical-hind-marginal series of six inter-nervular rays, diminishing in length but increasing in breadth downward; hind-wing with neuration across middle and a diffuse inner-marginal border pale rufous-fulvous with

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* It must, however, be observed that in several examples of both sexes of *P. duplex* the lower of the loops is more or less developed, as shown in my figure of that form from a Transvaal ♀ specimen.

† *P. extensa* (Butl.), from Salisbury, Mashonaland (Proc. Zool. Soc. Lond., 1898, p. 188, pl. xx, f. 1), seems to stand in the same relation to *P. duplex*, var. major, as *P. bera* does to *P. natalii*; that is to say, the pattern and markings closely correspond in the two forms, but there is exhibited a most conspicuous difference in colouring, *P. extensa* being entirely devoid of the rufous-ochreous patches so prominent in *P. duplex*. It occurs to me as possible that these singular relations may prove to be seasonal in these butterflies; but I have at present no material or data affording support to this conjecture. The type of *extensa* (♀) from Salisbury, Mashonaland, taken by Mr. G. A. K. Marshall, is in the National Collection, accompanied by a ♀ *duplex*, var. major, from the same locality and donor.
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a slight pinkish tinge. Under-side.—Fore-wing: fuscous not so dark; rufous-fulvous costal and inner-marginal borders paler, irregularly widened in parts and confluent at base; apical-hind-marginal border widely creamy, traversed by inter-nervular rays like those on upper-side but narrower. Hind-wing: fuscous broken and macular in basal and inner-marginal areas, and blacker,—the ground-colour there being pinkish-red; outer half of discoidal cell creamy; mesial neuration conspicuously and diffusely creamy, penetrating fuscous area to beyond middle; hind-marginal series of seven large well-defined broad creamy-whitish lunules.

Exp. al. 1 in. 11 lin.

The example here described belongs to the darker variety of A. aglaonice described by me in Proc. Zool. Soc. Lond., 1894, p. 27, and pronounced by Mr. G. A. K. Marshall (Trans. Eut. Soc. Lond., 1896, p. 555) to be the summer form of the species; but so completely altered is its appearance by the intrusion and singular distribution of the smoky-black suffusion, and the almost entire suppression of the ordinary black spots, as well as by its unusually small size, that, had it not been for the exact agreement with the ♂ aglaonice in the colouring and marking of head, thorax, and abdomen, I doubt whether I could with confidence have referred it to that species. It was taken at Melville, a suburb of Johannesburg, Transvaal, by Mr. G. T. Weeks, on the 7th May, 1904.

The range of this Acrea extends from Southern Matabeleland to Eastern Mashonaland and Delagoa Bay, and also through the Transvaal as far south as Johannesburg and eastward to the Lydenburg district, and it further includes Delagoa Bay, Zululand, and (apparently very exceptionally) Natal.

Mr. Feltham, writing to me in June 1904, made the following interesting remarks on the winter appearance of A. aglaonice and certain other Acrea at Johannesburg: "We are just now, in the depth of the cold weather, having an irruption of newly-emerged butterflies of this species. They have been with us for the last month, and are scattered generally, but singly (not in quantities) about the hills and even in the streets. The same thing happened about nine years ago, also in mid-winter, when frost is on the ground in the mornings and most butterfly life has disappeared. In 1894, also in winter, we had a great incursion of Acrea buxtoni, in weather so cold that the
butterflies could hardly move. Some other Acraeae occasionally make their appearance here, whether as stragglers or bred locally one cannot say, but almost invariably when the cold weather begins. It is difficult to conjecture why these butterflies should select the winter to visit or emerge upon the highest and coldest area for many miles round, considering what much more favourable conditions appear to be offered by the rapid downward trend of the country to the Northward as far as the 'Low Veldt' just beyond the Magaliesberg."

Subfamily NYMPHALINÆ.

Genus Harma, Westw.

HARMA CORANUS (H. Grose Smith). (Plate IV, figs. 5, 5a.)


I am glad to have the opportunity of figuring this species, which seems to be still decidedly rare in collections. The types described by Mr. Grose Smith were noted as captured by Mr. Last in the neighbourhood of Mombasa; but a broken specimen of the ♂ had reached me some years previously from Pinetown, Natal, where it was taken by Col. Bowker in June 1883. In a collection formed in Zululand by Captain A. M. Goodrich a ♂ and a ♀ occurred, which were labelled as taken in April 1887, and October 1886, respectively; and a ♂ sent from the same locality by Mr. W. H. Heale is—I am informed by Mr. Heron—in the British Museum. To these examples may now be added two brought home by Mr. Feltham, a ♂ taken by Mr. Roberts in June 1904, at Port St. John's, Pondoland, and a ♀ captured by Mr. Feltham himself, on 14th February, 1904, at Port Shepstone, Umzimkulu, Natal.

This ♀ is here figured; and on comparing it with a coloured drawing of the type example—made and kindly lent to me by Mr. Heron—I find that on the upper-side it differs in presenting a narrower discal common white band, and a much narrower and more macular sub-costal oblique white bar in the fore-wing, and also in the latter wing in having the sub-costal commencement of the discal band
indicated by a whitish spot, and that of the discal series immediately beyond the band by two small but distinct white sub-apical spots. These differences from the drawing of the type are also shown by the ♀ taken in Zululand by Captain Goodrich.

I figure the Zululand ♀ received from Capt. Goodrich in preference to Mr. Roberts' Pondoland ♀, because the under-side in the former agrees in ground-colour with Mr. Smith's description of "stramineous," while in the latter it is of a much duller tint, pale ochreous-yellow before the common dark-brown median streak and creamy-ferruginous beyond it, with all the markings before middle attenuated and all those beyond middle grey and very indistinct. Variation in the colouring of the under-side is extremely prevalent in both sexes of the nearly allied *H. alcimeda* (Godt.), the only other *Harma* yet discovered in South Africa.*

Mr. Feltham makes the following notes on *H. coranus*:

"In a wooded dell on the Umzimkulu at Port Shepstone, on the 14th February, 1904, I saw several specimens, both ♀ and ♂, but could only succeed in capturing a single ♀, being unfortunately provided with too short-handled a net. Both sexes flew at least 6 or 8 feet above the ground, and settled at about the same height on leaves of trees in large bushes. Their flight resembled that of *H. alcimeda*, which was plentiful close by; but I noticed this peculiarity in it, that, between the strokes of the wings, the motion conveys the impression that the butterfly is progressing with its wings set slanting somewhat downward on either side instead of horizontally.

"During my stay at Port St. John's, from 1st to 7th March, 1904, I looked carefully for *H. coranus*, but did not see it; although *H. alcimeda* was quite common there, frequenting the ripe fruit of the wild vine. Before leaving I asked my friend Mr. Roberts to keep a sharp look-out for *coranus*, and he succeeded in detecting and securing the ♀ example in June 1904."

* This genus is emphatically West-African; out of about 50 species, besides the two South-African natives under notice—of which *coranus* inhabits also the East-African Coast at Mombasa—only 5 or 6 species appear to have been met with in British East Africa, even as far inland as the Victoria Nyanza. It is thus remarkable that a small representative should have penetrated to the extreme South of the continent, and flourish there wherever the native woods still extend.
Family Lycænidae.

Genus Deloneura, Trim.


When defining this remarkable genus in 1868, I little thought for how long a time the three Kaffrarian examples captured by my lamented collaborator, the late Col. J. H. Bowker, would remain its only known representatives. To this day, no further specimens of the type, D. immaculata, Trim., are forthcoming. Staudinger's insect figured (Exot. Schmett., i, pl. 94.—1887) under that name being rightly referred by Aurivillius (Rhop. Äthiop., p. 278.—1899) to the genus Liptena. Plötz's Deloneura marginata (Stett. Ent. Zeit., xli, p. 204.—1880) has been identified by Aurivillius (l. c. p. 284) with the type of Mr. F. Kirby's genus Aslanga, vid. A. marginalis, K. (Ann. and M. Nat. Hist., (6), 6, p. 261.—1890). No doubt the absence of specimens of Deloneura led to the misplacing of these West-African butterflies; yet my diagnosis and figure (l. c. 1868) gave very clearly the singular disco-cellular and radial neuration of the fore-wings and other characteristic features, and should have sufficed to prevent the addition to the genus of species not possessing those features.

The discovery of a new species of Deloneura (described below as D. millari), in Natal, enables me to dismiss a suggestion I made in 1868 (l. c., p. 82, footnote) that the fore-tarsi might be (as in a very few other genera of Lycænidae) perfect in both sexes, and that of the three extant examples of D. immaculata—all of which possessed completely articulated and clawed fore-tarsi—the two smaller might be ♂ ♂ and the third alone a ♀. The three examples of the new Natalian species comprise two unquestionable ♂ ♂, exhibiting not only unarticulate fore-tarsi, blunt and less than half the length of the tibie, but also a conspicuous sexual badge on the submedian nervure of the fore-wings, consisting of an apparent slight membranous expansion or inflation, covered both on upper and under surfaces of the wings—but much more densely on the upper surface—with elongated pointed scales, and
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extending from the base to considerably beyond the middle. The ♂ further differs from the ♀ in having the fore-wing more pointed at the apex and more prominent at the middle of the hind-margin, and the terminal joint of the palpi longer, more slender, and more acuminate.

*Deloneura* can no longer be held as an endemic South-African genus, two Tropical-African congeners being now known, one from Kinsembo, on the coast of North Angola, and the other from Kisumu on the N.E. shore of Victoria Nyanza. These two species have been constituted as a new genus, *Poultonia*, by Mr. S. A. Neave (Novit. Zool., xi, 1904, pp. 336-37); but now that both sexes of *Deloneura* are forthcoming, it is unquestionable that *Poultonia* is in all respects structurally inseparable from the older genus. It is noteworthy that these two tropical species, coming from such widely-separated localities, are not only closely related, but that in pattern and marking they are both much nearer to the Natalian *D. millari* here described and figured than to the unicolorous *D. immaculata* from Kaffraria. They differ from *D. millari* in possessing a fuscous-brown apical-hind-marginal border on the upper-side of the hind-wings, broader in the Angolan *D. barca* (H. G. Smith)* than in the Victoria-Nyanza *D. ochraceens* (Neave).†

**Deloneura millari,** n. sp. (Plate IV, fig. 6, 6a, 6b.)

*Exp. al.* (♂) 1 in. 5¼ lin.; (♀) 1 in. 6 lin.

♂. Warm ochreous-yellow (rather brighter than the colour of *Pentila tropicalis* (Boisd.)); fore-wing with a fuscous costal and apical border, hind-wing without marking. Fore-wing: fuscous border of moderate width, commencing abruptly and obliquely at some little distance from base, and narrowing to almost a point about origin of third subcostal nervule, whence it suddenly broadens apically but rapidly diminishes again hind-marginally and terminates in a point between second and third median nervules; throughout, this dark border has a narrow external edging of duller ochreous-yellow than the ground-colour, widest before and at apex; sexual inflated badge occupying about two thirds of submedian nervure from base. Under-side.—Fore-wing: ground-colour rather paler than on upper-side; costal border fuscous-brownish with some indistinct greyish-creamy mottlings, broader than on upper-side, commencing at

† *Poultonia ochraceens*, Novit. Zool., l. c. (1904); ♂, pl. i, p. 13.
base itself, extending up to costal edge, and emitting two small downward projections, one just before and the other a little beyond middle; apical border greyish-creamy but with some fuscous-brownish clouding along its internal edge to below second radial. *Hind-wing:* from base to beyond middle of the same fuscous-brownish as costal border of fore-wing, except for a narrow inner-marginal greyish-creamy border; outer edge of this fuscous-brownish area irregularly excavated; all sub-marginal and hind-marginal area greyish-creamy; at base, three indistinct spots, a sub-basal transverse series of four spots (one in discoidal cell), and a terminal disco-cellular spot,—all greyish-creamy; indistinct traces of one hind-marginal and two sub-marginal series of small fuscous-brownish spots. Two examples.

♀. Like ♂, except that the fuscous-brownish costal-apical border of fore-wing is broader apically and hind-marginally and extends rather further along hind-margin, very nearly reaching 1st median nervule. *Under-side.*—Border of fore-wing and whole of hind-wing of a more uniform pale ashy-grey tint, almost without the fuscous-brownish clouding shown in ♂, but with all the spots, both pale and dark, much less indistinct. *Fore-wing:* fuscous cloud and two projections on inner edge of costal-apical border smaller, but darker and more sharply defined; two additional similar small fuscous projections, in a line with but before the others, in discoidal cell. *Hind-wing:* a discal curved series of seven sub-sagittiform greyish-creamy inwardly dusky-edged spots, immediately before the inner of the two sub-marginal series of fuscous-brownish spots. One example.

In both sexes the head, with palpi and antennae are dull-black, but the second joint of palpi is internally ochreous-yellow, and the antennae are tipped with the same colour; there are also two spots on the front, two on the vertex, and two behind the eyes, all ochreous-yellow. Thorax fuscous-brownish clothed superiorly with rather sparse pale ochreous-yellow scales and short hairs, and marked laterally and inferiorly with several indistinct pale ochreous-yellow spots. Legs fuscous-brown, in ♂ indistinctly, in ♀ distinctly, ringed with ochreous-yellow at extremities of femur and tibia and of each tarsal joint. Abdomen pale ochreous-yellow, slightly tinged with greyish superiorly.

This *Deloneura* is at once distinguished from *D. immaculata*, Trim., the type of the genus, by its possession on the upper-side of a fuscous costal and apical border in the forewings, and on the under-side of a greyish-creamy and fuscous-brownish mottled costal-apical border in the forewings, and similar colouring, with various paler and darker
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markings (more distinct in ♀), throughout the hind-wings. *D. immaculata* is of a paler ochreous-yellow than *D. millari* and is quite devoid of markings on both surfaces of the wings.

The nearest ally of *D. millari* is *D. ochrasecus* (Neave), a native of Usemi and Kisumu, Kavirondo Bay, N.E. shore of Victoria Nyanza, but it differs on the upper-side in having the dark border of the fore-wing, though rather narrower apically, prolonged to posterior angle, and in presenting also in the hind-wing a similar but more even dark border from before apex throughout hind-margin to anal angle. On the under-side, too, *D. ochrasecus* presents a more uniform ground-colour, but with the discal series of spots paler and better defined in the hind-wing.

The existence of this notable addition to the LyciGnidm of the South-African Sub-Region was made known to me in November 1902, by Mr. A. D. Millar, who sent me a coloured sketch by Mr. G. W. Jeffery of Durban, Natal, of a single specimen taken by the latter, on 14th September, 1902, on the Bluff ridge overlooking the town of Durban. Though the sketch evidently represented some apparently undescribed form, it did not give the structural details necessary to determine the genus of a butterfly; but I was supported by both Mr. W. F. Kirby and Prof. Chr. Aurivillius in the view that the species depicted was new, and might prove to constitute a new genus. Mr. Jeffery noted that the example in question was "flitting about from leaf to leaf on a shrub about twelve feet in height; the day was exceedingly windy, so perhaps the insect might have been brought for some distance by the wind;" and he adds that he soon after revisited the locality, and spent a whole day there, but did not meet with another example.

Not until August last had I the pleasure of receiving from Mr. A. P. Millar both Mr. Jeffery's original specimen, and a second captured by himself, with some other examples, in May 1905. It was at once clear that the butterfly was a *Delonecura*, but both examples being male, it seemed possible that they might be that sex of the exceedingly rare *D. immaculata*. Mr. Millar, on my representing how things stood, most kindly found and sent me a female, which is described above, and which satisfactorily establishes the form as a distinct species of the genus.
Considering that it is over forty years since the discovery of *Delonecura* in South Africa, and over thirty-five since I published in our "Transactions" the discoverer's account of the habits of *D. immaculata*, in the only locality and on the only occasion recorded for its appearance, great interest attaches to the following details relating to the new Natalian species, communicated to me by Mr. Millar. He writes under date of the 9th June, 1905:—"On hearing that three more specimens had been taken on 30th April, 1905, about the same place where Jeffery took his example, several of us went in search of the butterfly; and on the 7th May we managed to secure no less than eight specimens, some of which were fresh from the pupa, and three of which were captured by myself. The weather being windy, the butterfly was not active; but on passing the tree where previous captures had been made, one of our party disturbed the branches, and out flew about a dozen. They took short flights, but at an elevation of about fifteen feet, and like *Liptena aslarga* settled on twigs and dead branches, where the assimilation of the underside colouring rendered them difficult of detection. Their flight was slow and wavering, resembling that of a day-flying moth of the same colouring which flew in the same locality; and so strong was the likeness of the butterfly to the moth on the wing that on several occasions great efforts were made in capturing what was thought to be the former but turned out to be the latter. I send you a specimen of the moth in question. All the specimens of the butterfly were found about one tree, which I think it probable is the food-plant."

This account agrees very remarkably with the observations on *D. immaculata* made by Col. Bowker, who particularly noticed the resemblance, both in colouring and flight, of the butterfly to the "yellow tree-moth," common in wooded spots.

Several species of the Liparide genus *Aroa*, Walk., are numerous and widely distributed in South Africa. The species forwarded by Mr. Millar as that with which *D. millari* associates at Durban, is *A. punctifera*, Walk.,* which occurs also in the eastern part of Cape Colony and

at Delagoa Bay. I give here (Pl. IV, fig. 7) a figure of the example of this moth received from Mr. Millar, in order to show how completely the butterfly accords with the moth in prevalent ochreous-yellow colouring, though differing considerably as regards the upper-side of the fore-wing and the under-side of part of the fore-wing and the entire hind-wing. The case is instructive as indicating how effective in flight for mimetic purposes can prove even an inexact likeness, provided that the general colouring and the action on the wing are the same. As far as human observation is concerned, it certainly would appear that Deloneura has successfully evaded notice—even in so long known and well "worked" a locality as Durban—mainly by simulating the colour and motion of certain common more or less gregarious day-flying moths with which it associates, and which are most probably protected species rejected or avoided by insectivorous animals.

Genus Lycaena, Fab.

Lycaena patricia, Trim. (Plate V, figs. 8, 8a.)


I indicated (l.c.) the close affinity of this species with L. parsimon, Fab., notwithstanding the great disparity in the colouring of the males on the upper-side of the wings, and mentioned how the exceedingly similar females could be distinguished by the longer tail and one fewer sub-basal under-side spot in the hind-wing characteristic of L. patricia.

Since my description was published the extended South-African range of this form has been considerably enlarged, Mr. G. A. K. Marshall having taken it at Gadzima in Mashonaland, in 1895.* The Transvaal variation which I noted (l.c., p. 21)—and which presents in both sexes a darker under-side with all the sub-marginal markings very much fainter—has been taken ("1st to 3rd January, 1904") by Mr. Feltham at Venter's Kroon, on the Vaal River.

In view of the unmistakably close alliance existing between L. parsimon, L. patricia, and L. glauca, Trim., much interest attaches to Mr. Feltham's note that he took all three forms, as well as the dark variation of patricia, at the same time and at the same spot, "on flat low-lying grass-land dotted with mimosia trees."

LYCÆNA ORTYGIA, Trim.  (Plate V, figs. 9, 9a.)


Since I noted (l. c.) the occurrence of an example of this near ally of _L. asteris_, Godt., near Cape Town, several specimens of both sexes have been taken in the Cape Peninsula, vid., by Mr. E. R. Howes at Hout Bay, Mr. H. Bevan at Simon's Town, and Mr. Feltham at Muizenberg. These individuals are all of smaller size than the typical form, and appear to represent a slight local variation; in which the upper-side in the ♂ is of a purer less violaceous-blue than in the typical form (from Eastern Cape Colony, Basutoland, and the Orange River Colony), and in the ♀ seems constantly, instead of rarely, to present a discal series of fuscous spots in the fore-wing. The examples figured were taken on Muizenberg Mountain on the 1st (♂) and 4th (♀♀) January, 1900, by Mr. Feltham, who writes:—“This is not an uncommon species in its proper habitat. I have only found it on or just below the summits of the Table and Muizenberg mountains, especially the latter; its favourite spots being little gullies or sheltered corners of the rocky ridges on the top of the range. The ridge in which the Kalk Bay caves are situated is a good example of this butterfly’s haunts.”

Another local variation of _ortygia_ was discovered in December 1893, at Knoeflok’s Kraal, in the Caledon district, Western Cape Colony, by Mr. T. D. Butler, then taxidermist of the South-African Museum. These examples are like the Cape-Peninsula form as regards the purer less violaceous-blue of the upper-side, but the ♂ (10) have the hind-marginal fuscous border of the fore-wing quite three times as broad, and the ♀ ♀ (8) have the blue more restricted in area and unmarked by any fuscous discal spots. This variation also differs in being fully as large as the typical form.

LYCÆNA TANTALUS, Trim.  (Plate V, figs. 10, 10a.)


This rare _Lycæna_ seems to be little known to Lepidopterists, and since the publication of my description above quoted I have seen only six additional specimens, taken at Malvern, Natal, by my friend, Mr. C. N. Barker,
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and presented to me by him with the rest of his fine collection of South-African Lepidoptera in 1898.

Although on the upper-side not unlike the variety of L. niobe, Trim., found in Kaffraria and Natal (l. c., p. 37), on the under-side this species is remarkably different, especially in wanting the transverse whitish band beyond middle of hind-wing; and in presenting a discal series of elongated (not rounded) fuscous spots, with scarcely any indication of whitish edging, and a narrower and much more sharply-defined submarginal fuscous lunulated streak, together with a paler ground-colour, quite hoary-grey in hind-wing.

Mr. Barker notes this butterfly as frequenting grassy spots on hill-sides on the coast of Natal.

LYCÆNA IGNOTA, Trim.  (Plate V, fig. 11.)


Both sexes of this obscurely-tinted form were sent from the Potchefstroom and Lydenburg districts of Transvaal in 1879 by Mr. T. Ayres; and besides these (6) examples, I have received 6 ♂ ♀ and 2 ♀ ♀ taken at Estcourt, Natal, in 1893 and 1898, by Mr. J. M. Hutchinson and Mr. C. N. Barker. The dull greyish-brown upper-side is similar to that of L. letseca, Trim. (Trans. Ent. Soc. London, 1870, p. 362, pl. vi, ff. 3, 4), but darker, and wanting the yellowish anal-angular lunules in the hind-wing; while the under-side is characterized by the very imperfect development of all the ordinary whitish markings.

Mr. C. N. Barker records that L. ignota occurs among grass in the “Thorn” country near Estcourt.

LYCÆNA PEPHREDO, Trim.  (Plate V, fig. 12.)


This is another of the duller-coloured Lycænae in which both sexes are of an unvaried dark greyish-brown on the upper-side, much like that of L. ignota, Trim., but darker, and without any trace of the ordinary anal-angular spot in the hind-wing. The pure-white cilia constitute a further distinction; and the under-side differs very widely from that of ignota, alike in the ashy-grey ground-tint, in the
conspicuous development of its discal white band, and the irregular obsolescence or failure of many of the ordinary markings.

Estcourt, in Natal, remains the only known locality to me of this species, which was discovered by Mr. C. W. Morrison, and sent (5 ♂ ♂ and a ♀) by him for my determination in 1888. Mr. Morrison wrote that he took about a dozen examples; and two more captured in the same locality were presented to me more recently by Mr. C. N. Barker, with a note that they were found about grassy spots.

Lycæna dolorosa, Trim. (Plate V, figs. 13, 13a.)


In the ♂ the violaceous of the upper-side is of a rather sombre tone, and in the ♀ it is much reduced in area being very broadly bordered with fuscous—especially in the fore-wing; and the under-side is also of a duller brownish-grey than usual, with the ordinary markings scarcely darker than its ground-colour and inconspicuously whitish-edged. These features characterize the typical specimens described by me (l. c.) from Kaffraria and Natal; but as regards the under-side, examples recently taken by Mr. Feltham at Delagoa Bay and (one out of three) at Johannesburg, differ markedly, having not only a much paler ground-colour, but all the white markings very distinct and sharply defined, especially in the hind-wing. The figures here given delineate a typical ♂ from Estcourt, Natal, taken by Mr. J. M. Hutchinson, and a ♀ of the variation just noted from Delagoa Bay.

Mr. Feltham writes:— "I first found this butterfly on the Umveloosi River, about 20 miles up from the mouth at Lourenço Marques, on a patch of hard gravelly land forming a low elevation at some distance from the river-bank. In flight it resembles L. lysimon, being weak but rather persistent on the wing, and keeping always just above the ground. It was quite local,—the entire area on which I found it was about 100 yards square.

"Its extremely local habit is further shown by the fact that, although I had been collecting at Johannesburg since 1893, I never found this species there until after my return from Delagoa Bay in 1903, when I fell in with it on a very circumscribed area on the grassy ledges of the hills
just north of the town. This was on 15th and 16th November, and I met with it subsequently in the same locality on December 6th and 13th, and on August 28th and November 16th, 1904." It is the ♀ taken on the date last-named that agrees on the under-side with the Delagoa Bay examples above mentioned.

LYCÉNA LUCIDA, Trim. (Plate V, figs. 14, 14a.)


This member of the *lysimon*-group of the genus is readily recognized by the longitudinal white ray from the extremity of the discoidal cell to near the hind-margin of the hind-wing on the under-side. It is rather remarkably variable in size, the ♀ ranging from $8\frac{1}{2}$ to 11 lines, and the ♀ from $8\frac{1}{2}$ to $12\frac{1}{2}$ lines. The ♀ varies very little in the violaceous of the upper-side which has a slight pink tinge; but the ♀ varies very considerably, from a wholly dark-brown upper-side to one with smaller or larger violaceous patches.

The range of the species in South Africa is very wide, but it has not to my knowledge been met with in the Cape Colony west of Knysna. In the tropical area it has occurred not only in Ovampoland and South Angola, but on the eastern side in Nyassaland, German East Africa, and Zanzibar—from which latter locality Mr. P. de la Garde, R.N., showed me a ♀ captured by him in August 1893.

Mr. Feltham remarks that *L. lucida* is not very common at Johannesburg, frequenting grassy places along the northern slopes of the Witwatersrand line of hills. I agree with him in thinking it probable that so small and inconspicuous a species is in reality much commoner than it appears to be.

The examples figured are a ♀ taken at Malvern, Natal, by Mr. C. N. Barker, and a rather small ♀ captured at Johannesburg by Mr. Feltham.

LYCÉNA STELLATA, Trim. (Plate VI, figs. 15, 15a.)


As pointed out by me in 1887 (*l. c.*) this very small and
distinct *Lycena* best agrees with *L. lucida*, Trim., in its under-side markings, though with a rather more yellowish tint and fainter spots in the hind-wing; but the upper-side is totally different, not only from *lucida* but also from all its congeneres, being blackish with many sub-annular and other white spots arranged in correspondence with those of the under-side.

The original discovery of this interesting form near Burghersdorp, N.E. Cape Colony, by Dr. D. R. Kannemeyer in 1882-83, was followed in February 1892, by Mr. F. Graham's capture of thirty-six specimens at Holspruit about 21 miles from Dordrecht in the Wodehouse district. Mr. Graham's observations fully confirm Dr. Kannemeyer's regarding the extremely local habit of *L. stellata*, and its abundance where it does occur. The places named are both in the Stormberg range of mountains, and remained the only recorded habitats until 1900, when at the Tring Museum I found a long series of the species from so distant a region as British Central Africa, in an extensive collection formed by Dr. Ansorge at various localities between the coast and Lake Nyassa.

Both surfaces of the wings seem to be remarkably constant in tint and markings. The paired sexes were taken by Mr. Graham near Dordrecht in February 1892; the ♀ was 8½ lines in expanse, but the ♂—the smallest I have measured—scarcely over 6 lines. Both Dr. Kannemeyer and Mr. Graham observed that the insect was only in abundance about damp ground near water, active on the wing, and constantly settling on flowers; on one occasion Mr. Graham found at least a dozen upon fresh cow-dung. The ♂ and ♀ figured are from Mr. Graham's Dordrecht series.

*LYCENA METOPHIS*, Wallengr. (Plate VI, figs. 16, 16a.)


Since I described (S.-Afr. Butt., ii, pp. 55–6) the distribution of this *Lycena*, its known range has been extended to Natal, where it has been taken at Estcourt, Weenen county, by Mr. J. M. Hutchinson and Mr. C. N. Barker, as well as by Mr. G. A. K. Marshall, who has
contributed a series to the National Collection. The ♂ here figured is one of the Estcourt examples taken by Mr. Barker, and the ♀ an example captured by Mr. R. M. Lightfoot at Port Nolleth, Namaqualand, Cape Colony, in August 1890.

**Lycæna bowkeri**, Trim. (Plate VI, figs. 17, 17a.)


This very distinct ally of *L. thespis* (Linn.) seems to be only known from a limited area in Natal. It was discovered by the late Col. J. H. Bowker in 1881, near the "halfway house" between Durban and Maritzburg overlooking the Inchanga valley. In the Barker collection presented to me in 1898 there were three ♂ and two ♀, taken at Karkloof, some 20 miles to the N.W. of Maritzburg, and the species was noted by the donor as occurring about grass on the outskirts of woods. The ♂ and ♀ figured are from Mr. Barker’s series.

**Lycæna natalensis**, Trim. (Plate VI, figs. 18, 18a.)


To the various characters which I have particularized (l. c.) as distinguishing this species from both *L. moriqua*, Wallengr., and *L. jenkins*, Guer., may be added the presence in both sexes of a conspicuous oblique superior white streak near the extremity of the club of the antennæ—the actual tip itself being dull-reddish.

Except for a ♀ ticketed Delagoa Bay in the British Museum (Hewitson collection), and another from Etshowe, Zululand, collected by the late Mr. T. Vachell, I have seen no examples but those from Natal, Estcourt and Bushman’s River furnishing the majority of the known specimens.

* Mr. G. A. Butler (Proc. Zool. Soc. Lond., 1896, p. 119) identified this species with his *L. sigillatus* (Ann. and Mag. N. H., 4th Ser., XVIII, p. 483. 1876) from Abyssinia; but on examining his types (a ♂ and a ♀) of the latter in the British Museum, I found them to be identical with the allied but quite distinct *L. moriqua*, Wallengr. Independent support of this determination of mine is afforded by the fact that, in the National Collection, the types of *sigillatus*, Butl., are associated with *moriqua* as synonymous.
Genus Zeritis, Westw.

Zeritis oreas, Trim. (Plate VI, figs. 19, 19a.)


This extremely distinct species of Zeritis—as I have pointed out (l. c.)—comes closer to Z. chrysantas, Trim., than to any other congener, but its under-side marking is quite unique.

I have given (l. c.) Mr. J. M. Hutchinson's interesting account of his discovery of Z. oreas in the year 1890, at an estimated elevation of about 7,000 ft. in the Drakensberg Mountains, Natal, and Mr. Butler has published (l. c.) Mr. G. A. K. Marshall's notes of his subsequent visit with Mr. Hutchinson to the same locality, in September 1896, identifying it as the "summit of Niginya, 6,500 ft., some 10 miles from Ulundi." On this visit over fifty specimens were taken, but only in a limited area of two or three acres. No other locality for this butterfly is known. The ♀ here figured is one of those captured by Mr. Marshall on the occasion mentioned, and the ♂ was taken by Mr. Hutchinson, and presented to me by Mr. C. N. Barker in 1898.

Genus Arrugia, Wallengren.

Arrugia protumnus (Linn.). (Plate VI, figs. 20, 20a, 20b.)


I give figures of the typical (Cape Town) form of this remarkable South-African butterfly, because those hitherto published—Cramer's, Herbst's, Donovan's, and Staudinger's—are extremely poor, and fail to render its characteristic features with any approach to accuracy.

As described by me in S.-Afr. Butt., ii, p. 228 (1887), the typical form of protumnus is the dullest in colouring, and appears to belong only to the extreme S.W. of Cape
Colony; while two or three variations—all in the direction of a brighter yellow ground-colour and diminution of the black markings as well as of the blackish borders,—prevail in the other parts of the Colony, and (to judge from a single Transvaal ♂) probably also further to the north.

An outline figure of the fore-leg of the ♂ is shown, to illustrate the full development of the tarsi,—a condition so rare in the Lycaenidæ of that sex that I only know of two other genera, Lachnocnema and Aslanga*—also African—in which it occurs.

* I have only quite lately discovered that the genus Aslanga (Kirby, 1890) agrees with the two other Lycaenide genera named in this respect. Mr. A. D. Millar sent me, in 1891, from Durban, a single example of what I held to be a slight variation of the exceedingly rare Aslanga purpurascens (Holland), described ['Psyche,' 1890, V, p. 424] from a single specimen taken on the Ogowe River, Gaboon. Dr. Halland’s insect was recorded as a ♀, and the Durban specimen appeared to be of that sex from an examination of the fore-tarsi. I returned the latter to Mr. Millar, and not until early in January 1906 did I see it again; when it came accompanied by a second example, taken at Durban recently by Mr. H. A. Green, in whose collection it had been detected by Mr. Millar. This second South-African specimen is undoubtedly a ♂, possessing a rather conspicuous white-scaled elongate sexual badge seated on the upper-side of the sub-costal nervure of the hind-wing, but the fore-tarsi are fully articulated and clawed terminally just as in the ♀. In the first Durban specimen there is no sign of this badge, and the rather fainter and duller colouring supports the belief that it is a ♀.

On comparing these examples with the closely-allied A. marshalli, Butler (Proc. Zool. Soc. Lond., 1898, p. 908), of which I possess four specimens taken at Salisbury, Mashunaland, by Mr. G. A. K. Marshall, I find that three of the latter exhibit a similar ♂ badge, but thinner and of a duller white than that borne by the Durban individual, while having the fore-tarsi completely articulated and bearing terminal claws.

It is noticeable that the two Natalian specimens are considerably closer to the Gaboon type of A. purpurascens than to the Mashunaland A. marshalli. From the former they differ chiefly in the very much fainter almost obsolete common dark streak running from immediately before apex of fore-wing to a little before anal angle of hind-wing on the under-side; while the Mashunaland form is on the upper-side duller and browner, with a fainter purplish (not blue) gloss, and not darker marginally or paler centrally in fore-wing as in purpurascens, and differs besides on the under-side in its warmer more ochre-yellowish tint not inclining to whitish towards the hind-margins, so that the fusaceous iroration is less conspicuous, the common dark streak being extremely faint or altogether absent. It is possible that A. marshalli, which has the angulation of the wings more pronounced, may be a seasonal form of A. purpurascens.
Mr. Roland Trimen on some New

Genus D'Urbania, Trim.


D'Urbania limbata, Trim. (Plate VI, fig. 21.)

D'Urbania amabilis, Staud., Exot. Schmett., p. 268 (1888).

This near ally of the type of the genus, D. amakosa, Trim., is easily distinguished by the different form and position of the hind-marginal orange-red band on the upper-side of both wings and also on the under-side of the fore-wings. It was first taken (1882-84) at Estcourt, in Natal, by Mr. J. M. Hutchinson, and afterwards met with in the same locality by Mr. C. W. Morrison. The late Mr. A. E. Hunt took a series of both sexes at Newcastle, in the northernmost part of Natal, in April of 1893 and 1894; and also found the pupae of a D'Urbania attached to the under-surface of over-hanging stones on the same hill where D. limbata was numerous. He sent me two dead pupae and four pupa-skins, which presented no marked difference from those of D. amakosa, except that on the back and sides the tufts of hair on the thorax and basal half of the abdomen are all sandy, and those on the terminal half of the abdomen are composed partly of sandy (instead of whitish) and partly of dark brown bristles.

I have not seen examples of this species from any other locality than those above mentioned, but Staudinger notes "Transvaal" as a habitat.

D'Urbania saga, Trim. (Plate VI, fig. 22.)


This butterfly is altogether unlike its congeners, and may at once be recognized by the conspicuous sharply-angulated inwardly brown-bordered white discal stripe on the under-side of the hind-wing. It may be noted, too, that the club of the antennae is more abruptly formed, rounder, and broader than in D. amakosa and D. limbata.

First discovered at Hex River, Worcester District,
Cape Colony, in 1882, by Mr. L. Péringuey, Assistant Curator of the South African Museum, and afterwards found by me at Ceres in the adjacent district of Tulbagh, *D. saga* is not known to me from any other locality; but, looking to the nature of its haunts in rocky mountainous spots, its reluctance to take flight, its dull tints, and the close resemblance of the under-side colouring to that of the rocks or stones on which it rests,—it is probable that the restriction of its range is more apparent than real, and that it will be met with in many other mountain nooks in the Cape Colony.
Explanation of Plates.

Plate IV.

Fig. 1. Conyra rufiplaga, n. sp. ♂. (Buiskop, Transvaal.) Page 59.


4. Acraea aglaonice, Westw.—Melanic aberration, ♂. (Johannesburg, Transvaal.) Page 64.


6, 6a. Deloneura millari, n. sp. ♂ and ♀. (Durban, Natal.) Page 69.

6b. Fore-leg of ♂.

Explanation of Plates.

Plate V.

Figs. 8, 8a. *Lyceana patricia*, Trim. ♂ and ♀. (Malvern, Natal.) Page 73.


Explanation of Plates.

Plate VI.

Figs. 15, 15a. Lycæna stellata, Trim. ♂ and ♀. (Dordrecht, Cape Colony.) Page 77.

16, 16a. Lycæna metophis, Wallengr., ♂ and ♀. (♂ Estcourt, Natal, ♀ Port Nolloth, Cape Colony.) Page 78.

17, 17a. Lycæna bowkeri, Trim. ♂ and ♀. (Karkloof, Natal.) Page 79.

18, 18a. Lycæna natalensis, Trim. ♂ and ♀. (Malvern, Natal.) Page 79.


20, 20a. Arrugia protumus, Linn. ♂ and ♀. (Cape Town.) Page 80.


22. D'Urbania saga, Trim. ♂. (Ceres, Cape Colony.) Page 82.
V. Some observations on the Reproduction of the Hemiptera-Cryptocerata. By C. Gordon Hewitt, B. Sc., The University, Manchester. Communicated by Prof. E. B. Poulton, D. Sc., M. A., F. R. S.

[Read February 7th, 1906.]

During a short visit to the Sutton Broad Fresh-water Laboratory in the Easter Vacation of 1905, I was able to make a few observations on some points in the reproduction of three families of this subdivision of the *Hemiptera*. The *Hemiptera-Cryptocerata* form the second series of the *Hemiptera-Heteroptera*, and are interesting on account of their aquatic habits. The species studied belong to the families *Nepidae*, *Corixidae*, *Naucoridae*.

As I am unaware of any account of the copulation of *Nepa cinerea*, and as this process is interesting in this form, I shall describe it in detail.

**Nepa cinerea.**

This insect, the common water-scorpion, was fairly common in the dykes near the laboratory, and wishing to obtain eggs at different stages of development, I placed a number of males and females in an aquarium. Whether it was on account of the sexes being brought into close proximity I don’t know, but it was not long before the males discovered the presence of the females.

There are no preliminary amorous passages in the courtship of *Nepa*. This may possibly be accounted for by several facts. The antennæ, which play such an important part in the courtship of those insects whose habits at this stage have been studied are too short to be of use in these operations, so that we do not find any “caressing of antennæ.” Nor do they appear to be of use for perceiving the presence of the female, as far as can be observed.

The movements of the male *Nepa* are in accordance with its usual habits. On perceiving a female, whether it is by sight or by some sense of smell I cannot say, he advances till he is within a short distance and then with...
a slight dart he seizes her, and crawls in an awkward manner on to her back. The female generally struggles to rid herself of the male at first, but if the male has made sure of his hold, she gives in. The male usually

approaches the female from behind or from the side, but he often advances vis-à-vis, and then, having made firm his hold on the back of the female, he very carefully turns round till both face the same direction; it is during this manoeuvre that the female often manages to get rid of the male.
One of the chief peculiarities of the *Neptia* is that they are provided with a siphon at the posterior end of the body. This is composed of two setæ arising from the dorsal side of the apex of the abdomen and having their inner grooved surfaces, which are provided with a double row of setæ forming a trough-like channel, closely adpressed, so that a perfect tube is formed, the distal end of which communicates with the air, and the proximal end with the single pair of large stigmata.

The chief interest in the copulatory process of *Neptia* lies in the method of disposition of these setæ, so that the male and female genital organs may be *in coitu*, and at the same time both individuals may receive a supply of air for respiratory purposes.

The male bends down the end of its abdomen underneath that of the female so that the coitus can take place. This awkward position causes the proximal ends of the setæ forming the respiratory siphon to separate somewhat, but they are brought in as close juxtaposition as possible; the distal end communicates with the air as in the female, the siphons of both male and female are in close proximity. In the individuals observed, copulation took place in the evening and lasted till the following day.

It was interesting to note that the female during copulation did not seem to mind the presence of the male in the least, and continued feeding. Prof. Poulton observed the same phenomenon in *Pezotettix pedestris.*

**Corixa.**

Several species were placed in an aquarium in order to obtain their eggs. Copulation takes place by the male clinging to the back of the female by means of the first two pairs of legs; the female swims about with the male in this position, and copulation lasts several hours.

The female begins to deposit her eggs the following day. The species under observation were provided with growing plants of *Hottonia,* and they deposited their eggs on these singly, in all positions, a short time elapsing the deposition of each egg, sometimes as much as an hour, but of course they were not under entirely natural conditions. In depositing an egg, the female grasps the leaflet or portion of the plant selected with the first two pairs of legs and then

a longitudinal motion of the abdomen is observed, the tip resting on the spot where the egg will be deposited. During this movement the minute drop of fluid which affixes the egg to the plant is emitted, and placed in the desired position, the egg is then laid with the micropyle farthest away from the point of attachment and the female swims away.

Several days may be occupied by a single female in depositing her batch of eggs, the number of eggs deposited daily decreasing.

The habits of *Naucoris* are similar to those of *Corixa*, and need not be described.

The general conclusion arrived at as a result of these observations is that there does not appear to be any sexual selection in the *Hemiptera-Cryptocerata*. 
VI. On some bionomic points in certain South African Lamellicorns. By G. B. Longstaff, M.D., F.E.S.

[Read February 7th, 1906.]

Mr. Trimen, in the introductory chapter of his “South African Butterflies,” after remarking on the poverty of the Rhopalocera of the Cape Peninsula as compared with the richness of its Flora, and stating that in that part of the world butterflies cannot perform a very prominent part in the fertilization of flowers, goes on to say: “The great number of densely hairy flower-frequenting Coleoptera in South Africa must also play a large part in plant fertilization.”*

The beetles referred to are chiefly Lamellicornia of the sub-families Cetoniinae and Hopliinae.

Cetoniinae.

As regards the former group, Dr. Dixey and I met with but eight species, being doubtless too early in the season. Of the beautiful gem-like Oxythyrea hemorrhoidealis, Fab., which was not uncommon on flowers by the banks of the Nahoon and Buffalo Rivers, near East London, I have nothing to remark save that Fabricius might well have given such a beautiful creature a more appropriate name. The more dingy Oxythyrea marginalis, Schönh., was first met near Pretoria on the lavender-coloured flowers of a Loganiaceous plant of the genus Buddleia, but at East London it was abundant, occurring sometimes on composite flowers, but mostly on the “Pride of Madeira” (Echium fastuosum), a Boragineous plant with a long dense terminal spike of small flowers with prominent stamens. The spikes are from four to six feet high with blue or creamy-white flowers, those in the Queen’s Park being all of the latter variety; they proved very attractive to insects of several orders and especially to the small Oxythyrea marginalis, Schönh. I noticed at the time that this beetle was rendered strangely inconspicuous by the white specks on


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thorax and elytra breaking up the dark ground-colour and simulating the general look of the anthers of the flower. Another small Cetoniid, Stringophorus flavipennis, G. and P., occurred on the same flowers and its elytra bear similar spots. Together with these were two specimens of a third and still smaller Cetoniid, Comythovalagus fusciculatus, Schönh., which were quite difficult to distinguish, but in this case the means of concealment was different, for the thorax and elytra bear numerous conical, horny projections, while there are two conical tufts of scales near the apex of the abdomen.

Two larger species, Rhaddotis (Pachnodia) sobrina, G. and P., dark olive-brown and white, and Macroma cognata, Schönh., dark chocolate-brown and canary-yellow, both seemed conspicuous enough, the one at the sweet white flowers of Dombeia, the other on the wing, but I strongly suspect that in their case too, when on an appropriate background the breaking up of the dark colour by light markings aids concealment.

With Gametis baileata, De G., the case is different. This beetle is black and red, or perhaps orange-brown more correctly describes its decoration. At East London, on one of the tributaries of the Buffalo River, there grows a profusion of a climbing composite with greenish-white flowers, a plant in general habit and appearance very suggestive of Clematis vitalba, L. On one of these plants I took a number of specimens of two species of Haploleucus, which are represented in the National Collection but as yet unnamed. These Malacoderms have the usual Lycus coloration, viz. orange-brown with the apical two-fifths of the elytra black, and a black stripe down the middle of the thorax. On the same day, on another bush of the same climbing composite growing a hundred yards higher up the stream, I took an example of Gametis baileata, De G., and was at once struck by the striking resemblance of the two insects. I may remind any Fellows who are not familiar with living specimens of beetles of the Lycus group, that during life the orange-brown colour is much redder than might be supposed from cabinet specimens, whereas the Cetoniid preserves its colour well.

The very next day Dr. Dixey saw both these beetles in some numbers (3 Haploleucus and 8 Gametis) in the Queen's Park on and about a flowering tree and noted their similarity. With them were two specimens of a Lycoid-coloured
in certain South African Lamellicorns. 93

Braconid (Zombrus, sp.). The Gamctis resembles the Haploleucus the other way on, the head of the one being coloured like the tail of the other, but probably that fact does not detract from any benefit that it may derive from the likeness. Mr. G. A. K. Marshall has proved experimentally that Lyroid beetles are very distasteful to Kestrels and Baboons.* Gamctis bahnta may now be added to the wonderful synaposematic Lyroid group figured in Plate XIII of Mr. Marshall’s paper.

Hoplinae.

We met with thirteen species of Hopliinae in Cape Colony. The most obvious characteristic of the group is the great length of their posterior legs. The development of these varies greatly in different species, but in the majority of cases is much greater in the males than in the females. Indeed in some species the male femora and tibiae are grotesquely disproportioned to the animals; moreover both femora and tibiae are provided on their inner sides with strong spurs or spines (perhaps better described as teeth). These strange limbs evidently attracted the attention of the older writers, since Fabricius named one species dentipes, and Burmeister another foreipatus. The explanation of these hypertrophied legs that is usually received is that they are used by the males to grasp the females. Mr. Trimen, accepting this explanation, tells me that he thinks that copulation is attended with especial difficulty in these beetles.

The latest writer on the subject, Mr. Péringuey, rejects the ordinary explanation in the following words:—

"The great development of the hind-legs is not intended for securing a better hold of the female. There is nothing more ridiculous than to see half-a-dozen males with their long hind-legs emerging from the pistils of a composite flower where they are mobbing a female which is almost entirely buried head foremost in the pistils, the sub-horizontal pygidium alone being exposed to view. But it is when disentangling themselves that the use of the long hind-legs becomes apparent; by means of his long, hinged claw the male hooks himself out of the corolla. It is not only amongst the flower-frequenting kinds that this extraordinary development of the hind-legs with their curiously

serrate, dentate and mucronate tibiae is met with, because the species of *Hoplocnemis*, in which the development has become almost a monstrosity, do not feed on flowers, or at least have not been observed doing so. Their habits seem to be more those of certain *Dynastinæ*, and I suspect them to live, while in the larval state, in the excrement deposits of the subterranean white ant, *Hodotermes viator*, Latr.*

Mr. Péringuey, I am bound to say, fails to convince me, and I venture upon yet another explanation.

Many of the species of *Diechelus* and *Heterochelus* burrow into the disks of composite flowers, eating out the ovaries. When so engaged the whole of the body of the insect may disappear from view, or the extremity of the abdomen may alone protrude, but in either case the hind-legs extend beyond the florets, widely separated and closely resembling the open jaws of an ant-lion. While picking one out of a flower I was startled by receiving a very respectable pinch, or bite, inflicted by the formidable teeth above referred to.

Now the suggestion that I have to offer is this: while probably in the first instance adapted to assist the male insect in grasping its mate, these huge hind-legs are now of great advantage to the otherwise helpless beetle when

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* *Transactions of the South African Philosophical Society*, vol. xii, pp. 625, 626. *Descriptive Catalogue of the Coleoptera of South Africa, Hoplitinæ*, by L. Péringuey, F.E.S.
burrowing into flowers in search of food. The widely
gaping jaws may probably terrify some enemies, but
they certainly afford by no means despicable weapons of
defence against such foes as may presume to come to close
quarters.

This suggestion meets with support from the fact that
*Lepitrix lineata*, Fab., a pretty species that I found
abundantly on the flowers of *Mesembryanthemum* at Simon's
Town, has long thin hind-legs not provided with teeth, but,
unlike *Heterochelus* and *Dichelus*, this insect is very active,
taking to its wings almost as readily as a bee.

Dr. Dixey did not notice this beetle on *Mesemb-
ryanthemum*, but not far off found five specimens in spathe
of the “Cape Lily,” i.e. common white arum (*Richardia
africana* = *Calla ethiopica*), three in one spathe and two in
another. He says that they did not attempt to fly.
Possibly the fact that they were to some extent enclosed
in the arum, whereas those on *Mesembryanthemum* were
exposed, may explain this notable difference of habit.

In conclusion I have to thank Messrs. C. J. Gahan and
G. J. Arrow, of the British Museum Staff, for their great
kindness in naming my South African Coleoptera.
VII. Some Rest-Attitudes of Butterflies. By G. B. Longstaff, M.D., F.E.S.

[Read March 7th, 1906.]

About a year ago I called the attention of Fellows to the attitudes assumed by certain Indian butterflies when at rest, noting especially the following points: (1) Heliotropism, or the turning of the body-axis so that the head is away from the sun; (2) the habit of certain Lycaenids of resting head downwards; and (3) a sideways attitude, a tilting or "list" of certain Satyrids to the right or left.*

Heliotropism.

Professor G. H. Parker appears to have been the first to describe what he terms the "negative heliotropism" of Vanessa antiopa, L., in the United States. He records his numerous observations in great detail, and states that some species of Grapta have the same habit. The object of the creature thus turning its tail to the sun is, he believes, to display its colouring to the greatest advantage.†

Mr. E. E. Green, describing the cryptic habits of Melanitis ismene, Cr., in Ceylon, says: "I have watched the fly, immediately after pitching, alter its position so that its axis is directed towards the sun, thus casting no shadow."‡

Quite independently and perhaps at about the same time as Mr. Green (October 1903) I saw near Simla, Pararge shabra, Koll., settle three times with its back to the sun, and noted that its shadow was thereby reduced to a mere line. When a butterfly with cryptically coloured under-side rests upon a flat surface in bright sunshine its shadow is often more conspicuous than the insect itself, so that economy of shadow may be a valuable means of protection.

backgrounds of sand-paper of various colours to imitate natural backgrounds of sand or rock.}

Admitting the fact of Heliotropism a third possible explanation suggests itself. This special attitude exposes not only wings, but the insect's body, most completely to the sun's rays, and we may fairly suppose that such an essentially sun-loving creature as a butterfly finds them agreeable. To this explanation Dr. Dixey advances an at least partial objection, viz.: that when the wings are closed up both wings and body are least exposed to the sun's rays.

As the result of numerous observations made in Algeria in February and March 1905, I satisfied myself that:

Except early in the day, or when the sun is dull, or when feeding on flowers, *Pararge meone*, Cr., settles with the axis of the body turned so that the tail points more or less accurately to the sun, therefore when the wings are raised, in the attitude of repose ... the shadow is reduced to insignificant dimensions.*

After somewhat intimate acquaintance with *P. meone*, Cr., in Algeria, it was pleasant, in May 1905, to study its northern form *P. aegeria*, L., which is common in and about my garden at Mortehoe, North Devon, and this was the more pleasant because our butterfly is undeniably much more beautiful than its southern sister.

I have notes on ten specimens observed, and it may be instructive to give them in detail.

May 3. Observed two *P. aegeria*; one settled several times with tail to the sun, the other was less particular.

May 9. Saw *aegeria* settled with wings open and tail directed towards the sun.

May 15. Saw one specimen of *aegeria* settle twice with fairly accurate orientation; another specimen settled first accurately oriented; then it settled again with the body nearly at right angles to, but with the head somewhat towards, the sun; thirdly it settled again at right angles, but with its head turned to the opposite side.

May 19. Watched three specimens of *aegeria* and saw each of them orient itself accurately twice. The same day I saw another specimen orient itself four times.

My last observation was made on an *wegeria* within a few yards of my study window; this I disturbed many times with a view to noting its behaviour; out of seventeen occasions it oriented itself correctly but five times, it faced the sun once, but placed itself at right angles to its rays no less than eleven times!

The unusual behaviour of this butterfly gives strong proof that individual flies may differ much in behaviour, and as I should be disposed to describe it, in moral character. What entomologist who has sugared regularly in the same place has not observed among common *Noctua* some individuals bolder and greedier than others?

I often saw *mcione* settle on sandy roads, rocks, or walls, but the *wegeria* here referred to were for the most part settled on leaves, and the question of protection by economy of shadow could scarcely arise in their case.

The next subject of observation was *Pararge megera*, L., which was especially interesting to me as nearly allied to *P. shakra*, Koll., the common Himalayan butterfly in which I first noted heliotropism in October 1903.* The spring brood was not so numerous as the summer brood usually is, and only ten specimens were noted settled. Of these the first, a female, was watched on a Devonshire "dry ditch," settling for the most part on the rough slates of which it was built, that is to say, on surfaces not always well adapted for precise orientation. It was however observed to settle several times with its tail to the sun, and on one of these occasions it raised its wings over its back so that its shadow was scarcely visible, but two or three times it settled at right angles to the sun. Six other specimens were observed with their wings open, settled for the most part on flat ground, and all correctly oriented (one observed twice). Another specimen was first seen settled on the flowers of *Potentilla tormentilla*, Sibth., at right angles to the sun, but afterwards on *Scilla vulgaris*, Sm., correctly oriented. Yet two other *megera* were seen settled, one on the road, the other on a flat stone, both with their wings closed up, correctly oriented, so as to throw practically no shadow.

During May 1905 hybernated specimens of *Vanessa io*, L., were unusually common at Mortehoe, and the attitudes of at least fifteen different individuals were noted on seven different days. Of these, eleven, or three-fourths, oriented

themselves correctly so as to turn their tails to the sun. Of the minority, the one-fourth that settled otherwise than with tail to the sun, two were settled on the flowers of the wild hyacinth or "blue-bell" (Scilla

*verbatim* nutans, Sm.), and of these one was facing the sun. A third specimen, settled on flowers of lilac (Syringa

*verbatim* persica), appeared to be quite indifferent to the sun's direction. The fourth was at first settled facing the sun, but it very soon moved, settled again, and at once adjusted its position so as to be perfectly oriented with tail to the sun. I subsequently watched the same butterfly settle three times, the first time with tail turned to the sun correctly, but the second and third times it alighted on "blue-bells" and did not orient itself.

*Vanessa urticae*, L., was far less common and only two specimens offered themselves for observation, of which the first was twice seen to adjust itself to correct orientation, but the second, on the same lilac bush with the *V. io* mentioned above, appeared like it to be indifferent to the sun's direction.

From the preceding observations it may fairly be inferred that *Vanessa io* (and probably also *V. urticae*) when settled in full sunshine, except sometimes when feeding on flowers, habitually places itself so that its tail is directed towards the sun. As however the butterflies were not seen to close their wings over their backs nothing can be said as to the shadow question.

The next species that came under my notice was *Melitaea aurinia*, Rott., which was very abundant in a restricted North Devon locality. All the specimens observed were settled on flowers or low plants. In the great majority of cases the wings were fully expanded, though a few had the fore-wings drawn back so as to form an approximation to the "Deltoid" shape. In order to secure perfect fairness my method was to record the position of every specimen seen so long as the sun was shining brightly. Three series of observations were thus made, with the following results:

<table>
<thead>
<tr>
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<th>First series</th>
<th>Second series</th>
<th>Third series</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tail to sun</td>
<td>13</td>
<td>20</td>
<td>69</td>
<td>111</td>
</tr>
<tr>
<td>Side to sun</td>
<td>2</td>
<td>6</td>
<td>9</td>
<td>17</td>
</tr>
<tr>
<td>Head to sun</td>
<td>1</td>
<td>2</td>
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<td>3</td>
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Adjustments after settling were often noticed, occasionally repeated adjustments. When there was a wind
they settled at first with their heads to it, one butterfly succeeding in orienting itself only after much struggle. When the sun was not shining they were often noted settled at right angles to its direction.

In the case of *M. aurinia*, under the circumstances in which the butterfly occurred, it is difficult to see that the amount of shadow thrown could have been of any moment, though doubtless its colours would show up more if the under-sides of the hind-wings when at rest had the sun shining directly on them rather than tangentially.

The recent visit of the British Association to South Africa gave me more extended opportunities; it gave me moreover the advantage of Dr. F. A. Dixey's co-operation, which was the more valuable by reason of his great patience in observing and careful accuracy in recording results.

*Eurytela hierbas*, Dru., is a Nymphalid butterfly, with a very Satyrine aspect and habits not unlike those of *P. aegeria*. It is common in woods round East London and Durban, affecting partial shade. At East London I saw it in a small wood within 100 yards of high-water mark. It does not seem to be attracted by flowers, but moves about bushes with a slow gliding flight; it may settle on leaves, or on the ground, the wings being commonly three-fourths expanded, though sometimes more fully. When thus settled the wings are often slowly shut in part and again opened, though I never saw them quite shut. On at least three several days they were noted to have their tails turned to the sun, but the orientation was imperfect, often 15°–30° out, and occasionally they settled with the body axis at right angles to the sun.

*Precis elecia*, Cr., is a Nymphalid butterfly that is common and widely distributed in South Africa. The dark upper surface of the wing is rendered very conspicuous by white spots near the tip of the fore-wing and a large blue spot on the hind-wing, but the under-side is marbled with shades of light grey and is very quiet and unobtrusive. As regards its habits I cannot do better than quote Dr. Dixey's very graphic account of its behaviour as observed in "the Old Cemetery," at Sydenham, near Durban, in the middle of August:—

Common at one spot in the cemetery. It has a habit of flying a little way, sometimes in pursuit of another butterfly, making a round and returning to
the same, or nearly the same place. It settles on the ground, or on a low plant, nearly always turning its back to the sun, and often closing its wings over its back. I saw one settle at right angles to the sun, casting a broad shadow; but as there happened to be several objects close by casting similar shadows, it was not very conspicuous. Presently the same individual flew up and settled down again, this time on a bare piece of earth and with its back to the sun in the usual way.

Another note, also relating to Sydenham, is:—

*P. clelia* seen to settle, and then rapidly turn its back to the sun; it did not close its wings. *P. clelia* seen here seems *always* to turn its back to the sun.

To Dr. Dixey's description I would add that the wings are usually about three-fourths expanded, nearly as with *Vanessa atalanta*, L., at home. One specimen was observed to settle with tail to the sun five consecutive times. It was only occasionally that I saw them close their wings over their backs, when the shadow was reduced to a minimum, but I did observe this several times, both in the neighbourhood of Durban and at the Victoria Falls. As a rule *P. clelia* seemed to pitch correctly, but now and then it was seen to adjust itself.

*Precis Erebus*, Trim., is another common and widely-distributed South African butterfly. Though very differently coloured from *P. clelia*, it is nearly, though not quite, as conspicuous when the upper-side is displayed, but the almost uniformly clay-coloured under-side is scarcely distinguishable against certain back-grounds, such as sand, clay, or rock of a grey or yellow tint. It is fond of frequenting dry "spruits," or watercourses, settling on the rocks or boulders, but in the Zambesi country Dr. Dixey often saw it settle in trees. It was repeatedly observed to orient itself fairly accurately, but did not appear to close its wings as often as *P. clelia*. A note made by me at Ladysmith, August 26th, says:—

Oriented within about 10°–15°; settled often upon cliffs of yellow sand or mud on which it was moderately conspicuous. One specimen was repeatedly observed to close its wings, its shadow was then near the minimum and the insect inconspicuous.
Precis natalica, Feld., a somewhat dingy species, though generally distributed, was much less common than the two preceding. It is somewhat of a shade-lover and usually settled on the ground or on a leaf, its wings more spread than delia or crebrena. Except when settled in the shade its tail was directed towards the sun. One was seen to close and open its wings, another was watched for some time and observed over and over again to orient itself correctly, and twice to close its wings so as to leave practically no shadow.

Precis elgiva, Hew., is not uncommon in woods near Durban, it was noted as sitting with wings fully expanded and tail to the sun.

Precis sesamus, Trim., is a large, dark, handsome butterfly which reminds one of Vanessa io, L. It is fond of hiding itself in ditches and under dark banks, often several together; this is not always done with a view to seek shelter from the wind, though on some occasions that seemed to be the object. It pitches with the wings fully expanded and close to the ground, just as P. natalica; in this position it is less conspicuous than might be supposed, especially when it settles on dark clay, or peaty soil, as it appeared to be fond of doing. Both Dr. Dixey and I saw it orient itself like its congeners, sometimes with adjustment. On one occasion only did I see it close its wings over its back, casting, as a result, a minimum shadow.

Another Precis, nearly the colour of the red soil, but more orange in tint, was observed to orient with tail to the sun. This I saw several times but missed; it was on August 18th, on somewhat open ground at the edge of a large banana garden above the Congella woods, Durban. I thought at the time that this was P. octavia, Cram., the wet-season form of P. sesamus, but it is just possible that it may have been P. cloantha, Cram., which I took on the other side of Durban. With the possible exception of this doubtful Precis all my remarks about South African butterflies apply to dry-season forms.

Hamanumida dædalus, Fab., is a common African Nymphalid that we only met with on the banks of the Zambesi. We both noted that it usually flies near the ground, on which it settles with the wings closely adpressed to the surface. It occasionally flaps its wings, but as long as they are still it is very inconspicuous, its grey colour approximating closely to that of the sand, the whitish spots
aiding its concealment by breaking up the surface. One was observed to walk about on mud regardless of the sun's direction, but it finally settled down with tail to the sun and wings spread out in the usual way.

[Abisara (Zcmcras) flegyas, Cr., a common oriental Erycinid, has a strikingly similar pattern to the last-named Nymphalid, but I do not know what its favourite resting-places are.]

Pyrameis cardui, L. I summed up my observations on this butterfly in Algeria in the following words:—

I can confidently say that it generally settles with its tail to the sun, though it does not do this with the regularity of Pararge meone. I saw two specimens turn their faces to the sun, and saw a third settle twice with its body at right angles, though the third time it settled normally.*

At Durban, on August 21st, I watched this cosmopolitan butterfly orient, but full weight must be given to the following very definite observation of Dr. Dixey’s when watching lizards:—

Ladysmith (North East Defences), Aug. 27th, watched several P. cardui, which settled frequently. They would settle at any angle with regard to the sun, but perhaps rather more often with back to it. They fanned their wings, and often shut them up tight (keeping them so for some time) in any position with regard to the sun.

This was late in the afternoon, but I do not gather from Dr. Dixey (nor from personal recollection) that the sunlight was feeble, or that there was a strong wind, or that the butterflies were feeding or drinking—all disturbing causes. There can I think be no doubt that the habit of heliotropism is not as fixed in “The Painted Lady” as in many Nymphalids.

Among our notes on heliotropism there are but three references to Pierines. The first is interesting as tending to negative the suggestion that the purpose of heliotropism is to minimize the butterfly’s shadow and so aid in its concealment. Dr. Dixey writes:—

Durban (The Bluff), August 16th. Teracolus ione, Godt. (speciosus, Wallengr. = jubina, Butl.) ⌂. When first seen it was settled in the sunshine with wings expanded; then it flew a short distance

and settled on a reddish sandy path. Cloud came over the sun, and the butterfly closed up its wings, so that only the hind-wing and tip of the fore-wing were visible.

In explanation of this note Dr. Dixey emphasizes the fact that in the dry-season form of Ione (= speciosus, Wallengr.) the under-side of the hind-wing and the tip of the fore-wing are reddish, hence the tightly-closed attitude is cryptic on red soil. He adds that doubtless when the butterfly contemplates a long stay (as at night, or when the sun goes behind cloud) the closed-up attitude is adopted to take advantage of its cryptic colouring, and not to minimize its shadow.

The other observations were made on Belenois severina, Cram., a white butterfly that we found very abundant at Durban.

Dr. Dixey says:—

B. severina, ♂ and ♀; when clouds come over the sun, this species generally settles on a grass stem, and, closing its wings tightly, becomes part of the picture. It certainly generally turns its back to the sun when it settles in sunshine, and then does not often close up its wings.

My note is as follows:—

B. severina, 2 ♀ seen to settle across the sun, early in the day. Late in the afternoon many ♂ severina seen settled with wings three-quarters open, and tail more or less to the sun; but where much exposed to wind the wings were closed and the head turned to the wind, so as to be almost across the sun.

It is worthy of remark that throughout all these observations of heliotropism, I cannot recall a single case in which an adjustment, or subsequent movement of the butterfly after pitching, tended to throw it out of orientation. Hence it is fair to assume that if the insects had been watched longer after pitching positive results would have been observed in a larger proportion of cases.

But, be that as it may, beyond doubt it is a habit with a number of butterflies, especially Nymphalids, to settle with their backs to the sun. Whether they do this, as Professor Parker supposes, to display their charms to the greatest advantage, or whether the first impulse was
given by the light or warmth of the sun's rays, I am unable to determine, but that in the case of such species as Pararge megera and Precis clelia the diminution of the shadow when the wings are closed helps to conceal the butterflies from their enemies I have no longer any doubt.*

Further observations will show how far the habit is general within the families in which it has been observed, and whether it prevails in other families.

The inverted attitude of Lycaenids.

In the paper first referred to I drew the attention of the Society to the fact that the curious lobes at the anal angle of the hind-wings of certain Indian Lycaenids, to wit species of the genera Aphanaeus, Pratapa and Rajkda, are everted so as to be nearly at right angles to the plane of the wing. I showed by a diagram that this eversion of the lobe helped in the suggestion of a head where the tail should be. The original sketch for the diagram was made before I had heard of the "false head theory." † The resemblance would of course be more striking if the Lycaenids in question, like so many of the family, habitually rest with the head downwards.

Prof. Poulton discussed the "false head" at some length in his notes to Mr. G. A. K. Marshall's paper on "The Bionomics of South African Insects." ‡ Prof. Poulton showed by a reference to Kirby and Spence that the resemblance of the tails of some Lycaenids to antennae was observed early in the 19th century. I venture to give the passage in full:

Dr. Arnold has made a curious observation (confirmed by Dr. Forström with respect to others of the genus) on the use of the long processes or tails that distinguish the secondary wings of Hesperia iarbas. These processes, he remarks, resemble antennae, and when the butterfly is sitting it keeps them in constant motion; so that at first sight it appears to

* In the discussion which followed the reading of the paper the President (Mr. F. Merrifield) threw out the suggestion that possibly the object of negative heliotropism might be to enable the butterfly to see to the greatest advantage.

† Trans. Ent. Soc. Lond., 1905, pp. 85, 86.

have a head at each extremity: which deception is much increased by a spot resembling an eye at the base of the processes. These insects, perhaps, thus perplex or alarm their assailants.*

_Hesperia iarbas_ at first puzzled me, but it would appear to be the insect now known as _Deudorix (Rapala) iarbas_, Fab., and the very close ally of _D. melampus_, Cram., one of the insects in which I first noticed the peculiar structure of the anal lobe, about 86 years after Dr. Arnold's observation!

I remember well seeing a Lycaenid at rest on a leaf at Solon, on the road to Simla, in October 1903, and was struck by its tails waving about, as I thought at the time blown by the wind.

On March 12th, 1904, the pretty white, black and orange _Talicada nyseus_, Guér., was positively swarming near Kandy. I repeatedly watched it settle with its head upwards and immediately turn about so that its head looked downwards.†

At Mortchoe, June 5th, 1905, Mr. A. L. Onslow and I searched from sundown to dusk for _Emmelesia albulata_, Schiff., in a field adjoining my house; we failed in our search, but incidentally came across a number of _Lycena iarbus_, Rott., asleep on the stems of grasses, etc. Out of fifteen specimens, twelve had the head down, three had the head up.‡

The lobed and tailed Lycaenids are not too easy to observe; they are active and commonly fly about the tops of shrubs or small trees; when at rest they are not conspicuous and when disturbed dart swiftly off.

Dr. Dixey noted:—

Aug. 20. Durban (Botanical Garden). Saw an "amphisbaenoid" _Lycena_ settled twice; the first time horizontally, the second time head downwards. On both occasions the "false head" looked much more like a head than the real one did. There was a constant slight movement of the hind-wings; and a waving of the false antennae.

‡ When this butterfly first settles on flowers in full sunshine it expands its wings very fully, the primaries being drawn somewhat away from the secondaries.
Unfortunately this specimen eluded capture. Again Dr. Dixey noted:—

August 16. Durban (The Bluff). Saw a Lycœnid settled on the top of a leaf horizontally. The "false head" was much more conspicuous than the real head, which was almost concealed; the real antennae were quite concealed.

This proved to be *Virachola antalus*, Hopfi.; I have a note referring to the same species:—

A Lycœnid boxed off a plant close to the ground; it was sitting with the head downwards, but the "false head" was missing, having been bitten off, probably by a lizard.

Dr. Dixey was more fortunate than I with *Axiocerecs harpax*, Fab., since he notes:—

Sept. 9. Bulawayo, Rhodesia (near the Waterworks). This species was abundant at the catkin-like flowers of a shrub said by Mr. Davey to be a species of *Combretum*. When settled, it closely resembled (at a little distance) the seed vessels, of which many remained on the plant, though the latter was just coming into flower. On a near view, the false head of the Lycœnid looks extremely life-like, and is moved about by the butterfly in a most deceptive manner. The species settles either horizontally or head downwards. Attention seems to be drawn to the false head by alternate partial folding and unfolding of the everted margin of the hind-wing, while the butterfly is settled. [Butterfly and seed-vessel exhibited.]

Coming now to my own observations, the "false head" was noted during life in five specimens (all females) of *Argiolaus silas*, Westw., but in none of them was the attitude at rest determined, indeed the insects usually settled high up on the trees beyond my limit of clear vision.

Sept. 10. Matopo, Rhodesia. A male of the beautiful *Stygela bowkeri*, Trim., was twice seen to settle with its head downwards on the catkin-like racemes of the shrub *Sclerocaria caffra*. The "false head" was very obvious. It opened and shut its hind-wings while settled.

Sept. 28. East London (Buffalo River). A specimen of *Phasis chrysaor*, Trim., was seen settled head downwards.

A female *Hypolycæna philippus*, Fab., exhibited a “false head,” but was not seen at rest.

Sept. 15. Victoria Falls. A specimen of *Catochrysops malathiana*, Bois. (=asopus, Hopff.), was seen in the Rain Forest settled with its head downwards.

Sept. 26. East London. Two specimens of *Tarucus telicanus*, Lang., were seen in the Queen’s Park sitting horizontally. They were moving their hind-wing alternately in the plane of the wings, exactly as I had in the Nilgiris seen a *Lampides* do.*

Till to one side, or “list.”

This, which I first described as “a sideways attitude,” a term not without ambiguity, may be exactly defined as an attitude resulting from a rotation of the insect about its longitudinal axis, as heliotropism results from a rotation about an imaginary vertical axis at right angles to this. Heliotropism corresponds to the movement of a vessel in answer to the helm. Most vessels, independently of wind, waves, or tide, have a tendency to lean somewhat to one side or the other; this inclination is termed by sailors “a list,” and, although I am aware that the analogy is not quite close, since the insect may lean at one moment to one side, at another to the other, I shall for brevity term such an inclined or tilted position a list.

So far as I know this list was first observed by Col. C. T. Bingham in the case of a *Melanitis* in 1878, but the observation was not published till long afterwards. The extracts from his diary of that year, brought to light by Prof. Poulton, give a most vivid description of some phases of the struggle for existence as it may be seen in a tropical forest. Col. Bingham says:—

The *Melanitis* was there among dead leaves, its wings folded and looking, for all the world, a dead dry leaf itself. With regard to *Melanitis*, I have not seen it recorded anywhere that the species of this genus when disturbed fly a little way, drop suddenly into the undergrowth with closed wings and invariably lie a little askew and slanting, which still more increases their likeness to a dead leaf casually fallen to the ground.†

Mr. W. H. Edwards, in his *Butterflies of North America*, 1897, quotes Mr. William Couper's observation as to a habit of *Colias philodice*, Godt., in Anticosti:—

When it alights on a flower, instead of being erect on its feet, it lies sideways, as if to receive the warmth of the sun.

The original passage occurs in the *Canadian Entomologist*, vol. vi, p. 92, 1874; if therefore this be truly such a list as is under discussion, Mr. Couper deserves the credit of having first observed it, but at present I am doubtful on the point.

In the summer of 1903, at Mortehoe, Dr. Dixey and I observed a like habit in *Satyrus semele*, L.; and later in that year (and in the following) I found that other British Satyrids, such as *Parnage wegeria*, L., and *Megera*, L.; *Epinephele jurtina*, L., and *hyperanthus*, L., had a similar habit, though less marked. The butterflies when confined in a box were seen to assume the list more often in sunshine than in shade.*

In India, in the late autumn of 1893 I noted the same habit in the Satyrines *Hipparchia parisatis*, Koll., and *Aulocera swaha*, Koll.†

On the voyage out to South Africa the usual call at Madeira gave us little more than a glimpse at its butterflies. The local race of *Satyrus semele*, L., was common on the Caminho do Meio at an altitude of about 800 ft., and Dr. Dixey has this note:—

Settled on the ground, low herbage, walls and tree-trunks. The fore-wings are depressed with a snap as in the English *semele*. Two were specially noted settling in sunshine (not strong) both turned head to sun and listed—one to port and one to starboard.

My note is:—

A specimen seen settled face to sun, list 30° to starboard.

It was of course only to be expected that on the fifth day from leaving Southampton we should both use nautical phraseology.

South Africa contributed little to increasing our knowledge of the "list." The genus *Pseudonympha*, somewhat suggestive of *Erebia*, is characteristic of Cape Colony; at

* Entomologist's Monthly Magazine, 1905, p. 44.
† Trans. Ent. Soc. Lond., 1905, pp. 64, 135.
East London I observed several *P. cassius*, Godt., at rest, but did not see any list.

*Mycalcesis safitza*, Hew. Though I took many odd specimens of this dingy butterfly, I never found it really common, and have but two notes of its resting attitude:—

Berea, near the hotel, Aug. 14th, seen to settle in the shade, wings upright.

And,

Congella, Aug. 18th. This species does not appear to orient: a slight list away from the sun, but sun not very bright at the time of observation.

Dr. Dixey, however, in the case of this butterfly obtained more positive results:—

Durban (Botanic Garden), *Mycalcesis safitza* has a very strong list when settled in the open; it may be to right or left in the same individual.

Durban (Botanic Garden), saw *Mycalcesis safitza* settled on bare ground; it had a strong list to the left. Saw it fly and settle in strong sunshine; once with its back to the sun, with list to left; once with head to sun, right list; once at right angles to sun, throwing a broad shadow.

It would therefore seem that *Mycalcesis safitza* may be included among the Satyrs with a list, but this does not appear to help concealment by diminishing the shadow, as I suggested would be the case if the list were towards the sun.*

Near Darjiling, in 1903, I observed a slight list in *Mycalcesis indistans*, Moore. And in Japan, in 1904, the fine Satyrid, *Blanida goschkevitschii*, Mén., had a striking list.†

**General.**

That the term "Rest Attitude" is used in this paper very loosely I am well aware. A butterfly may be conceived as resting in several stages. First, it may settle to feed. *Sphinx* feeds on the wing; many a *Papilio* settles on a flower to feed, but flutters while sucking the honey, this, e.g., is the habit of *P. erihonius*, Cr., *P. hector*, L., and *P. dissimilis*, L. Thus in Ceylon I found that the best way of distinguishing the last-named from the Danaids

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† *Loc. cit.* pp. 91, 135.
which it mimics so closely was by this fluttering. Many moths, notably \textit{Platia}, are intermediate between \textit{Sphinx} and \textit{Papilio} in this respect. The vast majority of butterflies feed with their wings still, in some cases more or less widely spread out, in others closed over the back. The Skippers of such genera as \textit{Syriethus}, \textit{Pamphila} and \textit{Gegenes} settle with the hind-wings horizontal, the fore-wings nearly vertical, but other Skippers, such as \textit{Baoris} and \textit{Eretis}, settle with the wings fully spread out.

Again, butterflies often rest from flight on the ground, on the upper-side of leaves, or on tree-trunks. A few Skippers, such as \textit{Celencorrhinus}, \textit{Caprona} and \textit{Pterygosidea} (Tagiades), settle on the under side of leaves, with their wings spread like Geometers.

Such a state of rest is more reposeful than that first described, but in many species it is varied by occasional closing and re-opening of the wings; or in some Lycaenids by curious horizontal movements of the hind-wings only.

A third stage is when they rest for a long time in one position, then the wings are usually raised over the back (even in the case of \textit{Hesperia}, etc.) and often the fore-wings are withdrawn within the hind-wings. In some species, notably \textit{Euchloe} and \textit{Synchloe}, when the creature is at rest the hind-wings do not approach the stem on which it sits, but the abdomen is elevated some $30^\circ-40^\circ$ and quite concealed between the hind-wings. This attitude greatly increases the similarity of the insect to a leaf. [Exhibited.]

The actual habits of butterflies when asleep are but little known, the great majority almost certainly close their wings over their backs, but some of the larger Skippers, such as \textit{Caprona}, etc., probably sleep with them spread out like Geometers. Certainly our common Skippers, \textit{Pamphila sylvanus}, Esp., and \textit{P. linea}, adopt the usual butterfly attitude, but many years ago Mr. Roland Trimen called attention to the fact that \textit{Nisoniades tages}, L., sleeps with the wings inclined so as to form a roof, like many \textit{Noctua}.* I noted in South Africa that in some Skippers the posterior third of the hind-wing is curiously plaited when at rest, thus again resembling \textit{Noctua} and other moths. This may be well seen in the big \textit{Rhopalocampta keithlea}, Wallengr., and \textit{Pterygosidea flesus}, Fab., as well as in the little \textit{Gegenes zetterstedti}, Wallengr. (= \textit{hottentota}, Latr.).

* Barrett's Lepidoptera of the British Islands, vol. i, p. 309.
Intimately bound up with the attitude at rest is the question whether or no insects select resting-places of a character likely to make the most, so to say, of their cryptic colouring.

Many years ago the late Mr. Geo. Norman and myself took a lot of Polia chi, L., at rest close to the hydropathic establishment at Forres, and we were much puzzled by the fact that while many were taken on whitewashed walls, where they were difficult to detect, quite as many were found resting on dark tree-trunks and could be easily seen at many yards' distance.

Mr. Hamm has made some striking observations tending to an affirmative answer to this question.* In the Baghi Forest, near Simla, I was struck by the way in which the conspicuous yellow Terias hecabe, L., disappeared when it settled on a low shrub with oval leaves fading to a yellow tint, the rounded form of the wings aiding its concealment.† But the most convincing case that has come under my own observation was a large yellow butterfly (I had no net but think it was probably Catopsilia catilla, Cr.) which I saw in the garden of the University of Bombay. I saw this settle again and again, invariably in a small shrub with yellow leaves. The very conspicuous fly would vanish suddenly, and it was only after several attempts that I succeeded in getting a glimpse of it when settled, so strong was the protective resemblance.‡

In an analogous S. African case I am able to supply fuller details:—

_Eronia cleodora_, Hüb., is a common Natal Pierine. Few insects are more conspicuous in the net than this beautiful fly with its combination of creamy-white, jet black and deep yellow, and one might well wonder how it could possibly manage to hide itself. I watched it settle once upon the ground, and strangely enough it was not conspicuous when its wings were closed and the brilliant yellow of the under-side was fully exposed to view. Then I twice saw it settle on grass; when the wings were half open it was very conspicuous, but when they were closed it was far otherwise. Four times I saw specimens go to

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rest on the leaves of the Acanthaceous under-shrub, *Isoglossa woodii*, Clarke [= *Echeinanthus origanoides*, T., and of J. Medley Wood's *Natal Plants*, vol. i, plate 22], called by the natives *u-Bomaan*, which forms the bulk of the undergrowth of the scrub on The Bluff, at Durban. It hung more or less downwards with its wings closely shut up, in which position its general shape was not unlike that of a leaf, while its colour, yellow blotched with purplish-brown, had a striking resemblance to the many yellow, eaten and blotched leaves upon the shrubs. The brilliant insect lost itself in its surroundings, although this was not a case of definite leaf mimicry as in *Kallima* or even in *Precis*. A rough-coloured sketch made at the time gives (apart from artistic shortcomings) a faithful representation of some of the leaves, though the yellow colour hardly shows by artificial light. [Sketch and butterflies exhibited.]

Dr. Dixey has a note which confirms the above:—

The Bluff, Durban, Aug. 16. *Eronia cleodora*, ♀, observed to settle near leaves which, turned yellow and showing slits and circular holes, closely resembled its under surface.

Mr. J. Medley Wood, the Director of the Natal Botanic Gardens, kindly writing to give me the name of the plant, says that the food plants of *E. cleodora* are *Capparis zeyheri*, Turcz, and *Nicoburria pedunculosa*, Hochst.

Perhaps the most tropical-looking butterfly that we met with in S. Africa was the large Nymphalid, *Salamis anacardii*, L.; nearly 4 inches across the wings, greenish-white, with a strong pearly lustre, it is a very beautiful creature. Its flight is very weak. Mr. A. D. Millar of Durban said that it was fond of resting in a particular tree or shrub with glaucous leaves.

Dr. Dixey has a note:—

Sydenham, Durban, Aug. 15. Watched *Salamis anacardii*, L. It flew in a slow, flappy, undecided way from side to side of the road, settling each time for a second or two on a tree. Presently it reached a tree whose leaves were about the same size as the *anacardii* when resting with wings over its back. Here it settled, beneath a cluster of leaves, being fully exposed to view and yet well concealed. It remained quiescent until forcibly disturbed.
I have no manuscript note, but remember well that before Mr. Millar mentioned the fact of _anacardii_ having a proclivity for such trees, I saw one take refuge in a shrub, or small tree, having large glaucous leaves; and I am almost sure that I beat another specimen out of the same kind of tree, but I failed to see the insect at rest.

Writing of _Colias philodice_, Godt., Mr. W. H. Edwards says: "On marigolds and brilliant single zinnias they delight to pasture, for they have a keen sense of colour. I have known one of them alight on an amethyst in a lady's ring, after hovering about its owner so persistently as to attract attention, and it rested some seconds." *

Mr. S. H. Scudder quotes the following interesting observations on the same butterfly, _Euonymus philodice_, Godt. (called in America 'the sulphur').

"Dr. Minot once observed that when searching for its honied food the butterfly most frequently alighted on yellow flowers; and Dr. Packard has recorded that in a field where white asters and yellow golden rods were abundant the yellow sulphur butterfly visited the flowers of the golden rod much oftener than those of the aster, while the opposite was the case with _Pieris rapae_." † Again, in another place, he says, "and Jenner Weir has noticed how the white butterflies settled on the variegated leaves in his garden." ‡

The preference shown by the two butterflies for golden rod and asters respectively is interesting. These genera, highly characteristic of North America, are closely allied _Compositae_. On the other hand, _P. rapae_ was introduced into the country in 1860 or thereabouts.

Dr. Dixey has kindly placed at my disposal the notes of a number of his observations on common English butterflies which have a bearing upon the point under discussion.

1897, July 12, Morteboe. _S. semele_; flight more rapid than that of _H. janira_; it is also more apt to settle. When settling, chooses if possible a bit of grey rock or bare pathway. Sits with antennae expanded and projecting forwards, body raised somewhat on legs. At first settling, eye-spot of fore-wing generally just appears; then by a definite

* _Butterflies of North America_, vol. ii, 1897, _sub philodice_ (not paged).
‡ _Ibid._, vol. ii, p. 1102.
sharp movement the wings are further closed, and the eye-spot is visible no longer. *H. janira* as a rule shows eye-spot while resting [*i.e.* during temporary rest in daytime].

**July 12. Mortehoe.** Watched *G. brassicae*, ♀, resting on a *bramble* flower; wings closed so that the tip was the only part of fore-wing visible.

**July 13. Mortehoe.** Watched *V. urticae* at rest, quite 5 m. without stirring. It raised its wings but did not completely close upper-wing behind lower, so leaving a (roughly) equivalent triangle of upper-wing showing, including the whole of the dark costal mark.

**July 14. Mortehoe.** *H. hyperanthus* at rest shows eye-spot of fore-wing, like *H. janira* [*i.e.* at temporary rest].

At 8.25 p.m. saw *H. janira* settle down to rest. Eye-spot of fore-wing quite concealed.

At 8.35 p.m. saw *P. sylvanen* resting. Wings turned up flat over back, not in characteristic "skipper" attitude.

**July 15. Mortehoe.** Saw *H. janira* settled (in sunshine) with eye-spot of fore-wing quite covered.

Saw *G. napi* settled with about half of discoidal cell of fore-wing showing. Afterwards saw one with only tip of fore-wing showing.

**August 11. Mortehoe.** *P. megara* at rest does not shut up like *S. semele* (at least not during temporary rest in hours of flight). It usually sits with wings almost completely expanded.

**Aug. 12. Mortehoe.** Saw *G. rapa*, ♀, settled, towards dusk (nearly 8.0 p.m.), on a *bramble* leaf in a hedge. Wings vertical. On left side none of fore-wing showing but bare apex. On right side a large part of fore-wing showing. On careful examination this was found to be due to the fact that the right hind-wing was split, and the fore-wing had got caught in the cleft, this preventing complete closure on that side.

**Aug. 13. Mortehoe.** Saw *H. titonus* at rest; wings entirely closed up. A cloudy evening.

**Aug. 23.** Watched whites in Sandy Lane. When settled for rest they look very much like turned-back leaves of *bramble*, near or on which they are
fond of settling when meaning to remain settled for some time. In bright sunshine they often settle on flowers with wings partly or entirely spread, but in dull windy weather like this morning's, they are apt not to fly unless disturbed, and then to settle again very soon. I disturbed one *G. rapae*, *♀*, eight times and watched it settle again seven times. Five times it settled on *bramble*, although there was plenty of other vegetation. Of the other two times, the first was on the head of a yarrow, and the second on another low plant close to a spray of *bramble* with recurved leaves, which it closely resembled at a little distance.

Aug. 27. Saw *G. brassicae*, *♀*, settle twice on *bramble* and close up its wings.

1898. Sept. 7. Have several times lately, when coming up Sandy Lane at dusk, seen *G. rapae* settled, apparently for the night. Generally on *bramble*, wings quite closed. They will allow themselves to be seized with fingers or forceps, but then generally wake, and fly off if let go.

Aug. 8. Observed that *L. icarus* is fairly well protected (*i.e.* concealed) on heads of *bramble-blossom* when wings are closed.


This observation was referred to by Professor Poulton. [Trans. Ent. Soc. Lond., 1902, p. 372.] Compare the observation on *Tearculus ioni*, p. 104, 105, *supra*.

1904. Highcliff, Hants. Aug. 8. Watched *G. brassicae*, *♀*, settle down for the night about 7.15 p.m. After much fluttering about the stems of tall grasses, it came to rest on a head of hawkweed in the *peppus* condition, and remained there with wings hanging downwards and closed over its back.

Recently M. J. Th. Oudemans has published an interesting memoir entitled "Étude sur la Position de Repos chez les Lépidoptères."*

M. Oudemans only treats of one aspect of the subject which he deals with exhaustively by numerous observations on living specimens of all the chief groups of Macrolepidoptera. His conclusions may be shortly expressed, almost in his own words, thus:—Lepidoptera have a sleeping-dress; this dress forms a harmonious whole. The different parts which contribute to form the whole dress harmonize in their colours and usually in their patterns. The parts of the insect which are concealed during rest are quite frequently strongly contrasted in colour or pattern to the exposed parts. M. Oudemans explains the facts by the influence of exposure to light.*

M. Oudemans does not allude to the points chiefly dealt with in this paper, but one of his beautiful photographs shows Chrysophanus phleas, L., sitting with abdomen tilted up at an angle of about 45° to the thorax, as I have shown in the specimen of Euchloe belenia, Es., exhibited. He does not however call attention to its peculiar attitude. That it must greatly increase the resemblance to a dead leaf is obvious enough.

In bringing this somewhat disconnected paper to a close I venture to make a remark which has a wide bearing on the whole question of cryptic and mimetic resemblances.

Butterflies are most numerous and varied within the tropics. In the tropics the length of daylight varies much less than in temperate zones, and is many hours shorter than in the temperate summer. At the equator the sun is above the horizon for twelve hours every day; at the tropics the sun is above the horizon from a minimum of 10½ hours to a maximum of 13½ hours.

But although the sun is visible for these long periods, not so the butterflies. Very few comparatively are to be seen on the move before 9 a.m., and few after 3 p.m.†

Now my point is that tropical birds, lizards, and other insectivorous animals have some six hours of full daylight in which to hunt butterflies, when the latter are more or less at rest. This is a fact not usually allowed for in the discussion of questions of protective resemblances or mimicry, but it emphasises the need for concealment.

* Compare Dr. M. Standfuss. Die Beziehungen zwischen Färbung und Lebensgewohnheit bei den Palaeartischen Grossschmetterlingen. Vierteljahresschrift der naturforsch. Gesellschaft in Zürich. XXXIX Jahrgang, 1894. (Read November 6, 1893.)

† Mr. A. D. Millar says that in the afternoon female butterflies are relatively more commonly seen.
VIII. Notes upon some remarkable parasitic insects from North Queensland. By F. P. Dodd, F.E.S.; with an Appendix containing descriptions of New Species, by Colonel Charles T. Bingham, F.Z.S., and Dr. Benno Wandolleck.

[Read March 7th, 1906.]

Hymenoptera parasitica.

[The material upon which the following interesting observations have been made has been kindly placed in my hands by the author, with the desire that I should make it available for the use of naturalists. Inasmuch as it mainly bears upon those bionomic questions which are so much studied at Oxford, the great majority of the specimens have been placed in the Hope Department; but wherever possible, co-types of the new species have been deposited in the British Museum of Natural History. The type of the interesting Cyrtid fly, Ogyodes doddi, has been added to Dr. Wandolleck's famous collection of this group at Dresden.

Mr. Dodd is to be congratulated upon these carefully-recorded observations throwing so much new light upon many of the North Australian Hymenoptera Parasitica. The hosts of the extraordinary Chalcid genus Schizaspidea have been hitherto unknown; we here find that S. doddi is parasitic upon ants. In other cases, such as the Chalcidid genus Rhipipallus and the Cyrtid fly, the general group to which the host belongs is already known, but Mr. Dodd furnishes us with exact data of the utmost value and interest. Many observations here recorded show a remarkable and long-persistent vitality in larvae attacked by Braconid parasites. It is probable that in hot latitudes, where a dead insect would quickly dry up and in other ways deteriorate as food, the attacks of parasites have been specially adapted to prolong the victim's life to its very utmost. The adaptation of course always exists, but here we probably see it at its highest level.

It is unnecessary to specify any localities, inasmuch as
the whole of the material was collected by Mr. Dodd at Townsville, North Queensland.—E. B. POULTON.]

Nos. 1 and 2 are from the caterpillars of Delias argenthone, F. The larvae of the larger species (No. 1) push their way through the sides of their host, and at once commence to construct their cocoons in a mass, the caterpillar dying and shrivelling up very quickly. The flies emerge through the end of the cocoon by forcing open the lid. The eggs of the smaller species are, I suppose, deposited upon the larvae of the larger one they are secure in the cocoons: they do not push open the lid, but gnaw holes to escape.

[Colonel C. T. Bingham has kindly described the Braconid parasite (No. 1) as Apanteles deliadiis (Appendix, p. 125); the Chalcidid hyperparasite (No. 2) as Microterys corniculus (Appendix, p. 127). Four Bracons and three Chalcids bear the date Jan. 2, 1903; seven Chalcids, Jan. 6, 1903; and nine Chalcids Jan. 9, 1903.]

No. 3.—From Chorocampa oldenlandi\* \*\* F. [Theretra oldenlandi\* \*\* fimata (Walk.), Rothschild and Jordan, Rev. Sphing., Nov. Zool., ix, suppl., p. 783.] In this (and two following species) only a single parasite attacks the caterpillar. The larva emerges through the side of its victim, and spins a cocoon, like a full grain of wheat, crosswise upon the back, just in front of the horn. The caterpillar never moves from one spot, and lingers until some time after the parasite has flown. The caterpillar, which is exhibited in formalin, did not die until forty-eight hours after the emergence of the fly, and I found it, with the cocoon seemingly finished, seven days before the appearance of the Hymenopterous insect.

[Col. Bingham has described this Braconid parasite as Microgaster basalis (Appendix, p. 125). The single specimen with its oval cocoon, from which a terminal lid has been pushed off, bears the date Feb. 11, 1903.]

No. 4.—Host Notodonta [Cerura] cyanoptera, Lower. The larva of this insect comes through the side or back of the caterpillar: it rears itself nearly upright and is almost entirely outside the aperture when it constructs the cocoon, which leans backwards at an angle of about forty-five degrees. Some twenty or twenty-four hours after, when the cocoon appears to be complete, the larva contrives to move its case from the host's back to the leaf. Wondering how this transference could be effected, I examined the
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case before removal, and observed that there was a tiny hole, through which the larva could push its head. The imago emerges through a lid in the upper end. The caterpillar never shifts from the position it has taken up, along the midrib on the under-side of the leaf. Like the preceding and following species it is very irritable. Death takes place about the sixth day, generally a day or so before the fly emerges; but I have found a caterpillar still alive after the fly had gone. One cocoon produced a number of minute Hymenoptera which are shown together with the case from which they had bored their way. In formalin several of the stung caterpillars are exhibited, each showing the wound caused by the full-grown Hymenopterous larva in its exit.

[Colonel Bingham has described the Braconid parasite (No. 4) as Microgaster percleans (Appendix, p. 126). The minute hyperparasites are shrivelled and indeterminable.

Two cocoons (one attached to piece of leaf), 1 Braconid and 5 hyperparasites bear the date Feb. 26, 1902.

One cocoon, 1 Braconid and 5 hyperparasites bear the date Feb. 27, 1902.

One cocoon, 1 Braconid, 5 hyperparasites, and 1 caterpillar of Notodonta, bear the date March 2, 1902.

Three cocoons and 1 Braconid bear March 11, 1902.

Four of the cocoons have been opened by pushing off a terminal lid. The lids have been preserved with their respective cocoons in three examples. The cocoon on the leaf has not been opened by a lid, but bears two minute apertures, one in the side and one near the end. It is probable that the fifteen hyperparasites emerged through these holes. Two cocoons, dated March 11, 1902, had not been opened from within. These two, unlike the others, are strongly marked by longitudinal furrows, and bear the appearance of a distinct cap at one end, clearly marked off from the rest of the cocoon by a circular ridge. They also differ from the other five cocoons in wanting the oblique flattened area towards one end which doubtless marks the base of attachment to the surface of a leaf.]

No. 5.—Host the bee-hawk Hemaris kingi [Cephonodes kingi, McLeay, of Rothschild and Jordan, Revision, p. 463.] This larva also places the cocoon across the back of the caterpillar immediately in front of the horn. One day I noticed three small caterpillars upon twigs: the next day in passing I found that each carried a case. I then took
them and observed that after several days the cocoons had dropped off. The parasites appeared in the perfect state on the eighth day, the first caterpillar dying two days, the second five days and the third eight days after the appearance of their respective parasites. The third caterpillar seemed dead on the seventh day, but movements were noticeable in the claspers during this and well into the eighth day.

It will be noticed that this and the two preceding species of caterpillars must be stung when they are exceedingly small, for they are all only about the size of healthy eight- or nine-days-old larvae.

I had another species of these flies from a common noctuid (Achaea sp.). The larva came out under the twelfth or thirteenth segment and affixed its cocoon to the twig, the caterpillar’s tail being raised to accommodate it and pressing on and partly around it. In this position the caterpillar remained, though not fastened to the case in any way, it died on the third or fourth day after the appearance of the Hymenopterous imago.

[This Braconid parasite (No. 5) has been described by Col. Bingham as Microgaster basalis, viz. the same species as No. 3, also parasitic upon the caterpillar of a hawk-moth (Appendix, p. 125). The single specimen of No. 5 together with its cocoon bears the date Feb. 19, 1902. The cocoon has lost its terminal lid.]

No. 6.—From the handsome Lycænid Ogyris genoveva, Hew. [a synonym of O. zosine, Hew.] The larvae of this butterfly are befriended by several species of ants, chiefly by a large Camponotus, in whose nests they pass the day. When young however they hide under loose bark or in crevices, and can easily be stung by small parasites. The numerous larvae crawl out from under the host and form their heap of cocoons, the victim dying very slowly. The flies emerge in about seven days, the caterpillars having a little life left in them up to five days later.

[This Braconid parasite (No. 6) has been described by Col. Bingham as Protopanteles reviventris (Appendix, p. 127). Five Braconids, 1 shrivelled Lycænid larva, and 7 cocoons bear the date March 21, 1902; 5 Braconids and a heap of many cocoons bear Dec. 22, 1902; five Braconids and another large heap bear Dec. 23, 1902. The white oval cocoons have been opened by pushing off a terminal lid which in many cases remains attached as it were by a
Parasitic insects from North Queensland.

When the cocoons are affixed end to end in the heap, the lids appear to be always formed and pushed off at the free ends.

Nos. 7 and 8.—From the pupæ of the case moth *Arctostercus moretoncella*, Walk., the larvae of which live in the nests of small black tree ants. The Lepidopterous larvae never leave these nests; but in order to pupate they approach closely to the entrances, when they are, no doubt, victimised.

[No. 7 is borne by the following undated set of specimens: a Lepidopterous case from which the empty pupal skin of a moth projects, so that this particular specimen was not parasitised; 2 ♀ Chalcididae described by Col. Bingham as *Stomatoceras fuscipennis* (Appendix, p. 128); 4 ants identified by Prof. Auguste Forel as *Cremastogaster leviceps*, Smith.

No. 8 is borne by a set of specimens dated June 5, 1902: 2 flattened dumb-bell-shaped Lepidopterous cocoons the larger of which has been pierced by an emerging parasite, the other very small; 1 Chalcid considered by Col. Bingham to be probably a species of *Halticella*, but too fragile to bear removal from the card for examination; 2 *Cremastogaster leviceps*, Smith, ♀.]

No. 9.—These bright little Chalcididae I have bred frequently from the pupæ of the fine long-jawed ant *Odontomachus* sp., several sometimes coming from the one cocoon.

[No. 9 is borne by 2 ♀ and 1 ♀ Chalcididae described by Col. Bingham as *Rhhipipallus affinis* (Appendix, p. 129). They are dated July 30, 1902. Another set of specimens, without number, but dated March 16, 1902, contains 1 ♀ and 1 ♀ of the same species of Chalcidid, 1 worker ant identified by Prof. Forel as *Odontomachus ruficeps*, Sm., subsp. *coriarius*, Mayr., ♀, and 1 ant cocoon. A third unnumbered set, dated Oct. 1902, contains 1 ♀ and 2 ♀ of the Chalcidids, and 1 worker of the above-named species of ant.]

No. 10 is a great rarity and the only specimen I have bred from several lots of pupæ of a large ant, *Camponotus* sp. From one lot I obtained some large bright pink mites, but I lost these in a great cyclone on March 9, 1903.

[No. 10 is borne by the ♀ of a beautiful and remarkable Chalcidid described by Col. Bingham as *Schizaspidia doddi* (Appendix, p. 130). It is dated Jan. 1903.]
Diptera.

No. 11.—In the crevices of the leaf nests of our interesting green ant, *Ecophylla virescens*, Fabr., a pretty jumping spider takes shelter and breeds. Generally it selects the nests which are partly abandoned. I was carding some of these spiders, but one ♀ being rather bulky, seemingly with eggs, I kept her in a glass-bottomed box to deposit them. One morning I found the spider dead, with abdomen strangely small and shrunken, and, instead of a mass of eggs, I noticed a peculiar dark object in a thin web the spider had spun. Later in the day the object became much lighter and I made it out to be a short thick pupa of some kind, not unlike that of a butterfly. Finally in about twelve days' time the pupa produced the dipteron now shown. The exact dates, and box carefully preserved with pupal shell in the web, were lost in the storm already alluded to, owing to the destruction of the house I lived in, when various entomological specimens of interest were destroyed.

[No. 11 is borne by an Attid spider kindly identified by my friend Dr. G. W. Peckham, of Milwaukee, as *Cosmophasis biteniata*, Keys. Dr. Peckham informs me that the ♀ = *Sobera biteniata*, and the ♂ = *Selephora rubra*, in Koch and Keyserling's "Arachn. Austral.," p. 1365, and p. 1374. The specimen, which is dated Nov. 15, 1902, has a shrivelled abdomen, and bears the word "Dipteron," so it is certainly the host of the Cyrtid fly, *Ogcodes doddi*, Wandolleck, sent with it. The *Ogcodes* bears the locality and date, Nov. 20, 1902. (See Appendix, p. 131.)

No. 11 is also borne by two more spiders of the same species, dated Nov. 11, 1902.]
APPENDIX.

1. *New species of Bracónidae and Chalcididae from N. Queensland, bred by F. P. Dodd.* By Colonel Charles T. Bingham, F.Z.S.

**BRACONIDÆ.**

No. 1. *Apanteles deliadis,* form. nov.

♀. Head broader than long, face below the antennae slightly raised, front and vertex smooth, occiput not margined. Thorax short, broad anteriorly, pro- and mesonotum and scutellum minutely but very closely punctured; wings hyaline and iridescent, legs long, posterior tibiae slightly incrassate. Abdomen short irregularly obliquely truncate at apex, compressed, ovipositor slightly exserted. Black; antennae reddish-brown; the trochanters, femora, tibiae and tarsi of the legs, and the basal three segments of the abdomen on the sides, dark brownish-yellow.

♂. Similar in sculpture and colouring to the ♀ but the abdomen is vertically not obliquely truncate.

Length ♀ 3⅓ mm., of ovipositor ⅓ mm.; ♂ 3 mm.

Exp. ♂ ♀ 5 mm.

♀ and ♀ types in Hope Department, Oxford University Museum; ♂ and ♀ co-types in British Museum of Natural History.

_Hab. N. Queensland, Townsville (F. P. Dodd)._ A true *Apanteles,* with the antennae 18-jointed, eyes minutely pilose, and the radial and cubital abscissi faintly marked. No form of the genus has, so far as I know, been previously recorded from Australia.

The hyperparasites (No. 2) of the above species belong to a new species of *Chalcididae* described on page 127 as *Microterys coerulescens.*

Nos. 3 and 5. *Microgaster basalis,* form. nov.

♂. Head smooth and shining, vertex broad, ocelli prominent. Antennae elongate 18-jointed densely pilose. Thorax broad, gibbous anteriorly, smooth; mesonotum with two longitudinal short deep impressed lines, mesopleuræ not furrowed smooth; scutellum
triangular, its apex blunt; median segment posteriorly rounded vertically tricarinate and coarsely cribrate between the carinae. Wings: apical two-thirds fuscous, basal third hyaline; legs normal except for the posterior femora and tibiae which are somewhat thickened, pilose. Abdomen: broad, depressed, basal segment superficially lightly and finely punctured, the rest smooth and shining. Head black, antennæ brown, basal joint red; thorax red; anterior and intermediate legs and coxae and trochanters of posterior pair pale brownish-yellow, femora and tarsi of posterior legs dark brown. Abdomen basal segment and sides of 2nd and 3rd segments yellow, remainder of the abdomen jet black.

Length ♂ 5 mm. Exp. 12 mm.

♂ type (No. 3) and co-type (No. 5) in Hope Department, the former from a Chorocampa, the latter from a Hemaris larva.

_Hab. N. Queensland, Townsville (F. P. Dodd)._ 

Belongs to Marshall's Section 2 of the genus.

No. 4. _Microgaster perelegans_, form. nov.

♀. Head: face in front, vertex and behind the eyes closely but very minutely punctured; antennæ 18-jointed densely pilose; thorax smooth or with only a few scattered punctures anteriorly, the mesonotum and scutellum separated by a conspicuous short broad transverse furrow the two sides of which are mediately connected by cross carinae; scutellum triangular smooth; median segment obliquely truncate, coarsely cribrate, and with a medial and a lateral (one on each side) prominent vertical carina; wings hyaline lightly infuscate; legs long, posterior pair slightly pilose. Abdomen depressed, polished and shining above. Head median segment and abdomen jet black; thorax anteriorly and up to the scutellum red; legs: anterior and intermediate pair reddish-yellow, posterior pair black with a broad sub-basal ring on the tibia white; sides of 1st and 2nd segments of the abdomen yellowish-white; ovipositor black scarcely exserted.

♂. Similar except that the abdomen is slightly more depressed and there is of course no ovipositor.

Length ♀ ♂ 4 mm. Exp. 9 mm.

♂ and ♀ types in Hope Department, ♀ co-type in British Museum of Natural History.

_Hab. N. Queensland, Townsville (F. P. Dodd)._
Belongs to Marshall's Section 1 of the genus with the basal segment longer than its breadth at apex and the 2nd cubital cell subtriangular and open.

The minute hyperparasites sent with this are shrivelled and indeterminable.

No. 6. Protapanteles rufiventris, form. nov.

♀. Head lightly punctured; face medi ally carinate below the eyes; antennae long, pilose, 18-jointed. Thorax shining broad and gibbous, anteriorly finely punctured; scutellum triangular convex divided from the mesonotum by a short broad transverse furrow and with a punctured very narrow groove bordering both sides and meeting at the apex; median segment not carinate oblique, slightly convex, somewhat more closely and coarsely punctured than the pro- and mesonotum; wings hyaline iridescent; legs robust, posterior femora somewhat compressed. Abdomen broad, basal two segments punctured like the median segment, remainder smooth and shining, apex rounded, ovipositor only slightly exserted.

Head, thorax and median segment black; antennae reddish-brown; legs and abdomen brownish-yellow, basal segment reddish-brown above, apical segment shaded with fuscous.

♂. Similar, slightly smaller; abdomen shorter and more truncate posteriorly.

Length ♀ 4, ♂ 3 mm. Exp. ♀ ♂ 9 mm.

Types in Hope Department, co-types in British Museum of Natural History.

Hab. N. Queensland, Townsville (F. P. Dodd).

This agrees in generic characters with Protapanteles, Ashmead. In the classificatory tables given by this author in the Proceedings of the United States National Museum, vol. xxiii, pp. 1–220 (1900), the presence or absence of a longitudinal carina on the median segment is given as the chief point of difference between the genera Apanteles and Protapanteles. The present form differs from Apanteles deliadiis (supra), besides other characters, in the much more lengthened median segment.

CHALCIDIDÆ.

No. 2. Microterys coeruleus, form. nov.

♀. Head, thorax and abdomen smooth and shining, the face in front and the prothorax anteriorly with a few scattered punctures.
Antennæ 7-jointed, scape smooth, flagellum pilose opaque, the joints distinct; eyes large, bulging out on either side of the head. Thorax, sutures between pro- and mesonotum, scutellum, post-scutellum and median segment distinct; wings hyaline iridescent; legs slender. Abdomen lanceolate apically acute, above depressed, concave, ovipositor not exerted. Head, thorax and abdomen metallic-blue, flagellum of the antennæ and the femora of the legs except at apex dark brown, scape of the antennæ and apex of femora, tibiae and tarsi pale yellow.

♂. Only differs from the ♀ in being smaller, the antennæ are 10-jointed with the flagellum more densely pilose; head and thorax minutely but densely punctured, and the abdomen short, rounded posteriorly, not acute.

Length ♀ 2½, ♂ 1½ mm. Exp. ♂ ♀ 4 mm.

Types in Hope Department; co-types in British Museum of Natural History.

_Hab. N. QUEENSLAND, Townsville (F. P. Dodd)._  
Hyperparasitic upon _Apaneles deliadis_ (page 125).

**No. 7. STOMATOCERAS FASCIATIPENNIS, form. nov.**

♀. Head and thorax closely and evenly punctured. Clypeus and face below the base of the antennæ cribrate; face and front above the base of the antennæ deeply and widely vertically sulcate, the furrow bordered on each side and above, just below the vertex, by a well-marked carina; scape of antennæ long about one-third of the whole length of the latter, smooth but minutely pilose, flagellum simple, granulo-se, 10-jointed. Thorax: robust, pronotum margined anteriorly; scutellum large oval convex overhanging the median segment, bidentate at apex, posteriorly with a very narrow sub-marginal furrow or channel; median segment short, truncate, bearing on its posterior vertical face a median looped carina and two lateral oblique carinae; wings hyaline with sub-basal and post-median broad transverse fuscous fascia; legs minutely pilose, posterior femora edged posteriorly with numerous extremely minute teeth. Abdomen subsessile smooth and shining, the basal abdominal segment as long as the rest united. Head, thorax and dorsal surface of abdomen black; apex of scape of antennæ, tegulae of wings, the legs, and sides and ventral surface of abdomen blood-red.

Length ♀ 5 mm. Exp. 8 mm.

♀ type in Hope Department.

_Hab. N. QUEENSLAND, Townsville (F. P. Dodd)._
Parasitic insects from North Queensland.

Somaticoceras, Kirby, is another widespread genus occurring in Africa, Japan, and America, and now recorded from Australia.

No. 8. The single specimen of this Chalcidid is too fragile to remove from the card for examination. It probably belongs to the genus Halticella.

No. 9. Rhipipallus affinis, form. nov.

♂. Head lenticular; clypeus triangular deeply incised anteriorly, front below the antennæ slightly raised, smooth and shining, cheeks face and vertex finely but somewhat absolutely longitudinally striate; scape of antennæ short smooth and shining, flagellum finely granulose, pilose, the hairs very short, the basal two joints simple, the rest except the apical joint with long slightly elevate rami on each side, two to each joint, apex distinctly incrassate. Thorax densely and somewhat coarsely punctured; scutellum conical produced, the apex terminating in two short teeth; at base a transverse series of foveæ or large shallow punctures; postscutellum and median segment very coarsely cribrate, the latter with two or three irregular more or less vertical carinae; wings hyaline and iridescent; legs slender. Abdomen smooth and shining, its petiole opaque granulose. Mandibles tibie and tarsi pale yellowish-brown; coxae and femora dark blue or black; antennæ dark reddish-brown; head, thorax anteriorly, scutellum and median segment, metallic-green with in certain lights a bronze tint; middle of thorax above entirely coppery-bronze; petiole and abdomen dark metallic-blue.

♀. differs from the ♂ as follows: Clypeus not incised; antennæ moniliform, the joints simple not provided with lateral rami; scutellum not bidentate at apex, at base a deep, broad transverse sulcation within which is situated the transverse series of foveæ so conspicuous in the ♂; petiole of abdomen much shorter, abdomen as in the ♂. Antennæ paler, head and thorax more bronze than green; abdomen a darker blue.

Length ♂ 5; ♀ 4 mm. Exp. ♂ ♀ 9 mm.

♂ ♀ types in the Hope Department, ♂ ♀ co-types in British Museum of Natural History.

Hab. N. Queensland, Townsville (E. P. Dodd).

Superficially this form closely resembles the type of the genus (R. volusus, Walker), but besides other points of difference it is easily separable by the sculpture of the transverse carinae, the former having these transverse carinae more strongly developed.
Mr. F. P. Dodd's Notes upon some remarkable thorax, which in volusus has the humeral angles of the thorax conspicuously smooth and shining, not coarsely punctured and no carinae on the median segment.

No. 10. Schizaspidia doddi, form. nov.

♂. Mandibles sickle-shaped with three teeth, apical tooth long acute, two small teeth on the inner margin; clypeus short quadrate with the cheeks and face below the base of the antennae transversely striate, the striae curving round upwards and becoming vertical behind and between the eyes, vertex longitudinally striate; scape of antennae smooth, flagellum finely granulose, 1st joint simple rounded, remaining joints throwing outwards comparatively short, slightly clavate rami. Thorax: short and stout, densely and somewhat deeply punctured; scutellum: produced elongate conical overhanging the median segment and bearing a stout bifurcate process at apex, the points of the fork blunt with a tooth on the inner side of each; postscutellum and median segment vertical and vertically striate the division between them well marked. Abdomen petiolate, petiole shorter than the rest of the abdomen which is sub-oblunconical depressed above and broad and bluntly rounded posteriorly. Mandibles, scape of antennae, and coxae, femora, tibiae and tarsi of the legs pale yellowish-brown, flagellum darker brown; head and thorax rich golden bronze with in certain lights scattered green and purple points; wings hyaline iridescent; abdomen shining bronze-brown.

Length ♂ 5 mm. Exp. 12 mm.

♂ type in Hope Department.

Hab. N. QUEENSLAND, Townsville (F. P. Dodd).

Schizaspidia, Westw., is a genus, so far as is recorded, of small extent but wide distribution: forms of it occur in Australia, the Philippines, India and South America.

Occodes doddi, n. sp.

♀ (?) N.E. Australia.

A small species, allied to *Og. darwini*, Westw.

Body brown, grey-haired. Head black, ocellar tubercle prominent and polished. The facets are of equal size. The horizontal groove of the eyes longer than in *Og. darwini*. Neighbourhood of the mouth grey tomentose, thickened, with a deep vertical notch. Antennæ small, the onion-shaped part of the third joint dark brown, the remaining part light brown and transparent. Thorax brown, smooth, grey-haired. Prothoracic plates small, light brown. Wings brownish; veins stout, brown; squamæ of the same
Notes upon some remarkable Parasitic insects.

colour as the wings, with a stout brownish margin; grey-haired. Legs light brown; tarsi darker; claws and pulvilli blackish-brown; abdomen light brown; tergites yellowish with a narrow white band in

Wing of Oycodes doddi.

front; middle of the first and second sternite yellow, the other sternites mottled with dark yellow patches; margins yellowish-white.

Length 4 mm.
IX. Observations on the Life History of Trichoptilus paludum, Zell. By T. A. Chapman, M.D.

[Read March 7th, 1906.]

Plate VII.

This species is the smallest and most delicate of our British Plume moths, and also perhaps one of the least common. It has up to the present been remarkable as the only British species of the group, whose early stages were quite unknown.

For the discovery of its early stages we are altogether indebted to Mr. E. R. Bankes, who by reasoning not only scientific, but almost mathematical, arrived at the conclusion that its food-plant must be Drosera, although he seemed to fear that this determination would be scouted as absurd.

He supplied me with eggs of the species, and with a first installation of plants of Drosera; and from this basis I have succeeded in observing a good deal of its life history, and fully confirming Mr. Bankes' determination of what its food plant must be.

The food plant, Drosera rotundifolia (and probably the other forms; I found many larvae on rotundifolia, but the Dorset plants varied somewhat towards intermedia), is one that was probably never suspected to support a Lepidopterous larva, and was therefore never searched for that of this species. The prevailing idea is that the plant devours insects, and though this is undoubted, it now appears that to assume that insects would not and could not also eat it, is to fall into a plausible but false method of reasoning. Nevertheless, it comes as somewhat of a surprise to find that a Lepidopterous larva, without any special means of protection, but simply acting in the ordinary larval manner, attacks it with entire impunity. No doubt it avoids walking over, and especially resting upon the gluey glands, but it does this apparently merely because it has no call to do so, and the glands with their secretion are certainly favourite items of its food, especially when it is small.

My observations began in August 1904, when I received
several eggs from Mr. Bankes, laid by females captured at Wareham, Dorset. I find from my notes that a♀ taken August 20th laid eggs from which two larvae hatched on August 30th; and from a female captured August 23rd two larvae hatched on September 6th. A further supply of eggs were received on August 31st. The first larvae that hatched were placed on all sorts of bog plants obtainable near Reigate, but without result, and when these were finally placed on the Drosera plants sent by Mr. Bankes, they were already rather exhausted.

It was on August 31st that the plants of Drosera arrived, along with 16 eggs on the same date.

These eggs were loose, two on leno and the rest on a flower-stalk, or rather fruit-head of Drosera. Three of the original larvae survived, and though obviously exhausted, seemed more at home on the Drosera than on anything yet tried. One placed on a leaf was, however, in process of digestion next morning. The others had disappeared somewhere, apparently in the heart of the little plants. When the new set of eggs began to hatch after a few days, September 6th, much time was spent in watching the young larvae on the plants; none were placed amongst the glands on the leaves, but the largest of the unexpanded leaves was selected. They eventually got down towards the centre of the plant and became much more quiet and sluggish there, but still on the move. The next day none of them could be found.

Sept. 14th. Looked at occasionally, nothing could be made of the Drosera plants, but to-day a careful examination shows a small pile of frass near the centre in two of the plants. Another shows nothing, and in the fourth is a living larva of paludum, a little grown, but out, exposed, and looking sluggish. A curious point is that of the August 30 eggs; those separate, and one on the muslin, hatched, the others on the muslin proved infertile and did not change colour. These hatched September 6th, the eggs on the seed-stem are still (14th) unhatched, they changed colour a day or two later than the others, and their hatching was expected about the 8th, but they make no sign. The young larvae inside have, since that date, been obviously mature. These ultimately proved to be dead. The eggs remain free from shrinking, mould, or other sign of death or decay, and give the impression of intending hibernation.
Sept. 16th. On one plant a small larva, by the conspicuousness of his darkish tubercles, in its second skin, is seen down amongst the leaf-stems just outside the central heart, covered by a slight web of silk, and this a little obscured by some frass. On another plant a small larva is exposed in about the same situation; this one is well-fed up in first skin.

Remaining eggs are still unhatched.

Sept. 17th. The larva under the web has thickened it both with silk and other material (frass?), so that he is now invisible. On another plant the exposed larva is now quite fat in first skin but is still exposed.

Sept. 22nd. The cocoon is still firm and opaque, its strong structure leads one to suppose it is for hibernation. It is placed between an outer dying leaf-stalk (of a not thriving plant) and the central bud-bulb and the adjacent leaf on its inner side looks as if dying at the tip from being eaten or excavated; this is the only point to suggest that larva is feeding.

The "exposed" larva, though looked for every day, has been invisible since 17th, and it was feared something might have happened to it; to-day, however, it is out crawling over the minute leaves of leaf-bud in centre of plant; no trace is seen (of course without pulling plant to pieces) of where it spent the interval. It is now in 2nd instar. It is about 1.5 mm. long, head dark of about same width as body. I and II are on one large chitinous base, III, IV, and V, smaller. These bases have a slight dark tint, the hairs are long, II nearly as long as width of body, I perhaps ⅓ of II, III long, IV and V each rather shorter. The larva might be described as pale whitish-fuscos with a reddish dorsal line and another between II and III, but it seems more accurate to say the ground-colour is pale reddish-brown, and that there is a narrow white line round each large tubercular plate. The larva being young, in this instance I and II reach practically from front to back of segment, leaving only room for the narrow pale line. The hairs are very distinctly thickened at the tips.

Sept. 24th. A plant on which a larva was placed, September 6th, and of which no trace could since be found although the plant has been examined most carefully nearly every day, when examined to-day was found to have on it a larva in second skin which was constructing a silken web over itself, at the side of the central bud and
close to the base of a larger leaf. No trace of any of the work of the larva in the interval can be found.

The larva found on 17th has thickened its web and pellets of frass are conspicuous on its upper surface. The larva can still be faintly outlined beneath. The first larva is quite invisible.

Oct. 22nd. The three inhabited plants are not looking flourishing; two which have the largest green centres have the cocoons as last described, the third, however, has only a small central bit of green, and there is a new and larger cocoon on the other side of this from the original one, that does not look much different; the new cocoon is still imperfect, and one glimpse was got through it of the black head of the larva moving about and apparently spinning, and again of the body of the larva, of which no details appeared, but it was decidedly larger and of a flesh tint. It is unfortunate that the larva was not seen when on the move and transferred to a better plant and a description of it taken. The presumption is that it is now in its third skin.

Oct. 24th. This larva is found crawling about outside to-day, it is a question whether it is not merely in second stage; it is just fully 2 mm. long, head black, general colour flesh-colour, made up of white and reddish markings. The tubercles I and II are united on one base, II the longest hair, and has one secondary hair behind it, one or two tubercles seem to have another secondary hair. No other secondary hairs to be found. Base of hairs and spiracles dark, first thoracic plate has a white central line with black line on each side and a black spot further out.

Each tubercle is surrounded by a white area, between is dull red; the red area has fine skin points which are absent or very indistinct in the white areas. Hairs slightly clubbed, III bent forwards, front upper of IV + V directed rather forwards, shorter than the posterior, which is directed outwards.

The white and red is perhaps better described as in longitudinal lines, a red dorsal one, then a broad white, including I and II, then a red one which has various processes, so that the description of white circles round tubercles results from these taking circular arcs, with tubercles, spiracles, etc., for centres. But there are other centres with white that are not at present occupied by tubercles. On first segment is a little longitudinal stripe
of red from I forwards, and on the thorax the dorsal and
next red line are more or less conjoined.
Under low magnification the thoracic plate looks nearly
black and somewhat homogeneous in colour.
Inside I and II is a dark depressed spot. Anal plate
not dark.
The larva is not tormented to get a fuller description,
but is carefully placed on a better plant in hopes of
rearing it.
Oct. 27th. The larva was found (25th) to have made
some slight spinning. Yesterday (26th) the spinning was
a fairly complete cocoon with some black dots of frass, and
to-day it is more dense and the larva is completely hidden.
Nov. 20th. Larva (No. 2) noted 27th remains in statu
quo. Another (No. 1) is found to-day to have begun a
new tent; it is still somewhat visible through the silk,
and can be seen to be fat and larger if anything than
No. 2 at its spinning, but no details are discernible.
No. 3 has its cocoon wet from water soaking up the plant;
on this plant the centre bud is wet as it is not in plants of
1 and 2. The cocoon does not look very satisfactory, and
possibly the larva inside is not doing well.
Dec. 10th. No. 2 (of Nov. 20th) is found to-day outside
its tent on the move, and opportunity taken to describe
it. It does not seem to have grown or to be in feeding
humour—moves very sluggishly—is thick and short, is
yellow with very large porcellaneous-white plates or per-
haps is rather porcellaneous-white with certain yellow or
orange-ochreous lines. The plates being apparently sur-
roundings of tubercles, the tubercles and hairs are black, so
that the little larva is a rather striking object when closely
examined.
Length when stretched 2·7 mm. Taking the white as
the ground-colour, there is a narrow dorsal orange line,
a little widened in front of each segment and sending
branches, pale and less conspicuous, along the front and
back margins of segment, so that they are lost in the
incisions when the larva is not stretched. I and II are
close together, and on a common eminence, and almost con-
joined. These and other tubercles single-haired. Between
I and II and III is another longitudinal ochreous line.
Round I and II the surface is smooth and porcellaneous,
but in front of segment on each side of dorsum is an area
with five skin points. Head and spiracles black. The
subdorsal yellow line (between I, II, and III) sends down branches marking off a somewhat square white area round III; III placed slightly backward, IV + V, first one highest with shorter hair. Hairs about half the diameter of larva in length. Props of prolegs rather short.

When at rest the incisions are deep and the segments stand out high and cushiony with the elevation of the tubercles—especially I and II, and IV and V—making angular points.

Below IV and V is a single hair and at base of prolegs the usual three hairs, which are however very conspicuous, being black in a white ground. On 1st thoracic the plate is rather dark, divided centrally by a pale, hardly yellow line, with, on either half, a nearly central large hair, a small one at outer angle and three along front edge, a three-haired tubercle in front of spiracle and one at base of leg.

Second and 3rd thoracic has on either side four double tubercles along middle of segment, the third with an extra hair above and behind it and the prolegs carry 7 crotchets in a circle, incomplete at its outer margin. The black crotchets on the pale white base have a very pronounced aspect different from the more usual pale brownish crotchets on a yellowish base.

1905. Jany. 14th. Not liking the look of my plants I examined them. The first was dead, remains of a larval head detected. No. 2 was alive, but no trace of larva could be found. The third contained a larva, which was preserved, lest worse befall him. He seemed much as described at last entry. The cavity containing his cocoon was excavated towards the heart of the button, or bud of the plant, several of the small undeveloped leaves (?) being well eaten into. This bud preserved in formalin. When the cocoon was removed, the eaten portion, or rather what was not eaten, formed a small hollow into which, or on to which the cocoon would just fit.

This closed the campaign with the 1904 eggs. It appeared from this that the young larva feeds somewhere in the centre of the plant as an internal feeder, and finally makes a cocoon in the heart of the plant for hibernation. The one cocoon of which I made the most satisfactory examination, consisted of a cavity the greater part of which was excavated out of the material of the outer leaves of the centre bud (winter bulb) and completed by a silken
cover. This renders it certain that some of the central material of the plant is eaten; but for this, my experience in 1905 would have led me to suspect that the young larvae fed on the leaves as those of the summer brood do. The larvae in their first instar on the leaves are often very difficult to see and find, even when one is sure they are there, so that in my ignorance in 1904 I might easily have overlooked them. I am still inclined to suspect that it is possible that in the first instar they feed on the leaves in the same way as the summer brood do, and only descend to the centre of the plant in the second instar. Against this is the fact that the young larvae directed their wanderings to the centre of the plant, and that the centre was found to have afforded a good deal of food material. The note in describing one larva, as to the presence of secondary hairs (October 22nd), and the surmise that it was in third instar, agrees with later observations; it is probable that this larva was endeavouring to complete its cycle without hibernating, and really was in third instar, as second instar larva do not show any secondary hairs. This larva probably perished earlier than the others.

So the matter remained for further investigation in 1905. The larva, like so many of the Platyptiliid division of the Plumes clearly hibernated full-grown in its second instar, and ought to be discoverable in the spring in its further stages. I owe it to Mr. R. South that I was able to visit a locality for the species, and to continue the observations in 1905. Of course I did not quite know what to look for, but, as good luck would have it, the discovery of the larva in the spring proved fairly easy.

1905. May 31st. Accompanied Mr. South to a locality in the Esher district of Surrey, where Drosera is found, and where T. paludum had been taken, and searched for larva of T. paludum and found about a score.

The first specimen was found seated on the under-side of the petiole of a leaf of Drosera. It was nearly full-grown, and was of about the length of the petiole. This will give some idea of the size and state of the plants, which were growing on peaty ground amongst heath and apart from Sphagnum; most of them were very small with the leaves lying flat to the ground, the one above noted being a fine specimen about twice the size of the majority. There had been a drought for a considerable period before this, and the ground was by no means boggy. The small size was
more probably due to drought than to the period of the season. A fine plant would be 35 mm. across only, a majority 25–30, and some only 20, and even less.

The remaining larvæ were found in various positions, some on the petiole, some under and some on top of the leaves, and some sitting across the centre of the little plant. In no case, either in the field or in various observations afterwards at home, did a larva place himself on the top of a sound healthy leaf. They seemed on the whole, however, to be rather reckless in the way they moved about amongst them. Their hairs probably protect them against contact with the leaf-glands unless they actually walk over them. They would eat any part of the plant, least frequently, however, attacking the central bud. The most usual point of attack was the margin of a leaf, approached by the larva seated on the petiole or beneath the leaf, and in several cases the attack was continued till the whole leaf was eaten and a portion of the petiole also. In one or two cases the larva attacked and ate the glandular processes, until it had cleared the middle of a leaf which then formed its resting-place. Twice a larva, looking for a place to pupate, escaped from a flower-pot by crossing the water in the saucer, so that they are probably able to deal with the habitat being flooded without much injury.

The larva is a brownish-red above, varying from rather dark to a bright rosy colour, and sometimes with some greenish shades; beneath, it is green. The dorsal tubercles are darker and more rosy, and retain a bright rose colour when the rest of the larva when fixed for pupation becomes quite green; the colour involves not only the tubercles but a little of the base around them, especially behind. The hairs are long and slightly clubbed or rather flattened at the end, and so the ends reflect light so as to look larger than they actually are. The resulting appearance of the larva is that it looks very much like some aspects of the Drosera leaf; sometimes the hairs, sometimes the red tubercles suggesting the glands and their supports on the Drosera leaves, and the general tone of colour is much that of the green leaf seen through the forest of rosy hairs. In looking for a larva a slightly edgeway view of a leaf often suggests a larva, and a larva is probably easily overlooked by its close assimilation to the plant.

The larva taken were for the most part in their last skins, and their measure was 7 mm., and a large or well-
stretched one 8 mm. long. Several were, however, in the previous skin, and one so small that I took it to be in the antepenultimate. This was clearly erroneous.

The following day, June 1st, several fixed themselves for pupation, one on the under-side of a Drosera leaf, another on a thread of heath-stem.

June 2nd. Several more fixed themselves up.

" 1 pupated this afternoon.
" 3rd. 7 a.m., two are now in pupa.

The rapidity of their finishing feeding is apparently great. The temperature of the last day or two has been about 70°.

June 15th. The last larva has pupated.

" 18th. 1 moth emerged this morning and one in the afternoon.
" 19th. 3 emerged about 10 to 11 a.m.
" 21st. Two more moths emerged yesterday.

These seven moths have all been confined over a pot of food plant as they emerged. Yesterday one was found entangled in a fold of the muslin cover, this is probably the same one that is found dead this morning with one hind-leg missing. Another is found attached by the Drosera gum to a leaf by the tip of one leg. Two eggs are also detected, one beneath a petiole, and the other attached to a gland-stalk at the margin of a leaf.

June 29th. The last moth emerged to-day.

Mr. South notes on July 15th that all four of his paludum pupae emerged. Two paired, and the female was kept alive and laid eggs by the 19th on and around the food plant; it was from some of these ova, as well as from some laid by my own moths, that I was able to rear examples of the summer brood.

He also gives me a note on the emergence of the moth from the pupa, as follows: “July 25th. Watched an imago of paludum emerge about 12 o'clock (noon). When first seen, about half the insect was free from the pupa, which was attached to the side of a tumbler; it then remained perfectly still, except for a slight gliding forward motion which continued for about three minutes, by which time only three segments remained in the pupal case, then all movement ceased for a few seconds, when, with a sudden jerk, the insect shot forward and downward alighting on the glass about two inches from the pupa. All the time it was under observation, the antennae and first pair of legs were free but perfectly still.”
This describes very well the habit of this and some other Plumes I have observed, of resting during emergence, and for a good deal of wing expansion to take place during the process, so that it almost looks as if the wing was extended by the process of drawing it out of the pupa-case.

June 26-28. Eight larvæ hatched from eggs received from Mr. South, and were placed each on a plant of Drosera, on petioles low down, in the belief they wanted to go to the central bud.

June 29th. Four of these larvæ are now easily seen in the centre of a leaf leisurely eating the very short stemmed hairs and glands that occupy that position; one has already cleared a little circle of more than his whole length in diameter. The intestinal contents look dark. One concludes that those eggs are most naturally placed that are on the stem of the glands at the margin of a leaf.

One observes also that the Drosera is infested by an Aplis. This is of interest as bearing on the supposed immunity of the plant from insect attack due to its insectivorous habit. Such immunity would appear to be a fiction.

July 2nd. These larvæ clear the centre of the leaf of the short stems and glands that occur in that position, leaving the longer marginal ones alone; the little larva itself, even when grown a little, is very inconspicuous and difficult to find. With a lens, the cleared central portion of the leaf, with red frass scattered over it, is easily seen; but without a lens, the red frass gives very nearly the same tone to the leaf as the glands do, so that except by very close scrutiny nothing unusual presents itself.

July 2nd. This morning one larva is found to have changed its skin, and appears to be eating the cast skin. The moult occurred near the centre of the leaf, where the feeding was done; the only protection by way of web, tent, or any other shelter, is a few threads spun across the tops of the adjacent glands, making a flimsy and almost invisible cover. The larva has a relatively rather large head, and the hairs are about as long as the larva is thick and look dense and crowded together. The larva is still pale and transparent looking, but the eye-patch is densely black, the dorsal tubercles (not the hairs) are dark, and the dorsum has a pale ruddy tint; the longer hairs are slightly clubbed at their tips.

In the first skin the larva grows a good deal but remains
very colourless or rather transparent, the dark intestinal contents being conspicuous, and the only coloration being a denser white round the bases of the dorsal tubercles.

July 3rd. Two larvae (of the eight that hatched from Mr. South's eggs) that had gone a-missing are now seen to have hidden themselves, and still are, in unopened leaves, amongst the undeveloped glandular hairs, with which their interiors are full. The leaves are now slightly opened and frass is very evident. These larvae, therefore, went into incompletely expanded leaves in order to eat the glands; these were not, however, probably functionally active at this stage. The smallest larva found was just about to moult for the last time but one; its general aspect was precisely that of the larger larvae and the disposition of the primary hairs is identical though they are not so long; there are no secondary hairs, however, to be discovered. The length is 4.5 mm., the longest hairs are about 0.5 mm.

The next smallest larva was about to moult for the last time, its length was about 6.0 mm. The longest hairs about 0.8 mm., and there are a good many secondary hairs, two or three round I and II, one behind III and one above and behind IV and V. These are secondary tubercular hairs not skin hairs, as are also those of the larva in its last skin.

The full-grown larva is 7 to 8 mm. long, of a form much like rhododactylus or zophodactylus, thickest about third or fourth abdominal segment, and tapering to either end, but when at rest or feeding has the forward segments rather contracted, so that it looks thickest about the metathorax, and the mesothorax seems nearly as large; in colour the dorsum is red or reddish-brown or pink, with an underlying green tone, the difference of tint being due rather to the attitude of the larva, and the degree to which it is fed up, rather than to individual variation. The hairs are very long and many of them are clubbed, being somewhat flattened at the tips especially; some are dark with white tips which look club-like. The hairs transmit and reflect the red of the larva and of the hair-glands of the plant, so that the resemblance of the larva, in some aspects, to a leaf is very close; in others a leaf seen edge-wise may be easily mistaken for the larva one is in search of. This is assisted by the lower surface of the larva being green, separated from the upper red surface by a yellow line, sometimes not very conspicuous in tint, but in some
very bright; it occupies the lateral prominence (upper portion of lateral flange) which carries tubercles V and IV. Below this is a second flange-like projection carrying VI (a single hair directed forwards), which is marked off above and below by a rather deep sulcus, and which bends downwards in front, upwards behind. There are two paler dorsal lines just within the dorsal tubercles, rather curved outwards at the middle of each segment; the space between them is a rather greener pink than the rest of the dorsum, due to the dorsal vessel showing somewhat. There are other pale marblings, especially a tendency to a line through I and II. This, however, is much interfered with by the large size of the combined base of these tubercles, almost entitled to be called a hump, which is of a dark dense red that extends a little beyond, especially behind, the lump. This red, which at that stage becomes a brighter pink, persists when the larva is laid up for pupation, when all the rest of the larva has become green. The lateral yellow line is abdominal only, the same region of the thorax is pink. There is a pale (yellow) spot in front of III, and below there is a pink shade in the green (yellow?) under-surface, above, behind, and below VI, which stands out on a yellow eminence, as does also the eminence of the three hairs at base of prolegs. The larva at rest is about 1·1 mm. thick, whilst the dorsal hairs (II) are about 1·6 mm. long, legs nearly colourless, prolegs pale (colourless), tall, slender, with a bulbous end, hooks wanting on outer aspect 7 to 8 in number, 9 on claspers.

With regard to four larvae taken by Mr. South on May 31st he remarks that one was suspended when he found it "head downwards from its anal attachment to a slender twig of heather. Another was on the middle of the crown of its food-plant; neither of them changed its position, but are now pupae in the exact places they occupied as larvae when I came across them. A third larva had pupated on a heather twig, and the fourth had pupated on the flat rim of a fern pan in which I set the food plants. A curious fact in connection with this last larva is that although I had twice removed it from the rim of the pan, it succeeded in getting its own way, and became a pupa on the spot it had fixed upon, and there it now remains."

July 8th. A small larva (very young in second skin) had wandered off in the test tube in which I had put it for observation and was probably hungry. I put him on
the petiole near the base of a vigorous leaf on which the red glands had each a large globule of gum. He walked very deliberately to the base of the leaf (upper side), apparently spinning a web, and also searching carefully from side to side. At length he arrived at the gland hairs which next the petiole are deflexed down it; these he carefully examined on each side of his way even moving quite to the side of his proper track, his method looked as if he contemplated climbing up them. The largest are about three times his length (2 mm.), but actually when he reached as far as he could without removing more than one pair of prolegs from the leaf, he withdrew and continued his march. At length he got nearer the middle of the leaf, and found that his reaching-up process brought him to the glandular top of the hair. This (the red knob and transparent gum) is thicker than, and in bulk nearly one-third that of the larva. I watched him demolish one of these, which he did rather quickly, and make considerable inroads on another. The gum, which is thick and glairy and draws out into threads, was eaten; he got his legs into it, and ate the stuff off his legs and also ate up the portion drawn out between them; he did not, however, appear to completely clean his legs, yet shortly after they were certainly quite clean and the gum was removed; though he worked at one side only, it disappeared also from the other. Possibly the elasticity of the gluey stuff pulled it off, but I was certainly puzzled to know how several legs got quite clean in some mysterious way. He ate up the red knob of a size about equal to his own head. He left the green gland stem. In attacking the second gland, he appeared to get the front of his head into the gum, and drew it out showing the front of his head and his legs to be involved in it. He ate away, however, quite unconcernedly, and though again I saw no definite cleaning process, he was apparently quite clean immediately afterwards. The gum stuck to his head and legs in such a way as to make it difficult to suppose they got clean because it did not stick to them, nor did it appear to be wiped off against the plant. Up to full growth in the second skin the food of the larva seems to be entirely the red glands and their secretion.

July 14th. Visited *T. paludum* in its habitat, and observed three larvae, two laid up for second moult and one for a third.
Moths that were confined over growing *Drosera* with a view to eggs never got caught by the plants, except on one occasion when a moth escaped only by losing a leg caught in the glue; another moth fell on a leaf, where it died, and, being left there, was largely enveloped by the leaf after a few days.

July 16th. The larvæ fed up in confinement have been paler than the captured ones of the first brood, and also than those taken two days ago. These pale larvæ are green, with no red except on the dorsal tubercle as in the ordinary newly changed pupa, and a pupa is without any trace of red whatever. These green larvæ show very well the greenish-yellow subdorsal lines (just dorsal to the tubercles I and II) and also the slightly oblique one below them.

The larvæ when small were given to wandering, if the plant was not strong and healthy enough to surround the red glands with plenty of fluid gum, these glands and the gum being their favourite (and only) food, unlike the winter brood which eats the central portion of the plant. Later the larvæ would eat anything, being fond of the flower-bud and flower-stems, and eating nearly the whole of the leaf. When nearly full-fed, if the plant was a small one and the leaves well demolished, the larvæ would eat portions of the petioles and finish by clearing off the spring leaves and central bud of the plant. One or two young larvæ appear to jerk the frass away, but as a rule the frass remains where excreted. The young larvæ thus leave minute red dots more or less in rows or groups, in some degree replacing the devoured glands in the colour scheme of the leaf. In its later stage a larva would sometimes eat a large quantity without moving; this especially happens when it takes to the middle of the plant and can reach much food without moving, a pile of green-black frass about twice as bulky as the larva accumulating in some instances. All being well with the food plant, the larva has no tendency to move until the time for pupation arrives.

**Egg.**

The egg is laid (in confinement) on the petioles of the glands near the margin of the leaves; this was sufficiently frequent to suggest it as the situation preferred. They were also laid on the
under sides of the leaves, on the petioles and on the dead flower-stalks of the previous year, and even on the peat beside the plant. It is bright yellow at first, becoming afterwards duller in tint. It is oval in any longitudinal section, circular in any transverse one. Its length is 0.38 mm. and its diameter 0.24 mm.

It has very large bold sculpturing consisting of a net-work of ribs enclosing irregular polygons. The ribs are broad, about one-third of the width of the enclosed hexagons (or as may be). The diameter of the cells is about 0.02 mm., of a cell and one wall about 0.026 mm.

**Newly-hatched Larva.**

The newly-hatched larva is fully 1 mm. in length when stretched out. Head, prothorax, and anal plate dark, but not black, hairs and bases dark, the rest white or colourless. Tubercles I and II are distinct from each other but very close together, I very small, hair about one-sixth the length of that of II which is about 0.06 mm. long, both incline backwards. The corresponding hairs on 2nd and 3rd thoracic and 9th and 10th abdominal segments are no less than 0.20, 0.23, 0.40, and 0.20 mm. long respectively, that on 9th abdominal segment being in fact as long as half the length of the larva, when it is not extended. III is about 0.17 mm. long and is directed forwards. IV and V are on distinct bases but very close together, rather more on a level than usual (the contrary, for example, of *Amb. acanthodactyla*), front hair 0.06 mm., posterior 0.18 mm. long. A long way below, about middle of segment, are two hairs, one about 0.17 mm. long and the other below and in front of it about 0.1 mm. VI appears to be absent and these are two of the three hairs of VII. On the prothoracic plate one of the three usual front hairs seems to be absent, and only the long central one of back row is clearly seen. Of the usual four pairs of hairs on meso- and meta-thorax, the third appears to be represented by one hair only.

The props of prolegs are about 0.04 mm. long, with three crotchets, four on claspers.

The larva appears to have 4 instars. In the first it is without tubercle VI, and without skin points. In the second instar it acquires these, and I and II acquire a common chitinous base. There are no secondary hairs. At this stage it hibernates in the autumnal brood.

In the third instar it acquires a small number of secondary tubercular hairs, making the tubercles into warts.

In the fourth instar it differs from the third in the
secondary hairs being more numerous, but there do not appear to be any secondary hairs on the general skin surface, VI remains a solitary hair, and there is no indication of secondary tubercles either on the thorax, or behind the spiracles on the abdomen, I and II form one compound wart, though the two primary hairs are quite distinct. The proleg have 6 and 7 crotchet.

**Description of Larva of *T. paludum* from summer brood.**—July 7th.

*First Instar.*—Rather over 1 mm. long, whitey-green, almost transparent. Head black, thoracic plate dark, as well as scutes of tubercles and anal plate. Each tubercle has a distinct plate, larger than the mere hair base. I and II are on a common base, as are also IV and V, the hairs are black. The thoracic plate has three hairs of same length in front, central of back series very long, other two short. Single hair in front of spiracle. On second and third thoracic segment are the usual four pairs of tubercles on each side, each pair on a single plate and third pair apparently possesses a third hair on the same plate. The head has a very long hair on the centre of each side of the front of the cranium. The long hairs on head and 1st and 2nd thoracic segments about 0.13; hairs II, III, and IV on abdominal segments about 0.1. Points of hairs white and apparently clubbed, towards moult shows some reddish tinting between the tubercles.

*Second Instar.*—2 mm. long; hairs white, arising from black points, more clubbed and proportionately shorter than in first skin. No secondary hairs. The tubercles are on distinct largish plates of a faint cinereous tint, and round them is a whitish shade as of a porcellanous-white thickening of the skin. The rest is a pale brownish-red, forming a dorsal band, a line along the posterior border of each segment giving a branch forwards (and obliquely upwards) between II and III and between III and spiracle. There is however some variation in tint and extent of red marking, either in different specimens or according to different degrees of maturity. The central hair on head is still long. The first and third posterior hairs of thoracic plate are very short compared with the long second one, the outer one of front row is also long. The prothoracic plate is paler, with dark marbling on each side of central suture, and the dark spot between 2nd and 3rd hairs is distinct, rather nearer posterior margin of plate. The perspiracular tubercle has three
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hairs. Anal plate carries six hairs on either side, the spiracles are black but not very large or prominent.

Third Instar.—3·5 mm. long before feeding much; it has now quite the adult "plumage," though the secondary hairs are fewer and much smaller than in last instar. The tubercles are on or rather form almost raised humps. The secondary hairs are four on I and II, two or three of them very small and inconspicuous, one on III, none on IV and V or on VI. These secondary hairs are white and clubbed. The primaries arise from black points, are ochreous, with white clubbed tips. The skin points, wanting in 1st instar, transparent and sparse in 2nd, are now abundant. The tubercular areas are free from them; these areas, which probably correspond to the earlier tinted scutes which are not present now, have a little differentiation of colour and texture to mark them off from the surrounding skin. The larva is still very transparent and flimsy looking. The white under the tubercles seems subcutaneous, as does also the red-brown of the dorsal stripe and of a great part of the rest of the larva. The red is however in marks or marblings, but not in continuous streaks. Two hairs on head and on meso-thorax are long but only little longer than the longer ones on the abdomen. The longer hairs are from 0·35 to 0·4 mm. long, not, some three times as long as others, as in previous instar. The prolegs are long props, slightly bulbed at end and with seven dark crotchets round the inner margin. The six eyespots are very prominent, more than hemispheres. The head is translucent with ochreous marblings. A large black mark under eyespots, but three of them escape it, or seem to do at certain angles and look quite white.

There is a short hair ventrally close to middle line in abdominal segment without prolegs, probably present in other instars though not noted. The last joint of the true legs is markedly long and slender.

These detailed notes on the progress of individual larva were much broken up and rendered of little use by the way in which the larva succeeded in hiding themselves, as well as cases of wandering away to another plant, really getting lost, etc. This occurred with larvæ each on a separate plant. In several cases, I gave up the larva for lost, but it duly reappeared again. These facts apply most to the youngest larvæ, and are the ground for my suspicion that in the autumnal larvæ I may have been wrong in thinking they all fed only in the centre of the plant, though the extrusion of frass there, in one instance observed, could only be compatible with the larva being
ensconced amongst the leaf-buds of the central rosette. These notes refer frequently to the young larvae (1st and 2nd instars) eating especially the glands, the leaves themselves being attacked only by the older ones (3rd and 4th instars). It is also noted that the larvae eat their cast skins. As to one larva it is noted as very green and yellow, with no red except the dorsal tubercles, and that it was on a rather pale plant of Drosera surrounded by plenty of Sphagnum. And the identity of their schemes of colour with that of the plants or leaves they were on, is several times referred to.

**Pupa of T. paludum.**

The larva seeks for pupation a bit of slender upright stem, the ideal position possibly being the dead stem of last year flowers; a slender bit of heath will serve, one of mine pupated on the under-side of a leaf of Drosera, and Mr. South met with one that pupated across the centre of the food-plant. But a bit of dead grass-like stem is what the larva prefers; no fewer than three selected the only piece of this material in one of my tins, and a fourth fixed itself at its base, being crowded off by the previous tenants. Of six in this tin, the two others selected slender stems of heath. The larva will take a horizontal position and does not much mind which side it is up, but appears to prefer one with dorsum upwards. When it obtains its pupal position on a vertical stem, it always fixes itself head downwards.

The change before pupation in the larval colour is very marked, the whole larva becoming green except the hump of I and II, which assumes a conspicuous dark rosy-pink. For some time after pupation the pupa has the same coloration, the pink eminence being very conspicuous and ornamental in the green pupa; gradually however the colours change, the pink fades and the rest of the pupa, remaining green, acquires an overshading of faint ruddy brown, disposed, roughly speaking, in longitudinal bands; in one of these the tubercles I and II still present a slightly darker shade but in only one or two cases at all decidedly so.

The length of the pupa is 6·7 mm. width, thorax 1·3, abdomen 1·2, 1 mm. about 5th abdominal, the ♀ apparently a little shorter and thicker. The thickness is much the same to nearly the end of 5th abdominal segment (and wing cases), whence it (in 2 mm.) tapers regularly to a rather fine point, at least it does as seen sideways, and, seen dorsally the thorax is wider than the following segments and th
tapering of 6th abdominal onwards is by a curved outline with sharper finish in 9th and 10th segments. The head in front is rounded but has two lateral and a double (or two minute) frontal eminences between them. Seen dorsally when the form has been fully acquired, but the pink colour of the dorsal tubercles persists, it is a most beautiful object from the elegance of its outline and delicate but bright colouring. The hairs are of some assistance to the pleasing effect. Before describing the hairs, it may be best to note that there is the usual double dorsal-flange or ridge beginning behind middle of mesothorax with a rounded eminence succeeded by a lower one, then running across metathorax and abdominal segments in line of tubercles and ending with tubercles on 3rd abdominal segment. It is not high and marked as it is in some plume pupae, but is quite definite and distinct, the tubercles on the following abdominal segments (4th, etc.) are in line with it but represented only in the middle of each segment, there being no continuous ridge between them.

The hairs on the mesothorax are, on either side, two in line of the dorsal ridge but in front of it, and about the distance apart that the last one is from the initial hump on the ridge, outside each of these, is again another hair, all equally spaced, so that there are two rows of four hairs across mesothorax in front of anterior end of ridge. The prothorax has a row of six hairs across it, three on either side. One or two of the head (antenna-basal?) hairs come into this same dorsal view. These hairs are all colourless and about 0.7 or 0.8 mm. long (two-thirds thickness of pupa). On the head are, in front above, two hairs on each side and one on each side below, above the labrum. These are 0.3–0.4 mm. long, colourless. On the metathorax are two hairs, one on either side, white, about 0.6 mm. long, porrected and arising at front margin of segment from the ridge. They appear to correspond with the first of the two hairs in the following abdominal segments which have the same appearance, nearly the same length and direction (porrected) but arise further back on the segment. The metathorax has no posterior hair as the other segments have. 1st, 2nd, 3rd, and 4th abdominal segments have each two hairs on either side, apparently I and II, not arising very close together but still on a common eminence which on 1st, 2nd, and 3rd is part of the dorsal ridge, the hairs are at an angle to each other of about 90°, the first directed forward, the latter backwards and increasing the angle by a little curvature, the posterior one is black, quite 0.6 mm. long, whilst the front one is shorter on each segment, up to the 4th abdominal. On the 5th and beyond there is only the posterior one, on to the 9th segment, when it is at posterior margin of segment. It has about the same length (0.6 mm.) on each segment. On these segments is
a little eminence and scar suggesting where the missing I would have been. On the front outer angle of metathorax are two minute black dots. On the first abdominal segment at same place, is a similar dot with a large spiracle-like oval scar behind it and of a dark colour. Otherwise there are no hairs or other structures, except the small ochreous spiracles down to the subspiracular flange, on this are two minute black dots (IV and V) on 3rd to 7th segments, on 8th are at the same places two short (0·3 mm.) hairs. These are repeated on 9, except that the 1st has another just below it. On 10th one similar hair seems distinct from cremaster hairs to which it is very close and equally short but straight. The double dots that occur on 3rd abdominal to 7th are forwards rather close together and behind the spiracle. More ventral on 5th, 6th and 7th abdominal segments, in fact ventral, are on either side two short deflexed hairs (VII) about 0·1 and 0·2 mm. long; on a pale line between these and the subspiracular flange is a small black dot, hardly a hair (VI). A similar trace of III is also to be detected. On the several lines of these, viz. III, IV+V, VI and +VII, there are longitudinal pale lines, that look sometimes like ridges, largely owing however to coloration, but this is just so much raised on the subspiracular (IV and V) one that I have ventured to call it "subsp. flange."

The appendages reach to the middle and even to the posterior margin (in ♂♂!) of 5th abdominal and look attached to them but are free beyond 3rd.

The cremaster consists of two portions, a small one in centre of 9th and a larger one on 10th. The hairs, together with the dorsum of the last two segments, are pinkish about 0·1 mm. long, straight or nearly so with a small knob at one side of the end, as though a hook had soldered itself to the shaft where it had turned round to.

The appendages are transparent green, with rather darker olive shading, beside the wing veins, on antennae, and first leg.

The variation in the colour of the pupa is first in the amount of pink. This tends to fade as the pupa matures, and some pupæ lose it altogether, becoming entirely green. One pupa, on the other hand, has a dorsal, a broad subdorsal (through hump and hair bases), and a lower (along III ?) rose-pink line nearly continuous from end to end of the pupa, and is consequently a handsome, brilliant pupa. The depth of green also varies a little, especially on the
wings and appendages which may be pale and transparent, or a deep solid-looking green. A certain olive-brown tint appears as the pupa matures for emergence, the eyes, wings, etc., becoming black.

One other point in the variability of the pupa has regard to the forward hairs (I) of the abdominal dorsum. The most usual form is perhaps that described with this hair on the first five segments, and wanting in the others; it does not often show any length on 5th segment, and is more frequently wanting on 4th, 3rd, or even 2nd, and presumably may be entirely absent. When absent it is, however, usually represented by more or less of a stump or abbreviated hair, and its site when absent is marked by a basal circle or point. It is unusual, however, as happened in the specimen described for the hairs present to be well developed and the rest to be absent, i.e. merely a basal trace present. It is more usual for there to be one or two intermediate abbreviated hairs, as, for example, 1st and 2nd good hairs, 3rd shortened hair, 4th very short, 5th stump, 6th wanting or some such formula.
EXPLANATION OF PLATE VII.

Fig. 1. Egg magnified \( \times 56 \).
2. Larva 1st Instar \( \times 30 \).
3. ,, 2nd ,, \( \times 20 \).
4. ,, 3rd ,, \( \times 14 \).
5. ,, 4th and last Instar side view, \( \times 8\frac{1}{2} \).
6. ,, ,, semidorsal view, \( \times 8\frac{1}{2} \).
7 and 8. Pupa. Lateral and dorsal views, \( \times 8\frac{1}{2} \).
9. Larva in 2nd Instar in centre of leaf. In the figure the conspicuousness of the larva is much exaggerated. Correctly represented it would hardly be visible. \( \times 4 \).
10. Last stage larva feeding.
11. Portion of leaf as eaten by larva.

In Fig. 2, except a dorsal hair or two, the setae shown are only those of the one side. 1 and II together, III spiracle not shown, IV and V together, VI wanting, two hairs of VII.

In Fig. 3, the tubercles I and II of both sides are shown, VI present, VII hardly visible being beneath, spiracles hardly indicated.

In Figs. 4 and 5, dorsal tubercles of other side, only indicated by a hair or two.

Fig. 9, almost impossible to show satisfactorily.

May 29, 1906.
X. Progressive melanism on the Riviera (Hyères), being further notes on Hastula hyerana, Mill. By T. A. Chapman, M.D.

[Read March 21st, 1906.]

PLATE VIII.

Merely as further notes on the life history of *Hastula hyerana*, Mill., the following facts would hardly have been worth presenting, as an addition to the account of the species I presented in the Entomologist’s Monthly Magazine for 1905. Their value appears to lie in the further light they throw on melanism in the species at Hyères, and raise to something like certainty, what was last year little more than a suggestion, that melanism is a decided feature of the species at Hyères at present, though fifty years ago there was no trace of it. That melanism really exists in the Hyères race of *H. hyerana* is shown by Mr. Powell having reared 10 specimens at Hyères, of which 4 were dark, whilst from 10 larvae collected at the same time which he sent to me in cocoon, and which were kept till emergence in England, only 2 dark specimens appeared, the other 8 being of the pale (typical) form. This seems to show clearly that the dark specimens I reared are naturally melanic, and are in no way artificial results of removal to the English climate. That such removal has no such effect is also proved by the breeding at Reigate of specimens of *H. hyerana*, from larvae collected in Sicily, every one of which was of the typical pale form, with a good deal of variation in dark marking, but with no trace whatever of the melanic form. These Sicilian specimens resembled very much the typical (pale) Hyères form, so much so that, omitting a few of the more marked varieties, they are probably a fair representation of the Hyères examples bred fifty years ago by Milliere. I obtained also some larvae from the Island of Capri; these produced moths of a very pale straw tint, with pale straw-coloured hind wings, possessing only a trace in one or two, of the fuscous tint that is the
(not quite invariable) rule in the Sicilian examples and the pale ones from Hyères.

I suppose I ought to make some effort to explain why _H. hyerana_ should in fifty years have acquired and developed a melanic tendency. The probability seems to be, in reality, that the change has occurred in a considerably shorter time, but this is mere surmise, founded on the belief that _H. hyerana_ has during that interval been collected at Hyères, and that no record, so far as I can find, exists of the melanic form having been observed. As a matter of fact, however, I am aware of no records of such captures at Hyères, but this is not perhaps surprising, as no melanic form occurring, the collector had little to add to Milliere's account and so published nothing. My friend M. I. Bourgeois on one occasion bred one or two pale ones, without making any record of the fact anywhere. We must, nevertheless, stick to the fifty years as the period during which the change has taken place. It is, no doubt, highly probable that a long period might elapse before the effective cause, whatever it was, accumulated sufficient effect to produce one or a few dark specimens; but thereafter the change by which about two-fifths of the race became dark was probably fairly rapid. It will be interesting to know whether a few more years produce any further effect, or merely confirm the present position.

What has produced the melanism? Hyères is doubtless a larger place than it was fifty years ago, and therefore more urban; but that that change has been accompanied by the very slightest appreciable change towards making it a smoky district with natural objects blackened, has only to be mentioned to raise a smile at the absurdity of the idea. I think we may therefore reject any trace of identity in causation, with those cases where, in England, urban increase and manufacturing activity are the basal causes of melanic change. I am not aware that there is the slightest evidence that Hyères is a wetter locality of late years than it used to be. Nevertheless there may be something in the circumstance that the rainy season at Hyères is in the autumn when the moth is on the wing; although this has always been the case no doubt, and is also a climatic feature, more or less, of the whole area of distribution of the moth.

The special fact that seems to me to throw most light on the matter is that _H. hyerana_ has its head-quarters in
South Spain, North Africa, Southern Italy, Sicily, etc., and that Hyères is the extreme northern limit of its range. I pointed out in my previous notes how restricted the habitat of H. hyerana is on the Riviera, and that it is quite absent from many places, apparently suitable to it, as regards food-plant, etc. These places, however, are all of fractionally more northern climate than Hyères, which has the mildest climate of any French station west of Marseilles. This slight difference in climate between Hyères and the Riviera further east is probably the efficient cause of its localization to that one spot. How does this affect the matter? I do not desire to suggest that the northern position is the cause of the melanism, I do not think I should agree with the arguments likely to be adduced in support of such a contention. My suggestion amounts to this, that fifty years ago H. hyerana was a recent immigrant at Hyères, possibly for the first time, more likely it had previously established itself there on several occasions, but the locality being at the northern limit of its distribution, a few adverse, or even one very bad season might suffice to destroy it, and its place would be vacant until the arrival of individuals from some other locality. The new arrival would multiply in the form it had maintained in the locality it came from, until, after a sufficient lapse of time, it was modified to suit Hyères conditions. I suppose then that Milliere found it unmodified, but that now it has a form adapted to Hyères conditions. If the hypothesis of occasional extinction at Hyères be accepted, it might no doubt equally be suggested, that the species has disappeared during the last fifty years and the present form is the result of new arrivals (marginata occurs at Gibraltar), or such arrivals may have produced the change without the original race having disappeared. The objection to this is that it seems to postulate immigration, say, probably about every twenty-five years, whereas, change during the past fifty years postulates it, say, only once in about a hundred years, or more. The mixed melanic race would thus be the one suitable to Hyères, probably owing to the nature of the objects on which the moth would rest. The Capri form being so much paler than the Sicilian, would appear to prove that the dominating influence was not climate but locality. I advance this hypothesis simply because it seems incumbent on me to produce some sort of a rushlight to illuminate the way of further inquiry. The real interest of the case
rests on the possibility that it may assist in elucidating those instances of British melanism that seem outside the main stream, due to darkening of objects by deposited carbon.

In the imaginal state the three races I have (the fourth from Paestum is very close to that from Capri, but being represented by only one specimen does not admit of further discussion) differ materially from each other. The Capri race, of which I have 12 specimens, are very pale, var. pal·lens, of a very light straw colour, and the hind wings with no dark suffusion, are almost to be called white, the black spot very small, about normal in one specimen, and curiously even a little extended in another, which is otherwise one of the whitest. The Sicilian race, of which I have about 170 specimens, is decidedly darker than those from Capri. About 16 or 17 (10 %) are practically indistinguishable, but the majority have the hind wings fuscous and the fore wings a darker straw colour, i.e. with just a trace of orange. The greater part of these are paler than the similar form from Hyères, there is, however, one Hyères specimen (at least) that would mix indistinguishably with them. A further but very small number make a fair approach to what may be called the ordinary or typical Hyères form, which is at once rather redder and greyer than the mass of the Sicilian.

Then there are a certain number that present variation in the black markings, the tendency is rather (as compared with Hyères specimens) to smallness of the black spot, and a few have it absent or represented by an odd scale or so only. These are not necessarily the palest specimens, one with perhaps the least trace of spot (if any) is one of the darker orange specimens. The lighter and least spotted specimens are more numerous amongst the females.

There are only about 6 specimens (4 %) showing extension of the black spot; whilst about 20 % (of the pale form) from Hyères show this variation.

Hardly any show the row of dark points along the inner margin, and a smaller proportion show the dark scaling over the wing that usually takes the form of dots on the outer part of the wing, but several exceed in this respect any I have from Hyères (figs. 7 and 8), with black markings distributed over the whole wing; probably the larger number of specimens present the greater range of variation.
These dark spotted forms bring us to consider a point that did not clearly arise on the Hyères specimens. It may perhaps be best formulated by saying that the species has two directions in which it becomes darker, and these spotted specimens are the extremes I have in the direction of an increase of black scales. The other tendency does not exist apparently in the Italian forms; this is a tendency, not to black scales appearing, but to the yellow scales changing their tint to orange and then to deep purple, not in spots and patches like the black scales appear in, but by gradual change of all the scales, or more usually by the appearance of the purple scales singly scattered amongst the others. In describing my Hyères specimens I stated there were no intermediates between the pale and the dark, at least to this extent, that each specimen was at once referred either to light or dark, without hesitation. This, however, true as it may be, misrepresents the facts. Setting aside the pale Hyères forms, which, though darker on the average, might be matched from amongst the Sicilian forms, there are a considerable proportion of the pale forms that cannot be matched amongst Taormina forms, and, though pale, and though I so regarded them, really belong to the dark purple variety (marginata, Wlsm.). These number 8 out of 26 of my original specimens, 1 out of 8 of 1905 specimens, and 4 out of 14 of the Reigate bred specimens of 1905. These differ from the other pale ones by the presence of some purple scales over the wings (a somewhat indefinite character, that I have rather, therefore, neglected, and which may exist to some extent on those I have classified as pale) but especially (because easily noted) by a narrow line of red or purple scales down the middle of the costal fringe, more marked apically. This line is very distinct in every specimen of var. marginata, except one or two in which the dark disc of the wing almost reaches and absorbs it. I presume the yellow fringe, with this fine line, round the dark wing, suggested the name marginata. I would suggest that the typical point is really this fine line, and would regard it rather than the yellow fringe as the margin, so as to bring into the name marginata those pale forms possessing this line and that belong more truly to the dark than the pale series. It might perhaps be convenient to give these a separate name, say marginula.

The present proportion of marginata + marginula at
Hyères is 65%. No trace of either of these occurs in the Italian races. Nor does Milliere record the slightest trace of them (and he was rather keen on variations) amongst over 50 specimens bred from Hyères fifty years ago. Without subdividing and naming aberrations on the cristana and hastiana system, it may be useful to give names to the principal forms.

The typical form Hyerana, Mill., would be characterized as having lighter or darker straw-coloured upper wings with black discal spot and little or no black scaling, and the disc of the hind wings more or less fuscous. This would include the whole of the species as known to Milliere and the species as a whole as it exists in Sicily. As aberrations of this we should have Millière’s var. a, hyerana, ab. alpha, Mill., with greater or less spreading of the discal spot; hyerana, ab. nigro-punctata, n. ab., with more or less conspicuous black scaling in dots and spots; hyerana, ab. obsolescens, n. ab., with the discal spot reduced to a scale or two or absent.

The very pale race at Capri would be hyerana, var. pallens, n. var., characterized by general lightness of the tint of the upper wings, and especially by the pale hind wings, with no fuscous tinting.

This form may occur as an aberration of the type form, and may present as aberrations ab. alpha and ab. obsolescens.

Then we have var. marginata, Wlsm. This is clearly not a mere aberration of the type form, but is trying to establish itself as a distinct race at Hyères by swamping and ousting the type, which it is very possible it has done at some other locality or period. This has the aberration marginata, n. ab., with the general aspect of a richly or darkly coloured type specimen but possessing the fine red line in the fringe. It may be regarded as an aberration either of hyerana or marginata or as a cross between them. To be an aberration of hyerana, however, its absence from Sicily makes its claims very doubtful.

The habits of the larva of H. hyerana at Taormina differed remarkably from those of the same species at Hyères; so much so, that at first, when the larvæ I found were small, I confess I had some doubts as to their being some other species, unicolorana. perchance (I may here mention that I found no trace of unicolorana at Taormina). The great point of difference in habit was that instead of being numerous on a plant, almost gregarious as at Hyères,
they were almost absolutely solitary, one to a plant. Their position in the plant was amongst the central leaves rather low down, different from that of *T. unicolorana*, which occupies and remains in the tips of the older leaves and is fairly conspicuous in consequence. Very occasionally two larvae were found in a plant, and on one occasion only did I find four larvae in a plant. A marked result of this variation in the habits of the larva is that, whilst at Hyères an affected plant was conspicuous at some distance, and “wrecked” and “destroyed” were words one naturally employed to describe the effect on the foliage and inflorescence of the plant, at Taormina a plant containing a larva differs at first view in no way from one without one, and it is only on closer scrutiny and usually after moving the leaves a little, that one finds some of the central ones to be suspiciously close together as an indication that a larva is present. I am not inclined to think these differences have much to do with accidental differences of season, but that they are the normal habits of the species at the two localities; probably due to the different effect of the local climates on the food-plant. The Taormina asphodel seems to be the *A. microcarpus*, the same as that at Hyères, but the aspect of the plants regarded as vegetables is considerably different. At Hyères most plants were large, vigorous and succulent, two feet or more high (three or four sometimes), with great bundles of thick leaves, affording abundant food for a dozen or more larvae. At Taormina I only saw two or three such plants, growing in favoured damp situations, and on these and others nearly as vigorous I saw no larvae of the Tortrix. The mass of the plants are about fifteen to eighteen inches high with few leaves, and a very small proportion attempt to flower. On one slope on April 8th, when only about a third of the larvae had done feeding, these stunted plants were already dying down from maturity or drought. On the other hand, these stunted plants are often very abundant and tolerably close together.

It was puzzling to understand how a moth could survive who laid her eggs in large batches, and yet only supplied each plant with one larva. It is still rather a puzzle to see how one larva only exists in each plant, but there can be little doubt that as soon as the young larvae are hatched, they exercise an
instinct that gave me trouble enough when I reared them from the egg, viz. a determination to wander away, in spite of all obstacles, getting through the finest crannies, and going too far to be recaptured. I found the most practicable method of preventing their dispersion was to put the vessel containing the eggs in the middle of a vessel of water, on which all the young larvae would be found floating (in a mass usually) and could be put on their food. No doubt at Taormina by this wandering a batch of eggs provided larvae that spread over a whole patch of asphodel, though how one, and one only, stuck to each plant is difficult to guess.

In this way one easily accounts for finding a larva in nearly each plant at one place and none at all at another. This method of dispersion no doubt implies the loss and destruction of a large number of young larvae, but makes no extravagant call on one's faith in the travelling capacities of the young larvae.

Another feature of the larvae at Taormina was the number of alternative food-plants they affected—always, I think, where plenty of asphodel was near, but this may merely have appeared so from my not looking for them much elsewhere. The commonest of these was Phlomis fruticosus, on which the larvae were so frequent and thriving, that I came to regard it as being but little less acceptable to them than the asphodel, and the moths bred therefrom are as fine as those from asphodel, notwithstanding that it was a less satisfactory food with which to supply the larva. There were frequently several on a shrub of Phlomis, but always solitarily, rolling up the leaves and fastening together the opening shoots in very ordinary tortrix manner, and eating down the central stem much as many tortrices do on shrubs and trees. Several larvae were found doing well on Teucrium fruticans, on a very spinous Cytisus (much like the Riviera Calycotome), on an annual spinous woolly Gnaphalium-like composite that did not flower before we left Taormina, and on one species of thistle, and on one only, of several handsome species. This also I did not see in flower, but the leaves were, in texture, so like those of our common Cnicus arvensis, that I tried my homebred larvae with the leaves of that pest of the farmer, and found that they seemed to prefer it almost to lupin. Lupin, by the way, the only alternative food-plant discovered at Hyères, was not found
attacked at Taormina, but then it was not observed except when cultivated.* Two larvae were found on the unopened flower buds of a *Scilla?* (*Scilla sicula*?). As the plant was rarely seen (being inconspicuous till the flowers appear), it probably finds this plant of similar attractiveness to the asphodel.

Most curious of food-plants, I found two larvae amongst those of *Acroelita consequana* collected from *Euphorbia*. At Capri the plants were a little more vigorous and succulent than at Taormina, but equally on open exposed slopes (top of cliffs near the sea), and, though their depredations were a little more visible than at Taormina, they might be described as having substantially the same habits as at Taormina. On April 20th some had already gone off full-fed to make their aestivating cocoons.

On April 15th at Paestum one larva only was found, with traces of perhaps a score of others that had already left full-fed. These larvae also fed singly and cryptically, although the plants here (in the enclosures round the temples) were very large and vigorous, with leaves four feet or so long, and the flowers making a brave show. They were (counting empty domiciles as larvae), however, exceedingly rare, having regard to the luxuriance and abundance of the plant, and in most places no traces of the larva could be found amongst great thickets of the plant.

About Albano, acres of the plant were looked over without seeing a trace of *H. hyerana*; looking to its rarity at Paestum and the difficulty of finding it there, I should hesitate to say that the moth is absent in the Roman district, and even if absent near Albano, it would probably be found to occur nearer the coast. I have, in fact, never met with it as far from the sea as Albano is.

I noted (E. M. M., *l.c.*) having reared certain larvae to spinning up, from eggs laid by moths that emerged from my Hyères stock. These were two or three months in advance of their cousins of the same generation at large at Hyères, and spun up in January and February.

These emerged as moths during July and August 1905, their parents having emerged in the beginning of October. These presented hardly any typical pale forms, and might

* In captivity I tried the larvae with the leaves of two cultivated species; they readily ate the broad fleshy leaflets of a white-flowered one, but refused the narrow curled ones of a kind with blue flowers.
be classified as 19 *marginata*, 4 *marginula*, 10 dark (black, not purple) *hycreana*. Their parents were a pale $\varphi$ and a dark $\delta$ specimen. One or two of the *marginata* are of a very beautiful form, hardly represented amongst the parent brood, with a brilliant wash of gold round the margins of the wings. A number of these specimens were rather small, probably from some sort of starvation.

From a pair of these, both dark, and both very small, I obtained eggs on August 22nd.

It may be noted as regards dates that at the end of August the Sicilian moths were emerging, and on September 1st a pair of these laid some eggs. The Sicilian one I will, however, return to. The Hyères (3rd generation) larvæ spun up chiefly in November. On the 1st March, 1906, on looking at the box they were in I found 7 moths had emerged, all dark, and also all quite spoilt (two dead). I failed to obtain eggs from these. A $\delta$ (dark) emerged on the 4th, a pale $\varphi$ on the 5th, and 2 dark specimens on the 15th. Unlike their parents, these were all of good size. The dark parentage did not therefore prevent a specimen of the type appearing. On March 15th the remaining cocoons contained 9 pupæ and 11 larvae. I suppose this hastening forward, by which a brood occupies under ten months instead of twelve, is due to the warmer climate of my room, especially during the larval period. At Hyères I imagine the larval period is from October to April, about six months, in my boxes it takes about three.

I may note that the eggs laid by a Sicilian moth (all fertile) were counted as 1086.

I made several efforts to observe the duration of the pupa state, and have the following notes on the Sicilian race.

Pupated October 12; emerged November 14 $\delta$

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13
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(temperature 55°-70°; average perhaps 63°)

Pupated December 23; emerged February 2, 1906

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January 4
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12
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12
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13
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February 1
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March 10
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14 pupated between Oct. 11 and 22; emerged Nov. 15, 15, 17, 18, 19, 19, 20, 20, 22, 22, 22, 22, 28 (one missing).
14 pupated between Oct. 22 and Nov. 5; emerged Nov. 30, 30, Dec. 2, 5, 5, 7, 8, 8, 11, 12, 12, 16, 17, 23.
6 pupated Nov. 16–30; emerged Dec. 28, Jan. 1, 2, 2, 2, 5.
5 " Dec. 1–23; " Jan. 9, 10, 15, 17, 21.

It would appear that four to six weeks is therefore the duration of the pupal period.
The prolonged period during which the moths emerged is remarkable, and may be shown by the actual dates of emergence, or by a census of specimens still in larval state at different dates. All spun up within a week or two of the end of April 1905.

The first moths emerged August 26, 2; 27, 1.

<table>
<thead>
<tr>
<th>September</th>
<th>1–16</th>
<th>14</th>
<th>i.e. during</th>
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<tr>
<td>17–30</td>
<td>41</td>
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<td>August 3</td>
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<tr>
<td>October</td>
<td>1–14</td>
<td>30</td>
<td>September 55</td>
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<td>14–31</td>
<td>22</td>
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<td>October 52</td>
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<td>November</td>
<td>1–30</td>
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<td>13–29</td>
<td>2</td>
<td>April 2</td>
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When there still remained one pupa and one active larva.
A census of the asphodel feeders only from Taormina showed:

<table>
<thead>
<tr>
<th>October</th>
<th>11</th>
<th>Emerged 69</th>
<th>Pupae 40</th>
<th>Larvae 56</th>
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<tr>
<td>22</td>
<td></td>
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<td>40</td>
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<tr>
<td>November 15</td>
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<td>December 23</td>
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<td>22</td>
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<td>1</td>
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<tr>
<td>March 20</td>
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The parasites from which *H. hyerana* suffered at Taormina differed entirely from its liability in this respect at Hyères. At Hyères it seemed quite immune, except from the attack of the larva of *Xanthandrus comtus*, a parasite in a broad sense, but not in the sense we usually mean in regard to insects, the larva of the fly hunting that of the
moth and demolishing it when caught, yet except this I
found no larva suffered any attack whatever at Hyères.
At Taormina, however, _X. comites_ was not met with as
attacking _H. hyerana_, though it was not absent from the
locality, being found living on the larvæ of _Acroclita consen-
quana_ in precisely the same way as it does at Hyères on
that of _H. hyerana_.

This immunity from one attack, however, was well
compensated by the attack of two Tachinid flies and of
four Hymenopterous parasites. Mr. Wainwright tells me
the commonest Dipter is _Gymnoparia crassicornis_, ap-
parently a widely-spread and common species. Why does
this fly not attack it at Hyères, since no doubt it occurs
there as over the rest of Europe, attacking as it does
a great variety of the smaller Lepidoptera? A solitary
specimen was also bred of a comparatively large Tachinid
named as a var. of _G. crassicornis_, so large that one can only
just suppose its host to afford it food enough, if it be one
of the largest and fattest specimens.

The commonest Hymenopteron was a _Microgaster_ near
$subcompletus_, Nees., which spun a small white cocoon, each
larva affording one parasite. This is very similar to (identical
with ?) one _Tortrix unicolorana_ at Cannes and Hyères,
where, however, it never touches _hyerana_. A number of
Bracon variegatus were also bred, a species of _Ayathis_ and
a _Pteromalus_ (names kindly supplied by Claude Morley,
Esq.).

We must, I think, explain this remarkable difference in
the parasites by the differences in the habits of the larva of
_H. hyerana_ at the two localities, and not by the presence
or absence of the parasites or by any differences in their
habits.

The moths selected for figuring (figs. 1 and 2) are a pair
of the very pale form from Capri (var. pallens), to which the
specimen from Paestum is very close, and to which a few
odd specimens from Hyères make some approach. Figs.
3 and 4 are a pair selected from the Taormina specimens as
fairly representing the mass of that race. It may also be
taken as practically indistinguishable from the typical pale
race at Hyères. Figs. 5 and 6 are a pair of the dark
(melanic) form from Hyères (_maryinata_, Wls.) (bred 1904).
Figs. 7 and 8 are two forms of a variety occurring
amongst the Taormina specimens. Whilst they are the
nearest approach to a dark form that that race afforded, it
may be noted that nothing closely approaching them occurred amongst the Hyères race (ab. nigro-punctata). Figs. 9 and 10 are two varieties from Taormina, similar specimens were present in the Hyères specimens; 9 is probably Milliere’s, ab. alpha; 10, a less extreme form of ab. nigro-punctata than 7 and 8. In both the Taormina and Hyères races a good many varieties in the extension of the spot occurred, several having more or less of an additional dark line above the one present in fig. 9. In other specimens, not otherwise especially pale, the spot tends to obsolescence, but almost invariably there remains at least one dark scale at this spot. I believe I have one specimen in which it is absolutely wanting on one side, but this is so rare that one does not like to be certain that the last single scale was not removed by some accident. Fig. 11 is an exceedingly rosy specimen from Hyères.

It is a very marked form of ab. marginula, to which also belong figs. 12 and 13, bred at Reigate (1905) from the egg. Fig 14, another of the same brood, is rather var. marginata, but is remarkable for its richness of colouring, and especially the golden suffusion round the margins of the wings. Figs. 12, 13 and 14 show the alliance of ab. marginula with var. marginata rather than with type hyerana.

Thirty specimens bred from eggs laid at Reigate by Taormina moths, varied less than those bred from larvae collected at Taormina.

As regards the long period of emergence, may be noted a Hyères specimen that emerged June 4 from a larva collected only two months before, viz. in April 1906. I have met with no other example so precocious.

The whole of the specimens of *Hastula hyerana* referred to in this paper, have been added to the Walsingham collection of Micro-Lepidoptera in the Natural History Museum.
Figs. 1, 2. *Hastula hyerana*, var. *pallens* (Capri).

3, 4. ,, ,, (Taormina).

5, 6. ,, ,, var. *marginata* (Hyères).

7, 8. ,, ,, ab. *nigro-punctata* (Taormina).


10. ,, ,, approaching *nigro-punctata* (Taormina).

11. ,, ,, ab. *marginula* (Hyères).

12, 13, 14. ,, ,, ,, ,, (Hyères race, bred from ova at Reigate).
XI. *On the Genus Imma*, Walk. (=Tortricomorpha, Feld.)
By E. Meyrick, B.A., F.R.S.

[Read May 2nd, 1906.]

The interesting genus, which is the subject of the present paper, has been the object of so much misapprehension and redescription, that it seemed worth while to clear up the generic synonymy, give a classified list of the described species, and describe the additional material which I possess, so as to bring the whole up to date. This I have done to the best of my knowledge, but authors have found the species so puzzling, and have referred them to such unexpected quarters, that I can hardly hope not to have overlooked some. I should be glad to be informed of any omitted. The authorities of the British Museum have also submitted to me their unworked material, containing many interesting forms.

The true location of the genus is unquestionably amongst the *Plutellidae*. There is a group of this family in which the cilia of the hind-wings are commonly (though not invariably) relatively shorter in proportion to the breadth of the hind-wings than in any other *Tineina*, and the antennæ are also short; and it is to this group that *Imma* belongs. The group is more especially characteristic of the Indo-Malayan region, but *Brachodes (Atychia)* and *Simaethis* are familiar European exponents. Recent writers have usually admitted the genus to belong to the *Tineina*, but have referred it to the *Gelechiidae* or *Xyloryctidae*, from both of which it is immediately separated by the posterior tibiae being smooth above, whilst in those families they are clothed with long hairs; moreover, as explained below, the forms with veins 7 and 8 of the fore-wings separate are generically inseparable from those with 7 and 8 stalked, and the former would be wholly inadmissible into either of these families as now understood. Further the labial palpi are quite different from the slender acute sickle-shaped type which is characteristic of those families and...
the Ecophoridae. I am not acquainted with any larva of the genus, but have received the cocoon of *L. mackwoodii* from Ceylon, and it is surrounded by an open network, as in *Plutella* itself and some other genera of the family.

Together with *Imma* I have described two curious new genera, which, whilst possessing peculiar types of neuration, are more allied to *Imma* than to anything else known at present.

The mutual affinities of the individual species are extremely puzzling; when closely compared no two are alike in structure, and species which resemble one another in one apparently important structural point usually differ in several others, so that it is hard to know on which to rely. Hence I can only offer a tentative arrangement of the species, which may be modified by subsequent further knowledge.

**Imma, Walk.**

*Imma*, Walk., xvi, 195 (1858) . . . type *rugosalis*.

*Pingraea*, Walk., xvi, 226 (1858) . . . " *accuralis*.


*Moca*, Walk., xxvii, 102 (1863) . . . . " *velutina*.

*Topaza*, Walk., xxix, 808 (1864) . . . . " *alienella*.

*Vinzea*, Walk., xxxiv, 1260 (1865) . . . . " *inaptales*.

*Jobula*, Walk., xxxv, 1888 (1866) . . . . " *semilinea*.


*Bursadella*, Snell., Mid. Sum. 83 (1880) . . . . " *dichroalis*.


*Devendra*, Moore, Lep. Ceyl. iii, 520 (1886) . . . " *mackwoodi*.

*Collartona*, Hamps., Moths Ind. i, 233 (1892) . . . " *purpurascens*.


*Hyperperissa*, Wals., Swinh., Cat. ii, 546 (1900) . . . " *aurantiacia*.


Head with loosely appressed hairs, sometimes brushed upwards between antennae or erect on crown in ♂; ocelli small or absent; tongue developed. Antennae $\frac{1}{2}-\frac{3}{4}$, in ♂ moderately ciliated, seldom fasciculate-ciliated or bipectinated, basal joint thickened or tufted with scales, sometimes very elongate in ♂. Labial palpi moderately long, curved, ascending, basal joint sometimes elongate, second joint
thickened with dense scales, in \( \sigma \) often laterally excurred, sometimes long-haired above, terminal joint seldom more than half second, pointed or obtuse, in \( \sigma \) sometimes shorter or minute or aborted. Maxillary palpi obsolete. Thorax in \( \sigma \) sometimes with lateral hairpencils from beneath fore-wings. Abdomen in \( \sigma \) sometimes with lateral tufts or hairpencils. Middle and posterior tibiae with appressed scales above, sometimes in \( \sigma \) with dense brushes of hairs beneath. Fore-wings elongate, more or less dilated; 1\( \frac{1}{2} \) furcate, 2 from near angle, 7 and 8 separate or stalked, 7 to termen, 8 usually to termen, sometimes to apex or costa, rarely absent (coincident with 7), 9-11 tolerably equidistant, no secondary cell. Hind-wings 1-1\( \frac{1}{2} \), trapezoidal-ovate, cilia \( \frac{1}{4} - \frac{1}{3} \); 2-5 remote and tolerably parallel, 6 and 7 stalked or seldom 6 absent (coincident), 8 connected with cell in middle; in \( \sigma \) sometimes with subdorsal groove or prominent tornal lobe.

Notwithstanding the variability of accessory characters, the constant structure of the palpi and neuration is so marked and distinct that no genus is easier of recognition. The nearest allied genera (apart from *Palamernis*, described hereafter) are *Simaethis* on the one hand, and *Phyodes* and *Brachodes* (*Atychia*) on the other. In distribution *Imma* is essentially tropical, probably Indo-Malayan in origin, since the large majority of species are natives of that region, but with indigenous representatives in Africa, Australia, and Central America.

In classing together as congeneric those forms which have veins 7 and 8 of the fore-wings separate, and those which have them stalked, I have relied upon the analogy of other genera of the *Plutellidae*; in many of the principal genera of this family (*Olyphipteryx*, *Hilarographa*, *Pray*, *Argyresthia*, *Pyrozela*, *Mieza*, *Lectura*, etc.) these veins are found both separate and stalked, whilst the species show no other important structural or superficial distinction; the maintenance of pairs of allied genera in all these cases would in my opinion be artificial and unscientific. I should lay it down as a principle that in the *Plutellidae* the stalking or separation of these particular veins is insufficient for the discrimination of genera unless supported by other characters. It is interesting to compare this state of things in the more primitive *Plutellidae* with that found in the more specialized families of *Gelechiidae* and *Ectophoridæ*, where these two veins are invariably stalked or coincident, without exception.


_Fiji._


*Imma rugosalis*, Walk., xvi, 195.

♂. Abdomen with long lateral hairpencils from base (apparently). Tibiae with dense brushes of rough scales beneath. Fore-wings elongate-triangular, termen oblique, prominent above middle; 7 and 8 stalked, 8 to termen; fuscous, with darker discal dot at \( \frac{2}{3} \). Hind-wings darker fuscous.

_Ceylon._ The above notes were made from the type, which is the only specimen I know of; the form of fore-wings is peculiar, quite different from any other species.


*Pingrasa accuralis*, Walk., xvi, 227.

♀. 20 mm. Head, thorax and abdomen light ochreous-fuscous, abdomen beneath and face ochreous-whitish. Palpi ochreous-whitish, fuscous-tinged, terminal joint short, light fuscous. Fore-wings elongate, posteriorly dilated, costa slightly arched, apex rounded, termen rounded, hardly oblique; 7 and 8 stalked, 8 to termen; ochreous-fuscous; a suffused darker discal dot or mark at \( \frac{2}{3} \); a small ochreous-whitish oblique costal mark before apex; a dark fuscous terminal line; cilia fuscous. Hind-wings dark fuscous, lighter towards base; cilia fuscous.

_Ceylon._ It is possible that this may be the other sex of *rugosalis*, but the differences are considerable. Walker's type, described as a male, is really a female, and I possess another specimen; his "perforations" are simply pin-holes.


_Amboina._ I have not seen this species.
the Genus Imma.

5. *I. mylias*, n. sp.

♀♂. 20–22 mm. Head and thorax light greyish-ochreous or pale whitish-fuscous, patagia sometimes finely edged with yellowish. Palpi whitish-yellowish, second joint externally light grey except towards base, terminal joint short, grey. Antennae fuscous, beneath pale ochreous. Abdomen light fuscous, beneath whitish. Posterior tibiae in ♀ beneath with broad brush of long whitish hairs. Fore-wings elongate, posteriorly dilated, costa gently arched, somewhat bent beyond middle, apex obtuse, termen slightly rounded, somewhat oblique; 7 and 8 stalked, 8 to termen; light fuscous with a faint purplish tinge, densely strewn with pale ochreous-yellowish hair-scales; obscure ochreous-yellowish short oblique streaks from costa at middle and $\frac{3}{4}$, first seldom continued as a faint zig-zag line to $\frac{3}{4}$ of dorsum; a round dark fuscous discal dot at $\frac{5}{7}$, above which is sometimes a second indistinct dot, and a line of dark scales edging costal streak; a fine ochreous-yellowish line round apex and termen, edged on apex and upper part of termen by a fine blackish marginal line, and on lower part of termen by dark fuscous dots; cilia light fuscous, extreme tips whitish. Hind-wings fuscous, becoming dark fuscous posteriorly; cilia fuscous-whitish, with fuscous basal line.

CEYLON (Puttalam, Haputala, Peradeniya, Matale); seven specimens (*Pole, Green*).


♀. 19–20 mm. Head and thorax ochreous-yellow, thorax with two oblique fuscous bars approximated posteriorly. Palpi whitish-yellowish, terminal joint short. Antennae whitish-ochreous. Abdomen grey, beneath whitish. Fore-wings elongate, posteriorly dilated, costa gently arched, somewhat bent beyond middle, apex rounded-obtuse, termen rounded, little oblique; 7 and 8 stalked, 8 to termen; deep ochreous-yellow; longitudinal suffused fuscous streaks above and below middle from near base to near middle; a narrow slightly curved fuscous fascia, anteriorly edged with dark leaden-metallic, from beyond middle of costa to $\frac{3}{4}$ of dorsum, posteriorly with median and supratauronal projecting branches not reaching termen; a waved fuscous terminal line, somewhat dilated towards apex (cilia imperfect). Hind-wings rather dark grey; cilia grey.

SINGAPORE; two specimens in British Museum (*Ridley*).


**NEW GUINEA, CELEBES, JAVA, SINGAPORE**; and I have a specimen reputed to be African, but perhaps by error.


**BISMARCK IS., QUEENSLAND.** Lower’s description is incomplete, but I possess specimens from his locality which agree fully with Pagenstecher’s description. The middle and posterior tibiae of ♂ have very large brushes of hairs beneath, as in the preceding species.


♂ 24 mm. Head fuscous, face ochreous-white, hairs brushed upwards between antennae. Palpi fuscous, second joint whitish internally and on a lateral streak, terminal joint short, acute. Antennae fuscous. Thorax rather dark fuscous, posterior extremity whitish. Abdomen dark grey, beneath ochreous-white. Fore-wings elongate, posteriorly dilated, costa gently arched, apex very flatly rounded, termen rounded, somewhat oblique; 7 and 8 stalked, 8 to termen; rather dark fuscous, faintly purplish-tinged, costa somewhat darker; three short slender oblique wedge-shaped ochreous-whitish marks on costa before middle, before ♀, and before apex; cilia fuscous. Hind-wings dark grey; cilia grey.

**S. INDIA** (Wainad). One specimen in British Museum.


**CELEBES.** Not known to me.
the Genus Imma.

11. I. acosma, Turn.


**South-east Australia.**


♂ ♀. 25–28 mm. Head and thorax fuscous, face whitish-ochreous. Palpi fuscous, second joint whitish-ochreous above and internally, terminal joint short. Antennae dark fuscous, basal joint with tuft of scales anteriorly. Abdomen fuscous, in ♂ ochreous-whitish on two apical segments and beneath, in ♀ whitish-ochreous beneath, in ♂ with very large exsertible whitish genital tuft, grey on basal half. Fore-wings elongate, posteriorly dilated, costa gently arched, apex rounded, termen rounded, somewhat oblique; 7 and 8 stalked, 8 to termen; fuscous, faintly purplish-tinged; an indistinct dark fuscous discal dot at \( \frac{3}{2} \); in ♀ a narrow terminal fascia of dark fuscous suffusion, in ♂ linear and nearly obsolete; cilia fuscous. Hind-wings in ♂ with shallow submedian groove, furnished with some long hairs; rather dark fuscous, in ♀ becoming more blackish-fuscous posteriorly; cilia fuscous.

**New Guinea, Halmahera;** nine specimens, and nine others in British Museum.

13. _I. marileulis_, n. sp.

♂ ♀. 24–25 mm. Head, palpi, antennae, thorax, and abdomen fuscous, abdomen beneath whitish-ochreous, in ♂ rough-haired above on basal half; terminal joint of palpi very short; basal joint of antennae tufted. Fore-wings elongate, dilated, costa gently arched, apex rounded-obtuse, termen slightly rounded, little oblique; 7 and 8 stalked, 8 to termen; rather dark fuscous, slightly purplish-tinged; a small cloudy dark fuscous discal spot at \( \frac{3}{2} \); cilia fuscous. Hind-wings dark fuscous; cilia fuscous.

**Queensland** (Duaringa); two specimens (Swinhoe). Also two specimens in British Museum, said to be from South Australia.

14. _I. leiochroa_, Low.


**Queensland.** Not known to me.
15. *I. psithyristas*, n. sp.

♀. 23–24 mm. Head, antennæ, and thorax ochreous-fuscous basal joint of antennæ tufted anteriorly. Palpi greyish-ochreous, second joint much expanded with scales, terminal joint very short. Abdomen fuscous. Fore-wings elongate, rather broad, posteriorly dilated, costa gently arched, apex rounded, termen slightly rounded, little oblique; 7 and 8 stalked, 8 to apex; rather dark purplish-fuscous, strewn throughout with fine pale ochreous-fuscous strigule; a dark fuscous discal dot at ½; cilia fuscous. Hind-wings rather dark fuscous; cilia fuscous.

**Solomon Islands** (Choiseul); two specimens (*Meek*).


♂. 17–20 mm. Head, palpi, antennæ, thorax, and abdomen rather dark fuscous; palpi with second joint long, excurved, ochreous-whitish internally, terminal joint aborted or concealed. Fore-wings elongate, posteriorly dilated, costa posteriorly slightly arched, apex rounded, termen rounded, slightly oblique; 7 and 8 stalked, 8 to termen; light ochreous-fuscous, suffusedly strigulated throughout with dark fuscous; small obscure whitish-ochreous spots on costa beyond middle and before apex; an ochreous-whitish discal dot at ½, followed by a dark fuscous dot; cilia fuscous, with dark subbasal shade, and basal series of minute ochreous-whitish dots. Hind-wings rather dark grey; cilia grey, with darker subbasal shade and fine pale basal line.

**Ceylon** (Peradeniya, Madulsima); two specimens (*Green, Vaughan*).

17. *I. cyclostoma*, n. sp.

♂ ♀. 21–22 mm. Head pale fuscous, face in ♀ whitish-ochreous, with a circular central space surrounded by a shining pale grey ring. Palpi pale ochreous-yellowish, anteriorly fuscous externally, and in ♀ fringed with somewhat rough scales internally, terminal joint in ♀ imperceptible, in ♀ very short. Antennæ dark fuscous, yellowish beneath. Thorax fuscous, with a few yellowish scales. Abdomen fuscous, in ♀ with rough lateral hairs brushed upwards to dorsum, beneath ochreous-whitish. Fore-wings elongate, posteriorly dilated, costa slightly arched, apex rounded, termen rounded, little oblique; 7 and 8 stalked, 8 to termen; rather dark fuscous, more or less sprinkled finely with pale ochreous, which sometimes forms a broad
the Genus Imma.

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posterior discal suffusion; a line of pale ochreous scales along sub-
median fold towards base; a faintly indicated irregular line of
similar scales from middle of costa to \( \frac{2}{3} \) of dorsum; an obscure
dark fuscous discal dot at \( \frac{2}{3} \); a more or less defined pale whitish-
ochreous apical mark, and terminal row of minute sometimes con-
ected crescentic dots; cilia fuscous, with dark fuscous basal line.
Hind-wings dark fuscous, somewhat lighter towards base; cilia
whitish-fuscous, with dark fuscous basal line.

Assam (Khasi Hills), Tenasserim (Tandong); four
specimens.

18. *I. metriodoxa*, n. sp.

♀. 22 mm. Head fuscous mixed with whitish-ochreous, lower part
of face whitish-ochreous. Palpi fuscous, second joint above and
internally whitish-ochreous, terminal joint short. Antennae fuscous.
Thorax fuscous sprinkled with whitish-ochreous. Abdomen light
fuscous, beneath whitish-ochreous. Fore-wings elongate, posteriorly
dilated, costa gently arched, apex rounded, termen rounded, some-
what oblique; 7 and 8 stalked, 8 to termen; fuscous, finely sprinkled
with ochreous-whitish; a small indistinct ochreous-whitish spot on
costa before middle; a moderate dark fuscous discal dot at \( \frac{2}{3} \); a
slender ochreous-whitish oblique streak from costa at \( \frac{2}{3} \), angulated
above middle and thence proceeding as a faint sinuate line to tornus;
an ochreous-whitish almost apical dot; an irregular terminal line of
dark fuscous suffusion; cilia fuscous, extreme base ochreous-
whitish. Hind-wings fuscous; a suffused submedian streak paler
and ochreous-tinged; cilia fuscous, toward tornus with tips whitish.

Sumbawa: one specimen.


Hist. Soc. 1905, 611.

Ceylon. Also in British Museum, from Borneo.

20. *I. lysidesma*, n. sp.

♂♀. 25–28 mm. Head pale ochreous, hairs in ♀ brushed up-
wards between antennae. Palpi whitish-ochreous, in ♀ externally
brownish-tinged, terminal joint short. Antennae fuscous, in ♀
bidentate with acute triangular processes. Thorax fuscous, posterior
extremity ochreous-whitish. Abdomen dark fuscous, beneath
whitish-ochreous. Fore-wings elongate, posteriorly dilated, costa gently arched, apex rounded, termen rounded, little oblique; 7 and 8 stalked, 8 to termen; in ♂ dark fuscous, in ♀ somewhat lighter ochreous-fuscous; a slender irregular whitish-ochreous line running from a narrow spot on middle of costa to near dorsum at ⅔, interrupted above middle, variable in development and sometimes nearly altogether obsolete; cilia fuscous, darker towards base, tips in ♀ whitish. Hind-wings dark fuscous; cilia as in fore-wings.

ASSAM (Khasi Hills); five specimens. Also one from Perak in British Museum.


♂ ♀. 20–21 mm. Head pale ochreous, tinged with fuscous on crown. Palpi pale yellow-ochreous, anteriorly infuscated, terminal joint short. Antennae, thorax, and abdomen fuscous; thorax in ♂ with very long whitish-ochreous lateral hairpencil beneath wings. Fore-wings elongate, posteriorly dilated, costa gently arched, apex rounded-obtuse, termen somewhat rounded, hardly oblique; 7 and 8 stalked, 8 to termen; rather dark fuscous, slightly purplish-tinged; a hardly darker cloudy discal dot at ⅔; a whitish-ochreous triangular dot on costa beyond middle; a whitish-ochreous streak from costa before apex to termen above tornus, triangularly dilated towards costa, confluent at extremities with a toothed whitish-ochreous line along termen; cilia fuscous. Hind-wings and cilia fuscous.

AMBOINA; two specimens. I describe this species, as no description has ever been published.

22. *I. priozona*, n. sp.

♂. 19 mm. Head whitish-ochreous, crown and a frontal tuft of scales mixed with fuscous. Palpi whitish-ochreous, second joint anteriorly fuscous-tinged and with a dark fuscous streak above externally, terminal joint short, fuscous. Antennae dark fuscous, basal joint somewhat tufted anteriorly. Thorax fuscous, with ochreous-whitish posterior spot. Abdomen rather dark fuscous, beneath whitish-ochreous. Fore-wings elongate, posteriorly dilated, costa slightly arched, bent about ⅔, apex rounded-obtuse, termen nearly straight, little oblique; 7 and 8 stalked, 8 to termen; rather dark fuscous, faintly purplish-tinged; a whitish-ochreous basal dot; a slender irregular whitish-ochreous fascia from before middle of costa
the Genus Imma.

23. *I. aulonias*, n. sp.

♀. 18 mm. Head pale fuscous. Palpi fuscous-whitish, second joint short, much expanded with scales, fuscous anteriorly towards apex, terminal joint very short, anteriorly fuscous. Antennae fuscous. Thorax and abdomen fuscous, beneath whitish. Fore-wings elongate, posteriorly dilated, costa gently arched, apex rounded, termen somewhat rounded, little oblique; 7 and 8 stalked, 8 to apex; ochreous-fuscous, finely sprinkled with dark fuscous; basal third of dorsum suffused with dark fuscous; a straight slender irregular-edged whitish streak from middle of costa to \( \frac{2}{3} \) of dorsum; a dark fuscous dot in disc at \( \frac{1}{2} \); an ochreous whitish dot on costa at \( \frac{2}{3} \); a slender twice sinuate ochreous whitish line from costa near apex to tornus; cilia pale whitish-ochreous with two fuscous shades. Hind-wings dark fuscous, somewhat lighter towards base; cilia fuscous, with darker basal line.

**Solomon Islands** (Rendova): one specimen (*Meek*).


*Vinzela inaptalis*, Walk., xxxiv, 1261.

**Borneo, Perak.**


**Celebes, Sangir, Buru, Bismarck Islands.**


♂. 26 mm. Head and thorax light fuscous, face whitish-ochreous, thorax with lateral pencil of long ochreous-whitish hairs from beneath fore-wings. Palpi yellow-ochreous, second joint anteriorly fuscous, terminal joint short, pale fuscous. Antennae fuscous. Abdomen fuscous, beneath whitish-ochreous, beyond middle with two
tufts of hairs on each side brushed upwards to dorsum. Fore-wings elongate, posteriorly dilated, costa hardly arched, sinuate before middle, apex rounded-obtuse, termen somewhat rounded, little oblique; 7 and 8 stalked, 8 to termen; fuscous, slightly ochreous-tinged; a whitish-ochreous somewhat irregular line from middle of costa to 2 of dorsum, faintly bent in disc; a whitish-ochreous waved line from costa before apex to termen above tornus, dilated on costa; cilia fuscous. Hind-wings with median and submedian grooves; dark fuscous, lighter towards base; cilia fuscous.

SULU: one specimen in British Museum. This species is closely allied and very similar to bilineella, but structurally distinct by the possession of the lateral tufts of abdomen, and differs slightly in other details.

27. I. porpanthes, n. sp.

♂. 24 mm. Head whitish-ochreous, crown suffused with dark fuscous. Palpi ochreous-yellowish, second joint externally with a fuscous streak on upper half, terminal joint half second, dark fuscous. Antennae dark fuscous, basal joint long, thickened with scales anteriorly. Thorax and abdomen dark fuscous, beneath ochreous-whitish. Fore-wings elongate, posteriorly dilated, costa gently arched, apex rounded-obtuse, termen somewhat rounded, slightly oblique; 7 and 8 stalked, 8 to termen; rather dark fuscous, tinged anteriorly with purplish, posteriorly with ochreous; markings pale ochreous-yellowish; a small irregular basal spot, and three others in a subbasal transverse series; a narrow irregular fascia from 2 of costa to near dorsum beyond middle, interrupted in middle; a triangular spot on costa at 4; a small round spot near termen beneath apex, and a transverse spot near termen below middle; cilia fuscous. Hind-wings and cilia dark fuscous.

PERAK: one specimen in British Museum (Doherty).

28. I. thyriditis, n. sp.

the Genus Imma.

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gate, grey, whitish-yellowish on sides and beneath, in ♀ dark grey, ochreous-whitish beneath. Posterior tibia hairy beneath on basal half. Fore-wings elongate, posteriorly dilated, costa gently arched, apex rounded-obtuse, termen slightly rounded, nearly vertical; 7 and 8 stalked, 8 to termen; in ♀ ochreous-fuscos, more or less wholly suffused with ochreous-yellow, especially on veins and in cell, in ♀ darker fuscos; a dark fuscos streak along basal fourth of dorsum; a slender irregular pale yellowish fascia from before middle of costa to $\frac{2}{3}$ of dorsum, edged anteriorly with a few dark fuscos scales, in ♀ darker fuscos; a pale yellowish streak along basal fourth of dorsum; an indistinct darker discal dot at $\frac{2}{3}$; a small pale yellowish spot on costa at $\frac{2}{3}$, whence proceeds an undefined pale line or series of marks to tornus, in ♀ nearly obsolete; costal edge in ♀ blackish between this spot and the next; a small pale yellow triangular spot on costa towards apex, whence proceeds a pale yellow submarginal line to termen above tornus, edged posteriorly with blackish-fuscos; cilia pale fuscos, beneath apex with a pale yellowish patch. Hind-wings in ♀ with slight submedian and subdorsal grooves; dark fuscos, basal $\frac{2}{3}$ almost naked, transparent, with dark fuscos veins; cilia fuscos, towards base dark fuscos, tips whitish.

SOLOMON ISLANDS (Choiseul, Gizo, Rendova): six specimens (Meek).

29. *I. dioptrias*, n. sp.

♀. 18 mm. Head fuscos, sides of crown yellowish, face yellow-whitish. Palpi yellowish, second joint externally with a dark fuscos streak on upper half, terminal joint short, fuscos. Antennae dark fuscos, basal joint with apical anterior scale-tooth. Thorax purplish-fuscos, with a few yellowish hairscales. Abdomen dark purplish-fuscos, beneath yellow-whitish. Fore-wings elongate, narrowed towards base, posteriorly dilated, costa posteriorly gently arched, apex rounded, termen somewhat rounded, little oblique; 7 and 8 stalked, 8 to apex; dark fuscos, basal $\frac{2}{3}$ suffused with violet-blue; short yellowish subcostal and median streaks from base, connected at base, merged posteriorly in a broad transverse band of tawny-ochreous suffusion, limited by a narrow yellow fascia from before middle of costa to near middle of dorsum, not quite reaching it; a triangular pale yellow spot on costa just before apex, and a series of faint yellowish dots before termen; cilia fuscos. Hind-wings transparent, with dark fuscos veins; a broad costal and narrower irregular terminal band dark fuscos; cilia fuscos.

NEW GUINEA (Aroa River); one specimen (Meek).
30. *I. cælestis*, n. sp.

♂ ♀. 36–38 mm. Head orange, crown mixed with blackish. Palpi orange, second joint with a short black apical streak in front, terminal joint very short, black. Antennæ blackish. Thorax orange, with three broad undefined stripes of purple-blackish suffusion. Abdomen orange, with dorsal, lateral and sublateral series of purple-blackish spots. Fore-wings elongate, hardly dilated, costa gently arched, apex rounded, termen rounded, somewhat oblique; 7 and 8 stalked, 8 to costa; purple-blackish; costal edge ochreous-whitish except towards extremities; an irregular orange basal spot not reaching margins, connected by an irregular mark with dorsum near base; veins more or less marked by whitish-yellowish lines edged with a pale bluish tinge, not reaching margins, broadest on ¹ and lower and posterior margins of cell, partially or quite obsolete on veins 2, 5, 6, and 9; a similar dorsal streak from ½ to beyond middle; cilia white, basal third blackish, apical third light grey. Hind-wings blackish-fuscous, lighter towards base; a pale orange median dash from base; an orange subdorsal streak, not quite reaching termen; cilia white, basal third dark fuscous.

W. China (Kia-ting-fu); two specimens in British Museum, from Mr. Leech's collection.


*Hypsa saturata*, Walk., pl. xxxi, 217.

Java. Not known to me, but I am indebted to Sir George Hampson for the following comparative notes, in relation to the preceding species, to which it is closely allied: “quite distinct from *cælestis*, larger, cilia of both wings black; hind-wings without the pale streaks, with a bluish-white discoidal striga and triangular spots in interspaces of terminal area.”

32. *I. acroptila*, n. sp.

♂ ♀. 16–17 mm. Head whitish-ochreous, in ♀ on crown with very long erect spreading ochreous-whitish hairs mixed with fuscous. Palpi ochreous-yellowish, anteriorly fuscous, second joint in ♀ thickened, terminal joint in ♀ half second, in ♀ represented by a long curved expansible pencil of grey and yellowish hairs, concealing actual joint. Antennæ yellowish, basal joint elongate, in ♀ above
with apical scale-tuft. Thorax dark fuscous, a dorsal line and posterior extremity orange. Abdomen dark fuscous, beneath ochreous-whitish. Fore-wings elongate, posteriorly dilated, costa moderately arched, apex rounded, termen rounded, little oblique; 7 and 8 stalked, 8 to costa; dark fuscous, mixed with glossy purplish-slaty on veins, in ♀ mixed with ochreous between veins; a short orange dash from base, and a slender streak beneath costa towards base; several small scattered orange spots and streaks in disc; in ♀ an obscure submarginal orange-ochreous line from ⅔ of costa to tornus (cilia imperfect). Hind-wings dark fuscous.

Sierra Leone (Mabang, Moyamba); two specimens in British Museum (Dudgeon). These are in poor condition, but the character of the ♀ palpi is very distinctive.

33. I. radiata, Wals.

Jobula radiata, Wals., Trans. Ent. Soc. Lond. 1897, 46, pl. iii, 16.

West Africa. Not known to me.

34. I. hyphantis, n. sp.

♀. 21 mm. Head, palpi, and antennae light ochreous-yellowish, sides of crown pale whitish-fuscous; palpi anteriorly whitish-fuscous, terminal joint short. Thorax light fuscous, with dorsal, subdorsal and lateral yellow lines. Abdomen pale fuscous, beneath whitish-fuscous. Fore-wings elongate, posteriorly dilated, costa gently arched, apex rounded, termen rounded, hardly oblique; 7 and 8 stalked, 8 to termen; fuscous; fine ochreous-yellow lines beneath costa from base to near middle and on submedian fold from near base to beyond middle; a small ochreous-yellow spot in disc at ¼; an irregular ill-defined ochreous-yellow line from a small spot on middle of costa to ⅔ of dorsum, obsoletely interrupted above and below middle; between this and termen all veins marked with extremely fine pale yellowish lines, between which are some shorter pale ochreous-yellowish fine interneural streaks; an ochreous-yellow line round apex and termen, thickened round apex, edged by a dark fuscous marginal line; cilia whitish-ochreous, obscurely barred with fuscous (imperfect). Hind-wings dark fuscous, lighter towards base; cilia whitish, with fuscous basal line.

Ceylon (Matale); one specimen (Pole).

*Jobula semilinea*, Walk., xxxv, 1889.

SULU. Not known to me.

36. *I. procossa*, n. sp.

♂. 24 mm. Head pale greyish-ochreous, sides of face yellowish. Palpi yellow-ochreous, internally fuscous-whitish, terminal joint short. Antennae ochreous. Thorax fuscous (defaced). (Abdomen broken.) Fore-wings elongate-oblong, costa moderately arched, apex rounded, termen rounded, vertical; 7 and 8 stalked, 8 to apex; rather dark ochreous-fuscous, slightly purplish-tinged, streaked with ochreous between veins and in cell, and towards costa anteriorly with orange; all veins marked by fine ochreous lines, terminating in a submarginal yellow-ochreous streak from middle of costa to tornus, edged posteriorly with dark fuscous, and leaving a narrow fuscous border all round costa and termen; cilia light ochreous, basal third dark fuscous. Hind-wings dark grey, lighter towards base; cilia grey, with darker basal line.

Borneo (Pulo Laut); one specimen in British Museum (Doherty).

37. *I. neurota*, n. sp.

♂ ♀. 16-20 mm. Head in ♂ whitish-ochreous, in ♀ fuscous, lower part of face whitish-ochreous. Palpi whitish-ochreous, second joint externally yellowish, in front fuscous, in ♂ somewhat excurved, terminal joint in ♂ minute, in ♀ very short. Antennae dark fuscous, beneath pale ochreous, basal joint somewhat tufted anteriorly. Thorax and abdomen dark fuscous, beneath whitish-ochreous. Fore-wings elongate, posteriorly dilated, costa slightly arched, in ♂ straighter, apex rounded-obtuse, termen slightly rounded, little oblique; 7 and 8 stalked, 8 to apex; dark fuscous, markings ochreous-yellow; in ♂ a short streak beneath costa from base, in ♀ reduced to a basal dot; in ♀ a slender zigzag transverse streak from costa beyond middle, reaching 3⁄4 across wing, dilated on costa, in ♂ represented by a transverse series of three small spots or marks, costal somewhat triangular; a subdorsal dot beneath this; veins posteriorly marked with fine lines; a slender almost marginal streak round apex and termen to tornus, broadest at apex; cilia fuscous, darker in ♀. Hind-wings in ♂ with slight subdorsal
groove; dark fuscous, lighter towards base, especially in ♂; in ♀ a fine pale yellowish almost marginal line round apex and upper half of termen; cilia fuscous, tips whitish.

**Borneo; two specimens. Also two in British Museum.**


*Topaza alienella*, Walk., xxix, 808.

**Borneo.**


♀. 19 mm. Head ochreous-yellow, face paler, crown pale grey. (Palpi broken.) Antennæ yellowish, dark fuscous above, basal joint rather large, with scales angularly projecting anteriorly. Thorax dark purplish-fuscous, with two anterior and two posterior orange-yellow spots. Abdomen dark fuscous, beneath whitish-ochreous. Fore-wings elongate, posteriorly dilated, costa gently arched, apex rounded, termen rounded, somewhat oblique; 7 and 8 stalked; 8 to apex; dark purple-fuscous, irregularly strewn with yellow-ochreous scales between veins; a short orange line beneath costa from base; cilia ochreous-white, with dark fuscous basal line. Hind-wings fuscous, thinly scaled towards base, terminal third suffused with dark fuscous; cilia as in fore-wings.

**Borneo (Pulo Laut); one specimen in British Museum (Doherty).**

40. *I. trichinota*, n. sp.

♂ ♀. 17-18 mm. Head, thorax, and abdomen rather dark fuscous, sides of face whitish-ochreous. Palpi dark leaden-grey, second joint relatively short, yellowish above, terminal joint ⅙ of second. Antennæ dark fuscous, ochreous beneath. Fore-wings rather elongate, posteriorly dilated, costa gently arched, apex rounded, termen rounded, little oblique; 7 and 8 stalked; 8 to costa; dark purplish-fuscous; in ♂ a longitudinal impression beneath costa from ½ to middle, containing a tuft of long ochreous-whitish scales from posterior extremity, covered by a flap of very long fuscous hairs from anterior extremity; costal edge ochreous-white from before middle to ¾; cilia ochreous-white, basal third blackish-fuscous. Hind-wings with 6 and 7 stalked in ♂, coincident in ♀; dark fuscous, towards base thinly scaled, with undefined semitransparent median and subdorsal streaks; cilia as in fore-wings.
Mr. E. Meyrick on

Celebes; two specimens. A female from Bali in British Museum, without palpi, appears otherwise quite identical. The terminal joint of palpi is not really longer than usual, but the unusual shortness of the second joint causes it to appear relatively longer. This and the two next species are nearly allied together, but structurally distinct.

41. *I. otoptera*, n. sp.

♂ ♀. 16-19 mm. Head and thorax fuscous, face whitish-ochreous. Palpi shining leaden-grey, second joint above with a subapical spot of yellowish suffusion, base light yellow, terminal joint half second. Antennae dark fuscous, in ♀ ochreous beneath. Abdomen dark fuscous, beneath whitish. Fore-wings elongate, posteriorly dilated, somewhat broader in ♀, costa gently arched, apex rounded, termen rounded, little oblique; in ♂ 7 and 8 stalked, in ♀ 8 absent (coincident), 8 when present to costa; dark fuscous; in ♂ a roundish impression beneath costa at ⅓, containing a tuft of whitish-ochreous scales from upper margin, covered normally by a flap of long fuscous scales from anterior margin; extreme costal edge ochreous-whitish on posterior ⅔; cilia ochreous-whitish, with dark fuscous basal line, towards tornus infuscated. Hind-wings with 7 absent (coincident with 6); dark fuscous, somewhat thinly scaled towards base, with indications of two or three semi-transparent streaks; in ♂ a more distinct pale suffused streak from base through disc to beyond middle; cilia as in fore-wings.

Borneo; five specimens. Also two in British Museum.

42. *I. chlorosphena*, n. sp.

♂ ♀. 15 mm. Head fuscous, face paler, sides ochreous-yellowish. Palpi ochreous-yellow, base whitish, second and terminal joints anteriorly dark leaden-grey from a submedian ring of second joint to apex, terminal joint half second. Antennae dark fuscous. Thorax and abdomen rather dark fuscous, abdomen ochreous-whitish beneath except apical joint. Fore-wings elongate, posteriorly dilated, costa gently arched, apex rounded, termen rounded, somewhat oblique; 7 and 8 stalked, 8 to costa; rather dark fuscous, slightly ochreous-tinged, darker posteriorly, costa and termen suffusedly blackish-fuscous; in ♂ an oval impression beneath costa at ⅔, containing a tuft of whitish-ochreous scales from upper margin, covered by a flap of long fuscous scales from anterior
margin; cilia ochreous-white, basal third blackish. Hind-wings with 6 and 7 stalked; blackish-fuscous; an elongate wedge-shaped ochreous-whitish spot in middle of disc; cilia as in fore-wings.

CEYLON (Maskeliya); three specimens (Alston).

43. *I. tesseraria*, n. sp.

♀ 23 mm. Head and thorax fuscous, face paler, sides yellowish. Palpi ochreous-yellow, anteriorly with a dark shining leaden-metallic streak on terminal joint and upper half of second, terminal joint half second. Antennae ochreous, above with dark fuscous streak towards base. Abdomen dark fuscous with a few yellowish scales, beneath pale yellowish. Fore-wings elongate, posteriorly dilated, costa gently arched, apex rounded, termen rounded, little oblique; 7 and 8 stalked, 8 to termen; dark fuscous, with purplish and bronzy reflections, posteriorly with a few fine yellowish scales; a very indistinct spot of whitish-ochreous suffusion in disc at § (on under-surface represented by an oblique yellowish fascia not reaching margins); cilia ochreous-whitish, with blackish basal line, towards tornus fuscous-tinged. Hind-wings with submedian groove towards base; blackish-fuscous; a moderate elongate ochreous-yellow spot in middle of disc; cilia whitish, with dark fuscous basal line.

BORNEO; one specimen.

44. *I. diluticiliata*, Wals.


ASSAM, SULU. Not known to me.


ARU. Not known to me.

46. *I. homalotis*, n. sp.

♂ ♀. 21-22 mm. Head fuscous, face ochreous-yellowish. Palpi in ♀ ochreous-yellowish, second joint much thickened with scales somewhat expanded towards apex above, terminal joint very short (in ♀ broken). Antennae dark fuscous, basal joint in ♂ much thickened with scales projecting anteriorly towards apex. Thorax

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ochreous-fuscous. Abdomen rather dark fuscous, beneath whitish-yellowish. Fore-wings elongate, posteriorly slightly dilated, costa gently arched, apex rounded, termen rounded, hardly oblique; 7 and 8 stalked, 8 to apex; rather dark ochreous-fuscous, anteriorly slightly purplish-tinged; cilia fuscous, tips paler. Hind-wings dark fuscous, somewhat lighter towards base; cilia as in fore-wings.

Borneo (Pulo Laut); two specimens in British Museum (Doherty).

47. *I. auxobathra*, n. sp.

♂ ♀. 15-16 mm. Head in ♂ fuscous, collar and sides of face yellow-ochreous, in ♀ wholly yellow-ochreous. Palpi ochreous-yellow, second joint anteriorly in ♂ whitish-fuscous, in ♀ fuscous, terminal joint short. Antennæ ochreous-fuscous, above dark fuscous, basal joint in ♂ very long, in ♀ long, stalk in ♂ thickened with rough scales above towards base. Thorax dark fuscous, anteriorly with lateral and in ♀ also subdorsal streaks and posterior extremity orange. Abdomen dark fuscous, segmental margins in ♀ pale yellowish, beneath pale yellowish. Fore-wings elongate-triangular, costa gently arched, apex rounded, termen rather obliquely rounded; 8 absent (coincident with 7); in ♂ dark purplish-fuscous, in ♀ blackish; markings ochreous-orange; a subcostal streak from near base to ⅓; an oblique streak from beneath middle of this to ⅔ of dorsum; an oblique series of three small spots beyond these, middle one dash-like; a larger subtriangular spot on middle of costa; in ♀ a pear-shaped blotch extending almost from apex of this to near dorsum at ⅔, bilobed beneath, in ♂ reduced to two dots representing extremities; in ♀ a moderate spot in disc beyond this, in ♂ dot-like; a curved series of about ten longitudinal marks from beneath costa at ⅔ to above tornus, in ♂ reduced and ill-defined (cilia imperfect). Hind-wings with 7 absent (coincident with 6); in ♀ blackish-fuscous, with a pale yellowish triangular spot in middle of disc, and a slender pale yellowish subdorsal streak not reaching base or tornus; in ♂ dark fuscous, lighter on discal and subdorsal streaks from base, tornus produced into a rounded prominence, above with a deep dorsal groove containing a pencil of long hairs.

Borneo; two specimens.

48. *I. megalynnis*, n. sp.

♀. 19 mm. Head whitish-ochreous, crown mixed with blackish. (Palpi broken.) Antennæ whitish-ochreous, above dark fuscous. Thorax dark fuscous, with yellowish sublateral stripes and posterior
the Genus Imma.

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spot (partly defaced). Abdomen dark fuscous, somewhat sprinkled with yellowish, beneath pale yellowish. Fore-wings elongate-triangular, costa gently arched, apex rounded, termen rounded, little oblique; 7 and 8 stalked, 8 to termen; blackish-fuscous, markings ochreous-yellow; a submedian streak from base to \( \frac{2}{3} \), posteriorly dilated; a small oblique wedge-shaped spot on costa at \( \frac{1}{2} \); two large rounded-triangular spots on costa at \( \frac{1}{4} \) and \( \frac{3}{4} \), and two larger spots in dorsal half of wing rather obliquely beyond these respectively; cilia whitish, with blackish basal line. Hind-wings blackish-fuscous, towards base more thinly scaled and with several slender semi-transparent streaks; a longitudinal ochreous-yellow spot in disc beneath middle; cilia as in fore-wings.

Borneo; one specimen.

49. I. hecla, n. sp.

♀. 17 mm. Head ochreous-yellowish, crown fuscous. Palpi pale ochreous-yellow, second joint anteriorly fuscous-tinged, terminal joint short, light fuscous. Antennae dark fuscous. Thorax fuscous, with a whitish-ochreous posterior spot. Abdomen dark fuscous, somewhat mixed with pale yellowish, beneath pale yellowish. Fore-wings elongate, posteriorly dilated, costa gently arched, apex rounded, termen rounded, little oblique; 7 and 8 stalked, 8 to costa; blackish; a moderate ochreous-yellow streak from base below middle of disc to \( \frac{3}{4} \); a slightly curved ochreous-yellow fascia from middle of costa, broadest on costa and at \( \frac{3}{4} \), constricted above middle, not quite reaching dorsum at \( \frac{3}{4} \); cilia ochreous-white, base dark fuscous. Hind-wings dark fuscous, with thinly scaled lighter elongate patches along dorsum and in anterior portion of disc; cilia as in fore-wings.

Borneo; one specimen.

50. I. mesochorda, n. sp.

♂. 15–16 mm. Head whitish-ochreous, crown infuscated. Palpi pale ochreous-yellowish, second joint fuscous externally on upper half, terminal joint short, fuscous. Antennae dark fuscous, beneath pale yellowish, fasciculate-ciliated. Thorax and abdomen dark fuscous, beneath ochreous-whitish. Fore-wings elongate, posteriorly dilated, costa gently arched, apex rounded, termen rounded, somewhat oblique; 7 and 8 stalked, 8 to apex; dark fuscous; a slender rather irregular light ochreous-yellow slightly curved fascia from middle of costa to \( \frac{3}{4} \) of dorsum, but not quite reaching dorsal edge, constricted beneath costa; cilia dark fuscous, tips paler, round apex
ochreous-whitish except on basal third. Hind-wings dark fuscous, lighter towards base; cilia fuscous, round apex whitish, basal third dark fuscous.

Assam (Khasi Hills); two specimens.


Philippines, Java. Not known to me.

52. *I. aurantiaca*, Semp.


Philippines. The antennae of ♂ in this and the next species are bipectinated.


*Sidyma basilflava*, Semp., Schmett. Phil. ii, 500, pl. lix, 8.

Philippines. Not known to me, but it is very near the preceding species.

54. *I. panopta*, n. sp.

♂ ♀. 34-40 mm. Head dark fuscous, orbits ochreous-yellowish. Palpi ochreous-yellow, terminal joint very short. Antennæ, thorax and abdomen dark fuscous, abdomen ochreous-yellow beneath. Forewings rather broad, especially in ♀, costa rather strongly arched, apex obtuse, termen rounded, hardly oblique; 7 and 8 stalked, 8 to termen; blackish-fuscous, slightly purplish-tinged; an orange median band, greatly dilated downwards, anterior edge running from ⅓ of costa to ⅓ of dorsum, straight, somewhat irregular, posterior edge running from before middle of costa to ⅔ of dorsum, twice curved outwards above and below middle; cilia dark fuscous. Hind-wings blackish-fuscous; a rather irregular orange blotch resting on median third of costa, narrowed downwards, reaching more than half across wing; cilia dark fuscous.

Flores; three specimens (*Swinhoe*).
55. *I. grammaticis*, n. sp.

♂. 33 mm. Head ochreous-white, crown dark fuscous towards centre. Palpi ochreous-whitish, terminal joint nearly half second. Antennae dark grey. Thorax ochreous-white, with dark fuscous subdorsal stripes. Abdomen grey, beneath ochreous-whitish. Fore-wings broad, costa rather strongly arched, apex rounded, termen rounded, vertical; 7 and 8 stalked, 8 to apex; dark fuscous; markings ochreous-white; a streak beneath costa from base to 2/3; a fine dorsal streak from near base to near tornus; all veins marked by strong streaks, not quite reaching margin, posteriorly terminating in a curved submarginal streak which is broadest opposite apex; a violet-metallic line along termen; cilia fuscous, becoming whitish towards tornus, basal half dark fuscous. Hind-wings dark fuscous, lighter towards base; a suffused whitish streak along upper half of termen; cilia ochreous-white, round tornus and dorsum fuscous.

New Guinea (Kapaur); one specimen in British Museum (Doherty).

56. *I. minatrix*, n. sp.

♀. 33-36 mm. Head orange-yellow, crown with two blackish lines. Palpi ochreous-yellowish, terminal joint short, with a few blackish scales anteriorly. Antennae blackish. Thorax orange-yellow, with four broad blackish stripes. Abdomen dark fuscous, beneath ochreous-yellowish. Fore-wings elongate, much dilated posteriorly, costa strongly arched, apex rounded, termen rounded, somewhat oblique; 7 and 8 stalked, 8 to apex; yellow-orange, markings purple-blackish; a costal streak from base, terminating in a patch which occupies apical 2/3 of wing beyond a curved line from middle of costa to dorsum before tornus, except a curved anteapical fascia of ground colour from near costa at 1/4 to near termen above tornus; a subcostal streak from base, sometimes reaching posterior patch; median and submedian streaks from base to near middle, median basally confluent with subcostal; a dorsal streak from base to 3/4 attenuated at base; cilia blackish. Hind-wings blackish-fuscous, centre of disc purple-blackish; an anteapical yellow-orange fascia, attenuated downwards to termen below middle; cilia blackish-fuscous, on termen pale orange from 1/4 to 3/4.

New Guinea (Fergusson Island); two specimens in British Museum (Meek). There is also in British Museum an example from Kapaur, New Guinea, which has the
orange fascia of hind-wings anteriorly dilated so as to extend over centre of disc (thus destroying the central purple-black patch), and the cilia wholly blackish, not orange; without further material I am unable to determine whether this is a variety of _minatrix_ or a closely allied species; and further it is conceivable that one or both forms may be the other sex of _grammalistis_, notwithstanding the extraordinary difference in appearance.

57. _I. dichroalis_, Snell.

_Bursadella dichroalis_, Snell., Mid Sum., 83; _Scaptesyllic hemichryseis_, Hamps., Trans. Ent. Soc. Lond. 1895, 283.

_Burma, Sumatra._

58. _I. epichlaena_, n. sp.

♀. 16 mm. Head, palpi, antennae and thorax ochreous-yellow; palpi with a fuscous spot at apex of second joint externally, terminal joint short, fuscous except at base; basal joint of antennae dark fuscous at apex, with scales projecting anteriorly. Abdomen dark grey, beneath ochreous-whitish. Fore-wings elongate, posteriorly dilated, costa gently arched, apex rounded, termen rounded, little oblique; 7 and 8 stalked, 8 to apex; dark fuscous; basal $\frac{3}{4}$ deep yellow, edge paler, irregular, followed by a thick line of leaden-metallic suffusion; small yellow spots on costa at $\frac{1}{2}$ and $\frac{3}{4}$; cilia ochreous-white, at tornus dark grey, basal third dark fuscous except on an apical patch. Hind-wings dark fuscous; cilia whitish, towards tornus greyish, basal third dark fuscous.

_Borneo_ (Pulo Laut): one specimen in British Museum (Doherty).

59. _I. flavibasa_, Moore.


_Eastern Himalayas, Assam._

60. _I. hemixanthella_, Holl.


_Buru_. Not known to me.
61. *I. amphizantha*, n. sp.

♀ 20 mm. Head, antennæ, and thorax yellow. (Palpi broken.) Abdomen dark fuscous, beneath yellowish. Fore-wings elongate, posteriorly dilated, costa gently arched, apex rounded-obtuse, termen nearly straight, hardly oblique; 7 and 8 stalked, 8 to costa; ferruginous-brown; a deep yellow basal blotch occupying \(\frac{1}{2}\) of wing, outer edge straight, slightly irregular, followed by some dark purple-fuscous suffusion; within this blotch is an elongate fuscous spot on base of dorsum; a deep yellow streak running round apical fourth of costa and termen to near tornus, broadest at apex of wing, attenuated to extremities; cilia yellow, at tornus grey. Hind-wings dark fuscous, somewhat lighter towards base; cilia whitish-ochreous, with fuscous basal line.

**Borneo**; one specimen.

62. *I. cymbalodes*, n. sp.

♀ 18-21 mm. Head and palpi light yellow-ochreous, palpi anteriorly infuscated, terminal joint half second. Antennæ fuscous, yellowish beneath. Thorax fuscous, edges of collar and patagia, and posterior extremity more or less yellowish. Abdomen fuscous mixed with green, sides posteriorly with fringe of hairs, beneath pale ochreous-yellowish. Fore-wings elongate, posteriorly dilated, costa gently arched, apex rounded, termen somewhat rounded, little oblique; 7 and 8 stalked, 8 to termen; rather dark ochreous-fuscous; an ochreous-yellow basal patch occupying \(\frac{1}{2}\) of wing, base partially suffused with fuscous, outer edge straight; an ochreous-yellowish dot on costa at \(\frac{1}{3}\); an indistinct streak of ochreous-yellowish suffusion round apex; cilia fuscous, becoming whitish-ochreous round apex. Hind-wings dark fuscous; cilia as in fore-wings.

**Assam** (Khasi Hills); two specimens.


*Callartona purpurascens*, Hamps., *Moths Ind.* i, 233.

**Nilgiris**.

64. *I. microsticta*, Hamps.


**Assam**.


HIMALAYA. Not known to me.

66. *I. melotoma*, n. sp.

♂. 20 mm. Head and palpi ochreous-yellow, terminal joint of palpi short. Antennae dark fuscous. Thorax fuscous, collar, margins of patagia, and a posterior spot deep ochreous-yellow. Abdomen ochreous-yellowish, suffused with orange towards base, posteriorly infuscated except anal tuft. Fore-wings elongate-oblong, costa bent towards middle, nearly straight posteriorly, apex rounded-obtuse termen slightly rounded, little oblique; 7 and 8 stalked, 8 to termen; fuscous, markings deep ochreous-yellow; an almost basal mark from costa, reaching half across wing; a moderate, subquadrate spot on dorsum at \( \frac{1}{4} \); a short indistinct suffused mark from costa at \( \frac{3}{4} \); an almost apical oblique spot from costa, not quite reaching termen, placed in a darker fuscous terminal fascia; cilia fuscous or light fuscous, round apex pale yellowish. Hind-wings with shallow submedian furrow towards base, placed between ridges of rough orange hairs, scales of disc modified, hairlike, somewhat raised; fuscous, tinged with orange, especially towards base, with suffused dark fuscous terminal band; cilia ochreous-whitish, basal half fuscous.

SIKKIM; two specimens.

67. *I. crocozela*, n. sp.

♂. 21 mm. Head, palpi, antennae, and thorax ochreous-yellow; terminal joint of palpi short; thorax with posterior third purple-grey. Abdomen dark grey, at apex and beneath pale yellowish. Posterior tibiae rough-haired beneath. Fore-wings elongate, posteriorly dilated, costa gently arched, apex rounded, termen rounded, little oblique; 7 and 8 stalked, 8 to termen; dark fuscous-purple; markings ochreous-yellow; a fine costal streak, dilated towards base; a streak in disc from near base to middle; a large oblique triangular blotch on middle of costa, apex directed towards tornus and reaching \( \frac{3}{4} \) across wing; an elongate mark along dorsum from \( \frac{1}{3} \) to \( \frac{3}{4} \); a narrow fascia round apical fourth of costa and termen to tornus, broadest at apex; cilia ochreous-yellow, on termen fuscous. Hind-wings with subdorsal groove; dark fuscous, lighter towards base and dorsum; cilia whitish-fuscous with darker fuscous basal shade, at apex whitish.

NEW GUINEA (Sariba I.); one specimen (*Meek*).
68. *I. chrysoplaea*, n. sp.

♀ 19 mm. Head, palpi, antennae, and thorax ochreous-yellow; terminal joint of palpi short; posterior half of thorax purplish-fuscous. Abdomen fuscous, beneath yellowish. Fore-wings elongate, costa slightly arched, apex rounded-obtuse, termen slightly rounded, hardly oblique; 7 and 8 stalked, 8 to termen; purplish-fuscous, markings ochreous-yellow; a small spot on base of costa, and a moderately large subtriangular spot on costa about middle, extreme costal edge between these yellow; a moderate streak round apical fourth of costa and termen to near tornus, broadest at apex of wing, narrowed to extremities, extreme apical margin black; cilia ochreous-yellow, at tornus fuscous. Hind-wings fuscous; cilia pale fuscous, on upper half of termen whitish-ochreous.

New Guinea; one specimen. I think it not unlikely that this may be the other sex of the preceding species, but the differences are considerable, and at present I prefer to keep them separate.

69. *I. phalerata*, n. sp.

♂ 22 mm. Head whitish-ochreous. Palpi whitish-ochreous, basal joint rather long, second joint excurved, terminal joint very short. Antennæ dark fuscous. Thorax fuscous. Abdomen dark fuscous, beneath ochreous. Fore-wings elongate, posteriorly dilated, costa gently arched, apex rounded-obtuse, termen rounded, little oblique; 7 and 8 stalked, 8 to termen; rather dark ochreous-fuscous, with slight purple gloss, markings ochreous-yellow; a narrow somewhat curved fascia from ⅓ of costa to ⅔ of dorsum, attenuated on lower half; a moderate triangular spot on costa at ⅔, and an elongate spot on costa towards apex; cilia fuscous, at apex paler and becoming pale yellow at base. Hind-wings dark fuscous; a moderate longitudinal ochreous-whitish streak in disc from ¼ to ¾; cilia fuscous, with suffused ochreous-whitish apical patch.

Assam (Khasi Hills); one specimen.

70. *I. epicomia*, n. sp.

♂ ♀ 23–25 mm. Head and thorax yellow, slightly sprinkled with fuscous. Palpi yellow, anterior edge and in ♀ most of terminal joint fuscous, terminal joint rather more than half second. Antennæ ochreous-yellow. Abdomen dark fuscous, beneath light ochreous-
yellowish, in ♂ hairy towards base above, apparently with large genital tuft. Fore-wings elongate, posteriorly rather dilated, costa gently arched, apex rounded, termen somewhat rounded, little oblique; 7 and 8 stalked, 8 to termen; yellow, sprinkled with brownish, costa narrowly and termen more broadly ochreous, terminal half in ♀ tinged with ochreous-orange; a fuscous mark along basal fourth of dorsum; a trisinuate dark grey line from middle of costa to ⅔ of dorsum, edged posteriorly with lilac suffusion except towards costa; a curved series of undefined dark grey dots midway between this and termen, indented in middle, not reaching margins; an irregular curved series of similar dots from a mark on costa before ⅔ to tornus; some very indistinct grey terminal dots; cilia ochreous, with grey or dark grey subbasal line, and a dark grey spot at apex. Hind-wings dark grey; a whitish-ochreous streak above middle from base to end of cell, where it extends to lower angle; cilia ochreous-whitish, with grey subbasal line and apical spot.

SOLOMON ISLANDS (Choiseul, Florida); two specimens (Meek).

71. I. mackwoodii, Moore.

Davendra mackwoodii, Moore, Lep. Ceyl. iii, 520, pl. cxxi, 13.

CEYLON.

72. I. lithosioides, Moore.


CEYLON. This species varies very considerably in the development of the pale yellowish markings, and I am now satisfied that diphtherina is only a form of it.

73. I. ergasia, Meyr.


CEYLON. Described from ♀; the ♂ (since received) has second joint of palpi laterally excurved, light ochreous-yellowish, anteriorly fuscous, terminal joint ⅔ of second; abdomen without the median tufts of lithosioides.
74. *I. chlorosoma*, n. sp.

♂. 27 mm. Head, palpi, and thorax whitish-ochreous mixed with pale ochreous, facial scales brushed upwards between antennae; palpi with second joint excurved, terminal joint very short; thorax beneath fore-wings with broad patch of long hairs directed backwards. Antennae dark fuscous, beneath pale ochreous, ciliations very short. Abdomen fuscous, becoming ochreous-whitish towards base, beneath whitish-ochreous, posteriorly with lateral fringe of dense rough scales. Fore-wings elongate, narrowed anteriorly, dilated posteriorly; costa posteriorly slightly arched, apex rounded, termen rounded, little oblique; 7 and 8 stalked, 8 to termen; dark purple-fuscous; an ochreous-whitish basal patch, outer edge running from base of costa to ½ of dorsum, more ochreous towards costa; very indistinct dots of ochreous suffusion on costa at ⅔ and ⅔ and before apex; some slight ochreous suffusion towards tornus; cilia fuscous. Hind-wings with dorsal area clothed with dense long hairs; fuscous, becoming dark fuscous posteriorly; a basal patch of white suffusion; an irregular elongate-triangular patch of white suffusion in disc, on which lower margin of cell appears as a dark fuscous intersecting line; cilia fuscous, becoming fuscous-whitish on dorsum.

Assam (Khasi Hills); one specimen.

75. *I. strepsizona*, n. sp.

♀. 26 mm. Head whitish-ochreous, face more yellowish, hairs brushed upwards between antennae. Palpi light ochreous-yellowish, terminal joint very short. Antennae fuscous, basal joint whitish-ochreous. Thorax light ochreous-yellowish, sides sprinkled with fuscous. Abdomen fuscous, beneath yellow-ochreous, on posterior half with dense lateral ridge of rough hairs. Fore-wings elongate, posteriorly much dilated, costa posteriorly gently arched, apex rounded, termen rounded, somewhat oblique; 7 and 8 stalked, 8 to termen; fuscous, irrorated with dark fuscous and towards base with pale ochreous; a small ochreous-yellowish basal spot beneath costa; two suffused pale ochreous-yellowish tranverse streaks enclosing a moderate fascia of ground colour partially mixed with pale yellowish, running from middle of costa to ⅔ of dorsum, above middle constricted and with streaks twice confluent; wing beyond this fascia wholly blackish-fuscous; cilia dark fuscous, base ochreous-whitish at apex. Hind-wings dark fuscous; cilia ochreous-whitish with a fuscous patch on middle of termen, basal half dark fuscous.

Celebes; one specimen.
76. *I. acluropis*, n. sp.

♂. 25 mm. Head, palpi, and antennae light brownish, terminal joint of palpi short. Thorax brown. Abdomen fuscos, beneath whitish-ochrous, hairy above towards base. Fore-wings elongate, posteriorly slightly dilated, costa slightly arched, apex rounded, termen rounded, somewhat oblique; 7 and 8 stalked, 8 to termen; rather dark ochrous-fuscos, slightly purplish-tinged; small indistinct spots of pale ochrous suffusion on costa before middle, before ¾, and at apex; an oblong pale ochrous patch extending on dorsum from middle to tornus and reaching nearly half across wing, suffused above; cilia fuscos. Hind-wings dark fuscos; cilia fuscos.

Borneo (Sandakan); one specimen in British Museum (Pryer).

77. *I. albofascia*, Feld.


♀. 22-23 mm. Head fuscos mixed with whitish, face suffused with whitish. Palpi fuscos-whitish, with dark fuscos anterior and lateral stripes, basal joint somewhat elongate, second joint rather short, terminal somewhat more than half second. Antennae fuscos. Thorax fuscos irroration with dark fuscos, patagia edged with ochrous-whitish. Abdomen fuscos, beneath ochrous-whitish. Fore-wings elongate, posteriorly somewhat dilated, costa gently arched, apex rounded, termen almost straight, rather oblique; 7 and 8 stalked, 8 to apex; fuscos, sprinkled with dark fuscos; a patch of dark fuscos suffusion extending along costa from base to ½ and reaching ¾ across wing, terminated posteriorly by a tornal blotch of whitish suffusion obscurely extended towards apex (but this blotch is sometimes almost obsolete); an almost marginal series of ochrous-whitish marks round apex and tornus; cilia fuscos mixed with dark fuscos, with a pale basal line. Hind-wings dark fuscos; cilia grey, with darker basal line.

Ceylon (Uva), S. India (Belgaum); according to Felder from Amboina.

78. *I. stilbiota*, Low.


Queensland. Not known to me.
the Genus Imma.  

79. *I. lichenopa*, Low.

*Tortricomorpha lichenopa*, Low., Trans. Roy. Soc. S. Austr. 1903, 69 (misprinted *lichnopa*).

QUEENSLAND. Not known to me.


Christmas Island. Not known to me; it is however clearly allied to the preceding species, these two being very different from anything else.

81. *I. tyrocnista*, n. sp.

♂ ♀. 33–35 mm. Head and thorax dark purplish-fuscous sprinkled with whitish-ochreous, thorax posteriorly in ♂ with one large spot, in ♀ with two smaller spots of raised darker modified scales, surrounded with paler scales. Palpi dark slaty-fuscous, second joint internally and on upper longitudinal half pale yellowish, terminal joint extremely short. Antennae dark fuscous. Abdomen fuscous, in ♂ with basal half clothed with long hairs, and with large white exsertible genital tuft, beneath pale ochreous-yellowish. Fore-wings elongate, dilated, costa gently arched, apex obtuse, termen rounded, somewhat oblique; 7 and 8 stalked, 8 to termen; dark purplish-fuscous, irregularly strewn with whitish-ochreous scales; small indistinct cloudy dark fuscous spots in disc at ⅓, and before and beyond middle; a cloudy spot of pale irroration on costa at ⅔; a terminal series of pale ochreous connected lunulate marks alternating with cloudy dark fuscous dots; cilia fuscous, with darker basal shade. Hind-wings dark fuscous, rather lighter anteriorly; cilia fuscous, tips whitish.

ANDAMAN ISLANDS; two specimens (*Swinhoe*); also three in British Museum.

82. *I. chasmatica*, n. sp.

♀. 31–33 mm. Head and thorax fuscous. Palpi fuscous, apex of second and terminal joints pale yellowish, terminal joint half second. Antennae and abdomen dark fuscous. Fore-wings elongate-oblong, costa anteriorly moderately, posteriorly slightly arched, apex rounded-obtuse, termen rounded, hardly oblique; 7 and 8 stalked, 8 to costa; fuscous finely sprinkled with blackish, with
some obscure pale strigulae, especially on costa anteriorly; a blackish streak beneath costa from near base to near middle, interrupted by pale strigulae; an undefined blackish line along submedian fold almost throughout; an undefined irregular blackish streak in disc from \( \frac{1}{3} \) to termen, posteriorly split into three more or less marked branches on veins, interrupted by a suffused whitish-ochreous dot at \( \frac{1}{2} \); veins towards costa before apex and towards tornus more or less marked with blackish; a small apical spot of pale ochreous suffusion; cilia fuscous, sometimes blackish-mixed, tips suffused with light ochreous. Hind-wings dark grey; cilia grey. Under surface of fore-wings with a well-defined pale yellowish apical spot.

**Sikkim, Assam**: four specimens.

83. *I. nepheleastra*, n. sp.

♂. 18 mm. Head dark fuscous, orbits and face ochreous-whitish. Palpi ochreous-whitish, second joint externally fuscous, terminal joint imperceptible (concealed or aborted). Antennæ dark fuscous, basal joint long, thick, tufted in front. Thorax dark fuscous, shoulders obscurely edged with pale ochreous (partly defaced). Abdomen dark fuscous. Middle tibiae thickened with long dense hairs above. Fore-wings elongate, posteriorly dilated, costa posteriorly gently arched, apex rounded, termen rounded, little oblique; 7 and 8 separate, 8 to costa; blackish-fuscous, markings pale ochreous, cloudy and ill-defined; a short longitudinal streak from base in middle; a small spot beneath costa at \( \frac{1}{4} \), and one on dorsum at \( \frac{1}{2} \); an incurved transverse spot in disc at \( \frac{3}{4} \), nearly reaching costa but not nearly dorsum; a moderate roundish spot on costa beyond middle, another towards dorsum at \( \frac{3}{4} \), and a third in disc at \( \frac{3}{4} \); a narrower transverse spot on costa at \( \frac{6}{4} \), very indistinct marks above tornus and towards middle of termen; cilia ochreous-whitish, basal third dark fuscous. Hind-wings dark fuscous, more thinly scaled towards base, with two or three undefined semitransparent streaks towards dorsum; cilia as in fore-wings, at apex and tornus becoming fuscous.

Borneo; one specimen. This species presents a combination of characters, which makes it difficult to determine its true position in the genus.


*Gyrtona pardalina*, Walk. xxvii, 91.

♂. 20–21 mm. Head whitish-ochreous, crown mixed with fuscous. Palpi whitish-ochreous, anteriorly fuscous-tinged, terminal joint
imperceptible. Antennae dark fuscous, basal joint elongated and enlarged, with dense projecting tuft of scales anteriorly. Thorax and abdomen fuscous. Fore-wings elongate, posteriorly dilated, costa slightly arched, apex rounded, termen rounded, somewhat oblique; 7 and 8 separate, 8 to costa, 11 curved and approximated to 12; fuscous; submedian fold forming a whitish-ochreous groove towards base, terminating in a small basal spot of raised whitish-ochreous scales; median area forming a very indefinite ochreous-whitish band, anterior edge running from about \( \frac{3}{4} \) of costa to before middle of dorsum, acutely triangular-prominent above middle and indented above and below this, on lower half preceded by dark reddish-fuscous suffusion, posterior edge from about \( \frac{1}{3} \) of costa to \( \frac{2}{3} \) of dorsum, undefined; within this band are a semioval cloudy dark fuscous spot on middle of costa and a longitudinal blackish-fuscous sometimes interrupted mark in disc, strongly hooked upwards at posterior extremity; posterior area reddish-tinged and finely irrorated with blackish-fuscous, with a submarginal series of irregular brownish-ochreous triangular marks; cilia fuscous, with dark fuscous basal line, towards tornus whitish. Hind-wings with subdorsal groove; dark fuscous, somewhat lighter towards base; cilia fuscous, with darker basal line.

**Borneo, Singapore, Selangor.** I have redescribed this species, as Walker's description is unrecognizable. It is closely allied to *velutina*, but differs structurally by the elongate basal joint of antennæ, and relatively shorter and broader fore-wings; in *velutina* also the palpi are largely marked with dark fuscous.


*Moca velutina*, Walk. xxvii, 102.

**Ceylon.**

86. *I. nephallactis*, n. sp.

♂ ♀. 17–20 mm. Head and thorax fuscous sometimes suffusedly mixed with whitish, shoulders and sometimes patagia streaked with black and whitish-ochreous, more sharply in ♀. Palpi white, second joint with broad dark fuscous median band, terminal joint short, dark fuscous except apex. Antennæ grey. Abdomen fuscous, apex sometimes white, beneath white. Fore-wings elongate, posteriorly dilated, costa gently arched, apex rounded, termen rounded, somewhat oblique; 7 and 8 separate, 8 to costa; grey or fuscous sometimes variably sprinkled or suffused with white, in one specimen strongly violet-tinged; a black variably interrupted line
beneath costa from base to middle, edged beneath anteriorly by a fine pale yellowish line; a dark fuscous or blackish costal spot at \( \frac{1}{4} \), and sometimes one near base, sometimes confluent; a thick irregular dentate dark fuscous line from this spot, not reaching dorsum, usually cut by a fine white line on submedian fold; a dark fuscous or blackish transverse mark in disc at \( \frac{3}{4} \), terminating beneath in a round suffused spot, and two spots on costa before middle and at \( \frac{3}{4} \) separated by a white space, the whole sometimes merged into a large semioval dark fuscous costal blotch reaching \( \frac{3}{4} \) across wing; two or three dark fuscous subdorsal marks; a series of dark fuscous or blackish marks from \( \frac{3}{4} \) of costa to tornus, angulated above middle, where there is a larger spot, and sometimes a dark fuscous streak running from discal mark through angle to termen; a waved-dentate pale terminal line, preceded by a dark fuscous shade; cilia fuscous, with a darker basal line, sometimes barred with whitish. Hind-wings rather darker posteriorly, especially in \( \delta \); cilia as in fore-wings.

**VENEZUELA (Ciudad Bolivar); eighteen specimens. A variable species.**

87. *I. cuneata*, n. sp.

\( \delta \) \&. 22–23 mm. Head pale brownish, lower part of face white. Palpi fuscous, basal joint white, second joint relatively short, white at base and apex, terminal joint somewhat more than half second, obtuse. Antennae dark fuscous, with a streak of whitish scales. Thorax brownish irrorated with whitish, in \( \delta \) beneath laterally tufted with hairs. Abdomen fuscous, beneath whitish-brown. Fore-wings elongate-triangular, costa slightly arched, faintly sinuate before middle, apex obtuse, termen obliquely rounded; 7 and 8 separate, 8 to costa; whitish, more or less suffusedly irrorated with purplish-brown; markings very deep brown; a very oblique acute wedge-shaped mark from costa near base, limited anteriorly by a vertical white line from costa to fold; a small spot on costa at \( \frac{1}{4} \), almost connected with a transverse elongate-triangular spot in disc beyond \( \frac{1}{4} \); a semioval spot on costa before middle; some irregular spots towards dorsum; a transverse I-shaped mark in disc at \( \frac{3}{4} \), beneath which is an irregular patch of dark suffusion; an elongate blotch extending from near discal mark to near termen, crossed by a streak of undefined suffusion from \( \frac{3}{4} \) of costa to tornus; a pale waved terminal line, preceded by a series of suffused dark dots; cilia fuscous, with indications of whitish bars beneath apex and towards tornus. Hind-wings dark fuscous; cilia fuscous, with darker basal line.

**Brazil, Columbia; two specimens in British Museum.**
88. *I. metachlora*, n. sp.

♀. 27 mm. Head brownish, lower margin of face white. Palpi fuscous, basal joint white, second joint relatively short, base and apex whitish, terminal joint rather more than half second, obtuse. Antennae dark fuscous. Thorax dark brown, sprinkled with whitish. Abdomen dark fuscous, beneath whitish-brown. Fore-wings elongate-triangular, costa slightly arched, apex obtuse, termen rounded, somewhat oblique; 7 and 8 separate, 8 to costa; brown irregularly irrorated with pale grey, markings very dark brown; an irregular transverse spot on middle of costa, costal edge beyond this ochreous-white for a short distance; two small spots transversely placed in disc at 3, between which is an X-shaped pale suffusion; a short contorted linear mark beneath middle of disc; an irregular subterminal fascia from beneath apex to tornus; a terminal series of small subconfluent spots; cilia brown, above tornus with an ochreous-white patch. Hind-wings dark fuscous; cilia fuscous, with dark fuscous basal line.

One specimen in British Museum without locality, but certainly South American, probably from Brazil.

89. *I. thymora*, n. sp.

♂♀. 21-22 mm. Head brown, face mostly ochreous-whitish. Palpi dark fuscous, basal and second joints anteriorly ochreous-whitish, terminal joint very short, obtuse. Antennae dark fuscous. Thorax dark brown, streaked with ochreous-whitish. Abdomen dark fuscous, beneath whitish-brown. Fore-wings elongate, posteriorly dilated, costa slightly arched, apex obtuse, termen rounded, rather oblique; 7 and 8 separate, 8 to costa; brown, slightly reddish-tinged, strewn with small irregular ill-defined whitish-ochreous spots, nearly obsolete on apical area beyond an irregular angulated series from costa beyond middle to dorsum before tornus; a terminal series of pale dots; cilia fuscous, darker towards base. Hind-wings dark fuscous; cilia grey, with dark fuscous basal line.

BRAZIL (Ega); two specimens in British Museum.

90. *I. cincta*, Druce.


GUATEMALA.

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Mr. E. Meyrick on

91. *I. ciniata*, Druce.

*Thalpochares ciniata*, Druce, Biol. Centr. Amer. ii. 497, pl. xcv, 23.

**Panama.**

92. *I. cancanopis*, n. sp.

♂♀ 25-26 mm. Head grey, face white. Palpi white, second joint with a broad dark grey median band narrowed anteriorly, terminal joint half second, obtuse, grey. Antennae grey. Thorax dark grey, somewhat mixed with ochreous-whitish. Abdomen dark fuscous, beneath pale brownish. Posterior tibiae and basal joint of tarsi in ♂ with brushes of dense hairs beneath. Fore-wings elongate, posteriorly dilated, costa gently arched, apex obtuse, termen rather obliquely rounded; 7 and 8 separate, 8 to costa; purplish-fuscous, more purplish in ♂, irregularly sprinkled with blue-grey-whitish, with dark fuscous streaks on veins broken up into short dashes arranged in irregular transverse series; the whitish iroration tends to form series of undefined marks between these; a black dash beneath costa from base, edged beneath with ochreous-white; a pale waved terminal line, preceded by indistinct dark dots; cilia fuscous. Hind-wings dark fuscous; cilia fuscous.

**Columbia, Cayenne;** three specimens in British Museum.


*Aglossa chloromelalis*, Walk. xxxiv, 1249.

**Brazil.** Not known to me; Sir George Hampson writes "palpi with second joint shorter than usual, terminal as long as second; hind-wings with veins 3 and 4 approximated; characters otherwise as in Imma."

94. *I. boeta*, Druce.


**Panama.**


*Gauris quadrivittana*, Walk. xxviii, 417.

**Brazil.** Not known to me; Sir George Hampson informs me that the head of the type is missing, and veins 6 and 7 of hind-wings are coincident; other characters apparently as in Imma.
LOXOTROCHIS, n. g.

Head with appressed scales; ocelli absent; tongue developed. Antennæ (partly broken) in ♂ rather strongly ciliated, basal joint short, stout. Labial palpi moderate, curved, ascending, second joint thickened with dense scales, laterally compressed, somewhat excurved, terminal joint very short, thick, pointed. Maxillary palpi absent. Posterior tibiae smooth-scaled. Fore-wings with 1b furcate, 2 from towards angle, 3 and 4 approximated, 7 and 8 out of 9, 7 to apex, 10 out of 9 below 7, 11 from beyond middle. Hind-wings 1, oblong-ovate, cilia $\frac{1}{2}$; 3 and 4 stalked, 5 parallel, 6 and 7 stalked.

This seems to be allied to Imma, yet it is very distinct; the characteristic palpi are quite similar, but the neuration is altogether different, yet such that it might be a derivative of Imma.

L. sepias, n. sp.

♂ 28 mm. Head, palpi, antennæ, and thorax fuscous. (Abdomen broken.) Fore-wings elongate, gradually dilated, costa moderately arched, apex rounded, termen rather obliquely rounded; rather dark fuscous, veins obscurely paler; cilia fuscous. Hind-wings dark grey, with a faint purplish tinge; cilia grey.

NEW HEBRIDES (Espiritu Santo); one specimen in British Museum.

PALAMERNIS, n. g.

Head with appressed scales; ocelli very large; tongue short. Antennæ $\frac{3}{4}$, in ♂ stout, simple, basal joint short, without pecten. Labial palpi moderate, obliquely ascending, second joint thickened with appressed scales, terminal joint short ($\frac{3}{4}$), thick, hardly pointed. Maxillary palpi obsolete. Posterior tibiae with appressed scales, in ♂ with a pencil of long hairs from before middle above. Fore-wings with vein 1b long-furcate, 2-10 near and equidistant, 7 to apex, 11 from $\frac{2}{3}$, no secondary cell. Hind-wings over 1, ovate, cilia $\frac{1}{3}$; 2 and 3 stalked from lower angle of cell, 4-7 tolerably parallel.

This curious form is apparently allied to Imma and Brachodes, but very distinct from either; the neuration of hind-wings is quite unique.
Mr. E. Meyrick on the Genus Imma.

P. canonitis, n. sp.

♂. 22–24 mm. Head and thorax fuscous, somewhat whitish-mixed, thorax beneath with a fringe of projecting flat white scales between middle and posterior legs. Palpi fuscous, whitish beneath and towards base. Antennae dark fuscous. Abdomen fuscous, segmental margins whitish. Fore-wings elongate, costa gently arched, apex rounded-obtuse, termen rather obliquely rounded; brownish or pale fuscous, irrorated with dark fuscous; submedian fold sometimes obscurely whitish from base to middle; cilia light fuscous. Hind-wings rather dark fuscous, lighter anteriorly, sometimes with obscure streak of whitish suffusion from base to middle of disc; cilia whitish-fuscous with darker basal line, towards tips whitish.

HIMALAYA (Simla); two specimens in May (Major C. G. Nurse).

[Read June 6th, 1906.]

Plates IX—XII.

The following notes on the bionomics of African butterflies mainly refer to the large collection recently sent to the Hope Department, Oxford University Museum, by Mr. C. A. Wiggins, M.R.C.S., F.E.S., etc., etc. This magnificent collection, with excellent data, has already been described in Nov. Zool. vol. xi, pp. 323–363, 1904.

A further large and important collection from the same region, made by Mr. A. H. Harrison, has also been made use of to some extent. Where numbers are given, they generally refer to Mr. Wiggins' collection only.

The district whence these specimens come proves itself to be of peculiar interest to students of geographical distribution. It is here that we have a great commingling of Eastern and Western forms. In the list of specimens in the paper above referred to will be found records of such species as Elymnias phoebe, Fabr., Bicyclus icius, Hew., many species of Planema, Eucanthe crossleyi, Charaxes zingha, Cram., to mention only a few, all of which until a few years ago were thought to be species confined to the tropical West Coast of Africa. These are mingled among many truly East African forms.

As will be seen later, A. niarius and dominicanus, originally described as distinct species and subsequently considered distinct forms, are now shown to form a syngamic group. This extension of the Western fauna to E. Central Africa is most probably due to the extension eastward of dense forest land, similar to that on or near the western tropical coast. The climate on or near the equator has apparently much less defined wet and dry seasons, resulting in a humid atmosphere and equable temperature more suitable to the growth of dense vegetation.

This absence of well-defined wet and dry seasons has a marked effect on the seasonal forms in the Lepidoptera of the country, well-marked seasonal characters being relatively scarce. In studying the mimetic groups in such a large

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number of specimens there are to be found many points of interest. We can hardly fail to notice that nearly every species which exists in large numbers (and has therefore been successful in the struggle for existence) almost invariably forms the model for other species, or itself exhibits Müllerian mimicry with other abundant and distasteful species. In some cases it is true a few models, viz. certain species of *Planema*, were only taken in very small numbers, but when we see that their mimics (spp. of *Pseudaeroka*) were also equally scarce, it is allowable to suppose that either owing to their retiring habits or some other such cause these species were overlooked, or that the collection was made near the edge only of their area of distribution.

Association of *Amauris echria jacksoni*, Sharpe, and *A. albimaculata*, Butler, with *A. psyttalea f. damoelides*, Staud.

On examining a large series of both *Amauris echria* and *A. albimaculata*, which, as Messrs. Rothschild and Jordan* have recently pointed out, are clearly distinct species, I was much struck with the difference between the Victoria Nyanza specimens and those from Southern Africa.

The *echria* specimens have long since been described by Miss Sharpe as *A. jacksoni,†* a distinct species, but are doubtless not more than a geographical race of *A. echria*.

The *albimaculata* specimens are extremely like, if not identical with *A. hanningtoni* of Butler,‡ which is also only a form of *albimaculata*. I shall endeavour to show that both these forms differ from typical South African ones in a common direction, and that these differences are due to the presence of *A. psyttalea*, bringing all three species into a clearly marked synaposematic group.

The Uganda specimens of both species, more especially the ♀♀, bear a marked general resemblance to *A. psyttalea damoelides*, Staud. The chief character by which this resemblance is obtained seems to be the markedly greater average size and roundness of the spot within the discoidal cell of the fore wing. I have therefore measured both the length and breadth of this spot in a number of specimens from South Africa, East Africa, and Uganda.

The results are appended in the following table:—

<table>
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<tr>
<th>Region</th>
<th>Species</th>
<th>No. of specimens</th>
<th>Discocellular spot average</th>
<th>Species</th>
<th>No. of specimens</th>
<th>Discocellular spot average</th>
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<td>Length</td>
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<td>Length</td>
<td>Breadth</td>
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<tr>
<td>S. Africa (S. of the Limpopo)</td>
<td><em>A. echeria</em>, Stoll.</td>
<td>12</td>
<td>2.26 mm.</td>
<td>1.13 mm.</td>
<td><em>A. albimaculata</em>, Butler</td>
<td>22</td>
</tr>
<tr>
<td>B. E. Africa (E. of the Rift Valley)</td>
<td><em>A. echeria jacksoni</em>, Sharpe.</td>
<td>3</td>
<td>3.73 mm.</td>
<td>1.46 mm.</td>
<td><em>A. albimaculata</em>,</td>
<td>5</td>
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<td><em>f. intermediate to</em></td>
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<tr>
<td>E. and N.E. of the Victoria Nyanza</td>
<td><em>A. echeria jacksoni</em>, Sharpe.</td>
<td>85</td>
<td>4.049 mm.</td>
<td>1.525 mm.</td>
<td><em>A. albimaculata</em>,</td>
<td>30</td>
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<td><em>hanningtoni</em>, Butler</td>
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<tr>
<td>W. and N.W. of the Victoria Nyanza</td>
<td><em>A. echeria jacksoni</em>, Sharpe.</td>
<td>23</td>
<td>3.947 mm.</td>
<td>1.704 mm.</td>
<td><em>A. albimaculata</em>,</td>
<td>38</td>
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<td><em>hanningtoni</em>, Butler</td>
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</table>
It is therefore fairly safe to say, even considering the comparatively small number of specimens measured, that there has been a marked increase in the size of this spot as we advance northward along the East Coast, and thence turn westward to the apparent limit of the area of distribution of the species. In addition to this increase in area of the spot, which is common to both species, it is fairly evident from the above table that there is an increase of a peculiar kind, the spot becoming distinctly more circular in shape as we proceed westward. As will be seen from the table, the ratio of breadth to length is appreciably greater in both species west of the lake than east of it. In A. albimaculata this progressive increase occurs as we come up from the south, as well as from east to west.

Other points of superficial resemblance which both species share, are greater expanse of wings and much better development of submarginal spotting on the hind wing. As might be expected, the resemblance in the ♀ ♀ is markedly closer than in the ♀ ♂. The ♀ specimen of albimaculata from Toro, figured, shows this resemblance in an astonishing manner, and has the additional characteristic of the pale buff area at the base of the hind wing being somewhat diffused. This resemblance becomes all the more significant when we remember that A. psyttalea does not occur in South Africa, while it is a very dominant species in Uganda, and also occurs, but not so commonly, in British East Africa. I have not had an opportunity of comparing numbers of specimens of A. psyttalea from the east and west shores of the lake, but it is undoubtedly very common, and occurs in the Wiggins collection from every locality except the more open open plains.

This clear influence that the presence of one species has had upon two other closely allied ones (all being highly distasteful), seems to be one of the most striking examples of Mullerian mimicry that it is possible to imagine.

The specimens of A. psyttalea are themselves remarkably interesting, the species being apparently in rather an unstable condition. The majority of the specimens, especially from the more eastern localities, are of the form damoecides, Staud., but a number from the north-west of the lake are typical A. psyttalea, Plotz, from the tropical Atlantic coast. These specimens, which are accompanied by many intermediates, are distinguished from A. psyttalea
damocides by a reduced pale area at the base of, and the absence of submarginal spots on the hind wing, giving them a marked general resemblance to western forms such as A. damocles, Beauv. (non Fabr.), and hecate, Butler. A. hecate does itself occur sparingly on the shores of the Lake; as also another species allied to it, viz., the recently-described A. disa, mihi (2).* In this species all the white markings and (especially the pale area at the base of the hind wings) are even more reduced than in hecate.

The above is a striking case of a species acting as a model, at one and the same time as certain individuals of it are being attracted into another group. This complicated condition of mimetic association in which a species is both model and mimic at the same time is well known to be paralleled in the Neotropical region, where we find similar but still more complicated instances among the Danainæ, Heliconiæ and Ithomiæ.

The specimens of Amauris niavius, Linn., are also deeply interesting. Whilst the specimens taken west and north-west of the Lake (with one exception from Entebbe which is intermediate in character) are all A. niavius niavius, the typical western forms, those from the north-eastern shores numbering about thirty specimens are nearly fifty per cent. of them intermediate to A. niavius dominicanus, which occurs at Mombasa.

The two chief points of distinction in the latter form are the greater extent of all the white areas and spots on both wings. The spot within the cell and subapical bar of the fore wing, together with the white basal area of the hind wing, are especially larger. In A. niavius niavius the discocellular spot is evanescent, and the white basal area of the hind wing seldom even reaches the extremity of the cell.

The specimens above mentioned occurring from the east of the Lake are remarkably intermediate in respect of these characters. The discocellular spot is well marked but not so large as in dominicanus. The subapical white bar is broader than in niavius, but not so broad as in dominicanus. The basal white area of the hind wing extends well beyond the extremity of the cell, but not nearly so far as it does in dominicanus.

The two instances above of two geographical forms of a species meeting and appearing in an intermediate form on

the confluent edges of their distribution is of remarkable interest.* It should help to impress upon systematists the importance of carefully considering the question of geographical races of species before making new species on slight differences.

Mimetic Groups with Danaine Models.

The black and white Amauris niavius, Linn., forms the model for an important group of butterflies of many families. It is evidently very abundant on the shores of the Lake. There are 118 specimens in the Wiggins Collection.

The group comprises:

Euralia anthedon, Doub. et Hew. (14).
Hypolimnas monteironis, Druce (4 ♂ ♀, 3 ♀ ♂), of which the ♀ only is mimetic.
Papilio dardanus ♀, f. hippocoon, Fabr. (8), mostly from the eastern side of the Lake. The ♂ ♀ of dardanus (46) were common nearly everywhere.

Elymnias bammakoo, Westw. (7), all from the Western districts.

In all these forms the resemblance to the model is remarkably good, the distribution of white markings on a black or dusty ground faithfully follows those of the model and differs in much the same way from the South and East African mimics (H. wahlbergi, P. cenea, hippocoonoides, etc.) of A. niavius dominicanus as the two models do from each other.

The ♀ ♂ of Planema godmani, Butler (2), with the recently described Pseudacraea tirikensis, mihi (3), resembling it in an astonishing manner, form a subsidiary black and white group within the larger assembly having niavius as its model. This is, perhaps, especially the case when the insects are on the wing. At rest the Planema, and the Pseudacraea closely following its model, present the character so common in the larger Ethiopian Acrininae of a black-spotted chocolate-brown triangle at the base of the hind wing on the under surface. The influence of this character on other forms and of other forms on it has

* Professor Poulton has already called attention to the case of A. niavius in his Presidential Address to the Entomological Society 1904. Trans. Ent. Soc. 1903, p. xciv,
already been considered by Professor Poulton.* He points out the great influence which the *Papilio* of the *zenobia* group have had in respect of this character.

It is interesting to note that this group of *Papilio* is well represented in the collection, comprising the following species:

- *P. homeyeri*, Plotz. . . 39 specimens.
- *P. cynorta*, Fabr. . . 8
- *P. peculiaris*, Neave . . 1
- *P. zenobia*, Fabr. . . 49
- *P. gallicus*, f. whitalli, Neave 6

As Professor Poulton has pointed out, *loc. cit.* p. 489, in *P. gallicus* and its allies, the basal patch is very large and is traversed by black lines instead of spots, a character not occurring in *Planema*. In the other species the area is smaller and the lines replaced by spots. This condition reaches its extreme in *P. peculiaris*, *mihi ♀*, which, as will shortly be shown, is an extraordinarily close mimic of *Planema paragra*, Grose-Smith. *P. homeyeri* is also remarkable for the fact that the colour of this patch is more chocolate-brown in colour instead of golden-brown as in other species. In this respect it approaches *P. godmani* and *P. tirikensis* mentioned above.

*Neptis agatha*, Stoll (47), and its allies may also be not improbably members of this group. This species exhibits in common with other species of the Ethiopian region a concentration of the white markings on both wings, as Professor Poulton has already pointed out,† in contrast to the broken character of these markings in Oriental species. The flight of these species is also singularly slow and floating when undisturbed and much like that species of *Planema* and black and white *Amauris*.

The variable *A. psyttaea*, Plotz (81), from many localities was accompanied by its equally variable mimic *Hypolimnas dubius*, Pal. (9), in the more western localities.

**Amauris echeria Group.**

Owing to their extremely close resemblance, *A. echeria jacksonii*, Sharpe, and *A. albimaculata hanningtoni*, Butler,

* Trans. Ent. Soc. 1902, p. 488,
† *Loc. cit.* p. 467,
may be conveniently taken as the same model. They both seem common in nearly every locality except the more exposed and open plains. There were 176 specimens from various localities in the two collections, but Mr. Wiggins speaks of them as his "pet aversion," explaining that they were enormously abundant. The best mimics of these species in the collection are:

_Euralia mima_, Trim. (16), mostly from the west shore of the Lake.

_Papilio homeyeri_, Plotz, 36 ♂ ♂ and 3 ♀ ♀, of which the latter only are mimetic.

_Papilio dardanus_ ♀, f. cenua, Stoll.

This form of the ♀ did not occur in the Wiggins collection, but there are three specimens in the Harrison coll. from Nyangori, near the north-east shore of the Lake.

As Professor Poulton has pointed out, loc. cit. p. 485, there is a very remarkable secondary resemblance between these mimics. The ♀ of _P. homeyeri_, which does not occur in the group mentioned by him, further bears this out, having an actually closer resemblance to _Euralia mima_ than to _Amauris echeria_ itself. There are also in the collection some other less good mimics of _A. echeria_ lying on the outskirts of the group, comprising:—_Hypolimnas dinarcha_, Hew., the forms of _Pseudacra _lucretia_, and a number of the smaller _Acraxas_ such as _A. servona_, Godm., _A. circeis_, Dewitz, _A. oceas_, Sharpe, and its form _albimaculata_, and especially _A. johnstoni_, f. _flavescens_. _Neptis woodwardi_, Sharpe, also comes into the same group.

For a full account of the convergence between many species of _Acraxas_, including most of the above-mentioned, and species of _Amauris_, see Professor Poulton's paper, read before Section D of the British Association at Toronto, 1897.*

**LIMNAS CHRYSIPPUS GROUP.**

_Limnas chrysippus_, L. (342) and _Hypolimnas misippus_, L. (160), were abundant in every locality. They were somewhat less numerous in forest districts.

_Acrava encedon_, L. (442), was also very common everywhere.

Table of forms of above species.

<table>
<thead>
<tr>
<th>Species</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>L. chrysippus chrysippus</td>
<td>136</td>
<td></td>
</tr>
<tr>
<td>H. misippus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P. misippus</td>
<td>55</td>
<td></td>
</tr>
<tr>
<td>A. encedon</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P. encedon</td>
<td></td>
<td>164</td>
</tr>
<tr>
<td>P. aleippioides 16.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P. aleippus 18.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P. aleippioides 7.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P. aleippina</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>P. lycia</td>
<td></td>
<td>126</td>
</tr>
<tr>
<td>P. dorippus 163.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P. inaria 36.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P. daira 124.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P. albicus 13.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P. dorippoides 6.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

It is evident from the above numbers that Mr. Wiggins did not think it worth while to send many ♀♂ of misippus. Consequently the true proportion of the occurrence of this species is not obtainable. Two specimens of a new Acria, both ♀♀ (A. wigginsii, mihi), exhibit a remarkable synaposemetric resemblance to A. encedon and indirectly to L. chrysippus. The species is allied to and intermediate in many respects between A. bomba, Grose-Smith, and A. anacreontica, Grose-Smith. It differs from both these species in possessing a subapical white bar. This being probably a mimetic and not an ancestral character it is possible that the ♀♂, not yet known, may not have it.

Tirumala petiverana Group.

The black and green Tirumala limniae petiverana, Dbl. and Hew. (67), an abundant species, was taken in five different localities.

Of its mimic Papilio leonidas, Fabr., eight specimens were collected. Also two specimens of Euxanthe crossleyi ansorgyi, R. and J., which is probably an outlying member of the group.

Melinda formosa, Godm., and M. mercedonia, Karsch, with the mimetic Papilio rev, Oberth. (hitherto considered the mimic of the Danaine), occur in both collections and are of considerable interest. Their distribution is as follows—

<table>
<thead>
<tr>
<th>Location</th>
<th>M. formosa</th>
<th>M. mercedonia</th>
</tr>
</thead>
<tbody>
<tr>
<td>N.E. Shore</td>
<td>50 specimens</td>
<td></td>
</tr>
<tr>
<td>N.W. Shore</td>
<td></td>
<td>36 specimens</td>
</tr>
</tbody>
</table>

Nyangori, a few miles north-east of the Lake shore, is apparently the eastern boundary of M. mercedonia, and from this locality come all the five specimens recorded above. West and north-west of the Lake mercedonia is
common, and formosa does not seem to occur. There is, strange to say, not a single ♀ amongst all the specimens of mercedonia and only four of formosa.

The specimens of Papilio rex, eight ♂♂ and two ♀♀, in the Wiggins and Harrison collections all come from Nyangori, and are very remarkable. Only two ♂♂ are fairly typical rex; the other specimens especially the ♂♀ are markedly intermediate between P. rex and P. mimeticus, Rothschr. The latter species, it will be remembered, bears a strong resemblance to M. mercedonia. The intermediate characters are shown in the reduction in size of the spots, and in the extension of red-brown colour over the hind wings.

This fact becomes of great importance when we recollect that normal specimens of P. rex occur on the Kikuyu escarpment to the east, while the only specimen of mimeticus at present known comes from Msaromsaro northwest of the Lake. It is therefore of very great interest that, at the place where both species of Danaines do occur the Papilio should be intermediate in appearance between them; further, that where mercedonia exists apparently alone to the west of the Lake the mimeticus form should only be found; to the east, where formosa only occurs, rex should be the only form. All three species were captured at the same time of the year.

Müllerian Association of Danaines and Papilios.

In studying the last two groups one cannot fail to be struck with the fact that the mimicry has not all been on the side of the Papilios.

In the first place the widely distributed Tirumala petiverana, Dbl. and Hew., may safely be regarded as the ancestral form of the three Danaine members of the group. It extends nearly all over tropical Africa in the more wooded districts, and can only be considered a geographical race of T. limniace, so common in the Oriental region. Ethiopian specimens are of interest in exhibiting amongst other differences a distinct shade of reddish-brown on the under-side toward the base of the fore wing. Melinda mercedonia, Karsch., and M. formosa, Godm., on the other hand, are specialized forms with a comparatively small and local distribution. In addition to their striking red and reddish-brown colour, they differ
from *T. petiverana* in the greater length of the fore wings and in the possession of pale sulphur-yellow areas at the base of the hind wings only interrupted by dark crossing nervures. *M. formosa neunmanni*, Roths., from Abyssinia is of great interest, and differs in several significant particulars from typical *formosa*.

These differential characters are—

(a) Slightly shorter fore wings.

(b) The presence of a V-shaped mark of pale yellow between the median nervure and first median nervule near their junction.

(c) The brown colour of the fore wing is darker and less extensive.

This latter characteristic has already been pointed out by Mr. Walter Rothschild, Nov. Zool. 1902, p. 596.

The above characters are also of great interest in that they all of them show affinities to *T. limniace*. β is especially characteristic of that species.

Having therefore inquired somewhat into the ancestry of *M. mercedonia* and *formosa* it will be seen that their elongated fore wings and pale areas at the base of their hind wings are new developments and non-ancestral characters. These two points however are characteristic features not only of *Papilio rex* (in which they are specially marked) but of several other African "Swallow-tails," including *P. leonidas* itself, the mimic of *T. petiverana*.

There can be little doubt therefore that the above-mentioned characters of these Danaines have been obtained from the *Papilio*. As regards the brown colour of both *Papilio* and Danaine, on the other hand, the Danaine has almost certainly been the model. In this matter we must remember that red or reddish-brown is very rare in African *Papilios*. It occurs in the *trophonius* ♀ form of *P. cenea* and *P. ridleyanus*, White, both mimetic; also to a less extent in the golden-brown triangle at the base of the hind wing in the *zenobia* group of *Papilios* mentioned above. In Danaines, on the other hand, this colour is by no means uncommon, e.g. *Limnas, Salatura* and the allied genus *Anosia*. Further, as we have already seen, *T. petiverana* (the probable ancestor of the two Danaines in question) exhibits a tendency to brownness as compared with its Oriental allies. It is also a significant fact that
Mr. S. A. Neave: some biometric

this brown colour is more marked in the ♀ of P. rex than in the ♂. The Danaines again have most probably formed the model for the spotting of the Papilio, which is not quite like that of any of its allies. Considering these facts we may cite the above group as a complete example of diaposematic resemblance.

GROUPS WITH ACRÉINE MODELS.

The fine Planema poggei, Dewitz, occurred in fair numbers in both collections, about 20 specimens from several localities. This very striking species with its brilliant orange band on the fore wing has several interesting mimics.

First and perhaps most important of these is the plane-moides ♀ form of Papilio dardanus, Brown, recently described by Mr. Roland Trimen, F.R.S.,* from a single specimen collected by Mr. Hobley of Kisumu. There are six of these ♀♀ in the collections of Messrs. Wiggins and Harrison. Amongst these is a considerable variation in the extent and completeness of the orange band on the fore wing. One specimen is remarkable for showing an intermediate character to the ♀ form of cenea dardanus, and the orange colour, though present, is much broken up into spots, and the basal area of the hind wing is buff coloured as in the cenea form instead of white as in typical planemoides.

Other interesting mimics of P. poggei in the collection are:—Pseudacraea hobleyi Neave, (2), in which the resemblance is best in the ♀ but remarkably close in both sexes. Pseudacraea kunowi neumannii, Thur. 2. Acrēa aurivillii, Stand. (14), synaposematic with poggei. Elymnias phegea, Fabr. (2) (also referred to by Mr. Trimen loc. cit.).

An outlying member of this group was recognized in the 3 ♀♂ of Precis vanana, Grose-Smith, which bear an orange bar across the fore wing as in the ♂ ♂ (14); but have a white discal bar instead of an orange one to the hind wing. This gives them the same general appearance as the above forms.

Planema tellus, Auriv. (9), from the western districts, is resembled by the recently described Pseudacraea terra, nihi (1), also from the western side of the Lake, the resemblance being astonishingly close.

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All the members of a small group of peculiar interest were captured by Mr. Wiggins at Entebbe on the north-west shore of the Lake within a few days of each other.

The dull-coloured Plancma paragea, Grose-Smith, 1 ♂ (April 5, 1903) and 1 ♀ (April 9, 1903) is the model of the group. It is mimicked by two species both recently described, viz.:

*Pseudoerxa obscure*, 1 ♂, 1 ♀ (April 5, 1903), of which the ♀ is the better mimic.

*Papilio gallienus peculiaris*, 1 ♀ (April 6, 1903).

This species is remarkable for its small size and sombre colour relieved by pale cream-coloured markings, thus closely resembling the model.

Remarkable evidence of the coincidence of mimetic forms in time and space is here afforded by the fact that three such widely-separated species, all very closely resembling one another, should all have been captured on the same spot and on nearly the same date.

The plentiful *Acrxa sotikensis*, Sharpe (37), has only one mimic in the collection but that a remarkable one, viz. *Mimaerxa poulioni*, mihi (3). The resemblance on both surfaces is extremely close. The group of spots on the underside at the base of the hind wing and the characteristically marked hind margin of the *Acrxa* is faithfully represented on the Lycaenid.

A very large number of small orange-red and black *Acrxas*, forming a synaposematic group occur in the collection comprising:

* Acrxa vinidia*, Hew. (1287).
  " alicia, Sharpe (147).
  " nenu, Grose-Smith (5).

And the more outlying *A. screna*, Fabr. (1451). They are mimicked by the Lycaenid *Telipna carnuta*, Hew. (2).

A similar group is that in which the common *Pardopsis*

* loc. cit. pp. 333 and 342.
† N.B.—Dr. Karl Jordan, of the Tring Museum, informs me that this species may not improbably prove to be a mimetic form of the ♀ of *ceynorta*, Fabr., the ♀ (not represented in the Wiggins coll.) being hardly distinguishable from that species.

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Punctatissima, Boisd. (150), is the model. Two species of Lycaenidae are associated with it, viz.:


"clarensis, Neave (10).

Note.—Prof. Poulton informs me that he discovered two specimens of *P. amenaida*, Hew., placed among the *Acraea* in the Hope Collection by Professor Westwood.

Another synaposematic group among the *Acraeinae* consists of the larger red and black species, viz.:

*Acraea* *cgina*, Cram. (21).

*Acraea* *perenna*, Dbl. and Hew. (42).

*Acraea* *zetes*, Linn. (7).

*Acraea* *pharsalus*, Ward (8).

*Acraea* *orina* f. *orinata*, Oberth. (6).

These species belong to no less than three different subdivisions of the *Acraeinae*.

These species—especially *Acraea cgina*—are resembled closely by *Papilio ridleyanus*, White (4).

*Psilacraea boisduvali*, Dbl., though not in the Wiggins or Harrison collection, was obtained by Mr. A. W. Hobley in the same district, and also closely mimics *Acraea cgina*.

*Momira zingha*, Cram. (1), is probably an outlying member of this red and black group.

It is by no means improbable that the outlying gigantic mimic, *Papilio antimachus*, Drury, will also ultimately be found here.

**Mimicry in other Groups.**

*Atella phalantha* (144), so common all over Africa, occurs plentifully in the collection, together with its mimic, *Pseudocoryphis hegeonoe*, Godt. (35), from many of the same localities. As is so often the case, the resemblance is closer in the ♂ than in the ♀.

**Mimicry among the Pierinae.**

Three very differently coloured species of *Mylothris* form the models of three well-marked groups.

1. *Mylothris jacksonii*, E. M. Sharpe, with white fore wings and sulphur-yellow hind wings, is only represented by a
single specimen in the Wiggins collection, but it appears to be common in other collections from the same area.

It is mimicked by:

A yellow hind-winged ♀ form of *Belenois zochalia*, f. *formosa*, Butler, of which there are three specimens. Of the ordinary form of the ♀ there are 2, and 44 ♂ ♂.

*Phrissura lasti*, Grose-Smith (1).
*Phrissura phoebe*, Butler, (2), in which the resemblance is on the upper surface alone.

II. *Mylothris agathina* (189), a very common species, is white with blackish marginal spots on the upperside, while beneath, the apex of fore wings and whole of hind wings are ochreous; furthermore the base of underside fore wing is largely, and that of hind wing slightly, diffused with orange-red.

These characters on both surfaces are faithfully imitated by:

*Belenois thyse*, Hopfi. (14).
*Pinacopteryx rubrocostalis*, Lanz. (14).
*Phrissura phoebe* (2), mimics *M. agathina* on the under surface only, thus entering Group II. as well as I.

III. *Mylothris yunii*, Butler (25), and *Mylothris poppea*, Cram. (40), form a synaposematic pair, both being silvery-white with black marginal markings and both having the base of the fore-wing underside flushed with ochreous.

They are closely mimicked by:

*Phrissura sylvia*, Fabr. (17).
*Pinacopteryx diceyi*, Neave (12).

The latter species is only represented in the collections from the Toro country on the eastern slopes of the Ruwenzori Mts., some distance west of the Lake. The other species occur both east and west of the Lake.

The extremely abundant yellow and black *Terias*—

*T. brigitta*, Cram. (89)
*T. desjardinsi*, f. *regularis*, Boisd. (45)
*T. senegalensis* (70)

are closely mimicked by the Lycænid, *Teriomima zantha*, Grose-Smith (4).
Seasonal Forms.

Pressure of time, owing to my sudden departure to N.E. Rhodesia in January 1904, prevented me from studying the seasonal forms in this collection as much as I should have wished. They seem to be mainly of interest in the following particular. Just as on the equator the seasons are not nearly so well marked as in South Africa, so the seasonal forms are not so well marked, while intermediates are more common.

The most interesting specimens are several fine dry season Precis coelestina, Dewitz, and some remarkable intermediate and dry specimens of P. archesia, Godt.

In conclusion, I should like to express my unbounded gratitude to Professor Poulton, D.Sc., F.R.S., of the Hope Department, Oxford University Museum, at whose suggestion the work was undertaken, and who has given me the inestimable benefit of his unique knowledge of these subjects.
EXPLANATION OF PLATES.

PLATE IX.

Fig. 1. *Amauris hecate*, Butler, ♂. From Toro, Western Uganda.
1a. *Amauris psyttalea psyttalea*, Plotz, ♀. From Toro. Exhibiting a great general resemblance to Fig. 1 by reason of the reduction of pale basal area and submarginal spots on the hind wing as compared with Fig. 3.

From the N.E. shore of the Lake.

From Toro. Exhibiting a great resemblance to the foregoing by reason of the large spot in the discoidal cell of the fore wing, and in the marked submarginal spotting of the hind wing.
5. From Malvern, near Durban, S.A. Exhibiting a strong contrast to the preceding Uganda specimens.
3b. From Entebbe on the W. shore of the Lake. Remarkable for large size and well-marked spot in the discoidal cell as compared with the next species.
7. ♂ from Malvern near Durban, S.A. ♀ from Durban.

PLATE X.

Fig. 1. *Planema poggei*, Dewitz, ♂. From N.E. of the Lake. Remarkable for its brilliant orange discal bar on the fore wing, and white bar on the hind wing.
3. *Pseudacrae a kuenovii neumanni*, Thur., ♂. From N.W. shore of the Lake. Bears a marvellous resemblance on both surfaces to Fig. 1.
6. ♂ from N.E., ♀ from N.W. shore of the Lake. The ♀ only is mimetic.
8. *Papilio durianus ♀ i. planemoides*, Trim. This magnificent form, with its orange discal bar to the fore wing and white basal area to the hind wing, bears a very close resemblance to the model.
PLATE XI.

Fig. 1. Melinda formosa, Godm., ♂.
1a. " " " ♀.
♂ from Kikuyu escarpment. ♀ from N.E. shore of the Lake.

2. Papilio rex, Oberth., ♂.
2a. " " " ♀.
From the Kikuyu escarpment.

PLATE XII.

Fig. 3. Papilio rex, f. intermediate to ♂ mimeticus, Rothschr.
3a. " " " " " ♀ " " " From N.E. shore of the Lake. From this locality both the Danaines, M. formosa and M. mercedonia, occur.

From the N.W. shore of the Lake.

5. Papilio mimeticus, Rothschr., ♀.
From the N.W. shore of the Lake.
XIII. On the habits of a species of Ptyelus in British East Africa. By S. L. Hinde. Communicated, with Notes, by Professor E. B. Poulton, F.R.S.

[Read June 6th, 1906.]

Plate XIII.

[Mr. S. L. Hinde, in a letter written from Fort Hall, British East Africa, Jan. 12, 1903, gives the following account of the locality and mode of occurrence of an insect which is closely allied to Ptyelus flavescens, F., if indeed it is not actually the same species.—E. B. P.]

"I have started a new station, which ought to be a nice collecting ground. It is perhaps 6000 ft. altitude, on the east of Kinangop* and Sattima, i.e. Aberdare Range: the bamboo is only about six or seven miles away. The Bamboo Forest is about 9000 to 11,000 ft. altitude. Kenya (17,200 ft.) is about fifty miles away, across the Tana Valley.

"I send you a most interesting insect, which grouped resembles flowers in the imagines and fruit or buds in the larva; it is a cuckoo-spit we found on the banks of the Chania River (where I have placed the new station); the Chania River is a large one, not marked on any map. The insects were on a large tree, perhaps 40 ft. high, and almost every branch was covered with insects, and there was a continuous drip under the tree like rain from their secretions. When within 6 to 10 ft. or more of the insects they looked like flowers and fruit or buds. On the ground there were larvae and imagines, singly and in groups, that had fallen off the tree. I broke off a branch covered with insects and brought it to the tent. Mrs. Hinde made sketches at once, which we send by this mail. I send you also a box of the insects which have already faded."

Notes by Professor E. B. Poulton.

The specimens sent by Mr. Hinde in illustration of his remarks are to be seen in the British Natural History

* In a letter, dated July 2, 1906, from Fort Hall, Mr. Hinde writes:—"Kinangop on many maps, real name Nandarua (altitude 13,000 ft.), is the southern end of the Aberdare or Sattima Range. The insects were found on the Chania River (altitude 5,800 ft.) on the ground that is now Nyeri Government Station, sixteen miles north-east of Nandarua."

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Museum and the Hope Department, Oxford University Museum. They were compared by Mr. C. O. Waterhouse and myself with specimens of *Ptyclus flavescent*, F., in the British Museum, and probably belong to this species, allowing for the change of colour described by Mr. Hinde and shown by comparison with Mrs. Hinde’s paintings, representing an insect for which *flavescent* would be a most appropriate name.

The locality given on Mrs. Hinde’s drawings is Nyeri.

The native name of the tree appears on the drawings as “Muroha.” I have sent Mrs. Hinde’s careful drawing of it to Kew, and the Director kindly informs me that it is probably a species of *Heptaglottum (Araliaceae)*.

Livingstone observed in Angola an insect evidently allied to the *Ptyclus* painted by Mrs. Hinde.* He speaks of it as congregating in small companies of seven or eight on the smaller branches of trees of the Fig family. Such a group would produce three or four pints of fluid in the course of a night. He does not enable us to infer whether many companies inhabit a single tree, but the impression is produced that the numbers are very much less than those described by Mr. Hinde and shown in Mrs. Hinde’s drawings. Livingstone believed that the fluid was derived from the atmosphere and not from the tree and made some experiments which appeared to support his opinion. They are however unconvincing, while so improbable a contention demands for its establishment the most incontrovertible of evidence.

Dr. David Sharp, F.R.S., gives the following account of two species with habits somewhat similar to those described by Mr. Hinde:—“In Madagascar it is said that *Ptyclus youdolot* exudes so much fluid that five or six dozen larvae would about fill a quart vessel in an hour and a half†

. In Ceylon the larva of *Machaxvota yuttigera* constructs tubes fixed to the twigs of the tulip-tree, and from the tube water is exuded drop by drop.” (Cambridge Natural History, Insects, Pt. II. London, 1899, pp. 577, 578.) This latter fact is opposed to Livingstone’s hypothesis, inasmuch as the tube would tend to hinder contact with the air.

The interpretation of the copious exudation is almost certainly to be found in the relatively small amount of

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† See also Westwood, Introd. Mod. Class. Ins., Lond. 1840, vol. ii., p. 433.
nutriment contained in the sap, so that a great quantity must pass through the body of the insect in order to yield a sufficient supply of food. Analysis of sap drawn direct from the tree as compared with that of the fluid which has passed through the body of the insect might well yield interesting results bearing upon the physiology of insect nutrition.

The frothy covering is a good example of the utilization of an excretory substance for the purposes of defence, entirely analogous to the covering of fæces constructed by many larvae, the calcium carbonate in the form of minute aragonite crystals rubbed into its cocoon by Bombyx neustria, or the hardened paste of calcium oxalate excreted and made use of by the larva of Eriogaster lanestris.

Dr. David Sharp (l.c. p. 578) makes the following statement concerning the protective value of the froth:—"The frog-spit is considered by some naturalists to be a protective device; the larvæ are, however, a favourite food with certain Hymenoptera, which pick out the larvæ from the spits and carry them off to be used as stores of provisions for their larvæ." It is strange that Dr. Sharp should quote this observation as if in refutation of the opinion that the secretion is protective. I do not know of a single naturalist, except the late Dr. Haase, who holds or has held that any defence of this kind is effective against all enemies and that universal immunity is thereby conferred. Such a conclusion is unthinkable, and yet it is the only conclusion controverted by Dr. Sharp's statement. The category of special defences to which belongs the covering of froth involves conspicuousness and easy capture by special classes of enemies. But can it be doubted that the adaptation confers nevertheless a balance of advantage in the struggle for existence? The justification of any such doubt requires evidence on a very different scale from that brought forward by Dr. Sharp.

The method by which the froth is produced has been misunderstood and erroneously described probably by every author who has written upon the subject, until it was studied by my friend, Professor E. S. Morse of Salem, Massachusetts. Even his account is but little known by entomologists, because published in a somewhat unusual channel.* The general statement has always been that

* At first in an elementary book on zoology; later in Appleton's "Popular Science Monthly" for May 1900, p. 23.
the *Aphrophora* secretes or emits the froth from its body. Thus Dr. Sharp summarizes the older opinion in the following words:—"... When in the immature stages, certain of them [Cercopidae] have the art of emitting the liquid in the form of bubbles which accumulate round the insect and conceal it" (l. c. p. 577). Professor Morse shows that when the insect is cleared from the bubbles and placed on its food-plant, "it will crawl quite rapidly along the stem... , stopping at times to pierce the stem for the purpose of sucking the juices within, and finally settling down in earnest, evidently exerting some force in thrusting its piercing apparatus through the outer layers, as shown by the firm way in which it clutches the stem with its legs. After sucking for some time, a clear fluid is seen to slowly exude from the posterior end of the abdomen, flowing over the body first and gradually filling up the spaces between the legs and the lower part of the body and the stem upon which it rests. ... During all this time not a trace of an air-bubble appears; simply a clear, slightly viscid fluid is exuded, and this is the only matter that escapes from the insect. ... This state of partial immersion continues for half-an-hour or more. ... Suddenly the insect begins to make bubbles by turning its tail out of the fluid, opening the posterior segment, which appears like claspers, and grasping a moiety of air, then turning the tail down into the fluid and instantly allowing the enclosed air to escape. ... These movements go on at the rate of seventy or eighty times a minute. At the outset the tail is moved alternately to the right and left in perfect rhythm, so that the bubbles are distributed on both sides of the body, and these are crowded towards the head till the entire fluid is filled with bubbles, and the froth thus made runs over the back and around the stem." Many other interesting facts and observations are recorded in this paper which should, I think, be reproduced in a more accessible form, together with the simple but entirely adequate illustrations. The probability of some accessory aid to respiration by means of thin-walled leaf-like appendages is also discussed. The whole problem of the respiration of the insect enclosed in its mass of froth would be a fascinating subject of inquiry. The mere contemplation of it is enough to bring home the utter improbability of the older view as to the origin of the included gas.—E. B. Poulton.
EXPLANATION OF PLATE XIII.

The main drawing of the larvæ, etc., on the tree was made from life by Mrs. S. L. Hinde on Dec. 5, 1902. It is reduced to about \( \frac{3}{4} \) of the natural size.

The two drawings of the perfect insect with wings expanded and closed respectively and the two drawings of the immature stages were made from life by Mrs. Hinde on Dec. 2, 1902. These are unreduced.
I. Remarks on the Sub-Families Ectobiinae and Phyllodromiinae.

A careful study of the genera composing the sub-families Ectobiinae and Phyllodromiinae has convinced me that the characters usually employed to discriminate the members of the respective sub-families are so diverse in structure even within generic limits that but little reliance can be placed on them as criteria of distinction. The short transverse supra-anal lamina, the presence of a triangular apical field in the wings or of a large reflected apical area, and the sparse armature of the femora are the so-called diagnostic features of the Ectobiinae. Yet nearly all the species of the genus Anaplecta, and many species of the genus Theganopteryx have the supra-anal lamina produced and triangular; again, the triangular apical field appears in numerous species of Phyllodromiinae, sometimes much reduced in size but often as large as in Ectobia lapponica, L.; now as the presence of this apical field is more or less a mechanical result of a peculiar method of wing-folding, it is a character that may be expected to re-appear in other sub-families of Blattidae, and such indeed is found to be the case, too much importance therefore should not be attached to it alone as a diagnostic feature. The armature of the femora is also unsatisfactory; for though the posterior femora of Ectobia and of Anaplecta are armed with only two spines on the anterior margin beneath, in Pseudectobia and Theganopteryx they are frequently strongly spined, whilst in Chrastoblatta and Caloblatta, two Phyllodromiine genera, the femora are most sparsely armed. It will be
seen by the foregoing that the Ectobiinæ and Phyllodromiinæ possess features common to both sub-families, and the question arises as to whether there does exist a character that can be relied on as a diagnostic criterion of sub-family rank. I own to having been nearly completely baffled in my search for such a character, and I have seriously considered the advisability of transferring the genera Ectobia and Hololampra (= Aphlebia) to the Phyllodromiinæ, leaving in the depauperated Ectobiinæ—henceforth to be called, following de Saussure, the Anaplectinæ—only the genus Anaplecta and a new genus described below.

However, it is not necessary to make such a revolutionary change, for I believe that I have hit on a feature of great use in distinguishing the members of the two sub-families in question, namely, the form of the vena ulnaris of the wing. This vein is either simple or bifurcated or else ramose, and it is to be noted that when this vein is ramose a reduction in size of the triangular apical field generally ensues, the reduction leading on in many cases to entire obliteration. Moreover it is possible to trace a shifting backwards of the apical triangle; in Ectobia lapponica, L., this field is close to the anterior margin of the wing so that the median vein and ulnar vein impinge on its upper border, and do not attain the outer margin of the wing; in such a species as Theganopteryx conspersa, Ss., the apical triangle is shifted back so that the median vein and the upper branch of the bifurcated ulnar vein reach the outer margin of the wing, anterior to the apical triangle and only the lower branch of the ulnar vein impinges on it; in many species of Phyllodromia the median vein and the numerous branches of a ramose ulnar vein all reach the outer margin of the wing, the apical triangle having undergone a further backward shifting; finally we have those forms, such as the species of Pseudomops in which the apical triangle has disappeared entirely, and in these the anterior part of the wing projects beyond the posterior part, producing a marked sinuosity of the outer margin. Taking into consideration the great range of variation of these characters, I find it not possible to use them as criteria of sub-family rank, except to this extent, that all forms with a single or bifurcate ulnar vein and a conspicuous triangular apical field may be regarded as Ectobiinæ, and those forms with ramose ulnar vein as Phyllodromiinæ, whether the apical triangle is present reduced or absent.
Brief diagnoses of these two sub-families may be given as follows:—

ECTOBINÆ.—Femora spined beneath; sub-genital lamina of female not provided with valves; supra-anal lamina not quadrate or lobate; wings when present with a conspicuous triangular apical field or reflected apical area, the ulnar vein simple or bifurcate; tarsi without pulvilli.

PHYLLODROMIINÆ.—Femora spined beneath; sub-genital lamina of female not provided with valves; supra-anal lamina not quadrate or lobate; wings when present with or without a triangular apical field, never with a reflected apical area, the ulnar vein ramose; tarsi without pulvilli.

In spite of this new importance attached to the form of the vena ulnaris of the wings only three changes of genera are necessitated, viz. Pseudectobia is transferred from the Ectobiinæ to the Phyllodromiinæ; Hemithyrsoeera, Ss., and Mallotoblatta, Ss. and Zehntn., from the Phyllodromiinæ to the Ectobiinæ. Pseudectobia was considered by de Saussure as a division only of the genus Theganopteryx, Br., but such species as P. insularis, Šs., and P. littuwifera, Stål., in their general facies are quite Phyllodromiine in appearance and moreover have the femora strongly spined, whilst the supra-anal lamina in some species is produced. Hemithyrsoeera nigra, Br., and H. histrio, Burm., have been actually re-described by de Saussure (Mé. Orthopt. ii, pp. 50 and 52, 1869) as Theganopteryx indica and Th. juvenda respectively, surely sufficient testimony to the difficulty of discriminating between Ectobiinæ and Phyllodromiinæ, if no account is taken of the form of the vena ulnaris alarum. Mallotoblatta is placed by de Saussure and Zehntner with some doubt in the Phyllodromiinæ, and the sub-family Ectobiinæ is suggested by these authors as the correct resting-place for this interesting genus. If the form of the vena ulnaris alarum in conjunction with the extent of the triangular apical field is consulted by systematists, I believe that little or no difficulty will be experienced in deciding into which of the two sub-families a given species is to be placed. Some exceptions, it is true, must be noted; firstly, the new genus described below on page 247, which, though quite evidently closely allied to Anaplecta, nevertheless has the vena ulnaris alarum ramose; secondly, Phyllodromia...
germanica, L., and allied species such as P. parenthesis, Gerst., P. madeccassa, Sss., and P. humbertiana, Sss., which have the vena ulnaris alarum simple or bifurcate; in these species however the triangular apical field is much reduced, and for the present they must be regarded as forms transitional between the Phyllodromiinae and Ectobiinae. The species difficilis, Sss., and massa, Sss., I remove from the genus Phyllodromia to Theganopteryx; in these the supra-anal lamina is shortly produced or transverse, which character in conjunction with the prominent triangular field and simple or bifurcate vena ulnaris, renders their transfer only logical.

The genus Pachnepteryx, Br., I am unable to place with certainty since I have seen no examples and the wing-venation of the known species has never been described. It is quite evident that Thyrsocera histrio, Burm., cannot be referred to the genus Pachnepteryx as suggested by Brunner (Nouv. Syst. des Blatt., p. 116, 1865), it belongs to the genus Hemithyrsocera. I agree with de Saussure in relegating Chorisonocera to the sub-family Oxyhaloinae (= Plectopterinæ).

Genus Malloptoblatta, Sss. and Zhmtu.

Malloptoblatta obscura, n. sp.

♂. Head, pronotum and tegmina with sparse erect hairs. Rufocastaneous. Vertex, antennae at the base, abdomen, legs and cerci testaceous. Pronotum trapezoidal, sides deflexed with the lateral and anterior margins hyaline, disc rufocastaneous with sometimes an irregular central macula testaceous in colour. Mediastinal and marginal fields of tegmina hyaline; wings hyaline with the veins rufo-fuscous. Tegmina with thirteen to fifteen costal veins, the most distal ones branched, radial vein bifurcated, discoidal field traversed by six longitudinal veins, anal vein reaching the sutural margin at one-third of its length. Wings with nine to ten costal veins, their extremities swollen, radial vein bifurcated, median vein simple, ulnar vein simple, first axillary vein bifurcated, triangular apical field prominent, projecting beyond the anterior part of the wing. Anterior femora armed on the anterior margin beneath in the proximal half with three long spines, in the distal half with numerous short spines (type A of de Saussure); the posterior femora are armed with five spines on each border beneath; the formula of the apical spines is 1, 1, 1; a genicular spine is absent from the
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anterior femora. Supra-anal lamina slightly produced, trigonal; sub-genital lamina produced, irregular in shape, without styles; cerci mutilated. On each side of the middle line of the sixth abdominal tergum appears a mamilliform tubercle with a small orifice at the summit of each. Total length 10 mm.; length of tegmina 7 mm.

**MADRAS.** Five examples. (Oxford Museum.) The specimens are in bad condition, and the erect hairs in some examples have been rubbed off. I have no doubt however of the correct generic position of the species.

**Genus Theganopteryx, Br.**

*Theganopteryx apicigera*, Wlk.  

♂ and ♀. Rufo-testaceous or flavo-testaceous. Head, antennæ, legs and cerci fusco-castaneous; abdomen testaceous above, darker below. Pronotum trapezoidal, sides not deflexed, with hyaline lateral margins. Tegmina with the apices fuscous, the part of the right tegmen overlapped by the left, hyaline, twelve costal veins, anterior ulnar vein quadri-ramose, posterior ulnar vein simple. Wings hyaline, apex infuscated, marginal field flavo-testaceous, ten to eleven costal veins, their extremities swollen, median vein simple, ulnar vein bifurcate, first axillary vein tri-ramose, triangular apical field conspicuous but not projecting beyond the anterior part of the wing. Anterior femora not spined beneath, mid- and posterior femora with two or three spines only on each margin beneath; formula of apical spines 1, 1, 1; no genicular spine on anterior femora. Supra-anal lamina of male short, rounded, of female slightly produced; sub-genital lamina of male ample, with two styles. Ootheca with a longitudinal crest and carried with the crest uppermost, so that the eggs are vertically disposed. Cerci elongate.

Type (♀.) Total length 11 mm.; length of tegmina 9.5 mm.  
♂. " " 9 mm.; " " 8 mm.  
♀. " " 11 to 12 mm.; length of tegmina 9 to 10 mm.

JAVA (Wallace—Type), SUMATRA (Weyers), SARAWAK, BORNEO (Shelford). Nine examples. (Oxford Museum.) The position of the ootheca when carried by the female before deposition is not a character of sub-family import-

trans. ent. soc. Lond. 1906.—Part II. (sept.) 16
 ance; in all the Ectobiinae the ootheca is carried in the way described above, but it is so carried also by Ellipsidium and some species even of Phyllodromia.

_Theganopteryx bouvieri_, n. sp.

♂. Testaceous. Head rufous, antennae testaceous; pronotum rufous, with hyaline borders, a central line and a broad crescentic macula in the hinder part of the disc, testaceous; tegmina pale testaceous, hyaline; wings hyaline with the veins testaceous; abdomen above rufous, beneath castaneous; legs and cerci rufous. Pronotum transversely hexagonal, the postero-lateral borders one-third the length of the posterior margin; the posterior margin obtusely angled. Tegmina with twenty-one costal veins; ulnar vein with eleven oblique branches, posterior ulnar not visible. Wings with seventeen costal veins, the last two or three bifurcate, their extremities slightly swollen, ulnar vein bifurcate before the middle, first axillary vein tri-ramose, triangular apical field large, but not projecting beyond the anterior part of wing. Anterior femora with no spines beneath, posterior femora with two spines on each margin beneath; formula of apical spines 1, 1, 1; genicular spines on all the legs. Supra-anal lamina produced, triangular, sub-genital lamina without styles.

Total length 12.5 mm.; length of tegmina 10 mm.

_Diego Suarez, Madagascar_ (Alluaud, April 1896). Seven examples. (Paris Museum.)

Named in honour of Professor Bouvier, to whom I am indebted for the opportunity of examining an interesting collection of _Blattidae_ in the Paris Museum.

_Theganopteryx gambiaensis_, n. sp.

♂. Coloration almost the same as in _Ectobia lapponica_, L.; head piceous, antennae fuscous; pronotum castaneous, anterior and lateral margins hyaline; tegmina flavo-testaceous, marginal field hyaline; wings infuscated; abdomen fuscous with testaceous lateral margins above and below, the last two segments and the supra anal lamina testaceous above; first pair of coxae testaceous, second and third pairs tipped with testaceous, first pair of femora castaneous, second pair castaneous at apex and along lower margin the remainder testaceous. (Third pair missing), tibia testaceous tipped with castaneous, spines testaceous; cerci fuscous. Tegmina with ten costal veins, radial vein ramose at extremity, anterior ulnar vein bifurcated, posterior ulnar multi-ramose. Wings as in _Ectobia_.
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*lapponica*, L. Supra-anal lamina shortly triangular; ante-penultimate segment with posterior border notched; sub-genital lamina produced, rounded, without styles, the sternum of the preceding segment represented by two lateral lappets, the central part concealed beneath the preceding sternum.

Total length 13 mm.; length of tegmina 11 mm.

**GAMBIA.** One example (Oxford Museum).

This species is remarkably like *Ectobia lapponica*, L., the resemblance extending to the wing structure; the venation of the tegmina is however sufficient to separate the species.

The following table shows the differences between the four known species of *Theganopteryx* from W. Africa:

1. Pronotum bordered with hyaline.
2. Tegmina not black.
3. Tegmina with 20 to 22 costal veins, wing venation different from that of *E. lapponica* . . *T. senegalensis*, Sss.
3'. Tegmina with 10 costal veins, wing venation exactly as in *E. lapponica* . . . . . *T. gambiensis*, mihi.
2'. Tegmina black . . . . . *T. xthiopica*, Sss.

*Blatta amena*, Wlk., ♂, appears to be the same as *T. senegalensis*, Sss., but the female is a species of *Temnopteryx*; a specimen from Natal under the same name in the British Museum is a distinct species of *Theganopteryx*. I doubt if *Blatta fulvipes*, Wlk., can be separated from *Blatta amena*, Wlk., ♀.

*Theganopteryx xthiopica*, Sauss.

The form of the "titillator" is shown in Plate XV, fig. 3, it is almost identical in *Th. senegalensis*, Sauss.

**Genus Hemithyrsocera, Sss.**

This is not a satisfactory genus, unless it is restricted to one species, *histrio*, Burm., which has plumose antennæ in both sexes, and exhibits a remarkable form of sub-genital lamina in the male; in the other species the antennæ are inconspicuously pilose in the male sex and not pilose in the female, and there is really little to prevent the inclusion of
the species in the genus *Theganopteryx*; in some of the species the posterior ulnar vein of the tegmina is markedly angled, in others it is not. The form of the "titillator" in *H. lateralis*, Wlk. (= *H. major*, Br.) is shown in Plate XV, fig. 2, and is seen to be very different from that in *Th. ethiopica*, Sss.; unfortunately we know so little of the structure of this organ in the Blattidæ, that at present we can make no use of it in generic distinctions. The titillator of *H. histrio*, Burm., is almost the same as in *H. lateralis*, Wlk.

The synonymy of *Hemithyrsocera histrio*, Burm., is here given:—

*Thyrsocera histrio*, Burm., Handb. Ent. ii, p. 499, n. 7 (1838).


The sub-genital lamina and adjacent parts in the male are figured on Plate XV, fig. 1.

*Hemithyrsocera ignobilis*, n. sp.

♀. Differs from *H. ferruginea*, Br., in its smaller size; the golden lateral margins of the pronotum reach the anterior margin, but are not curved inwards here to the extent that they are in *ferruginea*; the posterior legs and the tips of the cerci are ferrugineous.

Total length 12.5 mm.; length of tegmina 10 mm.

No locality. (An identical specimen in the British Museum comes from the Khasia Hills.)

One example (Oxford Museum).

**Genus Escala, nov.**

Allied to *Theganopteryx*, Br., but the sub-genital lamina of the male bearing an asymmetrical lobe which may be unarmed, or armed with a series of hooks or replaced by a stout hook; the right style sometimes absent, the left style acuminate. Supra-anal lamina produced, triangular, not projecting beyond the sub-genital
lamina; cerci elongate. Wings with median and ulnar veins simple, reaching the outer margin of the wing, anterior to the somewhat inconspicuous apical triangle.

_Escala circumducta_, Wilk. (Plate XV, fig. 4.)


♂. Testaceous. Head rufo-castaneous; antennae, palpi clpeus testaceous. Pronotum with the disc rufous, lateral and anterior margins hyaline and a central testaceous macula. Tegmina with twelve costal veins, mediastinal vein bifurcate, radial vein with extremity ramose. Wings clear hyaline, with ten costal veins, radial vein bifurcate near the apex, apical triangle elongate but narrow, first axillary vein tri-ramose. Posterior femora with three spines on anterior margin beneath, four on posterior margin; formula of apical spines, \( \frac{1}{1}, \frac{1}{3}, \) no genicular spine on anterior femora. Supra-anal lamina produced, triangular, but doubled on itself so that in dorsal view the apex cannot be seen and the lamina appears then to be short and transverse. Sub-genital lamina ample, semi-circular in outline. The left style acuminated, the right absent, the lobe bearing five curved hooks bent over the edge of the sub-genital plate. Cerci elongate.

Total length 14 mm.; length of tegmina 11.5 mm.

ADELAIDE, S. AUSTRALIA. Five specimens, including the type (Oxford Museum).

_Escala longiuscula_, Wilk. (Plate XV, fig. 5.)


♂. Testaceous; head rufo-testaceous; lateral and anterior margins of pronotum hyaline. Tegmina with nineteen costal veins, radial vein not bifurcate, not ramose at extremity, anterior ulnar vein bifurcate, posterior ulnar multi-ramose. Wings as in preceding species. Posterior femora with five spines on each margin beneath, formula of apical spines \( \frac{1}{1}, \frac{1}{1}, \) genicular spines on all the femora. Supra-anal lamina produced, trigonal; sub-genital lamina as in the preceding species, the right style absent, the lobe modified to form a stout double-pointed hook; cerci elongate, their apices curved downwards.

Total length 13 mm.; length of tegmina 11 mm.

ADELAIDE. Four examples, including the type (Oxford Museum).
Escala insignis, n. sp. (Plate XV, fig. 6.)

♂. Rufo-testaceous; head castaneous, anterior and lateral margins of pronotum hyaline; wings clear hyaline with rufous shading on either side of the apical triangle; abdomen and legs testaceous. Tegmina with thirteen costal veins, anterior ulnar vein bifurcate, posterior ulnar vein ramose. Wings with eleven costal veins, first axillary vein bifurcate, apical triangle larger than in the two preceding species. Supra-anal lamina not much produced, trigonal; sub-genital lamina ample with two acuminate styles and an asymmetrical lobe, covered with short setae but not armed with hooks.

Total length 11.5 mm.; length of tegmina 9.5 mm.

AUSTRALIA. Two examples (Oxford Museum).

This species is structurally very close to Theganopteryx and may be regarded as the least highly modified species of the genus Escala. In general facies the species resemble each other closely, but the nature of the sub-genital lamina affords admirable specific characteristics, and if this is examined there can be no possible difficulty in distinguishing the species. I have seen no female examples of the genus.

Genus Anaplecta, Burm.

Anaplecta maculata, n. sp. (Plate XV, fig. 7.)

♀. Castaneous; head rufous, antennae fuscous; lateral margins of the pronotum and tegmina pellucid; a testaceous macula in the centre of the pronotum but nearer the posterior than the anterior margin; wings infuscated; the ventral surface of the abdomen, the legs and cerci testaceous. Tegmina with seven parallel costal veins, the discoidal field traversed by four longitudinal veins, the anal vein impressed. Wings with five costal veins joined by oblique venulae; the marginal field not dilated, the medio-discal field crossed by six transverse venulae, the first of which is oblique, no longitudinal vein dividing the apical part of the medio-discal field, two transverse venulae anteriorly connecting the median with the ulnar vein, the first axillary vein tri-ramose, apical area two-fifths of total wing-length.

Total length 6.5 mm.; length of tegmina 5 mm.


This and at least two other species are in the British Museum under the label Phyllodromia (?) gyrinoides, Wlk. I have compared A. maculata, mihi, and the two
following species with Walker's type and find that they are quite different from it; *gryinoides*, Wlk., also from Ceylon is undoubtedly a species of *Anaplecta*. The genus has not hitherto been recorded from Ceylon. *A. maculata* falls into the section of the genus that includes *A. major*, Sss. and Zhnt., *A. dohrniana*, Sss. and Zhnt.

*Anaplecta zeylanica*, n. sp. (Plate XV, fig. 8.)

♂. Small; rufo-castaneous; pronotum and tegmina with the lateral margins hyaline; legs and cerci testaceous. Tegmina with six costal veins, discoidal field with three longitudinal veins. Wings with the apical area, marginal field and veins pale fuscous, six costal veins, marginal field slightly dilated, medio-discal field crossed by four transverse venulae and the median vein connected with the ulnar vein by two transverse venulae near the apex, first axillary vein tri-ramose, apical area parabolic, its basal margin not angled, nearly one-half of total wing-length. Supra-anal lamina produced, trigonal.

Total length, 4 mm.; length of tegmina, 3:7 mm.

**CEYLON** (*Thwaites*, 1872). One example (Oxford Museum).

It is possible that the species is conspecific with *A. fulva*, Br., from Burma, but the description of that species does not include an account of the wing venation.

*Anaplecta thwaitesi*, n. sp. (Plate XV, fig. 9.)

♀. Head castaneous; pronotum castaneous with broad hyaline lateral margins; tegmina flavo-hyaline, wings with the apical area, marginal field and veins fuscous; abdomen fuscous; legs and cerci testaceous. Tegmina with eleven costal veins, the ulnar vein multi-ramose, the bases of the mediastinal and median veins and the anal vein strongly marked with castaneous. Wings with six costal veins, their extremities swollen, the marginal field dilated, the first bifurcated and connected with the humeral branch of the radial vein by an oblique venula, a transverse venula joins the humeral and discoidal branches of the radial vein near their point of origin, medio-discal field crossed by five transverse venulae, ulnar vein bifurcate, first axillary vein quadri-ramose, apical area parabolic, its base slightly obtusely angled, two-fifths of total wing-length. Supra-anal lamina produced, trigonal, slightly emarginate.

Total length 6 mm.; length of tegmina 5 mm.

**CEYLON** (*Thwaites*). One example (Oxford Museum).
Anaplecta malayensis, sp. n. (Plate XV, fig. 10.)

♂ and ♀. Fusco-castaneous, lateral margins of pronotum and tegmina hyaline. Tegmina with seven costal veins, discoidal field traversed by four longitudinal veins, anal vein impressed. Wings with marginal field and apical area fuscous, with five costal veins, marginal field not dilated, radial vein bifurcate, medio-discal field crossed by three to four transverse venulae, humar field half as broad, first axillary vein tri-ramose, apical area two-fifths of total wing-length, its basal margin obtusely angled.

♂. Total length 5 mm.; length of tegmina 4 mm. ♀. Total length 5 mm.; length of tegmina 4'8 mm.


Anaplecta obscura, sp. n. (Plate XV, fig. 12.)

♀. Fusco-castaneous, smooth, shining. Head piceous, maxillary palpi testaceous, antennae fuscous; lateral margins of pronotum and mediastinal fields of tegmina hyaline; centre of abdomen beneath, legs and cerci testaceous; wings with the marginal field and most of the apical area infuscated, an oblique pale fascia crosses the upper half of the apical area. Wings with the marginal field dilated, seven costal veins, median vein obsolescent, curving from the apex of the radial vein to join it again near its middle, thus forming a trapezoidal areolet, 1st axillary vein bi-ramose, a short branch being given off from the transverse bar joining the two rami, apical area equals half the total wing-length, its basal margin straight.

Total length 4 mm.; length of tegmina 3'5 mm.

Malay Peninsula (Errington de la Croix and P. Chapé, 1899). One example (Paris Museum).

The great reduction in the extent of the wing-venation is alone sufficiently diagnostic of this interesting little species.

Anaplecta borneensis, n. sp. (Plate XV, fig. 11.)

♀. Fusco-castaneous; lateral margins of pronotum and tegmina hyaline. Tegmina with eight costal veins, discoidal area traversed by three longitudinal veins, reticulated. Wings hyaline, apical area slightly infuscated; four costal veins, the last obsolescent, radial vein bifurcated, medio-discal area crossed by two transverse venulae near the middle and by two short oblique venulae at the apex, first axillary vein tri-ramose, apical area divided unequally by one longitudinal
vein, apex incised, basal margin very obtusely angled, about two-fifths of total wing-length. Supra-anal lamina slightly produced. Legs testaceous.

Total length 4.8 mm.; length of tegmina, 4 mm.

KUCHING, SARAWAK. Three examples. [No. E.] (Oxford Museum.)

The following table will help to show the differences between the various Oriental species:

1. Rufo-castaneous or fulvous.
2. Medio-discal field of wing with five transverse venules, ulnar vein bifurcated, ulnar field without transverse venules . . . . . . . . A. thwaitesi, mihi (Ceylon)
2'. Medio-discal field of wing with four transverse venules, ulnar vein simple, ulnar field with two transverse venules . . . . . . A. zeylanica, mihi (Ceylon)
1'. Fusco-castaneous.
2. Disc of pronotum with pale central macula . . . . . . . . A. maculata, mihi (Ceylon)
2'. Disc of pronotum without pale central macula.
3. Median vein of wing obsolescent at its distal end . . . . . . A. obscura, mihi (Malay Peninsula)
3'. Median vein of wing not obsolescent at its distal end.
4. Medio-discal field of wing with four venules.
5. These venules transverse, apex of apical area not incised . . . . . . A. malayensis, mihi (Malay Peninsula)
5'. Two proximal venules, very oblique, apex of apical area incised . . . . . . A. borneensis, mihi (Borneo)
4'. Medio-discal field of wing with two transverse venules . . . A. javanica, Sss. (Java)

I have not been able to examine critically A. gyrinoides, Wlk., from Ceylon, the type of which is in the British Museum, however it enters into Sect. 1' in the above table but can be readily distinguished by the fulvo-testaceous pronotum. A. fulva, Br., from Burma belongs to Sect. 1 in
but as the wing venation of the species has not been described, it is not possible to show how it differs from the two Ceylon species.

**Anaplecta pulchra**, sp. n.

♀. Flavo-testaceous. Antennae fuscous, except the two basal joints, and five joints close to the apex which are flavo-testaceous; pronotum with hyaline lateral margins; tegmina transparent; wings deeply infuscated, the anterior border of the marginal field, the proximal halves of the radial, ulnar and first axillary veins yellow; apex of abdomen beneath castaneous, the remainder bright flavous. Tegmina with eight costal veins, discoidal field with six longitudinal veins, anal vein impressed, axillary veins obsolete. Wings with six costal veins, the radial vein bifurcated, the median vein curved distally up towards the radial vein, the medio-disecal field crossed by one proximal transverse venule, first axillary vein tri-ramose, apical area nearly half the total wing-length. Supra-anal lamina produced, trigonal.

Total length 6 mm.; length of tegmina 4-5 mm.

**Fernando Po** (*L. Conradt, 1901*). One example (Paris Museum).

**Anaplecta dahomensis**, n. sp. (Plate XVI, fig. 2.)

♂ and ♀. Fusco-castaneous. Labrum and clypeus rufous; apical seven joints of antennae testaceous, the last tipped with fuscous. Prothorax piceous, its lateral margins broadly bordered with semi-opaque white. Tegmina entirely fusco-castaneous, with eight to nine costal veins, the discoidal field traversed by four longitudinal veins which are strongly marked. Wings hyaline, the marginal field and apical area infuscated, the axillary area iridescent fuscous; six to seven costal veins, the radial vein bifurcated but the branches soon reunite forming an areolet which is crossed by a transverse venule, the median vein obsolescent proximally where it is joined by a transverse venule to the radial vein, the ulnar vein simple, the first axillary vein tri-ramose, apical area nearly one-half of total wing-length, its basal margin straight. Second and third pairs of legs and cerci testaceous, first pair of legs fuscous, except the distal extremity of the tibiae and tarsi.

Total length 5 mm.; length of tegmina 4-2 mm.

**Athiémé, Dahomey.** A long series (Oxford Museum).

The species differs from *A. cineta*, Gerst., by the absence of a white border to the tegmina, by the strongly-marked veins of discoidal field of the tegmina, by the different colour of the legs.
Anaplecta brunneri, n. sp. (Plate XVI, fig. 1.)

♂ and ♀. Rufo-testaceous, vertex of head darker; antennae fuscos except at the base. Lateral margins of pronotum and of tegmina as far as termination of mediastinal vein hyaline; legs and cerci testaceous. Tegmina with ten to eleven costal veins, the last two or three irregular, discoidal field with three longitudinal veins, anal vein well marked. Wings infuscated, with seven costal veins, their ends slightly swollen, the medio-discal field crossed by three venulae, the proximal one bifurcated, the median vein obsolescent proximally, distally bent up to join the radial vein before its apex, anterior ulnar vein simple, posterior ulnar obsolescent distally, first axillary vein quadri-ramose, apical area as long as broad, two-fifths of total wing-length, its basal margin straight. Supra-anal lamina produced, its posterior border rounded, sub-genital lamina of male with one style, the left.

Total length 6 mm.; length of tegmina 5 mm.


The only two species with which this can possibly be confused are A. pallida, Bol., from Ecuador, and A. fulgida, Sss., from Mexico; from the former it differs by the narrow costal margin of the tegmina, by the smaller apical area of the wings, and by the smaller number of transverse venulae in the medio-discal field of the wings; from A. fulgida, Sss., by the longitudinal discoidal veins of the tegmina, and by the different wing-venation.

Anaplecta pavida, n. sp. (Plate XVI, fig. 3.)

♀. Flavo-testaceous; pronotum almost orbicular with broad hyaline margins; abdomen fusco-testaceous; legs and cerci testaceous. Tegmina hyaline with an irregular fuscos macula at base of the median vein; ten costal veins, discoidal field with four longitudinal veins. Wings slightly infuscated, ten costal veins, medio-discal field crossed by two transverse venulae, the distal one giving off an oblique longitudinal branch, one-fourth the length of the medio-discal field, first axillary vein quadri-ramose, apical area a little broader than long, one-fifth of total wing-length, basal margin obtusely angled. Supra-anal lamina produced, rounded.

Total length 6 mm.; length of tegmina 5 mm.

The species is allied to *A. nahuiz*, Sss., from Mexico, but differs in coloration.

*Anaplecta fusca*, n. sp. (Plate XVI, fig. 4.)

♀. Minute; fusco-castaneous. Head piceous; pronotum elliptical, entirely dark castaneous-brown. Tegmina castaneous, with ten highly irregular costal veins connected with each other by transverse venulae, discoidal field with two longitudinal veins, reticulated. Wings dark fuscous, five costal veins, radial vein with a humeral and a discoidal branch, median vein approximated to the radial vein and the very narrow medio-disegal field crossed by two transverse venulae, an oblique transverse venula runs from the apex of the ulnar vein to the median vein and from this two short obliquely longitudinal venulae are given off, first axillary vein quadri-ramose. Apical area more than two-fifths of total wing-length, basal margin straight. Cerci golden-yellow, supra-anal lamina rounded.

Total length 4 mm.; length of tegmina 3·5 mm.

**Cachabi, Ecuador (W. F. H. Rosenberg coll., Dec. 1896).** One example (Oxford Museum).

The venation of the tegmina and wings in this species is highly characteristic, and unlike that of any other known species.

*Anaplecta varipennis*, n. sp. (Plate XVI, figs. 5, 6.)

♀. Closely allied to *A. parvipennis*, Sss. and Zhnt., but differs in the following particulars:—the lateral borders of the pronotum and the mediastinal field of the tegmina are opaque white not hyaline, the clypeus is testaceous, the discoidal field of the tegmina is reticulated, the medio-disegal field of the wings is crossed by two transverse venulae, the sub-genital lamina is deeply cleft and has almost a valvular appearance. The tegmina vary in length from 4·8 mm. to 4 mm., the wings from 6 mm. to 3 mm., in the latter case the most notable reduction is that of the apical area which ranges in size from two-fifths of the total wing-length to one-sixth.

Total length 6·2 mm.

**Paramba, Ecuador, 3500 feet (W. F. H. Rosenberg coll., May 1897).** Five examples (Oxford Museum).

In spite of the variation in size of the wings, their venation remains practically unaltered; as already noted, the most marked range of size is shown by the apical area
and the variation is almost an epitome of the changes whereby the small triangular apical field of such genera as *Ectobia* and *Theganopteryx* has become modified into the large parabolic apical area of the genus *Anaplecta*.

*Anaplecta chrysoptera*, n. sp. (Plate XVI, fig. 7.)

♀. Very convex. Rufous. Antennae testaceous; third joint of maxillary palpi black; pronotum with lateral margins rufo-testaceous; abdomen and cerci castaneous, the apical joint of the latter yellow. Marginal field of tegmina nearly half the total breadth, thirteen parallel costal veins; the tegmina strongly overlap, veins of discoidal field of left tegmen obsolete, strongly marked in that part of the right tegmen which is covered by the left, the ulnar vein sends six branches to the sutural margin, anal vein strongly marked, axillary veins obsolete. Wings with the apical area and marginal field golden-yellow, fourteen costal veins, their ends slightly swollen, radial vein straight, medio-discal field crossed by eight transverse venulae, ulnar vein simple, first axillary vein quadri-ramose, apical area two-fifths of total wing-length, its basal margin obtusely angled. Supra-anal lamina transverse, sub-genital lamina large, its posterior border shortly cleft and compressed laterally in the centre simulating a valvular appearance.

Total length 7.5 mm.; length of tegmina 6 mm.

**Amazons (H. W. Bates).** One example (Oxford Museum).

This somewhat remarkable species is most nearly allied to *A. flabellata*, Ss. and Zhnt. The unique example was labelled in Walker's handwriting "*Biatia sp.*"; the genus *Biatia* (type *B. jucidicomis*, Wlk.) is too close to *Anaplecta* to be entitled to separate rank.

**Genus Anaplectoidea, nov.**

Differs from *Anaplecta*, Burm., in the branching of the ulnar vein of the wing. Elliptical, smooth, shining; vertex of head reaching anterior border of pronotum; eyes less remote than the insertions of the antennae; pronotum transversely elliptical. Tegmina with marginal field very broad occupying almost half the total breadth. Ulnar vein multi-ramose, anal vein deeply impressed, axillary veins obsolete. Wings with numerous costal veins, medio-discal field crossed by numerous transverse venulae, ulnar vein multi-ramose, the veins being given off towards the dividing vein, apical area small.
Supra-anal lamina slightly produced; sub-genital lamina large, spoon-shaped; cerci moderate.

The genus bears the same relation to Anaplecta, that *Pseudocelobia* does to *Theeganopteryx*.

**Anaplectoiidea nitida**, n. sp. (Plate XVI, figs. 8, 9.)

♀. Rufo-castaneous; antennæ, tarsi and cerci rufo-testaceouss. Lateral borders of the pronotum and mediastinal field of tegmina hyaline. Tegmina transparent, thirteen costal veins, ulnar vein with six branches. Wings infuscated, with twelve costal veins, their extremities swollen, medio-discal field crossed by eight transverse venulae, ulnar vein with six branches, apical area broader than long, one-fifth total wing-length, its basal margin obtusely angled.

Total length 11 mm.; length of tegmina 9 mm.

**Batchian** (*W. Doherty*), **Macassar** (*W. Doherty*). Two examples (Oxford Museum).

**II. The genera** *Pseudomops*, Serv., and *Thyrsocera*, Burm., *of the sub-fam. Phyllodromiæ*.

There has been considerable confusion regarding those species of Phyllodromiæ with incrassated antennæ and angulate ulnar veins in the tegmina. The steps whereby this confusion has grown may be summarized shortly as follows:—

The genus *Pseudomops* was founded in 1831 by Serville for the reception of the *Blatta oblongata* of Linnaeus, though whether Serville's determination of the Linnaean species is correct is not certain. Burmeister in 1838 included in his genus *Thyrsocera* the species *spectabilis*, *crinicornis*, *cincla*, *affinis*, *flavipes*, *laticornis* (Perty), *histrio*, *oblongata* (Linn.), *anulicornis* and *hirticornis*; of these ten species eight are Neotropical, two (*spectabilis* and *histrio*) are Oriental; *spectabilis* must be selected as the type of the genus. Brunner, de Saussure, and other authors have ignored Serville's name *Pseudomops* and have employed *Thyrsocera* instead; however de Saussure in 1893 created the genus *Hemithyrsocera* for those Oriental species with a triangular apical triangle to the wings and with a simple or bifurcated *vena ulnaris alarum*; of this genus *jucunda* is
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the type. Kirby (1904) employs the name *Pseudomops* for all the South American species placed by various authors in the genus *Thyrsocera*, six Oriental species are placed in the genus *Thyrsocera* and fourteen in the genus *Hemithyrsocera*. Rehn (1904) also applies *Pseudomops* to the Neotropical species, but sinks *Hemithyrsocera* as a synonym of *Thyrsocera*, *spectabilis* being selected as the type of that genus. An examination of most of the species on which these conclusions are based brings to light the following facts:—i. *Thyrsocera spectabilis*, Burm., is a Periplanetine, as shown by the valvular character of the last ventral segment of the female and by the wing-structure; *Ellipsidium speciosum*, Wlk., the type of which is in the Oxford Museum, is closely allied. Dr. A. Brauer, director of the Berlin Zoological Museum, has kindly favoured me with a drawing of Burmeister's type and a sketch of the sub-genital lamina of that example, and there can be no doubt but that *Thyrsocera*, Burm., is a ditypic genus of the sub-fam. Periplanetinae.

*Thyrsocera* may be re-described as follows:—

**Thyrsocera**, Burm.

Antennae incrassated in the basal half and hirsute, the hairs being longer and more dense on eight to ten joints just beyond the middle of the antennae forming here a conspicuous tuft; third joint not longer than second. Head projecting slightly beyond the vertex; eyes and antennal sockets equally widely separated. Pronotum, smooth, trapezoidal, sides deflexed. Tegmina extending considerably beyond the abdomen with the marginal field broad, the veins in the basal part indistinct, marked by series of punctures. Wings with the basal half of the marginal field coriaceous, both radial and ulnar veins multi-ramose. Front femora with a serried series of short spines on the anterior margin beneath, with one or two spines only on the posterior margin, the other femora sparsely armed, all with apical spines on both margins and genicular spines. Tibiae with spines in three rows above. Metatarsus equal in length to the remaining joints. Supra-anal lamina quadrate, cucullate with a median carina, its posterior border emarginate; sub-genital lamina of usual Periplanetine type. Cerci of moderate length, flattened and spatulate. Males unknown.

The two species may be distinguished as follows:—

Three joints beyond the antennal tuft white. Pronotum broadly
margined with yellow all round its border leaving a trefoil-shaped black centre.

_Th._ spectabilis, Burm. (Nepal, Ceylon, Malacca.) (Type in Berlin Museum.)

Two joints beyond the antennal tuft white. Pronotum with posterior margin and with two antero-lateral spots yellow, the black of the disc forming a cruciform figure. Ante-penultimate segment of abdomen beneath yellow.

_Th._ speciosa, Wlk. (E. Indian Archipelago.) (Type in Oxford Museum.) (Plate XIV, fig. 5.)

ii. The Oriental species exclusive of _spectabilis_, hitherto included in the genus _Thyrsocera_, belong to two different genera, viz. one in which the vena ulnaris alarum is simple or ramose and an apical triangle present, _Hemithyrsocera_, Ss., another in which the vena ulnaris alarum is ramose and an apical triangle absent: for the latter species a new genus is created and may be diagnosed as follows:—

**Pseudothyrsocera**, gen. nov.

Similar to _Pseudomops_, Serv., but with the anterior ulnar vein of the tegmina bifurcated instead of simple, and the pronotum truncate behind instead of produced. Antennae more or less incrassated and plumose in both sexes, whereas in _Pseudomops_ the antennae are not always plumose in the male. Rami of the posterior ulnar vein of the tegmina angulate; ulnar vein of the wings ramose, but sending no branches towards the dividing vein.

The species to be included in this genus are:—

1. _P. scutigera_, Wlk.

2. _P. pica_, Walker.

3. _P. xanthophila_, Walker.

The types of these are in the Oxford Museum.
4. *P. montana*, n. sp.

♂. Piceous. Head piceous, a triangular ochreous spot below the eyes, basal joints of maxillary palpi rufous, antennae slightly incrassated, black. Pronotum trapezoidal, not covering the vertex, sides deflexed, posterior margin rounded, slightly produced. Tegmina piceous, apex of mediastinal field testaceous, sixteen to seventeen costal veins, discoidal field with six longitudinal sectors. Wings infuscated, ulnar vein tri-ramose. Abdomen, coxae and femora rufous; cerci, apices of femora, tibiae and tarsi black, tibial spines rufous. Supra-anal lamina produced, trigonal, sub-genital lamina trapezoidal, with one style.

Total length 16 mm.; length of tegmina 12·5 mm.

**Mt. Matang, 3000 feet, Sarawak, Borneo.**

Two examples (Oxford Museum).

The species in general facies approaches the genus *Pseudomops*.

5. *P. ruficollis*, n. sp. (Plate XIV, fig. 6.)

♂. Head and pronotum bright rufous; eyes, antennae (mutilated) and maxillary palpi black. Tegmina black, a white spot on each mediastinal area and at the base of each anal field. Wings fuscous. Abdomen black. Coxae with their distal ends and outer borders testaceous-white; the remaining joints of the legs are missing.

Total length 16 mm.; length of tegmina 13·2 mm.

**Penang (Cantor).** One example.

The arrangement of the veins of the tegmina is the same as in *P. pica*, Wlk., and to that species this one is most nearly allied, and I expect that the antennae when perfect specimens are taken will be found to be plumose in the basal half as in *P. pica*. The insect is remarkably fusiform and both in colour and in shape is very like an Elaterid beetle.

iii. The genus Hemithyrsocera, Sss., for reasons already given, has been transferred to the sub-fam. Ectobiidae; the type species is *H. histrio*, Burm., since with this *H. jucunda*, Sss., is synonymous (vide ante). The determination of the species of the genus *Pseudomops* is attended with some difficulty owing to the brevity of the diagnoses of the older authors and to the great variability of some of the species. I have been at some

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trouble to determine with accuracy those species that are contained in the Oxford Museum, and I think that the subjoined list and notes made in the course of my labours may be of assistance to other workers in this order of Insects. I should like to record here my grateful thanks to Dr. O. Taschenberg of the Halle Museum who kindly lent me the type of *P. affinis*, Burm., and one or two other interesting examples of the genus; also to Dr. A. Brauer of Berlin for admirable drawings of the types of *P. flavipes*, Burm., *P. annulicornis*, Burm., *Blatta discoidalis*, Burm., and *B. discicollis*, Burm.

**List of Species of the Genus Pseudomops, Serv.**

I. *Cerci* not spatulate.

1. *P. oblongata*, L. *(Surinam.)*

*Blatta oblongata*, Linnaeus, Syst. Nat. (ed. x), i, p. 425, n. 9 (1758); De Geer, Mém. Ins. iii, p. 541, pl. 44, ff. 11, 12 (1773).


In spite of de Geer's admirable description and readily recognizable figure, subsequent authors have confused another species, *P. intercepta*, Burm., with this, explaining discrepancies in appearance as due to variability; the pattern of the pronotum is so different in the two species that I see no valid reason for confounding them. The general colour of the insect is fulvous and the disc of the pronotum is marked by two dark points which may be joined and by a crescentic dark band near the posterior margin.

2. *P. intercepta*, Burm. *(Mexico, Guatemala, Honduras.)*

*Blatta intercepta*, Burmeister, l. c. p. 497, n. 10 (1838); de Saussure, Mém. Mex. Blatt, p. 113 (1864).


*Thyrsoeera oblongata*, Brunner, Nouv. Syst. d. Blatt. p. 121, n. 8, pl. iii, f. 11 (1865); de Saussure, Miss. Mex. Orth. p. 50, pl. i, f. 29 (1870); de Saussure and Zehntner, Biol. Centr.-Amer. Orth. i, p. 32, n. 3 (1893).
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*Thysrocerata tolteca,* de Saussure, Rev. Zool. (2) xiv, p. 168 (1862); Mém. Mex. Blatt. p. 124, pl. i, f. 21 (1864); Brunner, l. c. p. 125, n. 18 (1865).

I agree with Kirby in regarding this as quite distinct from *P. oblongata,* L.; de Saussure and Zehntner on the other hand sink it as a synonym of *P. oblongata,* L. Good figures of the species have been published, so that it can be readily recognized.

3. *P. inclusa,* Wlk. (Brazil, Pernambuco.)


*Thysrocerata amena,* de Saussure, Mél. Orthop. fasc. iv, p. 97 (1872).

The species can easily be distinguished by the horseshoe-shaped dark mark on the pronotum. In some specimens this may be considerably reduced, but it is never entirely absent; the dark shadings on the tegmina are subject to considerable variation. The type of *inclusa* is in the Oxford Museum.

4. *P. laticornis,* Perty. (Brazil.)


*Thysrocerata laticornis,* Burmeister, l. c. p. 499, n. 6 (1838); Brunner, l. c. p. 123, n. 11 (1865); de Saussure, Miss. Mex. Orth. p. 51 (1870).


*Pseudomops concinna,* Walker, l. c. p. 82, n. 20 (1868).

Perty’s excellent figure is a valuable aid to the identification of this species; from the Halle Museum I received two examples which I was able to identify without much doubt. The following is a short description of them:

♂. Head red, shading to darker on the labrum, antennae black with a testaceous annulus occupying eight joints, base scarcely incrassated; pronotum rufous shading to fuscous posteriorly, borders testaceous; tegmina fuscous, distal half of mediastinal field and centre of marginal field testaceous; abdomen rufo-fuscous, cerci
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fuscous broadly tipped with testaceous; legs rufo-fuscous, coxae tipped with testaceous. Length of pronotum 2.8 mm.; of tegmina 10.5 mm. ♀. Vertex only of head red, antennae incrassated at base, the testaceous annulus occupying fourteen joints; pronotum rufous with a fuscous curved line posteriorly; tegmina fuscous with a broad testaceous vitta extending from distal half of mediastinal field and occupying the whole of the marginal field to near the apex of the tegmina, posteriorly the tegmina are fusco-hyaline; abdomen fuscous, cerci and legs as in the male. Length of pronotum 3 mm.; of tegmina 10 mm. Perty describes the head of this species as black, but his figure shows it to be red.

5. *P. annulicornis*, Burm. (Brazil, Bahia.)

*Thyrsocera annulicornis*, Burmeister, l. c. p. 500, n. 9 (1838); Brunner, l. c. p. 125, n. 16 (1865).  
*Pseudomops deceptura*, Walker, l. c. p. 82, n. 21 (1868).

The type is at Berlin, and from a sketch of it made for me by Dr. Brauer I am of opinion that *P. deceptura*, Wlk., is synonymous; the insect is testaceous-rufous with an infuscated patch on the posterior part of the pronotum, the white band on the antennae occupies ten joints. The species is undoubtedly very closely allied to *P. laticornis*, Perty, but as Burmeister was acquainted with that species and yet described *annulicornis* as new, it seems advisable to keep them separate. *Blatta annulicornis*, Wlk., the type of which is in the Oxford Museum, is a species of *Phyllodromia*.

6. *P. aurantiaca*, Sss. and Zhntn. (Panama.)

*Thyrsocera aurantiaca*, de Saussure and Zehntner, l. c. p. 32, n. 6, pl. 3, ff, 6, 7 (1893).

I have compared the type of this with the type of *P. deceptura*, Wlk., and find that the two are distinct.

7. *P. grata*, Rehn. (Costa Rica.)


The species is unknown to me.
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8. *P. americana*, Sss. *(Argentine Republic.)*


The type is in Paris. This is another rufous species, perhaps not distinct from *P. annulicornis*, Burm.

9. *P. mimica*, Wlk. *(Brazil, Para.)*

*Pseudomops mimica*, Walker, l. c. p. 80, n. 17 (1868).

♀. Head black, antennæ mutilated, pronotum rufous, with a fuscous crescentic band on the hind margin. Tegmina dark fuscous, mediastinal area and a small spot at the base of the marginal field hyaline-testaceous. Abdomen black, the fifth tergum with two lateral testaceous spots; cerci mutilated; supra-anal lamina produced, quadrate. Legs dark castaneous, apices of coxae and trochanters testaceous. Length of body 8 mm.; length of tegmina 10 mm.

Type in the British Museum.

The dark tegmina and the rufous pronotum render this a sufficiently conspicuous insect.

10. *P. cincta*, Burmeister. *(Mexico, Guatemala, Nicara gua.)*

*Thyrso cer a cincta*, Burmeister, l. c. p. 499, n. 3 (1838); Brunner, l. c. p. 122, n. 9 (1865); de Saussure, Mém. Mex. Blatt. p. 50, pl. 1, f. 28 (1870); de Saussure and Zehntner, l. c. p. 32, n. 1 (1893).

*Thyrso cer a mexicana*, de Saussure, l. c. p. 122 (1864).

*Thyrso cer a sallei*, de Saussure, l. c. p. 123 (1864).

*Pseudomops sallei*, var., Walker, l. c. p. 77, n. 4 (1868).


The species exhibits a great range of variation, the extreme forms are very different in coloration, but as de Saussure has examined a considerable series of specimens which help to bridge over the differences, I accept his conclusion that *P. sal lei* is merely a rufous variety of *cincta.*
11. *P. neglecta*, n. sp. (Brazil, Rio Grande do Sul.)

♀. Head and mouth parts piceous; antennæ black with a testaceous band beyond the middle occupying six joints, incrassated at base and pilose. Pronotum as long as broad, anteriorly truncate, not covering the vertex of the head, posteriorly produced, obtusely angled, dark fuscous, all the margins bordered with yellow, broadest laterally. Tegmina fuscous or rufo-fuscous, mediastinal field hyaline or testaceo-hyaline, marginal field partially hyaline; seventeen to eighteen costal veins, discoidal field with six longitudinal sectors. Wings infuscated. Abdomen fuscous, segments laterally bordered with testaceous, apex rufo-fuscous; supra-anal lamina triangular, produced, sub-genital lamina ample, semi-orbicular, rufous, posteriorly margined narrowly with fuscous; cerci fuscous. Legs black, the tibial spines rufous, the coxae margined with testaceous.

Total length 10-5 mm.; length of tegmina 8 mm.; pronotum 3 mm. × 3 mm.

Three examples labelled in Brunner’s handwriting "Thyrsocera sp. n.” (Oxford Museum).

The species is allied to *P. cincta*, Burm., and may be distinguished from it chiefly by its smaller size, shorter tegmina, broader pronotum and by the colour of the legs. A similar example from Monte Video in the Paris Museum stands under the name *P. cincta*.

12. *Pseudomops affinis*, Burm. (Surinam, Brazil, Para.)


*Thyrsocera hirticornis*, Burmeister, l.c. p. 500, n. 10 (1838); Brunner, l.c. p. 124, n. 14 (1865).

Dr. Taschenberg of Halle having kindly lent me the type of *P. affinis* I have been able to compare it with Brunner’s description and find that it agrees admirably with that account. The type of *P. hirticornis* is apparently in Brunner’s collection and is considered by Brunner to be the male of *P. affinis*.

13. *Pseudomops flavipes*, Burm. (Brazil, Rio de Janeiro.)

*Thyrsocera flavipes* Burmeister, l.c. p. 499, n. 5 (1838); Brunner, l.c. p. 125, n. 16 (1865).
Pseudomops flavipes, var., Walker, l. c. p. 79, n. 10 (1868).

As shown by a drawing of the type now at Berlin this species is very closely allied to P. affinis, and the arrangement of colours on the pronotum is identical, however flavipes has flavid legs and the abdomen and tegmina appear to be paler.

14. P. angusta, Wlk. (Santarem, Colombia.)
Pseudomops angusta, Walker, l. c. p. 81, n. 19 (1868).

♀. Head shining black with a round yellowish spot on the frons; clypeus yellow, labrum black; maxillary palpi luteous, apical joint black. Antenna with the basal half incrassated, black, a white band at the base of the apical half occupying eight joints. Pronotum with the posterior border strongly produced, black, bordered all round with bright yellow, the lateral borders at one point on each side produced inwards to form two broad projections which do not meet. Tegmina ferruginous at the base, at the apex flavo-hyaline, the costal margin testaceous between the veins, the mediastinal field hyaline; a slender fuscous humeral stripe. Wings flavo-hyaline. Abdomen, cerci and legs luteous-yellow; bases of the coxae black. Cerci long, not spatulate. Supra-anal lamina, produced, quadrate.

Total length 13 mm.; length of tegmina 10 mm.

This description is taken from a specimen in the Hope Museum, Oxford; it differs a little from the type which is in the British Museum, but is too close to be separated.

The species is allied to P. flavipes, Burm., but differs by the broader testaceous band on the antennæ, by the greater extent of the yellow margins of the pronotum, the black disc of the pronotum being almost divided into two by the inward projections of the yellow lateral borders; the intervenular stripes of opaque testaceous on the tegmina are variable characters.

15. P. burri, n. sp. (Ecuador, Cachabi.) (Plate XIV, fig. 1.)

♀. Allied to P. angusta, Wlk., but smaller, prothorax not so markedly produced behind. Head orange-yellow with the vertex and frons black or entirely black with orange lines above the antennal sockets and at base of clypeus; two orange lines behind the eyes; the
antennae with basal half incrassated, black, a luteous band occupying five joints beyond the middle. Prothorax luteous with a pyriform black central marking, the point directed backwards. Tegmina ferruginous at the base; the mediastinal field hyaline, the marginal field flavo-hyaline with intervenular streaks of opaque testaceus; apex of tegmina flavo-hyaline, the veins ferruginous. Wings flavo-hyaline. Legs, abdomen, and cerci bright luteous, the coxae at their extreme bases outwardly tipped with black and with pale borders. Cerci elongate. Supra-anal lamina triangular, produced.

Total length 12 mm.; length of tegmina 10 mm.


Named after Mr. Malcolm Burr to whose generosity the Oxford Museum owes a magnificent collection of exotic Orthoptera.

The species differs from P. angusta, Wilk., in the following points:—The less extent of the white band on the antennae, the different shape of the black disc of the pronotum, the testaceous stripes on the tegmina.

16. P. discicollis, Burm. (Mexico.) (Plate, XIV, fig. 2.)


Thyrsocera discicollis, Brunner, l.c. p. 123, n. 10 (1865).


This is a very well-marked species, and the most robust of the genus. The type, of which I have a drawing, is at Berlin; another example is in the collection of Central American Orthoptera in the British Museum, and stands under the name of P. laticornis, Perty; a third, from which the following description is drawn up, is in the Oxford Museum.

♂. Head and mouth parts black, antennae mutilated (in the type, very long, black at base with a testaceous annulus occupying nineteen joints about the middle of total length, beyond the middle fuscous). Pronotum almost orbicular, but truncate in front, not covering the vertex and produced behind, disc piceous with broad lateral borders of orange-yellow, the posterior border margined with a fine yellow line; the black of the disc which just fails to meet the yellow anterior margin is narrowed anteriorly. Tegmina
dark fuscous, mediastinal field at apex testaceous, fifteen costal veins, discoidal field with nine longitudinal sectors, wings fuscous. Abdomen, cerci and legs dark fuscous, coxae outwardly margined with whitish. Supra-anal lamina quadrately produced.

Total length 19.5 mm.; length of tegmina 15 mm.; pronotum 5 mm. \( \times \) 6 mm.

17. *P. gueriniana*, Sss. (Mexico.)


The type is in the Paris Museum.

18. *P. obscura*, Sss. (Bolivia, Santa Cruz.)


The type is in the Paris Museum.

19. *P. magna*, n. sp. (Ecuador, Paramba.)

♂. Entirely black, except a testaceous band on the antennæ beyond the basal incrassated portion and the testaceous terminal three joints of the cerci which are not spatulate; an orange patch in the middle of the ventral surface of the abdomen. The borders of the coxae are not white, and the mediastinal area of the tegmina is not hyaline. Body depressed. Posterior border of prothorax obtusely rounded. ♀. Like the male but without the orange patch on the abdomen; the supra-anal lamina is triangular, its apex slightly incised.

<table>
<thead>
<tr>
<th>Total length</th>
<th>Length of body</th>
<th>Length of tegmina</th>
</tr>
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<tbody>
<tr>
<td>♂ 18 mm.</td>
<td>15.6 mm.</td>
<td>14</td>
</tr>
<tr>
<td>♀ 18 mm.</td>
<td>14 mm.</td>
<td>13.5</td>
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</table>

One male and two females (*W. F. H. Roscnberg* coll. February and May 1897). (Oxford Museum.)

20. *P. albostriata*, n. sp. (Ecuador, Cachabi.)

♀. Black; antennæ beyond the penicillation, with a testaceous band occupying nine joints. Pronotum quite black except for a very narrow border of testaceous, not occurring on the front margin; the
Mr. R. Shelford's *Studies of the Blattidae*.

Pronotum is strongly produced backwards. Tegmina with the mediastinal area, except at the base, and eight oblique costal streaks, testaceous. The sub-genital lamina and the discs of the sterna of the three preceding segments bright rufous. Coxæ white-edged. Cerci black, not spatulate.

Total length 12 mm.; length of tegmina 10 mm.


The species appears to be quite distinct from all the other black species of this genus; it approaches *P. lucutiosa*, Sss., more closely than any other.

21. *P. bicolor*, n. sp. (Ecuador, Paramba.) (Plate XVI, figs. 12, 12a; and Plate XIV, fig. 7.)

♂. Head and antennæ (mutilated) black. Pronotum orange-red with some very obscure darker markings. Tegmina fuscous with the costal margin narrowly fulvous for two-thirds of its length. Wings fusco-hyaline. Abdomen bright luteous except the last five terga and the sub-genital lamina which are black; on the 6th tergum is a prominent mamillary tubercle covered with an orange pubescence and with a small opening on each side. Cerci black with the two terminal joints white. Coxæ and trochanters bright luteous; the 2nd and 3rd pairs of femora bright luteous with the apices fuscous; the 1st pair of femora, the tibiae and tarsi fuscous; the tibial spines rufous.

Length of body 13·5 mm.; length of tegmina 14 mm.


This species is quite distinct from all the known forms. The opening of the so-called repugnatorial glands on the 6th abdominal segment is remarkable and unlike any other known to me. The 7th abdominal tergum is almost entirely covered by the 6th tergum, the posterior border of which is incised.

II. Cerci spatulate.

22. *P. femoralis*, Wlk. (Brazil, Rio de Janeiro.)

*Pseudomops femoralis*, Walker, l. c. p. 81, n. 18 (1868).
*Thyrsocera crinicornis*, Brunner, l. c. p. 126, n. 21 (1865).

Brunner's description of *P. crinicornis* applies with great exactitude to this species, four examples of which
are in the Hope Museum, Oxford; one example was sent to Berlin for comparison with Burmeister’s type of *crinicornis* and was found to be quite distinct; nor was it found to agree with the other species described by Burmeister in that collection.

23. *P. brunnери*, Ss. (Surinam.)


I have examined the type at Paris, and in my opinion the species is distinct from *P. femoralis*, Wlk.

24. *P. crinicornis*, Burm. (Brazil, Para.)

*Thyrsocera crinicornis*, Burmeister, l. c. p. 499, n. 2 (1838); de Saussure, Rev. Zool. (2) xxi, p. 111 (1869); Miss. Mex. Orth. p. 48 (1870); de Saussure and Zehntner, l. c. p. 33, n. 7 (1893).

*Pseudomops affinis*, Walker, l. c. p. 79, n. 9 (1868).

De Saussure has identified this species correctly, and his description of it should render its determination easy; a drawing of an example in the Hope Museum, Oxford, was sent to Berlin, and found to correspond closely with Burmeister’s type.

25. *P. luctuosa*, Ss. (Surinam.)

*Thyrsocera luctuosa*, de Saussure, Rev. Zool. (2) xx, p. 99 (1868); Miss. Mex. Orth. p. 48, pl. 1. ff. 27, 27a (1870).

The species is quite distinct from *P. crinicornis*, Burm.

26. *P. tristicula*, Stål. (Brazil, Rio de Janeiro.)


*Thyrsocera tristicula*, Brunner, l. c. p. 125, n. 17 (1865).

An entirely black species with a testaceous vitta on each side of the abdomen beneath.
27. *P. puiggarii*, Bol. (Brazil, San Pablo.)


This is possibly conspecific with *P. tristicula*, Stål., but the description of the latter is so inadequate that certainty on this point is not possible without comparison of types.

28. *P. nigrita*, Sss. (Brazil.)


This species was described from a specimen lacking the abdomen and antennae, and on the strength of the different colour of the legs was held to be different from *P. tristicula*, Stål. A perfect example of what appears to be undoubtedly this species was sent to me by Dr. Taschenberg of Halle and shows that the species is quite distinct from *tristicula*, the abdomen being orange-red above and below. In the male the supra-anal lamina is triangularly produced and deeply notched, the sub-genital lamina is ample and orbicular, bearing two short acuminate styles; the cerci are orange and broadly spatulate; the ante-penultimate tergum has the posterior margin notched in the middle, whilst the preceding tergum is very broadly and deeply emarginate, exposing nearly the whole of the following tergum.

29. *P. melana*, Wlk. (Brazil.)

*Pseudomops melana*, Walker, l. c. p. 80, n. 16 (1868).

Distinguished by a luteous band on the abdomen above.

30. *P. simulans*, Stål. (Brazil.)

*Pseudomops simulans*, Stål. l. c. p. 310 (1858).


This species, owing to the inadequacy of the description, cannot be recognized with certainty; it may not even enter into the section of the genus with spatulate cerci.

*Pseudomops melanodryoides*, Wlk. (l. c. p. 84, 1868) is a species of *Phyllodromia*.
TABLE OF SPECIES INCLUDED IN THE GENUS

*PSEUDOMOPS*, Serv.

**A. CERCI NOT SPATULATE.**

1. Pronotum not unicolorous, margins paler than disc.

2. Ground colour of pronotum some shade of rufous.


3'. Lateral pale margins of pronotum not inwardly produced.

4. Disc of pronotum with definite darker markings.

5. Two dark spots on the disc of the pronotum . . . . *oblongata*, L.

5'. A horseshoe-shaped mark on the disc of the pronotum. *inclusa*, Wlk.

4'. Disc of pronotum without definite darker markings.

5. General colour of tegmina rufous.


5'. General colour of tegmina orange.

6. Tegmina with apex only infuscated . . . . *aurantiaca*, Sss. and Zhnt.

6'. Tegmina with apical three-fifths infuscated . . . . *grata*, Rehn.

5''. General colour of tegmina fuscous . . . . *mimica*, Wlk.

**2'. Ground colour of pronotum fuscous.**

3. Lateral yellow borders of pronotum not broad.

4. Lateral yellow borders not inwardly produced.

5. Pronotum longer than broad *cincta*, Burm.

5' Pronotum not longer than broad . . . . . . *neglecta*, mihi.
264 Mr. R. Shelford's Studies of the Blattidae.

4'. Lateral yellow borders inwardly produced.
5. Legs not entirely yellow . . . affinis, Burm.
5'. Legs entirely yellow.
6'. Lateral yellow borders of pronotum less strongly produced inwards . . . flaripes, Burm.

3'. Lateral yellow borders of pronotum broad.
4. Yellow border of pronotum nearly equally broad throughout . . . . . . . . . gueriniana, Sss.
4'. Yellow border of pronotum narrowed anteriorly and posteriorly.
5. Of large size . . . . . discicollis, Burm.
5'. Smaller . . . . . . . burri, mihi.

1'. Pronotum unicolorous.
2. Pronotum red . . . . . . . bicolor, mihi.
2'. Pronotum black or fuscous.
3. Abdomen not orange in the male.
4. Tegmina without white streaks obscura, Sss.
4'. Tegmina with white streaks . albostriata, mihi.
3'. Abdomen orange in the male . magna, mihi.

B. Cerci spatulate.

1. Pronotum with broad yellow borders.
2. Tegmina fuscous . . . . . . . femoralis, Wlk.
2'. Tegmina fulvous . . . . . . . brunneri, Sss.
1. Pronotum with narrow yellow borders or none.
2. Abdomen orange . . . . . . . nigrita, Sss.
2'. Abdomen black.
3. Abdomen entirely black.
4. No white lines on the tegmina . . crinicornis, Burm.
4. Tegmina with white lines . . . iuctuosa, Sss.
3'. Abdomen not entirely black.
4. Abdomen rufous at base . . . puiygar, Bol.
4'. Abdomen not rufous at base.
Abdomen with transverse testaceous band above... melana, Wlk.

Abdomen with longitudinal vittæ below... tristicula, Stål.

III. Some new Blattidae from Sarawak, Borneo, in the Hope Department, Oxford University Museum.

Mr. J. Hewitt, Curator of the Sarawak Museum, recently forwarded to me for determination a small collection of cockroaches; thirteen of the species appear to be new to science and are described below. The rediscovery of the species described by Serville as Blatta decorata is of some interest. The numbers attached by Mr. Hewitt to his specimens are quoted in square brackets.

Genus Ischnoptera, Burm.

Ischnoptera excavata, n. sp. (Plate XVI, fig. 11.)

♂. Fulvo-ferruginous. Eyes closer together than the antennal sockets. Pronotum trapezoidal, sides deflexed, posterior margin obtusely angled. Tegmina with the radial vein bifurcated near base, seventeen costal veins, seven discoidal sectors. Wings hyaline, marginal field and veins ferruginous, mediastinal vein with five branches, radial vein bifurcated, eleven costal veins, ulnar vein sending four rami to apex, two to dividing vein, first axillary vein tri-ramose. Anterior femora with anterior margin beneath strongly spined, the proximal spines longer than the distal; all the femora with apical spines on both margins and with genicular spines. Supra-anal lamina profoundly modified, proximally it is deeply depressed with a median elevated carina, so that two wide pits are formed which are directed forwards beneath the preceding tergum, posterior margin of the lamina rounded, slightly emarginate. Sub-genital lamina of normal shape, but without styles. Cerci moderate.

Total length 21 mm.; length of tegmina 17 mm.

Kuching (March 1899). One example [No. 32].

I know of no other species of Blattid in which so extensive a modification of the supra-anal lamina occurs;
the opening of the so-called "repugnatorial" glands in many species leads to modifications of the penultimate or antepenultimate terga, but not to that of the supra-anal lamina.

*Ischnoptera montis*, n. sp. (Plate XVI, fig. 10.)

♂. Head castaneous, antennae rufo-fuscous. Pronotum trapezoidal, castaneous, sides deflexed. Tegmina testaceous-hyaline, thirteen to fourteen costal veins, anterior ulnar vein quadri-ramose, posterior ulnar tri-ramose. Wings hyaline, mediastinal vein long with two branches, radial vein unbranched, eight costal veins, the four proximal ones incrassated, median vein simple, ulnar vein giving off five veins to apex and three to the dividing vein. Abdomen castaneous, the first few segments paler; the first segment above with a median deep depression, the anterior wall of which is fimbriated with rufous hairs that appear to conceal a minute orifice, from the posterior wall projects a blunt tooth covered with a rufous pubescence. The middle of the seventh segment is depressed and the middle of the posterior margin of the sixth segment is slightly elevated, forming a wide-mouthed tube in which can be seen numerous hairs. Supra-anal lamina trapezoidal; subgenital lamina asymmetrical with two acuminate styles asymmetrically placed, the right being almost median, the left lateral. Cerci castaneous, mutilated. Legs rufo-castaneous, front femora with several spines along the anterior margin beneath, the distal members of the series shorter than the proximal.

Length of body 13 mm.; length of tegmina 14 mm.

Mt. Matang, 3000 feet. One example [No. 21].

The secondary sexual characters of the Oriental species of *Ischnoptera* appear to be most diverse in character, and a careful anatomical study of the structures whose presence is revealed by openings to the exterior and modifications of the overlying terga is much to be desired. The modification of the first abdominal tergum described above appears to be unusual amongst the Blattidæ.

Genus *Pseudophyllodromia*, Br.

*Pseudophyllodromia pulcherrima*, n. sp. (Plate XIV, fig. 3.)

♂ and ♀. Piceous. Head large and broad projecting beyond the pronotum, with a narrow golden line between the eyes; antennae fine, setaceous, longer than the body. Pronotum trapezoidal, sides
not deflexed, bordered all round with a narrow golden line, the line is marginal on the anterior and posterior margins of the prothorax but submarginal on the lateral margins. Tegmina with the mediastinal area, a horseshoe-shaped vitta astride the radial vein near its base, and an elongate vitta in the apical part of the marginal field, golden (faded to white in dried specimens). The surface of the tegmina is somewhat rugulose; marginal field broad, nine costal veins, ulnar vein with nine oblique branches, no division of the vein into an anterior and posterior trunk, anal vein strongly impressed. Wings infuscated, especially strongly in marginal field and at apex, a clear hyaline spot in marginal field; nine somewhat irregular costal veins, ulnar vein with four rami, no apical triangle, first axillary tri-ramose. Abdomen piceous; supra-anal lamina of male transverse, of female slightly produced, emarginate; abdomen beneath piceous, the centre of the last few segments rufous, sub-genital lamina of the male short, transverse, of the female large, ample; cerci moderate, piceous, apical three joints golden above. Legs piceous, apices of coxae and trochanters golden, tarsi and tibial spines rufous. Front femora unarmed beneath, mid-femora with two spines on anterior margin, three on posterior margin, hind femora with two on anterior margin and four on posterior margin, all the femora with apical spines on both margins and with genicular spines. The genital apparatus of the male appears to be very complicated. The ootheca is almost cylindrical, longitudinally finely striated, with a longitudinal serrulate crest, it is carried by the female with the crest uppermost and the contained eggs vertically disposed. The larvae have the anterior and lateral margins of the pronotum, the lateral margins of the meso- and metanotum, two spots on the metanotum and on the fourth and fifth abdominal terga, golden.

Total length 10 mm.; length of tegmina 6 mm.

KUCHING. Several examples [No. 12].

This little cockroach is abundant in decayed wood; in general appearance it is unlike the South American species of the genus, but I can find no character of sufficient importance to entitle it to separate generic rank, unless the undivided trunk of the ulnar vein of the tegmina can be so regarded. An allied species occurs in Penang, but the unique example before me is in such bad condition that I prefer to await additional material before describing it. *Phyllodromia laticeps*, Wilk., and *P. laticarpit*, Br., should also be referred to the genus *Pseudophyllodromia*.

TRANS. ENT. SOC. LOND. 1906.—PART II. (SEPT.) 18
Genus Allacta, Sss. and Zhutn.

Allacta parva, n. sp.

♂. Head and antennae testaceous, two pyriform vitse on the frons castaneous. Pronotum transversely elliptical, castaneous, with a triangular testaceous mark on the centre of the anterior margin. Tegmina castaneous, mediastinal area and a transverse spot just before the middle of the tegmen continuous with it, hyaline; ten costal veins, anterior ulnar vein with three longitudinal rami, posterior trunk simple. Wings hyaline, six costal veins, the third, fifth and sixth bifurcate, their extremities swollen; radial vein bifurcate, ulnar vein with four branches. Femora moderately armed. Supra-anal lamina transverse, sub-genital lamina orbicular, with two styles. Cerci elongate.

Total length 8 mm.; length of tegmina 6 mm.

KUCHING. Two examples [No. 23].

Genus Epilampra, Burm.

Epilampra saravacensis, n. sp.

♀. Allied to E. indicata, Wlk., but larger, the ocelliform spots on the tegmina smaller and less numerous, the part of the right tegmen overlapped by the left not marbled or ocellated, marginal field of wings not so strongly marked with rufescent.

Pale fulvous; head with darker points densely arranged; pronotum not covering the vertex of the head, its posterior margin obtusely angled, covered with densely arranged fuscous and rufous points, but not punctate. Tegmina with a few small white ocelliform spots, except on that part of the right tegmen overlapped by the left, which is uniform fulvous. Wings with apex slightly fulvous. Abdomen flavo-testaceous above, rufous below. Front femora with six stout spines on the middle of anterior margin beneath, three on posterior margin in distal half, mid- and hind-femora with three spines on anterior, four on posterior margin; formula of apical spines $\frac{5}{2}, \frac{1}{1}, \frac{5}{4}$; genicular spines on mid- and hind-femora, none on the front pair; pulvilli margined with spines, the second joint with spines beneath in addition.

Total length 56 mm.; length of body 43 mm.; length of tegmina 48 mm.

LINGGA, BATANG LUPAR RIVER. One example [No. 15].
Epilampra goliath, n. sp.

♂. Allied to *E. moloch*, Rehn., from Siam, of the same dark vinaceous brown above and of the same elongate ovate shape. It differs as follows: Head not projecting beyond the pronotum, vertex and a broad stripe extending to the clypeus fuscous, the front of the head and antennae testaceous; pronotum with two crescentic impressions on the disc. Marginal field of tegmina very broad, almost equalling half the total breadth, mediastinal vein with five branches. Wings with anterior part suffused with rufous, strongest at apex. Subgenital lamina broad, asymmetrical with two flattened styles. Abdomen flavo-testaceous above, rufo-fuscous below with paler margins, a dark stigma on each side of each segment. Front femora with five spines on median part of anterior margin, three on posterior margin, mid- and hind-femora with three to five spines on each margin, all the femora with genicular spines, formula of apical spines $\frac{1}{2}, \frac{1}{2}, \frac{1}{3}$; pulvilli of posterior tarsi not margined with spines.

Total length 58 mm.; length of body 50 mm.; length of tegmina 50 mm.

Mt. Matang, 3000 feet. One example [No. 14]; N. Borneo opposite Labuan. One example.

If the admirably detailed description of *E. moloch*, Rehn (Proc. U.S. Nat. Mus., xxvii, p. 550, 1904), be compared with the foregoing description it will readily be seen in what features the two insects differ; I have omitted descriptions of those features wherein the two species resemble each other. Both species bear a marked resemblance to *Molytria baudia*, Br.

Epilampra miranda, n. sp.

♂. Allied to the preceding species. Fulvo-testaceous. Head with very convex front, eyes more remote than ocellar spots, vertex with three longitudinal stripes. Pronotum shaped as in *E. moloch*, Rehn, and *E. goliath*, mihi, but somewhat more cucullate, only just covering the vertex of the head, with scattered punctures and with two crescentic impressions on the disc. Tegmina with marginal field equal to half the total breadth, mediastinal vein with seven branches; speckled with paler spots, radial vein at base fuscous. Wings hyaline, veins flavo-testaceous. Supra-anal lamina bilobate, not extending beyond the sub-genital lamina which is quadrate and slightly asymmetrical (styles mutilated); cerci moderate, acuminate; ventral segments with a black stigma on each side. Front femora with
seven spines on anterior margin beneath, mid- and hind-femora with three to four spines on anterior margin, two on posterior margin; formula of apical spines 3, 1, 3, no genicular spine on front femora. Posterior metatarsus barely equal in length to remaining joints, which are not spined beneath, pulvilli not margined with spines. Total length, 55 mm.; length of body, 44 mm.; length of tegmina, 42 mm.; pronotum, 18 mm. x 11 mm.

Mt. Penrisseen, 3500 feet (R. Shelford coll.). One example [No. 16].

*Epilampra flavomarginata*, n. sp.

♂ and ♀. Rufous. Head testaceous with minute rufous points, antennae fuscous except at base. Pronotum not covering the vertex, sides deflexed, posterior margin obtusely angled, covered with small confluent dots darker than the ground-colour, except on the anterior and posterior margins which are flavo-testaceous. Tegmina with mediastinal area flavo-testaceous, the rest rufous with fine yellow streaks on the veins, the right tegmen where covered by the left is infuscated; branching of mediastinal vein very obscure. Wings with the marginal field luteous, the apex and veins infuscated. Abdomen flavo-testaceous. Supra-anal lamina bilobate, strongly produced in the female; sub-genital lamina in the male sub-quadrate, asymmetrical, in the female ample, semi-orbicular. Front femora with three to four spines on the proximal half of the anterior margin beneath, with close set minute spines in the distal half, mid- and hind-femora with four to five spines on anterior margin, three on posterior margin, apical spines on both margins on all the femora, all the genicular spines present. Posterior metatarsus much longer than succeeding joints, second joint spinose beneath, pulvilli margined with spines.

Total length, 21 mm.; length of body, 17 mm.; length of tegmina, 17 mm.

Kuching; several examples [No. 17].

This species falls into the same group that includes *E. papua*, Sss., *E. loricollis*, Sss., *E. puncticollis*, Wlk., *E. plena*, Wlk., etc. Its coloration alone ought to render it easy of recognition.

**Genus Homalosilpha**, Stål.

_Homalosilpha decorata_, Serv. (Plate XIV, fig. 8.)


This species of unknown habitat has been ignored in
the lists of Blattidae described by earlier authors; neither Brunner nor Kirby mention it. The type specimen from the Marchal collection is in the Hope Museum, Oxford, and from an examination of it I am able to place it without a doubt in the genus Homalosilpha. An identical example from Mt. Penrissen, Sarawak [No. 28] gives the habitat of this species that has for so long been unrecognized. It may be mentioned that another of Serville's types of Blattidae, viz. Blatta alcarazzas, is also in the Oxford Museum.

**Genus Miroblatta, nov.**

Head covered by the pronotum, eyes closer together than the antennal sockets; antennae very long, third joint twice as long as second. Pronotum longer than broad, anterior border arcuate, posterior border truncate, exposing the scutellum; markedly euculate and narrowed anteriorly, anterior and lateral margins reflected, disc with symmetrically disposed elevated ridges. Tegmina broad, oval, barely reaching extremity of abdomen, overlapping considerably, apex obtusely rounded; corneous, densely reticulated, venation obscure, no anal vein or anal field, radial vein strongly elevated at base, mediastinal field on under surface elevated, keeled, space between mediastinal and radial veins broad, inflexed, forming with mediastinal field an epipleuron, the outer margin of which is the anterior margin of the tegmen, the inner margin formed by the mediastinal vein. Wings broadly ovate, of same length as tegmina, coriaceous, anterior part nearly twice as broad as posterior part, the outer margin deeply indented at the point of division between the two parts, the wing appearing bilobate; mediastinal and radial veins fused, their base elevated forming a prominent ridge, six ramose branches given off to apex and outer margin, ulnar vein reduced with three ramose branches only, numerous transverse venules between all the veins; posterior part of wing not folding in fan-like manner but merely doubling under anterior part. Supraanal lamina of male broadly transverse, slightly emarginate. Subgenital lamina of male subquadrate, styles minute. Cerci long, very sharply pointed. Legs long, slender; femora unarmed beneath; spines on posterior tibiae in two rows. Posterior tarsi with metatarsus longer than remaining joints, no spines beneath, pulvilli large, the second occupying whole length of joint. Female not known, probably apterous.

The affinities of this highly remarkable genus appear to
be with Archiblatta, Vollenh., as shown by the unarmed femora and the structure of the tarsi; the form of the "epipleuron" is very different, in Archiblatta this is formed by a simple deflexion of the anterior part of the tegmen, whereas in Miroblatta the area between the mediastinal and radial veins is deflexed, but the mediastinal field itself is in the same plane as the disc of the tegmen, forming in repose a sort of flange; I know of no parallel modification of the tegmina in other Blattidae. The method of wing-folding in Miroblatta is met with again only amongst the Corydiinae.

*Miroblatta petrophila*, sp. n. (Plate XIV, figs. 4, 4a.)

♂. Elongate ovate; dark castaneous. Head fuscous, front concave, lower face rugose, clypeus flavo-testaceous, mouth parts castaneous; antennae longer than total length of body, a broad white annulus before the middle, occupying twenty-one joints. Pronotum castaneous, disc with strong elevated ridges in the form of a horseshoe, giving off anteriorly two short diverging branches and laterally two backwardly directed branches which are less strongly marked, a median carina on the anterior cucullate part of the pronotum; area between the limbs of the horseshoe rugose, ridges and adjacent parts black, a pair of orange spots on each side of the anterior carina and another pair on each side of the limbs of the horseshoe-shaped ridge; scattered about the surface of the pronotum are numerous small tubercles bearing erect setae. Tegmina castaneous, the radial vein black. Wings flavo-hyaline, marginal field and apex suffused with flavo-castaneous. Abdomen dark castaneous, paler at the base above. Legs dark castaneous, apices of femora flavo-castaneous; formula of apical spines \( i, i, i \), no genicular spines on anterior femora.

Total length 40 mm.; length of tegmina 26 mm.; pronotum 13 mm. \( \times \) 16 mm.

Mt. Santubong, 2500 feet, amongst rocks. One example. About half-a-dozen specimens of this cockroach were captured by a native collector in August 1900; he stated that they ran with great activity and that they were incapable of flight.

Genus Corydia, Serv.

*Corydia cocculea*, n. sp.

♂. Brilliant blue with metallic reflections. Head, pronotum and anterior margins of tegmina and wings pubescent, antennae fuscous,
moniliform. Pronotum transversely elliptic, punctate with two deep impressions on the disc, humeral angles well marked. Tegmina blue, with purplish reflections and some obscure orange maculae on the disc, an orange streak on the margin of the tegmen just beyond the mediastinal field; the right tegmen where covered by the left reddish-purple. Wings hyaline, marginal field infuscated, with purplish reflections, four bifurcated costal veins, ulnar vein with seven rami. Mesonotum and metanotum purple. Abdomen orange, the last two segments blue. Supra-anal lamina transverse, widely emarginate; sub-genital lamina quadrate with acuminate and pubescent styles. Cerci stout, fuscous. Legs dark blue, tarsi fuscous.

Total length, 13.5 mm.; length of tegmina 10 mm.

MT. MATANG, 3000 feet (Shelford coll.). One example [No. 9].

The species appears to be most closely allied to C. dasyloides, Wlk.

Genus Areolaria, Br.

Areolaria signata, n. sp.

♂ and ♀. Head black, vertex with a testaceous patch on which occur two short black lines, maxillary palps testaceous, antennae black, incrassated in the basal half and plumose, the apical half with sixteen joints testaceous and the terminal three joints fuscous. Pronotum almost quadrangular, broader than long, sides deflexed slightly, disc closely punctate, black with a central testaceous vitta incompletely divided longitudinally, posterior margin narrowly testaceous, lateral margins testaceous-hyaline. Tegmina corneous, mediastinal field hyaline, the remainder griseo-testaceous with a broad fuscous stripe running along the radial vein then turning at right angles to cross the apex of the anal field and to meet its fellow of the opposite tegmen, left tegmen with a fuscous stripe on the sutural margin, the portion of the right tegmen that is overlapped by the left is black and shining; all the veins marked by lines of punctures. Scutellum prominent, black, punctate. Wings hyaline, marginal field infuscated, thirteen costal veins, strongly incrassated and connected by transverse venule, median vein simple, mediadiscal area crossed by nine transverse venule, ulnar vein tri-ramose, first axillary vein quadri-ramose, triangular apical field very large, unequally divided by a longitudinal vein. Abdomen of male flavid above, fuscous below, supra-anal lamina, shortly produced, triangular, sub-genital lamina narrower, apex deeply and triangularly cleft with two short styles, cerci flavid. Abdomen of female broader fuscous
above and below, supra-anal lamina more produced with a median carina, sub-genital lamina very large, its surface with shallow confluent punctures. Front legs and all the coxae fuscous, all the tarsi, the mid and posterior tibiae testaceous with the bases fuscous, the mid and posterior femora testaceous at base, fuscous at apex.

Total length, 9 mm.; length of tegmina 6½ mm.

KUCHING. Four examples [No. 7].
The incrassated and plumose antennæ in both sexes will serve to distinguish this species from those already described.

Genus Homopteroidea, nov.

Head as in Latinia, Stål, antennæ elongate. Pronotum elliptic, sides not deflexed, with arcuate sulci, with a sparse erect pubescence. Tegmina membranous, slightly exceeding the abdomen in length, or much longer, venation irregular, apical part of discoidal area reticulate, no oblique vein. Wings as long as tegmina in both sexes. Supra-anal lamina produced, triangular, sub-genital lamina in the female deeply cleft. Cerci elongate. Femora unarmed beneath; tibiae sparsely spined, spines in two rows; tarsi without arolia.

The genus differs from Latinia, Stål, by the absence of an oblique vein in the tegmina, from Paralatindia, Sss., by the presence of alar organs in both sexes, from Ipisoma, Bol., by the equally long tegmina and wings, from Hemilatindia, Sss., by the pronotum without deflexed sides and by the entirely membranous character of the tegmina.

There are four species in the Oxford Museum, all from the Oriental region, but the specimens are in bad condition. The insects which in life appear very like small Homoptera of the family Fulgoridæ (e.g. Lenzara, Stacota, Epura) are extremely fragile and it is a matter of difficulty to capture perfect specimens.

Homopteroidea nigra, n. sp. (Plate XVI, figs. 13, 14.)

♀. Head black, antennæ fuscous, clypeus with an erect pubescence. Pronotum almost orbicular, margined all round, a few erect hairs on the anterior and lateral margins, disc irregular with two converging sulci posteriorly, black, lateral margins dark castaneous. Tegmina castaneous, radial vein giving off four costal veins, three longitudinal sectors in discoidal field, apex of tegmina reticulate, anal vein angled, axillary veins reduced, reticulated. Wings infuscated, four costal veins, ulnar vein tri-ramose, apex of wing reticulated.
Mr. R. Shelford's *Studies of the Blattidae*. 275

Abdomen fusco-castaneous; supra-anal lamina large, produced, margin slightly reflected, emarginate in the middle and with a stiff erect pubescence, sub-genital smaller than the supra-anal lamina, compressed laterally and deeply cleft; cerci mutilated. Legs fusco-castaneous, tarsi paler, front femora with apical spine on anterior border beneath, no genicular spine, mid-femora with two apical spines and a genicular spine, hind femora missing; tarsi without arolia.

Length of body 7 mm.; length of tegmina 3 mm.

**Kuching.** One example [No. 26]. An example of this species from Sumatra is in the Paris Museum.

**Genus Paranaupheta, Br.**

*Paranaupheta atra*, n. sp.

♂ and ♀. Entirely black, shining, except the apical third of the antennæ which is testaceous, and the labrum which is flavo-testaceous. Pronotum marked with irregular depressions. Tegmina with radial vein ramose, fourteen to fifteen costal veins, their basal halves obsolescent, anterior ulnar vein bifurcate, posterior ulnar multi-ramose, anal vein not reaching the middle of the sutural margin. Wings infuscated, radial vein irregular, costal veins obsolete, ulnar vein sending many branches to the dividing vein, an inconspicuous apical triangle. Supra-anal lamina in both sexes large, the cerci barely exceeding it, its posterior margin in the female slightly emarginate; sub-genital lamina in male large, asymmetrical with prominent acuminate styles, in the female ample.

Total length, 27 mm.; length of tegmina, 21 mm.

**Kuching.** A long series [No. 6].

*Paranaupheta affinis*, n. sp.

♀. Allied to *P. basalis*, Serv., but with no yellow band on the head between the eyes; abdomen beneath with no yellow spots, the last three segments of the abdomen above with very small yellow spots; the supra-anal lamina entirely black. Tegmina and wings variable in length, in one example not extending beyond the middle of the sixth abdominal segment, in no case attaining the extremity of the abdomen.

Total length 22 mm.; length of tegmina 13 mm. to 15 mm.

**Bhutan.** Four examples (Paris Museum).]
IV. The Type of *Epilampra brasiliensis*, Fab.

Fabricius' description in his "Systema Entomologicum," 1775, p. 272, of this species is as follows:—

"B. pallida, abdomine atro.
"Paulo major *B. lapponica*. Tota pallida, abdomine subtus atro. Antennae fuscæ."

So brief a description of a member of a genus including numbers of cryptically-coloured species, renders its determination by subsequent authors almost impossible. The synonymy of the species according to Brunner (Nouv. Syst. d. Blatt. 1865, p. 159) is:—


None of these species can be recognized with certainty, since the descriptions of them are inadequate and the types of some are missing. The Hope Museum at Oxford contains some drawings made by the late Professor Westwood of several of Serville's types, amongst others the type of *Blatta maculicollis*, and on comparing this with the Fabrician type of *Blatta brasiliensis* in the Banksian cabinet at the British Museum, I have come to the conclusion that the two species are distinct. Brunner's own description does not apply to the Fabrician type, nor to the drawing of *maculicollis*, and I would therefore suggest the name of *Epilampra burmeisteri*, Guér., for this species. *Epilampra burmeisteri* has been well described also by de Saussure (Mém. Mex. Blatt., p. 131), though I am by no means certain if this author had the opportunity of seeing Guérin's type which came from Cuba. Examples in the Oxford Museum from Jamaica, Guiana and Brazil appear to be identical with each other and they correspond well with Brunner's and de Saussure's descriptions. It remains then only to give a detailed description of the Fabrician type.
On referring to the Banksian cabinet I found two specimens belonging to distinct species under the name *Blatta brasi-liensis*; one measured in total length 18 mm., and had the abdomen fuscous beneath, the other measured 25·1 mm., and had the abdomen beneath rufous with pale disc. The former specimen corresponds the more closely to the diagnosis of Fabricius and may be selected as the type of the species; the following is a description of it:—

♂. Dull testaceous. Head with a few small brown maculae on the front and face, palpi pallid; (antennae broken). Pronotum broadly transverse not covering the vertex, lateral margins broadly hyaline, disc testaceous, unspotted. Tegmina testaceous hyaline, unspotted; mediastinal vein unbranched, radial vein with eight costal branches, the two last bifurcate, apex of radial vein ramose and not reaching end of tegmina, anterior ulnar vein bifurcate, the branches becoming ramose, posterior ulnar vein simple, anal sulcus strongly marked, four axillary veins. Wings hyaline, veins testaceous. Abdomen fuscous above and beneath becoming rather paler towards the extremity; supra-anal lamina produced subquadrate, testaceous, posterior border slightly emarginate; sub-genital lamina semi-orbicular, ample, with large acuminate styles (cerci mutilated, fuscous). Legs testaceous, coxae with fuscous line on outer border; front femora with ten spines on the anterior margin beneath, extending from the middle to the apex, the middle ones longest, four spines on posterior margin, mid-femora with six spines on anterior margin, three on posterior margin, hind femora with six spines on anterior margin, four on posterior margin, formula of apical spines \( \frac{3}{1}, \frac{6}{4}, \frac{1}{1} \), of genicular spines 0, 1, 1.

Total length, 18 mm.; length of body, 12·2 mm.; length of tegmina, 15 mm.; breadth of pronotum, 6·5 mm.

The other specimen is slightly darker in colour. ♀. Eyes whitish-grey, face testaceous, a rufous-fuscous stripe on the frons extending down to the base of the clypeus, thinning out to a line on the vertex. Pronotum more trapezoidal, lateral margins hyaline. Tegmina with two-branched mediastinal vein, radial vein giving off eleven costals, its end ramose, seven axillary veins. Abdomen rufous beneath with the disc paler; supra-anal lamina triangularly produced; sub-genital lamina narrow, produced, asymmetrical with one acuminate style. Front femora with two spines on anterior margin beneath in the middle, four on the posterior margin (hind femora lost), formula of apical spines, \( \frac{3}{1}, \frac{6}{4}, \frac{1}{1} \)?

Total length, 25·1 mm.; length of body, 17 mm.; length of tegmina 21 mm.; (pronotum crushed).
Mr. R. Shelford's Studies of the Blattidae.

Which of these two specimens, if either, is identical with the _Blatta grisca_ of De Geer it is not possible to say; it would scarcely be wise to sink _brasiliensis_ as a synonym of _grisca_ and I hesitate also to give a name to the second of Fabricius' specimens.

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**Explanation of Plates.**

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**Plate XIV.**

1. *Pseudomops hurri*, n. sp. (Type ♂.)
2. _discollis_, Burm., ♀.
3. *Pseudophyllodromia pulcherrima*, n. sp. (Type ♂.)
4. *Mirobatta petrophila*, n. sp. (Type ♂.) Nat. size.
5. Ventral aspect of same, showing the "epipleura."
6. *Thyrsoerca speciosa*, Wlk. (Type ♀.)
7. *Pseudothyrsoerca ruficollis*, n. sp. (Type ♂.)
8. *Pseudomops bicolor*, n. sp. (Type ♂.)
Fig. 1. Sub-genital lamina of *Hemithyrsocera histrio*, Burm., ♂

s. = spiracle, t. = "titillator."


3. " " *Theganopteryx ethiopica*, Sss.


5. End of abdomen of *Escala longiuscula*, Wlk., ♂, dorsal view.

6. Sub-genital lamina of *Escala insignis*, n. sp. ♂.

7. Wing of *Anaplecta maculata*, n. sp.

8. " " *zeylanica*, n. sp.

9. " " *thwaitesi*, n. sp.

10. " " *malayensis*, n. sp.

11. " " *borneensis*, n. sp.

12. " " *obscuroa*, n. sp.
**PLATE XVI.**

**Fig. 1.** Wing of *Anaplecta brunneri*, n. sp.

2. " " *dahomensis*, n. sp.

3. " " *parida*, n. sp.

4. " " *fusca*, n. sp.

5. " " *varipennis*, n. sp. (long-winged form).

6. " " " " (short-winged form).

7. " " *chrysoptera*, n. sp.

8. " *Anaplectoidea nitida*, n. sp.

9. Tegmen of *Anaplectoidea nitida*, n. sp.

10. Dorsal view of abdomen of *Ischnoptera montis*, n. sp. ♂.

11. End of abdomen of *Ischnoptera excavata*, n. sp. ♂, dorsal view.

12. Opening of scent-glands in *Pseudomops bicolor*, n. sp. ♂, dorsal view; a, side view.

13. Pronotum of *Homopteroidea nigra*, n. sp.

14. Tegmen of *Homopteroidea nigra*, n. sp.
XV. Mimetic Forms of *Papilio dardanus* (merope) and *Acrux johnstoni*. By EDWARD B. POULTON, D. Sc., M.A., Oxon., Hon. LL.D., Princeton, F.R.S., Hope Professor of Zoology in the University of Oxford, Fellow of Jesus College, Oxford.

[Read June 6, 1906.]

Plates XVII–XXII.

A. Mimetic forms of *Papilio Dardanus*, Brown.

I. Synepigonic Group bred in 1904 by G. F. Leigh, F.E.S., from a trophonius ♀ form of *P. dardanus* subspecies *cenea*, near Durban.

This piece of work is an interesting and important addition to the breeding experiments upon *P. dardanus* undertaken by Mr. Leigh in 1902 and 1903. (Trans. Ent. Soc., Lond. 1904, p. 677.) As a result of this latest inquiry the trophonius ♀ form has for the first time been bred from a parent of the same form.

On May 4, 1904, Mr. G. F. Leigh observed a trophonius female laying eggs on the food-plant, at Bellair, five miles from Durban, Natal. He collected the eggs but the parent butterfly escaped. From these eggs Mr. Leigh succeeded in breeding six males and seven females. Of these all the males and five of the females are represented about two-fifths of the natural size on Plate XVII, Figs. 1–11. The dates of emergence are given in the explanation of Plate XVII (pp. 312, 313), so it is not necessary to repeat them here. The two unfigured females were in both cases *cenea* forms:—one greatly deformed and shrivelled (pupated June 30, 1904, emerged July 30: the ninth to emerge); one not included in Mr. Leigh’s consignment (it was the twelfth to emerge).

(a) The males.

The six males of this interesting synepigonic series are represented on Plate XVII, Figs. 1–6. If compared with Trans. Ent. Soc. Lond. 1906.—Part 11. (Sept.)
the account (in Trans. Ent. Soc. Lond. 1904, p. 684) of the equal number of males in the family bred in 1902 by Mr. G. F. Leigh, it will be seen that the latter possess as a whole far darker submarginal bands on the hind-wing. A single male (Plate XVII, Fig. 6) and that by far the darkest of the 1904 family is about as dark as one of the medium specimens of 1902. The other five are far less dark than any except the dwarfed "specimen 6." It is not necessary to describe and compare the condition of the submarginal bands, inasmuch as the whole series is figured, and this is a character which can be reproduced with great fidelity, and can be as well compared in somewhat reduced figures as in those which represent the natural size.

The hind-wings of these males, less heavily marked as compared with the 1902 and 1903 groups, probably exhibit seasonal differences, and the same explanation is even more certain for the under-side coloration, which is darker and more uniform in the specimens here described.

It will be noticed that the inner border of the black margin of the fore-wing is strongly serrated in Fig. 5, less so in Figs. 4 and 6. This serration is characteristic of both male and female in the ancestral *Papilio meriones* of Madagascar, but strangely enough it does not reappear in the most ancestral of the continental males which I have had the opportunity of examining. I do not find it in *P. antinori* (3 males), *P. polytrophon* (5 males), or in *P. merope* from the west coast. It appears however in a small proportion of the males from the northern end of the Victoria Nyanza and in the southern and eastern *cenea*. In the latter case it is to be found not uncommonly among the captured specimens as well as among those that have been bred. It is certainly remarkable that this ancestral feature should on the continental area be chiefly found in the most highly specialized of all the sub-species,—*cenea* of the south and south-east.

(β) The females.

The *trophonius* offspring (Plate XVII, Fig. 7) is seen to be a perfectly normal example of the southern type. As regards the *cenea* forms, the relative development of buff and white in the spots of the fore-wings may be shown by comparison with the earlier family classified on p. 681 of Trans. Ent. Soc. Lond. 1904.
Plate XVII, Fig. 8, about the same as No. III on p. 681.

The two ceece represented in Figs. 8 and 11, on Plate XVII, show the influence of trophonius parentage (see description of Figures, p. 313).

In the latter pages of this memoir these 11 specimens, both male and female, will be often referred to and compared with other forms.

II. Papilio dardanus f. trimen, new form.

In his Presidential Address to the Entomological Society of London in 1898 (Proc. 1897, pp. lxxxviii, lxxxix) Mr. Roland Trimen, F.R.S., described a remarkable form of the female dardanus, sub-species tibullus, from Zanzibar, in the Hope Department. After expressing the opinion that the West African dionysos was the least modified as compared with the male of all the various tail-less continental female forms known until that time,* he went on to describe the specimen from Zanzibar as "a much closer approximation to the masculine coloration. In this female the tranverse trace of black in the fore-wings is even fainter than in the dionysos form, and the colour of the wide pale spaces and the hind-marginal spots in all the wings is almost exactly of the pale creamy-yellowish tint of the male P. ceece; and on the under-side, while the pale yellowish of the fore-wings is better divided by blackish than on the upper-side, the colouring of the hind-wings corresponds much more nearly to that of the male than in any other female I have seen—the characteristic break in the submarginal brownish band being moreover very complete and wide. There can be no doubt that in this specimen we have a marked case of reversion to the original colouring of the female, but it is unaccompanied by any inclination towards the recovery of the lost tail of the hind-wings." In the same address (p. lxxxviii) the distinguished African naturalist expresses the opinion that "we may not unreasonably hope to dis-

* Speaking of dionysos, Mr. Trimen quotes his earlier paper in Trans. Ent. Soc. Lond. 1874. The reference is erroneously given as p. 178: it should be p. 148.
cover, at some point in the wide territories between Abyssinia and Zanzibar, females of the Μεροπε-group exhibiting stages intermediate between the long-tailed mimetic females of *P. antinorii* and the entirely tail-less ones of *P. cenca."

It was reasonable not to attempt to name this primitive variety while it remained as a single example; but now that it has been discovered in large numbers as one of the female forms of the sub-species *polytrophius*, Jordan, on the Kikuyu Escarpment, the case is different. It is one of the most instructive if not actually the most instructive of all the female forms of *dardanus*; and I propose to call it *trimenii*, in honour of the great naturalist who solved the mystery, and laid a firm foundation for all future work upon the most interesting and complex example of mimicry as yet known throughout the world.*

The specimen referred to by Mr. Trimen is here represented on a slightly reduced scale on Plate XIX, Fig. 1. In Plate XVIII, Fig. 1, one of the smaller *trimenii* forms from the Kikuyu Escarpment is represented of about the natural size. Of these there are four in the Hope Department. Judging from these four specimens the ground colour is sometimes yellow, exactly like that of the male (1), sometimes of a rather paler shade (2), and sometimes a little darker (1).

(a) Occasional occurrence of rudimentary "tails" to the hind-wing of *trimenii* and *hippocoon*.

The *trimenii* form frequently possesses ancestral characters additional to those described in the Presidential Address. The most interesting of these supplies the confirmation of Mr. Trimen's prediction that stages would be found "intermediate between the long-tailed mimetic females of *P. antinorii* and the entirely tail-less ones of *P. cenca."

The specimen represented on Plate XVIII, Fig. 1, is seen to have a small but distinct rudimentary "tail," containing an extension of the third median nervule. This nervule also enters the tail in the male, showing that the rudimentary tail of the female is entirely homologous with that of the other sex. The other three specimens of *polytrophius* f. *trimenii* do not exhibit this feature, but it is

* It is perhaps unnecessary to say that I allude to the great monograph in *Trans. Linn. Soc.*, vol. xxvi, 1870, Pt. III, 1869, p. 497.
possessed by an interesting example, to be described below (see p. 290), showing the origin of *trophonius* from *trimeni*. It is also possessed by two examples of the sub-species *merope* ♀ f. *hippocoon* in the National Collection. These specimens, both from the west coast, are represented in Plate XIX, Figs. 2 and 3.

(β) **Prominence of submarginal pale spots in hind-wing of *trimeni*, etc.**

Another primitive feature usually characteristic of *trimeni* is the large size and prominence of the submarginal pale spots in the black border of the hind-wing. These spots are of course persistent traces of the yellow ground colour of the male and unmodified female enclosed between the two black bands parallel with the hind-margin of the hind-wing. The band of ground colour is widest and most prominent between the root of the "tail" and the "inner gap," as will be seen by a glance at Figs. 1-6 on Plate XVII. Furthermore this especially prominent patch is widest immediately on the inner side of the root of the "tail," because it is here continuous with the ground colour in the "inner gap" (Plate XVII, Figs. 1-5) or enters the bay by which the closed gap is indicated (Fig. 6). It is precisely in this region, between the second and third median nervules, that the pair of submarginal spots even in the most specialized female forms often tend to be largest and most conspicuous. This is well seen in the *cenca* forms represented on Plate XVII, Figs. 8 and 11; and in the *hippocoon* shown on Plate XIX, Figs. 2 and 3. In the more primitive *trimeni* we expect to find and we do find these tendencies more marked and accompanied by a far higher degree of development of the whole series of paired submarginal spots on the hind-wing. The special size of the pair marking the position of the inner gap is well seen in the *tibullus trimeni* represented on Plate XIX, Fig. 1, and even better in the *polytrophus trimeni* of Plate XVIII, Fig. 1. In this latter the two enlarged spots have fused into a single and prominent patch. The development of the series of submarginal spots in *trimeni* is however far better seen in three specimens of this form of the sub-species *polytrophus* in the Hope Department,—specimens which in other respects were less instructive than that represented on Plate XVIII, Fig 1.

We can at once understand by the study of the examples
of *trimeni* figured on Plate XVIII, Fig. 1, and XIX, Fig. 1, and by comparison with the *hippocecon* forms on the same plates (XVIII 2, XIX 2–3), why it is that the submarginal yellow ground colour should be represented in the mimetic females by a pair of pale spots between each pair of nervules. It is evidently because the marginal development of black was brought about not only by a growth in width of the two marginal black bands of the male (Plate XVII, Figs. 1–6), but was also aided to an important extent by the appearance of black inter-nervular streaks. These naturally cut the ground colour still persisting between each pair of nervules into two halves.

(y) *Traces of costal and inner gaps in black margin of hind-wing of trimeni, etc.*

Apart from the indication of the "inner gap" afforded by the special development of the corresponding pair of pale submarginal spots, other distinct traces of both gaps are among the primitive features of *trimeni*. They are especially strongly developed in the specimen shown in Plate XVIII, Fig. 1. The "costal gap" is remarkably clear in the figure, while the site of the "inner gap" is rendered visible by two faint yellow streaks passing outwards into the broad black margin. They are better seen in the right hind-wing of Fig. 1. The *trimeni* represented on Plate XIX, Fig. 1, is a♀ form of the east coast sub-species *tibullus* in which the black band of the male is more developed than elsewhere, while the gaps are reduced to a minimum (Trans. Ent. Soc. Lond. 1904, p. 683). Nevertheless the "costal gap" can be clearly recognized. It is seen in Fig. 1 that the inner border of the black margin is not curved parallel with its outer border forming the edge of the wing but is made up of two straight lines meeting in an obtuse angle. This angle is the point where the central yellow invades the black margin most deeply and represents the costal gap of the male. This identification will be at once admitted when Fig. 1 on Plate XVIII is compared with Fig. 1 on XIX. The squarish shape thus originating persists in many examples of the more specialized female forms. It may be distinctly seen on the two *hippocecon* (Figs. 7, 8) and three of the *cenea* (Figs. 5, 6, 10) forms represented on Plate XXXI of Trans. Ent. Soc. 1904; and in the present memoir in *trophonius* represented on Fig. 7 of Plate XVII, and the
cevea on Fig. 11 of the same Plate. It is remarkably distinct in the polytrophus ♀ f. hippocoon shown on Plate XVIII, Fig. 2, although barely recognizable in the same forms from the west coast seen in Figs. 2 and 3 of Plate XIX.

III. *Papilio dardanus*, sub-species *merope* ♀ f. *dionysos*, Doubl.

Before proceeding to consider the origin of the mimetic female forms of *dardanus* it is necessary to say a few words of this remarkable and primitive variety which is not uncommon on the west coast. It is very probable that it also occurs among the wonderful series of *polytrophus* females from the Kikuyu Escarpment, but I have not yet met with an example.

In *dionysos* the hind-wings are those of the *merope* ♀ f. *trophonius* except that they are of a distinctly paler tint and thus nearer to *trimeni*. The costal gap is also very strongly marked. The fore-wings possess the black and white coloration of *hippocoon*, but with a primitive diminution of the black markings which is very like *trimeni*. In fact in one specimen (Cameroons: Cutter: 1869) in the Hope Department the oblique bar dividing the two chief white markings of the fore-wing is even less developed than in any of the five specimens of *trimeni* in the same collection. It is probable that *dionysos* was an early variant from *trimeni*, presenting a mixture of the characters which in other proportions were to be selected into *trophonius* on the one hand and *hippocoon* on the other.

IV. The sub-species of *Papilio dardanus* (= *merope*).

Before discussing the origin of the mimetic female forms it is necessary to consider the division of *dardanus* into sub-species. Dr. Karl Jordan* has examined 509 males and 270 females in the Tring Zoological Museum. Excluding the forms from N.E. Africa and Madagascar and only considering the males Dr. Jordan finds south of Sierra Leone five sub-species distinguished chiefly by the extent of black on the hind-wings. Differences in sex-organs are confined to the valve-edges. Dr. Jordan's five sub-species are as follows:

* Der Gegensatz zwischen geographischer und nichtgeographischer Variation. Zeitsch. f. wissenschaft. Zool., Bd. lxxiii. Dr. F. A. Dixey has very kindly lent me for the purpose of this memoir an abstract which he has prepared of this interesting paper.
Professor E. B. Poulton on Mimetic Forms of

(1) *P. cenea*. S. Africa. Transition to next form in geographical position and morphological character is complete.

(2) *P. tibullus*. Delagoa Bay northwards to Mombasa; west limit unknown, but occurs in Uganda.

(3) *P. polytropus*. B. E. Africa.

(4) Transitional forms from Victoria Nyanza.

(5) *P. dardanus dardanus*. Unyoro to west coast. Congo specimens are larger, as in some other cases.

Dr. Jordan furthermore states that *P. dardanus* is not sharply marked off into geographical forms. East and west coast examples can be distinguished, but neither assemblage is a complete unit. It is significant that the valve-process is generally present in eastern and absent from western forms.

In the following pages I have followed Dr. Jordan's conclusions and terminology with the single exception that I have called the fifth sub-species *dardanus merope* instead of *dardanus dardanus*.

V. The origin of the mimetic female forms of *Papilio dardanus* from the ♀ f. *trimeni*.

There can be little doubt that all the well-known mimetic females of *dardanus* as well as the latest discovery *planemoides* originated by modification of this primitive female form, either directly or by the combination and development of characters on their way to produce other forms. I propose to consider the evolution of these forms in the order of specialization, beginning with the most primitive:

(1) *Hippocoon*. The relationship of *hippocoon* to *trimeni* is at once seen by comparing Fig. 2 with Fig. 1 on Plate XVIII. The transformation is remarkably direct and simple, consisting merely in the greater intensity and sharpness of black markings already distinctly indicated in *trimeni*, and in the alteration of the pale yellow tint of the latter into white. There are four examples of this form from the Escarpment in the Hope Department. The other three are fairly represented by the figure of the fourth on Plate XVIII, Fig. 2, and it is rather surprising that none of them possess an indication of rudimentary "tails." It cannot be doubted however that *hippocoon* is by far
the most primitive of the mimetic female forms of *dardanus*, and I have been deeply interested to find well-marked rudimentary "tails" on two specimens from the west coast. These examples of the sub-species *merope* ♀ f. *hippocoon* exist in the National Collection, the "tails" being pronounced in one (Plate XIX, Fig. 2), distinct in the other (Fig. 3). By kind permission of the authorities I am able to submit the reproductions, referred to above, of Mr. Alfred Robinson's beautiful photograph, made in the Oxford University Museum.

The sporadic occurrence of this ancestral feature in association with precisely that form which still retains the most primitive pattern is a difficulty to be surmounted by those who have been inclined to minimize or even to deny the occasional cropping-up by reversion of long-lost characters.

The name *hippocoonoides* has been given by Haase to this form in the eastern and southern sub-species *tiblius* and *enea*. This seems to me a most unnecessarily complex and inconvenient procedure. The *trophonius* of the western sub-species *merope* is at least as different from that of the southern *enea* as are the two forms of *hippocoon* from the same areas. It is pretty certain indeed that each female form of every sub-species has certain peculiarities and is not exactly like the same form of any other sub-species. But this is quite sufficiently indicated by prefixing to the female form name the sub-specific name. *Papilio dardanus* sub-species *merope* ♀ f. *hippocoon* of the west coast is naturally different from *P. dardanus* sub-species *enea* ♀ f. *hippocoon* from Natal, and it is quite unnecessary to express this by turning the last name into *hippocoonoides*. To do so without making corresponding changes in the other forms is inconsistent; to be consistent in this respect is immensely to increase and to increase uselessly an already tremendous terminology.

The *hippocoon* forms are everywhere mimics of the abundant and conspicuous Danaines, *Amauris niavius* of the west and its sub-species *dominicanus* of the east coast and the south. They also exhibit a strong secondary mimetic approach to their Nymphaline co-mimics *Euradlia anthedon* of the west and *E. waltheryi* of the east and south (Trans. Ent. Soc., Lond., 1902, p. 486). The *hippocoon* form is probably dominant in all the sub-species of *dardanus* except *enea* and perhaps *polytrophon*; and it is present in fair proportion in both these.
(2) Trophonius. This form possesses the pattern of hippocoon, but white has been replaced by fulvous over the great continuous patch occupying most of the hind- and a large part of the fore-wing. The remaining pale markings are white, so that the yellow of trimeni in part originated white and in part fulvous,—a more complex change than that which produced hippocoon. Considering the identity of pattern I first supposed that trophonius arose from hippocoon instead of having an independent origin in the trimeni. Although the former view may be correct, the latter is I think more probable, being strongly supported by an interesting specimen from the Kikuyu Escarpment, in the Hope Department. In this butterfly the great patch is fulvous except upon the distal border of the part upon the fore-wing. This border, together with all the other pale markings on both wings, is not white like hippocoon, but retains the yellow of trimeni. The specimen furthermore possesses a rudimentary "tail" nearly as much developed as that of the trimeni represented on Plate XVIII, Fig. 1, while the sub-marginal yellow spots of the hind-wing are very large and prominent, far more so than in the particular specimen of trimeni just referred to. This specimen, with its primitive features, strongly supports the direct independent origin of trophonius from trimeni, the most convincing evidence being supplied by the pale markings which had not been converted into white, but remained of the ancestral yellow.

The trophonius form at any rate of the merope sub-species appears to be more unstable and is probably a more recent development than either of the other mimetic female forms hippocoon and planemoïdes. A specimen in the Hope Department (Angola: Rogers: 1873) presents a very primitive form of the oblique black bar dividing the two chief pale spaces of the fore-wing. It is even less developed than in a specimen of diónysoi in the same collection and much like that of the tündhulae trimeni represented on Plate XIX, Fig. 1. Meropé trophonius is very apt to appear as a variety in which the fulvous tint overspreads the whole of the pale markings of both wings. One of the two polytrophus trophonius forms at Oxford is of this variety. It is moreover a very poor mimic of Limnas chrysippus as compared with the smaller more deeply-coloured trophonius of the eenea sub-species (Plate XVII, Fig. 7). It is also noteworthy that the merope trophonius
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does not, so far as I am aware, present a variety with white hind-wings like the forms of Limnus chrysippus, var. alcippus, universal on the west coast.

Trophonia forms, although probably always relatively rare, occur in all five sub-species distinguished by Dr. Jordan.

(3) Cenea. Here too it is almost certain that the female form developed direct from trimeni, the ancestral yellow ground colour being transformed into buff without first becoming white. The evidence is similar to that advanced in the case of the last female form, but is stronger, inasmuch as there is not in cenea that close resemblance to the pattern of hippocoon which is borne by trophonia. Comparing the trimeni on Plate XVIII, Fig. 1, with the hippocoon in Fig. 2, and the cenea in Fig. 3,—all polytrophus forms from the Escarpment,—it is at once seen that the change from the apical half of the fore-wing of the ancestral form to that of cenea is nearly as simple as the change to hippocoon. For the rest of the pattern, cenea requires only a more widespread invasion of black than hippocoon. There are six examples of polytrophus f. cenea in the Hope Department, and all exhibit primitive characteristics in the pale tint of the chief patch of the hind-wing. In none is this buff like the Danaine models, but it is pale yellowish like trimeni in three, and pale yellowish with a faintly brownish tinge in the other three, including the specimen represented on Plate XVIII, Fig. 3. In five cases the chief spot of the fore-wing follows the tint of the hind-wing patch, in the sixth the chief spot is white. The other spots on fore- and hind-wings are generally pale yellowish, sometimes white. It is quite clear that we have in three specimens a stage in the transformation of the ancestral yellow tint into buff. It is of interest to observe that the pattern of the cenea form is completely attained in three specimens whose pale colour remains entirely ancestral. Not one of the six specimens exhibits rudimentary "tails," although the sub-marginal hind-wing spots are strongly developed. (Plate XVIII, Fig. 3.)

The cenea f. form is dominant in the sub-species cenea of the south and south-east, and common in polytrophus of the Kikuyu Escarpment. It occurs, but more rarely than hippocoon, in other parts of British East Africa, as a female form of tibullus and of the intermediate forms round
the Victoria Nyanza. It is unknown and probably entirely wanting from the sub-species 
merope on the west coast, but it may perhaps occur at the extreme eastern development of the sub-species in Uganda. Its distribution is thus co-extensive with that of its Danaine models the forms of Amauris echria and albimaculata.

(a) Evidence of diaposematic mimicry between the cenea ♀ f. of P. dardanus and two species of the Danaine genus Amauris.

It has been shown on p. 286 that the squarish shape of the large pale patch on the hind-wing of the female forms of dardanus is extremely ancestral, and the question arises as to whether Amauris echria and albimaculata have not mimicked and indeed exaggerated this feature in the Papilio which in other respects has mimicked them. There are many reasons in favour of diaposematic relationship between Danaine and Papilio. The squarish patch in the two species of Amauris, although far more marked than in the cenea form, is in all probability a recent development. It shows remarkable synaposematic sensitiveness, losing much of its characteristic sharpness and angularity in the presence of other species of the same genus. This change may be seen by a glance at Mr. S. A. Neave's Plate IX in the present volume. Amauris albimaculata (♀ Fig. 2a, ♀ Fig. 3a) shows this change in the presence of Amauris psyttalce, form damoclides, ♀ Fig. 2, ♀ Fig. 3. Compare the shape of the patch in the two sexes of albimaculata, with that of the same species from Natal far beyond the influence of damoclides,—♀ Fig. 4, ♀ Fig. 5. Amauris echria is also changed in the same direction by the presence of the same model, as may be seen by comparing ♀ Fig. 2b and ♀ Fig. 3b under the influence of damoclides (♀ Fig. 2, ♀ Fig. 3), with the same species from Natal—♀ Fig. 6, ♀ Fig. 7. Amauris lobengula (Plate XXII, Fig. 1), closely allied to A. echria and probably ancestral to it, because less peculiar in the genus, possesses a larger hind-wing patch in which the square shape is not nearly so marked. It is in fact almost precisely similar in shape to that of the trimeni form shown on Plate XIX, Fig. 1, and the hippocoon on Plate XVIII, Fig. 2. The exaggeration of the feature in Amauris albimaculata and echria is no reason against the hypothesis that it has been derived by mimicry. In the great majority of the forms of Acrea
johnstoni, undoubtedly mimetic in this respect, we meet with a still further exaggeration of the same character, the outer corner of the square being pulled out so as to form the most distinctive feature of the wing (see Plate XXI, Figs. 1b, 3a, and 4a, Plate XXII, Figs. 1a and 2a). That diaposematic resemblance is apt to arise between the P. johnstoni and the most distasteful groups in the same region has been shown by Dr. F. A. Dixey (Trans. Ent. Soc. Lond. 1896, p. 75; also 1894, p. 298) as regards S. America, and recently in a very striking manner by Mr. S. A. Neave (Trans. Ent. Soc. Lond. 1906, pp. 216–218) as regards certain other African species.

(4) Planemoides. Until Mr. C. A. Wiggins presented his splendid series of captures made in 1903 near the N.E. and N.W. shores of Lake Victoria Nyanza, there only existed in the Hope Department a single specimen labelled "Angola; Rogers, 1873." This specimen was, as far as I am aware, up to 1903, the unique representative of planemoides in European collections. There are at the present moment no less than ten examples of the form, or of intermediates between it and other forms, at Oxford,* so that it is now possible to compare planemoides with the other mimetic females of dardanus and to attempt to assign its place and suggest its past history.

It is convenient first to describe the intermediate specimens.

(a) ♀ form intermediate between cenea and planemoides.

The specimen here described is represented on Plate XX, Fig. 1. The discal patch of the hind-wing is not white as in planemoides but nearer to the buff of cenea, although with a faintly reddish-brown tinge which may perhaps indicate some influence of trophonius. The submarginal light spots are more developed than is usual in planemoides, although the example represented in Fig. 4 does not differ widely in this respect. While the hind-wings more nearly resemble the ♀ f. cenea, the fore-wings are on the whole much nearer to planemoides, as may be inferred by

* Some of these do not belong to the Hope Collection, but are the property of Mr. A. H. Harrison. They are however available for study and comparison, and two of them are represented on Plate XX, Figs. 1, 4. No less than five out of the ten examples are figured on the plates accompanying the present memoir; and a sixth by Mr. S. A. Neave on Plate X, Fig. 8.
comparing the intermediate form (Plate XX, Fig. 1) with \textit{planemoides} represented below it (Fig. 2), and with the \textit{f. cenea}, represented on Plate XVIII, Fig. 3. The colour of the markings is the deep rich tint of \textit{planemoides}, not the far paler shade of \textit{cenea}. The fusion of the three spots grouped round the outer end of the cell, and the shape of the marking thus produced, is almost precisely as in the specimen shown on Plate XX, Fig. 2; while the spreading outwards and downwards of the chief spot (below the cell) reproduces the inner marginal end of the band of \textit{planemoides}. The central part of the band is wanting, but a tendency towards fusion can be detected in the figure and is far more evident on the specimen. The \textit{planemoides} selected for comparison with this intermediate specimen, and shown in Fig. 2, is unusual owing to the overspreading of the white patch of the hind-wing by greyish scales. It is also a little abnormal and suggests transition towards the specimen above described (Fig. 1) in the separation of the spot within the fore-wing cell from the fulvous band (compare Figs. 3 and 4) and also in the comparative narrowness of the band itself, which is especially marked in the central portion where the discontinuity appears in Fig. 1. Figures 1 and 2 considered alone would suggest the origin of \textit{planemoides} from the \textit{cenea} form.

(\textit{\beta}) \textit{f. form intermediate between hippocoon and planemoides.}

The insect represented in Fig. 3 shows a tendency towards the \textit{hippocoon} form in the extension of the fulvous band (representing of course the white of \textit{hippocoon}) towards the base of the fore-wing, along the inner margin, as well as in the trace of an invasion of dark ground colour dividing the band at its centre. The effect is to produce a considerable approximation to the fore-wing pattern of \textit{hippocoon} (Plate XVIII, Fig. 2) or even more of \textit{trimeni} (Plate XVIII, Fig. 1). Fig 3, on Plate XX, compared with the fine example of typical \textit{planemoides} represented in Fig. 4 suggests the origin of the latter from \textit{hippocoon} or \textit{trimeni}.

(\textit{\gamma}) \textit{f. form intermediate between trophonius and planemoides.}

Only quite recently Mr. Harry Eltringham, F.E.S., has kindly shown me a beautiful coloured representation of a specimen from Entebbe which is intermediate between
Papilio dardanus (micrope) and Acræa johnstoni. 295

planemoides and a trophonius of the western or micrope type.* The latter strongly preponderates: the hind-wings are entirely those of trophonius. The fore-wings exhibit the fulvous area of planemoides spreading inwards along the inner margin and there becoming continuous with the fulvous area of trophonius. The pattern of the fore-wing is very like that represented on Plate XX, Fig. 3, but the fulvous area is somewhat larger and much less invaded by dark ground colour. The apical half of the fore-wing is typical planemoides, closely resembling that of the figure just quoted. This specimen taken alone would suggest the origin of planemoides from trophonius.

(6) Intermediates between planemoides and other mimetic female forms of dardanus, not ancestral but due to first crosses between female of one form and male representing another form.

The three intermediate examples described above (α, β, and γ) suggest the origin of planemoides from the fully developed cenea, hippocoon and trophonius respectively; and yet it is unreasonable to suppose that planemoides arose from more than one of the other female forms. We are thus driven to believe that such intermediates are not necessarily ancestral and to inquire what other significance they may possess. Here we derive the greatest assistance from Mr. G. F. Leigh's breeding experiment in which it has been seen (see pp. 283, 313) that the cenea offspring of a trophonius parent exhibited distinct traces of the latter form. It will be remembered that this influence was evident in the deeper tint of the hind-wing patch in one specimen (Plate XVII, Fig. 8) and the inner marginal markings on the fore-wing of another (Fig. 11).† The intermediates described in this section of the paper are probably always the result of first crosses between females of one form and males bearing the tendencies of other female forms. We are compelled to believe that in later generations their female offspring

* Easily distinguished from the trophonius of the south and east by its greater size, by the marked invasion of the margin of the fulvous area on the hind-wing by internervular radii, and by the much paler shade of the fulvous areas.
† A faint trace of the same marking is to be seen in the cenea offspring of a trophonius bred by Mr. Leigh in 1903. It can be just detected in the reduced representation on Fig. 11, Plate XXXI, Trans. Ent. Soc. London, 1904.
would not remain intermediate, but would split up, in accordance with the Mendelian conception, into the parent forms; and we can thus understand the comparative rarity of intermediates. But while this is almost certainly true of the sub-species of _dardanus_ in the W., S., and on the E. coast of Africa, where the specialization of the female forms has been carried to a high pitch, it is probably not equally true of the sub-species _polytrophus_ of the Kikuyu Escarpment.

(e) **Probable origin of planemoides from early variants of trimeni.**

The abundance of intermediates of all kinds among the females of _polytrophus_ and the relative numbers of the ancestral form _trimeni_ indicate a near approach to the origin of the diverse female forms. It is probable indeed that first-cross intermediates between the specialized forms themselves would split up into the parent forms on the Escarpment as in other parts of Africa; but it is by no means equally certain that the intermediates between each of them and their primitive ancestor _trimeni_ would behave in this manner. Only thus does it seem possible to explain the relative abundance on the Escarpment of intermediates almost always exhibiting primitive characteristics, viz. some approach to _trimeni_.

It would be of the highest interest to breed any of the sub-species of _dardanus_ through several generations: especially is this desirable in the case of _polytrophus_, which is certain to yield results of the utmost importance from many points of view.

It is probable that _planemoides_ arose from _trimeni_ by a combination of the varieties which were to produce _ceacea_, _hippocoon_, and _trophonius_. The size and shape of the white hind-wing patch probably arose from varieties on the way to _ceacea_, its whiteness from those which were forming _hippocoon_, while the fulvous tint of the fore-wing was a utilization in another direction of the characteristic colouring of _trophonius_.

The argument made use of with regard to _planemoides_ applies to all the other mimetic female forms; for intermediates between them occasionally occur probably in every sub-species and in all parts of the area of distribution. But while such varieties are not to be looked upon as ancestral, the case is very different with the Escarpment.
forms. Every one of the six polythrophus cenea which have come under my observation are primitive in the tint of the pale markings and we must assume that in this case we are in presence of a truly ancestral feature.

(¢) An interesting gynandromorphic specimen of the ♀ f. planemoides.

Although the male and the diverse female forms of the southern P. dardanus—the sub-species cenea—have been shown by direct evidence to be a single species by the important breeding experiments of Mr. G. F. Leigh, F.E.S.,* the same proof is unfortunately still wanting in other parts of Africa. It is therefore very satisfactory that other evidence has become available in the case of the most recently discovered form planemoides. This is in part supplied by the existence of intermediates between it and the other female forms of dardanus, two of which are shown on Figs. 1 and 3 on Plate XX. But still more striking evidence is supplied by a remarkable gynandromorphic specimen collected by Mr. T. T. Behrens, R.E., and represented on Plate XVIII, Fig. 4. The butterfly was obtained in 1902-3 on the west shore of the Victoria Nyanza between Entebbe and the mouth of the Kageru River. The admixture of male colouring, which is confined to the left wings, is very well represented in the figure, except upon the white patch of the hind-wing, where the pale yellow streaks could not be differentiated from the white background by photographic means. If the black ground colour of the left hind-wing be compared with that of the right, it is seen that three submarginal irregular areas of a deeper shade are present on the former wing but absent from the latter. These represent the submarginal band of the male while the spaces between them are the costal and inner gaps. The yellow male scales pass through the costal gap as an almost continuous streak, while they are developed in small scattered masses in the neighbourhood of the inner gap. The yellow scales reach the extreme margin of the hind-wing in the concavities of the scalloped border, as in the male, while the yellow of the two concavities nearest the anal angle

* Published in Trans. Ent. Soc. 1904, p. 677, and in the present memoir.
(omitting from consideration the one that has been accidentally injured) possesses a pale brownish edging also characteristic of the male.

In the fore-wing the yellow male streaks and patches are strongly developed on the disc below the cell. It is deeply interesting to observe how sharply cut off they are when, crossing the lower part of the fulvous band, they reach the black border. We are driven to infer that this portion of the border almost precisely corresponds in the two sexes and that the black border of this and other female forms is inherited unchanged from an ancestor like the male. In fact this character carries us further back than the ancestral trimeni form (Plate XVIII, Fig. 1) in which the male border has already been greatly modified. It is to be observed furthermore that the abrupt termination of the yellow streaks confers upon the black border a sharpness of outline entirely wanting in the female form, as is at once seen when the right and left sides are compared. Opposite to the middle of the hind margin the black border is invaded by an outward extension of the fulvous band—due to that part of it which represents the sub-apical bar of the hippocoon ♀ form (compare Figs. 2 and 4 on Plate XVIII). Here the ancestral male border has been much reduced, and in the gynandromorphic specimen the site of the invading fulvous concavity is in part covered by grey scales quite distinct from the yellow ones on those parts of the wing surface which are yellow in the male. The photographic method however only imperfectly renders the difference.

(η) Mimetic relationships and distribution of planemoidees.

This beautiful form, only recently recognized as a mimic of Plancma poggi by Trimen and Neave (Proc. Ent. Soc. Lond., Oct. 7, 1903,) is not known to occur as a female form of any sub-species of dardanus except mecope (= dardanus dardanus). The occurrence at Taveta of a fine variety of Acræa johnstoni (Plate XXI, Fig. 2 a) strongly convergent towards planemoidees renders it probable that this latter exists in the neighbourhood, perhaps as one of the female forms of the sub-species tibullus. The immense increase in our knowledge of planemoidees during the last two or three years encourages the hope that we shall at no distant date be fully acquainted with its range.
B. Mimetic forms of Acraea johnstoni, Godman.

Introductory.—In the following section the attempt will be made to show that the whole series of diverse forms which have given to this species its long synonymic list has arisen through the development of mimetic likeness to several distinct models, both Danaeine and Acraeine. The form-names suggested by Oberthür* have been followed throughout, Acraea torunana, Grose-Smith, being regarded as a form of semifulvescens, Oberth. In a later part of the section facts will be brought forward which appear to prove that this protean butterfly is not only conspecific with fallax, Rogenh. (= kilimandjara, Oberth.), as Aurivillius suggests, but also with Godart's species, lyra.

I owe the opportunity of writing this part of the present memoir to my kind friend, the Rev. K. St. Aubyn Rogers, M.A., of Wadham College, Oxford, who has presented to the University Collection the deeply interesting series of models and mimics represented on Plate XX. The whole of the butterflies there represented together with other examples of the same mimetic forms were captured on the slopes of Kilimanjaro in 1905. In addition to this extensive material Mr. St. Aubyn Rogers has presented many examples of A. johnstoni from Taita and Taveta in British East Africa, including the fine and remarkable variety from the last-named locality, represented on Plate XXII, Fig. 2a. The series of models and mimics would however have lacked completeness if other kind friends had not also afforded valuable help:—Mr. Guy A. K. Marshall sending me an extreme south-eastern form (Plate XXII, Figs. 1a, 1b) with its model (Fig. 1); and Mr. C. A. Wiggins the extreme western mimetic form (Plate XXII, Fig. 3a) with the model (Fig. 3) from the same district.

The mimetic resemblance of the commonest forms of A. johnstoni (proteina and flavescens) to Danaeine butterflies of the genus Amauris was suggested by the present writer in 1897.† Although greatly impressed by the likeness of Acraeine to Danaine, I was then quite unaware of the existence of this wonderful range of forms and of the

* Etudes d'Entomologie: Dix-septième Livr.: Avril 1893.

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striking example of Müllerian mimicry which it was to supply.

I. Mimetic forms of Acræa johnstoni, Godman.

It is now proposed to consider the various often widely-separated forms of johnstoni in the probable order of their evolution in time, and to point out the models in each case.

(1) Acræa johnstoni, Godm., form proteina, Oberth. Oberthir (Etudes D'Entomologie: Dix-septième Livr.: Avril 1893: Pl. II, Fig. 14) considers the variety with white spots in the fore-wing and a squarish pale buff discal patch in the hind-wing as the typical form of the species; and it is probably more ancestral than any other. It appears to be much more abundant than the buff-spotted form flavescens, and also to have a wider range. The most southern examples in the Hope Collection, viz. three specimens sent to me by my kind friend Mr. Guy A. K. Marshall from Chirinda Forest, Gazaland, in S.E. Rhodesia (4000 feet), are all of this form, and it is also far more numerous than any other in the Rev. K. St. Aubyn Rogers' series from the Kilimanjaro district, as also in the series from the Tiriki Hills on the N.E. shores of the Victoria Nyanza (5100 feet) kindly given me by Mr. C. A. Wiggins.

The proteina form is an obvious and beautiful mimic of Amuris albimaculata and the white-spotted forms of Amuris echria. Its synaposematic sensitiveness is well seen in Mr. Marshall's specimens from Chirinda in which the squarish discal patch of the hind-wing is unusually large, clearly as an approach to Amuris lobengula (Plate XXII, Fig. 1), one of the dominant Danaines of this locality. The discal expansion is more pronounced in the female Acræa (Fig. 16) than in the two males, one of which is represented in Fig. 1a. The more perfect mimetic likeness of the female is an example of the well-known and widely applicable principle explained by A. R. Wallace.*

The resemblance of proteina to the Danaine model is far less perfect on the under-side, although the spots of the fore-wing and the patch of the hind-wing are still the prominent features. The ground colour in the marginal

part of the hind-wing and the apical part of the fore-wing is marked by alternating dark and light stripes,—dark veins, paler ground colour and again darker internervular radii. This is certainly the conspicuous feature of the insect during prolonged rest with closed wings hanging downwards, and it is an appearance characteristic of many Acræinae.* Hence in complete rest the prominent characters are synaposematic with other Acræinae; during flight and in brief rests with wings open the characters are synaposematic with the genus Amauris.

Oberthiür's form semialbescens (l. e., Plate III, Fig. 29) with white spots on the fore-wings and reddish-brown hind-wings bearing a paler discal patch of the same colour, may be looked upon as an exceptional variety of proteina. It is of much interest as an example of the variational material out of which natural selection has probably produced such mimetic forms as flavescens (Plate XXI Fig. 4a), and toruna (Plate XXII, Fig. 3a.)

(2) Acræa johnstoni, form flavescens, Oberthiür (l. e., Pl. I, f. 4). This form differs in the spots of the fore-wing being buff instead of white. It is an obvious mimic of the buff-spotted forms of Amauris cecilia. Every gradational shade between pronounced buff and the pure white of proteina is to be found. A good intermediate example is figured on Plate XXI, Fig. 1b, but the methods of photography do not at present enable us to distinguish between these pale tints. The remarks upon the under-side colouring of proteina apply equally to flavescens.

(3) Acræa johnstoni, form semiflavescens, Oberthiür (l. e., Pl. II, f. 19). This is the form of the species described by Godman from Kilimanjaro, and therefore from the systematist’s point of view the type of the species. From every other point of view it is evidently highly specialized—a comparatively modern offshoot from the ancestral Amauris-mimicking forms proteina or flavescens. The change has been brought about by selection in the direction of other models, Acræine in place of Danaine. There are at least three different sub-forms included under semi-

* It is also reproduced in the mimicry of Acræinae, e. g. in the males of certain species of Pseudocera. In the magnificent W. African Lyceenid, Epitola honorinus, F., the portions of the under-side exposed in prolonged rest are beautifully mimetic of this Acræine appearance, not only as regards the radiate markings but also in the characteristic group of black spots at the base of the hind-wing.
fulvescens, each of the three mimicking a different Acraeine species or form.

(a) The most primitive sub-form is typical semifulvescens as it occurs on Kilimanjaro,—represented in Plate XXI, Fig. 3a. The whole of the fore-wings, within the zigzag line of the four spots, is bright fulvous, while the discal patch of the hind-wings is pale yellowish. Thus is produced a considerable superficial resemblance to Planema quadricolor,* Rogenh., from the same mountain (Fig. 3). The zigzag line of pale spots bordering the fulvous area of the fore-wings represents the black margined fulvous band which borders the deep rich brown of the Planema. The relative position of darker and lighter shades is the same, although the inner half of the surface is much brighter in the mimic than in the model. In the hind-wing the semifulvescens form has a far larger pale area than the Planema, in which the rich brown black-spotted triangular basal patch of the under-side is reproduced upon the upper. The discal band of the Planema, if smaller than the squarish patch of the mimic, is brighter in tint, being white instead of pale yellow. In one specimen of semifulvescens from Kilimanjaro the black ground colour has greatly encroached upon the basal margin of the discal patch, leaving a pale band which closely approximates to the form of the marking in the Planema.

(β) The second sub-form of semifulvescens (Plate XXII, Fig. 2a) is a splendid member of the group of mimics clustered round Planema poggei (Fig. 2) as the central model,—the combination of which so many members have been described and figured by Mr. S. A. Neave (Trans. Ent. Soc. 1906, p. 218; Plate X). It differs from Oberthür's form (α) in the restriction of the fulvous area of the fore-wing to the neighbourhood of the zigzag line of pale spots (compare Plate XXII, Fig. 2a, with XXI, Fig. 3a). On the distal side of each spot as in semifulvescens the ground colour of the wing is black; but it is also very dark brown, almost black, on the proximal side of the innermost spot, except along the costa, where the fulvous tint extends nearly to the base of the wing. The discal patch of the hind-wing is moreover white instead of

* This Planema, of which a male and a female were presented by Rev. K. St. Aubyn Rogers, was new to the Hope Collection, and is unrepresented in the National Collection. It was kindly named for me from a photograph by Prof. Chr. Aurivillius.
Papilio dardanus (mcrepe) and Acraea johnstoni. 303

pale buff. The resemblance of this striking and beautiful form is also promoted by its size; for it is one of the largest specimens of johnstoni which I have ever seen. As in so many other cases this mimic is an even closer approach to a co-mimic than it is to the primary model. And of all the species which are grouped round Planema poggei there can be no doubt that its resemblance is strongest to the planemoides female of Papilio dardanus (Plate XX, Figs. 2, 4). I do not know of this latter from Taveta where the (β) form of semifulvescens was collected by Mr. St. Aubyn Rogers; but planemoides exists in the A. H. Harrison collection from Nairobi, so that its existence in the neighbourhood of Kilimanjaro and Taveta is at any rate probable; and the same may be said of Planema poggei, the primary model, also labelled Nairobi in the same collection.

In both (α) and (β) sub-forms of semifulvescens the fulvous part of the fore-wing under-side would be hidden by the hind in the attitude of prolonged rest, so that the appearance becomes synaposematic with many of the smaller Acraeinae rather than with the particular Planemas. On the other hand, in flight and probably during brief rest between successive flights the basal part of the fore-wing under-side would contribute to the visible appearance and serve to reinforce the resemblance to the Planemas.

(γ) The third sub-form of semifulvescens is the toruna form (Plate XXII, Fig. 3α), described under that name from Toro, W. Uganda, by Mr. H. Grose-Smith. There can be no doubt I think that this is a further development of the form described by Oberthür from Kilimanjaro—a modification brought about by mimetic resemblance to another Planema model,—P. latifasciata, E. M. Sharpe (Plate XXII, Fig. 3). It is altogether a much more perfect mimic of this Planema than semifulvescens (α) is of the allied P. quadricolor. The rich brown colour of the basal half of the fore-wing is here alike in model and mimic, while the zigzag row of four spots tend in toruna to fuse and generally completely fuse into a zigzag fulvous band somewhat resembling but more irregular than that of the Planema model. In P. latifasciata the black inner border of the fulvous band is far more feebly developed than in P. quadricolor, so that the absence of this border in toruna does not greatly detract from the likeness. On the other hand, the fulvous band itself is far wider and more con-
spicuous in *latifasciata*, and this is well matched except in form by the mimic. In fresh specimens moreover the ground colour of both wings in the Toro model and mimic is of a distinctly brownish shade of black, wanting in the dark ground of the more eastern pair. The discal band of the hind-wing in *P. latifasciata* (Plate XXII, Fig. 3) is fulvous and broader than the white band of *quadricolor* (Plate XXI, Fig. 3): the triangular basal brown patch of the hind-wing under-side is reproduced above in both species of *Planema*, but the black spots are indistinctly seen on the upper-side of *latifasciata*, while the chief members of the group are conspicuous, being in fact reproduced on the upper-side of *quadricolor*. In *toruna* the discal patch on the hind-wing is fulvous, and the effect at a little distance is singularly like that of the model. It is however produced in a different way; for the uniform bright fulvous tint of *latifasciata* is imitated by a fusion of two distinct colour elements in *toruna*,—viz. the paler fulvous ground colour of the patch and the deep fulvous internervular and intracellular rays which traverse it. The shape of the discal patch has also been modified into close resemblance to the band of *latifasciata*, although a trace of the angle, so well known and conspicuous in the forms of *johnstoni*, remains as a guide, indicating the path of evolution. The basal invasion by deep rich brown of the pale patch on the hind-wing suggests the basal triangular area of the *Planema* model. On the under-side the patterns of both model and mimic are reproduced in paler shades, still maintaining their close resemblance. The discal band of the hind-wing of *Planema* and the corresponding patch of the *Acrsea* are white, and in the latter the characteristic squarish shape is far more prominent than on the upper-side. The basal spots of the hind-wing under-side which are so concentrated towards the base in other forms of *johnstoni* are here moved outwards and are placed upon and along the borders of a rich brown triangular area resembling but much smaller than that of the model. The *toruna* form of *johnstoni* is one of the most interesting of the mimetic appearances developed by this remarkable and protean species.

(4) *Acrsea johnstoni*, form *fulvescens*, Oberthür (l. c., Pl. II, f. 21). This, the last of a wonderful series, is one of the most remarkable, the black ground colour persisting only as
a narrow margin widened at the apex of the fore-wing (Plate XXI, Fig. 4a). The whole of the rest of the surface of both wings is bright fulvous, with the four spots of the fore-wing and the squarish patch of the hind-wing visible (especially the former) as a paler shade of the same colour. At a little distance and during flight these markings would become inconspicuous, and the butterfly would closely resemble a small specimen of the form of Limnas chrysippus dominant in British East Africa, viz. the dorippus form (= klugi), without the black and white apex to the fore-wing (Plate XXI, Fig. 4). On the under-side the resemblance of fulvescens to the primary model is less close because of the absence of the distinct black margin so conspicuous on the upper-side. But this very appearance, together with a radially striped pattern caused by the alternation of dark veins and brighter ground colour, and the increased paleness of the marginal part of the hind-wing and the apical area of the fore-wing, promote a deuterosynaposematic resemblance to another Acræine mimetic of dorippus,—the diaira form of Acræa encedon. These two Acræas are moreover of nearly the same size, while the Danaine primary model is of course a far larger butterfly. The chief basal spots of the hind-wing under-side are not black and prominent but dark fulvous and therefore inconspicuous, in this case producing an appearance suggestive of dorippus, and unlike any of the forms of encedon in which the black spots are so conspicuous a feature.

II. Acræa johnstoni, Godm., and A. fallax, Rogenh., the eastern forms of A. lyca, Godt.

The three forms which it is here proposed to unite under a single species are thus grouped by Aurivillius: *—


"110. A. fallax, Rogenh., forma præcedentis ?; Kilimanjara, Oberth.

"111. A. lyca, God.; ab. ♀ Butleri, n. ab. lyca, var. ♀ Butl."

* Rhop. Æthiop. 1898, pp. 114, 115. References are omitted from the quotation. The italics indicate synonyms.
We see therefore that Aurivillius keeps *A. lycoa* distinct, while he suggests that *A. fallax* (*kilimandjara*) may be a form of *johnstoni*. I believe that he is right in this last opinion, although positive proof can only be gained by breeding; but the facts set forth below render it certain that *fallax* is the eastern form of *lycoa*. If Aurivillius is right in his association of *fallax* it will inevitably follow that the whole series of varied forms must fall under Godart's species,—*lycoa*.

*Acraea lycoa* of the tropical west coast is distinguished from *A. johnstoni* by the following characteristics:—

(1) The large size of the four spots on the fore-wing and the tendency of the subapical pair to fuse and form a subapical bar: the tendency of the more interior pair similarly to form a patch extending from below the end of the cell towards but not quite reaching the posterior angle of the wing. The spots are, however, sometimes separate, although much larger and more nearly approximated than in *johnstoni*.

(2) The pronounced sexual dimorphism of which no trace can be found in *johnstoni*. The males of *lycoa* have a much browner ground colour than the females, especially in the hind-wing, while the spots of the fore-wing are pale buff instead of white and are sometimes evanescent. Furthermore the white discal patch of the hind-wing is unrepresented in those males I have had the opportunity of examining, while the development of the internervular radii is correspondingly increased.

(3) The apex of the fore-wing of *lycoa* is more broadly rounded and the costal margin more curved than in *johnstoni*. The outline of the wing between the apex and the posterior angle is straight or even convex in the females, straight or very slightly concave in the males. In *A. johnstoni* it is probably always concave, although sometimes very slightly so.

(4) The basal black spots on hind-wing under-side are smaller in *lycoa* and less concentrated towards the extreme base of the wing. The spot in the base of the cell with the two spots on the costal side of it forms in *lycoa* a characteristic approximately equilateral triangle. Owing to the greater concentration of spots the corresponding triangle in *johnstoni* is nearly always isosceles with its base towards the root of the wing. It is moreover less conspicuous as a feature in the wing of this latter form.
(5) The discal white patch on the hind-wing of the female _lyceoa_ is somewhat larger than in _johnstoni_: moreover it is rounded and not subquadrangular as is the buff patch of the eastern form, although rare exceptions both as regards contour and tint are not wanting in the latter. The rounded margin of this patch in the female _lyceoa_ is more invaded by internervular radii than in _johnstoni_, and consequently less sharply defined. Outside the discal patch the strong development of these dark radii contrasted with the paler (greyish or rarely brown) ground colour produces a very different effect from the almost uniformly dark appearance of the corresponding area in _johnstoni_.

When we reach the western part of Uganda, in the uplands of Toro, at a height of 7–9000 feet, _lyceoa_ is still a dominant _Acraea_. The only male I have seen resembles the western form except that there is a slight tendency towards the development of a buff discal patch in the hind-wing. Some of the females resemble those of the west coast except that the white discal patch is very slightly smaller; in others the four white spots of the fore-wing are widely separated and smaller, approaching the condition of _johnstoni_, while in these very individuals the discal patch of the hind-wing is smaller and more sharply defined. In all other respects the western characters described above are still maintained.

Passing still further east to the N.W. shore of the Victoria Nyanza at Entebbe, we find that the males have now gained the four widely separated buff spots in the fore-wing, not nearly so distinct and sharply defined as those of _johnstoni_, but otherwise very similar. Many individuals have a small trace of the buff discal patch. All the females I have seen resemble the most _johnstoni_-like of those from Toro, except for the tint of the discal patch of the hind-wing, which has become a very pale buff. These females are nearly indistinguishable from the _kilimanjara_ figured by Oberthür * (= _fallax_, Rogenh.). Owing to the kindness of my friend, Mr. T. T. Behrens, R.E., I have had the opportunity of examining a pair of this form from the Anglo-German boundary west of the Lake, but not more than sixty miles from it. While the female resembles those from Entebbe, the male has a far

more marked but very imperfectly defined buff discal patch.

We now pass to the N.E. shore of the lake. The Hope Department possesses an interesting series of specimens kindly presented by Mr. C. A. Wiggins. They come from the Tiriki Hills, 5100 feet, twenty miles N. of Kisumu. In the more defined buff discal patch of the hind-wing the three males are a further advance in the direction of the fallax form than that reached by any male I have seen from further west. In the four females the discal patch is slightly less pale than that of any as yet mentioned, while the rest of the hind-wing is more uniformly dark. They are in fact almost precisely similar to females of the kilimamundjara form (see Plate XXI, Fig. 2a) from the mountain after which it was named by Oberthür; only differing in the smaller size of the discal patch and its slightly paler tint. A single female obtained by Mr. Wiggins at Kakamega's (5500 ft.) near Mumias on the Uganda Railway, about fifteen miles N.E. of Kisumu, is of the same type, but the patch is even smaller and very slightly deeper in tint. Mr. C. A. Wiggins' Nyanza and Toro specimens were identified as forms of A. lycoa by Mr. S. A. Neave (Nov. Zool., vol. xi, March 1904, pp. 348, 349), and I find that the same forms from Toro and Nyangori are labelled "lycoa?" by Miss E. M. Sharpe in the A. H. Harrison Collection.

We now pass to the most eastern specimens I have examined, viz. those kindly sent me by Rev. K. St. Aubyn Rogers from Taita, Taveta, and Kilimanjaro. In these forms the buff-spotted males with an enlarged discal patch of pronounced buff (Plate XXI, Fig. 1a) mimic the buff-spotted and buff-patched Amauris echeria, while the white-spotted females (Plate XXI, Fig. 2a) with slightly paler buff patches, also enlarged as compared with the Nyanza forms, mimic Amauris albimaculata and the white-spotted forms of A. echeria. They are certainly Rogenhofers fallax and Oberthür's kilimamundjara. They are equally undoubtedly the eastern forms of Aeraxa lycoa, modified by the mimicry of Danaines not known on the west coast. The sexual dimorphism of lycoa persists in fallax, and remains of the same kind though very different in degree; for, as pointed out above, the males bear buff spots on the fore-wing and the females white, while the discal patch is paler in the latter sex. The johnstoni of
Godman (proticina of Oberthür) differs from fallax and lycoa in that it is not sexually dimorphic. I have found males and females both present in the semifulvrescens form and the white-spotted Amauris-like forms. Both sexes would probably be found in a sufficient series of any variety. It also differs in possessing squarish as compared with a rounded discal hind-wing patch, which is also more sharply defined because less invaded by internervular radii. In fallax the contour of the fore-wing has greatly approximated from lycoa towards johnstoni, but the apex is still slightly more broadly rounded, and the costa of the fore-wing rather more bent. On the other hand, a concavity between the apex and the posterior angle, although faint or absent in the females, has now become distinct in the males of fallax,—as distinct as in johnstoni. In this respect and the more uniformly dark ground colour of the hind-wing outside the discal patch these extreme eastern forms of lycoa show an approach to johnstoni. The basal spots of the hind-wing under-side remain however precisely those of the western lycoa.

A most curious change in lycoa as we advance from west to east is the shrinkage of the discal patch to a minimum at the N.E. of the Victoria Nyanza and its subsequent slight expansion further east.

In the collections I have already mentioned supplied by the generosity of many friends Acraxa johnstoni was first found (in about equal numbers) accompanying the forms of lycoa (fallax) in the Tiriki Hills; and in far greater numbers at Kilimanjaro, Taveta, and Taita. The great majority are easily separated from the lycoa (fallax) forms by the characters already mentioned but intermediate individuals certainly occur. The most striking of these appeared among four males sent to me from the Kenya District by my friends Mr. and Mrs. S. L. Hinde. Of three specimens captured on February 8, 1903, at Fort Hall (about 4000 feet) two are obvious johnstoni while the third possesses a well-defined buff patch intermediate in outline between fallax and johnstoni. The basal spots of the hind-wing under-side resemble those of fallax. On the other hand, the spots of the fore-wing are white and not buff as in the males of fallax. The fourth specimen, captured above the Goura River (5–7000 feet) February 21, 1903, is somewhat nearer to fallax and the fore-wing spots are buff. A very fine intermediate example also exists in
the National Collection. In view of these intermediate specimens, and the variation in all the distinguishing characters observed when a sufficiently long series of *johnstoni* are examined I do not doubt that Aurivillius is correct in suggesting that *fallax* is conspecific with *johnstoni*. Strong support is also afforded to Aurivillius' suggestion by the observations of Rev. K. St. Aubyn Rogers, who knows both *johnstoni* and *fallax* in life in their natural habitat and looks upon them as a single species. It has been shown here that *fallax* is undoubtedly the eastern form of *lycoa*. It therefore becomes extremely probable that the whole wonderful series of forms—many of them totally unlike—associated under the name *johnstoni*, or as it was still more appropriately named by Oberthir, *proteina*, are all of them specifically identical with Godart's species *lycoa*. Furthermore, this remarkable series must be still further extended to include the *toruna* of Grose-Smith.

In conclusion, it is possible to attempt to reconstruct the history of the changes through which *lycoa* and its descendants have passed. It is probable that the male of the western *lycoa* represents the ancestral form of the whole group,—a semi-transparent fuscous and brownish *Acrea* with ill-defined markings. As regards the semi-transparency it is noteworthy that the character tends to crop up not uncommonly in the most modified form *johnstoni*, where it is often seen in the discal patch of the hind-wing. The female of the western *lycoa* became modified by synaposematic approach to the black and white species of the Danaine genus *Amauris* on the west coast. The same is substantially true of the species in Western Uganda where the black and white *Amauris* are still predominant and have even drawn the *echria* and *albimaeculata* types of their own genus after them. (See S. A. Neave in *Trans. Ent. Soc.* 1906, pp. 208–210.) As we go further east however these latter types become themselves predominant, and the *fallax* forms of *lycoa* follow them, the males becoming strongly mimetic and approaching the buff-spotted Danaine models, while the females still retain the ancestral colour and resemble those that are white-spotted. As regards the hind-wing both sexes gain a buff discal patch similar in colour but not in shape to the models. Finally, from the most strongly-marked of these eastern forms with the deepest shade of ground
Papilio dardanus (merope) and Acraea johnstoni.

colour there probably arose still more perfect mimics of the same models in proteina and fluxescens, the two forms of johnstoni which are nearest to fallax. It is to be observed that the change in the shape of the fore-wing which occurred as fallax gave rise to johnstoni is in the direction of the form of the Danaine and Planema models. Johnstoni once formed, variation in other directions, guided by natural selection, led to the mimicry of various additional Danaine and Acraeine models: — of Limnas chrysippus, var. dorippus, of Planema quadricolor, Planema latifasciata, and Planema peggi.

[My friend Mr. Guy A. K. Marshall has kindly read through the proof-sheets of this paper, and has made many valuable suggestions.]
Explanation of Plate XVII.

The offspring of a *trophonius* form of *Papilio dardanus*, sub-sp. *cenea*, observed laying eggs on May 4, 1904, at Bellair, five miles from Durban, Natal. The observation was made and the eggs collected by Mr. G. F. Leigh, but the female parent escaped. The figures represent eleven out of the thirteen offspring bred by Mr. Leigh from these eggs at Durban. The specimens are in the Hope Department, Oxford University Museum.

All the figures are about \( \frac{3}{4} \) of the natural size.

**Fig. 1.** Male offspring: pupated July 4, 1904; emerged August 5.

The 10th to emerge. In this specimen the submarginal black band of the hind-wing is the least developed. There is however a slight trace of a narrow "sickle" partially closing the costal gap.


The 8th to emerge. The costal gap closed by a narrow "sickle."


The 5th to emerge. Although the costal gap is open there are traces of a black mark partially closing the inner gap.


The 4th to emerge. Very similar to Fig. 3, but the costal gap is here completely closed.

In this figure and the two succeeding it is seen that the inner border of the black margin of the fore-wing is distinctly serrated, recalling the appearance of *meriones*.

5. Male offspring: pupated June 10, 1904; emerged July 5.

The 2nd to emerge. Submarginal band of hind-wing slightly more developed, and the gaps slightly less than in Fig. 4.

The *meriones*-like serration described under Fig. 4 here reaches its maximum development.


The 6th to emerge. Hind-wing far more heavily marked than in any other of the male offspring, both gaps being completely closed. These males, emerging in July and August 1904, are as a whole far less heavily marked than those bred in November 1902 and November 1903, by Mr. G. F. Leigh.
Fig. 7. Female offspring, *trophonius* form: pupated July 6, 1904; emerged August 26. The 13th to emerge. A typical example of the southern form of *trophonius*, here for the first time bred from a *trophonius* female parent.

8. Female offspring, *cenea* form: pupated June 12, 1904; emerged July 17. The 3rd to emerge. The discal patch on the hind-wing is distinctly browner than usual,—a result of *trophonius* parentage appearing in an otherwise typical *cenea* ♀ form.


10. Female offspring, *cenea* form: pupated July 8, 1904; emerged August 24. The 11th to emerge. The right-hand wings, being somewhat crippled, are only partially shown in the figure.

11. Female offspring, *cenea* form: pupated June 11, 1904; emerged July 4. The 1st to emerge. The shape of the principal spot of the fore-wing, and the development of a light patch on its inner margin, as well as the evident tendency of the two markings to fuse, show a distinct influence of the *trophonius* parentage.

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**Explanation of Plate XVIII.**

Female forms of *Papilio dardanus*.

All the figures are about the natural size. The butterflies were intended to be precisely of the natural size, but as a matter of fact they are all slightly enlarged. Furthermore, probably in consequence of the concurrence of minute errors, the figures on the right side, 3 and 4, are rather more magnified than those on the left, 1 and 2. The error is well within the limits of individual variation.

Fig. 1. *Papilio dardanus*, sub-sp. *polytrophus*, ♀ f. *trimeni*, n. f. Kikuyu Escarpment, British East Africa, 6500–9000 feet. W. Doherty, October—November 1900; in the Hope Department, Oxford University Museum. The specimen shows distinct rudimentary "tails" to the hind-wing. The pale tints are yellow and not white, while the pattern is also very ancestral as compared with the *hippocoon* form from the same locality (Fig. 2).
Fig. 2. *Papilio dardanus*, sub-sp. *polytrophus*, ♀ f. *hippocoon*: data as in Fig. 1, except that the specimen was captured September—October 1900. Although far more specialized by mimicry of the black and white *Amauris niavus* form *dominicanus*, the origin of the pattern from that of the *trimeni* form (Fig. 1) is clear and simple. It is accompanied by a change of the pale markings from yellow to white.

3. *Papilio dardanus*, sub-sp. *polytrophus*, ♀ f. *cenea*: data as in Fig. 2. This form is far more specialized, viz. further from the ancestral pattern still borne by the male insect (Plate XVII, Figs. 1–6), than the *hippocoon* (Fig. 2). At the same time it is by no means difficult to trace the independent origin of the *cenea* from the *trimeni* form by the spreading of the black ground colour.

4. *Papilio dardanus*, sub-sp. *merope*, ♀ f. *planemoide*, partially gynandromorphic on the left side. The male influence is not only seen in the conspicuous patches and streaks of pale yellow scales on both fore- and hind-wing, but also in the traces of the three submarginal black patches on the hind-wing (compare Plate XVII, Fig. 1). These are inconspicuous because placed on a dark ground; but they can be at once recognized by comparing the left with the right hind-wing which exhibits no trace of gynandromorphism. The pale markings on the right fore-wing were caused by accidental injury and are in no way comparable with the appearance on the left side due to the existence of yellow scales like those of the male. This interesting specimen was collected by Mr. T. T. Behrens, R.E., in Buddu, on the west shore of Lake Victoria, Nyanza, between Entebbe and the mouth of the Kageru River: December 3, 1902—March 1, 1903.
EXPLANATION OF PLATE XIX.

Ancestral females of *Papilio dardanus*.
All the figures are about \( \frac{9}{10} \) of the natural size.

Fig. 1. *Papilio dardanus*, sub-sp. *tibullus*, \( \Phi \) f. *trimeni*, n. f.
Zanzibar, Lieut. Turner, 1884: in the Hope Department, Oxford University Museum.

In this highly ancestral form of female the colour of the central part of the wings is not so white as in the *hippocoon* form, but very pale buff and thus far nearer to the colour of the male. The subapical patch is also imperfectly divided from the main pale patch of the fore-wing.

2. *Papilio dardanus*, sub-sp. *merope*, \( \Phi \) f. *hippocoon*.

The exceptional variety of the *hippocoon* form here figured exhibits distinct rudiments of "tails" to the hind-wings. It is of much interest that this ancestral character should be associated with the ancestral pattern of the *hippocoon* form.


This specimen of *hippocoon* also exhibits traces of the lost 'tails,' although to a much less extent than in the last figured specimen.
Planemoides females of *Papilio dardanus* together with intermediates between this and the other female forms.

All figures are about \( \frac{2}{3} \) of the natural size.

Fig. 1. *Papilio dardanus*, sub-sp. *merope*, ♀ form intermediate between *cenea* and *planemoide*. In coll. A. H. Harrison, from Unyori, N.E. of Kisumu, about 1903. The specimen figured is beautifully intermediate between these two ♀ forms, of which the *planemoide* is seen in Figs. 2 and 4 and the *cenea* in Plate XVIII, Fig. 3. The discal patch of the hind-wing of this intermediate variety is not white as in *planemoide*. It is much nearer to the buff of *cenea*, but exhibits a faint reddish tinge which may indicate some influence of *trophonius*. Taken alone the specimen here represented would strongly suggest the origin of *planemoide* from *cenea*.


3. *Papilio dardanus*, sub-sp. *merope*, ♀ f. *planemoide*, tending somewhat in the direction of *hippocoon*. From the same locality as Fig. 2. Collected about 1903 by A. H. Harrison. In Hope Department, Oxford University Museum. The *hippocoon* influence is seen in the great extension of the fulvous area along the inner margin of the fore-wing. This specimen taken alone suggests the origin of *planemoide* from *hippocoon* or *trimeni*. Compare Figs. 2 and 4 with 3.

EXPLANATION OF PLATE XXI.

Forms of *Acrsea johnstoni*, together with their *Danainae* and *Acraxine* models, from the slopes of Kilimanjaro, 1905.

The whole of the specimens figured, models as well as mimics, were presented to the Hope Department by Rev. K. St. Aubyn Rogers.

All the figures are about \( \frac{3}{4} \) of the natural size.

Fig. 1. *Amauris echeria*, Boisd., ♂. The three largest spots of fore-wing and submarginal spots of hind-wing are buff-coloured; the submarginal and costal spots of fore-wing much paler buff, almost white. December 15–31, 1905: native collector.

1a. *Acrsea johnstoni*, form *fallax*, Rogenh. (= *klimandjara* Oberth.), ♂. *Fallax* differs from the *flavescens* (Fig. 1b) and *proteina* (Plate XXII, 1a, 1b) forms mainly in the broader, rounder apex of the fore-wing, the rounded instead of the squarish discal patch of hind-wing, and in the sexual dimorphism,—the males of *fallax* (Plate XXI, 1a) having buff spots in the fore-wing, the females (Fig. 2a) white. Furthermore the rounded discal patch of the hind-wing is here well seen to be indistinctly defined owing to the invasion of dark internervular rays, while the squarish patch of *flavescens* and *proteina* is sharply outlined. Intermediate forms occur, and there can be little doubt that Aurivillius is right in suggesting that *fallax* is a form of *johnstoni*.

The male of *fallax* with buff-spots in the fore-wing is seen to be an excellent mimic of the buff-spotted forms of *Amauris* such as that represented in Fig. 1.

The specimen shown in Fig. 1a was captured December 15–31, 1905, by a native collector.

1b. *Acrsea johnstoni*, form *flavescens*, Oberth. The individual represented possesses very pale buff spots in the fore-wing, much paler than those of the male *fallax* (Fig. 1a). Specimens of *flavescens* however often possess spots of a pronounced shade. The individual shown in Fig. 1b is a mimic of *Amauris echeria* (Fig. 1), but as regards the pale spots is transitional towards the mimics of
Explanation of Plates.

*Amauris alhimaculata* (Fig. 2), viz. the white-spotted *proteina* forms (Plate XXII, Figs. 1a, 1b), and towards the female of *fallax* represented in the next figure.

The hind-wing of *flavescens* (Fig. 1b) is seen to present a far more perfect resemblance to the Danaine models (Fig. 1, 2) than that of *fallax* (Figs. 1a, 2a). The superiority is brought about by a characteristically squarish buff discal patch which is sharply outlined and exhibits hardly any invasion of marginal rays. December 15-31, 1905: native collector.

**Fig. 2. Amauris alhimaculata, Butl., ♂.** In this specimen all the spots of both wings are pure white, the only buff marking being the discal patch of the hind-wing. December 15-31, 1905: native collector.

2a. *Acrxa johnstoni*, form *fallax*, Rogenh., ♀. The white-spotted female of this form is beautifully mimetic of the Danaine shown in Fig. 2. The discal patch of the hind-wing is however very similar to that of the buff-spotted male represented in Fig. 1a and like it less markedly mimetic than either the *flavescens* (Fig. 1b) or *proteina* (Plate XXII, Figs. 1a, 1b) forms. December 15-31, 1905: native collector.

3. *Planema quadricolor*, Rogenh., ♂, the model of the *semifulvescens*, Oberth., form of *Acrxa johnstoni* shown in Fig. 3a. The basal area of the hind-wing and the inner half of the fore-wing,—viz., the whole of its area on the basal side of the black-margined curved fulvous subapical band,—are of a deep rich brown hardly to be distinguished from black by photographic methods and therefore barely recognizable in the figure. N.E. slopes of Kilimanjaro, about 5000 feet; State of Mamba: September 25, 1905: Rev. K. St. Aubyn Rogers.

3a. *Acrxa johnstoni*, form *semifulvescens*, Oberth., ♂. The four characteristic spots, pale yellow in tint, lie on the borders of the fulvous inner area of the fore-wing; thus suggesting a likeness to the model (Fig. 3), where the inner area is also separated by a subapical bar of lighter tint from the black apical region. The pale yellowish discal patch of the hind-wing of course forms an area much broader than that of the model. In another specimen of this form however (Kilimanjaro, December 15-31, 1905, native collector) the basal half of this patch is almost obliterated by suffusion with ground colour, producing a much closer approximation to the hind-wing pattern of
the model. The specimen is unfortunately in too poor a condition for figuring.

Locality of specimen represented in Fig. 3a., N.E. slopes, Mamba State, about 5000 feet, September 26, 1905: Rev. K. St. Aubyn Rogers. It will be observed that the mimic was captured the day after that on which its model was taken.

**Fig. 4. Limnas chrysippus, L., form dorippus, Klug. (= klugii, Buttl.), ♀.** This is the dominant form of *chrysippus* in British East Africa. Kilimanjaro, May 1905.

4a. *Acraea johnstoni*, form fulvescens, Oberth., ♂. An obvious and beautiful mimic of *dorippus* (Fig. 4). The ancestral markings persist, faint but distinct; and characteristic in shape and position on both wings. On the underside they are more conspicuous. The basal spots on the hind-wing under-side are distinct, but the most prominent are in this form brown instead of black, and therefore comparatively inconspicuous. December 15–31, 1905: native collector.

---

**EXPLANATION OF PLATE XXII.**

Forms of *Acraea johnstoni* together with their Danaine and Acreeine models.

All the figures are of the natural size.

**Fig. 1. Amauris lobengula**, E. M. Sharpe, ♀, from the forest, Mt. Chirinda (about 3600 feet), Melsetter, Gazaland, S.E. Rhodesia. Captured October 7, 1905, by Guy A. K. Marshall. The model of Figs. 1a and 1b.

1a. *Acraea johnstoni*, Godm., form proteina, Oberth., ♂. From the same locality as the last, and captured by Mr. Marshall on the same day. The relatively large size of the squarish discal patch of the hind-wing (compare Fig. 1b on Plate XXI) is an evident synaposematic approach towards the *Amauris* represented in Fig. 1, also characterized by an especially large discal patch.
Explanation of Plates.

Fig. 1b. Acrsea johnstoni, form proteina, ♂, from the same locality as 1 and 1a. Captured by Mr. Marshall, October 11, 1905. The female exhibits a patch even larger than that of the male, and of a shape which approximates more closely to the model shown in Fig. 1.

2. Planema poggei, Dew., ♂, from Buddu, between Entebbe and the mouth of the Kagern River, west shore of Lake Victoria Nyanza; collected December 3, 1902—March 1, 1903, by T. T. Behrens, R.E. This Acrœine butterfly with its broad fulvous band crossing the fore-wing, and white band crossing the hind-wing is evidently the primary model of the particular variety of the semifulvescens, Oberth., form of A. johnstoni, shown in Fig. 2a.

At the same time the latter exhibits a nearer approach to the planemoides, Trim., ♂ form of Papilio dardanus, Brown., one of its co-mimics (compare Plate XX, Fig. 4), than it bears to the central model of the group, Planema poggei.

2a. Acrsea johnstoni, form semifulvescens, Oberth., ♂. From Taveta (about 2500 feet), British East Africa; May 15, 1905, Rev. K. St. Aubyn Rogers. This form possesses a pure white patch on the hind-wings, while the inner area of the fore-wings is black instead of fulvous as in typical semifulvescens (Plate XXI, Fig. 3a). This form appears to mimic the planemoides female of Papilio dardanus more closely than any other member of the large group clustered round Planema poggei (compare Plate X of the present volume, accompanying Mr. S. A. Neave's memoir).

3. Planema latifasciata, E. M. Sharpe, ♂; from Toro, W. Uganda (7-9000 ft.). November—December 1900; Major Rattray. This Planema is the model for the toruna form of johnstoni represented in the next figure.

3a. Acrsea johnstoni, form toruna, H. Grose-Smith, ♂; from the same locality and date as the preceding. The mimetic likeness is strong in the deep rich brown of the inner area of the fore-wings and basal region of hind-wings in model and mimic, in the fulvous subapical band crossing the fore-wing and discal band crossing the hind-wing, and finally in the dark ground colour external to these striking markings.

In all forms of Acrsea johnstoni here represented (Figs. 1a, 1b, 2a, and 3a), the under-side exposed during prolonged rest, when most of the fore-wing is hidden by
the hind, is not mimetic of the respective Danaine (Fig. 1) and Acræine (Figs. 2 and 3) models, but presents an appearance synaposematic with many Acræas of about the same size. During flight, on the other hand, and probably during brief rest, nearly the whole of the fore-wing under-side is revealed, and the effect is then such as to reinforce the mimetic resemblance of the upper-side.

September 22nd, 1906.

PART I.
Predaceous Diptera, Neuroptera, Hemiptera, Orthoptera, and Coleoptera.
[Read June 6th, 1906.]

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TRANS. ENT. SOC. LOND. 1906.—PART III. (JAN.) 22
The following memoir, including numerous and varied groups of insects, has made large demands on the time and work of many naturalists. It is a pleasant duty to speak of the extremely kind and sympathetic help by which alone the publication has been rendered possible: help in bringing together a large mass of original records; help in working out the material and in searching through the literature of the subject. I must admit that in the desire for the utmost fulness and precision in the data and the determinations, my friends have been somewhat burdened with correspondence: the one to whom I owe the most even likened me to a "pom-pom"! I fear indeed that among the chief reasons for welcoming the final appearance of the paper will be a feeling of relief and security, of a haven of rest where the inexorable letter-writer will cease from troubling.

In addition to the solid contributions of material upon which this paper has been built, the unceasing contact with sympathetic friends has been in itself a source of encouragement and inspiration. Where is there a subject the equal of natural history in bringing about friendly co-operation in the labour of accumulating evidence or of solving some difficult problem?

The material of this memoir is far more due to the efforts of Colonel J. W. Yerbury than to any other naturalist. It was chiefly but by no means exclusively collected in the British Islands, and has contributed to nearly all the groups of predaceous insects. In the section devoted to Empidæ, the specimens collected by Colonel Yerbury more than equal those obtained by all other naturalists put together.

Next in importance is the splendid series of examples collected by Mr. Guy A. K. Marshall in South Africa, the great majority from the neighbourhood of Salisbury,
Mashonaland. During the past five years Dr. T. A. Chapman has presented to the Hope Department a fine series of predaceous insects and their prey from a number of European localities, chiefly Spain. Mr. H. St. J. K. Donisthorpe has for many years presented valuable material in many groups of predaceous insects from numerous British localities. In the course of a visit to La Granja in the Sierra Guadarrama, Spain, I was able, in July 1902, to make a considerable collection of Asilid flies and their prey, and in particular to study the habits of *Dasypogon diadema*, which is very abundant in that locality.

Small collections of material making up altogether an important part of the foundation on which this paper rests have been contributed by the following naturalists:—Mr. C. N. Barker and Mr. F. Muir from the neighbourhood of Durban, Natal; Mr. S. A. Neave, from N.E. Rhodesia; Rev. K. St. Aubyn Rogers, from British East Africa; Lieut. T. Bainbrigge Fletcher, from Port Sudan; Mr. E. E. Green, from Ceylon; Col. C. T. Bingham, from Burma; Dr. Richard Evans, from near Penang; Mr. J. C. Kershaw, from Macao; Rev. F. D. Morice, Monsieur Chretien, Mr. G. C. Champion, Mr. W. Holland, and Mr. A. H. Hamm, from Spain.

Small collections from British localities have been presented by Mr. Edward Saunders, F.R.S., Dr. G. B. Longstaff, Mr. W. J. Lucas, Mr. A. H. Hamm, and Mr. J. Collins; and single examples by Commander J. J. Walker, Mr. R. Shelford, Mr. W. Holland, Mr. A. J. Chitty, Mr. L. D. Saunders, Mr. H. A. Saunders, Mr. J. E. Collin, and Mr. E. A. Cockayne.

Many naturalists have rendered kind assistance by drawing attention to published or manuscript records. Many interesting British records, several of them now published for the first time, were kindly communicated by Colonel J. W. Yerbury and Mr. Claude Morley; and valuable help of the same kind was afforded by Mr. G. H. Verrall, Mr. J. E. Collin, Mr. G. C. Bignell, and Mr. G. T. Porritt. Mr. W. L. Distant kindly drew my attention to many published records of the attacks of predaceous insects, especially in South Africa.

It is equally pleasant to acknowledge all the kind help received in working out the material, half of which, viz. the prey, was generally in bad condition and very difficult to determine. Here also I am chiefly indebted to Colonel J. W. Yerbury, who has devoted an immense amount of time and labour to the largest part of the collection, the
Diptera. In this group very kind help has also been received in special cases from Mr. G. H. Verrall, Mr. J. E. Collin and Mr. E. E. Austen. In working out the Neuroptera kind assistance was received from Mr. W. J. Lucas, Mr. W. F. Kirby, Mr. Kenneth J. Morton and Mr. C. A. Briggs; the Orthoptera, by Señor Don Ignacio Bolivar, Mr. W. F. Kirby and Mr. R. Shelford; the Lepidoptera, by Sir George F. Hampson, Dr. F. A. Dixey, Mr. J. Hartley Durrant and Mr. R. South; the European and British Rhynchota, by Mr. Edward Saunders, F.R.S.; the Rhynchota from other parts of the world, by Mr. W. L. Distant; the Coleoptera, by Commander J. J. Walker, Mr. Guy A. K. Marshall, Mr. G. J. Arrow, Mr. C. J. Gahan, Mr. G. C. Champion, and Mr. W. Holland.

The Hymenoptera have been especially difficult. Mr. Edward Saunders, F.R.S., has determined the European and British Aculeates; Colonel C. T. Bingham, the Oriental and African Aculeates and Parasitica; Mr. Claude Morley, the European and British Parasitica; Rev. F. D. Morice, the European and British Tenthredinidae; Mr. A. J. Chitty devoted much time to the difficult problem presented by a minute Cynipid.

A minute species of Collembola, which had puzzled many naturalists, was finally traced to its true position by Mr. Claude Morley.

The British Spiders have been kindly studied by Mr. F. P. Smith, but the results of his labours are almost confined to the material for Part II.

Special inquiries have been courteously answered by Mr. C. O. Waterhouse, Mr. G. T. Lyle, Mr. H. O. Forbes and Mr. W. R. Ogilvie-Grant, as well as by the naturalists whose names have been already mentioned.

Numerous errors are so difficult to avoid in a memoir of this kind, dealing with such varied material and bristling with data, that exceptional time and trouble have been devoted to the correction of proofs. Not only have they been read several times by the writer, but the following friends have also most kindly been through them and made many corrections and valuable suggestions:—Mr. Edward Saunders, F.R.S., Colonel J. W. Yerbury, Mr. G. H. Verrall, Mr. J. E. Collin, Mr. Claude Morley, Mr. G. A. K. Marshall, and Commander J. J. Walker. Mr. W. J. Lucas read through the proofs of the Neuroptera. Mr. Marshall also rendered the kindest assistance in bringing together upon a single copy the corrections on six sets of
 proofs. Mr. R. Shelford, M.A., and Mr. A. H. Hamm have not only read proofs, but they have also greatly helped me in comparing them with the data on the specimens. It is impossible to hope that mistakes have been entirely avoided, but at any rate exceptional labour has been expended upon their reduction to the lowest possible number.

The present memoir was undertaken in order to determine, as far as possible, the enemies of those groups of insects which are believed on good grounds (see especially Mr. G. A. K. Marshall's experiments recorded in Trans. Ent. Soc. Lond. 1902, pp. 292—405) to be specially defended against entomophagous Vertebrates. So far from following Haase in the belief that such groups enjoy absolute immunity from all attacks, including those of parasites, it seemed probable that the lessened exposure to Vertebrate enemies would be largely compensated by a relatively increased exposure to predaceous Invertebrata, and especially insects. And this conviction has been confirmed even more fully than would have been anticipated from the limited extent of the recorded material. Thus it will be found from African records alone that the widely mimicked Limnas chrysippus has been seen to be devoured by an Asilid fly, a large Dragonfly, and a Locustid; while another species of Locustid and a large wasp have been found eating the larva. Attacks by predaceous insects upon the specially defended groups of Coleoptera, and upon the stinging Hymenoptera are also proportionately numerous.

It was originally intended to conclude the present paper with a large number of records of predaceous Hymenoptera and their prey, chiefly due to the energy and power of observation of Mr. A. H. Hamm, who is especially devoted to the study of the Fossorial group. It was not at first contemplated that any attempt would be made to search through the vast literature of this subject, extending through two centuries and a half. This widening of the field of work was brought about through a misunderstanding. I wrote to my kind friend Mr. Edward Saunders for records of attacks by Fossors, meaning such records as are contained in his note-books or on the specimens in his collection. In reply he sent me a most valuable abstract of recent literature on the subject, and expressed the opinion that a list of the published records was greatly needed. Under these circumstances Mr. A. H. Hamm began to search systematically and was soon aided by Mr. R. Shelford and Commander Walker. A little later
Mr. G. A. K. Marshall joined in the work, and after a time convinced me that it would be better to defer the records of predaceous Hymenoptera to a second part. So much has been done that the paper would appear to be a complete abstract of literature bearing on the subject; and if it failed to be truly complete great harm would be done; for the way to an adequate statement would certainly be barred for many years to come. It was therefore determined to put off the appearance of Part II, devoted to the predaceous Hymenoptera, until the abstract of published records is as full and complete as it can be made. It is believed that the work will be finished early in 1907, and that no long interval need elapse between the two sections of the memoir.

The same argument does not apply to the First Part, which is in the main a presentation of new records, and does not profess to contain anything like a complete abstract of the published records scattered chiefly in the form of brief notes, though a voluminous literature. At the same time any published statements which have come to light are included; and many more will certainly be found in the systematic search for records of predaceous Hymenoptera. Any such additions to Part I will appear in the form of an Appendix at the end of Part II.

I desire to thank the Council for their courtesy in permitting, as an exceptional privilege, the inclusion of predaceous insects and their prey captured after the date at which the paper was read,—June 6th, 1906. All such additions will be immediately recognized by their dates. Owing to this concession many of the conclusions rest upon a far broader foundation than would otherwise have been possible.

It is hoped that this paper will be of some use to those who are interested in the problems of Economic Entomology rather than in the study of Insect natural history or biomics for their own sake. With this object the popular names have been used whenever possible, and the classificatory position of the prey indicated. I have been much impressed with the imperative necessity for the accumulation on a very large scale of this kind of evidence, if trustworthy conclusions are to be reached—conclusions safe enough to become the justification for practical measures. It is not sufficient to know that an insect is predaceous, and that it is believed in a general way to attack particular species or groups of species. We need precise records and the careful preservation of material for critical examination in the future. Thus it will be found in numbers of cases that
the predaceous species frequently or even normally attack insects which are themselves predaceous or parasitic, in such instances tending towards the preservation rather than the destruction of insect life. It is unnecessary to quote instances when they will be found in numbers scattered through the following tabulated records; but I may allude to the amusing reciprocity exhibited by examples 268 and 293. In the former an Empid fly was devouring the Anthomyid fly, Caricea tigrina: in the latter Caricea tigrina was devouring an Empid!

In order to facilitate reference, all records in Part I of this memoir have been conspicuously numbered. In Part II, dealing with the predaceous Hymenoptera, the reference numbers will be confined to original records, published for the first time. The difference in method is due to the small proportion in Part I of examples previously published, as contrasted with their immense preponderance in Part II.

The study of the original records here brought forward and their comparison with the results obtained in the future, will be aided by a statement, made whenever possible, of the collection in which each example is to be found. The words, “In Hope Dep.,” “In Brit. Mus.,” etc., appearing beneath the name of the predaceous species implies that the prey as well as the captor exists in the collection indicated. A modified statement will make it clear when the captor alone or the prey alone is known to be in existence.

References to previous publication will in Part I be found under the name of the observer. For the sake of brevity the publications of the Entomological Society of London are indicated by no more than the abbreviation “Trans.” or “Proc.,” together with the year of publication and page.

In Part I the Orders to which the predaceous insects belong are treated merely in the order of the number of records. It will at once be recognized that evidence of importance has only been obtained in the Diptera of Part I and the Hymenoptera Aculeata of Part II.

I. DIPTERA.

The records in the first part of this memoir are set forth in a tabular form, beginning with the family which stands foremost among predaceous Diptera,—the Asilidae.

A. ASILIDÆ AND THEIR PREY.
<table>
<thead>
<tr>
<th>Species of Asilid</th>
<th>Species of Prey</th>
<th>Locality and Date</th>
<th>Observer</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. DASYPOGONINÆ</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A scorpion-fly, Panorpa, sp.</td>
<td>Lodiswell, S. Devon. May 24, 1896</td>
<td>J. W. Yerbury</td>
</tr>
<tr>
<td>2. Dioctria celandica, L.</td>
<td>A small moth with long antennae, probably Adela, sp.</td>
<td>Lodiswell, S. Devon. May 24, 1896</td>
<td>J. W. Yerbury</td>
</tr>
<tr>
<td>?Sex, specimens uncaptured.</td>
<td></td>
<td>Lodiswell, S. Devon. May 25, 1896</td>
<td>J. W. Yerbury</td>
</tr>
<tr>
<td>?Sex, specimens uncaptured.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In Hope Dep.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>5. Dioctria atricapilla, Mg., ♂</td>
<td>The Ichneumonid (Ophiioninae), Meloboris (Limneria) rufiventris, Grav., ♂</td>
<td>Ledbury. June 4, 1895</td>
<td>J. W. Yerbury Trans. 1902, p. 333 (prey erroneously called Ichneumon).</td>
</tr>
<tr>
<td>In Brit. Mus.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In Brit. Mus.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In Hope Dep.</td>
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<td></td>
<td></td>
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<tr>
<td>In Hope Dep.</td>
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<tr>
<td>9. Dioctria rufipes, De G., ♂</td>
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<td>In Hope Dep.</td>
<td></td>
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</tr>
</tbody>
</table>

x 12. This and the other similarly marked specimens of *Dasypogon* (*Sedipogon*) *diadema* correspond to Loew's description of *D. melanopterus*. I have preferred to leave them among the *diadema* until the special distinction between the two forms is confirmed.
<table>
<thead>
<tr>
<th>SPECIES OF ASILID.</th>
<th>SPECIES OF PREY.</th>
<th>LOCALITY AND DATE.</th>
<th>OBSERVER.</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. DASYPOGONINE (continued).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Predaceous Insects</td>
<td>Prey</td>
<td>Location</td>
</tr>
<tr>
<td>-----</td>
<td>--------------------</td>
<td>------</td>
<td>----------</td>
</tr>
<tr>
<td>29.</td>
<td><em>Dasypogon diadema</em>, F., ♀</td>
<td>A small insect was captured on the wing and then thrown away, perhaps because the Asilid was disturbed.</td>
<td>La Granja, Spain, about 4000 ft.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SPECIES OF ASILID.</th>
<th>SPECIES OF PREY.</th>
<th>LOCALITY AND DATE.</th>
<th>OBSERVERS.</th>
</tr>
</thead>
</table>

*See note on p. 331.

*43. All the examples captured at a height of 7000 ft., viz. Nos. 43-48 and 50-54, were taken by Dr. Chapman upon La Peñalara, the mountain immediately behind La Granja.
<table>
<thead>
<tr>
<th>No.</th>
<th>Species</th>
<th>Gender</th>
<th>Prey</th>
<th>Location</th>
<th>Date</th>
</tr>
</thead>
</table>

* 55. Mr. G. H. Verrall remarks that the wings are much broader than in *D. (S.) melanoptera* as he recognizes it.
<table>
<thead>
<tr>
<th>Species of Asilid</th>
<th>Species of Prey</th>
<th>Locality and Date</th>
<th>Observer</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. Dasypogoninae (continued)</td>
<td></td>
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<tr>
<td></td>
<td>In Hope Dep.</td>
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<td></td>
</tr>
<tr>
<td>59. Microstylum dux, Wied., Φ. This specimen and three Φ of Promachus sp. in a paper with the Cicada and two Φ of the Vespa. In Hope Dep.</td>
<td>Probable prey, the Cicada, Rihana ochracea, Walk., ♂, or the wasp, Vespa cincta, F., var. affinis, F., Φ.</td>
<td>Macao, S.E. China. July 18, 1905.</td>
<td>J. C. Kershaw.</td>
</tr>
<tr>
<td>No.</td>
<td>Species</td>
<td>Gender</td>
<td>Location</td>
</tr>
<tr>
<td>-----</td>
<td>---------</td>
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<td>----------</td>
</tr>
<tr>
<td>64</td>
<td>Microstylum gutosum, Lw., ♀</td>
<td>In Hope Dep.</td>
<td>Malvern, near Durban, Natal, 800 ft.</td>
</tr>
<tr>
<td>66</td>
<td>Isopogon brevirostris, Mg., ♀</td>
<td>In Hope Dep.</td>
<td>Barmouth, N. Wales.</td>
</tr>
<tr>
<td>67</td>
<td>Stenopogon ochripes, Lw., ♂</td>
<td>In Hope Dep.</td>
<td>Moncayo, about 40 miles W. of Saragossa, 4-5000 ft.</td>
</tr>
<tr>
<td>68</td>
<td>Stenopogon, sp. perhaps near subandus, F., ♀</td>
<td>In Hope Dep.</td>
<td>Moncayo, about 40 miles W. of Saragossa, 4-5000 ft.</td>
</tr>
</tbody>
</table>

**Predaceous Insects and their Prey.**
<table>
<thead>
<tr>
<th>SPECIES OF ASILID.</th>
<th>SPECIES OF PREY.</th>
<th>LOCALITY AND DATE.</th>
<th>OBSERVER.</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. DASYPOGONIÆ (continued).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>II. LAPHRINÆ.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* 79. Following Col. Yerbury's advice I have adhered to the old divisional line between the Dasyopogoninæ and Laphrinæ, and have not followed Hermann in placing *Hopistomermes* in the former subfamily.
<table>
<thead>
<tr>
<th></th>
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<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>*84. <em>Hyperechia xylocoipiformis</em>, Walk., ♀. Fig. suggests a ♀.</td>
<td></td>
<td></td>
<td>T. A. Chapman.</td>
</tr>
<tr>
<td>In Hope Dep.</td>
<td></td>
<td></td>
<td>Trans. 1902, p. 335; Ent. Record, 1902, p. 72.</td>
</tr>
<tr>
<td>In Hope Dep.</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>In Hope Dep.</td>
<td></td>
<td></td>
<td>Trans. 1902, p. 335; Ent. Record, 1902, p. 72.</td>
</tr>
</tbody>
</table>

* The observer noted that one of the insects was dead and in the clasp of the other. There is of course no doubt that the *Xylocopa* was the victim.
<table>
<thead>
<tr>
<th>SPECIES OF ASILID</th>
<th>SPECIES OF PREY</th>
<th>LOCALITY AND DATE</th>
<th>OBSERVER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>II. LAPHRINE (continued).</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In Hope Dep.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>G. H. Verrall remarks &quot;unusually broad for this sp., and red extends further than usual towards base of abdomen.&quot;</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In Hope Dep.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>In Brit. Mus.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>91. Lamys, sp., probably <em>gulo</em>, Lw., ♀.</strong></td>
<td>The wasp (<em>Diploptera</em>), <em>Belenogaster macilenta</em>, De Sauss., ♂. The wasp was itself eating a caterpillar, a part of which is still held in the mandibles.</td>
<td>Mazoe, Mashonaland, 4700 ft. Dec. 27, 1905.</td>
<td>G. A. K. Marshall.</td>
</tr>
<tr>
<td>but differs somewhat from Loew's description. In Hope Dep.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>92. Lamys, sp., probably <em>gulo</em>, Lw., ♀.</strong></td>
<td>An Asilid fly (<em>Dasypogoninae</em>) of the genus <em>Leptogaster</em>. The Lamys had seized a pair in coitus, but it is uncertain which individual was being devoured.</td>
<td>Petauke, East Loangwa Distr., N.E. Rhodesia, 2400 ft. Feb. 1, 1905.</td>
<td>S. A. Neave.</td>
</tr>
<tr>
<td>In Hope Dep.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Species</td>
<td>Description</td>
<td>Location</td>
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</tr>
<tr>
<td>94</td>
<td><em>Graspedia</em>, n. sp., ♂</td>
<td>The Xylocopid bee (Carpenter-bee), <em>Xylocopa bryorum</em>, F., ♀</td>
<td>Townsville, Queensland.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Dec., 1902.</td>
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<td></td>
<td></td>
<td></td>
<td>March 13, 1904.</td>
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<td></td>
<td></td>
<td></td>
<td>Dec. 26, 1904.</td>
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<td></td>
<td></td>
<td></td>
<td>Jan. 1, 1905.</td>
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<td></td>
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<td>Feb. 5, 1905.</td>
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<td></td>
<td></td>
<td></td>
<td>Feb. 5, 1905.</td>
</tr>
<tr>
<td>LOCALITY AND DATE</td>
<td>OBSERVED</td>
<td>SPECIES OF ASILID</td>
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<td></td>
</tr>
<tr>
<td>Salisbury, Mashonaland, 5000 ft.</td>
<td>Oct 6, 1901.</td>
<td>The Odonate, (Dragonfly), <em>Telithraea</em>, sp. ♂, probably an immature <em>T.</em></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NUMBER</th>
<th>SPECIES OF ASILID (continued)</th>
</tr>
</thead>
<tbody>
<tr>
<td>104.</td>
<td><em>Promachodes</em>, sp. inc. m., ♀. In Hope Dep.</td>
</tr>
<tr>
<td></td>
<td>In Hope Dep.</td>
</tr>
<tr>
<td><strong>115. Promachus maculatus, F.,</strong></td>
<td>The Odonate (Dragonfly), <em>Brachythemis contaminata</em>, F.</td>
</tr>
<tr>
<td>Species of Asilid</td>
<td>Species of Prey</td>
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</tr>
<tr>
<td>III. Asilinae (continued).</td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Species</td>
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</tr>
<tr>
<td>128</td>
<td><em>Alicium stenurus</em>, Lw., ♀</td>
</tr>
<tr>
<td>132</td>
<td><em>Alicium alamannus</em>, Walk.</td>
</tr>
</tbody>
</table>

**Durban, Natal.**
Jan. 21, 1903.


Durban and neighbourhood, Natal. 1902–3.

Durban and neighbourhood, Natal. 1902–3.

Umtali, Mashonaland, 3700 ft. Dec. 29, 1900.


Mazoe, Mashonaland, 4000 ft. Dec. 25, 1905.


Salisbury, Mashonaland, 5000 ft. Nov. 28, 1903.

F. Muir.

C. N. Barker.

F. Muir.

F. Muir.


Rev. K. St. A. Rogers.


*129. The Rev. K. St. Aubyn Rogers probably refers to this species in the following extract from one of his letters, written from Taveta, July 5, 1905—*“I have several times observed a butterfly in the bushes of a predaceous fly which seems absolutely indifferent to protection afforded by unpalatable species, as I have seen it devouring *L. chrysippus*.”*
<table>
<thead>
<tr>
<th>Species of Asilid.</th>
<th>Species of Prey.</th>
<th>Locality and Date.</th>
<th>Observer.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>III. ASILIN.E (continued).</strong></td>
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<tr>
<td></td>
<td>In Hope Dep.</td>
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<td></td>
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<tr>
<td>In Hope Dep.</td>
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<tr>
<td>In Hope Dep.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Specimen much greased. In Hope Dep.</td>
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<tr>
<td>In Hope Dep.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>In Hope Dep.</td>
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</tbody>
</table>

* 138. Mr. S. A. Neave also gives me the following notes upon an Asilid almost certainly of this genus, inasmuch as the elongate body was specially noticed and probably of this species. In the same month in which the above capture was made, January 1905, an Asilid was observed devouring the Pierine butterfly, Catophrus florula, F. On the same spot of ground 7–8 dead butterflies of this species were then seen lying about as if they had been sucked dry and abandoned by the same flies. These observations were made in a small damp area beside a stream, below the station of Petauke. Asilids were most abundant in N.E. Rhodesia in December, January, and February.
<table>
<thead>
<tr>
<th>No.</th>
<th>Species</th>
<th>Sex</th>
<th>Location</th>
<th>Captor</th>
</tr>
</thead>
<tbody>
<tr>
<td>140</td>
<td>Apodea femoralis, Wied.</td>
<td>♀</td>
<td>Port Stanan, 40 miles N. of T. Bainbridge</td>
<td>347.00</td>
</tr>
<tr>
<td>141</td>
<td>Philanthus alboceps, Mg.</td>
<td>♂</td>
<td>In Brit. Mus.</td>
<td>347.00</td>
</tr>
<tr>
<td>142</td>
<td>Philanthus alboceps, Mg.</td>
<td>♀</td>
<td>In Coll. C. 4.8.26.</td>
<td>347.00</td>
</tr>
<tr>
<td>143</td>
<td>Philanthus alboceps, Mg.</td>
<td>♂</td>
<td>In Coll. C. 4.8.26.</td>
<td>347.00</td>
</tr>
<tr>
<td>144</td>
<td>Philanthus alboceps, Mg.</td>
<td>♀</td>
<td>In Coll. C. 4.8.26.</td>
<td>347.00</td>
</tr>
<tr>
<td>Species of Asilidae</td>
<td>Species of Prey</td>
<td>Locality and Date</td>
<td>Observer</td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
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<td></td>
</tr>
<tr>
<td>In Hope Dep.</td>
<td>rant in the genus <em>Sematocera</em>, or in a new genus allied to it.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In Hope Dep.</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In Hope Dep.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>In Hope Dep.</td>
<td>The Galerucid beetle, <em>Sermylia halensis</em>, L.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Taxon Name</td>
<td>Scientific Name</td>
<td>Location</td>
<td>Date</td>
</tr>
<tr>
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</tr>
<tr>
<td>155</td>
<td>Asilus crabroniformis, L.</td>
<td>♂</td>
<td>Hope Dep.</td>
<td></td>
</tr>
<tr>
<td>156</td>
<td>Asilus crabroniformis, L.</td>
<td>♀, sex, Asilid uncaptured</td>
<td>Hope Dep.</td>
<td></td>
</tr>
<tr>
<td>157</td>
<td>Lophonotus, sp.</td>
<td>??</td>
<td>Hope Dep.</td>
<td></td>
</tr>
<tr>
<td>158</td>
<td>Lophonotus, sp.</td>
<td>♂</td>
<td>Hope Dep.</td>
<td></td>
</tr>
<tr>
<td>159</td>
<td>Lophonotus, sp.</td>
<td>♀</td>
<td>Hope Dep.</td>
<td></td>
</tr>
<tr>
<td>160</td>
<td>Lophonotus, sp.</td>
<td>probably suillus, F.</td>
<td>Brit. Mus.</td>
<td></td>
</tr>
<tr>
<td>161</td>
<td>Lophonotus suillus, F.</td>
<td>♂</td>
<td>Hope Dep.</td>
<td></td>
</tr>
<tr>
<td>162</td>
<td>Lophonotus suillus, F.</td>
<td>♀</td>
<td>Hope Dep.</td>
<td></td>
</tr>
</tbody>
</table>

The Acridian (Grasshopper), *Gomphocerus maculatus*, Thunb., ♂.
The Odonate (Dragonfly), *Trithemis arteriosa*, Burm., ♀: 47 mm. across wings.
The Melolonthid (Lamellicorn) beetle, *Heterococus*, sp., ♂.
The Fossor (Sand-wasp), *Notogonia*, sp. ♀: allied to the W. African *N. palpibula*, Kohl, and *N. thyssanomera*, Kohl, but distinct.
The Fossor (Sand-wasp), *Pseudagenia*, sp. nov., ♂.
A Chalcidid of the genus *Eucharis*, ♀.
<table>
<thead>
<tr>
<th>Species of Asilid.</th>
<th>Species of Prey.</th>
<th>Locality and Date</th>
<th>Observer</th>
</tr>
</thead>
<tbody>
<tr>
<td>In Hope Dep.</td>
<td></td>
<td></td>
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<tr>
<td>In Hope Dep.</td>
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<td>In Hope Dep.</td>
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<td>In Hope Dep.</td>
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<td>In Hope Dep.</td>
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<td>In Hope Dep.</td>
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<tr>
<td>In Hope Dep.</td>
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</tbody>
</table>

* 169-174. All the Spanish species of *Dysmachus* in this list, including also the prey of No. 48, are closely allied to the British *D. trigonus*, but are somewhat larger than that species. Accurate specific determinations or description of new forms will require far more material. See note to p. 357.
<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>171</td>
<td><em>Dysmachus</em>, sp., probably <em>setiger</em>, Lw., heretofore only known from the Levant, ♂. In Hope Dep.</td>
</tr>
<tr>
<td>172</td>
<td><em>Dysmachus</em>, sp., considered by J. W. Yerbury to be perhaps <em>stripes</em>, Lw., ♀. Captured with two ♀ ♀ above and selecting the same prey. In Hope Dep.</td>
</tr>
<tr>
<td>174</td>
<td><em>Dysmachus</em>, sp., ♂. In Hope Dep.</td>
</tr>
<tr>
<td>175</td>
<td><em>Entolmus apicatus</em>, Lw., ♀ and ♀ in cop., the lower insect, probably ♀ ♀, with prey. In Hope Dep.</td>
</tr>
</tbody>
</table>

- **Predaceous Insects and their Prey**

<table>
<thead>
<tr>
<th>Species</th>
<th>Description</th>
<th>Location</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Mydaea</em>, probably either <em>M. urbana</em> or <em>pagana</em>; greased.</td>
<td>Montserrat, near Barcelona, about 4000 ft. July 15, 1901.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Stenobothrus</em> (Stauroderus) <em>vagans</em>, Fieb., ♀.</td>
<td>La Granja, Spain, about 4000 ft. July 20, 1902.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- E. B. Poulton.
- Rev. F. D. Morice.
- T. A. Chapman.
- G. C. Nurse. Trans. 1902, p. 335, where Asilid stands as *Neotanis grisea*.
<table>
<thead>
<tr>
<th>Species of Asilid</th>
<th>Species of Prey</th>
<th>Locality and Date</th>
<th>Observer</th>
</tr>
</thead>
<tbody>
<tr>
<td>III. Asilinae (continued).</td>
<td></td>
<td></td>
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<tr>
<td>In Hope Dep.</td>
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</tr>
<tr>
<td><strong>179. Machimus chrysitis, Mg., ♂</strong></td>
<td>The Tabanid fly (Horse-fly), Pangonia, sp., ? micans, Mg., ♀.</td>
<td>La Granja, Spain, about 4000 ft. July 22, 1902.</td>
<td>E. B. Poulton.</td>
</tr>
<tr>
<td>In Hope Dep.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>183. Machinus chrysitis, Mg., ♀. See remarks by G. H. Verrall on No. 178. In Hope Dep.</strong></td>
<td>The Acridian (Grasshopper), Stenobothrus (Stauroderus) vagans, Fieb., ♀.</td>
<td>La Granja, Spain, about 4000 ft. July 26, 1902.</td>
<td>E. B. Poulton.</td>
</tr>
<tr>
<td>No.</td>
<td>Species</td>
<td>Details</td>
<td>Location</td>
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</tr>
<tr>
<td>184</td>
<td>Machimus chrysitis, Mg., ♀</td>
<td>See remarks by G. H. Verrall on No. 178</td>
<td>El Escorial, Spain, about 3400 ft. July 28, 1902</td>
</tr>
<tr>
<td></td>
<td>The Ant, Camponotus cruentatus, Ltr., ♀; winged.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>185</td>
<td>Machimus chrysitis, Mg., ♀</td>
<td>See remarks by G. H. Verrall on No. 178</td>
<td>Pto. de Pajares, Spain, 4000 ft. July, 1904</td>
</tr>
<tr>
<td></td>
<td>The Tiger-beetle, Cicindela sylvetica, L., ♀.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>186</td>
<td>Machimus, sp., ?chrysitis, Mg., ♀</td>
<td>The abdomen in this and the succeeding six specimens is of a more brilliant &quot;old gold&quot; colour than in typical chrysitis.</td>
<td>Hyères. June 17, 1898</td>
</tr>
<tr>
<td></td>
<td>The Pierine butterfly (Large Garden White), Pieris brassicae, L., ♀.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The Honey-bee, Apis mellifica, L., ♀.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>188</td>
<td>Machimus, sp., ?chrysitis, Mg., ♀</td>
<td>In Hope Dep.</td>
<td>Pto. de Pajares, Spain, 4000 ft. July 12, 1904</td>
</tr>
<tr>
<td></td>
<td>The Aphodiid beetle (Dung-beetle), Aphodius depressus, Klug, ♀.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The Melolonthid beetle (Chafer), Rhizotrogus felicitanus, Reitter, ♀. Cf. Trans., 1905, pp. 43, 44.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The Melolonthid beetle (Chafer), Rhizotrogus felicitanus, Reitter, ♀. Cf. Trans. 1905, pp. 43, 44.</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>The bee, Andrena fuscipes, Kirb., ♀.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Species of Asilid</td>
<td>Species of Prey</td>
<td>Locality and Date</td>
<td>Observer</td>
</tr>
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<td>------------------------</td>
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<tr>
<td>III. Asilinae (continued)</td>
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<tr>
<td>Predaceous Insects and their Prey</td>
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<td>----------------------------------</td>
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<tr>
<td><strong>199. Machimus gonatistes, Zell.,</strong></td>
<td></td>
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<tr>
<td><em>♀.</em> In Hope Dep.</td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>200. Machimus atricapillus,</strong></td>
<td></td>
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</tr>
<tr>
<td><em>Flin., ♀.</em> In Hope Dep.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>201. Machimus atricapillus,</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Flin., ♀.</em> In Hope Dep.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>202. Machimus atricapillus,</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Flin., ♀.</em> In Hope Dep.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>203. Machimus atricapillus,</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Flin., ♀.</em> In Hope Dep.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>204. Machimus atricapillus,</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Flin., ♀.</em> In Hope Dep.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>205. Machimus atricapillus,</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Fln., ♀ and ♀ in cop., the ♀ with prey.</em> In Hope Dep.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>206. Neoitamus cyanurus,</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Lw., ♀.</em> In Brit. Mus.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| **The Acridian (Grasshopper), Podisma frigida, Bolt., ♀.** |
| **Cerbère, Eastern Pyrenees, France.** July 17, 1901. |
| **Brockenhurst, New Forest.** June 14, 1894. |
| **Cusop Dingle, Herefordshire.** July 26, 1902. |
| **New Forest.** Aug. 24, 1902. |
| **Deal.** July 9, 1904. |
| **Deal, Sandhills.** Aug. 6, 1905. |
| **Newton Abbot, S. Devon.** July 30, 1906. |
| **Lyndhurst, New Forest.** June 25, 1894. |

| **E. B. Poulton.** Trans. 1902, p. 335, where Asilid stands as Epitriptus arthriticus. |
| **J. W. Yerbury.** Trans. 1902, p. 333. |
| **J. W. Yerbury.** |
| **W. J. Lucas.** |
| **A. J. Chitty.** |
| **A. H. Hamm.** |
| **J. W. Yerbury.** |

Where the prey is unnamed.
<table>
<thead>
<tr>
<th>SPECIES OF ASILID.</th>
<th>SPECIES OF PREY.</th>
<th>LOCALITY AND DATE.</th>
<th>OBSERVER.</th>
</tr>
</thead>
</table>

*207. Mr. C. H. Verrall has kindly sent me the following note on the moth-catching propensities of this species of Asilid:—
"*Neocamus cyanurus* was lying in wait in large numbers in Darragh Wood, on June 18th, 1868, on the leafless ends of the twigs of shrubs, and pouncing upon every specimen of *Tortrix viridana*, L., which flew past, though even fair-sized Geometridæ were also caught and eaten."
<table>
<thead>
<tr>
<th>No.</th>
<th>Specimen</th>
<th>Collection</th>
<th>Date</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>216</td>
<td><em>Psilomys setifer</em>, <em>Olaf.</em></td>
<td>Specimen not taken.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>218</td>
<td><em>Sphecodes communis</em>, <em>F.</em>, <em>E.</em></td>
<td>August 8, 1904</td>
<td>Walton, Surrey.</td>
<td>H. A. Saunders.</td>
</tr>
</tbody>
</table>

*220* Mr. G. H. Verwul considers that it is inexpedient to attempt to work out the more obscure Spanish classification until further material has been obtained from this country. This remark applies to several of the Spanish species of *Mandulina* and probably to all German *Sphecodes*. See note on p. 333.
### III. Asilinae (continued).

<table>
<thead>
<tr>
<th>Sub-family</th>
<th>Species of Prev.</th>
<th>Locality and Date</th>
<th>Observer</th>
</tr>
</thead>
</table>

In addition to the above there are the following records of attack by uncaptured and undetermined species of *Asilidae*.
The prey also was untaken.

Certain general conclusions of much interest may be reached from the study of the preceding list.

**Proportions of the Sexes.**

Females are far more commonly found with prey than males—being in fact between three and four times as numerous. These results will be found to be curiously reversed in the case of the *Empidæ* (p. 388). The following table shows the exact proportion of the two sexes in the recorded examples:

<table>
<thead>
<tr>
<th></th>
<th>Females</th>
<th>Males</th>
<th>Sex Doubtful</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Dasygogoninx</em></td>
<td>51</td>
<td>17</td>
<td>10</td>
</tr>
<tr>
<td><em>Laphrinae</em></td>
<td>12</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td><em>Asilinae</em></td>
<td>97</td>
<td>28</td>
<td>8</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td>160</td>
<td>47</td>
<td>19</td>
</tr>
</tbody>
</table>

Nos. 225 and 226 are omitted from the above table, but the total reaches 226 because three individuals are included under the single No. 117.

**Analysis of the Prey.**

Although conclusions of interest at once suggest themselves when the sexes of Asilid victims are studied, the consideration of this part of the subject is postponed until after the accumulation of a far larger number of data.

Before proceeding to consider the list of *Asilidae* in detail it is of importance to analyse the prey as a whole. We shall thus gain a standard with which to compare the habits of particular species and genera of these predaceous flies.

**Analysis of Prey.**

I. **Orthoptera.**

*Acridiidae* (Grasshoppers). . . . . 13

**Total** . . . . 13
II. **Neuroptera.**

<table>
<thead>
<tr>
<th>Family</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Termitidae</em> (White ants)</td>
<td>2</td>
</tr>
<tr>
<td><em>Odonata</em> (Dragonflies)</td>
<td>4</td>
</tr>
<tr>
<td><em>Panorpidae</em> (Scorpion-flies)</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>7</td>
</tr>
</tbody>
</table>

III. **Hemiptera.**

<table>
<thead>
<tr>
<th>Family</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Coreidae</em></td>
<td>2</td>
</tr>
<tr>
<td><em>Lygaeidae</em></td>
<td>1</td>
</tr>
<tr>
<td><em>Pentatomidae</em></td>
<td>1</td>
</tr>
<tr>
<td><em>Cimicidae</em></td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>5</td>
</tr>
</tbody>
</table>

IV. **Homoptera.**

<table>
<thead>
<tr>
<th>Family</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Cicadidae</em></td>
<td>6</td>
</tr>
<tr>
<td><em>Cercopidae</em></td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>7</td>
</tr>
</tbody>
</table>

V. **Coleoptera.**

<table>
<thead>
<tr>
<th>Family</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undetermined</td>
<td>2</td>
</tr>
<tr>
<td><em>Cicindelidae</em></td>
<td>1</td>
</tr>
<tr>
<td><em>Hydrophilidae</em></td>
<td>1</td>
</tr>
<tr>
<td><em>Coptidae</em></td>
<td>5</td>
</tr>
<tr>
<td><em>Aphodiidae</em></td>
<td>4</td>
</tr>
<tr>
<td><em>Glaaphyridae</em></td>
<td>6</td>
</tr>
<tr>
<td><em>Melolonthidae</em></td>
<td>11</td>
</tr>
<tr>
<td><em>Curculionidae</em></td>
<td>1</td>
</tr>
<tr>
<td><em>Cetoniidae</em></td>
<td>(1 abandoned) 2</td>
</tr>
<tr>
<td><em>Buprestidae</em></td>
<td>1</td>
</tr>
<tr>
<td><em>Galerucidae</em></td>
<td>1</td>
</tr>
<tr>
<td><em>Meliridae</em></td>
<td>2</td>
</tr>
<tr>
<td><em>Lagriidae</em></td>
<td>1</td>
</tr>
<tr>
<td><em>Cantharidae</em></td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>40</td>
</tr>
</tbody>
</table>
VI. LEPIDOPTERA.

A. HETEROCERA.

<table>
<thead>
<tr>
<th>Family</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hepialidae (Swifts)</td>
<td>1</td>
</tr>
<tr>
<td>Lymantridae</td>
<td>1</td>
</tr>
<tr>
<td>Geometridae</td>
<td>2</td>
</tr>
<tr>
<td>Noctuidae</td>
<td>2</td>
</tr>
<tr>
<td>Pyralidae</td>
<td>2</td>
</tr>
<tr>
<td>Crambidae (Grass-moths)</td>
<td>2</td>
</tr>
<tr>
<td>Tineidae (Including 1 Adela? and 1 Sinaethis)</td>
<td>3</td>
</tr>
</tbody>
</table>

B. RHOPALOCERA.

<table>
<thead>
<tr>
<th>Family</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Danainae</td>
<td>2*</td>
</tr>
<tr>
<td>Acrininae</td>
<td>1</td>
</tr>
<tr>
<td>Nymphalinae</td>
<td>3</td>
</tr>
<tr>
<td>Lycenidae (Blues)</td>
<td>6</td>
</tr>
<tr>
<td>Pierinae (Whites)</td>
<td>7†</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>32</td>
</tr>
</tbody>
</table>

VII. HYMENOPTERA.

A. PHYTOPHAGA.

<table>
<thead>
<tr>
<th>Family</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tenthredinidae</td>
<td>1</td>
</tr>
</tbody>
</table>

B. PARASITICA.

<table>
<thead>
<tr>
<th>Family</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chalcididae</td>
<td>1</td>
</tr>
<tr>
<td>Ichneumonidae</td>
<td>10</td>
</tr>
<tr>
<td>Braconidae</td>
<td>(1 doubtful) 2</td>
</tr>
</tbody>
</table>

C. ACULEATA.

<table>
<thead>
<tr>
<th>Family</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anthophila (Bees)</td>
<td></td>
</tr>
<tr>
<td>Hive-bee</td>
<td>14</td>
</tr>
<tr>
<td>African form of hive-bee</td>
<td>1</td>
</tr>
<tr>
<td>Other Anthophila</td>
<td>14</td>
</tr>
<tr>
<td>Diploptera (Wasps)</td>
<td>6</td>
</tr>
<tr>
<td>Fossores (Sand-wasps)</td>
<td>9</td>
</tr>
<tr>
<td>Heterogyna (Ants)</td>
<td>9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>67</td>
</tr>
</tbody>
</table>

* Including the *L. chrysippus* mentioned in the footnote on p. 345.
† Including the *C. florella* mentioned in the footnote on p. 346.
VIII. DIPTERA.

Undetermined .................................................. 1
Tipulidæ (Daddy-longlegs) ...................................... 5
Stratiomyidæ .................................................... 1
Tabanidæ (Horse-flies) ........................................... 4

Females devouring males of same sp. 3
Females females 1
Prey a species different from captor 10

Empidæ ............................................................ 3
Dolichopodidæ .................................................... 1
Syrphidæ ............................................................ 8
Conopidæ ............................................................ 2
Tachinidæ ..............................................................
Sarcophaginæ ..................................................... 5
Devinæ .................................................................
Muscinæ ............................................................... 4
Anthomyidæ ........................................................ 6

Total ................................................................. 57

The whole of the 226 records in the tabular statement are included in this analysis, except No. 29, in which the nature of the prey is uncertain. To these 225 are added the 2 butterflies in the footnotes on pages 345, 346, together with one extra example, because three victims accompany the two Nos. 59 and 117 in the Table. Thus the total number included in the analysis of prey is 228.

A glance at the above list shows that the Hymenoptera, Diptera, Coleoptera, and Lepidoptera, placed in the order of importance, make up between them \( \frac{9}{10} \) of the recorded prey. The other Orders are of small importance, but it is a striking fact that Acridiidae are the only recorded prey among the Orthoptera, Cicadidae (except for a single Cercopid) among the Rynchota Homoptera.

HYMENOPTERA.—About 30\% of the entire records belong to this order. The Aculeata are strongly represented, other groups except the Ichneumonidæ (restricted), very weakly. Among the Aculeates the Anthophila include more than half the victims; but this immense preponderance is brought about by the numbers of Apis mellifica. Reasons will be given below (p. 366) for the conclusion that the hive-bee, weakened by domestication, is an easy prey,—a conclusion supported by the fact that there is only
a single record* of the capture of the African wild form of the species as compared with 14 of the European domesticated race. It is interesting to observe that the Fossors contribute more victims than the Diploptera. The latter are doubtless more formidable and chiefly attacked by specially adapted Asilids. The ants were probably all winged when captured, and the numbers must here be considered in relation to the limited period when the prey possesses the power of flight.

DIPTERA.—The most striking facts are the wide range of selection in the Order, and the marked predominance in the number of victims from the Asilidæ themselves (14 out of a total of 57). This predominance goes some little way to reduce the economic significance of Asilidæ as destroyers of insects.

COLEOPTERA.—The range of selection is here also very wide, but there is this in common between the victims: all are conspicuous flower-haunting forms or species which are freely upon the wing by day.

LEPIDOPTERA.—The range of selection is wide, the only predominance being among the Lycaenidæ and Pierinæ—probably the two groups of butterflies most abundant in individuals. The moths—with the possible exception of the single Hepialid—are probably all such as are on the wing by day or fly readily when disturbed.

Looking at the list as a whole there is, as we should expect, a marked absence of purely cursorial forms and of forms that hide by day.

ASILIDÆ AS THE ENEMIES OF SPECIALL Y PROTECTED INSECTS.—This investigation into the habits of predaceous insects was largely undertaken in order to ascertain the enemies of the specially protected groups. The conclusion had already been provisionally reached that the Asilidæ take an important place among these foes (Trans. Ent. Soc. Lond. 1902, pp. 336–337). "The stings of the Aculeates, the distasteful qualities of Danaidæ and Acribinæ and of the odoriferous Layria, the hard chitinous covering of Coleoptera, the aggressive powers of Odonata, are alike insufficient protection against these active and voracious flies." The sentence just quoted (l. c. p. 336) conveyed the

* Mr. Guy A. K. Marshall however writes as follows (Nov., 1906):— "Mr. E. S. Buttemer, of Estcourt, Natal, who kept wild bees on a considerable scale, told me that they were much preyed upon by Asilidæ."
impression made by a study of 36 examples (pp. 332-335). The conclusions expressed are confirmed and extended by the consideration of 190 additional examples recorded in the present Memoir.

The analysis on pp. 359-362 makes evident the following facts:

1. The great predominance among the prey of that specially defended Order, the Hymenoptera, and within its limits of the section including the stinging insects.

2. The fact that half the families of Coleoptera which contributed victims are looked upon as specially protected:—The _Galerucidae, Melyridae, Cantharidae, Aphodiidae, Cetoniidae, Lagriidae, and Cicindelidae_ (Trans. Ent. Soc. Lond. 1902, pp. 392-397).*

3. Among Rhopalocera the inclusion of _Danaine, Acræine and Pierine_ (including _Mylothris_) victims: among Heterocera of a Lymantrid victim.

4. The existence, although in small numbers, of Hemipterous prey.

Conclusions as to the habits of the species and genera of Asilidæ recorded in this Memoir.

I. _Dasypogoninæ._

_Dioctria_ (Nos. 1 to 10).—It is not necessary to present any further analysis of the tabulated record in the case of this genus. It is obvious that _Ichneumonidae_ form the chief prey of these slender Ichneumon-like Asilids (Trans. Ent. Soc. Lond. 1902, p. 336). In 4 out of 10 examples the prey belonged to this group; while in the whole of the _Asilidae_ other than _Dioctria_, only 6 instances of Ichneumonid prey are tabulated. Hence we are led to believe that the species of _Dioctria_ are the chief Asilid

* This list of specially protected Coleopterous victims will undoubtedly be extended. Indeed some evidence is already in existence as recorded in the following statement by Kirby and Spence (Fifth edn. 1828, vol. i, p. 396), which I owe, together with the quotations on pp. 365 and 388, to Mr. A. H. Hamm, Assistant in the Hope Department:—"De Geer has seen an Asilus pierce . . . the elytra of a lady-bird; and I have myself caught them with not only an _Elater_ and weevil, but even a _Hister_ in their mouths."
foes of the Ichneumonidæ.* The other insect prey is very varied: a Bracon?, a Tenthredinid, two flies, (a Syrphid and an Empid), a Panorpa and a small moth. Further material is greatly needed in order to test the provisional conclusions here arrived at, and to afford grounds for estimating the relative influence of the various species of the genus.

Dasypogon (Selidopogon) diadema, Nos. 11—55.—The record in the case of this species is remarkably complete, no less than 45 examples being tabulated. Of these all except one, in which the nature of the prey is uncertain, are available for an analysis which demonstrates at a glance the relative preferences of this predaceous species.

The Prey of Dasypogon (Selidopogon) diadema.

Hemiptera.

Coreidæ ........................................ 1

Total ........................................ 1

Coleoptera.

Hydrophilidæ .................................... 1
Copridæ .......................................... 1
Glaphyridæ ...................................... 3
Cetoniidæ ...................................... (abandoned) 1

Total ........................................ 6

* That the Hymenoptera are the special victims of Dioctria was well known to Kirby and Spence. Thus we read (Fifth edn. 1828, vol. i, p. 274) :—"The Asili also, which are always upon the chase, seize insects with their anterior legs and suck them with their haustellum. The cognate genus Dioctria, particularly Dioctria, prey upon Hymenoptera, by some unknown means instantaneously killing the insect they seize."

This last observation is also of great interest. The collapse of the Asilid's victim—often an active powerful insect—is so instantaneous that there can be little doubt that a poison is injected. In the case of Laphria gibbosa (No. 86) which was devouring the Buprestid beetle Ancylocheira flavomaculata (see p. 339) the proboscis was thrust through the cephalo-thoracic articulation. Dr. Chapman has pointed out to me that if the beetle had not been already killed or killed the instant of insertion it could have crushed the Asilid's proboscis with ease. When an Asilid is captured and held by the wings it often extrudes as if in defence a frothy liquid from the end of its proboscis; and it is probable that this is the poison. It would be interesting to experiment upon insects with it, introducing a minute quantity by means of a finely drawn out glass tube.
Hymenoptera.

*Ichneumonidae* 3
*Anthophila*
- *Hive-bee* 12
- *Other Anthophila* 5
*Diptera* 3
*Fossores* 4
*Heterogyna* 5

**Total** 32

Diptera.

*Asilidae*
- *♀* eating ♀ of own sp. 1
- Prey a sp. different from captor 1
*Syrphidae* 2
*Sarcophaginæ* 1

**Total** 5

Comparing this analysis with that of all the recorded prey of *Asilidae*, we find no examples of *D. diadema* attacking Orthoptera, Neuroptera, Homoptera, or Lepidoptera, and only a single instance in which Hemipterous prey was selected. Rather less than \( \frac{1}{3} \) of *D. diadema*'s captures were selected from among the Coleoptera, and an equal proportion from the Diptera. The great majority of the victims, \( \frac{3}{4} \) of the whole, were Hymenopterous, and of these about half belonged to the Anthophila. The numbers of these latter are inflated by the abundance of the hive-bee and probably by the fact that this artificially protected species is extremely abundant in certain localities, and especially easy to capture. Probable evidence of the comparative helplessness of the hive-bee is afforded by the following considerations. The sexes are recorded in 42 out of the 45 tabulated examples of this Asilid: 30 were females, 12 were males. The smaller weaker males selected upon the whole smaller weaker victims than the females. But in 3 cases out of the 12 the comparatively large and heavy hive-bee worker was found in the clutches of a male *diadema*. As regards the female also, the 9 hive-bees were considerably larger than the average of the other victims selected by this sex. (See also p. 362.)

*The Courtship of Dasypogon (Selidopogon) diadema.*

Only a single pair were observed *in coitu*, both male
Predaceous Insects and their Prey. 367

and female being without prey at the time. On the other hand three females with prey (Nos. 22, 23 and 40) were seen to be persistently courted by males. In one case (No. 40) both sexes were resting on a leaf, the female absorbing the juices of a small ♀ Ichneumonid, Pimpla (Himpeletis) pomorum, which was soon sucked dry. She then deliberately withdrew her proboscis from the victim and dropping it upon the leaf faced round upon her suitor in a menacing manner. The male, as if realizing the danger, at once became far more cautious and wary in courtship. When we remember that once in this species (No. 41), and once each in the case of two other species of Asilidae, Promachus aequalis (No. 96), and Promachus, sp. A. (No. 103), the female has been captured devouring the male of her own kind, we can well understand the increased wariness observed on this occasion, as well as the persistent courtship of females already provided with prey and the well-known examples of females with prey captured in coitu.* Four instances of this latter kind are recorded in the present paper,—Laphria gibosa, No. 86; Eutolmus apicatus, No. 175; Macrimum atricapillus, No. 205, and Neoitamus cyanurus, No. 208. That the male is extremely wary in the courtship of females without prey, the following observations upon D. diadema sufficiently prove.

July 24th, 1902, 11.45 a.m. La Granja, Sierra Guadarrama, Spain.—I watched a male Dasypogon diadema pursuing the female. Every time the female flew the male followed and almost invariably settled behind, about three or four inches away, with his head towards her. Sometimes the female on alighting turned round so as to face the direction from which she had flown, and the pursuing male; but the latter flew round her and took up the characteristic position behind. Not only on these occasions but usually the male flew once or twice round her before alighting, but until the final act this particular male never touched the female. About a quarter of a minute after settling the male flew nearer to the female. Although only three or four inches away he did not walk but flew towards her, taking up a nearer position, in which he sometimes faced her from the side, sometimes

* Also frequently observed in the Empidæ, as stated by Kirby and Spence. For their amusing conjectures as to the significance of the fact see footnote † on p. 388.
from behind. On one occasion he alighted only an inch behind the female.

The only movements observed in the female after alighting were of the head, but the male often fluttered his wings.

Pairing took place after the courtship had been watched for six minutes, during which the insects flew and alighted several times. The male seized the female in the air after she had flown a short distance, and both fell to the ground together from a height of about eight inches. Copulation probably occurred the instant the insects reached the ground, but the movements were too rapid to be followed. In flight the female supported the male, but the horizontal position of the latter was apparently maintained by the use of his wings. When the female alighted the male always hung in a vertical position. Coitus was not terminated by capture, or even by boxing.

The courtship of another pair was watched on the same morning and in the same locality. Coitus was not seen, the insects being lost after 12½ minutes of observation. In this case the female when settled moved her abdomen up and down. Movements of the third pair of legs were also seen, while those of the head were frequent and pronounced. The male also sometimes faced the female, and once or twice darted down upon her, certainly touching some part of her dorsal surface.* After one of the flights, when they had come to rest upon a couple of flower-heads about two inches apart, the male more than once took a turn in the air round the female, and then returned to his flower-head. In spite of the differences here stated, the relative positions of male and female were generally similar to those of the last pair. In fact, the positions first taken up after each flight of the female are probably characteristic.

*Dasygon (Solidopogon) diadema, a mimic of its most conspicuous victims.

The dark-winged, dark-bodied *Dasygon diadema* is undoubtedly mimetic of the Hymenoptera Aculeata.

* A male, watched on the previous day, July 23, also appeared to dart at and touch the female. The observation was made in the same locality, and the female was in this instance carrying a bee.
Especially is this true of the female, which with a red band across the abdomen, strongly suggests the appearance of a large group (Trans. Ent. Soc. Lond., 1904, pp. 647, 648) of similarly banded Aculeates. Out of 29 Aculeate victims three belonged to the group in question, — *Pompilus viaticus*, *Sphecodes gibus*, and *Ammophila hirsuta*. All three were captured by female Asilids. With the exception of a single *Bombus* these three victims are the most conspicuously marked of all the prey of *D. diadema*, and the most suitable models for mimetic resemblance. (Trans. Ent. Soc. Lond., 1904, pp. 661–662.)

Remaining genera of the *Dasypogonine*.

Of these there is not much to be said, inasmuch as the number of records is insufficient to justify conclusions as to preferences. Especially is this the case with *Saropogon*, Nos. 56, 57, and *Isopogon*, No. 66; while the three examples of a single species of Tipulid prey seized by the bee-like *Lasiopogon cinctus*, Nos. 76–78, were all observed in the same locality and at nearly the same time. However, so far as it goes the evidence certainly suggests a mainly Dipterous diet for this latter species. The seven or eight victims recorded for the genus *Microstylum*, Nos. 58–65, indicate comprehensive tastes; including 3 beetles, 2 or 3 Cicadas (or possibly a Vespid), 1 grasshopper and 1 Asilid fly. The huge *Microstylum dux* appears to be an Aculeate mimic. *Stenopogon*, Nos. 67–69, twice captured the specially protected *Melyridae* among the Coleoptera, and once a well-defended bug, *Thyanta*. In *Sclropogon*, Nos. 71–73, alone among the *Dasypogonine*, we meet with the record of a butterfly victim, a species of the distasteful sub-family *Danainae*. The two remaining captures recorded for this genus are Asilid flies. One of these offers an example—so far unique—of a female Asilid preying upon another female of the same species. The two species of *Damalina*, Nos. 74, 75, are probably specialized foes of the Dammar-bees (*Melipona*), and both are beautiful mimics of their victims. The two tabulated examples support this conclusion, but further observation is greatly wanted. Colonel C. T. Bingham, to whom we owe both the records, has however recorded that flies of this genus “persistently hover round the nest-mouth of the dammar bees, and catch the latter on the wing as they issue from the nest.” (Trans. Ent. Soc. Lond. 1902, p. 336.)
II. Laphrineæ.

The number of records in this sub-family is small, so small indeed that we can only reach provisional conclusions as to the preferences of the species. Mimicry of the Hymenoptera Aculeata is here more conspicuous than elsewhere among these predaceous flies. Lamyra (Nos. 91, 92) and Proagonistès (No. 93) are beautiful mimics of dark-winged Aculeates, and two out of the three recorded individuals were preying upon Aculeates, although not upon their models. It is probable that these species present us with a case similar to Dasypogon diadema, where there is a general attack upon the Aculeata accompanied by mimicry of a type of colouring common and specially conspicuous, but by no means universal among the victims. The bee-like Laphria, sp. ? gilva (No. 89), was captured with a fly, Laphria gibbosa (Nos. 86, 87), a mimic of the heavy Bombus type of Aculeates, was twice, and the bee-like Hoplistomerus serripes (No. 79) once, recorded with a beetle. These species may probably be grouped with the common Asilus crabroniformis, mimetic of a specially abundant and conspicuous Aculeate type, but showing no preference for an Aculeate diet. Laphria flavâ (No. 88),—also Bombus-like—recorded with an ant, may perhaps belong to the same category as Lamyra and Proagonistès. The species of Lavenecera (Nos. 80–83)—all mimetic of Aculeates (bees) and all preying upon Aculeates although usually not upon their models—appear undoubtedly to belong to this latter category. Hypocrechia (Nos. 84, 85), long suggested as a specialized foe of the Aculeate genus Xylocopa (Trans. Ent. Soc. Lond. 1904, p. 662, and Proc. 1904, p. lxxxvi), has now for the first time been proved to prey upon its model. It offers a case precisely parallel to that of Damalina.

Not only are the Laphrineæ here recorded more generally mimetic than the species of either of the other sub-families but their resemblances are curiously restricted to the group of bees (Anthophila), although Lamyra and Proagonistès offer magnificent exceptions.

III. Asilinæ.

Cruspœdia (No. 94), now shown for the first time to attack the Xylocopidae, is probably a specialized foe of these bees,
and is a mimic of its victim. Save for the less perfect mimetic resemblance, it falls into the same category as Damalina and Hyperechia.

Promachus (Nos. 95–121).—We find in this large genus examples sufficiently numerous and interesting to justify separate tabulation.

The Prey of Promachus.

<table>
<thead>
<tr>
<th>Order</th>
<th>Family</th>
<th>Promachus ( \text{equalis} )</th>
<th>Promachus, other species</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuroptera</td>
<td>Termiteidae</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Odonata</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Hemiptera</td>
<td>Coreidae</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Homoptera</td>
<td>Cicadidae</td>
<td>3 or 4*</td>
<td></td>
</tr>
<tr>
<td>Coleoptera</td>
<td>Coelidae</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Melolonthidae</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rutelidae</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lagriidae</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Hymenoptera</td>
<td>Ichneumonidae</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Anthophila (Apidae)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Diploptera</td>
<td>1 or 2*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fossores</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Heterogyna (Formicidae)</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Diptera</td>
<td>Tabanidae</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Asilidae { of same species. 1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>{ prey different sp. 3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sarcophaginiæ</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Totals</strong></td>
<td>7</td>
<td>21 or 22</td>
</tr>
</tbody>
</table>

* One of these alternatives—Cicadidae or Diploptera—must be included, and both may be: see No. 117, p. 344.

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Promachus aequalis (Nos. 95-101) is probably an imperfect mimic of the white-banded Xylocopidae; but with the exception of the winged Termites and the male of its own species, its victims (4) were all Coleopterous. Hence if a mimic at all it must be classed with Asilus erabroniformis (Nos. 149-156). The second column of the table includes a fine species, testaceipes? (No. 117), from Macao, probably mimetic of a wasp. Its prey is insufficently known, but must include one, perhaps two wasps, although apparently not the model, and may include a Cicada. The tolerably indiscriminate list of victims in this column seems however to indicate an undoubted preference for Dragonflies and Cicadas, inasmuch as the majority of the records of these insects are here to be found.

*Philodicus, Alcimus* and *Apoloea* (Nos. 122-140).—We here encounter the most obvious preference for a particular diet to be met with anywhere among the *Asilidae*, except in those specialized forms which prey upon their models. Omitting the doubtfully determined *Philodicus* sp., which had attacked a Tachinid fly, the prey of the remaining species of these three genera is tabulated below:

### The Prey of Alcimus and allied genera.

<table>
<thead>
<tr>
<th>Orthoptera, Acrididae</th>
<th>Alcimus</th>
<th>Apoloea</th>
<th>Philodicus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orthoptera</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lepidoptera</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterocera</td>
<td>Lymantridae</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Noctuidae</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pyralidae</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Rhopalocera</td>
<td>Nymphalidae</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lycanidae</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Pierinae</td>
<td>3</td>
<td>1 or 2</td>
</tr>
<tr>
<td>Totals</td>
<td>15</td>
<td>1 or 2</td>
<td>1</td>
</tr>
</tbody>
</table>

When this table is compared with the general analysis of prey (pp. 359, 361), the preference for Lepidoptera and Orthoptera will be seen to be remarkably clear. As re-
gards Rhopalocera the preference is even more marked than this comparison suggests; for some and perhaps all the butterflies seized by uncaptured Asilids were probably the prey of *Alcimus*. The species of this genus stand out as by far the most important of the Asilid foes of butterflies, and the study of the habits of the group is especially commended to those who believe that all *Asilidae* are indiscriminate in their attacks on insects. The preference for Lepidoptera manifested in common by these genera is an interesting example of the support which a purely structural foundation for affinity may receive from the study of instincts, themselves the outcome of structure in the central nervous system.

As regards mimicy the remarkably long-bodied species of these three genera are perhaps protected by a vague resemblance to the more slender Hymenoptera—Parasitic or Aculeate—but, as the above analysis shows, they have not been hitherto observed with victims belonging to this Order.

*Philonicus* (two species), Nos. 141–147.—So far as the insufficient evidence justifies any conclusion this genus appears chiefly to attack Diptera (6 examples), although a single Tineid victim is also recorded.

*Pamponcrus germanicus* (No. 148).—The single example—a Melolonthid beetle—does not justify conclusions as to the preferences of this species.

*Asilus crabroniformis* (Nos. 149–156).—Considering the abundance and conspicuous appearance of this fine insect the records of prey are somewhat scanty. I am myself familiar with the species in several localities but have only once seen it with prey—a beetle (No. 150). The other tabulated instances, including 3 different grasshoppers, indicate a preference for Orthoptera and Diptera. The four recorded examples of the latter Order belong to four different families or sub-families—*Asilidae*, *Syrphidae*, *Sarcophagidae* and *Muscinae*. *Asilus crabroniformis* "recalls in a general way the type of Aculeate colouring and pattern which is commonest and most conspicuous in its region"*—especially the black and yellow banded appearance of the most abundant Palaearctic species of *Vespa*. At the same, time I have been unable to find a single example of an attack by this species upon Hymenoptera.

An observation on the cryptic attitude of Asilus crabroniformis during prolonged rest.

As this Memoir contains certain miscellaneous observations upon the Asilidae, such as the notes upon the courtship of Dasypogon (Solidopogon) diadema on pp. 366-368, I have thought it worth while to include the following. On the evening of July 28, 1906, I observed a female of this species at rest on a head of Centaurea scabiosa beside the footpath leading to Stone's Copse, above North Hinksey, near Oxford. The insect had evidently gone to rest for the night and was quite torpid. The appearance strongly suggested a rolled-up crumpled brown leaf or leaf-fragment which had accidentally fallen upon the flower. This cryptic resemblance was brought about by a remarkable attitude, the insect being precisely in the position formed by a half somersault,—arrested when the ventral surface was uppermost. Hence the closely-folded wings and the conspicuous gold and black bands were entirely invisible from above; the only appearance being that of the brown shades on the legs and ventral surface. The colouring of these was so beautifully adapted to produce the cryptic effect suggested above that I think it is probable that I witnessed a single example of an attitude commonly assumed by the species during prolonged rest.

Lophonotus (two species), Nos. 157-162.—Hymenoptera contribute half of the six victims recorded for this genus. The list is as follows: a Dragonfly, a beetle, a Geometrid moth, two Fossorial wasps, and a Chalcid. Some preference for Hymenoptera may be regarded as probable.

Dysmachus (Nos. 163-174).—Five species have been discriminated by Col. Yerbury and Mr. Verrall in the material upon which this paper has been prepared. (See, however, note on p. 350.) They differ but slightly in size and superficially resemble each other in appearance. Twelve examples are tabulated, the prey belonging to the Coleoptera (3 Melolonthids, 1 Coprid), Lepidoptera (1 Geometrid, 2 Crambids), Diptera (1 Stratiomyid, 1 Empid, 1 Anthomyid), and Hymenoptera (1 Ichneumon, 1 winged ant). At first sight the selection seems entirely indiscriminate and haphazard, but when regard is paid to the circumstances of the case it is found that choice was exercised at least in one case. When I captured the three specimens (Nos. 169, 170, 172) with Melolonthid
Predaceous Insects and their Prey.

victims on Peñalara, these beetles were by no means conspicuously common, while on the same ground the grasshopper, Gomphocerus sibiricus, was positively swarming. This species is certainly attacked by other kinds of Asilids: an example is in fact put on record in the table (No. 192). The attacks upon Lepidoptera also probably indicate some preference, especially when we consider that only one other Geometrid victim is recorded,* and that, except Dysmachus, no Asilid is known as the captor of a Crambus.

_Eutolmus_ (Nos. 175, 176).—Of the two species one is not with certainty to be included in this genus. The records are insufficient to justify conclusions; but there is one interesting point about _Eutolmus apicatus_ which deserves notice. The species was very common on Montserrat, and 14 specimens (6 ♂ and 8 ♀) captured July 14–15, 1901, exist in the Hope Collection; yet only a single pair of the insects were observed in _colitum_, and the female of this pair was the only individual of the species observed with prey (an Anthomyid fly). The coincidence supports the conclusion already arrived at, that females with prey are especially sought by the males (p. 367).

_Machimus_ (Nos. 177–205).—At least 7 species are discriminated by my kind friends Col. Yerbury and Mr. Verrall; and no less than 29 examples of prey are recorded. These are so numerous and striking that the results are shown below in a tabular form on page 376.

Certain preferences are very obvious in this table. The choice of Acridians is clearly seen in the fact that nearly half the number recorded for the whole of the Asilidae are found in the first two columns. Apart from this, the best known form is seen to attack beetles freely, Hymenoptera and Diptera slightly, while there is a single record of a butterfly and a Lygaeid bug among the victims. _M. seti-barbus_ is only known to attack Diptera. The British species also exhibits a strong preference for Diptera; for these contribute 5 out of the 6 records of prey. The sixth record is interesting, as it affords the only example of an attack on the Ceropidæ as yet observed among Asilids.

_Neotimus_ (Nos. 206–216).—Of the two species with prey there is, in the case of the British form, _N. cyanurus_, evidence suggesting that Diptera are the chief element in

* See, however, footnote on p. 356.
Professor E. B. Poulton on

The Prey of Machimus.

<table>
<thead>
<tr>
<th>Class</th>
<th>Subclass</th>
<th>Order</th>
<th>Family</th>
<th>Species</th>
<th>Christis +</th>
<th>Gonatistes</th>
<th>Sethanon</th>
<th>Astrakhan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orthoptera</td>
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<td>Acridiidae</td>
<td></td>
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<td>2</td>
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</tr>
<tr>
<td>Hemiptera</td>
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<td>Lygaeidae</td>
<td></td>
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<td></td>
</tr>
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<td>Homoptera</td>
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<td>1</td>
</tr>
<tr>
<td>Coleoptera</td>
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<td>Cicindelidae</td>
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<td>Copridae</td>
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</tr>
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<td>Glaphyridae</td>
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<td>Melolonthidae</td>
<td></td>
<td></td>
<td>2</td>
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</tr>
<tr>
<td>Lepidoptera</td>
<td></td>
<td></td>
<td>Nymphalidae</td>
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<td>1</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>Pierinae</td>
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<td>Hymenoptera</td>
<td>Anthophila</td>
<td>Aculeata</td>
<td>Apidae</td>
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<td></td>
<td>2</td>
<td>1</td>
</tr>
<tr>
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<td></td>
<td>Heterogynae</td>
<td>(Formicidae)</td>
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</tr>
<tr>
<td>Diptera</td>
<td>Tabanidae</td>
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<td>1</td>
<td>1</td>
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</tr>
<tr>
<td></td>
<td>Asilidae</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Dolichopodidae</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Syrphidae</td>
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<tr>
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<td>Sarcophagidae</td>
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<td></td>
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</tr>
<tr>
<td></td>
<td>Muscinae</td>
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</tr>
<tr>
<td></td>
<td>Anthomyiidae</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Totals: 16 2 2 6 3

* Including three uncaptured specimens probably belonging to this species.
Predaceous Insects and their Prey.

a mixed diet. Six examples out of ten belong to this Order (1 Tipulid, 1 Empid, 1 Conopid, 1 Syrphid, 1 Tachinid, 1 uncertain), the other victims being an Aphodiid and a Curculionid beetle, a Cimicid bug, and a Hepialid moth.* A single example of another species of the genus Neoitamus was carrying a beetle.

*Epitrix* (Nos. 217–219).—The three victims (2 small moths, and 1 Muscid) recorded for two species are quite insufficient as evidence for the existence of any preference; but comparing the number of the moths with that shown in the complete analysis (p. 361), it becomes not improbable that future observation will demonstrate some preference for this diet.

The remaining records (Nos. 220–226), dealing with undetermined *Asilidae*, cannot of course be considered in this section.

**Mimicry in Asilidae recorded with Prey.**

The statements on mimicry and its varying relationship to the prey attacked by the mimetic species, scattered through the preceding pages, and already published (Trans. Ent. Soc. Lond. 1904, pp. 661–665) may now be gathered together into a tabular statement. It is important to remember that most of the species are only provisionally included in their respective groups on account of the insufficiency of the records. It is hoped however that the publication of a tabulated scheme, given on page 378, will stimulate observation and the preservation of material, so that at no distant date the means for a more comprehensive and more trustworthy classification may be gained.

* Mr. G. H. Verrall's observation recorded in footnote* on p. 356, proves that moths are sometimes attacked on a large scale by this species.
<table>
<thead>
<tr>
<th>Mimetic Species of Asilid</th>
<th>Model</th>
<th>Prey</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Lasiopogon cinctus</em></td>
<td>A small bee</td>
<td><em>Tipula,</em> — 3 records</td>
</tr>
<tr>
<td><em>Laphria gibbrosa</em></td>
<td>A bee of the genus <em>Bombus</em></td>
<td>Beetles, — 2 records</td>
</tr>
<tr>
<td><em>Laphria, sp.? gilta</em></td>
<td>A hairy bee such as a very small <em>Bombus</em></td>
<td>Flies, — 1 record</td>
</tr>
<tr>
<td><em>Hoplistoneurus servipes</em></td>
<td>A rather large bee</td>
<td>A beetle, — 1 record</td>
</tr>
<tr>
<td><em>Promachus aequalis</em></td>
<td>A white-banded <em>Xylocopid</em> bee</td>
<td>Beetles, — 4, Termites, — 2, 5 of its own species, - 1</td>
</tr>
<tr>
<td><em>Philodicus gracilis</em></td>
<td>Long-bodied slender <em>Aculeate</em> or <em>Ichneumonid</em></td>
<td>Lepidoptera, — 18 or 19 records: grasshoppers, 4 records</td>
</tr>
<tr>
<td><em>Alcinus, 3 African sp.</em></td>
<td>A large yellow dark-banded <em>Aculeate</em></td>
<td>Flies, — 4 records: beetle, — 1 record: grasshoppers, — 3 records</td>
</tr>
<tr>
<td><em>Asilus crabroniformis</em></td>
<td><em>Ichneumonididae</em></td>
<td>Insects of various orders, but chiefly <em>Ichneumonididae</em></td>
</tr>
<tr>
<td><em>Dioctria, 3 British species</em></td>
<td><em>Dark red-banded Aculeates, Pomphilus, Anomophila, &amp;c.</em></td>
<td>Insects of various orders, but Aculeates far more frequently than others. Models of ? ? are among the most conspicuously coloured of the prey</td>
</tr>
<tr>
<td><em>Dasypoyn diadema</em></td>
<td>Uniformly dark <em>Aculeates</em></td>
<td>Cicada and beetle: may also include wasp</td>
</tr>
<tr>
<td><em>Dasypoyn diadema &amp;</em></td>
<td><em>Large Aculeate</em></td>
<td>The single record is an Aculeate— an ant</td>
</tr>
<tr>
<td><em>Microstylum dux</em></td>
<td><em>Bees of the genus</em> <em>Bombus</em></td>
<td>The three examples were all Aculeates, but quite unlike the Asilids</td>
</tr>
<tr>
<td><em>Laphria flava</em></td>
<td><em>Bees of medium size</em></td>
<td>Of the two records one is an Asilid! while the other is a wasp (<em>Belenogaster</em>) unlike its captor in appearance</td>
</tr>
<tr>
<td><em>Laxeneeca, 2 African species</em></td>
<td>A slender blue-black yellow - barred <em>Aculeate</em></td>
<td>The single record is a small bee (<em>Halictus</em>) totally unlike its captor</td>
</tr>
<tr>
<td><em>Lamyra, sp.? gulo</em></td>
<td><em>A large dark Fosser with orange legs, such as Saliv</em></td>
<td>A large <em>Vespa,</em> apparently not a model—was certainly attacked, 1 or 2 records: also perhaps one Cicada</td>
</tr>
<tr>
<td><em>Proxonyistes, sp.? praceps</em></td>
<td><em>Large Aculeate</em></td>
<td>The models</td>
</tr>
<tr>
<td><em>Promachus, sp.? testaceipes</em></td>
<td><em>The black and white Dammar bees (Melipona)</em></td>
<td>The single record is a bee (<em>Apis florea</em>) which the captor superficially resembles</td>
</tr>
<tr>
<td><em>Doratina, 2 Burmese species</em></td>
<td><em>A bee of medium size</em></td>
<td>The models, — one record and another probable one</td>
</tr>
<tr>
<td><em>Laxeneeca flavibarbus</em></td>
<td><em>Dark Xylocopid bees</em></td>
<td>The models, — one record</td>
</tr>
<tr>
<td><em>Hyperechia xylocopiformis</em></td>
<td><em>Dark Xylocopid bees</em></td>
<td></td>
</tr>
<tr>
<td><em>Craspedia, sp. from Queensland</em></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
B. Empidæ and their Prey.

Sixty-five records of Empidæ with prey are tabulated below in the same manner as that adopted in the Asilidæ. More than half of these I owe to the skill and powers of observation of my kind friend Col. J. W. Yerbury, who also gave me the most valuable assistance in naming the Diptera—the captures of others as well as his own. The credit for this section of the Memoir belongs almost entirely to him.

<table>
<thead>
<tr>
<th>Species of Empidæ</th>
<th>Species of Prey</th>
<th>Locality and Date</th>
<th>Observer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>In Hope Dep.</strong></td>
<td>The Homopteron (Typhlocybidae), <em>Typhlocyba quercus</em>, F.</td>
<td>Torcross, S. Devon. Aug. 9, 1903.</td>
<td>J. W. Yerbury.</td>
</tr>
<tr>
<td>SPECIES OF EMPID.</td>
<td>SPECIES OF PREY.</td>
<td>LOCALITY AND DATE.</td>
<td>OBSERVER.</td>
</tr>
<tr>
<td>------------------</td>
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</tr>
<tr>
<td>Page</td>
<td>Animal</td>
<td>Location</td>
<td>Collector</td>
</tr>
<tr>
<td>------</td>
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<td>-----------</td>
</tr>
<tr>
<td>244.</td>
<td>Empis tessellata, F, ♂</td>
<td>Tarrington, Herefordshire</td>
<td>J. W. Yerbury</td>
</tr>
<tr>
<td>245.</td>
<td>Empis tessellata, F, ♂</td>
<td>Malvern Hills</td>
<td>J. W. Yerbury</td>
</tr>
<tr>
<td>246.</td>
<td>Empis tessellata, F, ♂</td>
<td>Malvern Hills</td>
<td>J. W. Yerbury</td>
</tr>
<tr>
<td>247.</td>
<td>Empis tessellata, F, ♂</td>
<td>Malvern Hills</td>
<td>J. W. Yerbury</td>
</tr>
<tr>
<td>248.</td>
<td>Empis tessellata, F, ♂</td>
<td>Tarrington, Herefordshire</td>
<td>J. W. Yerbury</td>
</tr>
<tr>
<td>249.</td>
<td>Empis tessellata, F, ♂</td>
<td>Ledbury, Herefordshire</td>
<td>J. W. Yerbury</td>
</tr>
<tr>
<td>250.</td>
<td>Empis tessellata, F, ♂</td>
<td>Pamber Forest, near Basingstoke</td>
<td>H. St. J. K. Donisthorpe</td>
</tr>
<tr>
<td>251.</td>
<td>Empis tessellata, F, ♂</td>
<td>Nethy Bridge, Spey Valley, Inverness</td>
<td>J. W. Yerbury</td>
</tr>
<tr>
<td>252.</td>
<td>Empis tessellata, F, ♂</td>
<td>Nethy Bridge, Spey Valley, Inverness</td>
<td>J. W. Yerbury</td>
</tr>
<tr>
<td>253.</td>
<td>Empis tessellata, F, ♂</td>
<td>Twitchen, Mortehoe, N. Devon</td>
<td>G. B. Longstaff</td>
</tr>
<tr>
<td>254.</td>
<td>Empis tessellata, F, ♂</td>
<td>Twitchen, Mortehoe, N. Devon</td>
<td>G. B. Longstaff</td>
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</table>

**Predacious Insects and their Prey.**
<table>
<thead>
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<th>Species of Empid</th>
<th>Species of Prey</th>
<th>Locality and Date</th>
<th>Observer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Empisae (continued).</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>258, 259, 260. Empis livida, L. Three ♂ specimens. Empids in Hope Dep.</td>
<td>The Tortricid moth, Tortrix viridana, L. Specimens not taken, but great numbers seen in the grasp of these Empids.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>262. Empis livida, L., ♂. In Hope Dep.</td>
<td>The Tortricid moth, Tortrix viridana, L.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>Species</td>
<td>Location</td>
<td>Collection Details</td>
</tr>
<tr>
<td>-----</td>
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</tr>
<tr>
<td>SPECIES OF EMPID.</td>
<td>SPECIES OF PREY.</td>
<td>LOCALITY AND DATE.</td>
<td>OBSERVER.</td>
</tr>
<tr>
<td>---------------------------</td>
<td>------------------------------------------------</td>
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</tr>
</tbody>
</table>

* *279. Mr. Morley records that the Pachymeria femorata, observed on July 8, 1904, were flying in the hottest sunshine over grass along a hedgerow. All these Empids and their victims were named by Mr. G. H. Verrall. Mr. Verrall notes that P. femorata frequently hovers in a slow waving flight under lime trees in front of his house at Newmarket, always in copula and the ♀ with prey.*
<table>
<thead>
<tr>
<th><strong>OCYDROMINÆ.</strong></th>
<th><strong>TACHYDROMINÆ.</strong></th>
<th><strong>Porthcawl, S. Wales.</strong></th>
<th><strong>Tarrington, Herefordshire.</strong></th>
<th><strong>J. W. Yerbury.</strong></th>
</tr>
</thead>
</table>

Nearly all the important conclusions to be drawn from the above records of *Empidæ* and their prey are shown in the table on pp. 386, 387. The whole of the *Empidæ* are included except the last-named—*Tachydrornia* sp. (No. 291).
<table>
<thead>
<tr>
<th>Ephemeroidea</th>
<th>Plecoptera</th>
<th>Trichoptera</th>
<th>Leptoceridae</th>
<th>Tortricidae</th>
<th>Cromidae</th>
<th>Hydropsychidae</th>
<th>Formicidae</th>
<th>Caddidae</th>
<th>Myxophyllumidae</th>
<th>Bibionidae</th>
<th>Chironomidae</th>
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</thead>
<tbody>
<tr>
<td>Ephemeroidea</td>
<td>Phryganeida</td>
<td>Plecoptera</td>
<td>Trichoptera</td>
<td>Leptocerida</td>
<td>Tortricidae</td>
<td>Cromidae</td>
<td>Hydropsychidae</td>
<td>Formicidae</td>
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<td>Myxophyllumidae</td>
<td>Bibionidae</td>
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<tr>
<td>Predaceous Insects and their Prey.</td>
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</tr>
<tr>
<td><strong>Males</strong></td>
<td><strong>Females</strong></td>
<td><strong>Unrecorded</strong></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

SEXES

| Limnodiidae | Tipulidae | Leptidae | Theretridae | Empididae | Sepsididae | Tachinidae | Serrophagidae | Muscidae | Anthomyiidae | Sepsidae | Anthomyiidae | Sepsidae | Bactrididae | TOTALS |
|-------------|-----------|----------|-------------|-----------|------------|------------|--------------|----------|-------------|---------|--------------|---------|-------------|--------|----------|
| 1           |           | 1        | 1           | 1         | 2          | 1          | 64           | 1        | 2           | 1       | 64           | 1       | 1          |        |
| 1           | 3         | 2        | 1           | 1         | 3          | 1          | 2            | 1        | 40          | 19      | 19           | 5       | 5          |        |
Proportion of the Sexes.—In the recorded Asilidae it was found (p. 359) that females with prey were between three and four times as numerous as males with prey. In the Empidæ tabulated above, such females are almost exactly half as numerous as males carrying prey. In spite of this great preponderance of the latter sex, females alone were found in 7 species, males alone in only 5, while 4 included both sexes. The large proportion of males is entirely due to their numbers in only 4 species out of the 15, viz. Hybos grossipes, Empis tessellata, Empis livida, and Pachymeria femorata.

Female Empidæ with prey captured in coitu.—This fact is recorded frequently in Pachymeria femorata,* twice in Empis tessellata, Nos. 243, 244, once in E. livida, No. 273, and once in E. opaca, No. 274. These instances out of 65 recorded cases form a much higher proportion than in the Asilidae; but there are as yet no examples of the female attacking the male of its own species or of a remarkably cautious pursuit by the male during courtship, to support the interpretation which seems inevitable in the former group (see p. 367).†

The choice of Prey by Empidæ.—Only provisional conclusions can be reached in all the tabulated species except E. tessellata, with 20 records, and E. livida with 16. All others, except Hybos grossipes (7) and Pachymeria femorata (6), are hopelessly insufficient.

Hybotinae.—The 10 records divided between three pairs, show an attack upon minute Homoptera, ants and Braconidæ; and the Mycetophilidae and Bibionidæ among the Diptera.

Empinæ.—It is evident that Diptera form by far the most important insect food of this sub-family. In fact, we find no other prey, except in the case of Rhamphomyia

* Vide footnote on p. 384.
† Kirby and Spence were well acquainted with the facts recorded in the above paragraph, and make amusing suggestions as to their significance. Thus we read (5th edition, 1828, vol. i, pp. 271, 275):—“Many species also of Empis, whose haustellum resembles the beak of a bird, carry off in it Tipulæ and other small Diptera; and what is remarkable, you can seldom take these insects in coitu, but the female has a gnat, some fly, or sometimes beetle in her mouth. Can this be to deposit her eggs in, as soon as they are impregnated by the male? or is it designed for the nuptial feast?” No Coleo-

pterous victim of an Empid is recorded in the present Memoir. On the other hand, the predominance of Dipterous prey is abundantly confirmed.
dentipes attacking an Ephemerid, and Empis livida, the foe of Tortrix viridana and other small moths, also captured with a Phryganid. The 20 records of Empis tessellata—all Diptera—render it improbable that other insects are attacked.* The variety of prey within the limits of this Order is remarkable, no less than 8 families or sub-families being divided between the 20 victims. Of these the Bibionidae (7) and to a far less extent the Tipulidae (4) are responsible for more than half.

The 16 records of Empis livida include 6 moths (4 examples of Tortrix viridana, 2 of Crambidae,) 1 Phryganid, and 9 Diptera, belonging to 5 different groups of which the Anthomyiidae furnish the largest number of victims (3). Of special interest in this species is the series of 9 examples (264–272) with prey captured by Mr. H. St. J. K. Donisthorpe at Huntingfield, Kent, on the evening of July 21, 1906. In circumstances such as these, when an abundant predaceous species is feeding in a locality where insects are common and varied, we obtain the most valuable information possible as to the range of its preferences. It is to be hoped that much time and labour will be directed to the collection of all possible material whenever such exceptionally favourable opportunities arise. The deeply interesting results of Mr. Donisthorpe's captures of E. livida, and of the two series of Dasypogon diadema (15–41 and 43–54) observed at nearly the same times at La Granja, indicate the importance and interest of the conclusions which may be thus reached.

The records of the other species of Empinæ, though quite insufficient in numbers, render it likely that their diet also is normally confined to Diptera of various groups.

Ocydrominæ.—The single example was found devouring a Mycetophilid.

Tachydrominæ.—Only 5 captures are recorded for 3 species. Of these 3 are Diptera (a Cecidomyid, a Mycetophilid, and an Empid), the 4th a minute Braconid, the 5th a minute Cynipid. The evidence is entirely

* It is pretty clear that the Rev. J. G. Wood was mistaken in speaking of Empis tessellata as the captor of Tortrix viridana. Thus he says:—“There are several species of this useful fly, one attaining some size; but the one that claims our notice... is the little empis, scientifically called Empis tessellata.” Now this latter is a large species, and Wood doubtless witnessed the attacks of the smaller E. livida. For the otherwise excellent popular account see “Common Objects of the Country,” London, N. D., pp. 101, 102.
insufficient, but such as it is suggests that Diptera and minute Hymenoptera form the chief prey of this sub-family.

Summing up, we may conclude that with comparatively few exceptions the Empidæ are the foes of their own group,—the Diptera. In the vast preponderance of captures within the limits of a single Order, they are sharply contrasted with the Asilidæ.
C. Predaceous Diptera other than Asilidae and Empidæ.

Although the following Diptera with insect prey belong to very different families the number of records is so small that it seems advisable to include the whole of the material (with the exception of two species considered separately at the close of this section) in a single tabular statement.

<table>
<thead>
<tr>
<th>SPECIES OF DIPtera.</th>
<th>SPECIES OF PREY.</th>
<th>LOCALITY AND DATE.</th>
<th>OBSERVER.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DOLICHOPODIDÆ.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ANTHOMYIDÆ, Cenosinae.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>CORDYLRIDÆ.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Species of Diptera</td>
<td>Species of Prey</td>
<td>Locality and Date</td>
<td>Observer</td>
</tr>
<tr>
<td>-------------------</td>
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</tr>
<tr>
<td>Cordyluridae (continued).</td>
<td>The fly (Dexinae), Macronymchia viatica, Mg., ♀. The victim was an addition to the list of British Diptera.</td>
<td>Porthcawl, S. Wales. June 12, 1903.</td>
<td>J. W. Yerbury.</td>
</tr>
<tr>
<td>303 Scatophaga stercoraria, L., ♂. In Hope Dep.</td>
<td></td>
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</tbody>
</table>

* 301. Mr. Claude Morley records the following details of the mode of attack:—"On observation I found the ♀ had bored a large hole in the back of the head of the ♂, and had sucked it quite dry; it now had its proboscis deeply inserted in the front of its victim's thorax and the action of absorption was easily seen." The Scatophaga was seated on a Heracleum flower in a garden at Ipswich.
Dolichopodidae and Anthomyidae.—The single record of a victim captured by a species of each of these families will I trust be of value in calling the attention of naturalists to the fact that these flies are predaceous, and that specially directed observation will surely yield the material upon which to base a sound conclusion.

Cordyluridae.—The fact that flies of the genus Scatophaga are predaceous is fairly well known, although the extent of their attacks is probably insufficiently recognized. We here find 10 records as the result of the observations of five observers in several very different British localities. The prey is remarkably scattered through varied Dipterous groups, as will be seen at a glance in the following table:—

**The Prey of Scatophaga.**

<table>
<thead>
<tr>
<th>Hymenoptera</th>
<th>Tenthredinidae</th>
<th>Scatophaga arctica</th>
<th>Scatophaga lutaria</th>
<th>Scatophaga auriculata</th>
<th>Scatophaga aeronavaria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diptera</td>
<td>Mycetophilidae</td>
<td></td>
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<tr>
<td></td>
<td>Bibionidae</td>
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<td>Syrphidae</td>
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<tr>
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<td>Dexinae</td>
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</table>

* Mr. G. H. Verrall informs me that all the Dolichopodidae are predaceous. Only one sub-family of the Anthomyidae is predaceous, namely, the Cenostinae which are closely allied to the Cordyluridae.
The predaceous habits of the *Cordyluridae* were well known to Messrs. Kirby and Spence:

“Even *Scatophaga stercoraria* and *seychalaria*, and probably many others of the same tribe, feed upon small flies, though their proboscis does not seem so well adapted for animal as for vegetable food.” *

The sexes of the captors are seen to be nearly evenly divided in the only record that is fairly complete; that of *S. stercoraria*. It is certainly remarkable that each of the 7 victims of this species should belong to a different family or sub-family of Diptera. The surprising example of a Tenthredinid victim (of *merdaria*) is of much interest, and prepares us for a wide variety of insect diet when naturalists have seriously turned their attention to the habits of the genus *Scatophaga*.

*Ochromyia jejuna*, F., Nos. 304–308.

The *Muscinae* are not admitted among predaceous Diptera, the structure of the mouth-part being different from that in flies which attack and kill other insects. It is therefore of the utmost importance that any evidence which is held to prove the contrary opinion should be tested and sifted with far more than ordinary care.

During the past summer (of 1906) I received through the kindness of Mr. E. Ernest Green, a female example (304) of the abundant fly *Ochromyia jejuna*, together with a winged termite identified by Mr. W. F. Kirby as *Termes taprobanes*, Hg. The insects had been taken at Wellawaya, Ceylon, in November 1905, and Mr. Green described the termite as the prey of the Muscid. The observation is recorded in “Spolia Zeylanica” (see the number following date of capture). Colonel Yerbury, who determined the fly, was decidedly of the opinion that the observation was erroneous. I therefore wrote again to Mr. Green, and received the following reply:—“*Peiridcnyia*, Ceylon, July 17, 1906. The circumstances were as follows. I was personally working my moth-trap, which consists of a powerful acetylene lamp throwing its light on to a white cotton screen. Immediately after lighting up, the screen was covered with a crawling mass of winged termites. While watching these, I noticed the flies actually pouncing

upon the termites. They did not attempt to carry them away, but fastened themselves on to the dorsum of the abdomen of each termite. There must have been some fifteen or twenty termites, each with its attendant fly. I very much regret that I did not bottle any of the couples alive and watch the subsequent proceedings. Instead of that I put them all into my poison bottle. Should the opportunity again occur, I shall pay closer attention to the actions of the fly. I think that the note in 'Journ. Bombay Nat. Hist.' (vol. xvi, No. 4, p. 747), to which I have already referred you, is a strong corroboration of the supposed fact, though we do not know for certain that the Indian fly was the same species as my Ceylon insect. I am writing to ask if specimens can be obtained for comparison."

In a few days Mr. Green obtained four of the specimens (305–308) referred to, and forwarded them to me, with the following letter:—"Pseudomyia, Ceylon, Aug. 2, 1906. I am now able to send you some of the actual specimens that were the subject of the note in 'Journ. Bomb. Nat. Hist. Soc.' (vol. xvi, No. 4, p. 747). They have been received from the Secretary of the Society. They appear to be identical with or very closely allied to the flies taken by myself under similar circumstances, in Ceylon. These Indian flies are said to have been seen actually hawking the termites—on the wing. I think this is another sound link in the chain of evidence! I remember noticing particularly that the flies invariably attacked the abdominal part of the termite,—where the chitinous derm is thinner and softer than on the thorax."

The four specimens are all females of Ochromyia jejuna. They were captured by Capt. K. E. Nangle, 96th Berar Infantry, at Tarbund, Secunderabad, on July 17, 1905. Captain Nangle's note in the "Journ. Bomb. Nat. Hist. Soc." (vol. xvi, 1905, p. 747) is as follows:—"Last night after heavy rain there was a large flight of flying ants at about 9.30 p.m. After the swarm appeared we heard a loud humming noise and went out into the verandah to see what it was and found these flies in swarms. We at first thought from the noise, until we caught some, that it was bees swarming, although it was so late at night. We found these flies were hunting the flying ants, regularly hawking at them in the air. When a fly seized an ant it proceeded to devour the soft hind quarters."
"This swarm was noted all over our quarters: every house our Officers were present in at that time reported them."

"We none of us have ever come across a case like this during our service in the country. . . ."

Colonel Yerbury believes, from his knowledge of the fly, that it is erroneous to suppose that it actually hunts and kills living termites. He has written to me as follows upon the subject:—"Oct. 11, 1906. With reference to the Ochromyia jejuna question I can only reiterate my opinion that it is absolutely impossible for this fly to kill anything. All Muscidæ will go to moisture, and as winged termites come to grief in many ways, doubtless many a crushed termite attracts a muscid. The tongue of O. jejuna and O. juscipennis is an extraordinary organ, but it is not that of a predaceous fly but more closely resembles that of Glossina without the piercing tip which the Tsetse flies possess. Possibly this is the explanation of my observation* in Ceylon of these flies taking away grains of sugar from large ants (Lobopelta and Camponotus), i.e. that the tongue acts as a suction pump—so when it is a case of 'pull devil, pull baker' between the fly and the ant the former gets the best of it."

If the opportunity should occur again, it is to be hoped that the flies may be subjected to a most minute and critical observation, in which special attention is directed to the tongue. If such examination should prove that Ochromyia is undoubtedly predaceous, we should be driven to suppose that the tongue contains some piercing instrument, undiscovered and concealed, or that the thin body-walls of the termite are penetrated by suction alone. The statement of these alternatives may serve as some slight guide to future observations.


The preceding examples of predaceous Diptera have been confined to the perfect insect; but as the material for the present Memoir accumulated, I received an instance of

* Colonel Yerbury tells me that he observed this on the verandah of the Rest House, Kanthalai, Oct. 19, 1890.
a predaceous Dipterous larva of such special interest that I determined to include it.

Dr. T. A. Chapman ("Ent. Mo. Mag." 1905, pp. 150, 151; 1906, pp. 14-16) has observed the larva of *Xanthandrus comtus* feeding upon Tortricid larvae, but only upon such as are gregarious or at any rate numerous upon their food plant. *Hastula hyerana* fulfilled this condition at Hyères, *Acroclita consequana* in Sicily, and a larva, probably of *Ancyhs derasana* in the Alps: in all these cases Dr. Chapman found the larva of the Syrphid feeding upon that of the Tortricid. In Sicily *H. hyerana* occurred singly, and the Syrphid was not found attacking it. Dr. Chapman concludes from these instances that "*X. comtus* feeds especially on the larvæ of Tortrices when there are many on a plant," while "the isolation of the individual larvæ" renders them "an unsuitable prey for this parasite." The Syrphid larva would in fact "perish when it had destroyed its solitary prey and could find no others."

It is of the highest interest therefore to establish the fact, as Mr. G. T. Lyle of Brockenhurst has now done, that the larva of this species is found attacking single Lepidopterous larvae when they are large enough to provide sufficient food.

In August 1903 Mr. Lyle found the full-fed Syrphid larva inside the shelter (constructed of sallow leaves loosely spun together) of the larva of the Geometrid moth, *Scotosia undulata*. Nothing remained of the latter except the dry and empty skin. The Syrphid larva was of a bright apple-green colour with darker markings. In September 1903 the perfect insect emerged. The specimen, together with the empty globular puparium,* was presented to the Hope Department by Mr. W. J. Lucas to whom Mr. Lyle had given it. The fly, a male (309), was kindly identified for me by Col. J. W. Yerbury.

Putting together Dr. Chapman's and Mr. Lyle's observations, there is reason for the opinion that the female Syrphid is instinctively led to deposit her eggs where there are either many minute larvæ or single larvæ of sufficient size. The adaptation to two different conditions under either of which sufficient food may be provided is of much interest, and it is to be hoped that further observations will be directed to the subject, so that

conclusions which at present seem to be justified may be confirmed or modified.*

The instincts of certain moths with phytophagous larvae do not seem to be equally perfect. I have often observed, and every student of Lepidoptera must have noticed, that the large solitary larvae of *Sphingidae* are far more frequently found upon small bushes of their food-plant than upon large ones. It appeared to me that the explanation was to be found in the instincts of the parent moth leading her to deposit two or three eggs on each bush or tree, irrespective of size. If this were the case, the larvae would of course be much easier to find and their effect upon the food-plant far more conspicuous upon the smallest bushes. However this may be, the parental instinct is certainly liable to error, for such large larvae may occasionally be found still immature upon a bush so small that it has been completely denuded of its leaves.

II. NEUROPTERA.

Records of the attacks of predaceous insects are very scanty in all Orders except the Diptera and Fossorial Hymenoptera. It is hoped, however, that the following brief tabular statements will draw attention to the great need for a large body of accurate observations.

Leaving the Hymenoptera to form Part II of this Memoir, because of the voluminous literature and the fact that Fossors are predaceous in a somewhat peculiar and special sense, the remaining Orders are arranged in a succession determined by the number of records. The Neuroptera follow the Diptera, because the list of examples, although short, is longer than that of any except the two chief Orders.

* Compare Professor A. Giard's observation that the larvae of *Melanostoma mellinum* L., generally supposed to feed upon Aphides, can be reared upon *Musca domestica* and *Chortophila pusilla* (Bull. Soc. Ent. Fr. 1896, p. 234). Quoted in Verrall's British Flies, p. 303 (bottom line) and p. 311 (lines 12-17).
<table>
<thead>
<tr>
<th>Species of Odonata</th>
<th>Species of Prey</th>
<th>Locality and Date</th>
<th>Observer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SPECIES OF ODONATA.</strong></td>
<td><strong>SPECIES OF PREY.</strong></td>
<td><strong>LOCALITY AND DATE.</strong></td>
<td><strong>OBSERVER.</strong></td>
</tr>
<tr>
<td>-------------------------</td>
<td>---------------------</td>
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</tr>
</tbody>
</table>
In addition to the above records W. L. Distant quotes the observation, made at Candahar, that Cicadas formed the prey of Dragonflies.*

Looking at the above list the most striking fact is the great variety of the prey and the marked inclusion of specially protected forms. The latter are as follows:—Limnas chrysippus, two common wasps (2 species) and three beetles belonging to distasteful groups, a Malacoderm, a Coccinellid, and a Galerucid. Thus specially protected species make up more than one-third of the 16 recorded captures, and include the whole of the Coleopterous victims. It is also of much interest to observe that a single species of Dragonfly, Cordulegaster annulatus, was responsible for both the wasps (Nos. 312, 315), and the Malacoderm (No. 314). The remaining victim of this species was a Tabanid fly (No. 313.)

As regards the ten species of prey which do not appear to belong to specially protected groups, we find 3 Diptera (1 Syrphid, 1 Tabanid, and 1 Mu-cid), 3 Lepidoptera (1 ? Lycænid, 1 Hesperid, and 1 Crambid), 4 Neuroptera (1 Ephemerid, 2 Odonata, and a Termite). Of the latter three specimens are only counted as one, inasmuch as the actual attack on these three victims was not witnessed and the number of individual foes is therefore unknown. Many Dragonflies, flying high, were seen attacking large numbers of Termites. It was of course impossible to determine whether these particular Termites had been seized by one, two, or three of their enemies.

The inclusion of 2 Dragonflies (Nos. 311, 316) among the prey shows that the attacks of Odonates, as in the case of so many other predaceous insects, do not altogether tend to the destruction of insect life; for here the predaceous forms themselves are the victims. The same considerations are suggested by the two species of Vespa devoured by Cordulegaster annulatus.

Short as it is, the list is extremely interesting, and raises the expectation that Dragonflies will be found to prey rather largely upon specially defended groups of insects.

### B. THE PREY OF PANORPIDAE (SCORPION-FLIES).

<table>
<thead>
<tr>
<th>Species of Panorpidae</th>
<th>Species of Prey</th>
<th>Locality and Date</th>
<th>Observer</th>
</tr>
</thead>
<tbody>
<tr>
<td>325. <em>Panorpa meridionalis</em>, Ramb., ♀♀♀ ♀♀♀ Viz. 3 out of about 18 specimens. In Hope Dep.</td>
<td>All surrounding a dead worm: about half were sucking it and none more than 6 inches distant from it.</td>
<td>Near Gimmelwald, on the road to Mürrren, Bernese Oberland. July 12, 1898.</td>
<td>E.B. Poulton; confirmed by Mrs. Poulton and Miss Cora B. Sanders, F.L.S.</td>
</tr>
</tbody>
</table>

*330. The specimens, of which Mr. E. E. Green sent two and has retained others, were observed to be capturing and devouring small moths attracted by the light of a powerful acetylene lamp. The prey was caught and held with the third pair of legs. A note of the observation is published in "Spolia Zeylanica" (see the number following date of capture). Mr. W. F. Kirby informs me that at least up to 1892 and probably up to the present time, no example of the *Bittacidae* has been recorded from Ceylon. Two species are known from India, viz., *Harpobittacus indicus*, Walk., and *Bittaca latipennis*, Guér.; and one from Shanghai:—*B. sinensis*, Walk. Mr. E. E. Green's specimens appear to be indistinguishable from the first-named which is known to occur in S. India.*
In addition to the above records Kirby and Spence quote Lyonnet's observation of a *Panorpa* attacking a Dragonfly many times its size.*

This brief list of the attacks made by *Panorpidae* contains facts of much interest. The crowd surrounding a dead worm (No. 325) seems to prove beyond doubt that the Panorpas had been attracted by smell. The insects had congregated round the worm in a sheltered position on a roadside bank. The Telephorid victim (No. 329) is a striking example of specially protected prey; while the Empid (No. 328) and the Dragonfly recorded by Lyonnet show that predaceous insects are attacked as well as others. It must be borne in mind however that the first record (No. 325) strongly suggests, although it does not prove, that these insects devour dead prey. The record of actual capture and the condition of the victim become therefore of special interest and importance in the *Panorpidae*.

III. HEMIPTERA.

Considering the immense number of predaceous species included in the Hemiptera the following table is insignificant. I trust however that it may lead to abundant future observations on which trustworthy conclusions may be based.

So far as it is possible to judge from the following table it appears that Hemiptera will prove to be extremely dangerous foes to the specially protected groups. Thus out of 15 victims, we find 3 Lepidopterous larvæ (Nos. 331, 333, 337) all probably defended by special qualities; 2 stinging Hymenoptera (Nos. 335, 338); 2 Phytophagous beetles (Nos. 332, 345) and a Cetoniid (No. 334); 2 Hemiptera (Nos. 341, 342);—altogether no less than two-thirds of the total records. The remaining five examples include a Lycænid butterfly, 2 Longicorn beetles of one species, and 2 Diptera. Even among these the conspicuous colouring of the beetle suggests the probability of special defence.

THE PREY OF HEMIPTERA.

<table>
<thead>
<tr>
<th>SPECIES OF HEMIPTERON.</th>
<th>SPECIES OF PREY.</th>
<th>LOCALITY AND DATE.</th>
<th>OBSERVER.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PENTATOMIDÆ.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pentatomid in Hope Dep.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>REDUVIDÆ.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* 333. The captor with its prey was beaten off oak. Undisturbed by the shock the bug was still sucking the caterpillar when it fell into the beating-tray, and continued to do so for an hour, by which time its victim appeared to be quite faceted. Mr. Lyle informs me that he has commonly observed such Hemipterous larvae devouring caterpillars in the New Forest, but that he has never seen one before with prey of so large a size.

† 334. Twice observed as the victim of the much smaller and less active bug. Belt suggests that the Pentatomid inserts its probosces and poisons the beetle while sleeping. W. L. Distant quotes Belt’s observation and points out that the correct name of the Pentatomid is Euthyrhynchus floridanus (Biol. Centr. Am. Rhynch. Het., vol. i, 1880-1893, p. 42.)
<table>
<thead>
<tr>
<th>No.</th>
<th>Insect</th>
<th>Location</th>
<th>Date</th>
<th>Observer</th>
</tr>
</thead>
<tbody>
<tr>
<td>337</td>
<td>Harpactor iracundus, Scop., ♀.</td>
<td>In Hope Dep.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>338</td>
<td>Harpactor iracundus, Scop., ♀.</td>
<td>In Hope Dep.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>339</td>
<td>Harpactor iracundus, Scop., ♀.</td>
<td>In Hope Dep.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>340</td>
<td>Harpactor erythrops, L., ♀.</td>
<td>In Hope Dep.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>341</td>
<td>Coranus subapterus, De G.</td>
<td>In Coll. C. Morley</td>
<td></td>
<td></td>
</tr>
<tr>
<td>343</td>
<td>Nabis limbatus, Dahlb., ♀.</td>
<td>In Hope Dep.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>344</td>
<td>A larva.</td>
<td>In Hope Dep.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>345</td>
<td>Notonecta glauca, L.</td>
<td>Specimen uncaptured</td>
<td></td>
<td></td>
</tr>
<tr>
<td>337.</td>
<td>The larva of the Noctuid moth, Cucul×nia lychnitis, Ramb.</td>
<td>La Granja, Spain, about 4000 ft. July 22, 1902.</td>
<td></td>
<td>Monsieur Chretien.</td>
</tr>
</tbody>
</table>
IV. ORTHOPTERA.

Although the predaceous Orthoptera are so well known to all naturalists who have visited the tropics, I have been able to find very few precise records of their attacks in the wild state. I do not of course include in this Memoir any of the results obtained by experiments, a fine series of which, conducted by Mr. G. A. K. Marshall, upon Mantidae, will be found recorded in Trans. Ent. Soc. Lond. 1902, pp. 297–315; 316–319. As a matter of fact I have not been able to find so many exact observations upon the predaceous habits of the Mantidae as upon those of the Locustidae, a group often assumed to be entirely plant-eating.

The meagre records of predaceous Orthoptera are set forth below in a tabular form.

### THE PREY OF MANTIDÆ AND LOCUSTIDÆ.

<table>
<thead>
<tr>
<th>SPECIES OF ORTHOPTERA</th>
<th>SPECIES OF PREY</th>
<th>LOCALITY AND DATE</th>
<th>OBSERVER</th>
</tr>
</thead>
<tbody>
<tr>
<td>MANTIDÆ.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>347. Gongylus gongyloides, L. Specimens uncaptured.</td>
<td>The Pierine butterflies, Delias eucharis, Drury (several times); and Belenois mesentina, Cr.; and the Hesperid (Skipper), Haseura alexis, F.</td>
<td>On flowers of Duranta sp., Trinkomali, Ceylon. 1890–1891</td>
<td>J. W. Yerbury</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Acroleine butterfly, *Aceria hortula*, L., ♂. The Mantis ate the abdomen and a little of the thorax and then threw the butterfly away.


**LOCUSTIDAE.**

In Hope Dep.

The larva of the Danaeine butterfly, *Limnas chryseps*, L.


351. *Hemisaga predatory*, Dist.

The Danaeine butterfly, *Limnas chryseps*, L.


In Hope Dep.

A Noctuid moth, almost certainly *Caradina ambigua*, F., ♀. Abdomen, right hind-wing and third legs only.


The Noctuid Moth, *Xylophasia polyodon*, L.


354. A Locustid about the size of *L. viridissima*. Specimens uncaptured.

The Acridian (grasshopper), *Gomphocerus sibiricus*, L., var.

Nr. Weisshorn Hotel, above Vissoye, Val d'Anniviers, Switzerland, 7690 ft. Aug.–Sept., 1895. E. B. Poulton. Trans. 1902, p. 329, where the prey is unnamed.

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*353. Mr. G. T. Porritt has kindly supplied me with further details. He writes, Oct. 31, 1906:— "Just as I threw the light of the lantern on the post, the polyodon came up, and was at once seized, to my great astonishment, as up to then I had regarded these Locustids as strict vegetarians! Scores of times since then I have seen these Orthoptera in such situations on the South Devon coast as well as at Deal, but, as it is comparatively rarely that a moth will sit on the sugar under the glare of a lamp, I have not again seen one devoured in this way. The fact that *L. viridissima* does visit posts for such purposes is well known and has been seen over and over again by those who sugar the sandhills regularly. I alluded in my paper on *Melanism* [Sec. D., Brit. Assoc., 1900] to this Locustid occurring in very large quantities on the thistle-heads on a marshy part of the Deal sandhills, last year (1905). I have no doubt that this was with the same object of obtaining food. I have seen them in the same way on nettles. The flowers of both these plants are very attractive to moths at times, and I am convinced that this is one of the ordinary methods of *L. viridissima* for obtaining its food." [See also No. 392.]"
In addition to the above, Mr. W. L. Distant draws attention to the records of Cicadas attacked by species of *Mantis* at Delagoa Bay and in the Transvaal.*

Although the evidence is so inadequate, it presents indications that conclusions of much value will be reached by extended observations. In the first place, the whole of the victims except one were Lepidopterous. In the second place, the proportion of specially protected forms was very high. Thus a *Delias* was attacked twice, an *Aenescia* once, *Limnas chrysipus* once in the imaginal and once in the larval state. In respect of the attacks on such forms no distinction can be drawn between the *Mantidae* and the *Locustidae*. We are led to believe that the predaceous Orthoptera are important foes of those Lepidoptera that are specially defended from vertebrate insect-eaters.

V. COLEOPTERA.

The following brief list is chiefly useful in drawing marked attention to the urgent need for observations with full and accurate data. The experiments of Professor F. Plateau (Mém. Soc. Zool. Fr. t. vii, p. 375, § 9; see also Trans. Ent. Soc. Lond. 1902, p. 330) suggest that predaceous beetles are probably important foes of specially protected insects. These experiments are not quoted on the present occasion inasmuch as the Coleoptera were fed in confinement. The present Memoir deals only with the prey selected by predaceous forms in the wild state.

It must be remembered that beetles are frequently scavengers rather than truly predaceous. Thus the observation of an actual capture becomes of especial value. In the following list the two flies had certainly fallen into the water, and No. 357 may have been drowned before it was seized. The *Agabus*, No. 356, and Elaterid, No. 362, were certainly attacking living prey.

<table>
<thead>
<tr>
<th>CICINDELIDÆ.</th>
<th>DYTISCIDÆ.</th>
<th>GYRINIDÆ.</th>
<th>STAPHYLINIDÆ.</th>
<th>HISTERIDÆ.</th>
<th>LATHRIDIDÆ.</th>
<th>ELATERIDÆ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>The Cicada, Callipsalta longula, Stål.</td>
<td>The living Empid fly, Empis tessellata, F., ♀. The fly was also being eaten by another A. chalconotus which escaped.</td>
<td>The Cordylurid fly, Scatophaga merdaria, F.</td>
<td>The Carabid beetle (Ground-beetle), Pterostichus madidus, F.</td>
<td>The Coprid beetle, Onitis alexis, Klug: far larger than its captor.</td>
<td>Aphodid beetles.</td>
<td>A Thrips (Thysanoptera), perhaps Coleothrips fasciata, L.</td>
</tr>
</tbody>
</table>

* 357. The fact that Gyrinus is predaceous was known to Kirby and Spence. Thus we read in the 5th Ed. 1828, Vol. I, pp. 271, 272: "Most of the aquatic beetles, at least the Gyrini and Dytiscæ, prey upon other insects both in their first and final state."

† 358. The head of the Pterostichus is still projecting from the mouth of the Ocyopus as though the prey had been swallowed entire. It is however probable that the appearance is deceptive and that the Carabid was devoured piecemeal, the head last.
XVII. Notes on the dominant Müllerian group of Butterflies from the Potaro District of British Guiana. By William J. Kaye, F.E.S.

[Read October 3rd, 1906.]

Plates XXIII—XXVII

At the request of Prof. E. B. Poulton I have undertaken to give some account of the Bionomics of British Guiana insects, especially of the Lepidoptera. The long and interesting paper by Mr. G. A. K. Marshall in the Transactions for 1902 has also impressed one that perhaps similar notes from another continent, though in no sense so full and complete, might not only prove of interest but perhaps of value in clearing up some debatable points. For the most part deductions have been made in the present case from the accumulation of specimens and no such experiments as recorded by Mr. Marshall can be given. Dates and conditions of capture have been recorded, and in many instances I am able to give my own observations on the specimens in Nature. Furthermore my collector, Mr. C. B. Roberts, who has been the whole time on the same ground, is able to supply many facts which are of value. It is a little unfortunate that he is not a trained naturalist or his notes might have been much fuller and more complete. The specimens that he has captured are however taken all together so remarkable that the bare list of what has occurred in one particular forest-path, would probably be thought sufficiently interesting. Besides this particular district—a forest road stretching for 16 miles back from the Potaro river about 30 miles above its confluence with the Essequibo—I personally in March, April, May, and early June in 1901, collected in many other districts, but I propose to deal chiefly if not exclusively with the joint captures by Mr. C. B. Roberts and myself made on the Potaro road. The road is more or less a winding track varying from 12 to 15 or even 20 feet wide and is in places on sandy soil, in others gravel, and is crossed with "corduroy" * for a great part of its length, while a small part is built up with the natural gravel. On either side it

* "Corduroy" is the term employed for a road made similarly to a railway track, i.e. with the small trunks of trees split in half and laid close together with the flat side downwards.

TRANS. ENT. SOC. LOND. 1906.—PART III. (JAN. 1907)
is flanked throughout its entire length with heavy forest containing greenheart, wallaba, and mora, besides a vast number of other less known trees.

The forest itself is dark and gloomy and throughout the greater part of the year excessively damp owing to a superabundant rainfall. The character of the vegetation is always the same as even in the dry season the trees are never otherwise than a fresh green. It is not surprising therefore that practically the whole of the Lepidoptera, excepting of course the several species of *Morpho*, present a very uniform sombre tone of coloration. Even the very fine and brightly-coloured *Heliconius catharinae*, *Heliconius astydamia* and *Heliconius egeria* do not strike one in their surroundings as particularly gaudy, and one is bound largely to admit the assertion of A. H. Thayer in his memoir in Trans. Ent. Soc. 1903, p. 553, that many species we call conspicuous are not really so in their surroundings. It must however have been quite impossible for Nature to have, evolved such minutely close resemblance in unrelated groups without the aid of Müllerian mimicry. It is impossible to imagine that say an Erycinid butterfly *Esthemopsis sericina*, should have arrived at the identical colour and markings of a Syntomid moth *Agyrta micilia* purely and simply by the process of syncryptic selection. It is the minutest details in the coloration that dispel such a probability: moreover in certain cases, as Prof. E. B. Poulton has cited, I could definitely state that butterflies settled on most “unsuitable” flowers for their protection. A good example is found in the *Lycoracea*, *Melinacea*, *Heliconius* group that frequents the white flowers of the plant *Eupatorium macrophyllum*. This becomes a most valuable piece of evidence, as the species frequenting these flowers form one of the most extensive of all the groups that we are in the habit of calling Müllerian. Although this *Lycoracea*, *Melinacea*, *Heliconius*, etc., group is by far the largest and most dominant, there are many other groups in the region: in fact the vast majority of the individuals belong to one or other of a “coterie” of similarly coloured species. In the *Hesperidæ* there are one or two conspicuous examples of synaposematic coloration, and the *Erycinidæ* offer some examples, and it is only in the *Lycaenidæ* that there appears to be an absence of it; this bears out exactly what Prof. Poulton said in the Trans. Ent. Soc. 1902, p. 500. It should however be
noted that the Lycaenids here are all very uniformly of a blue shade of colour, and doubtless amongst themselves they offer protection in some sort of way.

By far the most numerous, conspicuous and characteristic group of butterflies is the large Ithomiine, Lycoreane, and Heliconine group. The number of individuals contained within this series, certainly more than equals all the other butterflies to be found in most of the months of the year and probably in every month. This group is composed of the following species in their respective Families and Subfamilies:

Family NYMPHALIDÆ.

Subfamily ITHOMIINÆ.

Genus MELINÆA.

1. Melinae mneme, Linn.
2. Melinae crameri, God. and Salv.
3. Melinae egina, Cram.

Genus MECHANITIS.

1. Mechanitis panniferà, Butl.
2. Mechanitis polynia, Linn.

Genus CERATINIA.

1. Ceratinia philidas, God. and Salv.
2. Ceratinia euclea,* Godt.

Subfamily HELICONINÆ.

Genus HELICONIUS.

1. Heliconius numata, Cram.
2. Heliconius vetustus, Butl.
3. Heliconius sylvana, Cram.
4. Heliconius eucoma,† Hüb.

Genus EUEIDES.

1. Eueides nigrofulva, Kaye.
2. Eueides isabella, Cram.
3. Eueides vibilia, Godt.

Subfamily NYMPHALINÆ.

Genus ERESIA.

1. Eresia eunice.‡

* The more transparent Ceratinia species, C. harii and C. vallonii, do not strictly belong to this association.
† 1 ab. of H. numata.
‡ Accidentally omitted from text.
Family DANAIDÆ.
Subfamily LYCOREANÆ.
Genus LYCOREA.

1. Lycorea ceres, Cram.
2. Lycorea pasinuntia, Cram.

Family ERYCINIDÆ.
Subfamily LEMONIINÆ.
Genus STALACTIS.

1. Stalachtis calliope, Linn.

Supplementary species belonging to the group but occurring in other localities and not yet detected from the Potaro:—

Family NYMPHALIDÆ.
Subfamily ITHOMIINÆ.

Subfamily NYMPHALINÆ.
Protagonius hippona, Fab. (true).

Family PIERIDÆ.

Dismorphia amphione.

Of all these there is no doubt whatever that the several species of Melinwa are the models to which all the other species are converging. Melinwa mneme at the present time occurs in prodigious numbers. From March to May and from September to December inclusive (these approximating to the two dry seasons), it is almost invariably to be found sitting upon the white flowers of Eupatorium macrophyllum wherever that plant is found growing. In much lesser numbers Melinwa crameri is to be found. Melinwa egina is rather more plentiful than M. crameri, yet a very long way from being as common as M. mneme. Of the fourth Melinwa there is little to be recorded; it is a single straggler that was taken on March 17th, 1905, and is either Melinwa mnasius or a closely
allied undescribed species. There must be much speculation as to whether *M. mneme* or *M. crameri* commenced to draw the many other species to them in coloration and pattern. *Melinnea mneme* is a strong variant in both fore- and hind-wings while *M. crameri* is very constant above and only as a very rare aberration is a form found with the black of the hind-wing divided by the ground color so as to form a band. On the under-side, however, there is considerably more variation. The latter species, owing to its comparative constancy, must be looked upon as older than *M. mneme*, a very variable and apparently unstable species. It is however certain that if *M. crameri* was first in the field, *M. mneme* must have entered soon after, for many of the associated species of other genera follow *M. mneme* to a greater extent than *M. crameri*.

In fact *M. mneme* must have been far more potent than *M. crameri*, and the strong variability must have been a great factor in drawing so many different species to the association. Of *M. egina* there is every reason to suppose that it became a fixed and well-defined species early in the history of the group, for we find only one other species closely following it, and that also is a usually very constant species, *Heliconius silvana*. It should here be mentioned however that two specimens of *Heliconius* have been caught, one in March 1905, the other without date, which appear to be aberrations of *H. silvana* with a distinct transverse black band to the hind-wing. These undoubtedly point to a not very distant genetic relationship with *Heliconius numata*.

Unquestionably the closest "pairs" are the *Melinnea* with *Heliconius* species. *Mechanitis* follows them very closely with *Lycorea* also. While *Eueides*, *Ceratinia* and *Stalactis*, in the order named, diverge more and more from the protected pattern. The identical pattern and color in some of the forms of *Heliconius numata* to *M. mneme* is remarkable, as in the Potaro district the *Heliconius* is apparently never abundant, rarely even really common. I have only 32 specimens, and this represents the whole take. The series is most remarkable for the very extensive variation, some having a narrowly barred hind-wing, others having almost the whole of the hind-wing black except for the costal portion. The *Lycoreas* are certainly more abundant, while the *Mechanitis* species, both *pannifera* and *polymnia*, occur in large numbers. Of
the *Eueides* species the new *E. nigrofulva* has turned up twenty-four times to the twice only of the usually common *E. isabellae*. *Ceratinia philidas* is probably only just beginning to be influenced by the group generally, and comparatively few specimens have been taken, in fact one only from the district proper.

The following table will show at a glance the adherents to each *Melinnea*, though doubtless the stress is a very complicated one, and inclined to form a general uniform pattern in the long run, rather than four.

The numbers under each species show the numerical quantity, actual or estimated.

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>ceres</td>
<td>mneme</td>
<td>numata</td>
<td>pannifera</td>
<td>nigrofulva</td>
<td>philidas</td>
<td>calliope</td>
</tr>
<tr>
<td>30</td>
<td>33</td>
<td>80</td>
<td>24</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>pasiminita</td>
<td>40</td>
<td>8</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>70</td>
<td>1</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>400</td>
<td></td>
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</tr>
</tbody>
</table>

Some of the above large numbers are estimated only. A trained collector might have detected many more specimens of some of the apparently rare species.

The result of a single day's catch recorded by Professor E. B. Poulton, p. liv-lvi, Trans. Ent. Soc. 1903, fairly well upholds the proportion of the various species. Mr. Roberts has been collecting for me for over four years, and my own three months brings the period up to four and a half years, so it must now be tolerably certain that we know all the species of the group and approximately the proportion of each one to one another.

This is a matter of very great interest, and it shows how the *Ceratinia* may obtain protection doubly—(1) when fresh by conforming to the main group, and (2) when it is worn and of a different appearance by being then mistaken for one of another group of species, a group composed of species of *Nupreogenes, Ceratinia* and *Saís*, etc.

Although *Melinnea mneme* is nearly always present when

* Collector stopped catching this species. He could doubtless have taken several thousand.

† See under *Ceratinia*, p. 421.
a collection of these brown and black insects is found on
the Eupatorium flowers, it is not so invariably. On May
14th, 1901, I remember being disappointed (from the
collector's point of view), in coming upon a bush where
there were only Mechanitis polymnia and Ceratinia euclea
(C. philidas and C. bendis) present. Such a case as this
clearly shows the value it is to these members to have
been brought into harmony with the colours of the
dominant Melinæa mneme. As although these species are
only commencing to conform to the main colouring of the
model they are able even among themselves to alight on
these flowers and be comparatively immune from danger.
It would have been interesting had every specimen of
Melinæa mneme been retained to see the accurate propor-
tions of the different forms. I have actually kept 70 set
specimens, and these are divided up as follows:—

Melinæa mneme.

| Hind-wing distinctly banded | 40 = 57 % | Upper-side and |
| Hind-wing obscurely banded  | 22 = 31½ % | Under-side |
| Hind-wing with band obliterated | 8 = 11½ % |

Thus only 1 in 9 is heavily black, and this I have more
than once verified to be the approximate percentage.

A further interesting phase of variation is the presence
or absence of the red marks just before the yellow apical
band on fore-wing. The specimens give these figures:—

<table>
<thead>
<tr>
<th>UPPER-SIDE.</th>
<th>UNDER-SIDE.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fore-wing with large red spots or band before yellow apical band</td>
<td>12 = 17%</td>
</tr>
<tr>
<td>Fore-wing with faint or greatly suffused spots</td>
<td>40 = 57%</td>
</tr>
<tr>
<td>Fore-wing with red spots, band obliterated, or nearly so</td>
<td>18 = 26%</td>
</tr>
</tbody>
</table>

These comparative figures are of great interest, as
although this species is so dominant in point of numbers,
the influence it exerts with its dark forms is very small
indeed compared with that of its banded forms. It there-
fore becomes tolerably clear that the allied Melinæa,—
crameri—which, although not nearly such a common
species, but has a very constant black pattern, must
have acted very strongly to create the powerful darkening
tendency in the hind-wing.
Mr. W. J. Kaye's Notes on the dominant Müllerian *Melania crameri.*

Of the 28 specimens retained of this species there are the following proportions with regard to the dark area in the hind-wing:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hind-wing without a band</td>
<td>27 = 96 %</td>
<td>21 = 75 %</td>
</tr>
<tr>
<td>Hind-wing with a band</td>
<td>1 = 4 %</td>
<td>7 = 25 %</td>
</tr>
<tr>
<td></td>
<td>28</td>
<td>28</td>
</tr>
</tbody>
</table>

The single specimen that shows a band above only shows it very indistinctly, but the seven that show banding beneath have it well defined, three of them show it particularly well, yet on the upper-side it is hardly discernible. A specimen in the Hope Collection at Oxford shows a very distinct band on the upper-side and this came from the same locality and was caught on August 28th, 1903. Seven other specimens were captured on the same day, but all of these were unbanded. It should be noted that this presence of a band on the under-side only, while the upper-side shows no sign of it is particularly instructive and interesting as it shows that selection on the wing and selection at rest are two different factors; moreover, as it will be shown later, the under-side shows more general agreement in the various members of the group taken as a whole.

The proportions of the spotted to non-spotted, with reddish, before the yellow apical band is most striking, especially when compared with the same on the under-side.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fore-wing with distinct red marks before yellow apical band</td>
<td>1 = 5 %</td>
<td>15* = 54 %</td>
</tr>
<tr>
<td>Fore-wing with faint red marks</td>
<td>1 = 5 %</td>
<td>13 = 46 %</td>
</tr>
<tr>
<td>Fore-wing without any red marks</td>
<td>26 = 90 %</td>
<td>0 = —</td>
</tr>
<tr>
<td></td>
<td>28</td>
<td>28</td>
</tr>
</tbody>
</table>

* These show the spots coalesced into a band.
It appears evident from the specimens that the banding of the hind-wing and the presence of the red marks before the apex of fore-wing go together. It is also significant that these specimens have been secured in one or other of the two dry seasons. My own specimen, with an indication of a band in the hind-wing, has also the red marks before apex and was taken on March 27th, 1905, the end of the short dry season. Professor E. B. Poulton's banded specimen has also red marks before apex and was taken on August 28th, 1903, the early part of the long dry season.

In view of the great interest attached to this species as to whether it is the centre of the association of the darkened hind-winged insects, it may be useful here to look at the range of the insect. From the limited material available it seems certainly to be most plentiful in British Guiana. It occurs in the Berbice district adjoining Surinam, and from the only two specimens seen from there one shows a tendency to banding above and strongly below, the other is normal, both have indications of red apical marks on upper-side and strongly developed beneath. Six specimens originally in the Godman and Salvin collection now at South Kensington are labelled Roraima. This must mean somewhere in the Roraima district and not the mountain itself, which is bare rock and out of the Forest region. None of these six are at all banded, either above or below, and only one shows any apical marks, and that is only weakly and on the underside. These six specimens are therefore interesting as suggesting a more extreme dark form away back in the interior of the country. A single specimen has the label "Bartica," a place 40 miles in from the mouth of the Essequibo, and I myself took it there, though only singly. The only locality outside of British Guiana that I have been able to discover is a specimen with a label "Colombia," which like the Roraima specimen is now in South Kensington, but originally in the Godman and Salvin collection. Were it not that all insects in the latter collection have been set up and labelled with the greatest care one would be inclined to discredit the locality. The specimen is a very interesting one. It is strongly banded below, and both above and below has exceptionally strong red apical marks.

Of the other two Melinia species there is little variation to record. Melinia egina is extremely constant on the

upper-side, but again on the under-side there is a most interesting minor piece of variation. It is that there are indications of the formation of a black patch in the centre of the wing by the presence of a long black streak between veins 6 and 7 extending inwards towards base of wing. From 32 specimens examined the following are the tabulated results:—

<table>
<thead>
<tr>
<th>Description</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under-side with black streak well developed</td>
<td>6 = 19 %</td>
</tr>
<tr>
<td>Under-side with black streak slightly developed</td>
<td>14 = 44 %</td>
</tr>
<tr>
<td>Under-side without black streak</td>
<td>12 = 37 %</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>32</strong></td>
</tr>
</tbody>
</table>

Thus no less than 63 % show some slight development towards the pattern of *Melinaea crameri* on the under-side.

The other *Melinaea, M. mnasias*, is only represented by a single specimen and is probably only a wanderer to the Potaro district, its home being further south on the Amazons. As a link with the *Ceratinias* it is extraordinarily close, and indeed when sitting with closed wings would be even passed over by a skilled collector, so alike is it to a large *Ceratinia euclea*.

*Mechanitis pannifera.*

This is a most variable species and is very common. The ♀ is apparently quite rare compared to the male as I find I have only three in a series of 56 examples. The likeness however of these females, and one in particular, to the darkest forms of *Melinaea mneme* is extraordinary, for not only is the pattern and marking so close but the greatly enlarged size give the insect a look much more in general like the *Melinaeas* than the smaller and narrower *Mechanitis* species.

The 56 specimens divide up as follows:—

<table>
<thead>
<tr>
<th>Description</th>
<th>UPPER-SIDE</th>
<th>UNDER-SIDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hind-wing with a well-defined band</td>
<td>6 = 10 %</td>
<td>18 = 32 %</td>
</tr>
<tr>
<td>Hind-wing with the band partly obscured</td>
<td>26 = 46 %</td>
<td>35 = 63 %</td>
</tr>
<tr>
<td>Hind-wing with the band wholly obscured</td>
<td>21 = 44 %</td>
<td>3 = 5 %</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>56</strong></td>
<td><strong>56</strong></td>
</tr>
</tbody>
</table>
It will be noticed there are only three examples exhibiting a wholly obscured band on the under-side. Two of these are of males and one a female. All three have the extreme dark upper-side as well. Those put in the "partly obscured" category are examples showing a great contraction of the fulvous band by an extension of the black inwards from the outer margin. It, again, in this species is evident that on the under-side a wholly black area is the exception and not the rule while on the upper-side nearly half (44%) the individuals are of the extreme black form. Again, looked at from another point of view there are no less than 95% showing some sort of banding on the under-side, while on the upper-side there are only 56%, and of these only 10% that are well banded.

Mechanitis polynamia.

This species, which in point of numbers comes next to Melinva mneme, is here as elsewhere a very constant one. I have estimated that at least 700 specimens have passed through my hands and I have detected only one example that showed any tendency towards a darkening of the hind-wing. This individual, a female, was taken on March 14th, 1905. On the upper-side the whole of the ground colour is darker and in the hind-wing the central black band and the black marginal band are considerably extended so that at the anal angle and near vein 5 these just meet. On the under-side of the hind-wing there is an even greater amount of black scaling. The costal band is increased in width in addition to the central and marginal bands, while the latter join at several points and between veins 4 and 5 completely coalesce.

There is a specimen that shows a very distinct yellow apical streak just as in the previous species M. pannifera but which is quite normal in the size of the band of the hind-wing. It also exhibits an almost complete suppression of the black mark between veins 2 and 3 of the fore-wing, and this also is a much more common phase of variation in the previous species.

Ceratinia species.

There yet remain the Ceratinia species, which although not very conspicuously within the group nevertheless link up certain other species of Napecogenes, Sais and Ceratinia.
These all group themselves together in a remarkable way, but it is not proposed here to deal with all of them. The Ceratinia which above all others conforms to the main group is Ceratinia philidas, G. and S. Whether this is a good species or a form of another is open to question. It becomes a matter of importance when one wishes to make a statement of its abundance or otherwise and its distribution through the different months of the year. C. philidas, G. and S., is in all probability only an aberrational form of C. ninonia, Hüb., and this again links up with intermediates to C. bendis, G. and S., and C. eulea, Godt. The species should therefore be called eulea, and all the different forms are merely aberrations on the Potaro. But the forms doubtless become fixed and definite in different localities. Thus at Roraima the philidas form seems predominant, but in Trinidad typical eulea occurs alone. C. ab. philidas is much more frequent in the ♀ sex. The genitalia of C. philidas look hardly different to C. ninonia, the former only having a longer clasper, but the genitalia of C. eulea and C. ninonia are the same. The very transparent look of some C. ninonia males is unquestionably due to wear, the scales brushing off in the way that the Hemarine Hawk Moths do. C. barri, Bates, is, however, a good species, and is always to be distinguished. Of undoubtedly C. philidas only seven specimens have been secured, but only one on the Potaro.* None of these show anything very different from the type which has the black central band not joined at any point with the black marginal band. It is of interest to note that the type specimen came from the Sierra de Sta Martha in Colombia. Although hitherto the Potaro district has not produced any very extreme forms there is no reason to suppose that they don't exist, as at Omai lower down the Essequibo some much darker forms have occurred, and I have a specimen from there with a black streak in the cell of the hind-wing and which has a much heavier and wider black central band. But in the National Museum at S. Kensington are two remarkable specimens labelled "Roraima," which have the whole of the lower half of the hind-wing black as in the dark Lycorea species and in Heliconius vetustus. Further evidence from Roraima supports that adduced from the Melinaxa crameri that probably there there is to be found a much darker association generally.

* The specimen mentioned on page 416.
**Heliconidæ.**

Having reviewed the whole of the *Ithomiinae* of the group one turns to the *Heliconidæ.* The members of this family form much the closest mimics, and the varied series of *Heliconius numata* makes a remarkable "pair" in all its forms to the equally variable *Melinaeæ mneeme.*

The association of all the *Heliconius* species within the group must be very ancient as there is never any great divergence from some one or other of the Melinaeæs. It is a remarkable fact that while there are many other differently coloured *Heliconius* species in the neighbourhood they are never (? absolute) found on the white blossoms of the Eupatorium.

Four species of *Heliconius* have occurred that belong to the group. It is possible that one of these, *H. eucoma,* is not distinct from *H. numata.* But it is just probable, if unlikely, that several of the supposed aberrations are really distinct. Thirty-three of what have been all called *H. numata* have occurred. These are tabulated as follows:

**HELCIONINÆ—Genus Heliconius.**

*Heliconius numata.*—Thirty-three specimens received in all.

<table>
<thead>
<tr>
<th>Description</th>
<th>Upper-Side.</th>
<th>Under-Side.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hind-wing narrowly banded black</td>
<td>3* = 9%</td>
<td>—</td>
</tr>
<tr>
<td>Hind-wing widely banded black</td>
<td>19 = 58%</td>
<td>—</td>
</tr>
<tr>
<td>Hind-wing with band almost submerged with outer margin</td>
<td>9 = 27%</td>
<td>—</td>
</tr>
<tr>
<td>Hind-wing with band totally submerged</td>
<td>2 = 6%</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>33</td>
<td>—</td>
</tr>
</tbody>
</table>

It will be seen that by far the largest percentage have the hind-wing very broadly (but very variably) black banded and that the extreme darkening is quite of rare occurrence, only 6% having been seen from the Potaro District. It is interesting to note that not a single

* One of these may prove to be a distinct species, having a much narrower wing and a much broader yellow post-median band.
one of the forms shows signs of forming the rounded shape of the black patch conforming to that of *Melinæa crameri*, yet I have six *H. numata* from the Demerara River, and two or three from much lower down the Essequibo, viz. Rockstone and Bartica, which show this in a remarkable way. Two in particular show a great extension of the black inwards about the cell, a phase of variation unknown to me from the Potaro.

The other two species of *Heliconius*, viz. *H. vetustus* and *H. silvana*, have occurred quite sparingly, the latter especially so. *H. vetustus* is here a comparatively constant species, and in the eight specimens secured the black area in the hind-wing is never divided by the ground colour. The only variation of the black area is that in some individuals the black extends nearer the costa, basally giving the appearance of a rounded area, while in others the black area stops short by quite a horizontal line.

*Heliconius vetustus.*

The eight specimens divide up thus:

Upper-side { Black area sharply cut off . 2 = 25 %
               Black area extended upwards 6 = 75 %

Under-side { Black area divided . . . 2 = 25 %
               Black area undivided . . . 6 = 75 %

The latter with the rounded black area agree very closely with some of the *H. numata*, especially those (6 % only) in which the black is undivided by the ground colour. But in the case of those that are almost undivided the shape is the same giving an agreement of another 27 %, or 33 % in all of the *H. numata* with this more usual form of *H. vetustus*.

A study of the red sub-apical patches in the fore-wing gives the following interesting result:

Upper-side of fore-wing without red markings before apex 8 = 100 %
Upper-side " with " 0 = 8

Under-side of fore-wing without red markings before apex 7 = 88 %
Under-side " with " 1 = 12 %
The solitary specimen with three red markings has them well developed. The specimen is a ♀, and has the more usual rounded black area to the hind-wing, and it was captured on July 19th, 1904—the height of the rainy season.

_Heliconius silvana._—The four specimens of this species are of remarkable interest. Two of them bear the usual pattern of black marking on the hind-wing while two show the black area divided by the ground colour, one being a good intermediate. Not one of the four have the white marginal spots developed. The species undoubtedly shows the strong local influence of its relatives, and especially is this to be noted in the two specimens with a banded hind-wing, these conforming with the predominant forms of _Melinxva mneme_ and _Heliconius numata._ These banded _H. silvana_, although rare, have been recorded elsewhere. There are two such specimens in the Hewitson collection at South Kensington. One labelled Upper Amazon, and another a much smaller specimen, but more completely banded, from Para. The species is evidently on one of the limits of its distribution or would surely be commoner, especially as elsewhere, such as at Para, it is a very common and plentiful insect.

_Heliconius eucoma._—A single specimen was secured by Mr. C. B. Roberts in 1902. It differs in no way from the type, and is a mere accidental visitor, apparently to the Potaro region. The home of the species is on the Lower Amazon. The species readily fits in with the group through the more extremely banded forms of _Heliconius numata._

**HELICONINÆ, GENUS EUCIDES.**

Three species of _Eucides_ have occurred, _Eucides isabella, Eucides vibilia_, and _Eucides nigrofida._* The two former only singly and the last not uncommonly. It is curious that one of the single specimens (that of _E. isabella_) is a common species, while the only species that has occurred at all frequently was found to be an undescribed species. It is this new species that conforms to a considerable extent to the main group, while _E. isabella_ (as far as can be ascertained from a single individual) is of the ordinary

* Vide Ent. 1906, p. 52. Three other species of _Eucides_ have occurred belonging to another small family group, _E. lybia, E. aliphera_, and _E. unifasciatus_ (?).
form and shows no special influence of the main group. *Eucides isabella*, it should be mentioned here as elsewhere, strongly retains the pattern of the abundant *Mechanitis polymenias*, and this association is probably so ancient that the two species have had time to become fixed and definite. Both these two latter insects occur over a very wide area, and small variations of climate and environment have apparently little or no effect.

*Eucides nigrofulva.*

Of this newly discovered species twenty-five individuals in all have been secured. No less than twenty-two have been females while but three males have been taken. This may indicate that the males and females have different habits, but it may be simply that the males and females emerging at different times and that when the males were out they were either overlooked for something else or perhaps not looked for at all. This latter explanation seems to be more plausible when one examines the under-sides of the specimens as remarked on later. The series of females shows considerable transition from a moderately heavy-banded hind-wing, tending to fuse with the dark outer margin, to a fairly narrowly-banded form with no trace of fusion.

Of the extreme dark form there are four examples, but in no case is the area between the central band and the dark outer margin uniformly black. The males, as will be seen by a reference to the specimen of the insect, have a very much less dark hind-wing, with the black band far more broken up into spots than is ever found in the female. This difference together with the absence of yellow bands to the fore-wing gives the male sex a very different general appearance above. On the under-side, however, except for size, these differences vanish and there is practically no variation in the whole series of either males or females. This is remarkable testimony to the efficacy of selection when the species is at rest. Not only do male and female closely resemble one another on the under-side, but they with closed wings have a remarkable similarity to the under-side of *Heliconius numata*, and particularly to the less dark individuals of that species. The series of white marginal spots to the hind-wing, the most interesting appearance of a yellow patch of scales beyond
the cell between veins 5 and 7, and three white apical spots on the fore-wing are alike found in both H. numata and E. nigrofulva, not to mention the general arrangement of bands and colours.

Eueides isabella and Eueides vibilia.

As already mentioned both of these species have occurred but only singly. E. isabella is a perfectly normal example. It is remarkable that on the under-side with the wings closed it is hardly to be distinguished from E. nigrofulva except for the smaller sub-apical yellow spots forming a band. The straw-coloured patch of scales between veins 5 and 7 is wanting, and points to a more recent association with the group or at least with Heliconius numata.

The example of Eueides vibilia is much more removed from the normal and illustrates how this species is assuming a darkened hind-wing above. The black scaling of the marginal band shows an extension inwards towards the cell, and this is quite a special development in this species. The sub-apical straw-coloured spots are smaller than in typical examples and follow the pattern E. isabella. It must be confessed that on the under-side this insect has little of the general appearance of the majority of the group. The strong rayed aspect of the hind-wing without any band gives the insect a much more distinct and different-looking appearance. But it cannot be overlooked that the dark suffusion of the hind-wing above is significant of the influence of the more pronounced black hind-winged species, and this like the Protonotius is probably a resultant of selection for this end made only on the wing.

FAMILY—DANAIDÆ.

Sub-family—LYCOREANÆ.

The two members of the family Danaidæ both offer remarkable instances of the influences of colour and pattern. The two species are Lycorea pasinuntia and Lycorea ceres. The former shows the influence of the darkening tendency in the hind-wing much less than the latter, and this is the more remarkable because in other
localities even as close as Venezuela and Trinidad *L. ceres* occurs, and never shows the deep black colour on the hind-wing, while *L. pasinuntia* has its home almost confined to Guiana and yet does not conform to the local influence to so great an extent nor in such a large proportion of the specimens. Both species occur chiefly in the long dry season which usually sets in at the end of August and lasts up to nearly the close of December, but odd specimens may be turned up at most times of the year, and I personally took several of each in May 1901, when the rainy season had begun in earnest a month previously.

As has already been seen with the Ithomiines the darkening of the hind-wing is far more pronounced on the upper-side, in fact on the under-side there is always a well defined area where the dark scales fail to obliterate the band. Tabulated, *Lycorea ceres* works out thus:—

<table>
<thead>
<tr>
<th><strong>Lycorea ceres.</strong></th>
<th><strong>Upper-side.</strong></th>
<th><strong>Under-side.</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hind-wing distinctly banded</td>
<td>6 = 30%</td>
<td>18 = 90%</td>
</tr>
<tr>
<td>Hind-wing obscurely banded</td>
<td>12 = 60%</td>
<td>2 = 10%</td>
</tr>
<tr>
<td>Hind-wing band obliterated</td>
<td>2 = 10%</td>
<td>0 = ——</td>
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<tr>
<td></td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>

We thus find that on the upper-side the specimens with a wholly and partially obscured band number 70%, while on the under-side they only number 10%, while the banded forms claim no less than 90%, an almost complete reversal of the one to the other.

That this species should vary so in regard to the colouring of the hind-wing is not to be surprised at, but it is very remarkable that the pattern of the fore-wing should remain so constant, as there is never any tendency to the form *atergatis*, such as is so frequently met with in Trinidad, nor is there any tendency to darkening of the fore-wing, such as is frequent in Peru, proving by the latter case that the species is in no need of adopting a more uniformly dark aspect, even though it is able under certain conditions to do so. The interest centring round *Lycorea ceres* must always be considerable. It is a species that occurs in one or other of its forms throughout nearly
the whole of Central and South America with Cuba and Haiti. It is true most of the forms are known as distinct species, but if we only could ascertain where the forms overlapped such as we know atergatis and ceres overlap in Trinidad, there could be no possible doubt that the species was continuous from Mexico to Southern Brazil and from Peru to Para, and that we should find the forms merging one into another. With such a species as this it should be possible to decide by experiment whether all different climates and different climatic conditions tend to produce different geographical races as we know them, or whether the action of mimicry by selection is sufficient to account for these changes. That such a species should adopt so many tones of colour cannot be, because the forest has such a varying aspect, and that the insect when on the wing is variously concealed. The species in several of its phases (?) all) is extremely conspicuous in flight, and in Guiana at least it is very conspicuous at rest on the flowers of Eupatorium macrophyllum. This Eupatorium is a widely distributed and common plant, and it is quite likely that in other parts of the continent it is frequented by this same Lycorrea under various guises.

**Lycorrea pasinuntia.**

This species is certainly commoner than the previous but its variation is not so considerable. And with regard to the complete darkening of the area of the band in the hind-wing it is a comparatively rare feature.

The variation works out thus with 27 examples:—

<table>
<thead>
<tr>
<th>Lycorrea pasinuntia.</th>
<th>Upper-side</th>
<th>Under-side</th>
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</thead>
<tbody>
<tr>
<td>Hind-wing distinctly banded</td>
<td>18 = 66 %</td>
<td>25 = 93 %</td>
</tr>
<tr>
<td>Hind-wing obscurely banded *</td>
<td>6 = 22 %</td>
<td>2 = 7 %</td>
</tr>
<tr>
<td>Hind-wing band obliterated †</td>
<td>3 = 11 %</td>
<td>0 = —</td>
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<td>27</td>
<td>27</td>
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* This is the extreme form, but it is not nearly so complete as in *L. ceres.*
† Under this class are placed all those that are not completely banded, but the average is not so great as with *L. ceres.*
Table showing comparative percentages of species exhibiting a large undivided black area on **Under-side** and **Upper-side** of hind wing.

<table>
<thead>
<tr>
<th>Family</th>
<th>Species</th>
<th>Under-side</th>
<th>Upper-side</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lycoreseae Danainae</td>
<td>Lycoreus</td>
<td>carsa</td>
<td>ceres</td>
</tr>
<tr>
<td>Heliconidae</td>
<td>Heliconius</td>
<td>cedrus</td>
<td>ceres</td>
</tr>
<tr>
<td></td>
<td>Ceratina</td>
<td>philidias</td>
<td>encona</td>
</tr>
<tr>
<td>Ithomina nymphalida</td>
<td>Meleina</td>
<td>philidias</td>
<td>encona</td>
</tr>
</tbody>
</table>

* The extreme black form still shows slight indication of banding beneath.  
† Still showing a trace of banding.
Tithorea harmonia, Protogoniuss hippona, and Dismorphia amphione. Of these three species that fit into the group but have not yet occurred on the Potaro it is highly probable that the Tithorea harmonia remains to be discovered. It has been taken at Aunai, a locality higher up the Essequibo. Two specimens at South Kensington bear Aunai labels, and it is remarkable that both of these show no trace of the darkening of the hind-wing but are of the extreme banded form. One of the specimens exhibits the characteristic red apical markings on the under-side while the other is wholly without them. It seems clear from the material available that Surinam and Cayenne produce the darkest forms of T. harmonia, while British Guiana gives the megara form which is banded. Cramer's figure of harmonia shows the insect on the under-side and gives the heavy black form with only the veins showing of the ground colour. It is however significant that in five specimens from Paramaribo at South Kensington only one shows an unbanded form on the under-side. In this latter form the Tithorea fits in much better with the group generally, as it has already been shown how frequently the black area is divided on the under-side even when complete on the upper-side.

Protogoniuss hippona fits in admirably with the group; many of the special characteristics being exceedingly well brought out. The only specimens that I know of and have seen of this species are one from Berbice and two from Cayenne. It is therefore possible that the insect belongs more strictly to the territory known as Dutch and French Guiana, Berbice being conterminous with Surinam although within the British area. The insect is chiefly remarkable in having besides the heavy blackening of the hind-wing a row of very conspicuous large white spots to the margin of the hind-wing, at once recalling the Lycoreas, ceres and pasinuntia. As with all the Protogoniuss species this one is doubly protected in having a cryptic under-side, while on the upper-side it gains protection by similitude to a protected group.

It cannot however here be insisted too strongly that the Protogoniuss proves most conclusively that when it is on the wing it must be the upper-side that is seen by its enemies, or else how could such a pattern be evolved independently of the very different pattern of the under-side?
Table showing members of the group that

<table>
<thead>
<tr>
<th>JANUARY</th>
<th>FEBRUARY</th>
<th>MARCH</th>
<th>APRIL</th>
<th>MAY</th>
<th>JUNE</th>
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<tr>
<td>Lycoren Danae.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L. passim.</td>
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<td>(</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L. cer.</td>
</tr>
</tbody>
</table>
have occurred in each month of the year.

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<tr>
<th>JULY</th>
<th>AUGUST</th>
<th>SEPTEMBER</th>
<th>OCTOBER</th>
<th>NOVEMBER</th>
<th>DECEMBER</th>
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<tr>
<td>C. euclea.</td>
<td>C. euclea.</td>
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<tr>
<td></td>
<td>L. pasinuntia.</td>
<td></td>
<td></td>
<td>L. pasinuntia.</td>
<td>L. pasinuntia.</td>
</tr>
</tbody>
</table>
In viewing the group as a whole what is most striking is that there is much closer agreement on the under-side than on the upper-side, and it is quite clear that selection must take place while the insects are resting with their wings folded. It should be convincing to the greatest sceptic that say the red apical marks on the under-side could never run through such a series if selection were made on the wing as is affirmed by all those who implicitly believe in the protective environment theory. What comes out clearly from these investigations is that only two species, *Melitaea crameri* and *Heliconius vetustus*, show a large proportion of specimens with a heavy black under-side. The tendency at the present time is all in favour of a banded under-side. On the upper-side the black development is far more pronounced as *Mechanitis panni-* *fera* joins in with 50% of its forms dark and *Lycorea ceres* with 40%. Whatever however may be the real cause of these darkened hind-winged forms so characteristic of the Guiana region it is certain that the forces at work are now not so potent for their development as for the more barred forms. It however may be that the selection for the upper-side made upon the flying specimen is acting much more slowly than upon the sedentary individuals, and this at least seems plausible as it is beyond question that the members of this large group spend the greater part of their time at rest on flower-heads and become so engrossed, that they show no inclination to fly, a collector being able to catch individuals with his fingers as they sit feeding.
EXPLANATION OF PLATES.

PLATE XXIII.

Mullerian group of Ithomiine, Lycoreane, Heliconine, and Lemoniine butterflies, showing the darkest forms. The upper- and under-sides of every specimen is shown.

All specimens are from the Potaro River, thirty miles above its confluence with the Essequibo, British Guiana. (Between the eighth and tenth mile from the Potaro, on the road to the gold mines.)

All figures are about $\frac{2}{3}$ of the natural size.

Fig. Ithomiinæ.
1. Mechanitis pannifera, ♂ : captured by C. B. Roberts, Aug. 28th, 1903; in Hope Dep.

The same specimen is represented in Fig. 7, Pl. XXVI.

Lycoreanæ.

Heliconinæ.

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**Explanation of Plates.**

**Fig.**


The same specimen is represented in Fig. 14, Pl. XXVI.


**Lemoniæ.**


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**Plates XXIV (upper-sides) and XXV (under-sides).**

Millerian group of Ithomiine, Lycoreane, and Heliconine butterflies, showing the extreme banded forms.

The specimens represented are the same, and their figures occupy corresponding positions on both plates.

All specimens are from the Potaro River, and all, except those represented in 10 and 14, from thirty miles above its confluence with the Essequibo, British Guiana. (Between the eighth and tenth mile from the Potaro, on the road to the gold mines.) Specimens shown in Figs. 10 and 14 are from Tumatumari, fifteen miles lower down the Potaro river.

All figures are \( \frac{3}{8} \) of the natural size.

**Ithomiine.**


The same specimen is represented in Fig. 2, Pl. XXVI.

Explaination of Plates.

Fig. Lycoraeanae.
The same specimen is represented in Fig. 2, Pl. XXVII.

Heliconinæ.
The same specimen is represented in Fig. 8, Pl. XXVI.
14. Eueides isabella: captured, in 1904, by G. C. Cole at Tumatumari (see Fig. 10): in Coll. Kaye.

Plate XXVI.

Series of Melinæa mneme and Heliconius numata, showing parallel transition from barred to black hind-wings.
All specimens are from the Potaro River, thirty miles above its confluence with the Essequibo, British Guiana. (Between the eighth and tenth mile from the Potaro, on the road to the gold mines.) All figures are 2/3 of the natural size.

The same specimen is represented in Fig. 6, Pl. XXIV, XXV.
Explanation of Plates.

Fig.

The same specimen is represented in Fig. 11, Pl. XXIV, XXV.
14. *Heliconius numata* : captured by C. B. Roberts, April 2nd, 1905: The same specimen is represented in Fig. 12, Pl. XXIII.

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*PLATE XXVII.*

Series of *Lycorea pasinuntia* and *Lycorea ceras*, transition from barred to black hind-wing, showing parallel.

All specimens are from the Potaro River, thirty miles above its confluence with the Essequibo, British Guiana. (Between the eighth and tenth mile from the Potaro on the road to the gold mines.)

All figures are about ⅓ of the natural size.


The same specimen is also figured in Plates XXIV and XXV, Fig. 9.


11. *Lycorea cerea*, submarginal bar as in last figure; the pale discal bar is however far more reduced in the specimen here represented: captured by C. B. Roberts, 1901, probably Dec., or 1902, probably Jan.: in Hope Dep.

12. *Lycorea cerea*, darkest form, only the costal end of the submarginal bar can now be detected, while the inner section of the discal bar is only represented by traces, and its outer part has disappeared. In this important respect *Lycorea cerea* is much in advance of *L. pasinuntia* in the tendency towards progressive darkening: C. B. Roberts, 1901, probably Dec., or 1902, probably Jan.: in Hope Dep.
XVIII. A Contribution to the Classification of the Coleopterous family Passalidæ. By Gilbert J. Arrow, F.E.S.

[Read October 3rd, 1906.]

The Passalidæ form a family which, almost universally distributed and very abundant in the forest regions of the Tropics, is probably as compact and homogeneous as any equally numerous and widely distributed group of animals. As a corollary we find the differences between the component forms very slight and with exceedingly numerous degrees of variation the separation into species is very imperfect.

Whether the remarkable secondary adaptation of the wings to serve as organs of sound-production is to be regarded as cause or effect, it seems to be the case that their primary function is becoming obsolete, species being found in different parts of the family in which they are already useless for flight. The result is that locomotion has become very restricted and segregation into a multitude of local forms, too recent for marked specific differentiation has taken place.

From their generally large size, general form and manner of life, the Passalidæ could not fail to be associated in the mind with the Lucanidæ, but the generally accepted view that there is a special relationship between the two families I believe, as I have previously stated, has little substantial foundation. A rather striking feature in which the Passalidæ differ from the Lucanidæ, as from wood-feeding insects in general, is their constancy of size, a phenomenon of which we have recently learnt the probable explanation. Dr. Ohaus has made the very interesting discovery that these insects are not during their early stages at the mercy of the rather precarious circumstances of their environment like others of the same habit of life, but that by a social organisation of a kind new to us among insects they have become to some extent masters of their fate. The Brazilian species studied by this naturalist live in small communities consisting of the two parents.
and from two to seven larvae, the parents tending their young, preparing their food and if necessary guiding them into safety.

The lamented death of Herr Richard Zang is only the latest of a series of misfortunes which have befallen a family of insects which as regards its systematic treatment has surely been the most unfortunate of groups. The remarkable classification of Kaup, based upon geometrical principles is notorious. The posthumously published monograph of Kuwert, without being founded upon a radically false conception, has similarly suffered from a futile attempt to achieve finality with extremely imperfect materials. The much less ambitious work of Stoliczka upon Oriental species, being the work of a naturalist who would scarcely have claimed to be an entomologist, has naturally in its degree increased instead of diminishing the confusion. And now a fresh misfortune has overtaken this study in the untimely death of a young entomologist who had within the last two or three years commenced a serious investigation of the family. The few papers already published by him reduced at least to a small extent the tangle existing and gave promise of a valuable accomplishment in a field where the exceptional difficulties must repel anyone not both enthusiastic and painstaking in a special degree. It can hardly be hoped that the loss will be soon repaired in spite of the great need. No list of the species has been published since 1868 although the number of names now almost quadruples that of the Munich Catalogue, nor can a complete catalogue be usefully undertaken until a thorough examination and comparison of the more than 600 types have been made by a specialist.

The Monograph of Kuwert is an admirably consistent and laborious work which, had its author lived and availed himself of increased materials and experience, would no doubt have been considerably corrected and improved. In its published form its value is largely destroyed by the aim at an impossible exhaustiveness having led him to include hasty determinations and descriptions based upon single, imperfect or abnormal specimens and to ignore the facts of geographical distribution and the rules of nomenclature.

Most of the common species of older authors have been subdivided by Kuwert by a minute examination of
external structure and some of the forms distinguished by him are no doubt constant and worthy of separation, but he seems not to have recognised the existence of variability and based species as confidently upon single specimens, even if immature or worn, as upon compared series. The absence of the types of the older systematists too rendered it impossible to allocate the old names among the forms tabulated by him, nor did he pay much attention to the indications afforded by locality, etc. A further complication has been introduced by the publication of a number of descriptions of Central American forms by Mr. T. L. Casey during the issue of Kuwert's Monograph.

Thus the *Paxillus leachi* of Macleay, hitherto regarded as ranging from Mexico to Brazil, has been divided into six species by Kuwert and the original name assigned to an insect from Guatemala, although Macleay indicates the habitat of the type as "S. America." Yet another name, *P. parvus*, has been bestowed upon specimens from Honduras by Mr. Casey who assigns *P. leachi* to Brazil, and distinguishes it as a larger species, although neither size nor province was specified by Macleay, whose type is presumably in Australia. Such work done in the dark has introduced almost hopeless confusion into many parts of the family. In the present instance I have been unable to find any specific distinctions after carefully examining a long series of specimens representing almost every province from Southern Mexico to the Amazons, and the range of size is not greater than that given by Mr. Casey for his Honduran examples. H. W. Bates was of the same opinion with regard to the Central American specimens, of which Kuwert makes five species. The latter's disregard for both geographical distribution and the element of wear is curiously shown in one of these five forms which he records from "Guatemala and Paramaribo," and distinguishes only by the absence of the customary slight hair-tufts upon the shoulders and in the separation of the five into two divisions according to the existence of two or three terminal teeth to the mandible. These features are valueless by themselves, since the shoulder-tufts frequently and the inner teeth of the mandible almost invariably, become worn down and indicate nothing but the age of the individual.

A considerable number of Kuwert's species have no greater value than these, but on the other hand his
minute research has led him to detect points of difference overlooked by others which in insular forms or when from any cause segregation has taken place have a real value.

In the present paper I have only attempted to correct a few of his errors which have come under my notice in the course of an examination of older authors' types existing in this country. M. René Oberthür, now the possessor of Kuwert's collection, has kindly sent me such of his types as were necessary for comparison. I have examined all the types of Hope, Smith, and Bates, and those of Percheron, Truqui and Kaup in our collections.

A second purpose of this paper is to enumerate the species of Passalidae brought by Mr. H. H. Smith from the islands of St. Vincent and Grenada, so completing my list of the Lamellicorn fauna of those islands so far as it is known. This has entailed the description of one new species. Descriptions of a few other new species in the British Museum collection have also been added.

The following list comprises the whole of the species of which the types are in the Oxford Museum placed in their modern genera, the names in brackets being those which become synonyms—

*Ceratoecus* (*Cithastatus*, Perch.) = *fronticornis*, Westw.
This is recorded by Percheron as of unknown locality, but his type bears the label “Hardwickii, Hope. Nepal,” and on another label “Bengal,” and was no doubt brought from Nepal by Maj. Gen. Hardwicke. The species was described two years earlier by Westwood, from the Melly collection in Ann. Mag. Nat. Hist., 1842, (viii), p. 124. There has been strange confusion about this reference.

*Comacupes punctifrons*, Hope.
*Spasalus hopei*, Perch.
*Veturius platyrhinus*, Hope. As stated by Hope, the type is from Venezuela. Kuwert has given the Amazons as its habitat, while Bates has put together several Central American forms under this name. Of these all the specimens from Nicaragua and part of those from Costa Rica and Panama belong to *V. sinuatocollis*, Kuw., and two other specimens I have described later on as *V. isthmicus*. The remaining specimens from Costa Rica and Panama agree with the short diagnosis of *V. platyrhinoaoides*, Kuw. (Bolivia) which I do not consider sufficiently differentiated.
from Hope’s example for separate recognition. We have also a series from Ecuador, but I have seen no examples of *V. platyrhinus* from Brazil.

*Epiphoroncus*, gen. nov. (*tetragonus*, Hope) = (*quadrifrons*, Perch. = * occipitalis*, Eschs). I have found in the Hope Collection, in addition to the type of Hope’s description, a specimen of this species labelled in Percheron’s handwriting ‘‘quadrifrons, *P*. localité?’’ In Percheron’s Monograph *quadrifrons* is said to come from the Cape of Good Hope, and Kuwert has placed it, on account of its reputed habitat in the genus *Didymus*. No *Passalidæ* are known in S. Africa, although Kuwert includes several others, and this insect seems to be not uncommon in Brazil. It was tentatively referred (as *tetragonus*, Perch.) by Kuwert to his species *Morosophus ruhli*, but is quite different and agrees with no existing genus, and I have been obliged to form one (characterised later) to receive it.

*Leptaulacix vicinus*, Perch. This occurs in Penang and Borneo (Sarawak). It is incorrectly put down by Kuwert as synonymous with *L. planus*, Ill., but is more related to *L. angustifrons*. It is rather larger and has no large punctures upon the metasternum, which is finely and thickly punctured in front. All these species belong to the genus *Leptaulacidès* as recently characterised by Zang.

*Eumelosomus africanus*, Perch. = (*E. lavipectus*, Auriv.). Burmeister and all subsequent writers have relegated this to *Didymus parastictus*, Imh. It is a much more convex species with a more thickly punctured thorax and by the median tooth of the clypeus is excluded from the gen. *Didymus* in Kuwert’s sense. In the British Museum there are specimens from Sierra Leone, Cameroon and even from Uganda (Msozi), so that its range is very wide.

*Pentalobus palinii*, Perch. Inhabits the Gold Coast (Akropong) and Gaboon.

*Basilianus cantori*, Perch.

*Gonatus naviculator*, Perch.

*Pharochilus rugiceps*, Hope, is probably *P. brevidentatus*, Kuw., and is exceedingly close to *P. politus*, Burm., but the side pieces of the mentum are smooth and sooty. It is placed by Kuwert in another section of the genus.

*Pharochilus cancrus*, Perch. = *P. dilatatus*, Dalm. This has been wrongly identified with a species of *Tiberius*. The type is a very immature specimen of unknown habitat and the error is therefore not surprising. Percheron
applied the name *dilatatus* to the allied *P. politus*, Burm., as has long been known. As the species to which the name *canerus* has hitherto been assigned is a well-marked one for which no other name is available it will be well to call it *Tiberius kuwerti*.

Certain of the most remarkable forms of Passalidæ have not yet found their proper places in the system. The genus *Cylindrocaulus* of Fairmaire, a curious Chinese insect, and the Mexican *Spurius bicornis*, Truqui, were together made into a sub-family by Kuwert, a strange proceeding due only to the absence in both of the median cephalic horn common to most sections of the family. *Cylindrocaulus bucerus*, Fairm., is an apterous insect of very peculiar form, but still more peculiar is *Aulacocylclus patalis*, Lewis, an allied Japanese species for which a new genus *Aurikulus* has been made by Zang. It was described and figured in the Trans. Ent. Soc., Lond., 1883, p. 341, Pl. xiv, figs. 6 and 7, but was overlooked by Kuwert. In both species the disc of the thorax is drawn out in front into a bifid protuberance, a feature very strange for this family, although slightly suggested by the form of the thorax in *Ceratocyclops*, and it is in the vicinity of that genus that other essential characters of these forms place them, although probably the most aberrant species in the family. In *C. bucerus* the front coxae are separated by a strongly elevated lamina, which is an infringement of a main feature of the Aulacocyclinae, but in *A. patalis* the coxae are more elevated than the intervening lamina, which is so much reduced that they are practically contiguous in the middle. The very short connate elytra (indicating inability to fly) are also quite exceptional, the only flightless Passalidæ hitherto recorded being of American genera. *A. patalis*, Lewis, has the elytra even shorter relatively and more bulbous than *C. bucerus*, Fairm., which I have been kindly enabled to examine by M. Oberthür, who possesses also an undescribed insect from Wa-shan which, although head and thorax are formed like those of *Cylindrocaulus*, is winged and has the hinder part of the normal shape. The head in these beetles is quite smooth and concave, and its lateral walls are produced above the eyes into a pair of horns, which in *C. bucerus* are slender and pointed and in *A. patalis* flattened, widening from base to extremity, where they are truncated by an incurved line. In the latter insect there is also a
the Coleopterous family Passalidae.

rather sharp tubercle below each shoulder formed by the extreme lateral margins of the elytra. The stridulating apparatus is like that of *Proculejus* and other flightless genera, a narrow strip of each wing having been retained for the purpose.

Another Oriental genus *Kaupiolus* (*Vellejus*, Kaup.), is flightless, a fact not hitherto recorded. Although having the form of the elytra always attending this condition it has no special affinity with any of the other genera exhibiting it.

I am able to supply the true habitat of two species of Aulacocyclinae of which it has remained unknown. The type of *Comacupes felderi*, Stol., is in M. Oberthür's collection, and I have identified it with an insect in our collection found by Wallace at Amboina. *Tenuocerus deypolletii*, Kaup, is recorded as coming from St. Denis in Réunion. M. Oberthür has sent me a specimen showing that this is due to a mis-reading of "Pt. Denis," an abbreviation standing for Port Denison in N. Queensland.

The *Passalus sagittarius* of Smith has been the subject of extreme confusion. In his "Prodromus," Kaup placed this first in his new genus *Oileus*, uniting *P. rimator*, Truqui, with it as conspecific. The types, both of which are in the British Museum, are quite different. Kaup determined a specimen in the collection as *sagittarius*, but evidently overlooked the type, for his description applies to neither that nor his identified specimen which are quite distinct from one another. In a later work he restricted *Oileus* to the so-called *sagittarius*, and another species (*heos*, Truqui), not previously assigned to it, and finally, in his Monograph he rejected *sagittarius* also, completing the transformation of his genus into "something new and strange." "Sagittarius" now constitutes, together with a second form *sargi*, Kaup, the genus *Rimor*; but further adventures are in store for it, for Kuwert has contributed his share to the tangle, dividing *Rimor* into two, and placing the perturbed ghost of *sagittarius* in his *Rimoricus*. Both authors refer to *rimator*, Truqui, by this name, and they have been followed by Bates in the "Biologia Centr.-Americana"; and it seems to have been again described by Casey as *Rimor munilus*. Our specimens, recorded by Bates, are chiefly from the same part of Mexico as those to which the later name is given, and although larger than Truqui's, vary considerably in their proportions. In
the latter respect, by which he distinguishes *R. munitus*, Casey’s dimensions agree almost exactly with those of Truqui’s type.

This species is therefore the proper type of *Oileus*. Zang has rightly indicated the true species but without knowing that Kaup had wrongly applied the name *sagittarius* to it and has so become involved in the confusion. *Passalus sagittarius*, Smith, of which no second specimen is yet known, really belongs to Kuwert’s group Petrejinae, differing from the genus *Petrejus* in being flightless, and having accordingly very short elytra fused together at the suture and curvilinear at the sides. A similar form has been described as *Procenulus inca* by Zang and, although the generic characters formulated from that species are not all exhibited by Smith’s insect, I think the two may very well be associated together. The type of *Procenulus sagittarius* is rather larger than that of *P. inca*, it has the labrum arcuately excised along its whole width, so that the angles are acute, as the clypeal ridges extend beyond the front margin and are distinctly tuberculated both at their extremities and a little before, and the median horn is long, free, acutely pointed and without lateral outgrowths behind.

The synonymy of *Oileus* is accordingly as follows:—

*Oileus*, Kaup, Col. Hefte, 1869, p. 3.
—, Bates, Biol. Centr.-Amer. (2) ii, pp. 10 and 383.
*Rimorius*, Kuwert, l. c.
*rimator*, Truqui, Rév. de Zool., 1857, p. 266.
*sagittarius*, Kaup (nec Smith).
—, Bates, l. c.
—, Kuwert, l. c.
*sargi*, Kaup, l. c.
*v. honestus*, Kuwert, l. c.

Kuwert’s *Rimor ridiculus* has been separated by Zang as *Coniger ridiculus*, Kuw., and for the second *Oileus* of Kaup (i.e. *heros*, Truqui) Zang has coined the new generic name *Nasoproculus*.

The differences which served Kuwert for the generic separation of *Oileus rimator*, Truqui, and *Sargi*, Kaup, are
very insignificant and I do not think the desirability of sinking his name Rimoricus will be disputed. Similarly Rimor honestus, Kuw., owes its existence only to the occasional absence in Costa Rican examples of O. sargi, Kaup, of a slight furrow upon the scutellum and a few other variable features of no greater importance.

Rhodocanthopus maillei, Perch., has been quite unnaturally removed by Kuwert to the neighbourhood of Phoroneus and renamed Polyacanthopus, which is certainly a redundant name. Of the specimens attributed by Bates to the same species I can only recognise those from Cordova, Orizaba and Jalapa as really belonging to it. Other Mexican examples belong to Neleides punctatostriatus, Perch. and curtus, Bates, the series from Nicaragua appears to be another species, and the specimen from Chiriqui yet another. R. molestus, Kuw., is very difficult to distinguish from R. maillei, Perch. The genera Rhodocanthopus and Neleides, although placed in different groups by Kaup and Kuwert, have been distinguished solely by the degrees of spininess of the middle tibia, which, as it shows a gradual crescendo from one extreme to the other, makes the line of demarcation quite arbitrary. Another difference which generally accompanies that of the middle tibia has not been noticed. It consists in the degree of prominence of the eyes, which in the species with strongly spined middle tibiae are sunk in the head, very small and in general coarsely facetted. In the other series (Neleides) they are large and prominent and typically finely-facetted. This correspondence although not exact, probably indicates some difference of habit. Rhodocanthopus curtus, Bates, and inops, Truqui, must be placed in Neleides. Both have been wrongly determined by Kuwert. The former is very closely allied to N. punctatostriatus, Perch., differing only in its shorter form. Although Bates recognised only a single specimen, identical individuals from Mexico, Guatemala and Panama were placed by him in R. punctatostriatus and R. maillei.

The genus Pleurostylus owes its existence only to the exigencies of the Kaupian system. The type specimen of Pleurostylus trapezoides in our collection is a Brazilian species of the very common genus Veturius. By some accident the label of an Indian insect became attached to it, but there is no apparent reason why Kaup assigned it to his "Solenocycleæ" as a probably African species,
except that in his geometrical scheme a blank chanced to occur at that point. *Veturius trapezoides* is larger than, but has otherwise almost the characters of *V. gabonis*, Kuw., which is also attributed to Africa with no greater credibility. It should never have been described and least of all by a name selected to perpetuate an error. *V. trapezoides*, Kaup, was found at Bahia by Lacerda. Its middle tibiae are rather thickly hairy and are also armed on the outer edge with a fairly strong spine.

A curious example of the Kuwertian method is afforded by his genus *Proculusoides*. This he formed for *Proculus championi*, Bates, of which the original specimens are in the British Museum. M. Oberthür has sent me a specimen of it from the Kuwert collection, which reveals the fact that this species is that figuring in the Monograph, not as *Proculusoides championi*, but as *Ogyges levior*, of Kaup, which is an obviously different insect. The few characters tabulated as distinctive of *Proculusoides championi*, Bates, do not apply to it, and were apparently only derived from what he wrongly assumed it to be from Bates' description. As it is very distinct from *Ogyges* it will be best to retain Kuwert's name while correcting his diagnosis. The front of the clypeus forms a broad depressed band, not cut off, as stated, by a transverse groove. The antennal leaflets are much shorter than those of *Ogyges levissimus*. The elytra are not at all flattened, the intervals very convex and the striae not punctured except faintly in the lateral ones. The sides of the elytra are quite without hairs but there are a very few minute ones scattered over the anterior face.

Herr Zang has added another species, *P. granulipennis*, Zang, which appears to have the true characters of the genus, but he was mistaken in also including *Proculus nudicostis*, Bates, which he knew from description alone.

The flightless Passalidae seem to vary in size to a greater extent than is usual in the family. There is a considerable range of variation in this respect in the giant *Proculus mniszechii*, and the same is the case in the genus *Publius*, of which the two species have both been described from unique specimens. Of *P. crassus*, Smith, we have, besides the types, two other specimens from Colombia, one of which is 50 mm. long and the other 42 mm.

By the kindness of Herr Schenkling, of the Deuts. Ent. National Museum, I have also been able to examine
the types of *P. spinipes*, Zang, of which we have specimens from Chulumani, Bolivia, and R. Marcapata, Peru. The Peruvian specimen is 47 mm. long. The spines upon the four posterior tibiae, from which the species is named, are not always easily distinguishable, but it is a very well-marked form, easily recognizable by the feebleness of the elytral striae, which, contrary to the almost invariable rule among these insects, become fainter instead of stronger towards the sides.

Kuwert has formed a new genus *Verrroides* for certain insects inhabiting Brazil and Guiana, of which he has recognized three species, differing from *Verrus* only in the labrum being very deeply cleft. I believe one or all of them to be *Verrus furcilabris*, Eschs., which Kuwert has left in the older genus. This is evidently due to some blunder, as he gives the habitat as Guatemala, although each of the authors quoted by him without comment has recognised it as a South American species. There are specimens in our collection, all of which I regard as belonging to *Verrroides furcilabris*, Eschs., from the Amazons (Monte Alegre and Para), Pernambuco, British Guiana (Georgetown) and Trinidad.

In the succeeding pages I describe, in addition to a new genus which I have already referred to as necessary for *Passalus occipitalis*, Eschs., a few well-marked new forms in our collection, beginning with one from the island of Grenada. In order to complete the enumeration of the Lamellicorn Coleoptera of St. Vincent and Grenada contained in two previous papers in these Transactions I give here a list of all the Passalidae from the West Indian Islands contained in our collection:

*Verrroides furcilabris*, Eschs., Trinidad.
*Sphasus puncticollis*, Serv. (Kuw.), Dominica, St. Lucia, Nevis.
*Passalus (Nelcus, olim) interruptus*, L., Trinidad.
*P. unicornis*, Serv., Dominica, St. Lucia.
*P. tlascalca*, Perch., Trinidad, Grenada, St. Vincent.
*Scalmus (Ninus, Kuwert), interstitialis*, Eschs., Trinidad, Grenada, Cuba, Jamaica. I can find no adequate justification for the numerous so-called species into which Kuwert has divided this.
*Pertinacides affinis*, Perch., S. Domingo, Hayti.
*Noleides antillarum*, sp. n., Grenada.

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Mr. Gilbert J. Arrow's Classification of

Neleides antillarum, sp. n.

Modice convexus, sat brevis, cornu pyramidal e postice vix producto, carinis anterioribus late et arcuatem divergentibus, brevissimis, tuberculis prominentibus a cornu et clypei dentibus externis fere aequidistantibus terminantibus; prothorace subquadrate, margine antico fere recto, postice leviter arcuato, lateribus medio paulo constrictis, angulis antice fere acutis, disco lateribusque impexctatis, linea lata sinuata postocular e ex punctis magnis consistente; scutello parcisime punctulato; elytris profunde punctato-striatis, interstitiis convexis, humeris paulo prominentibus, corpore subtus fere nudo, metasterno impunctato vel punctis obsolcis nonnullis lateraliter sparsuto.

Long. 18½-20 mm.

Hab. Grenada I., Windsor, Chantilly, Grand Etang.

Among described species this is most nearly related to N. guatemalensis, Kaup, but is rather larger and considerably more convex. It may easily be distinguished from that and all the other species tabulated by Kuwert by the form of the frontal carinae. The median cephalic process is short and upright, the posterior lateral appendages are obsolete and the anterior carinae are very short, enclosing a semicircular area with a slight elevation in the middle and stopping short at the frontal tubercles, which are placed only a little beyond the middle of the interval between the cephalic horn and the outer clypeal teeth. The shoulders are rather prominent and without hairs, and the elytra are deeply sulcate, with rather feeble puncturation in the sulci and highly convex intervals.

Beetles and larvae were found together by Mr. H. H. Smith in rotten logs in the forest between 500 and 2000 feet altitude.

The following is the third species of a peculiar and apparently rare Central American genus:—

Triænuragus solidus, sp. n.

Crassus, latus, subdepressus, clypeo antice toto marginato, minute quadridentato, dentibus interioribus distantiibus, cornu frontale longo, usque ad clypei marginem porrecto, postice gibbosso, profunde sulcato, carinis posticis brevibus, valde elevatis, anticis nullis; prothorace fere quadrato ubique minutissime punctulato; medio profunde sulcato, lateraliter obsolete cicatricoso, punctis nonnullis in cicatrice, linea angusta, marginali vix punctata, antice haux dilatata;
the Coleopterous family Passalidae.

scutello impunctato, medio sulcato; elytris connatis, pone scutellum paulo productis, nitidis, profunde sulcatis, sulcis subtiliter punctatis, humeris paulo acuminatis; prosterno postice producto, rugoso, mesosterno glabro, lateraliter punctato, metasterno polito, postice transversim impresso, lateraliter grossissime punctato, tibiis 4 posterioribus, vix spinosis, antennarum flabellis tribus modice elongatis.

Long. 41–43 mm.; lat. 17 mm.

Hab. GUATEMALA, Chuipache, Quezaltenango.

Two specimens found by Mr. Richardson have been presented to the Museum by Mr. F. D. Godman. The species seems to closely resemble T. junctistriatus, Kuw., which is intermediate in size between it and T. subopacus, Bates. In addition to its considerably larger size, it differs by the deep channel upon the posterior part of the cephalic horn, the absence of punctures upon the scutellum and the different form of the prosternal process. The median part of this is broad, parallel-sided, and strongly produced behind. In front it is deeply grooved at the sides and the median part is coarsely rugose. The mesosternum is quite smooth and shining in the middle and the metasternum, as in T. junctistriatus, Kuw., is hairy at the sides, with very large confluent punctures near the hind angles.

Veturius isthmicus, sp. n.

Parvus, modice elongatus, parallelus, cornu frontale parum elevato, carinis posticis transversis, frontalibus angulo acuto incipientibus, deinde angulo obtuso, tuberculo medio inclusu duobusque terminaliab aus clupei margine multo distantibus; prothorace modice transverso, margine antico fere recto, postico leviter arcuato, lateribus valde ampliatis, late sulcato, sulco obsolete punctato, antice haud dilatato, scutello dense punctulato, linea media angusta laevi, elytris sat profunde striatis, haud punctatis; meso sterno antice toto velutino, metasterno polito impunctato; tibiis 4 posterioribus spina valida post medium armatis, antennarum flabellis brevissimis.

Long. 32–5 mm.

Hab. COSTA RICA, La Virgen, Sarapique; PANAMA, Bugaba.

This is very near V. tuberculifrons, Kuw., from the Amazon region, and indeed the short description of that species applies also to this except for its rather smaller size and the fact that the sides as well as the middle of
the mesosternum are silky and opaque. It is one of the smallest species of the genus, being about the size and shape of *V. assimilis* and *cirratus*, from which it differs by the strong spine on each side of the four posterior tibæ and the deep but unpunctured elytral striae. The ridges of the head are well developed. The posterior carinæ are almost in a straight line and the frontal carinæ form a very acute angle at the base of the median horn and afterwards rather abruptly diverge obtusely and enclose a broad tubercle. The terminal tubercles are prominent and separated by an interval rather more than half the breadth of the clypeus. There is no sharply incised line on the vertex of the head behind the horn.

*Veturius punctatosstriatus*, sp. n.

Sat brevis, nitidus, capite laevissimo, clypeo paulo excurvato, utroque angulo late fossulato, cornu simplice; prothorace parum transverso, lateribus sat regulariter curvatis, fossa laterale lata, antice haud dilatata; scutello crebre punctato, linea media laevi; elytris profunde sulcatis, sulcis ubique punctatis, interstitiis valde convexis, prosterno postice dentato, mesosterno antice et lateraliter sericoe, postice nitido, metasterno nitido, impunctato, medio postice transverse impresso; tibiis 4 posterioribus post medium fortiter spinosis.

Long. 38 mm.

*Hab.* British Guiana, Georgetown.

A number of specimens were collected by the Rev. W. Harper in 1877. The species is very distinct from all hitherto described and is easily recognisable by its comparatively short form and the very deep punctured striae of the elytra. Like the last it must also be grouped with *V. tuberculifrons* in Kuwert’s arrangement. The head is very smooth, with a conical median horn, of which the lateral outgrowths (“nebenhöcker”) are obsolete. The clypeus is slightly rounded in front and minutely notched in the middle and it is divided into three parts of equal length by the frontal tubercles, the two lateral divisions being rather deeply excavated. The carinæ from the base of the horn to the frontal tubercles form almost a semicircle. The transverse impression behind the horn is strongly curved and deeply incised. The prothorax is about 1½ times as broad as it is long. The lateral margin is regularly curved and the channel is deep and punctured.
at the side but not punctured or dilated in front. The scutellum is thickly and finely punctured on each side of the median line. The elytra are rather short and convex, all the striae visibly and closely punctured and the interstices rounded. The labrum is slightly emarginate and the mentum has a protuberance at the middle. Each of the four posterior tibiae has a strong spine beyond the middle.

*Veturius peruvianus*, sp. n.

Parum elongatus, convexus, capite polito, cornu acuto, antice directo, carinis frontalibus triangulum equilaterale includentibus, carinis posticis fere transversis, paulo sinuatis, sulco postico paulo profundo, absque linea incisa; prothorace convexo, toto impunctato, sulco laterale profundo, margine antico sinuato, angulis omnibus arcuatis, scutello punctulato, medio lave; elytris profunde striatis, striis vix perspiciue punctatis, interstiiis convexis, humeris antice pilis perpunctis ornatis; meso- et metasterno glabris, impunctatis, illo antice toto sericeo-opaco; tibiis 4 posterioribus extus absque spinis, dense hirsutis.

Long. 42 mm.

*Hab.* S.E. PERU, Marcapata R.

This is closely related to *V. platyrrhinus*, Hope, but is smaller and has the elytra relatively shorter and more broadly rounded behind, with more elevated costae. The clypeal ridges are distinct but rather less divergent than in that species, and the median horn is similar but the transverse impression behind it is shallow and without any incised line. The prothorax is rather less broad and more convex, the front margin sinuated, but less strongly, and less prominent in the middle. The anterior angles are also less prominent.

*Verræ cavicolis*, Bates, was evidently unknown to Kuwert, since the insect described by him under that name is scarcely distinguishable from *V. hageni*, Kaup. We have a specimen, also from Jalapa, agreeing with Kuwert’s diagnosis. The true *V. cavicolis* is a quite unmistakable species with a very long horizontal horn and large, nearly circular, pits at the front angles of the pronotum.

The species described by Kuwert as *Verræ deflexicornis*, of which the habitat was uncertain, is also in our collection. It inhabits Costa Rica.


Mr. Gilbert J. Arrow's Classification of

*Petrejus archidonx*, sp. n.

Modice convexus, paulo brevis, clypei margine recto, capite postice glabro, cornu angusto, fere recto, hand sulcato, usque ad clypei marginem producto, carinis posterioribus fere parallelis, validis, carinis frontalibus postice transversis, deinde valde arcuata. antice recte productis, spatium triplice latius quam longius, subtiliter granulatum, includentibus, capite postice plane impresso, linea incisa valde arcuata, bajas intra utrumque extremitatem fossa profunda tuberculataque sat parvis; prothorace transverso, sulco medio integro punctisque perpaucis juxtaicis, scutello impunctato; elytris profunde punctato-striatis, convexis, humeris antice pilis nonnullis brevissimis ornatis; metasterni angulis posticis vix punctatis.

Long. 25 mm.

*Hab.* N. Ecuador, Archidona.

This appears from Percheron's sufficiently careful description to be very near *P. nasutus*, Perch., but with a rather different head. In *P. archidonx* the clypeus is finely granulated, and has no trace of the large impressions characteristic of the other species. The cephalic horn reaches as far forward as the front of the clypeus and is compressed and not channelled. The posterior accessory ridges are nearly parallel to it, carinated and separated from the base of the horn by deep grooves. There is a wide flat depression behind these which is bounded by a strongly curved and deeply incised line, at each end of which there is a small tubercle with an impression just behind it. The prothorax is gently curved outwards in front and behind and has its sides nearly straight to beyond the middle. The marginal channel is punctured and not dilated in front and there are a few large punctures in front of the lateral impressions. The scutellum is smooth and the elytra strongly punctate-striate. There are two or three punctures on each side of the metasternum behind.

*Petrejus henrici*, Rosmini, appears to be very similar to this species, but is smaller, and has the clypeus smooth except for small isolated punctures.

*Petrejus peruvianus*, sp. n.

Convexus, sat elongatus, capite rugoso, clypei margine recto, angulis productis, cornu antice producto, acuto, sed sat brevi, postice
lato, globoso, carinis posterioribus fere paralleliis, carinis frontaliis valde arcuatis, ante marginem evanescenibis, spatum grosse punctato-rugosum, duplo latius quam longius includentibus, capite postice plane depresso, linea arcuata incisa; prothorace lato, lateralter crebre et fortiter punctato, sulco marginale profunde punctato, antice arcuato, paulo dilatato; scutello postice impunctato; elytris modice convexis, profunde punctato-striatis, humeris antice pilis nonnullis brevissimis ornatis; metasterni lateribus postice parcissime punctatis.

Long. 23 mm.

Hab. Peru.

This species is very similar to **P. recticylpeatus**, Kuw., but the cephalic horn, although horizontally produced, reaches scarcely half way to the clypeal margin, whereas in Kuwert's species it attains to the front. The frontal carinæ terminate in slight tubercles before the margin of the clypeus, enclosing a wide, deeply pitted and rugose area. There are no wrinkles in front of the posterior carinæ, which are longitudinal. The punctures at the sides of the prothorax are coarse and numerous and the marginal grooves are punctured throughout and in front are very large, deep and strongly curved. The general form is more elongate than in the preceding species. The elytra are similarly sculptured, but the striæ are rather finer and the interstices less convex.

**Petricus spinosus**, sp. n.

Parallelus, parum depressus, capite fortiter spinoso, impunctato, clypeo laveo, quadridentato, dentibus interioribus indistinctis, cornu frontali longo, acuto, laterali paulo sinnato, supra fere carinato, postice haud globoso, carinis frontaliis obsoletis, tuberculis nullis, carinis posterioribus longitudinalibus, carina oculari utroque tri-spinosa, spina antica longissima, acuta, horizontali, secunda valida, obliqua, tertia minuta; prothorace parum transverso, medio anguste sulcato, lateribus medio irregulariter sat crebre punctatis, angulis anticiis paulo productis, acatis; scutello antice subtiliter punctato; elytris anguste striatis, striis dorsalibus hand persiciue, lateribus leviter, punctatis, humeris fere recte angulatis, nudis; metasterni medio polito, nitido, lateribus crebre punctatis, nudis, metasterni lateribus parce punctatis.

Long. 18–30 mm.

Hab. Ecuador, Cachabé.
Four specimens were collected by Mr. W. H. Rosenberg in November 1896, and, like the preceding species, formed part of the collection of the late Mr. Alexander Fry. It is a form very easily recognised by the strong spinous processes with which the ocular ridges are armed. It is smooth and almost entirely devoid of hair. The prothorax is long and its front angles sharply pointed. The elytra are less strongly sculptured than in any other species known to me, the punctures in the striae being not coarse at the sides and barely traceable dorsally.

_Tetraracus centralis_, sp. n.

_Elongatus_, parum convexus, antennarum clava articulis tribus ultimis longibus duobusque precedentibus multo breviaribus composita, clypeo antice 4-dentato, dentibus interioribus minutis, approximatis, exterioribus validis, cornu frontale minuto, carinato, carinis frontalis integris, arcuatis, spatium magnum rugosum includentibus, angulo obtuso, tuberculato; prothorace vix transverso, antice angustato, angulis antecis sese rectis, lateribus grosse irregulariter punctatis, sulco marginale angusto, antice valde sinuato, dilatato, grosse punctato; antennae postice impunctato; elytris profunde striatis, interstiiis convexis, striis fortiter punctatis, humeris parce flavo-hirsutis; mesosterno glabro, utrinque profunde fossulato, metasterno medio parce minute punctato, lateraliter grosse hauad numerose punctato.

Long. 19 mm.

_Hab._ Costa Rica, Volcan de Barba (1600 metres).

_Tetraracus_ is very closely related to _Paxillus_, from which it is unnaturally separated by Kuwert on account of the existence of two minute projections at the middle of the clypeal margin. The form of the club of the antenna in the present insect is shared by only two other described species of Passalidæ, although others exist. The three terminal lamellæ are long, and the two preceding them about half their length, so that even when the club is contracted a distinct break occurs. _T. centralis_ is smaller and more elongate than the other two species. The prothorax is rather narrow, distinctly tapering towards the front, with rather sharp front angles. The elytra are moderately flattened, with closely punctured striae and there are a few short hairs at the shoulders.

Two specimens have been sent to the museum by Mr. P. Biolley.
Eumelus nasutus, sp. n.

Elongatus, valde depressus, capite toto impunctato, clypeo producto, tridentato, dente mediano sat lato, apice subtiliter emarginato, lateralibus acutis validis, cornu frontale minuto, acuto, multo projecto, haud producto, carinis frontalis fere toto rectis, transversis, ante dentes laterales tuberculis terminantibus, area clypeali omnino laxe, cornu postice subtiliter producto, tuberculis lateralis rotundatis, sat validis; prothorace fere quadrato, angulis anticus leviter productis, acutis, lateribus forte disperso punctatis, angulis posticus subtus longe et dense hirsutis; scutello postice impunctato; elytris haud grosse, dorso subtiliter, punctato-striatis, humeris fere recte angulatis, nudis; meso- et metasterno omnino glabris, impunctatis, illo utrinque profunde fossulato; tibuis 4 posterioribus parce setosis, vix spinosis.

Long. 23 mm.

Hab. Ecuador, Cachabé.

One specimen was found at Cachabé by Mr. W. H. Rosenberg, and I have also received the species from M. Oberthür, whose specimens were collected by Semi-radski. It is a peculiar form for which a new genus would no doubt have been made by Kuwert, but in the present state of the classification I prefer to avoid the further multiplication of genera as much as possible. I cannot however compare this species with any other known to me.

The median part of the head is rather produced forwards, so that the anterior declivity of the frontal horn, which is smaller and vertical in front, is nearly on a level with the outer angles of the head, as well as the frontal carinae, which form almost a straight line. In front of the latter the clypeus forms a smooth transverse parallelogram terminating in three strong teeth of equal length, the outer ones triangular and acute and the middle one parallel-sided and slightly impressed at its extremity. The prothorax is rather long, with sharply pointed front angles, the elytra are strongly depressed, with finely punctured striae, and the body is very smooth beneath.

I have already mentioned that Passalus occipitalis, Eschs., has remained unknown to successive monographers of the group, and can be referred to no existing genus. I propose for this the name of Epiphoroneus, as it will enter the Phoroneiæ of Kuwert.
The clypeus is produced in the middle where it bears two closely approximate teeth. The frontal carinae are directed towards the two outer teeth which they do not quite reach. They are parallel in front, situated behind and meet in an acute angle far back upon the head, pushing the median horn back, so that it forms a backwardly-directed blunt tubercle. The elongate area enclosed by these carinae is densely covered with large annulated pits.

*Epiphoroncus occipitalis*, Eschs., is excellently described by its author, but the species to which the name was applied by Percheron is an obviously different insect. It is placed in *Phoroneosomus* by Kuwert, who refers only to the later description. In the Munich Catalogue Eschscholtz's species is strangely identified with the West Indian *Passalus (Neleus) unicornis*, Serv.

The references are as follows:


tetragonus, Hope, Cat. Lucanoid Coleoptera, 1845, p. 28.

*quadrifrons*, Perch., Monogr., 1835, p. 64.

The African *Passalidæ*, which are not very numerous, and form a fairly homogeneous assemblage, were arranged by Kuwert in two principal groups, which he placed far apart. The majority of them form the Mitrorhinae, named from the American *Mitrorhinus*, which he curiously associated with them. The other group, the Erionominae, he boldly placed in the very midst of the main body of American genera. All really belong to the *Lepi- taulac* group of Old World *Passalidæ*, *Erionomus* forming a section distinguished by its convexity and the hairy sides of its elytra. Two species of this latter genus were separated by Kuwert under the name of *Eriopterus*, on account of the existence of two minute projections at the middle of the clypeus, which are inconstant and of little importance. A more important feature by means of which the species may be separated is found in the elytral epipleura. In the two species forming Kuwert's *Eriopterus* (*E. pilosus*, Auriv., and *alterego*, Kuw.), the marginal costa of the elytron if traced from the apex will be found to shut off anteriorly a broad external strip. In *Erionomus latericrinitus*, Kuw., this strip is very narrow, and in *E. planiceps*, Eschs., the costa is not continued to the shoulder.
and the epipleural strip is consequently undefined. In the following new species a similar condition exists. This species, according to Kuwert's definition, would belong to *Eriopterus*, and, therefore, that genus must be abandoned. Zang has already pointed out that *Eriosternus* of Kuwert has no generic value.

**Erionomus platypleura, sp. n.**

Sat convexus, parum nitidus, capite ubique subtiliter punctato, elyseo fortiter 4-dentato, medio plerunque minute bidentato, carinis frontalis antice parallellis, postice angulo recto convergentibus, spatiis longitudinaliter plicaturn includentibus, cornu mediano breve, postice lato, tuberculis lateralibus fossis sat profundis distincte diviso; prothorace lato, ubique minute punctulato, punctis majoribus nullis, fossa laterale minuta, sulco laterale paulo rugoso, antice hand dilatato, paululo deflecto; scutello levii; elytris tenuiter et equaliter striatis, striis ubique impunctatis, interstitiis lateralibus ab humeris fere ad medium crebre punctatis et pilosis, costa marginalie postica hand ad humerum producta; prosterno postice convexo, crebre punctato, piloso, mesosterni medio anguste levii, convexo, lateribus crebre punctatis, pilosis; antennarum flabellis tribus ultimis brevissimis.

Long. 35 mm.

**Hab. British E. Africa, Kavirondo.**

*E. platypleura* is similar to *E. pilosus*, Auriv., in size and the configuration of the head, but markedly differs in the peculiarity already referred to in the lateral portion of the elytra, in which it most nearly resembles *E. planiceps*, Eschs. The lateral punctured area extends nearly half the length of the elytra and is rather flat, the striae becoming faint. The costa forming the outer edge of the elytron behind is not continued forward to the shoulder, so that no definite epipleura is traceable. The striae are everywhere destitute of the punctures faintly traceable in all the other species. The three lamellae of the antennal club are extremely short, as in *E. latericrinitus*, Kuw. The frontal carinae of the head at their posterior part, which is marked off by distinct tubercles, are slightly curved outwards, instead of inwards as in *E. pilosus*, and meet in a right angle. The posterior appendages of the median horn are separated from it by distinct grooves and form rounded bosses. The whole surface in our series of specimens is less glossy than that of the other species.
Didymus carnifex, Kuw. I have identified this species, of which the habitat is quoted by Kuwert as "Gaboon?" in a form collected at Kavirondo, British E. Africa. I have seen a series of specimens which are interesting as uniting Kuwert's genera Didymus and Eumelosomus. In some specimens there are two quite distinct teeth at the middle of the clypeal margin, while in one they are very closely approximated and in others actually form a single median tooth, which may or may not be minutely bifid at the end. I have not noticed similar variation in other species, but it is evident that Kuwert has attached undue importance to this feature and that, failing other means of differentiation, Eumelosomus cannot be retained as a distinct genus. The present species seems to be most closely related to D. (Eumelosomus) klugi, Kaup.

Didymus curvilineatus, sp. n.

Modice elongatus, depressus, capite vix distincte punctato, clypeo valde 4-dentato, medio vix emarginato, carinis frontalibus antice parallelis, postice acute convergentibus, cornu obtuso, postice sulcato, tuberculis lateralibus globosis; prothoracis lateribus fortiter arcuatis, haud crebre, postice pare, punctatis, angulis antecis paulo productis, acutis; scutello impunctato; elytris profunde striatis, striis dorsali-bus minute, lateralibus scalariforme, punctatis; mesosterno utrinque longe et profunde fossulato, metasterni postice medio et lateribus punctatis: abdominis segmentis omnibus lateriliter subtilissime rugosis.

Long. 26–27 mm.

Hab. BRIT. E. AFRICA, Kavirondo, Msozi (Uganda).

This is a rather broad and flat species, with the elytra conspicuously widening behind, so that the discoidal striae are strongly curved. The lateral interstices and their connecting rods are narrow, but less so than in the following species. The head is rather smooth and shining, without any coarse punctures. The frontal carinae are angulated behind the middle, where there is a tubercle, being nearly parallel in front of this and converging behind to an acute angle. There is a patch of punctures at the middle of the posterior part of the metasternum and a patch of larger punctures on each side. The abdomen is finely punctured at the sides and at the extreme apex of the terminal segment.
D. curvilineatus appears to be allied to D. haroldi, Kuw., but is smaller, the labrum is distinctly emarginate in front and the sides of the prothorax are punctured from the front to the hind angles.

Didymus congoensis, sp. n.

Modice elongatus, depressus, capite ubique parum profunde varioloso-punctato, clypeo valde 4-dentato, medio minute bi-tuberculato, carinis frontalibus antice leviter, deinde acute, convergentibus, cornu frontale obtuso, postice globoso, sulcato, cum tuberculis lateralibus minute punctulatis; prothoracis lateribus antice et postice grosse punctatis, ubique areuatis, angulis anticis acutis; scutello impunctato; elytris profunde striatis, striis dorsalibus vix perspicue punctatis, lateralibus latis, crebre scalariforme punctatis, interstitiis lateralibus angustis; metasterni postice medio et lateribus sat crebre et grosse punctatis, abdominis lateribus segmentoque ultimo toto subtilissime punctato-rugosis.

Long. 26-28 mm.

Hab. Congo, Mayanda; Angola, San Salvador.

This nearly resembles the preceding species, of which it has the size and form; but the elytra are more strongly sculptured laterally, with narrower longitudinal and transverse ridges. The head is punctured all over, the punctures being fine upon the elevated parts and large and round in the depressions. The punctures upon the posterior part of the metasternum, but at the middle and in the angles, are closer and more numerous. The last abdominal segment is finely punctured all over, but less closely at the middle.

In most respects the species agrees with D. latro, Kuw., but the lateral sculpture of the elytra is stronger and the transverse fold upon the last abdominal segment of that insect is absent.

Didymus levisternus, sp. n.

Modice depressus, capite punctato-rugo-so, postice nitido, clypeo fortiter 4-dentato, medio minute emarginato, carinis frontalibus arcuatis, post medium tuberculatis, hand angulatis, angulo apicale fere recto, cornu obtuse, lato, vix sulcato; prothoracis lateribus ubique hand crebre punctatis, arcuatis, angulis anticis fere rectis; scutello impunctato; elytris profunde striatis, striis dorsalibus
minutissime, lateralibus grossissime scalariforme, punctatis; abdominis segmento ultimo medio et lateribus subtiliter rugoso ibique dense fulvo-villoso.

Long. 28–30 mm.

*Hab.* BRITISH E. AFRICA, Kikuyu, Aberdare Mountains (Kenya Prov.).

A number of specimens were collected by Dr. S. L. Hinde in the Aberdare Mountains. In general appearance the species is closely similar to the last, although rather larger. It is easily recognised by the absence of punctures from the disc of the metasternum, a feature found previously only in *D. levis*, Klug. There is generally, though not invariably, a single large impression near the posterior margin of the metasternum, the sides of which are also smooth except for a few punctures in the hind angles. The last abdominal segment is finely rugose except at the front margin and the middle part bears a thick pad of golden hairs. The other segments have a small triangular rugose area on each side. The head is strongly rugose in front, the rugosity being produced by large shallow punctures which tend to coalesce and become obliterated. The median process is broad behind and scarcely sulcate. The lateral margins of the thorax are rather uniformly but not thickly punctured and those of the elytra have a strong scalariform sculpture.

*Didymus ruwenzoricus*, sp. n.

Parum depressus, supra ubique minute punctulatus, capite varioloso-rugoso,clypeo fortiter quadridentato, medio minute bidentato, cornu mediano parum prominente, tuberculis posticis distinctis, conicis, carinis frontalis integris, regulariter arcuatis, angulo acuto convergentibus, prothoracis lateribus leviter arcuatis, sat crebre punctatis, angulis antecis fere rectis; scutello impunctato; elytris punctato-striatis, punctis dorsalibus subtilibus, lateralibus densis, scalariformibus; mesosterno glabro, utrinque late foveolato; metasterni medio impunctato, angulis posticis punctis parvis nonnullis; abdominis segmentis utrinque triangulariter rugose impressis, segmenti ultimi dimidio postico crebre punctato et aureo-hirto.

Long. 21–22 mm.

*Hab.* UGANDA, Mount Ruwenzori.

A series of specimens were collected by the Hon. Gerald Legge.
This species is also distinguished by the metasternal plate being quite free from punctures. It is much smaller than the previous insect, but greatly resembles the West African *D. parastictus*, Imh. In addition to the unpunctured metasternal disc, it differs from that species in the rather less acute front angles of the prothorax, the sharply-limited rugose puncturing of the sides of the abdomen, which is confined to definite depressions, the very slight emargination of the last segment and the pilosity of its latter half.

*Didymus crassus*, sp. n.

Robustus, sat brevis, modice convexus, capite subtiliter punctato-rugoso, clypeo quadridentato, medio late emarginato, dentibus aqua-libus, carinis frontalibus vix arenatis, post medium angulatis et tuberculatis, cornu mediano obtuso, postice haud lato aut sulcato, tuberculis posticis transverse carinatis; prothorace levе, medio canaliculato, fossis lateralis minute punctatis, sulco laterale angusto, paulo punctato, prothorace preterea impunctato; scutello antice subtiliter punctulato, postice impresso; elytris striatis, striis lateralis leviter punctatis, duabus juxta-suturalibus fortiter impressis, tribus intermediiis tenuibus; mesosterno lato, glabro, utrinque fortiter foveolato, lateribus punctatis et hirsutis, metasterni medio et angulis posticis impunctatis, lateribus punctatis et hirsutis; abdominis segmento ultimo postice depresso et crebre punctato, penultimo omnino polito.

Long. 34 mm.

*Hab. Uganda, Mount Ruwenzori.*

A single example of this isolated form was found by Mr. Legge. Although agreeing in essential features with *Didymus* it has more the aspect of *Erionomus*. It is large, broad, and little flattened, the head is normal, the prothorax devoid of punctures except for a few minute ones in the lateral scars, and the elytral striae are only slightly punctured, the three exterior dorsal ones being much feeble than the rest. The sides of the elytra are naked, but there are a few hairs at the anterior face. The sides of the meso- and metasternum are hairy, and the latter is without punctures either at the middle or the hind angles.

*Eumelosomus affinis*, sp. n.

*E. sansibarico*, Har., proxime affinis, sed metasterni angulis posticis parce punctatis abdomenque fere omnino polito: sat convexus,
clypeo 5-dentato, carina media nulla, carinis frontalis valde arcuatis, angulo obtuso convergentibus, cornu mediano antice conico, postice vix sulcato, a tuberculis lateralis vix diviso; prothoracis lateribus grosse sat crebre punctatis, angulis anticae rectis; scutello polito; elytris punctato-striatis, punctis dorsalis subtilibus, lateralis grossis, scalariformibus; metasterni medio impunctato, angulis posticis sat sparse punctatis; abdominis lateribus vix punctatis, segmento ultimo polito, postice transverse bifoveolato.

Long. 26-28 mm.

Hab. Uganda, Mt. Ruwenzori.

Several specimens were collected by Mr. Legge.

This is of the same size and shape as *E. sansibaricus*, Har., from which it is only distinguishable by a close examination. It differs by the shield-like space between the frontal carinæ being rather less pointed behind and showing no trace of a median carina, by the thinly, instead of closely and coarsely, punctured hind angles of the metasternum, and the almost unpunctured sides of the abdomen.

*Leptaulacides pulchellus*, sp. n.

Parvus, subconvexus, niger, metasterno, abdomen elytrorumque dimidio anteriore rufis; capite parce punctato et piloso, clypeo quadridentato, dentibus exterioribus brevioribus, carina mediana obsoleta, antice perpaulo producta, cornu frontali acuto elevato, carinis anterioribus late divergentibus, vix arcuatis, ad marginem haud attingentibus, carinis posticis ad illas parallelis, angustis, productis; prothoracis lateribus ubique sat disperse punctatis; scutello postice impunctato; elytris parum depressis, punctato-striatis, punctis lateralis fere scalariformibus; metasterni lateribus punctis confluentibus bene demarcatis, medio uni-impresso; abdomine toto polito.

Long. 14 mm.

Hab. New Guinea, Ekeikei.

Of the 600 species of Passalidae hitherto described, all are unicolorous black (or castaneous when not fully coloured), with one exception which, having been described from a single specimen has been regarded as a possible abnormality. This is *Leptaulacides* (*Leptaulax* olim.) *glaber*, Kirsch., of which the anterior half of the elytra is red and the rest of the upper surface black. I have seen several specimens of this, all collected by Wallace in Batchian, and all exactly alike, and the insect described above is a second species ornamented in the
same way, so that the existence of forms less sombre-hued than the generality need no longer be doubted. The genus *Leptaulax* has been restricted by Zang to the large species in which there is a well-defined cephalic horn and lateral appendages behind completely separated from the supra-orbital elevations. They may generally be distinguished also by the four clypeal teeth being in a straight line at their tips and by the absence of hair from the depressed parts of the head. *Leptaulacides* comprises nearly all the remaining Oriental species of the family having only three leaflets in the antennal club and contains all the smallest representatives of the family. Although similarly coloured to *L. glaber*, Kirsch., *Leptaulacides pulchellus* is very distinct. It is smaller and less flattened, with much shorter leaflets to the antennae and the inner teeth of the clypeus more advanced. The shoulders of the elytra are less pointed, and the hinder border of the red band is a little indented at the suture, whereas in *L. glaber* it is slightly produced at that point.

*Chilomazus borealis*, sp. n.

Robustus, convexus, capite rugoso, antice late et arcuatim excavato, angulis acute productis, sinistro perpaule longiore, cornu mediano parum elevatis, lato, carinis posterioribus confuso, carinis anterioribus angulum acutum includentibus, brevissimis, ante tuberculos evanescentibus, his fortibus, approximatis, inter se et cum dentibus clypealiis connexis, prothorace sat longo, parum transverso, impunctato, stria mediana vix perspicua foveaque laterale rugosula; seutello postice laevi; elytris fortiter striatis, striis dorsalisibus band, lateralisibus vix punctatis, elytris postice paulo ampliatis, apice leviter acuminatis, humeris nudis; mesosterno polito, foveis nitidis, metasterni medio bi-impresso, lateribus rugoso-punctatis, hirsutis; antennarum lamellis tribus ultimis longibus, duabus precedentibus brevibus. Long. 37 mm.

*Hab. Assam, Naga Hills* (Doherty). I have seen only a single specimen of this aberrant species, which has many of the characteristics of *Tiberius*, but is excluded from that genus by the existence of a large well-defined tubercle on the anterior part of the mentum. The head is only very slightly asymmetrical. The median horn and the two anterior tubercles are placed very close together and enclose an equilateral triangle. The club of
the antenna is composed of three long and two short lamellae. The prothorax is rather long, without lateral puncturation, and the median groove is obsolete. The elytra are very broad behind, the shoulders rather prominent and not hairy, and the apical angles rather acute. The striae are very feebly punctured at the sides.

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[Read November 21st, 1906.]

PLATE XXVIII.

In this year's "Entomologist's Monthly Magazine," Ser. II, vol. xvii, p. 160, I have already recorded the fact of the breeding of Trochilium andreaniforme from larvae collected in Great Britain.

In the late summer of 1898 Mr. Sydney Webb of Dover suggested to the present writer that a search for the larva of this rare insect in the stems of Viburnum lantana might possibly prove successful. Mr. Sydney Webb had found an empty pupa-case protruding from the stem of this plant, and as the case in question undoubtedly belonged to a Sesiid he came to the conclusion that it could be none other than the present species.

It appears, however, that the food plant of this moth was already known at that time, though it was not until August of this year that the writer, on reading Max Bartel's book was made aware of this fact, and apparently the record has been generally overlooked. As stated by Max-Bartel, Mr. Heinrich Neustetter found in July 1896 two freshly emerged specimens of this moth at rest on the stem of a Guelder-rose from which the empty pupa-cases were protruding, in a garden at Bleiberg, in Austria.

‡ Bartel's reference to Neustetter's paper is misleading, as the page quoted is that of the separatum and not of the journal.

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All the larvae that I have examined were secured in stems of the Wayfaring tree, *Viburnum lantana*, but the above-mentioned record would lead one to suppose that the species mines both in *Viburnum lantana* and in *V. opulus*. The first larva that I found was mining in a bush of *V. lantana* at the edge of the author’s garden at Ashton Wold, Oundle, Northamptonshire, in November 1905. This specimen duly emerged as a fine female on the 12th June this year. During a walk in Surrey in the winter of 1905 I was surprised to see in a hedge several old mines of this species, but owing to a lack of time was unfortunately prevented from re-visiting the spot. At the author’s request Mr. H. McArthur went there in the following spring and secured two larvae in the same hedge, which never emerged. The author found a mined stem, this time containing a pupa or full-fed larva, in another part of Surrey in 1906, which, as previously recorded, emerged on the 10th June, this specimen being a male. Mr. H. McArthur then visited another locality in Kent, and there was successful in securing several larvae and pupae, two of which, a male and a female, emerged on the 2nd and 6th July respectively. Some of these larvae are still feeding at the time this article goes to press, and others produced ichneumons. The author found two more larvae, both of which unfortunately died, in Huntingdonshire, and numerous old mines in Kent. The description of the larva, presumably about two-thirds grown, and of the empty pupa-case (for which I am indebted to Mr. Eustace Bankes and Dr. T. A. Chapman), are appended to this article. The peculiarity of the present species is that the mine is unlike that of any other Sesiid with which I am acquainted, and to exhibit these peculiarities, photographs on Plate XXVIII have been taken. The empty mine of the insect in question is most characteristic and cannot, we fancy, be mistaken for anything else, see Plate XXVIII, fig. 2. It will be noticed from an examination of the photographs that the insect in question makes one straight mine in the centre of the twig or bough. One of the stems we have measures nearly two inches in diameter, while another is half an inch across or less. An opening from the mine to the outside of the bough (the opening from which the larval frass exudes and the insect emerges) is almost at right angles to the mine.

The larva of *Trochilium andreaniforme*, unlike that of
most Sesiiids, does not prepare a spot in the mine from which the imago emerges. The perfect insect on the contrary, as already stated, emerges from the only hole in the mine, from which the larval frass was also previously ejected. Some of the specimens cover the opening over with a cap consisting of a thin piece of bark quite separate from the rest of the twig, which apparently remains on until the insect emerges. The mine exhibiting this peculiarity, Fig. 4, contained a living pupa which was unfortunately cut through. Other mines lack the cap and have the characteristic appearance shown in Fig. 2, and in these cases the cap has obviously been dislodged. Other mines, again, have an irregular piece of bark gnawed right out, leaving the hole exposed, through which the frass of the living larva protrudes. In such cases as these one would imagine that the larva had failed to make a cap. The construction of this cap appears to us to be difficult of explanation, and it is hoped that some other entomologist will solve the difficulty. One specimen which we had in the breeding cage crawled out of the twig, re-entered it, and bored a hole through the bark, but not into the wood underneath it, and excavated a circular spot between the bark and the wood in which it lay concealed. Figs. 5 and 6 represent mined twigs from which ichneumons emerged. These have been identified by Mr. Claude Morley as Meniscus aqnaus, Grav. Demopheles caliginosus, Grav., also identified by Mr. Claude Morley, emerged from another mine.

While the present article was in the press I found several mines of this species at Tring, in Hertfordshire, in Viburnum lantana, and one old mine (undoubtedly belonging to this species) in Viburnum opulus.

* The mine of this specimen also contained the pupa of a Coleopteron.
Notes on the larva of Trochilium andrenæforme, *Lasp.*
By Eustace R. Bankes, M.A., F.E.S.

On July 26th last I received, through the generosity of the Hon. N. Charles Rothschild, a portion of a stem of *Viburnum lantana* that he knew, by deduction, must contain a feeding larva of the extremely rare *Trochilium andrenæforme*. As Mr. Rothschild had informed me that, although it was certain that some of the very few larvae he had obtained had made external journeys along the stems, he had not succeeded in catching sight of any of them, and, to the best of my belief, no human eye had ever rested on the insect in this stage, it was with all the more intense satisfaction that, at 7 a.m. on July 28th, I found my larva on the outside of the stem, near the top of it. Thinking that it might prefer a fresh-cut piece of stem, I started off in search of a suitable one, leaving it where it was, and it then proceeded to gnaw an excavation in the bark, and to build a circular, blister-like, chamber over itself, composed of fragments of bark and gnawed wood, woven together with white silk. The small size of the chamber, of which the diameter was only 6.5 mm., did not nearly admit of its owner lying stretched in a straight line therein, and, during the whole course of operations, extending over some hours, the latter had to maintain a curled or contorted attitude, though its truly marvellous flexibility enabled it to reverse its position, or to assume any one that might be necessary. I was not free to describe the larva until about 3 p.m., by which hour it had apparently completed its chamber—which was soft to the touch and projected noticeably above the surface of the surrounding bark—and was entirely concealed therein. In order to extract the larva for examination, it was necessary to break open its chamber, of which the walls had been finished first, the centre of the somewhat arched roof being the last portion to be filled in, and the occupant was then found busily engaged in boring into the solid wood of the stem. It is clear, therefore, that the chamber is constructed in order to conceal and protect the larva.
until it has been able to excavate a burrow, sufficiently large to receive it, in the wood itself, and it subsequently serves the further useful purpose of concealing and protecting from enemies the mouth of its burrow.

The following is the description that I made of the larva:—

Length, when moderately stretched, 11 mm. Greatest breadth (i.e. across prothorax) 1.75 mm. Head broad, rather flattened, highly polished, brownish-ochreous, clouded on the sides with tawny-brown, partially retractile into the prothorax; upper mouth-parts mostly blackish; ocelli minute, black, well separated. Prothorax of great breadth (the broadest part of the whole larva), with a large, highly-polished, almost transparent, watery-whitish-ochreous, undivided plate, through which the posterior portion of the head, when retracted, is clearly seen. Meso- and meta-thorax rather narrower than prothorax, and somewhat broader than abdomen. The thorax and abdomen together form a mass which tapers gradually from its anterior to its posterior extremity, and shows very clearly-defined segmental divisions; in colour it is semitransparent watery-ochreous-whitish, with the pulsating dorsal vessel showing through as a broad (zigzag, in reality, and of varying width), deep purplish-brown, mediiodorsal line. Skin not glossy, smooth, but with various transverse wrinkles, each segment being divided into three distinct subsegments, the larva being thus enabled to contort itself to an extent almost past belief. There is a well-developed lateral flange below the spiracles. Anal plate polished, semitransparent, watery-ochreous-whitish, the dark contents of the cloaca being clearly visible through it. Tubercles of moderate size, polished, concolorous with ground-colour, each emitting a single short hair. Spiracles small, watery-whitish, with ochreous centres. Hairs few, short, single, scattered, pale brown. Legs highly polished, whitish-ochreous externally, paler internally; claws dusky-brown. Prolegs semitransparent watery-ochreous-whitish, with dark brown terminations.

I inadvertently omitted to note down details about the ventral surface, but feel sure that it was concolorous with the dorsum. In colour, undulating constrictions on being touched, etc., this larva is decidedly maggot-like, though by no means so in shape when extended. Its movements are deliberate, and its rate of progression is remarkably slow.

At 3.45 p.m. the larva was placed on a crack in the bark of the fresh-cut stem of Viburnum lantana, and, ensconcing itself therein, it forthwith proceeded to build
Notes on the Larva of Trochilium andreniforme.

over itself another chamber, similar in construction to the previous one, only longer and much narrower, its breadth being made to coincide with that of the crack in the bark. By 11 p.m. the indefatigable subject of these notes had nearly completed its temporary domicile, and was almost concealed from view, though it could be seen, through the diminishing gap in the roof, to be still hard at work thereon. This chamber, which appeared quite finished by 7 a.m. on the following day (July 29th), and probably had been so for several hours, was elliptical in shape, 9 mm. long, by 3 mm. wide across the middle, and became covered externally with numerous frass-like pellets (mostly reddish-brown, though some were quite ochreous) of gnawed inner bark and wood, mixed with frass, which seems to vary in colour from reddish-brown to blackish-brown. The larva continued to feed in this same burrow, at any rate for the next two or three weeks, as was evidenced by the frass and pellets, which continued to be extruded through some invisible opening in the walls of the chamber, the pellets that could not adhere to these falling on the sand at the bottom of the cage. But, at some time between the middle of August and the latter part of October, it clearly left this burrow, wandered a few inches down the stem, constructed an elliptical-oval, blister-like, chamber (about 10 mm. long, by 5·5 mm. wide across the middle) over itself between the two Viburnum stems just where they closely approached one another, its base being fixed to one stem and its roof to the bark of the other, and bored thence into the solid wood, in which it still (November 7th) remains lost to view.

It seems obvious that the larva of T. andreniforme feeds throughout one year and through portions of two others, that is, for the greater part of two years, for there can be but little doubt that the individual under notice, which must have been deposited as an egg about mid-summer 1905, hatched out within the next month or two, and that it will not be full-fed before the spring of next year (1907).
Notes on the pupa of Trochilium andrenæformis, Lasp.*
By T. A. Chapman, M.D., F.E.S.

Pupa of Tr. andreniformis from an empty case (♀). Of the usual Aegeriad structure. Belongs to the genus Trochilium. The genera known to me may be divided as follows:—

Aegeria (erabroniformis=bombeiforme), has spines along front row of second abdominal segment, and five spines on each side of crown on tenth abdominal segment, the two dorsal ones (four altogether) very small.

Sciapteron (tabaniforme=wespiforme), has no spines on second segment (abdominal), on each side five nearly equal to crown on tenth.

Bembecia (hylaciformis), first and second abdominal segments very smooth, only one or two large spines on ninth abdominal (all the other genera have more or less of a row in both sexes, hylaciformis only in ♂), has six spines on each side of crown on tenth.

Trochilium has only four spines on each side in the crown on tenth segment. The first abdominal has no spines, the second varies in the different species (or individuals?).

In asiliforme (=epipiforme) and chrysidiforme there are present spines of both the anterior and posterior row.

In scoliaforme and formiciforme the spines are present in the front row, the back row being represented by a line.

The majority of the genus have faint spines on the front row and no very definite indication of the posterior, the surface being smooth and no line easily made out.

In andreniformis we have the extreme of this section, the front line has but faint elevations to mark some only of the spines, though the bases of those that are absent are rather more chitinized than the rest of the line, and there is a line showing the position of the posterior row. This is no doubt correlated with its being perhaps the palest (least chitinized) of all the species.

* Laspeyres wrote andrenæformis; it is a pity that this does not agree with Trochilium. I have not verified the names of other species referred to. T. A. C.

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In common with the whole group, *Trocilium* has the appendages fixed to first and second abdominal segments, and also almost as firmly to third; but this connection dissolves on dehiscence and the suture 1-2 abdominal also opens. Segments 3, 4, 5 and 6 (abdominal) carry two (an anterior and posterior) rows of spines directed backwards, *t* also does so in the *f*; in the *f* like 8 and 9 it only has the forward row. These spines are stronger on each segment than on the preceding one.

Specific characters are probably confined to the relative strengths and extensions of these rows, to the development of the nose-horn (beak) and to the exact details of the spines on anal segments, possibly also to the forms of the spines. Even so, it seems difficult to be sure in any case how far the variations observed are specific and how far individual.

*Sphexiforme, scoliaforme* and *culiciforme* differ slightly in build, the others taper regularly (or nearly so); these taper much more in the last few segments.

*Andreniformis* differs in the spines in all the rows being finer, smaller and paler than in the other species examined, just as the pupa itself is so, though probably the paleness of the spines affords a good part of the impression that the pupa as a whole is pale.

The nose-horn (beak) is in accord with the general weak structure in being very small and short, a mere fine nodule on the face, that one almost overlooks—it is nevertheless sharp. (In many species this is large, sharp and formidable.)

The above memoranda seemed necessary in order to define its generic and subgeneric position, and if possible to suggest points by which it might be distinguished from most nearly allied species. The individual variations are however so considerable and the distinction so slight, that I doubt whether any species of *Trocilium* could be named with certainty from its pupa. Having only one example of *andreniformis*, its range of variation cannot be estimated, and it is therefore so far fortunate that its general more delicate structure gives some points of difference with the other species examined. The following description is largely generic, or even family, rather than specific. The arrangement of the terminal crown of spines differs somewhat in most species.
The pupa-shell is 19 mm. long, the segments are extended and the shell curved, it might be 20 mm. if straight, 16 mm. with the segments contracted. The width is about 3 mm. from front of mesothorax to fourth or fifth abdominal segment, thence it tapers regularly to about 1·1 mm. at crown in tenth segment.

The maxillae extend down to 7·5 mm. from front and include basally a lozenge of labrum (palpi) of 1 mm. long, divided by a median line. The wings and second legs reach 0·5 mm. further (to 8·0 mm. from front), and the third legs extend by themselves 1 mm. beyond this to 9·0 mm., i.e. as far as fifth abdominal segment, but the flattening of abdominal ventral aspect shows that in some attitudes it would reach to quite end of sixth. The first femur is quite a large piece nearly 2·0 mm. long between the maxillae and the first leg (tibia) which reaches about 1·5 mm. further, these abut forwards against the eye-pieces and the maxillary palpus, which stretches inwards here from the antennæ, and almost shut out the second leg. The maxillary palpus is a transverse slip about 0·4 mm. long, about 0·12 mm. wide against antennæ narrowing inwards; it has a raised sutural margin and has transverse lines of fine points.

The labrum is pointed below and is very large in so far that it is not well marked off from the face and so reaches up to the beak; the mandibles are comparatively narrow slips, meeting each other in the middle line by their pointed extremities. The beak is a minute sharp point in the middle of the projecting and rounded front. The antennæ reach down to the same length as the maxillæ. In this dehisced specimen they are of course out of their grooves and in fact twisted away backwards, as often takes place in these *Trochilium*. There is a pair of hairs on the labrum (lower part of face), another pair above, and a hair at the base of each antennæ, about 0·12 mm. long.

The antennal segments are distinctly marked off. The maxillae also have many transverse markings like fine dotted wrinkles. Poulton's line is well marked, the portion beyond it at the apex being about 0·3 mm. long. The hind-wing is about 0·4 mm. broad at its base, and continues slightly narrowing for nearly 2 mm., then does so more thoroughly, but leaves a fine margin all along round to the apex of fore-wing or nearly so. The dorsal head-piece is nearly 0·5 mm. wide (on either side, 1·0 mm. right across), about 0·25 mm. longitudinally in middle line, pointed laterally. It has, like the prothorax, and the front of the mesothorax, a much raised sutural border, and has a ridge across it marking off the outer angle. The prothorax is similar in form, each side 1·0 mm. wide and 0·4 mm. long medially. The mesothorax is 2·6 mm. long with a central raised suture and a groove with raised inner margin extending back
from its front margin, marking off the wing base (or patagium?). It points to, but does not (by 0.7 mm.) reach the notch formed by the forward lateral extension of the metathorax, each half is about 1.2 mm. wide, 0.4 mm. long in middle line, 1.0 mm. at lateral forward extension. These portions of the thorax are smooth, with very minute tessellations. One minute hair is detected on mesothorax perhaps 0.05 mm. long—there are probably others.

The first abdominal segment is about 0.6 mm. wide (1.0 mm., with intersegmental membrane, after dehiscence). It has no marks, spines or processes, it probably has a hair or two, but they are not detected. The second abdominal segment is 1.3 mm. wide (with intersegmental membrane). Its spiracle lies in a hollow at its front outer angle, the hind-wing is slightly waved to make room for it, and there is a walled ridge round it internally and behind. Right across the front of the segment is a dark line in which it is just possible to believe one sees small elevations of obsolete spines, the more as their places are marked by dark lines radiating into the general surface; posteriorly, is a just discernible line. Each side carries three hairs (about 0.1 mm. long), one below and behind spiracle in the hollow with it, one just above inner front margin of hollow (III ?), and one nearer the middle line, a little behind spine ridge (r ?). The third abdominal segment is larger than the second. The spiracle is on the smooth surface, both lines have spines well developed, the upper one reaches almost as far out as spiracle, the posterior rather less. On the next (fourth) segment the front row goes ten spines ventral of spiracle, the posterior much as on third. On the fifth the front line reaches for about twelve spines ventral of spiracle, the posterior much the same as previous segment. On these the front row comes to margin of lateral flange, on sixth it goes well on to it, as also on seventh. On eighth it is only just below spiracular level and on ninth a little lower. The posterior row on 6 is much as on fifth. No trace of it on 7, 8 or 9 (probably like other species it exists on seventh in ♀). On third to ninth segments the dorsal hairs (1 and III ?) exist, getting on fifth very close to the row of spines and on the following ones almost on it. On third and fourth segments is a hair below the spiracle and on fifth, sixth and seventh are two hairs in this position, one directly above the other and close to each other and to the spiracle. No other hairs are found (except on tenth abdominal). The spines get larger on the later segments, but are much the same on 7, 8 and 9. On 9 there are about eleven spines on either side, with a dorsal vacancy of the width of three or four spines. On the fifth segment the front row has eighty-two spines. The larger posterior ones are wider and stronger than those in front, but not much longer, the longest about
the Pupa of Trochilium andreniformis. 481

0·1 mm. and about half their length wide at base (those in front two-fifths). The length of the base is nearly the same as the height of the spine; the form of the spines is much that of a rose-thorn but straighter and thicker, the front sloping backwards in a straight line, the back hollowed in a curve, but vertical to the surface of origin. The general surface is smooth, but very minutely tessellated like the thorax. The last (tenth abdominal) segment is not very definitely marked off ventrally from eighth and ninth. The curvature of the pupa and especially of this segment makes its termination rather ventral than posterior. It has a ring of eight strong spines round its margin, almost equally spaced, except that the space between the two ventral ones (3 and 4) on each side is rather less than the others. Each of these is about 0·1 mm. high, but stands on a little eminence making it twice as tall. All face to the centre of the segment, round which they form as it were the spikes of a crown; each rises outside by a convex slope, on the inner side the face is a hollow, with a ridged margin; it terminates in a neck rather bent inwards, the end being the base of a hair, which in each case points to the centre of the segment. The hair is about 0·1 mm. long. Looking from behind or rather from below to the centre of the ring formed by these spines, the space is occupied by a rounded swelling, higher above (posteriorly), where it is rather full and rounded (the obsolete cremastral spike). The front half has the longitudinal anal scar with some lateral parallel ridges and some radiating wrinkles into the boss behind. The whole width of the ninth segment has a longitudinal ventral suture a little widened against eighth. The eighth has an obscure ventral flattened smooth space notched at each margin, but with little trace of line or pore.

In dehiscence the fracture is down the median dorsal line through dorsal head-piece and through the whole thorax. The front head-piece separates from these and the antennæ lift out clear; the head-piece is held in place by the maxilla, whose extremities remain in situ, and by mere shreds connecting it with the first femora and legs; the femora separate except at their extremities being held to the tibia at one end and to the head (prosternum really) at the other. The eye-piece separates and forms a last element of a chain held together by membrane of mesothorax, pronotum, and dorsal head-piece. Essentially nothing is ruptured except the dorsal suture, and the dorsal from the ventral head-covering; though also no doubt much sternal delicate membrane interiorly suffers.
Fig. 1. Mine with empty pupa-case protruding. Imago ♀ emerged July 6th, 1906.
2. The same with pupa-case removed.
4. Mine showing "cap" in situ. The living pupa was accidentally cut through.
5. Mine from which the ichneumon *Meniscus aequalis*, Grav., emerged.
6. Vertical section of entire mine from which the Ichneumon *Meniscus aequalis*, Grav., emerged.
XX. *A permanent record of British Moths in their natural attitudes of rest.* By A. H. Hamm, Assistant in the Hope Department of Zoology, Oxford University Museum. Communicated by Professor E. B. Poulton, D. Sc., F.R.S.

[Read November 21st, 1906.]

**PLATE XXIX.**

Naturalists have often described the remarkable harmony between many of our common insects and their environment. Indeed no one can have collected or observed insects without noticing this for himself, particularly in the species which usually rest upon tree-trunks, rocks and walls.

Although the art of photography has recently made such rapid strides and has been utilized so successfully to demonstrate and record many of the processes and facts of Nature, very little has been done, so far as I am aware, to illustrate by its means the attitudes and resting habits of our common insects. Now, however, by the development and perfection of "half-tone" illustration, figures can be multiplied to an indefinite extent easily, inexpensively, and so far as the printing is concerned in a permanent form. The paper it is to be feared is "another story," and one which requires, but has not as yet received serious consideration on behalf of posterity. The natural histories of British insects of the immediate future will I believe be largely illustrated in this way, and the present paper is an attempt to demonstrate the feasibility and success of the method.

Any one unacquainted with living insects in their natural surroundings entirely fails to appreciate and value the various colours and patterns seen on glancing through a collection of insects, more especially Lepidoptera. Even less is he able to understand their meaning in the illustrations of the numerous works on the subject. It is not too much to claim that the figures on Plate XXIX are...
not open to this criticism, and that the moths represented
tell their own story at once to experienced naturalist or
beginner alike. And this is just because the figures are an
accurate register of the insects in positions assumed by
them on surfaces chosen by them.

Fig. 1 on Plate XXIX shows the male of *Hybernia*
leucophavoria, Schiff., one of the commonest and earliest
moths to appear in our oak woods. The example here
shown is fairly typical of this extremely variable insect.
The figure shows the moth in its characteristic attitude
with the body approximately horizontal. The object of
this position is also well seen, viz. in order to bring the
dark markings or bars of the fore-wings into parallelism
with the dark lines of shadow in the main fissures of the
oak bark. Thus the attitude has an obvious procrystic
meaning. In this and in all the other figures illustrating
this paper the natural orientation of the moths was care-
fully preserved on the negatives and is now recorded on
the Plate.

Another very common species, *Tiphrosia binodulavia*,
Bork., occurs in nearly every wood throughout the country.
In the south where the pale typical form occurs unmixed
with others the insect is far more conspicuous than *leuco-
phavoria.* This is especially the case when it is found on one
of its usual resting places, the dark bark of the larch. On
oak, however, it is far less prominent. Fig. 2 represents
the female at rest upon this tree in its usual attitude,
which is to be interpreted in the same manner as in the
species last described. The asymmetrical position of the
wings is doubtless due to the costal margin of the right
fore-wing being fitted closely against the side of the
vertical fissure in the bark. Had the attitude been sym-
metrical both sides of the fissure would have been entirely
covered by part of one wing and a more conspicuous effect
produced.

*Eupithecia abbreviata*, St., as every one knows who has
had experience of "trunk-searching" for "Pugs," is very
difficult to find when at rest upon oak; so much so indeed
that collectors generally prefer to hunt the smooth stems
of the underwood, where it is far more easily detected.
In Fig. 3 is seen a specimen of this common "Pug"
fitting into a depression in the bark of an oak, and the
beautiful manner in which it harmonizes with its environ-
ment is very evident. The main lines of the moth's
markings are seen to be rendered vertical by the attitude, as in the moths represented in Figs. 1 and 2.

Among the moths which are usually found at rest upon rocks or stone walls the species of the genus *Bryophila* are probably the best known. The well-known *B. perla*, Fabr., is so common everywhere throughout the country that very little need be said of it. The range of variation in this moth is not very great, although in a few districts it tends to resemble some local peculiarity in the prevailing tints of the walls upon which it both feeds as a larva and rests as an imago. A typical example is shown in Fig. 4, upon an old, lichen-covered, stone wall. The peculiar grey lichen-like markings of its fore-wings are seen to blend almost perfectly with the surface upon which the moth is resting. *B. muralis*, Först. = *glandifera*, Hübn., is a species chiefly confined to our southern coasts and presents an interesting contrast to *B. perla* in its great variability, ranging, as it does, from a grey through a number of intermediate shades to a very dark green. This wide range of variation may be seen in a single district, as I have found in the locality in which I have chiefly observed it, viz. South Devon, where however the darker forms predomi-nate. By this great variability the species is much aided in the struggle for existence in localities where stone walls and rocks are as varied in hue as they are in South Devon. Fig. 5 shows one of the darker forms which are extremely well concealed on many of the walls. In this particular instance the moth was rather more conspicuous than usual. Fig. 6 is an example of the yellowish-green form, which is less common than the other. It is however equally well protected when at rest on walls or rocks covered with yellowish-green lichens. It is to be observed that the moths of this genus adopt no special orientation in their attitudes of rest, a fact which is in correspondence with the irregular growth of lichen-masses on stone.
Explanation of Plate XXIX.

Photographed direct from nature, natural size.

The orientation of the living insects is accurately recorded on the plate in every case.

Fig. 1. *Hybernia leucophlebra*, Schiff., ♂, at rest on an oak trunk with head to the right, about 3½ feet from the ground, Bagley Wood, near Oxford, March 9, 1902.

2. *Tephrosia bimultaria*, Bork., ♀, at rest on an oak trunk with head to the right, about 3 feet from the ground, Henwood, near Oxford, May 10, 1902.

3. *Eupithecia abbreviata*, St., at rest on an oak trunk in a crevice of the bark, about 1½ feet from the ground, Henwood, near Oxford, April 27, 1902.

4. *Bryophila perla*, Fabr., at rest on an old lichen-covered stone wall, 3½ feet from the ground, Cheyney Lane, near Oxford, August 23, 1902.


6. *B. muralis*, at rest on an old lichen-covered stone wall, 3 feet from the ground, near the Coast Guard Station, Dawlish, South Devon, August 13, 1902.
XXI. Studies of the Blattidæ (continued). By R. Shelford, M.A., F.L.S.

[Read November 21st, 1906.]

Plate XXX.

V. The types of Blattidæ described by Francis Walker, and now in the Hope Museum, Oxford.

These types are all contained in the collection of Mr. W. W. Saunders which was presented in 1873 to the Oxford Museum by Mrs. F. W. Hope; the new species in this collection were described by Walker in his "Catalogue of Blattariæ" (1868); and in a supplementary volume, "Catalogue of Dermaptera Saltatoria and Blattariæ," published in 1869.

Owing to the inadequacy of Walker's descriptions and to his elastic views of generic limitations many of his species can only be recognized by those who have access to his types. A careful revision of Walker's work on Blattidæ is urgently needed, and the notes here presented are a first contribution towards a complete revision; thanks to Mr. Kirby's "Synonymic Catalogue of Orthoptera," vol. i (1904), the task has not proved so difficult as might have been expected. The species are discussed here not in the order in which they were arranged by Walker, but in the order that they take in modern and received systems of classification of the Blattidæ. Wherever it has appeared necessary the species have been re-described, but in some cases Walker's descriptions are quite recognizable, once the generic positions of his species have been fixed.

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Family BLATTIDÆ.

Sub-fam. ECTOBIINÆ.

1. Thelygopteryx apicigera, Wlk.
♀. Java (Wallace).

2. Escala circumducta, Wlk.
♀. S. Australia.

3. Escala longiuscula, Wlk.
   *Blatta longiuscula*, Walker, l. c. p. 143 (1869).
   *Escala longiuscula*, Shelford, l. c. p. 239. Pl. XV, f. 5 (1906).
♀. S. Australia.

   *Pseudomops fissa*, Walker, l. c. p. 213 (1868).
♀. Sumatra (Wallace).
   This is synonymous with *H. histrio*, Burm. (cf. Trans. Ent. Soc. 1906, p. 238.)

Sub-fam. PHYLLODROMIINÆ.

5. Pseudomops inclusa, Wlk.
   *Thyrsocera amena*, de Saussure, Mél. Orthop. IV, p. 97 (1872).
♀. Brazil.

   *Pseudomops pica*, Walker, l. c. p. 213 (1868).
   *Pseustothyrsocera pica*, Shelford, l. c. p. 250 (1906).


♀. SARAWAK (Wallace).


♀. MENADO, CELEBES (Wallace).

Fulvous. Antennae black, slightly incrassated in basal half and hirsute; apex of maxillary palpi black. Pronotum trapezoidal, covering vertex of head. Tegmina with thirteen costal veins, discoidal field with seven longitudinal sectors, three of which are given off from the anterior ulnar branch, four from the posterior ulnar, the latter are strongly angled. Supra-anal lamina triangular, produced, the posterior angles bear each a short downwardly directed spine; sub-genital lamina produced, narrow, covered with a dense pile of long hairs, asymmetrical, the left posterior angle slightly produced, no styles.

Total length 13 mm.; length of tegmina 10.8 mm.


♀. SINGAPORE (Wallace).

Rufo-castaneous. Basal half of antennae, terminal joints of maxillary and labial palpi, fuscous. Pronotum trapezoidal, sides deflexed, not covering vertex of head. Tegmina with nineteen costal veins, discoidal field with ten longitudinal sectors. Wings with the mediastinal vein three-branched, radial vein unbranched, twelve costal veins, ulnar vein with nine branches, three of which go towards the dividing vein. Supra-anal lamina triangular, sub-genital lamina ample, its border notched, two styles. Legs with the genicular angles of the femora, the tibiae and tarsi fuscous, all the femora with genicular spines, formula of apical spines, $\frac{1}{3}$, $\frac{1}{3}$, $\frac{1}{3}$, anterior margin of front femora with numerous spines, the more distal short and closely set.

Total length 20 mm.; length of body 13 mm.; length of tegmina 15 mm.


*Blatta crythrina*, Walker, l. c. p. 219 (1868).

♀. BRAZIL.

This is synonymous with *Ischnoptera rufa*, Br.

*Blatta colligata*, Walker, l. c. p. 221 (1868).


The type, which is in a very fragmentary condition, is from Amoy.


*Blatta amplectens*, Walker, l. c. p. 223 (1868).

Sex ? (abdomen lost). Morty (*Wallace*).

Fulvous. Pronotum with a fuscous horseshoe-shaped marking, the limbs of the horseshoe directed forward and not attaining the anterior border of the pronotum. Tegmina with sixteen costal veins, discoidal field with eight longitudinal sectors.

Total length 16·2 mm.; length of tegmina 13 mm.


♂. Sarawak (*Wallace*).

Pronotum not covering vertex of head, trapezoidal, sides scarcely deflexed, margined. Tegmina with twelve costal veins, the last three bifurcated. Supra-anal lamina triangular, sub-genital lamina ample, its posterior border slightly emarginate. Anterior border of front femora with three long spines in the middle, numerous piliform spines distally.

Near *P. lycoides*, Wlk., from India.


♂. Sarawak (*Wallace*).

The species is allied to *P. variegata*, Br., from Java. Walker’s description sufficiently illustrates its differences from that species.

15. *Phyllodromia contingens*, Wlk. (Plate XXX, fig. 4)


♂. (*humeralis*) Singapore (*Wallace*).

♀. (*contingens*) Sarawak (*Wallace*).
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Flavo-testaceous. Antennæ longer than total length. Pronotum transversely elliptical, lateral margins hyaline, posterior border not produced. Lateral margins of tegmina broadly hyaline, mediastinal area areolated, eleven costal veins. Supra-anal lamina of male shortly produced, trigonal, sub-genital lamina with the posterior angles produced to form two setiform processes, the styles situated in deep notches; supra-anal lamina of female short, transverse, sub-genital lamina ample, semi-orbicular.

♂. Total length 13 mm.; length of body 10 mm.; length of tegmina 10 mm.

♀. Total length 15 mm.; length of body 10 mm.; length of tegmina 12.8 mm.

   Blatta sequens, Walker, l. c. p. 229 (1868).
   Sex? (abdomen lost). Macassar, Celebes (Wallace).

Fulvo-testaceous; head not covered by pronotum, which is elliptical, and slightly produced behind, its lateral margins pellucid. Tegmina with eleven costals, anterior ulnar with four branches, posterior ulnar simple. Front femora with 8 long spines on the anterior margin beneath, all the femora with genicular spines, formula of apical spines $\frac{1}{3}, \frac{1}{3}, \frac{1}{3}$. Total length 13.2 mm.; length of tegmina 11 mm.

17. Phyllodromia virescens, Wlk.
   Blatta virescens, Walker, l. c. p. 231 (1868).
   ♀. Sarawak (Wallace).

The species is readily recognizable by its pale green colour. Small; pronotum not covering vertex of head, trapezoidal, margins broadly hyaline. Tegmina hyaline, eleven to twelve costals, disoidal sectors oblique. Supra-anal lamina trigonal, sub-genital lamina ample, cerci elongate. Front femora with close-set piliform spines on anterior margin.

18. Phyllodromia suffusa, Wlk.
   Blatta suffusa, Walker, l. c. p. 223 (1868).

Flavo-testaceous. Antennæ flavo-testaceous at base, terminal half fuscescent, basal half fuscous. Pronotum trapezoidal, not covering vertex of head, lateral margins pellucid, sides not deflexed,
posterior margin straight. Tegmina with ten costal veins, anterior ulnar with five oblique branches, posterior ulnar simple. Wings with eleven costals their apices incrassated, ulnar vein with three branches. Front femora armed on the anterior margin beneath with minute piliform spines, armature of the other femora very sparse; no genicular spine on anterior femora.

19. Phyllodromia laterifera, Wlk.
   *Blatta laterifera*, Walker, l. c. p. 231 (1868).

♀. SARAWAK (Wallace).

20. Phyllodromia propinquua, Wlk.
   *Blatta propinquua*, Walker, l. c. p. 228 (1868).
   *Blatta contigua*, Walker, l. c. p. 228 (1868).

♀. (propinquua). MACASSAR, CELEBES (Wallace).
♀. (contigua). NEW GUINEA (Wallace).

   *Blatta majuscula*, Walker, l. c. p. 139 (1869).

♀. CHAN-TI-BON, SIAM (Mouhot).

These three species are all large testaceo-hyaline forms with broadly elliptical pronotum, broad tegmina with the marginal area equalling half the total breadth. They may be distinguished by the form of the supra-anal lamina:

- a. Supra-anal lamina triangular and cleft at the apex; total length 17 mm. ... . . . . . . . . . P. propinquua.
- aa. Supra-anal lamina not cleft at the apex.
- b. Supra-anal lamina short, transverse; total length 18 mm. ... . . . . . . . . . P. laterifera.
- bb. Supra-anal lamina, slightly produced, trigonal; total length 21 mm. ... . . . . . . . . . P. majuscula.

22. Phyllodromia elegans, Wlk.

♀. SARAWAK (Wallace).

23. Phyllodromia picticollis, Wlk.
   *Blatta picticollis*, Walker, l. c. p. 140 (1869).

♀. MACASSAR, CELEBES (Wallace).
This and the two preceding species are all very closely allied. They are fulvo-testaceous insects about 17 mm. in total length with very long slender antennæ and with the tegmina projecting considerably beyond the end of the body; the venation of the tegmina is the same in all species, there being twenty to twenty-one costal veins, eight discoidal longitudinal sectors and the radial vein is bifurcated.

The following may be considered the differential characters of the three species:

Pronotum with disc fusco-castaneous, a W-shaped mark and central line testaceous, margins testaceous. Coxæ not spotted. Supra-anal lamina narrow, produced, triangular; sub-genital lamina irregular, deeply cleft; titillator nearly straight . . . . . P. elegans

Pronotum with disc rufo-castaneous, a dumb-bell-shaped mark and margins testaceous. Coxæ not spotted. Supra-anal lamina incised at apex . . . P. picticolis.

Pronotum fulvous with irregular paler marking on disc. Coxæ spotted with castaneous. Supra-anal lamina broad, produced, triangular; sub-genital lamina narrow, not cleft; titillator strongly curved P. guttifera.


Blatta polygrapha, Walker, l. c. p. 222 (1868).

Sex? (abdomen missing).

CHAN-TI-BON, SIAM (Mouhot).

This is closely allied to P. hieroglyphica, Br. but the head and pronotum are much more heavily marked with castaneous and the femora have their posterior margins marked with fuscous.


Blatta obtusifrons, Walker, l. c. p. 226 (1868).

♀. SARAWAK (Wallace).

Fulvo-testaceous. Head castaneous, antennæ twice as long as the body. Pronotum trapezoidal, barely covering vertex of head, posterior margin very slightly angled, sides only slightly deflexed,
disc marked with castaneous dots and lines symmetrically arranged. Tegmina with marginal field equalling half the total breadth, radial vein bifurcated, the lower branch ramose and sending its branches to the apical part of the anterior margin, eleven costals, anterior ulnar with five branches, posterior ulnar simple. Ulnar vein of wings with four branches. Supra-anal lamina shortly produced; sub-genital lamina ample, semi-orbicular; cerci elongate. Insertions of tibial and femoral spines marked with fuscous.

27. Phyllodromia ignobilis, Wlk.
   Blatta ignobilis, Walker, l. c. p. 224 (1868).
♀. Sula Is. (Wallace).

This is a small species, which can be recognized by the colouring of the tegmina; in these the veins are pale and the interstices filled with flavo-testaceous, in addition there are numerous castaneous points situated on the veins. The costal veins of the wing are somewhat irregular and their ends are clavate, they are ten in number, the ulnar vein has three branches and there is a prominent triangular apical area. The anterior margin of the front femora beneath are armed only with minute and close-set piliform spines.

   Blatta marmorata, Walker, l. c. p. 140 (1869).
♀. Mt. Ophir, Malacca (Wallace).

A pale testaceous species, marbled with castaneous; evidently a cryptic coloration.

29. Phyllodromia extenuata, Wlk.
   Blatta extenuata, Walker, l. c. 221 (1868).
♂. Egypt.

This is synonymous with P. supcollectilium, Serv.

30. Phyllodromia annulicornis, Wlk.
   Blatta annulicornis, Walker, l. c. p. 219 (1868).
♂. Para, Brazil.

Head black, shining; eyes pale; antennae fuscous, with a testaceous annulus occupying eight joints, before the middle. Pronotum black, shining, with the posterior and lateral margins pale testaceous, not covering vertex of head, posterior margin slightly produced.
Tegmina rufo-testaceous, infuscated at base, fifteen costal veins, discoidal field reticulated. Abdomen and legs black, tibial spines and apical tarsal joints rufous. Sub-genital lamina small, narrow, quadrate, with two styles.

31. Pseudectobia bipunctata, Wlk. (Plate XXX, fig. 3.)

Blatta bipunctata, Walker, l. c. p. 141 (1869).
♀. Macassar, Celebes (Wallace).

The species is rather convex, the marginal field of the tegmina is broad, the veins of the discoidal field are very indistinct, a triangular apical area is present in the wings, the supra-anal lamina is short and transverse and the femora are sparsely armed, which characters taken in conjunction may be considered as diagnostic of the genus Pseudectobia.

32. Pseudophyllodromia laticeps, Wlk.

Blatta laticeps, Walker, l. c. 142 (1869).
Phyllodromia laticarpus, Brunner, Abhandl. Senckenb.
Ges. xxiv, p. 205, pl. 16, f. 9 (1898).
♀. Singapore (Wallace).

In Singapore examples the disc of the abdomen beneath is testaceous, whereas in examples from Borneo (= laticarpus, Br.) this is rufous, otherwise the two forms are identical.

33. Allacta latirupta, Walk.

Blatta latirupta, Walker, l. c. p. 143 (1869).
Blatta patula, Walker, l. c. p. 143 (1869).
Blatta biteniata, de Saussure, Mél. Orthopt. II, p. 63 (1869).
♀. (= latirupta, Wlk.) NEW SOUTH WALES.
♀. (= patula, Wlk.) SYDNEY.
A. mundicola, Wlk. is the earliest name for this species.

34. Duryodana palpalis, Wlk.

Blatta palpalis, Walker, l. c. p. 225 (1868).
Phyllodromia palpata, Brunner, Abhandl. Senckenb.
Ges. xxiv, p. 207, pl. 16, f. 13 (1898).
♀. Sarawak (Wallace).
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Sub-fam. **EPILAMPRINÆ**

35. *Pinaconota obliqua*, Wlk. (Plate XXX, fig. 5.)

*Ischnoptera (?) obliqua*, Walker, l. c. 148 (1869).

♂. Brazil.

Pale testaceous. Head castaneous, a fuscous band between the eyes, clypeus and mouth-parts testaceous, sparsely but deeply punctate; antennæ about half the body-length, testaceous. Pronotum transversely elliptical, anterior margin truncate, not nearly covering vertex of head; posterior margin nearly straight, sides deflexed, with large scattered punctures; two angulate black vittae extend from the anterior to the posterior margins. Tegmina with basal fourth punctate, a short humeral stripe castaneous, radial vein bifurcated, extremities ramose, ten costal veins, discoidal field reticulate. Scutellum exposed, marked with castaneous, punctate. Supra-anal lamina large, fimbriated; sub-genital lamina large with two styles asymmetrically placed; cerci short; legs short, the front and mid tibiae shorter than the corresponding femora. Front femora armed on the anterior margin beneath with a close-set row of short spines, two spines on the posterior margin; mid-femora with twelve spines on anterior, four on posterior margin; hind-femora with five spines on anterior, four on posterior margin beneath; the spines on the anterior margin about half the length of those on the posterior margin; formula of apical spines ½, ½, ½; minute genicular spines on mid and hind-femora. Tarsi short, both tibiae and tarsi fimbriated, posterior metatarsus shorter than remaining joints; pulvilli large. Total length 21 mm.; length of body 18 mm.; length of tegmina 17 mm.; pronotum 5 mm. × 7 mm.

This somewhat remarkable species appears to be undoubtedly referable to the genus *Pinaconota*, Sauss., it can be distinguished from the only other species in the genus, *P. bifasciata*, Sauss., by its much larger size.


_Epilampra dotata_, Walker, l. c. p. 130 (1869).

♀. Singapore (Wallace).

The same as *Molytria budia*, Br.


_Epilampra polyspila_, Walker, l. c. p. 197 (1868); l. c. p. 133 (1869).


♂ Sumatra (Wallace).

The species is very close, perhaps too close to *M. badia*, Br.; it differs by the paler colour of the pronotum and tegmina, by the more rufous coloration of the abdomen and legs, by the narrower pronotum (11 mm. × 14.5 mm. as against 11 mm. × 17 mm. in *badia*) and by the more ample subgenital lamina and more spatulate styles.


*Epilampra basifera*, Walker, l. c. p. 131 (1869).

♂ Ceram (Wallace).

Synonymous with *H. macassariensis*, Haan.

40. *Homalopteryx adusta*, Wlk. (Plate XXX, fig. 6.)


♀ Sarawak (Wallace).

Head testaceous, a cruciform castaneous marking on the front, vertex with small castaneous points, apex of maxillary palpi castaneous. Pronotum with the disc castaneous, the lateral margins broadly testaceous, marked with numerous castaneous points, the surface granular, two impressions on the disc, black, lateral margins slightly reflected, posterior margin with a row of larger granules. Tegmina testaceous heavily mottled with castaneous, marginal area paler, serio-punctate, just failing to reach extremity of abdomen. Abdomen beneath with the disc heavily mottled with castaneous, margins testaceous; supra-anal lamina bilobate, sub-genital lamina ample; cerci testaceous. Legs testaceous, dotted with castaneous, four spines on anterior margin of front femora, formula of apical spines ½, ½, ½, no genicular spine on front femora; posterior metatarsus shorter than remaining joints, spinous beneath, pulvillus not produced backwardly. Total length 23 mm.; length of tegmina 17 mm.; pronotum 8.5 mm. × 12 mm.


♀. **Sarawak** (Wallace). "From the stomach of a cuckoo, *Phenicophasus erythrognathus*” [conformis].

♀. **Sumatra** (Wallace) [scita].

Both these species and also *P. congra*, Wlk., are the same and synonymous with *P. nebulosa*, Burm. The species is highly variable both in size and coloration, but the study of a long series from all the greater Sunda Is. convinces me that there is no character that can be relied on to discriminate distinct species; the Bornean race is generally larger and with the veins of the marginal area of the tegmina more strongly marked; but even these characters are not constant.

42. **Hedavia concinnula**, Wlk.


♀. **Timor** (Wallace).

The species is very close to *H. procer*, Br., but differs in the more heavily armed front femora, the sinuate tip of the wing and more mottled coloration of the tegmina.

43. **Hedavia parvicollis**, Wlk.


♀. **Sarawak** (Wallace).

Very like *H. procer*, Br., but the pronotum is much smaller, measuring 7 mm. × 8.5 mm., its anterior angles are less rounded, its anterior margin less arcuate, so that in general appearance it is more like a heraldic shield than is usual in the genus *Hedavia*. The posterior margin of the subgenital lamina is sinuate and from the slightly produced posterior angles spring the slender styles.

44. **Epilampra inclarata**, Walk.

*Epilampra inclarata*, Walker, l. c. p. 198 (1868).

♀. **Sarawak** (Wallace).

* This genus is very badly defined, but the genus *Epilampra* is already so unwieldy that one is induced to welcome any attempt to split it up.
Allied to *E. saravaecensis*, Shelf. Testaceous; the ground-colour however obscured by a dense castaneous maculation and vermiculation. Pronotum not covering vertex of head, not punctate, posterior margin angulate, 9.5 mm. × 13 mm. Large ocelliform spots on the distal halves of the tegmina; mediastinal vein stout with three short branches and one slender ramose branch, costals few but highly ramose; surface of tegmina not punctate. Wings with marginal field semi-coriaceous and suffused with castaneous, apex not sinuate or angulate. Sub-genital lamina produced, trigonal. Front femora beneath with eight spines on anterior margin, two on posterior margin, no genicular spine; formula of apical spines 7, 1, 1.


*Epilampra plena*, Walker, l. c. p. 211 (1868).

*Epilampra fervida*, Walker, l. c. p. 211 (1868).

♀. Macassar, Celebes (Wallace) [plena].

♂. Macassar, Celebes (Wallace) [fervida].

*E. plena*, Wlk.; *E. puncticollis*, Wlk.; *E. quadrinotata*, Wlk.; *E. leucicollis*, Sss., and *E. flavomarginata*, Shelf. form a congeries of species that it is not easy to discriminate; the differences in coloration are slight, and it is almost impossible to express them in writing. The species are small, averaging 25 mm. in total length; they are amber-coloured or testaceous, the ground-colour however being obscured by densely placed and minute castaneous or fuscous maculae, and vermiculatious, so that the insects appear to be of some shade of castaneous. The pronotum does not cover the vertex of the head, its posterior margin is obtusely angled and produced, its surface is quite smooth. The posterior legs are long and slender, the metatarsus particularly so, and the pulvilli are margined with spines. The veins of the tegmina are strongly marked, and between them at the base only of the tegmen appear series of shallow ill-marked punctures. *E. puncticollis*, Wlk., from Borneo can be distinguished by two converging impressions on the front part of the pronotum; *E. leucicollis*, Sss., from Java is possibly synonymous; *E. quadrinotata*, Wlk., from Borneo is smaller (20 mm. total length), has four fuscous maculae on the pronotum, and the supra-anal lamina is notched deeply, not merely cleft; *E. plena*, Wlk., from Celebes and New Guinea has no impressions on the pronotum and is larger than *quadrinotata*, the form *fervida*.

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is less heavily marked and is of a rufous hue; *E. flavomarginata*, Shelf., can be distinguished by its coloration. A revision of the genus *Epilampra* is much to be desired, but without a comparison of all the types it is a matter of such consummate difficulty that it has been shirked by every student of the Blattidæ. The species noted above might well be considered typical of Kirby's genus *Heterolampra*, but Mr. Kirby in his Synonymic Catalogue of Orthoptera includes in it all the old world species of *Epilampra* that cannot be fitted into the genera *Hedaria* and *Calolampra*; the result is a heterogeneous assemblage, whose diagnostic generic characters are in most cases merely their locality labels.

46. *Epilampra varia*, Wlk. (Plate XXX, fig. 9.)

*Epilampra varia*, Walker, l. c. p. 130 (1869).

♀. SARAWAK (Wallace).

Head flavo-testaceous, with a large black patch covering nearly the whole of the front from between the eyes to the labrum, vertex mottled with castaneous; antennæ broken; eyes pale. Pronotum not covering vertex of head, its posterior margin truncate, sides deflexed, smooth, shining, dark castaneous, all the margins flavo-testaceous, spotted with castaneous. Tegmina short, reaching only to the middle of the penultimate segment, coriaceous, smooth and shining, the venation obsolescent, the anal and axillary veins being entirely absent; serio-punctate, the punctures indicating the obsolescent venation; flavo-testaceous heavily marked with castaneous, the part of the right tegmen overlapped by the left castaneous, its surface reticulated. Wings equalling in length the tegmina, marginal area coriaceous. Supra-anal lamina not markedly bilobate, its posterior margin merely notched slightly; sub-genital lamina ample; cerci short, flavid. Legs mottled with castaneous; front femora with three stout spines on anterior margin beneath, one on posterior margin; formula of apical spines $2, 1, 1$.

Total length 28.5 mm.; length of tegmina 20 mm.; pronotum 8.5 mm. $\times$ 11 mm.

This species, together with *E. imitans*, Br., and an undescribed species from the Malay Peninsula, might constitute a new sub-genus, distinguished by the reduced
wings and tegmina and the truncate or shortly produced posterior margin of the pronotum; they are smooth shining insects somewhat ovate in form.

Sub-fam. **BLATTINÆ**.


♀. **AUSTRALIA**.

Synonymous with *Methana soror*, Sss.


*Periplaneta aterrima*, Walker, l. c. p. 151 (1869).


♀. **PERU**.

Kirby regards *P. aterrima*, Wlk., as synonymic with *Nyctibora tenebrosa*, Wlk. (Syn. Cat. Orth. I, p. 108, 1904); this is certainly erroneous, as *tenebrosa* is a true *Nyctibora*.


♀. "**EASTERN ARCHIPELAGO**" (Wallace).

Sub-fam. **PANCHLORINÆ**.


♀. **CHAN-TI-BON**, **SIAM** (*Mouhot*).

Testaceous. Head with large castaneous marking on the front, extending to base of clypeus. Pronotum punctate, disc with a large castaneous lyrate mark, margins hyaline. Tegmina serio-punctate at base, testaceo-hyaline, veins castaneous; both tegmina and wings extend considerably beyond apex of abdomen. Sub-genital lamina shortly transverse, an asymmetrical projecting lobe on the right side. Legs testaceous, femora marked with castaneous towards apex.
51. Tribonium guttulosum, Wlk.
Nauphea guttulosa, Walker, l. c. p. 184 (1868).
♀. Brazil.

Allied to T. elegans, Br., but much larger, head entirely black, apical half of antennae fulvous, pronotum and tegmina more heavily marked, abdomen and legs darker.

52. Stenoblatta paralella, Wlk. (Plate XXX, figs. 7, 7a.)
Stenoblatta paralella, Walker, l. c. p. 193 (1868).
3 ♀♀. Brazil.

This extraordinary linear and flattened cockroach has apparently not been met with since Walker's description of it appeared. Walker placed it in his family Hypnormidæ (= Plectopterinae) and Kirby (Syn. Cat. Orth. I, p. 179) places it at the end of the Plectopterinae; but since the wings do not possess a triangular intercalated area this classification is evidently wrong; the large, produced supra-anal lamina with notched margin and the presence of large arolia between the tarsal claws fix the position of the genus amongst the Panchlorinæ of which sub-family, it may be considered an aberrant member.

Walker's description, so far as it goes, is quite accurate, except in his determination of the sex of the specimens, and the following may be regarded as merely supplementary to it:

Head much flattened, the vertex between the eyes forming a sharp edge, semicircular in outline, eyes very narrow. Tegmina punctate at base, radial vein very straight, bifurcate, the lower branch ramose, costals numerous, obsolete and irregular, five discoidal sectors, discoidal field reticulated, nine axillary veins. Wings with anterior half flavid, posterior field infuscated, costal veins highly irregular and reticulated, median vein quite straight, ulnar vein with five branches, two of which go to the dividing vein. Supra-anal lamina projecting considerably beyond the sub-genital lamina; cerci equal in length to supra-anal lamina. Legs very short, femora without spines, tibiae very sparsely spined, the front pair with four apical spines only, hind pair with a few in a double row on the upper border, two only on the lower border and four apical spines. Arolia relatively enormous, tarsi only half-length of tibiae, which are two-thirds length of femora, metatarsus not longer than the following three joints, shorter than the last joint.
53. *Oniscosoma punctosa,* Wlk.

*Ischnoptera (?) punctosa,* Walker, l. c. p. 149 (1869).
*Ischnoptera punctuosa,* Tepper, Tr. R. Soc. S. Austral. xvii, p. 55 (1893).
*Pseudopanchlora punctosa,* Kirby, Syn. Cat. Orth. i, p. 189 (1904).

♀. Australia.

Head castaneous, darkest on the frons which is very concave; ocelli testaceous; eyes wide apart; on the vertex a longitudinal carina testaceous in colour; antennae mutilated, fuscous. Pronotum eciliate, an anterior carina, two converging impressions posteriorly; its surface covered with granules, anterior margin slightly reflexed, posterior margin angulate; testaceus with castaneous mottlings and a quadrate castaneous patch on posterior part of disc. Tegmina testaceous, mottled with castaneous, six to seven costal veins. Wings hyaline, venation as in *O. granicollis,* Sss. Abdomen above testaceus, below testaceous with a castaneous patch on the disc; supra-anal lamina short not projecting so far as the sub-genital lamina; cerci short.

Length of body 11 mm.; length of tegmina 10·4 mm.

There is really nothing to prevent the inclusion of this genus in the sub-family *Perisphériinae*; the sexual dimorphism debarred it from occupying a natural position in the *Panchlorinae.*

Sub-fam. CORYDIINÆ.

54. *Corydia dasytoideus,* Wlk.

*Euthyrphra dasytoideus,* Walker, l. c. p. 191 (1868).
*Corydia tonkinensis,* Kirby, A.M.N.H. (7) xi, p. 405 (1903).

♀. Amoy.

Walker regarded as a variety of this species, another species from Siam which is evidently quite distinct, being the same as *C. xenea,* Br.; it is a ♀ collected by Mouhot.

The genus *Corydia* includes five closely allied species, some of which may possibly be regarded later as mere geographical races of one species; unfortunately the insects are rare in collections and additional examples are required before the exact relationships that they bear one to another can be elucidated. The following key will help in the identification of the species.
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1. Tegmina crossed by an orange band.
   2. The band interrupted ... . . . . purpuralis, Kirby (S. W. Fokien)
   2'. The band not interrupted . . . . dasytoides, Wlk. (Amoy, Tonkin)

1'. Tegmina not crossed by an orange band but with an orange costal patch.
   2. Apex of tegmina yellow . . . . . . hilaris, Kirby (Hab. ?)
   2'. Apex of tegmina not yellow.
      3. Abdomen orange with blue tip . . . . cerulea, Shelf. (Borneo)
      3'. Abdomen blue-black with marginal orange vittæ . . . . . . . . . . . . . . . . . anea, Br. (Burma)

55. Euthyrrhapha ipsoides, Wlk.

      Euthyrrhapha ipsoides, Walker, l. c. 191 (1868).

♂. Para, Brazil.

A synonym of the widely-distributed E. pacifica, Coq.

56. Holocompsa debilis, Wlk.

      Holocompsa debilis, Walker, l. c. p. 192 (1868).

♀. Sarawak (Wallace).

The only Oriental representative of the genus.

57. Dyscologamia pilosa, Wlk.


♂. Java.

Allied to D. capucina, Br. but larger, more rufous, pronotum anteriorly more cucullate, tegmina with only one hyaline spot in the basal third.

58. Dyscologamia silphoides, Wlk.

      Polyphaga silphoides, Walker, l. c. p. 182 (1868).

♀. Cambodia (Mouhot).

Much larger than D. capucina, Br. ♀, otherwise very similar, so far as can be gathered from the description of that species.
Sub-fam. *OXYHALOINÆ*.


*Blatta fragilis*, Walker, l.c. p. 218 (1868).

♀. *Brazil*.

Synonymous with *C. nigrifrons*, Serv.

60. *Chorisoneura glabricula*, Wlk.

*Blatta glabricula*, Walker, l.c. p. 218 (1868).

♂. *Brazil*.

Synonymous with *C. discoidalis*, Burm.


♀. *Brazil*.

Occiput, vertex, and centre of frons dark castaneous, a testaceous band between the eyes, traversed by a narrow black line, rest of head testaceous; antennae testaceous, the basal joints fuscous above. Pronotum transversely elliptical, all the margins hyaline, the disc castaneous with two large semilunar markings, testaceous. Tegmina clear hyaline, the veins testaceous, veins of discoidal area oblique, reticulated. Abdomen beneath testaceous, margined with fuscous; cerci testaceous. Legs testaceous.


♂. *Batchian (Wallace)*.


♀. *Ceram (Wallace)*.

In this species the sub-genital lamina is relatively enormous occupying nearly half the total length of the abdomen.

64. *Prosoplecta trifaria*, Wlk.

*Prosoplecta trifaria*, Walker, l.c. p. 190 (1868).

*Prosoplecta megaspila*, Walker, l.c. p. 190 (1868).

♂. (*trifaria*). *Batchian (Wallace)*.

♀. (*megaspila*). *Batchian (Wallace)*.
Sub-fam. *PERISPHÆRINÆ.*

   *Nauphaeta rubricosa*, Walker, l. c. p. 185 (1868).
   ♂. S. Africa.
   Synonymous with *A. cingulata*, Burm.

   ♂. Singapore (Wallace).

   This may well be the male of one of the Indo-Malayan species that have been described from female examples only. It is apparently most closely allied to *P. fornicata*, Br. from Burma, but is larger.

   Total length 25 mm.; length of body 22 mm.; length of tegmina 19 mm.; pronotum 7 mm. × 10 mm.

   *Zetobora carinata*, de Saussure, Mél. Orth. iv, p. 139, Pl. x, f. 50 (1873).

68. *Hypospharia leucopthalma*, Wlk.

   According to Kirby, who has compared the types, this is synonymous with *H. tenebrosa*, Wlk., a species placed by Walker in the genus *Punctilora*! It is somewhat doubtful if *tenebrosa*, Wlk, is not the same as *H. stylifera*, Br., but the wings are different in colour, and I hesitate to merge the species without comparing the types. *H. rugicornis*, Sss. and Zhnt. is also closely allied but can be distinguished by the colour of the antennæ.
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3. Cape of Good Hope.

According to Kirby, who has compared the types, this is the equivalent of *B. contusa*, Wlk. (l. c. p. 30, 1868), and it is probable that it is synonymous with *B. pilifera*, Stål, the description of which is rather brief.

70. *Hormetica subcineta*, Wlk.  (Plate XXX, fig. 8.)
    *Brachycola subcineta*, Walker, l. c. p. 188 (1868).

3. Colombia.

Allied to *H. verrucosa*, Br.  Head testaceous with a large black marking on the front, extending to base of clypeus; labrum, palpi and antennae fusco-castaneous. Pronotum as in *H. verrucosa* but not bordered with black. Tegmina short, transversely truncate, not extending beyond the second abdominal segment, colour and markings as in *H. verrucosa*. Abdomen black, bordered above with testaceous, supra-anal lamina testaceous, sub-genital lamina rufo-castaneous, cerci black tipped with testaceous.

Total length 31 mm.; length of tegmina 9 mm.; pronotum 12 mm. × 18 mm.

The female has the abdomen above coloured as in the male, whereas in *H. verrucosa*, Br. ♀, the abdomen has transverse testaceous bands above and marginal testaceous spots below. The species varies considerably in size.

    *Brachycola interna*, Walker, l. c. p. 188 (1868).

3. Nauta (Bartlett).

Allied to the preceding species but the head not so heavily marked with black, the pronotum more punctate, the tegmina with a large semicircular band castaneous in colour, abdomen beneath margined with testaceous.

Total length 27 mm.; length of tegmina 11 mm.; pronotum 10 mm. × 15 mm.

Of the seventy-seven species in Mr. Saunders’ collection described by Walker, fifty-seven can stand as distinct species.
the remainder must be sunk as synonyms of previously described species; one of Walker’s species it has been found necessary to separate into two. The following table gives the revised nomenclature of these species, which are now arranged in the order adopted by Walker in his “Catalogue of Blattidæ”:

<table>
<thead>
<tr>
<th>Walker’s Nomenclature</th>
<th>Revised Nomenclature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Polyphaga silphoides</td>
<td>Dyscologamia silphoides, Wlk.</td>
</tr>
<tr>
<td>Panecholora pilipes</td>
<td>Blepharodera contusa, Wlk.</td>
</tr>
<tr>
<td>Nauphecta guttulosa</td>
<td>Tribonium guttulosum, Wlk.</td>
</tr>
<tr>
<td>Nauphecta rubricosa</td>
<td>Aptera cingulata, Burm.</td>
</tr>
<tr>
<td>Zetobora leucophalma</td>
<td>Hypophoraria tenebrosa, Wlk.</td>
</tr>
<tr>
<td>Zetobora cervina</td>
<td>Hostilia cervina, Wlk.</td>
</tr>
<tr>
<td>Zetobora flexicollis</td>
<td>Perisphaeria flexicollis, Wlk.</td>
</tr>
<tr>
<td>Zetobora pilosa</td>
<td>Dyscologamia pilosa, Wlk.</td>
</tr>
<tr>
<td>Brachycola interna</td>
<td>Hormetica interna, Wlk.</td>
</tr>
<tr>
<td>Brachycola subincta</td>
<td>Hormetica subinceta, Wlk.</td>
</tr>
<tr>
<td>Prosoplecta quadriplagiata</td>
<td>Prosoplecta quadriplagiata, Wlk.</td>
</tr>
<tr>
<td>Prosoplecta gutticollis</td>
<td>Prosoplecta gutticollis, Wlk.</td>
</tr>
<tr>
<td>Prosoplecta trifaria</td>
<td>Prosoplecta trifaria, Wlk.</td>
</tr>
<tr>
<td>Prosoplecta megaspila</td>
<td>Prosoplecta trifaria, Wlk.</td>
</tr>
<tr>
<td>Euthyrhraphe dasytoides</td>
<td>Coryphia dasytoides, Wlk.</td>
</tr>
<tr>
<td>Euthyrhraphe dasytoides, var.</td>
<td>Coryphia dasytoides, Wlk.</td>
</tr>
<tr>
<td>Holocompsa debilis</td>
<td>Coryphia debilis, Wlk.</td>
</tr>
<tr>
<td>Stenoblatta parallela</td>
<td>Holocompsa debilis, Wlk.</td>
</tr>
<tr>
<td>Epilampra polypila</td>
<td>Stenoblatta parallela, Wlk.</td>
</tr>
<tr>
<td>Epilampra polypila</td>
<td>Molytria maculata, Br.</td>
</tr>
<tr>
<td>Epilampra conformis</td>
<td>Epilampra inaculata, Wlk.</td>
</tr>
<tr>
<td>Epilampra scita</td>
<td>Pseudophoraspis nebulosa, Burm.</td>
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<tr>
<td>Epilampra plena</td>
<td>Pseudophoraspis nebulosa, Br.</td>
</tr>
<tr>
<td>Epilampra ferrida</td>
<td>Epilampra plena, Wlk.</td>
</tr>
<tr>
<td>Epilampra dotata</td>
<td>Epilampra plena, Wlk.</td>
</tr>
<tr>
<td>Epilampra varia</td>
<td>Molytria badia, Br.</td>
</tr>
<tr>
<td>Epilampra adusta</td>
<td>Epilampra varia, Wlk.</td>
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<tr>
<td>Epilampra basifera</td>
<td>Homalopteryx adusta, Wlk.</td>
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<tr>
<td>Epilampra ramifera</td>
<td>Homalopteryx macassariensis, Haan.</td>
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<tr>
<td>Epilampra parricollis</td>
<td>Molytria ramifera, Wlk.</td>
</tr>
<tr>
<td>Epilampra concinnata</td>
<td>Hedia parricollis, Wlk.</td>
</tr>
<tr>
<td>Pseudomops inclusa</td>
<td>Hedia concinnata, Wlk.</td>
</tr>
<tr>
<td>Pseudomops scutigera</td>
<td>Pseudomops inclusa, Wlk.</td>
</tr>
<tr>
<td>Pseudomops fissia</td>
<td>Pseudothyrsocera scutigera, Wlk.</td>
</tr>
<tr>
<td>Pseudomops pica</td>
<td>Hemithyrsocera histrio, Burm.</td>
</tr>
<tr>
<td>Ellipsidium speciosum</td>
<td>Pseudothyrsocera pica, Wlk.</td>
</tr>
<tr>
<td>Blatta calogramma</td>
<td>Thyrsocera speciosa, Wlk.</td>
</tr>
<tr>
<td>Blatta fragilis</td>
<td>Chorisoneura calogramma, Wlk.</td>
</tr>
<tr>
<td>Blatta glabricula</td>
<td>Chorisoneura speciosa, Serv.</td>
</tr>
<tr>
<td>Blatta annulicornis</td>
<td>Chorisoneura discoidalis, Burm.</td>
</tr>
<tr>
<td>Blatta erythrina</td>
<td>Phyllodromia annulicornis, Wlk.</td>
</tr>
<tr>
<td>Blatta extenuata</td>
<td>Ichneoptera rufa, Br.</td>
</tr>
<tr>
<td></td>
<td>Phyllodromia suppellectilium, Serv.</td>
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</tbody>
</table>
VI. Viviparity amongst the Blattidæ.

Attention was first called to this phenomenon amongst the Blattidæ by Riley ("Insect Life," vol. iii, p. 443, 1890–1891 and vol. iv, p. 119, 1892), who observed it in Panchlora viridis, Burm. Scudder had already noted (Psyche, vol. v, p. 405, 1890) the occurrence of a female specimen of Panchlora nivea, L., found alive in a bathroom at Salem, Mass., surrounded by numerous newly-hatched young, but he had not been able to demonstrate the actual birth of these young. Riley dissected one of
his specimens and found that it contained a perfect egg-cluster of crescentic form, the eggs to the number of forty-four and in different stages of development being arranged in a double row. The egg-mass was contained in a thin-walled prolongation of the genital pouch, which may be termed the brood sac. Whilst in most cockroaches the egg-capsule is a horny structure, in *Panchlora viridis* it is a fine membranous sheath enclosing only the basal half of the egg-mass. The colleterial glands have always been regarded as secreting the substance of the horny ootheca of *Blattidae*, and Riley assumed that they are absent or much reduced in *Panchlora viridis* but did not test the truth of his assumption by dissection. From another specimen examined by Riley young larvae and nearly mature embryos had been extruded.

Holmgren in a paper on viviparity amongst insects in general (Zool. Jahrb. Syst. xix, p 434,) records viviparity for three more genera of *Blattidae*, viz. *Eustegasta micans*, Sss. and Zhnt., *Oxyhaloa saussurei*, Borg, and an undetermined species of *Blabera*. In the latter species the developing eggs are contained in a horny and sculptured capsule which lies in a thin-walled brood-sac and is apparently retained there till the eggs are mature or nearly so. In *Eustegasta micans* the ootheca splits open whilst still in the brood-sac, and the young larvae emerge two by two from the mother. Holmgren divides *Blattidae* into three sections according to their method of reproduction, as follows:—

1. Oviparous species, which carry the ootheca for some days protruding from the tip of the abdomen.
   Ex. *Periplaneta*.

2. Viviparous species, the ootheca retained within a brood-sac.
   Ex. *Eustegasta, Oxyhaloa, Blabera*.

3. Viviparous species, the ootheca practically absent.
   Ex. *Panchlora*.

To this last section and possibly to the second I am able to add more examples.

My own attention was specially drawn to this phenomenon of viviparity amongst *Blattidae* in rather an interesting manner. Whilst arranging the South
American species of *Epilampa* in the Hope Museum, Oxford, I had occasion to examine closely a series of specimens of *Epilampa burmeisteri*, Guér., collected in Brazil by the distinguished traveller, W. J. Burchell, and I observed that one female example had been preserved with two young larvae actually emerging from the tip of the abdomen, and that they were still partially shrouded in some shreds of the embryonic membranes. The specimen is numbered "1400" and is the only one of the series that does bear a number. Those who have had occasion to study Burchell's collections know that he attached numbers to the specimens that were of special interest to him and his observations on such specimens were recorded in his note-books under corresponding numbers. Unfortunately Burchell's note-books with records of specimens numbered from 1345 onwards are lost, but we can be tolerably sure that the young larvae emerging from the abdomen of his specimen No. 1400 did not escape the notice of this keen observer and that the specimen was consequently numbered and the fact actually recorded. To Burchell then may well be accorded the credit of first discovering the phenomenon of viviparity in *Blattidae*.

In Sarawak, Borneo, I captured a female of *Pseudophoraspis nebulosa*, Burm., with numerous young larvae clinging to the under surface of the abdomen, and in the Hope Museum is a female of *Phlebonotus pallens*, Serv., with the following label attached:—"Ceylon. J. Staniforth Green. Carries its live young beneath its wing-covers. 1878." In the females of this species the tegmina are large and convex, the wings somewhat reduced and the abdomen above is concavely depressed, so that a brood-chamber is formed under the tegmina in which there is ample room to accommodate several young larvae. It is hardly reasonable to suppose that these two species of *Epilampa* deposit an ootheca containing newly-fertilized eggs and stay beside the ootheca until the young larvae hatch out and return to the mother from whom they originated. It is, on the contrary, in the highest degree probable that the eggs are retained in the body of the mother until they attain maturity, but whether they are enclosed in a horny ootheca lying in a brood-sac or whether the ootheca is absent or much reduced as in *Panchlora viridis* is not known. I have dissected the female *Pseudophoraspis nebulosa* that I captured with her
young and find that below the genital pouch lies a forward prolongation of it with rather thick walls; this is the brood-sac and as it is not much larger than the genital pouch itself and much smaller than the brood-sac in *Panchlora viridis* and in *Molytria maculata* and *Panesthia javanica*, as described below, it is rather difficult to explain its function, unless one supposes that it becomes very much dilated as the fertilized eggs pass into it from the uterus, its walls then becoming membranous and the whole organ pushing forward to lie amongst the abdominal viscera as is the case in other viviparous species. The brood-sac was empty in the specimen examined; the genital pouch

![Dissection of *Panesthia javanica*, showing brood-sac, etc.](image)

Dissection of *Panesthia javanica*, showing brood-sac, etc.

- 3-7 = Nos. of segments.
- R. = Rectum.
- G.P. = Genital pouch.
- C.G. = Collateral gland.
- Sp. = Spermatheca.

had thick muscular walls, and when opened the four finger-like gonapophyses were seen attached to the dorsal wall and directed backwards; in the ventral wall was seen the orifice leading to the brood-sac and lying at the bottom of a depression in the wall of the pouch. The right collateral gland was well developed, but the left one was aborted.

In *Panesthia javanica*, Serv., the egg-mass, which is about 18 mm. long, is contained in a thin-walled brood-sac lying asymmetrically on the left side of the abdomen
and extending as far forward as the third abdominal sternite; this brood-sac is, as in the other viviparous species, connected with the genital pouch. The eggs number from 36 to 40 and are retained in the brood-sac until mature; they do not form a crescentic mass as in \textit{Panehlorra viridis}. The left colleterial glands are absent, but those on the right are well developed. It is by no means clear that these glands secrete the chitinous ootheca of \textit{Periplaneta}, etc.; it is remarkable to find that on one side at least they are well developed in a species whose eggs are enclosed in a thin membrane. I have not been able to dissect \textit{Molytria maculata}, Br., as I have nothing but dried specimens, but I have frequently removed egg-masses in all stages of development from the brood-sacs of freshly-killed females during my sojourn in the Eastern tropics and I have several of these egg-masses in my possession now; they are larger than those of \textit{Panesthia javanica}, but otherwise show no differences worth considering at present. I hope ere long to study the embryonic development of these two viviparous genera \textit{Panesthia} and \textit{Molytria}; it is possible that it differs considerably from that of oviparous species. Viviparity is now known to occur in six of the eleven sub-families of \textit{Blattidae}, viz. \textit{Epilamprinæ} (4 genera), \textit{Panchlorinæ}, \textit{Blaberinæ}, \textit{Oxyhaloinæ}, \textit{Perisphæriinæ}, \textit{Panesthiinæ} (one genus each), and is consequently of more usual occurrence than was suspected; I think it likely that it will be shown eventually that it occurs almost, if not quite, universally amongst the \textit{Epilamprinæ}. \textit{Eustegasta} is a genus placed by all authors in the \textit{Perisphæriinæ}, but in the majority of its characters it is much more closely allied to the \textit{Epilamprinæ} than to the other members of the \textit{Perisphæriinæ} and it is of interest that viviparity occurs in this genus.

\textbf{Note.}—Just before going to press I received alive a female specimen of \textit{Panchlorra vireseens}, Thunb., and some females of \textit{Phylodromia germanica}, L. Mr. H. Main, to whom I am indebted for the latter specimens, informs me that \textit{P. germanica} ♀ carries the egg-capsule protruding from the tip of the abdomen for some weeks and deposits it only one or two days before the contained young hatch out. I was surprised to observe in the living female of \textit{Panchlorra vireseens} an egg-mass partially protruding from the end of the abdomen; so far as can be determined
by a superficial examination the eggs are not in a very advanced state of development; in this specimen the egg-mass is so large that it cannot be retained entirely in the brood-sac; the ootheca is represented by a thin transparent membrane, which however is complete, not incomplete as in the species observed by Riley. In an undescribed species of Temnopteryx from East Africa, the female carries the eggs contained in a transparent membrane protruding from the end of the abdomen; in the only example examined the eggs are very advanced in development. These new facts enable me to modify Holmgren's "series" of Blattidæ as follows:—

1. Oviparous species. Eggs enclosed in a chitinous ootheca and carried by the female for a short time only.
   Ex. Ectobia, Blatta, Periplaneta.

2. Ovo-viviparous species. (a) Eggs enclosed in a semi-chitinous capsule and carried by the female, protruding from the abdomen during the greater part of the embryonic period.
   Ex. Phyllodromia germanica.

(b) As above, but eggs enclosed in a transparent membrane.
   Ex. Temnopteryx sp.

3. Viviparous species. (a) Eggs enclosed in a chitinous ootheca which is retained in the brood-sac of the mother. Ex. Oxyhaloa saussurei, Eustegasta micans, Blabera sp. [?Pseudophoraspis nebulosa and Phlebonotus pallens].
(b) Eggs enclosed in a transparent membrane, which is retained in the brood-sac of the mother. i. Membrane complete. Ex. Molytria maculata, Epilampra burmeisteri, Panchlora virescens, Panesthia javanica [?Pseudophoraspis nebulosa and Phlebonotus pallens]. ii. Membrane incomplete. Panchlora viridis, P. nivea.
VII. A New Genus of Symbiotic Blattidae.

Genus Sphecophila, nov.

Superficially resembling Attaphila, Wheel., but tegmina absent in the male; subgenital lamina of male provided with two styles; femora unarmed beneath; no arolia between tarsal claws; frons swollen; eyes reduced; ocelli present; antennae short, but conforming to normal Blattid type.

The only known species was taken from the nest of the wasp, Polybia pygmaea, Fab., in French Guiana.

We have in this little cockroach an example of the difficulties which beset the systematist when he has to deal with aberrant species modified by peculiar habits and environment to a similar general facies.

The genus Attaphila contains two species of myrmecophilous cockroaches, A. fungicola, Wheel., and A. berqi, Bol., found respectively in the nests of Atta fervens, Say, in Texas, and Atta lundii, Guér., in Uruguay. Wheeler, who first made known the genus (Amer. Nat. vol. xxxiv, p. 851, 1900), suggests that among the Blattidae it occupies "a peculiar if not unique taxonomic position;" and Bolivar (Comm. del. Mus. Nac. d. Buenos Aires, p. 333, 1901) creates for its reception the sub-family Attaphiline, regarding the peculiar antennal characters of high importance. This sub-family takes its place in the first of the two great divisions in which the Blattidae have been brigaded, viz. that in which the femora are spined beneath. Sphecophila cannot be placed in this division, for the femora are unarmed beneath; much less then can it be placed in the sub-family Attaphiline, though its general resemblance to Attaphila is most striking. Must then a new sub-family be created for the reception of Sphecophila? I think not; the multiplication of sub-divisions for the reception of anomalous genera is a practice to be deprecated for many reasons, chief among which is the consideration that it tends to obscure the relationships which must exist between these anomalous genera and genera of more normal type. In my opinion Attaphila may be regarded as an aberrant Phyllodromiine, akin to Loboptera, Br., or Temnopteryx, Br., and Sphecophila as an aberrant member.

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of the sub-family Corydiinæ (＝Heterogamiinæ). Bolivar (l. c.) is much impressed by the structure of the antennæ in *Attaphila*, the increasing lengths of the joints in proportion to their breadth particularly attracting his attention, and he states that in all other Blattidæ the joints of the antennæ, with the exception of the first, are short and transverse. This as a matter of fact is scarcely accurate; in cockroaches of normal type the first joint of the antennæ is longer than broad, the second usually broader than long, and the third much longer than broad; the succeeding joints are short and transverse but gradually increasing in length until they are longer than broad, and the apical joints are usually sub-moniliform. *Attaphila* is peculiar in that the third joint of the antennæ is short and transverse and the increase in length of the succeeding joints is not gradual but sudden. Unfortunately in all the specimens of *Attaphila* that have been examined, the antennæ are mutilated, so we know nothing of the terminal ends of these organs. Wheeler examined forty-five examples of *A. fungicola*, and found that in seventeen specimens the mutilation of the antennæ was symmetrical, in twenty-one specimens almost symmetrical, the difference being not more than one joint; in only seven specimens were the antennæ very asymetrically mutilated. He concludes that the ants, with which this cockroach lives, crop the antennæ of their guests and suggests that the peculiar structure of the antennæ is a result of continual clipping. Without subscribing to this opinion, it may be pointed out that a modification of the antennæ of an insect living in the dark and under very peculiar circumstances is rather to be expected; indeed, it might be expected that profound modifications of the antennæ would invariably accompany a marked reduction of the other sense-organs, the eyes, if *Sphecophila* was not a standing proof to the contrary. *Attaphila*, as shown by an examination of the contents of the alimentary canal, feeds on the fungus cultivated by the leaf-cutting ants; *Sphecophila* is nourished otherwise. The wasps of the genus *Polybia* construct small paper nests pendant from the under surface of leaves or twigs; in some species the nest is made up of a number of cells without any outer common covering; every cell containing a larva is open at the lower end, and it is only the cells containing nymphs that are closed, each with a paper cap. *Polybia pygmaea* however constructs a nest composed of a
number of cells enclosed in a common covering of paper, and the entrance to the nest is by one orifice in the floor of the nest. The mother wasp feeds the larvae with insects or spiders that she brings to them, and it is probable that the symbiotic cockroaches living on the floor of the nest feed on any small fragments of food that may drop down from the wasp-larvae in the cells above. I owe this suggestion to my friend Vicomte R. du Buysson, who discovered the cockroaches in the nest of the Polybia, which was sent home by the collector, M. F. Geay. In conclusion, we may regard these two genera, Attaphila and Sphecophila, as affording an admirable demonstration of convergence in development, a result which we may fairly assume to have been brought about by very similar modes of life, viz. symbiosis with social Hymenoptera. The following tables show more graphically the similarities between the two genera and their dissimilarities, and it will be seen that whilst the former are in the main superficial and obvious, the latter are deep-seated and of great taxonomic importance, showing that the genera have arisen from totally different stocks.

Features common to the two genera:—

- Colour.
- Pubescence.
- Size.
- Shape.
- Reduction of eyes.
- Vertex not covered by pronotum.
- Shortness of legs.
- One-jointed cerci.

Differences between the two genera:—

**ATTAPHILA. ♂.**

- Third antennal joint short.
- Ocelli absent.
- Tegmina and wings present.
- Supra-anal lamina trigonal.
- Styles absent.
- Femora armed beneath.
- Tarsal arolia present.

**SPHECOPHILA. ♂.**

- Third antennal joint long.
- Ocelli present.
- Tegmina and wings absent (? in nymphs only).
- Supra-anal lamina semi-orbicular.
- Styles present.
- Femora unarmed beneath.
- Tarsal arolia absent.
Mr. R. Shelford's *Studies of the Blattidæ.*

*Sphecothela polybarum.* (Plate XXX, figs. 10–12.)

♂. Fulvo-testaceous, with a fine fulvous pubescence. Vertex not covered by the pronotum; front of head swollen and projecting as is common amongst the Corydiidæ; eyes very much reduced, scarcely visible from the front and almost entirely hidden under the deflexed sides of the pronotum; one pair of true ocelli situated low down on the frons and closer together than the antennal sockets; maxillary and labial palpi small. Antennæ short, of twenty joints, the first joint longer than broad, the second as broad as long, the third longer than broad, the remaining joints at first broader than long, but gradually becoming longer, the last four or five joints almost monili-form. Pronotum with anterior and posterior margins truncate, narrower in front than behind, longer than broad, sides deflexed; meso- and metaventum broader than long, their posterior angles only slightly produced backwards. Nine abdominal tergites, including the supra-anal lamina, are visible, posterior margins of the first three and of the eighth straight, of the fourth to the seventh concave; the supra-anal lamina is semi-orbicular. Cerci one-jointed, acute, equal to the supra-anal lamina in length. Eight abdominal sternites, including the sub-genital lamina, are visible; sub-genital lamina slightly produced, not extending as far as the supra-anal lamina, with one pair of styles equalling in length the cerci and clothed with a few erect hairs. Femora without spines, on the anterior margin beneath of the front femur is a row of stiff setæ, a genicular spine on each femur, no apical spines. Spines on tibiae above in three rows, five apical spines on the posterior tibiae. Metatarsus longer than the remaining joints, no arolium between claws.

♀ unknown.

Total length 3 mm.—3·2 mm.

Ste. Marie, Oyapock, French Guiana (F. Geay, 1900). Ten examples (Paris Museum); from the nest of *Polybia pygmaea,* Fab.

The absence of female examples is striking, but it is possible that the entire colony was not secured by the collector, some individuals may have escaped from the nest. I cannot be certain that the specimens here described are fully adult, but I am inclined to think that they are, or if not, that the adults are apterous, for nymphs of winged cockroaches have the posterior angles of the mesonotum and metanotum much more strongly produced backwards than is the case in the specimens before me.
Explanation of Plate XXX.

Fig. 1. Supra-anal lamina of Pseudothyrsocera xanthophila, Wlk., ♂.
2. Sub-genital lamina of Pseudothyrsocera xanthophila, Wlk., ♂.
   a. side view.
10. Head of Sphecophila polybiarum, mihi, ♂ × 35.
11. Supra-anal lamina of Sphecophila polybiarum, mihi, ♂ × 25.

[Read December 5th, 1906.]

Plate XXXI.

Among the geographical forms of Huphina nerissa, Fabr., there occurs in Java, Bali and Lombok a fairly well-marked island race to which Wallace in 1867 gave the name of corva. A similar form, called by Butler from its habitat H. sumatrana, seems almost indistinguishable from Wallace's type.

The object of the present paper is to call attention to the remarkable similarity that exists between both sexes, but especially the female, of Huphina corva, and certain females of a form of Ixias found in the same locality. The Ixias in question belongs to the group containing I. venilia, Godt., and I. reinwardtii, Voll., being indeed scarcely separable from the latter. It is the local race inhabiting the island of Bali, and has accordingly received the name baliensis from Fruhstorfer.

The resemblance here spoken of is well seen on Plate XXXI, but is still more striking when the actual specimens are examined. It can, I think, scarcely be doubted that the likeness between these forms of such diverse affinities has a mimetic significance. The specimens represented in Fig. 3–7 were all captured on the same occasion by Mr. R. Shelford, M.A., F.E.S., and were kindly given by him to the Hope Department at Oxford. It does not appear to have been noticed that the series contained an Ixias until the insects were on the point of being incorporated with the general collection.

It will be observed that the resemblance to Ixias baliensis, though shared by both sexes, is stronger in the female than in the male Huphina. This is in accordance with the well-known rule as to the superior means of protection employed by the female sex in correspondence with its
greater needs—a rule which holds good not only in mimicry but also in other kinds of defence. Another point worthy of notice is, that as shown by Figs. 6 and 7, compared with 6A and 7A, the resemblance borne to each other by the upper surfaces of the two insects does not extend to the lower. This seems to favour the view that the enemies in this instance guarded against are such as attack butterflies on the wing rather than at rest.

But the most interesting feature in the case is the evidence it affords of diaposematism, or the interchange of warning characters between mimic and model. In his original description of \textit{H. corve}, Wallace drew attention to the fact that this form possesses a black border to the hind-wing, "much wider and more defined than in the allied forms" (Trans. Ent. Soc. Lond., 3rd Series, IV, 1867, p. 339). This dark border, as can be seen in Plate XXXI, figs. 3–6, is present in both sexes; it is formed in the female by the fusion of the submarginal row of V-shaped spots seen in Fig. 1 with the actual dark edging of the wing. A somewhat similar feature, though less pronounced, occurs in \textit{H. lichenosa}, Moore, from the Andaman Islands; but in the ordinary allied forms known as \textit{Huphina nerissa}, \textit{H. \\textit{phryne}}, \textit{H. copia}, etc., it does not exist. A comparison of Figs. 1 and 2, which represent the female and male respectively of the typical \textit{H. \textit{phryne}} of continental India, with the figures of \textit{H. corve} in the same Plate, will show the difference referred to by Wallace. This difference is even better marked in the dry-season form of \textit{H. \textit{phryne}} than in the wet, the latter being the phase here figured.

Now it is in large measure to the presence of this dark border on the hind-wing that \textit{H. corve} owes its correspond-ence in aspect with \textit{I. balicensis}. It is of course open to anyone to assert that the dark border is merely an accidental feature in \textit{H. corve} without any special significance. But when we consider that this feature is practically restricted to that form of the \textit{H. nerissa} group whose range overlaps that of the \textit{Ixias} which it so closely resembles, the conclusion seems at once to suggest itself that the presence of the dark border in \textit{H. corve} is the result of a mimetic approach to the other insect. In this respect, then, the \textit{Huphina} has acted as the mimic and the \textit{Ixias} as the model. If, however, we turn to the fore-wing, we find the process reversed; here it is the \textit{Ixias
that has departed from the usual aspect of its nearest relatives, becoming in this case the mimic, while the *Huphina* stands as the model. The resemblance has therefore been attained by a process of give-and-take on both sides; nor would it be easy to find a better illustration of the principle of reciprocal change or diaposematism.

It is fair to note that specimens of *H. corva* from Java and the representative form *H. sumatrana* from Sumatra also possess the dark border to the hind-wing, and are not known to be in mimetic association with any *Ixias* found in those islands. It is perhaps unlikely, though not impossible, that a corresponding *Ixias* may yet be observed to inhabit these localities; but in view of well-ascertained facts as regards the shifting of areas of distribution among butterflies it would not be extravagant to suppose that the *Huphina* has somewhat extended, or the *Ixias* has contracted its range since the resemblance was first set up.

In any case, we have the fact that the specimens shown in Figs. 3–7 were all caught by the same person in the same place and on the same day. *H. corva* occurs also in Lombok, where its relation with *Ixias reinwardtii*, Voll. ♂ is no doubt the same as with *I. baliensis* in the neighbouring island.

It is to be observed that not all female specimens of *H. corva* show the mimetic approach to *Ixias* in the same degree. The hind-wings are sometimes rather conspicuously veined, as often in the wet-season phase of *H. phryne*; moreover the dark *Ixias*-like border is less distinct in some specimens than in others. So too, *I. baliensis* ♂ may possess a pale orange suffusion in the central area of the fore-wing. These features, which may possibly be dependent on season, certainly tend when present to impair or abolish the excellence of the mimetic picture.

Mr. Finn, in the "Journal of the Asiatic Society of Bengal," 1895, pp. 621, 624, 626, 635, etc., has produced some direct evidence that *Huphina phryne* is disliked by insectivorous birds (*Liothrix* and *Chloropsis*). There is not, so far as I am aware, any such evidence in the case of *Ixias*. But if the foregoing conclusions are well-founded, it will follow that the association between the two forms here discussed must be synaposematic and not pseudosematic, Müllerian and not Batesian.
EXPLANATION OF PLATE XXXI.

Fig. 1. Huphina phryne, Fabr. ♀.
2. Huphina phryne, Fabr. ♂.
These figures (1 and 2) represent the ordinary form from continental India.
6a. Huphina corva, Wallace ♀ underside.
7. Ixias baliensis, Fruhst. ♀.
7a. Ixias baliensis, Fruhst. ♀ underside.
The above butterflies (3–7) were all taken by Mr. R. Shelford at Buliling, Bali, on May 19, 1905. The resemblance between H. corva ♀ and I. baliensis ♀ does not extend to the lower surface, as will be seen on comparing 6, 7 with 6a, 7a. In the dark border of the hind-wing, H. corva (3–6) is seen to depart from the aspect of the closely allied H. phryne (1, 2) and approach that of I. baliensis (7).
XXIII. Xanthorhoe ferrugata (Clerck) and the Mendelian Hypothesis. By Louis B. Prout, F.E.S.

[Read December 5th, 1906.]

About ten to twelve years ago, consequently some time before I first made acquaintance with Mendel's theory, I undertook some rather extensive heredity experiments upon Xanthorhoe (Coremia) ferrugata, Clerck, generally known to British entomologists as Coremia unidentaria, Haw., a common little Geometrid species which exhibits very definite colour dimorphism. A tolerably full account of the results I obtained has already been published in the “Transactions of the City of London Entomological Society” for 1897–98, pp. 26–34, but as that periodical has had but a limited circulation, and as, for obvious reasons, I made no reference to the relation of the experiments to the views of Mendel, I make no apology for republishing the main outlines.

The synonymy of this species and its closest relative, X. spadicearia (Schiff.), Bkh. = ferrugaria, Haw., has been much confused, and is almost unintelligible in most of our catalogues, but will be found clearly set forth in Meyrick’s “Handbook of British Lepidoptera,” p. 229. The only fault there is that Meyrick omits to mention that the purple-banded form is the “type” of both Clerck and Linnæus, and occurs (though sparingly) in Britain as well as “abroad,” while the black-banded form is the ab. (et var.) unidentaria of Haworth. For the purpose of the present paper it will be sufficient to speak of the type as “purple” and the aberration as “black,” thus avoiding any tax on the memory of those who may not be familiar with the complexities of the synonymy.

There is no doubt that, in Britain, the black is the “dominant” form, in the ordinary acceptance of the word, and without postulating any Mendelian application. I have repeatedly bred from wild black females and have invariably obtained therefrom black specimens only, sometimes carrying on the strain for two or three generations. Many friends have had the same result, and so has the
German entomologist Fuchs, who—on account of this "epigonic" evidence—recently proposed to erect the form as a distinct species under the name of excimiata (fide R. Püngeler). The var. stupida of Alphéraky, from Central Asia (No. 3370a, in Staudinger's "Catalog") is also invariably black-banded, so far as I have been able to learn; and a series which I have, through the kindness of Mr. F. H. Wolley Dod, received from Calgary, Alberta, shows the same stability of colour. The very few recorded cases of breeding purple examples among broods raised from wild black females may therefore pretty safely be taken as indicating mongrel origin—"hybrids" in the Mendelian sense—the male parent being assumed to have been purple-banded.

I know of no locality where the purple form entirely ousts the black, but I understand from Dr. R. T. Cassal that the first-named is the more frequent in the Isle of Man. Further, wild purple specimens have nearly always yielded a percentage of black in the progeny. The most important exception known to me was a considerable brood reared by my friend Herr Rudolf Püngeler, at Aachen.

Coming now to the heredity experiments, I may say that the whole of the material which is of any significance for present purposes was obtained from a single locality, Sandown, Isle of Wight, where both forms (purple and black) occur together, with a considerable preponderance of the black. I have reared isolated broods from other British localities, which have merely tended to confirm the general results.

From various causes, set forth in my earlier paper, I was unable to work as systematically as I could have wished. The resistance of this species to any continuous inbreeding is more pronounced than in any other case which has come under my notice, and many attempted crossings failed utterly, while many others yielded so few specimens as to be practically valueless for statistical purposes. I shall, in consequence, almost confine consideration to the larger broods, referring those who desire more detailed information of the rest to the afore-mentioned "Transactions of the City of London Entomological Society."

Black x Black.—Taking these first, as I have called them "dominant," I find there are four batches to be
considered; these produced respectively 16, 22, 17 and 27
imagines, and all were black with the exception of a
single intermediate* in the brood of 22. In this brood,
and also in that of 27, the paternal grandmother was
black, the maternal purple; in the other two, the reverse
was the case; in no instance was a male grandparent
known, as all were second generations from wild females.
It is interesting, too, that in one of the broods which
almost failed, the only four imagines that developed were
black, notwithstanding that both the parents (black) were
the offspring of a purple female. Practically therefore,
black × black could be depended upon to breed true,
whatever the ancestry.

**Black × Purple.**—Five broods give the following
results: (1) 42 black, 27 purple; (2) 37 black, 32 purple,
4 intermediate; (3) 36 black, 31 purple; (4) 49 black,
47 purple; (5) 7 black, 10 purple. This gives a total of
171 black, 147 purple, 4 intermediate; or respectively
(omitting fractions) 53 per cent., 45 per cent., 1 per cent.

The brood which shows the greatest disparity in the
representation of the two forms—numbered (1) above—
had the ♂ parent black and the ♀ purple, while in the
other four cases the sexes were reversed; but I am not
inclined to attach much weight to this slight discrepancy.
The pedigree, so far as known, was as follows: (1) paternal
grandmother black, maternal purple; (2) and (3) vice
cetera; (4) ♀ parent a wild purple specimen, ♂ parent
(black) the offspring of black ♂ and ♀, which, in their turn,
sprang of captured purple and black females respectively;
(5) both parents (brother and sister) the offspring of a
captured purple female.

**Purple × Purple.**—I reared nine of these broods,
mostly with somewhat complicated pedigree, as I was
especially interested in attempting to eliminate the black
element by selection; that I failed in this attempt, the
following figures will show. Six of the broods were large
enough, numerically, to be taken into account:† (1) 52
purple, 21 black (♂ parent purple, wild; ♀ parent purple,

* Real intermediates are, in my experience, of exceedingly rare
occurrence; I have only reared 10 which can be so regarded,
amongst considerably over 1000 specimens—i.e. less than one per
cent.

† Even the few specimens reared in the remaining three cases
showed, in each instance, at least one black specimen.
bred from purple × purple, these being brother and sister reared from wild purple female). (2) 37 purple, 9 black, 1 intermediate (♂ parent purple, from a wild purple female; ♀ parent purple, a member of the brood just described as (1)). (3) 6 purple, 11 black (♂ parent purple, from a wild purple ♀; ♀ parent purple, likewise from a wild purple ♀). (4) 13 purple, 2 black, 1 intermediate (♂ parent purple, from wild purple ♀; ♀ parent purple, from wild purple ♂ × black ♀, the latter the offspring of black ♂ and ♀, which, in their turn, sprang from wild purple and wild black ♀ respectively). (5) 13 purple, 8 black (♂ parent purple, from a wild purple ♀; ♀ parent purple, likewise from a wild purple ♀). (6) 16 purple, 7 black (♂ parent purple, from wild purple ♀; ♀ parent purple, from the brood just noticed as No. (3)). These figures give a total for the six broods, of 137 purple, 58 black, 2 intermediate; or respectively (omitting fractions) 69 per cent., 29 per cent., 1 per cent. It will be observed that in one case, No. (3), the black form actually preponderated, notwithstanding a known purple ancestry for two generations; in the other five, the percentage of black varied from 38.1 per cent. to 12.5 per cent. approximately.

It will be at once manifest, that the weakness of the above statistics for the purposes of elucidation of Mendelism consists in the almost constant necessity of introducing wild stock of unknown pedigree. Nevertheless, the "discontinuity" of the two forms and the apparent "purity" of most members of the black race give sufficient impression of a "Mendelian species" to justify my offering a few comments.

I cannot refrain from remarking, in the first place, that if only certain species are "Mendelian" in their behaviour—as seems to be hinted by some writers, e.g. Doncaster in "Ent. Record," xviii, p. 249—it would, to me, be a grave argument against our attributing the Mendelian phenomena, when observed, to any deep-seated biological cause; it is inconceivable that, among organisms so homogeneous as the various species of Lepidoptera—or even Insecta—there could be cytological differences vast enough to allow of gametic purity in certain cases only. Probably, however, it may be a sufficient reply that all species are really alike "Mendelian" in vital organization, but that it by no means thence follows that a particular manifestation of
dimorphism which appeals to the human eye—e.g. of coloration, as in our *Xanthorhoe*, is necessarily correlated to the true gametic differentiation. This is, at least, a possible interpretation of Doncaster's words (loc. cit.) that in some cases, such as that of the melanism of *Aplecta nebulosa*, "the inheritance is not Mendelian."

The only in-bred broods of which I reared any imagines deserve mention here, in spite of their small numbers. (1) From a wild purple ♀, which produced 21 black, 15 purple, and one intermediate in her progeny, a pairing of two of the purple examples was obtained. From this pairing, 10 purple and 2 black were reared, none of which were successfully paired together. (2) From another wild purple ♀, which produced 9 black and 4 purple, a pairing of two of the black was obtained. From this there resulted only 4 imagines, all of which were black. Again the strain failed at this point. (3) From a third wild purple ♀, which produced 5 black and 8 purple, a pairing of purple ♀ with black ♀ was obtained. This pairing resulted in the brood of 7 black and 10 purple, which has already been alluded to as "black × purple, No. 5." Yet again the strain failed at this point.

Neither of these results seems to suggest with any clearness that either form was a "recessive"; one looks in vain for any approximate 3:1 ratio, such as might have been expected, by the ordinary laws of chance, even when allowance had been made for the large percentage of loss in rearing. Rather do they suggest some kind of biometric interpretation, and with the potency of each colour approximately equal (or black somewhat the stronger) and equally direct in its effect. In the case numbered (1), a brood in which \( \frac{5}{12} \) were purple, gave, in the next generation and by the aid of purple selection, \( \frac{9}{12} \) purple, or just double the percentage. In that numbered (2), a brood in which \( \frac{9}{13} \) (69 per cent.) were black, gave one, by black selection, in which one hundred per cent. were black. In that numbered (3), where there was a cross-pairing of the two colours, the percentages in the two generations were very little disturbed, working out (roughly) at 38.5 per cent. and 41.2 per cent. of black specimens respectively.

It remains to consider whether the larger experiments detailed earlier in this paper throw any further light on the statistical aspects of the question. It is manifest from the figures I have given, that there has been no behaviour
analogous to that of Mendel's classic "round" and "angular" peas, or Raynor's Abraxas grossulariata and ab. flavofasciata (cfr. "Ent. Record," xv, pp. 142-144); no case, that is to say, in which a crossing of the two colours has resulted in the appearance of a first generation manifesting one colour only (Mendel's "Dominant"). This, I apprehend, is not necessarily fatal to the application of the Mendelian hypothesis, as it is always conceivable that none of the pairings may have happened to be made with sufficiently pure stock; assuming the black to be the dominant colour, it is still not impossible that all those which were mated with purple specimens chanced to be really "hybrids" in their organization, and in this event a part of the latent purple element in them should, in fertilization, meet the purple element of the "recessive," and result in specimens of that colour. But it seems to me improbable that this should always have happened, considering the number of pairings obtained; it must be remembered that hybrids only outnumber pure dominants in the proportion of 2:1.

Further, I do not see how to account for the reappearance of black specimens in all my considerable broods of purple × purple. If the recessive colour appears only in pure recessive individuals, two of such, when mated, should always breed true. And following the same line of thought, one feels that the black pairings ought not to breed true with the persistence which experience has revealed; for two-thirds of them ought to be veritable "hybrids" with simply an external dominant character.

Taking all the facts into consideration, it thus appears demonstrable that the colour dimorphism of Xanthorhoe ferrugata does not obey Mendelian law. If there is any correlation at all between the colouring and gametic purity, it must be of so involved a nature as to baffle our present powers of discernment. For instance, it is possible, on certain analogies which might be adduced, that the dominant form of this species may be a constantly black or a constantly purple one, and the "recessive" a variable one in colour, one of its forms being indistinguishable—so far as the human eye is yet trained—from the "dominant." Or conversely, the recessive may be constant to one colour and the dominant variable. To me, however, the simplest view is still that which I deduced from my work at the time when it was undertaken, and
which I have mentioned in this paper as supported by the very few successful experiments of actual inbreeding; namely, that in this species there is in general a "very direct" response to immediate parentage, especially if black; black × black producing black only (irrespective of ancestry), red × red producing over two-thirds red, red × black roughly half and half, or black slightly in the ascendant" ("Trans. City Lond. Ent. Soc. for 1897–8, p. 30"; of course "red" in this quotation corresponds to "purple" of the present paper). If I could learn how to inbreed it for a few generations with even tolerable success, I should be strongly tempted to resume my experiments upon it, with a view to definite biometric work; I am decidedly of opinion that with a little more practice and experience, it would be possible to forecast almost exactly the percentages of the two colours in a given brood of known parentage.
XXIV. A note on the Cryptic Resemblance of two South American Insects, the moth Draecena rusina, Druec, and the Locustid, Plagioptera bicordata, Serv. By Edward B. Poulton, D.Sc, M.A., F.R.S., Hope Professor of Zoology in the University of Oxford and Fellow of Jesus College, Oxford.

[Read October 17th, 1906.]

PLATE XXXII.

By the kindness of my friend Mr. W. J. Kaye I have had the opportunity of making a detailed examination of the deeply interesting moth exhibited by him on Oct. 17, 1906 (Proc. Ent. Soc. Lond. 1906, p. lxxviii). Mr. Kaye has also kindly permitted me to add the results of my study, in the form of the following note, to Plate XXXII of the Transactions,—the Plate illustrating his exhibit of Oct. 17 last.

Before I had heard of Mr. W. B. Grove's suggestion that leaves attacked by fungi are the models resembled by Kallima (Proc. Ent. Soc. Lond. 1905, pp. xxxii, xxxiii), I too should have thought that the transparent networks of Draecena represent "the work of some leaf-mining insect." Mr. Grove's suggestion however throws new light on the problem, and I now think that the moth bears a cryptic resemblance to a dead leaf partially destroyed by fungi. Mr. Kaye also considers that this interpretation is probably correct, and he points out that the position in which the moth was found is in favour of it.

With Mr. Kaye's permission I have added to Plate XXXII, figures of the upper and under surface of the Locustid, Plagioptera bicordata, for comparison with the moth.

It is interesting to observe that the effect of the ragged outline of the wings of Draecena is intensified in precisely the same manner as in Crapta (Polygonia) c, album (Proc. Ent. Soc. Lond. 1903, pp. xxvi—xxviii). In both insects.
the fore- and hind-wings are sufficiently separated to produce a notch far deeper than any other in the irregular contour.

The upper surface of *Dracenta rusina* exhibits an almost uniform pale brown colour with a narrow darker margin. Both wings are marked with reticulations of a tint faintly darker than the ground-colour, and barely visible at a little distance. The ground-colour is also very faintly deepened in tint at the extreme margin of the transparent networks. Although this deepening requires the use of a lens for its due appreciation, its effect upon the unassisted eye is undoubtedly considerable, the patches gaining a sharper outline and a greater prominence. Along the costa of the fore-wing the linear margin is made up of an irregular alternation of dark and light sections. The effect is to break up the hard line of the costa and produce the appearance of an outline eaten at irregular intervals into little shallow bays, each corresponding to one of the light sections.

The chief projecting angles bounding the deeply cut bays along both hind margins curve either upward or downward out of the plane of the wings. Corresponding angles on the two sides are bent in the same direction in Mr. Kaye's specimen, and thus probably retain the appearance presented in life, an appearance promoting the cryptic resemblance to a tattered piece of dead leaf with the most prominent angles of its margin bent or twisted. The curvature is chiefly marked in the principal or costal angle of the small bay at the extreme apex of the fore-wing, and is here in a downward direction. The three chief projections near the anal angle of the same wing are on the other hand bent upward. In the hind-wing the curvature is much less pronounced, the chief projection at the apical angle being bent very gently downward, that at the anal angle rather less gently upward.

Transparency is attained very much as in *Castnia*, by the scales themselves becoming transparent and, at least in some of the areas, set on edge. The obliquity of the scales varies in different parts of the wing, but in the most completely transparent patches the two causes—transparency and verticality,—always co-operate, and of the two the latter seems to be the more effective. The evolution of a transparent area from one in which the same effect

* Linn Soc. Journ.—Zool., vol. xxvi, p. 601, Pl. 44, Fig. 6.
was more roughly produced by means of light, strongly reflecting, opaque body-colour is in some respects clearer in this moth than in butterflies of the genus *Kallima*. The presumably older less realistic method is found in the small patches placed nearest the base of the fore-wing, and in the small distinct patches bordering the lenticular nearly closed bay between fore- and hind-wing. The large irregular network of areas grouped round the anal angle of the fore-wing is clear and transparent over the greater part of its extent, but the meshes nearest to the anal angle itself are far less transparent, being covered with pale pigmented scales. On the hind-wing, apart from the border of the lenticular bay, the same contrasted stages of evolution are even better seen. Thus the anal network of areas is pale-coloured over its anal half, transparent over the other half. Of the network at the base of the wing, the three meshes—two large and one small—nearest to the inner margin are pale, the others transparent. A small isolated area coming to the very edge of the inner margin between this network and that last-named, is unusually opaque, but even this lets through a little light. The distinction between the two methods by which transparency is suggested can, in some cases, be made out in the representation given in Fig. 1, Plate XXXII. Thus the small basal pale patch of the fore-wing can be recognized as somewhat different from the transparent areas of the network which lies next to it. Transition is easy; for the pale reflecting areas are also transparent, although to a much less extent than the others. We can apparently recognize four stages in the evolution of the clearest and most transparent areas of *Dracenta*:—(1) Opaque white strongly reflecting pigment, employed as an artist would use "body-colour" to suggest the bright light coming through a hole. (2) The pigment becomes less opaque and semi-transparent; so that some effect is produced when the surface of the wing is in deep shadow with a bright light on the other side of it. (3) The scales lose their pigment and become completely transparent. (4) The scales assume a more upright position so that most of the light passes between them; in the fullest development of this stage they become vertical. The second and fourth of these stages are very evident on part of the wing of this interesting moth and I think the third is also present. Some of the
pale patches are more opaque than others, but the first stage in its typical form is not now to be found: the species has passed beyond it.

The under surface is in many respects very different from the upper. The pale brown ground-colour has the appearance of being overspread with a greyish bloom. The dark line is wanting from the costal and inner margins, but is far broader than on the upper surface along the hind-margin of both wings, especially so on the posterior. Centrally this broad marginal band passes by a gradual transition into the ground-colour.

The transparent areas themselves are, of course, the same on both surfaces, but on the under-side of the hind-wing there is developed around and between them a black reticulated pattern with its meshes in some parts filled in with unaltered ground-colour, in others with a darker pigment, in others again with a much paler reflecting pigment. Furthermore many of the pale-coloured areas of the upper surface are distinctly darker on the under surface; especially those near the anal angle of both wings, as can be well seen by comparing Fig. 1A with Fig. 1. The whole effect on the hind-wing is to produce the impression of a fungoid growth spreading in reticulate fashion over the surface, and producing here and there at points longest exposed to injury, the culminating effect of transparency. The scattered masses of transparent areas appear to become the centres of greatest injury in an almost continuous network of decay. This effect, which probably represents in considerable detail the results of a leaf-attacking fungus, can in large part be made out in the representation of the left hind-wing under-side (right side of the figure) shown in Fig. 1A, Plate XXXII. The transparent meshes of the moth may represent actual holes in a leaf, or its transparent cuticle filling in the meshes of a network whose strands are the resistant fibro-vascular bundles. The latter appears to be the more probable interpretation.

The most characteristic feature on the under surface of the fore-wing is the development of large patches of dark pigment which appear to stand out in low relief. This is especially the case with the largest and most prominent patch placed a little below the centre of the wing and distinctly seen, as indeed are all the others, on Fig. 1A of the accompanying plate. Except in the case of the small irregular dark areas near the apical and the anal angles,
these patches are traversed by a network of black pigment enclosing in its meshes scales of a lighter but still dark tint. This, although not well seen in Fig. 1A, is especially clear and well defined in the chief patch alluded to above.

It is evident that the network covering the dark patches represents at another stage the network with transparent and pale meshes. It is probable that the former corresponds to the fullest activity in the life of a leaf-destroying fungus, the latter to its ultimate effect. It has been already suggested that intermediate stages are represented on the under surface of the hind-wing.

Comparing these two surfaces of the wings we see that the under possesses a pattern of varied and complex detail, representing as I believe prominent stages in the destruction of a dead leaf by a fungus. The upper surface on the contrary exhibits a pattern strong in contrast but deficient in detail; representing only the ultimate effect of such an attack upon the tissues of a dead leaf. The pale meshes are not only paler than on the under surface, but the margins of the networks appear to be cleanly and sharply punched through the substance of the wing. The difference in this respect between the upper and under surface is fairly well brought out by the figures, especially when the right side of Fig. 1 is compared with the left side of Fig. 1A.

It seems to me possible that this wide difference between the surfaces is an adaptation associated with the normal position assumed by the moth: that in the usual attitude of prolonged rest the under surface is well illuminated while the upper is in comparatively deep shadow. If approached from the well-lighted side all the detail would be apparent; if from the dark side the light would be seen shining through the meshes. The upper surface has developed, on this hypothesis, all that could be seen on the shaded side of a dead leaf undergoing destruction by the attack of a fungus, the under surface all that could be seen on the well-lighted side.

There is however another more probable interpretation which suggests itself,—that the fungus model is a species which attacks the leaf on one surface only, presumably the lower, finally destroying the tissues as far as the upper, cuticle or even so far as to cause complete perforation. And the final stage, that of transparency, would then be seen on
the upper surface, all the earlier stages on the lower. The upper surface of the moth would of course represent the former and its under surface the latter. It is to be hoped that the fungi attacking dead leaves in tropical America will be observed from the points of view here suggested, as well as the precise attitude of rest assumed by the moth.

It is interesting to compare with *Dracenta rusina* the small South American Locustid, *Plagioptera bicordata*, of which the upper surface is shown in Fig. 2, the lower in Fig. 2A of Plate XXXII. Instead of the complex networks of small areas seen on the wings of the moth, the Locustid exhibits on each fore-wing a single coarse network including four large meshes and an isolated area enclosing a brown curved line. The transparent portions are surrounded by a brown margin, sharply demarcating them from the green ground-colour of the tegmina. It is probable that the Locustid in the attitude of prolonged rest, with its tegmina enclosing both body and under-wings, resembles a much bent or even rolled green leaf which has been attacked by a species of fungus producing in living leaves effects in some respects similar to those wrought in the dead leaves to which the moth *Dracenta* bears a likeness.

The two insects come from the same Region, and both are probably widespread. The Locustid is indeed known to be so, while the capture of the moth in Trinidad and Guatemala suggests the likelihood of an extended range.
EXPLANATION OF PLATE XXXII.

All the figures are the natural size.

Fig. 1.—The Thyridid moth, Dracenta rusina, Druce, showing the upper surface. Tunapuna, Trinidad, 1905, L. Guppy. In Coll. W. J. Kaye.

Fig. 1a.—The under surface of the moth shown in Fig. 1. The cryptic resemblance is seen to be more detailed than that of the upper surface, including black fungus-like patches which present an appearance of standing out in relief. It is probable that during rest the lower surface is exposed as much as the upper, and perhaps even more completely.

Fig. 2.—The Locustid, Plagioptera bicordata, Serv. Each of the green tegmina is marked by two transparent patches with brown outlines and marked by brown lines. These patches probably resemble the injuries caused by a leaf-attacking fungus. The transparent patches, save for their small number and much larger size, are singularly like those on the totally different insect represented in Fig. 1. Colombia, S. America. In Hope Dep.

Fig. 2a.—The under surface of the Locustid shown in Fig. 2. The appearance resembles that of the upper surface, which in this case is probably the only one exposed during rest.

January 23, 1907.
African Butterflies.
South-African Butterflies.
South-African Butterflies.
TRICHOPTILUS PALUDUM
MELANISM IN HASTULA HYERANA.
Synaposematic resemblance between species of the Danaine genus *Amauris*, near the Victoria Nyanza.
Acræine, Nymphaline, Elymniiine and Papilionine mimics of Planema poggei, from near the Victoria Nyanza.
Synaposematic resemblance between Danainae and Papilioninae from the East of the Victoria Nyanza.
Synaposematic resemblance between Danainae and Papilioninae from the Northern shore of the Victoria Nyanza.
Ptyelus sp., probably *flavescens* F. upon an Araliaceous tree in the Aberdare Range, British East Africa, Dec. 2—5, 1902.
NEW SPECIES OF BLATTIDÆ
NEW SPECIES OF BLATTIDÆ
NEW SPECIES OF BLATTIDÆ.
Forms of *Papilio dardanus*, sub. sp. *cenea*, bred in 1904 from a *trophonius* form of female. Durban, Natal.
Three female forms (1-3) of *Papilio dardanus* from the Kikuyu Escarpment, B.E. Africa—*trinervi* (1) with primitive pattern, colouring, and rudimentary "tails" being ancestral to the other two. A *planuloides* ♀ form (4) from near Entebbe, gynandromorph on left side.
Ancestral females of *Papilio dardanus.*—the pattern and pale yellowish colouring characteristic of *trimeni* (1), and the rudimentary "tails" of these exceptional examples of *hippocoon* (2,3).
The *planemoides* ♀ f. of *Papilio dardanus* (2, 4), with intermediate between *planemoides* and *cenea* (1), and between *planemoides* and *hippocoon* (3).
Forms of _Acræa johnstoni_, together with their Danaine (_Amauris, Limnas_) and Acræine (_Planema_) models, from the slopes of Kilimanjaro, 1905.

All figures are about 1/10 of the natural size.
Müllerian (Synaposematic) Resemblance between Ithomiine, Lycoreane and Heliconine Butterflies, with barred hind wings; from the Potaro River, British Guiana.

The under surface of every specimen here represented is shewn in the corresponding figure of the following Plate.
Müllerian (Synaposematic) Resemblance between Ithomiine, Lycoreane, Heliconine and Lemoniine Butterflies with dark hind wings; from the Potaro River, British Guiana. Upper and under surfaces shewn. Barred forms of nearly all the figured species are shewn on Plates XXIV. and XXV.
Müllerian (Synaposematic) Resemblance between Ithomiine, Lycorean and Heliconine Butterflies, with barred hind wings; from the Potaro River, British Guiana.

The upper surface of every specimen here represented is shewn in the corresponding figure of the preceding Plate.
Parallel transition from barred to black hind wing in an Ithomiine butterfly and its Heliconine (Müllerian) Mimic; from the Potaro River, British Guiana.
Parallel Transition from barred to black hind wing in two Lycoreane butterflies; from the Potaro River, British Guiana.
Mine of Larva of Trochilium andreniforme.

(Natural size.)
British Moths in their natural attitudes of rest on Bark or Stone.
Photographed from Nature in 1902.
TYPES OF BLATTIDÆ.
Diaposematism in the upper-side pattern of *Huphina* and *Ixias* from Bali. The fore wing of the ♀ *Ixias* (7) resembles that of the ♀ *Huphina* (6); the hind wing in the ♂ and ♀ *Huphina* (3-6) resembles that of the ♀ *Ixias* (7). Compare *Huphina phryne* from India (1, 2).
All the figures are the natural size.

Upper and underside of the Moth, *Dracenta rusina*, and of the Locustid, *Plagioptera bicordata*, shewing cryptic resemblance to leaves with holes or transparent areas in them.

South America.