





TRANSACTIONS  
OF THE  
ENTOMOLOGICAL SOCIETY  
OF  
LONDON



*R. Smiles*

*Royal*

THE  
TRANSACTIONS  
OF THE  
ENTOMOLOGICAL SOCIETY  
OF  
LONDON  
FOR THE YEAR  
1909.



LONDON:

PRINTED FOR THE SOCIETY BY RICHARD CLAY AND SONS, LIMITED,  
LONDON AND BUNGAY.

SOLD AT THE SOCIETY'S ROOMS, 11, CHANDOS STREET,  
CAVENDISH SQUARE, W.,

AND BY LONGMANS, GREEN AND CO.,  
PATERNOSTER ROW, E.C. ; AND NEW YORK.

1909-1910.





QL 461  
.R65

DATES OF PUBLICATION IN PARTS.

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Part  $\frac{I.}{II.}$  { (TRANS., p. 1-328) was published 4 June, 1909.

„ III. ( „ 329-438, Proc., i-xxxii) was published 20 Sept., 1909.

„ IV. ( „ 439-514, „ xxxiii-lxxx) „ 31 Dec., „

„ V. (————— „ lxxxi-clxxii) „ 30 Mar., 1910.

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# List of Fellows

OF THE

## ENTOMOLOGICAL SOCIETY OF LONDON.

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### HONORARY FELLOWS.

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Election.

- 1900 AURIVILLIUS, Professor Christopher, *Stockholm*.  
1905 BOLIVAR, Ignacio, *Paseo de Recoletos Bajo, 20, Madrid*.  
1901 FABRE, J. H., *Sérignan, Vauchuse, France*.  
1894 FOREL, Professor Auguste, M.D., *Chigny, près Morges, Switzerland*.  
1906 GANGLBAUER, Custos Ludwig, *Hof-Museum, Vienna*.  
1898 GRASSÍ, Professor Battista, *The University, Rome*.  
1908 OBERTHÜR, Charles, *Rennes, Ille-et-Vilaine, France*.  
1906 REUTER, Professor ODO MORANNAL, *The University, Helsingfors, Finland*.  
1895 SCUDDER, Samuel Hubbard, *Cambridge, Mass., U.S.A.*  
1885 SNELLEN, P. C. T., *Rotterdam*.  
1893 WATTENWYL, Hofrath Dr. Carl Brunner von, *Lerchenfeldstrasse 28, Vienna*.  
1898 WEISMANN, Dr. August, *Freiburg, Baden*.
- 

### FELLOWS.

Marked † have compounded for their Annual Subscriptions.

Marked \* deceased during the year.

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Date of  
Election.

- 1908 ACKERLEY, F. B., c/o Messrs. Clarke Bros., and Brown, Ltd., P. O. Box 2215, *Johannesburg, South Africa*.  
1901 † ADAIR, Sir Frederick E. S., Bart., *Flixton Hall, Bungay*.  
1877 ADAMS, Frederick Charlstrom, F.Z.S., 50, *Ashley-gardens, Victoria-street, S.W.*  
1877 ADAMS, Herbert J., *Roseneath, London-road, Enfield, N.*  
1902 ADKIN, Benaiah Whitley, *Trenoweth, Hope-park, Bromley, Kent*.  
1885 ADKIN, Robert, *Wellfield, Lingards-road, Lewisham, S.E.*  
1904 AGAR, E. A., *La Haut, Dominica, B. W. Indies*.

- 1904 ALDERSON, Miss E. Maude, *Park House, Worksop, Notts.*  
 1899 ANDREWS, Henry W., *Shirley, Welling, S.O., Kent.*  
 1908 ANDROS, Thomas G., Ph.D., *Wilton-house, 31, St. Saviour's-road, Jersey.*  
 1901 ANNING, William, 39, *Lime Street, E.C.*  
 1908 † ANTRAM, Charles B., *The Insectarium, Kanny-Koory, Silchar P. O., Cachar, India.*  
 1907 ARNOLD, G., M.Sc., *University of Liverpool, Liverpool.*  
 1899 † ARROW, Gilbert J., 87, *Union-grove, Clapham, S.W.;* and *British Museum (Natural History), Cromwell-road, S.W.*  
 1907 ASHBY, Sydney R., 119, *Greenvale-road, Eltham-park, Kent.*  
 1886 ATMORE, E. A., 48, *High-street, King's Lynn.*  
 1850 † AVEBURY, The Right Honble. Lord, D.C.L., F.R.S., F.L.S., F.G.S., etc., *High Elms, Farnborough, Kent.*
- 1901 BACOT, Arthur W., *York Cottage, York-hill, Loughton, Essex.*  
 1904 † BAGNALL, Richard S., *Penshaw Lodge, Penshaw, Durham.*  
 1909 BAGWELL-PUREFOX, Capt. Edward, 34, *Sloane-Court, S.W.*  
 1903 BALDOCK, G. R., *Oakburn Villa, Enfield Highway, Middlesex.*  
 1886 BANKES, Eustace R., M.A., *Norden, Corfe Castle, Wareham.*  
 1890 BARCLAY, Francis H., F.G.S., *The Warren, Cromer.*  
 1886 BARGAGLI, Marchese Piero, *Piazza S. Maria, Palazzo Tempi No. 1, Florence, Italy.*  
 1895 BARKER, Cecil W., *The Bungalow, Malvern, Natal, South Africa.*  
 1887 \* BARKER, H. W., 147, *Gordon-road, Peckham, S.E.*  
 1902 BARRAUD, Phillip J., *Bushey Heath, Watford.*  
 1907 BARTLETT, H. Frederick D., 113, *Richmond-park-road, Bournemouth.*  
 1894 † BATESON, William, M.A., F.R.S., Fellow of St. John's College, Cambridge, *Merton House, Grantchester, Cambridge.*  
 1904 BAYNE, Arthur F., c/o Mrs. Freeman, *Castle-street, Framlingham, Suffolk.*  
 1908 BAYFORD, E. G., 2 *Rockingham-street, Barnsley.*  
 1896 † BEARE, Prof. T. Hudson, B.Sc., F.R.S.E., 10, *Regent Terrace, Edinburgh.*  
 1908 BECHER, Major Edward F., *Cranfield House, Polzeath, St. Minver, Cornwall.*  
 1908 BECK, Richard, *Sandihayes, Bitterne Park, Southampton.*  
 1905 BEDFORD, The Duke of, K.G., Pres. Z.S., etc., *Woburn Abbey, Beds.*  
 1899 BEDWELL, Ernest C., *Bonnicot, The Grove, Coulsdon, Surrey.*  
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 1904 BENGTTSSON, Simon, Ph.D., Lecturer, University of Lund, Sweden ; Curator, Entomological Collection of the University.  
 1897 BENNETT, W. H., 15, *Wellington-place, Hastings.*  
 1906 BENTALL, E. E., *The Towers, Heybridge, Essex.*



- 1885 BETHUNE-BAKER, George T., F.L.S., 19, *Clarendon-road, Edgbaston, Birmingham.*
- 1895 BEVAN, Lieutenant H. G. R., R.N., 38, *The Common, Woolwich.*
- 1880 BIGNELL, George Carter, *The Ferns, Homepark-road, Saltash.*
- 1891 BLABER, W. H., F.L.S., 12, *Great Castle-street, Regent-street, W.*
- 1904 BLACK, James E., *Nethercroft, Peebles.*
- 1904 BLAIR, Kenneth G., 23, *West Hill, Highgate, N.*
- 1889 BLANDFORD, Walter F. H., M.A., F.Z.S., 12, *Arundel Gardens, Ladbroke-grove, W.*
- 1885 BLATHWAYT, Lt.-Col. Linley, F.L.S., *Eagle House, Batheaston, Bath.*
- 1909 BLENKARN, Stanley A., *Norham, Cromwell-road, Beckenham.*
- 1904 BLISS, Maurice Frederick, *Coningsburgh, Montpelier-road, Ealing, W.*
- 1886 BLOOMFIELD, The Rev. Edwin Newson, M.A., *Guestling Rectory, Hastings.*
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- 1907 BONNET, Alexandre, 54, *Boulevard Bineau, Neuilly-sur-Seine, Seine, France.*
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- 1852 † BOYD, Thos., *Woodvale Lodge, South Norwood Hill, S.E.*
- 1893 BRABANT, Édouard, *Château de Morenchies, par Cambrai (Nord), France.*
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- 1904 BRIDGEMAN, Lieut. The Hon. Richard O. B., R.N., H.M.S. "Bramble," *China Station.*
- 1877 BRIGGS, Charles Adolphus, *Rock House, Lynmouth, R.S.O., N. Devon.*
- 1870 BRIGGS, Thomas Henry, M.A., *Rock House, Lynmouth, R.S.O., N. Devon.*
- 1894 BRIGHT, Percy M., *Fairfield, Wimborne-road, Bournemouth.*
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- 1878 BROUN, Major Thomas, *Mount Albert, Auckland, New Zealand.*
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- 1909 BRYANT, Gilbert E., *Fir Grove, Esher, Surrey.*
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- 1880 CANSDALE, W. D., *Sunny Bank, South Norwood, S.E.*
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 1875 DISTANT, Wm. Lucas, *Shannon-lodge, Selhurst-road, South Norwood, S.E.*  
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- 1885 DONOVAN, Major Charles, M.D., R.A.M.C., *Ardmore, Passage West, County Cork.*
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- 1867 DRUCE, Herbert, F.L.S., F.Z.S., 43, *Circus-road, St. John's Wood, N.W.*
- 1900 DRURY, W. D., *Rocquaine, West Hill Park, Woking.*
- 1894 DUDGEON, G. C., *The Imperial Institute, South Kensington.*
- 1907 DUER, YEEND, *Tokyo, Japan.*
- 1906 DUKINFIELD-JONES, E., *Castro, Reigate.*
- 1883 DURRANT, John Hartley, *The Cottage, Merton Hall, Thetford.*
- 1890 EASTWOOD, John Edmund, *Enton Lodge, Witley, Godalming.*
- 1865 EATON, The Rev. Alfred Edwin, M.A., *West House, Simondsburry, Bridport, Dorset.*
- 1904 ECKFORD, George, F.Z.S., c/o Sir Morgan Tuite, Bart., *Kilruane, Nenagh, co. Tipperary, Ireland.*
- 1902 EDELSTEN, Hubert M., *The Elms, Forty Hill, Enfield, Middlesex.*
- 1886 EDWARDS, James, *Colesborne, Cheltenham.*
- 1884 EDWARDS, Stanley, F.L.S., F.Z.S., 15, *St. Germans-place, Blackheath, S.E.*
- 1900 ELLIOTT, E. A., 16, *Belsize Grove, Hampstead, N.W.*
- 1900 ELLIS, H. Willoughby, *Holly Hill, Berkswell, Warwickshire.*
- 1886 ELLIS, John W., M.B., L.R.C.P., 18, *Rodney-street, Liverpool.*
- 1903 ELTRINGHAM, Harry, M.A., F.Z.S., *Eastgarth, Westoe, South Shields.*
- 1878 ELWES, Henry John, J.P., F.R.S., F.L.S., F.Z.S., *Colesborne, Cheltenham.*
- 1886 ENOCK, Frederick, F.L.S., 13, *Tufnell Park Road, London, N.*
- 1903 ETHERIDGE, Robert, *Curator, Australian Museum, Sydney, N.S.W.*
- 1908 EUSTACE, Eustace Mallabone, B.A., *Challacombe Rectory, Parracombe, R.S.O., N. Devon, and Wellington College, Berks.*
- 1909 EVANS, Frank J., *The Botanical Department, Trinidad, B.W.I.*
- 1899 FARMBOROUGH, Percy W., *Lower Edmonton, Middlesex.*
- 1890 FARN, Albert Brydges, *Breinton Lodge, near Hereford.*
- 1907 FEATHER, Walter, c/o British Somaliland Fibre and Development Co., *Berbera, Somaliland, E. Africa.*
- 1900 FELTHAM, H. L. L., *P. O. Box, 46, Johannesburg, Transvaal.*
- 1861 FENN, Charles, *Eversden House, Burnt Ash Hill, Lee, S.E.*
- 1886 FENWICK, Nicolas Percival, *The Gables, New-road, Esher.*
- 1908 FENWICK, Norman Percival, Junior, *The Gables, New-road, Esher.*

- 1889 FERNALD, Prof. C. H., *Amherst, Mass., U.S.A.*  
 1878 FINZI, John A., 53, *Hamilton-terrace, N.W.*  
 1900 FIRTH, J. Digby, F.L.S., *Boys' Modern School, Leeds.*  
 1874 FITCH, Edward A., F.L.S., *Brick House, Maldon.*  
 1905 FLEET, Wilfred James, *Imatra, King's Road, Bournemouth.*  
 1900 FLEMING, The Rev. W. Westropp, M.A., *Coolfin, Portlaw, Co. Waterford.*  
 1898 FLETCHER, T. Bainbrigge, R.N., *Wynton Hollow, Worple-road, Wimbledon, S.W.*  
 1883 † FLETCHER, William Holland B., M.A., *Aldwick Manor, Bognor.*  
 1905 FLOERSHEIM, Cecil, 16, *Kensington Court Mansions, S.W.*  
 1885 FOKKER, A. J. F., *Zierikzee, Zeeland, Netherlands.*  
 1900 FOULKES, P. Hedworth, B.Sc., *Harper-Adams Agricultural College, Newport, Salop.*  
 1898 FOUNTAINE, Miss Margaret, *Quex Lodge, West End-lane, West Hampstead, N.W.*  
 1880 FOWLER, The Rev. Canon, D.Sc., M.A., F.L.S., *Earley Vicarage, near Reading.*  
 1908 FRASER, Frederick C., M.D., I.M.S., *Trichinopoly, India.*  
 1896 FREKE, Percy Evans, *Southpoint, Limes-road, Folkestone.*  
 1888 FREMLIN, H. Stuart, M.R.C.S., L.R.C.P., *Mereworth; Maidstone.*  
 1903 FRENCH, Charles, F.L.S., Government Entomologist, *Melbourne, Victoria, Australia.*  
 1908 FROGGATT, Walter W., F.L.S., *Government Entomologist, 138, George-street, Sydney, New South Wales.*  
 1891 FROHAWK, F. W., *Ashmount, Rayleigh.*  
 1906 † FRY, Harold Armstrong, *P.O. Box 46, Johannesburg, Transvaal Colony.*  
 1900 FRYER, H. Fortescue, *The Priory, Chatteris, Cambs.*  
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- 1865 † GODMAN, Frederick Du Cane, D.C.L., F.R.S., F.L.S., F.Z.S., *South Lodge, Lower Beeding, Horsham; and 45, Pont-street, S.W.*
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- 1855 GORHAM, The Rev. Henry Stephen, F.Z.S., *Highcroft, Great Malvern.*
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- 1893 † GREENWOOD, Henry Powys, F.L.S., *Whitsbury House, Salisbury.*
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- 1906 GURNEY, Gerard H., *Keswick Hall, Norwich.*
- 1906 HALL, Arthur, 16, *Park Hill Rise, Croydon.*
- 1890 † HALL, A. E., *Cranfield House, Southwell, Notts.*
- 1885 HALL, Thomas William, *Stanhope, The Crescent, Croydon.*
- 1898 HAMLYN-HARRIS, R., D.Sc., F.Z.S., F.R.M.S., *Toowoomba Grammar School, Queensland, Australia.*
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- 1886 JOHN, Evan, *Llantrisant, R.S.O., Glamorganshire.*
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- 1889 JOHNSON, The Rev. W. F., M.A., *Acton Rectory, Poyntz Pass, Co. Armagh.*
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- 1885 † LLOYD, Robert Wylie, I, 5 and 6, *The Albany, Piccadilly, W.*
- 1903 LOFTHOUSE, Thomas Ashton, *The Croft, Linthorpe, Middlesbrough.*
- 1908 LONGSDON, D., 20, *Holland-park, W.*
- 1904 † LONGSTAFF, George Blundell, M.D., VICE-PRESIDENT, *Highlands, Putney Heath, S.W.*
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- 1900 MACKWOOD, The Hon. F. M., M.L.C., *Colombo, Ceylon.*
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 1880 MEYRICK, Edward, B.A., F.Z.S., F.R.S., *Thornhanger, Marlborough.*  
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 1883 MILES, W. H., *The New Club, Calcutta.*  
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 1899 MOORE, Harry, 12, *Lower-road, Rotherhithe.*  
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- 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 Enzo, *Helsingfors, Finland.*
- 1894 RIDING, William Steer, B.A., M.D., *Standlands, Buckereil, Honiton.*
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- 1904 SLIPPER, The Rev. T. J. R. A., M.A., *Tivetshall Rectory, Norwich.*
- 1902 SLOPER, Gerard Orby, F.Z.S., J.P., *Badminton Club, Piccadilly, W.*
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- 1889 STANDEN, Richard S., F.L.S., *Townlands, Lindfield, Sussex.*
- 1898 STARES, C. L. B., M.R.C.S., L.R.C.P., *The Limes, Swanley Junction, Kent.*
- 1898 STEBBING, Henry, *Norham House, Sheen-road, Richmond, Surrey.*
- 1889 STRATON, C. R., F.R.C.S., *West Lodge, Wilton, Salisbury.*
- 1896 STRICKLAND, T. A. Gerald.
- 1900 STUDD, E. A. C., *Kerremens, British Columbia.*
- 1895 STUDD, E. F., M.A., B.C.L., *Oxton, Exeter.*
- 1882 SWANZY, Francis, *Stanley House, Granville-road, Sevenoaks.*
- 1908 SWIERSTRAY, Commr. T., 1st Assistant, *Transvaal Museum, Pretoria.*
- 1884 SWINHOE, Colonel Charles, M.A., F.L.S., F.Z.S., 6, *Gunterstone-road, Kensington, W.*
- 1894 SWINHOE, Ernest, 6, *Gunterstone-road, Kensington, W.*

- 1876 SWINTON, A. H., c/o Mrs. Callander, *Vineyard, Totnes.*
- 1908 TALBOT, G., 11, *Palace Gardens, Enfield.*
- 1893 TAYLOR, Charles B., *Gap, Lancaster County, Penn., U.S.A.*
- 1903 TAYLOR, Thomas Harold, M.A., *Yorkshire College, Leeds.*
- 1909 TETLEY, Alfred M., 22, *Avenue-road, Scarborough.*
- 1901 THOMPSON, Matthew Lawson, 40, *Gosford-street, Middlesborough.*
- 1892 THORNLEY, The Rev. A., M.A., F.L.S., 17, *Mapperley-road, Nottingham.*
- 1907 TILLYARD, R. J., B.A., *The Grammar School, Sydney, New South Wales.*
- 1897 TOMLIN, J. R. le B., M.A., *Stoneley, Alexandra-road, Reading.*
- 1907 TONGE, Alfred Ernest, *Aincroft, Reigate, Surrey.*
- 1907 TRAGÅRDH, Dr. Ivar, *The University, Upsala, Sweden.*
- 1859 † TRIMEN, Roland, M.A., F.R.S., F.L.S., 133, *Woodstock-road, Oxford.*
- 1906 TRYHANE, George E., *Pedro Meguel Canal Zone, Panama.*
- 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, *Begmead-avenue, Streatham, S.W.*
- 1898 TURNER, A. J., M.D., *Wicksham Terrace, Brisbane, Australia.*
- 1893 TURNER, Henry Jerome, 98, *Drakefell-road, St. Catherine's Park, Hatcham, 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.*
- 1904 TYLECOTE, Edward F. S., M.A., *The Lodge, Ringstead, Kings Lynn.*
- 1893 URICH, Frederick William, C.M.Z.S., *Port of Spain, Trinidad, British West Indies.*
- 1904 † VAUGHAN, W., *Cocogalla, Madulsima, Ceylon.*
- 1866 VERRALL, George Henry, M.P., *Sussex Lodge, Newmarket.*
- 1897 VICE, William A., M.B., 19, *Belvoir-street, Leicester.*
- 1909 VIDLER, Leopold A., *The Carmelite Stone House, Rye, Sussex.*
- 1895 WACHER, Sidney, F.R.C.S., *Dane John, Canterbury.*
- 1901 WADDINGTON, John, *Park Holme, Harehill-avenue, Leeds.*
- 1899 WADE, Albert, 11, *Starkie-street, Preston, Lancashire.*
- 1897 WAINWRIGHT, Colbran J., 45, *Handsworth Wood-road, Handsworth, Birmingham.*
- 1878 WALKER, James J., M.A., R.N., F.L.S., SECRETARY, *Aorangi, Lonsdale-road, Summertown, Oxford.*
- 1863 † WALLACE, Alfred Russel, O.M., D.C.L., Oxon., F.R.S., F.L.S., F.Z.S., *Broadstone, Wimborne, Dorset.*
- 1866 † WALSINGHAM, The Right Honble. Lord, M.A., LL.D., F.R.S., F.L.S., F.Z.S., High Steward of the University of Cambridge, *Merton Hall, Thetford; and 66a, Eaton-square, S.W.*



- 1886 WARREN, Wm., M.A., 33, *Western-road, Tring, Herts.*  
 1908 WARREN, Bernard C. S., *The Avenue, Amersham.*  
 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, The Rev. W. Beresford, *St. Martin's Vicarage, St. Philip, Barbados, W. Indies.*  
 1893 WEBB, John Cooper, 218, *Upland-road, Dulwich, S.E.*  
 1908 WELLMAN, F. Creighton, M.D., *Ciudad de Senhores Silva & Lopes, Benguella, Africa Occidental (viâ Lisbon).*  
 1908 WEST, F. E., c/o Messrs. Gamlin & Gamlin, 314, *Gray's Inn-road, W.C.*  
 1876 † WESTERN, E. Young, 36, *Lancaster Gate, Hyde Park, W.*  
 1886 WHEELER, Francis D., M.A., LL.D., *Paragon House School, Norwich.*  
 1906 WHEELER, The Rev. George, M.A., 37, *Gloucester-place, W.*  
 1907 WHITE, Harold J., 42, *Nevern-sq., Kensington, S.W.*  
 1906 WICKWAR, Oswin S., *Charlemont, Gregory-road, Colombo, Ceylon.*  
 1903 WIGGINS, Clare A., M.R.C.S., *Entebbe, Uganda.*  
 1896 WILEMAN, A. E., 9, *Warwick-road, Clifton Vale, Margate.*  
 1894 WOLLEY-DOD, F. H., *Millarville P. O., Alberta, N.W.T., Canada.*  
 1900 WOOD, H., *Kennington, near Ashford, Kent.*  
 1881 WOOD, The Rev. Theodore, *The Vicarage, Lyfford-road, Wandsworth Common, S.W.*  
 1905 WOODBRIDGE, Francis Charles, *The Briars, Gerrard's Cross, S.O., Bucks.*  
 1888 YERBURY, Colonel John W., late R.A., F.Z.S., *Army and Navy Club, Pall Mall, S.W.*  
 1892 YODALE, William Henry, F.R.M.S., *Daltonleigh, Cockermouth.*

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ERRATA.

TRANSACTIONS.

- Page 8, line 14 from top, for *gueinzi* read *guienzii*.  
Page 73, line 2 from bottom, for *she* read *the*.  
Page 359, line 6 from bottom, for *rabbae* read *rabbaiae*.  
Page 404, line 12 from bottom, for *acevorum* read *acervorum*.  
Page 407, line 4 from bottom, for *myrmecophilous* read *myrmecophilus*.  
Page 417, line 12 from top, for *Thiasophilia* read *Thiasophila*.  
Page 422, line 15 from bottom, for *fuliginosis* read *fuliginosus*.  
Page 434, line 16 from bottom, for *Pseudolycoena* read *Pseudolycaena*.

PROCEEDINGS.

- Page x, bottom line, for *Mymecocoris* read *Myrmecoris*.

EXPLANATION OF PLATES.

- Plate XIV, Explanation, for 10 read 11, and for 11 read 10.





THE  
PROCEEDINGS  
OF THE  
ENTOMOLOGICAL SOCIETY  
OF  
LONDON  
FOR THE YEAR 1909.

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Wednesday, February 3rd, 1909.

Dr. F. A. DIXEY, M.A., M.D., President, in the Chair.

*Nomination of Vice-Presidents.*

The President announced that he had nominated Dr. KARL JORDAN, Ph.D., Dr. GEORGE BLUNDELL LONGSTAFF, M.A., M.D., F.R.C.P., and Mr. CHARLES OWEN WATERHOUSE Vice-Presidents for the Session 1909-10.

*Election of a Fellow.*

Mr. LEOPOLD ARNON VIDLER, of the Carmelite Stone House, Rye, was elected a Fellow of the Society.

*Election to the Council.*

The President announced the resignation of Professor EDWARD B. POULTON, D.Sc., M.A., F.R.S., as a member of the Council, and the election of Professor THOMAS HUDSON BEARE, B.Sc., F.R.S.E., to serve in his place.

*Exhibitions.*

POLYMORPHIC EASTERN PAPILIOS.—Dr. K. JORDAN exhibited some Oriental Papilios illustrating polymorphism. Almost  
PROC. ENT. SOC. LOND., III. 1909.

everywhere between Ceylon, Eastern China and Singapore, two *Papilio*s are found, *dissimilis* and *clytia*, which have long been considered distinct species. More recently acquired evidence, however, decidedly points to these two insects being but forms of one species. Although they have not yet been bred from the eggs of one female, both have been reared from one batch of larvæ, which appeared to be all alike. The chrysalis, too, is the same in both *Papilio*s, and the two insects have been observed *in copulâ*. Morphology affords further evidence of weight. The allied species of this group of mimics, such as *P. veiovis*, *epicydes*, *slateri*, etc., differ very markedly in the genitalia. Even the various geographical representatives of *P. clytia* and *dissimilis* (namely *flavolimbatus* from the Andamans, *panopinus* from Palawan, *palephates* from the Philippines and *echidna* from the Lesser Sunda Islands), show some slight distinctions in these organs. Therefore, if *clytia* and *dissimilis* were distinct species, one should expect that they too differed in the genitalia. However, we do not find any structural difference whatever. Although *clytia* and *dissimilis* do not actually intergrade, there occur rather frequently in North India specimens of *clytia* in which the *dissimilis*-streaks are more or less indicated. All this shows distinctly that we have to do with one dimorphic species.

*P. clytia* does not occur on the Greater Sunda Islands, but is represented by geographical races on the Andamans, on Palawan, the Philippines, and the Lesser Sunda Islands. All these outlying forms are monomorphic, the southern ones (Andamans and Lesser Sunda Islands) being of the *dissimilis*-type, and the northern ones (Palawan and the Philippines) of the *clytia*-type.

This being so, the question at once arises, which species fills up the large gap in the area of distribution of *P. clytia*, and how does that *Papilio* vary? There occurs indeed a near ally of *P. clytia* on the Greater Sunda Islands, namely *P. paradoxa*. This *Papilio* extends northward to Assam and Palawan and eastward to Java, *i. e.* its area of distribution overlaps with that of *P. clytia* in the north. *P. paradoxa* is structurally different from all the races of *P. clytia*. It is individually variable, especially in the ♀, and has developed into quite a

number of geographical forms. All these geographical races of *paradoxa* differ from each other a little in the genitalia.

In the same countries and even in the same localities as *P. paradoxa*, there flies the much rarer *P. caunus*, the well-known mimic of *Euploea rhadamanthus*. This *P. caunus* is in structure exactly the same as *P. paradoxa*, the various geographical races showing the same minute differences as the races of *paradoxa*. What conclusion have we to draw from this statement of facts? We think, only one interpretation is admissible. If *P. clytia* and *dissimilis* are one species, *P. paradoxa* and *caunus* also are forms of one species only.

MIMICRY OF ORIENTAL COCKROACH AND BEETLE.—Mr. O. E. JANSON showed a cockroach and a beetle from Celebes, exhibiting a remarkable case of mimicry. The first was apparently an undescribed species of *Prasoplecta*, or an allied genus; and the latter he had identified as *Coelophora formosa*, Crotch.

Mr. G. A. K. MARSHALL pointed out the notable similarity of structural detail as well as of the general scheme of colour and marking.

Mr. C. O. WATERHOUSE remarked that many *Blattidae* were good mimics of the *Coccinellidae*.

ATTACK BY EARWIG ON *AGROTIS VESTIGIALIS*, ROTT.—Mr. W. PARKINSON CURTIS sent for exhibition two specimens, a ♂ and ♀ of *Agrotis vestigialis*, Rott., obtained August 19th, 1908, at Studland, Purbeck, Dorset. When working the sandhills he saw the dead ♀ apparently sitting on the grass, and then noticed that she had a part of the ♂ genitalia attached to her. He then found the ♂, which a common earwig was busily engaged in devouring. The earwig seemed in no wise anxious to relinquish its prey, but as the ♂ was lifted, it dived into the herbage and he failed to capture it. The ♂ was quite freshly killed, and so was the ♀, in fact the rigor of the muscles had not set in. The earwig had evidently found the pair *in copula*, and had seized the ♂ by the head, the insect in its frantic struggles having apparently torn away the genital valves and partially eviscerated itself, so far injuring the ♀ internally as to cause death. The earwig had then eaten the maxillary appendages and the greater part of the head of the ♂, and was

continuing its meal. He had never observed any other attack by this species on Lepidoptera that he could recall.

Dr. T. A. CHAPMAN felt it impossible to accept the conclusions arrived at by the exhibitor with regard to the earwig. An earwig would probably not attack a living *Agrotis*; if it did the *Agrotis* would probably repel it successfully. Supposing it to attack with all its strength it could not produce the damage observed, and again the damage to the two moths as recorded and exhibited on the specimens shown, would not result in their dying there and then on the spot. It seemed evident then that some accident had happened to the moths, whether from some bird or beast there was no evidence to show, but the part of the earwig was merely that of a petty pilferer, coming to regale himself on the feast provided.

SWARMS OF LOCUSTS AND DRAGONFLIES IN AFRICA.—Mr. C. O. WATERHOUSE exhibited a specimen of *Acridium peregrinum* from a swarm that visited Las Palmas, Grand Canary, in October 1908. Dr. Taylor, who sent the specimens to the Natural History Museum, states in his letter that the authorities had killed fifty tons of these locusts, and he estimated that there were 150 tons more. Mr. Waterhouse said 16 locusts weighed one ounce, but allowing 15 to the ounce (as the specimens may have lost in weight), one ton would represent 537,600 locusts, and the 200 tons 107,520,000. Besides these the vessels reported that the sea was in many places covered with them. He also exhibited a dragonfly, *Tramea basilaris*. This species occurred in such numbers on one occasion in Portuguese Congo that the natives mistook them for a swarm of locusts. They rested on the trees for the night and went off next day.

THE SAWS OF SAW-FLIES.—The Rev. F. D. MORICE exhibited photo-micrographs (magnif. about 210 diam.) of the "saws" in 10 British sawflies—species of the genus *Dolerus*. After briefly alluding to the specific characters presented by them, to certain points in which all alike differed from the ordinary tenon-saws employed by carpenters, he invited suggestions which might account for these differences. Thus, whereas in a carpenter's saw the teeth point away from the handle (or base) of the tool towards its apex, in the insect's saw they point from the

apex towards the base. Might it be inferred from this that the insect's saw is made to cut not like the carpenter's saw by a *push* (outwards or forwards), but by a *pull* (inwards or backwards), and if so, is it because the latter movement involves less risk or damage to these delicate structures through bending or breakage? Again, what can be the use of certain extremely fine denticulations (so small as to be only just visible in the photographs) on the teeth themselves, not at their apices, nor on that side of them which on the hypothesis above would be their cutting edge, but at the *base* of each tooth close to the sinus separating it from the tooth next adjoining, so that it was difficult to see how their presence or absence could assist the cutting action of the teeth? Might it be that in some way they helped to clear the cut and prevent clogging—the very “wide-set” of the teeth in most of the saws shown suggesting that this had to be provided for—or to make the saw less liable to “pinch,” *i. e.* become jammed in the cut, and remove any obstacle that might be met with in withdrawing it when its work was done? Very little if anything seemed to have been put on record, from actual observation of the process, as to the manner in which these saws were actually employed; and the exhibitor mentioned that although he had long collected sawflies, both in England and abroad, he had never been so fortunate as to see one actually at its work.

A discussion followed in which Prof. T. HUDSON BEARE supported on the whole the hypotheses suggested by the exhibitor.

Dr. T. A. CHAPMAN was strongly of opinion that the name “saw” for these instruments, though well describing their general appearance, was question-begging as regards their function. They were really knives, all their cutting was done during the forward movement, the notches being merely a ratchet to hold one “saw” in place whilst the other advanced, as they alternately moved. The “saw” must get in before it could (if it did) saw, but if it can get in without sawing, it can go on without doing so. The angle at which the margin lies makes it certain that especially towards the point of the instrument, the least retraction would free the saw without

doing any cutting.\* The action is precisely that of a bee-sting.

A point, not mentioned by the exhibitor, came up in the discussion, viz. that the saws were *paired* and not *single* saws. This would, no doubt, in some way affect the manner of their working, but as to *how* it would do so, no definite suggestions were offered. The exhibitor inclined to think—considering the structure of their “attachments”—that the saws work *simultaneously* and not, as some have thought, *alternately*, but he said that he did not venture to argue in defence of this thesis without further investigation.

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Wednesday, March 3rd, 1909.

Dr. F. A. DIXEY, M.A., M.D., President, in the Chair.

*Election of a Fellow.*

Mr. FRANCIS HAMILTON LYON of Addlestone, Surrey, was elected a Fellow of the Society.

*Exhibitions.*

MENDELISIM IN *ACIDALIA VIRGULARIA*, HB.—Mr. L. B. PROUT, on behalf of himself and Mr. A. BACOT, brought for exhibition a very extensive series of *Acidalia virgularia*, Hb., bred in ten successive generations from various crossings of the London and Hyères race, which had been undertaken with a view to the further study of Mendelism. The results showed non-Mendelian inheritance, there being no segregation with pure and hybrid forms in definite proportions; and thus supported Mr. BACOT's opinion that such were only to be expected in cases of hybridization of forms in which Natural Selection had virtually eliminated intermediates, or in other words, that apparent Mendelian phenomena were manifestations of selective purity, rather than of gametic purity.

\* Reaumur describes the alternate movement of the saws; he clearly believed that this involved withdrawal of one, during which actual sawing took place, but his account, a better one than any one has given since, leaves me satisfied that what he saw, was alternate advance, without retraction.—T. A. C.

A discussion followed in which Mr. BACOT, Dr. T. A. CHAPMAN, Mr. G. MEADE-WALDO and the PRESIDENT took part, Mr. A. HARRISON pointing out that in similar experiments conducted by himself with Mr. H. MAIN with British *Pieris napi* × *P. var. bryoniae* from Switzerland carried through three generations, they had quite failed to obtain Mendelian proportions, but in the case of *Aplecta nebulosa* the Mendelian proportions were absolute. (Cp. Proc. Ent. Soc. 1907, p. liv.)

PUPAL COLORATION OF PIERIS.—Mr. H. M. EDELSTEN showed a living pupa of *Pieris rapae* attached to a blade of *Clivia*, the deep green pigment assimilating closely to the coloration of the leaf.

HYBRID ZYGAENA.—Mr. R. ADKIN exhibited a hybrid? between *Zygaena filipendulae* and *Z. achilleae*, taken by Mr. A. W. Renton in the neighbourhood of Oban, N.B.

Mr. J. W. TUTT expressed his opinion that the form was an aberration of *Z. filipendulae*, and that in nature the two species were unknown to pair.

#### *Papers.*

Mr. HAMILTON H. DRUCE, F.L.S., F.Z.S., communicated a paper "On some new and little known Hesperidae from Tropical West Africa."

Mr. G. A. K. MARSHALL, F.Z.S., read a paper entitled "Birds as a Factor in the production of Mimetic Resemblances in Butterflies." He explained that one of the chief criticisms directed against the theories of mimicry was to the effect that, on the whole, birds did not destroy butterflies to any appreciable extent; he had therefore collected together all the available evidence bearing on the question. As indicating the extent of such observations, it was stated that these records refer to a considerable number of species of both birds and butterflies, as might be judged from these approximate figures: Palearctic Region: 33 birds, 34 butterflies; Ethiopian: 26 birds, 26 butterflies; Oriental: 27 birds, 46 butterflies; Nearctic: 46 birds, 20 butterflies. Unfortunately in the Neotropical Region, from which the greatest amount of evidence might have been expected, such exact observations had been almost

entirely neglected. It was contended that the negative evidence on this subject, which appeared to have been very generally accepted, was really of very little scientific value, because in no case had it been shown that the observer had any adequate knowledge of the actual food-habits of birds, or that any careful and exhaustive inquiry had been made into the subject. Instances were also cited to show how very easily destruction of this kind might be overlooked; while negative evidence derived from an examination of the contents of birds might be very misleading, owing to the fact that in so many instances the butterflies' wings are not swallowed, so that any recognition of the remains becomes extremely difficult. Finally, it was urged that the large body of evidence resulting from merely casual observations indicated that the assumption that birds do not eat butterflies to any extent is certainly premature, and that a fuller inquiry will probably show it to be entirely unfounded.

A discussion followed in which Mr. A. W. BACOT, Mr. H. ROWLAND-BROWN, Mr. H. MAIN, Mr. A. E. TONGE, Mr. H. M. EDELSTEN, Mr. J. W. TUTT and other Fellows, gave their experiences on the subject, Mr. W. SHARP suggesting that the actions of the sparrow, as a domesticated bird, was not evidence for conditions which exist in the case of purely natural species. Dr. T. A. CHAPMAN suggested that the paucity of observations on the point was largely due to the shyness of birds eating in the presence of human beings. Mr. W. J. KAYE said that he had never observed birds attacking butterflies in tropical South America, and Commander J. J. WALKER gave similar testimony with regard to the many Australasian and other oversea localities visited by him.

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**Wednesday, March 17th, 1909.**

Dr. F. A. DIXEY, M.A., M.D., President, in the Chair.

*Election of Fellows.*

Capt. E. BAGNELL-PUREFOY, The Cottage, East Farleigh, Maidstone; Mr. STANLEY A. BLENKARN, 44 Romola Road,



Tulse Hill, S.E.; Mr. LEONARD BOX, the Floral Nurseries, Hailsham, Sussex, and 28 St. James's Street, Bedford Row, W.C.; Mr. HENRY BRITTEN, Prospect House, Salkeld Dykes, Penrith; the Rev. C. R. N. BURROWS, of Mucking Vicarage, Stanford-le-Hope, Essex; and Mr. W. A. ROLLASON, "Lamorna, Truro, were elected Fellows of the Society.

#### Obituary.

The decease was announced of Capt. FREDERICK HALLAM HARDY, R.A.M.C., a Fellow of the Society.

#### Visitors.

M. A. JANET, member of the Entomological Society of France, and M. SEVERIN, member of the Entomological Society of Belgium, were present as visitors.

#### Exhibitions.

FORMS OF *RUMICIA* *PHLAEAS*, AND *PLEBEIDI*.—Mr. H. ROWLAND-BROWN exhibited two extreme forms of *Rumicia* (*Chrysophanus*) *phlaeas* from Alten, Norwegian Finnmark, and the Mediterranean region—Greece, Syria, Corsica, and the south of France. He drew attention to the apparent identity of the form from arctic Europe—*hypophlaeas*, Bdv.,—with the species described as *americanus*, D'Urb., from North America. He also showed series of *Plebeius argyrognomon*, Brgstr., taken by him at Alten, and Abisko Swedish Lapland; *P. argus*, L., var. *corsica* from Vizzavona, and la Foce, and *P. argus*, approaching ab. *bella*, H. Sch., from Digne, Basses-Alpes.

Mr. H. HAMILTON DRUCE also brought for exhibition examples of *Plebeius argus*, L., taken by him in various localities in Russia.

GYNANDROMORPHOUS *EUCHLÖE*.—Mr. G. MEADE-WALDO exhibited a gynandromorphous example of *Euchlœe cardamines*, bred from a larva found at Hever, Kent. The wings on the right side showed the male characters, on the left the female, the orange apical coloration showing faint traces on the latter as seen in *E. euphenoides* ♀.

OVIPOSITION OF *COENOBIA*.—Mr. H. M. EDELSTEN brought for exhibition stereoscopic photographs of the anal segments of *Coenobia rufa* ♀, showing the spines. These spines are

driven into the dead stems of *Juncus lamprocarpus*, making a longitudinal slit, they are then opened, and the ovipositor thrust into the pith and the ova deposited in small bunches. Ovipositor and spines are then withdrawn, and the cut, closing up, is hardly visible.

ABERRANT FORM OF *CHRYSOPHANUS HIPPOTHOË*, L.—Mr. W. SCHMASSMAN showed on behalf of Mr. H. Welte a curiously marked ♀ of *Chrysophanus hippothoë* caught on July 22nd, 1908, at Goeschenen, Switzerland. The black spots, forming the marginal row on the underside of the two fore-wings and one of the hind-wings, were elongated. The other hind-wing and the wings on the upper side were normal.

MAMMOTH SCALE INSECT OF RHODESIA.—Mr. C. O. WATERHOUSE sent for exhibition living males and immature females of the Mammoth Scale Insect which infests the M'sasa tree in Rhodesia. Also a dead example of the fully grown female scale. These were recently received from Mr. J. Cameron of the Department of Agriculture, of Rhodesia. The males were in abundance in white cocoons among dead leaves under the trees. They are what are known in collections under the generic name *Monophloeus*. The female has been named *Lophococcus maximus* by Mr. Lounsbury.

COLEOPTERA AND HEMIPTERA NEW TO BRITAIN.—Mr. E. A. BUTLER exhibited one species of Coleoptera, and five of Hemiptera recently added to the British Fauna; viz. (a) *Myrmecopora brevipes*, Butl., from Tintagel, Cornwall, a species allied to *M. uvida*, Er.; (b) *Cymus obliquus*, Horv., from Ashburnham, Sussex, in the Hastings district, a species allied to *C. glandicolor*, Hahn.; (c) *Empoasca butleri*, Edw., and *E. populi*, Edw., the former from dwarf sallows on the sandhills of Caermarthenshire, and the latter from Lombardy Poplars, Highgate; and (d) on behalf of Mr. Jas. Edwards, *Typhlocyba frustrator*, Edw. and *T. fratercula*, Edw. (together with a sketch of the appendages of the oedeagus in each case), both from Colesborne, Gloucestershire. These two species were described by Mr. Edwards in April 1908, but by an oversight they were omitted from the new catalogue of British Hemiptera which has recently been published. Mr. Butler also showed the unique example of *Mymecocoris*

*gracilis*, Sahlb., taken by him at Fleet, Hants, in August 1903.

**INJURIES TO CETONIID BEETLE.**—Mr. G. J. ARROW exhibited examples of a Cetoniid beetle, *Dicronorrhina* (subg. *Neptunides*) *manowensis*, Moser,\* to show injuries of a remarkable character which he was quite at a loss to explain. The first specimen was quite normal, the second had each elytron perforated just behind the middle in an exactly symmetrical manner, the third had the perforations in an apparently incipient stage, the superficial chitin having disappeared at the same spot, and in a fourth specimen there was a discoloration on each side. In all the marks were perfectly symmetrical and occupied exactly the same position. The specimens were sent from Chirinda, Rhodesia, by Mr. Guy Marshall's collector.

**POLYMORPHIC PAPILIO AND STYX INFERNALIS.**—Dr. K. JORDAN exhibited the polymorphic *Papilio lysithous* and *P. hectorides* from Brazil and the models which they imitate. The exhibit illustrated a phenomenon observed in various groups of butterflies: that a mimetic species is broken up into a number of very different-looking individual varieties, which are all specifically the same, while the imitated models are specifically distinct from one another. He also exhibited both sexes of the peculiar Peruvian butterfly *Styx infernalis* apparently regarded by Staudinger as a Pierid. Dr. Schatz made a mistake in describing the foretarsus of the ♂ as being fully developed. The distal segments of this tarsus are more or less completely fused and the claws are absent. The insect is decidedly an Erycinid in the structure of the antenna, thorax, legs, neuration and the egg.

**MIMETIC LOCUST.**—Dr. JORDAN also showed, on behalf of the Hon. N. Charles Rothschild, an *Acrotylus* which Mr. Rothschild had observed in some numbers in the desert on the Upper Nile. The colour of these small locusts so closely agrees with that of the sand and the pebbles (also exhibited) that, when settled, the insects disappear entirely from view.

**CLERUS FORMICARIUS WANTED**—Mr. H. St. J. DONISTHORPE

\* This insect, although described by Moser as a variety of *D. polychron*, Thoms., is very distinct.—G. J. A.

read a letter from Mr. E. E. Green of the Botanic Gardens, Peradeniya, Ceylon, inviting Fellows of the Society to send him living specimens of *Clerus formicarius* for introduction into Ceylon.

DISCUSSION ON THE TWO SIMILAR SPECIES PLEBEIUS ARGUS (ÆGON) and P. ARGYROGNOMON.—Mr. J. W. TUTT opened a discussion on the affinities of the two Palearctic species *Plebeius argus*, L., (*aegon*, Schiff.; *argyrotoxus*, Brgstr.), and *P. argyrognomon*, Brgstr. (*argus*, auctorum). He said that there was great confusion from the earliest description onwards as between the two species, and cited the following authorities:—

1758. Linné, *Systema Naturae*, 12th ed., p. 483—*argus*, blue butterfly with silvery blue spots beneath. Also *idas*, p. 488, an Indian species.
1761. Linné, *Fauna Suecica*, 2nd ed., p. 283—*argus*, with same references. Also *idas*, p. 284—and suggesting it as the ♀ of *argus* (not therefore *idas* of the 10th ed.).
1767. Linné *Systema Naturae*, 12th ed., pp. 789–90—*argus*, with same description, but *idas* referred as ♀ to same species.
1775. Schiffermüller, *Wien. Verz.*, p. 183 (note), referred Linné's *argus* to the non-British insect now known as *argyrognomon*, and described *aegon* as another species, distinguishing it clearly as the species we know as *aegon*.
1787. Schneider, *Syst. Besch.*, p. 252 }  
 1788. Borkhausen „ „ p. 154 } followed Schiffermüller.

Hübner, Illiger, Laspeyres, Herbst, Ochsenheimer, Oken, Gödard, Boisduval, Duponchel, Freyer, Herrich-Schäffer, and a whole army of other reputable authors followed his conclusion—calling our species *aegon*, the non-British species *argus*.

Fabricius, Lewin, Haworth, Stephens, Curtis, Wood, Westwood, etc., maintained the Linnean name *argus* for *aegon*.

Stephens supported this by pointing out that in the "Linnean collection" at Burlington House there were no *argus* as understood by the continental entomologists.

In 1853, Wallengren (apparently only knowing one species our British one) said it was Linne's *argus*. Afterwards, knowing both, he maintained our British insect as *argus*.

In 1871, Kirby in his "Synonymic Catalogue" called our species *argus*.

In 1882, Schöyen wrote a critical review (*Ent. Tids.*, iii, pp. 34, 100), concluding that the Linnean *argus* was our *aegon*.

In 1901, Staudinger followed the conclusion of the Scandinavians, and since then every one has followed Staudinger.

On the descriptions we should have followed Schiffermüller.

On the fact that there are still in the Linnean collection at Burlington House, besides four examples of *aegon* labelled as English in Smith's handwriting and one without any label, two specimens, a ♂ labelled "1074," the "*Faun. Suec.*" number of Linne's *argus*, and a ♀ labelled "1075, *idas*," the *Faun. Suec.* number of Linne's *idas*—we are inclined to agree with the advisability, now that the change has become effective, of maintaining *argus* for our *aegon*, and *argyrognomon* for the continental insect so long known as *argus*.

Mr. TUTT next drew attention to the remarkable distribution and local races of our British *Plebeius argus* (*aegon*), pointing out that in Britain we have three distinct forms, a chalk-hill, a heath, and a moss or moorland form. On the continent, in Northern (except the far north) and Central Europe the type occurred as the form of the plains. In the high Alps *philonomus*, Brgstr. (= *aegidion*, Meissner), was the racial form; *aegiades*, Gerh., occurred in Central Europe on the heath land; the var. *corsica*, Bellier, was confined to Corsica, and further east in Asia Minor the form *orientalis*, with its ab. *bella*, H.-Sch. From west to east of the Palaearctic region the chief racial forms of *argus* were distributed as follows:—

Pyrenean .	$\left. \begin{array}{l} \textit{pyrenaica}, \text{Tutt.} \\ \textit{hypochionoides}, \text{Tutt.} \end{array} \right\}$	French Pyrenees.
		$\left. \begin{array}{l} \textit{hypochiona}, \text{Ramb.} \text{—white underside.} \\ \textit{bejarensis}, \text{Chpmn.} \\ \textit{casaicus}, \text{Chpmn.} \\ \textit{brañuelasensis}, \text{Tutt.} \\ \textit{vigensis}, \text{Tutt.} \end{array} \right\}$
Spanish . .		

Asiatic . .	{ <i>orientalis</i> , Tutt, and ab. <i>bella</i> , Gerh. <i>sifanicus</i> , Grm.-Grshm. <i>ongodai</i> , Tutt.
Japanese .	

*P. argyrognomon* has an almost exactly similar range in the Palaeartic area. Its range of variation is also almost parallel with that of *P. argus*, the large eastern race from Japan equalling the var. *koreana* in size. The Corsican forms of the two species, much alike on the upperside, are very distinct on the underside; *P. argyrognomon* var. *corsica* with black-centred ocellated spots, *P. argus* var. *corsicu* with the centres grey or pale brown (wing of the ground colour). The Alpine race too is smaller, the southern races larger, so that both species appear to show a parallel range of variation in the mountain, plain and southern forms respectively. Structurally and superficially considered the two species present several marked differences. For instance (*a*) in *argyrognomon* the spine on the front tibia is absent: (*b*) the shape of the wings in *argus* is more rounded): (*c*) the wing-fringes wider: (*d*) in *argus* the ground colour of the undersides is pale to white, in *argyrognomon* the colour is more uniformly grey: (*e*) there is a difference in the angulation of the row of transverse spots on the underside of the forewings, those of *argus* being more curved under the discoidal lunule: (*f*) the androconia in *argus* are elongated (8 to 9 rows of points run across each), in *argyrognomon* they are rounded (10 to 12 rows of points): (*g*) the conspicuous white hair scales in *argyrognomon* are absent in *argus*: (*h*) the genitalia show marked differences in both species: and lastly (*j*) the early stages, and life-history, are entirely different, and whereas *argyrognomon* has two broods in the year, *argus* has only one.

Dr. T. A. CHAPMAN then showed lantern slides of preparations of the larvae at their various instars of *P. argus* (*aegon*), and of the first stage of *argyrognomon* also, for comparison, and of various points in the larval and pupal external

anatomy and of the male accessory appendages of *argus*, *argyrognomon* and other species for comparison, and of the tibiae of these species showing how far they differed in the so-called tibial spine. Commenting upon them, he said—

“In examining the tibial spines of *argus* and *argyrognomon* I found a curious reversion in one specimen of *argus* from Spain; the tarsus is normally (in the ♂) in one piece, all the joints and terminal claw being fused together without trace of articulation. The first Spanish specimen I examined had the tarsus, however, divided into three joints. I wondered, of course, whether this might be a character of the Spanish races, but I failed to find another such specimen, the Spanish and others absolutely agreeing. There is an ambiguity in calling this a tibial spine, it is the extremity of the tibia itself. What is usually called the tibial spine is a separate process not present in these species.

“The comb-like end of the clasp of *P. argus* presents greater variation than one would quite expect, the total number of teeth varying within considerable limits, and the presence or absence of one or several minor or ill-developed teeth at either end of the series is another point in which there is great inequality in different specimens. The opposite clasps of one individual differ very frequently, and a different number of teeth to the comb may be found in specimens from one locality. There is probably also some geographical variation, but this I have not demonstrated.

“We may conclude that considerable differences in this portion of the clasp do not interfere with complete syngamy in the species. The tendency to variation is obviously sufficiently strong easily to establish a new species, if a section of the present species could be segregated for no very long time. We may also conclude that these special and formidable processes do not correspond with any portion of the female appendages similarly differentiated, else four prongs to the comb would not be equally useful with five, six, seven, or eight.

“The great difference between the genitalia of *argus* and *argyrognomon* has suggested to me the question as to whether these two species are really so closely related as we suppose. It is open to us to believe that they are from different portions

of the Plebeiid stock that have approximated as a matter of mimicry, or since both are common, but rarely, if ever, common together, that they have approximated as occurring under very similar conditions, and in a slight variation of those conditions each capable of taking the place of the other. We find that the dorsal armature differs very much, and in these Lycaenids the dorsal armature usually has generic rather than specific value. Taking *icarus* or *bellargus* as an average Plebeiid, we find in *argus* each lateral member of the dorsal armature is long, slender, curved and slightly hooked at the tip, and the accessory hook is sharply bent with the terminal portion long, straight and slender, except that it also is slightly curved and hooked at the tip. *Argyrognomon* on the other hand differs from *icarus* in the opposite direction; it has the lateral process, short, broad and blunt, and the accessory bends in a prolonged curve, so as to give the impression that it is curved throughout, and though it has a slight terminal bend or hook, like *argus*, it differs in being broader and more robust.

“When we compare the ends of the clasps, the difference is immense, *argus* with a few long teeth rather on the side of the hard process, *argyrognomon* has a number of very fine teeth on the rather broad end of the process. These, therefore, seem to be almost unrelated (within the Plebeiid group) forms of appendages.

“To accept them as closely related, I have to give a somewhat exaggerated value to a consideration that is of much importance in the study of these genitalia.

“The genitalia are under entirely different conditions as regards selection, to the external characters we more usually examine. These external characters are subject to a constant process of selection in relation to such items of the environment as enemies, climate, food-plant, etc. The genitalia, though equally inclined to vary, and probably in response to similar disturbing elements of environment, are under no selective force exercised by the environment. Within the limits of a species, variation from the mean value must not go so far as to prevent the individual from finding a mate, but it is quite open to the mean value gradually to change in any



direction. As long as a group of individuals is syngamic (*i. e.* is a species) the genitalia may vary similarly throughout the group, but may not run into definite varieties. When, however, such a group is divided into two portions or groups by geographical seasonal or other segregation, each portion must keep a form of appendages constant throughout the portion, but probably drifting away from those of the other group, which may be varying in another direction. When such drifting has proceeded far enough, the two portions are no longer syngamic, and act towards each other as distinct species, should opportunity of mixing occur. It seems very probable that such drifting apart may take place with considerable rapidity, in view of the many cases we know, of two or three species quite distinct as to the genitalia, quite asyngamic, and yet in external character much alike, even difficult to distinguish. It is very probable that such pairs of species whilst segregated may have drifted apart in external characters, but when subjected again to the same environment come to resemble one another very closely, quite apart from any question of mimicry.

“The dorsal armature of the genitalia of *argus* and *argyrognomon* seems to me to negative such an hypothesis, but it is really nevertheless possible, and is indeed the hypothesis commonly held, that these two are species derived from a common stock in some such way as I have indicated.

“The point I wish to direct attention to as bearing on such cases, is that if a comparatively small portion of a species be fully segregated, it may vary more or less in external characters taking up a position suitable to the new and restricted environment and there remaining constant, but that the genitalia are under no restrictions, being free to vary to any extent, subject only to all within the group varying together. When the group is small in numbers, a tendency to vary will have greater possibility of resulting in change, as there will be no large mass of individuals to absorb contrary tendencies and by its inertia prevent change. Whilst, therefore, little or no change in the genitalia may take place in some or a majority of cases, in others it will probably take place with some rapidity and to a considerable extent.

“It is to be noted that there are a good many species whose appendages seem more or less intermediate between those of *argus* and *argyrognomon* and I show you on the screen photographs of five such species that most resemble *argus* in having large spines. It is to be noted that all these intermediate species (intermediate *quâ* genitalia) are abundantly different from both *argus* and *argyrognomon* in external characters. *Argus* and *argyrognomon* are the only European species of this group (except the very local *P. zephyrus* and its var. *lycidas*), and they resemble each other more in Europe than they do elsewhere.

“This circumstance seems to point to their having been rather widely apart within their own small group; but that they have approximated in external characters where they have again occupied very similar habitats.”

At this point the discussion was adjourned, owing to the lateness of the hour.

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### Wednesday, April 7th, 1909.

Dr. F. A. DIXEY, M.A., M.D., President, in the Chair.

#### *Exhibitions.*

Mr. R. SHELFORD exhibited a case containing a number of examples of mimetic Oriental *Blattidae*, the models being Coleoptera, principally *Coccinellidae* and *Chrysomelidae*.

OVA OF *TAPINOSTOLA FULVA*.—Mr. H. M. EDELSTEN exhibited ova of *Tapinostola fulva* (*in situ*) laid within the curled leaf of *Carex paludosa*. Also a photograph of the anal segments of the ♀ showing the ear-like appendages, from the ventral side. These when not in use are carried flat as in the photograph, but when the ♀ is going to lay, they are folded together and thrust between the curled edges of a leaf to force it apart; the fold makes a hollow in which the ova are deposited; and the leaf closes over the ova when the appendages are withdrawn.

DISCUSSION ON THE TWO SIMILAR SPECIES *PLEBEIUS ARGUS* (= *AEGON*), AND *P. ARGYROGNOMON*.—The discussion adjourned

from the last meeting was resumed, Mr. H. ROWLAND-BROWN raising the question of the probable meaning of the apparent mimicry of the two species. The Rev. G. WHEELER commenting on Mr. TUTT's statement that as a rule the two species in the lowlands are rarely, if ever, common together, remarked that at Bérisal they often occurred simultaneously in vast numbers, though *P. argyrognomon* would sometimes be a full month before *P. argus* came on the scene. He objected to the suggestion of mimicry because there was no ground for supposing that it would be of any utility to either species. Mr. G. A. K. MARSHALL suggested that the resemblance between the species was not due to mimicry, but to close relationship; and that the differentiation into species had arisen as a result of a dimorphic variation in the genitalia. Dr. K. JORDAN pointed out that, as was usual in such cases, the differences in the genitalia were of degree rather than of kind; he considered that the two forms were certainly distinct species, and could not be regarded as dimorphic varieties. Mr. J. E. COLLIN, the PRESIDENT, and other Fellows, continued the discussion.

The PRESIDENT having invited Mr. TUTT to reply on the discussion, Mr. TUTT stated that he did not think that there was any question of mimicry in the similar appearance of the two species. He considered that the two species were really closely allied, and that the great differences in the ancillary appendages possibly did not denote so great a division between them as might appear. He pointed out that the life-histories of the two species were quite distinct, and had been known quite 135 years. With regard to the appearance of the two species together it was to be remembered that, in the lowlands, *argyrognomon* was double-brooded and *argus* largely single-brooded, and this did not allow of any real overlapping, though there was some; in the mountains it was true both species occurred more or less at the same time, largely however there with *argyrognomon* well ahead of *argus*. There could be no doubt about the distinction of the species; Mr. Marshall's idea of the two forming a dimorphic species had nothing whatever to support it.

*Papers.*

Mr. H. St. J. DONISTHORPE read a paper "On the Origin and Ancestral Form of Myrmecophilous *Coleoptera*."

Mr. W. L. DISTANT communicated a paper on "Rhynchota Malayana."

Mr. J. E. COLLIN communicated a paper by Mr. W. Wesché, F.R.M.S., "On the Antennae of Diptera, and the present classification of the *Nemocera*, with two subsidiary sections bearing on the latter subject."

Mr. G. A. K. MARSHALL read a paper entitled "On Reciprocal Mimicry. A Rejoinder to Dr. F. A. Dixey." In the course of his remarks the author explained that the main difference between his views and those of Dr. Dixey as to the development of Müllerian resemblances might be stated as follows. The latter gentleman considers that within the limits of a Müllerian association every species exercises a mimetic influence upon every other, the amount of the influence depending upon its dominance, which is determined by its numbers, distastefulness and general notoriety. Thus, as between any two species, the mimetic approach would be mutual and result in an interchange of characters. This interchange would be proportionate to the relative dominance of the two species; where this is unequal, the weaker species would take on, to a considerable extent, the superficial appearance of the stronger, while the latter would adopt only some small characters from its mimic; but where the dominance is equal, the interchange would be equal, so that this would constitute the optimum condition for the production of Reciprocal Mimicry.

On the other hand, Mr. MARSHALL contended that this gravitational conception of mimicry was really based on a false analogy and was at variance with the real principle of Müller's theory. While admitting the theoretical possibility of mimetic interchange, he urged that a logical application of Müller's argument would lead to the view that mimetic approach would be one-sided only, that is, from a weaker species towards a stronger and never in an opposite direction; further, that when the relative dominance of the two species

was equal the mere operation of Müller's factor would produce no mimetic effect, until some other factor had first produced a condition of inequality. On this view mimetic interchange would never be mutual and simultaneous, but would only result from a complete reversal of the relative dominance of the two species during the production of the mimetic resemblance. For this process he had suggested the name of "Alternate Mimicry." The author was also compelled to reject entirely Dr. Dixey's new hypothesis as to the "function of the double aposeme," because it completely left out of consideration the differences and resemblances between the various forms regarded from the standpoint of general facies; he contended that resemblance in general effect was of the first importance in considering mimetic relationship, and that this new hypothesis was liable to be extremely misleading on account of the exaggerated significance which it attached to the merely partial resemblance which might be said to exist between two species possessing a single conspicuous feature in common but differing markedly in other respects. Moreover, not only was the theoretical position of Reciprocal Mimicry very unsatisfactory and unconvincing, but further, the cases which had been cited as proving its actual occurrence in nature appeared open to serious criticism. For while in some cases the facts did not appear to justify the assertion that an interchange had taken place, in the others such an interpretation involved many difficulties which disappeared when the mimetic phenomena were interpreted as being due to the simple mimicry of one form by another.

In illustration of his contentions Mr. MARSHALL exhibited a number of butterflies, the great majority of which had been kindly lent for the purpose by Mr. W. J. KAYE, the remainder having been kindly supplied by Dr. K. JORDAN and Mr. HAMILTON DRUCE.

Dr. DIXEY then stated that he did not consider the Presidential Chair to be a proper place in which to reply to Mr. Marshall's criticism, and that he would therefore deal with the points at issue on some future occasion. Mr. C. J. GAHAN very strongly supported the opinions advocated by Mr. Marshall, and expressed the view that while Dr. Dixey

professed to support Müllerian mimicry, yet his defence of Reciprocal Mimicry really constituted a severe attack upon that theory. For he pointed out that Dr. Dixey had condemned certain of Mr. Marshall's contentions as vitiated and valueless because they were based on inaccurate postulates, whereas these postulates were the very ones which Fritz Müller himself had used.

Mr. S. A. NEAVE said that as a result of his field experience in Africa he was unable to accept the theory as to the function of "double aposemes," but he did not mean thereby to imply that he rejected every case of Reciprocal Mimicry. He suggested that Alternate Mimicry might not be so uncommon a phenomenon as Mr. Marshall appeared to think.

Mr. J. W. TUTT asked whether Mr. Marshall really knew of a single instance in which two species, supposed to carry different aposemes, lived in the same place with another species that showed the double aposeme of these species, and occurred with them at the same time. He remarked further that in his exhibit Mr. Marshall showed two species with different aposemes living in Peru, together with the presumed species showing the double aposeme, which he noted did "not occur within 1000 miles of Peru"; was there no instance known in nature which illustrated the point at issue, and so removed the question from the rank of pure theory?

Mr. MARSHALL said that such a case was not known to him.

Mr. W. E. SHARP and Professor T. HUDSON BEARE also made some brief comments on the subject.

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Wednesday, May 5th, 1909.

Dr. F. A. DIXEY, M.A., M.D., President, in the Chair.

*Exhibitions.*

RHINOCEROS OESTRID FLY.—Mr. S. A. NEAVE exhibited three specimens of a remarkable Oestrid fly belonging to the genus *Spathicera*, Corti, captured on the carcase of a rhinoceros shot by him near Fort Jameson, N.E. Rhodesia, in February

1908. He pointed out the extreme rarity of individuals of this genus in the imago state, though Oestrid larvae had long been known and frequently recorded in the intestinal canal of *Rhinoceros bicornis*, and recently Professor Sjöstedt had succeeded in rearing one individual from a larva, described by him under the name *meruensis*.\* The only other known specimen from Africa seemed to be that reported from Gallaland by Brauer under the name *pavesii*.

Mr. NEAVE remarked that this seemed to be the first recorded occasion on which the adult insect had actually been observed to be following the rhinoceros, and it was of some interest in this connection that both sexes were represented (2 ♂♂, 1 ♀). The resemblance of these insects to Hymenoptera of the genus *Salix*, an individual of which, *Salix* n. sp. near *imperialis*, Sm., he exhibited for comparison, was so marked that, having no net with him, he had hesitated to catch the flies by hand, though this was easy to do owing to their sluggish flight and reluctance to leave the carcass. In conclusion Mr. NEAVE put forward the suggestion that the presence of these parasites may be an explanation of the peculiar and well-known habit of the rhinoceros in invariably scattering his dung with his horn. It seemed not improbable that the animal did this in an instinctive attempt to kill the larvae by exposing them to the sun's rays.

RARE BRITISH ANTS.—Mr. H. ST. J. DONISTHORPE brought for exhibition examples of (a) *Formica exsecta*, Nyl., from four nests found on April 26th last in Parkhurst Forest, Isle of Wight, where Mr. E. A. Butler had taken a single ♀ by sweeping in 1907, and from the same locality (b) *Dinarda hagensi*, Wasm., hitherto only observed (with the same ant) in Britain at Bournemouth by the exhibitor; also (c) *Tetramoperia donisthorpei*, Kieffer, n. sp., and *T. femoralis*, Kieffer, n. sp., taken by himself with *Tetramorium caespitum*, L., at Whitsand Bay, Cornwall, on April 15th last; (d) *Paracletes cimiciformis*, taken with *T. caespitum*, L., at Rames Head, Cornwall, on April 19th last; and (e) *Antennophorus*

\* Wissenschaftliche ergebnisse der schwedischen zoologischen expedition nach dem Kilimandjaro, dem Meru. Diptera. Oestridae, Pl. I, fig. 1, 2, 1908.

*pubescens*, Wasm., a species new to Britain, taken on *Lasius flavus* at Whitsand Bay on April 18th.

COLOUR VARIATION IN COLEOPTERA.—Mr. W. E. SHARP exhibited examples of the following Coleoptera from the West of Ireland to illustrate the prevalence of colour variation in that region:—*Carabus nemoralis*, Müll., *C. granulatus*, L., *C. arvensis*, F., *Notiophilus aquaticus*, F., *N. biguttatus*, L., *Leistus ferrugineus*, L., and *Corymbites cupreus*, var. *aeruginosus*, F.

Mr. H. ST. J. DONISTHORPE also showed three melanic forms of *Carabus nitens*, *C. arvensis*, and *Pterostichus dimidiatus* from the New Forest; all quite black, and other species from Ireland.

Mr. SHARP explaining his exhibit said that in his opinion these dark forms were racial, and represented the survival of an older race, and that the melanism was not due to protective necessities, derived from the environment of the localities in which the several species existed.

Mr. G. C. CHAMPION mentioned that the black variety of the common Tiger Beetle was found both in Spain and in Scotland, but very rarely.

Mr. J. W. TUTT also expressed his opinion, citing parallel instances in lepidoptera, that these dark forms probably belonged to an older race of the species. He was inclined, however, to dissent from the conclusion that they had no cryptic significance, for if, as Mr. Sharp averred, the black forms of some of these species were more conspicuous than the paler normal forms, a possible explanation based on protective advantage was at once forthcoming as to the replacing of the assumed older darker race by the assumed newer, normally lighter, more numerous, and, apparently, less easily detected one, and since, as Mr. Sharp indicated, the percentage of dark forms of one of the species exhibited varied from a bare 1 per cent. in the eastern counties of England to from 15 to 20 per cent. in the western parts of Ireland, there appeared to be a further suggestiveness that the assumed newer, normal, form had, probably, owing to its more highly developed protective coloration, displaced the older dark race more completely in the east than in the west. The statement that two races of the same species occupied the same ground, in different proportions, without advantage to either, could neither be proved



nor disproved, and only removed the explanation of the reason of the colour-difference observed in the two forms a step backward. It is just as conceivable that originally dark races of coleoptera (and lepidoptera) are now less suitable to their changed conditions (clearance of forests, and consequent lessened humidity of certain areas, etc.), and are being ousted by lighter or more suitable forms, as, in other instances, particularly in wet, smoky, manufacturing districts, originally light races are now less suitable to their changed environment, and are being rapidly ousted by what appears to be more suitable melanic forms.

The President, Mr. G. A. K. MARSHALL, and other Fellows joined in the discussion.

PIERIS MANNI FROM SOUTH FRANCE.—Mr. H. ROWLAND-BROWN exhibited a series of *Pieris manni*, Mayer, taken and bred at le Vernet, Pyrénées-Orientales, and received by him from M. René Oberthür, calling attention to the superficial differences which presented themselves when compared with imagines of *P. rapae*.

NEW LOCALITY FOR CASSIDA FASTUOSA.—Mr. E. C. BEDWELL exhibited a series of *Cassida fastuosa* taken by him on Boxhill, Surrey, mostly from the leaves of young foxgloves.

DANAIDA CHRYSIPPUS, Linn.—Dr. G. B. LONGSTAFF exhibited a series of 33 specimens of *Danaida chrysippus* taken by him in Egypt and the Sudân during January and February 1909. Two taken at Cairo, one at Kom Ombo and one at Aswân, were all typical, but somewhat dark. A few other specimens were seen at each of these localities, but none of them had white hind-wings. At Khartûm, where the butterfly was fairly common, 25 specimens were taken: of these two might be described as typical, though lighter than the Egyptian specimens; in eight the veins near the middle of the hind-wings were dusted with white scales; in seven the centre of the hind-wings was more or less white, as in Moore's *alcippoides*; while seven might be described as typical *alcippus*, Cram. One specimen only was seen of the form *dorippus*, Klug, and this had the hind-wings almost entirely white—f. *albinus*, Lanz. So far as could be estimated in the field, three-fourths of all the specimens seen at Khartûm were either *alcippus* or *alcip-*

*poides*. On the White Nile between El Duêm and Gebel En (lat. 14–12½° N.) four specimens were taken, three typical or nearly so, one of the *alcippus* form. These figures are in marked contrast to the proportions found by the President\* among Mr. Loat's captures on the White Nile in lat. 11–4¾° N. In that case out of the same total (33), no less than twelve were referred to "*dorippus*" (2), or "*klugii*" (10). Dr. Longstaff called attention to the fact that whereas the transition from the type to *alcippus*, or from *dorippus*, Klug, to *albinus*, Lanz., is quite gradual; on the contrary, that from the type to *dorippus* appears to be abrupt.

TWO MIMICS OF *DANAIDA CHRYSIPPUS* IN CEYLON.—Mr. T. BAINBRIGGE FLETCHER exhibited two mimics of *D. chrysippus*; the ♀♀ of *Elymnias undularis*, and of *Argynnis hyperbius* (*niphe*), whose ♂♂ in both cases show the ordinary coloration of the genera to which they belong. He said that although in the ordinary preserved condition the resemblance of these two ♀♀ to *Danaida* was rather "rough and ready" and by no means comparable to the close imitation of pattern seen in the ♀ of *Hypolimnas* (also exhibited), yet under natural conditions of flight the likeness between model and mimic was exceedingly close and deceptive. Indeed, on the occasion of his first acquaintance with *Argynnis hyperbius* ♀ on the wing at Hongkong on April 22, 1897, he was completely deceived, and took the butterfly for a *Danaida* until it settled on a flower. The flight of the ♀ is slow and quite different from the elegant sailing flight of its ♂.

The habits and flight of the two sexes of *Elymnias undularis* are also quite different. The ♂ flies in the shade of thick bushes and is wary and hard to catch, whilst the ♀ flies slowly along in the open.

Although *Danaida* is probably well protected when on the wing, he had noted at Galle on April 20, 1907, that these butterflies, when settling down for the night about sunset, exhibited a distinct preference for resting on small *dead* bushes whose dry and withered leaves approximated closely in colour to that of the undersurface of the butterfly.

CASES OF MIMICRY FROM CEYLON.—Mr. FLETCHER further

\* Trans. Ent. Soc. Lond. 1903, p. 141.

exhibited (a) specimens of a large and conspicuous Mydaid fly, *Mydas ruficornis*, Wied., which show a striking resemblance when on the wing to the large and powerfully armed Scoliid wasps so common throughout Ceylon. This fly was first found in Colombo by Mr. O. S. Wickwar, whose collecting-boys brought him specimens when sent out to capture Hymenoptera, and a single example was obtained by the exhibitor at Yala (S.E. Ceylon). When on the wing, the resemblance to a Scoliid is very close and deceptive, the likeness being generally Scoliiform, rather than mimetic of any particular species of *Scolia*. (b) A red spider (taken at Galle on October 26th, 1908), found on a "bilimbi" tree (*Averrhoa bilimbi*), up the trunk of which numbers of the common leaf-nesting red ant, *Oecophylla smaragdina*—a model for several different insects and spiders—were running. In life the resemblance is extremely close and the ant holds up its first pair of legs to mimic the antennæ of its model. (c) Some newly-hatched Mantids, upon which the following note was made. "May 13th, 1908, at Madulsima.—On passing a tea-bush my attention was called to what were apparently several groups of the common leaf-nest ant (*Oecophylla smaragdina*). They were grouped in masses of about a dozen each, on the terminal shoots of the tea-bush. It struck me as unusual to find this ant at this elevation\* (3500 feet), and a closer inspection showed a dark band on the tarsi of the hind-legs. This led me to look more closely still, and I was surprised to find that these supposed ants were really young Mantids. The resemblance, both in colour, size, and the quick jerky movements, was so close as to have completely deceived me. The fore-legs were held tucked up in the usual Mantid manner, and the ends of the tibiæ may imitate the jaws of the ant. The abdomen was curled upwards in quite an ant-like manner. Even taken by itself, one of these young Mantids looks very like an ant; in a cluster of a dozen or so, all moving jerkily about but keeping together in a conspicuous position, the resemblance is very greatly increased."

\* I afterwards found nests of *O. smaragdina* in the tea-bushes in this same locality, but they are not common at this elevation. Still, they do occur.—T. B. F.

Mr. FLETCHER's exhibition also included (*d*) examples of a small Pyralid moth (*Syngamia floridalis*). When flying, the black marginal edging of the orange-red wings is practically invisible, and the moth looks exactly like a Coccinellid beetle. This resemblance is so close that on at least one occasion the moth was actually netted under the impression that it was one of the beetles which forms its model, and (*e*) a yellow-spotted Reduviid bug, *Acanthaspis quinquespinosa*, Fab., an interesting case of warning coloration common to various Carabid beetles found in the same locality and situations (under logs, etc.). In life both these insects are extremely similar in general appearance, and both are protected by the emission of a very powerful and noxious odour.

BIRDS ATTACKING BUTTERFLIES.—Mr. FLETCHER further said that he could add at least two instances of birds attacking butterflies noted by him in Ceylon: i. *Neptis eurynome* pursued, caught and eaten by a small bird locally called the "Ceylon robin." This was at Diyatalawa in September 1906.

ii. At Galle on June 20th, 1908, he saw a drongo fly down from a tree and attack a ♂ *Elymnias undularis*, which was flying close to him. The bird missed it once but took it at the second attempt, flew up to the branch of a coco-nut palm and devoured it.

Specimens of both these butterflies were exhibited.

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### Wednesday, June 2nd, 1909.

Dr. F. A. DIXEY, M.A., M.D., President, in the Chair.

#### *Election of Fellows.*

Mr. FRANK PRICE JEPSON, of Pembroke College, Cambridge, and Thanet Lodge, Bromley, Kent; Mr. ERNEST CHARLES CHUBB, of the Rhodesia Museum, Buluwayo, South Africa; Mr. JOHN F. MUSHAM, of 53, Brook Street, Selby, Yorks., and Mr. OSCAR CECIL SILVERLOCK, of "Allington," Burbage Road, Herne Hill, S.E., were elected Fellows of the Society.

*Obituary.*

The decease was announced of Mr. JOHN BROWN, a Fellow of the Society.

*Exhibitions.*

NORTH AMERICAN SAWFLY IN LONDON.—Mr. SELWYN IMAGE exhibited an example of the North American sawfly, *Sirex caudatus*, Cresson, bred from a larva found at Highbury in a piece of wood, together with photographs of the larva and its galleries by Mr. Hugh Main.

ANTHOCHARIDS FROM SOUTH FRANCE.—The Rev. G. WHEELER brought for exhibition a series of *Anthocharis tages*, var. *bellezina*, from Aix-en-Provence, taken this year, and of *A. belia* from the South of France for comparison; also a series of *Lycaena corydon* with dark undersides—the typical form in the south, expressing the view that in these regions the butterfly was not only double, but triple brooded; an observation supported by the extreme dates of its appearance in a fresh state.

REDISCOVERED MICRO-LEPIDOPTERON FROM THE SOUTH OF FRANCE.—Lord WALSINGHAM showed two set examples and pupal cases of *Holocacista rivillei*, Stn., called by the late Mr. Stainton “The lost Pleiad,” because originally described in 1750, and not again found before 1870,—mining leaves of the grape-vine. The name *Holocacista*, Wlsm. and Drnt., is now proposed for a new genus, Mr. Stainton having placed it in *Antispila*, Tr., from which it is found to differ materially in neuration, suggesting a more probable alliance with *Heliozela*, otherwise *Tinagma*, Stn.

NEW PALAEARCTIC SPECIES OF CALLOPHRYS.—Dr. T. A. CHAPMAN exhibited specimens of *Callophrys avis*, a new species from the South of France, first taken by him at Hyères three years ago, and in the following year, and now obtained by him this year from the Pyrénées-Orientales. It is very closely allied to *C. rubi*, but distinguishable by its larger size, ruddier colour, red hairy face without silver lines round the eyes, the very different form of the androconial band, the red underside to the club of the antennae, the different tone of the green of the underside and the different character of the white line.

It has probably been passed over in the field as merely *rubi*, but could hardly be so in the collection, though the only specimen seen by the exhibitor, and not in his own possession, is one in the Natural History Museum at South Kensington, series of *C. rubi*, labelled "*Tangier*, Elwes coll." The species is doubtless scarce and local. DR. CHAPMAN said he hoped to submit later a paper on the species giving some details of habits and life history; he thought it better not at present to forestall any interest that communication might possess.

He ventured to say, however, in case the present exhibit left any doubt as to whether *C. avis* might not be merely a variety of *C. rubi*, that there were great differences in the larvae, of which also he exhibited examples in the last instar. The most remarkable was perhaps in the first stage. In two species, so closely allied, one rather expected there would be no appreciable difference between them in the first stage. There were, however, not only differences of colour and markings, but notable differences in the development of the hairs.

FORMS OF PARARGE AEGERIA.—DR. CHAPMAN also showed two examples of *Pararge aegeria* from Southern France, with a typical Southern specimen (*aegeria*), and an English one (*aegerides*), for comparison, and remarked that it was no exaggeration to say that the two specimens were about as far from *aegeria* in one direction as *aegerides* is in the opposite, and much more extreme than any examples in the Natural History Museum. As it occurs on the same ground as the type, it is most likely an aberration, but it is not highly improbable that it is a Mendelian variety.

BUTTERFLIES FROM DURBAN.—DR. T. P. LUCAS, who was present as a visitor, brought for exhibition a box containing thirty-one species of butterflies taken by him in the neighbourhood of Durban in two hours. He also gave a short account of the abundance of Lepidoptera at Brisbane, Queensland.

RARE BRITISH BEETLE.—MR. E. C. BEDWELL exhibited two examples of the myrmecophilous beetle, *Hetaerius ferrugineus*, Ol., from Box Hill, a species not recorded from Britain for forty-six years.

The species was first captured by Mr. E. W. Janson in 1848 at Hampstead with *Formica fusca* and *F. flava*, and again in

1856 ("Ent. Annual," 1857, p. 77), and it was recorded in 1863 ("Ent. Annual," 1863, p. 113) as having been taken by Dr. Power at Weybridge with *Formica rufa*, and by Douglas and Scott near Croydon with *Formica sanguinea*.

Mr. H. ST. J. DONISTHORPE heartily congratulated Mr. Bedwell on his capture and remarked on the scarcity of the species in this country. He said it was more abundant abroad, that the principal hosts were *Formica fusca*, *F. sanguinea* with *F. fusca* as slaves, and *Polyergus rufescens* with *F. fusca* as slaves. It was also found with *F. rufa*, *pratensis*, *exsecta*, *rufibarbis*, *Lasius flavus*, *niger*, *fuliginosus*, *Tapinoma erraticum*, *Leptothorax acervorum* and *Myrmica scabrinodis*. The geographical distribution was London to Gibraltar in the west, and as far east as the Caucasus.

ANTS FROM NORTH BRITAIN.—Mr. H. ST. J. DONISTHORPE exhibited (a) specimens of *Formica exsecta* (♀ and ♂♂), several nests of which he had discovered near Aviemore in Inverness-shire in May. He pointed out that it had never been recorded from Scotland or the North before, and showed a map of the British Isles to illustrate the British distribution of the species. The localities at present known for it are Aviemore, Bewdley in Worcestershire, New Forest, Parkstone, Bournemouth, as far west as Poole and as far east as Ringwood, Parkhurst Forest, Isle of Wight, Bovey Tracey in Devonshire, and the Land's End in Cornwall; also (b) specimens of *Formica rufa-pratensis*, ♀♀, ♂♂, pseudogynes and micrergates from Nethy Bridge, Inverness-shire, and remarked that this was the chief form there. He described the nests, and mentioned that a number of them were being extinguished by the undergrowth. Moss starts to grow round the base of the nests, then "bilberry" and heather which creep upwards all round the hillock, gradually driving the ants to the summit and eventually extinguishing the colony. Professor Wheeler, in a paper "On Relations of Ants to Plants," records similar cases in America and Europe, and is of opinion that the colony eventually dies off.

MENDELISM IN ABRAXAS GROSSULARIATA.—Mr. L. DONCASTER exhibited a drawer of *Abraxas grossulariata* and its var. *lacticolor*, illustrating breeding experiments.

The various pairings give the following results:—

(1) *lacticolor* ♀ × *grossulariata* ♂ gives all offspring *grossulariata*.

(2) Heterozygous *grossulariata* ♂ and ♀ paired together give all ♂s *grossulariata*, ♀s half *grossulariata*, half *lacticolor*.

(3) *lacticolor* ♀ × heterozygous *grossulariata* ♂ gives equal proportions of *grossulariata* and *lacticolor* in both sexes. The variety is thus transferred to the male by this pairing.

(4) The converse pairing heterozygous *grossulariata* ♀ × *lacticolor* ♂ gives all ♂s *grossulariata*, all ♀s *lacticolor*.

(5) *lacticolor* ♀ × *lacticolor* ♂ gives only *lacticolor* in both sexes.

(6) Wild ♀ × *lacticolor* ♂ gives all ♂s *grossulariata*, all ♀s *lacticolor*.

These results show—(1) that *lacticolor* is a Mendelian recessive to *grossulariata*; (2) the converse pairings Nos. 1 and 6 above, show that wild ♂s are homozygous (pure) *grossulariata*; but wild ♀s are heterozygous, bearing recessive *lacticolor*. They suggest that the sex-determinants also behave as Mendelian characters, femaleness being dominant, and that ♂s are homozygous in respect of sex, ♀s heterozygous.

NEW IRISH BEETLE.—Mr. J. R. le B. Tomlin exhibited examples of *Micropeplus caelatus*, Er., taken on marshy ground last April, near Cloghane, co. Kerry, by Dr. Norman Joy and himself, an interesting addition to a small genus, so far, reported only from Germany and Sweden. It comes nearest to *M. porcatus*, Payk., from which it is very distinct by its much smaller size, the much feebler raised line on the vertex of the head, the much more rugose sculpture of the head and thorax, and in other points. It has the proportions of *M. tesseraula*, Curtis, but is larger and has the interstices of the elytra strongly punctured.

A MIGRATION OF LADYBIRDS.—Dr. G. B. LONGSTAFF exhibited a number of specimens of *Coccinella 11-punctata*, L., from the White Nile. On February 16th, 1909, when about 40 m. above Khartûm, numerous lady-birds settled upon the steamer—there were probably many hundreds; they all flew from the East against a slight westerly breeze; the flight lasted from 4.50 p.m. till nearly 6 p.m.; all those taken (25) proved to be



*Coccinella 11-punctata*, L., a widely-distributed species, and apparently the common lady-bird of Egypt and the Sudan, as Dr. Longstaff met with it near Cairo, at Aswân, at Khartûm, and 125 miles south of that city at El Duwém on the White Nile. Swarms of lady-birds in England are alluded to by E. C. Rye ("British Beetles," p. 228); the occurrence of immense swarms of lady-birds on mountains was referred to at a meeting of the Society by Prof. Poulton, quoting Prof. V. L. Kellogg (Proc. Ent. Soc. Lond., 1904, p. 23 *et seq.*). Kirby and Spence (7th Ed., p. 295) mention having personally witnessed *Coccinellae* alight upon a ship at sea.

Dr. G. B. LONGSTAFF also exhibited a *Scarabaeus* taken by him on the edge of the desert within half-a-mile of the Sphinx. It differed in several structural points from the common *S. sacer*, L., and has since been identified as *S. compressicornis*, Klug, an Arabian species.

CARVED EGYPTIAN SCARAB.—Professor E. B. POULTON, F.R.S., exhibited a scarab beautifully carved out of a hard limestone. The specimen had been obtained by Dr. G. B. Longstaff in Upper Egypt and presented to the Hope Department. Mr. F. Ll. Griffith, the Reader in Egyptology at Oxford, pronounced it to be a good example of the art of about the sixth century B.C.—it might possibly be as late as the third century B.C. Mr. W. Holland and Commander J. J. Walker had not found any beetle so likely to have been copied by the artist, as *Scarabaeus sacer*, L., and Mr. G. J. Arrow, who had examined the specimen, remarked, "The head seems to point to that species undoubtedly, and the striation of the elytra must have been added from the artist's observation of other groups, or from his notions of entomological propriety."

SPECIES OF TWO GENERA OF COCCINELLIDAE CAPTURED IN COITU.—Professor E. B. POULTON exhibited a specimen of *Adalia obliterata*, L., captured *in cop.* with *Halysia 18-guttata*, L., by Mr. Joseph Collins, of the Hope Department. The specimens were beaten out of a fir-tree at Tubney, Berkshire, on August 5th, 1908. They remained paired after being placed in the laurel bottle, and the specimens were seen to be still united.

DIPTERA FROM OXFORD AND THE NEW FOREST.—Professor E. B. POULTON exhibited the following Diptera, bred or captured by Mr. A. H. Hamm, of the Hope Department. The observations recorded below were from Mr. Hamm's notes.

(1) Ten specimens of *Eccoptomera microps*, Mg., bred from pupae found on February 6th, 1909, in a single mole's nest, on the Headington Wick Farm, near Oxford. They emerged at intervals, the first on March 15th, and the last on April 12th, 1909.

(2) Two specimens of *Miltogramma germari*, Mg., a species new to the British list. They were taken with *M. punctatum*, Mg., on a sandy path, near Shotover Hill, Oxford, on August 7th, 1907. The path is very much frequented by various species of Aculeate Hymenoptera, about the burrows of which they were captured. (*Vide* E. M. M., 1909, p. 105.)

(3) A specimen of *M. punctatum*, Mg., was one of several observed following the bee, *Colletes succincta*, L. The fly exhibited was captured as it was following a male of the bee along a sandy bank, near Lyndhurst, on August 2nd, 1907, both it and the bee being taken in a single sweep of the net. Mr. Hamm and his friend, Mr. G. Arnold, watched them frequently following the *Colletes*, but not so persistently, as in the case of *Chortophila unilineata*, Ztt., recorded in Proc. Ent. Soc. Lond., February 7th, 1906.

(4) A specimen of *Sphēcapatā conica*, Fln., was one of two which very persistently followed the Fossor, *Crabro scutellaris*, Sm., ♀. All three were netted together, but one of the flies escaped while endeavouring to box them. The observations were made and the specimens captured near Denny Bog, in the New Forest, August 14th, 1908.

A RARE CASTNIA BRED FROM AN ORCHID IN ENGLAND.—Professor POULTON exhibited an example of the rare Castniid moth, *Castnia therapon*, Kollar, captured on December 26th, 1908, flying in his orchid-house at Broadstone, Dorset, by Dr. A. R. Wallace. The empty pupa-case, also exhibited, was found among the roots of a *Stanhopea*, which had been more than a year in Dr. Wallace's possession. Its previous history was set forth in the following statement received by

him from Mr. Hall, of Buenos Ayres: "The *Stanhopea* I sent you had been in my conservatories for some years. It originally came from Santos, Brazil (Province of Saõ Paulo)." Dr. Wallace had written to Professor E. B. Poulton concerning this very interesting observation: "As Mr. Hall's conservatories are in the suburbs of Buenos Ayres, the *Castnia* is hardly likely to have inhabited that treeless region. Southwest of Santos there appears to be an almost uninhabited tract of hilly country between the Sierra and the sea, and therefore probably forest-clad and more likely to produce both the orchid and the moth. I should not wonder if the coast forests of Saõ Paulo were very rich and perhaps not much known, as every traveller wants to get into the 'interior,' and away from the coast. Of course, 'some years' may mean 'more than one,' and the plant having been gathered when dry and dormant the insect may have been delayed in emerging."

EURYTELA HIARBAS, DRURY (1782), A PROBABLE FORM OF *E. DRYOPE*, CRAMER (1775).—Professor POULTON said that he had received a letter from Mr. G. F. Leigh, F.E.S. of Durban, containing the following interesting observation: "I have to record that on two occasions within a week, viz. on the 3rd and 7th of April [1909], I saw *Eurytela dryope*, *in cop.* with *E. hiarbas*, and only once *in cop.* with its own form. I am going to breed from a ♀ of *E. hiarbas*, and perhaps I shall prove that it and *E. dryope* are forms of the same species, as indeed I quite expect them to be."

Professor POULTON said he had asked Mr. Marshall his opinion as to the specific identity of these two forms and had received the following reply: "I have long had suspicions as to these two forms; for not only did Bowker take them paired long ago, but he also caught what appears to be an intermediate form, described by Trimen, and named *hiarbas* var. *flavescens* by Aurivillius. On the other hand, if they are species it is rather singular that their ranges are not coincident. For instance, *hiarbas* is common in the forest regions of Eastern Cape Colony and even ranges as far west as Knysna, while *dryope* is not yet known from south of Natal. Again a form of *dryope* occurs in Madagascar, but no *hiarbas*, and so forth. Then *hiarbas* varies geographically in the width of the

h.w. band, but there does not seem to be a corresponding variation in *dryope*, as one might expect. They both vary in the angulation of the f.w., but the range of the forms is not quite coincident, for apparently in Angola and the Congo region the southern form of *dryope* occurs in conjunction with the western form of *hiarbas*. These are not insuperable difficulties in the way of considering the two forms as conspecific, but they emphasise the necessity for proof by breeding before any such view can be properly accepted. I sincerely hope that Leigh will be able to carry out the experiment he suggests."

A little later Mr. Marshall again wrote on the same subject: "I was looking at the *Eurytelae* in the British Museum the day before I left, and I was interested to notice that the southern form of *dryope* differs notably from *hiarbas* in the disposition of the markings below the cell on under-side of f.w. But in one of the western forms (*alinda*, I think it is,) these markings are identical with those of the western *hiarbas*, and the h.w. band is also very similar in width and position; so that this possibly represents the more primitive form of *dryope*."

HEREDITY IN THE FEMALE FORMS OF *HYPOLIMNAS MISIPPUS*.  
 —Professor POULTON showed a series of forty-nine females and seven males (being all that had been kept of this sex) of *Hypolimnas misippus*, bred by Rev. K. St. Aubyn Rogers, M.A., F.E.S., from a female captured October 31st, 1908, at Rabai, near Mombasa, British East Africa, where the *inaria* form of female is no commoner than the type form. The female parent was intermediate between the type and the *inaria* form, but on the whole nearer the former: it bore a very faint white patch on each hind-wing, thus slightly tending towards the var. *alcippoides*. It was a very remarkable fact that the whole of the female offspring were *inaria*,—not a single type form, not a single intermediate. On the other hand, twenty-one specimens possessed to a variable extent, and on the whole very slightly, the *alcippoides* characteristic of a white patch on the hind-wing. The dates of emergence of the females (including a crippled *inaria* emerging Nov. 27th and not retained) and the whole of the males were as follows, the letter *a* indicating *alcippoides*:—

1908.	Females.	Males.
Nov. 27	8 (3a.)	21
„ 28	28 (12a.)	18
„ 29	9 (4a.)	1
„ 30	5 (2a.)	—
Totals	50	40

Professor POULTON said that this remarkable experiment perhaps tended to support Col. Manders' suggestion that the species could be influenced in the direction of the *inaria* form by dry conditions; but large experiments specially designed to test this hypothesis were required before it could be accepted. The distribution of the *inaria* form in Africa did not seem to point in this direction. We did not yet know the conditions of moisture or dryness under which these larvae and pupae had been kept by Mr. Rogers. Whatever the interpretation,\* the results were extremely interesting, and contrasted in a remarkable manner with those obtained by Mr. G. F. Leigh, F.E.S. (Trans. Ent. Soc. Lond., 1904, pp. 689, 690, Plate XXXII). The relative number of the females and the slightly earlier average emergence of the males were interesting points shown in the above table.

MÜLLERIAN MIMICRY IN EUPLOEINAE.—Professor POULTON exhibited sets of Euploeine butterflies from Southern India, the Solomon Islands, New Guinea, and Fiji, showing that the pattern, which differed at each of these localities, was followed by various local species. Two different patterns were shown from New Guinea and two from the Solomons. The exhibition was intended to meet the criticisms contained in a letter by Lt.-Col. Manders, read at a recent meeting and now published in the "Entomologist's Record" for May (pp. 120, 121). The writer of this letter implied that the resemblances figured by

\* Mr. L. Doncaster, F.E.S., who examined the series at the conclusion of the meeting, suggested that the results may be due to the Mendelian dominance of the *inaria* over the type form of female, the tendency to *inaria* having been carried by the male parent. It would be of the highest interest to test this suggestion by breeding from the first filial generation (F. 1).—E. B. P., June 20th, 1909.

Mr. J. C. Moulton on Plate XXXIV of the 1908 Transactions were precisely parallel to those of the commoner British species of *Pierinae*. The specimens exhibited, to which many others might have been added, proved that the argument was unsound. The patterns of *Pierinae* did not exhibit anything like the same local peculiarities and local resemblances as those of the *Euploeinae*. Col. Manders had also implied that the Müllerian interpretation of the resemblances between Euploeas was a recent innovation, whereas it had been suggested by Prof. Meldola, F.R.S., in 1882 ("Ann. Mag. Nat. Hist.," 5th Ser., Vol. X, 1882, p. 417), and set forth in detail by the late Frederick Moore in the following year ("Proc. Zool. Soc., Lond.," 1883, p. 201). There was evidence that Euploeas were distasteful, and resemblances independent of affinity between distasteful species had been reasonably interpreted by the Müllerian hypothesis. The interpretation in this case, although offered nearly thirty years ago, had not, so far as the speaker was aware, been called in question before. In the absence of Mr. Moulton in Borneo, Professor Poulton wished to say these few words in defence of his communication published in the Transactions of last year (p. 585).

As bearing on the same subject, Professor Poulton showed a male example of the Euploeine butterfly, *Tronga crameri*, Lucas, sent to him by Mr. J. C. Moulton, F.E.S., together with a large Lycosid spider which was said to have captured it. The specimens had been brought to Mr. Moulton by one of his collectors who stated that he saw the butterfly in the grasp of the spider. They were found (April 21st, 1909) on a post near Kuching, Sarawak. The observation threw light on the enemies of specially defended groups of insects.

SMALL MOTHS CAPTURED AT SEA PROBABLY 190 MILES FROM THE LAND THEY HAD LEFT.—Professor POULTON exhibited moths observed at sea and sent to him by Mr. F. Muir, F.E.S., and Mr. J. C. Kershaw, F.E.S. Mr. Muir in a letter written on his way from Hongkong to Ceram, and dated December 24th, 1908, gave the following account of the observation :—

" I enclose some small moths taken at sea on November 29th, 1908, about 107°20 E. and 6° N., that is, about 190 miles S.S.E. of the Lower Cochin China coast, and about 120 miles

N.N.W. of Great Natunas. The wind was fresh and blowing from off the Cochin China coast: about 10 a.m. we noticed many small moths settled over the deck and all in *perfect* condition, as if just hatched. At first we suspected that they were bred in the ship, but soon discovered that they were coming on board in numbers. For about five hours we noticed these moths in great numbers travelling from about N.N.W. to S.S.E. They had the power of resting on the surface of the sea—even in the broken water around the bows of the boat—and then rising and continuing their journey. There were several other species in small numbers, and among them the delicate little plume moth which I send. I think these moths must have come from off the Lower Cochin China coast, and, if no bad weather turned up, would reach the various islands, or even Borneo, in fair numbers.

“What surprised us most was the beautiful condition so many of them (or, to be more exact, nearly all) were in, showing that their long journey had had no ill effects upon them.”

Professor Poulton said that the species, of which a list is given below, had been kindly named for him by Sir George Hampson, and the “Plume” by Paymaster T. Bainbrigge Fletcher.

<i>Schoenobius bipunctifera</i> , Walk.,	7	specimens.
„ <i>incertulas</i> , Walk.,	7	„
<i>Glyphodes celsalis</i> , Walk.,	1	„
<i>Alucita niveodactyla</i> , Pag.,	1	„

The specimens had unfortunately been attacked by “pests,” so that the majority were in bad condition. The small and delicate white “Plume” had escaped this injury and was beautifully preserved.

The species named above possessed the following distribution as shown by the series in the British Museum.

*S. bipunctifera* :—India, Ceylon, Assam, Burma, China (including places so distant as Omei-shan and Chusan Islands), Formosa, Singapore, Java, Sumatra, Borneo.

*S. incertulas* :—India, Ceylon, Burma, Singapore, Borneo, Java, Cassini Island (N.W. Australia).

*Glyphodes celsalis* :—India, Ceylon, Assam, Burma, China

(Central and Western), Japan, Singapore, Borneo, New Guinea, Trobriand Islands.

Mr. T. Bainbrigge Fletcher had informed the speaker that the *Alucita* extended from India to the Philippines and the Solomon Islands, but had as yet been but little observed in the Malay Archipelago.

The wide area over which these species were at present known to range and the absence of any marked local variation might with probability be explained by the power of distribution in the manner detected by Mr. Muir and Mr. Kershaw.

NOTES ON THE LIFE-HISTORY OF AULACODES SIMPLICIALIS, SNELL.—Professor POULTON exhibited specimens and drawings of *Aulacodes simplicialis*, Snell., one of the *Hydrocampinae*, also sent to him by Mr. Muir and Mr. Kershaw. Mr. Muir's letter of Dec. 24th, 1908, already referred to, contained the following reference to his and Mr. Kershaw's observations:

“Before leaving Macao we found a little moth living in the streams, and also a parasite that attacks it. I enclose you some sketches (made by Kershaw) of it, along with some notes, and specimens of imago, larva, pupa and cocoon. If the life of this species be unknown the observations may be of interest, and you can use the notes as you wish.”

Accompanying the letter was the following interesting record of the observations conducted by these two naturalists:—

“One of the last entomological excursions we made before we left China was to Lappa, a mountainous island on the western side of the harbour of Macao. Many streams arise among these granite mountains and rush down the steep gullies in a series of small waterfalls. In several spots where the water was most rapid we found the larva of a species of *Hydrocampinae* living on the surface of the rocks, sometimes under eighteen to twenty-four inches of swiftly flowing water, at other times under a few inches, or where the rocks were continuously covered with a shower of spray.

“The larva appeared to be very similar to De Geer's figure of *Paraponyx stratiotata*, L., the second and following ten body segments bearing a protuberance on each side, from which forty to fifty thread-like gills arise (Fig. 1). The pupa is



slightly more thick-set in the thorax than *P. stratiotata* and its proboscis and legs project some way beyond the end of the abdomen. The second, third and fourth abdominal segments bear raised spiracles.

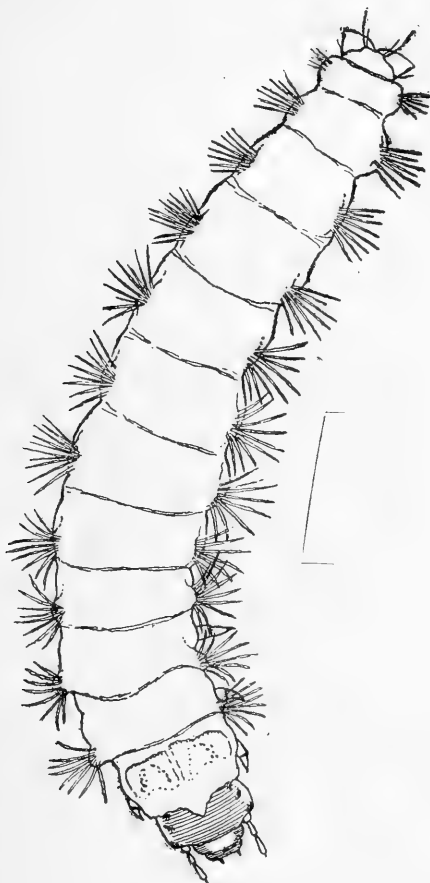


FIG. 1.  
Dorsal view of larva.

“The larva constructs flat, silken tunnels over the surface of the rocks and fastens little pieces of green alga, upon which it feeds, into the structure. The alga grows and gives the tunnels a cryptic appearance. When full-grown the larva

constructs a complex cocoon. A stout silken dome is constructed, with a series of holes near the anterior and posterior edges (*b* in Figs. 2, 3, and 4). This is fastened down to the rock by its posterior and lateral edges, and by the pillars of a series of arches that join the lateral affixed edges, slightly posterior

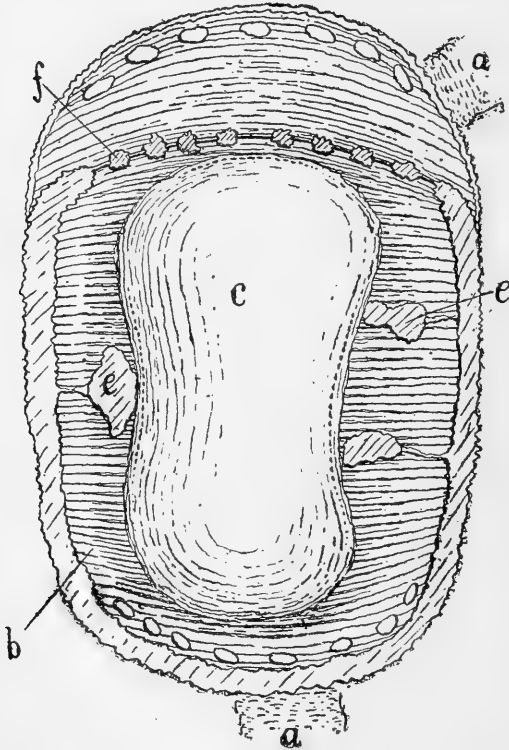


FIG. 2.

Ventral view of Cocoon.

*a.* Larval tunnels.      *b.* Dome.      *c.* Outer cover.  
*e.* Pillars of dome.      Pillars of arches.

to the front margin (*f* in Figs. 2 and 3). Two, three or four stout pillars also act as strengtheners to hold the dome (*e* in Figs. 2 and 4). Under this dome is a second cover, formed of finer silk and composed of an upper and lower sheet, with their edges fastened together all round (*c* in Figs. 2, 3 and 4). Within

this is a third cover closely attached, and similar to the second but of still finer texture (Fig. 4, *d*), in which the pupa lies. The water enters under the anterior margin, which is sometimes fastened down at one or two points, and through the anterior holes, and passes out through the posterior holes, the pupa is thus kept dry but well supplied with air. The cocoon

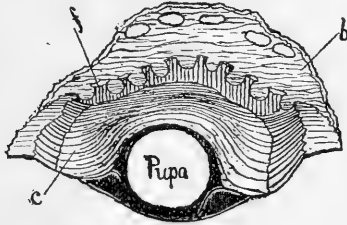


FIG. 3.

Transverse section, showing ventral view of anterior end.

*b.* Dome. *c.* Outer cover. *f.* Pillars of arches.

varies in size and shape according to the position in which it is built.

“We took several pupae home and constructed a suitable breeding-cage, in which we hatched out the moth, and also a large Ichneumonid. We had noticed the cocoon and emergence

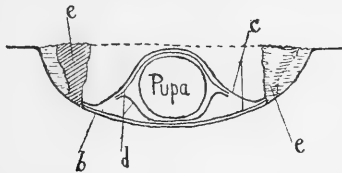


FIG. 4.

Diagrammatic section through centre of cocoon.

*b.* Dome. *c.* Outer cover. *d.* Inner cover. *e.* Pillars.

holes of this parasite at the time when we were collecting the material.

“Copulation took place at night: the male flutters over the female for a few seconds and then they unite very quickly. Two nights later eggs were laid. The eggs are numerous and deposited in rather irregular and straggling batches, but mostly in contact with and adhering to one another. They are obtusely

oval, smooth, shiny, and of a rather pale orange colour. They were laid on the sides of the breeding-jar just above the water, and on wet blotting-paper, but the female never entered the water for the purpose of ovipositing, although there were water-plants and algae in the cage. The eggs laid on dry surfaces soon collapsed and dried up, while those on wet surfaces kept in good condition for so long as suitable conditions could be maintained. Unfortunately such conditions could not be maintained on board ship, and all the ova died before we reached Java.

“The adult moth readily takes to the water when frightened, diving below the surface, and using its legs for swimming. The wings are appressed to the body, and the whole insect more or less covered with air-bubbles. They are capable of remaining thirty minutes or more below the surface, clinging to plants and submerged weeds. It is possible that in suitable situations the females enter the water to oviposit, but this would be impossible where the stream runs swiftest, and in such places it is possible that they lay their eggs on the wet rocks along the edge of the water. We were not fortunate enough to observe the method of oviposition of the parasite.”

THE USE OF THE SAW BY A SAWFLY DURING OVIPOSITION.—Professor POULTON said that he had noticed the discussion at a previous meeting upon the “saw” of the female Sawfly, and observed that there was but little direct evidence of its use. He therefore thought it might be of interest to record that about the year 1886 he had watched the female of *Croesus septentrionalis*, L., ovipositing on the under surface of a birch leaf, in his garden at Oxford. Some of the ova then laid were exhibited to the meeting, preserved in spirit. The speaker had been much struck with the deliberate movements of the insect and the facility with which she could be approached and examined with a lens without any interference with her work. He distinctly remembered the saw being moved backwards and forwards as in the ordinary act of sawing, but could not be sure whether the work was done in the pull (as in certain pruning saws) or the push (as in most saws). The effect was to cut a slit in the leaf tissue beside and obliquely to the axis of the midrib or some chief vein. The saw was

then withdrawn and a sausage-shaped egg laid in the slit: another slit was cut parallel with and immediately below the last, and another egg laid. The operation was repeated until a long row of obliquely-placed eggs lay like a seam beside the midrib or vein. He had watched the rapid swelling of the eggs thus laid, probably by absorption from the leaf tissues, and had preserved examples at various stages up to the point at which the larvae hatched. These were exhibited to the meeting.

WIDE-RANGING LEPIDOPTERA.—Mr. T. BAINBRIGGE FLETCHER exhibited examples of Lepidoptera common to the African, Indian and Australian Regions (some of them occurring in America also), and remarked that, in working out the Lepidoptera of the "Sealark" Expedition collected by him in 1905 amongst the Islands of the Indian Ocean, he had been much struck with the large proportion—some 30 per cent. of all the species collected—which were common to these three regions. The usual remark, he said, would be that these were all common and widely-distributed species, but this observation though correct enough in itself entirely failed to give any reason for their wide distribution. Many of these Lepidoptera are extremely variable, and it appeared to him incredible that they should retain their specific facies throughout the vast area of their distribution in the absence of some fairly constant syngamic connection. The existence of what has been called a "syngamic chain" had been postulated in the case of certain strong-flying species such as *Pyrameis cardui* and some such connection seemed a necessary assumption; at the same time this "syngamic chain" theory threw little light on the natural means of dispersion which, especially in the case of small and weak-winged insects such as *Pyralidae* and *Pterophoridae*, would appear to be much more efficient and regular than was usually supposed to be the case. He put forward the suggestion that this means of dispersal was to be found in the action of cyclonic storms in conjunction with the movements of the upper strata of the atmosphere.

BLACK ANTS AND THEIR MIMICS.—Mr. FLETCHER also brought for exhibition (*a*) examples of four species of black ants: a Cicindelid beetle, *Derocrania concinna*; an Attid spider; and two species of Rhynchota, all of which have under

natural conditions a strikingly ant-like appearance. *D. concinna* is found at Hambantota, Ceylon, on the trunks and branches of the Mustard Tree, *Salvadora persica*, and other trees; it is decidedly conspicuous and its quick jerky motions and general appearance combine to make it look like a large black ant. In the Madulsima District the closely-allied *D. scitiscabra* is common, conspicuous and ant-like, and is usually seen on bare slopes of earth such as the sides of termitaria. The Attid spider (from Galle, Ceylon) may possibly mimic *Lobopelta*, a genus of ants armed with a powerful sting.

MASS OF BUGS RESEMBLING A FLOWER.—He also exhibited (b) specimens of *Dysdercus cingulatus*, taken at Yala, S.E. Ceylon, on 9th February, 1909. This bug is usually abundant and conspicuous, and Mr. Fletcher had often seen it at Galle clustered gregariously in large masses of individuals on walls and tree-trunks, especially on trunks on the "Suriya" tree, *Thespesia populnea*; it is extremely nauseous, being rejected even by lizards and toads. On this particular occasion, a mass of these bugs, in all stages of development, was clustered around the otherwise bare tip of an upright twig, none occurring separately below the main body, in such a way that the general effect of this mass of red bugs was to resemble at a short distance a scarlet flower growing from the twig; and (c) a homoeochromatic assemblage composed of an ant, a wasp and a bug (*Camponotus holosericeus*, *Pompilus arrogans*, and *Dieuches femoralis*), all found together at the same time at Hambantota. All three of these insects run along the ground in the barer sandy patches amongst the bushes in the same jerky sort of way and all are coloured much alike—sufficiently so to have in life quite a noticeable resemblance.

BEETLE CARRIER OF WINGED DIPTERA.—Exhibiting an example of *Scarabaeus gangeticus* Mr. FLETCHER said that it was one of several captured at Yala, S.E. Ceylon, on February 9th, 1909, when they were wheeling about swiftly but heavily in the bright sunshine. All these beetles were found to be carrying small winged Diptera (*Borboridae*) which were running actively about over the ventral surface of the thorax and abdomen of the beetle and which seemed very loth to use their wings even when the beetle had been caught and was

being handled. Of four beetles caught, one was carrying twelve of these flies, another three, and the other two three between them; but it is very probable that in the last three cases some of the flies had been brushed off in netting the beetle or during its struggles in the net.

It seems probable that these flies fill the *rôle* rather of passengers than of parasites in the strict sense of the word, clinging to the beetle as an easy means of transport to, and discovery of, their pabulum, which is probably in this case the dung of wild buffaloes.

*Papers.*

“On some new and little-known Neotropical *Lycaenidae*,”  
by HAMILTON H. DRUCE, F.L.S.

“A Description of the Superior Wing of the Hymenoptera,  
with a view to give a simple and more certain Nomenclature  
to the Alary System of Jurine,” by CLAUDE MORLEY, F.Z.S.

“On the Colonisation of new nests of ants by Myrme-  
ophilous Coleoptera,” by H. ST. J. DONISTHORPE, F.Z.S.

“New Genera of British *Mymaridae* (Haliday),” by FRED.  
ENOCK, F.L.S.

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**Wednesday, October 6th, 1909.**

Dr. F. A. DIXEY, M.A., M.D., President, in the Chair.

*Cambridge Darwin Centenary.*

THE PRESIDENT, giving an account of the proceedings at the Cambridge University Darwin Centenary Celebration, mentioned that the Address of the Entomological Society had been received with special applause.

*Election of Fellows.*

Mr. HUGH SCOTT, B.A., Trinity College, and the Museum of Zoology, Cambridge, and Mr. CARLTON C. GOUDEY, B.Sc., Uganda, British East Africa, were elected Fellows of the Society.

*Obituary.*

The decease was announced of Mr. H. G. PALLISER, and of Mr. H. W. BARKER, Fellows of the Society.

*Exhibitions.*

NEW NOCTUID.—Sir GEORGE HAMPSON brought for exhibition the unique example of a Noctuid moth new to science captured in the neighbourhood of Aberdeen by Mr. L. G. Esson, and presented to the National Collection by the Hon. N. C. Rothschild. It would be necessary, he said, to constitute a new genus for it, as it presented characters not known to exist in allied species.

BUTTERFLIES FROM DAUPHINÉ.—Mr. A. H. JONES exhibited examples of *Melitaea deione*, from la Grave, and aberrant forms of *M. didyma* from Digne, taken in July last. This is the first record of the former species occurring so far north in the French Alps, and it was noteworthy that the specimens showed a nearer affinity to the meridional form than to the var. *berisalensis* of the Rhone Valley in Switzerland. The *M. didyma* included one very fine aberration taken at Digne, Basses-Alpes, on July 16th, in which the black spots on the central area of the fore-wing were confluent, forming a broad black band; the outer margin broadly black, and this continued to the hind-wing.

RARE BRITISH BEETLES.—Professor T. HUDSON BEARE exhibited specimens of *Trechus rivularis*, Gyll., taken at Wicken Fen on 15th September, 1909. This insect is very local and rare; the only specimens which have been taken for many years were two, captured by the late Mr. Chitty, also at Wicken Fen. Also specimens of *Pseudopsis sulcata*, Newm., taken at Sandown, Isle of Wight, in haystack refuse, in August last. This genus and species were originally described by Newman on specimens taken in the Isle of Wight. The species has never been taken in the island since that date until the present capture.

RARE BEETLES, DIPTERON AND BRACONIDÆ.—Mr. H. St. J. DONISTHORPE showed examples of the following—(a) *Tychius polylineatus*, Germ., taken at Ditchling by Mr. Dollman and



himself, on September 9th. (b) *Trechus rivularis*, Gyll., specimens taken September 15th and 16th, 1909, at Wicken Fen; also (c) the Dipteron *Meigenia floralis*, Fall. (with its host *Phytodecta pallida*), bred from larvae taken at Chilworth in July last, with the pupa-case in larva-skin of the beetle; and the following Braconidae—(d) *Euphorus bistigmaticus*, Morley, n. sp., ♂ type bred from *Formica rufa* nest from Weybridge, 15th June, 1909, ♀ ♀ taken hovering over ants on *F. rufa* nests at Weybridge, July 7th, and Beaulieu Forest, July 21st, all of this year. (e) *Spilomma falconivibrans*, Morley, n. g. et sp., ♂ and ♀ bred from *F. fusca* nest from Porlock, July 29th, 1907; and *Pachylomma buccata* ♀ taken at St. Helens, Isle of Wight, hovering over a nest of the ant *Lasius niger*.

ASCALAPHUS COCCAJUS FROM GENEVA.—Mr. W. J. LUCAS showed a male and a female example of *Ascalaphus coccajus*, and a pair of the same insect near the var. *leucocilius* with the golden yellow markings replaced by white. They were taken by the Rev. F. D. Morice, with other specimens, in June of this year at Geneva.

NORTH AMERICAN CHRYSOPHANIDS.—Mr. G. BETHUNE-BAKER showed a series of *Chrysophanus dorcas*, which occurs in North America from Labrador, and Alaska down to Michigan in marshy localities, and pointed out the peculiar characteristic of the egg, which was more Thecloid than Chrysophanid. He also exhibited a finely radiated example of *Chrysophanus hypophlaeas*; also a North American species.

BREEDING EXPERIMENT WITH CHARAXES.—Mr. G. F. LEIGH exhibited the ♀ parent and 21 specimens of the offspring of *Charaxes zoolina neanthes*. This result was obtained from ova deposited by the *zoolina* form of the ♀, and produced 4 ♂♂ and 2 ♀♀s like the parent, and 15 ♂♂s and 9 ♀♀s of the *neanthes* form. Last year the same result was obtained in a smaller degree, but the eggs on that occasion were obtained from the *neanthes* form of the ♀. All the specimens exhibited, the breeding of which was undertaken at the special request of Professor E. B. Poulton, will be placed with those shown last year in the Hope Department, University Museum, Oxford. The proving by breeding from ova that

these two forms are one species has cleared up two or three other similar cases of Butterflies occurring in other parts of the world, that have forms of totally different colour, but are structurally the same. With regard to the examples exhibited Mr. Leigh said that although the *zoolina* form are consistent in both the wet and dry season, there are two quite distinct forms of the *neanthes* variety.

*Papers.*

Mr. H. ELTRINGHAM, M.A., F.Z.S., read a paper on "Edibility Experiments with Larvae and Lizards."

Mr. F. ENOCK, F.L.S., read a paper on "New British *Mymaridae*," and illustrated his remarks with a number of lantern slides of both sexes of the species discovered and described by him.

The following papers were also read:—

"On the Characters and Relationships of the less-known groups of Lamellicorn Coleoptera, with Descriptions of new species of *Hybosorinae*, etc.," by Gilbert J. Arrow.

"A list of Chrysidids taken by the writer in two visits to Jaffa, Jerusalem and Jericho, with descriptions of new species," by the Rev. F. D. Morice, M.A.

"A Revision of the African Species of the genus *Lycaenesthes*," by G. Bethune-Baker, F.L.S.

Mr. G. C. DUDGEON communicated the following notes on (a) *Teratoneura isabellae*, n. sp.; (b) *Stugeta marmorea*, Butl.; (c) *Argyrocheila undifera*, Staudg.; (d) *Lycaenesthes*, sp.; (e) *Mycalesis abnormis*, n. sp.; (f) *Acraea pseudopaea*, n. sp., *Planema epaea*, Cram.; and (g) *Acraea vesperalis*, Grose-Smith, and sent for exhibition examples to illustrate his remarks.

"Family LYCAENIDAE.—The specimen exhibited (a), belongs to the sub-family *Lipteninae*, but cannot be assigned to any described African genus. It seems to have affinities with *Aslaruga* and *Epitola*, but differs from both in the shape of the wings and the distortion of veins 2 and 3 of the fore-wing. That wing possesses the full complement of veins, 7, 8 and 9 being on a stalk arising from the end of the cell, which latter is closed by nearly straight discocellular veins; 6 free from near the origin of the stalk of 7, 8 and 9; 5 given off from

slightly above the centre of the discocellulars; 4 arising from the lower angle of the cell and 2 and 3 from points well before the angle and conspicuously bent downwards, the last reaching the margin close to the outer angle. In outline the fore-wing shows the outer margin nearly rectangular with the costa, from the apex to vein 4, after which it is concave as far as vein 2, and then becomes gradually confluent with the inner margin. In the hind-wing, vein 8 is curved near the base; 6 and 7 and 3 and 4 arise from the angles of the cell, and 5 springs from the centre of the discocellulars, which are slightly angled outwards. The whole wing is sub-quadrate, and the costa is concave beyond the middle; the outer margin being slightly angled at veins 7 and 4. The palpi have the second joint somewhat swollen and the third thin. The legs are thickened and clothed in granulated scales, the hind pair having the tibiae and tarsi flattened. The antennae are nearly half the length of the costa, gradually thickened, reddish-brown with pale tips. I propose the name of *Teratoneura* for the genus and attach the description of the species."

(a) *Teratoneura isabellae*, n. sp.

♂. Fore-wing dark brown, with a large orange-red patch extending from near the base of the inner margin to about 2 mm. from the outer margin; occupying the basal portions of interspaces 3 and 4 and two-thirds of 2, expanding to the inner margin; two quadrate orange spots present in interspaces 4 and 5, beyond the line of the outer edge of the large orange patch. Hind-wing bright orange-red with an even dark brown marginal band, 2 mm. in width. Under-side with the orange markings of the fore-wing upper-side replaced by yellowish similar ones; the ground colour of the remainder of the wing variegated with greyish and brown, with a few reddish scales on the costa before the apex and on the margin in interspace 2, where there are indistinct sub-marginal yellowish patches. The hind-wing is variegated with dark brown and silvery grey; a leaden fascia extends from the apex to the middle of the inner margin, where it is bifurcated; a silvery, sub-basal, broad comma-like mark present on the costa, and an indistinct orange marginal mark on the tornus.

*Exp.* ♂ 42 mm.

*Hab.* Bullom, Sierra Leone. The only specimen, which is exhibited, was taken by me settled upon a dry twig (in the manner adopted by the insects of the sub-family) in January 1908.

(b) *Stugeta marmorea*, Butl. ♀.

This specimen is shown, as the species has only previously been recorded from East Africa. The example was taken in the dry country in the Northern Territories of the Gold Coast. Specimens were also seen at Lemu, near Bida, and on the Kano-Rogo road in Northern Nigeria. February to May 1908–1909.

(c) *Argyrocheila undifera*, Staudg. ♂.

A single specimen captured in dense forest in the Ashanti-Akim country, south-east of Bompata.

(d) *Lycaenesthes*, sp. ♀.

A curious feature in this specimen is the large pale brownish terminal abdominal tuft. This peculiarity appears to be slightly developed in the female of *L. voltae*, Sharpe, also.

Family SATYRIDAE.—The insect marked (e) differs from all other insects of the genus *Mycalesis*, which have been recorded from Africa, in the elongate form of the hind-wing and the uniform dark velvety colour of the under-side of both wings, which are unmarked interior to the row of minute ocelli.

(e) *Mycalesis abnormis*, n. sp.

♂. Both wings above purplish brown. Fore-wing with the cell inconspicuously clothed with brown hair; a distinct pale bar from the outer margin above vein 3 nearly reaching the costa at  $\frac{5}{8}$  from the base and not extending over the extreme apex, bearing a black spot on it in interspace 5; costa and cilia narrowly pale. Hind-wing produced and elongated posteriorly; costa much arched and pale as far as the middle of interspace 6; a long pencil of light brown hair along the upper part of the cell covering a small, oval, black, granulated spot situated on and below vein 7; cilia pale. Under-side of both wings blackish brown with a marginal pale line and the pale sub-apical bar of the fore-wing extending to the apex, showing a waved sub-marginal, darker line. The fore-wing has

minute white-pupilled ocelli in interspaces 2 and 5, and similar ones in interspaces 1c (two), 2, 5 and 6 of the hind-wing.

*Exp.* ♂ 48 mm.

*Hab.* Gold Coast, Ashanti (Bompata). Only two males taken in February in dense forest. The type is shown here and the co-type is in the British Museum.

Family NYMPHALIDAE, Sub-Family ACRAEINAE.—(*f*) is an insect belonging to the section of the genus *Acraea* having elongated V-shaped marks between the veins on the outer area of the hind-wing. In the present species these are disposed as in *A. oberthuri*, Butl., but are more elongated and narrower at the margin. The species seems allied to *A. althoffi*, Dewitz, but differs from the specimen in the British Museum in the basal area of both wings being dark. In general appearance and position of markings it so nearly resembles *Planema epaea*, Cram., that I have called it *A. pseudepaea*.

(*f*) *Acraea pseudepaea*, n. sp.

♂. Fore-wing blackish brown with indistinct black spots in, below and near the end of the cell; a large orange patch from the middle of the inner margin to the base of vein 3, defined by black patches inwardly in the interspaces 1b and 2, somewhat excised in both places; an orange sub-apical bar formed of quadrate spots in interspaces 4, 5 and 6, the lower part of the first named produced outwardly and with a postmedial quadrate orange spot attached below the extended part in interspace 3; the median veins powdered with reddish scales. Hind-wing with the basal and sub-basal areas dark brown with black spots in and below the cell; the disc bright orange with the outer margin of it produced into attenuated streaks on each side of the veins, which are broadly defined with black, producing black V-shaped markings between the veins; the outer area blackish. Under-side of the fore-wing with the orange markings of the upper-side reproduced, the sub-apical bar pale; the inner two-thirds of the cell suffused with orange; a round black spot in the cell, two irregularly shaped black spots in interspace 1b and one in the basal part of interspace 2; a large black patch extending over and beyond the end of the cell into the basal part of interspace 3; the outer

area and apical portion beyond the sub-apical bar suffused with dull ochreous scales, with the veins dark and a sub-marginal series of attenuated pale streaks between them. Hind-wing with the sub-basal area deep ochre with thirteen black, irregularly shaped spots; the light area of the wing forming a pale ochreous ante-medial band, the outer half suffused with dark brown scales with the veins black, with elongated V-shaped streaks between them, each V enclosing a light grey triangular patch on the margin. Body as in the male of *P. epaea*, Cram., a specimen of which is exhibited for comparison.

*Exp.* ♂ 70 mm.

*Hab.* Ila (Southern Nigeria). Only one example procured.

(g) *Acraea vesperalis*, Smith. This insect is one of eight examples which I captured within a radius of fifty yards of a small patch of forest near Mano in the Ronietta district of Sierra Leone. The eight specimens were taken in the same locality in the month of January in four successive years. All differ only from the figure of *A. vesperalis* in Smith and Kirby, Rhop. Exot. 19, *Acraea*, p. 7, pl. 3, figs. 1 and 2 (1892), in the lighter ground colour of the hind-wing, which is very pale lemon yellow. The species had been previously recorded from East Africa and the Congo.

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### Wednesday, October 20th, 1909.

Dr. F. A. DIXEY, M.A., M.D., President, in the Chair.

#### *Election of a Fellow.*

MR. ALFRED NEWSTEAD, of the Grosvenor Museum, Chester, was elected a Fellow of the Society.

#### *Elections to the Council.*

The SECRETARY announced that Mr. G. T. BETHUNE-BAKER, F.L.S., and Dr. MALCOLM BURR, D.Sc., F.L.S., etc., had been elected members of the Council in the place of Mr. G. A. K.

MARSHALL, F.Z.S., and Mr. R. SHELFORD, M.A., F.L.S., resigned.

*Exhibitions.*

HUNGARIAN BUTTERFLIES.—Mr. W. G. SHELDON exhibited series of the following butterflies collected by him at Budapest and Herculesbad during the past summer:—*Chrysophanus dispar*, var. *rutilus*, *C. alciphron*, *C. thersamon*; *Plebeius argyrognomon*, *Polyommatus orion*, gen. vern. *ornata*, Stgr.; *Melitaea trivialis*; *Brenthis hecate*; and *Pyrgus orbifer*.

BUTTERFLIES FROM CENTRAL ITALY.—The Rev. G. WHEELER exhibited three small cases of butterflies from Central Italy, containing specimens of *Melitaea parthenie* and *M. phoebe*, small and with somewhat light ground-colour; *Hirsutina dolus*, *Polyommatus meleager*, with blue ♀; *P. escheri*, one ♀ being much suffused with blue; *P. icarus*, ab. *celina*, the ground-colour being of deep “royal” blue; *Aricia astrarche* of extreme *calida* form; specimens of two broods of *Plebeius argus* (*aegon*) and the intervening brood of *P. argyrognomon* (*argus*); a ♀ *Coenonympha pamphilus* with a row of black spots on the upper-side hind-wing; four *Melanargia galatea*, one being ab. *leucomelas* two with obsolescent markings on the under-side, ♂ and ♀, and the fourth unevenly marked, one side being almost entirely, and the other only very partially suffused with black; and lastly five specimens of *Agriades* hybr. *polonus*, Zeller, supposed to be hybrids between *A. corydon* and *A. thetis* (*bellargus*), three of which were taken amongst the latter species and two among the former, when *A. thetis* was quite over.

Mr. J. W. TUTT stated that he had recently been engaged in unravelling the history of *Agriades* hybr. *polonus*, Zell., as a Palearctic insect. He noted that he had exhibited the only British example yet known, at the meeting of the Ent. Soc. London, held on April 11th, 1894, observing that he had himself found it at Cuxton, Kent, where it flew in company with *A. thetis*, and that it is undoubtedly a hybrid between that species and *A. corydon*, the genitalia being similar and the food plants identical. He further noted that a specimen had been exhibited by Mr. Dadd at the meeting held on October 21st, 1908. Zeller's original Posen example, now in

the Brit. Mus. Coll., was described in Stett. Ent. Ztg., 1845, p. 351. Another in the Brit. Mus. Coll. is labelled "Shar Deresy, Leech Coll.;" others had been noted by Dr. Keynes from the Pyrenees (Ent. Rec., xx., p. 178) as *Agriades coridon* var. *corydonius*, and Mr. Tutt said that he had little doubt that the *A. coridon* var. *calydonius*, Lowe, was also *A. hybr-polonus*, Zell. Staudinger's treatment of the insect in his Cat., 2nd ed., p. 12, and Cat., 3rd ed., p. 86, had hopelessly muddled the matter, and, in combining it with the blue forms of *A. coridon* taken in Asia Minor and Aragon, and treating it as a variety of *A. thetis* (*bellargus*), had altogether lost touch of the real value of this remarkable form. The speaker stated that the full history of this insect has been recently published in Vol. iii of "A Natural History of British Butterflies," pp. 323-325.

Dr. T. A. CHAPMAN, Mr. TUTT, and Mr. WHEELER discussed the number of broods of *A. coridon* in South Europe, the opinion of Mr. WHEELER being that it was double, or even sometimes triple brooded.

Mr. TUTT, however, largely dissented from this view. There was no real evidence, he said, that the species was anywhere double-brooded in the Palaearctic area, except along the Mediterranean littoral, from Hyères to Genoa, and possibly at Nîmes, whilst its supposed double-broodedness in Italy was at present largely problematical. Indeed, the general single-broodedness of this species, and the double-broodedness of *A. thetis*, together with the difference in the hibernating stage, were in his opinion two of the most important biological elements in the differentiation of these closely-allied species. He was anxious to obtain definite and reliable information on the point of the double-broodedness of *A. coridon*, especially in Spain and Asia Minor, but he was unable to accept as satisfactory evidence, mere opinion based on the fact that *A. coridon* can be caught in any given place from late June to early October. This happens in England; but there is no question involved in this fact of its possible double-broodedness here.

WEST AFRICAN LYCAENID.—Mr. G. TALBOT showed a remarkable new Lycaenid butterfly from the Cameroons—now



in the collection of Mr. W. J. Adams—probably constituting a new genus. The neuration most resembled that of the genus *Aslauga*, Kirby, but varied chiefly in the different place of origin of the sub-costal nervures of the fore-wing, and in the deeply excised inner-margin of the hind-wing.

ARCTIID FROM HYÈRES—Mr. J. W. TUTT exhibited examples of *Spilosoma mendica*, bred by Dr. Chapman, from ova found at Hyères, Var., the females mostly normal, but some with a well-defined black border round all the wings. These latter, ab. *nigromarginata*, Tutt, were rather striking, but the total variation was much less than that exhibited in Mr. Porritt's well-known series, described and figured in the Transactions in 1889.

COLOUR VARIATION IN HELICONIINE BUTTERFLIES.—Mr W. J. KAYE exhibited series of the two species of *Heliconius*—*H. chestertonii* and *H. weymeri* from Western Colombia. The series of *H. weymeri* included beautiful transitional forms to the aberration *gustavi* in which all trace of the fore-wing markings had vanished. Here there was what appeared on the surface to be an approach of the species *weymeri* to *chestertonii*, but the elevations at which the two species occurred were widely different, *H. chestertonii* occurring in the lowlands and according to Mr. W. F. H. Rosenberg, its range never exceeds 1000 feet above sea level, while *H. weymeri*, according to Mr. A. H. Fassl, with its varied forms was found at from 4–5000 feet, at which elevation the specimens shown were caught. It is probable that there was some common influence at work to produce a black fore-wing, as this phenomenon was found in several other species of *Heliconius* from Colombia, particularly in the Cauca valley. *Heliconius doris* in both its red and blue hind-winged forms produced black fore-wing aberrations known as *tecta*. *Heliconius ismenius* also occasionally produced much darkened fore-wings.

TEMPERATURE EXPERIMENTS WITH PUPAE OF *PIERIS BRASSICAE*.—Dr. T. A. CHAPMAN exhibited pupae of *Pieris brassicae* and made the following remarks upon them:—

“Early in October I happened on a fence with scores of larvae of *Pieris brassicae*, scampering over it in search of pupating stations. I brought home on several occasions

numbers of these, and placed them in boxes, some at temperature 86° Fahr., some at 56° Fahr. The latter took four or five or even more days to pupate. The former (at 86°) had all pupated in 48 hours in each lot so treated. The pupation of a number seemed to be so accelerated that they had not time to make their suspension complete or correctly, and of these not a few did not pupate satisfactorily; the girth catching them in an awkward place, or the larval skin unsuccessfully passing it, etc. After sixteen days there is no sign of any of these making an autumn emergence, though, of the hundreds of ichneumons—*Apanteles glomeratus*—a few dozens came out at the end of eight or nine days from capture of larvae; or eight from escape of ichneumon larvae from caterpillars.

“The only point of serious interest, so far observed, is that the pupae at 86° are much paler and the black spots smaller than in those at normal temperature. Both lots were in the dark. The only explanation I have to suggest is that those at high temperature were not allowed time to develop pigment, just as they had not time (in all cases) to properly suspend themselves.” (See Pl. C.)

NEW BRITISH HEMIPTERON.—Mr. E. C. BEDWELL showed eight examples of *Odontoscelis dorsalis*, Fabr., taken at the roots of *Erodium* on June 21st last, in the neighbourhood of Lowestoft, Suffolk. This is the first record of the species occurring in Britain.

RARE BRITISH BEETLE.—Professor T. HUDSON BEARE exhibited a specimen of *Cryptamorpha desjardinsi*, Guér., taken by Mr. J. Taylor of Sandown, I.W., on a bunch of bananas, on August 30th last. The specimen was kindly presented at the time to the exhibitor and is now in his collection.

RARE AND VARIANT COLEOPTERA.—Mr. H. ST. J. DONISTHORPE exhibited examples of *Chaetocnema arida*, Foudras, a species of Coleoptera new to Britain, taken near Ryde, Aug. 26th, 1909; and varieties of *Cassida nobilis* (also exhibited by Mr. J. W. H. DOLLMAN), taken at St. Helens, I.W., in August 1909. When alive they had a crimson horse-shoe mark on the elytra, and were found at the roots of *Chenopodium*, the crimson colour being the same as at that of the joints of the leaves, and the green ground-colour that of the leaves themselves.

GYNANDROMORPHOUS ANTS.—Mr. DONISTHORPE also showed two examples of *Formica sanguinea*, Latr., one being half ♂ half ♀, and the other, half ♂ half ♀, taken in Bewdley Forest in July; and of one example of *Myrmica scabrinodis*, Nyl., half ♂ half ♀, taken by Mr. Dollman, at Ditchling, in September last.

*Papers.*

Dr. T. A. CHAPMAN, M.D., F.Z.S., communicated a further series of photographs (see Pl. B) and "Notes on the Ancillary Appendages of species of *Plebeius*, to illustrate the relationships of *Plebeius argus* (*aegon*)."

Mr. R. SHELFORD, M.A., F.L.S., F.Z.S., communicated a paper "On two Remarkable Forms of Mantid Oothecae."

Mr. C. T. PEAD communicated "Notes on some Rare or Little-known South African Homoptera," with examples of the several species.

Mr. W. F. ROSENBERG then read the following notes on

THE LIABILITY OF BUTTERFLIES TO ATTACKS BY BIRDS  
AND LIZARDS.

"I have been greatly interested in reading Mr. Guy A. K. Marshall's paper on 'Birds as a Factor in the Production of Mimetic Resemblance among Butterflies,' which appears in the last part of the Society's Transactions.

"I have frequently seen in both Colombia and Ecuador birds attack butterflies on the wing. I must, however, at once confess that I have no definite data as to the species of either the birds or the butterflies in question. As a matter of fact, I am one of those people who, as Mr. Marshall suggests, thought that it was such an ordinary everyday occurrence as not to be worth noting in detail; and it comes upon me as a surprise that the frequency of such attacks should be questioned.

"The collector in the tropics finds himself confronted with such an enormous amount of work in actual collecting, and with such a wide field for observation, that it becomes impracticable to take notes of all the phenomena that come under his notice. But I am quite certain that if collectors

were given an outline of particular directions in which they could do good work by careful investigation, they would be only too glad to take the matter up, feeling that by making observations for a specific purpose they would be adding more to scientific knowledge than they would by taking a mass of notes on miscellaneous subjects without any definite purpose. With this object in view, I have asked some of my most careful collectors for information on the point in question, with the suggestion that they should make special observations and communicate their notes to me from time to time.

“I stayed for some months at a place on the west coast of Colombia where butterflies were extremely plentiful, and the common *Callidryas* and *Papilio*s frequented the damp spots by hundreds. A telegraph line ran along this road, on which were usually perched a number of birds, especially of the larger Tyrant Birds, such as *Tyrannus melancholicus*. It was a constant occurrence to see the birds leave their perch and dart at, and occasionally capture one of the butterflies. The Pierines seemed to be the most frequently attacked, but this may have been merely due to the fact that being so plentiful, of conspicuous colour and size, and frequenting a comparatively open place as was the road in question, instances of attacks on specimens belonging to this family forced themselves on the casual observer to a far greater extent than raids on individuals of smaller and less brightly coloured groups which did not come so boldly into the open.

“I often receive specimens of butterflies with pieces taken out of the wings, obviously by the attacks of birds, inasmuch as the specimens are otherwise in perfectly fresh condition, and do not show that worn and ragged appearance which would be the case were the damage due to age.

“In South America, at all events, butterflies are also much subject to the attacks of lizards. That part of the world is extremely rich in these reptiles, both terrestrial and arboreal. In the locality in Colombia above referred to, the river Dagua runs parallel to the road, and on its sandy shores large groups of butterflies used to settle in the damper spots. Under some small bushes between the road and the river shore there lurked a number of young iguanas and other lizards, which

used to creep craftily to within striking distance of a group of butterflies, snatch a victim, and dart back into the bush with their prey, or, as quite frequently happened, with nothing but a mouthful of wing. In this connection, it is perhaps worth noting that after the *Callidryas*, the most abundant butterflies belonged to species with 'tailed' hind wings, such as the *Papilios* of the *protesilaus* group and Nymphalines of the genus *Megalura*. These 'tails' may possibly play an important part in the protection of the species by enabling the insect to escape with the loss of part of the 'tail.' The extremely long 'tails' of *Papilio protesilaus* and its allies are particularly noticeable, and I have often observed that these *Papilios* usually keep their wings quivering with great rapidity while settled, which would have a tendency to attract the attention of a lizard to the 'tails.'

"It is a curious fact that the South American Acraeine butterflies of the genus *Actinote* exhibit no fear whatever of any enemy. I have repeatedly seen them, especially in Ecuador, settled on damp patches on river shores in groups of twenty or thirty. They are quite an ideal butterfly to collect in a hot climate, all one has to do being to sit down beside a group and pick up the specimens one by one with the fingers. They do not make the least attempt to fly, or even to open their wings. In these groups one sometimes comes across individuals of the Nymphaline genus *Eresia*, always of the species mimicking the *Actinote* with which it is found. In a group of twenty or so *Actinote* one may find perhaps one or two of the *Eresias*. But the latter do not appear to have much confidence in their protective resemblance to the distasteful *Actinote*, as, instead of sitting tight, they invariably give themselves away by rising with a slow laboured flight.

"I was much interested in Mr. Marshall's mention of M. Jelski's opinion that the crest of the bird *Muscivora regia* served as a lure for butterflies. What appears to be an analogous case came under my notice in Ecuador. In tropical South America there is found a genus of arboreal lizards called *Anolis*, usually of small size, and including a great many species. The males of these lizards possess a brilliantly coloured, laterally flattened pouch on the throat, which is

capable of being expanded at the will of the reptile, and is extremely striking, as most species of the genus are otherwise somewhat sombre in general coloration. Walking along a forest path near Chimbo in Ecuador, I saw one of these lizards on a tree-trunk (their favourite haunt), with its bright scarlet pouch fully distended. As I was watching, a butterfly of the genus *Catagramma* darted at the pouch, and the lizard snapped at the insect but missed. This incident gave me the idea that possibly one of the uses of the gular pouch is as a decoy for butterflies. Many of the most handsome *Nymphalidae*, such as the *Catagrammas*, delight in settling on tree-trunks, and they are constantly chased off by other individuals, apparently out of pure mischief. So that when one of these butterflies sees a patch of colour on a tree-trunk, it darts at the supposed intruder, and if the latter turns out to be the gular pouch of an *Anolis* so much the worse for the insect."

Mr. G. A. K. MARSHALL congratulated Mr. Rosenberg on his extremely interesting notes, and said that he had been endeavouring to stimulate entomologists in the Tropics to make observations on the behaviour of birds, etc., towards butterflies by sending copies of his paper to them.

The PRESIDENT, Mr. G. C. CHAMPION, Mr. J. W. TUTT, Dr. T. A. CHAPMAN and other Fellows continued the discussion.

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### Wednesday, November 3rd, 1909.

Dr. F. A. DIXEY, M.A., M.D., President, in the Chair.

#### *Election of Fellows.*

Mr. C. TURNER CLARK, F.Z.S., of 90, The Mall, Newport, Isle of Wight; Mr. REGINALD LEIGH LEIGH-CLARE, c/o Messrs. Allen and Gledhill, Singapore; Mr. THOMAS DOBSON, of Park Avenue, The Park, Sharples, Bolton; Mr. FRANK JAMES EVANS, of the Botanical Department, Trinidad, British West Indies; Dr. T. P. LUCAS, Wakefield's Buildings, Adelaide Street, Brisbane, Australia; and Dr. GILBERT WILLIAM NICHOLSON, M.A., M.D., of the Cancer Hospital, London, S.W., were elected Fellows of the Society.

*Visitor.*

Dr. E. P. FELT, D.Sc., State Entomologist of Albany, New York, was present as a visitor.

*Exhibitions.*

LIVING TROPICAL BUPRESTID.—Mr. C. O. WATERHOUSE exhibited a living Buprestid beetle of the genus *Chrysobothris*, found in an orchid-house in the north of London. It was probably Brazilian, but there was nothing quite like it in the Natural History Museum.

PARNASSIUS FROM THE SWISS JURAS.—Mr. A. E. GIBBS brought for exhibition a case containing a series of *Parnassius apollo* taken by him this year in the Vallée de Joux, Swiss Juras, at 3,300 feet, and at Eclépens. He pointed out that the usual form found in the Jura has a tendency toward the form known as ab. *pseudonomion*, and this is more strongly marked in examples from the lower level at Eclépens.

HUNGARIAN BUTTERFLIES.—Mr. W. G. SHELDON showed a series of characteristic butterflies collected by him in June of this year at Herculesbad, South-eastern Hungary. They included examples of *Neptis lucilla*, *N. aceris*, *Melanargia galatea* var. *procida*, *Erebia medusa*, var. *psodea*, and *Pararge roxelana* as described by him in the current volume of "The Entomologist."

Professor E. B. POULTON, F.R.S., exhibited a set of three species of *Planema* (*Acraeinae*), with their Nymphaline and Papilionine mimics, all captured on the same day in a small isolated patch of forest about a mile and a half from Entebbe, by Mr. C. A. Wiggins, a Fellow of the Society. The examples, which were taken on July 11th of the present year, are shown in the following list:—

ACRAEINE MODELS.	NYPHALINE MIMICS.	PAPILIONINE MIMICS.
<i>Planema poggei</i> , Dew. 2 ♂, 1 ♀.	<i>Pseudacraca hobleyi</i> , Neave. 2 ♂.	<i>Papilio dardanus</i> , ♀ f. <i>planemoides</i> , Trim.
<i>Planema alcinoe</i> , Feld. 1 ♀.	<i>Pseudacraca hobleyi</i> , 1 ♀.	
<i>Planema tellus</i> , Auriv. 2 ♂, 1 ♀.	<i>Pseudacraca terra</i> , Neave.	<i>Papilio dardanus</i> , ♀ f. <i>niobe</i> , Auriv.

Professor POULTON said that the ample material kindly sent by Mr. Wiggins had now shown beyond any doubt that *Pseudacraea tirikensis*, Neave, was the female of *Ps. hobleyi* of the same author, the two sexes being mimetic of different species of *Planema*. This last point was an interesting one, inasmuch as the sexes of the mimetic *Pseudacraeas* usually mimic the corresponding sexes of the same species of model. Here, however, the female *hobleyi* was a beautiful mimic of the female of *Planema alcinoe*, while the male of *hobleyi* did not mimic the male *alcinoe* but bore the closest superficial resemblance to both sexes of *Planema poggei*.

The speaker expressed the hope that Mr. C. A. Wiggins would persist in his investigation of this deeply interesting locality, and continue his kind and most efficient help to the study of mimicry by forwarding the captures of single days selected at intervals up to the end of next May, thus completing an entire year. It was to be hoped and expected that more light would thus be thrown on the study of mimicry than has ever yet been received from any source whatever.

RARE AND ABERRANT LEPIDOPTERA.—Mr. H. J. TURNER exhibited (a) two extremely small *Cupido minimus*, taken with normal-sized specimens near Winchester on June 12th, 1909. The expanse of wings was 15 mm. He had similarly small specimens from Galway and from the Sepey Road, near Aigle, Rhone Valley; (b) an example of *Anthocera achilleae*, in which the blotches on the fore-wings were all fused together, giving at a casual glance the appearance of a small A., captured at Gex, Ain, France, on August 11th, 1909; (c) a white aberration, ab. *alba*, of *Rumicia phlaeas*, taken at Brasted, Kent, on August 28th. This rare form has usually been reported as ab. *schmidtii*, but, as Mr. Tutt has pointed out in "British Butterflies," Vol. I, pp. 357-8, the latter form is straw-coloured; and (d) examples of *Heodes virgaureae* var. *miegii*, a form of the ♂ in which a large discoidal spot and a transverse partial row of black dots near the apex of the fore-wings are developed, and var. *zermattensis*, a form of the ♀ in which the usual copper colour is suppressed and much of the area has become more or less dusky. They were taken at Zermatt in early August. The form *miegii* is



said to be unusual outside Spain, but Mr. TURNER said he had seen quite a number with the spots more or less apparent. Var. *zermattensis* was the usual form of the ♀ at Zermatt.

NEW AND RARE BRITISH BEETLES.—Mr. G. C. CHAMPION exhibited specimens of *Melanophila acuminata*, De Geer, *Crioccephalus fesus*, Muls., and other Coleoptera found on pines near Woking. He called attention to the numerous interesting forms that had been found on pines during recent years, not only in the south of England, but in Scotland also. The Buprestid had probably not been searched for previously at the right season—during the driest time at the end of the summer and early autumn—at a period when few insects are to be found. He stated that he had met with various other Buprestids, both in Spain and in Tropical America (e.g. *Buprestis sanguinea*, F., and *Actenodes chalybeitarsis*, Chev.), in the dry season or when the trees had been scorched by fire.

Mr. NORMAN H. JOY showed the following new British Coleoptera: *Epipeda nigricans*, Thoms., *Pityogenes trepanatus*, Nordl., both taken at Blair Atholl, Perthshire, September 1909; *Lathrobium dilutum*, Er., captured at Dalwhinnie, Invernessshire, September 1909; *Cryptophagus pallidus*, var. *argenteus*, var. nov., differing from the type form in having silvery pubescence; he also exhibited *Philonthus trossulus*, Nordl. (*nigritulus*, Brit. Colls.), from Dalwhinnie; the genitalia of *Gnathoncus nidicola*, Joy, and *G. rotundatus*, Kugel., and of *Anisotoma anglica*, Rye, and *A. cinnamomea*, Er.; and a series of *Sunius lyonessius*, Joy, from the Scilly Isles, and he pointed out the structural characters by which this species may be distinguished from *S. angustatus*.

RARE BRITISH DRAGONFLY.—Mr. W. J. LUCAS exhibited a very fine ♀ example of *Sympetrum fonscolombii*, Selys, on behalf of Mr. F. W. Edwards, of Cambridge, who took it on September 24th, 1908, at Frensham Ponds, in Surrey. Probably this species is always an immigrant with us, and but few specimens have been recorded. One ♀ in Stephens' cabinet was supposed to have been taken near London. Mr. McLachlan possessed a ♂ from Mr. T. Desvignes' collection. A ♂ was taken at Deal in 1881. Messrs. Briggs took 17 males in June 1892 on Ockham Common, in Surrey.

In June 1903 Mr. W. C. Boyd secured a ♀ near Trewoofe, in W. Cornwall. Mr. Edwards' insect is therefore only the twentieth localised and well-authenticated British specimen. A ♀ was taken in Alderney on July 11th, 1899, by Mr. E. D. Marquand, which was at that time, Mr. LUCAS believed, the only dragonfly ever taken in the island.

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### Wednesday, November 17th, 1909.

Dr. F. A. DIXEY, M.A., M.D., President, in the Chair.

#### *Nomination of Officers and Council.*

Mr. H. ROWLAND-BROWN, one of the Secretaries, announced that the Council had nominated the following Fellows to act as Officers, and to serve on the Council of the Society for the Session 1910-11:—President, Dr. FREDERICK AUGUSTUS DIXEY, M.A., M.D.; Treasurer, Mr. ALBERT HUGH JONES; Secretaries, Mr. H. ROWLAND-BROWN, M.A., and Commander JAMES J. WALKER, M.A.; Librarian, Mr. GEORGE CHARLES CHAMPION, F.Z.S.; and as other members of the Council, Professor T. HUDSON BEARE, F.R.S.E., Mr. G. T. BETHUNE-BAKER, F.L.S., Dr. MALCOLM BURR, D.Sc., F.L.S., F.Z.S., Mr. H. ST. J. DONISTHORPE, F.Z.S., Mr. ALBERT HARRISON, F.L.S., F.C.S., Mr. SELWYN IMAGE, M.A., Dr. KARL JORDAN, Ph.D., Mr. HUGH MAIN, B.Sc., Mr. ALFRED SICH, Mr. HENRY JEROME TURNER, Mr. ROWLAND E. TURNER, and Mr. JAMES W. TUTT.

#### *Election of Fellows.*

Mr. GILBERT E. BRYANT, of The Grove, Esher, Surrey, and Mr. ALFRED TETLEY, M.A., of Avenue Road, Scarborough, were elected Fellows of the Society.

#### *Obituary.*

The decease of Dr. GUSTAVE KRAATZ, of Berlin, was announced, and Dr. KARL JORDAN gave a short account of the services rendered to Entomological science by the deceased gentleman, who was for many years a Fellow of the Society.

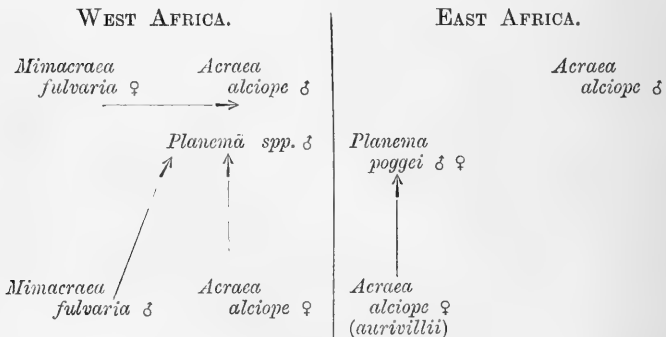
*Exhibitions.*

## MIMETIC RELATIONS OF EAST AND WEST AFRICAN BUTTERFLIES.

—Mr. H. ELTRINGHAM exhibited examples of certain African butterflies, and explained that when working out the mimetic relations of *Acraea alciope*, Auriv., he had been struck by the fact that whilst in West Africa the female of that species was well known, it having in fact been described from a female, all East African examples were males. He had written to Dr. Jordan to ask him if he had seen any East African females, and the latter had replied that in East Africa *alciope* appeared to be represented by the *alicia* of Grose-Smith and Kirby (erroneously described as a *Planema*), that the alleged male (type) of this latter species was in fact a female, and that in all probability the East African female *alciope* would be found to have white hind-wings. Acting on this suggestion he had examined various *Acraeas* from the neighbourhood of Entebbe, and found that *Acraea aurivillii*, Staud., common in that region was always female.\* He had then visited Tring, where he found that Dr. Jordan had already, some time previously, associated *aurivillii* with *alciope*. It was found that the alleged male *alicia* of Grose-Smith and Kirby was in fact an aberrant female, and that the female which had been described as such was not distinguishable from *aurivillii*. A visit to the National Collection showed that there *aurivillii* had been associated with *alciope* though less definitely, and that Mr. Heron had, with characteristic insight, supplied a note to the effect that the supposed male *alicia* was probably a form of female. The result of the whole investigation was that in *alciope* we had an extremely interesting and complicated case of mimicry. In West Africa the female *alciope* was in an unstable condition, but, generally speaking, mimicked a male *Planema* which was probably a form of *salvini*. At Sierra Leone the pattern of the female was fairly constant, but at Fernando Po intermediate varieties were found, one example he had seen having the fore-wings of the Western type and the hind-wings almost as in *aurivillii*.

\* In the hurry of his departure for Africa, Mr. Neave erroneously described the examples of *aurivillii* in the Wiggins collection (Novit. Zool., Vol. II, 1904) as males. They are certainly females, as are all the specimens, some fifty or more, examined by me.—H. E.

Passing across to Uganda, whilst the male remained the same, the female became established in the form hitherto known as *aurivillii*, and was a very perfect mimic of *Planema poggei*, Dew., one of the commonest species of that genus at Entebbe. It was very remarkable that in *aurivillii* there was a complete development of the brown patch at the base of the hind-wing underside. This brown patch is especially noticeable in many species of *Planema* and also in their mimics. The case was further complicated by the fact that in West Africa the male *alciope* formed the model of the female *Mimacraea fulvaria*, Auriv., whilst the male of this *Lycaenid* accurately resembled a male *Planema* allied to that which formed the model of the female *alciope*. All the species involved were exhibited, the female *Lycaenid* being represented by an imitation specimen made of paper and copied from Aurivillius's figure, there being no example of the female in this country. The mimetic relations might be illustrated diagrammatically in the following manner, the arrows expressing the connection of model and mimic, and pointing from the latter to the former.



One result of the investigation was that the *alicia* of Smith and Kirby could no longer stand, firstly because it was an *Acræa* and not a *Planema*, secondly because the name was preoccupied, thirdly because the alleged male was a female, and fourthly because the female was the same as *aurivillii*, and *aurivillii* was *alciope*. The latter might be retained as a varietal name for the East African female.

Mr. ELTRINGHAM said he would like to express his sincere thanks to Dr. Jordan, to whom to a great extent the result of the investigation was due.

PROBABLE MIMETIC ASSOCIATION OF ACULEATE HYMENOPTERA.—The Rev. F. D. MORICE brought for exhibition a number of specimens of Aculeate Hymenoptera which he suggested formed probably a Müllerian group. Though belonging to several widely separated genera they were on the whole very similarly coloured (most of them *e. g.* having yellowish-hyaline wings with black tips). All were taken on a single occasion visiting the small yellow flowers of one particular tree in the alluvion of the Wady Kelt, near Jericho. Another specimen of the same tree grew close by, but no other (in spite of careful search) could be found anywhere in the neighbourhood. Nor had the exhibitor, except on this one occasion, encountered several of the largest and most striking species then taken in the course of three weeks spent at Jericho and devoted entirely to the search for Hymenoptera. The tree has since been identified as one of the *Chenopodiaceae*—*Ochrademus baccatus*, Del. The insects included the magnificent *Sphex hirtus*, Kohl, a large *Pompilus*, probably *P. vespiiformis*, Klug, also *Eumenes dimidiatipennis*, Sauss., and an enormous *Odynerus* (apparently undescribed), whose coloration both of body and wings exactly reproduced that of the *Eumenes*.

Professor E. B. POULTON, F.R.S., agreed with the exhibitor that this was apparently a Müllerian group, and referred to similar groups observed by Mr. G. A. K. Marshall in South Africa and described in the Society's Transactions. The insects, he said, while alive and in flight would appear even more similar in their general appearance, than as now when pinned in the carton.

BUTTERFLIES FROM CENTRAL ITALY.—Mr. A. H. JONES exhibited a few butterflies collected during last summer at Formia, near Naples, including *Melanargia arge*, probably the most northerly limit of the species. Fine forms of *Hipparchia semele*, *Satyrus statilinus*, *Melitaea parthenie*, and *Lampides boeticus*; also various *Lycaenidae*, presenting little if any difference from the types found in the Swiss Alps.

ABERRANT PALAEARCTIC BUTTERFLIES.—Mr. HY. J. TURNER

exhibited (a) an example of *Melitaea didyma* in which the greater portion of the black pigment had more or less failed to develop. The usual markings were all in position, as in normal specimens, but were of a light grey. Some of the spots had a few scattered black scales, and when examined with a glass numerous scales were seen to have only the tips black. The black markings near the insertions of the wings were of the normal density of colour and the ground-colour was about the usual depth of tint. The insect was captured at Zermatt on August 3rd, 1909; (b) a specimen of *Brenthis euphrosyne*, taken in the same locality on July 31st, the spots composing the submarginal line well developed, and most of them elongated towards the base; (c) a specimen of *Polyommatus damon*, in which there was no trace of the transverse row of eye spots on the underside of the forewings, the discoidal spot only being present. The insect was taken on the road leading from Aigle to Sepey on July 29th of the present year; and (d) two series of *Melitaea parthenie*, the first taken on the Riffel-alp on August 1st, and the second up the Valley of the Zmutt, Zermatt, on July 31st. Among them were several specimens referable to the form *varia*, which Dr. Chapman considers to be a species, on account of the distinctive characters of its genitalia.

NEW AND RARE BRITISH HETEROCERA.—Mr. A. SICH exhibited a pair of *Depressaria putridella*, Schiff., bred from larvae taken last June at Whitstable, Kent. This species, named by the authors of the Vienna Catalogue in 1776, was extremely scarce until the larvae were discovered, about 1865, in Germany. The first British examples were taken in the larval state by Mr. E. D. Green, in 1906. Mr. Green subsequently handed over the specimens he bred for identification, and the species has now been recorded in the "Entomologist's Record." Mr. SICH showed also a pair of *Coleophora chalcogrammella*, Zell., taken last August in Richmond Park, Surrey. This species used to occur near Scarborough, but was always scarce, and he believes it has not hitherto been taken in Britain further south than Suffolk.

NEW ABERRATIONS OF LEUCANIDAE.—Mr. H. M. EDELSTEN exhibited a bred series of *Nonagria neurica*, Hb. (*edelsteni*)

from Sussex, including two new aberrations for which he suggested the names *rufescens* and *fusca*. He mentioned that, as far as he was aware, these two forms had not been previously noted on the Continent. He showed, also, ova and pupa *in situ*, with photographs by Mr. Hugh Main to illustrate the life-history of the species.

HUNGARIAN PIERIDS AND FIREFLIES.—Mr. W. G. SHELDON brought for exhibition a case containing several series of *Pieridae* taken by him this year at Herculesbad, including *Pieris napi*, var. *napeae*, and imagines bred from ova of the same. He drew attention to those labelled *Pieris rapae*, and suggested that some of them might belong to *P. ergane*, or *P. manni*, to which respectively they bore a remarkable superficial resemblance. Mr. SHELDON also exhibited examples of the following Coleoptera ("Fireflies")—*Luciola mingrelica*, from Herculesbad; and *Phausis splendidula*, ♂ and ♀, from Tatra Fured, Hohe Tatra, Eastern Hungary.

LARVAL HABIT OF OSMYLUS.—Mr. W. J. LUCAS exhibited two imagines and a larva of the finest of our Neuroptera, *Osmylus chrysops*. The exhibit was made on account of the larva which was taken by Dr. D. Sharp, F.R.S., near Queen's Bower in the New Forest. It pierces and sucks dry some small animals, but its life-history is not well known. The mouth parts are similar to those of *Hemerobius* and *Chrysopa* which feed on the juices of Aphides. *O. chrysops* is, however, at least partly aquatic. It is nearly related to *Sisyra*, of which we have three species, one at least of which feeds on *Spongilla fluviatilis*.

TERATOLOGICAL EXAMPLE OF A CARABID.—Dr. G. B. LONGSTAFF showed a teratological specimen of a Carabid beetle from Ceylon (*Omphra*, Latr., sp.). The middle femur of the right side was dilated at the distal end, bearing at its anterior angle two supplementary tibiae coherent at the base; the rudimentary tarsi were also adherent.

COLOUR VARIATION OF AGLAIS PUPAE.—Mr. A. W. BACOT showed two boxes containing pupal cases of *Aglais urticae* collected by Mr. Hugh Main in one locality. Those taken from the food plant were yellowish-white; those taken from the cage in which the larvae pupated quite black, thus

demonstrating the effect of surroundings upon the pupal coloration.

*Paper.*

Dr. T. A. CHAPMAN, M.D., F.Z.S., read a paper "On *Callophrys avis*," a Palaearctic Butterfly new to science.

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**Wednesday, December 1st, 1909.**

Dr. F. A. DIXEY, M.A., M.D., President, in the Chair.

*Nomination of President, Officers and Council.*

The SECRETARY again read out the list of nominations published at the previous meeting.

*Appointment of Auditors.*

The SECRETARY announced that the PRESIDENT had appointed the following Fellows to act as Auditors for the current financial year:—from the Council, Mr. H. ROWLAND-BROWN, Mr. ROWLAND E. TURNER, and Mr. C. O. WATERHOUSE; other Fellows, Mr. R. ADKIN, Mr. R. WYLIE LLOYD, and Mr. H. J. TURNER.

*Election of Fellows.*

Mr. W. C. CRAWLEY, of Tollerton Hall, Nottingham, and Mr. G. H. GROSVENOR, M.A., of New College, and 3, Blackhall Road, Oxford, were elected Fellows of the Society.

*Conversazione, 1910.*

The PRESIDENT announced that the Society would hold a Conversazione in the month of May, 1910, and invited the co-operation and assistance of Fellows.

*Exhibitions.*

LATE AUTUMN COLEOPTERA.—Commander J. J. WALKER exhibited 128 species of Coleoptera, belonging to 68 genera, which he had taken, by sweeping only, at Wytham Park, Berks., between 12.30 and 3.30 p.m. on November 5th, 1909.



Several local and uncommon species were included among these, such as *Homalota puberula*, Sharp, *Anisotoma cinnamomea*, Panz. (both sexes), *A. punctulata*, Gyll., *Hydnobius punctatissimus*, Steph., *Cryptophagus pubescens*, Sturm, *Phloeophilus edwardsi*, Steph., *Mantura matthewsi*, Curt., *Salpingus castaneus*, Panz., *Apion filirostre*, Kirby, etc., etc.

THE UNIDENTIFIED LUPERINA.—The Rev. C. R. N. BURROWS sent for exhibition examples of several species of *Luperina* (*Apamea*), and communicated the following remarks upon them :—

“The capture in the past season, on the Lancashire coast, of further specimens of an insect which, twenty years ago, created some interest, has induced some of us to look into the matter again with a view to ascertaining, if possible, its exact position. Mr. South discussed the insect in the ‘Entomologist,’ vol. xxii, p. 271, where he expresses the opinion that it may be a form of *Luperina testacea*, intermediate between *L. gueneei* and *L. nickerlii*. The specimen was exhibited at the Meeting of the Entomological Society on October 2nd, 1889, under the name of *L. nickerlii*, and under the same name to the South London Entomological Society, on October 10th of the same year. This position was not universally accepted, for when the specimen was again produced at the City of London Entomological Society’s Meeting, March 19th, 1891, in connection with an exhibition of pale forms of *L. testacea* taken by Mr. Hodges in the Isle of Wight, Mr. Tutt inclined to the opinion that it might be an aberration of *L. testacea*, but could not possibly be = *L. nickerlii*. This view Mr. Tutt maintains in his ‘Varieties of British Noctuae,’ vol. i, p. 140, where he names the insect *Luperina testacea*, var. *incerta*. The recent captures have provided material for further investigation, and material has been collected also, for comparison and examination. The preparation of the genitalia is not yet complete, but Mr. Pierce finds five points of difference between those of *L. testacea* and the Lancashire insect.

“The boxes exhibited contain three specimens of what are taken to be authentic *L. nickerlii*. The first two obtained through Messrs. Watkins and Doncaster, from a Vienna collection, are said to be Nickerl’s own collecting, and over fifty

years old. The third specimen belongs to Mr. South, and is labelled 'Bohemia.'

"A series of undoubted *L. testacea*, mostly labelled from about the same (Lancashire) district, is followed by four specimens of the unidentified insects, and these again by several specimens undoubtedly of *L. testacea*, of the palest form, taken by myself, mostly at Rainham, named more for convenience than from conviction, *L. gueneei*.

"It will be noticed at once that the form of the fore-wings in the Lancashire insect is much narrower than in either *L. testacea* or (reputed) *L. nickerlii*.

"With respect to the possible connection of these Lancashire specimens, with *L. gueneei*, I have consulted what I believe to be Henry Doubleday's original description in the 'Entomologists' Annual,' for 1864, p. 123. He says of *L. gueneei*, 'It differs from *L. testacea* in the thorax and abdomen being slenderer, in the peculiar mottled appearance of the upper wings, and in the absence of the *three round white dots* on the costa near the apex, which are so distinct in *L. testacea* and *L. nickerlii*. The posterior wings in both sexes are of a much purer white than in *L. testacea*.'

"For myself, I would only remark that I am not acquainted with the *three round white dots*, in our common species, and do not see them in the (reputed) *L. nickerlii*.

"The second box contains a further supply of *L. testacea*, and pale forms thereof from Rainham."

#### DISCUSSION OF THE AFFINITIES OF AGRIADES THETIS (BELLARGUS) AND A. CORIDON.

In the absence of Mr. J. W. TUTT, who was indisposed, Dr. T. A. CHAPMAN opened a discussion on the affinities of *Agriades thetis* (*bellargus*) and *A. coridon*, and exhibited a number of photographs upon the screen to illustrate his views, being details of species included in the Plebeiid group. These included slides of the ova of *thetis* and *coridon* by Mr. F. Noad Clark and Mr. A. E. Tonge, and of the first instar of the larvae of *Plebeius argus*, L., *P. argyrognomon*, Bergs., *A. coridon*, and *A. thetis*; a photograph of the larva of *thetis* by Mr. Hugh Main, also showing the "fan" structures remark-

ably well ; also many slides illustrating the differences in the genital armature of the two species under review, and their allies.

Proceeding, Dr. CHAPMAN said—

“Not only in the Plebeiids but in all the Blues, the hair bases in the larvae are stellate. Those of *Lampides boeticus* show them well. In contrast with these the hair bases in Hairstreak larvae are petaloid, shown in a slide of hairs of *Laeosopis roboris*. In the ‘Coppers’ the hair bases are simple, but have a very deep socket for the hairs. In the Chrysophanids it is the hairs themselves that become complicated, varying both on larvae and pupae into remarkable forms of fungi-form and umbrella hairs.

“There is a curious hair on the prothorax of the larvae of Blues, and present also in other sections of Lycaenids ; in the last stage of *A. thetis* (*bellargus*) it forms a very beautiful object with the curious modification of the surroundings, it is not quite so special in *coridon*. Unfortunately time did not allow of slides of these being made, but I show you the similar hairs in *L. telicanus* and *Cupido minimus* ; in these it is a very long slender hair, like nothing else on the larva, and has a very special base. In the larva of *thetis* and some others there is a dark spot marking this region.

“The honey-gland on the 7th abdominal segment is present in most Blues, and also in Thestorids : it is well marked in the majority of Plebeiids : it is not present in the first instar. The narrow slit has usually a large number of lenticles along each margin, with clubbed and curved hairs in many species. In prepared skins there are usually four faint circles seen apparently in the gland. These are no doubt glandular structures, and are probably modified hairs, possibly hairs of tubercles I and II which disappear when the honey-gland develops. These circles are seen most plainly in the slide of *C. rubi*, of those shown.

“The pupae of *coridon* and *thetis* are typical ‘Blues,’ short, thick, and with the ends tucked under so that what are in most butterfly pupae the extremities are here quite ventral. They are not quite so short and dumpy as some other Blues, and decidedly less so than many Theclids. They are

of rather delicate texture (compared with their allies), but have similar surface sculpturing. On the prothorax of *thetis* are seen multitudes of lenticles, a good many hairs of several varieties, the ordinary network of raised lines, but in this specimen no 'rosettes.' Near the 6th abdominal spiracle ribbing (or network) largely gives way to lenticles, and short clubbed (and spiculated) hairs are numerous. Near the 7th spiracle there happen in this specimen to be a few longer baton-like hairs, fewer lenticles and a few rosettes, these are the flower-like points that occur at meeting-places of the ribs of network.

"The cremastral area is quite devoid of hooks, and possesses a few hairs. The cremastral hooks are homologous not with hairs, but with rosettes, and we see in *thetis* a good many rosettes in this area, a reversion or degeneration. This specimen shows well the finer skin structure, corresponding probably to the skin-points of the larva (seen in slide of Honey-gland).

"In the Lycaenid pupa, certainly in many other butterflies and probably in some other pupae, there is a structure on the legs, that I only observed comparatively recently. The appendages (wings, antennae, legs, maxillae, etc.) have only the ribbing of the network and are without hairs, rosettes, or lenticles; but to this rule there is the exception, that lenticles, hairs, etc., are to be found at the tibio-tarsal articulation of the legs, and sometimes on the tarsal joints. They are well seen in *Callophrys avis* as a little group of lenticles. A portion of the wing of *C. avis* is shown as a normal example, contrasting in its want of hairs, etc., with the other portions of the pupa of *thetis* shown. In *thetis* the pupa is so delicate that the netting of the wings cannot be photographed so effectively."

Passing to the structure of the male appendages, Dr. CHAPMAN continued:—

"My study of these in the 'Blues' has led me to recognise certain definite groups, and also that outside these there is a large territory of which I am still too ignorant to recognise very clearly marked groups.

"The greater number of our British 'Blues' belong to the

group of Plebeïids, and this makes me regard them as a sort of datum from which to note the divergences of other groups, without really any sort of idea that they are basal or phylogenetically older. Their dorsal armature is definitely bilateral, each side is rather narrow and pointed, and has an angulated hook hinged to it. Perhaps more characteristic is the large somewhat spindle-shaped clasp, with a comparatively small toothed margin at its extremity. This toothed margin is curled round and difficult to observe unless pains be taken to straighten it out, or see it from a proper angle. These clasps are wonderfully similar throughout the group, and it is the toothed ends to which one looks for the easiest means of distinguishing them.

“ Another group is that of the Lycaenopsids (*Celastrina argiolus*), in which the dorsal armature, still bilaterally distinct, is rather flattened, and any points it may have are parts of it, the special character of the group being that the hinged hooks are wanting. The clasps vary much throughout the group.

“ Another group is that of the Everids with dorsal armature, which we may regard as that of the Plebeïids with the two side portions united in the middle line.

“ In the Lycaenid (*Lycaena arion*) group we have the clasp of peculiar form, very little varied through a number of rather dissimilar species.

“ In *Tarucus theophrastus* and *Lampides boeticus* we have examples of which I will only say they do not belong to any of the above groups, and may be taken as samples of the large field unrepresented in Britain.

“ The slides now shown illustrate the appendages of all our British and one or two other Plebeïids. Those of *Argus*, L. (*aegon*) and *argyrognomon* I have already exhibited. *Argus* is well distinguished from *argyrognomon*, and all British species by the large development of the serrations into strong teeth. *Orbitulus* has the serrated end remarkably rounded, almost disk-shaped. *Astrarche* has a specialisation on the clasps, of which some trace also exists in its near relation *eumedon*, and is quite an exception to the remarkably featureless character of the shaft of the clasp in the group. There is

a row of toothed and notched eminences all down one side of the clasp, *donzelli* and *eros*; the other members of this little set are without these.

“The other photographs shown are not intended to enable you to distinguish the several species by the appendages, but rather to show how much alike these various species are, and by what small differentia they may be distinguished from each other. I may say, however, that there is a peculiarity about both the dorsa and the clasps that increases the difficulty of seizing distinctions between the different forms. The dorsal armature of either side has a strong chitinous frame, but it has also a soft portion that I may call a wing. This soft portion may be very expanded or contracted, and as it is so, gives to specimens of one species a greater variety of appearance than really subsists between some different species. The same is true of the clasp; there is a soft median portion, between the rounded and haired division of the serrated end. This soft portion allows of these two ends being nearer or further apart, of the turning over of the serrated end, and also itself may project more or less between the two terminal portions, often looking like a third division, even of more importance than the other two. It appears to present important specific characters, until one learns to give it its true value.

“As distinguishing *coridon* from *thetis* the dorsal hooks of *coridon* have a very square angle, are slighter at the point, and have a more pronounced terminal hook. In *coridon* the end of the clasp is much wider at corresponding parts of its length, and though the terminal teeth are very similar, there are one or two more in *coridon* than in *thetis*.”

The Rev. G. WHEELER, while regretting the unavoidable absence of Mr. Tutt, said that he had formed independently almost the same conclusions on the relationship of the two species. Practically both have a similar range; for it is not known that *coridon* does not extend into Mauritania, and their eastern and western limits are identical. *Thetis*, apart from mere aberration, is a very constant species, the North African being the only local race. *Coridon* is, also, except for aberrational forms (including the margins of the upper-side,

and the spotting of the under-side, and the presence of blue in the females), very constant in its northern and central range, but develops local races alike in the south-east and the south-west. The names of these forms have been complicated greatly owing to Staudinger's failure to look up the original descriptions. The Spanish races are three :—

(a) *albicans*, Bdv., originally described by Rambür without a name, and eventually named from this description in the following year by Boisduval. This is the Sierra Nevada form; very large; very white, and weakly marked beneath;

(b) *aragonensis*, Gerh. (= *albicans*, H.-S.); the bluish figure with white wedge-shaped dashes inside the border in Herrich Schäffer's work and the greenish white figure of Gerhard would never be taken to represent the same form, except by those who happen to know the insects. But really they represent only the way in which the light falls on the wings—full in one case, sideways in the other;

(c) *hispana*, H.-S. This, both according to the author's figure and description, is a bright blue form, but Staudinger none the less calls it *albicans*, and regards it as equivalent to *aragonensis*. It should be noted, also, that this form runs through the whole gamut of aberration of the typical *coridon*.

The Eastern races are also three in number :—

(a) *olympica*, Lederer, which he calls "milk-blue," but, as we have his specimens in the National Collection, we know that, in this case, "milk" must represent a colour between that of *coridon* and that of *icarus*;

(b) *caucasica*, Led., of which we have also the type specimens in the National Collection, and which are of a "royal" blue like the last brood of *icarus* in Central Italy, and as now seen in a single magnificent example exhibited by Mr. Bethune-Baker;

(c) *corydonius*, H.-S., more of the *thetis* colour, or at least approaching it; Gerhard's var. *ossmar* exactly corresponding with Lederer's specimens of *olympica*. There are besides sporadic examples of a *meleager*—blue colour (= *polonus*, Zeller), which, so far as we know at present, must be regarded, at least temporarily, as hybrids, *thetis* × *coridon*; and the fact that they are taken in Central Italy both among *thetis* and among *coridon* is a strong argument in support of this conclusion.

Mr. J. W. TUTT sent for exhibition a long series of *Agriades thetis*, captured in various parts of Europe: also a long series of *A. coridon* (occupying some five cabinet drawers). The series included Dr. Chapman's and his own material, the Spanish forms of *A. coridon* comprising var. *albicans*, Bsdv., from Andalusia; var. *aragonensis*, Gerh., and its ab. *coerulescens*, Tutt (= *albicans*, H.-S.), from Aragon; ab. *plumbescens*, from Jaca on the Spanish side of the Pyrenees, and a typical ♂ from Punto de Pajares (giving a hint as to the direction of the habitats of the typical form in Spain). He also showed a long series of the spring race of the double-brooded form of the species (*meridionalis*, gen. vern.) from Hyères, Draguignan, and Nîmes, but chiefly from Ste. Maxime, Var, where it was taken by Dr. Chapman in April—May. With these were exhibited long series of other French, Swiss, Austrian, and Bosnian examples, including most of the better-known forms of *tithonus*, Meig. (= *syngrapha*, Kef.), *corydonius*, Bergstr. (= ab. *cinnus*, Hb.), *obsoleta*, Tutt, *parisiensis*, Gerh. (often erroneously called *tiphys*, Esp., which is the parallel form of *A. thetis*), *addenda*, Tutt, *costajuncta*, Tutt, *basijuncta*, Tutt, *extensa*, Tutt, *striata*, Tutt, etc. The arrangement of the insects in geographical sections made comparison easy.

Mr. WHEELER said he believed that Mr. Tutt was wrong in proposing to change the name of the var. *syngrapha* to *tithonus*, as although Meigen's figure is *syngrapha* he refers to Hübner's *tithonus*, which = *eros*; and Mr. Tutt's having subdivided the genera ought not to alter the fact that, as *tithonus* = *eros*, the name cannot be used to describe any form of *coridon*.

Mr. C. P. PICKETT, Mr. A. E. GIBBS, and Mr. G. BETHUNE-BAKER also submitted series of *coridon* and *thetis* with varietal forms and aberrations, and after some remarks by Mr. BETHUNE-BAKER, the discussion was adjourned.

#### Papers.

Mr. T. BAINBRIGGE FLETCHER, R.N., communicated a paper "On the genus *Deuterocopus*, Zeller."

Mr. H. St. J. DONISTHORPE, F.Z.S., communicated a paper on "Some Experiments with Ants' Nests."



M. ERNEST OLIVIER communicated the following note:—

SUR LES LUCIOLA D'AUSTRALIE.—Mr. A. M. Lea m'ayant aimablement communiqué les Lampyrides cités dans sa "Revision of the Australian and Tasmanian Malacodermata," \* j'ai pu faire à la suite de leur examen les observations suivantes:—

Les *Luciola* australiennes, de grande taille, à prothorax roux et élytres noirs sont assez difficiles à reconnaître à cause de l'insuffisance de leur description.

Voici comment je crois que l'on peut les séparer.

LUCIOLA AUSTRALIS, Fabr. Boisd.—Prothorax arrondi en avant, dessous du corps et jambes complètement d'un roux fauve à l'exception du quatrième segment qui est plus ou moins rembruni, le dernier arrondi postérieurement. C'est bien l'espèce qu'a décrite Boisdual dans le "Voyage de l'Astrolabe," mais ce n'est pas du tout celle de Guérin ("Voyage de la Coquille"), et Castelnau a proposé pour cette dernière le nom de *guerini*.

LUCIOLA GUERINI, Cast. = *australis*, Guér. et Ern. Oliv., *neq* Fabr.—Prothorax anguleux dans le milieu de sa marge antérieure; quatre premiers segments du ventre, tarses, tibias et sommets des fémurs noirs, deux derniers segments d'un blanc de cire, le dernier, triangulaire. C'est cette espèce que j'ai décrite à tort dans le *Catalogue des Lampyrides du Musée de Gènes*, comme étant l'*australis* de Fabricius.

LUCIOLA RUFICOLLIS, Guér.—Prothorax à bord antérieur tronqué; dessous du corps flave, dernier segment trilobé.

Mr. A. M. Lea n'admet les *Luciola gestroi*, Ern. Oliv., et *coarcticollis*, Ern. Oliv., que comme simples variétés de *Luciola flavicollis*, Macl. Grâce aux exemplaires typiques qu'il m'a obligeamment envoyés, j'ai pu me convaincre que *coarcticollis* n'en est que la forme à élytres noirs étroitement bordés de flave. Mais *L. gestroi*, Ern. Oliv., reste une espèce valable et bien distincte par la forme du prothorax beaucoup plus court, à angles antérieurs arrondis, etc. †

\* Trans. Ent. Soc. Lond., June 1909, pp. 45-251.

† Voir les figures de ces deux espèces, *L. coarcticollis*, in *Annales de la Société Entomologique de France*, 1888, pl. I, fig. 9, et *L. gestroi* in *Annali del Museo Civico di Storia naturale di Genova*, 1885, pl. V, fig. 10.

*Luciola platygaster*, Lea, a beaucoup de rapport avec *L. pupilla*, Ern. Oliv., et devra peut-être lui être réunie. La coloration est identique, la forme tridentée du dernier segment ventral est la même. Les seules différences que j'y vois, c'est que *platygaster* est d'une taille un peu plus avantageuse et n'a que deux segments, du ventre blanc, tandis qu'il y en a trois chez *pupilla*.

Le genre *Atyphella*, Oll., est bien voisin de *Luciola* et comme dit Mr. Lea, il n'en est plutôt qu'un sous-genre. Je ne l'avais d'abord pas admis, mais comme les insectes qui le composent proviennent de la même région et ont un facies homogène assez spécial et que, d'autre part, le genre *Luciola* comprend déjà un très grand nombre d'espèces, je crois préférable de le conserver, et il y a lieu d'y faire entrer *L. leucura*, Ern. Oliv., de la Nouvelle Bretagne et *L. peculiaris*, Ern. Oliv., de la Nouvelle Guinée.

## ANNUAL MEETING.

Dr. F. A. DIXEY, M.A., M.D., President, in the Chair.

Mr. R. WYLIE LLOYD, one of the Auditors, read the Treasurer's Balance Sheet, showing a balance of £28 8s. 10*d* in the Society's favour, and moved the adoption thereof. Mr. J. R. le B. TOMLIN seconded the motion, which was carried unanimously.

### Report of the Council.

During the Session 1909-10 seven Fellows have died, viz. Mr. H. W. Barker, Mr. John Brown, Capt. Frederick Hallam Hardy, R.A.M.C., Mr. H. G. Palliser, the Rev. Dr. Henry Charles Lang, M.D., Mr. Edward Connold, F.Z.S., and Mr. Basil George Nevinson, M.A., F.Z.S.; ten Fellows have resigned, the names of two have been removed from the list, and twenty-two new Fellows have been elected.

The number of Fellows deceased, as also of those who have resigned, or for other causes have been removed from the list, is considerably below the average. We regret to observe, however, that there is a decided falling-off in the total of Fellows elected, though the number of those waiting election in the early part of the new year is more satisfactory.

At present the Society consists of twelve Honorary Fellows, five hundred and twenty-one Life and Subscribing Fellows, making a total of five hundred and thirty-three.

The Transactions for the year 1909 form a volume of five hundred and fourteen pages, containing sixteen Memoirs by the following authors: Mr. G. J. Arrow, Mr. W. L. Distant, Mr. H. St. J. Donisthorpe (two), Mr. Hamilton H. Druce, Mr. F. Enock, Mr. H. Eltringham, Sir George F. Hampson, Bart., Mr. G. A. K. Marshall, Mr. E. Meyrick, F.R.S., the Rev. F. D. Morice, Mr. Claude Morley, Mr. A. M. Lea, Mr. R. Shelford (two), and Mr. R. Trimmen, F.R.S.

Of these sixteen papers, five relate to Lepidoptera, four to Coleoptera, three to Hymenoptera, two to Orthoptera, one to Homoptera-Hemiptera, Rhynchota, and one to Birds as a factor in the production of mimetic resemblances among Butterflies.

The Memoirs above referred to are illustrated by seventeen

plates, of which three are coloured. Towards the cost of Plate XI Mr. F. C. Adams contributed the sum of £10, and the Hon. N. C. Rothschild £3 towards the cost of Plate XVI.

The volume of Proceedings consists of eighty-two pages in all, containing among other notices several short papers of considerable entomological interest, two of which are illustrated by three half-tone plates presented by the author, Dr. T. A. Chapman.

Thanks to the continued generosity of Mr. F. Merrifield, we were once again able to send an entomologist to Switzerland during the summer under our "Travel Grant."

During the past year thirty-eight volumes, in addition to a large number of Separata, and the usual Periodical Publications, have been added to the Library, the value of which to Fellows is adequately demonstrated by the fact that while generally well patronised for purposes of reference, two hundred and ninety-eight volumes have been issued for home reading as against two hundred and seventy-eight in 1908.

The Treasurer reports that after carrying forward to 1910 £16 16s. for subscriptions paid in advance in 1909, and investing £47 5s. for three Life Compositions received in 1908 and 1909, making the total so invested £949 13s., there remains a genuine cash balance in the Society's favour of £28 8s. 10d. This balance is all the more satisfactory when it is remembered that during the financial year the Society has paid off the outstanding liabilities for Parts III, IV, and V of 1908, as well as of Parts I, II, III of current Transactions; a result due to the administration of the newly-established Business and Publication Committee. The sale of the Society's Transactions to the outside public also shows a material increase. Encouraged by these signs of interest, and by the success of the *Conversazione* held in May 1908, the Council proposes to hold a second meeting of the kind in Burlington House on May 27 next, and appeals to all Fellows to make it a success by attending with their friends, and assisting with exhibitions of entomological value.

ENTOMOLOGICAL SOCIETY OF LONDON,

11, CHANDOS STREET, CAVENDISH SQUARE, W.

19th January, 1910.

On the motion of the Rev. GEORGE WHEELER, seconded by Mr. H. St. J. DONISTHORPE, the Report was adopted unanimously.

The Secretaries not having received any notice proposing to substitute other names for those contained in the list prepared by the Council, the following Fellows constitute the Council for 1910-11:—Professor T. Hudson Beare, B.Sc., F.R.S.E., George T. Bethune-Baker, F.L.S., Dr. Malcolm Burr, D.Sc., F.L.S., F.Z.S., George Charles Champion, F.Z.S., Dr. Frederick Augustus Dixey, M.A., M.D., Horace St. J. Donisthorpe, F.Z.S., Albert Harrison, F.L.S., F.C.S., Selwyn Image, M.A., Albert Hugh Jones, Dr. Karl Jordan, Ph.D., Hugh Main, B.Sc., Henry Rowland-Brown, M.A., Alfred Sich, Henry Jerome Turner, Rowland E. Turner, James W. Tutt, and Commander James J. Walker, M.A., R.N., F.L.S.

The following were re-elected as officers:—President, Dr. F. A. Dixey, M.A., M.D.; Treasurer, Albert Hugh Jones; Secretaries, H. Rowland-Brown, M.A., and Commander James J. Walker, M.A., R.N., F.L.S.; Librarian, George C. Champion, F.Z.S.

Dr. F. A. DIXEY, the President, then delivered an Address; at the close of which a vote authorising the printing of the Address, coupled with thanks to the PRESIDENT for his Address and for his services as President during the past year, was proposed by Mr. C. O. WATERHOUSE, seconded by Professor R. MELDOLA, F.R.S., and carried unanimously.

On the motion of Dr. T. A. CHAPMAN, seconded by Mr. J. W. TUTT, it was agreed unanimously, also, that the illustrations used by the President for his Address be incorporated with it when published in the Society's Proceedings.

Mr. W. E. SHARP then proposed a vote of thanks to the other officers of the Society. This was seconded by Mr. HAMILTON H. DRUCE and carried unanimously. The PRESIDENT, Mr. A. H. JONES, Mr. ROWLAND-BROWN, and Commander J. J. WALKER, R.N., replied.

## ENTOMOLOGICAL SOCIETY OF LONDON.

## Balance Sheet for the Year 1909.

RECEIPTS.		PAYMENTS.	
	£ s. d.		£ s. d.
Balance on hand, 1st Jan., 1909, and at Bankers ...	10 19 0	Printing Transactions, etc. 292 14 9	
Subscriptions for 1909 ...	442 1 0	Plates, etc. ... .. 69 12 9	
Arrears ... .. 31 10 0		Rent and Office Expenses ... .. 190 6 6	
Admission Fees ... .. 35 14 0		Books and Binding ... .. 54 9 1	
Donations ... .. 19 19 6		Investment in Consols ... 47 5 0	
Sales of Transactions ... 81 16 10		Subscriptions in Advance, per contra carried to 1910 ... .. 16 16 0	
Interest on Investments:—		Balance in hand and at Bankers ... .. 28 8 10	
Consols ... .. £22 10 8			
Westwood Bequest:—			
Birmingham, 3 per cents. ... 6 15 11			
	29 6 7		
Subscriptions in Advance ... ..	16 16 0		
Life Compositions ... ..	31 10 0		
	£699 12 11		£699 12 11

## TRAVEL GRANT.

	£ s. d.		£ s. d.
Received from Mr. Frederic Merrifield ... ..	21 0 0	Paid to Mr. John Alderson	21 0 0

## ASSETS.

	£ s. d.
Subscriptions in arrear considered good ... ..	50 0 0
Cost of £985 16s. 3d. Consols. Present value at the price of 82½ on 3rd Jan. 1910, £816 19s. 9d. ... ..	949 13 0
Cost of £239 12s. 4d. Birmingham 3 per cents. Present value at the price of 89 on 3rd Jan. 1910, £213 5s. 2d. ... ..	250 0 0
Balance in hand ... ..	28 8 10
Additional Assets:—	
Contents of Library, and unsold Stock.	
	£1,278 1 10

## LIABILITIES.

Cost of printing, etc., Parts 4 and 5 of the Transactions.  
(In the press.)

Audited, compared with vouchers and found correct.

R. W. LLOYD.  
CHAS. O. WATERHOUSE,  
H. ROWLAND-BROWN.  
R. ADKIN.  
HY. J. TURNER.  
ROWLAND E. TURNER.

A. HUGH JONES, *Treasurer*.  
6th January, 1910.

## THE PRESIDENT'S ADDRESS.

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LADIES AND GENTLEMEN,

WHILE the political storm rages without, it is a relief to turn aside into a haven where party feeling holds no sway, and where all are ready to co-operate in the single purpose of the advancement of our subject.

My first duty is to congratulate the Society at large on the continuance of its prosperity. Our Meetings during the past year have been excellent in point of attendance; one of them, if I mistake not, constituting a record for recent times. The communications made to us have been of great interest and high scientific importance. It is difficult to select any of these for special mention without seeming to be invidious; I cannot, however, refrain from expressing the appreciation we must all feel for the work done by Mr. Doncaster, Mr. Bacot and Mr. Prout on the laws of inheritance; by Mr. G. A. K. Marshall on birds in relation to mimicry; and, in another province of our study, for the minute and careful investigation of the relations of well-known species which we owe to Dr. Chapman and Mr. Tutt. Not the least valuable lesson to be learnt from the work of these two gentlemen, and other labourers in the same field, is that even among the most familiar objects of our interest there still remain many problems to be solved, and much untrodden country yet to be explored.

All who have had experience of the working of such societies as our own, know how greatly their success depends on the efforts of those whom, leaving out of sight the occupant for the time being of the Presidential Chair, I may call the active Officers. This Society has never been slow to acknowledge its obligations to its Secretaries, Treasurer and Librarian for their constant devotion to its interests, a devotion which

involves, as I well know, the expenditure of much time and trouble. At the conclusion of my first year of office I wish to add to the thanks of the Society an expression of my own personal gratitude for the assistance and support I have received at all times from those gentlemen I have mentioned, and from my other colleagues on the Council and Publications Committee. One and all have united to make the task of your President an easy and pleasant one to fulfil.

During the past year several of our number have dropped out of the ranks. We have to deplore the loss of Captain FREDERICK HALLAM HARDY, R.A.M.C., whose Fellowship of the Society dates only from 1908; of JOHN BROWN, noted for his special knowledge of the old fen fauna, and H. G. PALLISER, who joined us in 1886 and 1898 respectively.

Another of our Fellows, H. W. BARKER, who died on September 21st, at the age of 49, was well known to many entomologists as the active and efficient Honorary Secretary of the South London Entomological and Natural History Society from 1886 to 1893, and also as an industrious collector of British Lepidoptera. He had been a Fellow of our Society since 1887.

One summer day, many years ago, as I was wandering about country lanes, a schoolboy with a butterfly-net, I was accosted by a pleasant-looking young man, who, after asking me what success I had had, bestowed on me some excellent advice as to where to go and what to look for. At parting he gave me his card, and invited me to call on him. The name on the card was H. C. LANG. I never saw him again, but I have always remembered his kindness to a stranger whose only claim on him was the freemasonry of entomologists. The news of his sad death within the last few weeks has come as a great shock not only to all who have ever been brought into personal contact with him, but also to all who realise how much he has done to create and foster among British entomologists an interest in the butterfly fauna of Europe. The Rev. Henry Charles Lang, M.D., was, I believe, a Fellow of this Society in early days, and after an interval rejoined us in 1900.

Outside the circle of our own Society, we have to lament



the decease of Dr. J. H. BAILEY, well known for his work on the Coleoptera of the Isle of Man.

Transatlantic entomology has suffered a severe loss in the death of the veteran traveller and naturalist W. H. EDWARDS, who passed away at the age of 87. It is well for us to remember that it was the narrative of his early travels on the Amazon that helped to inspire Bates and Wallace to undertake their famous expedition in that region. Those of us who know Edwards's splendid volumes on the Butterflies of North America will, I think, agree that the plates in that work reach a point of excellence that in their way has never been surpassed.

Another veteran on last year's death-roll is the great coleopterist Professor GUSTAV KRAATZ of Berlin. It is pleasant to remember that he was a Fellow of our Society for over thirty years, only resigning after failing eyesight had practically put an end to his active work. He died on November 2nd of last year at the age of 78. We all remember the sympathetic words which fell from his friend, Dr. Karl Jordan, on the occasion of the announcement of his decease to this Society. An appreciative account of his life and work from the pen of Dr. Jordan appears in the current issue of one of the entomological monthlies.

Lastly, we cannot, as naturalists, pass over without notice the death of Professor FRITZ RÖMER, Director of the Frankfurt Museum of Natural History, who died on the 20th of March after a short illness. His services to that Institution were very great, and his admirable personal qualities endeared him not only to his colleagues, but also to all who sought assistance from his wide and varied learning.

It would not be possible for me in the time at my disposal to notice a tenth part of the publications interesting to Entomologists that have appeared during the past year. Important works by Fellows of our own Society are "Mendel's Principles of Heredity," by Professor Bateson, whom we are glad to congratulate on his appointment as Director of the John Innes Horticultural Institution at Merton, and "Charles Darwin and the Origin of Species," by our former President, Professor Poulton. The latter book, issued on the fiftieth

anniversary of the appearance of the "Origin," is a worthy memorial of the three great Darwin commemorations which have lately claimed so much of our attention, and with which the name of our former President, Alfred Russel Wallace, still happily on our list of existing Fellows, is inseparably connected.

Of treatises published abroad, I may perhaps mention Karl Fiebrig's careful investigation of the supposed symbiosis of trees and ants, to be found in the Leipzig *Biologisches Centralblatt*; and Meisenheimer's very remarkable experiments on secondary sexual characters in Lepidoptera, recorded in his *Experimentelle Studien* published by Fischer in Jena.

The past year has been rich in events interesting to all Entomologists. A departure of great importance has been taken by the Colonial Office in the constitution of a Committee for Entomological Research, on which body several of our most distinguished Fellows are serving, and in connection with which responsible posts are held by Mr. G. A. K. Marshall and Mr. S. A. Neave. Under such auspices the enterprise cannot fail to accomplish work of the highest value. In view of the peculiar significance of this undertaking, I shall ask to be allowed to quote some words used elsewhere by me in reference to it:—

"The announcement of the appointment of this Committee will be received with much satisfaction in all quarters where the importance of a scientific basis for administrative and other official action is duly recognised. Among the advances of biological science in the last few years, none has been more remarkable than the discovery that the cause of many diseases whose nature and origin had hitherto escaped detection, was to be sought in the presence of parasitic micro-organisms of various kinds and qualities in the tissues of animals and plants. The part played by insects and ticks in the dissemination of these morbid parasites is now known to be of immense importance, and great efforts have already been made, not without success, to restrict the occurrence of malarial and other disorders by the systematic destruction of the insect-carriers of the organisms concerned. For this purpose it is essential to distinguish with accuracy between various closely-allied species; and it is here that the work of the

skilled entomologist proves its necessity. It was well remarked by Dr. A. E. Shipley, in his recent Presidential Address at Winnipeg to the Zoological Section of the British Association, that 'a few years ago no knowledge could seem so useless to the practical man, no research more futile than that which sought to distinguish between one species of a gnat or tick and another ; yet to-day they knew that that knowledge had rendered it possible to open up Africa and to cut the Panama Canal.' This witness is true ; and it would be difficult to point to a more complete demonstration of the fact that natural knowledge pursued for its own sake, without any direct view to future utility, will often lead to results of the most unexpected kind, and of the very highest practical importance. It is this that justifies the demand that both Governments, and such private individuals as have the means, should do all in their power to encourage the study and pursuit of science as science, without waiting for such applications as may prove to be of commercial or political value. When the benefits to be derived from the scientific treatment of a subject are so manifest as in the present case, even the most indifferent of public bodies can hardly afford to stand aloof ; and it is to be hoped that the activity of the Colonial Office in this direction, begun under the auspices of Mr. Chamberlain, and culminating for the present in the recent action of Lord Crewe, may be taken as an indication that the Government of this country is becoming increasingly alive to the importance of securing the co-operation of scientific authorities in administrative measures. But beyond this, the movement will deserve a still greater welcome if it helps to emphasise the importance of encouraging the pursuit of genuine science, even when no immediate prospect is offered of material results."—*Nature*, Sept. 2, 1909, p. 278.

I take this opportunity of reminding Fellows of this Society of the existence of the Association of Economic Biologists, which deals with subjects of special concern to Entomologists. The Association held a very successful Annual General Meeting at Oxford in July of last year, under the genial presidency of Dr. A. E. Shipley.

But the crowning event for all naturalists, and indeed for all men directly or indirectly interested in Science, has been

the great celebration at Cambridge of the double anniversary of Charles Darwin,—the hundredth of his birth, and the fiftieth of the publication of the “Origin of Species.” I cannot attempt on the present occasion to do even partial justice to the immense interest of the ceremonies that marked that commemoration ;—probably the most important event of the kind that the present generation will witness. I should wish, however, to express my gratification in being permitted to bear a part in it as your accredited representative, and I take this opportunity of putting on record the terms of the Address presented to the University on your behalf. It runs as follows :—

“To the CHANCELLOR, VICE-CHANCELLOR and MEMBERS of the UNIVERSITY OF CAMBRIDGE.

“The Entomological Society of London feels greatly honoured at the invitation to associate itself with the University of Cambridge in celebrating the Centenary of her illustrious alumnus, CHARLES ROBERT DARWIN. In common with all other students of nature, Entomologists recognise in the life and work of Darwin an influence which has transformed for them the whole aspect of their labours. Every department of their field of study has been quickened into fresh life by the genius of the great naturalist whose work received its first direction within the precincts of the University of Cambridge. Insect Systematics, Morphology, Physiology, and Embryology, as pursued at the present day, all owe their significance and their aims to the illuminating doctrine of Natural Selection. The vast subject of Insect Bionomics, which affords one of the most fertile fields at present open for the interpretation of natural phenomena, dates not only its importance but its very existence from the publication of the views which found expression in the ‘Origin of Species.’ The Entomological Society of London points with pride to the fact that, while Entomologists in all parts of the world have found in the career and personality of Charles Darwin at once a stimulus and an example of unrivalled power, many of the researches which, during the past thirty years, have done most to illustrate, confirm and extend the Darwinian views of species-transformation have

been laid before the scientific world by means of the Society's own publications.

“The heartiest congratulations on the occasion of this Centenary Celebration are due and are now offered to the University of Cambridge, as the nursing mother of a man who has revolutionised thought, and whose overmastering influence has made itself felt not only in the sphere of Biological Inquiry, but also in those of Physics, of Politics, and of Philosophy.”

In the composition of the above Address I had the great advantage of the assistance of Professor Poulton, and of one of our former Vice-Presidents, the Rev. F. D. Morice.

I must not omit to mention that another of our ex-Presidents, Lord Walsingham, the recent transfer of whose magnificent collection of microlepidoptera to the National Collection is one of the chief events of the Entomological year, took a prominent part in the proceedings as High Steward of the University of Cambridge.

Certain coming events demand our notice. We are proposing to hold another *Conversazione* next May, when the experience we have gained will no doubt enable us to ensure an even more successful result than on the last occasion. I need hardly impress upon those present the desirability of hearty co-operation towards this end.

It is to be hoped that some of our number will be able to attend the International Zoological Congress to be held at Graz next August. But whether this be so or not, we ought certainly to send a strong contingent to the First International Congress of Entomology, the establishment of which is chiefly due to the tact and energy of our Vice-President, Dr. Karl Jordan. The Congress, as I think we all know, is to be held in Brussels, during the first week of August.

I now turn to the more special portion of my Address, for which I have chosen as a subject,

#### THE PLUME-SCALES OF THE PIERINAE.

The form of scent-distributor most characteristic of the Pierinae is the plume-scale or plumule. This is a chitinous lamina, flat like the ordinary wing-scale, terminating distally

in a row of processes, probably tubular, which may be called the *fimbriae*, and furnished at its proximal extremity with a hollow prolongation or footstalk, connecting it with an accessory disc which articulates with a socket in the membrane of the wing. This form of scale is often comparatively ill-provided with pigment. It occurs under various modifications in nearly every Pierine genus, the exceptions being the *Dis-morphia* group and *Leptosia*; *Colias* with its allied genera, such as *Catopsilia*, *Gonepteryx* and *Terias*; and in addition to these the genera *Prioneris*, *Elodina*, *Metaporis*, *Baltia*, *Phulia*, and *Eucheira*. It is confined to the upper surface of the wings, and to individuals of the male sex. The fact, recognised by Fritz Müller in 1878, that the occurrence of these scales very frequently coincides with the presence of a distinct perfume is strong evidence of their general function as a scent-distributing apparatus, though it is to be observed on the one hand that a characteristic odour may be developed in their absence, and on the other, that they may be present in large numbers without giving rise to any perfume recognisable by the ordinary human perception. It is certain that, in some cases at all events, a scraping of scales from the upper surface of the fresh wing of a male Pierine will emit the characteristic odour of the species, provided that plumules be included; a similar scraping from the underside of the male, or from either surface of the female wing giving a negative result. Any one can easily verify this for himself, as was first pointed out by Weismann, by applying a clean camel-hair brush to a freshly-caught specimen of the "green-veined white" (*Ganoris napi*). It may be remembered that I have shown the possibility of extracting the perfume from the wings containing these scales by steeping them in alcohol. In a series of these alcoholic extracts, which were exhibited at a meeting of this Society, the species from which the preparations were made could be easily recognised by the scent of the extracts alone.

In view of these facts there is little room to doubt that under ordinary circumstances a certain amount of perfume attaches to the plumules themselves, though from their purely chitinous structure it cannot be supposed that they are in any way concerned in its production. This latter is no doubt the

function of specialised cells embedded in the hypodermis of the wing. Cells of this kind, noticed by Weismann in 1878, have been described and figured by Günther under the name of "Drüsenzelle" or "gland-cells," though so far as I am aware they have not yet been observed in direct connection with the plume-scales. The odoriferous secretion, which is possibly of the nature of a volatile oil, must pass in the first instance into the basal disc; thence along the footstalk, which is undoubtedly tubular, into the interior of the lamina or main portion of the scale; and finally into the outer air by way of the array of fimbriae.

The basal appendage, by which the whole scale articulates with its socket in the membrane of the wing, has by some writers been called the "bulb." But it is certainly in most cases a comparatively flat structure like the lamina itself, and I therefore prefer to speak of it as the basal or accessory "disc," or simply as the "disc" without qualification. It is usually furnished with an internal chitinous structure which in many cases bears the appearance of a convoluted tube. There is also apparent in many instances an aperture, generally proximal, by which I suppose the interior of the disc to be put into communication with the secretory apparatus contained in the wing. Connection between the interior of the disc and that of the lamina is provided by means of the pervious footstalk.

The footstalk often shows a sharp S-shaped bend; but it may, at least in the detached scale, be straight. The portion of the basal area of the lamina immediately adjacent to the insertion of the footstalk is usually clear; and, except for a fan-shaped system of faintly-marked streaks radiating from the point of insertion, is apparently structureless; but at a distance from that point, which varies according to the species, a chitinous structure becomes visible. This occupies the interior of the lamina, and frequently presents a more or less scalariform appearance. A longer or shorter region at the distal end of the lamina is again comparatively clear, often exhibiting a longitudinal striation, which may be faint or distinct. It frequently happens that between this striated area and the portion of the lamina exhibiting the scalariform

structure, there is an intermediate region where the markings become crowded and indistinct, the appearance presented being that of a dense accumulation of granules. This is no doubt chiefly due to the presence of pigment, and is especially well seen in certain species of the genera *Ganoris*, *Pinacopteryx*, *Delias* and *Nepheronia*.

The lamina varies much in shape in different groups. From its distal margin, which is usually pointed, but may be rounded or nearly straight, the fimbriae take their origin. These are usually from twenty to thirty in number, and appear to be in direct connection with the chitinous divisions of the lamina indicated by the longitudinal striation above mentioned. It is not easy to say from actual observation whether their distal extremities are open, though their aspect under a high power suggests this; and it would seem to be necessitated by the view here taken of the function of the plume-scale, that the fimbriae should consist essentially of tubular prolongations of the intra-laminar cavity, provided with terminal orifices. That the lamina itself is permeable to fluids can be easily demonstrated by applying moisture in the form of breath to a glass plate on which some of these structures are displayed. Under a moderate power of the microscope it can be seen that the plume-scale readily fills up by capillary attraction, and it is frequently obvious that the invasion of fluid does not proceed uniformly along the lamina, but follows the longitudinal lines marked out with more or less distinctness by the ribbed or scalariform internal chitinous structure of the scale. As the fluid is apt to run more rapidly along some of these lines than along others, the general line of advance tends to be uneven.

This appearance, it may be noted, is not confined to the plume-scale, but is observable also in wing-scales of the ordinary character.

In view of the structural features that have now been described, the interpretation suggests itself that in the most usual form of plume-scale the greater part of the cavity of the lamina is divided more or less completely into longitudinal channels, with or without lateral communications. These channels arise by divergence from that portion of the base of



the lamina where the footstalk is inserted, this giving rise to the fan-shaped appearance already noted. Leaving the base, the channels run more or less parallel with one another towards the distal margin, passing on into the fimbriae, and finally debouching into the atmosphere by means of the terminal orifices of those structures. This may be considered the normal arrangement, but it is liable to considerable modification in certain groups.

The articulation of the plume-scale with its socket in the wing-membrane has been spoken of by some writers as a ball-and-socket joint. This is incorrect; for, as has been seen, the articulating portion of the scale is not a ball or globule, but a flattened disc. The socket for the reception of the disc is usually easily distinguishable from the sockets for the attachment of the ordinary wing-scales by its superior size and by certain other features. The shape of the socket is more or less adapted in conformity with that of the corresponding disc; it does not, however, receive the whole of that structure; a portion, which may be the larger, being left outside the socket.

The distribution of the plume-scales on the surface of the wing is liable to great variation as between different groups. In some instances they are scattered at regular intervals over the greater part of the upper surface of both fore- and hind-wing. In others they are confined to certain areas, within which they may be so numerous as to produce an appearance easily recognisable by the naked eye. But these accumulations of plume-scales in the Pierinae seldom, if ever, become so conspicuous as the "sexual brands" seen for example in *Amauris* or *Euploea*. The scales composing the brands in *Dismorphia* and in certain species of *Colias*, *Terias*, *Catopsilia* and some allied genera are of a different character from the plume-scales. As I hope to deal with these Pierine brands on a future occasion, I will here only remark that they are commonly, though not invariably, so placed as to be closely covered up during rest, often as by a sliding lid. This is no doubt for the purpose of economising the perfume; and it may also here be mentioned that in several of these cases I have detected a special supply of tracheal branches distributed to the brand or scent-patch, suggesting a means by which, when the covering

structure is removed, the escape and evaporation of the odoriferous substance may be assisted. My observations do not enable me to explain the exact mechanism of this process, supposing it to take place. But the special distribution of tracheae to these patches is a fact which can be verified without difficulty, though I believe it is now noticed for the first time.

The plume-scales, on the other hand, even when collected into more or less definite patches, are seldom provided with a cover. The conjecture may be hazarded that their insertion among other scales, usually larger and longer than themselves, may prevent a too rapid dispersal of their odour; it may also perhaps be the case that the disc so often possessed by the plume-scales, but invariably absent from scent-scales of the other type, may act as a reservoir; the scent escaping a little at a time through the comparatively narrow footstalk. The sharp bend so often to be seen in the course of the footstalk may impede the passage of the scent under ordinary circumstances, and if we may proceed a little further along the path of conjecture, we may venture on the hypothesis that the peculiar fluttering about the female, which is a noticeable feature in the courtship of some Pierines, may have the effect of causing a certain erection of the scales, with a consequent straightening of the footstalk, and more plentiful liberation of the perfume. After this digression into the realms of guess-work we will return to the region of sober fact.

When definite "brands" are present, they are, of course, available as an aid in distinguishing the sexes; they have, in fact, long been so employed. But I think it has not been noticed, or at any rate recorded, that in very many instances among the Pierines, even where the plume-scales are scattered over the general surface and are not collected into definite areas, their presence imparts such a peculiar roughened character to the texture of the wing as seen with the naked eye, that the sexes can be distinguished at a glance by this feature alone, without recourse to any other means of recognition.

It was suggested many years ago that the characters of wing-scales might be used for purposes of diagnosis. The suggestion was dismissed by the late Professor Westwood

on the ground that scales of many diverse forms could be found in the same individual. This, of course, is perfectly true; nevertheless the suggestion is not entirely unworthy of notice. There are probably few cases, if any, where a specific diagnosis can be made from the ordinary wing-scales. But it is occasionally possible on an inspection of these structures to pronounce with some confidence on the genus of their possessor. The long spatulate scales of the genus *Pinacopteryx*, for example, can scarcely be mistaken, and the short, rounded scales of *Baltia* and *Phulia* are characteristic.

When, however, the plume-scales are examined, the case is seen to be entirely different. These, speaking generally, are fairly constant within the limits of a species, and often present distinct specific features. Still more striking are the characters exhibited by them which may be called generic. Though there are some remarkable exceptions, it would on the whole be true to say that most of the genera now usually recognised could be defined on the structure of their plume-scales; a circumstance which is satisfactory as tending to show that our Pierine genera are for the most part natural groups. No one who had once seen the plume-scale of any African species of *Mylothris* could ever take it for anything else, nor could he fail to recognise the genus of any other African *Mylothris* whose plume-scale he might meet with afterwards. In this connection it is interesting to observe that the plume-scales of the American species *pyrrha*, *malenka*, *lypera* and *lorena* are of an entirely different type from the African species with which they have been supposed to be congeneric. This is so far confirmatory of the opinion expressed by me many years ago, in agreement with Mr. Trimen, that the affinities of these American species must be sought in another direction; any resemblance between them and the African *Mylothris* being merely superficial. I shall have more to say on this point presently.

There is sometimes a kind of rough relation between the ordinary scales and the plume-scales in the matter of size. The ordinary scales differ much in dimensions, particularly in length, between different species. Elongated plume-scales are frequently found in relation with elongated scales of the

common type. But this is not invariably the case ; it sometimes happens that the plume-scales are conspicuously shorter than the other scales amidst which they are embedded.

Having now briefly discussed the usual appearance and characteristic features of these structures, I propose in the next place to give some account of the various forms assumed by them in the different Pierine genera ; noting incidentally any marked exceptions to the general statements advanced above. For the sake of uniformity I employ the generic names adopted by Dr. Butler in his arrangement of the Pierinae in the National Collection ; these having also been used by me in a paper on Pierine Phylogeny in our "Transactions" of 1894. A few of his identifications have been altered in accordance with the present arrangement in the British Museum.

The Indian and Malayan genus *Ixias* consists of white or yellow butterflies with an orange tip which may be absent in the female. All the species are provided with plume-scales, which with one exception bear a strong family likeness to one another. The exception is *Ixias marianne*, one of the white species, in which the lamina is sharply triangular. In the other forms of *Ixias* the lamina is rather long and narrow, slightly compressed laterally, and somewhat expanded at the base, which tends to be bilobed. *Ixias nola*, the other white species, has a plume-scale which bears a greater resemblance to the yellow forms than to *I. marianne*, though it approaches the latter in the sharpness of its apex. In all the species the disc is moderate in size, oval or circular.

The large orange-tipped butterflies belonging to the genus *Hebomoia* are furnished with plume-scales which are not unlike those of *Ixias*, though much larger. The lamina is long, narrow, and laterally compressed, with an acute apex and rounded base. The footstalk shows a sharp curve ; the disc, moderate in size, is often depressed in the middle, thus becoming concavo-convex or ladle-shaped. The appearances presented by the fimbriae are a little difficult to interpret. Some of them seem to be bifid, especially those towards the base of the apical triangle. Frequently they appear to end in sharp-pointed hooks, which on a change of focus are replaced by well-defined circular dots giving the idea of terminal

orifices. Occasionally they look as if they were enlarged at the distal extremity, but so far as I have been able to observe, this is never actually the case; the appearance resulting either from imperfect focussing or from a twist in a fimbria which is flattened rather than strictly cylindrical. These appearances are specially well-marked in *Hebomoia*, but are also observable in many other genera with greater or less distinctness.

One of the most interesting of Pierine groups is the genus *Teracolus*. This large assemblage falls naturally into subordinate sections, two of which, under the names of *Idmais* and *Callosune*, have occasionally been considered to be worthy of generic rank. These divisions correspond to a great extent with differences in the scent-distributing apparatus. Thus, in the *Idmais* group there are no plumules; *T. fausta*, *T. puellaris*, and the species allied to them being provided instead of plumules with specialised scales of another type, collected into definite "sex-brands."

The plume-scales of the African purple and maroon-tips, *T. phlegyas*, *T. ione*, *T. regina*, *T. hetaera*, and *T. ludoviciae*, are remarkable for the great size of the disc. In other respects they resemble the *Ixias* type, though generally smaller, and with a sharper apex. Scales with discs of very much the same appearance are found in *T. mananhari* and *T. elgonensis*, also in the little group of desert forms constituted by *T. halimede*, *T. heliocaustus* and *T. pleione*. The disc in all these is a very remarkable structure, but still more curious is the form that it assumes in *T. chrysonome* and *T. protomedia*. In these species we find in place of the usual rounded disc a large semi-transparent plate, generally oval or shuttle-shaped, with the axis transverse to the axis of the lamina, and exceeding the breadth of the lamina in measurement. This basal plate has a marginal thickening of chitin, which in *T. protomedia* is beaded. In both cases fine chitinous lines are seen radiating from the centre of the plate. The attachment of the footstalk, as in other cases, is marginal. In taking specimens of these scales, the plates are very apt to become detached; and when I first examined a preparation made from *T. protomedia*, I was for awhile puzzled by the numerous fusiform objects, like delicate silver

fligree basket-work, that were scattered over the slide. In appearance they were so dissimilar from the ordinary disc that their real nature did not suggest itself to me; and it was some time before I discovered, from the accidental occurrence of a lamina with the plate still attached, that they were homologous with the well-known accessory discs of other Pierine plume-scales.

In the crimson-tipped group, *T. annae*, *eupompe*, *dulcis* and *danae*, the disc is moderate-sized or small, contrasting in a marked manner with the corresponding structure in the purple-tips. The shape of the lamina may be described as ovoid with a sharp apex. The base tends to be squared; in *T. eupompe* the lamina is cordate. *T. annae* stands somewhat apart from the rest of the group by the breadth of its lamina in proportion to its length. The sides are parallel and the apex less acute. The scale in *T. danae* is markedly smaller than in the other crimson-tips.

The plume-scales in *T. ephyia* and *T. etrida* are still smaller than those in *T. danae*, but are of similar general character. In a group composed of *T. evippe*, *omphale*, *achine*, *evanthe* and *lais* the disc is large and the footstalk often straight. Together with a strong family resemblance there are minor points of specific difference. *T. antigone* presents a broader scale, with a squared instead of a rounded base. The scale appears to be longer and narrower in the wet-season form than in the dry. *T. niveus* has a scale of the same character; in both of these species the disc is large. It is a curious fact that neither in *T. auxo* nor in *T. incretus* have I been able to discover any plume-scale or corresponding structure; nevertheless, I know from my own observation that *T. auxo* has a distinct and fragrant odour. Both *T. evarne* and *T. phillipsi*, which appear to be nearly related to the species just mentioned, possess plume-scales with small discs, and seemingly scanty in number. It is worth remarking that in *T. incretus*, *phillipsi* and *evenina* many of the orange-pigmented scales of the ordinary kind show a lateral curvature. These curved scales have a rounded distal extremity, with no processes. In *T. subfasciatus* the plume-scale is long, narrow and laterally compressed, as in *Ixias*. The disc is small. A still longer and narrower scale,

with an equally small disc, is that of *T. eris*; the footstalk also in this species is unusually long. *T. agoje*, a noteworthy species in other respects, has a remarkable plume-scale. The lamina is long and narrow with an expanded and rounded base. The disc is large, and in preparations appears to be set at right angles to the lamina. The fimbriae are few—not more than twelve, which is about half the usual number. Ordinary scales with orange pigment, process-less like those of *T. evenina*, etc., occur in *T. agoje*; but no lateral curvature has been detected in them hitherto.

The plume-scale of *Herpaenia eriphia*, as might be expected, is like that of a *Teracolus*. It may be described as a somewhat shortened and thickened version of that of *T. eris*. The footstalk is long, as in that species.

We now come to the genus, or group of genera, known as *Eronia*. With respect to this assemblage it is interesting to observe that its sub-division into *Nepheronia*, *Leuceronia* and *Eronia* proper, which was made on other characters, is entirely borne out by differences in the plume-scales. It would be quite easy to determine from a single specimen of these scales to which of the three genera its possessor belonged, and in many cases it would be possible to pronounce at once upon the species. In *Nepheronia*, which is entirely Eastern in distribution, the plume-scale is characteristically long and narrow, with an extremely sharp apex. In a few species the breadth of the lamina is uniform; in others the lamina tapers more or less gradually from base to apex. In most the base is rounded, in one or two it tends to be squared; in the Moluccan form *N. argolis* it is ogee-shaped. A curious feature in several of the species is a clear area occupying the breadth of the lamina, a little proximal to the apex. Both distally and proximally to this area the lamina is densely granular, giving the appearance of pigmentation. The disc is usually small, in some species very small; but in *N. phocaea* and one or two other of the island forms it is comparatively large. A circular mark is often apparent, which may be the usual proximal orifice of the disc, or may possibly denote the insertion of the footstalk.

A remarkable fact about the scent-scales in *Nepheronia* is

their mode of distribution on the surface of the wing. Though they may, at any rate in some species, be found sparingly on the general surface, they are much more numerous in a certain circumscribed area along the border of the hind-wing; in one or two species they appear to be confined to the costal extremity of this area. Along this marginal region they occur in such abundance as to cause a marked difference in the texture of the wing, making their presence plainly visible to the naked eye, and almost deserving the appellation of a "sex-brand." Mixed with them are found in great abundance scales of a different kind; these are elongated, of the shape of an Indian club, not distally indented, very heavily loaded with dark pigment, and showing especially dark longitudinal streaks. The ordinary scales from the blue portions of the wing are curiously sculptured and apparently unpigmented.

*Nepheronia avatar* differs somewhat from its congeners. Its scent-scales are distributed over the general surface of the wing; they are much smaller than in other *Nepheronias*, and have a correspondingly small disc.

The species of *Leuceronia* are exclusively African. In this, as in the preceding genus, we find the scent-scales densely congregated within definite areas, not, however, to the entire exclusion of other parts of the wing. On a careful examination of the wing-surface in *L. thalassina*, *argia*, *pharis* and *buquetii*, a slight depression or pucker will be seen at the end of the cell of the hind-wing. This depression is usually visible in both sexes; in the male it marks the situation where the plume-scales are most certainly to be found. It is a very curious fact that, so far as my observations extend, the plume-scales in *Leuceronia argia* from Natal and S. Rhodesia (*L. varia* of Trimen) are confined to this situation; whereas in specimens from the West Coast, the Kassai region of the Congo, the River Lualaba, and British E. Africa, they are to be found plentifully distributed over the general surface.

In *L. thalassina* the lamina is somewhat long and thin, with parallel sides and an expanded and rounded base. The whole scale is curiously glassy and translucent; it appears to be entirely devoid of pigment. In *L. argia* the lamina is longer;



the base is still more expanded, and ends in curved lateral processes or cornua, which are more strongly marked in the Western than in the Southern forms, reaching in a specimen from Ashanti a development which approaches that of the next species, *L. pharis*. This last-named butterfly, noteworthy for its superficial resemblance to *Nychitona melusa*, possesses a highly remarkable scent-scale. The lamina is very long, very narrow, and exhibits a greatly expanded and strongly cornuated base, which may be called "half-moon shaped." A collection of these scales examined with a low power reminds one forcibly of a cuneiform inscription thrown into confusion—a kind of "printer's pie."

But perhaps the strangest form of scent-scale to be found in this genus is that of *L. buquetii*, which is very large, of nearly uniform breadth, but slightly narrower towards the greatly blunted apex. The basal corners are slightly rounded, but the whole aspect of the lamina is quadrangular. The chitinous ribbing is very pronounced; a slightly altered arrangement along the central axis produces the effect of a core for about the basal two-thirds of the scale. The fimbriae are unusually short. In all these species of *Leuceronia* the disc is large; extremely so in *L. buquetii*, least so in *L. thalassina*. In *L. argia*, and to a less extent in *L. pharis*, some of the ordinary scales have sharp basal prolongations, giving them, with the footstalk, a three-pronged appearance. It is observable that, as probably would have been guessed from their general appearance, the species of the last two groups that come nearest to each other in respect of their scent-scales are *Nepheronia avatar* on the one hand, and *Leuceronia thalassina* on the other. *L. buquetii* seems to be the most divergent.

The two species of *Eronia* proper, viz. *E. cleodora* and *E. leda*, present a different kind of plume-scale from the preceding. In *E. cleodora* the lamina varies somewhat in breadth, but is always U-shaped, with parallel sides and rounded base. The fimbriae are rather short and tend to be wavy; they may apparently be bifid, and may anastomose. In *Eronia leda* the lamina narrows gradually from base to apex; the base is provided with lateral cornua more or less

pronounced, and the fimbriae, like those of *E. cleodora*, are wavy. The disc in both these species is remarkably small, contrasting strongly with that in the two preceding groups. Another point of difference is that in *Eronia* proper the scent-scales seem to be generally distributed, and not gathered into definite spots.

In Madagascar there occurs a curious form, "*Ptychopteryx*" *lucasi*, the affinities of which are doubtful, though on the whole it seems more nearly allied to the *Eronia* group than to any other assemblage of Pierines. Its plume-scales, which are very numerous, do not give much help towards determining its position, for they may be said to be unique. The lamina is somewhat slug-shaped, expanding proximally. The apex is blunt and the fimbriae short. The base ends in two thin, sharp-pointed cornua, inclined towards one another in the form of a **V**; the points sometimes meet one another, sometimes overlap. Between them the footstalk passes to a large, clear, nearly circular disc. The scale by its general outline, its blunt apex, short fimbriae and unusually large disc, shows points of resemblance to that of *Leuceronia buquetii*; the latter, however, gives no indication of the sharp-pointed, introverted basal cornua which form one of the strangest features of this remarkable structure. The ordinary scales are frequently spatulate, in which respect they bear some resemblance to those of the African genus *Pinacopteryx*, but this correspondence, such as it is, is not borne out by other characters of the two genera.

We come next to *Euchloe*, the genus of the Palaearctic and American orange-tips. In some species the plume-scales appear to be entirely absent; I have found none, for example, in *E. scolymus*, *E. sara*, and *E. euphenoides*. In *E. genutia*, *E. pima*, and *E. eupheno* they are scanty; *E. cardamines* and *E. ausonia* have them in fair numbers, while in *E. creusa*, *E. bellezina* and *E. belemia* they are abundant. The scent-scales of most of the species that possess them resemble each other in general character. A marked feature that they have in common is the small size of the accessory disc; this is especially noticeable in *E. cardamines* and *E. belemia*. In some species the sides of the lamina are parallel or nearly so,

in others they are laterally compressed and diverge distally, in which case the lamina assumes a trumpet-shaped, or rather perhap a goblet-shaped appearance. This is best seen in *Euchloe creusa*; it is also liable to occur in *E. bellezina* and *E. belemia*. The apex is often blunt and rounded; this is especially visible in *E. creusa*; somewhat less so in *E. pima*, *genutia* and *cardamines*. The base is usually rounded, but may be noticeably squared, as in *E. pima*.

The scent-scales in *Euchloe eupheno* are peculiar. The lamina is long and narrow with a very slight bilateral compression. The rounded apex is extremely blunt, and the base is tapering. The fimbriae are short, about 12 in number, and seem to be continued into the scale as chitinous bars; there is no distinct line of demarcation between fimbriae and lamina. The foot-stalk is narrow; the disc appears to be represented by a small ladle-shaped dilatation close to the proximal end of the foot-stalk, the actual termination of the latter being visible as a slight projection from the disc. The conjecture may be hazarded that this is a comparatively early and unspecialised form of plume-scale, presenting points of resemblance to certain hair-scales that occur in other Pierine groups where plume-scales are not developed. Unique within the genus as at first sight it appears to be, in its blunt apex, tapering base and minute disc it is not greatly dissimilar from the corresponding scale in *E. creusa*. I have indeed on one occasion obtained from the latter species a long, trumpet-shaped scale which came very near that of *E. eupheno*. It is, however, just possible that this scale may not have really belonged to the specimen. Why *E. euphenoides*, which so closely resembles *E. eupheno*, should be apparently devoid altogether of these structures it is hard to say; but there are several parallel instances.

*Zegrus* is perhaps scarcely worth separating from *Euchloe*. In *Z. eupheme* I find no scent-scales, unless certain Indian-club shaped, pigmented scales, without either disc or fimbriae, are to be taken as such. *Z. olympia* has a scale of the *Euchloe* pattern, with parallel sides, squared base and small disc. The lamina is proportionately broad, and the fimbriae are short.

The plume-scale of the remarkable Chilian orange-tip,

*Eroessa chilensis*, belongs by its goblet-shaped lamina, with rounded base and minute disc, to the *Euchloe* type. It is perhaps most like the plume-scale of *Euchloe creusa*, but is much larger than that of any *Euchloe* known to me.

The South American genus *Hesperocharis* is provided with plume-scales which also in some respects resemble those of *Euchloe*. The laminae are U-shaped, with parallel sides and a rounded base. The disc is small, in some species tending to be triangular. The laminae show, however, little indication of the goblet form seen in *Eroessa* and some species of *Euchloe*, and they further differ from most species of the latter genus in having a very sharp apex, which contrasts strongly with the blunt and rounded distal margin seen in *Euchloe genutia*, *pima*, *cardamines*, *creusa*, *bellezina* and *eupheno*. They are usually broad in proportion to their length, and vary in size from species to species, *H. marchalii* and *H. erota* marking the extremes among the species known to me, the former being the largest. *Mathania agasicles*, so far as its scent-scales are concerned, is a *Hesperocharis*.

*Daptonura*, another South American genus, suggests by its neuration and some other features a relationship with *Belenois*. This suggestion, however, is not borne out by an examination of the plume-scales. These in *Daptonura* are of an entirely different type from that of *Belenois*, and indeed of nearly every other genus of Pierines. They are abundant in all forms of *Daptonura*, and are of the same character throughout the genus, showing but little difference from species to species. They are more like hairs than scales, being long and narrow, generally club-shaped, and possessing no disc. They taper gradually from the distal extremity towards the base, which ends in a footstalk like that of an ordinary scale. The distal extremity may be either (1) rounded, (2) truncate or slightly excavated, or (3) two-lobed. The fimbriae are few and very short; in no case are they found at the centre of the distal margin, but project only from its sides, occasionally from one side alone. The rounded end in (1), the truncated border or slight concavity of (2) and the inter-lobular notch of (3) are always free from them. No connection is traceable between the fimbriae and the chitinous framework of the scale. In

*D. leucanthe* and *D. lycimnia* the fimbriae seem sometimes to be connected inferiorly with the body of the scale by a transparent triangular membrane. This recalls an appearance occasionally to be seen in veritable hair-scales, which structures the present scales also frequently resemble in being rather heavily charged with pigment. That these curious organs are really scent-scales is made probable by the fact that they are confined to the male sex; but they differ from every other kind of plume-scale known to me in being found on the under as well as the upper side of the wing of their possessor. In this respect they conform to the condition that is often seen in scales that are congregated into definite sexual brands or patches, but is never to be observed, so far as I am aware, in the normal plume-scale.

The African genus *Pinacopteryx* forms a very natural assemblage; in its neuration resembling *Belenois*, but differing widely from that genus in respect of its plume-scales. These are characterised by the expanded, usually rounded bases of their laminae. In the West Coast species *Pinacopteryx cebron* and *P. falkensteini*, especially in the former, the lamina is long and tapering and the base angulated. In *P. falkensteini* the disc is unusually large. The plume-scale of *P. dixei* from Toro is like that of *P. falkensteini*, except that the disc is very much smaller. The forms grouped together as *P. pigea* and *P. astarte*, including Mr. Neave's striking series from N.E. Rhodesia and the Congo, exhibit the same general character of a long, narrow, tapering lamina with a more or less expanded and rounded base, and moderate-sized disc. In *P. orbona* from the West Coast, and a specimen from Toro which is probably to be identified with *P. rubrobasalis*, the base, still rounded, is less expanded, and the lamina less tapering. *P. vidua* has a distinctive scale somewhat of the *pigea* type, but much shorter and rather broader in proportion. The scent-scale in *P. spilleri* is also of the *pigea* type, but with a more expanded base, which shows a tendency to angulation. These structures do not share in the yellow pigmentation of the ordinary scales of this species. A well-defined section of *Pinacopteryx* is formed by *P. doxo*, *P. simana*, *P. charina* and *P. liliana*. The base in these forms is expanded, as in all

other species of the genus, but the expansion is abrupt and the sides of the lamina distal to it are parallel. The shape suggested by the lamina in the first three species is that of a chemist's combustion-tube, short and broad in *P. doxo*, longer and narrower in the other two. The plume-scale of *P. libiana* is quite distinctive, and one of the most curious known to me. The basal expansion is very large and well-rounded, the base itself being usually flattened. The appearance suggested by the outline of the lamina is that of the thin glass flasks used in chemical laboratories. The long axis of the lamina, however, is not straight, but obtuse-angled. This gives the neck of the flask a decided list. At the junction of the neck with the body of the flask is a very conspicuous granular area, oval in shape, dark by transmitted light, and showing a comparatively transparent, roughly circular patch in the middle. The apex of the lamina is sharp. The disc is large, figure-of-eight shaped, and exhibits a clear, round or oval area, which appears to mark the point of attachment of the footstalk. The latter is sharply bent. A small bright point which is usually visible in connection with the clear discal area just mentioned may be an orifice, or may possibly indicate the actual termination of the footstalk. The ordinary scales in *Pinacopteryx* are very frequently spatulate.

The next genus, *Belenois*, has its metropolis in Africa, but outlying forms occur in Southern Asia, the Malayan Islands, and even as far eastward as Fiji. One species stands quite apart from the rest in virtue of the very remarkable character of its plume-scale, which may really be called unique. This is *Belenois gidica*. The lamina in this species is slug-shaped, somewhat broader towards the base. The distal and proximal borders are both rounded, the former more so than the latter. The fimbriae appear to be represented by four or five minute tubercles on the distal border or apex; the footstalk is long, and the disc, in marked contrast to the rest of the genus, very small. The lamina shows a curious sculpturing, looking like a series of short grooves arranged in longitudinal rows. These may possibly be orifices, compensating for the apparent absence of fimbriae; their appearance is somewhat suggestive of the markings on the "battledore scales" of Lycaenids.

Another very remarkable scent-scale is that of the Madagascar species, *Belenois antsianaka*. This is very large; the lamina is somewhat hastate, the sides being convex near the expanded base, concave near the apex. The base shows a tendency towards cornuation, the apex is sharp. The axis of the lamina is occupied by a "core," a mesial streak of the same translucence as the bulk of the scale, with an opaque granular streak on each side of it. At the base of the apical triangle the translucent streak disappears, and the lateral streaks become merged in an opaque granular round or oval mass occupying about half the breadth of the scale at this situation. The chitinous ribbing of the lamina is very prominent; it somewhat resembles the condition obtaining in *Mylothris*. The fimbriae are slightly waved near their attachment. The disc is large; it is chestnut-shaped, and looks dark under transmitted light.

A scale of somewhat similar character, but much smaller, and without the central "core," is met with in *Belenois ianthe* from the West Coast, and *B. solilucis* from the Nyanza region. Modifications of the same type occur in *B. helcida*, *B. hedyle*, *B. calypso* and *B. dentigera*. In these the lateral compression, though present, is much less evident; the chitinous ribbing is in *B. hedyle* especially well-defined, and the lamina in this and some other species tends to be curved about the vertical axis like the blade of a gardener's trowel. The fimbriae in *B. hedyle*, *B. ianthe* and *B. solilucis* have an S-shaped curve, which may be compared to that of a swan's neck. In *B. calypso* they appear as if arising from a fenestrated border instead of an entire margin. The lamina in *B. thysa* is rather long in proportion to its breadth, and the sides are parallel.

The scent-scales of *B. grandidieri* and *B. zochalia* are smaller than the preceding, but otherwise not dissimilar. The lamina in the latter species is often slightly unsymmetrical. In *Belenois severina* the sides of the lamina are nearly parallel and the base somewhat angular. The apex is sharper in specimens from the West Coast than in those from East Africa. In Indian specimens of *B. mesentina* the lamina is broad and the apex acute; African specimens generally have the lamina longer and narrower. The plume-scales of *B. java*,

*B. teutonia* and *B. peristhene* are of the *mesentina* type, those of *B. clarissa* tend to be laterally compressed and somewhat tapering. The disc in all species of *Belenois* except *B. gidica* is large, chestnut-shaped and opaque by transmitted light. It is apparently filled with a closely-packed convoluted chitinous tube.

No plume-scales are discoverable in the genus *Prioneris*. This was noticed many years ago by Watson, and is commented on by Wallace in his valuable paper on the Eastern Pierinae.

In the great Oriental and Australian genus *Delias* we come to an entirely different kind of scent-scale from those already dealt with. The lamina is usually large, and more or less tapering towards the distal extremity. The base is generally rounded, and the apex filiform, having, with the fimbriae, a really plume-like appearance. The sculpturing of the lamina with a moderately high power looks granular; in several species, notably *D. harpalyce*, *D. gabia* and *D. agostina*, the granular arrangement is modified along the course of the axis, giving the idea of a central core. This may be well-defined, as in the first of the species named, or diffused as in *D. aganippe*. The lamina may be called kite-shaped in *D. pyramus*, *D. vinus*, *D. egialea* and other members of the *pyramus* group; pyriform in *D. agostina*; tadpole-shaped in *D. belladonna*. In the *belisama* section the lamina resembles an Indian club reversed; that of *D. indistincta*, from its nearly squared base, is like an elongated champagne-bottle; and similar contours are shown by *D. nysa*, *D. momea*, the *aganippe* and *isse* groups. The scent-scales in these species are mostly very long, in correspondence with the ordinary scales of the wing. They are often abundant, occasionally even seeming to outnumber the ordinary scales, and in common with these latter are, as a rule, easily detached. The disc is usually large, frequently kidney-shaped, and often with the internal chitinous structure especially well-marked. In *D. momea* it is exceptionally small; in *D. aruna* it is cocked-hat shaped. In the *pyramus* group there is generally a sharpish median proximal projection. The scales are long in the *belisama* and *aganippe*, comparatively short in the *isse* assemblage. The *pyramus* section in this respect is intermediate.



There is an important group of *Delias*, consisting of *D. mysis*, *D. argentona*, *D. caeneus*, and *D. eucharis* with the geographical forms *D. stollii*, *hierte* and *hyparete*, which is marked off from the rest of the genus no less by the character of its plume-scales than by its obvious aspect. The laminae in these species possess the common character of a triangle with elongated apex, so that their outline may be compared to that of an inverted funnel or trumpet. In *D. argentona* and *D. hyparete*, the lamina, from its expanded and rounded base, may perhaps more aptly be termed decanter-shaped. The apex in these species, though narrow, is blunt, and not filiform as in the majority of the species of *Delias*. It is often laterally bent, and may be slightly twisted. The fimbriae, which are rather short, are termino-lateral. The scent-scales in all this group are very much smaller than those of most other members of the genus; the discs are large in proportion, generally rounded, and in some species, notably *D. caeneus*, well-displayed in consequence of the straightness of the footstalk.

As regards their scent-scales, *Delias nigrina* and *D. ornytion* are in some ways transitional between the *eucharis* group and the rest of the genus. Like the former, they have a triangular lamina with a prolonged apex; this, however, is acute though not filiform. The lamina is much larger than in the *eucharis* section, but still below the average size of the genus. A curious feature in *D. ornytion* is the frequent presence, on one lobe only of the somewhat cordate base, of a sharp spur looking like a rudimentary form of such a spine as occurs in "*Ptychopteryx*" *lucasii*.

It is perhaps worth noticing that when I was investigating the genus *Delias* from the point of view of colour-patterns, I was inclined to consider *D. nigrina* as a term in the series leading through *D. harpalyce* up to *D. aganippe*. The evidence of the scent-scales, without contradicting this, seems to indicate an approach on the part of *D. nigrina* to the *eucharis* group, as well as to that with which I formerly associated it; and seems also to show that its affinity with *D. ornytion* is closer still.

Next on our list comes the neotropical genus *Pereute*. The

scent-scales of this assemblage are very remarkable. There is a strong family resemblance between them, though the species are easily distinguished. The plume-scale of *Pereute charops* is a fair representative of the genus. The sides of the lamina in this species are parallel or with a very slight lateral compression, expanding somewhat towards the base. The apex is blunt and the fimbriae narrow. The most curious feature in the scale is the prolongation of the base into two long tapering cornua, which are often bent like a pair of mammalian hind-legs. The long, narrow lamina with its cornuated base strongly suggests the egg-case of a skate, commonly known as the "mermaid's purse."

The plume-scale of *Pereute swainsonii* is very like that of *P. charops*, but the basal processes or cornua are still longer and as a rule more wavy and divergent. The scale in *P. callinice* has the same general character, but the lamina is broader at the base and the apical region is comparatively narrow. The apex itself is blunt, and occasionally twisted. In *Pereute leucodrosime* the base is still broader and the lamina tapers more gradually. In other respects there is a close resemblance to *P. callinice*.

It is curious that *P. antodyca*, which is superficially so much like *P. swainsonii*, has a very different kind of scent-scale. The lamina is ovoidal, broader towards the base. The chitinous framework is very distinct, somewhat like that to be found in the genus *Mylothris*. The apex is blunt; the fimbriae short, often wavy or twisted. The base, instead of being furnished with long tapering processes as in *P. swainsonii* and other species of the genus, is prolonged into short cornua shaped like claws or talons. In *Pereute callinira* we get a form intermediate between *P. antodyca* and *P. callinice*; the laminae, which vary somewhat both in length and breadth, have sides more nearly parallel than in *P. callinice*, but still showing a distinct basal expansion. A curious point in this species is the almost invariable asymmetry of the cornua, one being short and claw-shaped, the other generally longer and often angulated, as commonly in *P. swainsonii*. This species also possesses peculiar scales shaped like an Indian club.

The disc in *Pereute* is moderate in size, that of *P. antodyca*

being the largest. Its form varies somewhat according to the species. The footstalk is uniformly narrow.

*Leodonta*, which resembles *Pereute* in neuration, presents us with scent-scales of a similar type to those of that genus. The laminae are, however, shorter, and also broader in proportion. The base is cornuated, but the basal processes are generally less elongated than in the preceding genus. The base is usually asymmetrical, as in *Pereute callinira*. This is least marked in *L. zenobia*, but even in this species one cornu tends to be blunt and the other sharp. The footstalk in *Leodonta* is thin and the disc moderate in size; both of which features are also characteristic of *Pereute*.

Still keeping to the Neotropical Region, we come next to the extensive genus *Catasticta*. Here again, together with specific differences, we meet with considerable family resemblance. The lamina in *C. corcyra*, *C. pieridoides* and *C. toca* resembles that of *Leodonta* in having the base more or less asymmetrically cornuated. In the two former species the likeness to *Leodonta zenobia* is increased by the slight convexity of the laminal sides. The genus is characterised throughout by the comparative thickness of the footstalk; this is a point of distinction from both *Leodonta* and *Pereute*. Another characteristic feature, frequent though not universal, is the extreme breadth of the lamina as compared with its length. Among the species known to me, this is best seen in *Catasticta flisa* and *C. bithys*; it is also marked in *C. bryson* and *C. hegemon*. The lamina in the latter is peculiar. In shape it is like a very broad arrow-head, the barbs being represented by short, blunt cornua. The sides are strongly convex, almost angular; the fimbriae, long and straight, are set on about the distal two-thirds of the nearly straight line which runs from the point of greatest convexity up to the apex. There is no angle, such as exists in nearly every other kind of plume-scale, marking the point at which the fimbriae begin. The lamina in *C. colla* is somewhat similar, but less broad and more regularly cordate. In most of the species of *Catasticta* the base is right-angled; it is often slightly bilobed; seldom rounded off, though this occurs in *Catasticta thersa*, *C. manco*, and one or two others. The sides are nearly always

parallel; they may diverge slightly towards the distal margin, as in *C. clemene*, *C. sisamnis*, *C. semiramis* and *C. chrysolopha*. Rarely they show a slight distal convergence, as in *C. tomyris* and sometimes in *C. corecya*. The lamina in *C. manco* is heavily pigmented.

Two points with regard to the fimbriae in this genus remain to be noted. In *C. flisa*, and to a somewhat less degree in *C. philone*, these distal structures have a beaded appearance, as if furnished with a row of orifices, or perhaps with a scalariform framework. In *C. corecya* they are sometimes plainly bifid, but in *C. chrysolopha* they are arranged in groups, each group with a common stem.

It would not, I think, be surprising if the scent-scales in *Euterpe* were like those in the three preceding genera. As a matter of fact they are very different. The lamina in all species of *Euterpe* is long and narrow, the distal border is straight or very slightly convex, the sides taper more or less gradually into a comparatively stout footstalk, which opens proximally into a moderate-sized disc. Slight specific differences are present; in *E. approximata* the sides of the lamina are nearly parallel, in *E. critias* and *E. rosacea* there is slight lateral compression, in *E. tereas* the lamina tapers gradually into the footstalk, the base being scarcely marked. In *E. negrina* the fimbriae are very short, perhaps barely separated; in *E. rosacea* they are longer than in the rest of the genus. There are some indications of an unequal distribution of scent-scales in at least one species of *Euterpe*, viz. *E. critias*, but I have not at present come upon anything in these species deserving to be called a sex-brand.

The plume-scales in *Leptophobia*, another neotropical genus, form a very natural group, chiefly characterised by the minuteness of the accessory disc. This takes throughout the genus the form of a hardly perceptible expansion of the footstalk; a proximal orifice is apparent in some of the species, e. g. *L. semicaesia* and *L. tenuicornis*. In *Leptophobia penthica* the plume-scales appear to be scanty in the white area of the wing, and abundant in the black. This may also be the case with other species of the genus. The laminae are rather long in proportion to their breadth, though much less

so than in *Euterpe*. The apex is usually rather sharp, especially so in *L. eleone*, *L. tovaria*, *L. semicaesia*, *L. tenuicornis* and *L. caesia*. The sides as a rule are nearly parallel; there is slight lateral compression in *L. eleone*; in *L. aripa* and *L. tovaria* the sides converge slightly towards the apex; in *L. tenuicornis* they diverge slightly towards the base. The fimbriae are fairly long, in *L. penthica* they appear to be unusually broad. The base is well rounded in *L. erinna*, *L. eleone*, *L. semicaesia* and *L. cinerea*; it is slightly cornuated in *L. tovaria*, *L. penthica* and *L. tenuicornis*. The lamina of *L. caesia* is somewhat exceptional in the genus, a little recalling some of those in *Catasticta*. It is triangular, the sides converging towards the apex, which is acute. The base is prolonged into distinct cornua, which may be sharp and almost claw-shaped. The disc, however, is thoroughly characteristic of *Leptophobia*, bearing no resemblance to that of the former genus.

The group of neotropical butterflies to which Dr. Butler restricts the generic name *Pieris*, and which is known to some other authors as *Perrhybris*, falls apart, so far as its scent-scales are concerned, into two very distinct sections. The first of these consists of species allied to *Pieris calydonia*, such as *P. viardi*, *P. locusta* and *P. pylotis*. The second comprises what may be called the *P. buniae* group, including *P. phaloe* and *P. sevata*, as well as one or two forms at present unnamed. In the former division the plume-scales are not unlike those of *Leptophobia*, being moderate in size, with sides more or less parallel. They can, however, be at once distinguished from those of *Leptophobia* by the appearance of the disc, which instead of being represented merely by a slight proximal swelling of the footstalk, is a definite structure generally oval or circular in outline, and attaining in *P. pylotis* considerable relative dimensions. The sides of the lamina converge slightly towards the apex in *Pieris locusta* and *P. apicalis*; in *Pieris tithoreides*, *P. calydonia* and *P. demophile* they show a slight distal divergence. The base is rounded in *P. viardi*, *P. demophile* and *P. calydonia*, squared or angulated in *P. tithoreides*, *P. mandela*, *P. marana* and *P. pylotis*; *P. locusta* and *P. apicalis* possess rudimentary basal cornua. In

*P. viardi*, *pylotis* and *apicalis* the fimbriae are unusually long. The disc in several of the species has an evident proximal orifice; this in *P. apicalis* is exceptionally distinct, and is furnished with a chitinous rim. Some of the ordinary scales in *P. marana* are peculiar, being shaped somewhat like a green fig, and heavily loaded with pigment.

In *Pieris phileta*, more generally known as *P. monuste*, the scent-scales are numerous. They are much like those of *P. tithoreides* and *P. demophile*, but larger. The base is rounded and somewhat narrowed; the sides diverge towards the apex, which is sharp. The disc is small, triangular, and possesses an evident aperture. The fimbriae are rather long, straight and distinct.

Coming now to what I have called the second section of *Pieris*, we find plume-scales of a very different type from those just described. The laminae are exceedingly long and narrow, with a more or less rounded base. The apex is seldom quite so filamentous as in many species of *Delias*, but the general contour and to a great extent the sculpturing of the lamina is strongly reminiscent of that genus. A well-marked point of difference, however, exists in the disc, which in this section of *Pieris* is extremely small. A conspicuous peculiarity of the assemblage now under notice is the localised distribution of the scent-scales on the surface of the wing. If the male of one of these butterflies, say *P. phaloe* or *P. buniae*, be examined, it will be seen, as has indeed been pointed out by Dr. Butler, that the upper surface of both fore- and hind-wing is divided between a smooth and a mealy or roughened area, the difference of texture between the two being on a naked-eye view very like that which is apparent on the wings of male individuals of the genera *Catopsilia* and *Callidryas*. In these species of *Pieris*, however, the roughened area, instead of constituting a kind of border to the wings, occurs in the form of streaks which follow more or less closely the course of the nervures, ending in a tapering extremity as the margin of the wing is approached or reached. These roughened or mealy streaks, which are easily visible to the naked eye, mark the situations where the plume-scales are to be found. Here these structures, which are very easily detached, are so

abundant as frequently to outnumber the scales of the ordinary kind.

In most if not all of the species of this section, the plume-scales are somewhat variable in size and shape, according to their situation; but all are very long and narrow. Scent-scales from the forewing of *Pieris phaloe* have the lamina tapering gradually from the base for about three-quarters of the distance from base to apex; the sides for the last quarter run nearly parallel. The base is rounded, the apex very narrow and acute. The laminae of scales from the hindwing tend to be shorter and broader, but retain the same general character as those from the forewing. In some, the base tends to squareness, and the sides taper uniformly nearly up to the apex. The ordinary scales are also long; especially those from the forewing. They show what is a very common if not universal character in the subfamily; viz. that the distal margin tends to be indented in scales from the upper side of the forewing; smooth in those from the underside of the forewing and both surfaces of the hindwing.

The scales in *P. ausiæ* are scarcely to be distinguished from those of *P. phaloe*; in *P. sevata* they are somewhat shorter and smaller. In *P. buniae* again, the plume-scales are extremely abundant, far outnumbering, in their special situation, the ordinary scales of the wing. They resemble the scales in *P. phaloe*, and, like them, vary somewhat according to the part of the wing from which they are taken. They can, however, be distinguished from those of that species by the fact that the laminae taper more gradually from base to apex, not showing an attenuated distal portion with sides almost parallel. A species of *Pieris* from Lower California hitherto undescribed, presents us with the longest plume-scale, except those of two or three species of *Huphina*, that I have ever yet met with. It tapers gradually from base to apex just like the similar structure in *P. buniae*, from which in fact it only differs by its extraordinary length and narrowness. As in other species of this section, the base is rounded and the disc minute. The mealy streaks of the forewing are richly provided with these remarkable scales; the hindwing, which has no mealy areas, is devoid of them or at least only scantily furnished. The species

which comes nearest to the form just mentioned is apparently *Pieris josepha*. I have been unable to examine the scent-scales of the latter insect, as the specimens at my command are all females. A form of *Pieris*, also undescribed, brought by Dr. G. B. Longstaff from Venezuela, belongs to the present section. Like *P. buniae* and others, it has conspicuous mealy streaks, well-developed on the forewing, and less extensive on the hind-wing.

*Pieris phileta*, otherwise *P. monuste*, shows by its scent-scales no resemblance whatever to the last-mentioned section. On the other hand, its affinity with the first section of the genus, as already stated, appears to be very close. The plume-scale, but for its larger size, might almost be taken for that of *P. tithoreides* or *P. demophile*.

We now come to a group of neotropical species, which on account of their similar venation were ranked by Mr. Butler along with the African species *agathina*, *chloris*, etc., in the genus *Mylothris*. As already mentioned, I had for a long time suspected that the evidence of the venation was in this instance deceptive, and that there was no close affinity between "*Mylothris*" *pyrrha*, *malenka*, etc., and the old-world forms with which they had been associated. Mr. Trimen had expressed a similar opinion, though I was not aware of this at the time. From these considerations, the examination of the scent-scales became especially interesting. Their testimony was clear; the scent-scales of the neotropical species mentioned belong to an entirely different type from that of the African genus *Mylothris*. On the other hand, they are by no means unlike the corresponding structures in what I have called the first section of *Pieris*, and in one or two points show a resemblance to *Catastiota*. If we depended on the evidence of the scent-scales alone, we should unhesitatingly rank *pyrrha* and its associated species with *Pieris locusta*, *mandela*, *apicalis* and *demophile*.

The plume-scales in *M. pyrrha* itself are rather scanty. The lamina is somewhat exceptional in being lance-headed, the sides showing a regular curve instead of an angle. The condition is a little like that seen in *Catastiota hegemon* and *C. colla*, but the scale is not nearly so broad as in those species.



The base is squared and the apex sharp. In *M. malenka* also the scent-scales are scanty. They are like those of *M. pyrrrha*, but narrower in proportion. The apex is still sharper, and makes a distinct angle with each side of the lamina. The disc, which is somewhat smaller in proportion than that of *M. pyrrrha*, has an evident proximal aperture.

In *M. lorena* and *M. lypera* the scent-scales are fairly numerous. They are of the *P. calydonia* and *P. demophile* type. The sides of the lamina in *M. lorena* diverge slightly towards the distal border; the disc is moderate in size, roundish or oval. Among these scales I have found one specimen of a scale presenting a very different appearance. It is large, long and narrow, the proximal two-thirds tapering gradually into a short, wide footstalk, which ends in a small oval disc. The distal border of the lamina is very slightly convex, and the fimbriae are rather short. The scale has very much the appearance of a *Euterpe* plumule, though the lamina is larger and the disc smaller than in any species of that genus known to me. As in all cases of scales unique among their surroundings, the doubt arises as to whether it really belongs to the specimen from which it was taken, or whether it has accidentally found its way there from an extraneous source of origin. *M. lypera* has a scale like that of *M. lorena*, but with the lamina shorter and squarer. The sides are nearly parallel and the fimbriae long and wavy. The scales seem to vary somewhat in breadth. One scale has been observed which is very much larger than the usual form; the sides of the lamina diverge widely from a narrow and somewhat squared base, the distal border is segmental, not angulated, and the fimbriae are much as in the usual form, being long, thick and wavy.

The scent-scales of the African, or true *Mylothris*, are like one another, but like nothing else in the world except perhaps a dice-box or a lady's corset. The lamina in every species shows lateral compression; this is specially well-marked in *M. poppea*, *M. phileris* and *M. agathina*; less so in *M. jacksoni*. The proximal half of the lamina contains about twelve to fourteen prominent chitinous ribs, roughly parallel, and connected laterally with one another by cross-pieces, the whole

forming an irregular reticulum. The central ribs, generally to the number of six, are prolonged through the median constriction of the lamina into the distal portion, where they diverge, afterwards converging slightly towards the distal extremity of the lamina. These chitinous ribs are connected by means of a clear interstitial membrane, which in the distal portion is not interrupted by cross-pieces or other visible structure. The extreme tips of the ribs are free. The disc is clear, usually triangular and apparently bilobed.

It is not easy to bring the structure of these remarkable bodies into relation with that of the usual type of plume-scale. It may however be plausibly conjectured that the chitinous ribs, though comparatively few in number, and somewhat irregular in disposition, are homologous with the similar structures to be observed more or less distinctly in the scent-scales of many other genera. The distal portions of the ribs, or their free extremities, may conceivably correspond more or less exactly with the fimbriae of the ordinary plume-scale, which in many cases appear to be simple prolongations of the intra-laminar ribs. It is worthy of note that among the ordinary scales of most, perhaps all, of the species of African *Mylothris*, some occur of a peculiar shape; being nearly rectangular and provided with sharp proximal spines. These peculiar scales often exhibit a row of distal projections, caused by protrusion of the ribs beyond the general border of the scale. So far as my observations extend, these scales are confined to the male sex. They certainly suggest comparison with the curiously specialised scent-scales of the genus.

With regard to specific differences within the limits of the genus, there is not much to be said. The median constriction of the lamina is very slight in *M. jacksoni*, less slight in *M. bernice* and *M. rubricosta*, moderate in *M. chloris* and *M. rüppellii*, and strongly marked in *M. agathina*, *M. phileris* and *M. poppea*. The base in all the forms is angular rather than rounded; in those species where the constriction is best marked, the proximal portion of the lamina is broadened at the base. *M. poppea* may have indications of basal cornua. The ribs in some species are beaded; this is very

evidently the case in *M. jacksoni*, and may also be seen in *M. rüppellii* and *M. agathina*. The lateral connections between the ribs in the proximal part of the scale are especially prominent in *M. jacksoni*. In *M. rubricosta* the ribs of the distal part, after their original divergence, appear to converge and then again to separate slightly; the interstitial membrane ceasing at the point of nearest approach. The disc, which preserves the same bilobed character throughout the genus, is large in *M. chloris* and *M. agathina*, moderate in *M. rüppellii* and *M. phileris*, small in *M. bernice*, *M. rubricosta*, *M. poppea* and *M. jacksoni*. The scent-scales from one of the transitional forms between *M. chloris* and *M. agathina* bear a closer resemblance to the latter than to the former. Two specimens of "*M. poppea*" show differences in the form of the lamina, one having definite cornua and a less strongly-marked median constriction. Both are from Lower Nigeria. A feature especially well seen in *Mylothris* is the convergence of the ribs of the scent-scales proximally towards the footstalk, presumably to take up the odoriferous substance conveyed by the latter. In scales of the ordinary type, the ribs take throughout a nearly parallel course, with little or no reference to the footstalk. This applies to all genera.

In the genus *Elodina* I have so far failed to find scent-scales. In the species of *Nychitona* from Africa I have been equally unsuccessful, though I have examined many specimens of the different forms to be found in that continent. After this experience, I scarcely expected the Asiatic *Nychitona* to yield any positive result; however, on examining a preparation taken from a specimen of *Nychitona xiphia* captured at Singapore, I was agreeably surprised to find numerous plume-scales of a form different from any that I had previously met with. The lamina of these structures is shaped like the blade of a mason's or bricklayer's trowel; the apex is sharp and the base rounded. The fimbriae are rather long and distinct, the footstalk straight, the disc cylindrical with a proximal orifice.

The Hope Collection possesses a co-type of the large *Nychitona* captured by Wallace in Celebes, and described by him as *Pontia dione*. Scent-scales from this specimen are of the same general character as those of *N. xiphia*, but the

lamina is much broader. The fimbriae are rather long and distinct; the footstalk is straight, terminating in a cylindrical disc with a minute proximal orifice. The base of the lamina is rounded; almost semicircular. The scent-scales in this specimen are not numerous.

We now come to the large group of Pierines in which the anal valves of the male are furnished with a conspicuous tuft of hairs. This peculiarity was first brought into notice by Mr. A. R. Wallace, who founded upon it his genus *Tachyris*. At the present time it has been found convenient to subdivide Wallace's genus; and the generic or subgeneric names *Glutophrissa*, *Phrissura*, *Appias*, *Saletara*, *Hyposcritia*, and *Catophaga*, in addition to *Tachyris*, are all in use. It may be doubted whether each of these sections, though the arrangement is serviceable in practice, forms a perfectly natural group; I much question, for example, whether there is any good distinction between *Glutophrissa* and many species of *Phrissura*; while two or three forms of the latter genus appear to stand apart from the rest. *Tachyris* again, even as at present restricted, is not homogeneous; the *celestina* group being somewhat sharply marked off from that assemblage of species that centres round *Tachyris hippo*.

The genus or subgenus *Glutophrissa* is common to Africa and South America with the West Indies; *Phrissura* is African and Oriental; the remaining genera are Oriental and Australian. *Glutophrissa* in America consists of several subspecies or local races which may all be ranked under the general head of *G. drusilla*. Similarly, the African species, *Glutophrissa saba*, occurs under somewhat different forms in different parts of the Ethiopian province, including Madagascar.

In *Glutophrissa drusilla* from Guatemala the scent-scales are numerous. The sides of the lamina are parallel; the apex moderately sharp; the base rounded at the corners. The fimbriae are distinct; the footstalk often bent; the disc somewhat elongated and furnished with an orifice. In a specimen from Brazil, the lamina is generally a little longer in proportion to its breadth than in the individual just described from Central America.

In *Glutophrissa saba* the scent-scales are much like those

of the American species. The lamina, however, is broader in proportion and the apex somewhat blunter. The base is less rounded, and has a well-marked clear area. The fimbriae, somewhat shorter than in *G. drusilla*, are distinct; the disc moderate in size and cylindrical.

The plumules of *Phrissura lasti*, which are numerous, are much like those of *Glutophrissa*. The lamina is longer in proportion than in *G. saba*, bearing in this respect a greater resemblance to the American species. The disc, as in the forms above described, is moderate in size and cylindrical.

*Phrissura sylvia* has fairly numerous scent-scales. They are not unlike those of *P. lasti*, but broader in proportion. The fimbriae show a lyriform arrangement at the apex of the lamina; this is also visible in *P. lasti*, to some extent in *G. saba*, and occasionally in *G. drusilla*.

The scent-scales in *Phrissura phaola* and *P. nagare* are of a somewhat different character from those in the rest of the genus. In *P. phaola* they vary a little in breadth, but are always slightly goblet-shaped; with the base rounded, the sides diverging slightly towards the distal aspect, and a well-defined clear area at the base. The fimbriae are very short; the footstalk is usually bent; the disc is large and oval, showing often a distinct proximal aperture.

*Phrissura nagare* has plumules like the last, but generally broader. The base of the lamina is less rounded and somewhat tapering; the basal clear area is less well-defined. The sides, as before, diverge distally; the fimbriae are not quite so short. The disc is large, and may be oval or spheroidal.

*Phrissura aegis* from the Philippines presents us with a scent-scale having a long, narrow lamina, with slight lateral compression and rounded base. There is a well-defined clear basal area; the fimbriae are long, the disc small and oval. The scale is not much like that of an African *Phrissura*, but rather recalls that of a *Tachyris* of the *hippo* group.

In *Appias libythea* the sides of the lamina are nearly parallel; the base almost squared, or with a slight indication of cornua. The disc is oval, moderately large, and generally shows a very distinct orifice, not always terminal. The lamina in *Appias zelmira* is a little shorter and broader than in its congener.

The sides are slightly convex, usually converging towards the apex, which is sharp. The fimbriae are rather short; the base has its angles slightly rounded off. The disc is spheroidal or chestnut-shaped.

In both species of *Saletara* the scent-scales are numerous. They are small; in *S. panda* markedly smaller than the ordinary scales. The laminae in *S. liberia* are somewhat variable in length and breadth; they are usually constricted in the middle, and are occasionally goblet-shaped. The fimbriae are distinct; the base well rounded; the disc small, narrowly conical, and proximally truncated. *S. panda* has plumules similarly variable in shape; like the last they show a median constriction and a well-rounded base. The disc again is small, almost linear, and presents a similar proximal truncation.

We now come to a group of these brush-tailed Pierines, the members of which possess certain obvious characters in common. This is the group to which Mr. Wallace's original generic name of *Tachyris* is still applied. It appears to fall into two sections, the first of which consists of *Tachyris celestina*, *clementina*, *placidia*, *zarinda* and *nero*. The mutual affinity of these forms is borne out on an examination of their scent-scales, as regards both their structure and their distribution. The most noticeable characteristic of the assemblage from this point of view is the large size and usually pyriform outline of the disc. Another remarkable feature is the difference in the shape and size of the scale, and in the relative proportion of its several parts, according to the region of the wing from which it comes.

Thus, on the forewing of *Tachyris celestina* ♂, the plumescules, which are not numerous, somewhat resemble those of *Appias libythea*, having the sides parallel or with a very slight distal convergence; the fimbriae straight and rather short; the base squared, with a bare indication of cornua. The disc is moderate in size and pear-shaped. But if the hindwing be carefully examined, a patch will be observed about half-way along the inner margin, which is distinguished by its paler colour from the general blue tint of the upper surface. This patch is practically a "sex-brand." It contains

in great abundance plume-scales of a very different character from those sparsely distributed over the forewing. These "brand-scales," as they may be called, have a lamina which is sagittate or hastate, the sides converging regularly from base to apex. The laminae vary somewhat in length and breadth, but the apex is always sharp and the basal cornua distinct. The fimbriae are rather short, generally straight, but with a sharp curve near the distal termination. These laminae are considerably larger than those of the forewing, but the most remarkable thing about the brand-scales is the enormous size, both relative and absolute, of the accessory disc. This is sometimes quite half the size of the lamina itself; it is pear-shaped, occasionally with a distinct narrow proximal prolongation. There is an evident proximal aperture, and the internal chitinous tubing is distinct. The footstalk is straight and rather wide. A feature to be found, as above noted, in very many species, is here well-marked; viz. that the ordinary scales from the forewing tend to be dentated distally, whereas in those from the hindwing the distal margin is usually smooth.

In *Tachyris clementina* there is less difference than in the preceding species between the scales of the sex-brand and those of the general surface. The latter on the forewing are scanty; larger than the corresponding scales in *T. celestina*; the lamina is cordate, with sides curving convexly from base to apex; the apex is sharp; the base has no distinct cornua; the moderately large disc is provided with a proximal aperture. *T. clementina* possesses a sex-brand on the hindwing like that of *T. celestina*. The plumules in this situation are abundant, the laminae are cordate, with the apex prolonged and very sharp. The basal cornua are strongly developed; the disc is large, pyriform, with proximal aperture. Under a low power and by transmitted light the disc looks dark in comparison with the lamina; this is probably due to its well-marked internal system of chitinous tubing.

The forewing of *Tachyris placidia* contains numerous scent-scales; these are large, subcordate and broad. The cornua are remarkable, being very long and tapering; they are often waved, and are turned inwards so as almost or quite to meet

each other, and frequently to obscure the disc. This is large and chestnut-shaped. A similar brand to that seen in *T. celestina* and *T. clementina* exists in *Tachyris placidia*, but in this case it is dark instead of pale. The plume-scales here are again numerous, and not unlike those of *T. celestina* from the corresponding situation. They are sagittate, tapering from base to apex; the cornua are here far less marked than in the scales from the forewing—a quite exceptional arrangement. The disc is very large, with an evident internal chitinous tubing; it is pyriform or flask-shaped with proximal aperture. The fimbriation is sometimes unsymmetrical, being continued further down from the apex on one side than on the other.

*Tachyris zarinda* possesses on its forewing an array of scent-scales somewhat resembling those of *T. celestina*; and, like them, not very numerous. The laminae are somewhat broader than in that species; the sides show a very slight distal convergence; the base is nearly square, and the disc is moderate in size, oval or triangular. There is no very evident scent-patch on the hindwings; but scales from the position occupied by the patch in other species of *Tachyris* have laminae that are cordate with a sharp apex, like those of *T. celestina* and other forms just described. They are, however, generally broader and show less indication of cornua. The disc is large, though not so large as in the preceding species; it is chestnut-shaped, has a slight proximal projection, and usually a very distinct proximal orifice.

In *Tachyris nero* there is less difference between the scent-scales of fore- and hindwing than we find in the allied forms above mentioned. The scales from the forewing are like those of *T. zarinda*, but their laminae have parallel sides and rounded bases. The apex is less sharp than in *T. zarinda*, and the disc is smaller. Scent-scales in the situation of the brand are not numerous; the laminae are broader than in those from the fore-wing, and there is a slight indication of cornua. The apex is sharper, though again less sharp than in *T. zarinda* and other allied forms, and the sides are nearly parallel until the fimbriae begin. The disc is pyriform and only moderately large.



The scent-scales in *Tachyris domitia*, the form representing *T. nero* in the Philippines, are not unlike those of *T. nero*, but show in some respects a transition from that species towards *T. zarinda*. Thus, in scales from both fore- and hindwing the base of the lamina exhibits indications of cornua; in scales from the latter region the apex is prolonged, and the sides of the lamina appear to converge slightly towards the distal margin. The disc, which is elongated and pyriform, approaches *T. nero* rather than *T. zarinda*. In the hindwing the elongation of the disc is often extreme.

With *Tachyris hippo* we enter upon a new section, characterised by scent-scales with long, narrow laminae and minute accessory discs. There is no definite sex-brand like those in *T. celestina* and its immediate allies, but there are usually slight differences to be observed between the scales from the fore- and hindwing respectively.

In *T. hippo* itself, the scales from the forewing have the lamina elongated, with sides tapering very slightly towards the apex. The base shows a tendency to cornuation; the fimbriae are long and wavy; the disc elongated and very small. The scent-scales from the hindwing are somewhat larger; moreover the sides of the lamina do not converge, but show a slight median compression. In other respects they resemble those from the forewing.

In *Tachyris ada* I have not found scent-scales. In *T. nephele* they occur, but not abundantly. They are of quite the same character as in *T. hippo*; the laminae in those from the hindwing are rather longer and narrower than in the rest, and their sides are perhaps more nearly parallel.

The plume-scales in *T. hombronii* clearly belong to the *hippo* group. As in those of the preceding species, the lamina is long, rectangular, with sides very nearly parallel; the base slightly cornuated, and the disc very small, almost linear. The scales from the hindwing vary somewhat in breadth, but are generally broader than those from the forewing.

The scent-scales of the *hippo* group recall those of "*Phrisura*" *aegis*, except for the rounded base of the latter. They may also be looked upon as an enlarged and elongated version of the scales in *Saletara liberia* and *S. panda*.

In *Hyposcritia lalage* the laminae are rather short, broad, and laterally compressed. The base is rounded; the disc small, oval or circular, and rather thickly loaded with chitinous tubing. On the hindwing the laminae are somewhat shorter, the sides more nearly parallel, and the base more rounded.

Certain specimens from Manipur, which I have been accustomed to consider as a dry-season form of *H. lalage*, show such differences in respect of their scent-scales as to suggest that they must be specifically distinct. In *H. lalage* the scent-scales are scanty everywhere; the laminae show a tendency to hour-glass compression; the discs are elongated and translucent. In the "dry-season" form referred to the scent-scales are abundant in the forewing; the laminae are long, with parallel sides; the disc is circular and opaque.

*Hyposcritia lagela* has on the forewing scent-scales which vary a little in shape, but generally recall those of the genus *Saletara*. They are, however, larger than in that genus, and the disc is differently shaped and larger in proportion. Lateral compression is well-marked, the base is rounded, the disc is circular and provided with a strongly-developed chitinous internal structure. On the hindwing the scent-scales are again variable, but usually larger than on the forewing. Some resemble those of the forewing; others are cordate in outline, and but for the small size of their discs would recall those from the forewing of *T. clementina*. Perhaps on the whole they are, though considerably larger, most like the scent-scales of *Appias zelmira*. A curious plume-scale, with sides straight and slightly diverging and no disc, has been observed in a preparation made from this species.

The scales in *H. indra* are rather variable, but on the whole they closely resemble those of the forewing of *H. lagela*.

The scent-scales in *H. pandione* from Java are like those of *H. lalage*. The disc is smallish, circular, and opaque. The scent-scales in *H. leptis*, also from Java, are like those of the "dry-season" form described under *H. lalage*.

*Hyposcritia plana* from Borneo has scent-scales like those of *H. leptis*, but with the lamina a little shorter and broader. The sides are very nearly parallel, the base is slightly rounded. The disc is generally circular, and has the appearance, common

in *Hyposcritia*, of great brightness by reflected, combined with opacity by transmitted light. It is occasionally notched, or otherwise irregular in outline. On the hindwing the lamina is usually longer.

The scent-scales in *Catophaga* are not widely different from those in *Hyposcritia*. A specimen of *Catophaga paulina* from Ceylon has the sides of the lamina parallel, the base slightly rounded, the disc moderate in size and oval. In a specimen from Bengal the lamina is broader, the sides slightly convergent towards the apex, the disc small and elongated. *Catophaga agave* shows on the forewing a rather small plume-scale; the sides of the lamina are laterally compressed, the base rounded, the disc small and oval. On the hindwing the scent-scales are similar in shape, but longer.

In *Catophaga melania* the lateral compression is better marked, and the base shows signs of cornutation. The disc, as before, is small and rather narrowly oval.

*Udaiana cynis* has a scent-scale which is very much like that of a *Catophaga* or a *Hyposcritia*. The lamina shows a lateral compression, the proximal being broader than the distal dilatation. The base is rounded, the disc rather small, circular or oval.

We now come to the well-marked genus *Huphina*, Oriental and Australian in distribution, which offers in many of its members so curious a parallelism in aspect with forms of the genus *Delias*. A comparison of the scent-scales shows that the resemblances between the genera are more than superficial. The scent-scales in *Huphina* at once recall those of *Delias*, from which they can scarcely be distinguished except by the comparative smallness of their accessory discs. Their likeness also to the *phaloe* group of *Pieris* is remarkable. A characteristic feature of the special scales in *Huphina* is their great relative abundance. In this respect likewise they resemble both *Delias* and the *phaloe* section of *Pieris*.

*Huphina boisduvaliana* presents a scale with lamina of the elongated pear-shape so frequently met with in the two genera just mentioned. The base is rounded; the disc small, circular or triangular. On the hindwing the special scales are similar, but the lamina is broader at the base and a little

shorter. The lamina in *Huphina pitys* is elongated and cordate, the sides tapering more abruptly than in the last species. The disc is small and circular, looking dark from the enclosed chitinous tubing. On the hindwing the special scales are similar, but broader at the base. The plume-scales in *H. wallaceana* are obclavate, less broad at the base than in the two preceding species, and tapering much more gradually. *H. quadricolor* has plume-scales of much the same character, but a little smaller. In *H. agnata* we meet with a scale which may be called triangular with elongated apex. The disc, as before, is small.

The scent-scales in *Huphina nerissa* are extremely abundant, apparently outnumbering those of the ordinary form. The laminae are very long, obclavate, tapering gradually up to the distal extremity; the disc is small and circular. In *H. lea*, again, the scent-scales appear to preponderate over the others. They are slightly shorter than in *H. nerissa*, and the lamina is a little broader at the base; hence the tapering is more abrupt than in that species. The condition in *H. nadina* is much the same, the scent-scales being very numerous, with laminae shaped like an elongated racquet. They are, however, somewhat shorter than is usual in this genus.

The scent-scales in *Huphina naomi* and *H. judith* resemble those in *H. lea*; the scales from the hindwing being generally, though not invariably, a little shorter and broader than those from the forewing. In *H. olga* and *H. aspasia* they are enormously long on the forewing, tapering gradually to the apex from a rounded base; on the hindwing they tend, as before, to somewhat greater breadth and shortness. The disc in these species, though still small, is larger than in the otherwise similar forms of *Pieris*.

*Huphina periclea*, *H. scyllara*, *H. remba*, *H. andersonii*, *H. julia* and *H. eperia* form a group in which the scent-scales all display, in slightly varying amount, an elongated pyriform outline like that seen in *H. boisduvaliana* and *H. pitys*. The scent-scales in *H. abnormis* are exceptional in the genus, being relatively very small, with the laminae laterally compressed, and not tapering to a point. They have, however, the rounded base and small circular disc characteristic of *Huphina*.

In the Central Asian genus *Metaporis* I have so far failed to find plume-scales of any description.

In the genus *Ganoris* we have *G. rapae*, *G. napi*, and the allied forms, with scent-scales similar to one another though specifically distinct. *G. brassicae*, with its geographical races, stands somewhat apart from the rest in this as in other particulars. The lamina of *G. brassicae* is very long, cordate with distinct cornua, the sides tapering gradually towards the narrow distal extremity, which is squared, not pointed, and furnished with fimbriae which are long, filiform and irregularly disposed, forming a sort of tangle. The plumule in *G. wollastoni* is scarcely to be distinguished from the preceding, but that of *G. cheiranthi* tends to be somewhat longer, and also thicker towards the apex.

The plume-scale of *Ganoris rapae* is well known. Its lamina is strongly cordate, with the distal portion elongated. The basal cornua are strongly marked, and the apex is sharp. The chitinous sculpturing is elaborate, consisting of longitudinal bars with frequent lateral connections. The bars, which follow roughly the contour of the lamina, converge towards the apex, forming an irregularly granular area at about a third of the distance from the apex to the base. The portion distal to the granular area is almost clear, but marked with fine longitudinal and parallel lines, probably corresponding to the fimbriae. The disc is moderate in size and nearly circular. The scent-scale in *G. canidia* much resembles this, but the narrowing of the lamina towards the apex is more abrupt, the sides of the distal portion being parallel. The cornua are more pronounced than in *G. rapae*. The scent-scale of *G. napi* resembles the last, but the lamina is somewhat larger, and has the cordate form still more distinctly marked, the sides of the proximal portion showing a strong convexity. The cornua are broad, blunt and very pronounced; they are generally turned inwards towards the middle line. The axes of the distal and proximal parts of the lamina are in these three species usually inclined to one another at an angle. The scales, both ordinary and special, of *Ganoris canidia* and *G. napi* suggest those of some forms of *Pinacopteryx*. The ordinary scales of *Ganoris brassicae* are very different from any of these, being very long,

narrow and straight-sided, showing no sign of spatulation. In every species of *Ganoris* known to me, but especially in *G. brassicae*, the scent-scales are abundant.

The plumule of *Ganoris crucivora* is much like that of *G. rapae*; those of *G. oleracea*, *G. melete* and *G. ajaka* are more of the *napi* type. *G. oleracea* is remarkable in having the cornua ending in sharp spines, which give a perfectly distinctive appearance to the plumule of that species. A certain approach to this condition is seen in *G. ajaka*, where many of the plumules have a rudimentary spine on one or both cornua. Forms included under the name of *G. melete* have scent-scales showing differences which may be specific. One such form has accessory discs which are enormously large in proportion to the laminae.

With respect to their scent-scales, the members of the genus *Synchloe* show a strong resemblance to many forms of *Euchloe*. The laminae, for instance, in *S. chloridice* are strikingly like those of *Euchloe creusa*, exhibiting a similar expansion towards the blunted distal margin. The discs in both genera are small, and circular or oval. *Synchloe hellica* and *S. johnstonii* have plume-scales of the like character, while those of *S. glauconome* differ chiefly by the sharpness of their apex. The laminae in *S. daplidice* vary considerably in breadth; they bear much resemblance to those of *E. ausonia* and *E. belemia*, having like them a somewhat short apex. In both genera, *Euchloe* and *Synchloe*, the laminae are characterised by a well-marked longitudinal ribbing, which is in obvious relation with the fimbriae.

The genera *Baltia* and *Phulia* appear to be devoid of plume-scales. Their ordinary scales are peculiar, being unusually short and broad; in which respect they are in some degree resembled by those of the genus *Tatochila*.

The scent-scales of this latter genus are not altogether dissimilar from those of *Synchloe*, though generally very much larger. They show interesting specific differences; the lamina, which is basally squared in *T. stigmadice* and rounded in *T. xanthodice*, being shaped like the blade of a mason's trowel in *T. theodice*, and having convex sides in *T. autodice*.

In *Pontia soracta* the plume-scales, which are very numerous,

are broadly goblet-shaped. The base is slightly rounded, the distal margin segmentally arched, not angulated. The fimbriae are short, waved and discrete. The scales vary somewhat in breadth and in other particulars. This is also the case with *P. crataegi*, where however the sides are usually parallel and the base rounded. The apex is sharp, as often in *Tatochila*, and the fimbriae resemble in character those of *P. soracta*.

The scent-scales in *Neophasia menapia* are found with difficulty, being to all appearance very scanty. They are peculiar in aspect, long and narrow, with the sides nearly parallel and the base sloping away into a footstalk which terminates in a slight expansion representing the accessory disc. In one of these scales the distal extremity is rounded, and a central tuft of very short fimbriae occupies about half of the distal margin; in another, the distal extremity has a distinct apex provided with very short fimbriae along its whole extent. The aspect recalls that of the narrower plume-scales in *Synchloe daphidice*, where also the fimbriae may be very short.

One of the most interesting members of the Pierine subfamily is the gregarious nest-making butterfly *Eucheira socialis*. This insect disappoints expectation by providing nothing in the way of scent-scales which might help in determining its affinities. If such structures exist, I have so far been unable to find them.

With *Eucheira* we may end our present survey of the Pierine subfamily. It now remains to notice some of the general results that the consideration of the Pierine plume-scales enables us to reach.

In the first place, it is obvious that inasmuch as the occurrence of these structures within the subfamily is not universal, we may make a rough division of the Pierines into those that possess them and those that do not. Such a division, however, though good in logic, would not by itself form an accurate basis for zoological classification. It would, for example, not only separate the *Idmais* group of *Teracolus* from the bulk of that genus, for which doubtless there is something to be said, but it would throw the African species of *Nyctitona* into one section and the Asiatic species into the other; besides intro-

ducing a similar division into such genera as *Tachyris*, *Euchloe*, *Synchloe*, and *Teracolus* proper itself. Facts such as these prove that too much dependence must not be placed on the presence or absence of the plume-scales as evidence of affinity. Nevertheless, it is quite certain that, if conducted with due discrimination, the examination of the occurrence, and still more the character, of these organs is capable of giving valuable assistance in the way of confirming or correcting the conclusions arrived at from other sources.

Thus, we have seen that the genus *Daptonura* is shown by the unique character of its plume-scales to be really a natural group; and on the same evidence we must pause before we consider it to be so nearly allied to *Belenois* as on the strength of other characters we might be tempted to suppose. Again, no assemblage could be more clearly marked out as closely related among its own members, and isolated from all other forms, than is the African section of *Mylothris* by its very peculiar scent-scales. On the like evidence we perceive that the resemblance borne to the African by the American species of that genus in the matter of neuration is merely superficial; and that the true affinities of the so-called American *Mylothris* are with a certain section of another genus, the so-called *Pieris*, inhabiting the same zoological region with itself.

The obvious resemblance between such forms as *Euchloe cardamines* ♀ and *Synchloe daphidice* suggests that in spite of certain differences in neuration these two genera must be closely allied. This suggestion is quite borne out by the characters of their respective scent-scales; and a further examination of the same structures indicates that there is no very near relationship between *Synchloe* and the groups represented by *Ganoris rapae*, *napi* and *brassicae*.

It has already been pointed out that the three recognised sections of *Eronia*, viz. *Nepheronia*, *Leuceronia*, and *Eronia* proper, are easily distinguishable by their scent-scales; a kind of bridge between the first two sections being afforded by *Nepheronia avatar* and *Leuceronia thalassina*. In this, as in many other Pierine assemblages, it is noticeable that specific distinctions between the plume-scales, though nearly always present and recognisable, are often very slight; that the



passage, in fact, from race to race and from species to species is commonly a gradual one. On the other hand, we do from time to time meet with cases that may come under the head of discontinuity; thus, while the scent-scales from the West African form of *Leuceronia argia* show very slight variation in structure from those of the Southern race or subspecies, the distribution of these scales on the surface of the wing is completely different in the two forms. On the other hand, the scent-scales in *Leuceronia buquetii* and in *Belenois gidica*, considered in relation to their congeners, may be said to be discontinuous in form though not in distribution. The sporadic cases of absence of scent-scales in the midst of genera usually possessing them, for instance *Teracolus auxo* and *T. incretus*, also apparently *Tachyris ada*, may likewise be accounted as instances of discontinuity.

In the genus *Pereute* the scent-scales constitute a fairly continuous series. But it is to be observed that if the species of *Pereute* were arranged according to the character of their scent-scales, the arrangement would not coincide with that founded upon the modifications of the colour-pattern. Thus, the plume-scale of *P. swainsonii* is very like that of *P. callinice*, but that of *P. antodyca* is quite different. *P. swainsonii* and *P. antodyca* are, however, like one another in general aspect, and unlike *P. callinice*. If we had only the scent-scales of the two former species to go upon, we should say, "here is discontinuity"; but another species, *P. callinira*, though discontinuous in aspect, supplies a link in the matter of scent-scales. Many reasons might be adduced in explanation of this phenomenon, which after all is only one instance of a principle constantly to be met with in all taxonomic investigation. One feature in the case may here be noticed: there can be little or no doubt that mimicry in one form or another has exercised a disturbing influence on the general aspect of the species of *Pereute*. From this influence the scent-scales must be free; and they are therefore, wherever this and similar factors are concerned, likely to be more trustworthy guides than the general aspect to the true affinities of the species.

*Pereute swainsonii* and *P. antodyca*, though so near to one

another in general aspect, can be distinguished at a glance, as we have just seen, by the character of their scent-scales ; and this serves to illustrate the usefulness of these structures as aids in specific diagnosis. I have found them, for instance, of great service in distinguishing between the extreme dry-season forms of some tropical species of Pierines. These may sometimes resemble each other so closely in general aspect as to baffle even the experienced naturalist. Another interesting case is the following—A rather worn and battered Pierine was brought from Mexico, and pronounced by competent authorities to be probably a *Ganoris*. The occurrence of a member of this genus in such a locality would be, to say the least, remarkable ; and I thought it desirable to submit the specimen to a careful examination. The microscopic inspection of a few scales showed me at once that the butterfly was neither a *Ganoris* nor a *Synchloe*, but a *Leptophobia*. A similar test proves the very curious South American form *Mathania agasicles* to be practically a *Hesperocharis*.

In some instances, as in the two *Pereutes* lately mentioned, the examination of a single scent-scale from each would be sufficient to separate the species ; but this would not always be the case. Just as in the use of the ordinary methods of diagnosis one may sometimes doubt about a single specimen, but find one's difficulties removed if a series is available, so with the scent-scales. And in measuring, or otherwise estimating, the average character of the scent-scales in a given preparation, we have the advantage of knowing that they all come from a single individual ; whereas we cannot always be certain that a supposed series of a species is really homogeneous. It is of course a limitation to this method of diagnosis that the scent-scales belong only to the male sex. This is a limitation shared to a very great extent by diagnosis from the genitalia ; but it is largely counterbalanced in the case of the scent-scales by the ease with which the examination can be made, by the facts that no special mode of preparation is necessary, and that the requisite material can be obtained without in the least interfering with the natural appearance of the specimen ; also by the further fact that few specimens are so badly preserved as not to afford ample scope for this kind of investigation.

We have seen that the evidence of the scent-scales demonstrates that the assemblage known in some arrangements as *Mylothris* is heterogeneous. We have observed also that the same is true of the South American genus called by Dr. Butler *Pieris*, and perhaps more usually known as *Perrhybris*. It has further been pointed out above that examination of the scent-scales suggests modification of the existing subdivisions of the old genus *Appias* or *Tachyris*. Thus, part of *Phrissura* seems indistinguishable from *Glutophrissa*; while another part, consisting of the Eastern species, is probably more nearly allied to the *hippo* section of *Tachyris*; a third part standing at a little distance from the rest. But the use of the scent-scales in suggesting differences between the members of assemblages supposed to be homogeneous is not confined to genera or subgenera. It can be carried into the domain of reputed species, and is of avail in the discrimination of subspecies or local races. An instance of this is afforded by two forms of *Ganoris* from the Far East, which, following Mr. Leech, I have been accustomed to rank together under the head of *G. melete*. But the differences between their plume-scales are so marked that, as stated in a previous part of this address, the question must be raised whether they are not specifically distinct. It will be recalled that there appears to be an appreciable, though slight, difference in respect of the scent-scales between African and Indian specimens of *Belenois mesentina*, while in addition to a small variation in form there is a marked difference in distribution of the scent-scales between the two geographical races of *Leuceronia argia*.

The question may fairly be asked whether any light is thrown by these means on Pierine phylogeny, and whether any conclusions emerge as to the developmental history of the plume-scales themselves. To such questions only a guarded answer can be given. Plume-scales, as is well known, are not confined to the Pierines, but are found in Nymphalines and Satyrines<sup>2</sup> as well. Pierines are in some respects more ancestral than either of the other groups, and it may be that the origin of the plume-scales is to be sought among the subjects now before us, rather than among the groups which have not been

dealt with on the present occasion. Certainly there exist among the Pierines, as we have seen, structures which bear the appearance of ordinary scales just beginning to take on the special features of plume-scales. Such may be seen in *Euchloe*, *Euterpe*, *Neophasia* and elsewhere. The accessory disc appears to be a form of specialisation characteristic of the Pierinae, and it is natural to conjecture that those Pierine forms in which the disc is absent or ill-developed are the earlier. But it is not always easy to determine whether apparent simplicity of structure is ancestral or the result of degradation; and it would be hazardous in the extreme to pronounce, for instance, that the feeble development of the disc in *Leptophobia* is an indication of high antiquity in that genus. At the same time, I venture to think that in both *Euchloe* and *Neophasia* we have early Pierine genera, the ancestral condition of which is in some sort represented by their plume-scales. The apparent absence of these structures from such presumably early genera as *Eucheira* and *Metaporis* is noteworthy; embryological investigation might possibly determine whether in these genera they ever existed. The remarkable scale of the African *Mylothris*, so often mentioned, is comparatively simple; but I am inclined to consider its simplicity as due rather to specialisation than to the persistence of ancestral conditions. It is obvious that we have here touched upon a subject that calls for much fuller investigation.

I should wish, before concluding, to put in a word of caution. The nature of the facts dealt with in the present address is such that it has not been possible to avoid a certain appearance of dogmatism. No one can feel more strongly than I do that dogmatism is, as a rule, out of place in science; and I do not wish my statements to be taken as more than the nearest approach to truth that I have been able to make after a long-continued investigation. I am quite sensible that my results ought to be checked by other observers; and that some, perhaps many, of them will require subsequent modification. In several instances I have had to depend on the examination of single individuals, and it has not been possible for me to be sure that these examples were truly represent-

ative of their species. When I have spoken of the scent-scales as absent, it may simply be that I have been unable to find them ; when they have appeared to be scanty, it may be that the particular specimen examined has happened to have lost them ; and other sources of error may very easily exist. Nevertheless, I may be permitted to feel with some degree of confidence that much of what I have put before you is both new and true, and that a path of research has been opened which may be followed up with good hope of both interesting and valuable results.



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TRANSACTIONS  
OF THE  
ENTOMOLOGICAL SOCIETY  
OF  
LONDON  
FOR THE YEAR 1909.

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- I. *On the Larvae of Hamanumida daedalus*, Fab., *Hoplitis phyllocampa*, n. sp., and *Eulophonotus myrmeleon*, Feld.; with descriptions of the Imagines of the two Heterocera. By ROLAND TRIMEN, M.A., F.R.S.

[Read October 7th, 1908.]

PLATE I.

I OWE to the kindness of my friend and correspondent for many years, Mr. Alfred D. Millar, of Durban, Natal, the interesting lepidopterous material here dealt with.

The hitherto unrecorded larva and the ♂ imago of the little known Cossid moth *Eulophonotus myrmeleon* were discovered by Mr. A. D. Millar himself at Durban; the ♂ imago being so strikingly dissimilar from the ♀ in its very small size and perfectly transparent wings that, unless they had been taken paired, it may well be doubted whether even a practised lepidopterist would have discerned them to be the sexes of the same species.

The other two larvae here described, viz.: those of *Hamanumida daedalus* and of *Hoplitis phyllocampa*, n. sp., are the discoveries, at Malvern, near Durban, of Mr. H. M. Millar, brother of Mr. A. D. Millar, and are of high interest as exhibiting—each in quite different fashion—a close protective resemblance to the leaves of their common food-plant. The concealment afforded by this resemblance may perhaps account in part for the long

delay in finding the larva of one of the most generally distributed of Tropical-African butterflies; and it is worthy of note that the discovery has occurred at what appears to be the extreme southern limit of the range of the species, viz. the Coast of Natal, where the butterfly is by no means common. The *Hamanumida* presents a method of protective resemblance for long well known in the case of the allied Indian genera *Adolias* (*Euthalia*) and *Symphædra*, and more recently in that of the related African genus *Euphædra*; but the larva of the Notodontid *Hoplitis phyllocampa*, n. sp., offers an entirely distinct mode of concealment, effected by a special adaptation of the combined three hinder abdominal segments—held erect and reversed in the attitude so characteristic of many Notodontid larva—in direct imitation of the leaf of the food-plant.

### Family NYMPHALIDÆ.

#### Sub-family NYMPHALINÆ.

#### LARVA of *Hamanumida daedalus* (Fab.), Plate I, fig. 1.

Length 1 in. 5 lin.; width generally  $2\frac{1}{2}$  lin., but head and first thoracic segment and anal segment only 2 lin.

Head unarmed; but on each succeeding segment, except first thoracic and anal segments, a latero-dorsal pair of long horizontally-projecting spines (10 pairs in all), tapering to a point and closely clothed with rather long fine bristles—which become shorter and sparser near tip. The first pair of these spines is directed forwards so as to obscure the outline of the first thoracic segment and of the head; the second and third pairs incline somewhat forward; the fourth, fifth, and sixth are nearly at right angles with the body; but the seventh, eighth, and ninth are increasingly inclined backward, and the tenth decidedly so. All the spines are about 4 lin. in length.

Along medio-dorsal line, a little anterior to bases of each pair of spines (except first, second, and tenth pairs), are two small elongate black spots rather widely apart from each other.

As regards colouring, the example under notice has suffered discoloration in formalin, being of a dull greenish-brown, whereas Mr. Millar describes it in life as “green, with a yellow stripe down middle of back.” The spines, however, retain much more green than the body, and their bristles are blackish or white in about equal numbers.

This larva is very similar to those of two West-African species of *Euphaedra*, vid. *E. ravola* (Hewits.), and (probably) either *E. janetta*, Butl., or *E. xypete* (Hewits.), figured by Aurivillius,\* but is somewhat intermediate, having the narrower head and first thoracic segment shown in fig. 3, but the longer and more plumose latero-dorsal spines of fig. 4. The spines are, however, more tapering and acuminate than shown in either of the figures cited, and do not bear the single very long terminal bristle which is so marked a feature in both figures. Except for its very much shorter latero-dorsal spines, the larva of *H. daedalus* nearly approaches in structure, as well as in colouring, the larva of the well-known Indian Nymphaline, *Adolias* (*Euthalia*) *garuda*, Moore, as depicted by Hardwicke,† and it also very much resembles the profile figure of the larva of *A.* (*E.*) *vasanta*, Moore,‡ though wanting the yellow rays emitted at right angles by the median dorsal stripe which are shown in that figure.

De Nicéville's description in the footnote § of the Indian *Garuda* larva might have been written of the Natalian *H. daedalus* larva, as shown by Mr. Millar's descriptive notes and photograph of the latter at rest on a leaf of its food-plant, *Combretum guienzii*, Sond.||

It is satisfactory to find the recognized affinity of *Euphaedra* and *Hamanumida* in the imago state confirmed by the discovery of the larva of the latter now admitting a comparison of the earlier stages of these two genera; and much interest attaches to the great similarity existing between the larvae of these exclusively African genera and those of the strictly Oriental genus *Euthalia*.¶

\* Ent. Tidskr., 1894, t. 5, ff. 3, 4.

† Horsfield and Moore, Cat. Lep. E.I.C. Mus. I, Pl. VI, f. 2 (1857).

‡ Lep. Ceylon, I, Pl. 17, f. 2a.

§ "The larvae of *Symphædra* and *Euthalia* are similarly formed, and are among the most peculiar and interesting in butterflies. I have often found that of *E. garuda* at rest in the middle of a mango leaf, in which position it is very difficult to see, though its form is so remarkable; its body, with the pale dorsal line, answers to the midrib of the leaf, while the lateral branched spines pass for the other veins of the leaf on which it is resting, forming a remarkable instance of protective coloration, structure, and habit combined."—De Nicéville, Butt. India, etc., II, p. 192 (1886).

|| Food-plant determined by Mr. J. Medley Wood, of Durban, Natal.

¶ The likeness between the earlier stages in *Euphaedra* and *Euthalia* is noted by Aurivillius (Rhop. Aethiop., p. 500, 1899).

I am unable to give a complete description of the pupa of *H. daedalus*; but from a note and some outline sketches, and also an empty pupal skin, sent to me by Mr. Millar, it is clear that it is considerably more slender than that of *Euphaedra*, and quite devoid of the great widening and projection laterally, as well as dorsal acuminate elevation, of the 4th abdominal segment so marked in the known pupae of that genus,\* and reaching a far greater development in the pupae of *Euthalia*.† The cephalic prominences are short but acute, and closer together than shown in the figures quoted of the two genera just mentioned. In profile the dorsal median outline is moderately elevated, arched, and ridged on thorax and abdomen. The length of the pupa-skin is 11 lines. The colouring is given by Mr. Millar as "pale-green, with a creamy streak down middle of back, and another round margin of wing-covers"; and he also notes that the pupal state, assumed on June 2nd, lasted until July 10th, 1907.

The larva was discovered at Malvern, near Durban, Natal, by Mr. H. M. Millar, brother of A. D. Millar.‡

## FAMILY NOTODONTIDAE.

### Genus HOPLITIS, Hübn.

*Hoplitis phyllocampa*, n. sp. Plate I, fig. 2 (♂), fig. 2a (♀).

*Exp. al.* 2 in. 3 lin. (one ♂, one ♀).

♂. *Fore-wing.* A moderate-sized basal patch, a rather broad inner-marginal border from base to beyond middle, and a conspicuous rather broad costal border from before middle to apex, all

\* Aurivillius, *l.c.*, t. 5, ff. 3a, 3b, pupa of *E. ravola*; ff. 5, 5a, pupa of *E. aureola*.

† Moore, *l.c.*, t. VI, ff. 1a, pupa of *A. (E.) aconthea*; 2a, pupa of *A. (E.) garuda*.

‡ In his account of Lieut. A. Schultze's collection of Lepidoptera made in Camaroon, Bornu, etc., Aurivillius (*Arkiv. för Zool.*, bd. 2, n. 12, p. 7, 1905) gives a note by that observer that at Yola, on the Benue River, he found a young greenish-white larva with long white-plumed lateral spines, that rested flat on the leaf of its food-plant ("*Combretaceae*"), and that he thought was probably the larva either of a *Euphaedra* or of *Humanumida daedalus*. The brief description of the young larva, together with the mention of its Combretaceous food-plant, incline one to the opinion that it belonged to *H. daedalus*.



greyish-white; the costal border considerably whiter than the other markings, and bounded costally anterior to its abrupt origin and thence inferiorly along its whole length to apex by wide dark-brown clouding which gradually pales into the grey tint of the discal and hind-marginal area; neuration not defined on the greyish-white markings, but elsewhere black, except for some whitish-discal scaling on the median nervules; basal patch with two transverse irregular black streaks, and bounded externally by a third; a submarginal irregularly-undulated whitish-grey streak, outwardly very finely and distinctly black-edged, but inwardly very indistinctly edged with dark-grey (except on and near inner-margin, where the dark edging is much widened); cilia brownish-grey with conspicuous white interruptions at extremities of nervules. *Hind-wing*: pure white; a slight fuscous edging on costa near apex; a well-marked triangular fuscous spot on hind-marginal edge, between first median nervule and submedian nervure, preceded by a very much smaller less distinct fuscous spot; inner-marginal border densely clothed and fringed with white hairs; cilia white, except for a fuscous interruption next to hind-marginal spot.

UNDERSIDE white. *Fore-wing*: three brownish spots on costal edge between middle and apex, and some ill-defined apical brownish clouding; cilia as on upperside. *Hind-wing*: markings as on upperside, but hind-marginal spots fainter, the smaller one obsolescent.

*Head* black, with two frontal short tufts of cream-coloured hairs; stem of antennae superiorly bright-red throughout, and with a small short tuft of bright-red hairs at its base,—the pectinations dark-brown superiorly but ochreous-yellow inferiorly. *Thorax* greyish-white with a short black median streak superiorly next to head. *Abdomen* white, with a broad black median dorsal band on basal third, but towards apex grey with two superior half-rings of brown.

♀. *Fore-wing*: darker, the basal and inner-marginal border and the upper portion of costal border considerably obscured with brownish; cilia less conspicuous, the nervular interruptions being smaller and yellowish-white. *Hind-wing*: a broad brownish-fuscous hind-marginal border, wider at apex, encloses the larger hind-marginal black spot but not the smaller anterior spot; cilia fuscous, whitish-tipped. UNDERSIDE.—*Fore-wing*: a submarginal brownish-fuscous band, broader apically and becoming macular inferiorly. *Hind-wing*: brownish-fuscous border as on upperside. Head, thorax, and abdomen as in ♂; and the antennae-stem superiorly, as well as the basi-antennal tuft, of the same bright-red.

LARVA. (Description of specimen preserved in formalin)  
Pl. I, figs. 2b, 2c.

Total length 3 in.

Head large, rounded; about 3 lin. both in vertical and transverse diameters.

First thoracic segment not much larger than head, superiorly flattened almost horizontally but forming a slight elevated ridge immediately behind head; second segment considerably and third very much larger than head.

Abdominal segments 1-3 all larger and thicker than thoracic ones, and also than the three next succeeding abdominal ones;—the first abdominal segment with a moderate median conical dorsal elevation, surmounted by a small smooth mammillated wart. Abdominal segments 7-9 greatly modified in form, being not only larger and thicker than the three next preceding ones, but having their lateral margins widely produced so as to constitute a large common expansion, more than 1 in. long and nearly  $\frac{3}{4}$  in. broad in widest part, thinning off to a leaf-like edge. No anal pro-legs, but possible rudiments of them in the shape of two very small minutely granulated ferruginous ridges. On flattened ventral surface this unified group of the last three segments presents the appearance of a sub-ovate acuminate leaf with irregularly flexed and sinuated margins, a median elevated longitudinal stripe of paler tint representing the midrib, and six pairs of slightly depressed transverse streaks, together with two similar basal but longitudinal ones, the branching veins; the whole surface being moreover finely pitted in resemblance to the stomata of a leaf. The humped back of the 8th segment bears at apex three minute mammillated warts, and the extremity of the anal segment two more prominent and acute warts.

General colour throughout a bright pale yellowish-green, apparently without markings.\* Head brownish-red, widely reticulated with ferruginous lines; mandibles reddish-yellow with conspicuous black extremities. Legs reddish-yellow with rusty-black terminal claw; pro-legs mixed greenish and ferruginous. On almost horizontal ridged front of first thoracic segment, immediately above head, two widely-apart elevated ferruginous spots, in position and

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\* This is the case in the specimen under description, but in Mr. Millar's photographs of the living larva there appears a general close minute speckling of paler dots on a darker ground (looking not unlike the granulation in *Smerinthus* larvae); and there is also, in the photographs which show a considerable part of the dorsal aspect, a very distinct and broad pale longitudinal median band beginning on second abdominal segment. Possibly the photographs represent a larva not in the final moult. See Pl. I, figs. 2d, 2e.

eye-suggesting effect not unlike the correspondingly situated black spots in the larva of *Cerura vinula*.

The Imago is allied to *H. postica* (Walk.), a native of Natal and the Transvaal, but easily distinguished by its conspicuous grayish-white costal and inner-marginal borders in the fore-wing, and generally much lighter and brighter colouring, as well as by the bright red stem of the antennae, which in *N. postica* is pale arenaceous.

There is, however, in the British Museum an unnamed ♂ of a much closer congener, from "Coomassie (*H. Whiteside*)," which also has the antennae-stems red (though paler than in *H. phyllocampa*), but in which the field of the fore-wing is white, with scarcely a vestige of the dark-brown clouding, while there is a rather large fuscous spot in the discoidal cell near its extremity.\*

A comparison of the Larva with Boisduval's description and figures † of that of *H. milhauseri* (Fab.), a well-known species of wide Palaearctic range, affords several points of agreement in the two caterpillars, *vid.*:—(1) the bright pale yellowish-green of the general colouring, (2) rufous head, (3) rufous spot on each side of anterior upper edge of first thoracic segment, (4) position on first abdominal segment of principal dorsal process, and (5) profile outline of elevated seventh, eighth, and ninth abdominal segments, especially dorsal prominence of eighth segment with its mammillated apex. But the differences are great, the *H. phyllocampa* larva presenting no approach to the long forked dorsal process occupying the first abdominal segment, nor any trace of the curved claw-like dorsal processes which succeed it on second, third, and fourth

\* Prof. Aurivillius (*Arkiv. för Zoologi*, II, No. 12, p. 27, 1905) notes a Notodontid larva from Camaroon, and gives an illustration reproducing the sketch of it made by the discoverer, Lieut. A. Schultze. The profile and back views given are so very like the larva of *H. phyllocampa*, that I think it not improbably may prove to be the larva of the closely-allied *Hoplitis* above mentioned as a native of Coomassie. It is noticeable that the profile sketch of the Camaroon larva shows a much higher and larger prominence dorsally on first abdominal segment than the larva of *H. phyllocampa* possesses, and that it represents a very erect attitude of the entire fore-part anterior to the third abdominal segment—which does not appear (from Mr. Millar's photographs) to be assumed by the Natal larva—and a corresponding very much less recurved and indeed not far from perpendicular carriage of the expanded hind segments.

† Boisduv., Rambur, and Graslin:—"Collect. Iconogr. et Hist. des Chenilles d'Europe," Pseudobomb., Pl. III, ff. 1, 2 (1832).

segments; neither does it possess the conspicuous reddish-creamy lateral band on abdominal segments 3-6 exhibited by *milhauseri*. On the other hand, the *milhauseri* larva possesses no indication of the leaf-like expansion of the abdominal segments 7-9 which is so very striking a feature of the *phyllocampa* larva.

When this leaf-like expansion is recurved over the back—an attitude which Mr. Millar writes is assumed when the larva is disturbed and also maintained when it is at rest—its extremity reaches so far forward as to cover the third abdominal segment. The reversed ventral surface thus exposed most successfully simulates in its contour, unevenly sinuated edges, and prominent venation, the leaf of its food-plant, *Combretum gueinzii*, Sond., and must largely screen the larva from detection, especially when the point of view is directly behind and rather below it.

A portion of the earthen cell in which this larva pupates has been sent to me by Mr. Millar; it is rather solidly and compactly made of minute particles of arenaceous soil cemented together, the interior surface being thickly and smoothly lined with the cementing secretion.

The larva was discovered at Malvern, near Durban, by Mr. H. M. Millar; the ♀ imago above described emerged on February 2nd, and the ♂ on October 16th, 1907.

## Family COSSIDAE.

### Genus EULOPHONOTUS, Felder.

Allied to *Zeuzera*, Latr. *Head* small, hairy; eyes prominent; antennae rather short, in ♂ bipectinate from base to about half their length but thence simple, in ♀ simple throughout and very slender.

*Thorax* in ♂ large, broad, prominently prolonged anteriorly, densely clothed with short hairs, in ♀ much smaller and shorter in proportion, only slightly prominent anteriorly, clothed with very dense but longer hair.

*Fore-wings* much prolonged apically, the apex itself more acute in the ♀: radial (discoidal) nervure wanting, but its nervules originating from a common point,—the upper one angulated upward to join disco-cellular nervule, and the lower one angulated downward to join third median nervule; in ♂, the costal nervure and the subcostal nervure, with its first, second, and third branches are

much crowded together on costal margin. *Hind-wings* very small and short, but in the ♀ larger than in the ♂, and much more prominent apically; costa prominent before middle, but with an abrupt downward flexure just above extremity of discoidal cell; costal nervure not traceable, apparently atrophied; subcostal nervure arched upward in conformity with costal outline, so that discoidal cell is very broad. *Legs* rather long, the femora and tibiae hairy, the tarsi long and smooth.

*Abdomen* of moderate length in ♂, stout, blunt at extremity, hairy laterally and sparsely tufted at tips; much larger in ♀, with a median dorsal series of conspicuous dense tufts of terminally widened and flattened bristles, and with a very large sub-globose anal cushion of closely packed short hair, sparsely interspersed with some much longer hair.

In naming this genus Dr. Felder gave no diagnosis, but figured the type, as *Eulophonotus myrmeleon* (Reise der Novara, Lepid., Heft IV, p. 4, t. lxxxii, f. 9, 1874), from a single ♀ sent to him by me in 1867. I am therefore glad to have the opportunity of defining the features of both sexes, and of pointing out that, while not unlike *Zeuzera* in some respects (and exceedingly like in the *larva* stage), *Eulophonotus* is well distinguished by its widely differing neuration; the radial nervure, so greatly and remarkably developed in *Zeuzera*, being absent in both fore-wing and hind-wing, and the costal nervure in the hind-wing (also robustly developed in *Zeuzera*) being aborted, while the subcostal nervure is unusually strong, and arched upwards in accordance with the prominence of the costa. In both sexes the hind-wings are considerably smaller and shorter in proportion than they are in *Zeuzera*, but this reduction is less marked in the ♀. The abdomen is smaller than it is in *Zeuzera*: in the ♂, too, it is tufted at the extremity; while in the ♀ it exhibits not only a dorsal series of long dense tufts of remiform rigid bristles, but also the peculiar character of a very large rounded anal expansion of extremely dense short silky hair, resembling that exhibited by various ♀♀ of the remote family *Liparidae*. The extraordinary disparity between the sexes as regards size, and the striking dissimilarity of the pellucid almost scaleless wings of the ♂ to the black closely vitreous-spotted ones of the ♀, contribute to emphasize the distinctness of *Eulophonotus* as a decidedly aberrant genus of *Cossidae*.

*Eulophonotus myrmoleon*, Felder, Reise der Novara, Lepid., Heft IV, p. 4, t. lxxxii, f. 9 [♀] (1874.)

*Exp. al.* (♂) 1" 3''; (♀) 2" 1½''. Plate I, fig. 3 (♂), fig. 3a (♀).

♂. *Wings almost wholly hyaline.* *Fore-wing*: a very few black scales along costal margin, and a narrow edging of dense black scaling along inner margin. *Hind-wing*: a densely scaled black edging along costa, broad at base and narrowing to a point a little beyond extremity of discoidal cell; anal-angular and inner-marginal area also black with intermixed greyish hairs. Neuration yellowish, with some sparse black scales. Underside the same.

*Head*, palpi, and antennae dark brown. *Thorax* yellowish-brown above, but fuscous in front, on sides, and beneath; *legs* brown, the femora densely tufted with mixed greyish and yellowish hair. *Abdomen* black above and on sides, yellowish-grey beneath, tufted with short bristly black hairs laterally, and with long ones at extremity.

♀. *Wings black; the fore-wing with numerous irregularly grouped small hyaline spots, most prevalent in discal area.* *Fore-wing*: on costal margin, from base to middle, 6 separate short hyaline marks of varying width; below these, in discoidal cell, a series of 6 minute spots in pairs; below median nervure 3 sub-basal larger and more elongate spots; the numerous irregularly placed discal and submarginal spots form little clusters most diverse in the number and size of their respective components; immediately beyond the outermost of these succeeds a more regular series of seven little groups situated along hind-marginal edge; an inwardly oblique ante-median rather wide irregular space from subcostal to sub-median nervure is without spots, and so is a narrower outwardly oblique sub-apical space from costa to near middle of hind-margin. *Hind-wing*: black duller, shading into greyish-fuscous outwardly, unspotted; costa with a rather narrow shining silvery-grey border from base as far as the abrupt downward flexure. **UNDERSIDE** like the upperside, except that in *fore-wing* the inner margin is shining fuscous-grey below submedian nervure, and in *hind-wing* the costal border is not silvery-grey but dull fuscous like rest of wing.

*Head*, palpi, and antennae black. *Thorax* above has been almost denuded in the specimen under description (but in Felder's figure of the type example is shown as very densely clothed with mixed fuscous and yellowish-grey hair); it retains some rather long intermixed thin grey and terminally thickened black hairs in front and laterally; beneath, also, there are remains of similar hairy clothing; *legs* black, the femora and tibiae densely tufted with hairs similarly mingled. *Abdomen* has been denuded laterally, but retains along

median dorsal line a series of dense tufts of long erect remiform black bristles; anal expansion large, rounded, with a dense felting of short silky yellowish hair, tightly compressed into successive transverse rings, and interspersed rather sparsely with fuscous hair, more developed dorsally than ventrally.

LARVA.—Plate I, fig. 3b. Cylindrical, thick. Head large, protuberant, smooth; first thoracic segment very large, bearing dorsally a large nearly semicircular smooth horny plate, with the anterior edge almost straight and the lateral and posterior margin strongly curved,—the middle of the latter being finely tuberculated; spiracles on this segment and on the eighth abdominal segment much larger, and those on the first abdominal segment rather larger than the rest; second thoracic segment considerably larger than any of the succeeding segments. Thoracic legs well developed, rather long, the extremities very acute; abdominal pro-legs short, the anal pair more prominent and close together. General colouring the usual dull yellowish-whitish of wood-boring larvae, with the head, prothoracic dorsal shield, and anal segment reddish-brown. A series of raised fuscous spots on each side of back, arranged obliquely in pairs (each posterior spot of a pair considerably larger than the anterior one) and becoming gradually more elevated and distinctly tuberculous on each segment towards the hind extremity; a lateral series of similar rather smaller spots arranged vertically in pairs—each pair consisting of a supra-spiracular spot and an infra-spiracular one; and an inferior-lateral series of minute single fuscous spots, one just above each leg. Length  $1\frac{1}{2}$  in.

Described from a single specimen (from its size almost certainly a ♀) in spirit. Mr. Millar writes that it was found tunnelling in the wood of a tree known as the “Natal Mahogany” (*Trichilia emetica*, Vahl.); it was about an inch and half below the bark, and its tunnel was eight inches in length.

PUPA.—(Empty skin only;—evidently that of a ♀.) Very like that of *Zeuzera aesculi*. Towards the anterior part of each abdominal segment is a slender roughened horny transverse ridge encircling the segment except for a rather wide ventral gap; and towards the hind part of each of the fourth, fifth, and sixth segments a similar but shorter transverse ridge confined to the dorsal region; the sites of the second, third, and fourth pairs of larval pro-legs are also marked by small similar but semicircular roughened ridges, and that of the anal rudimentary pair is indicated by two small roughened tubercles.

Mr. Millar found this empty pupa-skin projecting from the bark of the tree above mentioned immediately below

the freshly emerged ♀ *E. myrmeleon* here described, which was paired with the transparent-winged previously unknown ♂; this was on November 6th, 1907.

Felder (*loc. cit.*, p. 4) gave "Cape of Good Hope" as the *habitat* of the type specimen (♀) of this moth which I sent to him, but my distinct impression is that I received it in a small collection made at Port Natal. I have, however, lately seen in the British Museum a ♀ labelled "Kowie River,"—a locality situated on the eastern coast of Cape Colony.

There is also in the British Museum a ♂ *Eulophonotus*, which though larger than *E. myrmeleon* seems closely allied; it bears the locality label of "Gold Coast."

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#### EXPLANATION OF PLATE I.

[See *Explanation facing the PLATE.*]



II. *Descriptions of Micro-Lepidoptera from Bolivia and Peru.* By E. MEYRICK, B.A., F.R.S.

[Read November 18th, 1908.]

IN the following paper seven genera and fifty-three species from the highlands of Bolivia and Peru are described as new. The altitudes of the localities quoted are stated as under, viz.:

Pozuzo, Peru . . . . .	2,500 feet.
El Porvenir, Peru . . . . .	3,000 feet.
Aqualani, Peru . . . . .	9,000 feet.
Songo, Bolivia . . . . .	6,500 feet.
Chulumani, Bolivia . . . . .	6,500 feet.

The examples described are in my own collection.

PTEROPHORIDAE.

*Utuca prometopa*, n. sp.

♂ ♀. 25-32 mm. Head whitish-ochreous, laterally tinged with reddish-brown, with a strong conical horny frontal prominence clothed with a very long conical tuft of scales ( $3\frac{1}{2}$ ). Palpi long, ochreous-whitish irrorated with reddish-fuscous except towards apex. Antennae ochreous-whitish lined with fuscous. Thorax ochreous-whitish irrorated with reddish-fuscous. Abdomen whitish-ochreous more or less tinged or mixed with reddish-fuscous, with a lateral white streak edged beneath with reddish-fuscous. Legs reddish-fuscous, all tarsi white, anterior and middle tibiae white above. Fore-wings cleft to  $\frac{5}{8}$ , first segment narrow, acute, second very broad with pointed apex and obliquely rounded termen; reddish-brown becoming paler on posterior half, more or less sprinkled with dark fuscous, especially anteriorly, and irregularly irrorated throughout with whitish scales and strigulae; cloudy round dark fuscous dots in disc at  $\frac{1}{3}$  and  $\frac{2}{3}$ , and another obliquely beyond and above second: cilia pale brownish-ochreous mixed with reddish-fuscous, round apex of wing suffused with dark reddish-fuscous. Hind-wings grey, slightly reddish-tinged; cilia light greyish-ochreous.

PERU, Aqualani, in July and December; five specimens. Specially characterised by the unusually long frontal tuft.

TRANS. ENT. SOC. LOND. 1909.—PART I. (MAY)

## EUCOSMIDAE.

*Laspeyresia tetrasticta*, n. sp.

♂. 11-12 mm. Head rather dark fuscous, lower half of face beneath a ridge of scales smooth, ochreous-whitish. Palpi ochreous-whitish tinged with grey externally, apex and anteriorly projecting scales of second joint grey. Antennae, thorax, and abdomen dark fuscous. Fore-wings moderate, posteriorly considerably dilated, costa slightly arched, apex obtuse, termen rounded, somewhat oblique; dark fuscous, on posterior half with tips of scales pale fuscous, so as to appear finely striated; costa marked throughout with pairs of short fine whitish strigulae, from which on basal half proceed thick subconfluent dark bluish-purple striae, sharply angulated in disc; two curved deep fuscous streaks from dorsum indicating margins of a median blotch not paler than ground-colour, faintly bisected; beyond this two strongly curved deep fuscous striae, first irregular on dorsal half, and between these a thick deep blue-leadен stria; three short blue-leadен strigulae from costa posteriorly, and a mark beneath apex; a series of four black dots before lower portion of termen: cilia shining grey, with a purple tinge. Hind-wings dark fuscous; cilia grey-whitish, with dark fuscous basal line.

BOLIVIA, Songo; two specimens.

## TORTRICIDAE.

*Atteria cantharopa*, n. sp.

♀. 29 mm. Head orange, with dark grey central stripe. Palpi very long, blackish, towards base suffused with orange. Antennae blackish. Thorax orange, spotted with blackish (partly defaced). Abdomen blackish-grey. Fore-wings elongate, costa moderately arched, more strongly towards base, apex rounded, termen rounded, rather oblique; 7 to about apex (indefinite); orange; markings dark prismatic blue-green, edged with blue-black; about six small irregular spots towards base; two broad direct transverse fasciae at  $\frac{1}{2}$  and beyond middle; between these are four large dots, viz. costal, subcostal, subdorsal, and dorsal; a large roundish blotch in disc towards termen; a series of small semicircular spots or dots round posterior third of costa and termen: cilia orange, with green-blackish bars on marginal spots. Hind-wings orange; markings dark fuscous; a patch along basal  $\frac{2}{3}$  of costa, connected with a rounded spot in disc before middle, and confluent at base with an irregular patch along dorsum and lower  $\frac{2}{3}$  of termen, enclosing near

base a small spot of ground-colour; a large spot on costa beyond middle, and another in disc at  $\frac{3}{4}$ ; a series of small spots round apex and termen, those at end of series larger, first costal united with a spot below it into a transverse mark: cilia dark fuscous, spotted with orange at base on the orange areas.

BOLIVIA, Chulumani, in December; one specimen. The genus *Cerace*, Walk., is synonymous with *Atteria*.

*Tortrix sphaleropa*, n. sp.

♂. 14-16. Head, palpi, and thorax ochreous sprinkled with dark reddish-fuscous; palpi moderate, porrected, terminal joint very short; thorax with posterior crest. Antennae pale ochreous ringed with dark grey, rather shortly ciliated. Abdomen rather dark grey, anal tuft large, mixed with pale greyish-ochreous. Fore-wings sub-oblong, costa towards base strongly arched, posteriorly somewhat sinuate, apex obtuse, termen nearly straight, slightly oblique, rounded beneath; ferruginous-ochreous, with a few dark fuscous or reddish-fuscous strigulae on costa and dorsum; markings deep ferruginous, somewhat mixed with dark-reddish-fuscous; basal patch rather large, formed of irregular subconfluent striae, outer edge obtusely angulated below middle; central fascia moderately broad, irregular-edged, dilated below middle and becoming undefined towards dorsum, interrupted above middle, dark-marked below interruption; costal patch moderately large, semi-oval; an elongate-oval blotch with posterior extremity touching middle of termen; an irregular apical spot: cilia ferruginous-ochreous, becoming dark fuscous at apex and whitish-ochreous at tornus. Hind-wings dark grey, somewhat lighter towards base: cilia pale grey, with dark grey basal line.

BOLIVIA, Songo; three specimens.

*Tortrix xerophanes*, n. sp.

♂. 28 mm. Head and thorax deep red-brown. Palpi moderate, porrected, red-brown, terminal joint pale fuscous. Antennae fuscous, flatly dentate, ciliations very short. Abdomen grey, anal tuft mixed with whitish-ochreous. Fore-wings elongate, moderate, posteriorly dilated, costa moderately arched, apex obtuse, termen straight, rather oblique; ferruginous-ochreous; a triangular dark red-brown basal patch suffused with blackish, very narrow on dorsum but extending to  $\frac{1}{4}$  on costa; from this a very regular thick dark red-brown streak extends along fold and is bent upwards to terminate in a small suffused dark grey spot in disc at  $\frac{2}{3}$ ; small irregular blackish spots along costa; three oblique ill-defined red-brown streaks or series of

spots from costa, first terminating in plical streak, second traversing discal spot to tornus, third running to near termen above tornus; between second and third is a series of red-brown dots; terminal area mixed with grey, towards costa with small scattered dark grey and red-brown spots: cilia ferruginous-brownish somewhat mixed with grey, with a grey basal line. Hind-wings pale grey, faintly spotted with darker; cilia whitish-grey, with a grey subbasal line.

PERU, Aqualani; one specimen.

*Tortrix oreographa*, n. sp.

♀. 20 mm. Head, palpi, and thorax fuscous irrorated with whitish; palpi moderately long, porrected; thorax with a transverse bar of blackish irroration, crest ferruginous-brown. Abdomen grey-whitish irrorated with dark grey. Fore-wings elongate, costa moderately arched, apex obtuse, termen almost straight, somewhat oblique; whitish-brown tinged with ferruginous, posteriorly and on margins with very small indistinct dark fuscous strigulae; a slender white line, thickest towards base, rising from base of dorsum and running almost to costa at  $\frac{2}{3}$ , thence angulated and proceeding slightly sinuate almost to tornus, both sections of this line followed posteriorly by broad ferruginous-brown suffusion which is strongest in disc: cilia grey sprinkled with white and mixed towards base with ferruginous. Hind-wings grey, towards apex indistinctly strigulated with darker: cilia ochreous-whitish.

BOLIVIA, Songo; one specimen.

*Peronea bryographa*, n. sp.

♂ ♀. 29-33 mm. Head, palpi, and thorax white, irregularly mixed with grey and dark grey; palpi very long (4); thorax usually with a more or less developed dark purple-reddish transverse bar. Abdomen pale whitish-ochreous. Fore-wings elongate-oblong, costa anteriorly moderately, posteriorly slightly arched, unevenly roughened with scales, apex obtuse, termen nearly straight, rather oblique; white, irregularly mixed with grey, with numerous small scattered tufts of white scales; often more or less irregular marks of prismatic light emerald-green scales about these, especially in upper part of disc; seven or eight irregular bent transverse strigae more or less indicated by irregularly placed blackish marks, but these are very variable; sometimes a triangular purple-grey blotch much marked with black on dorsum before middle, a large tuft in this sometimes ochreous; sometimes an irregular broken longitudinal series of dark purple-reddish marks below middle from beyond this tuft to near

termen : cilia whitish sprinkled with grey, on basal half more or less barred with grey. Hind-wings very pale shining greyish-ochreous, more whitish-ochreous towards base, greyer towards apex : cilia whitish, with one or two ochreous-grey shades.

PERU, Aqualani; ten specimens. This large and elegantly coloured species is very variable; it is allied to *chiriquitana*, Z. I follow Prof. Fernald in resuming the use of the generic name *Peronea*, Curt., to supersede *Acalla*, *Oxygrapha*, and *Teras*.

### COSMOPTERYGIDAE.

I have come to the conclusion that the family *Elachistidae* as formerly understood by myself is heterogeneous, and includes forms of various origin. I use the family name *Cosmopterygidae* to include those genera with long sickle-shaped palpi, fore-wings with veins 7 and 8 stalked, 7 to costa, hind-wings lanceolate or linear, with veins 2-5 separate, nearly parallel, 3 from before angle of cell, 6 and 7 more or less approximated towards base. Characteristic genera of this family are *Cosmopteryx*, *Stagmatophora*, *Limnoccia*, and *Mompha*; but *Elachista* itself does not belong here. I regard the family as a development of the *Oecophoridae*, and believe I have a complete series of transitional forms.

#### *Zaratha mesonyctia*, n. sp.

♂ ♀. 17-19 mm. Head purple-grey, sides of crown pale yellowish. Palpi ochreous-yellow, second joint suffused with fuscous anteriorly except at apex, anterior edge of terminal joint dark fuscous. Antennae dark grey, with a white subapical band, anteriorly with a suffused ochreous-yellow streak towards base. Thorax dark purplish-fuscous, with a yellowish line on each side of back. Abdomen dark purplish-fuscous, beneath in ♂ ochreous-yellowish banded with white, in ♀ ochreous-white. Legs dark purplish-fuscous, beneath streaked with ochreous-yellow and white, anterior and middle tibiae banded with yellow, anterior tarsi with joints 3, 4 white, middle tarsi with joints 3-5 white, posterior tarsi with first joint suffused with yellowish towards base, joints 3-5 wholly white. Fore-wings extremely narrow, parallel-sided, short-pointed, apex round-pointed; dark purplish-fuscous, apical third lighter, central third suffused with blackish except towards costa; a lighter fuscous patch extending over dorsal half of basal third, marked above with a pale yellowish

streak, and edged above by a bluish-metallic line; a median blue-metallic line from  $\frac{2}{3}$  of disc to apex and a shorter subdorsal line beneath it, beneath each of these is a suffused pale yellowish streak towards termen; a pale yellowish streak along apical portion of costa: cilia dark fuscous. Hind-wings and cilia dark fuscous.

BOLIVIA, Songo; four specimens.

*Promalactis platyxantha*, n. sp.

♂ ♀. 10-12 mm. Head and thorax dark bronzy-fuscous. Palpi white lined with black. Antennae white lined with black, ciliations in ♂ 1. Abdomen grey. Fore-wings elongate, very narrow, costa gently arched, apex round-pointed, termen extremely obliquely rounded: dark fuscous; a very broad ochreous-yellow transverse band, extending from about  $\frac{1}{3}$  to  $\frac{2}{3}$ , its margins nearly direct, somewhat irregular, edged with pale shining golden-metallic, costal edge and a dorsal mark near its posterior margin dark fuscous, partially edged with pale golden-metallic; two or three whitish marginal dots round apex: cilia dark fuscous. Hind-wings rather dark grey, lighter towards base; cilia grey.

BOLIVIA, Songo; three specimens.

GELECHIADAE.

*Tinaegeria trabeata*, n. sp.

♂. 17 mm. Head, palpi, antennae, and thorax very dark prismatic bronzy-fuscous; antennae with a white subapical patch, ciliations 2; thorax on each side with an ochreous-brownish stripe crossing an oblique crimson stripe from shoulder. Abdomen crimson, with broad dorsal and narrow lateral dark fuscous stripes, apical tuft fuscous above, yellowish beneath. Fore-wings elongate, very narrow, slightly dilated, costa slightly sinuate, posteriorly gently arched, apex somewhat pointed, termen faintly sinuate, rather strongly oblique; very dark bronzy-fuscous; cilia concolorous. Hind-wings dark bronzy-fuscous, with a hyaline patch occupying dorsal half from base to beyond middle, except dark fuscous veins; cilia dark fuscous.

BOLIVIA, Songo; one specimen.

COMMATICA, n. g.

Head smooth; ocelli present; tongue developed. Antennae  $\frac{3}{4}$ , basal joint elongate, slender, without pecten. Labial palpi long,

recurved, second joint thickened with scales, somewhat roughly expanded towards apex above, terminal joint as long as second, slender, acute. Maxillary palpi rudimentary. Posterior tibiae clothed with hairs above. Fore-wings with 2 from near angle, 7 to costa, 8 absent, 11 from middle. Hind-wings 1, trapezoidal, apex produced, acute, termen obliquely emarginate, cilia 1; 3 and 4 connate, 5 somewhat approximated, 6 and 7 remote at base, rather diverging.

*Commatica cremna*, n. sp.

♀. 10 mm. Head, antennae, thorax, and abdomen dark fuscous, face and palpi grey. Fore-wings elongate, narrow, costa moderately arched, apex obtuse, termen very obliquely rounded; very dark fuscous; an almost marginal series of white specks round posterior sixth of costa and termen: cilia fuscous mixed with darker, with a subbasal blackish shade followed by a paler shade, with a white wedge-shaped mark on costal extremity of submarginal series of specks. Hind-wings dark fuscous, lighter towards base; cilia fuscous.

BOLIVIA, Songo; one specimen.

IDIOCRATES, n.g.

Head with appressed hairs; ocelli present; tongue developed. Antennae over 1, basal joint elongate, slender. Labial palpi very long, recurved, second joint with dense appressed scales, somewhat loose beneath, terminal joint much longer than second, slender, acute. Maxillary palpi very short, filiform, appressed to tongue. Posterior tibiae smooth-scaled. Fore-wings with 2 and 3 curved, parallel, 2 from near angle, 3 from angle, 4 straight, 5 and 6 closely approximated for some distance towards base, diverging posteriorly, 5 to apex, 7 absent, 8-10 parallel, 11 from rather before middle. Hind-wings 1, elongate-trapezoidal-ovate, cilia  $\frac{1}{3}$ ; 3 and 4 connate, 5 absent, 6 and 7 parallel.

Allied to the following genus, of which it is a specialised development.

*Idiocrates balanitis*, n. sp.

♀. 16 mm. Head whity-brownish, face white. Palpi white, a subapical ring of second joint, and subbasal and median rings of terminal joint dark fuscous. Antennae whitish, towards base and apex tinged with brownish. Thorax pale brownish, with an oblique dark fuscous bar on each side of back behind collar. Abdomen fuscous, beneath ochreous-whitish. Fore-wings elongate, rather

narrow, costa anteriorly gently arched, behind middle somewhat sinuate, apex rounded, termen rounded, rather strongly oblique; light bronzy-brownish; an oblique dark fuscous spot on base of costa, nearly followed by a similar larger spot; beyond this an oblique white patch on costa reaching to  $\frac{1}{2}$  and separated posteriorly by a dark fuscous strigula from an oblique white strigula followed by a dark fuscous patch suffused posteriorly; beneath the white strigula is some yellowish suffusion; from between the first two dark costal spots proceeds an oblique irregular-dentate pale partly whitish-tinged line to near dorsum, basal space before this mixed with dark fuscous, with a dark fuscous spot on dorsum; a thick irregular dark fuscous longitudinal streak from beyond this above middle of disc to  $\frac{2}{3}$ , cut by a curved whitish line about middle and another at  $\frac{2}{3}$ , and limited posteriorly by a deeply curved-dentate white line causing its extremity to be furcate; an elongate dark fuscous spot on fold before middle, edged with whitish posteriorly; apical fifth of wing shining silvery-metallic, including a transverse dark fuscous spot beneath costa, below which is a yellowish-white ring resting on lower part of termen but incomplete anteriorly; a yellowish-white line round posterior part of costa and termen: cilia pale brownish, tips whitish, round apex with a dark fuscous basal shade. Hind-wings fuscous; cilia whitish-fuscous, with a fuscous subbasal shade.

BOLIVIA, Songo; one specimen.

PSITTACASTIS, n. g.

Head with appressed hairs; ocelli present; tongue developed. Antennae almost 1, in ♂ serrate, very shortly ciliated, basal joint elongate. Labial palpi very long, recurved, second joint with dense appressed scales, terminal joint longer than second, moderate, pointed. Maxillary palpi short, filiform, appressed to tongue. Posterior tibiae clothed with hairs above. Fore-wings with 1b rather short-furcate, 2 and 3 curved, 2 from near angle, 3 from angle, 4 straight, 5 diverging, 7 and 8 stalked or coincident (*eurychrysa*), 7 to costa, 11 from before middle. Hind-wings 1, elongate-trapezoidal-ovate, cilia  $\frac{3}{4}$ ; 3 and 4 connate, 5 somewhat approximated, 6 and 7 remote, rather diverging posteriorly.

Type *P. tricrica*, Meyr. Allied to *Idiophantis*, Meyr., which it resembles in the peculiar terminal excavation of the fore-wings; in *Idiocrates* this acquired character has been again lost, but with some resulting distortion or displacement of the apex of wing.



*Psittacastis tricolorica*, n. sp.

♂ ♀. 14-16 mm. Head whitish-ochreous, with central fuscous or dark fuscous streak on crown, lower half of face white. Palpi whitish, second joint with three well-marked dark fuscous bands, terminal joint pale ochreous with two faint fuscous bands, tip white. Antennae dark grey ringed with whitish. Thorax light ochreous-brownish, anteriorly with a dorsal stripe and basal spot on patagia dark fuscous. Abdomen fuscous, beneath whitish-ochreous. Fore-wings elongate, rather narrow, costa gently arched, apex forming a narrow falcate prominence above a deep abrupt oblique excavation separating it from a shorter moderately broad rounded ternal prominence; ochreous-brown, paler and whitish-sprinkled towards dorsum; an oblique triangular spot of dark fuscous suffusion on base of dorsum, edged with whitish suffusion; a straight oblique streak composed of two ochreous-whitish lines separated by grey suffusion, running from  $\frac{1}{5}$  of costa to middle of dorsum; a trapezoidal white spot on costa before middle, beneath suffused with whitish-ochreous; below this is a patch of dark grey suffusion containing a whitish-ochreous ring centred with dark fuscous; two oblique white costal strigulae beyond middle, first giving rise to a very oblique bluish-leadened-metallic line dilated downwards, surrounded with orange-ferruginous suffusion, and terminating in a suffused white spot which almost reaches terminal indentation, second strigula finely black-edged posteriorly and soon running into this line; an oval leadened-metallic spot in disc at  $\frac{2}{3}$ , followed by a spot of ochreous-white suffusion; ternal area indistinctly streaked longitudinally with white and blackish irroration; a white spot occupying ternal prominence, centred with a black dot; apical prominence whitish-ochreous, separated by a dark fuscous spot from an inwardly oblique ochreous-whitish costal strigula, costa between this and the preceding strigulae suffused with dark fuscous; cilia whitish-ochreous, with a subbasal line of dark fuscous irroration. Hind-wings grey, darker posteriorly; cilia grey.

BOLIVIA, Songo; three specimens.

*Psittacastis garulica*, n. sp.

♀. 17-18 mm. Head whity-brownish, forehead suffused with violet-grey, lower part of face whitish. Palpi pale ochreous, second joint whitish towards base, with two indistinct fuscous bands, terminal joint with two indistinct fuscous bands. Antennae pale ochreous suffusedly ringed with dark fuscous. Thorax pale ochreous suffusedly mixed with fuscous or dark fuscous. Abdomen whitish-ochreous more or less suffused with grey. Fore-wings elongate, costa

gently arched, apex forming a rather narrow falcate prominence above a deep abrupt oblique excavation separating it from a shorter moderately broad rounded tornal prominence; bronzy-ochreous-brown, mostly concealed by mixed white and dark fuscous suffusion, indicating various irregular but very undefined markings; a white trapezoidal blotch on costa before middle, outer edge very oblique, margined by a leaden-metallic streak; beyond this two very oblique parallel streaks from costa, separated from it and from each other by fulvous interspaces, first violet-leaden-metallic, white on costa, black-edged posteriorly, dilated downwards, terminating in an elongate-oval violet-leaden-metallic spot in disc, second white, terminating in same spot; an inwardly oblique white strigula from costa midway between this and apex; a thick excurved pale bronzy-metallic transverse streak close before lower part of termen, its upper end preceded by a triangular blackish spot, terminal area beyond this white containing a black mark at base of indentation and another between this and apex of tornal prominence, terminal edge dark fuscous with a short projection between these two black marks: cilia whitish-ochreous, more ochreous-tinged in indentation, with two dark fuscous cloudy lines. Hind-wings and cilia grey.

BOLIVIA, Songo; three specimens. At first sight very similar to the preceding, and the complex details of marking are troublesome to compare, but the differently marked second joint of palpi is an easy distinction.

*Psittacastis eurychrysa*, n. sp.

♂ ♀. 9-10 mm. Head bright shining bronze, face shining whitish-ochreous. Palpi more slender than in the other species, light yellowish, terminal joint lined with blackish. Antennae blackish, with broad white subapical band. Thorax bright shining bronze, patagia orange except shoulder. Abdomen dark fuscous, apex mixed with yellowish. Fore-wings elongate, costa gently arched, apex shortly triangular-falcate above an abrupt deep concavity, termen beneath this rounded-prominent; 7 and 8 coincident; blackish, suffused with deep bronzy except towards costa; a purple-golden subbasal fascia, diluted dorsally so as to reach base; a moderate slightly curved purple-golden fascia somewhat before middle, followed by an orange band which is broadest in middle and contracted so as to leave a narrow spot of ground-colour between them towards costa, outer edge of this band strongly curved; an orange streak along costa from near beyond this band to apex; terminal and tornal area beyond this band wholly purple-golden-

metallic : cilia dark fuscous, round apex whitish, with dark fuscous lines (imperfect). Hind-wings and cilia dark fuscous.

BOLIVIA, Songo ; four specimens.

*Strobisia porphyraspis*, n. sp.

♂. 11 mm. Head shining prismatic-bronze. Palpi whitish, terminal joint dark grey anteriorly. Antennae dark fuscous. Thorax dark purplish-bronze. Abdomen dark fuscous. Legs dark bronzy-fuscous ringed with white. Fore-wings elongate, rather narrow, posteriorly somewhat dilated, costa subsinuate, apex obtuse, termen sinuate, little oblique ; 2 and 3 coincident, 7 and 8 stalked, 7 to apex ; dark bronzy-fuscous ; markings brilliant blue-metallic, with green and purple iridescence ; a spot on base of costa ; an angulated transverse line at  $\frac{1}{2}$ , not reaching dorsum ; a slightly curved entire transverse line slightly before middle ; two transverse linear marks in disc beyond middle, rather converging upwards, and a dot on fold beneath them ; an inwardly oblique mark from costa at  $\frac{2}{3}$  ; a large bright purple patch on lower part of termen, extending from tornus to above middle : cilia dark fuscous, round apex whitish with a broad dark fuscous shade (imperfect). Hind-wings and cilia dark fuscous.

BOLIVIA, Songo ; one specimen.

*Trichotaphe serena*, n. sp.

♀. 17 mm. Head and thorax brown, shoulders paler and yellowish-tinged. Palpi yellowish-brown, hairs of second joint yellow-whitish towards tips. Antennae brownish-ochreous ringed with dark fuscous. Abdomen blackish-grey. Fore-wings elongate, narrow, somewhat dilated posteriorly, costa slightly arched, apex obtuse, termen slightly sinuate, rather oblique ; on undersurface a pecten of hairs beneath vein 1c on basal half ; yellowish-brown, costal edge sometimes pale yellowish ; stigmata dark fuscous, plical obliquely beyond first discal, second discal larger and indistinctly edged with pale yellowish ; some indistinct pale yellowish dots on posterior part of costa and termen : cilia whitish-ochreous suffused with brownish towards base. Hind-wings blackish-grey ; cilia grey, lighter towards tips.

BOLIVIA, Songo ; three specimens.

OECOPHORIDAE.

*Doleromima cyanaspis*, n. sp.

♂. 23-24 mm. Head blue-blackish, with orange central stripe.

Palpi blue-black, second joint very long, terminal  $\frac{2}{3}$  of second. Antennae dark purple-fuscous, ciliations short, thin, becoming moderate (1) towards base. Thorax blue-blackish, patagia orange, tips purple. Abdomen dark purple-fuscous. Fore-wings oblong, costa anteriorly rather strongly, posteriorly gently arched, apex rounded, termen rounded, rather oblique; bright deep orange; two deep blue oblique fasciae edged with purple, not quite reaching dorsal edge, first moderate, near base, second broad, median, expanded in disc so that posterior edge is convex; a series of longitudinal purple-black marks terminating in posterior third of costa and termen, becoming shorter towards ends of series: cilia orange, towards tornus blackish. Hind-wings deep orange; an irregular-edged purple-blackish blotch occupying basal half; a row of black subquadrate spots round apex and termen; cilia orange, round lower  $\frac{2}{3}$  of termen and dorsum blackish.

PERU, El Porvenir, in October; two specimens.

#### GONIONOTA, Zell.

Head with dense loosely appressed hairs, projecting on forehead in a rough tuft; ocelli present; tongue developed. Antennae  $\frac{3}{4}$ , in ♂ shortly ciliated ( $\frac{1}{3}$ ) towards base more strongly (nearly 1), basal joint moderately elongate, without pecten. Labial palpi very long, recurved, second joint considerably exceeding base of antennae, thickened with dense scales, sometimes more or less roughly expanded above, terminal joint much shorter than second, with dense scales more or less expanded or forming a median projection posteriorly, acute. Maxillary palpi short, filiform, drooping. Thorax crested. Posterior tibiae clothed with rough hairs above. Fore-wings with 1b furcate, 2 from near angle, 7 and 8 stalked, 7 to termen, 11 from middle. Hind-wings 1, ovate, cilia  $\frac{1}{4}$ - $\frac{1}{4}$ ; 3 and 4 connate, 5-7 parallel.

I give the characters of this genus, which was incompletely described by Zeller, who regarded it as a group of *Hypercallia*, from which it is in fact very distinct, the resemblance being only superficial. It is most allied to the Australian genera *Enchocrates* and *Thudaca*, and probably also to the New Zealand *Izatha*. I am of opinion that *Brachyplatea*, Zell., and *Agricomma*, Zell., are merely synonyms of it. I am informed by Mr. A. Busck that the typical species of *Gonionota*, *G. notodontella*, Zell., has vein 9 of fore-wings rising from stalk of 7 and 8, a character which does not occur in any of the following

species, but even if this is found to be specifically constant, I shall not regard it here as requiring generic separation, the agreement in all other characters being so close.

*Gonionota isophylla*, n. sp.

♂. 22 mm. Head rosy-whitish mixed with pale yellowish. Palpi light rosy sprinkled with grey, second joint above with rough expanded hairs towards apex, mixed with blackish-grey near apex, terminal joint half second, with moderate rough median scale-projection posteriorly, and blackish-grey median band, tip whitish. Antennae grey, suffused with rosy towards base. Thorax yellowish-crimson. Abdomen pale grey. Fore-wings elongate, costa strongly and evenly arched, apex rounded, termen rather obliquely rounded; yellowish-crimson-rosy; extreme costal edge white; a broad suffused light yellow patch extending along costa from before middle to near apex, indistinctly spotted with pale fuscous suffusion; two or three very undefined black dots on termen beneath apex: cilia yellowish-rosy, on costa white. Hind-wings light reddish-grey; cilia grey-whitish tinged with reddish.

PERU, Huancabamba; one specimen.

*Gonionota comastis*, n. sp.

♂. 24 mm. Head, palpi, and thorax crimson-red mixed with yellow; palpi with second joint expanded with scales towards apex above, sprinkled with purplish-fuscous, terminal joint little more than half second, with short rough projecting scales towards base anteriorly (normal posterior scale-projection probably abraded), apex yellow. Antennae fuscous sprinkled with crimson, beneath pale ochreous. Abdomen ochreous-whitish. Fore-wings suboblong, somewhat dilated posteriorly, costa anteriorly moderately, posteriorly slightly arched, apex obtuse, termen almost straight, nearly vertical; bright deep yellow, broadly and suffusedly reticulated with crimson-red, becoming confluent towards margins; some small irregular scattered fuscous spots on anterior half; costal edge fuscous, interrupted with white before middle; and by a small triangular white spot at  $\frac{3}{4}$ ; a fuscous streak from middle of costa to  $\frac{1}{3}$  of dorsum, preceded by a small oblique white spot in disc, partially edged anteriorly with dark fuscous; a curved linear dark fuscous mark representing second discal stigma; some fuscous suffusion round white costal spot, whence proceed two rather curved rows of cloudy dark fuscous dots to before tornus; some purplish-fuscous suffusion along termen: cilia fuscous, towards tips whitish

on termen. Hind-wings yellow-whitish, towards costa whiter; posterior half suffused with light rosy-grey, more rosy anteriorly, greyer towards apex; cilia whitish, with a cloudy grey shade.

PERU, Huancabamba; one specimen.

*Gonionota alexandra*, n. sp.

♂. 18-20 mm. Head ochreous-whitish, hairs of crown suffused with brown. Palpi reddish-fuscous, second joint clothed above with long dense projecting scales on apical  $\frac{2}{3}$ , terminal joint with moderately strong posterior scale-projection, apex white. Antennae whitish-ochreous. Thorax reddish-ochreous-brown. Abdomen reddish-fuscous, anal tuft whitish-ochreous. Fore-wings elongate, moderate, costa anteriorly moderately arched, sinuate beyond middle, apex round-pointed, termen sinuate, oblique; brown, more or less largely suffused with light rosy-carmine; a suffused dark reddish-fuscous streak from base above middle to middle of costa, marked with a more or less distinct short pale ochreous-yellowish line from base and an ochreous-yellow oblique dash at  $\frac{2}{3}$ , costal extremity whitish-edged anteriorly; beneath this dash are two round white dots longitudinally placed in disc, second somewhat lower and larger; costal sinuation beyond dark streak marked with a wedge-shaped white spot, separated from it beneath by a suffused yellow spot; beyond this are two approximated inwardly oblique dark reddish-fuscous marks on costa; a dark reddish-fuscous streak along basal  $\frac{2}{3}$  of dorsum, thickest in middle, attenuated posteriorly; an oblique dark fuscous mark crossing subdorsal area at  $\frac{1}{4}$ ; suffused dark reddish-fuscous streaks along posterior half of submedian fold, posterior portion of lower margin of cell, and veins 2 and 3; an undefined triangular blotch covering veins 4-7 suffused with rather dark brown; cilia rather dark brown, darker round apex, on termen barred with ochreous-whitish. Hind-wings and cilia fuscous irrorated with dark fuscous.

PERU, Pozuzo; three specimens.

*Gonionota teganitis*, n. sp.

♂ ♀. 17-18 mm. Head ochreous-brown. Palpi ferruginous-brown sprinkled with whitish and dark brown, second joint with scales rather expanded above towards apex, terminal joint with moderate scale-projection, base and apex whitish. Antennae brownish, obscurely whitish-ringed. Thorax ferruginous-brown, with strong triangular crest. Abdomen dark grey. Fore-wings suboblong, rather short and broad, costa rather strongly arched,

shortly sinuate beyond middle, apex obtuse, termen nearly straight, almost vertical, rounded beneath; dark reddish-brown; costal edge dull reddish on basal  $\frac{2}{3}$ ; a very small carmine-white mark on costa at  $\frac{2}{3}$ , extreme costal edge between this and sinuation dark fuscous; a wedgeshaped white spot on costal sinuation, edged anteriorly with carmine-red; cilia dark red-brown, at apex and towards tornus suffused with dark fuscous, tips for some distance on each side of apex white. Hind-wings dark fuscous; cilia whitish, basal half more or less suffused with dark grey, round dorsum and tornus wholly grey.

PERU, Pozuzo; five specimens.

*Gonionota phocodes*, n. sp.

♂. 16 mm. Head ferruginous-brown sprinkled with whitish-ochreous. Palpi whitish-ochreous mixed with ferruginous-brown and sprinkled with dark fuscous, second joint with appressed scales, terminal joint with moderately strong expansible scale-projection. Antennae greyish-ochreous ringed with dark fuscous, towards base ferruginous-tinged. Thorax ferruginous-brown, with triangular crest, beneath white. Abdomen dark fuscous, beneath white. Fore-wings oblong, rather broad, costa strongly arched anteriorly, nearly straight posteriorly, abruptly and deeply notched at  $\frac{2}{3}$ , apex obtuse, termen slightly sinuate, little oblique; purplish-ferruginous-brown; some undefined fine whitish-ochreous irroration, especially towards costa anteriorly, and on a rather broad fascia from before middle of costa to tornus: cilia dark ferruginous-brown. Hind-wings dark fuscous, lighter anteriorly; cilia fuscous, basal half suffused with dark fuscous; undersurface yellowish except towards costa and apex.

PERU, Pozuzo; one specimen.

*Gonionota incisa*, n. sp.

♂. 18-19 mm. Head dark purplish-fuscous finely irrorated with whitish-yellowish. Palpi brownish more or less sprinkled with whitish, an apical ring of second joint and median band of terminal joint dark fuscous, terminal joint with strong median scale-projection. Antennae pale greyish-ochreous dotted with dark fuscous, towards base yellowish-tinged. Thorax dark purplish-fuscous, external edge of patagia whitish-yellowish, beneath white. Abdomen rather dark fuscous, beneath white. Fore-wings broad, oblong, costa strongly arched on anterior half, at  $\frac{2}{3}$  with an abrupt deep narrow notch, apex obtuse, termen faintly sinuate, almost vertical, rounded beneath, cilia projecting at apex and suddenly shorter beneath it so

as to appear rather strongly sinuate; dark purplish-fuscous, somewhat mixed with deep ferruginous; some irregular partly confluent striae on anterior half of wing, two lines along posterior part of fold, and an almost terminal stria formed by undefined whitish-yellowish irroration: cilia dark purplish-fuscous mixed with deep ferruginous, tips yellow-whitish. Hind-wings dark fuscous; cilia ochreous-grey-whitish, basal half dark grey.

BOLIVIA, Songo; three specimens. The curious notch in costa of fore-wings of this and preceding species is unlike anything else known to me.

*Gonionota saulopsis*, n. sp.

♂. 22-23 mm. Head orange-yellow, sides ferruginous-brown. Palpi orange, second joint and median band of terminal joint irrorated with dark ferruginous-brown. Antennae fuscous. Thorax deep yellow mixed with orange-red, patagia and a transverse median band dark brown. Abdomen white. Fore-wings broad, oblong, costa very strongly arched on anterior half, sinuate beyond middle, apex rounded, termen rounded, nearly vertical; dark ferruginous-brown, with irregular transverse paler striae slightly irrorated with whitish, interspaces usually more or less mixed with blackish-grey except towards costa; a slightly paler curved transverse band before middle, irrorated with white and pale rosy towards costa; towards posterior  $\frac{2}{3}$  of costa the striae become white, partly tinged with pale rosy; first discal stigma blackish, distinct, preceded by a small blackish dot obliquely above it, second dark grey, indistinct: cilia dark ferruginous-brown, towards tornus paler and mixed with grey, at base with blackish-grey. Hind-wings white; a dark fuscous apical blotch covering  $\frac{2}{3}$  of wing, anterior edge straight; cilia white, round apical blotch dark grey except at tips.

PERU, Pozuzo; BOLIVIA, Songo; seventeen specimens.

STENOMIDAE.

ORPHNOLECHIA, n. g.

Head with appressed scales; ocelli small; tongue developed. Antennae  $\frac{3}{4}$ , in ♂ rather strongly ciliated ( $2\frac{1}{2}$ -3), basal joint moderate, without pecten. Labial palpi long, recurved, with appressed scales, terminal joint somewhat shorter than second, acute. Maxillary palpi short, filiform, appressed to tongue. Posterior tibiae with tolerably appressed scales. Fore-wings with 1b furcate, 2 and 3 stalked, 7 to costa, 11 from about middle. Hind-wings somewhat



over 1, trapezoidal-ovate, cilia  $\frac{2}{3}$ ; 3 and 4 stalked, 5 absent, 6 and 7 stalked.

Type *O. crypsiphragma*.

*Orphnolechia crypsiphragma*, n. sp.

♂. 13 mm. Head and thorax dark grey, face white. Palpi dark fuscous, sprinkled with whitish. Antennae and abdomen dark fuscous. Fore-wings suboblong, costa anteriorly moderately arched, apex obtuse, termen slightly rounded, rather oblique; dark fuscous sprinkled with grey-whitish; stigmata round, moderate, blackish, plical somewhat beyond first discal; a small irregular white spot on costa before middle, and one on dorsum beyond middle; cloudy whitish dots below plical stigma, and above and below second discal; costal edge at  $\frac{2}{3}$ , and some scattered scales beneath it white; a nearly straight blackish line from costa beyond this to termen above tornus; an interrupted blackish line round apical portion of costa and termen, preceded by two or three minute cloudy whitish dots: cilia grey, with interrupted dark grey antemedian shade, tips towards middle of termen more whitish. Hind-wings dark bronzy-fuscous; cilia grey, basal half dark fuscous.

BOLIVIA, Songo; one specimen.

*Orphnolechia chionogramma*, n. sp.

♂. 12 mm. Head and thorax dark bronzy-grey, face white. Palpi grey, suffusedly irrorated with white. Antennae and abdomen dark fuscous. Fore-wings elongate, moderate, costa gently arched, apex obtuse, termen slightly rounded, rather oblique; dark fuscous, slightly bronzy-tinged; a slightly curved white line from middle of costa to dorsum beyond middle; a transverse streak of scattered white irroration before termen: cilia grey, with a dark grey line, at apex with a white patch somewhat produced at base along termen. Hind-wings dark bronzy-fuscous, lighter towards base; cilia grey, with dark grey basal shade, on costa abruptly white.

BOLIVIA, Songo; one specimen.

THIOSCELIS, n. g.

Head with appressed hairs; ocelli small; tongue developed. Antennae  $\frac{3}{5}$ , in ♂ moderately ciliated (1), basal joint stout, densely scaled. Labial palpi very long, recurved, second joint much thickened with dense tolerably appressed scales, terminal joint as long as second, densely scaled, pointed. Maxillary palpi very short, filiform. Thorax densely hairy beneath. Anterior legs short, tibiae

much dilated with dense rough hairs, tarsi thickened with dense scales; middle legs normal, tibiae clothed with dense rough hairs; posterior legs greatly elongated, thrice as long as abdomen, stout, tibiae very long, densely rough-haired above and beneath, tarsi longer than tibiae, thickened with rough scales above throughout, somewhat tufted towards apex. Fore-wings with 1b furcate, 2-5 approximated at base, 6-9 approximated at base, 7 to termen, 11 from middle. Hind-wings over 1, trapezoidal-ovate, cilia  $\frac{1}{2}$ ; 3 and 4 connate, 5 closely approximated, 6 and 7 closely approximated towards base.

*Thioscelis directrix*, n. sp.

♂. 62-63 mm. Head, palpi, and thorax pale whitish-fuscous; palpi externally tinged with ochreous-yellowish, second joint blackish externally on basal half, terminal joint anteriorly more fuscous; thorax white beneath. Antennae fuscous. Abdomen ochreous-yellow, beneath white. Legs ochreous, femora white, middle tibiae white, ochreous-yellow above towards base, posterior tibiae ochreous-orange above, white beneath, separated by a dark fuscous lateral line, middle and posterior tarsi mostly suffused with dark fuscous. Fore-wings elongate, rather narrow, posteriorly dilated, costa almost straight, apex obtuse, termen straight, vertical, rounded beneath; light fuscous, paler and whitish-tinged towards costa anteriorly; costal edge ochreous-brown; some ill-defined small blackish spots towards costa on median third, and two or three somewhat larger before apex of wing, a subterminal series of several very undefined blackish dots on costal half of wing; a series of undefined blackish dots or marks along termen: cilia pale ochreous tinged with fuscous. Hind-wings light or rather dark fuscous, more or less yellow-tinged towards costa posteriorly; cilia light ochreous-orange.

PERU, Pozuzo and El Porvenir; two specimens. A singular insect; the actual length of posterior leg is, femur 3 mm., tibia 14 mm., tarsus 24 mm.; total 41 mm.

*Antaeotricha glaciata*, n. sp.

♂. 27-29 mm. Head pale bronzy-grey, posteriorly whitish-tinged. Palpi white, second joint externally whitish-ochreous, suffused with grey towards upper surface and apex, terminal joint with grey basal band. Antennae grey, basal joint white beneath. Thorax pale whitish-ochreous-grey. Abdomen grey, beneath ochreous-whitish. Fore-wings elongate, rather narrow, costa gently arched, apex obtuse, termen slightly rounded, somewhat oblique;

ochreous-grey; basal area suffused with whitish, with costa and three cloudy oblique costal streaks grey, and a longitudinal median series of four blackish dots; costal area from  $\frac{1}{3}$  to apex broadly white, covering nearly half of wing, including oblique series from costa of two grey spots before middle, and three dark grey dots beyond middle; remainder of dorsal area streaked with blackish and white irroration on veins, its anterior portion forming an irregular area enclosed by dark fuscous suffusion and terminating above in a small blackish tuft, and marked beyond middle by a small white discal spot followed by two more indistinct transversely placed whitish spots, and crossed by an erect transverse streak of dark fuscous suffusion from tornus; an interrupted waved white line on lower part of termen: three or four fuscous marginal dots round apex: cilia pale brownish, with a darker fuscous basal shade, round costa and apex white. Hind-wings rather dark grey; a narrow streak of white suffusion along costa to apex; cilia pale grey with darker grey basal shade, round costa and apex white.

BOLIVIA, Songo; three specimens.

*Antaeotricha melanopsis*, n. sp.

♂. 36 mm. Head grey-whitish. Palpi densely scaled, grey, second joint white towards base beneath, terminal joint white, base greyish-tinged. Antennae grey, ciliations  $1\frac{1}{2}$ . Thorax grey-whitish, with two small indistinct grey dorsal spots. Abdomen whitish-fuscous, beneath white. Fore-wings elongate, rather narrow, somewhat dilated posteriorly, costa moderately arched, apex obtuse, termen nearly straight, rather oblique; white, somewhat mixed irregularly with fuscous and sprinkled finely with blackish; costal edge fuscous, extreme edge white except towards base; dorsal scale-projection tipped with fuscous; a cloudy fuscous spot on base of costa; two indistinct fuscous lines represented by small cloudy dark fuscous spots on costa at  $\frac{1}{3}$  and middle, and on dorsum at middle and  $\frac{2}{3}$  respectively, but nearly obsolete in disc; second discal stigma rather large, black, transverse; a curved fuscous line from a spot on costa at  $\frac{2}{3}$  to tornus; a suffused rather dark fuscous spot on costa before apex: cilia whitish, with two fuscous shades. Hind-wings fuscous; costal hairpencil whitish; cilia fuscous with rows of whitish points.

PERU, Huancabamba; one specimen.

*Stenoma columbaris*, n. sp.

♂. 28 mm. Head whitish. Palpi white, second joint dark fuscous above towards base, terminal joint slender, as long as second,

grey anteriorly except towards base. Antennae grey, ciliations 2. Thorax pale grey, collar whitish. Abdomen light grey, beneath ochreous-whitish. Fore-wings elongate, posteriorly rather dilated, costa gently arched, apex rounded-obtuse, termen somewhat rounded, little oblique; fuscous suffused with whitish, appearing whitish-fuscous; extreme costal edge ochreous-white; stigmata dark fuscous, discal remote, connected by a suffused ochreous-whitish streak, plical obliquely beyond first discal; two dark fuscous dots towards costa, first above plical stigma, second beyond middle; some fuscous suffusion towards dorsum in middle; an indistinct irregularly dentate fuscous line from costa beyond middle to  $\frac{3}{8}$  of dorsum; a curved line of dark fuscous dots from  $\frac{2}{3}$  of costa to dorsum before tornus, indented near costa; a series of dark fuscous dots round apical fourth of costa and termen: cilia whitish, indistinctly barred with fuscous. Hind-wings rather light fuscous, darker towards apex; cilia ochreous-whitish.

PERU, Huancabamba; one specimen.

*Stenoma tritypa*, n. sp.

♂. 25-28 mm. Head ochreous-whitish, face forming a cavity clothed with blackish scales and surrounded above by a raised rounded ring. Palpi considerably thickened with dense scales, whitish, basal joint dark fuscous, second joint with basal  $\frac{2}{3}$  dark fuscous externally, above with a tuft of black hairs from base, terminal joint  $\frac{2}{3}$  of second, with basal and subapical grey spots. Antennae fuscous, beneath ochreous, ciliations 2 $\frac{1}{2}$ . Thorax ochreous-grey-whitish, tinged with greenish. Abdomen grey, anal tuft ochreous-whitish. Fore-wings oblong, costa slightly arched, apex rounded, termen rounded, little oblique; ochreous-whitish; basal area tinged with olive-greenish; three blackish costal spots, first at  $\frac{1}{5}$ , small, second before middle, moderate, subtriangular, third at  $\frac{2}{3}$ , larger, transverse; more or less indistinct pale olive-greenish clouding in disc before middle, and towards middle of dorsum; an outwards-curved olive-greenish streak from second costal spot to tornus, upper portion broken into spots; a greenish-fuscous transverse discal mark near before this, preceded by a tuft of raised scales; an oblique olive-greenish line from third costal spot reaching half across wing; a series of subconfluent small greenish-fuscous spots near before termen; a terminal series of rather dark fuscous lunulate marks: cilia whitish, basal half suffused with pale yellowish. Hind-wings grey; cilia grey-whitish, with grey subbasal shade, base yellowish-tinged.

PERU, Pozuzo; two specimens.

*Stenoma monastra*, n. sp.

♂ 28 mm. Head ochreous-whitish suffused above with light fuscous. Palpi thickened with dense scales, fuscous-whitish, second joint with lower  $\frac{2}{3}$  externally dark fuscous, terminal joint  $\frac{2}{3}$  of second, base and a subapical suffused ring dark fuscous. Antennae fuscous, ciliations  $1\frac{1}{2}$ . Thorax fuscous mixed with paler. Abdomen dark fuscous, beneath ochreous-white. Fore-wings elongate, posteriorly dilated, costa gently arched, apex rounded, termen rounded, slightly oblique; fuscous suffused with brown, especially towards middle of disc; three indistinct darker fuscous transverse series of cloudy dots starting from small distinct spots on costa, first curved outwards above fold and inwards below it, preceded by pale raised scales in disc, second at first very oblique outwards, strongly curved in disc, obsolete towards dorsum, third curved outwards on upper half, forming a straight shade on lower half; a clear round white discal dot at  $\frac{2}{3}$ , partially edged with dark fuscous, and connected with first line by a longitudinal suffused dark fuscous bar; a very undefined sinuate subterminal line indicated by slight whitish suffusion and edged posteriorly with darker suffusion; some slight whitish suffusion towards apex; a terminal series of dark fuscous marks: cilia fuscous, towards tips mixed with whitish. Hind-wings dark fuscous; cilia fuscous, tips whitish-sprinkled; undersurface suffused with white except towards costa posteriorly and apical area.

PERU, Pozuzo; one specimen.

*Stenoma epophrysta*, n. sp.

♂. 23 mm. Head pale whitish-ochreous, crown mixed with brownish and dark grey. Palpi densely scaled, ochreous-whitish mixed with fuscous, lower  $\frac{2}{3}$  of second joint, and base and subapical ring of terminal joint dark fuscous, terminal joint  $\frac{2}{3}$  of second. Antennae fuscous, ciliations 2. Thorax whitish-ochreous mixed with brownish-ochreous. Abdomen dark grey, beneath ochreous-white. Fore-wings oblong, costa gently arched, apex rounded, termen rounded, little oblique; whitish-ochreous suffused with pale brownish-ochreous; a dark fuscous spot on costa at  $\frac{1}{4}$ , whence proceeds an irregular-dentate fuscous line to  $\frac{2}{3}$  of dorsum, preceded in disc by raised scales; a large dark brown transverse blotch resting on middle of costa and reaching to near dorsum before tornus, connected by a brown cloud in disc with preceding line; a curved-angulated transverse series of dark fuscous dots parallel to posterior edge of this, forming a dark fuscous spot on costa, and followed by a brown

shade enlarged on lower half into a rounded dark brown tornal blotch; a terminal series of dark fuscous marks; cilia fuscous. Hind-wings dark fuscous: cilia fuscous, basal third dark fuscous; undersurface pale grey.

PERU, Pozuzo; one specimen.

*Stenoma astronoma*, n. sp.

♂. 11 mm. Head, antennae, thorax, and abdomen dark bronzy-fuscous, face shining white, abdomen beneath white. Palpi white, terminal joint anteriorly dark fuscous, as long as second. Fore-wings elongate, costa gently arched, apex rounded, termen rather obliquely rounded; very dark bronzy-fuscous; a streak of blue-metallic suffusion beneath anterior half of costa; a small round white spot in disc at  $\frac{2}{3}$ ; immediately beyond this a broad transverse fascia of violet-blue-metallic suffusion not quite reaching costa and tornus; two white specks on costa above this: cilia dark fuscous, with a basal series of white specks, and a white patch at apex. Hind-wings dark fuscous; a rather large transverse white discal spot in middle, almost reaching costa; cilia fuscous, with a large white patch at apex extending some distance along termen, and a white spot on middle of termen.

BOLIVIA, Songo; one specimen.

PLUTELLIDAE.

COPOCENTRA, n. g.

Head smooth; ocelli present; tongue developed. Antennae 1 or over 1, stout, flattened, especially in ♂, tapering, simple, basal joint short, without pecten. Labial palpi rather short, slightly curved, porrected, filiform, pointed. Maxillary palpi rudimentary. Posterior tibiae in ♂ dilated above towards apex with long dense projecting scales, both outer spurs broadly dilated above and beneath with dense projecting scales, in ♀ with expansible projecting scales towards apex. Fore-wings with 2 from near angle, 7 to costa, 8 absent, 11 from middle. Hind-wings under 1, narrowly elongate-trapezoidal, apex obtuse, cilia 1; transverse vein absent between 2 and 5, 3 and 4 absent, 5-7 approximated towards base.

Nearly allied to *Heliodines*.

*Copocentra calliscelis*, n. sp.

♂. 13 mm., ♀ 9-10 mm. Head, palpi, antennae, and thorax dark shining prismatic-bronze; extreme tip of antennae in one

♀ white. Abdomen in ♂ orange, above suffused with dark violet-fuscous towards base and apex, in ♀ dark prismatic-fuscous suffused ventrally with ochreous-whitish. Legs dark bronzy-fuscous, in ♀ with middle tibiae ringed with whitish-ochreous in middle and at apex; in ♂ with middle femora, tibiae except base and apex, and basal joint of tarsi orange tinged with violet, posterior femora, tibiae, and base of tarsi orange tinged with violet except apical half of dilated outer spurs and tips of projecting scales of tibiae towards apex. Fore-wings elongate, very narrow, costa faintly sinuate, posteriorly slightly arched, apex obtuse, termen extremely obliquely rounded; dark purplish-fuscous, with bluish and bronzy reflections: cilia concolorous. Hind-wings rather dark fuscous, in ♂ with anterior  $\frac{2}{3}$  suffused with pale ochreous, in ♀ whitish-suffused towards costa; cilia rather dark fuscous.

BOLIVIA, Songo; four specimens.

*Heliodines obolarcha*, n. sp.

♂ ♀. 10-15 mm. Head and thorax dark bronzy-fuscous, collar orange. Palpi dark fuscous, towards base suffused with ochreous. Antennae dark fuscous, with a white apical band. Abdomen dark fuscous, ventrally suffused with orange. Fore-wings elongate, very narrow, costa slightly arched, faintly sinuate in middle, apex pointed, termen extremely obliquely rounded; 6 and 7 separate; orange; markings bronzy-metallic, with violet and golden reflections; a dot on base of costa, edged with black; four transverse anteriorly black-edged spots on costa between this and  $\frac{2}{3}$ , second largest, and three on dorsum alternating with these, second shortest; a longitudinal black-edged streak from apex of last costal spot to costa at  $\frac{5}{8}$ , and another from above tornus to apex, space between these black towards apex; tornal edge between last dorsal spot and lower streak suffused with dark fuscous: cilia dark fuscous. Hind-wings and cilia dark fuscous.

BOLIVIA, Songo; three specimens.

*Imma zophodes*, n. sp.

♂. 16-17 mm. Head fuscous, lower part of face tinged with pale greyish-ochreous. Palpi fuscous somewhat sprinkled with ochreous-whitish, second joint short, terminal joint about  $\frac{2}{3}$  of second, tolerably obtuse. Antennae, thorax, and abdomen rather dark fuscous, antennal ciliations  $\frac{2}{3}$ . Fore-wings rather elongate-triangular, costa gently arched, apex obtuse, termen rounded, little oblique; 7 and 8 separate, 8 to costa; rather dark fuscous, slightly and irregularly whitish-sprinkled; a small white discal dot at  $\frac{2}{3}$ :

a dark fuscous terminal line : cilia fuscous with a darker shade, base ochreous-tinged. Hind-wings rather dark fuscous ; cilia fuscous-whitish, basal third dark fuscous.

BOLIVIA, Songo ; three specimens.

*Imma protocrossa*, n. sp.

♂. 11 mm. Head fuscous. Palpi fuscous becoming pale greyish-ochreous towards base, second joint short, terminal joint  $\frac{2}{3}$  of second, tolerably obtuse. Antennae, thorax, and abdomen rather dark fuscous, antennal ciliations 2. Fore-wings rather elongate-triangular, costa slightly arched, apex obtuse, termen rounded, slightly oblique ; 7 and 8 separate, 8 to costa ; dark fuscous, slightly sprinkled with whitish-ochreous ; an irregular cloudy pale greyish-ochreous streak along termen, tending to be interrupted into spots, leaving terminal edge dark fuscous : cilia fuscous-whitish, basal half dark fuscous, with a waved pale greyish-ochreous basal line. Hind-wings with 2 and 3 approximated ; rather dark fuscous ; cilia whitish, basal third fuscous.

BOLIVIA, Songo ; one specimen.

*Setiostoma callidora*, n. sp.

♂. 11-12 mm. Head yellow. Palpi yellow, base dark fuscous. Antennae dark fuscous. Thorax and abdomen bronzy-blackish. Fore-wings moderately broad, dilated posteriorly, costa gently arched, apex obtuse, termen obliquely rounded ; bronzy-blackish ; a bright yellow transverse band, its anterior edge near base, convex, posterior edge running from  $\frac{1}{3}$  of costa to before middle of dorsum, straight ; close beyond this a moderate purplish-coppery fascia, separated from it by a blackish line ; apical third of wing wholly purplish-coppery, space between this and preceding fascia strewn with prismatic green and coppery scales : cilia dark bronzy-fuscous, with a blackish basal shade. Hind-wings dark bronzy-fuscous ; cilia fuscous, basal third dark fuscous : undersurface with a coppery-metallic patch at apex.

BOLIVIA, Songo ; two specimens.

MACHLOTICA, n. g.

Head smooth-scaled ; ocelli present ; tongue developed. Antennae  $\frac{3}{2}$ , basal joint moderate, without pecten. Labial palpi moderately long, curved, second joint short, loosely scaled, terminal joint twice as long as second, transversely compressed, laterally loosely scaled,



pointed. Maxillary palpi rudimentary. Posterior tibiae smooth-scaled. Fore-wings with 1b furcate, 2 from  $\frac{2}{3}$  or almost from angle, 5 and 6 approximated, 7 to apex, 11 from towards base, widely remote from 10. Hind-wings 1, elongate-trapezoidal-ovate, cilia  $\frac{1}{2}$ - $\frac{3}{4}$ ; 3 and 4 connate, 5-7 approximated towards base.

Type, *M. chrysodeta*.

*Machlotica chrysodeta*, n. sp.

♀. 13 mm. Head shining bronze, behind eyes yellow. Palpi pale yellowish, second joint dark fuscous except apex, terminal joint with base and an anterior streak blackish. Antennae dark fuscous spotted with pale yellowish. Thorax dark shining bronze. Abdomen dark bronzy-fuscous. Fore-wings elongate, posteriorly dilated, costa gently arched, apex rounded, termen obliquely rounded; shining coppery-bronze; five moderately oblique silvery-metallic black-edged streaks from costa between  $\frac{1}{3}$  and apex, alternating with four broader orange streaks, first silvery streak preceded by a small blackish costal spot, first two orange streaks united beneath and continued as a moderate ochreous-yellow fascia to middle of dorsum; beneath second orange streak is a blackish spot; an irregular dark fuscous patch extending beneath last three silvery streaks to termen: cilia dark fuscous, basal half coppery-bronze. Hind-wings thinly scaled, pale fuscous irrorated with dark fuscous, termen and an apical patch suffused with dark fuscous; cilia light grey, with blackish basal line.

BOLIVIA, Songo; one specimen.

*Machlotica nebras*, n. sp.

♀. 10-11 mm. Head dark bronzy-fuscous, hairs behind eyes and a fine line round sides and lower margin of face pale yellowish. Palpi yellow-whitish, second joint with two black bands, terminal joint with black anterior and posterior streaks. Antennae dark fuscous, beneath whitish-ochreous. Thorax dark fuscous, with seven longitudinal pale yellowish lines. Abdomen dark grey, beneath white. Fore-wings elongate, posteriorly dilated, costa gently arched, apex rounded, termen obliquely rounded; dark bronzy-fuscous; basal half wholly strewn with numerous irregular whitish-yellowish dots, marks, or dashes arranged in close longitudinal lines, outer edge of this patch curved, running from middle of costa to beyond middle of dorsum; near beyond this is a curved transverse bronzy-metallic line, of which the discal portion is dilated into a large transverse spot; between this and apex are two moderate oblique bronzy-metallic streaks from costa, and an orange streak between

these; space between these and tornus strewn with numerous irregular pale yellowish dots and marks; an orange streak round apex, and several bronzy-metallic dots or marks on termen: cilia dark fuscous, round apex with base orange and a white median shade. Hind-wings dark fuscous, rather lighter anteriorly; cilia grey, basal third dark fuscous.

BOLIVIA, Songo; two specimens.

*Machlotica atractias*, n. sp.

♀. 8 mm. Head and thorax shining bronze, with a fine white line round sides and lower margin of face, space behind eyes finely barred transversely with white. Palpi white, second joint with two black bands, terminal joint with black anterior and posterior streaks. Antennae dark fuscous, spotted with whitish. Abdomen dark fuscous, ventrally somewhat suffused with pale yellowish. Fore-wings elongate, posteriorly dilated, costa gently arched, apex rounded, termen obliquely rounded; very dark bronzy-purple; basal half crossed by numerous fine brassy-whitish-ochreous more or less interrupted and partially confluent longitudinal lines, posterior edge of this patch curved, running from middle of costa to middle of dorsum; a thick somewhat curved bronzy-metallic transverse streak near beyond this, becoming obsolete towards dorsum; three oblique bronzy-metallic streaks from costa posteriorly, space between first and preceding transverse streak longitudinally striated with prismatic whitish-ochreous; an irregular bronzy-metallic streak along termen, not quite reaching apex, furcate above, towards tornus preceded by more or less longitudinal prismatic whitish-ochreous striation: cilia dark bronzy-grey, tips pale. Hind-wings dark fuscous, lighter anteriorly; cilia grey, basal third dark grey.

BOLIVIA, Songo; three specimens.

*Choreutis hymenaea*, n. sp.

♂ ♀. 10-12 mm. Head white. Palpi white, tuft somewhat mixed with grey. Antennae blackish, ringed with white. Thorax white, with a dark grey bar near posterior extremity. Abdomen white, anal segment dark grey, three or four preceding segments more or less dark grey towards base. Fore-wings moderate, costa moderately arched, apex obtuse, termen rounded, somewhat oblique; dark prismatic bronzy-fuscous; a white basal patch occupying  $\frac{1}{4}$  of wing, outer edge straight, vertical, including a short direct dark grey strigula furcate near base, and a grey dot beneath this; rest of wing crossed by three curved series of irregularly placed small

silvery-metallic spots preceded by blackish suffusion, partly confluent into lines; a more or less developed inwardly oblique white mark in disc at  $\frac{2}{3}$ ; some silvery-metallic dots round apex: cilia dark fuscous, with a basal bronzy line, and fine interrupted white antemedian and apical lines. Hind-wings white; base irregularly suffused with dark fuscous; a dark fuscous terminal fascia, on costa covering about  $\frac{1}{3}$  of wing, attenuated downwards and ceasing before tornus, including a white almost marginal line or series of dots varying in development; cilia white, with dark fuscous basal and postmedian shades except towards tornus.

BOLIVIA, Songo; three specimens. Very like *C. blandinialis*, Z., but easily distinguished by straight (not angular-convex) margin of basal patch, and absence of blackish dot on it; and by white line or dots in terminal fascia of hind-wings.

*Choreutis lapidaria*, n. sp.

♀. 12 mm. Head pale ochreous irrorated with grey. Palpi whitish, second joint suffused with yellowish towards middle, with two dark grey bars above this, tuft mixed with grey, terminal joint sprinkled with grey. Antennae white ringed with black. Thorax bronzy-ochreous, with four fuscous lines irrorated with whitish. Abdomen dark bronzy-fuscous, segmental margins sprinkled with whitish. Fore-wings elongate-triangular, costa moderately arched, apex obtuse, termen somewhat rounded, oblique; fulvous, in disc mixed with fuscous; two fuscous fasciae closely irrorated with white, first at  $\frac{1}{3}$ , slightly curved, second from a white dot on costa at  $\frac{2}{3}$  to  $\frac{3}{4}$  of dorsum, strongly angulated-curved; numerous bluish-silvery-metallic markings partially and irregularly margined with black, viz., subcostal and median streaks on basal area and some irregular marks beneath these, several small spots beyond first fascia on upper half, one on middle of costa, one towards dorsum beyond middle, a streak margining upper third of second fascia anteriorly, a roundish black patch before second fascia in disc containing an irregularly angulated silvery streak, and an irregular interrupted line or series of dots margining second fascia posteriorly: cilia dark grey, with a basal series of blackish spots connected by a fine white line. Hind-wings dark fuscous; a slender transverse streak of whitish irroration towards termen in middle, crossing about  $\frac{1}{3}$  of wing, and some whitish marginal irroration round apex: cilia dark fuscous, with a whitish antemedian shade, tips white.

BOLIVIA, Songo; one specimen.

*Brenthia cyanastra*, n. sp.

♀. 14-15 mm. Head dark fuscous, face and sides of crown white. Palpi white, terminal joint dark fuscous. Antennae dark fuscous. Thorax dark fuscous with a white line on each side of back. Abdomen dark fuscous, a dorsal stripe and segmental margins more or less suffused with white. Fore-wings moderate, posteriorly dilated, costa gently arched, apex rounded, termen rather obliquely rounded; dark fuscous; markings white, edged or suffused with bright pale blue; a short narrow downwards-oblique streak from base; short oblique streaks from costa at  $\frac{1}{4}$  and  $\frac{2}{3}$ , between the first of which and dorsum are three small spots or dots arranged in a triangle; from second proceeds an irregular sinuate-curved line of dots to tornus; two small spots transversely placed and more or less connected in disc at  $\frac{2}{3}$ , another beneath these towards dorsum, and another on dorsum before this; a row of dots round apex and termen: cilia dark fuscous, with large white patches at apex and tornus except on a basal line. Hind-wings dark fuscous, lighter towards base; cilia white, with a dark fuscous spot below apex.

BOLIVIA, Songo; three specimens.

*Brenthia malachitis*, n. sp.

♂. 12-13 mm. Head and thorax dark bronzy-fuscous, eyes edged in front and behind with fine white lines, patagia with two fine white lines. Palpi thickened with scales, black, apex of second joint, and a subbasal ring and apex of terminal joint white. Antennae black dotted with white. Abdomen dark fuscous, beneath with segmental margins suffused with white towards middle. Fore-wings elongate-triangular, costa moderately arched, apex obtuse, termen slightly sinuate beneath apex, bowed, little oblique; dark fuscous; markings pale shining blue-metallic; two short fine oblique streaks from costa towards base, and three dots placed in a triangle between these and dorsum; short direct streaks from costa before middle and at  $\frac{3}{4}$ , latter forming a white dot on costa; a small spot in disc at  $\frac{3}{4}$ ; midway between this and termen a transverse line from near costa to near tornus, edged with black posteriorly, terminal fascia beyond this lighter than ground-colour: cilia dark fuscous, with a white patch beneath apex, and a small white spot above tornus. Hind-wings dark fuscous; an indistinct paler small discal mark before middle; a rather irregular paler transverse line at  $\frac{3}{4}$ ; a violet-blue-metallic posteriorly black-edged subterminal line, terminal fascia beyond this paler; cilia dark fuscous, with blackish basal

line ; a large white patch at apex, and two suffused white spots on lower part of termen.

BOLIVIA, Songo ; three specimens.

*Brenthia hexaselena*, n. sp.

♂ ♀. 11-12 mm. Head, thorax, and abdomen dark bronzy-fuscous, sides of face and posterior margin of eyes white, patagia with two fine white lines, abdomen white beneath. Palpi white, second joint short, with dark grey projecting scales towards base and a dark grey subapical ring, terminal joint longer, with black anterior line. Antennae blackish dotted with white. Fore-wings elongate-triangular, costa gently arched, apex obtuse, termen rather obliquely rounded ; blackish-fuscous ; two short oblique streaks from costa towards base, a short median streak from base, and a subdorsal mark beneath it light metallic-green-blue ; a white transverse spot on middle of dorsum, reaching nearly half across wing, connected with costa by a direct violet-blue-metallic streak ; a transverse-oval white spot in disc at  $\frac{2}{3}$  ; a somewhat curved violet-blue-metallic streak from costa about  $\frac{2}{3}$  almost to tornus ; a marginal violet-blue-metallic streak round apex : cilia fuscous with a dark fuscous line, at apex with a white patch. Hind-wings blackish-fuscous ; an oval white spot in middle of disc ; a triangular white spot on costa at  $\frac{3}{4}$  ; a violet-metallic subterminal streak almost reaching costa but not nearly to tornus ; between this and termen a shorter fuscous-whitish streak whose extremities touch termen ; cilia dark fuscous, with a white patch at apex, and two broad oblique white bars on upper part of termen.

BOLIVIA, Songo ; four specimens.

*Brenthia logistis*, n. sp.

♀. 9 mm. Head fuscous, lower part of face suffused with whitish. Palpi whitish, second joint with two dark grey rings, base and anterior edge of terminal joint dark grey. Antennae blackish dotted with white. Thorax fuscous, with a fine white line on each side of back. Abdomen dark fuscous, segments 3 and 5 with fine whitish marginal rings, beneath ventrally suffused with white. Fore-wings elongate-triangular, costa slightly arched, apex rounded, termen slightly rounded, little oblique ; dark fuscous, somewhat lighter towards base ; an undefined fascia of whitish irroration towards base ; irregular undefined fasciae of whitish irroration before and beyond middle, first straight, second curved on upper half, its costal fourth replaced by violet-blue-metallic specks ; between these is a transverse-oval spot in disc above middle outlined with white ; a small

whitish spot on costa at  $\frac{2}{3}$ ; a black terminal fascia, partially edged with whitish irroration anteriorly, and nearly separated into three blotches by slender projections of whitish irroration from anterior edge in middle and at  $\frac{1}{4}$  from costa, its terminal edge marked with six violet-blue-metallic dots: cilia light fuscous, with a dark fuscous thick antemedian line. Hind-wings dark fuscous, lighter towards base; a rather large oblique-oval whitish-fuscous spot in middle of disc; a small white spot on costa at  $\frac{2}{3}$ , a white transverse mark before termen in middle, and a small white mark near termen above tornus; a transverse violet-golden-metallic streak across apex; cilia fuscous, with a dark fuscous subbasal line, a white apical patch, and oblique white patches above and below middle of termen.

BOLIVIA, Songo; one specimen.

*Brenthia pavonacella*, Clem.

All South American specimens have the white patch on apical cilia of fore-wings more or less obsolete, and the oval discal spot in hind-wings before middle pale fuscous, sometimes partially whitish-tinged; whereas in North American specimens both these are clear white: I regard them, however, as only geographical forms of the same species, which ranges very widely in America.

TINEIDAE.

*Tinea coracopsis*, n. sp.

♀. 33 mm. Head blackish. Palpi dark fuscous. Antennae  $\frac{3}{5}$ , pale grey, suffusedly ringed with dark fuscous. Thorax prismatic whitish-fuscous, anterior edge blackish. Abdomen very pale brassy-ochreous. Fore-wings elongate, narrow, costa moderately arched, apex obtuse, termen rounded, rather strongly oblique; all veins separate; whitish-fuscous, indistinctly strigulated transversely with darker, with slight violet reflections; some scattered blackish scales beneath costa; plical and second discal stigmata black: cilia whitish-fuscous irrorated with darker, on lower part of termen with some undefined basal groups of dark fuscous scales. Hind-wings very pale shining brassy-ochreous; cilia ochreous-whitish.

PERU, Aqualani, in July; one specimen.

*Tinea xenodes*, n. sp.

♀. 10 mm. Head fuscous, hairs of face whitish-ochreous. Palpi whitish-ochreous, a subapical band of second joint, and terminal

joint except apex dark fuscous. Antennae  $\frac{3}{4}$ , fuscous. Thorax and abdomen fuscous mixed with dark fuscous. Fore-wings elongate, very narrow, costa slightly arched, apex round-pointed, termen extremely obliquely rounded; all veins separate; fuscous suffusedly irrorated with dark fuscous; a small whitish-ochreous spot on costa at  $\frac{5}{8}$ : cilia fuscous, sprinkled with dark fuscous. Hind-wings rather dark bronzy-fuscous; cilia fuscous.

BOLIVIA, Songo; one specimen.

*Amydria gemistis*, n. sp.

♂. 13-15 mm. Head pale ochreous, centre of crown somewhat mixed with fuscous. Palpi whitish-ochreous, second joint suffused with dark fuscous except towards apex, with dense long projecting scales beneath and two lateral bristles near apex, terminal joint with a suffused fuscous subapical band. Antennae pale ochreous suffusedly ringed with dark fuscous. Thorax pale ochreous mixed with dark fuscous. Abdomen whitish-ochreous suffusedly irrorated with fuscous. Fore-wings elongate, rather narrow, costa moderately arched, apex obtuse, termen rather obliquely rounded; whitish-ochreous suffusedly strigulated with brownish-ochreous, the strigulae more or less marked with dark fuscous; a suffused dark fuscous streak along costa from base to  $\frac{2}{3}$ , and costa beyond this spotted with dark fuscous, with a larger dark fuscous spot before apex; discal stigmata large, round, dark fuscous; dorsal half posteriorly more strongly strigulated with dark fuscous: cilia whitish-ochreous suffusedly barred with dark fuscous. Hind-wings and cilia rather dark grey.

BOLIVIA, Songo; three specimens.





III. *Revision of the Australian and Tasmanian Malacodermidae.* By ARTHUR M. LEA, F.E.S., Government Entomologist, Tasmania.

[Read October 7th, 1908.]

PLATES II—VI.

THE Australian and Tasmanian *Malacodermidae* have been comparatively neglected; in Masters' Catalogue only 114 species\* were recorded; since the Catalogue 147† have been recorded as new, 3 were overlooked, and I am now able to add 137 more. Excluding known synonyms and varieties the total now recorded is 363 species.

The reasons for the neglect are not far to seek; the species, although in life often of graceful form and of beautiful colours, after death frequently become badly distorted (especially when pinned) and discoloured; nor can they afterwards be properly set out. Most of the species are small, and the colours of many are exactly similar to those of other species, from which, however, they are distinguished by strongly defined structural characters.‡

In many species of *Helcogaster* the males have often almost quite identical colours, but are easily distinguished by the sculpture of the head. In *Hypattalus* many similarly coloured species are to be distinguished by the front femora of the male, or the hind tibiae of the female. In the *Lycides* I have given two small special tables of species, which are separated by profound differences of sculpture, and yet have a strong outward resemblance. Owing also to the contraction which almost invariably takes place, the shape of specimens of the same species often appears very different.§

A few of the species are very variable, but perhaps these

\* Excluding the then known synonyms, also a species wrongly referred to the family, another entered twice, and another wrongly recorded as Australian.

† Some of these, however, are here noted as synonyms or varieties.

‡ These, however, are often confined to the males.

§ This is especially the case with the incision of the penultimate segment of the abdomen of the males.

form no larger a percentage of the whole than in other families of equal extent.

The species almost entirely live on flowers or on leaves, and feed on nectar or on other insects; the larvae of but few species are known, but those of the *Lycides* live in rotting wood or underground.

I have to thank the Rev. T. Blackburn for co-types of several of his species; Mr. W. J. Rainbow for co-types of some species, the types of which are in the Australian Museum; but in particular Mr. George Masters for co-types and other specimens from his own and the rich Macleay Museum collections, without which my work would have been greatly hampered.

I have examined the whole of the types and other specimens in the Macleay and Australian Museums, the specimens in the National Museum in the Departments of Agriculture of New South Wales and Tasmania, and in the collections of Messrs. H. J. Carter, C. French, W. W. Froggatt, J. C. Goudie, H. H. D. Griffith,\* R. Illidge, Aug. Simson and Taylor. I have also received many specimens from Messrs. Edmund Allen,† A. J. Coates, D. Dumbrell, R. Helms, T. G. Sloane, J. G. Otto Tepper, J. J. Walker, J. C. Wiburd and others. With the localities for the new species I have always given the collectors' names, but I have not considered these necessary for previously described species.

The whole collection dealt with is rich in specimens from Queensland, New South Wales, Tasmania, and South-West Australia; comparatively rich from South Australia and Victoria, and poor from North-West Australia; whilst the Northern Territory and Central Australia are practically unrepresented. When not otherwise specified the types of the new species remain in my own collection.

At the end I have placed a number of species, which it is quite impossible to identify from the published descriptions, or even to satisfactorily place generically.

Two species (*Lampyrus marginipennis*, Guér., and *L. striata*, Fab.) have been wrongly recorded from Australia.‡

\* Including a fine series sent to him by Mr. F. P. Dodd from North Queensland.

† It was through receiving a remarkable species of *Laius* from this gentleman that I was induced to revise the family.

‡ See notes under *Luciola*.

The sub-families of *Malacodermidae* of the world are thus tabulated by Lacordaire.

- I. Antennes insérées sur le front ou à la base du rostre en dessus.
- a. Hanches intermediares distantes . . . . . LYCIDES.
  - aa. " " contiguës.
    - Antennes plus ou moins contiguës . . . . . LAMPYRIDES.
    - " " " distantes . . . . . TELEPHORIDES.
- II. Antennes insérées latéralement au devant des yeux.
- Epistome indistinct . . . . . DRILIDES.\*
  - " distinct . . . . . MELYRIDES.†

But the Australian and Tasmanian sub-families and genera ‡ may be tabulated as follows:—

- A. Body with exsertile vesicles (*Malachiides*).
- a. Elytra covering the abdomen.
    - b. Antennae of apparently ten joints. . . . . *Laius*.
    - bb. Antennae with eleven distinct joints . . . . . *Hypattalus*.
  - aa. Elytra not covering the abdomen.
    - c. Antennae flabellate in the male . . . . . *Balanophorus*.
    - cc. Antennae not flabellate in the male.
      - d. Head usually more or less convex in male. . . . . *Carphurus*.
      - dd. Head usually largely excavated in male.
        - e. Prothorax greatly constricted at base (eyes green) . . . . . *Neocarphurus*.
        - ee. Prothorax less constricted at base . . . . . *Helcogaster*.
- AA. Body without exsertile vesicles.
- B. Abdomen partly phosphorescent in life (*Lampyrines*).
    - f. Head covered . . . . . *Atyphella*.
    - ff. Head uncovered . . . . . *Luciola*.
  - BB. Abdomen not phosphorescent in life.
    - C. Prothorax usually divided into distinct areas, the elytra usually cancellate-punctate (*Lycides*).
      - g. Head uncovered . . . . . *Calochromus*.

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\* Not represented in Australia.

† The *Melyrides* of Lacordaire include the *Malachiides*.

‡ Except *Heliotis* which is unknown to me.



*Synchonnus*, Wat., Ill. Typ. Col., p. 59.

*Stadenus*, Wat., l. c., p. 61.

*Achras*, Wat., l. c., p. 61.

This is the genus most numerously represented in Australia and Tasmania of all the Malacodermes; it has as well a wide distribution in New Guinea and the Malay Archipelago. In consequence of the great diversity which exists in parts generally quite constant, it has been split up into a number of genera, but I think few of these will eventually stand.

The most remarkable variation occurs in the rostrum, in some species (*rhypidius*, *nigripes*, etc.) it is long, rather thin and shining; these were regarded by Mr. Waterhouse as belonging to a distinct genus—*Porrostoma*. In others (*rufipennis*, *fallax*, etc.) it is either entirely absent, or very short (wider than long), these he considered as belonging to *Metriorrhynchus*. Were there no intermediate forms undoubtedly two genera could be maintained, but there are so many of these that it is quite impossible to define a boundary between the two sections.

Great variation also occurs in the prothorax and antennae. The former is usually divided into 7 distinct areolets, but in a few species these are not very sharply defined. Others have but 5 or 3 areolets (all of these have the rostrum either very short or absent), and for these also new genera were proposed. One section has the prothorax 3-areolate, and the sutural costa of the elytra trifurcate at base; for this section the genus *Trichalus* was proposed, and is here regarded as distinct, but merely for the sake of convenience.

The antennae vary from being strongly flabellate in the male to but slightly serrate in both sexes. The second joint is usually very small and partially concealed.

*Lycus australis*, Boisd., and *ochraceus*, Dalm., probably belong to this genus, but I think it best at present to treat them as being of doubtful position.\*

The following species are unknown to me:—

*Clientulus*, Wat., *femoralis*, Macl., and *vittatus*, Blackb. These are commented upon at length hereafter.

\* See list of doubtful species at end.

*Prothorax five-areolate.*

*Clients*, Blackb. Apparently close to *clientulus*.

*Prothorax seven-areolate.**A. Elytral punctures in single series.*

*Miniaticollis*, Macl. A species with very unusual colours, its rostrum is short.

*Paradoxus*, Blackb. Apparently close to *cancellatus*.

*B. Elytral punctures in double series.*

*Brevirostris*, Wat. Coloured as *rhipidius*, but with the rostrum intermediate in length between that species and *rufipennis*. It would be dangerous to identify any species as *brevirostris* (except from N.W. Australia) without further information than that contained in the descriptions.\*

*Scalaris*, Wat. Apparently very close to *haemorrhoidalis*; the description in Ill. Typ. Col. is the best.

*Centralis*, Macl. The rostrum in this species is very short.

*Foliatus*, Macl., and *hirtipes*, Macl. Two species having very peculiar prothoracic margins; they should be very distinct—in *foliatus* the rostrum is long, in *hirtipes* it is of medium length.

*Fumosus*, Macl. Apparently like a small dingy specimen of *Trichalus ater*.

*Monticola*, Blackb. Apparently coloured much as *eremita*, but smaller and with differently sculptured elytra; seems close also to *coenosus* but with a longer rostrum and elytra somewhat differently coloured. It should perhaps be regarded as belonging to the group having the elytral punctures in single series.

*Occidentalis*, Blackb. Evidently close to *rhipidius*, but with part of the elytra black, although not as in *disconiger*.

*Mentitor*, Blackb. Apparently close to *eremita* and *ordinarius*, but the former has the suture black and the latter the rostrum long. The others † may be tabulated as follows :—

\* The original one is short enough, but that in Ill. Typ. Col. is still shorter.

† *Opacus* and *tibialis* were described after the table was drawn up, but in it *opacus* would have been placed next to *atratus*, and *tibialis* would have been given a distinct section next to C.

- A. Apterous . . . . . *apterus*, n. sp.
- AA. Winged.
- B. Elytral punctures in single series\*.
- a.* Prothorax 7-aerolate.
- b.* Prothorax pallid.
- c.* Antennae of male flabellate . . . . . *testaccicollis*, Macl.
- cc.* Antennae of male not flabellate . . . . . *diminutivus*, n. sp.
- bb.* Prothorax partly black . . . . . *coenosus*, Lea.
- bbb.* Prothorax entirely black.
- d.* Elytra of uniform colour.
- e.* Elytra red . . . . . *uniseriatus*, n. sp.
- ee.* Elytra black . . . . . *insignipennis*, Blackb.
- dd.* Elytra not of uniform colour.
- f.* Elytral margins pallid throughout . . . . . *cancellatus*, n. sp.
- ff.* Elytral margins not pallid throughout.
- g.* Antennae of male flabellate . . . . . *ramosus*, n. sp.
- gg.* Antennae of male not flabellate . . . . . *meyricki*, Blackb.
- aa.* Prothorax not 7-aerolate.
- h.* Prothorax pallid . . . . . *basiflavus*, n. sp.
- hh.* Prothorax black.
- i.* Third joint of antennae much shorter than 4th . . . . . *heterodoxus*, n. sp.
- ii.* Third joint no shorter than 4th.
- j.* Elytra shining . . . . . *constricticollis*, n. sp.
- jj.* Elytra opaque . . . . . *simplicicornis*, n. sp.
- BB. Elytral punctures in double series.
- C. Prothorax not 7-aerolate.
- k.* Prothorax entirely pallid.
- l.* Elytra entirely dark . . . . . *atricornis*, n. sp.
- ll.* Elytra pallid at base . . . . . *ampliatus*, Macl.
- kk.* Prothorax partly pallid.
- m.* Dark part of elytra apical . . . . . *cinctus*, Wath.
- mm.* Dark part not apical . . . . . *limbatus*, Wath.
- kkk.* Prothorax entirely black.
- n.* Apex of elytra pallid.
- o.* Dark portion of elytra black. *inquinulus*, Wat.

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\* Sometimes, however, they are in irregular double series towards the base and apex.

- oo. Dark portion infusate . . . *obscuripennis*, n. sp.
- nn. Apex of elytra black.
- p. Black apical portion not connected with base . . . *dichrous*, Wat.
- pp. Black portion connected with base.
- q. Elytra shining . . . . *triareolatus*, n. sp.
- qq. Elytra opaque . . . . *nigrovittatus*, n. sp.
- CC. Prothorax 7-areolate.
- D. Rostrum long.
- r. Entirely black . . . . . *moerens*, n. sp.
- rr. Not entirely black.
- s. Prothorax black.
- t. Elytra uniformly reddish *rhypidius*, W. S. Macl
- tt. Elytra partly black . . . *disconiger*, n. sp.
- ss. Prothorax partly black.\*
- u. Elytra uniformly reddish *lateralis*, Redt.
- uu. Elytra partly dark.
- v. More than half of suture dark . . . . . *ordinarius*, n. sp.
- vv. Less than half of suture dark . . . . . *variipennis*, n. sp.
- ss. Prothorax pallid.
- w. Elytra black at apex.
- x. Black portion confined to extreme apex . . . *serraticornis*, Macl.
- xx. Black portion at least one-eighth of the length of elytra.
- y. Metasternum black . . . *abdominalis*, Wat
- yy. Metasternum pallid.
- z. Abdomen dark . . . *apicalis*, Wat.
- zz. Abdomen partly pallid . . . . . *melaspis*, Bourg.
- ww. Elytra entirely reddish { *nigripes*, Macl.  
  *textilis*, Wat.  
  *uniformis*, Wat.
- DD. Rostrum of moderate length.
- a. Prothorax entirely pallid . . . *rufirostris*, n. sp.
- aa. Prothorax dark in middle . . *irregularis*, Wat.

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\* *Nigripes* is not included here, as in that species the dark portion of the prothorax is sometimes absent, and even when present appears to be of the nature of a stain only.



- DDD. Rostrum short.
- E. Prothorax black.
- b. Elytra entirely black . . . *atratus*, Fab.
- bb. Elytra partly or entirely reddish.
- c. Apex of elytra black.
- d. Reddish portion of elytra unusually dark . . . *batesi*, n. sp.
- dd. Reddish portion normal . . . . . { *togatus*, Wat.  
*brisbanensis*, n. sp.
- cc. Apex of elytra reddish.
- e. Elytra red only at apex and shoulders . . . *simsoni*, n. sp.
- ee. Elytral markings very variable but never as in *simsoni* . . . . *rufipennis*, Fab.
- EE. Prothorax entirely pallid.
- f. Elytra entirely pallid.
- g. Antennae of male flabellate . . . . . *miniatus*, Macl.
- gg. Antennae of male serrate *elongatus*, Macl.
- ff. Elytra mostly dark.
- h. Basal fourth of elytra pallid . . . . . *longicornis*, Macl.
- hh. Extreme base only pallid *costicollis*, n. sp.
- fff. Elytra mostly pale.
- i. More than one-third of apex dark . . . . . *posticalis*, Macl.
- ii. Less than one-sixth of apex dark.
- j. Antennae of male flabellate . . . . . *gracilis*, n. sp.
- jj. Antennae of male not flabellate . . . . . *fallax*, Wat.
- EEE. Prothorax partly pallid.
- F. Prothorax longer than wide *militaris*, n. sp.
- FF. Prothorax wider than long.
- G. Dark parts of elytra do not always include costae *fuscolineatus*, Wat.
- GG. Dark parts include costae.
- H. Size comparatively small *marginipennis*, Lea.
- HH. Size comparatively large . . . . . *eremita*, Blackb.

METRIORRHYNCHUS ATRATUS, Fab., (*Lycus*) Syst., El. II, p. 113; Lacord., Gen. Coleop. IV, p. 297, Nota 2; Boisd., Voy. Astr., p. 120; Blackb., T.R.S., S.A., 1900, p. 52. (*Fig.* 15.)

Mr. Waterhouse thought it possible\* that *Lycus atratus* was a variety of his *haemorrhoidalis*, and that both were varieties of *rufipennis*. There are at least three entirely black species occurring in Tasmania, practically any one of which might be *atratus*; but Blackburn has formerly described a species from Tasmania as the *atratus* of Fabricius, and unless it can be proved to be the contrary by examination of the type (if such is still extant), I think the species described by him as *atratus* should be accepted as such. This species, of which only the female was known to Blackburn, is rather small and narrow, with a very short rostrum; 3rd-9th joints of antennae about as long as wide (with the produced portions much less than in the male of *rufipennis*), and the reticulation of the elytra rather less clearly defined than usual. Of the other black Tasmanian species *insignipennis* can be readily distinguished by the elytral punctures being in single instead of in double rows; whilst *moerens* has the rostrum long and shining.

*Hab.* TASMANIA (widely distributed).

METRIORRHYNCHUS RUFIPENNIS, Fab. (*Lycus*), Syst. El. II, p. 114; Er., Wieg. Arch., 1842, p. 145; Blanch., Voy. Pole Sud. IV, p. 75, Pl. V, fig. 12; Germ. (*Porrostoma*), Linn. Ent. III, p. 182; Boisd., Voy. Astr., p. 117; Wat., Trans. Ent. Soc. Lond., 1877, p. 74, Pl. I, figs. 6-12; Ill. Typ. Col., p. 48, Pl. XII, fig. 6; Blackb., T. R. S., S.A., 1900, p. 56.

*nigrirostris*, W. S. Macl., Dej. Cat., 3 ed. p. 111.

*salebrosus*, Wat. (*Porrostoma*), Trans. Ent. Soc. Lond., 1877, p. 79, Pl. II, figs. 61-64; Ill. Typ. Col., p. 48, Pl. XII, fig. 6.

var. *marginatus*, Er., Wieg. Arch., 1842, p. 145; Wat., Trans. Ent. Soc. Lond., 1877, p. 85; Blackb., T. R. S., S.A., 1900, p. 56.

*goryi*, Le G. (*Lycus*), Rev. Zool., 1844, p. 222; Wat., Trans. Ent. Soc. Lond., 1877, p. 85; Masters (*Calopteron*), Cat. Sp. No. 3365.

\* Ill. Typ. Col., p. 49.

- var. *haemorrhoidalis*, Wat. (*Porrostoma*), Trans. Ent. Soc. Lond., 1877, p. 79, Pl. II, figs. 61<sup>a</sup>-64<sup>a</sup>; Ill. Typ. Col., p. 49.
- var. *plagiatus*, Wat. (*Porrostoma*), Trans. Ent. Soc. Lond., 1877, p. 80, Pl. II, figs. 65-68; Ill. Typ. Col., p. 49, Pl. XII, fig. 8.
- var. *lugubris*, Wat., Trans. Ent. Soc. Lond., 1877, p. 80, Pl. II, figs. 69-72; Ill. Typ. Col., p. 50, Pl. XII, fig. 7.
- var. *miles*, Blackb., T. R. S., S.A., 1900, p. 54.

The synonymy is very complicated\* and is rendered more difficult of elucidation owing to the brevity of some of the older descriptions.

Mr. Waterhouse in his first monograph, very briefly describes as *rufipennis* a species which I believe to be nothing but a small form of *rhipidius*, and throughout this work he consistently refers to this form as *rufipennis*; subsequently, however, he regarded his *salebrosus* as *rufipennis*.†

It seems to me that the description of *miles* was drawn up from a female, differing to but a slight extent from the normal *salebrosus*, and I certainly cannot regard it as worthy of a *specific* name.‡

I do not think that *brevirostris* can have any connection with this species, as the figure of the antenna is different, and the rostrum (despite the name) is figured (Plate I, fig. 14) as being longer than broad, and is so described (at least it is said to be "scarcely longer than broad.")

There is a specimen from the Leura Falls in Mr. Froggatt's collection, which has the antennae distinctly *thicker* than in the normal form; although otherwise much the same.

\* I believe the above references will have to be still further added to.

† He remarks in Ill. Typ. Col., p. 49, "It is difficult to decide whether *Lycus rufipennis*, F., should be considered identical with *P. erythropterum*, Er. (*rhipidius*), or with *P. salebrosus*, W. I have here adopted Erichson's view, by which the latter becomes synonymous with the Fabrician species. I here also regard the species with a short rostrum (*salebrosus*) as the *rufipennis* of Fabricius.

‡ I have, at any rate, a female from Victoria which agrees very well indeed with Blackburn's description, and it appears to me to be nothing but a very slight variety of *salebrosus*.

The species is certainly the most variable of the subfamily as regards its elytral markings, although the sculpture is remarkably constant. There is, however, one very remarkable variation; this occurs in the carina dividing the two apical central areolets of the prothorax. In about half of the specimens this is entire, as in other species of the genus, but in the others (more frequently in the females than in the males) it is longitudinally divided so as to appear as two carinae; as a consequence the median areolet, in these specimens, appears to be connected by a very narrow groove with the apex. I can be certain that I am not here confusing two allied species, having taken numerous specimens *in cop.*, and in numerous pairs the sexes differ in this respect.

In size it varies from 6 to 10½ mm.

The typical form and the variety *haemorrhoidalis*\* are very abundant on the undergrowth in heavily timbered parts of Tasmania.

I have seen an occasional specimen in which the elytra were so indistinctly tipped with red, that unless closely looked for it would escape observation; but usually in *haemorrhoidalis* the apex is very distinctly tipped with red; in a rare form the red is continued along the sides to the base and up the suture for a short distance (*marginatus, goryi*) and in another to the base both at suture and sides (*lugubris*); in several specimens the black occupies an elongated somewhat  $\wedge$  (compo reversed  $\vee$ )-shaped space (*plagiatus*)†; in one specimen from Mount Wellington the disc of each elytron is infusate only (an unnamed variety).

It is to be noted that in this (as in other species of the genus) the prothorax does not always contract in the same way in different specimens; usually it is quite strongly

\* I have examined a long series of specimens and cannot support Mr. Blackburn in his contention that *haemorrhoidalis* and *rufipennis* (*salebrosus*) are really distinct, though closely allied species, and which can be distinguished by "the produced piece of each joint beginning with the sixth"; in the sexes of course there is considerable difference in the antennae, but there is just as much individual variation in the males of one form as there is between the males of the two forms; moreover, a slight difference in position from which the antennae are viewed makes a considerable difference in their appearance.

† Mr. Waterhouse suspected that this form was only a variety of *haemorrhoidalis*.

constricted in the middle, but an occasional specimen of both the commoner forms may be obtained in which the outline is almost continuous; this naturally affects the apparent width of the basal (and to a less extent of the apical) areolets.

In connection with, although not of, this species it is curious to note that an almost parallel variation in colour occurs with one of the *Oedemeridae* (*Pseudolychnus haemorrhoidalis*, Fab.) frequently found in its company.

*Hab.* TASMANIA: Hobart, Mount Wellington, Huon River, Ulverstone, George's Bay, Sheffield; VICTORIA: Monbulk, Dividing Range; N.S. WALES: Forest Reefs, Sydney, Blue Mountains, Mount Brown, Merimbula, Como, Jenolan.

METRIORRHYNCHUS RHIPIDIUS, W. S. Macl. (*Lycus*), King's Survey, II, 1827, App. p. 442; Lacord., Gen. Col., IV, p. 297, note 1; Waterhouse, Trans. Ent. Soc. Lond., 1877, p. 84.

*septemcavus*, W. S. Macl. (*Lycus*), King's Survey, II, 1827, App. p. 442; Wat., Trans. Ent. Soc. Lond., 1877, p. 84.

*erythropterum*, Er. (*Porrostoma*), Wieg. Arch., 1842, p. 144; Wat., Trans. Ent. Soc. Lond., 1877, p. 74, Pl. I, figs. 1-5.

*gigas*, Blackb., P. L. S., N.S.W., 1891, p. 524.

*flagellatus*, Blackb., T. R. S., S.A., 1900, p. 53.  
(Figs. 16, 17, 18, 19, 20.)

This species is the most widely distributed and abundant of all the Australian *Lycides*, and may be taken from early to late summer. It is frequently to be seen on *Leptospermum*, *Kunzea*, *Eucalyptus* and other blossoms in countless thousands.

Mr. Blackburn appeared to regard his *gigas* as distinct, largely on account of its size, but I have specimens from New South Wales and Queensland, as well as from Western Australia, which agree not only in size\* but in all other details mentioned by him for *gigas*, and which I can only regard as belonging to *rhypidius*. So far as his statements as to the shape of the flabella in Waterhouse's figure of

\* He gives the length of *gigas* as 7-9 lines, whilst the type of *rhypidius* is 19 mm. in length, and one before me measures 21 mm.

*rufipennis*\* are concerned, it is to be borne in mind that the artist in drawing the antenna of an insect, part of which is compressed in one direction, and part in almost an opposite direction, must necessarily draw one portion from the side, when it appears totally different to what it does from in front; thus if the antennae of this species were drawn from one direction they would appear almost as rows of overlapping plates.

Neither can I regard *flagellatus* † as a valid species. I have numerous specimens differing in width (this difference is often more apparent than real, owing to the irregular contraction, liable to occur in this, as in many other genera of *Malacodermidae*). If the widened apical portions of the rami are examined, it will be noticed that the serrations are often due to hairs or setae, although frequently distinct in themselves, moreover are nearly always different in the different joints, are distinct in some specimens and indistinct or not at all traceable in others; in the type of *flagellatus* they are apparently as indistinct as in many specimens from Tasmania.

I have examined the type of *rhipidius*, which bears a label in the late W. S. Macleay's handwriting "Lycus rhipidion Capt. King Australasia," also the type ‡ of *septemcavus*, bearing in similar writing "Lycus 7-cavus Capt. King Australasia." The two specimens are certainly sexes of one species, as suspected by several entomologists (see figures 16 and 17 for antennae of these specimens).

The type of *rhipidius* is a very large male (by no means of uncommon size for Queensland, however), with the prothorax comparatively small, rostrum long and thin, and elytral punctures large and transversely oblong. I have figured (fig. 16) one of its antennae as seen from the side; and some of the rami (A, B, C, D and E).

I have also figured (fig. 18) the antenna of a normal male of *erythropterus*, showing the form most abundant in Tasmania (fig. 19 is that of the corresponding female);

\* See elsewhere as to the various species regarded and figured by Waterhouse as *rufipennis*.

† Mr. Blackburn apparently accepted Waterhouse's surmise (in T.E.S., 1877, p. 84) as to *rhipidius* and *septemcavus* being identical with *rufipenne*, as he does not mention either; although certainly the original descriptions are far from satisfactory.

‡ The antennae are damaged in this specimen, only nine joints being left on one side and fewer on the other.

it will be noticed that the true third joint is very different to what it is in fig. 16 (other joints are also different), but I have seen so many intermediate forms,\* all differing to a slight extent from each other, and forming distinct links between these two forms, that to regard the two figures as distinct would make it necessary to regard hosts of others as distinct. In several specimens before me the true third joint is even shorter than in fig. 16, with its ramus still longer; whilst I have seen others in which the third joint is still longer than in fig. 18 with its ramus still shorter.

The rami are very variable, especially when long, and are seldom, if ever, alike in both antennae. When the rami are shorter, they are often simple or almost simple, but frequently are terminated by several minute projections, which often appear more distinct than they really are, owing to being supplied with setose hairs.

The prothorax in the largest males often appears disproportionately small when compared with that of smaller specimens; in the type of *hippidius* for instance (which measures 19 mm. in length) it is actually no larger than in one measuring but 13 mm. in length. At its base it is not much wider than across the middle of one elytron, whilst in many others it is almost as wide as the width of both elytra across the middle.

The elytra also vary in their proportionate width to length.

In a pair from Forest Reefs, pairs from Sydney and Albany and pairs from Tasmania (all taken *in cop.*), the punctures across the middle of the elytra in the male are not much wider than long, and with more or less rounded corners; in the females they are strongly transverse, more sharply defined and much more regular. But the punctures appear to be always much more transverse and regular in the larger than in the smaller specimens of both sexes. The male from Forest Reefs has the antennae much as in fig. 18, but its female has them much shorter with the joints considerably wider than usual in the female.†

The second and sixth elytral costae (counting the smaller ones as true costae) are especially liable to variation in

\* I have critically examined some hundreds of specimens from many parts of Australia, and have seen many thousands.

† It is the only female I have seen in which the 4th-10th joints are all distinctly transverse.

thickness towards the base, but all are subject to variation. In many specimens the only costa distinctly elevated above the others beyond the middle is the true fourth; frequently the smaller costae (first, third and fifth) become very irregular and tend to disappear towards the apex, so that sometimes two rows of punctures become conjoined into one irregular row; two costae also sometimes become conjoined and narrowly connected with the apex; but towards the apex all the costae become irregular, and they are seldom exactly the same on both elytra.

The colour of the elytra varies slightly in living specimens, and is subject to alteration after death; the claws (or at least their tips) are invariably reddish.

The size varies from 9 to 21 mm., the male usually being smaller than the female, but the largest specimen before me is a male.

The brief description here given will enable this species to be distinguished from all others known to me.

Black; elytra reddish.

Rostrum long and thin. Antennae pectinate in the male, serrate in the female, 3rd joint distinctly longer than the 4th. Prothorax 7-areolate. Elytra quadricostate, the interstices each with two double rows of punctures.

This will include hosts of forms all differing to a certain extent in the lengths and shapes of the antennal joints, in the shapes and comparative lengths of the rami, in the proportional size and width of the prothorax to the elytra, in the size and shape of the elytral punctures, in the comparative size and terminations of the elytral costae, and in the different shades of colour.

*Hab.* QUEENSLAND: Brisbane, Gayndah, Southport, Inglewood, Darling Downs; N.S. WALES: Tweed, Richmond, Clarence and Hunter Rivers, Forest Reefs, Sydney, Ben Lomond, Mount Kosciusko, Jenolan, Blue Mountains, Monaro, Yass, Junee, Tamworth, Arundale, Condobolin, Queanbeyan, Goulburn, Kenthurst, Chatswood, Bathurst, Wentworth Falls; VICTORIA: Melbourne, Monbulk, S. Wandin, Gisborne, Launching Place, Grampians, Emerald; TASMANIA: Hobart, Mount Wellington (including the summit), Huon River, Launceston, Burnie, Woolnorth; S. AUSTRALIA: Mount Lofty, Adelaide, Murray Bridge; W. AUSTRALIA: Albany, Swan River, Pinjarrah.



**METRIORRHYNCHUS FEMORALIS**, Macl., Trans. Ent. Soc.,  
N.S.W., II, p. 262.

Mr. Rainbow informs me that the rostrum (not mentioned in the original description) of this species is as long as in *rhypidius* (a specimen of which I sent to the Australian Museum for comparison), and that the elytra of the male (as implied in the description) are unicolorous.

*Hab.* QUEENSLAND: Gayndah.

**METRIORRHYNCHUS NIGRIPES**, Macl., *l. c.*, p. 262.

*Porrostoma elegans*, Wat., Trans. Ent. Soc. Lond., 1877, p. 75, Pl. I, figs. 23-27; Ill. Typ. Col., p. 44, Pl. XI, figs. 6-6a.

The original description of this species is simply a comparison with the preceding one and is very unsatisfactory; but there are two co-types before me and these agree exactly with Waterhouse's description of *elegans*.

The species is variable to a slight extent, the dark markings in the three posterior areolets being variable in size and intensity, and in one specimen before me are entirely absent; the scutellum is occasionally entirely black, but usually its sides are reddish.

*Hab.* QUEENSLAND: Gayndah, Brisbane, Rockhampton, MacKay; N. S. WALES: Tamworth, Clarence River, Rope's Creek; VICTORIA: Wodonga.

**METRIORRHYNCHUS AMPLIATUS**, Macl. (*Xylobanus*),  
P. L. S., N.S.W., 1887, p. 233. (*Fig.* 80.)

The elytra of the type were described as being of the "usual quadricostate sculpture" and the prothorax as having "the discal areolet narrow and extending to the apex." These remarks are quoted, as on examination of the Macleay Museum types I noticed that Macleay had confused two species under the name *ampliatius*. Of these species one specimen agrees with the quoted remarks; its elytra have the usual four strong costae which on the basal two-thirds separate two double rows of punctures, towards the apex, however, the punctures become irregular. The other specimen has the elytral punctures in single series and the median areolet of the prothorax connected with the apex by a carina, but in colour it exactly agrees with the type; this species appears to be the more common

of the two, and I have named it *basiflavus*. Macleay did not mention the scutellum but in *ampliatus* it is flavous, a character which readily distinguishes it from *longicornis* (which otherwise is almost identical in colour). The colour of its upper surface is also almost identical with *Trichalus semiatratus*. As an instance of how deceptive colours are in this sub-family, a short table of these four species, which have the prothorax and base of elytra of almost identical colour, is here given:—

Subsutural costa trifurcate near base . . .	<i>T. semiatratus</i> , n. sp.
Subsutural costa simple.	
Elytral punctures in single series . . .	<i>M. basiflavus</i> , n. sp.
Elytral punctures in double series.	
Prothorax 7-areolate . . . . .	<i>M. longicornis</i> , Macl.
Prothorax 5-areolate . . . . .	<i>M. ampliatus</i> , Macl.

In *ampliatus* the five areolets are not as in *Xylobanus costifer* and *gratiosus* (the only species figured by Waterhouse\* as having the prothorax 5-areolate), but there is a costa extending from the central areolet towards the margin on each side, so as to divide the four outer areolets into almost equal sizes; these all being slightly transverse (in *costifer* and *gratiosus* there are two small ones in front and two much larger ones behind). The median areolet is much as in many species of *Trichalus*, but as the sutural costa is simple it cannot be referred to that sub-genus, in which there is already an *ampliatus*. Waterhouse would probably have referred it to *Synchonnus*.

One specimen before me differs from the type in being much smaller ( $2\frac{1}{2}$  lines only), but I can discover no other distinguishing feature.

*Hab.* QUEENSLAND: Barron River, Cairns.

METRIORRHYNCHUS TESTACEICOLLIS, Macl. (*Cladophorus*),  
*l. c.*, p. 234. (*Figs.* 21, 22.)

Under this name also Macleay had confused two species. The specimens that were standing under that name in the Macleay Museum are almost identical in colour, one being slightly more, the other slightly less than three lines in length. Both specimens have also the "antennae with the branches from joints 3 to 10 very much longer than the joints themselves"; with the rostrum practically

\* Ill. Typ. Col., Plate IX.

absent; both also have the base of the elytra not entirely black. But Macleay says "the middle one (of the prothoracic areolets) confined to the basal half, the others not very perfectly defined. The elytra are strongly quadricostate and punctured." The only specimen these remarks refer to has the four front areolets feebly defined and the elytra with strong punctures in single series, which, however, become confused towards the apex.\* The other specimen has the prothoracic areolets very well defined, the elytral costae unusually feeble and separating two distinct rows of punctures; the species is here described under the name of *costicollis*.

The female of *testaceicollis* † differs from the male in having the prothorax more transverse with the antennae shorter, stouter and strongly serrate only. It agrees very well (except that the specimens before me are three instead of four lines in length) with the description of *Xylobanus miniatocollis*, but I do not think that the types of that species can have been females of *testaceicollis*, otherwise I should probably have noticed it when examining the types.

The species tabulated below are practically identical in colour:—

Subsutural costa trifurcate near base.	. <i>T. atripennis</i> , Macl.
Subsutural costa simple.	
Elytral punctures in single series.	
Antennae of male strongly branched.	<i>M. testaceicollis</i> , Macl.
Antennae of male not branched	. <i>M. diminutivus</i> , n. sp.
Elytral punctures in double series.	
Prothorax 7-areolate.	. . . <i>M. costicollis</i> , n. sp.
Prothorax 3-areolate.	. . . <i>M. atricornis</i> , n. sp.

*Hab.* QUEENSLAND: Cairns.

**METRIORRHYNCHUS POSTICALIS**, Macl. (*Cladophorus*), *l. c.*, p. 234, fig. 81.

In the type the scutellum is pallid as well as the prothorax and portion of the elytra.

*Hab.* QUEENSLAND: Cairns, Barron River.

\* On the elytra of several other specimens, as well as on the type, double rows can be traced towards the apex and to a less extent near the base.

† The specimens here described were amongst the Macleay Museum duplicates.

**METRIORRHYNCHUS MINIATUS**, Macl. (*Cladophorus*), *l. c.*, p. 235.

The female differs from the male (the only sex described by Macleay) in having the antennae strongly serrated, instead of branched. In both sexes the rostrum is so short as to be practically absent and the scutellum is of the same colour as the prothorax and elytra.

*Hab.* QUEENSLAND: Barron River, Kuranda.

**METRIORRHYNCHUS ELONGATUS**, Macl., *l. c.*, p. 229.

In this species the elytral punctures are much closer together than usual, although the longitudinal costae separating the rows are of normal distance apart.

*Hab.* QUEENSLAND: Barron River.

**METRIORRHYNCHUS LONGICORNIS**, Macl. (*Xylobanus*), *l. c.*, p. 232.

Two specimens from the Macleay Museum belong to this species, but differ from the types in having the antennae shorter and scutellum entirely dark. They are however, females, the types probably being males.

*Hab.* QUEENSLAND: Russell River, Cairns.

**METRIORRHYNCHUS ABDOMINALIS**, Wat. (*Porrostoma*), *Trans. Ent. Soc. Lond.*, 1877, p. 75, Pl. I, figs. 19-22; *Ill. Typ. Col.*, p. 44, Pl. XI, fig. 10.

There are three female specimens before me\* which with some hesitation I refer to this species. In all of them the rostrum is diluted in places with red; two of them have a small medio-basal black spot on the prothorax,† and the scutellum black (not mentioned by Waterhouse but black in the figure); the other specimen has the prothorax and scutellum both entirely pallid. In all three the middle part of the abdomen is dark, but the dark portion is variable in extent and nowhere encroaches on the sides or apex.

*Hab.* QUEENSLAND: Brisbane, Mackay. VICTORIA: Wodonga.

\* From Brisbane and Bowen; the type was from "East Australia."

† At the extreme base only instead of as figured.

**METRIORRHYNCHUS TEXTILIS**, Wat. (*Porrostoma*), Trans. Ent. Soc. Lond., 1877, p. 77, Pl. I, figs. 32-35; Ill. Typ. Col., p. 46, Pl. XI, figs. 9-9a.

A female specimen from Brisbane (the type was from Moreton Bay,\* and also a female) agrees well with the figures and size of this species and with the description except as to the antennae. These are described as "Long and broad not diminishing towards the apex; each joint with a carina parallel with the lower margin." In the Brisbane specimen I cannot see any carinae and the terminal joints are distinctly narrower (although not by much) than the median joints; in the figure they are also so drawn. This specimen also is the only one I have seen having the disc of the prothorax and the scutellum entirely unclouded.

*Hab.* QUEENSLAND: Moreton Bay.

**METRIORRHYNCHUS RUSSATUS**, Wat. (*Porrostoma*), Trans. Ent. Soc. Lond., 1877, p. 77, Pl. I, figs. 36-38; Ill. Typ. Coll., p. 46, Pl. XI, fig. 11.

?*serraticornis*, Macl., P. L. S., N.S.W., 1887, p. 230.

Two specimens in Mr. Simson's collection certainly belong to *serraticornis*. I think also that they belong to *russatus*, in which case Macleay's (as the later) name must fall. In the description of *russatus* the elytra are stated to be "*flavorufis (apice excepto)*"; for *serraticornis* Macleay says "the extreme apex black." In the specimens before me only the thickened apical parts are black; the medio basal prothoracic areolet is infuscate in front in both, and in some specimens might easily appear black.

*Hab.* QUEENSLAND: Bowen, Mossman River.

**METRIORRHYNCHUS TOGATUS**, Wat. (*Porrostoma*), Trans. Ent. Soc. Lond., 1877, p. 78, Pl. I, figs. 49-52; Ill. Typ. Col., p. 47, Pl. XII, fig. 2; Lea, P. L. S., N.S.W., 1898, p. 559.

I have three males of what I presume to be this species as they agree with Waterhouse's descriptions and figures; but they differ in being smaller (the largest specimen only four as against five lines in length).

*Hab.* N.W. AUSTRALIA; W. AUSTRALIA: Albany, Mount Barker.

\* Practically the same locality.

METRIORRHYNCHUS CINCTUS, Wat. (*Porrostoma*), Trans. Ent. Soc. Lond., 1877, p. 80, Pl. II, figs. 73-77; Ill. Typ. Col., p. 58, Pl. XIV, figs. 9-10.

*capucinus*, Lea, P. L. S., N.S.W., 1898, p. 558.

There are three females which I refer to this species; in two of them the prothorax is coloured as described, but in the other it is entirely pallid. The prothorax in all three appears to be slightly notched in the middle but this notch is invisible from most directions. In two of them the scutellum is infuscate in the middle.

I regret to state that I have described the male under the name of *capucinus*, having been misled by certain slight colour differences.

*Hab.* QUEENSLAND: Brisbane, Mackay, Barron Falls, Bowen, Gympie.

METRIORRHYNCHUS CLIENTULUS, Wat. (*Porrostoma*), Trans. Ent. Soc. Lond., 1877, p. 81, Pl. II, figs. 78-81; 1878, p. 101; Ill. Typ. Col. (*Synchonnus*), p. 59; Pl. XV, fig. 2.

I have a specimen from the Richmond River which I think is possibly *clientulus* (it certainly belongs to Waterhouse's genus *Synchonnus*, which, to him, was monotypic), but it has about one-third (instead of one-fifth only) of the apex of elytra black and the elytral costae not alternately strongly elevated, as in most of the species, but (especially on the dark portion) appearing almost as nine equally elevated lines. Waterhouse says "the second of the four costae only well defined and extending to the apex; the others less distinct." This species, however, is certainly not the *clientulus* as identified by Blackburn\* as its prothorax has the basal two-thirds parallel-sided instead of having the hind angles produced outwards; in fig. 78 of Plate II the prothorax, it is true, is so drawn, but in the later figure † it is drawn exactly as in my specimen.

Since the above was written I received a reply from Mr. Waterhouse, to whom I had written about this species; he said, "My outline (fig. 78) of the thorax is the more correct. These are camera sketches and there is a tendency to

\* In a comment under *cliens*, Blackb.

† On comparing the figures of the prothorax, etc., in Trans. Ent. Soc., and Ill. Typ. Col., it will often be noticed that they are given as very different for the one species.

exaggerate, but this figure is fairly good. The figure by Wilson in the 'Types' is not good."

**METRIORRHYNCHUS INQUINULUS**, Wat. (*Porrostoma*), Trans. Ent. Soc. Lond., 1877, p. 81, Pl. II, figs. 82-86 \*; Ill. Typ. Col. (*Stadenus*), p. 61, Pl. XV, figs. 3-3a.

I have seen three specimens of this species from Victoria (exact locality for his types was unknown to Waterhouse). In appearance they are much like *haemorrhoidalis* but are larger and with the prothorax triareolate only. The figures given in the two publications quoted are not in accordance with each other.

*Hab.* VICTORIA: Launching Place.

**METRIORRHYNCHUS LIMBATUS**, Wat. (*Porrostoma*), Trans. Ent. Soc. Lond., 1877, p. 81, Pl. II, figs. 88-91; 1878, p. 180, genus 30; Ill. Typ. Col. (*Achras*), p. 62, Pl. XV, fig. 7.

There are several females before me which appear to be referable to this species, only one of them, however, agrees with the description in having "none (of the costae) reaching to the apex"; in the other specimens the second and fourth costae are distinctly joined to the apex. They vary in length from  $3\frac{1}{2}$  to  $4\frac{1}{2}$  lines.

In appearance the species closely resembles *coenosus* and *marginipennis*; from which, however, it may be readily distinguished by the sculpture of the prothorax.

*Hab.* † QUEENSLAND: Mount Tambourine; N.S. WALES: Thornleigh, Blue Mountains; VICTORIA: Studley Park.

**METRIORRHYNCHUS DICHROUS**, Wat. (*Porrostoma*), Trans. Ent. Soc. Lond., 1877, p. 86, Pl. II, figs. 86-87 ‡; 1878, p. 102, genus 29; Ill. Typ. Col. (*Stadenus*), p. 61, Pl. XV, fig. 5; Bourg. (*Porrostoma*), Ann. Soc. Ent. Fr., 1889, p. 235.

Only the female was known to Waterhouse; the male differs in being smaller with longer antennae, the joints of

\* 83a, 86a and 86b evidently do not refer to this species but to *dichrous*.

† Mr. Waterhouse gives "Australia" as locality for the type.

‡ There is some confusion as to the numbers attached to the figures of this species and *inquinulus*, as the latter are referred to as 82-86, the former 86-87. On examining the plate 86a, 86b and 87 all seem to agree with the description of *dichrous*.

which have longer rami, though not so long as in *togatus*; which species it very closely resembles but can be readily distinguished from it by the sculpture of the prothorax (3-areolate in *dichrous*, 7-areolate in *togatus*).

*Hab.* W. AUSTRALIA: King George's Sound.

METRIORRHYNCHUS IRREGULARIS, Wat. (*Porrostoma*),  
Trans. Ent. Soc. Lond., 1877, p. 76, Pl. I, figs. 18-18a;  
Ill. Typ. Col., p. 46, Pl. XI, fig. 8.

There are three specimens which I refer to this species; they are however all rather larger ( $4\frac{1}{2}$  to 5 lines) than the type (3 lines), but in other respects agree exactly with the original description and figures, and as so many species of the genus vary in size the difference in length may be of no importance.

In general appearance these specimens closely resemble small ones of *lateralis* but differ in the considerably shorter rostrum \* and shorter and differently formed antennae.

*Hab.* E. AUSTRALIA: Mackenzie River †; QUEENSLAND: Brisbane; N.S. WALES: Gosford, Sydney.

METRIORRHYNCHUS FUSCOLINEATUS, Wat., Ill. Typ. Col.,  
p. 47, Pl. XII, fig. 4.

*Porrostoma lineatum*, Wat. (*n. pr.*), Trans. Ent. Soc.  
Lond., 1877, p. 78, Pl. I, figs. 45-48.

*laetus*, Blackb., P. L. S., N.S.W., 1891, p. 526.

The type of this species was recorded from N.W. Australia, and a second specimen from Tasmania. Thinking it possible that *laetus* was identical I sent a specimen to Mr. Griffith of Adelaide asking him to have it compared with the type of *laetus*, I also sent an exactly similar specimen to Mr. Waterhouse, asking for it to be compared with the type of *fuscolineatus*. Mr. Griffith wrote as follows:—"Your specimen was duly handed to Mr. Blackburn, who says he sees no particular difference and is quite agreeable to call it a colour variety of *M. laetus*. One point in colour is that your specimen has the tops of the elytral carinae yellow, whilst in the type

\* Another similarly coloured species has practically no rostrum, but the only specimen I now have is not in condition to be described.

† I am unable to find this river on the map.



they are black."\* Mr. Waterhouse replied:—"The specimen you sent is certainly my *fuscolineatus*."

*Hab.* N.W. AUSTRALIA; TASMANIA: Hobart; N.S. WALES: Bulli, Galston, National Park.

METRIORRHYNCHUS MELASPIS, Bourg. (*Porrostoma*), Ann. Soc. Ent. Fr., 1889, p. 235.

A specimen (from N.W. Australia) agrees exactly with the description of this species except that it is much larger (14 mm. as against a maximum of 9 mm. known to Bourgeois). But a number of species vary to an even greater extent than this; so, till evidence to the contrary is forthcoming, I shall regard this species as being probably a large specimen of *melaspis*.

*Hab.* AUSTRALIA.

METRIORRHYNCHUS LATERALIS, Redt., Reise Novara, II, p. 100; Wat., Trans. Ent. Soc. Lond., 1877, p. 74, Pl. I, figs. 15-17.

*marginicollis*, Macl., Trans. Ent. Soc., N.S. Wales, p. 263.

I have examined the type of *marginicollis* and it belongs to the species described by Waterhouse as the *lateralis*† of Redtenbacher. Macleay does not mention the rostrum, but in his type it is long (much as in *rhypidius*). The species varies considerably in size.

*Hab.* N.S. WALES: Sydney, Jenolan, Tweed River; QUEENSLAND: Brisbane.

METRIORRHYNCHUS VITTATUS, Blackb., T. R. S., S.A., 1886, p. 258.

A female specimen received from Mr. Blackburn and bearing a label in his writing "*vittatus* Blackb." is probably the female mentioned by him when describing that species. I can only regard it, however, as one of the numerous varieties of *rufipennis*. At the same time, I do not think that *vittatus* can possibly belong to that species, as the antennae of its male are described as strongly flabellate

\* In the original description, however, Mr. Blackburn says:—"In the male before me the elytral costae are scarcely splashed with orange colour, in the female very distinctly; probably these colour characters are variable."

† I have not seen the original description of *lateralis*.

and the rostrum "nearly half again as long as wide." The prothorax also is described as "a little reddish on the sides."\*

**METRIORRHYNCHUS EREMITUS**, Blackb., *l. c.*, 1900, p. 55.

I have typically coloured specimens of this species from several localities.

Two specimens (sexes) in the National Museum from Studley Park evidently represent a variety; they have the reddish markings of the elytra confined strictly to the thickened sutural, apical and lateral margins. The prothorax has part of the sides, but not the extreme sides (which are black) of a dingy red, whilst its apex is black.

*Hab.* VICTORIA: Dividing Range, Studley Park, Brighton, Emerald; N.S. WALES: Blue Mountains.

**BREVIROSTRIS**, Wat. (*Porrostoma*), Trans. Ent. Soc. Lond., 1877, p. 74, Pl. I, figs. 13-14; Ill. Typ. Col., p. 44, Pl. XI, fig. 4.

N.W. AUSTRALIA.

**UNIFORMIS**, Wat. (*Porrostoma*), Trans. Ent. Soc. Lond., 1877, p. 76, Pl. I, figs. 28-31; Ill. Typ. Col., p. 45, Pl. XI, fig. 7.

QUEENSLAND: Bowen.

**APICALIS**, Wat. (*Porrostoma*), Trans. Ent. Soc. Lond., 1877, p. 77, Pl. I, figs. 39-44; Ill. Typ. Col., p. 46, Pl. XII, fig. 1.

QUEENSLAND: Cape York, Port Essington, Endeavour River.

**SCALARIS**, Wat. (*Porrostoma*), Trans. Ent. Soc. Lond., 1877, p. 79, Pl. I, figs. 53-56; Ill. Typ. Col., p. 48, Pl. XII, fig. 3.

N.W. AUSTRALIA.

**FALLAX**, Wat. (*Porrostoma*), Trans. Ent. Soc. Lond., 1877, p. 79, Pl. I, figs. 57-60; Ill. Typ. Col., p. 48, Pl. XII, fig. 5.

QUEENSLAND: Moreton Bay.

\* In the female before me the prothorax is of uniform colour.

CENTRALIS, Macl., P. L. S., N.S.W., 1887, p. 230.

QUEENSLAND : Cairns.

FOLIATUS, Macl., *l. c.*, p. 230.

QUEENSLAND : Mossman River.

HIRTIPES, Macl., *l. c.*, p. 231.

QUEENSLAND : Mossman River.

FUMOSUS, Macl. (*Xylobanus*), *l. c.*, p. 231.

QUEENSLAND : Cairns.

MINIATICOLLIS, Macl. (*Xylobanus*), *l. c.*, p. 232.

QUEENSLAND : Barron River.

MEYRICKI, Blackb., T. R. S., S.A., 1886, p. 258.

W. AUSTRALIA : King George's Sound.

INSIGNIPENNIS, Blackb., *l. c.*, 1900, p. 52.

TASMANIA : Hobart, Mount Wellington.

CLIENS, Blackb., *l. c.*, p. 53.

N.S. WALES : Tweed River.

MENTITOR, Blackb., *l. c.*, p. 54.

VICTORIA : Dividing Range.

PARADOXA, Blackb., *l. c.*, p. 55.

VICTORIA : Dividing Range.

MONTICOLA, Blackb., P. L. S., N.S.W., 1891, p. 526.

VICTORIA : Alpine District.

OCCIDENTALIS, Blackb., *l. c.*, p. 526.

W. AUSTRALIA : Eyre's Sand Patch.

MARGINIPENNIS, Lea, *l. c.*, 1898, p. 556.

N.S. WALES : Sydney, Blue Mountains, Bulli.

COENOSUS, Lea, *l. c.*, p. 557.

N.S. WALES : Sydney, Galston, Gosford, Blue Mountains.

METRIORRHYNCHUS APTERUS, n. sp. (*Fig. 1.*)

♀ Black ; elytra reddish testaceous.

*Rostrum* short (distinctly wider than long). *Antennae* short (scarcely passing hind coxae), serrate ; 2nd joint unusually distinct, 3rd at least half as long again as 4th ; 4th-10th transverse. *Prothorax* strongly transverse, distinctly 7-areolate, side constricted in middle, hind angles acute. *Scutellum* gradually decreasing in width to apex, which is rather feebly emarginate. *Elytra* short, indirect at base, each separately narrowed towards apex so that the apices are widely separated ; quadricostate, the interstices with double rows of large transverse rectangular punctures. *Abdomen* very large, strongly inflated, passing elytra for more than half its total length ; 2nd, 3rd and 4th segments each more than thrice as wide as long. Length 23 mm.

*Hab.* QUEENSLAND : Darling Downs (type in C. French's collection).

So far as I am aware this is the only apterous species of the subfamily known from any part of the world. In one of the two specimens before me the elytra are 6, in the other 9 mm. long ; in the former each is less than thrice as long as wide, in the latter each is fully four times as long as wide. The legs are rather stronger than usual, but are otherwise normal.

## METRIORRHYNCHUS UNISERIATUS, n. sp.

♂. Black ; elytra reddish-testaceous.

*Rostrum* very short or absent. *Antennae* long ; 2nd joint moderately distinct, 3rd slightly longer than 4th, its ramus slightly shorter than the joint itself, 4th-9th each with the ramus longer than the joint, in the 10th as long ; 11th as long as greatest length (including the ramus) of 10th. *Prothorax* moderately transverse, distinctly 7-areolate, apex rounded, sides constricted in middle, basal angles acute and laterally produced. *Scutellum* feebly depressed, narrowed apex and which is semicircular. *Elytra* narrow, feebly diminishing in width from base to apex ; each quadricostate, the interstices with single series of large transverse punctures separated by distinct and almost regular ridges. *Abdomen* with penultimate segment entire at apex.

Length 6 mm.

♀. Differs in being larger, antennae shorter stouter and strongly

serrate only, the 11th joint almost twice the length of 10th; the prothorax also is rather less transverse.

Length 8 mm.

*Hab.* N.S. WALES: Richmond River (*T. G. Sloane* and *A. M. Lea*).

Readily distinguished from all the similarly coloured species by the elytral punctures being in single instead of in double rows. Although no species having similarly punctured elytra were known to Waterhouse they appear to be fairly numerous in Australia, as three (*insignipennis*, *paradoxa* and *meyricki*) were described by Blackburn, one (*miniatcollis*) by Macleay, and several are here described.\* I am also acquainted with others which, for various reasons, are not now described.

In the penultimate segment entire at the apex in the male, the species differs from all others before me. The apical segment however is much narrower than in the female.

**METRIORRHYNCHUS CANCELLATUS, n. sp.**

♂. Black; suture sides and apex of elytra reddish-testaceous.

*Rostrum* absent. Antennae passing hind coxae, very strongly serrate (almost ramose); 2nd joint just visible from the sides, 3rd considerably larger but scarcely longer than 4th, its produced portion not as long as the truncated apex, 4th-9th with the produced portion about half the total length of each. *Prothorax* distinctly 7-areolate, rounded in front, constricted in middle, base slightly produced on each side. *Scutellum* semicircular at apex. *Elytra* narrow, parallel-sided; each quadricostate, the interspaces with single rows of large transverse or square punctures, separated by strong transverse ridges. *Abdomen* with penultimate segment feebly emarginate at apex.

Length 8 mm.

*Hab.* QUEENSLAND: Brisbane (*R. Illidge*); N.S. WALES: Blue Mountains (*Messrs. Taylor*); Mount Wilson (*A. S. Olliff*).

The remarkable sculpture of the elytra is much as it is described as being in *paradoxa*, but the connecting ridges, though everywhere distinct, are everywhere below the

\* *M. coenosus*, Lea, might also be fairly regarded as having the punctures in single rows.

level of the costae, as can plainly be seen on viewing the insect *along* the elytra; the elytra also have both the suture and the outer margins pallid to the extreme base,\* not as in *paradoxa* the suture black and the outer markings not continuous to base. Nevertheless it is possible that it will afterwards have to be placed as a variety of *paradoxa*, especially as the type of the latter was from a mountainous district and therefore especially liable to melanism.

#### METRIORRHYNCHUS SIMPLICICORNIS, n. sp.

♂. Black; basal three-fifths of elytra reddish-testaceous.

*Head* polished. Eyes large. Rostrum absent. Antennae serrate, passing pallid portion of elytra; 2nd joint rather distinct, 3rd distinctly longer than 4th, none of the others transverse. *Prothorax* moderately transverse, apex rounded, sides constricted in middle, posterior angles very acute; with a strong median areolet continuous almost to apex, from its middle obscurely connected with each side. *Elytra* narrow and parallel-sided; quadricostate, the interstices each with a single row of large rectangular punctures, becoming irregular at base and apex. *Abdomen* with penultimate segment widely and semicircularly but not very deeply excised in middle.

Length 6 mm.

*Hab.* QUEENSLAND: Mount Tambourine (type in R. Illidge's collection).

In appearance closely resembles the following species (which also has the elytral punctures in single series) but with antennae serrate only. I am not sure whether Waterhouse would have regarded the prothorax as 3- or 5-areolate; if the former it would have been referred to *Stadenus*, if the latter, to *Synchonnus*.

#### METRIORRHYNCHUS RAMOSUS, n. sp. (Fig. 23.)

♂. Black; basal three-fifths of elytra reddish-testaceous.

*Rostrum* absent. Antennae distinctly passing middle of elytra, strongly flabellate; 3rd joint not much longer than 4th, its ramus about once and one half the length of the joint itself, of the others (except the 10th) the ramus in each is about twice the length of the joint, 11th about twice the length of 10th. *Prothorax* moderately transverse, distinctly 7-areolate, apex rounded, sides constricted in middle, basal angles acute and laterally produced.

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\* The pallid markings, except at the apical 5th, are confined strictly to the thickened suture and margins.

*Scutellum* shining, apex semicircular. *Elytra* narrow, parallel-sided; each quadricostate, the interspaces with single rows of very large transverse punctures, separated by rather strong ridges. *Abdomen* with penultimate segment triangularly excised almost to base.

Length 7 mm.

*Hab.* N.S. WALES: Tweed River (*W. W. Froggatt*).

The antennal rami are unusually long for *Metriorrhynchus* as defined by Waterhouse. In colour the species greatly resembles *clientulus*, *dichrous*, *togatus*, etc., but may be at once distinguished by the elytral punctures being in single series.

#### METRIORRHYNCHUS BRISBANENSIS, n. sp.

♂. Black, basal two-thirds of elytra reddish-testaceous.

*Rostrum* very short (fully twice as wide as long). *Antennae* passing middle of elytra, very strongly serrate; 2nd joint moderately distinct, 3rd distinctly longer than 4th, the outline of the produced portion of each oblique (with but a slight swelling in the middle) from the base, the shorter side of each of the 4th-9th joints about half the length of the longer side. *Prothorax* feebly transverse, distinctly 7-areolate, apex rounded, sides constricted in middle, basal angles acute and laterally produced. *Scutellum* deeply impressed in middle, apex semicircular. *Elytra* long, thin and parallel sided, each quadricostate, the interspaces with double rows of more or less round and regular punctures. *Abdomen* with the penultimate segment equilaterally triangularly excised to its middle.

Length 8-9 mm.

*Hab.* QUEENSLAND: Brisbane (*R. Illidge*).

The smaller elytral costae separating the rows of punctures are no stronger than the transverse ridges separating each puncture, and are sometimes inclined to disappear. In one specimen the sutural punctures appear as a single row on each side to about the middle (where they become normal), being separated by oblique ridges without a trace of the smaller longitudinal costae; elsewhere they are very irregular.

From *clientulus*, *cliens* and *dichrous* readily distinguished by the seven prothoracic areolets; from the preceding species by the double rows of elytral punctures. From *togatus* by the elytra (of which less of the apex is dark) being longer and thinner; the medio-basal prothoracic areolet is also smaller, the carina connecting it with the

apex shorter and the sides more constricted in the middle; nevertheless it is very closely allied to *togatus*, and may eventually be considered as merely a geographical variety of that species.

**METRIORRHYNCHUS BASIFLAVUS, n. sp.** (Fig. 82.)

♂. Black; prothorax, scutellum, basal fifth of elytra, mesosternum, four anterior coxae and base of four anterior femora flavous.

*Head* shining. Eyes large. Rostrum absent. Antennae serrate passing middle of elytra, 2nd joint indistinct, 3rd considerably longer than 4th, none transverse. *Prothorax* small, transverse, apex truncate, sides lightly constricted in middle, posterior angles produced and acute; 3-areolate, median areolet rather narrow, a strong carina (rather more than one-third of the total length) connecting it with apex. *Scutellum* semicircularly emarginate at apex. *Elytra* narrow, slightly inflated towards apex; quadricostate, the 1st (from the suture) costa much stronger than the others, interstices with single rows of large, rectangular punctures, becoming irregular towards apex, but rather larger towards base. *Abdomen* with penultimate segment triangularly excised in middle.

Length  $7\frac{1}{2}$  mm.

*Hab.* QUEENSLAND: Barron River, Cairns (Macleay Museum).

The colour is apparently much like *longicornis* and *miniaticollis* (the latter has also the elytra uniseriately punctate), but from both it can be readily distinguished by the triareolate prothorax; *ampliatus* (Macleay nec Waterhouse) has the prothorax quinqueareolate and elytra with double rows of punctures, but till the sculpture is examined appears almost exactly the same; according to Waterhouse *ampliatus* would belong to *Synchonnus* and *basi-flavus* to *Stadenus*.

**METRIORRHYNCHUS CONSTRICTICOLLIS, n. sp.** (Figs. 24, 83, 164.)

♂. Black; basal half of elytra (except the suture and a sub-triangular space about scutellum) flavous.

*Rostrum* very short. Antennae stout, passing middle of elytra, joints wide and feebly serrated, 3rd slightly longer and wider than 4th, the others to 10th gradually decreasing in size. *Prothorax* moderately transverse; 3-areolate, apex not much narrower than base and slightly constricted in middle, sides strongly constricted,



basal angles acute and laterally produced. *Scutellum* shining, depressed, almost parallel-sided to apex, which is semicircularly emarginate. *Elytra* narrow, parallel-sided; each quadricostate, the interspaces with single rows of large rectangular punctures, separated by distinct ridges. *Abdomen* with the penultimate segment widely and subtriangularly excised.

Length 6 mm.

*Hab.* W. AUSTRALIA: Mount Barker.

In size, colour and general appearance strongly resembles *meyricki* (also from Western Australia, and with the elytral punctures in single series), but at once distinguished by the prothorax being distinctly divided into three areolets instead of into seven. The elytral punctures are usually transverse but are sometimes distinctly longer than wide, those of the two sutural rows are, as a rule, larger than the others. The median areolet of the prothorax is narrowly open posteriorly and terminates about one-third from the apex, with which it is connected by a narrow shining carina.

#### METRIORRHYNCHUS OBSCURIPENNIS, n. sp.

♂. Black; elytra dark reddish-brown, the sides and suture somewhat paler.

*Rostrum* very short. *Antennae* passing middle of elytra; 2nd joint moderately distinct, 3rd no longer than 4th, its ramus (as also that of 10th) slightly shorter than the joint itself, of the others mostly longer than the supporting joint. *Prothorax* moderately transverse; 5-areolate, the costae connecting the median areolet with the sides rather indistinct; anterior angles rounded, apex slightly produced and notched in middle, sides constricted in middle but basal fourth almost parallel-sided, posterior angles subacute but not laterally produced. *Scutellum* diminishing in width to apex, which is rather deeply emarginate. *Elytra* narrow, parallel sided; each quadricostate, the interspaces with double rows of large irregular punctures, the transverse and longitudinal ridges separating the punctures often indistinct. *Abdomen* with the penultimate segment triangularly excised.

Length 13 mm.

*Hab.* TASMANIA: Hobart.

In appearance somewhat like various forms of *Trichalus discoideus*, but the prothorax 5-areolate, sutural costa not

trifurcate at base, etc. It would probably have been referred to *Stadenus* by Mr. Waterhouse; from his *inquinulus* it differs in the colour of the elytra, the prothorax more transverse and angular and notched in the middle of the apex; elytral punctures less regular, etc.

**METRIORRHYNCHUS TRIAREOLATUS**, n. sp. (*Figs.* 84, 162, 163.)

♂. Black; elytra partly reddish-testaceous.

*Head* shining. Rostrum almost absent. Antennae strongly serrate; end joint moderately distinct, 3rd slightly longer than 4th. *Prothorax* moderately transverse, apex feebly emarginate in middle, sides feebly constricted in middle, all the angles strongly rounded; 3-areolate, the middle areolet continuous from base almost to apex. *Scutellum* larger than usual, apex semicircular. *Elytra* feebly increasing in width to apex; quadricostate, the interstices with double rows of subquadrate punctures, the ridges separating the punctures rather feebly elevated. *Abdomen* with penultimate segment narrowly and deeply excised.

Length  $8\frac{1}{2}$  mm.

♀. Differs in being larger, elytra less parallel, abdomen simple, etc.

*Hab.* W. AUSTRALIA: Vasse (*A. M. Lea*); King George's Sound (Australian Museum).

Although the antennae in all the specimens before me are damaged (in one male only five joints are left, in another male and in a female only one joint of each is left), I have described this species on account of its strong resemblance to *meyricki* and *constricticollis* (both from W. Australia) which yet are so differently sculptured as to render them easily separable. *Nigrovittatus* (from New South Wales) is very similarly coloured and also has the prothorax triareolate but the posterior angles are very decidedly acute; in the present species also the elytra are glabrous, shining, and with the costae rather widely separated, whilst in that species the elytra are pubescent, opaque, and with the costae much closer together. The black portion of the elytra is moderately wider at the base, is narrowed at the basal third and then dilates so as to cover the whole of the apical fourth.

**METRIORRHYNCHUS NIGROVITTATUS**, n. sp. (*Fig.* 161.)

♀. Black; elytra testaceous but with a broad black sutural stripe; which widens posteriorly.

*Rostrum* absent. Antennae moderately serrate, passing middle of elytra; 2nd joint unusually distinct, 3rd about twice as long as wide and longer than 4th, the others to 10th gradually decreasing in size. *Prothorax* feebly transverse; 3-areolate, apex regularly rounded, sides very feebly constructed in middle, basal angles acute and somewhat obliquely produced. *Scutellum* feebly depressed, parallel-sided, apex semicircular. *Elytra* narrow, parallel-sided; each quadricostate, the 2nd and 4th (from suture) much more distinct than the others, the interspaces with very irregular double (in many places appearing single) rows of punctures.

Length 7-8 mm.

*Hab.* NEW SOUTH WALES: 'Blue Mountains (Macleay Museum, *E. Ferguson*, and *H. J. Carter*).

The sutural stripe is enclosed between the second costae for about one-half of its length, it then dilates so that at the apex the entire surface is covered by it. The median prothoracic areolet is large, continuous to base and apex, and widest in middle, in each side of which there is a short cariniform spur, which if continued to the sides would cause the prothorax to appear 5-areolate. The punctures are very irregular and are frequently conjoined, both longitudinally and transversely, so that in some parts there appear to be but six rows on each elytron (the two outer rows being apparently always distinct). The smaller longitudinal ridges are altogether absent in places, so that the 1st and 3rd costae being less distinct than the 2nd and 4th each elytron appears almost as if only bicostate. The type is in the Macleay Museum.

#### METRIORRHYNCHUS MOERENS, n. sp.

♂. Black.

*Rostrum* long (scarcely shorter than the prothorax), shining, finely punctate at open, more noticeably towards base. Antennae stout, just passing hind coxae; 2nd joint invisible from above, 3rd considerably longer than 4th, its ramus about two-fifths of its total length, 4th-9th each with the ramus about half of its total length. *Prothorax* distinctly 7-areolate; apex much narrower than base, basal angles acute and laterally produced. *Scutellum* transverse, apex semicircular. *Elytra* each with four distinct costae, the interstices with almost regular double rows of transverse punctures. *Abdomen* with penultimate segment incised almost to base.

Length 12 mm.

♀. Differs in being larger than the male, the rostrum longer and thinner, antennae rather shorter and strongly serrate only.

Length 14–15 mm.

*Hab.* TASMANIA: Bruni Island (*A. M. Lea*), Hobart (*H. J. Carter*).

A male from the Huon River has the 3rd joint longer than the type, with its ramus shorter and nearer the parallel to the joint itself. A similar variation is common in *rhypidius*. In fact, practically the only really distinct feature separating this species and *rhypidius* is the colour of the elytra.

From the other black Tasmanian species it can be distinguished by the length of its rostrum (as against *atratus*), and by the double series of punctures on the elytra (as against *insignipennis*). It would be a *Porrostoma* according to Mr. Waterhouse. The specimens from Bruni Island were taken on *Leptospermum* blossoms.

**METRIORRHYNCHUS DISCONIGER, n. sp. (Fig. 160.)**

♂. Black; elytra partly reddish-testaceous.

*Head* moderately shining. Rostrum long (about twice the length of basal joint of antennae), but fairly stout. Antennae extending to middle of elytra, pectinate; 2nd joint indistinct, 3rd distinctly longer than 4th, its ramus not half its total length, 4th–8th each with the ramus half the total length, of 9th shorter, of 10th still shorter. *Prothorax* feebly transverse, apex rounded, sides feebly constricted in middle, posterior angles subacute; distinctly 7-areolate. *Scutellum* rather feebly emarginate at apex. *Elytra* rather less narrow than usual; quadricostate, the interstices with irregular double rows of punctures, becoming more regular and almost rectangular towards base.

Length 11 mm.

♀. Differs in being larger, prothorax and elytra rather wider, antennae shorter, strongly serrate only, and with the 4th–9th joints transverse.

*Hab.* VICTORIA (type ♂ in Macleay Museum, type ♀ in C. French's collection).

The black portion of the elytra is narrowest at the base, gradually dilated towards and widest at a little beyond the middle, and then contracted and terminated (with a rounded outline) at about one-seventh from the apex in the male, at about one-sixth in the female; at its widest it almost

touches the outer of the four discal costae. In both the specimens before me the scutellum has the appearance of being feebly longitudinally ribbed, but this may be accidental. In the male the abdomen is missing.

**METRIORRHYNCHUS ORDINARIUS, n. sp.**

♂. Black; sides of prothorax, sides and apical fifth of elytra reddish-testaceous.

*Head* moderately shining. *Rostrum* long, thin, and shining. *Antennae* long (extending to about one-fourth from apex of elytra), strongly serrate; 2nd joint indistinct, 3rd about twice as long as wide and distinctly longer than 4th, 6th–10th subtriangular. *Prothorax* feebly transverse, base much wider than apex, posterior angles produced but rounded, sides constricted in middle; 7-areolate, but the ridges bounding the areolets not very distinct. *Scutellum* diminishing in width to apex, which is semicircularly emarginate. *Elytra* narrow, parallel-sided; quadricostate, the interstices with somewhat irregular double rows of punctures, the ridges separating the punctures rather feeble except towards base, where the longitudinal ones are almost as stout as the costae. *Abdomen* with the penultimate segment deeply excised.

Length  $10\frac{1}{2}$  mm.

♀. Differs in being slightly wider, the antennae shorter and wider and the abdomen simple.

*Hab.* VICTORIA: Monbulk, Studley Park, Gippsland.

The pale margins of the elytra are very narrow at the basal two-thirds, but then dilate so as to cover the whole of the apical fifth, the black portion consequently is somewhat triangularly advanced along the suture. In colour it appears to resemble *monticola*, but its rostrum is fully thrice the length of the basal joint of the antennae. It would be a *Porrostoma* according to Waterhouse.

**METRIORRHYNCHUS BATESI, n. sp.**

♂. Black; basal three-fifths of elytra of a dark brownish-red.

*Rostrum* absent. *Antennae* stout, strongly serrate, extending to about middle of elytra; 2nd joint unusually distinct, 3rd distinctly longer than 4th. *Prothorax* transverse; distinctly 7-areolate, apex produced and slightly notched in middle, sides not constricted in middle, base deeply bisinuate and with a distinct median notch, basal angles rounded off but rectangular. *Scutellum* rather narrow and notched at apex. *Elytra* long, parallel-sided; each quadricostate, the

interspaces with regular double rows of fairly large transverse punctures, separated by distinct ridges, the longitudinal ridges separating the punctures at base fully as distinct as the regular costae, but becoming smaller (although still regular and distinct) from about the basal fourth.

Length 14 mm.

*Hab.* N.S. WALES: Tweed R. (*W. W. Froggatt*).

A very distinct species. Mr. Froggatt sent with this species a specimen which resembles it in size, colour and general appearance to a remarkable extent, and yet it belongs to the *Oedemeridae*. As a description may be of interest, this is appended as a footnote.\*

#### METRIORRHYNCHUS SIMSONI, n. sp.

♂ Black; shoulders and tips of elytra reddish-testaceous.

*Rostrum* almost absent. *Antennae* passing hind coxae, very strongly serrate but not ramose; 2nd joint indistinct even from the sides, 3rd joint perceptibly longer than 4th. *Prothorax* distinctly 7-areolate; not much wider than long, base not much wider than apex and almost right angled, middle constricted. *Scutellum* transverse, apex semicircular. *Elytra* each quadricostate; the interstices with

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#### \* PSEUDOLYCHUS WALLACEI, n. sp.

Black; basal three-fifths of elytra of a dark brownish-red. Clothed with short pubescence varying from greyish to black; each of the abdominal segments tipped with very distinct white pubescence.

*Head* with small concealed punctures. *Antennae* broad, extending to basal third of elytra; 1st joint as long as eye and much shorter, 3rd-10th strongly serrate, gradually decreasing in length and width, 11th thinner and longer than 10th. *Prothorax* slightly transverse, apex rounded, base slightly bilobed, sides feebly incurved to middle, disc with obtuse subtubercular elevations. *Scutellum* longer than wide. *Elytra* considerably wider and about six times longer than prothorax; sides and suture thickened and the disc of each with three distinct costae, interspaces more or less convex and with dense partially concealed punctures. *Legs* long; basal joint of hind tarsi longer than the rest combined, of the front tarsi almost as long as the three following combined, of the middle tarsi much shorter; claws obtusely lobed at base.

Length 14 mm.

*Hab.* N.S. WALES: Richmond River (*W. W. Froggatt*).

Readily distinguished from *haemorrhoidalis* and the allied species by the four apical joints of antennae not becoming suddenly narrower than the others. The prothorax has altogether ten subtubercular elevations; of these a moderately long one is on each side of the median line, two (irregular and partly conjoined) are on each side of the base and two (very indistinct) on each side of the apex.

irregular double series of punctures; from most directions (except towards base and apex) appearing uniseriately punctate. *Abdomen* with penultimate segment triangularly excised to base.

Length 11 mm.

*Hab.* TASMANIA (type in Aug. Simson's collection).

The figure of *Eros praefectus*, given by Waterhouse,\* will give a very good idea of the general appearance of this species, although in that species the elytra are not tipped with red. The antennae are sufficient to distinguish it from *rufipennis* and all the varieties of that species. The elytra when viewed directly from above appear to be without the fine intermediate ridges (and therefore as uniseriately punctate) but these (or parts of them) are sufficiently distinct from the side.

#### METRIORRHYNCHUS GRACILIS, n. sp.

♂. Of a sooty-brown colour; prothorax, scutellum, elytra (except an oblique space on each side of apex), coxae, and base of all the femora flavous.

*Head* shining. Eyes large. Rostrum absent. Antennae long, flabellate; 2nd joint distinct, 3rd slightly longer than 4th, its ramus (as also that of 10th) about half its total length, 4th-9th each with the ramus distinctly more than half its total length. *Prothorax* subquadrate, apex produced and rounded in the middle, no narrower than base, anterior angles feebly obtuse, posterior feebly acute, sides feebly constricted in middle, base trisinate; 7-areolate, the median areolet small, narrow and confined to basal half, the four front ones very feebly defined; apical half rather coarsely punctate. *Scutellum* feebly increasing in width to apex, which is semicircularly emarginate. *Elytra* long thin and parallel-sided; quadricostate, the interstices with regular (irregular towards apex) rows of rather small, rectangular punctures. *Abdomen* with penultimate segment widely excised almost to base.

Length 9 mm.

*Hab.* QUEENSLAND: Endeavour River (type in Macleay Museum).

Differs from the description of *miniatus* in having the apex of the elytra dark and the median prothoracic areolet confined to the basal half, with all of the anterior ones very ill defined; apparently also in the colour of the legs. It

\* Ill. Typ. Col., Plate IX, fig. 6.

seems fairly close to *posticalis* but with less of the elytra dark and prothoracic sculpture different. It is like *testaceicollis* in having the median areolet confined to the basal half, but is otherwise very different. Although the majority of the elytral punctures are really rectangular many of them appear to be almost circular till closely examined. This species would be a *Cladophorus* according to Waterhouse.

**METRIORRHYNCHUS COSTICOLLIS, n. sp.** (*Fig. 85.*)

♂. Black or dark brown; prothorax and scutellum reddish flavous.

*Rostrum* practically absent. Antennae moderately long, strongly ramose; ramus of 3rd joint the length of the joint itself, of each of the 4th–10th joints distinctly longer. *Prothorax* rather strongly transverse, sides incurved to middle; 7-areolate, the median areolets rather smaller than the lateral, but all four with distinct punctures, medio-basal areolet narrow and continuous to apical third; all the costae strongly defined. *Scutellum* triangularly excised at apex. *Elytra* long thin and parallel-sided, each with double rows of small almost regular punctures, the costae separating which, however, are distinct only on the basal two-thirds.

Length 6 mm.

*Hab.* QUEENSLAND: Cairns (type in Macleay Museum).

The portion of the elytra covered by the prothorax is also pale. Owing to the irregular contraction of the abdomen I have not been able to satisfy myself as to the exact shape of the penultimate segment in either of the two specimens before me. For a short special table dealing with this, the two following and several other species see notes under *testaceicollis*.

**METRIORRHYNCHUS DIMINUTIVUS, n. sp.**

♂. Blackish-brown, parts of three basal joints of antennae and parts of legs obscurely paler; prothorax, scutellum, muzzle, trochanters, base of femora, and four front coxae more or less flavous.

*Rostrum* practically absent. Antennae long and thin, joints somewhat serrate and none transverse. *Prothorax* moderately transverse, sides strongly incurved to middle, and apex bilobed, hind angles acute; 7-areolate, costae separating the four frontal areolets (except the median costa which is very distinct) short and not well defined; apex densely punctuate. *Scutellum* rather widely emarginate. *Elytra* long, slightly dilated posteriorly, with single series of large more or



less rectangular punctures. Penultimate segment of *abdomen* triangularly excised.

Length 5 mm.

*Hab.* QUEENSLAND: Cairns (type in Macleay Museum).

On the basal third of the elytra the third row of punctures becomes double owing to a short costa, but elsewhere, even towards the apex, there is not the least trace of gemination.

#### METRIORRHYNCHUS ATRICORNIS, n. sp.

♀. Black; prothorax, scutellum, trochanters and four anterior coxae flavous.

*Rostrum* practically absent. *Antennae* long, strongly serrate, none of the joints transverse. *Prothorax* strongly transverse, apex produced in middle, sides incurved to middle, front angles obtuse, hind very acute; 3-areolate, median areolet continuous or almost continuous to apex, a short costa on each side of its middle. *Elytra* long, thin, and subparallel; with double rows of small, somewhat irregular punctures; the second strong costa much more distinct than the others except towards the base.

Length 7-8 mm.

*Hab.* QUEENSLAND: Cairns (type in Macleay Museum).

The prothorax at first appears to be 3-areolate, and I have so described it, but on close inspection there is seen to be a short carina on each side of the median areolet, this latter in three specimens is continuous to both base and apex, but in two others is terminated before the apex. In two of them the scutellum is infusate at tip. I have described the females as the only male\* I have seen has lost both its antennæ, but as those of the female are unusually long for that sex, I do not think that in the male the joints are flabellate.

#### METRIORRHYNCHUS MILITARIS, n. sp. (*Fig.* 86.)

♂. Black, sides of prothorax, sides and suture of elytra and rostrum (except labrum) reddish.

*Rostrum* very short. *Antennae* long, rather strongly serrate, none of the joints transverse. *Prothorax* slightly longer than wide, apex rounded, sides very feebly incurved to middle; front angles strongly

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\* The penultimate segment of its abdomen is triangularly excised to the base.

obtuse, the hind almost acute; 7-areolate; the frontal half strongly punctate. *Elytra* long, thin and parallel-sided; with double rows of small round punctures, regular except towards apex; the four strong costae on each very well defined, though not very stout. Penultimate segment of *abdomen* subtriangularly excised.

Length  $7\frac{1}{2}$  mm.

*Hab.* N.S. WALES: Mount Wilson (*A. S. Olliff*, January, 1889).

The reddish markings of the elytra are very narrow and in the suture are terminated before the base. On one specimen the front margin of the prothorax is thickened and with a regular row of punctures on its upturned edge. In appearance it is close to *cancellatus* and some of the varieties of *rufipennis* but has the side of the prothorax pale. Of the other species having these sides pale and the disc 7-areolate it differs from *caenosus* by the elytral punctures being in double series; from *lateralis*, *ordinarius* and *fuscolineatus* by its very short rostrum; from *cremita* by the shape of its antennal joints; but it differs from *cremita* and the four previously named species by its very narrow form, long and almost parallel-sided prothorax with large punctures in front. In general appearance it is fairly close to *narginipennis*, but its elytral punctures are (except near apex) quite regular and the rostrum pallid; *monticola* has the prothorax transverse and the dark portion of elytra "of a width to include two costae."

#### METRIORRHYNCHUS VARIIPENNIS, n. sp. (*Fig. 87.*)

♂. Black, sides of prothorax, sides and suture of elytra reddish.

*Rostrum* long (almost twice the length of basal joint of antennae). *Antennae* long, strongly serrate, none of the joints transverse. *Prothorax* transverse, apex slightly produced, basal half much wider than apical half—being rather suddenly dilated at the middle; 7-areolate, costae distinct; sides and apex with distinct punctures. *Elytra* long, moderately thin, with double rows of more or less angular punctures; the four strong costae on each well defined throughout and all equal at base, but not posteriorly. Penultimate segment of *abdomen* deeply and narrowly excised, the incision rounded towards its end and wider there than at its entrance.

Length 11-14 mm.

*Hab.* N.S. WALES: Bulli (*H. J. Carter* and *A. M. Lea*), Belmore (*Messrs. Taylor*).

In the female the antennal joints are simply rounded on their inner edges, but in the male the 3rd-9th joints are slightly produced at the tip, so as to appear subjectinate. In all the specimens before me the elytra when in position do not touch except at their tips and near the base; this, however, is quite a common feature in the genus. The reddish margins of the prothorax occupy about half its surface. Some specimens have the elytra entirely dark except for the sutural and external costae and a space at the open; in others the reddish markings are continued along the costae; some specimens have the elytra entirely reddish except for a slight infuscation about the scutellum, whilst others have the disc of each (including the costae or not) longitudinally infuscate. In some specimens the outer edge of the third joint is obscurely reddish.

In general appearance much like *fuscolineatus* (*laetus*—also from Bulli) and with almost parallel variation of the elytra, but at once distinguished by the long rostrum (in the types of *laetus* the rostrum of the male is described as “*brevi*” and of the female “*multo minus brevi*”). The prothorax is also of different shape. Of the other species having the prothorax 7-areolate and its sides pallid it differs from *lateralis* by the slightly shorter rostrum and considerably shorter antennae; from *ordinarius* by the pale suture, shorter antennae and wider rostrum, *monticola* is said to have a short rostrum and the elytral markings are different. The dark form in appearance is much closer to *eremita* than to any other species, but the rostrum is much longer than in that species.

**METRIORRHYNCHUS HETERODOXUS, n. sp. (Figs. 25, 88.)**

♂. Blackish; sides of elytra reddish.

*Head* rather less concave than usual. Rostrum almost absent. Antennae stout, extending to middle of elytra; 1st joint as long as wide, and almost concealed, 3rd scarcely half the length of 4th, 4th slightly shorter and stouter than 5th, 6th-10th gradually decreasing in width; 11th slightly longer than 5th. *Prothorax* rather strongly transverse, apex bilobed, sides not incurved to middle, hind angles almost rectangular; 5-areolate, median areolet unusually large, narrowly open in front, its apical half twice as large as its basal, from each side of its middle a curved carina connecting it with the sides, a shorter and less distinct carina on each side near its base. *Scutellum* convex, triangularly notched. *Elytra*

much wider than usual and considerably wider than prothorax, each with but four continuous costae; these although strong are in places encroached upon by punctures; punctures large, usually rectangular and in single series; but in places (especially towards base and apex), subgeminate in arrangement, the transverse ridges separating them sometimes Y-shaped. Penultimate segment of *abdomen* triangularly excised.

Length 8-9 mm.

*Hab.* N.S. WALES: Blue Mountains (type in Macleay Museum).

Mr. Waterhouse would probably have proposed a special genus for the reception of this species, as the sculpture of the prothorax and elytra, convex scutellum, stout and unusually short 3rd joint of antennae are strongly at variance with the other members of the allied genera. The reddish margins of the elytra are comparatively wide, and are very slightly dilated at the base and apex. At the apex they are continued up the suture for a short distance.

#### METRIORRHYNCHUS RUFIROSTRIS, n. sp.

♀. Blackish; parts of head and of rostrum, edge of third joint of antennae, prothorax, scutellum, elytra and front trochanters reddish-flavous.

*Rostrum* robust, somewhat longer than broad. Antennae moderately long; 3rd joint much longer than 4th, 4th-5th feebly, 6th-10th strongly serrate, 5th-7th feebly transverse. *Prothorax* lightly transverse, apex produced in middle, base rather suddenly and angularly, but not very greatly dilated, front angles widely obtuse, hind angles almost rectangular; 7-areolate, all the costae well defined and continuous, median areolet narrow and terminated at apical third. *Elytra* long, thin and parallel-sided, with double rows of more or less regular, and angular punctures; larger costae well defined but at base not much more distinct than the smaller ones.

Length 13 mm.

*Hab.* QUEENSLAND: Somerset (*C. French*).

The shorter and differently coloured rostrum (which in length—excluding the labrum—is exactly equal to the first joint of antennae) readily distinguishes from *textilis*, *uniformis* and *nigripes*. The rostrum is longer than in *elongatus* and the third joint of antennae is different. The

sculpture of the elytra is much as in many of the larger females of *rhypidius*.

**METRIORRHYNCHUS OPACUS**, n. sp.

♀ Deep black.

*Rostrum* very short. Antennae rather long, 3rd joint once and one half as long as wide and distinctly longer than 4th, the succeeding ones feebly produced internally.\* *Prothorax* lightly transverse, apex slightly produced, hind angles produced; disc 7-areolate. *Elytra* long and thin, quadricostate, the interstices with double rows of rather small regular punctures.

Length  $10\frac{1}{2}$  mm.

*Hab.* QUEENSLAND: Cairns (*E. Allen*).

In general appearance close to *atratus* but narrower, the elytra entirely opaque and with much smaller and more regular punctures, the antennal joints are differently formed, the prothorax is much less constricted at its middle and its medio-apical areolets are larger. From the description † of *fumosus* it differs in its larger size, deep black colour and produced hind angles of prothorax.

The elytra are entirely without gloss and their punctures are small, regular, and rounded, except towards the base where they become angular and transverse; the first costa is stronger than the second towards the base, but weaker towards the apex.

**METRIORRHYNCHUS TIBIALIS**, n. sp. (*Figs.* 110, 111.)

♂. Black; prothorax (a large subcircular basal spot infuscate) and basal two-thirds of elytra reddish-testaceous.

*Rostrum* very short. Antennae rather short and wide, strongly serrated. *Prothorax* very feebly transverse, apex produced, sides rather strongly constricted in middle; disc 7-areolate, all the costae sharply defined. *Elytra* long and thin; quadricostate, the interstices with double rows of rather small punctures, becoming very irregular in places. Penultimate segment of *abdomen* narrowly excised to base. Hind *tibiae* with a strong, blunt, sublaminar, inner projection just beyond the middle.

Length  $6\frac{1}{2}$  mm.

*Hab.* QUEENSLAND: Cairns (*E. Allen*).

\* In the type three joints of the antennae are missing.

† The specimen described was received after I had examined the type of *fumosus*.

The hind tibiae \* at once distinguish from all previously described species, in general appearance it is something like *Trichalus nubicollis*. The dark portion of the prothorax, though alike in both specimens before me, appears to be of the nature of a stain only, on the elytra the dark portion is slightly advanced on the suture.

Genus TRICHALUS, † Wat., Trans. Ent. Soc. Lond., 1877, p. 82; 1878, p. 103; Ill. Typ. Col., p. 67; Blackb., T. R. S., S.A., 1894, p. 208; 1900, p. 51; Lea, P. L. S., N.S.W., 1898, p. 556.

*Xantheros*, Fairm., Journ. Mus. Godeffr., 1879, p. 99.

This subgenus of *Metriorrhynchus* is readily distinguished by the prothorax having a single discoidal lanceolate areolet ‡ and the sutural costa of elytra trifurcate at base.§ As pointed out by Blackburn there is nothing to distinguish *Xantheros* from it; there certainly is not in the two species described by Fairmaire, with which I am acquainted.

I am acquainted with all the Australian and Tasmanian species except the following:—

*Serraticornis*, Fab. This must be very close to *sulcatus*.

*Ochreatus*, Fairm. This should be distinct on account of its black prothorax and black apex of elytra.

The others may be tabulated as follows:—

- |      |  |                               |
|------|--|-------------------------------|
| A.   | Discal areolet of prothorax double . . .             | <i>insignis</i> , Lea.        |
| AA.  | Discal areolet single.                               |                               |
| B.   | Sutural costa bifurcate at base . . .                | <i>bifurcatus</i> , n. sp.    |
| BB.  | Sutural costa trifurcate.                            |                               |
| C.   | Entirely black . . . . .                             | <i>ater</i> , Macl.           |
| CC.  | Not entirely black.                                  |                               |
| D.   | Prothorax black.                                     |                               |
| a.   | Elytra entirely pallid . . . . .                     | <i>semicostatus</i> , Blackb. |
| aa.  | Elytra more or less infuscate in<br>places . . . . . | <i>discoideus</i> , Er.       |
| aaa. | Elytra pallid at apex . . . . .                      | <i>funereus</i> , Blackb.     |

\* The projections, however, are probably confined to the males.

† I have examined the type of *Calopteron amplipennis*, Macl., from New Guinea; it is quite an ordinary *Trichalus* with the subsutural costa trifurcate and prothorax triareolate.

‡ Except in *insignis*.

§ Except in *bifurcatus*.

- DD. Prothorax partly or entirely pallid.  
 E. Antennae flabellate in the male.  
   *b.* More than half of elytra black. *semiutratus*, n. sp.  
   *bb.* Less than half of elytra black. *flabellicornis*, n. sp.  
 EE. Antennae not flabellate in the male.  
 F. Elytra black except at extreme base . . . . . *atripeennis*, Macl.  
 FF. Elytra black except at apex . *apiciflavus*, n. sp.  
 FFF. Elytra black at base and apex . . . . . *angulicollis*, Fairm.  
 FFFF. Elytra more or less infusate along disc. . . . *ampliatus*, Wat.  
 FFFFF. Elytra black at apex, or entirely pallid.  
 G. Curvature of sides of prothorax not interrupted in middle . . . . . *griffithi*, n. sp.  
 GG. Curvature interrupted.  
 H. Apex of prothorax not notched in middle. . *flavopictus*, Wat.  
 HH. Apex of prothorax notched in middle.  
 I. Disc of prothorax more or less dark . . . . *nubicollis*, Fairm.  
 II. Prothorax entirely pallid.  
   J. Sterna pallid . . . *sulcatus*, Wat.  
   JJ. Sterna dark.  
     K. Posterior angles of prothorax moderately acute. . . *angustulus*, Macl.  
     KK. Posterior angles very acute . . *froggatti*, Macl.

TRICHALUS AMPLIATUS, Wat., Trans. Ent. Soc. Lond., 1877, p. 83, Pl. II, figs. 97-101; Ill. Typ. Col., p. 67, Pl. XVI, figs. 7-7a; Blackb., T.R.S., S.A., 1900, p. 52.\*

*auritus*, Lea, P. L. S., N.S.W., 1893, p. 600.

*distinctus*, Lea, l. c., p. 602.

\* Mr. Blackburn thought it possible that this species was also *ochraceus*, Dalm.; but I can quite agree with a previous note of his in which he states that it is not even possible to place *ochraceus* generically.

This species varies considerably in size and markings. The prothorax is sometimes pallid across the entire apex, but usually the black is continuous to the extreme apex, sometimes but very narrowly so, however. Sometimes the elytra are entirely pallid except for a slight longitudinal infuscation; sometimes there is a distinct longitudinal black patch, which affects the costae or not. Waterhouse gives the size as from  $4\frac{1}{2}$  to 6 lines, the specimens before me range from  $4\frac{1}{4}$  to 7 lines. Both of the figures (97 in *Trans. Ent. Soc.* and 7 in *Ill. Typ. Col.*), given of the prothorax are somewhat misleading.

I regret to state that I have re-described the species under two separate names—*distinctus*\* and *auritus*; of these *auritus* may be regarded as representing the small form common in northern New South Wales and Queensland, *distinctus* at first really appears to be distinct, the elytral costae being less sharply contrasted in thickness to the normal form †; the median costa of the basal trident is hardly more distinct than the lateral ones, not (as in the normal form) the only really distinct one of the three; whilst the punctures are more regular, transverse and sharply defined. I am convinced now however that it is deserving of varietal rank at most.

*Hab.* QUEENSLAND: Moreton Bay, Brisbane, Mount Tambourine; N.S. WALES: Tweed, Richmond and Clarence Rivers, Tenterfield, Dalmorton, Newcastle, National Park, Sydney, Galston; VICTORIA.

TRICHALUS SULCATUS, Wat., *Trans. Ent. Soc. Lond.*, 1877, p. 83, Pl. II, figs. 102–105; *Ill. Typ. Col.*, p. 68, Pl. XVI, fig. 8.

A specimen from Bowen in Mr. Simson's collection agrees with the description of this species except that the femora are tipped with black; it agrees also with the figures given except that of the prothorax (101) in *Trans. Ent. Soc.*, but this was evidently wrong, ‡ as the median areolet appears as terminating a considerable distance from the apex, whereas the prothorax is described as having "a longitudinal impression reaching nearly from the base to the apex."

\* Already commented upon by Mr. Blackburn.

† Mr. Blackburn relied on a somewhat similar character in one of his species.

‡ In the later figure it is correctly drawn.



Two specimens from Somerset agree with the one from Bowen except in having the median areolet of the prothorax slightly wider and the second elytral costa greatly thickened and elevated at the place where it is not parallel with the suture—much more so than in any other species I have seen; but I cannot regard the two forms as belonging to more than one species.

Thinking it possible that *sulcatus* was possibly a synonym or a variety of *serraticornis*, I wrote to Mr. Waterhouse for his opinion, he replied as follows:—" *Trichalus sulcatus* and *T. serraticornis* are quite distinct and my figures are fairly good. We have both sexes of *T. sulcatus*. *T. serraticornis* is a smaller insect, and has a more punctuated thorax. I have only seen the type, which is in poor condition and has lost apex of elytra."

*Hab.* QUEENSLAND: Brisbane, Port Essington, Bowen, MacKay, Somerset.

TRICHALUS FLAVOPICTUS, Wat., Trans. Ent. Soc. Lond., 1877, p. 82, Pl. II, figs. 92-96; 1878, p. 103; Ill. Typ. Col., p. 67, Pl. XVI, fig. 11.

There are five specimens from N.W. Australia before me which I believe represent a variety of this species, as two females agree exactly in all details of sculpture with a typical specimen from MacKay, whilst the others (males) agree with Waterhouse's description of the male. All five specimens have the discal areolet unclouded and fully half of the femora pallid (not almost only the extreme apex), four of them have the scutellum entirely pallid. The females have the undersurface entirely pallid except that in one of them the four basal segments of the abdomen have an infuscate median blotch; the males have the sterna pallid, in two of them the abdomen (except at the tip) is entirely black, whilst in the third it is dark only along the middle.

*Hab.* QUEENSLAND: Bowen, Mackay; N.W. AUSTRALIA.

TRICHALUS ATER, Macl. (*Xylobanus*), P.L.S., N.S.W., 1887, p. 233.

Two co-types of this species are before me; the species is certainly a *Trichalus*, having the sutural costa interrupted and irregular at base, the second from the suture

not parallel with the suture on its basal 5th, and the prothorax with a single well-defined and central areolet.

*Hab.* QUEENSLAND : Barron River, Kuranda.

TRICHALUS FROGGATTI, Macl. (*Xylobanus*), *l. c.*, p. 233.

A co-type of the species is before me ; it is certainly a *Trichalus*, although Macleay referred it to *Xylobanus*, and stated that it was possibly a *Bulenides*. The tip of the elytra in all the specimens I have seen is slightly stained black.

*Hab.* QUEENSLAND : Cairns.

TRICHALUS ATRIPENNIS, Macl. (*Xylobanus*), *l. c.*, p. 234.

I have examined the type of this species ; it is a typical *Trichalus*, the sutural costa being trifurcate at base (although only the median arm is distinct), and the prothorax with a single discoidal areolet. Macleay describes the 3rd joint of the antennae as slightly larger than the 4th, apparently having overlooked the true 2nd joint ; the true 3rd joint is really a little shorter than the 4th, but the 4th is slightly larger than the 5th. The portion of the elytra concealed by the prothorax is pallid as well as the prothorax itself.

*Hab.* QUEENSLAND : Barron River, Kuranda.

TRICHALUS ANGUSTULUS, Macl. *l. c.*, p. 235.

A specimen (probably from the vicinity of Cairns) before me agrees with the description of this species except that it is slightly larger (4 lines), and that the extreme apex (and sides near apex) of elytra, are slightly infusate. Mr. Masters informs me that in the type the apex is not infusate, but this is probably a character subject to variation. In appearance it is very close to *froggatti*, but it has the prothorax considerably less narrowed in the middle and the posterior angles much less acute ; features at once noticed when specimens of the two species are placed side by side.

*Hab.* QUEENSLAND : Barron River.

TRICHALUS ANGULICOLLIS, Fairm. (*Xantheros*), *Pet. Nouv. Ent.*, 1877, II, p. 167 ; *Journ. Mus. Godeff.*, 1879, p. 100.

A specimen, in Mr. Simson's collection from Bowen, differs from the type in being slightly larger (9½ as against

8½ mm.). Another from Thursday Island, in the Macleay Museum, has the prothorax entirely pallid. The species is a typical *Trichalus*.

*Hab.* QUEENSLAND: Brisbane, Bowen, Port Denison, Thursday Island.

TRICHALUS SEMICOSTATUS, Blackb. (*Metriorrhynchus*), P. L. S., N.S.W., 1891, p. 525; T. R. S., S.A., 1900, p. 51.

*Raymondi*, Lea, P. L. S., N.S.W., 1893, p. 600.

A specimen from Forest Reefs differs from the type of *Raymondi* in having the head entirely dark. The antennae may possibly reach quite to the middle of the elytra, although they do not appear to me to extend quite so far, but there is no doubt as to *raymondi* being a synonym of *semicostatus* with the description of which I did not check it, owing to that species being referred to *Metriorrhynchus*.

The species is very close to *discoideus*, which, however, always has the disc of the elytra more or less infuscate; the shape of the central prothoracic areolet appears to be somewhat different.

*Hab.* VICTORIA: Alpine District; N. S. WALES: Mount Kosciusko, Forest Reefs.

TRICHALUS FUNEREUS, Blackb., T. R. S., S.A., 1900, p. 51.

A specimen of this species is in the National Museum from Loutit Bay. I have seen two other specimens from Victoria (one in the National, the other in the Macleay Museum) which in size, colour and general appearance exactly resemble this species, but which belong to one of the numerous varieties of *Metriorrhynchus rufipennis*.

*Hab.* VICTORIA: Dividing Range, Loutit Bay.

SERRATICORNIS, Fab. (*Lycus*), Sept. Ent., p. 203; Oliv., Ent. II, p. 12, Pl. I, fig. 14; Boisd., Voy. Astr., p. 124; Wat., Trans. Ent. Soc. Lond., 1877, p. 82, Pl. II, figs. 106-108.

*Hab.* AUSTRALIA.

DISCOIDEUS, Er. (*Porrostoma*), Wieg. Arch., 1842, I, p. 145; Wat., Trans. Ent. Soc. Lond., 1877, p. 82, Pl. II, figs. 106-108.

*Hab.* TASMANIA (widely distributed); VICTORIA: Loutit Bay.

NUBICOLLIS, Fairm. (*Xantheros*), P. N., 1877, II, p. 167 ;  
J. M. G., 1879, p. 99.

*Hab.* QUEENSLAND : Peel Island.

OCHREATUS (*Xantheros*), Fairm., P. N., 1877, II, p. 167 ;  
Journ. Mus. Godeff., 1879, p. 99.

*Hab.* N.S. WALES : Sydney.

INSIGNIS, Lea, P.L.S., N.S.W., 1874, p. 601. (*Fig.* 89.)

*Hab.* N.S. WALES : Armidale.

#### TRICHALUS BIFURCATUS, n. sp.

♂. Black ; base apex suture and margins of elytra red and, to a less extent, the three discal costae on each.

*Antennae* passing middle of elytra, strongly serrate, 2nd joint distinct from above, 3rd very slightly longer than 4th. *Prothorax* shining, feebly transverse, 3-areolate ; apex and apical angles rounded ; sides feebly and irregularly increasing in width to base ; basal angles acute and obliquely produced. *Scutellum* depressed, sides increasing in width to apex—which is semicircular. *Elytra* long and narrow, slightly diminishing in width to base and apex ; tricostrate (quadricostate at base), the interspaces with double series of subquadrate punctures, each separated by rather small ridges ; the smaller sutural ridge or costa bifurcate at base, dividing the punctures into three rows. *Abdomen* with the penultimate segment feebly emarginate in middle of apex.

Length 10 mm.

*Hab.* TASMANIA : Huon River.

The general appearance somewhat like a small specimen of *discoideus*, but with the sutural costa bifurcate (instead of trifurcate) at base ; a character which will readily distinguish it from all previously described species.

#### TRICHALUS SEMIATRATUS, n. sp. (*Fig.* 27.)

♂. Black ; prothorax scutellum and basal two-fifths of elytra flavous.

*Eyes* very large. *Antennae* strongly flabellate, extending to about one-third from apex of elytra ; 2nd joint distinct, 3rd slightly longer than 4th, its ramus about twice the length of itself, of the others each is more than twice as long as the supporting joint ; 11th more than twice the length (excluding its ramus) of 10th. *Prothorax*

moderately transverse; 3-areolate; apical angles somewhat obtuse, apex itself produced in middle, basal angles obliquely produced and subacute; sides and apex strongly punctate; median ariole continuous to base and apex, but its walls highest in middle. *Scutellum* transverse, slightly increasing in width to apex, which is rather feebly emarginate. *Elytra* narrow, parallel-sided; each tricostate (at base quadricostate), the interspaces each with two regular rows of rather large rectangular punctures separated by small ridges, sutural costa trifurcate towards base, with its middle arm much thickened at base. *Abdomen* with the penultimate segment semi-circularly and not deeply excised.

Length 11 mm.

*Hab.* QUEENSLAND: Kuranda (type in H. H. D. Griffith's collection).

In colour this species closely resembles *M. (Xylobanus) ampliatus*, Macl.; but the two species have scarcely anything else in common. The two colours are sharply defined at about the middle of the body. This and the following are the only species of *Trichalus* yet known in which the antennae are supplied with long rami; these are very long and thin, that on the 3rd joint is placed nearer its base than apex, in the others it is gradually extended along so that on the 10th it is placed nearer the apex than the base. The rami are so thin that in the specimen before me they have become more or less twisted in drying up.

*TRICHALUS FLABELLICORNIS*, n. sp. (*Figs.* 28, 29.)

♂. Black; prothorax (in places infusate), scutellum and basal two-thirds of elytra testaceous.

*Eyes* very large. *Antennae* strongly flabellate, extending to black portion of elytra, 2nd joint distinct, 3rd slightly longer than 4th, its ramus about once and one-half its own length; of the 4th-9th almost or more than twice the length of the joint. *Prothorax* and *elytra* much as in the preceding species except that the prothorax has the anterior angles less obtuse, the apical portion more produced, the posterior angles more acute and the median ariole rather suddenly narrowed in front; the elytra are almost exactly the same. *Abdomen* with the penultimate segment rather more narrowly (but not so deeply) excised than in the preceding species.

Length 12 mm.

*Hab.* QUEENSLAND: Brisbane (type in R. Illidge's collection).

There are several large dark blotches on the disc of the prothorax, and the posterior angles are also dark. The antennal rami, although very long, are considerably shorter than in the preceding species, and their positions are not the same, that on the 3rd joint being distinctly nearer the apex than the base. As in other species having long antennal rami the edges of these are often peculiarly serrated or jagged. In the specimens before me of the preceding species all the costae (except of course the short scutellar one) are continuous to the apex; in the specimen described above the 1st and 2nd continuous costae become united close to the apex; but this character is subject to so much individual variation in other species that I attach no importance to it whatever.

TRICHALUS GRIFFITHI, n. sp. (*Fig. 90.*)

♂. Black; prothorax, scutellum, basal three-fifths of elytra and trochanters testaceous.

*Head* highly polished. Eyes very large. Antennae not much shorter than the body; 2nd joint distinct, 3rd-10th each slightly produced at tip, and almost twice as long as wide, 3rd distinctly longer than 4th, the others gradually decreasing in length, but 11th as long as 3rd. *Prothorax* apparently longer than wide, but really (by measurement at base) slightly transverse; 3-areolate, median areolet deep and very distinct, but its outer walls not sharply defined, joined to the apex by a feeble shining carina; apex obtusely rounded; sides gently and continuously emarginate; base much wider than apex, with the posterior angles obliquely produced and very acute. *Scutellum* transverse, sides dilated towards apex, which is feebly emarginate. *Elytra* narrow, almost parallel-sided; each tricostate (at base quadricostate), the interspaces with somewhat irregular double rows of rounded punctures (which are separated by small ridges); at base scutellar costa trifurcate, but only the middle arm distinct. *Abdomen* with the penultimate segment rather deeply excised.

Length  $6\frac{1}{2}$  mm.

*Hab.* QUEENSLAND: Herbert River (type in H. H. D. Griffith's collection), Wide Bay (Australian Museum).

On the type the apical dark marking is oblique, being wider on the margins than at the suture; although very distinct it is not sharply defined.

A specimen in the Macleay Museum (from the Endeavour

River) differs in being larger ( $7\frac{1}{2}$  mm.), with the darker parts lightly infusate instead of blackish.

TRICHALUS APICIFLAVUS, n. sp.

♀. Black; sides of prothorax and apical third of elytra flavous.

Head highly polished. Antennae extending to middle of elytra; 2nd joint moderately distinct, 3rd-11th all longer than wide, serrate, 3rd slightly shorter than 4th. Prothorax transverse, apex feebly notched in middle, posterior angles acute and obliquely produced; 3-areolate, the discal areolet connected with the apex by a short broad carina. Scutellum transverse, strongly depressed, apex feebly emarginate. Elytra narrow, sub-parallel, tri- (at base quadri-) costate; the interstices wide, with double rows of regular, large, transverse punctures, with the smaller longitudinal and the transverse ridges of almost equal size; sutural costa trifurcate towards base, with only the middle arm distinct.

Length 11 mm.

Hab. N. S. WALES: Sydney (*W. W. Froggatt*).

Allied to *funereus*, from which it can be readily distinguished by the pallid prothoracic margins. The only specimen before me is very dingy, but as it was taken in 1889 this is probably due to its age.

Genus DUMBRELLIA, n. g.

Head concave, without a distinct rostrum. Eyes very large. Antennae serrate, second joint moderately distinct. Prothorax rounded in front and projecting over the head (which is almost concealed by it). Elytra long and flat, sides sub-parallel; with fairly large punctures, in rows separated by moderately distinct costae. Legs and palpi much as in *Metriorrhynchus*.

I have to propose this genus for two species previously referred by me to *Calochromus*; from which genus, however, they are evidently distinct by the partially concealed head, much larger eyes, strong elytral punctures and flat legs. From *Metriorrhynchus* and *Trichalus* they are separated by the prothorax not divided into distinct areolets but with deep depressions (much as in *Calochromus*) and by the much smaller elytral punctures, the costae separating which are not distinctly alternately elevated. In Waterhouse's revision of the *Lycides* the only genus to which they could possibly be referred is *Melampyrus*; but I hesitate to refer them to that genus as its two species

are from Sarawak and Penang, and have the alternate costae of the elytra evidently strongly elevated.

The figure of *Dihammatus cribripennis* (Ill. Typ. Col., Plate VII, fig. 6) will give a good general idea as to the shape of both the species.

BREVICORNIS, Lea (*Calochromus*), P. L. S., N.S.W., 1898, p. 561.

N. S. WALES: Galston.

PILOSICORNIS, Lea (*Calochromus*), *l. c.*, p. 562.

QUEENSLAND: Barron Falls.

Genus CALOCHROMUS, Guér., Ann. Soc. Ent. Fr., 1833, p. 158; Lacord., Gen. Coleopt., IV, p. 302; Wat., Trans. Ent. Soc. Lond., 1878, p. 96; Ill. Typ. Col., p. 2; Blackb., P. L. S., N.S.W., 1891, p. 528; T. R. S., S.A., 1900, p. 58.

This genus is readily distinguished from the other Australian *Lycides* by the uncovered head, the prothorax transversely oblong and deeply impressed in places but not divided into distinct areolets, and by the elytra without large punctures. In the male the head is sometimes armed with a curved, beak-like process, which projects over the muzzle. Two species (*brevicornis* and *pilosicornis*) previously referred by me to *Calochromus* are now referred to a new genus (*Dumbrellia*).

The following species are unknown to me:—

*Distinguendus*, Fairm. This should be very distinct as its markings (prothorax entirely pallid, elytra black except for a small part of the base, etc.) are very different from those of all the Australian species hitherto described.

*Rostratus*, Blackb. This species has the head unarmed and is evidently something like *guerini*, but it has a short rostrum and the elytra entirely pallid.

The others may be tabulated as follows:—

A. Head armed in the male.

a. Prothorax partly red . . . . . *mastersi*, n. sp.

aa. Prothorax entirely dark.

b. Elytral markings widened posteriorly . . . . .

*simillimus*, Blackb.



- bb. Elytral markings narrowed posteriorly.\*
  - c. Markings covering more than half of the elytra. . . . *cucullatus*, Blackb.
  - cc. Markings covering but a small portion of the elytra *scutellaris*, Er.
- AA. Head unarmed in both sexes.
  - B. Prothorax partly red . . . . . *guerinii*, Macl.
- BB. Prothorax entirely dark.
  - C. Elytra dark at apex
    - d. Elytral costae indistinct, apical markings regular . *amabilis*, Lea.
    - dd. Elytral costae distinct, apical markings irregular . . . *basalis*, Wath.
- CC. Elytra of uniform colour.
  - D. Antennae of male as long as body . . . . . *dentipes*, n. sp.
- DD. Antennae of both sexes shorter than body.
  - E. Median prothoracic sulcus dilated in middle . . . . . *insidiator*, Fairm.
- EE. This sulcus parallel-sided . . . . . *minor*, n. sp.

CALOCHROMUS SCUTELLARIS, Er. (*Anarhynchus*), Wiegmann, Arch., 1842, p. 146; Wat., Cist. Ent., II, p. 195; Trans. Ent. Soc. Lond., 1877, p. 84, t. II, figs. 113-115; Ill. Typ. Col., p. 2.

*Bremei*, Le Guill., Rev. Zool., 1844, p. 221.

? *nodicollis*, Bourg., Ann. Soc. Ent. Fr., 1883, p. 63, Pl. IV, figs. 1-1a.†

\* This will not include the variety of *scutellaris* noted below.

† I sent a specimen of a species which appeared to agree with Erichson's description of *scutellaris* to my valued correspondent Mons. Bourgeois, telling him that it seemed also to agree with his description of *nodicollis*. In reply he stated: "The *Calochromus* is my *nodicollis* male, but not *scutellaris*, Er.; the two species are very different, I have seen the type of *scutellaris* at the Museum at Berlin. Its epistome is not triangularly notched as in both sexes of *nodicollis* but cut straight off in front." After his description of *nodicollis* he states that, "At first sight this remarkable species singularly recalls *C. scutellaris*. It is removed, however, from all its congeners by the profound emargination of the epistome, which causes the labrum

All the Tasmanian specimens (with one exception) which I have seen, have the dark markings about the scutellum continued very narrowly along the suture to about the middle. In an occasional specimen (especially when of large size) the black marking is continued along the suture almost to the apex. The exception (in Mr. H. H. D. Griffith's collection) is from Sheffield and has the elytra entirely red except for a small almost circular dark apical patch common to both elytra. It is true that Waterhouse says of *scutellaris*, "Elytra rusty red, sometimes with the apex black," but his specimens (from the "Swan River and N.W. Coast") in all probability belonged to the species he subsequently described as *basalis*.

In size the species varies from 9 to 17 mm. In the female the projecting spine is represented by a small tubercle at most, and the base of its head is very lightly (instead of deeply) longitudinally impressed.

I have not seen the references in Cist. Ent. and Rev. Zool.

*Hab.* TASMANIA (widely distributed); VICTORIA: Gisborne, Studley Park.

CALOCHROMUS BASALIS, Wat., Cist. Ent., 1877, p. 196;  
Ill. Typ. Col., p. 2, Pl. I, fig. 2.

Of this species I have a pair taken *in cop.*; the female has palpi as in Waterhouse's first section of the genus, the male as in his second section.\* The male differs also from the female in being longer and thinner with considerably longer and thinner antennae. In all the specimens I have seen the apex of the elytra has a

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to be entirely uncovered; the existence of a frontal spine in the male also constitutes an interesting character hitherto unrecorded in the genus *Calochromus*." The beautiful figures he gives leave no doubt as to the species described by Mons. Bourgeois, and despite the above statements I am still inclined to believe it to be *scutellaris*. At any rate it is the only species known to me from Tasmania, is common, and agrees exactly with Erichson's description. Some specimens before me certainly differ from the normal form in colour and size but not in sculpture. If the supposed differences really do exist there must be two distinct species, but it is to be noted that the shape of the epistome is by no means readily seen, except from certain directions, even in fresh specimens, and could easily become obscured by dust or grease.

\* The sexual variation of the palpi has already been commented upon by Mr. Blackburn.

purplish gloss\* much as in *amabilis*; the two species, however, are abundantly distinct, differing in the antennae, elytral costae, etc.

*Hab.* W. AUSTRALIA; Swan River, Mount Barker, Darling Ranges, Beverley.

CALOCHROMUS INSIDIATOR, Fairm., Journ. Mus. Godeffr., 1879, p. 101.

This species belongs to a group of which there are several closely allied species, and as the sex of his specimen was not mentioned by Fairmaire, and the antennae are not mentioned other than that they are "*corpore paulo brevioribus*," there is some difficulty in positively identifying it.

The specimens which at present I refer to it vary from 8 to 9 mm. (the type being  $8\frac{1}{2}$  mm.) in length, with shape and sculpture much as in *basalis*, and the antennae varying sexually much as in that species but distinctly stouter in both sexes.

In his description Fairmaire says, "*Capite tenuissime strigosulo*." In the above noted specimens the head at a glance appears to be very finely strigose, but this appearance is entirely due to the sparse pubescence with which it is clothed, and a similar appearance may be noted in other species, especially when the hair has been plastered down.

*Hab.* N.S. WALES: Sydney, Forest Reefs, Hunter River; VICTORIA; S. AUSTRALIA, Adelaide.

CALOCHROMUS CUCULLATUS, Blackb., T. R. S., S.A., 1900, p. 56.

A male from Victoria in Mr. C. French's collection is rather larger (6 lines) than Mr. Blackburn's largest specimen. Its front femora are armed beneath with a number of small teeth on their lower surface, but these are very small and indistinct.

*Hab.* VICTORIA: Dividing Range, Loutit Bay.

\* In fact, in all the species I have seen the dark elytral markings have a more or less purplish gloss.

GUERINII, Macl., Trans. Ent. Soc. N. S. Wales, II, p. 263 ;  
 Wat., Cist. Ent., II, 1877, p. 196 ; Fairm., Journ. Mus.  
 Godeffr., 1879, p. 101 ; Bourg., Ann. Mus. Civ. Gen.,  
 1889, p. 290 ; Lea, P. L. S., N.S.W., 1898, p. 562.  
*discicollis*, Fairm., Pet. Nouv. Ent., 1877, II, p. 174 ;  
 Journ. Mus. Godeffr., 1879, p. 101.

QUEENSLAND : Gayndah, Rockhampton, Brisbane ; N. S.  
 WALES : Tweed and Richmond Rivers.

DISTINGUENDUS, Fairm., Ann. Soc. Ent. Belg., 1883, p. 21 ;  
 Bourg., Ann. Mus. Civ. Gen., 1889, p. 291.

QUEENSLAND : Somerset.

SIMILLIMUS, Blackb., T. R. S., S.A., 1900, p. 57.

S. AUSTRALIA : Adelaide ; N. S. WALES : Mount Brown,  
 Blue Mountains.

ROSTRATUS, Blackb., *l. c.*, p. 58.

S. AUSTRALIA : Yorke's Peninsula.

AMABILIS, Lea, P. L. S., N.S.W., 1898, p. 560.

N. S. WALES : Sydney, Blue Mountains, Forest Reefs.

CALOCHROMUS MASTERSI, n. sp.

♂. Black ; prothorax (a large medio-basal spot black) and elytra (a rather small apical spot, common to both, black) reddish-testaceous.

*Head* highly polished, grooved along middle ; armed with a strong, sharp, beak-like process. *Antennae* fairly stout, extending to about one-third from apex of elytra, joints scarcely compressed. *Prothorax* transversely oblong, with a deep median somewhat pyriform sulcus, sides deeply impressed at base and apex, the impressions connected by a curved depression. *Scutellum* subquadrate. *Elytra* comparatively narrow, each with four distinct costae, between which are feeble elevations ; densely punctate. *Abdomen* with penultimate segment feebly emarginate. *Anterior femora* moderately stout, unarmed.

Length  $8\frac{1}{2}$  mm.

*Hab.* N. S. WALES (Macleay and National Museums). In appearance very much like *guerini*, but the head armed in the male.

A female, evidently belonging to this species, is in the National Museum ; it differs in having the head unarmed, antennae shorter, and the prothoracic spot connected with apex as well as with base.

CALOCHROMUS DENTIPES, n. sp.

♂. Black; elytra reddish-testaceous.

*Head* highly polished, unarmed, grooved along middle, the groove becoming foveate between eyes. *Antennae* extending to apex of elytra, joints subcylindrical and rather thin. *Prothorax* transversely suboblong, deeply impressed in middle, the impression slightly widening to base, sides deeply impressed at base and apex, the impressions obscurely connected. *Scutellum* subquadrate, depressed along middle. *Elytra* rather narrow, each with four distinct costae, of which, however, the 1st (from the suture) is most and the 3rd and 4th least distinct towards the base, interspaces feebly elevated; densely punctate. *Abdomen* with penultimate segment widely and rather deeply excised. *Anterior femora* stout, each armed beneath with a rather strong but obtuse tooth and with a few small granules.

Length 8-13 mm.

♀. Differs in being wider, antennae stouter and much shorter, the head not grooved at the base (but the foveate expansion between the antennae present), the prothorax rather wider at the base and the abdomen and femora simple.

Length  $9\frac{1}{2}$  mm.

*Hab.* QUEENSLAND: National Museum, Brisbane (*E. Jefferis Turner*); N. S. WALES: Blue Mountains (*Messrs. Taylor*), Wollongong (*A. M. Lea*).

In general appearance close to *scutellaris*, but the head of the male unarmed. From *insidiator* (also with the head unarmed in the male) its much larger antennae and narrower form will readily distinguish it; the female in fact is much the build of the male of that species, and has antennae fully as long.

CALOCHROMUS MINOR, n. sp.

♀. Black; elytra reddish-testaceous.

*Head* polished, deeply impressed between antennae. *Antennae* short (not extending to middle of elytra) stout, subcylindrical; 2nd joint almost half the length of 3rd, 10th almost as wide as long. *Prothorax*, *scutellum*, and *elytra* much as in the preceding species except that the median sulcus of the prothorax is parallel-sided, deep on its basal and shallow on its apical half.

Length  $5-5\frac{1}{2}$  mm.

*Hab.* N. S. WALES: Armidale (*W. W. Froggatt*), Sydney (*H. J. Carter*); QUEENSLAND: Mackay (*C. French*),

A specimen from Brisbane in Mr. Illidge's collection, which I believe to be the male, differs in being narrower, the antennae thinner and longer with the 10th joint more than thrice as long as wide; the head (which is unarmed) with a narrower impression connecting the inter-antennal impression with the base; the anterior femora, stouter and the penultimate segment of abdomen rather deeply semicircularly emarginate.

In general appearance much like the preceding species and *insidiator*; from the former it differs in being much smaller, the antennae shorter and stouter, femora unarmed in the male (if the male is correctly identified, as I think it is), besides the differences as noted above; from the latter species (of which at first the specimens appear to be very small examples) it can be distinguished by its rather narrower form and median prothoracic impression (in *insidiator* this is distinctly deepest and widest in the middle in both sexes); the end joint of its antennae is also differently proportioned.

#### SUBFAMILY LAMPYRIDES.

Genus LUCIOLA,\* Cast., 'Ann. Soc. Ent. Fr., II, p. 146;  
Lacord., Gen. Coleop., IV, p. 335; Olliff, P. L. S.,  
N.S.W., 1889, p. 652.

The Australian fireflies have been referred to two genera, but I have doubts as to the propriety of regarding *Atyphella* as more than a slight subgenus of *Luciola*. It is to be noticed that the shape of the terminal segments of the abdomen do not bear out the theory of generic distinction. In the only female of *Atyphella* (*lychnus*) that I know, the penultimate segment of the abdomen is much as in *L. humilis*, *flavicollis* and *platygaster*, whilst the two apical segments are much alike in the males of *A. scintillans*, *lychnus*, *brevis* and *L. pudica*; but these do not resemble the same segments in *L. flavicollis*, *humilis* and *cowleyi* (which are all much alike) and *platygaster* is again very different. In *Atyphella*, however, the front angles of the prothorax are much more rounded than in *Luciola*.

Germar redescribed in his "Insektenfauna von Adelaide," *Lampyris marginipennis*, Guér., and *L. striata*, Fab., referring them both to *Colophotia*; in Masters' Catalogue

\* For full synonymy of this genus see Lacordaire.

*striata* is placed in *Luciola* and recorded from S. Australia; *marginipennis* being omitted. Both, in fact, are not Australian; the latter was recorded as being "Trouvé à Offak, Terre des Papous,"\* the former as having its "Habitat in Insulis maris pacifici." As to Germar's specimens, he gives no indication as to where they were from, but they were certainly not S. Australian, it is possible of course that he had access to and re-described the types.

Quite recently Mons. Olivier has given a "Catalogue synonymique et Systématique des Espèces de *Luciola* et Genres Voisins" in which nine species † are recorded as Australian but the genus *Atyphella* was overlooked; his *decora*, however, is certainly Olliff's *Atyphella scintillans*. I have not seen the work in which the catalogue appears, but a reprint (for which I am indebted to Mons. Oliver) is marked as having been abstracted from the "Revue scientifique du Bourbonnais et du Centre de la France," for May, 1902.

The only living fireflies I have seen belong to *Atyphella lychnus*, and I did not examine their eyes when fresh; but in three species (*L. flavicollis*, *humilis* and *A. brevis*) recently received in spirits from Mr. Allen, the eyes, before the bodies dried up, were of a deep metallic-blue; these, however, changed to black on the bodies drying up.

The species of *Luciola* before me may be tabulated as follows:—

- A. Prothorax partly dark . . . . . *cowleyi*, Blackb.
- AA. Prothorax entirely pale.
- B. Elytra partly pale . . . . . *flavicollis*, Macl.
- BB. Elytra entirely dark.
- C. Metasternum pale . . . . . *pudica*, Oll.
- CC. Metasternum dark.
- D. Male with apical segment of abdomen strongly produced in middle only . . . . . *humilis*, Oliv.
- DD. Male with this segment produced at sides as well as in middle . . . *platygaster*, n. sp.

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\* I cannot find this place on any modern map. (The locality is in all probability Mount Arfak, in the north-western peninsula of New Guinea.—J. J. W.)

† Several of these are here regarded as synonyms.

LUCIOLA AUSTRALIS, Fab. (*Lampyris*), Syst. Ent., p. 201 ;  
Boisd., Voy. Astr., II, p. 125 ; Pl. VI, fig. 13 ; Gorham,  
Trans. Ent. Soc. Lond., 1880, p. 104.

*guérini*, Cast., Essai, p. 151, note.

*nigripennis*, Latr., Dej. Cat., 3 ed., p. 116.

The original description of this species is both brief and contradictory. It is first described as "*capite elytrisque fuscis*"; then "*Caput atrum . . . Elytra nigra*." It may quite possibly have been founded upon specimens of *pudica*, as it is further described as "*Subtus flavicans, abdominus ultimis segmentis flavissimis*." (This alone will readily distinguish it from *humilis* and *platygaster*.)

As Boisduval described the abdomen as "jaune ou d'un jaune roussâtre avec le quatrième segment d'un brun noirâtre," I think it extremely probable that the species described by him as *australis* was really not that species; especially as his specimen was from New Ireland, whilst the Fabrician type was taken by Banks in New Holland.

In Masters' catalogue, *guérini* and *nigripennis* are given as synonyms of *australis*. The description of *guérini* I have not seen, but *nigripennis* is a catalogue name only.

*Hab.* NEW HOLLAND.

LUCIOLA DEJEANI, Gemm., Col. Heft., VI, 1870, p. 120 ;  
Oll., P. L. S., N.S.W., 1889, p. 658.

*Lampyris apicalis*, Boisd. (*n. pr.*), Voy. Astr., II,  
p. 127 ; Dej., Cat., 3 ed., p. 116.

The specimen identified by Olliff as *apicalis* is a large and distinct species with one-fifth of the apex of the elytra dark. I have seen nothing else like it.

*Hab.* AUSTRALIA : Victoria River Expedition.

LUCIOLA COWLEYI, Blackb., T. R. S., S.A., 1897, p. 34.

Readily distinguished by the dark disc of its prothorax and by each elytron having several distinct costae. In general appearance, except as to its exposed head, it resembles the species of *Atyphella*.

*Hab.* N. QUEENSLAND.

LUCIOLA HUMILIS, Oliv., Nov. Zool., III, 1896, p. 2. (*Figs.*  
89, 99.)

Only the male was known to Olivier; the female differs in being slightly larger and wider, head with much smaller



eyes, the space between which is only slightly concave, abdomen with only one white segment and the following one widely and gently emarginate. The colour of the abdomen in both sexes is much as in *flavicollis*.

*Hab.* QUEENSLAND: Cairns, Kuranda, Bowen, Port Denison.

LUCIOLA FLAVICOLLIS, Macl., Trans. Ent. Soc., N. S. Wales, II, p. 263; Olliff, P. L. S., N.S.W., 1889, p. 653.

var. *gestroi*, Oliv., Ann. Mus. Civ., Genoa, 1885, p. 336, Pl. V, fig. 10.

*coarcticollis*, Oliv., Ann. Soc. Ent. Fr., 1888, p. 59, Pl. I, fig. 9.

The elytra of this species are very variable and might be regarded as either flavous with a dark (never black) discal patch of variable size on each, or as dark (in the male they are usually much darker than in the female) with the suture\* and sides (to a variable extent) pale, and often pale for a considerable space at the base at well. Olliff has well described the sexual characters. The size varies from 4 to 6½ mm.

I have no doubt whatever but that the description of *gestroi* was drawn up from a quite common variety of this species.

The description of *coarcticollis* reads remarkably like as if it belonged to *flavicollis*, except that the prothorax is described as "*quadrato*," whilst in *flavicollis* it is quite strongly transverse. No mention is made of the abdomen in the description. It is recorded from Victoria but the specimen was probably received from a Victorian naturalist, as I believe the genus is entirely absent from Victoria. The figure given would do very well for *flavicollis*.

*Hab.* QUEENSLAND: Gayndah, Rockhampton, Somerset, Port Curtis, Port Denison, Mount Dryander, Bowen, Cairns; S. AUSTRALIA: N. Territory; N.W. AUSTRALIA.

LUCIOLA PUDICA, Olliff, P. L. S., N.S.W., 1889, p. 652.

(Fig. 100.)

The female differs from the male in having an obtusely triangular apical segment of abdomen, with the preceding one moderately emarginate.

*Hab.* QUEENSLAND: Bowen, Port Curtis; N. S. WALES.

\* Occasionally the suture is dark except at the basal third.

LUCIOLA PLATYGASTER, n. sp. (*Figs. 101, 102.*)

♂. Blackish; prothorax, scutellum, mesosternum, trochanters and four front coxae more or less flavous; two apical segments of abdomen whitish throughout.

*Head* large, deeply impressed along middle. Eyes very large, occupying about two-thirds of the lower surface of head and less of the upper. Antennae passing hind coxae. *Prothorax* about twice as wide as long, sides gradually dilated to near apex, apex produced in middle, all the sides margined; densely and coarsely punctate; disc irregular. *Elytra* scarcely wider than prothorax; densely, rugosely and moderately coarsely punctate, and with traces (two on each) of very feeble costiform elevations. Two apical segments of abdomen large and wide, the apical one terminated by three large lobes, of which the median one is somewhat larger and just perceptibly shorter than the others, at its base is a subfoveate impression.

Length, 7 mm.

♀. Differs in being larger (7½ mm.), head smaller, and very feebly depressed between eyes, these also smaller; abdomen with only one white segment and the following one almost semicircularly emarginate.

*Hab.* QUEENSLAND: Cairns (Macleay Museum).

The colour of the under surface will readily distinguish from *pubida* and the description of *australis*. From *humilis* the shape of the apical segment of the abdomen in the male and the much more deeply emarginate segment of the female will readily distinguish it. In the males of both species, as also in *flavicollis*, the female appears to have a short triangular supplementary segment.

Genus ATYPHELLA, Olliff, P. L. S., N.S.W., 1889, p. 645.

The species of this genus or subgenus are all Australian, and may be tabulated as follows:—

- |     |                                     |                           |
|-----|-------------------------------------|---------------------------|
| A.  | Elytra entirely dark . . . . .      | <i>scintillans</i> , Oll. |
| AA. | Elytra not entirely dark.           |                           |
| B.  | Size comparatively large . . . . .  | <i>flammans</i> , Oll.*   |
| BB. | Size comparatively small.           |                           |
| C.  | Elytra parallel-sided . . . . .     | <i>lychnus</i> , Oll.     |
| CC. | Elytra with rounded sides . . . . . | <i>brevis</i> , n. Sp.    |

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\* I have examined the type of this species and it certainly appears to be a good one, but Olliff's remarks that "This species is conspicuous by the striped appearance of its elytra, and the black patch on its prothorax" does not serve to distinguish it from *lychnus*.

LYCHNUS, Olliff, P. L. S., N.S.W., 1889, p. 647.

*Hab.* NEW SOUTH WALES: Blue Mountains, Jenolan, Mount Wilson, Sydney, Kiama.

SCINTILLANS, Olliff, *l. c.*, p. 650; *decora*, Oliv. (*Luciola*),  
Revue Sc. Bourbonnais, p. 77 (1902).

*Hab.* NEW SOUTH WALES: Upper Hunter and Clarence Rivers, Newcastle.

FLAMMANS, Olliff, *l. c.*, p. 651. QUEENSLAND: Cloncurry.

ATYPHELLA BREVIS, n. sp. (*Fig.* 103.)

♂. Pale flavous; head, part of metasternum and the abdomen (two apical segments white) black; antennae, legs (in parts excepted) and elytra (suture sides and costae excepted) infuscate; an infuscate irregular spot on the apical portion of prothorax. Rather densely clothed with short pubescence.

*Head* large, deeply excavated between the eyes, the excavated space shining. *Eyes* large, partially visible from above. *Antennae* very little longer than the width across eyes. *Prothorax* about thrice as wide as long, apex slightly produced, sides rounded, front angles strongly rounded, with dense and moderately large punctures. *Scutellum* densely punctate, apex rounded. *Elytra* widest at about the middle, sides rather strongly rounded, with dense punctures, rather smaller and deeper than those on prothorax; each with the suture and side strongly raised and three very prominent costae and traces of another.

Length 6-6½ mm.

*Hab.* QUEENSLAND: Atherton (*E. Allen*).

In general appearance rather close to some males of *lychnus* but shorter and wider; elytra not parallel-sided and with much more prominent costae; eyes much larger (they are, however, no larger in proportion to the head), partially visible from above, and the space between them much more largely excavated. Its much smaller size readily distinguishes it from *flammans*. Mr. Allen sent me twelve males but no females, and wrote me that "These were obtained from the vicinity of Atherton, about 2,600 feet up, and inhabiting the dense scrubs of that district, distant about 65 miles from Cairns."

This species and *Luciola cowleyi* might fairly be regarded as linking *Atyphella* and *Luciola* together.

## SUBFAMILY TELEPHORIDES.

Genus TELEPHORUS,\* Schaffer, *Elem. Entom.*, Tab. 123; Lacord., *Gen. Coleop.*, IV, p. 353; Blackb., *T. R. S.*, S.A., 1886, p. 259.

This genus is rather numerously represented in Australia, and some of the species (*nobilitatus* and *pulchellus* especially) are to be seen in countless thousands. The species are all of large or medium size, but many are subject to great variation, especially in the males. A number of very small species have been referred to the genus, but these are here referred to *Heteromastic*. Little reliance is to be placed upon the prothoracic impressions as these are subject to considerable alteration on the insects drying up, the irregular contraction even appearing at times to alter the outlines.

In the females of both this genus and *Selenurus* the penultimate segment of the abdomen is semicircularly emarginate on each side, with a median (and sometimes acutely pointed) lobe between. The male has a narrow excavation only, but the preceding segment is also widely emarginate.

The Rev. T. Blackburn thinks it possible that *pulchellus* and other Australian species are really not congeneric with the European species of *Telephorus*. I am not prepared to go into this question, but regard all the species here noted or described as being congeneric with *pulchellus*.

It is remarkable that three of the species are apterous; of these one is from Lord Howe Island, and the theory advanced that species inhabiting small islands are apt to either become apterous or to develop very strong wings, may hold good in this case; but this theory will not account for the two other species, one of which is distributed over the whole width of the Australian continent.

There are several species before me which do not agree exactly with any of the published descriptions, but as they are allied to *mastersi* and as that species and several of its allies are variable in colour I have not ventured to describe them.

The position of *Cantharis australis*, Boisd. (appearing in Masters' catalogue as a *Telephorus*), is very doubtful; I prefer to refer to it at the end with other doubtful species.

\* For full synonymy of this genus see Lacordaire.

The species unknown to me are:—

*Tepperi*, Blackb.—Evidently belonging to the *mastersi* group as the prothorax is “half again as wide as long.” There are several species before me which might be this insect, but as they do not agree exactly with its described colours (even although Mr. Blackburn supposes these to be variable) I prefer to leave them untouched for the present.

*Palmerstoni*, Blackb.—The width of the prothorax is not given, but as the insect itself is described as closely resembling the preceding species (except in colours), it also is probably allied to *mastersi*.

*Mossmani*, Macl.—Belonging to the *mastersi* group, but with the upper surface entirely pallid.

The others may be tabulated as follows:—

A. Apterous.

a. Elytra fasciate. *alternatus*, n. sp.

aa. Elytra not fasciate.

b. Large and comparatively robust . . . . . *apterus*, Oll.

bb. Small and very thin . . . . . *kershawi*, n. sp.

AA. Winged.

B. Prothorax partly dark.\*

c. Elytra entirely dark.

d. Prothorax distinctly transverse in  
both sexes . . . . . *nobilitatus*, Er.  
(in part.)

dd. Prothorax distinctly transverse  
in female only . . . . . *pulchellus*, W. S. Macl.

cc. Elytra entirely pallid † . . . . . *flavipennis*, Macl.

ccc. Elytra dark with a subapical fascia. *notophilus*, Blackb.

cccc. Elytra dark at base and apex . . . . . *imperialis*, Redt.

cccc. Elytra dark at base and maculate  
near apex . . . . . *curvipes*, n. sp.

BB. Prothorax entirely pallid.

C. Elytra entirely dark.

e. Prothorax strongly transverse . . . . . *nobilitatus*, Er.  
(in part.)

ee. Prothorax at least as long as wide.

\* I have not included part of *nigroterminalis* here, as even when present the dark marking of the prothorax is only of the nature of a stain; for the same reason part of *viridipennis* is not included.

† There is occasionally an infuscate blotch about the scutellum.

- f. Antennae with 9th and 10th joints  
whitish . . . . . *inconstans*, n. sp.  
(in part.)
- ff. These joints dark . . . . . *viridipennis*, Macl.
- CC. Elytra entirely pallid . . . . . *macrops*, n. sp.
- CCC. Elytra partly dark.
- D. Dark portion at apex only.
- g. Prothorax strongly transverse.
- h. Antennae thin, elytra dark at  
tip only . . . . . *rubriceps*, Macl.
- hh. Antennae stout, elytra with  
at least apical fourth dark *rufiventris*, Macl.
- gg. Prothorax scarcely or not at all  
transverse.
- i. Antennae with terminal joints  
pale . . . . . *immaturus*, n. sp.
- ii. Terminal joints dark . . . . *nigroterminalis*, n. sp.
- DD. Dark portion not only at apex.
- E. Prothorax strongly transverse.
- i. Basal and apical markings of  
elytra sharply terminated . . *mastersi*, Macl.
- jj. These markings connected along  
sides . . . . . *froggatti*, Macl.
- EE. Prothorax as long as wide . . . *inconstans*, n. sp.  
(in part.)

TELEPHORUS PULCHELLUS, W. S. Macl., King's Survey,  
App., p. 442; Cast., Hist. Nat., i, p. 272; Boisd., Voy.  
Astr., ii, p. 131; Blackb., T. R. S., S.A., 1886, p. 260.

Var. *notophilus*, Blackb., T. R. S., S.A., 1900, p. 116.

The colour of the elytra of this species varies from a dull brassy-green to a rather deep blue. The males are usually smaller than the females and have longer and thinner antennae, the head, however, is but very little wider; frequently it has two feeble infuscate spots at the base of the prothorax, otherwise the sexes (at least of the common forms) do not differ in colour.

I have a female (also from the Adelaide Museum as were Mr. Blackburn's specimens) of the variety *notophilus* which is still fast *in cop.* with a quite normal male; and there is another specimen in the National Museum from Queensland.

*Hab.* N.S. WALES; VICTORIA; TASMANIA; S. AUSTRALIA.

TELEPHORUS NOBILITATUS, Er. (*Cantharis*), Wieg. Arch., 1842, i, p. 146.

*tricolor*, Cast., Hist. Nat., i, p. 275.

vars. *ruficollis*, Macl., Trans. Ent. Soc., N. S. Wales, ii, p. 264.

var. *proprius*, Blackb., T. R. S., S.A., 1886, p. 260.

var. *andersoni*, Blackb., l. c., p. 261.

var. *vibex*, Blackb., l. c., p. 261; P. L. S., N.S.W., 1891, p. 530.

(Figs. 2, 174, 175, 176, 177, 178.)

This is an extremely variable species in size, colour and markings, so it is no wonder that several of its varieties have been described as distinct species.

*Tricolor* is very briefly described, but there is no doubt in my mind but that Castelnau's specimens belonged either to the typical form of *nobilitatus*, or to one of its numerous varieties.

*Ruficollis* is the common form in New South Wales and Queensland; in fact, except from Mount Kosciusko,\* I have seen no specimens from outside Tasmania having the femora entirely dark.

I have varieties agreeing well with the descriptions of *proprius* and of *vibex* but not with the prothoracic markings attributed to *andersoni* †; but as Mr. Blackburn says these are three closely-allied species, *andersoni* being placed between *proprius* and *vibex*, it appears to me extremely probable that it also is only a variety.

If the type of *vibex* was, as supposed by Mr. Blackburn, ‡ a female, the pallid triangle at the base of the head is a most unusual feature, as in all the females I have examined the base is invariably black §; several males, however, before me have such a triangle.

\* Tasmanian species in all branches of natural history are usually darker (and frequently larger) than their mainland fellows, but the specimens from Mount Kosciusko and other mountains of the Australian Alps resemble those from Tasmania.

† Since this was written I have seen five specimens from Australia, one of which agrees exactly with Mr. Blackburn's description of *andersoni*; the others all resemble it in size, etc., but have the prothoracic markings reduced to a longitudinal spot on both sides.

‡ In a footnote he stated that he was not quite sure of the sexes.

§ That is to say, the exposed portion, part of the coloured portion usually being red.

Mr. Blackburn, in comparing *vibex* with *nobilitatus*, pointed out certain differences in colour, but these are all unreliable; and as regards the other features, the punctures of the elytra are different in different specimens, and their appearance is frequently altered by the elytral granules or subgranules being advanced almost to the base (especially in the males); and also by the different rates of shrinkage in individuals and the amount of gloss at the base. Tasmanian males appear to me to have the hind tibiae arched very strongly, certainly no more than in the males of *imperialis* and decidedly less than in *apterus*. The elytra in pinned specimens assume very different shapes to what they do in carded ones, but scarcely any two specimens selected at random agree in the final shape assumed both by the prothorax and elytra.

Specimens before me vary in length from 6 to 13 mm. (or, including the abdomen of gravid females, 16 mm.).

The flavous marking on the clypeus of the male is usually continuous from eye to eye, but it is occasionally completely interrupted in the middle,\* whilst it is even sometimes connected with the red basal portion by a rather indistinct reddish streak. The base of the head in the male is rarely entirely black, usually there is a wide patch which on its front margin is usually quite straight, sometimes it is bilobed or trilobed, whilst in others it is distinctly triangular. The head of the male is usually, but not always, wider than the prothorax, but is always wider (frequently very considerably so) than that of the female. The antennae also vary in length, in some males from Western Australia extending almost to apex of elytra; in the more normal forms, however, they are shorter, whilst they are always shorter in the females than in the males.

It is to be noted that the shape of the disc of the prothorax, and even the outlines, is subject to alteration after death, through contraction taking place irregularly. The apex is always bilobed, although sometimes only perceptibly so. With age it often turns to a dirty (often oily-looking) red. A variety rather common in Tasmania has, in both sexes, a large blackish blotch of variable shape and size (but always sharply defined) on

\* Usually the dark portion is advanced in the middle of the clypeus, being sometimes entire and sometimes bilobed, or even in the form of two spots, but in a few specimens it is continuous to the apex.



the disc; such specimens frequently mate with specimens having the prothorax immaculate.

On the bodies drying the elytra curl up so that they usually appear to be much narrower (especially in pinned specimens) than the abdomen. They vary in colour from green to purple, but the base is usually more or less shining and frequently with a coppery gloss; the greater part of the elytra, however, is usually more or less opaque.

The dark markings of the under surface also vary to a considerable extent, in some specimens nearly all, in others scarcely any, of the metasternum is black; in some all the abdominal segments are black at the sides, whilst in others the five basal segments are clear at the sides; the parts more or less concealed by the elytra also vary.

Three males from the Illawarra district have the greater portion of all the femora pallid, also the lower surface of the first and second joints of antennae, the metasternum (except for a triangular space) and abdomen (except for the apical segments); but at the sides of the abdomen in two of them there are infuscate spots. On the head the flavous frontal space is rather larger than usual; in one of them it is connected with the base by an indistinct infuscate streak, which widens out towards the base but near it is suddenly constricted; in the second specimen the pallid basal space forms a rather narrow triangle whilst in the third it is still narrower and very indistinct.

A very distinct variety from S. Australia is represented by two specimens in the Macleay Museum. These are very small (6-7 mm.), have the head red except for an interrupted black fascia between the eyes, the apical half of the prothorax (but not the extreme apex) black; the apex of the femora, the tibiae, tarsi and antennae (basal joints in parts paler) more or less dark; and the elytra of a dingy green.

*Hab.* QUEENSLAND; N. S. WALES; VICTORIA; TASMANIA; S. and W. AUSTRALIA.

TELEPHORUS FLAVIPENNIS, Macl., Trans. Ent. Soc., N. S. Wales, II, p. 264. (*Fig.* 171.)

This species can be readily distinguished from *imperialis* (which in many respects it closely resembles) by the bicostate elytra and unicolorous antennae.

Two specimens from the Tweed River differ from the

normal form in having a fairly large blackish blotch on each side of the scutellum.

*Hab.* QUEENSLAND: Gayndah, Brisbane; N. S. WALES: Tweed River; VICTORIA: Wodonga.

TELEPHORUS MASTERSI, Macl., *l. c.*, p. 264. (*Fig.* 158.)

This species is variable in its colouring. In some specimens the head is entirely pallid, in others the base is black. The markings at the base of the elytra are usually sharply defined and have a more or less sinuous outline posteriorly, but in one specimen before me they are almost absent, a slight infuscation of the shoulders and a space near the suture being all that is left. In some specimens the legs are almost entirely pallid, in others only parts of the femora are dark; the metasternum has a space of variable size varying from slightly infuscate to deep black. The antennae sometimes have the lower surface of all the joints pale, sometimes but of three or four.

*Hab.* QUEENSLAND: Gayndah, Brisbane, Cairns, Somerset, Fitzroy; N. S. WALES: Tweed and Richmond Rivers.

TELEPHORUS RUFIVENTRIS, Macl., P. L. S., N.S.W., 1887, p. 236.

In the description the antennae are stated to be "inserted almost beneath the eyes"; as a matter of fact each antennae is nearer to an eye than to its fellow but they are not inserted almost beneath the eyes. Of the specimens before me (two of them are co-types) two are females with the metasternum slightly infuscate at sides; the others are males with the metasternum much darker, the base of the head infuscate and the antennae considerably longer.

*Hab.* QUEENSLAND: Mossman River, Cairns.

TELEPHORUS FROGGATTI, Macl., *l. c.*, p. 237.

The antennae are inserted much as in *rufiventris*. The under surface is variable in colour, as in several specimens the abdomen, except at apex, is entirely pale. In the types and in other specimens the base of the elytra is stained with black, the stains are continued along the sides and are then dilated so as to touch the suture at

about the apical fifth; but the dark portions are somewhat variable and are not sharply limited.

*Hab.* QUEENSLAND: Mossman River, Cairns.

TELEPHORUS VIRIDIPENNIS, Macl. (*Selenurus*), *l. c.*, p. 238.

The head is not striolate although so described; there is certainly an appearance of striolation at first sight, but this is entirely due to pubescence. The space between the eyes is slightly undulating but the expression "a deep corrugated impression between the eyes" is misleading. In two specimens before me (co-types) one has the prothorax immaculate and the other has it slightly clouded in the middle. The elytral punctures are much as in *inconstans*; in fact, the most noticeable distinction between the two species being the white 9th and 10th joints of the antennae of *inconstans*.\*

I have tabulated the species with *Telephorus* as it appears to me to be out of place in *Selenurus*.

TELEPHORUS IMPERIALIS, Redt., Reise Novara, II, p. 103, Pl. IV, fig. 1; Fairm., Journ. Mus. Godeff., 1879, p. 98.

*pictus*, Cast., Hist. Nat., I, p. 275 (n. pr.).

*sticticus*, Gemm., Col. Heft., VI, 1870, p. 120. (Figs. 159, 172.)

The description of *pictus* is very short (the head antennae and legs are not even mentioned) but the colours exactly fit *imperialis*.

In the male the head is considerably wider than the prothorax, and the muzzle is flavous, much as in *nobilitatus*; in the females part of the 10th joint as well as the whole of the 9th is sometimes whitish. The specimens before me range from 5-14 mm. in length.

*Hab.* QUEENSLAND: Mt. Tambourine; N. S. WALES: Sydney, Wollongong, Richmond River; VICTORIA: Narracan, Gippsland.

MOSSMANI, Macl., P. L. S., N.S.W., 1887, p. 235.

*Hab.* QUEENSLAND: Mossman River.

\* Of the numerous specimens of *inconstans* which I have seen these joints are invariably pale; of four specimens of *viridipennis* they are invariably dark.

RUBRICEPS, MacL., *l. c.*, p. 236.

*Hab.* QUEENSLAND: Mossman River.

TEPPERI, Blackb., *l. c.*, 1888, p. 1424.

*Hab.* S. AUSTRALIA, N. Territory.

PALMERSTONI, Blackb., *l. c.*, p. 1425.

*Hab.* S. AUSTRALIA, N. Territory.

APTERUS, Olliff, Mem. Aust. Mus., II, 1889, p. 86, Pl. VI,  
fig. 3.

*Hab.* LORD HOWE ISLAND.

TELEPHORUS ALTERNATUS, n. sp.

♂. Black, the dark parts of the elytra with or without a bluish gloss; basal half of prothorax, a wide postmedian fascia on elytra, abdomen (except two apical segments), three basal and three apical joints of antennae and parts of coxae, flavous or almost so. Rather sparsely clothed with very short pubescence.

*Head* very finely punctate. Antennae passing apex of elytra, moderately stout, 3rd joint much shorter than 4th. *Prothorax* as long as its width across apex, apex much wider than base; hind angles strongly, the front moderately rounded, base and apex very feebly bilobed; very minutely punctate. *Elytra* very little wider and about once and one half the length of prothorax, each pointed at apex; densely, moderately coarsely and rugosely punctate; without raised lines. *Legs* long and thin. Length to apex of elytra 3 (♀ 5), of abdomen 5 (♀ 9) mm.

♀. Differs in being larger, head longer, prothorax less narrowed towards base, antennae and legs shorter and stouter, abdomen wider, etc.

*Hab.* N. W. AUSTRALIA (Macleay Museum), King's Sound (*W. W. Froggatt*); QUEENSLAND: Bowen (*Aug. Simson*), Chillagoe (*C. French*).

A very narrow species though considerably wider than the following; from both that species and *apterus* (the only other apterous species hitherto described) the fasciate elytra will readily distinguish it. The colours appear in alternate zones, the pale base of the prothorax occupies rather more than half the surface, the elytral fascia usually commences slightly before the middle and terminates rather close to the apex. The abdomen (except the apical segments) is usually entirely pallid, but on the upper surface is occasionally marked by infuscate spots or zones.


The 1st joint of the antennae is sometimes partly black above, the 4th is sometimes pale below, whilst the 11th is usually infuscate at the apex. The prothorax is impressed in various places, but the impressions seem to be mostly due to irregular contraction, as they are seldom the same on any two specimens. In the female the 4th–8th joints of the antennae are noticeably stouter than the others.

**TELEPHORUS KERSHAWI**, n. sp. (*Fig. 3.*)

♂ ♀. Black, elytra with a slight greenish or bluish gloss; prothorax flavous, but with a dark transverse irregular apical patch; upper surface of abdominal segments dark above, except at tips, lower surface pallid, but each with a spot on each side and one in the middle; the two apical segments entirely dark. Sparsely clothed with very short pubescence, longer at sides than elsewhere.

*Head* elongate, scarcely visibly punctate. *Antennae* moderately long; 3rd joint distinctly shorter than 4th. *Prothorax* much longer than wide, apex and all the angles rounded; impunctate. *Elytra* not as long as head and prothorax combined, and but little wider than either, each obtusely rounded at apex; coarsely sculptured. *Legs* long and thin. Length to apex of elytra 4, of abdomen 6 mm.\*

*Hab.* VICTORIA: Mordialloc (types in National Museum).

The long prothorax might be considered as evidence that this species belonged to *Selenurus*, but I have not considered it advisable to generically separate the three apterous species. It is so narrow that at first sight it might almost be thought to belong to *Carphurus*. The elytra are so sculptured that they might be regarded either as irregularly granulate or coarsely and rugosely punctate. The dark marking of the prothorax appears somewhat like a figure  on one of the females, but it is not exactly the same in any two specimens. The male is smaller than the female, with longer and thinner antennae and legs, larger head and narrower elytra.

**TELEPHORUS INCONSTANS**, n. sp.

♂ ♀. Head black, with a metallic-bluish gloss; each antennae inserted in an indistinct pallid spot; prothorax reddish; elytra dark

\* The lengths given are from a female; three other specimens before me are too much contracted to be measured satisfactorily.

green, or with a large pallid median space, or dark only at base and apex; abdomen and sides of meso- and metasternum flavous; scutellum and appendages black; 9th and 10th joints of antennae whitish. Clothed with short, dense pubescence, more noticeable on elytra and legs than elsewhere.

*Head* very finely punctate; with several shallow depressions between eyes. *Antennae* rather long and thin, 3rd joint much shorter than 4th. *Prothorax* about as long as the width across its apex, apex distinctly wider than base, all the angles rather strongly rounded off, base bilobed. *Elytra* long and thin, usually passing abdomen, base much wider than prothorax; very densely and moderately coarsely punctate, punctures smaller at base and extreme apex than elsewhere; each with a feeble raised line. *Legs* long and thin.

Length 12-15 mm.

*Hab.* QUEENSLAND: Brisbane (*E. J. Turner* and *R. Illidge*); N. S. WALES (National Museum), Clarence River (Macleay Museum and *A. M. Lea*).

I do not know which to regard as the typical form and which as the varieties of this species; of the twelve specimens before me four have the elytra entirely dark green, six have a rather short basal, and a somewhat larger apical space dark green, the intervening space (covering more than half of the surface) being pale flavous; whilst the other two have the basal and apical markings connected along the sides. The green parts occasionally become purplish where they approach the flavous parts. The 10th joint of the antennae is usually infusate at apex, the 2nd-8th are each frequently pallid at the extreme base. The two apical segments of the abdomen are usually feebly maculate.

Compared with the types of *viridipennis* to which it is very close (I am by no means certain but that the various forms described should not be at all regarded as varieties of that species), it differs in being larger, stouter, the head with much finer punctures, and the 9th and 10th joints of antennae of different colour.

#### TELEPHORUS NIGROTERMINALIS, n. sp.

♂ ♀. Of a rather dingy flavous; head (portion of the space between the antennae dull reddish), scutellum, apical 5th of elytra, antennae (four basal joints partly pallid), parts of palpi, legs (except knees, parts of coxae and of front tibiae), meso- and metasternum

(except parts of sides), black or blackish. Very densely (less densely on the head and prothorax than elsewhere) clothed with very short pubescence.

*Head* densely and finely punctate, with several feeble impressions between eyes and with a shallow longitudinal one. *Antennae* moderately long, 3rd joint much shorter than 4th. *Prothorax* about as long as wide, angles rounded, apex almost truncate, base rounded and not bilobed, surface irregularly impressed; densely and minutely punctate. *Elytra* long, not very much wider than prothorax; densely and rugosely but not coarsely punctate; each with traces of one or two feeble oblique raised lines. *Legs* long and thin.

Length 10-15 mm.

*Hab.* QUEENSLAND (*Aug. Simson*), Port Denison (Macleay Museum).

Although the descriptions of this and the following species may read somewhat like that of *mastersi*, and the numerous allies of that species, in appearance they are really very different, the most noticeable distinctions being the opaque derm and much longer prothorax. The male is rather smaller and narrower than the female, with a larger head and thinner and longer antennae. On an occasional specimen there is an infusate spot on the prothorax and another on each side of the scutellum. From some directions the dark apex of the elytra appears to be granulate.

#### TELEPHORUS IMMATURUS, n. sp.

♂. Pale flavous; head (parts between and in front of antennae excepted) and apical 5th of elytra almost black; apical half of femora, tarsi (and to a less extent the tibiae), middle of metasternum, apex of abdomen and 4th-8th joints of antennae more or less deeply infusate. Rather densely clothed with very short pubescence.

*Head* densely and finely punctate, almost regularly convex between eyes. *Antennae* rather stout and not very long, 3rd joint much shorter than 4th. *Prothorax* with apex and angles rounded, base bilobed; densely and minutely punctate. *Elytra* much as in the preceding species, except that the punctures are rather coarser and the raised lines even less distinct. *Legs* long and thin.

Length 9-10 mm.

*Hab.* N. W. AUSTRALIA (type in Macleay Museum)

At first sight not unlike pale undersized specimens of the preceding species but the differently coloured legs and antennae will at once readily distinguish it; the head also is without a longitudinal impression and the prothorax is different both at the base and apex. In the two specimens before me the scutellum is slightly infuscate at apex; the three basal and three apical joints of antennae are distinctly paler than the others. Owing to irregular contraction the prothorax of one of the specimens is distinctly longer than wide; in the other it is about as long as wide.

**TELEPHORUS MACROPS**, n. sp. (*Figs. 157, 173.*)

♂. Pale reddish flavous and highly polished; eyes black. Clothed with very short pubescence.

*Head* large, wider than prothorax, impunctate, nowhere distinctly impressed; eyes unusually large and strictly lateral. Antennae moderately long; 3rd joint scarcely, if at all, shorter than 4th. *Prothorax* about as long as wide, apex rounded, base feebly bilobed; front angles strongly, the hind rather feebly bilobed; sparsely and minutely punctate. *Elytra* the width of head across eyes; densely but not very coarsely (at base very finely) punctate; with traces of several very feeble raised lines. *Legs* long and thin.

Length 9 mm.

*Hab.* QUEENSLAND: Cairns (type in R. Illidge's collection).

This species belongs to the *mastersi* group, but is readily distinguished from all previously described Australian species by its entirely pallid colour, except as to the eyes. The eyes are considerably larger than in any other species here noted or described, and (partly of course owing to their colour) appear unusually distinct.

**TELEPHORUS CURVIPES**, n. sp. (*Fig. 157, 173.*)

♀. Black; a spot on each side of head (marking the insertion of antennae), prothorax (a large frontal fascia black), elytra (a basal space and a small subapical spot on each excepted), sides of metasternum, abdomen (two apical segments excepted), apex of coxae and base of trochanters pallid. Densely clothed with very short pubescence.

*Head* very finely punctate. Antennae thin but not very long, 3rd joint much shorter than 4th. *Prothorax* rather shorter than its



width at apex, all the angles rounded, both base and apex very feebly bilobed; densely and minutely punctate. *Elytra* long, not much wider than prothorax, each obtusely pointed at apex; densely, rather coarsely, and rugosely punctate; without raised lines. *Legs* long and rather thin; hind femora strongly curved.

Length 11 mm.

*Hab.* N. S. WALES: Sydney (*A. M. Lea*), Gosford (*H. J. Carter*).

The non-costate elytra with a dark basal zone and two subapical spots readily distinguishes from *flavipennis*. The entirely dark antennae and pallid anterior margins of prothorax, with a spot on each side close to but not on apex of elytra distinguishes from *imperialis*. The hind femora are unusually strongly curved. The base of the front tibiae and parts of the tarsi are indistinctly paler than the adjacent parts; the frontal fascia of the prothorax occupies about half the surface and appears, from above, to extend to the sides, although it does not really do so; there is also a small infuscate spot on each side of the base, such as there frequently is in *pulchellus*; the dark parts of the elytra have a slight bluish gloss, the basal space occupies about one-sixth (or less) of their length; the subapical spots are longer than wide, rounded, and distant about their own length from the apex.

Genus SELENURUS, Fairm., Journ. Mus., Godeff., 1879, p. 98; Blackb., T. R. S., S.A., 1886, p. 259; 1892, p. 221.

I know no distinct feature by which this genus is to be distinguished from *Telephorus*\*; but as both Sir William Macleay and the Rev. T. Blackburn have recognised it as valid I shall not propose to regard it as really synonymous with *Telephorus*. Should, however, it be eventually proved that the Australian species referred to *Telephorus* do not really belong to that genus, it may be advisable to unite them all under *Selenurus*.

*Apicalis*, Macl., is allied to *annulatus*. I have not a specimen before me now, but the others (excluding *appendiculatus* described after the table was drawn up) may be tabulated as follows:—

\* The species at present referred to the genus (except *granulatus*) are very homogeneous in appearance, however.

- A. Elytra entirely dark.  
 a. Metasternum pallid in middle . . . *granulatus*, Lea.  
 aa. Metasternum dark in middle.  
 b. More than half of prothorax dark *tricolor*, Lea (in part).  
 bb. Less than half dark . . . *sydneyanus*, Blackb.
- AA. Elytra partly pallid.  
 B. Tip of elytra pallid.  
 c. Pale apex connected with base . *v-flavus*, n. sp.  
 cc. Pale apex not so connected . . *annulatus*, Macl.
- BB. Tip of elytra dark.  
 C. Prothorax pallid . . . . . *luteopictus*, Fairm.  
 CC. Prothorax partly dark.  
 D. Elytra bifasciate . . . . . *variegatus*, Blackb.  
 DD. Elytra with remnants of  
 but one fascia . . . . . *tricolor*, Lea (in part).

SELENURUS DEPRESSICOLLIS, Macl. (*Ichthyurus*). Trans. Ent., N.S. Wales, II, p. 264; Blackb., T. R. S., S.A., 1892, p. 221; var. *luteopictus*, Fairm., 1877, p. 167, Journ. Mus., Godeff., 1879, p. 99. (*Fig. 156.*)\*

The apical joint of the antennae of the type of *depressicollis* is dark terminally, the spot on the prothorax is a stain only, although described as "a broad black band." *Luteopictus* is a form (the commoner of the two in my experience), in which the prothorax is immaculate.

Of three specimens now before me, two agree exactly with the description of *luteopictus*; the other agrees exactly in colour, but has the elytra much less coarsely sculptured, and the elevated line on each scarcely traceable.

*Hub.* QUEENSLAND: Gayndah, Brisbane, Peak Downs, Mackay; N.S. WALES: Tweed River.

SELENURUS ANNULATUS, Macl., P. L. S., N.S.W., 1887, p. 238. (*Fig. 155.*)

In a specimen from Cairns the dark basal and subapical markings of the elytra are disconnected, and the spot on the prothorax is small and of irregular shape; in two others (sexes) from Kuranda, the dark elytral markings are connected along the sides, and the prothoracic spot is almost a perfect semicircle, the convex side of which faces the apex.

*Hub.* QUEENSLAND: Mulgrave River, Cairns, Kuranda.

\* Var. *luteopictus*.

SELENURUS TRICOLOR, Lea, *l. c.*, 1895, p. 232.

*fernshawensis*, Blackb., T. R. S., S.A., 1900, p. 115.  
(*Fig.* 170.)

At the time this species was described I imagined that the specimens having the elytra immaculate were typical of the species; and that those with the subapical spot common to both elytra represented a variety. I have since however obtained four specimens all of which have the subapical spot; so that this form (which agrees exactly with Mr. Blackburn's description of *fernshawensis*) appears to be the typical one.

*Hab.* N. S. WALES: Blackheath, Mount Kosciusko (5,700–6,000 feet); VICTORIA: Fernshaw; TASMANIA: Huon River.

SELENURUS SYDNEYANUS, Blackb., T. R. S., S.A., 1892, p. 221.

Two specimens from Brisbane differ from the normal form in having the prothoracic fascia reduced to irregular spots or blotches.

*Hab.* QUEENSLAND: Brisbane; N. S. WALES: Sydney, Narrabeen, Wentworth Falls; VICTORIA.

APICALIS, Macl., P. L. S., N.S.W., 1887, p. 257.

QUEENSLAND: Mossman River.

VARIEGATUS, Blackburn, T. R. S., S.A., 1892, p. 220.  
(*Fig.* 154.)

N.S. WALES: Blue Mountains; QUEENSLAND.

GRANULATUS, Lea, P. L. S., N.S.W., 1895, p. 231.

W. AUSTRALIA: Bunbury.

SELENURUS V-FLAVUS, n. sp.

♀. Black; a spot on each side between eyes (marking the insertion of antennae), mandibles, margins of prothorax, an elongate stripe on each elytron, parts of sterna, of abdomen, and of coxae, flavous; 9th joint of antennae paler than the others. Clothed with short sparse pubescence.

*Head* moderately large; with some large punctures towards the middle of base, elsewhere very finely punctate. Antennae rather long and thin, 3rd joint much shorter than 4th. *Prothorax* longer than wide, apex and all the angles rounded, base feebly bilobed,

with a moderately distinct transverse median ridge; very minutely punctate. *Elytra* at base considerably wider than prothorax, the apices obtusely pointed and separated; densely coarsely and somewhat rugosely punctate; with scarcely any indications of raised costae. *Legs* long and thin.

Length 10 mm.

*Hab.* QUEENSLAND: Tambourine (type in R. Illidge's collection).

The pale prothorax margins are very narrow and on each side in front appear to be interrupted, but on examining the insect from the side it can be seen that the black does not extend to the extreme margins. The pale markings on the elytra extend from each shoulder to the apex and combined look like an elongated V; the sides from the base to the apical third are narrowly black, the median dark marking (and which has a slight bluish gloss) appears as a narrow triangle or wedge, with its base the exact width of the prothorax, and its apex about one-fourth from the apex of the elytra.

*SELENURUS APPENDICULATUS*, n. sp. (*Figs.* 104, 105.)

♂. Of a dingy mouse-coloured grey, head somewhat darker. Very finely pubescent.

*Head* convex, microscopically punctate; eyes large. *Antennae* long and thin, extending to apex of elytra; 2nd and 3rd joints subequal and shorter than 1st or 4th. *Prothorax* transverse surface irregular. *Elytra* not extending to apex of abdomen, each separately rounded; with scarcely visible punctures. *Abdomen* with apical and subapical appendages. *Legs* long and thin.

Length 2 mm.

♀. Differs in having the head more convex, antennae much shorter, legs shorter and abdomen simple.

*Hab.* TASMANIA: Mount Wellington, Hobart, Huon River (*A. M. Lea*).

Certainly the thinnest and almost the shortest of all the Australian Malacoderms, and perhaps the most remarkable. The abdomen of the male is terminated by a double curved appendage, the 4th\* segment on its lower surface appears to have a deeply cleft extension, and from the middle of this two appendages are continued, one on each side of the apical appendages.† Probably, however, in

\* I may be wrong in regarding this segment as the fourth.

† The whole is ridiculously suggestive of the skull of a mouse.

other males all these appendages will not be visible, or will appear to be different, as the insects (there are one male and two females under examination) are subject to great shrinkage. I think it probable that the species will not permanently remain in *Selenurus* \*; but the specimens will not stand the manipulation necessary for a critical generic examination. One specimen was taken from moss, the others from *Acacia* sp. in full bloom; these at the moment of capture looked much like minute Cecidomyid flies. The elytra are of so fragile a nature that they appear to twist almost as readily as the wings.

Genus HETEROMASTIX, Boh., Res. Eugen., p. 86.

This genus was proposed by Bohemann for a small insect having the 10th and 11th joints of the antennae curiously distorted; subsequently Blackburn referred two species having simple antennae to it and stated that he thought *Telephorus pusio* (*pusillus*, Boh.) was congeneric. This is my opinion also, and I think that *Telephorus victoriensis*, *galeatus*, *fusicornis* and *pauxillus* as well, should be referred to the genus.

The genus although close to *Telephorus* differs in the antennae abdomen and simple mandibles. All the species are small, with the prothorax strongly transverse (usually fully twice as wide as long). It is readily divisible into sections dependent on the antennae of the male.

1. Eleventh joint (and usually the tenth) distorted in the male.

2. Ninth joint distorted in the male.

3. Third to fifth joints distorted in the male.

4. Antennae simple in both sexes.

There is nothing, however, in the females to indicate to which of these sections they belong. The first section is the typical one, but is perhaps not so numerously represented as the fourth.

The mandibles are usually so folded as to be indistinct, and it is difficult to manipulate specimens to see them at all clearly; but in specimens of several species (*flavipennis*, *latus*, and *simplex*) before me they are exposed, and are

\* In the male of *Selenurus sydneyanus* there are also some remarkable subapical appendages in the abdomen; as this contracts so greatly in dying, it is difficult to make out their true nature, but there are at least two sharp curved long processes.

seen to be long, thin, strongly curved, sharp-pointed and edged and perfectly simple.

The prothorax is but little, or not at all, narrower than the elytra; and is usually impunctate, or if any punctures are present these are confined to the margins; the head also is either indistinctly or not at all punctate (except in *flavipennis*); the elytra, however, are usually densely and rugosely punctate.

In the male the penultimate segment of the abdomen is deeply excised, often semicircularly, but sometimes to the base itself; the preceding segment is widely emarginate or simple. In the female the abdomen is usually quite simple, but sometimes the penultimate segment appears lobed in the middle, with a depression on each side of the lobe: but the apex itself is not emarginate, or if so then throughout its entire length.

The tibiae seem to be always terminated by minute spines, but these are sometimes so very small as to be scarcely, or not at all, distinguishable from the pubescence. The basal joint of the hind tarsi is as long or almost as the three following joints combined.

I have not considered it necessary to describe the pubescence of each species, as it is much the same in all; that is to say, short and moderately dense on the elytra, and sparse or moderately sparse elsewhere; it appears to be comparatively easily abraded.

The sex should always be stated; I have seen no species (with the exception of *dolichocephalus*) in which the female is sufficiently distinctive to warrant a description being founded on that sex only; in fact, the females of most of the species are so closely allied in general appearances that it is often very difficult to separate them.

I have seen many other species which for various reasons are not here described, and I think it probable that the number now recorded will be more than doubled, and that other singular modifications of the antennae will be found to exist. I am acquainted with all the described species excepting possibly *galcatus*, which is commented on below. They may be tabulated as follows:—

A. Antennae with 3rd-5th joints distorted in male.

- |                                   |                           |
|-----------------------------------|---------------------------|
| a. Elytra entirely dark . . . . . | <i>distortus</i> , n. sp. |
| aa Elytra partly pale . . . . .   | <i>inflatus</i> , n. sp.  |

- AA. Antennae with 9th joint distorted in male.
- b. Head dark . . . . . *McDonaldi*, Lea.
  - bb. Head pale.
    - c. Elytra entirely dark . . . . . *fusicornis*, Blackb.
    - cc. Elytra partly pale . . . . . *macleayi*, n. sp.
- AAA. Antennae with 11th joint distorted in male.
- d. Elytra partly pale . . . . . *luridicollis*, Macl.
  - dd. Elytra entirely dark.
    - e. Head entirely pale . . . . . *mirabilis*, Lea.
    - ée. Head entirely dark.
      - f. Tenth joint not distorted in male . . . . . *decipiens*, n. sp.
      - ff. Tenth joint distorted in male.
        - g. Scutellum dark . . . . . *gagaticeps*, Lea.
        - gg. Scutellum pale.
          - h. Legs almost entirely pale . . . . . *pallipes*, n. sp.
          - hh. Legs almost entirely dark . . . . . *laticollis*, n. sp.
    - eee. Head with muzzle pale
      - i. Ninth joint of antennae in male strongly transverse *crassicornis*, Lea.
      - ii. Ninth joint not transverse.
        - j. Apical joints of antennae in male pale\* . . . . . *bicolor*, Boh.
        - ij. Apical joints dark.
          - k. Scutellum pale . . . . . *frater*, n. sp.
          - kk. Scutellum dark.
            - l. Muzzle very distinctly pale . . . . . *flavifrons*, n. sp.
            - ll. Muzzle indistinctly pale . . . . . *imitator*, n. sp.
- AAAA. Antennae simple in both sexes.
- B. Prothorax entirely dark.†
- m. Prothorax notched on each side of base . . . . . *tenuis*, n. sp.
  - mm. Prothorax not notched at base.
    - n. Elytra entirely dark . . . . . *niger*, n. sp.

\* Usually the entire antennae.

† There is a variety of *niger* in which the sides of the prothorax are not entirely dark.

- nn.* Elytra partly pale . . . . . *dolichocephalus*, n. sp.  
 BB. Prothorax with dark margins . *discoflavus*, n. sp.  
 BBB. Prothorax entirely pale.\*  
 C. Elytra pale . . . . . *flavipennis*, n. sp.  
 CC. Elytra dark.  
 D. Head pale.  
   *o.* Greater portion of legs pale *anticus*, Blackb.  
   *oo.* Greater portion dark . . *geniculatus*, n. sp.  
 DD. Head dark (the muzzle sometimes excepted).  
 E. Terminal joint of antennae in male constricted in middle.  
   *p.* Legs entirely dark . . *nigripes*, n. sp.  
   *pp.* Legs partly pale . . *latus*, n. sp.  
 EE. Terminal joint not so constricted.  
 F. Margins of prothorax simple.  
   *q.* Prothorax with very distinct submarginal punctures . . . . *victoriensis*, Blackb.  
   *qq.* Prothorax without punctures.  
   *r.* Antennae long and thin . . . . . *parvillus*, Blackb.  
   *rr.* Antennae comparatively robust . *simplex*, n. sp.  
 FF. Margins of prothorax not simple.  
   G. Elytra coarsely punctate . . . . . *perabundans*, n. sp.  
   GG. Elytra moderately punctate at most.  
   H. Elytra with very numerous distinct transverse ridges . *occidentalis*, n. sp.  
   HH. Elytra without such ridges.  
   I. Knees much paler than femora . *elegans*, n. sp.  
   II. Knees not at all or very slightly paler than femora . *pusillus*, Boh.

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\* Occasionally there is a dark stain at the base, or at both base and apex.



HETEROMASTIX BICOLOR, Boh., Res. Eugen., p. 81, Pl. I, fig. 3; Lea, P. L. S., N.S.W., 1895, p. 233. (*Figs. 41, 42.*)

In the typical form of this species the antennae of the male are uniformly pallid, rather stout, and somewhat shorter than the elytra; the 11th joint at its greatest length is fully twice the length of the 10th.

*Hab.* N.S. WALES: Sydney, National Park.

Var. PRIMUS, n. var.

Differs in having the antennae thinner and longer (slightly longer than the elytra) with the median joints infusate, but the terminal joints are of the same shape and colour as in the typical form.

*Hab.* N.S. WALES: National Park.

Var. SECUNDUS, n. var. (*Fig. 43.*)

Differs from the typical form in having the antennae thinner and much longer (as long as the head prothorax and elytra combined), the median joints infusate and the terminal joint not much longer than the 10th at its longest. Its elytra are more sparsely clothed and with darker pubescence, and the punctures of the same are larger and more noticeable.

Although the antennae of this form are so different in appearance to that of the typical form of *bicolor*, I have not considered myself justified in describing the unique specimen before me as belonging to a distinct species, especially as the preceding variety is clearly intermediate between the two forms.

*Hab.* N.S. WALES: Wollongong.

HETEROMASTIX PUSILLUS, Boh. (*Telephorus*), Res. Eugen., 1858, p. 80.

*Telephorus pusio*, Gemm., Col. Heft., vi, 1870, p. 120.

Var. *dilataticollis*, Blackb., T. R. S., S.A., 1892, p. 222.

This species is common in New South Wales, and varies in length from  $2\frac{1}{2}$  to  $3\frac{3}{4}$  mm. The basal joints of the antennae and the legs also vary in colour, but the paler portions are never of the clear colour of the prothorax. The dilated portion of the prothorax is much more conspicuous in some specimens than in others.

Numerous specimens from Western Australia before me

have the antennae slightly longer and the dilated portion of the prothorax less abrupt, but more noticeably thickened; the basal joints of antennae and legs also vary in colour. I cannot regard these specimens, however, as representing more than a variety of *pusillus*, and *dilataticollis* of Blackburn another.

*Hab.* N.S. WALES: Sydney, Galston, Jenolan, Tamworth, Forest Reefs, Blue Mountains; VICTORIA: Monbulk, Gisborne; S. AUSTRALIA: Adelaide; W. AUSTRALIA: Bridgetown, Karri-dale.

HETEROMASTIX LURIDICOLLIS, Macl. (*Malachus*), Trans. Ent. Soc., N.S. Wales, ii, p. 265.

The type of this species is a female and is in the Australian Museum; a second specimen from Gayndah is in the Macleay Museum and is a male. The type has brownish elytra, becoming paler at the base. Mr. H. J. Carter has taken several specimens at Byron Bay; these represent varieties having the apical third or fourth of elytra dark, the rest being paler than the prothorax; a specimen from Wide Bay in the Australian Museum has about half of the apex dark.

In both series the prothorax is transversely impressed at the base, each side of the impression opening into a fovea of irregular shape and size; in the description the prothorax is said to have "two small round deep foveae at the base." I certainly, however, cannot regard these foveae as being round (circular) and deep, nor are they isolated as the description implies, each being but a lateral enlargement of the basal impression.

In build and general appearance (except as to the colour of the elytra) the species strongly resemble *gagaticeps*, and the antennae of both sexes and the punctures of the elytra are much the same; so that it is quite an ordinary *Heteromastix*.

*Hab.* QUEENSLAND: Gayndah, Wide Bay; N.S. WALES: Byron Bay.

HETEROMASTIX VICTORIENSIS, Blackb. (*Telephorus*), P. L. S., N.S.W., 1891, p. 528.

Two males from Jenolan appear to belong to this species; in one of them the three basal joints of antennae are obscurely reddish, in the other the basal one only; the

9th joint is very slightly but perceptibly wider than the 8th or 10th, slightly shorter than the 11th, but longer than any of the others except perhaps the 1st.

*Hab.* VICTORIA: Alpine district; N. S. WALES: Jenolan.

HETEROMASTIX FUSICORNIS, Blackb. (*Telephorus*), *l. c.*, p. 529.

This species differs from *McDonaldi* in having the scutellum (not mentioned by Blackburn) and head entirely pallid, and more of the legs pallid. The 9th joint of the male antennae is much the same as in *McDonaldi*, except that it is larger, with its apical fovea larger and more distinct; and its head is smooth whilst in that species it is rather coarsely punctate. The female (unknown to Blackburn) differs from the male in having the head somewhat narrower, the 9th joint simple (although it is slightly wider than any of the others) and slightly shorter than the 11th—which is longest of all.

*Hab.* VICTORIA: Upper Yarra River; N. S. WALES: Sydney.

HETEROMASTIX PAUXILLUS, Blackb. (*Telephorus*), T. R. S., S.A., 1886, p. 261.

I have a specimen from the Rev. T. Blackburn bearing a label in his writing "*pauxillus*, Blackb.," and agreeing with his description except that it is much smaller ( $2\frac{1}{4}$  as against  $4\frac{1}{4}$  lines).\*

The species is exceedingly abundant and widely distributed in Tasmania, where it occurs on flowers. The male is smaller and thinner than the female, with longer (but still simple) antennae, longer legs and penultimate segment of abdomen semicircularly excised.

*Hab.* S. AUSTRALIA: Port Lincoln; TASMANIA.

HETEROMASTIX GALEATUS, Blackb. (*Telephorus*), P. L. S., N.S.W., 1891, p. 529.

? *gagaticeps*, Lea, *l. c.*, 1895, p. 233. (*Figs.* 30, 36.)†

*Telephorus galeatus*, Blackb., is certainly a *Heteromastix*, and quite possibly my *gagaticeps*, in which case the latter

\* Mr. Blackburn writes me, however, that  $4\frac{1}{4}$  lines was a misprint and should have been  $2\frac{1}{4}$ .

† From type of *gagaticeps*.

name must fall. There are, however, so many species having the 10th and 11th joints curiously distorted (all on the same plan though differing greatly in degree) in the male, that I hesitate to regard the two names as synonymous. In his description, Blackburn says "*femoribus tibiisque (anticis totis, ceteris ex parte) testaceis.*" I have only seen four specimens of *gagaticeps* having the legs so coloured, all the others (several hundreds) having the legs as in my own description; if therefore *gagaticeps* really belongs to *galeatus*, it is the typical form of a species of which only a rare variety was known to Blackburn.

The difficulty is not diminished by the fact that there are before me three specimens of one species, and one of another,\* which also agree with the description of *galeatus* as to colours and sculpture; they are, however, certainly different to *gagaticeps* as the 10th joint of the antennae is much longer (in the male of *gagaticeps* it is decidedly transverse), whilst the 11th is considerably longer and thinner. In one of these species the antennae also are about one-third longer, and the 3rd joint has an infuscate spot on its upper surface; in the other the antennae are of the same length and colours.

*Hab.* (*galeatus*) VICTORIA: Alpine District; (*gagaticeps*) QUEENSLAND: Brisbane; N. S. WALES: Chatswood, Condobolin, Forest Reefs, Blue Mountains, Sydney, Galston, Clifton, Tamworth; VICTORIA.

HETEROMASTIX McDONALDI, Lea, P. L. S., N.S.W., 1895, p. 234.

In the type male the 9th joint of the antennae is greatly inflated and has a deep apical fovea. A male from Galston has the 9th joint also inflated but to a less noticeable extent, and the fovea is also smaller. A male from Launceston agrees with the Galston specimen in the 9th joint, but has the legs entirely dark.

The elytral punctures are rather coarse and almost regular, but become very small at the apex.

*Hab.* N. S. WALES: Armidale, Galston; TASMANIA: Launceston, Strahan.

\* As either of these may be the true *galeatus*, I have not described them.

ANTICUS, Blackb., T. R. S., S.A., 1892, p. 221.

*Hab.* N. S. WALES: Blue Mountains.

MIRABILIS, Lea, P. L. S., N.S.W., 1895, p. 235.

*Hab.* QUEENSLAND: Barron Falls.

CRASSICORNIS, Lea, *l. c.*, p. 236. (*Figs.* 31, 37.)

*Hab.* QUEENSLAND: Cairns, Kuranda.

HETEROMASTIX DISTORTUS, n. sp. (*Figs.* 32, 40, 112.)

♂. Dark brown; prothorax, base of antennae, legs (except the tarsi, base of hind femora and apex of hind tibiae) flavous.

*Head* wide, depressed between eyes, impunctate, or almost so. Antennae long, 3rd-5th joints curiously inflated and distorted, 4th largest of all but no longer than 6th. *Prothorax* about twice as wide as long, sides regularly rounded. *Elytra* densely and minutely punctate, with traces of feeble raised lines. Penultimate segment of *abdomen* semicircularly excised. Front *tibiae* deeply notched at apex; basal joint of front tarsi strongly curved.

Length  $5\frac{1}{2}$  mm.

*Hab.* N. S. WALES, Sydney (type in Macleay Museum).

The two specimens before me are both injured; one having the head partly eaten and both with the terminal joints of antennae missing; they may also be somewhat faded and the parts described as dark brown may possibly be black in living specimens. The antennae and front legs of the male (the only sex known to me) are so peculiar, however, that it cannot be mistaken. The 4th joint of the antennae is very peculiar, from one direction it appears widest at the base, from another at the apex; the 5th is lobed near the base and slightly shorter than the 6th; each of the three distorted joints is obliquely produced at the apex. The head towards the base appears to be obliquely strigose, but this appearance is due solely to the pubescence.

HETEROMASTIX MACLEAYI, n. sp. (*Fig.* 33.)

♂. Flavous; elytra (base and sides diluted with flavous) and abdomen dark brown; metasternum somewhat paler; three terminal joints of antennae infusate.

*Head* wide. Antennae rather long and stout; 9th joint long, strongly inflated and foveate near apex; 11th distinctly longer than

10th, but slightly shorter than 9th. *Prothorax* twice as wide as long, apex slightly wider than base, sides rounded but not quite regularly so; with submarginal punctures. *Elytra* densely and rather coarsely punctate, the punctures nowhere confluent but connected in places by feeble transverse ridges.

Length  $2\frac{3}{4}$  mm.

*Hab.* QUEENSLAND: Cairns (type in Macleay Museum).

Owing to shrinkage the abdomen cannot be satisfactorily examined, but the penultimate segment is apparently semicircularly excised as in the males of other species. Its small size and bicoloured elytra will readily distinguish it from *fusicornis* and *McDonaldi*, the two previously described species having the 9th joint inflated.

HETEROMASTIX FLAVIFRONS, n. sp. (*Figs.* 44, 45, 46.)

♂. Black; muzzle, prothorax, two basal joints of antennae and lower surface of 3rd, front legs (tarsi excepted), parts of four hind coxae, of femora and of tibiae flavous or almost so.

*Head* convex, with several very indistinct impressions. Antennae stout, moderately long; 3rd-9th joints triangular, 10th produced at one side of apex, 11th considerably longer than 10th and constricted on one side. *Prothorax* twice as wide as long, sides regularly rounded. *Elytra* densely and rugosely but not coarsely punctate; with traces of feeble raised lines. Penultimate segment of *abdomen* deeply excised but not quite to base, the preceding segment widely and rather deeply emarginate.

Length 5-6 mm.

♀. Differs in having the antennae shorter, 11th joint simple although longer than 10th; the prothorax somewhat wider, and the abdomen simple.

*Hab.* N. S. WALES: Armidale (*W. W. Froggatt*).

The 11th joint of the male from one direction appears to be of an elongated reniform shape and almost as wide as the 10th joint; from another direction it appears to be much narrower and almost lanceolate. In this (as in many other) species, on each side of the prothorax at the base, there may often be seen a small tuft of pubescence (never distinct, however), which occasionally causes the posterior angles to appear acute. The elytral sculpture is not quite so coarse as in *gagaticeps*; from which species it also differs in having the muzzle pallid and 11th joint of different shape.

**HETEROMASTIX FRATER**, n. sp. (*Fig. 47.*)

♂. Black; muzzle and lower surface of head, prothorax, scutellum, legs (tarsi and apex of four hind tibiae infusate) and three basal joints of antennae flavous.

Shape much as in the preceding species.

Length  $4\frac{3}{4}$ – $5\frac{1}{2}$  mm.

*Hab.* N. S. WALES: Jenolan (*J. C. Wiburd* and *A. M. Lea*), Mittagong (*W. W. Froggatt*).

The antennae resemble those of the preceding species but are distinctly thinner, the 10th joint is more produced at the apex, and the 11th at the base. The females are smaller than the females of that species and have much shorter and thinner antennae; the scutellum is pale and a greater portion of the muzzle and legs is pale. Nevertheless, the two are very closely allied.

**HETEROMASTIX PALLIPES**, n. sp. (*Figs. 48, 49.*)

♂. Black; prothorax, scutellum, legs (two apical joints of tarsi slightly infusate) and two basal joints of antennae flavous.

*Head* comparatively small. Antennae long; 10th joint wide, strongly produced at apex; 11th long and distorted. *Prothorax* more than twice as wide as long, sides regularly rounded. *Elytra* very densely and rugosely but not coarsely punctate. Penultimate segment of *abdomen* widely semicircularly excised.

Length  $3\frac{3}{4}$  mm.

*Hab.* N. S. WALES: Sydney (*A. M. Lea*).

Moderately close to *gagaticeps*, but with entirely pallid legs and scutellum; the antennae are considerably longer, the 11th joint is much longer, and the apical portion projects at about  $45^\circ$  from the rest of the joint; the prothorax is wider and the elytral punctures are considerably smaller. From the preceding species it differs in having longer antennae, 11th joint of different shape and by its dark muzzle. The antennae are much longer and thinner than in any of the allied species; the 10th joint from one direction appears to be wide and at the apex feebly emarginate, from another direction it is seen to be strongly and obliquely produced; the 11th from one direction appears long, thin and slightly constricted in the middle, from another it appears to be joined at one corner to the 10th, with—from its outer base—a distinct spur projecting

outwards, whilst the apex is produced directly outwards. The whole joint has not the least resemblance to a helmet as may be noticed in *gagaticeps*.

#### HETEROMASTIX LATICOLLIS, n. sp. (Figs. 34, 38.)

♂. Blackish; prothorax and scutellum flavous; front coxae and all the trochanters almost flavous.

*Head* wide. Antennae long and stout, 2nd joint much smaller than usual, 10th and 11th distorted. *Prothorax* almost thrice as wide as long, sides almost regularly rounded but slightly thickened in front, base gently sinuous. *Elytra* rugosely sculptured, slightly dilated posteriorly. Penultimate segment of *abdomen* semicircularly excised.

Length 5 mm.

♀. Differs in having the prothorax wider and antennae and abdomen simple.

*Hab.* QUEENSLAND: Cairns (types in Macleay Museum).

The 11th joint is more strongly curved than in the other species; at its base on one side it is grooved, with part of the 10th joint (which is also peculiarly distorted) resting in the groove; from another direction the two joints appear very different. The prothorax is wider than in any other species here recorded. The elytra though very densely are not distinctly punctate, and appear to be covered with small and very irregular granules, somewhat after the style of *Telephorus nobilitatus*, etc., there are also on them traces of feeble raised lines, which are also broken up into indistinct granules. In the pair before me the male is the larger.

#### HETEROMASTIX DECIPIENS, n. sp. (Fig. 39.)

♂. Black; prothorax, front legs (tarsi excepted) apex of hind femora, base of hind tibiae and two basal joints of antennae flavous.

*Head* convex and smooth. Antennae rather long, 10th joint slightly produced at one side of apex but not distorted; 11th almost as long as the three preceding combined, distinctly constricted at about two-fifths from its apex. *Prothorax* almost twice as wide as long, sides regularly rounded. *Elytra* densely but not coarsely or rugosely punctate. Penultimate segment of *abdomen* with an almost parallel-sided incision to extreme base.

Length 5 mm.

*Hab.* N. S. WALES: National Park (*A. M. Lea*).



Coloured much as *gagaticeps*, even to the black muzzle ; but the 10th joint but little different to the 9th and certainly not distorted ; the 11th, however, is very different, appearing almost as two joints and without the peculiar lobe projecting backwards as in *gagaticeps* and most of the allied species ; in fact, at first the antennae appear to be distinctly 12-jointed. The elytral punctures are smaller than in *gagaticeps*, but are more clearly defined, although this may be partly due to abrasion, as the elytra are almost glabrous in the only specimen before me ; which also is without the middle pair of its legs.

**HETEROMASTIX TENUIS**, n. sp. (*Fig.* 91.)

♂. Black, shining ; elytra with a slight bluish gloss. Elytra more sparsely pubescent than usual.

*Head* impunctate ; eyes above the average size. Antennae long and thin, 11th joint distinctly longer than 10th. *Prothorax* distinctly less than twice as wide as long, disc more convex than usual ; each side of base with a small but distinct subtriangular notch. *Elytra* longer and thinner than usual ; densely and moderately coarsely punctate. Penultimate segment of *abdomen* semicircularly excised.

Length  $4\frac{1}{2}$ – $4\frac{3}{4}$  mm.

*Hab.* TASMANIA : Mount Wellington (*A. M. Lea*).

The antennae to the eye appear to be as long as the body, but by measurement they are seen to be really a trifle shorter. The margins of the prothorax from some directions appear to be supplied with very minute setiferous granules. The elytral punctures are often elongate and three or four are frequently separated from the others by short transverse or oblique wrinkles ; they are almost as large as *fusicornis*. The insect itself is longer and thinner than any of its congeners here recorded ; it is also the only one with the least trace of blue on the elytra. Even apart from colour, however, the species is very distinct.

**HETEROMASTIX NIGER**, n. sp.

♂. Black. Elytra more densely clothed with whitish pubescence than usual.

*Head* wide and indistinctly punctate. Antennae rather long ; 2nd joint more than half the length of third, 11th distinctly longer

than 10th. *Prothorax* twice as wide as long, sides thickened, with the anterior angles obliquely cut off. *Elytra* densely and moderately coarsely punctate, the punctures in irregular lines, between which are smaller punctures. Penultimate segment of *abdomen* excised almost to extreme base.

Length 3 mm.

♀. Differs in having slightly shorter antennae, and with the penultimate segment of abdomen feebly curved throughout.

*Hab.* TASMANIA: Launceston, Zeehan (*Aug. Simson*), Mole Creek, Hobart, Mount Wellington (*A. M. Lea*); VICTORIA: Oakleigh (National Museum).

This is the only entirely black species known, from the preceding species, to which in colour it approximates, it differs in being much shorter, prothorax wider and differently shaped; antennae shorter, etc. In an occasional specimen the sides of the prothorax are diluted with flavous.

#### HETEROMASTIX FLAVIPENNIS, n. sp.

♂. Black; prothorax, elytra, part of mandibles and of coxae flavous.

*Head* rather narrower than usual; densely and not very minutely punctate. Antennae long and thin. *Prothorax* not twice as wide as long, front angles strongly rounded, hind very feebly produced; widest at apical third. *Elytra* densely, rugosely and moderately coarsely punctate; with numerous irregular feebly raised lines. Penultimate segment of *abdomen* widely and rather shallowly emarginate.

Length  $5\frac{1}{2}$  (♀  $6\frac{1}{2}$ ) mm.

♀. Differs in being larger and wider, with narrower head and prothorax, shorter and stouter antennae and simple abdomen.

*Hab.* W. AUSTRALIA: Karridale (*A. M. Lea*).

This is the only species known to me in which the head is seen to be distinctly punctate; it is also the only one (except a species of which I have seen but a female) with the elytra entirely pallid. In the male the 3rd-11th joints are almost exactly the same lengths, the 11th being just perceptibly longer than the 10th; in the female, however, the 11th joint is distinctly longer than the 10th, although shorter than the corresponding joint of the male. The elytral punctures are frequently confluent.

**HETEROMASTIX DISCOFLAVUS**, n. sp.

♂. Of a smoky-brown, varying to blackish-brown on head and sides of prothorax; greater portion of prothorax flavous; elytra obscure flavous; a wide median and a narrow lateral space darker.

*Head* wide and indistinctly punctate. *Antennae* long and thin, 11th joint longer than 10th. *Prothorax* twice as wide as long, disc rather more convex than usual. *Elytra* densely and coarsely punctate throughout. Penultimate segment of *abdomen* semi-circularly excised to base.

Length  $3\frac{2}{3}$  (♀  $4\frac{1}{2}$ ) mm.

♀. Differs in being larger, with narrower head and shorter and stouter antennae (those of the male being slightly longer than the body, whilst in the female they are distinctly shorter), legs shorter and abdomen simple.

*Hab.* TASMANIA (types in Aug. Simson's collection).

The elytral colours are not sharply defined, the darker portions being of the nature of stains. In the male the sides of the prothorax are more reflexed than usual and almost perfectly parallel, so that the segment itself appears to be transversely oblong; in the female the sides are almost regularly rounded. The elytral punctures are coarser than in any other species known to me; on the male they are almost seriate in arrangement, but on the female exhibit a strong tendency to become confluent and rugose.

**HETEROMASTIX OCCIDENTALIS**, n. sp.

♂. Black, prothorax flavous.

*Head* wide and indistinctly punctate. *Antennae* long and thin, 11th joint scarcely longer than 10th. *Prothorax* scarcely twice as wide as long, sides thickened and inflated in the middle. *Elytra* very densely and rugosely but not coarsely punctate; with numerous feeble transverse ridges. Penultimate segment of *abdomen* widely semicircularly excised.

Length 4-5½ mm.

♀. Differs in being larger and wider, with distinctly shorter antennae and simple abdomen.

*Hab.* W. AUSTRALIA: Swan and Vasse Rivers (*A. M. Lea*).

From some directions, especially in the females, the elytra appear to be covered with minute granules, but this

appearance is deceptive. In appearance it is much like large specimens of *pusillus*, or small ones of *pauwillus*, the size being almost constantly intermediate between the two. From *pauwillus* it differs in the prothoracic margins being considerably thicker and rather suddenly inflated in the middle, much as in *pusillus*; from the latter species it differs in the antennae being longer and entirely black and its elytral punctures coarser. I have seen numerous specimens of both this species and *pusillus* from Western Australia and the differences mentioned seem to be quite constant; the two species, in fact, seem (in W. Australia) to be related to each other much as *perabundans* and *pauwillus* are in Tasmania.

#### HETEROMASTIX PERABUNDANS, n. sp.

♂. Black, prothorax flavous; base of tibiae and lower surface of three basal joints of antennae obscure testaceous.

*Head* scarcely visibly punctate and less transverse than usual. Antennae moderately long and stout; 2nd joint more than half the length of 3rd, 11th stouter and longer than 10th. *Prothorax* and *elytra* sculptured as in *niger*, except that the punctures are somewhat coarser. Penultimate segment of *abdomen* semi-circularly excised.

Length  $3\frac{1}{2}$  mm.

♀. Differs in being slightly larger than the male, with just perceptibly shorter antennae, prothorax slightly more transverse and the penultimate segment of abdomen gently curved throughout.

*Hab.* TASMANIA: Hobart, Mount Wellington, Huon River (*H. H. D. Griffith, Aug. Simson and A. M. Lea*).

The sculpture and pubescence are almost exactly the same as in *niger*; in fact, but for the colour of the prothorax the two species would be scarcely distinguishable. From *pusillus* it differs in having the elytra much more coarsely punctate and the prothorax less angularly dilated, the dilated portion also being basal and median instead of subapical. The base of the prothorax is usually stained with black.

Probably, during several months of the year this is the commonest of all insects on flowers about Hobart and Mount Wellington; I have seen tens of thousands of specimens in my beating umbrella at the same time.

HETEROMASTIX NIGRIPES, n. sp.

♂. Black ; prothorax reddish-flavous.

*Head* rather strongly convex. *Antennae* long and moderately stout ; 2nd joint one-third the length of 3rd ; 11th about twice the length of 10th and distinctly, although not very decidedly, constricted at its middle. *Prothorax* twice as wide as long, sides regularly rounded. *Elytra* very densely, rugosely and rather coarsely punctate. Penultimate segment of *abdomen* semicircularly excised.

Length  $4\frac{1}{2}$  mm.

♀. Differs in having shorter antennae, the 2nd joint of which is proportionately longer and the 11th shorter (although distinctly longer than the 10th) and not constricted in middle, being in fact slightly widest in front of the middle ; prothorax rather wider ; legs shorter and abdomen simple.

*Hab.* TASMANIA : Launceston, Beaconsfield, Karoola, George Town, Denison Gorge, East Tamar, Zeehan, Huon River, Hobart, Frankford, Mount Wellington (*Aug. Simson*, *H. H. D. Griffith* and *A. M. Lea*).

From the allied species, except *latus*, it can be readily distinguished by the long and constricted terminal joint of antennae in the male. The whole insect is larger and the sides of the prothorax are different to those of *per-abundans*, in the company of which species it is frequently taken. In the male the antennae are not much shorter than the body. The elytral punctures are about as large as in *fusicornis* but decidedly denser. As in a number of other species the base of the prothorax is sometimes stained with black. From *victoriensis* it differs in being shorter, with shorter antennae, entirely black legs, less coarsely punctate elytra and sides prothorax, which also is without submarginal punctures.

HETEROMASTIX SIMPLEX, n. sp.

♂. Black ; prothorax, mandibles, knees, trochanters, front coxae and two basal joints of antennae more or less flavous.

*Head* strongly transverse ; eyes larger than usual. *Antennae* moderately long and rather stout ; 2nd joint more than half the length of 3rd, 11th about one-third longer than 10th. *Prothorax* twice as wide as long, sides rounded except at extreme base ; with indistinct submarginal punctures. *Elytra* densely, moderately

coarsely and somewhat rugosely punctate. Penultimate segment of *abdomen* deeply semicircularly excised.

Length  $4\frac{1}{2}$  mm.

*Hab.* N. S. WALES: Jenolan (*A. M. Lea*).

Differs from the species I suppose to be *victoriensis* in being smaller and wider, legs somewhat differently coloured and antennal joints (especially the 9th–11th) differently proportioned. The elytra are more coarsely sculptured than in *gagaticeps*, to the female of which it bears a striking resemblance; in fact, but for the abdomen being essentially masculine I should have imagined the unique specimen before me to be a female of that species. The elytral punctures are the same size but much denser than in *fusicornis*; the rugose appearance is caused by small transverse wrinkles, but each puncture is usually clearly defined. From *pauxillus*, it differs in being more compact, antennae much shorter, basal joints pale, the 2nd proportionately longer, elytral punctures more sharply defined, legs not entirely black, prothorax less transverse, etc.

#### HETEROMASTIX LATUS, n. sp.

♂. Black; prothorax, parts of muzzle, mandibles, front legs (tarsi, apex of tibiae and part of base of femora infuscate), middle knees and base of hind tibiae more or less flavous.

*Head* strongly transverse. Antennae somewhat as in *nigripes*. *Prothorax* about twice as wide as long, sides almost regularly rounded. *Elytra* shorter and wider than usual, densely and rugosely but rather finely punctate. Penultimate segment of *abdomen* semicircularly excised.

Length  $5\frac{1}{2}$  mm.

♀. Differs in being slightly wider, prothorax more transverse, antennae shorter, 11th joint not constricted in middle and abdomen simple.

*Hab.* N. S. WALES: Forest Reefs (*A. M. Lea*).

I have referred this species and *nigripes* to the group having simple antennae, although the apical joint is somewhat constricted in the middle in the male, apparently denoting an approach to the group about *gagaticeps*. The 10th joint, however, is perfectly simple. The antennae of this species are much as in *nigripes*, except that they are somewhat shorter and stouter and with the 11th joint shorter and very feebly constricted in the middle; but the

insect itself is much wider, the elytra are less closely punctured, and parts of the legs and muzzle are pallid; the head also is distinctly more transverse and less convex. I have numerous specimens of both species and seen side by side they look very distinct. The elytra are wider than in *gagaticeps*, and the punctures are smaller and not quite so dense.

**HETEROMASTIX GENICULATUS, n. sp.**

♂. Head, prothorax, scutellum, base of 1st joint of antennae, front coxae and all the knees flavous; elsewhere black.

*Head* less transverse and eyes larger than usual. *Antennae* long and thin; 2nd joint less than half the length of 3rd, 11th just perceptibly longer than 10th. *Prothorax* not twice as wide as long, sides gradually dilated from base to near apex, but front angles strongly rounded; disc rather strongly convex. *Elytra* distinctly wider than base of prothorax; densely, rugosely, but not coarsely punctate. Penultimate segment semicircularly excised. *Tarsi* unusually thin.

Length 6 mm.

*Hab.* N. S. WALES: Burrawang (*T. G. Sloane*), National Park, Sydney (*A. M. Lea*).

There are one male and two female specimens before me, the females being both smaller (5 mm.) than the male and with shorter antennae and simple abdomen. In the male the antennae are almost as long as the body. The elytra from some directions appear to be covered with small granules, but this appearance is deceptive. From *anticus*\* (the only other described species having both the head pallid and antennae simple) it differs in being larger with antennae and legs not entirely pallid, elytra with denser and smaller punctures, prothorax narrower, etc.

**HETEROMASTIX IMITATOR, n. sp.**

♂. Black; prothorax, knees, trochanters and front coxae and femora flavous; tip of muzzle obscurely flavous, antennae (basal joints flavous) tibiae and tarsi infusate.

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\* The antennae of the male of *anticus* are described as having the 3rd-5th joints somewhat dilated; these joints, however, are not distorted as in *distortus*, but are slightly wider than those preceding or following them, and much as they are in many other species of the genus. Mr. Blackburn has kindly presented me with a male of *anticus*.

*Head* scarcely visibly punctate. Antennae rather thin; 11th joint about twice the length of 10th, compressed towards base, the basal portion lobed and fitted into 10th. *Prothorax* twice as wide as long, sides slightly dilated towards apex. *Elytra* with dense subrugose and rather small punctures. Penultimate segment of *abdomen* widely notched.

Length 3 mm.

*Hab.* N. S. WALES: Wentworth Falls (*Aug. Simson*).

In appearance very close to *pusillus* but with the 10th and 11th joints distorted; *bicolor* is about the same size but the two terminal joints are very different and the antennae and legs are differently coloured. It is much smaller than *flavifrons*, the antennae are thinner and the terminal joints of different shape. From one direction the 10th joint appears to be wider than any of the others and semicircularly notched at the apex, with the inflated base of the 11th fitting into the notch; from another direction it appears to be no wider than the others and the 11th appears to be normally attached to it and but little longer, whilst from the other direction the 11th appears to be twice as long; from still another direction the 11th has a faint resemblance to the helmet-like shape of that joint in *gagaticeps*.

#### HETEROMASTIX AMABILIS, n. sp.

♂. Black; prothorax, trochanters, parts of coxae (the front pair entirely) and knees flavous.

*Head* longer and with more prominent eyes than usual, with a wide but feeble elevation continuous between eyes; scarcely visibly punctate. Antennae extending to apex of elytra, rather thin, all the joints (except the 2nd) subequal in length, but the 11th noticeably longer than 10th. *Prothorax* about once and one half as long as wide, sides strongly reflexed and increasing in width to near apex, disc obtusely bilobed. *Elytra* with dense, rather small and subrugose punctures. Penultimate segment of *abdomen* semicircularly excised.

Length  $4\frac{1}{2}$  (♀ 6) mm.

♀. Differs in being larger, the antennae shorter (though longer than in many other species), the ridge between the eyes scarcely traceable, and the prothorax more transverse and with its disc scarcely visibly bilobed.

*Hab.* N. S. WALES: National Park (*A. M. Lea*), Blue Mountains (*H. J. Carter*).



In the male the basal joint of the antennae is almost entirely pale, in the female it is pale only at the extreme base. In the female specimen the mandibles are exposed, are pale at the base and dark brown at the tip. In shape it is almost identical with *geniculatus*, but its black head at once distinguishes it from that species. From *victoriensis* it is distinguished by the upturned front angles of prothorax and absence of marginal punctures and by the much smaller elytral punctures. From *pauvillus* it differs in the much less transverse prothorax, with different anterior angles, stouter antennae, bicoloured legs and much finer elytral punctures. In the table it is placed beside *pusillus*, but it is much larger than that species; the prothorax is less transverse, antennae considerably longer, legs differently coloured, etc.

*HETEROMASTIX INFLATUS*, n. sp. (*Fig. 35.*)

♂. Black; prothorax and basal half of elytra flavous; trochanters of a dingy brown.

*Head* densely and minutely punctate, largely but indistinctly impressed in front. *Antennae* rather long and thin, 3rd-6th joints more or less distorted. *Prothorax* about twice as wide as long, sides strongly reflexed, of equal width near base and apex. *Elytra* dilated beyond the middle, each separately rounded at apex; with dense, rather small, subrugose punctures becoming very small towards base. Penultimate section of *abdomen* triangularly excised almost to base.

Length  $4\frac{1}{2}$ -6 mm.

*Hab.* N. S. WALES: Gosford (*H. J. Carter*).

The elytra are distinctly inflated just beyond the middle with their dark portion slightly advanced along the suture. There are three males before me and the antennae (except to a slight extent in degree) are alike in all; the distorted joints, however, alter their appearance with the point of view. The 3rd is about the length of the 1st, slightly curved inwardly and the apex produced obliquely outwards, the 4th is considerably shorter than the 3rd, slightly inflated on one side and incurved on the other and feebly produced at the apex (from another direction it appears to be of equal width at base and apex, and feebly constricted in the middle), the 5th is the largest joint of all, at its base it is strongly produced (obtusely dentate) on one side, with a corresponding depression on the other; the 6th is

slightly bulged out at the base on one side ; the remaining joints are simple or almost so.

**HETEROMASTIX DOLICHOCEPHALUS, n. sp.**

♀. Black ; elytra reddish-flavous, suture and tip black ; parts of coxae obscurely diluted with red. Moderately clothed with greyish pubescence, very short on head but moderately long elsewhere.

*Head* longer than wide, with several feeble impressions in front ; punctures small and indistinct. Eyes small and not prominent. Antennae rather short, moderately stout, median joints stouter than the others, but simple. *Prothorax* about once and one half as long as wide, disc rather strongly convex, sides rather strongly margined, all the margins more or less angular and distinctly raised, widest near apex, impunctate. *Scutellum* transverse. *Elytra* not much wider than widest part of prothorax, almost conjointly rounded at apex, with dense but rather small and subrugose punctures. *Legs* moderately long ; tarsi 4th joint wide and deeply bilobed ; claws almost simple.

Length 6 mm.

*Hab.* W. AUSTRALIA : Swan River (*A. M. Lea*).

It may be necessary to place this species in a new genus eventually, but as I only know the female I have not considered it advisable to propose one now for its reception. The head may normally be partially concealed by the prothorax, but in the type its full length is exposed ; in any case, however, it is much longer than in any other species of *Heteromastix*. I cannot see the buccal appendages clearly, but behind the mentum is a deep sub-conical excavation, the base of which is on the mentum. If the tibiae are really spined at the tip, the spine is so small as to be quite concealed. The dark sutural marking is on each elytron rather more than one-third of its width at the base, but at the apex it is only about one-fifth.

*Subfamily* MALACHIIDES.

Genus LAIUS, Guer., Voy. Coq., p. 78 ; Lacord., Gen. Coleopt., IV, p. 381 ; Fairm., Journ. Mus. Godeffr., 1879, p. 101.

The species of this genus are all of small or comparatively small size ; and usually reddish, with metallic-blue, purple or green markings. The antennae are short, fairly stout

and apparently 10-jointed, but the true 2nd joint is hidden by the 1st, the true 3rd (here referred to as the 2nd, as it is by other entomologists) being usually enormously inflated in the males\* ; the 1st joint is also more or less inflated. The front femora are sometimes deeply groved in the males, and the 2nd joint of the front tarsi in the males is always of peculiar shape and tipped with black. The females of many species are very closely allied, and it is difficult to satisfactorily identify some of them from the descriptions ; but the males are always distinct, and given satisfactory descriptions their identification should be easy.

In addition to the species here noted or described there are about twenty others before me ; all, however, represented by discoloured males or by females only, and I have not considered it advisable to describe them.

The following species are unknown to me :—

*Guttulatus*, Fairm.—A small and evidently very distinct species, having the prothorax scarcely transverse. It seems to be allied to *sinus*. The type was probably a female.

*Fastidiosus*, Fairm.—A small species with elytral markings much as in *bellulus* and many others, but the prothorax with “ punctis 2 oblongis fuscis.” The type was probably a female.

*Insignicornis*, Fairm.—A small species evidently resembling *eyrensis*, *carus*, etc. Both sexes were known to Fairmaire, but all he says of the 2nd joint of the antennae of the male is that it is inflated.

*Rufovirens*, Fairm.—Evidently very close to the above species. The type was probably a female.

*Oblongosignatus*, Fairm.—A small species evidently rather closely allied to *tresignatus*.

*Asperipennis*, Fairm.—Appears to be a very distinct species of medium size, with the elytra entirely metallic-blue and granulated.

*Quinqueplagiatus*, Fairm.—Evidently a very ordinary-looking species of medium size and allied to *conicicornis*, *plagiaticollis*, *villosus*, etc.

*Rugulipennis*, Fairm.—Evidently allied to the above species ; I have seen numerous species which almost agree with the description.

\* It is to be noted that this joint usually looks different in shape, in almost every direction it is viewed from, and figures have been given of the antennae of several species as viewed from different aspects.

*Verticalis*, Fairm. (*nec* W. S. Macl.). Commented on below.

*Eremita*, Blackb.—A small species having the head red and antennae entirely black and the elytral markings piceous. It should be easily recognised.

*Pretiosus*, Blackb.—A small species of quite ordinary colouring, except that in the middle of the elytra there is large, isolated, diamond-shaped, red spot. The type was a female.

*Variiegatus*, Blackb.—A medium-sized species with peculiar apical markings on the elytra; no closely allied species are described, but two are known to me, both unfortunately females (as was probably the type).

The others \* may be tabulated as follows:—

- |      |   |                                |
|------|---|--------------------------------|
| A.   | Upper surface entirely dark . . . .                                   | <i>alleni</i> , n. sp.         |
| AA.  | Upper surface not entirely dark.                                      |                                |
| B.   | Prothorax with the apex strongly produced over head . . . . .         | <i>armicollis</i> , n. sp.     |
| BB.  | Prothorax trilobed at apex . . . .                                    | <i>sculptus</i> , n. sp.       |
| BBB. | Prothorax simple at apex.   |                                |
| C.   | Prothorax entirely dark . . . . .                                     | <i>tresignatus</i> , Germ.     |
| CC.  | Prothorax partly dark.  |                                |
| a.   | Antennae simple in both sexes . . . .                                 | <i>flavopictus</i> , n. sp.    |
| aa.  | Antennae with the basal joints distorted in male.                     |                                |
| b.   | Extreme apex of elytra dark . . . .                                   | <i>quinquenotatus</i> , Fairm. |
| bb.  | Extreme apex pallid.  |                                |
| c.   | Pale markings of elytra apical only . . . . .                         | <i>distortus</i> , Blackb.     |
| cc.  | Pale markings apical and median.                                      |                                |
| d.   | Second joint of antennae with two strong projections in male . . . .  | <i>plagiaticollis</i> , Fairm. |
| dd.  | Second joint differently formed.                                      |                                |
| e.   | Head of male deeply transversely and longitudinally impressed . . . . | <i>orthodoxus</i> , n. sp.     |
| ee.  | Head of male not so impressed.  |                                |

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\* *Cavicornis* was described after this table was prepared.



- l. Larger portion of head  
 pallid . . . . . *pallidus*, Lea.  
 ll. Larger portion dark . . . . . *carus*, Lea.  
 GG. Dark subapical markings  
 continuous across suture.  
 H. Second joint of antennae  
 partly dark . . . . . *cyanocephalus*, Lea.  
 HH. Second joint entirely  
 dark . . . . . *bellulus*, Guér.

LAIUS VERTICALIS, W. S. Macl. (*Malachius*), King's Survey, II, 1827, App. p. 442. (*Fig.* 124.)

I have examined the type specimen of this species; it bears a label in the late W. S. Macleay's handwriting, "*Malachius verticalis*, Capt. King, Australasia." It is a female measuring 7 mm. in length, and allied to *major* and *tarsalis*. From the latter it differs in its elytra being entirely without traces of elevated lines and the markings of different shape, and occupying a larger area, head without interocular ridges (this however may be a masculine character only), colour of legs, etc. From the female of the former it differs in being shorter and broader, antennae much shorter and elytral markings of different shape and size.

The antennae are almost black at the apex, and gradually diminish in intensity of colour, the two basal joints being entirely pallid. The legs are not entirely dark (as would appear from the original description) as the knees and anterior femora are pallid. The elytral punctures are as dense and regular on the apical markings as elsewhere, and exactly resemble those of *major*.

A female from Roebuck Bay appears to belong to this species, but differs from the type in having the entire femora (except the apex of the hind pair) pallid. It is clothed (as is the type) with fine whitish pubescence; its scutellum (as is also that of the type) is deep black. The ground-colour of its elytra is flavous, and certainly of a different shade to that of the type, which, however, is greatly discoloured by age (it is about eighty years since it was taken).

The species was omitted from Masters' catalogue, probably on account of there being a *Laius verticalis* by Fairmaire. The latter species (described from Peak

Downs in Queensland) I have not been able to identify, and do not believe that it can be satisfactorily identified from the brief original description.

LAIUS TRISIGNATUS, Germ., Linn. Ent., III, p. 182; Fairm., Journ. Mus. Godeffr., 1879, xiv, p. 104. (*Figs.* 125, 126, 127.)

In the male the end joint of antennae is concave above and convex below as in many other species of *Laius*. I have seen no specimens having the sutural marking obsolete, but in the Macleay Museum there is a male having this marking obscurely connected with the lateral ones, and there is a specimen from the Swan River in which the lateral markings are just traceable; a female from Port Denison is above the normal size, with the elytra more coarsely punctate and the pallid markings covering a greater area than usual.

*Hab.* QUEENSLAND: Port Denison, Cairns; S. AUSTRALIA: Adelaide; W. AUSTRALIA: Swan River.

LAIUS BELLULUS, Guér., Voy. Coq., p. 78; Boisd., Voy. Astr., II, p. 135; Germ., Linn. Ent., III, 1848, p. 182; Macl., Trans. Ent. Soc., N. S. Wales, II, p. 65; Fairm., Journ. Mus. Godeffr., 1879, XIV, p. 103. (*Fig.* 128.)

The insect redescribed by Germar as this species is common on sea-beaches, and has the dark subapical markings of the elytra with coarse punctures in front and close to the suture, but elsewhere these markings are impunctate or almost so.

The specimen identified as *bellulus* by Macleay from Gayndah is a female and has the dark subapical markings coarsely punctured throughout; it certainly belongs to a different species to the common S. Australian one.

*Hab.* S. AUSTRALIA; W. AUSTRALIA; N. S. WALES.

LAIUS CINCTUS, Redt. (*Apalochrus*), Reis. Novara, II, p. 106; Fairm., Journ. Mus. Godeffr., XIV, 1879, p. 103.

*mastersi*, Macl., Trans. Ent. Soc., N. S. Wales, II, p. 265.

*femoralis*, Blackb., P. L. S., N.S.W., 1891, p. 531; Lea, *l. c.*, 1898, p. 572. (*Figs.* 51, 65, 113, 114, 129, 130.)

I have examined the types of *mastersi*, they are male and female. The male has excavated anterior femora,

strongly concave (the inside portion pallid) 2nd \* joint of antennae and dark apex of elytra,† and agrees exactly with Blackburn's description of *femoralis*. In the species the elytral fascia varies considerably in width; on specimens from Queensland and the western parts of New South Wales, being, as a rule, larger than on specimens from Victoria and Tasmania.

Fairmaire gives *mastersi* as a synonym of *cinctus*,‡ and I previously (apparently not on good grounds) doubted this. Blackburn appeared to regard *femoralis* as distinct from *cinctus* partly on account of colour and partly on account of the shape of the prothorax; but the dark portions of the elytra in most species of *Laius*, and certainly in the present one, are subject to considerable variation, and, as above noted, the fascia is of variable width. Blackburn admitted not knowing the male of *cinctus*, of which Redtenbacher says of the prothorax "gegen das Schildchen etwas erweitert."

*Hab.* QUEENSLAND; N. S. WALES; VICTORIA; TASMANIA; S. AUSTRALIA.

*LAIUS VERTICALIS*, Fairm., *Pet. Nouv. Ent.*, 1877, p. 174.

The original description of this species is so worthless that I think it should be regarded as non-existent, at any rate until the type can be examined and further information obtained about it; the description is simply a short comparison with *bellulus*, and may have been drawn up from a variety of that species. In any case Fairmaire's name must fall, as the name was preoccupied by W. S. Macleay's *Malachius verticalis*, which, as noted above, is a true *Laius*.

*Hab.* QUEENSLAND: Peak Downs.

*LAIUS QUINQUENOTATUS*, Fairm., *Pet. Nouv. Ent.*, 1877, p. 174; *Journ. Mus. Godeffr.*, 1879, p. 102. (*Fig.* 140.)

There is a female from Planet Downs in the Macleay Museum which appears to belong to this species; it has all

\* Herr Redtenbacher correctly describes the 2nd joint as being quite in the top of the first, and the 3rd as much longer and thicker than the 4th; but I think it convenient to regard the true 2nd joint as non-existent; as in most species of *Laius* it is either traceable with extreme difficulty or quite invisible.

† In the description of *cinctus* the legs are not even mentioned.

‡ A combination of characters peculiar to this species.



parts of the elytra very densely (more densely than in any other species before me) punctate; and the pallid triangular spot common to both elytra does not extend quite to the apex, but is distinctly truncated at a short distance before it.

*Hab.* QUEENSLAND: Rockhampton, Planet Downs.

LAIUS CONICICORNIS, Blackb., T. R. S., S.A., 1886, p. 262.  
(*Figs.* 52, 131.)

The markings on the head of this species are variable and to a greater extent than described by Blackburn. The female differs from the male in having the head less densely punctate and only the muzzle pallid; the antennae simple; the elytra are somewhat inflated posteriorly, and the front tibiae are not entirely pallid. There are several species having almost exactly similar elytral markings; but the 2nd joint of the male antennae renders the species very distinct.

*Hab.* S. AUSTRALIA: Port Lincoln; VICTORIA: Brighton, Bacchus Marsh; N. S. WALES: Berrima, Rope's Creek.

LAIUS MAJOR, Blackb., P. L. S., N.S.W., 1888, p. 1426.  
(*Figs.* 53, 132.)

The female of this species differs from the male in being considerably longer (although no wider), the antennae slightly shorter and simple; the anterior tarsi simple; the prothorax more rounded and the elytral markings somewhat greenish and rather larger.

*Hab.* N. W. AUSTRALIA: N. Territory; QUEENSLAND: Chillagoe, Brisbane.

LAIUS SINUS, Lea, P. L. S., N.S.W., 1898, p. 562. (*Fig.* 54.)

In the original description the prothorax is described as "slightly longer than wide"; to the naked eye this appears to be the case, but by measurement it is actually a trifle wider than long.

*Hab.* N. S. WALES: Gosford.

LAIUS CYANOCEPHALUS, Lea, *l. c.*, p. 563. (*Figs.* 66, 133.)

A female from Victoria differs from the type males in having the elytral markings entirely of a deep violet.

*Hab.* N. S. WALES: Whitton; VICTORIA; QUEENSLAND: Bowen.

LAIUS PALLIDUS, Lea, *l. c.*, p. 565. (*Figs.* 55,<sup>r</sup>134.)

A variety of this species differs from the type in having the head infuscate at the base and the basal markings of elytra connected with the apical ones along (but not on) the suture.

*Hab.* W. AUSTRALIA: Geraldton.

LAIUS RUGICEPS, Lea, *l. c.*, p. 568. (*Figs.* 67, 135.)

A male of this species in the Macleay Museum differs from the type in having the head almost entirely pallid, and the prothoracic marking much more strongly constricted towards the base.

*Hab.* W. AUSTRALIA: Beverley, King George's Sound.

LAIUS INTERMEDIUS, Lea, *l. c.*, p. 571. (*Figs.* 68, 136.)

A male before me differs from the type in being smaller and in having the dark markings of the elytra of a rather dingy (washed-out looking) violet colour, instead of a beautiful metallic violet blue.

*Hab.* W. AUSTRALIA: Swan River.

LAIUS VILLOSUS, Lea, *l. c.*, p. 566. (*Figs.* 56, 69, 137, 138.)

There are before me one male and eight females\* of what appears to be a variety of this species; they differ from the types in being larger ( $\text{♂ } 5 \frac{1}{4}$   $\text{♀ } 6$  mm.), in having the median red fascia interrupted so as to appear as three longitudinal marks, that on the suture being usually confined to the sutural thickening, although on one it is almost conjoined to the lateral ones; these are usually rather more than twice as long as wide.

Two specimens (sexes) in the Macleay Museum from Monaro are intermediate between the above variety and

\* They were all taken by Dr. E. Jefferis Turner on Ben Lomond at an elevation of 4,500 feet.

the normal form; both of them appear to have the dark markings forming two longitudinal patches extending from the base, interrupted at the middle and terminating before the apex.

The female differs from the male in having the muzzle without the pallid triangle and without polished lateral spaces, the anterior legs almost entirely dark (in the type although not mentioned in the original description there is a blackish streak towards the apex of the anterior femora, which is also present in the varieties), and antennae simple with each of the two basal joints having a more or less distinct infuscate spot.

*Hab.* N. S. WALES: Forest Reefs, Queanbeyan, Mudgee, Oberon, Ben Lomond, Monaro.

GUTTULATUS, Fairm., *Pet. Nouv. Ent.*, 1877, II, p. 174;  
*Journ. Mus. Godeffr.*, 1879, XIV, p. 101.

QUEENSLAND: Peak Downs, Gayndah.

RUGULIPENNIS, Fairm., *Pet. Nouv. Ent.*, 1877, p. 174;  
*J. M. G.*, 1879, p. 102.

QUEENSLAND: Peak Downs.

PLAGIATICOLLIS, Fairm., *Pet. Nouv. Ent.*, 1877, p. 174;  
*J. M. G.*, 1879, p. 102; *Lea, P. L. S., N.S.W.*, 1898, p. 572. (*Figs.* 57, 139.)

W. AUSTRALIA: Pinjarrah.

QUINQUEPLAGIATUS, Fairm., *Pet. Nouv. Ent.*, 1877, p. 174;  
*J. M. G.*, 1879, p. 102.

QUEENSLAND.

INSIGNICORNIS, Fairm., *Pet. Nouv. Ent.*, 1877, p. 174;  
*J. M. G.*, 1879, p. 103.

QUEENSLAND: Peak Downs.

RUFOVIRENS, Fairm., *Pet. Nouv. Ent.*, 1877, p. 174;  
*J. M. G.*, 1879, p. 103.

QUEENSLAND: Gayndah.

FASTIDIOSUS, Fairm., *Pet. Nouv. Ent.*, 1877, p. 174;  
*J. M. G.*, 1879, p. 104.

QUEENSLAND: Peak Downs.

ASPERIPENNIS, Fairm., *Pet. Nouv. Ent.*, 1877, p. 174;  
J. M. G., 1879., p. 104.

QUEENSLAND.

OBLONGOSIGNATUS, Fairm., *Pet. Nouv. Ent.*, 1877, p. 174;  
J. M. G., 1879, p. 104.

QUEENSLAND : Peak Downs.

NODICORNIS, Blackb., T. R. S., S.A., 1886, p. 263. (*Fig.* 70.)  
S. AUSTRALIA : Sedan ; N. S. WALES : National Park.

DISTORTUS, Blackb., *l. c.*, p. 264.

S. AUSTRALIA : Port Lincoln.

EREMITA, Blackb., *l. c.*, 1895, p. 51.

CENTRAL AUSTRALIA : Oodnadatta.

VARIEGATUS, Blackb., P. L. S., N.S.W., 1888, p. 1426.

SOUTH AUSTRALIA : N. Territory.

EYRENSIS, Blackb., *l. c.*, 1891, p. 531.

S. AUSTRALIA : Lake Eyre.

PRETIOSUS, Blackb., *l. c.*, p. 532.

S. AUSTRALIA : Lake Eyre.

CARUS, Lea, P. L. S., N.S.W., 1898, p. 5, 64. (*Figs.* 58,  
141.)

N.W. AUSTRALIA : Behn River.

EGENUS, Lea, *l. c.*, p. 566. (*Fig.* 142.)

N. S. WALES : Forest Reefs, Como, Sydney.

PLANICEPS, Lea, *l. c.*, p. 567. (*Figs.* 71, 143.)

N. S. WALES : Whitton.

NIDICOLA, Lea, *l. c.*, p. 570. (*Figs.* 59, 72.)

W. AUSTRALIA : Pelsart Island, Houtman's Abrolhos.

ORCICORNIS, Lea, *l. c.*, p. 571. (*Fig.* 73.)

W. AUSTRALIA : Mount Barker.

*LAIUS ALLENI*, n. sp. (*Figs.* 60, 115.)

♂. Dark bluish-green; under surface blackish; base of tarsi, base and apex of tibiae obscurely dilated with red; antennae blackish, two basal joints flavous. Densely clothed with very short pubescence, greyish on prothorax and elytra, silvery on head and legs.

*Head* smooth, densely and very minutely punctate. Eyes small and projecting. Antennae moderately long; 1st and 2nd joints highly polished and almost as long as the rest combined; 1st almost twice as long as the 2nd, distorted towards, and with a small tuft of hair at apex; 2nd with its greatest length transverse to the line of joints, one edge rounded, the other notched, the upper surface on the notched side with two shallow excavations, lower surface gently convex and clothed with very minute whitish pubescence; 4th-9th joints subglobular. *Prothorax* strongly transverse, sides and angles rounded, gently convex throughout, densely and finely punctate, without coarse lateral punctures. *Elytra* smooth, without traces of costae and scarcely visibly punctate. *Front femora* thick, beneath with a deep oblique groove; front tibiae still thicker, especially in middle, and also with a deep oblique groove beneath; tarsi simple.

Length, 4 mm.

♀ Differs in having the antennae simple, the 1st joint as long as 2nd-4th combined, the 2nd as long as 3rd-4th combined; front legs simple.

*Hab.* QUEENSLAND: Cairns (*Edmund Allen*).

The uniformly convex and dark prothorax and elytra, absence of long hairs, dilated and grooved front femora and tibiae, simple tarsi and non-thickened elytral suture are strongly at variance with the other species of the genus. In general appearance it is not unlike *Necrobia rufipes*, except that the legs are dark.

I have great pleasure in dedicating this species to Mr. Allen, a gentleman from whom I have received many choice tropical insects.

*LAIUS ARMICOLLIS*, n. sp. (*Figs.* 4, 50.)

♂. Flavous; head between eyes of a vivid metallic green, a subtriangular basal portion blackish, elsewhere flavous in spots and patches; antennae blackish, the basal and three apical joints partly red; prothorax with a fairly large basal patch of vivid green, apical projection infuscate; elytra of a vivid green but with a fairly wide and somewhat zig-zag median fascia, which is widest at the margins and narrowest at the suture; scutellum, meso- and metasternum, apex

and sides of abdomen and the legs of a more or less obscure green ; tarsi obscure. Clothed with long, straggling, brownish hairs and in addition with short whitish pubescence, sparse on upper surface (denser at sides) but fairly dense on legs.

*Head* smooth in front, basal half deeply sculptured, in its middle a subtriangular space enclosing three shallow impressions, at each side a semicircular deep and large impression. *Antennae* short ; 1st joint as long as the four following combined, gradually inflated to its apex, 2nd-7th joints serrate internally and equal *inter se*, 8th-10th thinner and distinctly curved around, but the 8th and 9th in shape much as the preceding joints. *Prothorax* moderately transverse, sides strongly rounded, base feebly emarginate, apex rounded and with a strong projection over the head, the projection notched at tip and longitudinally concave ; with two shallow transverse impressions of which the basal is the deeper ; scarcely visibly punctate, even at the sides. *Elytra* slightly dilated towards apex, surface (especially about the middle) slightly wrinkled ; with a few small scattered punctures. *Front tarsi* with the 2nd joint large, curved at apex and tipped with black ; claw joint large, the claws unusually thick at base.

Length,  $6\frac{1}{3}$  mm.

*Hab.* VICTORIA : Loutit Bay (type in National Museum) ; N. S. WALES : Darling River (Macleay Museum).

The strong projection on the prothorax (which is about one-fourth of the length of that segment) is unique in at least the Australian species of *Malacodermidae* hitherto described. In the type the green portions of the elytra change to purple as they approach the median fascia ; in the other specimen only the extreme base of the elytra is green, the dark portions elsewhere being blue, changing to deep purple as they approach the median fascia ; this specimen also has the antennal joints each partly dark, and the prothoracic projection not much darker than the disc. There are also two specimens in the Australian Museum, marked as having been taken in Hely's expedition.

#### LAIUS SCULPTUS, n. sp. (*Figs.* 61, 144.)

♂. *Head*, base and apex of elytra (a rather wide median fascia flavous) of a vivid metallic coppery-green ; scutellum, under-surface (middle of basal segments of abdomen and prosternum reddish), and legs (front tibiae and tarsi more or less reddish), of a more obscure green ; prothorax flavous with a fairly large medio-basal patch of moderately bright green ; antennae blackish, the two basal joints

partly red. Very sparsely clothed with long brownish hair and in addition with sparse whitish pubescence, dense only on legs.

*Head* smooth in front, on each side of middle a rather small but very distinct and rounded fovea, behind these a deep semicircular impression extending from side to side. *Antennae* short; 1st joint moderately stout, shorter than the three following combined, 2nd \* simple but slightly longer than 3rd, 3rd-9th gradually decreasing in length and serrate internally. *Prothorax* moderately transverse angles obliquely cut off, apex trilobed, the median lobe small and somewhat rounded; with two transverse impressions, the basal very shallow, the apical deep, wide, very distinct and strongly interrupted at its middle (behind which there is a feeble depression on the disc); sparsely and minutely punctate, the sides moderately distinctly punctate. *Elytra* almost parallel-sided; with moderately dense, rather small, and evenly distributed punctures, except that towards the apex they become somewhat smaller. Second joint of front *tarsi* large, curved at apex and tipped with black.

Length  $5\frac{1}{2}$  mm.

*Hab.* VICTORIA: Macedon (*H. J. Carter*). The antennae simple in the male (the only sex known to me) is in itself a remarkable feature, but this is added to by the very unusual sculpture of the head and prothorax (the median lobe of the prothorax is not directed over the head as in *armicollis*). Previous to examining the sexual characters I thought the type was possibly the female of *armicollis* (in colour and general appearance the two species agree rather closely), but both the tarsi and abdomen are essentially masculine.

LAIUS ORTHODOXUS, n. sp. (*Figs.* 62, 145, 146.)

♂. Almost of an orange-red colour; head (except in front and the sides in front of eyes), a large subquadrate prothoracic patch (continuous almost to base but terminated some distance from the apex), scutellum, under surface (except prosternum, middle of basal segment of abdomen and extreme apex of the other), palpi and portions of legs, black; antennae pallid except for a black spot on the first joint. Sparsely clothed with long straggling hairs, head and legs in addition with whitish pubescence.

*Head* much narrower, with the eyes less projecting than usual;

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\* This is really the 3rd joint, the true 2nd in the majority of species of the genus being more or less atrophied, but in the specimen before me it is distinctly visible on one of the antennae although not on the other.

shallowly impressed on each side in front, deeply impressed between eyes, this impression connected with the base by a rather wide and moderately deep impression; in places densely and minutely punctate. Antennae moderately long, 1st joint slightly shorter than 2nd, thin at base, then suddenly and strongly inflated and distorted,\* 2nd sub-quadrate, one side feebly convex, the other deeply impressed towards the base, the impression increasing in depth and width to the summit, the others (except the 10th which is rather long and thin) moderately serrate. *Prothorax* moderately transverse, sides and angles rounded, base feebly transversely depressed; disc sparsely and feebly, the sides densely and coarsely punctate. *Elytra* somewhat inflated towards apex, sides and suture thickened; densely and coarsely punctate except towards base and apex, where the punctures become very small and sparse. Front legs rather slender; 2nd joint of tarsi smaller than 1st, feebly curved at apex and with a minute black speck.

Length 6 mm.

♀. Differs in having the median transverse impression of the head less (but still very) distinct and not connected with the base, the punctures more distinct, the antennae simple with the 1st joint considerably longer than the 2nd and the 2nd than the 3rd; the tarsi are also simple.

*Hab.* QUEENSLAND: Brisbane (*Mrs. C. Lea*).

The unusually deep excavations of the head in the male appear to be quite natural; the head is also unusually narrow with the eyes less projecting than is usual. The pale marking at the apex of each elytron is much in the shape of a parrot's beak. The coarse punctures of the elytra suddenly terminate soon after appearing in the darker portions. In the male the front legs (except the coxae), most of the middle femora and all the trochanters are reddish; in the female the middle femora are entirely and the front ones almost entirely dark; in the female also the antennae (except the basal joints) are more or less infusate.

In appearance this species is something like *plagiaticollis*, *conicicornis*, *villosus* and *rugiceps*, but the 2nd joint of the antennae in the male is very different. It appears also to

\* In figure 62 the antennae are drawn as viewed from one direction, but from another the 1st joint appears obtusely knobbed and considerably wider than 2nd, the 2nd from another direction appears almost pyramidal and in fact of different shape from every direction it is looked at.



be close to the description of *quingueplagiatus*\* but is larger, antennae, abdomen and prothoracic spot differently coloured, etc. From the description of *rugulipennis* it differs in being larger (6 as against 4-5 mm.), with a spot on the 1st instead of the 2nd joint of antennae, and the middle femora (as well as the anterior legs) in the male partly pallid.

LAIUS TARSALIS, n. sp. (Figs. 63, 74, 116, 147.)

♂. Flavous; basal half of head, scutellum, meso-metasternum, apex of abdomen, four hinder coxae, tip of middle and apical half of hind femora, four hinder tibiae (except at extreme apex) and tarsi, and apical joint of palpi black; seven terminal joints of antennae, front tarsi and apex of tibiae more or less infusate; elytra with four rather large purplish-blue spots; one on each at base forming the fourth of a circle and which does not quite touch the suture, and extends on the side for about one-fourth its length, the other sub-apical, subreniform in shape and touching the side but not the suture. Elytra and legs rather densely clothed with short whitish pubescence, intermingled with somewhat longer and darker hairs; elsewhere rather more sparsely clothed.

*Head* smooth and impunctate or almost so; a shining ridge extending (except for an interruption about one-third of its length) from eye to eye. *Antennae* very short, two basal joints almost as long as the others combined, 1st and 2nd joints strongly distorted and inflated, † 1st longer than 2nd, ridged above, the ridge at its highest suddenly curved round and descending almost at right angles to the joint, 2nd very large, convex and very finely pubescent below, above with three large and several smaller impressions, the surface between appearing as more or less distinct tubercular elevations; 3rd-9th globular, 10th moderately long but no thinner than 9th. *Prothorax* moderately transverse, apex considerably wider than base, front angles rounded, hind ones obsolete, feebly transversely impressed towards base; with small scattered punctures, no larger or denser at sides than elsewhere. *Scutellum* rounded posteriorly and finely punctate. *Elytra* parallel-sided to near apex, sides and suture thickened, each with feeble traces of two elevated lines; with very dense and moderately small punctures, no sparser or smaller on

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\* There are several other species before me which approach fairly closely to the description of that species.

† These two joints appear of different shapes according to the directions they are viewed from.

dark portions than elsewhere. Front *tarsi* with the 2nd joint larger than the 1st, hooked at apex and tipped with black.

Length 8 mm.

*Hab.* QUEENSLAND: Somerset (*C. French*).

In appearance somewhat resembling *major* and *verticalis* (Macleay *nec* Fairmaire); from the former it differs in the much shorter antennae, the two basal joints of which are very differently shaped; the elytra markings are also somewhat different. For its distinguishing features from *verticalis* see notes under that species. Although there are some moderately long hairs scattered about, these are much shorter than the straggling hairs so common in the species of *Laius*.

LAIUS FLAVOPICTUS, n. sp. (*Figs.* 148, 149.)

♂. Flavous; basal half of head (the dark portion M-shaped in front), prothorax (except extreme margins of both surfaces) scutellum, under-surface (base of middle segment of abdomen and tips of the others pallid), hind femora, and tip of basal joint of front *tarsi* black; hind edge of front femora, a transverse streak in front of head and a spot on basal joint of antennae infusate; each elytron with an elongated patch of black, having a more or less distinct greenish, bluish, or purplish gloss. Very sparsely clothed with long straggling hairs, and in addition (more noticeably on the head and legs than elsewhere) with short, whitish pubescence.

*Head* polished and impunctate or almost so, with several very indistinct impressions. Antennae stout, simple, moderately long; 1st joint obpyriform, about once and one-half the length of 2nd, 2nd longer than 3rd, 3rd-9th serrate. *Prothorax* strongly transverse, apex truncate; base rounded, feebly transversely impressed towards base; with minute scattered punctures becoming more distinct towards sides. *Elytra* slightly dilated posteriorly, suture but not sides thickened; moderately densely and not very finely punctate, the interspaces with very minute punctures. Front *tarsi* with the 2nd joint large, curved at apex and tipped with black; claw-joint and claws unusually large.

Length 3 mm.

♀. Has the antennae shorter and thinner (but otherwise much the same), with the elytra wider posteriorly and the *tarsi* simple.

*Hab.* S. AUSTRALIA (Macleay Museum).

The very unusual markings render this species peculiarly distinct, as in *sculptus* the male antennae are quite

simple. In the male the dark portion of each elytron covers more than half the surface, but nowhere touches the margins, although it almost does so at the shoulder and again beyond the middle. In the female it occupies much less surface and is shaped much like a nut-wrench. In all the specimens (5) before me the apex of the elytra is stained with brown.

*LAIUS CAVICORNIS*, n. sp. (*Figs.* 64, 75, 76, 150.)

♂. Black; muzzle, prothorax, a median zig-zig fascia and apex of elytra, middle (longitudinally) of abdomen, and tips of some of its segments, base of front femora and two basal joints of antennae, more or less flavous; basal two-thirds of head and greater portion of elytra blue or purple.

*Head* obliquely flattened, scarcely visibly punctate. Antennae moderately long; 1st joint stout, 2nd distorted, convex below and concave above, 10th almost twice as long as 9th. *Prothorax* rather strongly transverse, apex wider than base; sides with scarcely visible punctures. *Elytra* densely and moderately coarsely punctate, punctures smaller and sparser near base (where also the colour is usually greenish) than elsewhere, on dark subapical markings dense and regular. *Front femora* feebly compressed but not grooved.

Length 5 mm.

♀. Differs in being slightly larger with antennae simple, and head and legs entirely dark.

*Hab.* N. S. WALES; QUEENSLAND: Inglewood (Macleay Museum).

In size, colour, and general appearance strongly resembling *cyanocephalus* and *bellulus*, but the muzzle of the male flavous, the second joint of its antennae of very different shape and the dark subapical markings of elytra regularly punctured throughout; *quinquenotatus* is a similar size and has somewhat similar elytral punctures, but is otherwise very different. In the table it should be placed next to *tarsalis* and *major*, from both of which it is readily distinguished by its much smaller size and different antennae and elytral markings. The second joint of the male antennae is about once and one half as wide as long, and is but little more than a hollow shell; at its inner edge it is rounded and curved upwards, the upper portion being in three lobes, of these the median one is scarcely defined, the hind one is acute and projects slightly backwards, and the front one is subconical but obtuse.

Genus HYPATTALUS, Blackb., T. R. S., S. A., 1894, p. 208.

The Rev. T. Blackburn proposed this genus for several species differing in the tarsi from the European species of *Attalus*. I do not know that genus, and do not feel called upon to question the correctness of his proposal, but it will be noticed that there are profound differences in the legs of several species referred by me to the genus, and yet I believe the species here treated are all congeneric, although it is probable that some entomologists would regard them as belonging to several genera.\*

The modifications of the legs are indeed remarkable; in about one-third of the known species the front femora are strongly curved, with the trochanters unusually large and projecting; of these, one species (*dentipes*) has the front femora obtusely dentate, its female having the hind tibiae each terminated by a spur fully half the length of the tarsus; long as it is, however, this spur is sometimes not readily seen, as it is often closely pressed against the tarsus. But there is at least another species (*calcaratus*) having the hind tibiae spurred in the female but belonging to the group with normal femora in the male.† One of the most singular modifications, however, occurs in the hind tibiae of the males of several species (*elegans* and *distortipes*, at least), these are curiously twisted in the middle, the distorted portion being usually of a bright red colour.

The antennae are usually serrate internally in both sexes, with the 11th joint distinctly longer than the 10th; the 2nd joint, although shorter than the 3rd, is never very small; in the male the serrations are usually more pronounced than in the female, but (except in *dispar*, where the male has pectinate antennae) the difference is not sufficiently pronounced to be alone distinctive of sex.

The penultimate segment of the abdomen of the male

\* For instance, the following groups might be regarded as of generic value:—

1. Front femora of male curved with strongly projecting trochanters; hind tibiae of female spurred.
2. Front legs as in the preceding group but hind tibiae of female not spurred.
3. Front legs simple. Hind tibiae of female spurred.
4. Legs and antennae simp'le.
5. Front legs simple. Hind tibiae of male distorted in middle.
6. Legs simple. Antennae of male pectinate.

† A female belonging to another species before me has spurred hind tibiae, but as I do not know its male, it has not been described.

often appears as if it had a long median lobe, and towards each side a smaller lobe; the supposed median lobe, however, is the sheath of the penis, which appears in several species to be permanently exposed, in other species the sheath is just as distinct, but is really internal, its exposed appearance being caused by its horny nature not allowing it to shrink, as does the rest of the abdomen, in consequence the outer skin is drawn very tightly over it, and it then appears as an elongated shining ridge. In the female the abdomen is usually obtusely notched at the tip.

If the specimens (and especially females) are set out when soft, the elytra often appear too short to cover the abdomen, but the species are not truly brachelytrous.

I have not considered it necessary to describe the clothing of each species. It consists of long and straggling hairs, more noticeable on the sides and legs than elsewhere; the elytra in addition have short whitish pubescence, which, however, is indistinct from some directions. Nor have I considered it necessary to describe the prothorax\* other than as to its colour; in all the species it is strongly transverse, the disc widely and continuously convex, the base and sides (except in front, where the convexity is not at all interrupted) feebly margined, and the surface impunctate, or at most with a few very indistinct punctures.

Besides the species here recorded, there are five others before me (three of them being very distinct), but they are unfortunately all represented by females only, so I have considered it best to leave them undescribed.

I am not acquainted with *punctulatus*, but it is evidently a dingy species allied to *australis* and *elegans*. As no characters which can be recognised as sexual were given in the description, it is impossible to determine the sex of the types, and consequently it would be dangerous to identify it on any other than South Australian specimens. I am confident, however, that I have not seen it.

The others may be tabulated as follows:—

- A. Front femora of male strongly curved,  
the trochanters large and projecting.
- a. Elytra partly pale.
- b. Prothorax with distinct markings . *pulcherrimus*, Lea.

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\* This does not apply to *sordidus* and *montanus* which were described after the preparation of these notes.

- bb. Prothorax immaculate or with indistinct markings . . . . . *mirabilis*, Lea.
- aa. Elytra entirely dark.
- c. Hind tibiae of female spurred . . . . . *dentipes*, n. sp.
- cc. Hind tibiae of female not spurred.
- d. Elytra of female mucronate at apex . . . . . *mucronatus*, n. sp.
- dd. Elytra not mucronate.
- e. Four hinder tibiae of male angular and red at base . . . . . *flaviventris*, n. sp.
- ee. Four hinder tibiae of male simple and nowhere red . . . . . *australis*, Fairm.
- AA. Front legs of male simple.\*
- B. Prothorax entirely dark.
- f. Elytra entirely dark . . . . . *carteri*, n. sp.
- ff. Elytra partly pale.
- g. Pale markings median and apical . . . . . *exilis*, n. sp.
- gg. Pale markings humeral . . . . . *montanus*, n. sp.
- BB. Prothorax partly dark.
- h. Dark markings lateral . . . . . *sordidus*, n. sp.
- hh. Dark markings median.
- i. Elytra coarsely punctate . . . . . *distortipes*, n. sp.
- ii. Elytra almost impunctate . . . . . *collaris*, Lea.
- BBB. Prothorax entirely pale.†
- C. Elytra partly pale.
- j. Pale markings not entirely apical . . . . . *alphabeticus*, Lea.
- jj. Pale markings apical only.
- k. Elytra strongly punctate . . . . . *viridis*, Lea.
- kk. Elytra feebly punctate.
- l. Antennae of male pectinate . . . . . *dispar*, Lea.
- ll. Antennae of male serrate . . . . . *violaceus*, Lea.
- CC. Elytra entirely dark.
- D. Hind tibiae of male distorted and red in middle . . . . . *elegans*, Blackb.
- DD. Hind tibiae of male simple.
- E. Antennae of male almost as long as body . . . . . *longicornis*, Lea.
- EE. Antennae shorter.
- F. Hind tibiae of female spurred . . . . . *calcaratus*, n. sp.
- FF. Hind tibiae of female not spurred . . . . . *abdominalis*, Er.

\* Although I am not acquainted with the males of *collaris*, *viridis*, and *alphabeticus* they are placed here for reasons stated below.

† There is a variety (noted below) of *abdominalis* in which the prothorax is maculate.

HYPATTALUS ABDOMINALIS, Er. (*Attalus*, Er.), Wieg., Arch., 1842, I, p. 147; Blackb., T. R. S., S.A., 1894, p. 208.

*brevicornis*, Lea, P. L. S., N.S.W., 1898, p. 573.

var. *occidentalis*, Lea, *l. c.*, p. 573.

I have numerous specimens from various parts of Tasmania which agree with the description of this species, the type specimen of which had but one joint of its antennae left.

The antennae have the 4th-10th joints serrate; in the female they are about as long as the head and prothorax combined, in the male they are distinctly longer, and the serrations are more pronounced.

Dr. Erichson describes the abdomen as red, with the apex black; in the specimens I have examined the two basal segments are also black, or at least infuscate; whilst in some of the females all the segments are black.

The elytra are usually deep blue but are occasionally purplish or greenish. In four specimens before me there is a blotch on the prothorax varying from infuscate to deep black.

The small size and almost impunctate elytra will at once distinguish this species from the close allies of *australis*. Its front femora and hind tibiae are simple in both sexes.

On again examining the types of *brevicornis* I find they represent but the variety of *abdominalis* having the abdomen entirely black; of the seven specimens originally before me, I now have five, of these three have the abdomen black, whilst two have the median segments reddish; *brevicornis* therefore must be regarded as a synonym of *abdominalis*, or the ones with the abdomen black as a common variety of the female.

*Occidentalis*, described as a possible variety of *brevicornis*, is, I am now convinced, a variety only, and must therefore be referred to *abdominalis*.

*Hab.* AUSTRALIA and TASMANIA.

HYPATTALUS AUSTRALIS, Fairm. (*Attalus*), Pet. Nouv. Ent., 1877, II, p. 174; Journ. Mus. Godeffr., 1879, XIV, p. 104; Blackb., T. R. S., S.A., 1894, p. 208. (*Fig.* 117.)

The sex of his specimen was not mentioned by Fairmaire, but it was evidently female. His description would

apply fairly well to the females of several species before me; one of these bears a label in the Rev. T. Blackburn's writing "*Attalus australis*, Fairm."; and as it is the only common species I have from about Sydney (the type of *australis* being given as from Sydney) and agrees fully as well as any of the others with the description, I accept the identification as correct.\*

In the type of *australis* the lower surface of only the first of the antennal joints was pallid, in the specimens before me the number of joints that are pallid beneath vary in number from one to four, whilst occasionally the second joint is entirely pallid. Fairmaire describes the scutellum as "*triangulari*." In specimens having the elytra somewhat freed from the prothorax the scutellum appears as widely triangular with the apex widely rounded; with the prothorax overlapping the elytra, as is usually the case, the scutellum could scarcely be described as triangular. In the female the hind tibiae are moderately curved, and at the tip compressed, fairly wide and distinctly emarginate or notched, but not spurred.

The male (I have a pair taken *in cop.*) differs from the female in being slightly smaller, with longer antennae (which have the serrations of the joints more pronounced), the front femora stout, moderately curved and with strongly projecting trochanters; the front tibiae are rather stouter and the hind ones shorter and less curved than in the female.

*Hab.* N. S. WALES: Sydney, Como, National Park.

*HYPATTALUS ELEGANS*, Blackb., T. R. S., S.A., 1894, p. 209.

Of this species Blackburn says "*colore praecedenti (punctulatus) simillimus*" (except as to the elytra and legs) the colour of the abdomen not being mentioned; of *punctulatus* it is described as "*parte mediana rufis*," apparently as in the normal form of *abdominalis*. The type specimen was possibly examined without removal from the card, as in four females before me the two basal and the apical segments are blackish whilst the others are blackish or infuscate along the middle, but this could not be seen from the side; in the two males I have seen the abdomen is entirely red. The male is smaller than the female and the

\* Mr. Blackburn himself (*l. c.*) appears to have had some slight doubts as to the correctness of his identification.



antennae longer with the serrations more pronounced. Its front femora are normal but its hind tibiae are remarkable; just before the middle they are suddenly compressed, the compressed portion being red\*; seen from above the compressed part appears slightly wider than the rest of the tibiae whilst from the side it appears to be much narrower. This appearance at first appears to be accidental, but in another species (*distortipes*) before me it is even more pronounced.

*Hab.* N. S. WALES: Blue Mountains, Forest Reefs, Hillgrove; VICTORIA: Studley Park.

var. TASMANIENSIS, *n. var.*

I have eight specimens of what I regard as a variety of this species. They differ from the above noted ones in being darker (most of them have the elytra purplish-blue), and with the punctures much coarser. In two males the abdomen is red except at the apex, the hind tibiae are as described above even to the distorted portion being red in one and almost as dark as the rest of the tibiae in the other. The abdomen of the females varies from entirely dark to dark only at the apex. In one of them the apical half of the terminal joint of the antennae is distinctly reddish.

*Hab.* TASMANIA: River Isis, Mount Wellington (*H. H. D. Griffith*), Launceston (*Aug. Simson*), Stonor (*A. M. Lea*).

HYPATTALUS COLLARIS, Lea, P. L. S., N.S.W., 1898, p. 575.

The types of this species are females. I have tabulated it, however, with the species having the front femora of the male simple as it is evidently allied to *distortipes*, and probably has the hind femora distorted in the male.

*Hab.* N. S. WALES: Galston, National Park.

HYPATTALUS VIRIDIS, Lea, *l. c.*, p. 576.

Although I do not know the male of this species (the type is a female) I have tabulated it with those having the front femora of the male simple, as it is evidently allied to *calcaratus*, notwithstanding its simple hind tibiae.

*Hab.* N. S. WALES: Tamworth.

\* In one specimen, in the other it is almost as dark as the rest of the tibiae.

HYPATTALUS ALPHABETICUS, Lea, *l. c.*, p. 579. (*Fig.* 151.)

The type of this species is a female; in the table it is placed with those having the front femora simple in the male, as although differently coloured to any species of either section it is evidently not structurally close to any of the species having the front femora distorted.\*

*Hab.* N. S. WALES: Tamworth.

PUNCTULATUS, Blackb., T. R. S., S.A., 1894, p. 209.

S. AUSTRALIA: Eyre's Peninsula.

LONGICORNIS, Lea, P. L. S., N.S.W., 1898, p. 574.

N. S. WALES: Queanbeyan.

DISPAR, Lea, *l. c.*, p. 575. (*Fig.* 77.)

N. S. WALES: Galston.

VIOLACEUS, Lea, *l. c.*, p. 576.

N. S. WALES: Tamworth.

PULCHERRIMUS, Lea, *l. c.*, p. 577. (*Figs.* 118, 152.)

N. S. WALES: Armidale.

MIRABILIS, Lea, *l. c.*, p. 578.

N. S. WALES: Tamworth, Clarence River.

HYPATTALUS MUCRONATUS, n. sp. (*Figs.* 106, 119.)

♂ Black; elytra metallic-blue (or green); prothorax, front tibiae (wholly or in part) and parts of three basal joints of antennae flavous.

*Head* impunctate, with several very shallow impressions. Antennae rather long and thin, obtusely serrate internally. *Elytra*, except near base and apex, densely and moderately coarsely punctate; sides and suture (except on basal fourth) thickened, with the sides upturned along a lateral channel. Front legs with strongly projecting and obtusely pointed trochanters; femora strongly curved; tibiae curved at base and somewhat angular; hind tibiae notched at apex.

Length  $3\frac{1}{2}$  (♀ 4) mm.

♀. Differs in having simple front legs; the elytra rather more densely and irregularly punctate, the sides and the suture less

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\* Since this was written I have seen what is evidently the male, it differs in being larger (3 mm.) and in having the antennae pectinate, much as in the male of *dispar*. It is unique in Mr. R. Helms' collection, and was taken by him on the Macleay River.

thickened, the sides sub-parallel for the basal two-thirds, then suddenly and strongly narrowed, then widely rounded with the apex obtusely mucronate.

*Hab.* N. S. WALES: Jenolan (*J. C. Wiburd* and *A. M. Lea*); Sydney, Blue Mountains, National Park (*H. J. Carter*).

The legs of both sexes are much as in *australis*, and the males are much alike, except that in *mucronatus* the antennae are distinctly longer and that the elytral punctures are different and the lateral margins thicker. The elytra of the female, however, render the species remarkably distinct, not only from *australis*, but from any other of its congeners; the species, in fact, is one of the few in which the female is much more distinct than the male; seen from below each elytra appears to have a rather wide lateral flange, which at about the apical third is abruptly terminated.

#### HYPATTALUS FLAVIVENTRIS, n. sp.

♂. Black; elytra metallic bluish-green; prothorax, abdomen, front legs (tarsi and apical half of tibiae infuscate) and parts of three basal joints of antennae flavous; base of four hind tibiae red.

*Head* and antennae much as in the preceding species except that the antennae are somewhat shorter. *Elytra* with small and not very dense punctures in middle and almost absent elsewhere; a feeble channel towards sides, sides and suture slightly thickened. *Front legs* with trochanters large, wide, and acutely angular at apex; femora strongly curved; tibiae angular at base; hind tibiae angular at base and obtusely notched at apex.

Length  $3\frac{1}{4}$  mm.

♀. Differs in having the front legs and tip of abdomen dark and the legs simple except that the hind tibiae are acutely notched at apex.

*Hab.* N. S. WALES: Jenolan (*J. C. Wiburd*).

In appearance close to the preceding species and *australis*, but the colour and shape of the four hind tibiae in the male alone render it very distinct from all the allies of the latter.

#### HYPATTALUS DENTIPES, n. sp. (*Figs.* 120, 121.)

♂. Black, head with a slight bluish gloss; elytra deep metallic-blue; prothorax, anterior legs (in parts infuscate) and parts of three basal joints of antennae flavous.

*Head* and antennae much as in *mucronatus*. *Elytra* densely and moderately coarsely punctate, punctures smaller at base and apex than elsewhere; sides and suture moderately (towards apex rather strongly) thickened and sides feebly channelled. Front legs with strongly produced and obtusely pointed trochanters; femora strongly curved and with a large but obtuse subbasal tooth.

Length 3 (♀ 3 $\frac{3}{4}$ ) mm.

♀. Differs in having the front legs simple and (except the coxae) almost entirely dark, and the hind tibiae each with a long fixed spur rather more than half the length of the tarsus.

*Hab.* N. S. WALES: National Park, Sydney (*H. J. Carter* and *A. M. Lea*), Jenolan (*J. C. Wiburd*), Nowra (Macleay Museum).

Allied to *australis* and the two preceding species, but at once distinguished by the long spur to the hind tibiae of the female and the dentate front femora of the male. Parts of the coxae and trochanters are obscurely diluted with red. Seen from the sides the margins of the elytra of the female appear rather strongly arched at the middle, from above from certain directions they are reminiscent of those of the female of *mucronatus*, but this is more apparent than real, whilst the apex is quite simply rounded.

One male (probably immature) has part of the suture and sides of elytra and more of the legs and antennae obscurely pallid.

#### HYPATTALUS CALCARATUS, n. sp.

♂. Black; elytra deep bluish-green; prothorax reddish-flavous; three basal joints of antennae and parts of legs obscurely diluted with red.

*Head* and antennae much as in *mucronatus* except that the eyes are larger and antennae somewhat thicker. *Elytra* densely and moderately coarsely punctate, the punctures not much finer at base and apex than elsewhere; sides and suture very feebly thickened and the sides very slightly channelled. *Legs* simple.

Length 1 $\frac{3}{4}$ –2 mm.

♀. Differs in having the hind tibiae each terminated by a long thin curved fixed spur, distinctly more than half the length of the tarsus.

*Hab.* N. S. WALES: Sydney (Macleay Museum), National Park (*A. M. Lea*).

A very small species, in size and appearance somewhat

like *abdominalis*, but at once distinguished by the spurs to the hind tibiae of the female; the elytral punctures are also very distinct, instead of being scarcely visible as in that species. The preceding species (which also is spurred in the female) is very much larger and the front legs of its male are not simple.

**HYPATTALUS DISTORTIPES, n. sp.** (*Fig. 122.*)

♂. Black, head with a bluish gloss; elytra deep metallic bluish-green; sides of prothorax rather widely flavous; abdomen (the greater portion of middle infusate), parts of three basal joints of antennae, the trochanters and labial palpi testaceous.

*Head* with two moderately large subapical foveae. *Antennae* moderately long and rather strongly serrate internally. *Elytra* densely and rather coarsely punctate, the punctures larger in the middle than elsewhere; suture and sides scarcely thickened, and the latter not channelled. *Front legs* simple; hind tibiae curiously distorted in middle, the distorted portion of a bright red colour.

Length  $3\frac{1}{2}$  mm.

*Hab.* TASMANIA: Mount Wellington (*H. H. D. Griffith*), Hobart (*A. M. Lea*).

The hind tibiae are distorted much as in the male of *elegans*, but, besides the bicolorous prothorax, the elytra are more coarsely punctate, even than in the Tasmanian variety of that species. The colours of the prothorax are somewhat as in *collaris*, but the size, punctures and antennae of the two species are very different.

**HYPATTALUS CARTERI, n. sp.**

♂ ♀. Black; elytra with a deep metallic-green gloss.

*Head* with several feeble impressions. *Antennae* short (not passing middle coxae) and rather strongly serrate internally. *Elytra* smooth and impunctate or almost so, suture and sides not thickened, and the latter not channelled. *Legs* simple.

Length 2-2 $\frac{1}{2}$  mm.

*Hab.* TASMANIA: Hobart (*H. J. Carter*), Mount Wellington, Huon River (*A. M. Lea*).

The only species yet described having the upper surface and legs entirely dark. Parts of the abdomen and prosternum are seen to be reddish when exposed through shrinkage, but specimens as ordinarily preserved appear

to be entirely dark. Owing apparently to irregular contraction due to their thinness the elytra occasionally appear to be slightly rugulose, but no distinct punctures are traceable. The sexes do not differ in the antennae and legs.

*HYPATTALUS EXILIS*, n. sp. (*Fig. 153.*)

♂ ♀. Black with a slight bronzy gloss; tip of elytra and a spot on each side, coxae and trochanters pale flavous (almost white); knees and parts of basal joints of antennae obscure flavous.

*Head* with two distinct subapical foveae. *Prothorax* rather less transverse than usual, and with a few subapical punctures. *Elytra* thin, moderately densely and rather coarsely punctate on the basal half (except at extreme base) and almost impunctate elsewhere. *Legs* simple but thinner than usual.

Length  $2\frac{1}{4}$ – $2\frac{3}{4}$  mm.

*Hab.* TASMANIA: George Town (*Aug. Simson*), Mole Creek, Ulverstone, Hobart (*A. M. Lea*). On blossoms of *Bursaria spinosa*.

A very narrow species (narrower even than *longicornis*), the colour alone rendering it very distinct from all previously described species. The sexes (apart from a slight difference at the apex of abdomen) are scarcely distinguishable. The spot on each side of the elytra is widest at the margin and subtriangularly narrowed towards the suture and appears as a remnant of a median fascia; in one specimen each spot is obscurely connected with the apex along both suture and side so that the apical half appears pallid except for a large dark spot; in several others the suture beyond the middle is narrowly flavous. The pubescence is much sparser than in any other species here recorded, the upper surface at first sight being apparently glabrous, the antennae, though long, appear comparatively short, owing to the length of the elytra; they are but very feebly serrate internally, the subapical foveae of the head occasionally become united, when they appear as a moderately large shallow punctate impression. The elytral punctures are reminiscent of those of many species of *Cleridae*.

*HYPATTALUS SORDIDUS*, n. sp.

♂. Black; elytra dark submetallic blue or green, with or without patches glossed with purple; prothorax reddish flavous,

widely and deeply stained with black on the sides, and occasionally narrowly stained at base and apex; parts of basal joints of antennae and the knees more or less obscurely diluted with red. Sides rather densely clothed with long dark pubescence; elsewhere with short sparse pubescence.

*Head* densely and coarsely punctate, with a shallow subfoveate impression on each side of apex. *Antennae* short, 4th-10th joints strongly serrated. *Prothorax* twice as wide as long, apex truncate, base obscurely bilobed, sides strongly rounded; densely and moderately coarsely punctate, but punctures coarse on sides. *Elytra* wide, slightly dilated posteriorly, each separately rounded at apex, densely and rather coarsely punctate, the punctures larger than disc of prothorax but smaller than on head. Penultimate segment of *abdomen* slightly incurved at apex; apical segment deeply and narrowly excised. *Legs* comparatively short; femora simple, hind tibiae very feebly curved.

Length  $3\frac{1}{2}$ -5 mm.

♀. Differs in being larger and wider, antennae shorter and less strongly serrate, abdomen frequently partially uncovered and legs rather shorter.

*Hab.* N. S. WALES: Armidale (*A. M. Lea*); VICTORIA: Fernshaw (National Museum); S. Australia (Macleay Museum); TASMANIA: Hobart (*H. H. D. Griffith* and *A. M. Lea*), Launceston (*Aug. Simson*, No. 2625).

A large broad species of wide distribution, but apparently never common. In the female the abdomen is frequently inflated so that then it does not appear to belong to *Hypattalus*, but to approach the genera with short elytra (*Carphurus*, etc.), but the males (except as to the colour and punctures of the prothorax, look quite ordinary specimens of *Hypattalus*.

#### HYPATTALUS MONTANUS, n. sp.

♂. Black; shoulders, parts of basal joints of antennae, trochanters and extreme base and apex of tibiae more or less red. Clothed with sparse greyish pubescence, becoming longer on the side but still sparse.

*Head* rather large and strongly convex, with irregular scattered punctures. *Eyes* small, coarsely faceted and very prominent. *Antennae* long (extending to about one-fourth from apex of elytra) the five terminal joints fully half of their total length, the 3rd-7th rather distinctly serrate. *Prothorax* not twice as

wide as long, apex truncate, base obscurely bilobed, sides somewhat angular, with a rather feeble median line; with rather small scattered punctures. *Elytra* long, sides sub-parallel; densely, rather coarsely and almost regularly punctate throughout, sides and apical half of suture thickened. *Legs* long; femora simple; hind tibiae moderately curved.

Length 5 mm.

♀. Differs in being larger and considerably wider; head wider and less convex; eyes less prominent; antennae shorter, with the five terminal joints less than half their total length; prothorax more transverse, the sides more rounded; elytra with smaller punctures and the legs shorter.

*Hab.* TASMANIA: Mount Wellington (under bark of *Eucalyptus coccifera* close to and on summit, *J. J. Walker* and *A. M. Lea*).

In general appearance this insect does not look much like a *Hypattalus*, but as its elytra completely cover the abdomen, the body has extrusible vesicles and the antennae are 11-jointed, it could only be referred to that genus or to a new one, and at present the former course seems to be preferable. One of the females has the marginal and sutural thickenings of the elytra pallid as well as the shoulders. Owing partly to irregular contraction and partly to clothing, I am not able to define the sculpture of the apical segments of abdomen of either of the males before me, but they are evidently not distinctly notched.

BALANOPHORUS.

CARPHURUS.

NEOCARPHURUS.

HELCOGASTER.

In all four of these brachelytrous genera I am not able to find characters in the visible parts of the abdomen to denote sex. There may be such occasionally, but in all the specimens I have examined I have failed to find any; in some cases possibly owing to irregular contraction, but really I think owing to their absence. In many specimens the sheath of the penis, or part of the ovipositor is exposed, but these are so much alike that they are of doubtful use in diagnosing the sex. This being the case other parts have to be relied upon to denote sex. In *Helcogaster* and *Neocarphurus* the



head is nearly always largely excavated in the male, and gently convex in the female; but I am unable to define any external feature by which the sex of certain species of *Carphurus* and of *Balanophorus* can to a certainty be recognized. In *Carphurus* it is true the head is sometimes excavated, and the elytra armed, these being certain indications that the specimens are males; in *Balanophorus* the males always have flabellate antennae. But now comes what must be regarded as an "awkward" feature. The males of all four genera have the first joint of the anterior tarsi large (often of a peculiar shape), and supplied with numerous close-set teeth,\* evidently to act as a comb for the antennæ; but the females of *Balanophorus* also have this joint so formed. Another "awkward" feature is that the males of certain species of *Carphurus* have the antennae strongly serrate or subpectinate, much as they are in the females of *Balanophorus*; so that although the sex of a female *Carphurus* or of a male *Balanophorus* can always be ascertained, it is often quite impossible to be certain as to whether an unique specimen of a species having the basal joint large and curiously formed, with the antennae strongly serrate, is the female of a *Balanophorus* or the male of a *Carphurus*; and both genera are numerously represented in Australia, although the latter consists of a far greater number of species than the former.

In the species of all four genera the lower surface of the head is bifoveate, and the mandibles bifid at the apex. They all look very fine when well set out, but there are few beetles which look worse when badly set or pinned; and owing to the irregular contraction which always takes place, once dried they can never afterwards be properly set out.

I have described the colours as I found them, but it is to be noted that the reddish ones are frequently subject to considerable alteration with age or improper treatment, and I do not think that any *shades* of the pale colours from pale flavous to deep red are to be depended upon as of specific value; the dark blues, purples and greens, as in so many similarly coloured insects, are also variable, but appear to be little affected by age.

\* A compound power is necessary to see these teeth clearly; under an ordinary hand-lens each series appears as a black rim to the inner margin of the joint.

The lengths have been given to apex of elytra as well as the total lengths, as I believe the former are more important, and certainly are not so liable to alteration through the contraction which takes place in pinned or badly set specimens.

Genus *BALANOPHORUS*,\* Macl., Trans. Ent. Soc., N. S. Wales, II, p. 267.

The males of this genus can be readily recognised by their having flabellate antennae. There are two sections of the genus; the *mastersi*, having the eyes comparatively small in both sexes; and the *macleayi*, in which the eyes of the male are very large, occupying more than half the total width. As above noted I am unable to define any character by which a female of the genus can, to a certainty, be distinguished from a male *Carphurus*.

I do not know *biplagiatus* and *megalops*, both of which are commented on below; and I have excluded *brevipennis* from the table owing to doubts as to which section of the genus it belongs to, even if it is not a *Carphurus*. It is however an easily recognised species.

The others † may be tabulated as follows:—

- |     |  |  |  |
|-----|--|--|--|
| A.  | Eyes occupying fully half the width<br>of head in male.          |  |  |
|     | a.   | Head partly dark . . . . . <i>scapulatus</i> , Fairm.‡ |  |
|     | aa.  | Head entirely pale . . . . . <i>macleayi</i> , Lea.    |  |
| AA. | Eyes occupying much less than half<br>the width of head in male. |  |  |
|     | B.   | Elytra bicolorous.                                     |  |
|     |  | b.   | Head partly dark . . . . . <i>mastersi</i> , Macl.                   |
|     |  | bb.  | Head entirely pale . . . . . <i>pictus</i> , n. sp.                  |
|     | BB.  | Elytra unicolorous.                                    |  |
|     |  | C.   | Elytra distinctly punctured . . . . . <i>janthinipennis</i> , Fairm. |
|     |  | CC.  | Elytra indistinctly punctured . . . . . <i>victoriensis</i> , n. sp. |

\* The name *Balanophorus* will have to be altered, as it was used in 1825 by Briganti for a genus of worms.

† The description of *ater* was drawn up after this table was prepared.

‡ To judge by the descriptions *biplagiatus* and *megalops* may be tabulated with *scapulatus* as follows:—

- |   |                             |
|---|-----------------------------|
| Less than half of elytra dark . . . . . | <i>biplagiatus</i> , Fairm. |
| More than half of elytra dark.          |                             |
| More than half of legs pale . . . . .   | <i>scapulatus</i> , Fairm.  |
| Less than half of legs pale . . . . .   | <i>megalops</i> , Lea.      |

BALANOPHORUS BREVIPENNIS, Germ. (*Carphurus*), Linn. Ent., III, 1848, 138; Fairm., Journ. Mus. Godeffr., 1879, p. 110.

I have not seen the male of this species, but Fairmaire, although the species was unknown to him, probably correctly referred it to *Balanophorus*, as Germar describes the antennae as "in mare *pectinatis*, in femina *serratis*."

The basal joint of the anterior tarsus is of the remarkable shape that it always is in *Balanophorus*, but which is not confined to that genus.

Of three females before me two have the inter-ocular fascia as in the type, whilst a third has the basal two-thirds of the head entirely black, this specimen has also the upper surface of the two basal joints of the antennae black, and one of the others has a black spot on the basal joint; the latter specimen has the third abdominal segment with a black rounded spot on each side, in addition to the black median space.

*Hab.* S. AUSTRALIA; N. S. WALES: Leura, Forest Reefs; QUEENSLAND: Cairns; VICTORIA: Carlton.

BALANOPHORUS JANTHINIPENNIS, Fairm., Journ. Mus. Godeffr., 1879, p. 110.

The female of this species was unknown to Fairmaire; it differs from the male in being larger, the antennae strongly serrate and the basal joint of the front tarsi somewhat smaller, but still of considerable size; in appearance it resembles both sexes of *Carphurus bifoveatus*, but can be distinguished by its comparatively coarsely punctured elytra.

*Hab.* N. S. WALES: Sydney, National Park, Forest Reefs; TASMANIA: Beaconsfield.

BALANOPHORUS SCAPULATUS, Fairm. (*Carphurus*), Journ. Mus. Godeffr., 1879, p. 109.

Only the female of this species was known to Fairmaire, and he naturally referred it to *Carphurus*. I have now both sexes (three males and two females) before me. Of these one of each sex has an infuscate median patch on the head (apparently as in the type), whilst in the others the head (except the muzzle) is entirely black. In one of each sex the two apical segments of abdomen are

black (as in the type), but in the others the next one is also black.

The antennae of the male are clothed with long blackish hair and are exactly as I have described them in *megalops*; the two species in fact are closely allied.

*Hab.* QUEENSLAND: Rockhampton; NEW SOUTH WALES: Tweed River, Bulli, National Park, Galston.

BALANOPHORUS BIPLAGIATUS,\* Fairm., Journ. Mus. Godeffr., 1879, 110.

Apparently allied to *scapulatus*, but with the elytra pallid, except for a transverse subapical infusate spot on each.

*Hab.* QUEENSLAND: Peak Downs.

BALANOPHORUS MEGALOPS, Lea, P. L. S., N.S.W., 1901, p. 483.

The type of this species is in the Macleay Museum; it differs from *scapulatus* in having the greater portion of the legs black; the elytra with a bluish gloss, only one-fifth of the base pallid (the marking cut across) and conjointly, instead of separately, rounded at apex. The scutellum also is pale.

By an unfortunate error its prothorax was described as "almost twice as wide as long," this should have been "almost twice as long as wide." Its antennae were also once referred to as "funicle."

*Hab.* N. S. WALES: Otford.

MASTERSI, Macl., Trans. Ent. Soc., N. S. Wales, ii, p. 267; Lea, P. L. S., N.S.W., 1895, p. 261.

*Hab.* QUEENSLAND; N. S. WALES; VICTORIA.

MACLEAYI, Lea, P. L. S., N.S.W., 1895, p. 261; 1904, p. 91, Pl. IV, fig. 8.

*Hab.* N.W. AUSTRALIA.

BALANOPHORUS PICTUS, n. sp.

♂. Flavous; apical third (or fourth) of elytra of a bright metallic green; metasternum, tips of mandibles, seven (or eight) terminal

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\* In Masters' catalogue appearing both as a *Balanophorus* (3438) and as a *Carphurus* (3418).

joints of antennae, and four hind femora black or blackish. Middle of lower surface of two basal segments of abdomen infusate. Clothed with long, straggling, griseous hairs.

*Head* not very large, with several feeble impressions in front, and a feeble slightly curved ridge between eyes. Antennae not extending to apex of elytra; 3rd joint dentate, 4th-10th pectinate, 11th long and clubbed. *Prothorax* almost circular. *Elytra* with rather large but shallow, indistinct and rather sparse punctures. *Legs* moderately stout (for the genus); basal joint of front tarsi large and thick, rounded, and with a black comb almost the entire length of the inner margin.

Length to apex of elytra 4, of abdomen  $5\frac{1}{2}$  mm.

*Hab.* N.W. AUSTRALIA (type in Macleay Museum), Derby (*W. W. Froggatt*).

The antennal rami of the male are shorter than in the other species known to me, and are without the long hairs so characteristic of most of the species. In colour to a certain extent it resembles *macleayi*, but the head is smaller, with much less prominent eyes, and in fact these are not much larger than in *mastersi*, in which they are least prominent of all. The front legs are (excluding the comb) either entirely pallid or with the femora partly infusate; the same is the case with the middle tibiae and tarsi, whilst the hind tibiae are either pallid or black. On one specimen there is an infusate spot on the upper surface of each of the median abdominal segments.

A specimen in the Macleay Museum, which I presume to be the female, has the apical two-thirds of the elytra purplish-brown, its legs (except the hind femora and coxae) are pallid, and antennae pallid at base, becoming darker from the fourth joint, the 3rd-10th joints are strongly serrate; the prothorax is longer than wide, the sides rounded and decreasing in width to base, the elytra are wider with the sides at the basal third, suddenly widened but thence parallel to apex; whilst the eyes are even larger.

#### BALANOPHORUS VICTORIENSIS, n. sp.

♂. Black; elytra violet-blue; prothorax, muzzle, base of antennae and front coxae reddish-flavous. Clothed with long, straggling griseous hairs.

*Head* large; with rather large and prominent eyes; base in middle irregularly punctate, at sides strigose; with several feeble

impressions in front. Antennae extending almost to apex of elytra, 3rd joint dentate, 4th-10th pectinate, 11th long. *Prothorax* longer than wide, sides and apex rather strongly rounded. *Elytra* considerably wider than prothorax, smooth; with scattered indistinct punctures. *Legs* long and thin; basal joint of front tarsi with a black comb on the inner margin.

Length to apex of elytra  $3\frac{1}{2}$ , of abdomen 5 mm.

*Hab.* VICTORIA: Fernshaw (National Museum).

In size and general appearance very close to *janthinipennis*, but at once readily distinguished by the scarcely punctured elytra and black basal segments of abdomen; these, it is true, are reddish at the sides, but in the other species they are entirely red.

#### BALANOPHORUS ATER, n. sp.

♂. Black; sub-basal joints of antennae and knees obscurely diluted with red.

*Head* wide, feebly impressed on each side in front, with a few small scattered punctures. *Eyes* small but prominent. *Antennae* glabrous, passing apex of elytra; 3rd joint dentate, 4th-10th pectinate, 11th long. *Prothorax* moderately transverse. *Elytra* at base not much wider than prothorax; indistinctly punctate. *Legs* long and thin.

Length to apex of elytra  $1\frac{1}{2}$ , of abdomen 2 mm.

*Hab.* S. AUSTRALIA (type in Macleay Museum).

Readily distinguished from all the other species of the genus by its minute size and black prothorax. In the type the front tarsi are missing.

Genus CARPHURUS, Er., Entomogr., p. 132; Lacord., Gen. Coleop., IV, p. 396.

This genus may be regarded as the central one of the group of genera having exsertile vesicles and short elytra; branching off in one direction to *Balanophorus*; in another to *Helcogaster*, and in still another to *Neocarphurus*. It is more numerously represented in species than *Helcogaster*, but few of them are at all abundant in specimens as are many of the latter genus.

The genus of a female *Carphurus* can always be ascertained; but, as noted above, it is not always possible to tell whether a specimen, apparently a male, belonging to

it, is not really a female *Balanophorus*. This uncertainty, however, only applies to those species having subpectinate antennae.

The head of the male is usually smooth, or with but shallow impressions; sometimes, however, it is just as largely excavated as in many males of *Helcogaster*. In both sexes it is usually transversely strigose at the base, but this position is quite commonly concealed by the overlapping prothorax. Great variation occurs in the antennae, in some species these organs being almost cylindrical, in others strongly dentate, whilst in a few they are even subpectinate; the terminal joint is often obtusely rounded and indistinctly notched at apex. In a number of species the elytra are armed in the males, the prothorax is nearly always transversely impressed towards the base and more feebly towards the apex, but as I consider this character absolutely valueless, as an aid to identification, I have not described it in any of the new species.

The clothing in all the species consists of long straggling griseous hairs, frequently intermixed with shorter ones on the elytra, and appears to be easily abraded; I have seldom considered it necessary to mention it; nor that (as is invariably the case) the tips of the mandibles are dark.

Some of the species, especially those of the *armipennis* group, are variable in their colours.

In addition to *fasciipennis* and *basipennis*, which are commented on below, the following species are unknown to me:—

*Xanthochrous*, Fairm.—A pale species with the scutellum, parts of the legs and apex of antennae dark, and with the summit of the head sometimes infuscate. The head is stated to be punctulate, but its sculpture is not otherwise mentioned.

*Tachyporoides*, Fairm.—Close to but more convex than the preceding species, according to Fairmaire.

*Segmentarius*, Fairm. Described as close to *crisatifrons*, but with the head and elytra simple, although the head is said to be “inter oculos profunde excavato et utrinque compresso elevato.” The type was apparently a male.

*Nubipennis*, Fairm.—Described as close to *margini-ventris*.

*Telephoroides*, Fairm.—Apparently allied to *alterni-ventris*, *basiventris*, etc.; but with the legs entirely pallid. The type was apparently a male.

*Laesifrons*, Fairm.—The description of the head of this species is certainly suggestive of a male *Helcogaster*, and the elytra are coloured much as in some of the varieties of *H. varius*, but the abdomen and appendages are different.

*Atronitens*, Fairm. A small variable species, apparently belonging to *Helcogaster*; I have seen nothing which I can even doubtfully refer to it.

*Philonthoides*, Fairm.—Evidently a dingy species somewhat after the style of *pallidipennis*, but with the elytra darker and prothorax immaculate at sides.

The others may be tabulated as follows:—

- A. Elytra armed in the male.\*
- a. Armatura near apex.
- b. Armature knobbed at apex . . . *blackburnii*, Lea.
- bb. Armature thin and acutely pointed . . . . . *cristatifrons*, Fairm.
- bbb. Armature wide and obtusely pointed . . . . . *pravus*, n. sp.
- aa. Armature near base.
- c. Head bifasciculate in male.
- d. Head of male largely impressed and without distinct punctures . . . . *fasciculatus*, n. sp.
- dd. Head of male feebly impressed and densely and distinctly punctate . . . *uncinatus*, n. sp.
- cc. Head not fasciculate in male.
- e. Elytral armature pale and punctures dense and rather small . . . . . *armipennis*, Fairm.
- ee. Elytral armature dark and punctures sparser and much larger . . . . . *fossor*, n. sp.
- AA. Elytra unarmed in the male.
- B. Prothorax fasciculate and deeply transversely and longitudinally impressed in male . . . . . *rhytideres*, Lea.
- BB. Prothorax not as in *rhytideres*.

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\* In the few instances where I do not know the male I assume that the species does not belong to this division; although quite probably *frenchi* does do so, the female of that species, however, is very distinct.



- C. Prothorax very distinctly  
transversely strigose.
- f. Prothorax uniformly pale . *vigilans*, n. sp.
- ff. Prothorax with a wide  
black fascia . . . . *strigicollis*, n. sp.
- CC. Prothorax not strigose.
- D. Prothorax partly dark.
- g. Elytra entirely dark.
- h. Prothorax with large  
and distinct  
punctures, legs  
black . . . . *punctatus*, n. sp.
- hh. Prothorax with in-  
distinct punctures,  
legs pale . . . *telephoroides*, Fairm. ?
- gg. Elytra entirely pale or  
at most infusate  
in places.
- i. Elytra entirely pale *pallidipennis*, Macl.
- ii. Elytra longitudinally  
infusate . . . *marginiventris*, Fairm.
- ggg. Elytra with half or  
more of the surface  
black . . . . *elongatus*, Macl.
- DD. Prothorax entirely pale.
- E. Elytra entirely pale . . . *longus*, n. sp.
- EE. Elytra pale at apex . . *frenchi*, n. sp.
- EEE. Elytra entirely dark,  
or dark at apex.
- F. Basal joint of antennae of male much  
stouter than usual . . . . *cyaneipennis*, Macl.
- FF. Basal joint normal.
- G. Antennae subpectinate or very  
strongly serrate.
- j. Basal joint of front tarsi of male  
more than half their total  
length . . . . . *elegans*, n. sp.
- ij. Basal joint of male much shorter.
- k. Elytra partly pale.
- l. Pale markings longitudinal *longipes*, n. sp.
- ll. Pale markings transverse.
- m. Head partly dark . *variipennis*, n. sp.
- mm. Head entirely pale . *lepidus*, Lea (in part).

- nn.* Elytra entirely dark.\*
- n.* Abdomen with only one or two apical segments dark.
- o.* Intermediate segments maculate pale . . . *maculiventris*, n. sp.
- oo.* Intermediate segments entirely pale . . . *apiciventris*, Lea.
- nn.* Abdomen entirely dark, or with more than two apical segments dark.
- p.* Elytra very indistinctly punctate . . . *bifoveatus*, Lea.
- pp.* Elytra distinctly punctate.
- q.* Front tibiae entirely dark . . . . . *trimpessus*, n. sp.
- qq.* Front tibiae partly dark . . . . . *pictipes*, Lea.
- qqq.* Front tibiae entirely pale.
- r.* Four hind femora and tibiae pale . . . *rhagonychinus*, Fairm.
- rr.* Four hind femora and tibiae partly or entirely dark.
- s.* Head pale at base . . . . . *simulator*, n. sp.
- ss.* Head dark at base . . . *variipennis*, n. sp. (in part).
- GG. Antennae at most feebly serrate.
- H. Abdomen with at least one segment entirely pale.
- t.* Elytra pale at base . . . . . *atricapillis*, n. sp.
- tt.* Elytra entirely dark.†
- u.* Prothorax transverse . . . . . *basiventris*, Lea.
- uu.* Prothorax longer than wide.
- v.* Tip of abdomen dark . . . *alterniventris*, Fairm.
- vv.* Tip of abdomen pale . . . *longicollis*, Lea.

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\* In *maculiventris* the suture is sometimes pale at the base.

† In *alterniventris* the elytra are sometimes pale at the base, but never as in *apicalis*.

HH. Abdomen entirely dark, or without an entirely pale segment.

I. Femora partly pale.

w. Abdomen entirely dark . . . *facialis*, Fairm.

ww. Abdominal segments with pale margins.

x. Pale margins very narrow . . . *latipennis*, Lea.

xx. Pale margins of considerable width . . . *cervicalis*, Germ.

II. Femora entirely dark.

J. Muzzle pale.

y. Elytra dark, without metallic gloss . . . . . *invenustus*, Lea.

yy. Elytra metallic blue or green . . . . . *pallidifrons*, n. sp.

J. J. Muzzle dark.

K. Large and comparatively robust . . . . . *cyanopterus*, Boh.

KK. Very narrow and elongate . . . . . *angustatus*, Lea.

CARPURUS CERVICALIS, Germ., Linn. Ent., III, 1848, p. 183; Fairm., Journ. Mus. Godeffr., 1879, p. 110.

I have a specimen from S. Australia (from the Adelaide Museum) named as *cervicalis* and agreeing with the description of that species, except that it is larger ( $3\frac{1}{2}$  instead of  $2\frac{1}{2}$  German lines).\* Its head between the eyes has a roughly circular impression.

Two specimens from the Swan River may represent a variety; they have the elytra more of a coppery-green with the greater part of the head black† and more distinctly punctate at the base, in one specimen four, in the other five, of the basal joints of the antennae are red. There are also other slight discrepancies, but as these two specimens are males whilst the other is a female, I have not ventured to treat them as other than a possible variety.

*Hab.* S. AUSTRALIA: Yorke's Peninsula; VICTORIA: Chiltern.

\* *Brevipennis* (the preceding species in Germar's paper) is described as  $2\frac{1}{4}$  lines; I have never seen specimens less than 3 German lines in length.

† The red portion of the head varies considerably in *cervicalis*.

CARPHURUS CYANOPTERUS, Boh. (*Helcogaster*), Res. Eugen., 1858, p. 82, Pl. I, fig. 4.

The type of this species was described as having a small transverse black spot near the apex of the prothorax; two specimens before me have a blackish streak close to the front of the prothorax, but in all the others this segment is unclouded.

*Hab.* N. S. WALES: Sydney, Blackheath; VICTORIA: Macedon, Gisborne, Brighton, Loutit Bay; W. AUSTRALIA: Mount Barker.

CARPHURUS CYANEIPENNIS, Macl., Trans. Ent. Soc., N. S. Wales, II, p. 265; Fairm., Journ. Mus. Godeffr., 1879, p. 108.

Var. *aeneipennis*, Fairm., Pet. Nouv. Ent., 1877, p. 161; Journ. Mus. Godeffr., 1879, p. 107; *testaceipes*, Lea, P. L. S., N.S.W., 1895, p. 254.

The type of *cyaneipennis* is a male, and the basal joint of its antennae is very peculiar; I have seen no specimen agreeing with it in the colour of its elytra, but have myself described a form in which the elytra are of a dark brassy-green, at the time thinking it a distinct species. On comparing the types together, however, I was convinced that, despite the difference in the colour of the elytra, the two forms belonged to but one species.

The female has longer antennae than the male, with the basal joint smaller and not at all emarginate on its upper surface, and the apical six (to eight) joints infuscate. The female of this variety has been named *aeneipennis* by Fairmaire.

*Hab.* QUEENSLAND: Gayndah, Peak Downs, Port Denison; N. S. WALES: Tamworth, Forest Reefs, Whitton; S. AUSTRALIA.

CARPHURUS ELONGATUS, Macl., Trans. Ent. Soc., N. S. Wales, II, p. 206; Fairm., Journ. Mus. Godeffr., 1879, p. 105. (*Figs.* 168, 169.)

Although not mentioned in the description, the type has the inner angles at the apex of the elytra pale.

A male from Studley Park has the apical two-thirds of the elytra entirely dark; its head has a thick wheal-like

elevation, in front of which the surface is irregularly impressed; it is also rather smaller than the average male of *elongatus*.

*Hab.* QUEENSLAND: Gayndah, Peak Downs, Gympie, Bundaberg; N. S. WALES: Tweed River, Sydney, Forest Reefs, Oberon, Blue Mountains, Illawarra, National Park, Whitton; VICTORIA: Studley Park, Chiltern.

CARPURUS APICALIS, Macl., Trans. Ent. Soc., N. S. Wales, II, p. 266; Fairm., Journ. Mus. Godeffr., 1879, p. 106.

The type of this species is a male, and its head has a large median elevation narrowed in front so as almost to be pear-shaped.

There are two specimens before me which agree exactly\* with the description of *apicalis* and were previously tabulated by me as that species.† On comparing them with the type, however, I find that the male differs considerably in the sculpture of its head, and I have now formally described it under the name of *Helcogaster bacchanalis*.

CARPURUS AZUREIPENNIS, Macl., Trans. Ent. Soc., N. S. Wales, II, p. 266; Fairm., Journ. Mus. Godeffr., 1879, p. 108.

The type is a male, and the only specimen I have seen; in appearance it is close to the type of *cyaneipennis* except for its dark abdomen; but the head is very different, having a small subconical tubercle on each side near the eye, between these is a broad moderately long feebly elevated space. The description of the head in the original description is misleading, as I certainly cannot regard it as deeply bicanaliculate from any direction it is viewed from.

*Hab.* QUEENSLAND: Gayndah.

CARPURUS PALLIDIPENNIS, Macl., Trans. Ent. Soc., N. S. Wales, II, p. 267; Fairm., Journ. Mus. Godeffr., 1879, p. 105. (*Fig.* 92.)

The type of this species is a female. It is close to *marginiventris* but differs in having the head longer, the

\* Except that the prothorax by measurement is not really longer than wide, although apparently so at a glance.

† In that table the position assigned to *apicalis* will still hold good.

elytra immaculate and with somewhat smaller and denser punctures. Its elytra, as in that species, are clothed with fine whitish pubescence. Its abdominal segments are tipped with red.

There are two specimens before me which I believe to be males of the species; they were beaten from *Casuarina* close to the Parramatta River. They are rather smaller than the females and have the prothorax rather shorter, but in colour and in all characters except those subject to sexual variation they agree exactly with the type. Between the eyes is a slightly elevated space, on this are three tubercles, the median one of which is shaped somewhat as a top, of which the peg is long and directed towards the base; the lateral tubercles are smaller but more suddenly elevated and obliquely placed; seen from behind the tubercles appear to be placed in a transverse row and to be of equal size. The front of the prothorax has two small foveae, separated posteriorly but conjoined in front, in length they are about one-sixth of the length of the prothorax itself and conjoined are heart-shaped. The basal joint of the front tarsi is large and black-rimmed internally.

*Hab.* QUEENSLAND: Gayndah; N. S. WALES: Wollongong, Sydney.

CARPURUS MARGINIVENTRIS, Fairm., Journ. Mus. Godeffr., 1879, p. 106. (*Fig.* 93.)

I have only seen one specimen, a female, agreeing exactly with the description of this species; which is said to have a median black spot on the head, the prothorax with a longitudinal reddish vitta and the elytra with an indeterminate vitta on each and the apex infusate. The male (unknown to Fairmaire apparently) has (at least in the case before me) the dark markings at the sides of the prothorax much reduced in size and the median spot of the head absent; its elytra, however, are as in the female. The apex of its prothorax is depressed and slightly notched in the middle so that when seen directly from behind it appears to have projecting points. In both cases the sides of the prothorax are coarsely punctate.

*Hab.* N. S. WALES: Sydney, Gosford.

CARPHURUS FACIALIS, Fairm., *Pet. Nouv. Ent.*, 1877, p. 161; *Journ. Mus. Godeffr.*, 1879, p. 107.

A male from Sydney (the original locality) agrees with Fairmaire's description, except in having the tarsi (except at base) and the apex of tibiae infuscate.

*Hab.* N. S. WALES: Sydney.

CARPHURUS ALTERNIVENTRIS, Fairm., *Journ. Mus. Godeffr.*, 1879, p. 108; Lea, P. L. S., N.S.W., 1895, p. 251.

Of five specimens of this species before me two have the head entirely pale, the third has a transverse fascia between the eyes, the fourth has the sides and base dark, and the fifth has the head entirely dark except for a rather large indistinct subbasal spot.

*Hab.* QUEENSLAND: Peak Downs; N. S. WALES: Tweed and Clarence Rivers, Sydney.

CARPHURUS ARMIPENNIS, Fairm., *Journ. Mus. Godeffr.*, 1879, p. 109.

The type of this species was a male and from Queensland. It had the head 6-foveate, abdomen red and the elytra armed, with their suture reddish. This species is somewhat variable in colour and there are several others having the elytra of the males somewhat similarly armed, but differing in the colour of the abdomen, sculpture and clothing of head, and punctures of elytra.

The elytra are very variable in colour, occasionally being entirely dark, but often with the suture reddish, not infrequently there is a wide subbasal reddish fascia, or this fascia may be broken up into irregular spots, or with an extension reaching almost to the apex.

The female, as a rule, is larger than the male, has the head with several feeble impressions and the elytra simple; the latter are sometimes dark and sometimes their sides and suture are reddish, but I have seen no specimens in which they are fasciate.

*Hab.* QUEENSLAND: Cairns, Bowen, Port Denison.

CARPHURUS BASIPENNIS, Fairm., *l. c.*, p. 109.

I have previously identified and tabulated a South Australian insect as this species, and indeed it agrees very well with the original description; but it is so unlikely

that a South Australian insect should occur at Peak Downs in Queensland and at no intermediate places that I have for the present at least placed it amongst some undetermined forms. The South Australian species is a *Helcogaster*, a genus not acknowledged as distinct by Fairmaire.

*Hab.* QUEENSLAND: Peak Downs.

CARPHURUS FASCIIPENNIS, Fairm., *l. c.*, p. 109; Lea, P. L. S., N.S.W., 1895, p. 250.

I have previously identified and tabulated as this species an insect which, although it agrees fairly closely with the description, is, I am now convinced, not that species but an allied one. It is not here described, as the only specimen now before me has damaged antennae.

*Hab.* QUEENSLAND: Peak Downs.

CARPHURUS DIOPHTHALMUS, Fairm., *Pet. Nouv. Ent.*, 1877, p. 161; *Journ. Mus. Godeffr.*, 1879, p. 107.

There are two specimens (from Belmore and the Blue Mountains) which with some hesitation I refer to this species. In both specimens the antennae (not mentioned in the original description) have the three basal joints entirely and the next two partly pale, the rest being blackish. In one (a male) the head has a black spot at the base and the legs are entirely pallid; in the other (a female) the base of the head and the femora are infuscate.

*Hab.* QUEENSLAND: Gayndah.

CARPHURUS ANGUSTATUS, Lea, P. L. S., N.S.W., 1895, p. 250.

Although, as pointed out in the original description, this species is less robust than *cyanopterus*, it can be more readily separated from that species by its elytral punctures; of these in *angustatus* the majority are clearly cut, whilst in *cyanopterus* they are sparser and although many of them are larger there are but few that are at all clearly defined. In colour the two species are almost identical.

*Hab.* N. S. WALES: Tamworth; QUEENSLAND: Brisbane.

CARPHURUS LONGICOLLIS, Lea, *l. c.*, p. 252.

The male of this species has a thick and wheal-like but only moderate elevation on the head, the elevation



becoming irregular in front and marked by a small oblique tubercle on each side between the eyes.

A specimen representing a variety is in Mr. Froggatt's collection. It differs from the type in having the basal fourth of the elytra testaceous.

*Hab.* N. S. WALES: Gosford, Blue Mountains, Richmond River, Sydney, Galston; VICTORIA: Lilydale.

CARPHURUS LATIPENNIS, Lea, *l. c.*, p. 223.

This species is very close to *cervicalis*, but is larger, the elytra are wider with denser and more clearly defined punctures and the reddish margins to the abdomen are much narrower.

*Hab.* N. S. WALES: Forest Reefs, Sydney; VICTORIA: Brighton; W. AUSTRALIA: Swan River.

CARPHURUS APICIVENTRIS, Lea, *l. c.*, p. 257:

var. *dubius*, Lea, *l. c.*, p. 257.

There are three males of this species in the Macleay Museum and all have the legs (except parts of the tarsi) and the head entirely pallid.

*Hab.* N. S. WALES: Galston, Lane Cove, Otford.

CARPHURUS BIFOVEATUS, Lea, *l. c.*, p. 258.

The types of this pretty little species are both males; in appearance they are much like the females of *Balano-phorus janthinipennis*, but have the elytra very feebly punctate. The female has the front tarsi simple but the antennal serrations are much as in the males; of two specimens before me one has the front tibiae red and abdomen as in the males, the other has the front tibiae dark and four apical segments of abdomen black, the basal one being entirely (instead of partly) red.

*Hab.* N. S. WALES: Galston, Sydney.

CARPHURUS INVENUSTUS, Lea, *l. c.*, 1901, p. 482.

A female from Sydney differs from the type female in having the basal two-fifths of head deep black, and the prothorax almost without traces of the dark lateral patches.

*Hab.* N. S. WALES: Nowra, Sydney.

CARPHURUS RHYTIDERES, Lea, *l. c.*, p. 481. (*Fig.* 94.)

A male specimen sent to me from S. Australia (but without exact locality) by Mr. H. H. D. Griffith differs from the types in having the dark basal markings of the head reduced to a small spot, the apical patch of the prothorax much reduced in size and not transverse, the legs entirely pale and the apical two-thirds of the antennae infusate only. Its prothorax is without subfasciculate tufts of black hair and the latero-basal grooves are not so deep, but the ridges bounding them are higher and more like elongated tubercles than in the types.

*Hab.* W. AUSTRALIA: Geraldton; S. AUSTRALIA.

XANTHOCHROUS, Fairm., *Pet. Nouv. Ent.*, 1887, p. 161;  
*Journ. Mus. Godeffr.*, 1879, p. 105.

QUEENSLAND: Gayndah.

TACHYPOROIDES, Fairm., *Pet. Nouv. Ent.*, 1877, p. 161;  
*Journ. Mus. Godeffr.*, 1879, p. 105.

QUEENSLAND: Peak Downs.

CRISTATIFRONS, Fairm., *Pet. Nouv. Ent.*, 1877, p. 161;  
*Journ. Mus. Godeffr.*, 1879, p. 105; Lea, *P. L. S.*,  
*N.S.W.*, 1895, p. 247. (*Fig.* 107.)

N. S. WALES: Sydney, Galston; VICTORIA: Chiltern.

SEGMENTARIUS, Fairm., *Pet. Nouv. Ent.*, 1877, p. 161;  
*Journ. Mus. Godeffr.*, 1879, p. 106.

QUEENSLAND: Peak Downs.

NUBIPENNIS, Fairm., *Journ. Mus. Godeffr.*, 1879, p. 106.

QUEENSLAND: Peak Downs.

TELEPHOROIDES, Fairm., *l. c.*, p. 106.

QUEENSLAND: Peak Downs.

LAESIFRONS, Fairm., *l. c.*, p. 107.

QUEENSLAND: Peak Downs.

PHILONTHOIDES, Fairm., *l. c.*, p. 108.

QUEENSLAND: Rockhampton.

RHAGONYCHINUS, Fairm., *l. c.*, p. 108.

N. S. WALES: Sydney, Galston.

ATRONITENS, Fairm., *l. c.*, p. 109.

N. S. WALES: Sydney.

SCAPULATUS, Fairm., *l. c.*, p. 109.

QUEENSLAND: Rockhampton; N. S. WALES: Galston.

BLACKBURNI, Lea, P. L. S., N.S.W., 1895, p. 247. (*Fig. 108.*)

S. AUSTRALIA: Adelaide, Mount Lofty.

BASIVENTRIS, Lea., *l. c.*, p. 251.

N. S. WALES: Como.

LEPIDUS, Lea., *l. c.*, p. 255.

N. S. WALES: Galston.

PICTIPES, Lea., *l. c.*, p. 256.

N. S. WALES: Como, Belmore, Blue Mountains.

CARPHURUS PRAVUS, n. sp. (*Fig. 5.*)

♂. Flavous; base of head (both above and below), scutellum, a large space on each elytron, abdomen (except apical segment and apex and sides of the others), meso- meta- and apex of prosternum, coxae, femora (apex excepted) tarsi and seven terminal joints of antennae, black or blackish.

*Head* elongate; distinctly punctate and at base transversely strigose; largely excavated between eyes, the excavation divided into three parts, of which the median one is surrounded by an acutely raised and sinuous carina. *Antennae* rather short, 3rd-10th joints obtusely serrate, 11th longer than 10th and obtuse at apex. *Prothorax* distinctly longer than wide, side constricted near base. *Elytra* wider than prothorax, with small moderately dense punctures, sides from near base thickened and towards the apex semicircularly emarginate, near the hinder edge of emargination a short blade-like process projecting forwards and downwards. Basal joint of front *tarsi* small, shorter than 2nd, with a curved black-rimmed inner margin.

Length to apex of elytra 3, of abdomen 5 mm.

*Hab.* N. S. WALES: Jenolan (*A. M. Lea*).

The dark portion of the elytra is median in position and covers rather more than half the surface, it touches the suture but not the sides, the portion of the elytra behind it is paler than that before it. On the head the dark portion at the base is confined to the middle. The median of the three cephalic excavations is bilobed, and

surrounded by a narrow acutely raised continuous carina, almost in the shape of the figure 8. In *crisatifrons* the median excavation is of very different shape, being large at the base and open in front and seen from behind a much stronger and more acute elevation appears on each side of it. The armature of the elytra is also not sharp pointed and projects more downwards.

There is another species allied to *crisatifrons* but with the head crested as in the present species and the armature of elytra smaller. But the only specimens of it I have seen (and which are in the Macleay Museum) are not in condition to be described.

#### CARPHURUS FASCICULATUS, n. sp.

♂. Flavous; middle of base of head, elytra (except suture), tip of abdomen and base of each of the other segments (except the penultimate), meso- and metasternum, coxae four hind femora and seven terminal joints of antennae black; tarsi more or less dark. Head with two fascicles of black hairs, the fascicles conjoined at base; sides with straggling blackish hairs, distinctly denser in front of prothorax than usual.

*Head* elongate; indistinctly punctate, base transversely strigose; irregularly excavated between and behind eyes, the hinder excavation deep and quadrilobed, of these the median lobes are smaller but deeper than the others, and partly concealed by the fascicles. Antennae comparatively short and stout, 3rd-10th joints obtusely serrate, 11th the length of 10th and obtusely notched at apex. *Prothorax* distinctly longer than wide, not much narrower than head, apical two-thirds sub-parallel, thence rather rapidly diminishing in width to base. *Elytra* not much wider than front of prothorax; with dense moderately small but sharply defined punctures; sides at basal third suddenly and strongly incurved, thence gradually dilated towards apex. Basal joint of front *tarsi* as long as the two following combined, inner margin straight and black rimmed.

Length to apex of elytra 5, of abdomen 7 mm.

*Hab.* N. S. WALES: Richmond River (*A. J. Coates*).

Allied to *armipennis* but readily distinguished by the bifasciculate and differently impressed head and bicoloured abdomen. The bases of the fascicles (which are distinct from all directions) are on the lobe between the two sub-basal excavations. The elytra have a slight purplish gloss and the suture is very narrowly pale.

A variety from Gympie (from W. W. Froggatt) differs in being distinctly wider, with the elytra entirely dark and rather more strongly punctured and the head entirely pallid. Both sexes of this form are before me and the female differs from the male in having the head, elytra and tarsi simple.

Another variety (from the Clarence River) has a large space about the suture pallid and the basal spot on the head of large size.

CARPHURUS UNCINATUS, n. sp. (*Fig. 109.*)

♂. Flavous-red; elytra, abdomen (apex and sides of all the segments pale, except the apical which is entirely pale and the sub-apical which is dark at the base and sides) coxae, femora (except apical third of front pair) and seven terminal joints of antennae black; tarsi more or less infusate. Head with two fascicles (conjoined at base) of black hair; sides of prothorax in front with much longer, but not much denser hair than usual.

*Head* elongate; densely punctate, base transversely strigose; rather feebly impressed between eyes. Antennae much as in the preceding species. *Prothorax* not much longer than wide, sides slightly diminishing in width to apex and more noticeably to base. *Elytra* much as in the preceding species except that the punctures are slightly larger and the armature more pronounced. Basal joint of front *tarsi* almost as long as the two following combined, with a slightly curved black-rimmed inner margin.

Length to apex of elytra  $4\frac{1}{2}$ , of abdomen 7 mm.

*Hab.* N. S. WALES: National Park (*A. M. Lea*).

With the armed elytra and bifasciculate head of the preceding species, but the head very distinctly punctured, much less excavated between the eyes (that portion indeed being more convex than concave); prothorax shorter, elytra with denser and more rugose punctures and more of the legs and abdomen black. The fascicles are also somewhat different. The elytra have a slight bluish gloss.

A variety from Brisbane differs in having the apical fourth of the elytra reddish-flavous, this space being narrowly connected along the suture with a narrow triangular post-scutellar space of the same colour; not one of its abdominal segments is black, the basal ones being rather lightly infusate only. Its head has two oblique ridges on each side, an acute one commencing at the

middle of the eye and terminated at the fascicles and a more obtuse one, which immediately in front of the fascicles turns round and joins in with the acute one; at the outer angle of each band is a small circular impression.

The sculpture of the head is much the same in both the specimens before me, but is more distinct in the variety than in the type. It, however, cannot be seen distinctly except from certain directions.

#### CARPHURUS FOSSOR, n. sp.

♂. Flavous; sides of elytra (but not the extreme margins), metasternum, and seven terminal joints of antennae black or blackish.

*Head* elongate; indistinctly punctate, base very feebly transversely strigose; rather largely excavated, but the excavations not sharply defined. *Antennae* shorter but otherwise much as in the two preceding species. *Prothorax* not much longer than wide, very little narrower than head, base not much narrower than apex. *Elytra* not much wider than prothorax, with moderately dense and rather large clearly defined punctures, sides much as in *fasciculatus*. *Legs* comparatively short; basal joint of front tarsi as long as the two following combined, with a curved, black-rimmed inner margin.

Length to apex of elytra 4, of abdomen 6 mm.

♀. Differs in having the head very feebly impressed and with simple elytra and tarsi.

*Hab.* N. W. AUSTRALIA (types in Macleay Museum).

In the type male the legs, except for a slight infuscation of the tarsi, are entirely pale, in the female the four hind femora are dark. Regarding the dark portion of the elytra as the ground-colour, the pale discal marking commences very narrowly at the scutellum (itself pale), close behind it is suddenly dilated, then becomes sub-parallel to near the apex, and is suddenly terminated before the apex, the whole marking resembling the blade of a spade. The outer margins are very narrowly pale from the armature to the apex. The lower surface of the abdomen is also pale, except for a slight infuscation along the middle of the basal segments. On the head of the male there are about eight indistinct excavations, but except for a moderately distinct subbasal one there are no distinct costae.

Allied to the two preceding species, but readily distinguished from both by the nonfasciculate head. The impressions of the head are different to those of *armipennis*; the elytra have considerably larger and sparser punctures and the armed portion is dark instead of pale.

CARPURUS FRENCHI, n. sp.

♀. Flavous-red; base of head (both above and below), scutellum, greater portion of elytra, meso- meta- and front part of prosternum, abdomen (two apical segments and apex of each of the others excepted), coxae and femora (tips excepted) deep black; apical two-thirds of antennae and tarsi more or less infuscate.

*Head* elongate, sides and base punctate and base transversely strigose; feebly tri-impressed between eyes. Antennae moderately long and rather thin, obtusely serrate; 11th joint slightly longer than 10th and obtusely notched at tip. *Prothorax* distinctly longer than wide, sides rounded and towards base diminishing in width. *Elytra* gradually dilating towards apex, where each is separately strongly rounded; with rather small irregular punctures. Front *tarsi* simple.

Length of apex of elytra  $3\frac{1}{2}$ , of abdomen 5 mm.

*Hab.* VICTORIA (type in C. French's collection).

The dark basal marking of the head is slightly advanced along the middle. The apical fourth of the elytra is pale and there is a fairly large pale spot slightly inwards of each shoulder. The extreme base of the head is foveate in the middle, but this fovea is probably usually concealed by the overlapping prothorax.

In appearance somewhat resembling *blackburni* and possibly allied to that species (if it is the male will have armed elytra), but the elytra and abdomen differently coloured, and elytral punctures very different.

CARPURUS STRIGICOLLIS, n. sp.

♀. Black, elytra with a greenish or coppery-green gloss; parts of muzzle, a curved fascia connecting the eyes, base and apex of prothorax, extreme base of tibiae and lower surface of three basal joints of antennae red or reddish.

*Head* rather less narrowed towards base than usual; very densely punctate, base transversely strigose; feebly impressed between eyes. Antennae moderately long; 3rd-8th joints very feebly serrate, 11th

distinctly longer than 10th and obtusely pointed. *Prothorax* not much longer than wide, base and apex subequal; densely transversely strigose. *Elytra* gradually dilated towards apex, where each is separately rounded; densely and rugosely but not coarsely punctate. *Abdomen* with distinct punctures. *Front tarsi* simple.

Length to apex of elytra  $4\frac{1}{2}$ , of abdomen  $7\frac{1}{2}$  mm.

*Hab.* NEW SOUTH WALES: Jenolan (*J. C. Wiburd*); Victoria (National Museum); WEST AUSTRALIA: King George's Sound (Macleay Museum).

A very distinct species even apart from colour. The prothorax might be regarded as red with a dark subapical fascia occupying rather more than half the total area.

#### CARPHURUS VIGILANS, n. sp.

♂. Flavous-red, elytra black with a purplish gloss, front coxae pale except for an infusate spot on each; front tarsi and tibiae, four hind knees and apex of tibiae, two basal and parts of the 3rd and 11th joints of antennae pale, rest of legs and antennae black or infusate; middle of base of basal segments of abdomen infusate.

*Head* elongate, with scattered punctures, base transversely strigose; a deep curved impression between eyes, and a smaller impression in front, the space between elevated and with small acute tubercles. Eyes very large, about half the total width of head and rather more than half its total length. Antennae rather short and strongly serrate, 11th joint rounded at apex and slightly longer than 10th. *Prothorax* not much longer than wide, apex distinctly wider than base; densely transversely strigose. *Elytra* but slightly dilated towards apex, where each is rather strongly separately rounded; with dense, clearly defined but not very large punctures. *Front tarsi* rather short, basal joint shorter than the two following joints, with a strongly curved dark (but not black) rimmed inner margin.

Length to apex of elytra 3, of abdomen  $5\frac{1}{2}$  mm.

♀. Differs in having the head almost smooth, the eyes much smaller (though still of comparatively large size) and the tarsi simple.

*Hab.* QUEENSLAND: Kuranda (*H. H. D. Griffith* and *F. P. Dodd*), North Queensland (Macleay Museum).

On the inter-ocular elevation of the male there are five small conicle tubercles—two close to each eye, the other at the middle of its base. Seen from behind the head appears to have three small tubercles, of which the median is flat-topped; from the sides two tubercles can be seen, of which



the front one is twice the size of the other. The eyes of the male are considerably larger than in any other species here recorded, and in fact almost as large as in the male of *Balanophorus macleayi* or *scapulatus*. The prothorax is transversely strigose much as in the preceding species but the two have little else in common.

The type male is in Mr. Griffith's collection, the type female in the Macleay Museum.

CARPHURUS VARIIPENNIS, n. sp.

♂. Flavous or reddish-flavous; head (muzzle excepted), scutellum, elytra (wholly or in part), abdomen (sides and apex narrowly excepted), hind coxae, femora (front pair almost entirely pallid, the others only at the base), parts of tibiae and antennae (except basal joints), black; tarsi more or less infusate.

*Head* rather short, with several feeble impressions; feebly punctate and towards base feebly strigose. Antennae subpectinate, 11th joint clavate and considerably longer than 10th. *Prothorax* distinctly (but not much) longer than wide, apex and sides rounded, base feebly bilobed. *Elytra* slightly dilated posteriorly, each separately rounded at apex, densely and minutely punctate. Basal joint of front *tarsi* large and wide, as long as the two following joints combined, with a black-rimmed inner margin, 2nd joint inserted near base of first and rather strongly curved.

Length to apex of elytra  $3\frac{1}{2}$ , of abdomen 5 mm.

♀. Differs in having the head smoother, the eyes smaller, the antennal serrations less pronounced, the elytra wider and the front tarsi simple.

*Hab.* QUEENSLAND: Brisbane (*R. Illidge*).

As both sexes are before me, and the female has simple front tarsi, I can be certain that this species is not a *Balanophorus*; the serrations of the antennae, however, are more pronounced than usual, the ramus of each of the 7th–10th joints being longer than its supporting joint; and of the 4th–6th almost or quite as long. The elytral punctures though small are sharply defined. Of three specimens before me one has the apical fourth, one the apical half, whilst the other has the entire elytra dark; there is a certain amount of variation in the colour of the legs and the three basal joints of antennae are either entirely pale or pale only on their lower surface; the apical half of the 11th joint is obscurely pale.

The species is allied to *rhagonychinus* and *apiciventris*; from the latter it is readily distinguished by the colour of the abdomen, from the former by darker legs and considerably longer antennal rami of the male.

CARPHURUS SIMULATOR, n. sp.

♂. Reddish-flavous; an inter-ocular fascia, scutellum, elytra (these with a slight bluish gloss), metasternum, abdomen, hind coxae, four hind femora and tarsi, apex of four hind tibiae, and eight terminal joints of antennae black or blackish.

*Head* elongate, basal half punctate, base very indistinctly strigose, between eyes with a feeble curved elevation, behind which is a narrow impressed line; each side in front feebly depressed, the space between feebly elevated, flat and shining. Antennae moderately long; strongly serrate; 11th joint longer than 10th, its middle thickened and apex acutely pointed. *Prothorax* distinctly longer than wide, sides distinctly decreasing in width to base. *Elytra* considerably wider than prothorax, moderately dilated posteriorly; densely, rather minutely and subrugosely punctate. Basal joint of front *tarsi* large, about half their total length, with a slightly curved black-rimmed inner margin.

Length to apex of elytra 4, of abdomen 6 mm.

*Hab.* NEW SOUTH WALES: National Park (*A. M. Lea*).

The inter-ocular fascia although very distinct is not sharply defined on its edges; it is, however, marked on its hinder edge by a narrow, curved, impressed line.

The species is closer to *rhagonychinus* than any other known to me, but the legs are differently coloured and the antennal serrations, though strong, are much less pronounced.

CARPHURUS TRIMPRESSUS, n. sp.

♂. Black; elytra deep metallic blue; muzzle, prothorax, middle of lower surface of head, front coxae, base of front femora and parts of two basal joints of antennae flavous, or reddish-flavous.

*Head* moderately long; distinctly punctate, base rather strongly transversely strigose; a small but rather distinct impression between eyes and two larger and shallower ones in front. Antennae not very long, strongly serrate; 11th joint longer than 10th, thickened towards but obtusely pointed at apex. *Prothorax* considerably longer than wide, apex very little wider than base. *Elytra* distinctly dilated posteriorly, each rather feebly separately rounded,

with dense and rather minute but clearly defined punctures. Basal joint of front *tarsi* large, about half their total length, inner margin slightly curved.

Length to apex of elytra 4, of abdomen 6 mm.

*Hab.* VICTORIA: Monbulk (*H. H. D. Griffith* ex *Jarvis*), Moorabin (National Museum).

The partly red muzzle is different to that of *pallidifrons*, and the serrate antennae also distinguish from that species and *cyanopterus*; from the other species having serrate antennae the dark legs will readily distinguish it.

#### CARPHURUS LONGIPES, n. sp.

Flavous; part of elytra, metasternum, three apical segments of abdomen, four hind femora (extreme base excepted), hind tibiae (except at base), and eight terminal joints of antennae, black or almost so; tarsi more or less infusate.

*Head* short, indistinctly punctate; without distinct impressions. Antennae rather long; 4th-10th joints rather strongly serrate, 11th longer than 10th. *Prothorax* much longer than wide, apex distinctly wider than base. *Elytra* slightly dilated posteriorly, each feebly separately rounded at apex; with small, scattered, indistinct punctures. *Legs* considerably longer and thinner than usual; basal joint of front tarsi about half their total length, with a slightly curved black-rimmed inner margin.

Length to apex of elytra 4, of abdomen 6½ mm.

*Hab.* N. W. AUSTRALIA (type in Macleay Museum).

The dark portion of the elytra is very narrow at the base but is directed obliquely inwards so as to touch the suture at the apical third; in consequence there is a large elongate pale basal triangle. The apex of the apical joint of the antennae is pale.

I believe the specimen before me is a male *Carphurus*, but it is quite possibly a female *Balanophorus*.

#### CARPHURUS MACULIVENTRIS, n. sp.

♀. Flavous; elytra<sup>n</sup> deep metallic greenish- or purplish-blue; metasternum, apical segment of abdomen and a large spot on each of the 3rd and 4th, femora, four hind coxae and seven (or eight) terminal joints of antennae black; tarsi and four hind tibiae more or less infusate.

*Head* rather short; indistinctly punctate; a longitudinal impression on each side in front. Antennae rather short and strongly

serrate; 11th joint longer than 10th. *Prothorax* slightly transverse, wider than head and almost as wide as prothorax, apex and sides rounded, base feebly bilobed. *Elytra* moderately dilated posteriorly, each feebly separately rounded at apex; with moderately dense, rugose punctures. Front *tarsi* simple.

Length to apex of elytra  $4\frac{1}{2}$ , of abdomen  $7\frac{1}{4}$  mm.

*Hab.* N. W. AUSTRALIA (type in Macleay Museum).

Of two females before me one has the elytra entirely dark, the other has the suture pale for a short distance behind the scutellum. The lower surface of the four basal segments of abdomen are more or less dark along the middle. The elytral punctures are of moderate size and density, but are nowhere sharply defined. The body is unusually robust for a *Carphurus*.

#### CARPURUS PALLIDIFRONS, n. sp.

♂. Black; elytra deep metallic coppery-green (or blue); muzzle, prothorax, front coxae, knees and base of antennae, flavous or reddish-flavous.

*Head* rather short; with distinct scattered punctures, base transversely strigose; a large excavation between eyes, in the front two-thirds of which is a longitudinal space but little below the general level of head. Antennae long; 3rd-10th joints almost cylindrical, 11th longer than 10th and acutely pointed. *Prothorax* slightly longer than wide, almost as wide as head, base and apex subequal. *Elytra* rather narrow; at base very little wider than prothorax; with dense and rather small, subrugose punctures. Basal joint of front *tarsi* large, more than half their total length, with a curved inner margin.

Length to apex of elytra 4, of abdomen 6 mm.

♀. Differs in having the frontal impression less pronounced, the elytra wider and the tarsi simple.

*Hab.* VICTORIA: S. Wandin (— *Jarvis*), Jamor, Gisborne (*H. H. D. Griffith*), Preston (National Museum). N. S. WALES: Blue Mountains (*H. J. Carter*).

Of three specimens before me one male and one female have the two basal joints of antennae pale, in the other (a male) the five basal joints are pale. Most of the elytral punctures are confluent but a few are sharply defined.

The red muzzle, basal joints of antennae and knees readily distinguish this species from *cyanopterus* and *angustatus*;

the almost entirely dark legs and subcylindrical antennae from the other allied species.

**CARPHURUS ELEGANS, n. sp.**

♂. Flavous; elytra purplish-black; metasternum, apical segment of abdomen, hind femora (except at base) and apical half of antennae (but not the terminal joint), black or blackish; tarsi and four hind tibiae more or less infusate.

*Head* rather short; with several feeble frontal impressions; a feeble curved impressed line connecting the eyes; behind this some distinct punctures, but base not distinctly strigose. Eyes rather larger than usual. Antennae moderately long, strongly serrate; 11th joint distinctly longer than 10th and obtusely pointed. *Prothorax* distinctly longer than wide, sides and apex rounded, base feebly bilobed and almost the width of apex. *Elytra* longer than usual, at base distinctly wider than prothorax, dilated towards and each strongly separately rounded at apex; densely minutely and rugosely punctate. *Legs* longer than usual, basal joint of front tarsi about two-thirds of their total length, with the inner margin straight and black rimmed.

Length to apex of elytra 5, of abdomen  $8\frac{1}{2}$  mm.

*Hab.* QUEENSLAND: Kuranda (*H. H. D. Griffith*, ex *F. P. Dodd*, February 1904).

One of the largest and finest species of the genus, with the basal joint of the front tarsi much longer than in any other species of the allied genera and almost perfectly straight (a most unusual feature), in the four hind tarsi also the basal joint is of unusual length. Of two males before me one has the entire elytra dark, but in the other they are pale at the base within a line extending to each side from the hind margin of the scutellum.

**CARPHURUS LONGUS, n. sp.**

♀. Flavous, apical half of antennae infusate.

*Head* moderately long, with two feeble subfrontal impressions; indistinctly punctate; base feebly transversely strigose. Eyes rather above the usual size. Antennae long and thin; all the joints more or less subcylindrical and flattened, 10th and 11th almost equal in length. *Prothorax* distinctly longer than wide, apex and sides near apex rounded; base feebly bilobed and distinctly narrower than apex. *Elytra* longer than usual, dilated towards and each separately strongly rounded at apex; with very dense and minute but clearly

defined punctures. *Legs* long; tarsi simple, but in all the basal joint of unusual length.

Length to apex of elytra  $4\frac{1}{2}$ , of abdomen  $7\frac{1}{2}$  mm.

*Hab.* QUEENSLAND: Kuranda (*H. H. D. Griffith*, ex *F. P. Dodd*, February 1904).

A very distinct and almost entirely pale species in build of body much resembling the preceding, but the antennae and colours very different.

#### CARPHURUS ATRICAPILLIS, n. sp. (*Fig.* 167.)

♀. Pale reddish-flavous, apical third of antennae infusate; apical third of elytra and a transverse spot on each side of metasternum black. Elytra clothed with short whitish pubescence; elsewhere (and especially at the sides and apices of abdominal segments) with long, thin, blackish hairs.

*Head* longer than wide; feebly strigose at base, almost impunctate. Eyes large but not very prominent. Antennae long and thin, none of the joints transverse. *Prothorax* longer than wide, apex wider than base, with the front angles strongly rounded. *Scutellum* strongly transverse. *Elytra* larger than usual, dilated posteriorly; with dense, small, and rather clearly defined punctures. *Legs* long and thin.

Length to apex of elytra 6, of abdomen 9 mm.

*Hab.* QUEENSLAND: Cairns (*E. Allen*).

After the style of the two preceding species, but at once distinguished by the elytra, the black apical marking of these is not cut straight across, but is narrowly encroached upon along the suture and semicircularly emarginated between the suture and sides. The elytral punctures are rather larger than in *longus*, the eyes are not quite so prominent, and the antennae are slightly stouter.

#### CARPHURUS PUNCTATUS, n. sp.

♂. Black; elytra deep bluish-green; part of muzzle; parts of prothorax and lower surface of four basal joints of antennae more or less red.

*Head* short; strongly and irregularly punctate; a longitudinal impression on each side in front. Antennae rather short and very obtusely serrate. *Prothorax* slightly transverse, with rather large irregularly distributed punctures. *Elytra* rather strongly dilated posteriorly, each rather strongly separately rounded at apex; with dense rugose punctures of moderate size. *Abdomen* with distinct

punctures. *Legs* comparatively short; basal joint of front tarsi large, about half their total length, inner margin curved.

Length to apex of elytra 5; of abdomen 7 mm.

*Hab.* TASMANIA: Bellerive (type in H. H. D. Griffith's collection).

A large dingy species. On the head near the middle of the base there is an indistinct reddish spot, the middle of the apex of the prothorax has an equilaterally triangular reddish spot and this is very indistinctly connected with the base, of which about one-fourth is pale. I do not anticipate however that these markings are constant, but the species is a very distinct one apart from colour. In the only specimen before me the terminal joint of each antennae is missing.

Genus NEOCARPHURUS, Lea, P. L. S., N.S.W., 1898, p. 580.

In this genus the prothorax is so deeply impressed near the base, that seen from the side there appears to be no room for the passage of any substance from the mouth to the abdomen. The elytra are impunctate in all the species and the head is largely excavated and tuberculated in the male. The eyes when wetted or in living specimens are of a beautiful emerald green.

I am acquainted with all the described species, and these, with two new ones, may be tabulated as follows:—

A. Prothorax dark, except at extreme base.

a. Elytra of uniform colour . . . . . *sobrinus*, n. sp.

aa. Elytra pale at base . . . . . *basizonis*, Lea.

AA. Prothorax pale; at most maculate.

B. Elytra bicolorous.

b. Tarsi pale . . . . . *impunctatus*, Lea.

bb. Tarsi dark . . . . . *coatesi*, n. sp.

BB. Elytra unicolorous.

C. Elytra black . . . . . *tuberculatus*, Lea.

CC. Elytra pale . . . . . *chlorops*, Lea.

NEOCARPHURUS BASIZONIS, Lea, P. L. S., N.S.W., 1901, p. 483.

The type of this species is a female; another (in the Macleay Museum) has the elytral markings reduced to a comparatively small spot on each shoulder. Another

specimen in that museum is possibly the male; it has the head testaceous, largely excavated in the middle and with a large frontal elevation, which is emarginate posteriorly and longitudinally impressed towards its base, but convex and rounded in front (seen from behind the base of this elevation appears as two small tubercles). The base of its elytra (except about the scutellum) is pale, the pale portion indistinctly continued along the sides to the apical fourth, when it is diverted across the disc towards (but not to) the suture, so as to appear as an indistinct, interrupted, subapical fascia. At this place the elytra are quite symmetrically impressed (traces of these impressions can be seen in the type). The prothorax instead of being black and testaceous at the base, is of a dingy brown, and almost white at the base.

*Hab.* N. S. WALES: Nowra.

TUBERCULATUS, Lea, *l. c.*, 1895, p. 246 (*Helcogaster*).

N. S. WALES: Sydney.

IMPUNCTATUS, Lea, *l. c.*, 249 (*Carphurus*).

N. S. WALES: Forest Reefs.

CHLOROPS, Lea, *l. c.*, 1898, p. 580. (*Fig.* 95.)

N.W. AUSTRALIA: Behn River.

NEOCARPHURUS COATESI, n. sp.

♂. Deep glossy black; prothorax, basal third of elytra, four front femora and coxae, and base of hind femora of a reddish-brown; head and six basal joints of antennae somewhat paler, terminal joints infuscate. With a few moderately long scattered hairs.

*Head* irregularly and largely excavated; a strong trilobed elevation between eyes, the median lobe largest continued hindward and again elevated. *Antennae* simple, extending almost to apex of elytra, 11th joint long. *Prothorax* considerably longer than wide, sides decreasing in width from apex to base, near base strongly transversely impressed, base itself about half the width of apex. *Elytra* twice the width of the base of prothorax, and longer than prothorax and head combined; impunctate; sides towards apex largely but not suddenly impressed. *Legs* long and thin, basal joint of front tarsi dilated.

Length to apex of elytra 2, of abdomen 3 mm.

*Hab.* N. S. WALES: Sydney (*A. J. Coates*).



In the type specimen the apex of the abdomen appears to be terminated by three fascicles of hairs, much as it is in many of the *Staphylinidae*, a character apparently unique in the genus. Seen from the side the head bears a ridiculous resemblance to the head of a hen, the median tubercle standing for the comb. The basal joint of the front tarsi is rather smaller than is usual in the males of the allied genera, and owing to being much the same colour as the other joints is rather less distinctive.

*NEOCARPHURUS SOBRINUS*, n. sp. (*Fig. 6.*)

♂. Blackish-brown, abdomen black; legs piceous, in places diluted with testaceous; head and antennae (the terminal joints more or less infuscate) testaceous, extreme base of prothorax dull flavous, with pale, moderately long, scattered hairs.

*Head* wide largely and irregularly excavated; between antennae with a three-ridged elevated space (the spaces between the ridges concave), the median ridge longer than the others. *Prothorax* considerably longer than wide, sides diminishing in width from apex to near base, and then slightly dilated, near base less than half the width of apex and strongly transversely impressed, base itself feebly bilobed. *Elytra* much as in the preceding species. *Legs* long and thin; femora curved, basal joint of front tarsi large, with a black comb on its inner apex.

Length to apex of elytra  $1\frac{2}{3}$ , of abdomen 3 (circ.) mm.

*Hab.* N. S. WALES: National Park (*A. M. Lea*).

Seen from behind the head appears to be supplied with two small acute tubercles between the eyes, this appearance being due to the lateral ridges, the median one though longer than the others being on a lower level, so as to be invisible from behind.

Genus *HELCOGASTER*, Boh., Res. Eugen., p. 81.

I believe Fairmaire\* placed *Helcogaster* as a synonym of *Carphurus* and it probably is such †; but the majority of the species form a very natural group, the members of which are readily recognised by the naked eye alone, so that even if the genus is to be sunk in *Carphurus*, there

\* In a note I did not make a record of and cannot now find.

† The first species (*cyanopterus*) referred to it by Bohemann is quite an ordinary *Carphurus*.

can be no harm in referring species to it which can be readily separated from the majority of *Carphuri*. The main distinguishing feature of *Helcogaster*, as I regard it, is the large excavations which are usually present in the heads of the males (although in some of the species of *Carphurus* the head is also largely excavated); the species are also flatter, and usually with the elytra very indistinctly or not at all punctured, and the antennae are also considerably longer.

The male can always be distinguished by the basal joint of its front tarsi having a black, or at least very dark, inner rim; this joint also is usually strongly rounded on the inner side. The excavations of the head are often very large, being both wide and deep, the posterior outlines of the excavations are usually trisinate. On the front portion of the head there is often a large tubercle, this is often concave with more or less acute lateral ridges, and it is sometimes itself tuberculate; in a number of species it is present on the males even when the excavations are absent. The head when seen from behind or from the sides has often a very characteristic appearance and I have usually described these appearances as I believe them to be useful aids to the identification of most of the species; in looking at the head from behind the tubercles especially show up in a very distinctive way.

The clothing usually consists of long sparse hairs and in describing the species I have not considered it necessary to mention it. Some of the specimens examined were quite glabrous, but I have not even mentioned this as I think it quite likely that this was due in some cases to abrasion, as the hair appears to be but loosely fixed to the derm.

I previously described one species (*carinaticeps*) from a female only, and although this female is remarkably distinct I regret having done so, as I now think that no species of the genus should be described without knowing the male. The sculpture of the head is often so dissimilar, that without certain knowledge (such as by the examination of specimens taken *in cop.*), it is often quite impossible to mate the sexes; and the females of many species are so closely allied as to render their separation into species very difficult, even with the specimens before me; whilst from descriptions alone I believe it to be *impossible*; nevertheless the males, even although closely resembling each other

in colours, are very easily separated by the sculpture of the head.

With the exception of *brachypterus*, *impressifrons* and *carinaticeps*,\* which are commented upon below, the males† of all the described species may be tabulated as follows:—

- A. Prothorax strongly notched in front . . . *incisicollis*, n. sp.
- AA. Prothorax spinose in front . . . . *spinicollis*, n. sp.
- AAA. Prothorax entire at apex, or at most feebly bilobed.
- B. Basal joints of antennae distorted . . . *foveicornis*, n. sp.
- BB. Basal joints not distorted.
- C. Elytra very distinctly punctured . . . *punctipennis*, n. sp.
- CC. Elytra indistinctly or not at all punctured.
- D. Prothorax partly or entirely dark.
  - a. Head not largely excavated.
  - b. Head partly pale and distinctly punctured . . . *obliquiceps*, n. sp.
  - bb. Head entirely dark and impunctate . . . . . *gagatinus*, Lea.
  - aa. Head largely excavated.
  - c. Elytra partly pale . . . . *marginicollis*, Lea.
  - cc. Elytra entirely dark.
  - d. Prothorax raised in middle of apex.
  - e. Prothorax pale and strongly punctured on apical sides . . . . *ruficornis*, Lea.
  - ee. Prothorax entirely dark and without distinct punctures . . . . *canaliculatus*, Lea.
  - dd. Prothorax not raised in middle of apex.
  - f. Head with excavations transversely connected.
  - g. Head when seen from behind with a thin solitary tubercle . . . *parallelus*, Lea.

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\* And *punctilobus* and *bacchanalis*, which were described after the table was drawn up.

† I have not ventured to include any of the females in the table, although some of them are sufficiently distinct.

- gg. Head otherwise sculptured . . . . . *niger*, n. sp.  
 ff. Head with excavations not transversely connected.  
 h. Excavations closed behind . . . . . *ater*, n. sp.  
 hh. Excavations open behind . . . . . *basirufus*, n. sp.  
 DD. Prothorax entirely pale.  
 E. Head sometimes concave but never largely excavated.  
 i. With a large frontal tubercle.  
 j. Elytra abdomen and legs dark . . . . . *helmsi*, n. sp.  
 jj. Elytra abdomen and legs partly pale . . . . . *tuberculifrons*, n. sp.  
 ii. Without a large frontal tubercle.  
 k. Head concave between eyes *bilobus*, n. sp.  
 kk. Head convex between eyes.  
 l. Shoulders pale . . . . . *simpliciceps*, n. sp.  
 ll. Shoulders dark . . . . . *pulchripes*, n. sp.  
 EE. Head largely excavated.  
 F. Excavation trisinaute posteriorly.  
 m. Head entirely dark . . . . . *nigriceps*, n. sp.  
 mm. Head pale in front.  
 n. Greater portion of legs pale.  
 o. Head with a basal spot only . . . . . *maculiceps*, n. sp.  
 oo. Head with entire base dark . . . . . *fuscitarsis*, n. sp.  
 nn. Greater portion of legs dark.  
 p. Median tubercle decidedly raised above others . . . . . *tuberculatus*, n. sp.  
 pp. Median tubercle not so raised.  
 q. Median sinus narrower than the lateral ones . . . . . *varius*, Lea.

- qq. Median sinus wider than the lateral ones.
- r. Median sinus feebly curved . *decipiens*, n. sp.
- rr. Median sinus strongly curved *tropicus*, n. sp.
- FF. Excavation not trisinuate posteriorly.
- G. Excavations longitudinal and basal as well as median . . . . . *sulciceps*, n. sp.
- GG. Excavations transverse, or more or less rounded.
- H. Head longitudinally as well as obliquely strigose . . . . . *strigiceps*, n. sp.
- HH. Head transversely or not at all strigose.
- I. Head entirely dark . *insularis*, n. sp.
- II. Head entirely pale . *major*, Lea.
- III. Head partly dark.
- J. Antennae pale at base and apex . *foveiceps*, Lea.
- JJ. Antennae pale only at base.
- K. Elytra entirely dark . . . *concariceps*, Lea.
- KK. Elytra dark only at apex *rhyticephalus*, n. sp.

HELCOGASTER BRACHYPTERUS, Boh., Res. Eugen., 1858 , p. 82 ; Lea, P. L. S., N.S.W., 1895, p. 244.

I find that I was mistaken in my previous identification of this species, so that the remarks given in the above reference would best be taken as unwritten.

The species belongs to a group of which it is almost—(in some species quite)—essential that the sex (not mentioned by Bohemann) should be stated.

I have two distinct species which agree exactly with the original description and a number of others which agree

fairly well except as to "*Capite . . . tenuiter longitudinaliter canaliculatum.*"

*Hab.* N. S. WALES: Sydney.

HELCOGASTER IMPRESSIFRONS, Boh., Res. Eugen., 1858, p. 83.

Apparently allied *foveiceps*, but elytra paler and not uniformly coloured, and only the basal and apical joints of antennae pale.

*Hab.* N. S. WALES: Sydney.

HELCOGASTER FOVEICEPS, Lea, P. L. S., N.S.W., 1895, p. 237.

On a recently taken male of this species there is a narrow infusate fascia (slightly interrupted at the middle) just behind the middle of the prothorax.

*Hab.* N. S. WALES: Sydney.

HELCOGASTER GAGATINUS, Lea., *l. c.*, p. 238.

*Hab.* N. S. WALES: Sydney, Galston, Forest Reefs.

var. OCCIDENTALIS, n. var.

A male specimen from Rottnest Island (W. Australia) apparently represents a variety of this species; it differs from the type in being slightly smaller, with piceous instead of deep black elytra, and with the frontal impressions very feebly defined.

var. TASMANIENSIS, n. var.

Another apparent variety occurs in Tasmania; it has the legs entirely and the antennae almost entirely dark\*; the frontal impressions are rather less pronounced and the size is larger. The only male before me is 4 mm. in length, the females vary from 3 to 4 mm.

HELCOGASTER RUFICORNIS, Lea, *l. c.*, p. 239.

This species is very close to *canaliculatus*, and I was at one time inclined to think that the two forms belonged to but one species, but after a careful examination of the

\* Tasmanian specimens of many insects are noticeably larger and darker than their mainland fellows.

types (three of each), I cannot convince myself that such is the case. It differs from *canaliculatus* in having the antennae pale and the prothorax pale at the apex. Seen from behind the head appears to be in two irregular lobes with a deep channel between them. From behind the head of *canaliculatus* appears to have a rather shallow channel on each side in addition to the deep median one; but there may really be lateral channels in *ruficornis* that are concealed by the clothing. In both species from the sides there appear to be two tubercles over each eye (a small one at the middle and a larger one at the base), and the space between the median impression and each eye has a peculiar (almost spongiose) appearance. Both species were described as "almost impunctate," but in both there are some fairly distinct punctures on the head; whilst in *ruficornis* the apical sides of the prothorax are very decidedly punctate; in *canaliculatus* these parts are opaque but not distinctly punctured.

*Hab.* N. S. WALES: Sydney.

HELCOGASTER PARALLELUS, Lea, *l. c.*, p. 141; 1898, p. 580.  
(*Fig. 7.*)

The type of this species is probably not typical, as it has the prothorax entirely dark except for a slight trace of testaceous on each side of the base; two others before me\* have the base of the prothorax decidedly reddish.

A male also has the prothorax reddish at the base; its head is largely and deeply excavated between the eyes and in front. Seen from behind it appears to be largely excavated † with a thin, acute (almost spinose) median tubercle, and a large obtuse one close to each eye. Seen from in front the excavation appears to be very decidedly quadrisinuate posteriorly and supplied with three small conical tubercles in front.

The head of the female is more distinctly impressed than is usual in that sex.

*Hab.* W. AUSTRALIA: King George's Sound, Albany, ‡  
Karridale.

\* One of these was unfortunately described in 1898 as the male.

† In other species in which the head is fully as much or almost as largely excavated as in this, the head when seen from behind does not appear to be excavated at all, owing to the tubercles.

‡ Albany and King George's Sound are not necessarily the same; as Mr. Masters labelled all his captures both from the port itself

HELCOGASTER VARIUS, Lea, *l. c.*, 1895, p. 245.

var. PALLIDIPENNIS, Lea, *l. c.*, p. 246. (*Figs. 8, 165.*)

The elytra of this species are very variable in colour, ranging from entirely pale to entirely dark. The most common form perhaps and the one described by me as typical is that in which the sides at the base are pale, but the markings vary considerably in extent although the shoulders are always pale. A variety which I propose to name

var. NIGRIPENNIS, n. var.,

is perhaps almost as common; in this form the elytra are entirely dark. The variety in which the elytra are entirely pale I have seen only from Tamworth.

The various forms are all variable in size, are not sexual and freely pair with each other.

The species is abundantly represented in many parts of New South Wales, and there are many other species closely resembling both the typical form and the varieties, but as the head of the male is very peculiarly sculptured and quite constant in all the varieties (except to a slight extent in the depth of the excavations), I have considered it advisable to replace the original description of the head by a fuller one as follows:—

♂. Head transverse, with distinct punctures at base; largely excavated between the eyes, the excavation trisinate posteriorly (the hind margins almost level with an imaginary line connecting the base of the eyes); median sinus smaller than the others, in front of it a small conical tubercle which is behind a rather shallow frontal excavation, on each side of this a small excavation connected with the posterior one by a curved line. Eyes large but not especially prominent. Seen from behind the head appears to be supplied with five small tubercles—three of equal size median and conical, and a larger and obtuse one close to each eye. There are really six excavations on the head, three being larger than the others, but they are all more or less connected with each other and are all often

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and for some considerable distance inland as K. G. Sound; similarly Geraldton (there is also a Geraldton in Queensland) is not necessarily the same as Champion Bay, as Mr. Duboulay gave Champion Bay as the locality for insects that were collected many miles inland from that port. In the earlier days of Western Australia practically everything from that State was labelled "Swan River."



slightly obscured by pubescence. The extreme base of the head is transversely strigose, but this portion is usually concealed.

♀. Head less transverse and with smaller eyes, not excavated and with distinct punctures, basal third regularly convex, apical two-thirds flattened, with a feeble median longitudinal elevation in front.

It will be well for future entomologists before describing new species of the genus to try to identify this species; the sculpture of the head of the male is very distinct but the colours are very variable and each of its colour varieties is exactly or almost exactly represented in other species. It is widely distributed in New South Wales, and fully half of the specimens of the genus taken by myself or sent to me for examination belonged to it. The characteristic appearance of the male head is best seen from behind, the five tubercles being quite conspicuous and apparently (though really not so) in an even line. The head of the female, however, is much as in many other species.

*Hab.* N. S. WALES: Sydney, Galston, Little Bay, Mount Victoria, Jenolan, Queanbeyan, Clifton, Tamworth, Forest Reefs; VICTORIA: Mordialloc, Melbourne.

HELCOGASTER CARINATICEPS, Lea (*Carphurus*), *l. c.*, p. 248.

I was deceived by the sculpture of the head of the type of this species and noted it as a male *Carphurus*; its front tarsi are simple, however, and it is really a female *Helcogaster*. I do not know its male, but the tricarinate should render the female easy of recognition.

*Hab.* N. S. WALES: Sydney.

CANALICULATUS, Lea, P. L. S., N.S.W., 1895, p. 239.

N. S. WALES.

MARGINICOLLIS, Lea, *l. c.*, p. 240. (*Fig.* 166.)

N. S. WALES: Galston, Kurrajong, Blue Mountains.

CONCAVICEPS, Lea, *l. c.*, p. 242.

N. S. WALES: Galston, National Park, Mount Victoria.

MAJOR, Lea, *l. c.*, p. 243.

N. W. AUSTRALIA.

FUSCITARSIS, Lea, *l. c.*, p. 244.

N. S. WALES.

**HELCOGASTER OBLIQUICEPS**, n. sp.

♂. Black; head (except at base), basal half of antennae and parts of tibiae and tarsi testaceous; base of prothorax not quite as dark as the rest of its surface.

*Head* comparatively large, with small punctures at base, obliquely flattened and with coarse punctures between eyes. *Antennae* stout, rather short, the joints feebly serrate. *Prothorax* elongate, strongly transversely impressed at base. *Elytra* impunctate. Basal joint of front *tarsi* rounded and with a black inner margin.

Length to apex of elytra  $1\frac{1}{2}$ , of abdomen  $2\frac{1}{4}$  mm.

*Hab.* N. S. WALES: Jenolan (*J. C. Wiburd*).

Differs from the males of the other species having the prothorax black by its flattened non-excavated head and by the colours and punctures of same.

**HELCOGASTER NIGER**, n. sp. (*Fig. 9.*)

♂. Black; knees and parts of five basal joints of antennae obscure testaceous.

*Head* large, deeply and largely excavated between eyes, the excavation trisinate posteriorly, front with a large concave tubercle; base and sides transversely strigose and with a few scattered punctures. *Antennae* long, passing apex of elytra, none of the joints transverse. *Prothorax* feebly transverse, base strongly transversely impressed. *Elytra* almost impunctate. Basal joint of front *tarsi* about half their total length, rounded and with a black inner rim.

Length to apex of elytra 2, of abdomen 3 mm.

*Hab.* S. AUSTRALIA (type in Macleay Museum).

From the above the cephalic excavations are not unlike those of the males of *varius*, but seen from behind the head appears very different; and its sculpture is very different to all the others having the prothorax black. The large frontal tubercle from some directions appears to have its concavity opening behind into the deep median excavation, so that this then appears to be formed of four divisions of which the two lateral are larger than the two median. The lateral ones from some directions appear to be trilobed, so that the head then appears to have six instead of four irregular foveae. The elytra from some directions appear to be supplied with small wrinkled punctures, but these are never distinctly visible, and perhaps are really due to irregular contraction.

*HELCOGASTER ATER*, n. sp.

♂. Black; apical half of head, antennae (the apical half more or less infusate), knees and front tibiae testaceous.

*Head* rather large, densely and rather strongly punctate and transversely strigose at base; largely excavated between eyes, the excavations consisting of two large foveae, each of which is open in front and closed behind, the two separated by an elevated ridge. Antennae rather thin, extending almost to apex of elytra. *Prothorax* elongate, strongly transversely impressed at base. *Elytra* impunctate. Basal joint of front *tarsi* short and stout but with a black inner rim.

Length to apex  $1\frac{3}{4}$ , of abdomen  $2\frac{1}{2}$  mm.

*Hab.* W. AUSTRALIA: Donnybrook (*A. M. Lea*).

The large cephalic excavations of the male render this species very distinct.

*HELCOGASTER INCISICOLLIS*, n. sp. (*Fig. 96.*)

♂. Black; three basal joints of antennae testaceous; knees and part of front tibiae and *tarsi* very obscure testaceous.

*Head* with a transverse ridge between eyes, the ridge impressed in middle; each side of base with a large fovea or excavation, each side of middle of apex with a small rounded fovea. Antennae long and thin, passing apex of elytra. *Prothorax* longer than wide, produced and deeply notched in front, the produced apices slightly upturned; strongly transversely impressed at base. *Elytra* impunctate. *Legs* longer and thinner than usual. Basal joint of front *tarsi* not quite half their total length, rounded and with a black inner rim.

Length to apex of elytra  $1\frac{3}{8}$ , of abdomen  $2\frac{1}{2}$  mm.

*Hab.* W. AUSTRALIA: Swan River.

The distinctly notched apex of prothorax (probably confined to the male) renders this species remarkably distinct, its antennae also are larger than in any other species here recorded. The clothing of the head somewhat obscures its sculpture, but this is of a very unusual nature, as the largest excavations are basal instead of median. Seen from behind the head appears to be supplied with five small subconical equidistant tubercles; but of these two are really the points of the produced apices of the prothorax.

## HELCOGASTER BASIRUFUS, n. sp.

♂. Black; apical half of head, prothorax (a large transverse subapical blotch black and prosternum tipped in front with black), front tibiae, parts of front femora and tarsi, and two basal joints of antennae reddish-flavous; apex of antennae, four hind knees and parts of middle tarsi obscure testaceous.

*Head* subelongate; with distinct scattered punctures and with longitudinal and oblique excavations and elevations at the middle phase. Antennae extending to middle legs. *Prothorax* slightly longer than wide, apex very feebly lobed and base feebly transversely impressed. *Elytra* with a few scattered and indistinct punctures. Basal joint of front *tarsi* less than half their total length, but rather strongly inflated, rounded, and with a black inner rim.

Length to apex of elytra 3, of abdomen 5 mm.

*Hab.* W. AUSTRALIA: Geraldton (*A. M. Lea*).

The colour of the prothorax is somewhat after the style of *parallelus* (the black patch does not quite extend to the extreme apex or sides, however), but the sculpture of the head is totally different, both from that species and from any other here recorded. In the middle of the head is a longitudinal carina about one third of its total length, between this and each eye is a narrow curved carina and close to each eye another but less distinct one, the spaces between being more or less deeply excavated; of the excavations the largest ones are the lateral; each of these runs to a point at the front end of each eye, but posteriorly widens out so that the two become united; marking the position of their junction is a small impression connecting them with the median ones. Seen from behind the head appears to have three small median subconical tubercles. The two basal joints of antennae are distinctly paler than the following ones, the three next being very dark, the succeeding joints then gradually become paler but the apical joint is darker than the basal ones. In one of the two specimens before me the front tibiae are slightly infusate in middle.

## HELCOGASTER PUNCTIPENNIS, n. sp.

♂. Flavous; apical half of elytra purplish-black, six apical joints of antennae and tip of abdomen black; metasternum more or less infusate.

*Head* with scattered punctures and at base transversely strigose; concave but not largely excavated between eyes; in front with a large tubercle. *Antennae* rather long and thin, but not extending to apex of elytra. *Prothorax* longer than wide, base considerably narrower than apex and shallowly transversely impressed; a few small punctures at the sides in front. *Elytra* long; densely covered with rather large, sharply defined punctures. Basal joint of front *tarsi* about half their total length and with a dark inner rim.

Length to apex of elytra  $2\frac{1}{2}$ , of abdomen  $3\frac{3}{4}$  mm.

♀. Differs in being larger; head with more distinct punctures, without tubercle and absolutely bifoveate in front; and the front *tarsi* simple.

*Hab.* QUEENSLAND: Cairns (types in Macleay Museum).

Placed in *Helcogaster* on account of the concave head and long antennae, but the strongly punctured elytra (which alone readily distinguishes it from all recorded species of *Helcogaster*) would seem to imply that it belongs to *Carphurus*. The apical tubercle on the head of the male from above appears to be obtuse, ovate, and with a large median puncture; from the sides it appears as a narrow abrupt ridge, and from behind as a small acute tubercle.

#### HELCOGASTER TUBERCULIFRONS, n. sp. (Fig. 10.)

♂. Reddish-flavous. Seven terminal joints of antennae, apical three-fifths of elytra and two apical segments of abdomen black; metasternum and two apical joints of *tarsi* infusate.

*Head* with small punctures and at base transversely strigose; feebly impressed or flattened between eyes and on each side in front; with a large trilobed tubercle. *Antennae* rather long and thin, but not passing hind coxae. *Prothorax* slightly longer than wide, towards base with a large shallow impression, base distinctly narrower than apex. *Elytra* elongate; almost impunctate. Basal joint of front *tarsi* with a black inner rim.

Length to apex of elytra  $2\frac{1}{4}$ , of abdomen  $3\frac{1}{4}$  mm.

*Hab.* N. S. WALES: Illawarra (*H. J. Carter*).

From above the cephalic tubercle appears to be trilobed, the frontal lobe with the apex almost between antennae, the hinder lobes almost exactly midway between the eyes, the hinder lobes are connected with the frontal one but not with each other; from behind the head appears to have a small bilobed median tubercle, from the sides a

narrow median abruptly terminated ridge. In colour it resembles *apicalis*, *rhyticephalus* and *punctipennis*, from the latter distinguished by the almost impunctate elytra and from all three by the differently sculptured head.

**HELCOGASTER RHYTICEPHALUS, n. sp.**

♂. Flavous or reddish-flavous; a subtriangular basal spot on head, apical third (or fourth) of elytra, scutellum, metasternum, abdomen (all the segments more or less red at apex and sides) coxae, base of femora, two apical joints of tarsi and seven terminal joints of antennae black or blackish.

*Head* with scattered punctures, at base transversely strigose; largely excavated between eyes, the excavation bisinuate posteriorly, the two lobes separated by a projecting median tubercle, middle near apex with a large concave tubercle. *Antennae* thin, almost extending to hind legs. *Prothorax* slightly longer than wide, moderately strongly impressed at base. *Elytra* almost impunctate. Basal joint of front *tarsi* comparatively short, with a black inner rim.

Length to apex of elytra  $2\frac{1}{4}$ , of abdomen 4 mm.

♀. Differs in being larger, the head with more numerous and evenly distributed punctures, with a flattened space in front, which is marked at the sides and posteriorly by a curved impression; the eyes are smaller, placed nearer the front and the front tarsi are simple.

*Hab.* N. S. WALES (Macleay Museum): Sydney (*H. J. Carter*), Bulli (*A. M. Lea*).

The very largely and peculiarly excavated head of the male very readily distinguishes it from all those species having somewhat similar colours. The excavation occupies the entire space between the eyes, and about one half of the length of the head; the frontal tubercle is unusually large and posteriorly is continued as a process which overhangs the excavation and almost meets the median projecting tubercle, the latter is rendered more distinct by being tipped with black and with black pubescence. From behind the head appears to be composed of three large lobes, the median being composed of the two tubercles and the lateral bounded externally by the eyes. The dark parts of the femora vary in extent being sometimes noticeable at the extreme base only, whilst at other times they leave but little more than the knees reddish. The abdomen might be regarded as red with each of the segments clouded with black. The dark apical portion of

the elytra varies in extent and although usually is not always sharply defined.

**HELCOGASTER SULCICEPS, n. sp.**

♂. Flavous; scutellum, elytra (shoulders and part of the sides behind them excepted), metasternum, abdomen and from six to eight terminal joints of antennae black or blackish; apical joints of tarsi slightly infusate.

*Head* with three longitudinal impressions between eyes and at base; with a distinct median tubercle. Antennae scarcely passing middle coxae, some of the joints feebly transverse. *Prothorax*: about as long as the width at apex, which is considerably wider than base; strongly impressed at base. *Elytra* impunctate. Basal joint of front *tarsi* comparatively short, with a black inner rim.

Length to apex of elytra 2, of abdomen 3 mm.

*Hab.* N. S. WALES (type in Macleay Museum).

Almost in the exact middle of the head is a raised tubercle, seen from the sides this appears as a flattened ridge, but which is produced acutely backwards; immediately behind the tubercle is a comparatively shallow impression which is continuous to the base, its sides bounded by obtuse ridges; between each of these and the eye is a deep, curved, wide impression, which is continued to just in front of the eye. From behind the head appears flat, with a distinctly elevated median tubercle, which is flat topped and slightly produced on each side. In some lights and from certain directions the head appears to have five impressions instead of three, but this appearance is deceptive. The pale markings at the sides occupy about one-third of the length of the elytra, but although very distinct at the shoulders are not sharply defined behind. The elytra are much as in some of the varieties of *varius*, but the head and legs are differently coloured and the sculpture of the head is very different to that of any other species here recorded. *C. laesifrons* (which is possibly a *Helcogaster*) may be allied but its head is differently sculptured and its abdomen has the terminal segments pale.

**HELCOGASTER SIMPLICICEPS, n. sp.**

♂. Reddish-flavous; scutellum, elytra (a large patch on each shoulder excepted), metasternum, abdomen, parts of four hind coxae,

and apical half of antennae black ; intermediate joints of the latter and apical joints of tarsi more or less infuscate.

*Head* without excavations ; slightly flattened and with very distinct punctures between eyes. Antennae thin, almost extending to hind coxae. *Prothorax* elongate, strongly impressed at base. *Elytra* almost impunctate. Basal of joint *tarsi* moderately long, slightly rounded and with a black inner rim.

Length to apex of elytra  $1\frac{3}{4}$ , of abdomen 3 mm.

*Hab.* N. S. WALES : Gosford (*A. M. Lea*), Kurrajong (Macleay Museum).

The simple head of the male (in shape much as that of *obliquiceps*) readily distinguishes it from most species of the genus ; the elytra are coloured much as in some of the varieties of *varius*. The colours much resemble those of the preceding species except that a greater space in each shoulder is pale, but in that species the head is largely excavated.

A specimen (evidently the female) differs from the two males before me in having the head smaller, more convex and with smaller and sparser punctures ; its elytra also have their basal marking larger and continuous across the suture.

• **HELCOGASTER BILOBUS**, n. sp.

♂. Black ; apical half of upper and the entire lower surface of head, prothorax, shoulders and a short space behind them, knees (largely), base of tarsi, and basal joints of antennae, flavous or reddish-flavous.

*Head* distinctly and almost regularly punctate, base transversely strigose, concave but not largely excavated between eyes and without frontal tubercle. Antennae long and thin, almost extending to hind coxae. *Prothorax* moderately elongate, strongly impressed at base. *Elytra* with sparse and very indistinct punctures. Basal joint of front *tarsi* comparatively small but with a black inner rim.

Length to apex of elytra  $2\frac{1}{2}$ , of abdomen 4 mm.

♀. Differs in being larger, the head more convex, with a scarcely traceable median impression the eyes smaller, more to the front and the front tarsi simple.

*Hab.* N. S. WALES : Blue Mountains (*E. W. Ferguson*), Mount Victoria, National Park (*A. M. Lea*) ; VICTORIA : S. Wandin, Monbulk (— *Jarvis*).

The head of the male is not so simple as in *simpliciceps*



and *obliquiceps* but is much less excavated than usual, the concave portion has a trisinate outline posteriorly; seen from behind it appears to be in two distinct lobes and no tubercles appear (nor in fact are there any such). The strigosity is more distinct at the sides than elsewhere. Although at first sight apparently a variety of *varius* the shape of the head of the male is so totally different as to render the two species easily separable.

**HELCOGASTER MACULICEPS, n. sp. (Fig. 11.)**

♂. Flavour or reddish-flavour; a spot in middle of base of head, scutellum, elytra (except at base and the sides to beyond the middle), metasternum, abdomen (to a variable extent) and apical two-thirds of antennae, black or blackish.

*Head* with basal half distinctly punctate and (especially at the sides) transversely strigose; largely excavated between eyes, the excavation trisinate posteriorly, the median sinus deeper and wider than the lateral; middle of excavation with a small obtuse tubercle, front with a large concave tubercle. Antennae long, but not very thin, almost touching hind coxae. *Prothorax* longer than wide, rather widely and shallowly impressed towards base. *Elytra* almost impunctate. Basal joint of front *tarsi* about one-third of their total length, with an inner black rim.

Length to apex of elytra  $2\frac{3}{4}$ , of abdomen  $4\frac{1}{2}$  mm.

♀. Differs in having the head less transverse, the eyes smaller and more frontal in position, a semicircular impression in front, the antennae shorter and thinner, the prothorax shorter and the front *tarsi* simple.

*Hab.* N. S. WALES: National Park, Bulli (*A. M. Lea*).

The black spot on the head is slightly variable in size, but apart from this is quite constant and distinct in both sexes, so that the female is more distinct than usual in the species and varieties having similarly coloured elytra. The legs (except for a slight infuscation of the *tarsi*) are frequently almost entirely pale, but often have the femora (to a variable extent) dark at the base, and occasionally the tibiae are infuscate in the middle. In the female the head often has a black patch on its lower surface. The abdomen varies from being almost entirely dark to dark only along the middle, and both upper and lower surfaces are variable. In colour of elytra it is much like the typical form of *varius*, but (apart from colour of head and

legs) the excavation of the head of male with a suddenly elevated tubercle in its middle; and its median posterior sinus very wide, and the lateral ones indistinct; seen from both behind and the sides also it appears very different. The head is nearer to that of *fuscitarsis* than any here recorded, but is not the same, and with the elytra, is differently coloured; the prothorax also is decidedly longer. Seen from behind the head appears concave in the middle, but on raising the point of view the median tubercle (which is flat-topped) appears, at a slightly higher elevation a small tubercle appears on each ridge of it; these being really the tips of the frontal tubercle, which from in front is seen to be of semilunar shape.

**HELCOGASTER FOVEICORNIS, n. sp.** (*Figs. 78, 79.*)

♂. Reddish-flavous; basal half of upper surface of head, metasternum, parts of antennae, of tarsi, and of four hind tibiae, more or less infusate; elytra and abdomen deep black.

*Head* wider than usual; very indistinctly punctate; moderately convex, with a feeble longitudinal impression in middle and a feeble one on each side of apex. Antennae long, 1st joint (except at base) very stout, its outer apex foveate, 2nd much smaller than 1st, very narrow at base and then suddenly inflated on one side, 3rd and 4th comparatively stout, the others gradually decreasing in width. *Prothorax* as long as the width at apex, apex considerably wider than base; with a strong basal impression. *Elytra* impunctate. Basal joint of front *tarsi* about half their total length, with the inner margin strongly rounded and black rimmed.

Length to apex of elytra 2, of abdomen 3 mm.

*Hab.* N. S. WALES: National Park (*A. M. Lea*).

Readily distinguished from all the species here recorded by the basal joints of antennae, which in appearance much resemble those of the males of certain species of *Laius*. There are four males before me, of these one has the apical half of the antennae almost black, in another the apical third is moderately infusate, whilst in the two others the apical joints are but little darker than the others. In two of the specimens the basal joint has a dark spot. The scutellum is pale, an unusual feature in a species having the elytra entirely dark.

**HELCOGASTER INSULARIS, n. sp.**

♂. Deep black, elytra with a slight bluish or greenish gloss;

prothorax reddish ; parts of three basal joints of antennae and of mandibles obscure testaceous.

*Head* densely punctate, at base and sides transversely, in front longitudinally strigose ; largely excavated between eyes the excavation irregularly bilobed, with posteriorly a bi-sinuate outline, and an acute projecting median tubercle. Antennae extending to apex of elytra, more strongly serrate than usual. *Prothorax* not much longer than wide, strongly impressed at base. *Elytra* with shallow, rugose, indistinct punctures. Basal joint of front *tarsi* strongly rounded and about half their total length.

Length to apex of elytra 3, of abdomen 5 mm.

♀. Differs in being larger ; the head longer, with a shallow (but for the sex rather deep) impression between the eyes, the impression very irregular in front, the antennae shorter and thinner, with the serrations less strongly pronounced ; prothorax slightly transverse elytra larger and the front tarsi simple.

*Hab.* TASMANIA (*Aug. Simson*): Frankford, Huon River, Stonor, Mount Wellington (*A. M. Lea*), Hobart (*H. J. Carter*).

In the male the hind edge of the cephalic excavation is not emarginate in the middle but has a strong projecting lobe, a character at once distinguishing it from most of the species here recorded. In *conconciceps* the excavation is slightly lobed in the middle but the lobe scarcely interferes with the general sweep of the excavation, and the head when seen from behind appears concave, whilst in the present species it appears convex ; *conconciceps* is also a shorter and wider species, with shorter and less serrate antennae and legs not entirely black. The excavation is very irregular, and from some directions its posterior margin appears to be quadrisinuate, this appearance being due to a feeble elevation between the tubercles and each eye ; the frontal tubercle is so concave as to be practically absent, but its sides are marked by acute ridges which slightly converge posteriorly ; between the tips of these ridges is an acutely raised carina. Seen from the sides the head appears to have a conic tubercle, which is deeply cleft in the middle. From behind, as the point of view is raised, one, three, or five small and obtuse elevations appear. The elytra are rather densely punctate, but the punctures are nowhere sharply defined, and in fact are so rugose that they can scarcely be regarded as true punctures at all. The front tibiae are occasionally obscurely diluted with testaceous.

The impressions on the head of the female are slightly variable and on some specimens appear as a shallow impression on each side between the eyes, with several smaller ones or small obsolete foveae in front.

This and all the following species so strongly resemble each other in colour of prothorax, elytra and abdomen, and generally of head, antennae and legs, that practically the only reliable feature on which to differentiate them is the sculpture of the head of the male. The previously described *fuscitarsis*, *brachypterus* and *carinaticeps* and one form of *varius* are also similarly coloured, whilst *convexiceps* is somewhat similar and *major* might be regarded as just outside of the group. I have females of many other series belonging to the group, and probably of some of those of which only the males are now described.

#### HELCOGASTER T-TUBERCULATUS, n. sp. (*Fig. 12.*)

♂. Black; elytra with a slight bluish or greenish gloss; apical half of upper and the whole lower surface of head, prothorax, and three basal joints of antennae reddish-flavous, knees and 3rd and 4th joints of antennae obscure testaceous.

*Head* distinctly punctate, base transversely strigose; largely excavated between eyes, the excavation posteriorly trisinate; in middle of excavation a suddenly raised flat-topped tubercle, on each side in front of this to the apex a narrow acute ridge. Antennae not extending to hind legs. *Prothorax* longer than wide, shallowly impressed at base. *Elytra* almost impunctate. Basal joint of front *tarsi* moderately long, rounded and with a black inner rim.

Length to apex of elytra  $3\frac{1}{2}$ , of abdomen  $5\frac{1}{2}$  mm.

*Hab.* N. S. WALES: Jenolan (*A. M. Lea*).

Seen from behind with five elevations on the head as in *varius*, but the median one of different shape, being narrow at its base and at the top widened so as to somewhat resemble the letter T, it is also decidedly elevated above the others. *Fuscitarsis* (which from some directions appears to have the head similarly sculptured) when seen from behind appears to have but one tubercle on the head, and in addition has the legs paler and the prothorax shorter. The excavations are closed posteriorly but open in front; the frontal tubercle (except for the ridges marking its sides) is entirely absent. There are two males before me.

**HELCOGASTER TROPICUS, n. sp.**

♂. Colour as in the preceding species except that rather less of the base of the head is black, that its under surface is somewhat obscure, and that more of the four front tibiae are diluted with testaceous. The head is somewhat similarly sculptured but the median sinus is much wider the median elevation shorter (so as not to appear elevated above the rest when the head is viewed from behind) and obtusely conical, the frontal tubercle present (but still very concave), and its sides marked by subtubercular elevations instead of ridges. The antennae are somewhat thinner and the front tarsi are stouter.

Length to apex of elytra 3, of abdomen 5 mm.

*Hab.* QUEENSLAND: Cairns (type in Macleay Museum).

Seen from behind the head appears to have a small tubercle close to each eye and an obtuse median one, on making the range of view more oblique the median tubercle appears to divide into three—a rounded one, on each side of which is a small subconical one. The median sinus of the head occupies about two-thirds of the space between the eyes, whilst in the preceding species it occupies only about half the space. There are two males before me.

**HELCOGASTER NIGRICEPS, n. sp.**

♂. Deep black, elytra with a bluish gloss; prothorax and two basal joints of antennae reddish-flavous; parts of coxae and trochanters, base of front femora, and the extreme sides of basal segments of abdomen obscure reddish-brown.

*Head* densely punctate, the sides transversely strigose; largely and deeply excavated between eyes, in middle with a small subconical tubercle. Antennae not very long, just passing middle coxae. *Prothorax* scarcely longer than wide, sides strongly rounded, base feebly impressed. *Elytra* more dilated towards apex than usual; with small but moderately distinct punctures. Basal joint of front tarsi about half their total length, rounded, and with a deep black inner rim.

Length to apex of elytra  $2\frac{1}{2}$ , of abdomen  $3\frac{1}{2}$  mm.

*Hab.* N. S. WALES: Nowra (type in Macleay Museum).

The entirely dark head distinguishes from *T-tuberculatus*, *tropicus*, and the others having the cephalic impression trisinate posteriorly; the median elevation is shaped somewhat as in *T-tuberculatus* but is below instead of

above the general level, whilst the outline of the body resembles that of *concaviceps*. The excavation is nowhere open, and its whole outline is quadrisinuate. The median frontal sinus is narrower than the posterior one, in consequence the lateral ones are more apical than basal; the median basal sinus in fact is so wide that the base might be quite fairly regarded as unisinuate. From behind from one point of view there appear to be three small tubercles below the level of the non-excavated portion. From the sides there appears to be a small tubercle close to each eye. The elytral punctures are small, not very dense, and many of them are rugose, but from certain directions a few of them are sufficiently clear.

**HELCOGASTER DECIPIENS, n. sp.**

♂. Deep black, elytra with a slight greenish gloss; a subtriangular apical portion of head, prothorax, and two basal joints of antennae reddish-flavous; extreme base of tibiae testaceous.

*Head* with rather small punctures in places; base and sides more distinctly strigose than usual; largely excavated between eyes, the excavation trisinuate posteriorly; frontal tubercle large and concave, its sides in front thickened and subtuberculate, its base in middle marked by an acute conical tubercle. Antennae (and especially the apical joint) stouter than usual, terminated half-way between middle and hind coxae. *Prothorax* about as long as wide, apex very feebly impressed. *Elytra* almost impunctate. Basal joint of front *tarsi* not very large, but strongly rounded.

Length to apex of elytra 3, of abdomen 5 mm.

*Hab.* TASMANIA: Swansea (*A. M. Lea*).

The cephalic excavations, though large, are rather smaller than usual. The median sinus wide and without a projecting median lobe, elytra smoother and front of head pale readily distinguishes it from *insularis* (the common Tasmanian species) to which in colour and general appearance it bears a striking resemblance. The width alone of the median sinus at once distinguishes it from *varius*, although when viewed from behind the head appears to have five tubercles, but of these the median one is in a different position. From the others having the base of the excavation trisinuate it can be distinguished by the median tubercle (which is very distinct from the sides) not rising from its own base but forming part of the frontal elevation. In the unique specimen before me the extreme

sides of the elytra are almost white, but I attach no importance to this.

**HELCOGASTER STRIGICEPS, n. sp.**

♂. Deep black; elytra with a slight bluish gloss; prothorax reddish-flavous; four basal joints of antennae (wholly or in part) and extreme base of tibiae, testaceous.

*Head* with less prominent eyes than usual; densely strigose both obliquely and longitudinally; irregularly excavated on apical half. Antennae rather short, scarcely passing middle coxae. *Prothorax* slightly transverse, not impressed at base. *Elytra* very feebly punctate. Basal joint of front *tarsi* rather small, but strongly rounded and with a black inner rim.

Length to apex of elytra  $2\frac{1}{4}$ , of abdomen 4 mm.

*Hab.* N. S. WALES: Mount Victoria (*A. M. Lea*).

The cephalic excavations are very different to those of any species here recorded; they are not all more or less connected as is usually the case, but there are two comparatively small foveae forming a median excavation, the two combined occupying about half of the width between eyes, but only about one-fourth of the length of head; between them and each eye is a rather shallow, curved groove, completely margined all round (except at the extreme front) and the two separated in front by a rather wide median elevation the hind edge of which divides the median excavation into the two foveae. Seen from behind the head appears to have three slight, rounded, distant spaces, scarcely elevated above the general level; whilst from the sides it appears to be flattened. The strigosities of the head are denser than usual, and, instead of being transverse, are longitudinal at the base.

A specimen which is possibly the female (it was beaten from the same bush as the male) has the head feebly impressed in front, transversely strigose at the base, prothorax transversely impressed at the base and front *tarsi* simple. In colours and general appearance it exactly resembles the male but as its antennae are distinctly longer I am somewhat doubtful as to the two specimens being really correctly mated.

**HELCOGASTER HELMSI, n. sp.** (*Figs. 13, 14.*)

♂. Deep black, elytra with a decided bluish or greenish gloss; prothorax and three basal joints of antennae reddish-flavous.

*Head* rather densely and irregularly punctate; concave but not deeply excavated between eyes; with a large frontal tubercle, which in front has two small tubercles and behind a rather larger and acute one. *Antennae* terminated half-way between middle and hind coxae. *Prothorax* about as long as wide, base transversely impressed. *Elytra* with minute, scattered punctures. Basal joint of front *tarsi* rather large and rounded.

Length to apex of elytra 3, of abdomen 5 mm.

♀. Differs in having the head longer, with the eyes smaller and more to the front, convex between eyes, with an obtuse simple tubercle in the same position as the male; prothorax slightly transverse front *tarsi* simple.

*Hab.* N. S. WALES: Mount Kosciusko, 5,700–6,000 feet (*R. Helms*).

There are eight specimens before me, but only one of these is a male. Its head is rather roughly sculptured but nowhere deeply excavated or foveate; in front there is a large almost pear-shaped tubercle, which from certain directions appears to be simple, but there are really three smaller conical tubercles on it and these can be seen quite distinctly when the head is viewed from behind or from the sides. There are remains of the trisinate outline that is so distinct in many species, but this sinuous appearance is caused more by two very obtuse elevations than by the excavations.

#### HELCOGASTER PULCHRIPES, n. sp.

♂. Black, elytra with or without a slight bluish or greenish gloss, head (basal half of upper surface excepted) prothorax, four front femora and tibiae, and base of hind tibiae reddish-flavous; apical half of antennae more or less infuscate.

*Head* wider than usual; rather distinctly punctate and at the sides feebly strigose; a rather shallow impression on each side in front. *Antennae* not passing middle coxae. *Prothorax* slightly transverse, feebly impressed at base. *Elytra* densely and minutely punctate. Basal joint of front *tarsi* not quite half their length, strongly rounded and with a black inner rim.

Length to apex of elytra  $2\frac{1}{2}$ , of abdomen 4 mm.

♀. Differs in having the head slightly longer, the frontal impressions very shallow, the eyes slightly smaller and more to the front and the front *tarsi* simple.

*Hab.* W. AUSTRALIA: Geraldton (*A. M. Lea*).



The feebly sculptured head of the male is much as in many females of the genus, and in fact but little different from its own female, but the basal joint of the front tarsi is unmistakably masculine. Of the other species having the head almost simple and the prothorax pale *foveicornis* has the basal joint of antennae strongly inflated, and *simpliciceps* has the basal joint of front tarsi much smaller and the head legs and elytra differently coloured. The elytral punctures are somewhat rugose but sufficiently distinct, they are, however, very much smaller than in *punctipennis*, but, with that exception, are more distinct than in any other species here recorded. In the female the front femora have sometimes half their base dark, whilst the middle femora are almost entirely dark, but in the males the four front femora are usually entirely pale, although they are occasionally tipped at the base with black. In both cases the amount of flavous at the base of the hind tibiae is variable in extent. In the female the lower surface of the head is occasionally blackish.

**HELCOGASTER SPINICOLLIS, n. sp.** (*Fig. 97.*)

♂. Black; prothorax, shoulders, two basal joints of antennae, front knees and middle femora red or flavous.

*Head* large, transverse, deeply excavated. *Antennae* comparatively short and stout, many of the joints transverse. *Prothorax* transverse, sides rounded, base truncate, apex rather largely bilobed, with short acute projection from between the lobes. *Elytra* almost impunctate. Basal joint of front *tarsi* about half their total length and with black inner rim.

Length to apex of elytra  $1\frac{1}{2}$ , of abdomen  $2\frac{1}{4}$  mm.

*Hab.* N. S. WALES: Bulli (*A. M. Lea*).

In the type the shoulders are much paler than the prothorax, but I attach no importance to this. The head is deeply excavated on its basal half, the excavation being feebly bilobed posteriorly and irregular in front; across the middle of the excavation is an isolated carina. Seen from the front the middle of the front of the head appears to consist of a slightly concave, heart-shaped and rather coarsely punctured space; but the whole sculpture of the head is somewhat obscured by its clothing. It is at once distinguished from all the other known species by the apex of its prothorax.

**HELCOGASTER PUNCTILOBUS, n. sp.**

♂. Flavous, in places reddish; apical two-thirds of elytra and extreme tip of abdomen, black; apical two-thirds of antennae and metasternum infusate.

*Head* transverse, not largely excavated but divided into two large feebly convex lobes, each of which is densely and rather coarsely punctured, the space between depressed, shining and impunctate. Antennae long and thin. *Prothorax* rather feebly transverse; apex wider than base. *Elytra* rather long, each separately rounded at apex, almost impunctate. Basal joint of front *tarsi* about half their total length, with a rather wide black inner rim.

Length to apex of elytra 2, of abdomen 3 mm.

♀. Differs in having the head smooth, almost impunctate and less transverse, with smaller eyes and simple tarsi.

*Hab.* N. S. WALES: National Park, Bulli (*A. M. Lea*).

In three females the metasternum is darker than in the male and the abdomen varies—in one being almost entirely black, in another only the two apical segments are dark, whilst in the third it is slightly infusate below (except for the two apical segments) and almost entirely dark above. In the male the prothorax is strongly ridged (not carinate) along the middle, probably naturally so, but possibly owing to irregular contraction.

In appearance the species is close to *tuberculifrons* and the following, but the sculpture of the head of the male is very different. In the table\* it would have been placed next to *bilobus*, from which it is at once distinguished by its colour; the sculpture of the head, however, is also different.

**HELCOGASTER BACCHANALIS, n. sp.**

♂. Flavous; base of head and apical two-thirds of elytra black, metasternum, apex of abdomen and apical half of antennae infusate.

*Head* transverse, largely excavated between the eyes, these larger than usual. Antennae long and rather thin. *Prothorax* transverse, apex much wider than base. *Elytra* rather long and dilated posteriorly; with small, indistinct, rugulose punctures. Basal joint of front *tarsi* less than half their total length and with a black inner rim.

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\* This and the following species were described after the table was prepared.

Length to apex of elytra  $2\frac{1}{2}$ , of abdomen 4 mm.

♀. Differs in having the head with only two feeble impressions in front, and a greater portion of its area black.

*Hab.* N. S. WALES: Richmond River (*A. M. Lea*).

The two specimens before me were previously identified by me as the *Carphurus apicalis* of Macleay, with the description of which they closely agree, but the head of the male is very differently sculptured from that of the male of this species.\* The impressions on the head of the male of this species are trilobed posteriorly, the lateral channels are longer, but not quite so wide as the median one, the hind ends of all are level, but the front end of the median one is almost exactly level with the middle of each eye, and is there obscurely connected with the lateral ones; in the middle of its front portion is a short suddenly elevated carina (this from some directions causes the head to appear as if it had four longitudinal channels instead of only three), the carina appearing as a prolongation of a frontal raised space, the whole being shaped like a flask, of which the carina is the neck, the resemblance to a flask being most distinct from the back and from the sides obliquely. Seen from the sides, the head appears to have a longitudinal ridge, interrupted at its middle.

In the table it would have been placed next to *fuscitarsis*, but the head is differently sculptured and the elytra differently coloured.

#### SUBFAMILY MELYRIDES.

Genus DASYTES,† Payk., Faun. Suec., II, p. 156; Lacord., Gen. Coleop., IV, p. 400.

This genus is of world-wide distribution, but hitherto only four species belonging to it have been recorded from Australia, probably on account of the small size and obscure colours of most of the species. I do not know any foreign members of the genus, but the Australian species readily fall into two sections (or perhaps genera).

1. Of comparatively large size, flat bodied, with long hair and with the prosternum foveate.

2. Of very small size, rather strongly convex and densely

\* See comments under *apicalis*.

† For full synonymy of this genus see Lacordaire.

and finely pubescent; frequently also with a metallic gloss, prosternum not foveate.

To the first section belongs the species I have redescribed as *fuscipennis*, and in my opinion it belongs to a different genus to all the other species here noted (with the possible exception of *nigricans*) and which belong to the second section.

The pubescence of the members of the second section appears to be easily abraded, the antennae usually extend (when drawn backwards *over* the prothorax) to or slightly beyond the scutellum and in most of these species the individual joints are shaped much as they are in *squiresensis*. The abdomen of the species of this section also often appears to have the hinder edges of the segments serrated, but this appearance is really due to the pubescence being matted together.

The species, with the exception of *nigricans*, which is commented on below, may be tabulated as follows:—

- A. Prothorax with long setose hair . . . *fuscipennis*, Hope.
- AA. Prothorax pubescent.
  - B. Elytra with semi-upright hairs in addition to pubescence.
    - a. Elytra with numerous subgranular elevations . . . . *granulipennis*, n. sp.
    - aa. Elytra with punctures only . . . *squiresensis*, Blackb.
  - BB. Elytra pubescent only.
  - C. Prothorax with comparatively coarse punctures.
    - b. Punctures all sharply defined *sobrinus*, n. sp.
    - bb. Punctures more or less rugose . . . . *abundans*, n. sp.
  - CC. Prothorax (at least in middle) with small or very small punctures.
    - D. Femora partly pale . . . *bourgeoisii*, n. sp.
    - DD. Femora entirely dark.
      - E. Prothorax feebly transversely impressed near base.
        - c. Impression continuous *australiae*, n. sp.
        - cc. Impression interrupted in middle . . . *evanidus*, n. sp.
    - EE. Prothorax not so impressed.

- F. Prothorax as wide as  
 elytra . . . *amplicollis*, n. sp.
- FF. Prothorax narrower  
 than elytra . . .
- G. Pubescence dense  
 comparatively  
 long and al-  
 most pure  
 white . . . *helmsi*, Blackb.
- GG. Pubescence  
 sparse,  
 shorter, and  
 darker.
- H. Prothoracic and  
 elytral punc-  
 tures very  
 small . . . *corticarioides*, n. sp.
- HH. These punc-  
 tures small  
 but consider-  
 ably larger  
 than in *corti-*  
*carioides* . . . *wiburdi*, n. sp.

DASYTES FUSCIPENNIS, Hope, Trans. Ent. Soc. Lond., 1845,  
 p. 105.

Dark reddish or piceous, brown, sometimes almost black; appendages usually paler. Upper surface densely clothed with long blackish hair or setae, denser and shorter on elytra than elsewhere, tibiae densely setose, the rest of the legs and the under surface rather sparsely pubescent.

*Head* transverse, somewhat flattened; with large shallow punctures, moderately dense between eyes, absent elsewhere. *Antennae* extending to scutellum; 1st joint large, 2nd longer than 3rd, 4th-8th small and globular, 9th-10th larger and globular; 11th pyriform. *Eyes* large, rather coarsely faceted. *Prothorax* strongly transverse, sides and base margined; with large shallow punctures. *Scutellum* strongly transverse; with distinct punctures. *Elytra* not much wider than prothorax, parallel-sided to near apex; with close set rows (often subgeminata in appearance) of rather small, but distinct punctures.

Length  $3\frac{1}{2}$ - $6\frac{1}{2}$  mm.

*Hab.* QUEENSLAND: Brisbane, Dawson River; N. S. WALES: Forest Reefs, Jenolan, Tamworth, Sydney, Galston, Como, Windsor; VICTORIA: Benalla, Melbourne; TASMANIA: Hobart, Mount Wellington, Launceston; S. AUSTRALIA: Adelaide, Port Lincoln; W. AUSTRALIA: Swan River, Albany, King George's Sound, Mount Barker.

Frequently the sides of the prothorax are paler than its disc; the elytra are sometimes paler than the prothorax, but are often fully as dark; the appendages are usually paler than the head, the prosternum is nearly always paler than the abdomen and the abdomen than the metasternum; but specimens of an almost entirely uniform shade of colour (except that the appendages are slightly paler) are by no means uncommon. The prothorax often has a smooth impunctate median line, or this line may be even subcariniform; in well-kept specimens the long hair usually meets over it. On the prosternum between each coxae and the apical angle is a large fovea, at the bottom of which is a roughly circular flat space (this may be an enormously developed spiracle), there is nothing exactly like it on any other beetle known to me, although there is an approach to it in *Telephorus* and some of the species having exsertile vesicles. The first joint of all the tarsi is distinctly shorter than the second when seen from below, and from above is often quite invisible; the claws are long, thin and simple except for a slight basal swelling.

The insect to my thinking certainly belongs to a different genus to all the species (except *nigricans*) which follow; but as *Dasytes* is a world-wide genus and may include similar forms I have not felt called upon to propose a new genus for its reception.

The original description of *fuscipennis* (as also of *nigricans* described at the same time) consists of exactly twelve words, and is certainly insufficient for the positive identification of any species of the genus. I have described the above species as *fuscipennis*, however, as it is so named in several Australian museums, and a specimen of it has been sent to me as such by the Rev. T. Blackburn. The species is variable and probably the most widely distributed of all the Australian *Malacodermidae*; it may be taken under the bark of various species of Eucalyptus and often at lights at night-time.

DASYTES NIGRICANS, Hope, *l. c.*, p. 105.

The original description of this species is quite useless ; it may quite possibly have been founded upon one of the varieties of the above species, but without examination of the type, or of a specimen that had been compared with the type, I would not care to accept the name for any species, even from Adelaide.

*Hab.* S. AUSTRALIA : Adelaide.

DASYTES SQUIRENSIS, Blackb., T. R. S., S.A., 1892, p. 38.

I have a co-type of this species. Its elytra when viewed from the sides are seen to be covered with numerous short, semi-erect hairs in addition to the pubescence, and its trochanters (in addition to other parts of the legs) are red. The hind angles of its prothorax are strongly rounded.

In the species a variable number of joints of the antennae are pale, but the first is always of a deep glossy black, and in striking contrast to the bright red second joint.

*Hab.* S. AUSTRALIA : Mount Squires ; W. AUSTRALIA : Geraldton.

DASYTES HELMSI, Blackb., *l. c.*, p. 38.

The original description of this species is very brief, and although sufficient to prevent it from being confounded with the preceding, is too short for its positive identification. Mr. Blackburn, however, has been good enough to give me a specimen (the only one I have seen) of it. This specimen is very densely clothed with almost snowy-white pubescence, the elytra are without semi-upright hairs and are very indistinctly punctate, more on account of the small size of the punctures themselves than through being partially concealed by the clothing, towards the base they are fairly distinct, however. The prothorax is without depressions, is feebly rounded at the base and its entire base is closely applied to the elytra and is of almost exactly their width at base, although distinctly narrower than across their middle.

*Hab.* S. AUSTRALIA : Elder Expedition.\*

\* Exact locality not given.

**DASYTES ABUNDANS**, n. sp.

Black or blackish-brown, with a dark greenish gloss, more pronounced on the elytra than elsewhere; basal half of antennae, knees, tibiae tarsi and trochanters more or less obscurely diluted with red. Densely clothed with whitish pubescence.

*Head* transverse; with dense and moderately distinct punctures. *Antennae* extending to scutellum. *Prothorax* transverse, convex throughout, sides strongly rounded; with dense and rather large but somewhat rugose punctures, smaller in middle than elsewhere; with a feeble median line. *Elytra* not closely applied to prothorax; with dense but rather small punctures, becoming smaller posteriorly; suture very feebly raised on posterior two-thirds.

Length  $1\frac{1}{2}$ - $2\frac{1}{2}$  mm.

*Hab.* W. AUSTRALIA: Garden and Rottneest Islands, Swan River, Pinjarrah, Geraldton (*A. M. Lea*).

The reddish parts of the legs are much paler in some specimens than in others, but although varying in degree never seem to vary in extent; the antennae, however, are sometimes entirely dark; even on the elytra the greenish gloss is never very bright. On specimens in perfect preservation are to be seen two long hairs on each side of the prothorax and one on each side of the base of the head; but they all appear to be easily abraded, or at least plastered down so as to be indistinguishable. The prothoracic punctures, though strong are by no means sharply defined. In general appearance it is like *squiresensis*, but is smaller, the prothorax with coarser punctures and the elytra pubescent only. It is an abundant species.

**DASYTES BOURGEOISI**, n. sp.

Black, with an olive-green gloss; 2nd-4th joints of antennae and parts of the legs reddish. Moderately densely clothed with pale yellow pubescence.

*Head* strongly transverse, with scarcely visible punctures, antennae just passing scutellum. *Prothorax* twice as wide as long, convex throughout, sides and base strongly rounded; punctures small and indistinct. *Elytra* closely applied to prothorax; with dense and rather small punctures, but of almost equal size throughout; suture feebly raised on the posterior two-thirds.

Length  $2\frac{1}{4}$ - $3\frac{1}{4}$  mm.

*Hab.* TASMANIA: Hobart, Mount Wellington, common on flowers (*A. M. Lea*).



The elytra are much less densely clothed than in the majority of the species, and to the naked eye appear to be rather highly polished; the clothing is much as in the preceding species, but is sparser and rather darker and there are no lateral hairs. The elytral punctures are about the same size as those on the elytra of that species, but the prothoracic ones are much smaller and the prothorax itself is much wider. The tibiae, tarsi and trochanters are always reddish, and usually the four front femora as well; the deep black basal joint and the antennae is much as in *squiresensis*, to which in size and general appearance it approximates, but the clothing of the elytra at once distinguishes the two species.

I was under the impression that this species possibly belonged to *Dasytiscus*, and sent a specimen to M. Bourgeois for his opinion, he replied as follows: "As to the *Dasytides* these are not to my thinking *Dasytiscus*; they do not show any denticulations at the side of the prothorax and the tarsi are not the same." His figure of *D. transcaspicus*,\* however, will give a good general idea as to the appearance of this insect.

#### DASYTES AUSTRALIAE, n. sp.

Black, with a bronzy or bronzy-green gloss; parts of the legs piceous-brown or not. Densely clothed with white pubescence.

*Head* with small indistinct punctures. *Antennae* rather thin; passing scutellum for about one-third of their length. *Prothorax* about twice as wide as long, sides strongly rounded, widely and shallowly impressed at base; densely and minutely punctate. *Elytra* closely applied to prothorax; with dense almost uniform and rather small punctures, suture nowhere raised.

Length 2½–3 mm.

*Hab.* W. AUSTRALIA: Swan River (*A. M. Lea*).

In many respects close to *helmsi*, but the prothorax of different shape at the base and the clothing much sparser, etc. Its very fine prothoracic punctures readily distinguish it from *abundans*. Sometimes the tarsi and four front legs are not quite so dark as the rest of the insect, but they are never distinctly reddish; the antennae are of uniform darkness throughout. The species is very abundant about the Swan River.

\* Ann. Soc. Ent. Fr., 1885, Pl. V, fig. 1.

Three specimens sent to me from Birchip in Victoria by Mr. J. C. Goudie, differ in being longer and stouter, but as I can find no other distinguishing features I prefer to regard them as representing a variety rather than a distinct species.

**DASYTES GRANULIPENNIS, n. sp.**

Dark metallic bluish-green or greenish-blue; under surface and appendages black. Rather densely clothed with whitish pubescence; the elytra in addition with long more or less upright brownish hairs.

*Head* with small indistinct punctures; a shallow but distinct impression on each side in front. *Antennae* thin, passing scutellum for fully one-third of their length. *Prothorax* scarcely twice as wide as long; sides strongly rounded, gently convex throughout; with small punctures on sides becoming very small on disc. *Elytra* closely applied to prothorax; densely punctate, punctures small but of almost equal size throughout; with irregular series of small, shining, sub-granular elevations.

Length  $2\frac{1}{4}$ –3 mm.

*Hab.* TASMANIA (*J. R. Norman*), Hobart, Kempton (*A. M. Lea*).

A narrow species which can be readily identified by the clothing and subgranular appearance of its elytra.

**DASYTES SOBRINUS, n. sp.**

Reddish-brown, head prothorax and scutellum darker, appendages paler. Densely clothed with very short pubescence; each side of prothorax usually with two long hairs.

*Head* with clearly defined and comparatively large punctures; with a large shallow impression in front. *Antennae* thin; just passing scutellum. *Prothorax* not much wider than long, sides not very strongly rounded; with a feebly impressed median line; rather coarsely punctate. *Elytra* closely applied to prothorax, somewhat flattened, suture nowhere raised; punctures at base rather large (but smaller than on prothorax), becoming small posteriorly.

Length  $1\frac{1}{2}$ – $1\frac{1}{3}$  mm.

*Hab.* W. AUSTRALIA: Pinjarrah (*A. M. Lea*).

The elytra are darkest at the base, the colour gradually decreasing until at the apex they are only about as dark as the legs; the metasternum is darker than the rest of

the under surface; the femora are usually infuscate in the middle. The general colour is similar to that of many of the *Ptinidae*. In appearance it is somewhat like *abundans*, but is much smaller, the prothorax with coarser punctures and elytra of thinner texture (in *abundans* the elytra are always rigid, but in this species they become distorted after death).

**DASYTES EVANIDUS, n. sp.**

Blackish; elytra very little paler; knees, tibiae and tarsi dull reddish-brown. Rather densely clothed with short pubescence.

*Head* with dense indistinct punctures; a large shallow impression in front. *Antennae* rather thin, just passing scutellum. *Prothorax* not much wider than long; sides moderately rounded, towards base feebly impressed, the impression not continuous across middle; disc with small punctures, becoming larger (but not very large) on sides. *Elytra* closely applied to prothorax, with dense small punctures, becoming smaller posteriorly; suture narrowly raised in posterior half.

Length  $1\frac{1}{4}$  mm.

*Hab.* W. AUSTRALIA: Pinjarrah (*A. M. Lea*).

The antennae are either entirely dark or with the sub-basal joints slightly paler than the others; the elytra are but little paler than the prothorax and at a glance appear to be equally as dark. The species is close to the preceding but smaller (it is the smallest of the genus known to me), prothorax with smaller punctures and elytra more convex, etc.

**DASYTES WIBURDI, n. sp.**

Deep black, the upper surface with a slight greenish or coppery gloss. Densely clothed with whitish pubescence.

*Head* with dense and fairly distinct punctures. *Antennae* stout, just extending to scutellum. *Prothorax* almost twice as wide as long, gently convex throughout, sides strongly rounded, densely and minutely punctate the punctures larger on sides than disc. *Elytra* closely applied to prothorax, widest about the middle, suture narrowly raised on posterior half; densely punctate, towards base punctures larger than on prothorax, but becoming smaller posteriorly.

Length  $1\frac{3}{4}$ -2 mm.

*Hab.* N. S. WALES: Jenolan (*J. C. Wiburd*).

The pubescence is much like that of *helmsi*, but is distinctly shorter and not of the almost snowy whiteness of that species. In appearance it is close to the following species, but is slightly larger and with more distinct punctures on both prothorax and elytra; in shape it is intermediate between that species and *abundans*.

**DASYTES CORTICARIOIDES, n. sp.**

Black; the elytra sometimes not quite so dark. Densely clothed with short, whitish pubescence.

*Head* minutely punctate; gently convex. *Antennae* just passing scutellum. *Prothorax* twice as wide as long, sides strongly rounded, gently convex throughout; densely and minutely punctate. *Elytra* rubovate, closely applied to prothorax, suture narrowly raised on posterior two-thirds; densely and minute punctate, at base punctures rather larger than on prothorax.

Length  $1\frac{1}{2}$ – $1\frac{3}{4}$  mm.

*Hab.* W. AUSTRALIA: Rottneest Island, Darling Ranges, Swan River; N. S. WALES: Sydney (*A. M. Lea*).

Of the short robust form of *helmsi*, but much smaller, pubescence sparser and darker, etc. The elytra are often quite as dark as the rest of the body, but frequently are of a very dark brown only. Except as to its colour it is not unlike many species of *Corticaria*. I cannot find any distinguishing features between the eastern and western forms.

**DASYTES AMPLICOLLIS, n. sp.**

Black, the upper surface with a slight greenish gloss. Densely clothed with short whitish pubescence.

*Head* indistinctly punctate, gently convex. *Antennae* short, not extending to scutellum. *Prothorax* scarcely twice as wide as long; strongly convex; sides strongly rounded; with minute punctures in middle, becoming clearly defined and comparatively large on sides. *Elytra* rather closely applied to prothorax, but nowhere wider than the greatest width of that segment; with dense and rather minute punctures; suture scarcely visibly raised posteriorly.

Length  $1\frac{1}{2}$  mm.

*Hab.* W. AUSTRALIA: Swan River (*A. M. Lea*).

Of the size and somewhat after the build of the preceding species, but the prothorax considerably larger in proportion to the elytra and with larger punctures, especially at the sides.

SPECIES OF DOUBTFUL POSITION.

LYCUS (CHARACTUS) AUSTRALIS, Boisd., Voy. Astr., II, p. 119; Dej., Cat., 3 ed., p. 112; Wat., Trans. Ent. Soc. Lond., 1877, p. 74; Masters (*Calopteron*), Cat. Col. Aust., No. 3364.

"Supra croceus; thorace macula media nigra; elytris subparalleleis sulcatis; subtus antennisque nigris."

*Hab.* AUSTRALIA.

Of the species here recorded this description fits *Metriorrhynchus nigripes*, *lateralis*, *marginicollis*, *irregularis* and *Trichalus ampliatus*; without additional particulars therefore it would be dangerous to identify any species as *australis*.

LYCUS OCHRACEUS, Dalm., Sch. Syn. Ins., App., p. 31; Boisd., Voy. Astr., II, p. 122; Wat., Trans. Ent. Soc. Lond., 1877, p. 85; Masters (*Metriorrhynchus*), Cat., Sp. No. 3354.

"Subtus ater, supra ochraceus; thorace disco nigro; elytris stratis, reticulato-punctatis.

"Long 6 lin.

"Elytra ad scutellum infuscata."

*Hab.* AUSTRALIA.

There are about a dozen species before me, any one of which might be *ochraceus*, as they all agree with the above description.

PYROCOELIA BICOLOR, Fabr. (*Lampyris*), Syst. El., II, p. 100 (1801); Boisd., Voy. Astr., II, p. 129 (1835); Mots. (*Cratomorphus* Mots.), Etud. Ent., p. 34 (1853); Gorham, Trans. Ent. Soc. Lond. (1880), p. 91; E. Oliv., Notes Leyd. Mus., VIII, p. 199 (1886); Olliff, P. L. S., N.S.W. (1889), p. 646.

"Supra testacea, subtus atra, abdominis segmentis duobus penultimis striga abbreviata, albissima."

*Hab.* N. S. WALES?

This description may have been drawn up from a pallid specimen of *Luciola flavicollis*, or from a species of *Atyphella*.

CANTHARIS AUSTRALIS, Boisd., Voy. Astr., II, p. 133; Dej., Cat., 3 ed., p. 120; Masters (*Telephorus*), Cat., Sp. No. 3379.

"Minuta, nigra, thorace croceo; subtus nigra, pedibus thoraceque luteis."

*Hab.* AUSTRALIA.

This may be a *Telephorus*, but it is more likely to be a *Heteromastix*, or even a *Hypattalus*; but it is, however, quite certain that it would be absurd to attach the name to any species without additional particulars to the above.

HELIOTIS\* HOPEI, Cast., Hist. Nat., I, p. 257.

As in the description of this insect no indications are given as to its shape, and as I have not seen the generic description, I am not even able to refer it to its subfamily. The genus is not mentioned by Lacordaire, although long antecedent to his work.

*Hab.* W. AUSTRALIA: Swan River.

#### OEDEMERIDAE.

AGASMA SEMICRUDUM, Newm., Zool., App. cxvi-cxvii; Masters, Cat. Col. Aust., No. 3444.

I have not seen the original description of this genus and species, but Lacordaire has reproduced † the generic description amongst other genera unknown to him. In many Australian collections a species, which is quite common on the northern rivers of New South Wales, ‡ is standing under this name; and correctly so as it transpires. This species, however, belongs to the *Oedemeridae*; not having seen the specific description, and being doubtful as to the correctness of the name, I sent a specimen of the species to Mr. G. C. Champion, asking him to have it compared with the type §; this he has kindly done and has

\* Silb., Rev., IV, 1836, p. 18.

† Gen. Coleop., IV, p. 414.

‡ The type was from the Richmond or Clarence River.

§ In the British Museum.

written me as follows: "You are quite right about the *Agasma*; it is of course an Oedemerid, though Newman calls it pentamerous.\* The genus in the British Museum is correctly placed. I do not suppose Lacordaire knew it, except from description."

\* The tarsi are quite plainly 5-5-4.

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EXPLANATION OF PLATES II—VI.

[See *Explanation facing the PLATES.*]





IV. *Studies of the Blattidae.* By R. SHELFORD, M.A.,  
F.L.S.

[Read February 3rd, 1909.]

PLATES VII—IX.

X. A REVISION OF THE OLD-WORLD BLATTINAE BELONG-  
ING TO THE *POLYZOSTERIA* GROUP.

A STUDY of the collection of Blattidae recently made in West Australia by Drs. Michaelsen and Hartmeyer soon convinced me that a thorough revision of the Australian Blattinae was an urgent necessity. Tepper has described numbers of species in the Transactions of the Royal Society of South Australia, but the identification of his species has always been attended with considerable difficulty since this worker's views on classification are rather peculiar and his descriptions are not supplemented with figures. Kirby, in his Synonymic Catalogue of Orthoptera vol. i, has made a laudable endeavour to reduce the Tepperian species and genera into something like order, but as he had neither time nor opportunity to consult any types but those of Walker, he has not succeeded in decreasing the confusion. Guessing at the generic identity of species involves all sorts of risks, and consequently Mr. Kirby's emendation of Tepper's genera has resulted in several serious errors. To take one example:—he sinks *Temnelyttra*, Tepp., as a synonym of *Zonioploca*, Stål, though the two genera are totally distinct, and includes in the revised genus species belonging to no less than five genera. The straightening-out of the terrible tangle into which this group of cockroaches had been twisted has been attended with very great difficulty, for I have been unable to borrow types from the South Australian Museum and Mr. Tepper has not responded to appeals for the comparison with his types of specimens sent to him from the Hope collection. Fortunately Professor Baldwin Spencer and Mr. W. W. Froggatt most kindly came to the rescue; the former has sent me all the Tepperian types in the Melbourne Museum, and the latter has presented or lent to the Hope Museum specimens determined by Mr. Tepper himself. With these valuable aids, for which I cannot be too grateful, I have been able to determine

with accuracy the great majority of genera and species described by Mr. Tepper; in addition the types of Walker in the British Museum have been examined. Dr. Th. Kuhlitz, late of the Berlin Museum, has sent me drawings of Erichson's types and has compared specimens sent to him. Dr. K. Holdhaus of Vienna has lent me some of Brunner's types and Dr. Y. Sjöstedt of Stockholm all the types of Stål. I trust that the net result of the considerable correspondence and hard work expended on this memoir is a satisfactory classification which will bear the test of time and enable other workers to identify the species of the group without great difficulty.

The Blattinae can be divided into two chief sections according to the structure of the posterior tarsi; the first section, which may be styled the *Polyzosteria*-group, has the posterior metatarsus usually shorter than the succeeding joints and usually unarmed beneath,\* the succeeding joints are entirely unarmed and with large pulvilli; the second section or *Blatta*-group has the posterior metatarsus longer than the succeeding joints and armed beneath, the second and third joints are also armed and their pulvilli are apical (Pl. III, f. 40). A revision of the second section I hope to undertake on some future occasion. The *Polyzosteria*-group can be subdivided into an Old-World group and a New-World group, but the character on which this subdivision is based—the relative distances apart of the eyes and the antennal sockets—is so subtle that I doubt its practical importance and I temporarily regard the New-World group as distinct from the Old-World group for convenience sake only. In the Old World, Australia is undoubtedly the head-quarters of the *Polyzosteria*-group, nearly all the apterous species are confined to that continent and the islands immediately surrounding it; but one or two, and notably *Cutilia nitida*, Br., have a much wider range, extending into the Oriental region and Polynesian islands. The occurrence of an allied species at Bombay is very singular and an error in locality is suggested. As might be expected the winged species (genus *Methana*) have a wider range than is characteristic of the wingless forms, but even these do not extend to the Asiatic mainland. The group in Africa is represented by the single monotypic genus *Paramethana*. The geographical distribution of these cockroaches would appear to

\* *Cutilia* is an exception.

favour the view that they constitute a somewhat primitive group, for Australia is universally regarded as the last refuge of animal forms that have disappeared from the less isolated quarters of the globe. But I do not think that the Blattinae as a whole can be considered as other than the most highly evolved group of cockroaches, since the structure of the genital valves in the female sex is certainly a peculiar modification and not a primitive character, whilst the male genitalia are more complex than in many other subfamilies. Whether the *Blatta*-group is more primitive than the *Polyzosteria*-group, is open to argument, but I am inclined to think that it is not.

Structurally the *Polyzosteriae* offer valuable diagnostic characters, especially in the male sex, so that the separation of the species is not attended with the difficulties that confront one when dealing with such homogeneous genera as *Epilampra*, *Blabera*, *Gyna*, etc.; but the allocation of the females of some genera to their respective males is not easy and the descriptions of new species from females alone ought to be avoided in future.

Bionomically these insects are very interesting: some are brightly coloured, e.g. *Euzosteria mitchellii*, and the shining black species of *Platyzosteria* must also be very conspicuous. Many of the species have a disgusting odour, and one species of *Cosmozosteria* identified by Mr. J. J. Walker as *C. lateralis* extrudes from the apex of the abdomen when irritated a red vesicle and emits an odour so pungent that Mr. Walker was deterred from capturing specimens. Mr. Froggatt tells me that all the species expose themselves freely and are frequently found basking on the tops of fence-posts. The egg-capsules of a few species are known, and are typically Blattine in form.

#### KEY TO GENERA.

1. Ocelli usually absent. Tegminal rudiments absent. Abdominal tergites with well-marked stigmatic dots. Supra-anal lamina (♀) more or less bilobate. Cerci blunt and flattened, generally not extending beyond the supra-anal lamina.
2. Tibial spines in two rows . . . . . *Polyzosteria*, Burm.
- 2'. Tibial spines in three rows . . . . . *Euzosteria*, nov.

- 1'. Ocelli present. Tegmina present, rudimentary or absent. Abdominal tergites rarely with stigmatic dots. Supra-anal lamina (♀) not bilobate. Cerci longer, apex usually acuminate.
2. Wings absent or rudimentary. Tegmina rudimentary or absent.
3. Tegmina absent or represented by squamiform lobes.
4. Posterior angles of the 5th and 6th abdominal tergites backwardly produced.\*
5. Posterior metatarsus short, not spined beneath or with only a few spines; its pulvillus usually large, and occupying at least half of the joint.
6. Lateral margins of pronotum not incrassated. Thoracic tergites more or less smooth and nitid.
7. Supra-anal lamina (♂) not produced to form an acute spine . . . . . *Platyzozeria*, Br.
- 7'. Supra-anal lamina (♂) produced to form an acute spine . . . . . *Leptozozeria*, Tepp.
- 6'. Lateral margins of pronotum incrassated. Thoracic tergites punctate or tuberculate . . . . . *Zonioploca*, Stål.
- 5'. Posterior metatarsus longer, spined beneath, its pulvillus not occupying one half of the joint . . . . . *Cutilia*, Stål.
- 4'. Posterior angles of the 5th and 6th abdominal tergites not backwardly produced, or if produced the abdominal tergites are scabrous, Tegmina entirely absent.

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\* *Cutilia sedilloti*, Bol. (♂), is an exception.

- 5. Posterior angles of 7th abdominal tergite backwardly produced ; abdomen above scabrous. . . . . *Cosmozosteria*, Stål.
- 5'. Posterior angles of 7th abdominal tergite not backwardly produced ; abdomen above smooth, nitid.
- 6. Lateral margins of pronotum not incrassated. . . . . *Anamesia*, Tepp.
- 6'. Lateral margins of pronotum incrassated . . . . . *Desmozosteria*, Shelf.
- 3'. Tegmina quadrate, as long as the pronotum.
  - 4. Wings absent . . . . . *Temnellytra*, Tepp.
  - 4'. Wings rudimentary . . . . . *Scabina*, nov.
- 2'. Tegmina and wings well developed.
  - 3. Pronotum anteriorly parabolic, sides deflexed . . . . . *Methana*, Stål.
  - 3'. Pronotum discoidal, sides not deflexed . . . . . *Paramethana*, Shelf.

Genus 1. POLYZOSTERIA, Burm.

*Polyzosteria*, Burmeister, Handb. Ent. ii, p. 482 (1838); Brunner von Wattenwyl, Nouv. Syst. Blatt., p. 203 (1865).

*Chalcolampra*, Saussure, Mém. Soc. Sc. Phys. Nat., Genève, xvii, p. 132 (1863) (preoccupied in Coleoptera).

*Characters.* Ocelli absent. Antennae shorter than the body. Pronotum anteriorly somewhat cucullate, margins not reflected, posteriorly truncate. Tegmina and wings entirely absent. Posterior angles of the 7th abdominal tergite strongly produced backwards, angles of the preceding tergites not, or scarcely, produced, angles of the 9th tergite sometimes lobiform (cf. fig. 1). Stigmatic dots on abdominal tergites well-marked. Supra-anal lamina, (♂) quadrate, angles acute, (♀) sub-bilobate, cucullate. Sub-genital lamina (♂) sub-quadrate, styles short, obtuse. Cerci short, flattened, blunt at apex. Tibiae robust, almost quadrangular in section, spines on outer aspect in 2 rows. Posterior metatarsus very short, unarmed beneath, its pulvillus occupying the greater part of the joint.

KEY TO THE SPECIES.

- 1. Dorsal surface margined or spotted with ochreous yellow.

- 2. Legs aeneous.
- 3. Body above without tubercles.
  - 4. Pronotum with 2-4 deep punctures on the disc . . . . . *P. limbata*, Burm.
  - 4'. Pronotum without these punctures . . . . . *P. iridicolor*, Tepp.
- 3'. Body above with tubercles . . . . . *P. bagoti*, Tepp.
- 2'. Legs testaceous or castaneous.
- 3. Pronotum not tuberculate.
  - 4. Posterior margin of pronotum not ochreous-yellow . . . . . *P. cuprea*, Sauss.
  - 4'. Posterior margin of pronotum ochreous-yellow . . . . . *P. impressa*, Tepp.
- 3'. Pronotum tuberculate . . . . . *P. obscuroviridis*, Tepp.
- 1'. Dorsal surface unicolorous (except for margins of supra-anal lamina and cerci).
  - 2. Large species with dense sericeous pile. *P. pubescens*, Tepp.
  - 2'. Smaller species, sericeous pile absent or very sparse.
    - 3. Dorsal surface tuberculate . . . . . *P. oculata*, Tepp.
    - 3'. Dorsal surface not tuberculate.
      - 4. Colour dull bronze . . . . . *P. invisa*, Walk.
      - 4'. Colour metallic green . . . . . *P. viridissima*, sp. n.

The above key must be regarded as merely provisional, for I have not been able to see all the species described by Tepp, and from the descriptions alone of these it is not possible to determine their generic position with exactitude.

1. *P. limbata*, Burm.

*Polyzosteria limbata*, Burmeister, Handb. Ent., ii, p. 483 (1838).

*Polyzosteria aenea*, Burmeister, t. c., p. 483 (1838).

*Polyzosteria purpurascens*, Fischer, Orth. Eur., p. 93 (1853).

*Polyzosteria pulchella*, Saussure, Rev. Zool. (2), xvi, p. 308 (1864).

*Polyzosteria nitens*, Walker, Cat. Blatt. Brit. Mus., p. 155 (1868).

? *Polyzosteria frenchii*, Tepp, Tr. R. Soc. S. Australia, xviii, p. 178 (1894).

The species is well known and does not require re-description. It is very variable, as can be guessed from

the synonymy. A study of a long series convinces me that *aenea* is merely a colour variety of *limbata*; in typical *limbata* the colour is blackish and the yellow lateral margins of the pronotum are broad, whereas in typical *aenea* the colour is greenish-bronze and the pronotum is very narrowly flavo-marginate, but I have seen several intermediate specimens. The two examples of *P. nitens* in the British Museum look as if they had been varnished, but they show no characters whereby they can be separated from typical *limbata*. The only specimen of *P. frenchii* that I have seen is in the Melbourne Museum, it was determined by Mr. Tepper himself and is certainly the same as *P. limbata*. I have not seen the type.

NEW SOUTH WALES; VICTORIA; SOUTH and WEST AUSTRALIA; TASMANIA.

2. *P. iridicolor*, Tepp.

*Polyzosteria iridicolor*, Tepper, Tr. R. Soc. S. Australia, xvii, p. 73 (1893).

Known to me only by the description.

SOUTH AUSTRALIA, Gawler range. (Adelaide Mus., type.)

3. *P. bagoti*, Tepp.

*Polyzosteria bagoti*, Tepper, t.c., p. 79 (1893).

Known to me only by the description. It appears to be distinguished by the dorsal surface furnished with "irregular low tubercles." As it is only 14-16.5 mm. in length, it is probably the larva of some previously described species.

SOUTH AUSTRALIA, Port Augusta. (Adelaide Mus., type.)

4. *P. cuprea*, Sauss.

*Polyzosteria cuprea*, Saussure, Mém. Soc. Sc. Phys. Nat. Genève, xvii, p. 133, Pl. I, f. 2 (1864).

*Polyzosteria maculata*, Brunner von Wattenwyl, Nouv. Syst. Blatt., p. 206 (1865).

A well-known species.

SOUTH and WEST AUSTRALIA.

5. *P. impressa*, Tepp.

*Polyzosteria impressa*, Tepper [in] Horn Exped. Centr. Australia, ii, p. 361 (1896).

Known to me only from the description which I reproduce herewith.

"♀. Metallic blackish glaucous; fore- and hind-margin of pronotum and the hind-margins of all the other segments narrowly yellow. Face, antennae, legs (except ochreous coxae) and ventral segments of abdomen, brownish-red. Vertex of head dull metallic green, punctate; fore margin of clypeus whitish. Pronotum hooded, lateral margin broad, reflexed, impressed cribriform, rugulose, hind-angles moderately rounded; discal area limited by a semicircular interrupted impression, in front a low elevation succeeded by an inversely curved depression, and on each side of the middle an elongated pit; hind-margin concave. Meso- and meta-notum with similar sculpture and transverse impressions; hind-angles of former distinctly produced, hind-margin straight; of latter, hind-angles not produced, hind-margin very sinuous. Abdomen short, very slightly rugulose, margin of last two segments finely crenulate and hind-angles produced; 1st ventral segment and coxae bordered pale. Supra-anal lamina very flat and short, rotundate, entire, rugulose. Cerci very short, acuminate, pale yellow.

Total length 28 mm.; pronotum 8 mm. × 18 mm."

CENTRAL AUSTRALIA.

6. *P. obscuroviridis*, Tepp.

*Polyzosteria obscuroviridis*, Tepper, Tr. R. Soc. S. Australia, xvii, p. 73 (1893).

Unknown to me; it is distinguished by the pronotum, "studded with irregular rows of large raised tubercles" and by the bicolorous legs.

SOUTH AUSTRALIA, Gawler range. (Adelaide Mus., type.)

7. *P. pubescens*, Tepp. (Plate VII, fig. 1).

*Polyzosteria pubescens*, Tepper, t. c., p. 75 (1893); Froggatt, Australian Insects, p. 19, fig. 6 (1907).

Fuscous, with a greenish tinge, all the tergites very narrowly bordered posteriorly with testaceous. Dorsal surface with a dense



grey sericeous pile more or less worn along the middle line. Body subtectiform. Dorsal surface scabrous. Frons concave and rugosely punctate. Antennae ochreous. Pronotum anteriorly cucullate, anterior margin sub-sinuate. Body beneath ochreous outwardly margined with castaneous, apex of the abdomen castaneous. Cerci ochreous. Supra-anal lamina, (♂) sub-quadrate, (♀) produced, cucullate, apex emarginate. 9th abdominal tergite backwardly produced at its outer angles to form two blunt processes, outwardly margined with ochreous. Coxae testaceous with a castaneous stripe, femora, tibiae and tarsi castaneous with a metallic tinge. Femora beneath and tibial spines testaceous. Femoral spines very small.

Length (♂) 30-34 mm., (♀) 40-44 mm.; pronotum 10-11.5 mm. × 20-25 mm.

WEST AUSTRALIA (Oxford Mus.; Hamburg Mus.; Melbourne Mus.; Adelaide Mus., type).

8. *P. oculata*, Tepp.

*Polyrosteria* (sic) *oculata*, Tepper, t. c., p. 75 (1893).

Dull bronze above with irregular rows of flattened tubercles. Stigmatic dots very prominent. Laterally with faint indications of a sericeous pile. Cerci and supra-anal lamina edged with ochreous. Head rugose, frons not concave. Antennae castaneous at base, remainder fuscous. Underside of thoracic tergites orange. Abdomen beneath castaneous with metallic sheen, the underside of the lateral margins of the 7th abdominal tergite brilliant metallic green. Supra-anal lamina, (♂) quadrate, posteriorly widely emarginate, (♀) produced, broad, deeply emarginate. Sub-genital lamina (♂) sub-quadrate; styles stout, incurved, their apices acuminate. Posterior angles of 7th abdominal tergite very strongly produced backwards, angles of 9th tergite as in *P. pubescens*. Coxae margined with ochreous; femora castaneous, tibiae dark metallic green, spines ochreous tipped with rufous.

Length (♂ and ♀) 31 mm.; pronotum 9.3 mm. × 19 mm.

SOUTH AUSTRALIA; VICTORIA (Oxford Mus.; Melbourne Mus., ♂ type; Adelaide Mus., ♀ type).

9. *P. invis*a, Walk.

*Polyzosteria invis*a, Walker, Cat. Blatt. Brit. Mus., p. 162 (1868).

Ovate and depressed. Dark purplish above; finely rugose-punctate, not tuberculate. Posterior margin of supra-anal lamina,



- 2'. Tibiae metallic blue or green . . . *E. nobilis*, Br.  
 1'. Margins of pronotum not or scarcely reflexed.  
 2. Lateral margins of pronotum broadly testaceous, disc aeneous . . . *E. patula*, Walk.  
 2'. Pronotum castaneous or greenish with 4 oblique testaceous stripes . . . *E. mitchellii*, Angas.

1. *E. subverrucosa*, White.

*Blatta subverrucosa*, White [*in*] Grey, Journ. Exped. Australia, ii, p. 467 (1841).

*Polyzosteria reflexa*, Brunner von Wattenwyl, Nouv. Syst. Blatt., p. 208 (1865).

*Polyzosteria femoralis*, Walker, Cat. Blatt. Brit. Mus., p. 156 (1868).

*Polyzosteria figurata*, Walker, op. cit., p. 157 (1868).

A common and well-known species; *figurata* is merely a larval form.

SOUTH and WESTERN AUSTRALIA.

2. *E. subreflexa*, Tepp.

*Polyzosteria subreflexa*, Tepper, Tr. R. Soc. S. Australia, xix, p. 158 (1895).

The diagnosis does not show how this species differs from the preceding.

SOUTH AUSTRALIA, Ooldea (Adelaide Mus., type).

3. *E. nobilis*, Br.

*Polyzosteria nobilis*, Brunner von Wattenwyl, Nouv. Syst. Blatt., p. 209 (1865).

*Polyzosteria subnobilis*, Tepper, Tr. R. Soc. S. Australia, xvii, p. 81 (1893).

Tepper failed to recognise Brunner's species, his description of *subnobilis* corresponds exactly with *nobilis*; the smooth spaces that he describes on the abdominal tergites are hidden in contracted examples.

SOUTH AUSTRALIA, Adelaide, Kangaroo Is.; WEST AUSTRALIA, Swan River (Vienna Mus., type; British Mus.; Oxford Mus.; Adelaide Mus., type of *subnobilis*).

4. *E. patula*, Walk. (Pl. VII, fig. 2.)

*Polyzosteria patula*, Walker, Cat. Blatt. Brit. Mus  
p. 157 (1868).

Broadly elliptical. Above dark aeneous-green, posterior margins of thoracic tergites narrowly testaceous interrupted by maculae of the ground colour, posterior margins of abdominal tergites with flavo-testaceous maculae. Dorsal surface finely rugose. Head aeneous, coarsely rugose; mouth-parts flavo-testaceous; antennae castaneous at base, remainder rufous. Pronotum with lateral margins slightly incrassated and elevated, laterally broadly testaceous, posterior angles slightly produced. Supra-anal lamina, ( $\sigma$ ) subquadrangular, lateral margins serrate, ( $\text{♀}$ ) rugose, trigonal, apex not emarginate. Cerci very short, not exceeding the lamina, testaceous. Posterior angles of 7th abdominal tergite scarcely produced, 8th abdominal tergites with spiracles visible at their external angles; external angles of 9th tergite produced as blunt processes. Beneath testaceous. Legs testaceous, with upper aspect of femora and tibiae brilliant metallic green.

Length ( $\sigma$ ) 30 mm., ( $\text{♀}$ ) 33 mm., pronotum ( $\sigma$ ) 10 mm.  $\times$  20 mm., ( $\text{♀}$ ) 11.5 mm.  $\times$  22 mm.

This is a somewhat aberrant species and appears to be intermediate between *Euzosteria* and *Anamesia*.

SOUTH AUSTRALIA, Northern Territory (British Mus., type; Adelaide Mus.); WESTERN AUSTRALIA, Towranna plains (Oxford Mus.).

5. *E. mitchellii*, Angas.

*Blattamitchellii*, Angas, S. Australia Illustr. Pl. XLVIII,  
fig. 1 (1847).

*Polyzosteria mitchellii*, Saussure, Mém. Sci. Phys. Nat.  
Genève, xxiii, p. 106 (1873); Tepper, Tr. R. Soc. S.  
Australia, xvii, p. 78 (1893); Froggatt, Australian  
Insects, p. 19, fig. 5 (1907).

Tepper describes the colours of fresh specimens, which are very brilliant. In the female the pronotum anteriorly is parabolic, whereas in the male it is widely arched and subsinuate, the measurements show the difference in form very clearly ( $\sigma$  10 mm.  $\times$  21 mm.,  $\text{♀}$  11 mm.  $\times$  21 mm.); this sexual dimorphism in the form of the pronotum is unusual.

VICTORIA; S. AUSTRALIA; WESTERN AUSTRALIA.

## Genus 3. PLATYZOSTERIA, Br.

*Platyzosteria*, Brunner von Wattenwyl, *Nouv. Syst. Blatt.*, p. 204 (1865).

*Melanozosteria*, Stål, *Bih. Svensk. Akad.* ii (13), p. 13; (1874).

*Syntomaptera*, Tepper, *Tr. R. Soc. S. Australia*, xvii, p. 106 (1893).

*Drymaplaneta*, Tepper, *t. c.*, p. 109 (1893).

*Characters.* Ocelli absent. Antennae shorter than the body. Body depressed. Vertex of head not covered by pronotum. Pronotum not cucullate, its margins not reflected. Rudiments of tegmina present as squamiform lobes or absent. Wings absent. Posterior angles of all the abdominal tergites produced, those of the distal tergites strongly produced and spiniform. Supra-anal lamina variable in shape but never sub-bilobate in ♀. Genital styles long, slender, acuminate. Cerci frequently exceeding the supra-anal lamina, apex acuminate. Tibiae moderately spined, spines on outer aspect triseriately arranged. Posterior metatarsus very short, not spined beneath or with only a few spines, its pulvillus covering the greater part of the joint beneath.

Type of the genus—*P. melanaria*, Erichs.

*Melanozosteria*, Stål, is founded on a species of *Platyzosteria* erroneously identified as *nitida*, Br. *Syntomaptera*, Tepp., includes six species of *Platyzosteria* which the author quite incorrectly regards as allied to *Periplaneta*; Kirby for no obvious reason selects *scabriuscula*, Tepp., as the type of the genus (*Syn. Cat. Orth.*, i, p. 129, 1904). *Drymaplaneta*, Tepp., is based on variable and larval characters and cannot possibly stand.

## KEY TO THE SPECIES.

1. Uniform piceous or castaneous (cf., however, *P. bicolor*, Kirby).
2. Tegminal rudiments absent.
3. Dorsal surface not or only faintly scabrous.
4. Thoracic tergites not transversely seriate-punctate.
5. Vertex of head not orange rufous.

6. Supra-anal lamina, (♂)  
sub-quadrate or trigonal,  
apex emarginate, (♀)  
triangular, not or scarcely  
exceeding the cerci.
7. Large species (exceeding  
25 mm.) . . . . . *P. grandis*, Sauss.
- 7'. Smaller species.
8. Supra-anal lamina (♂)  
with three or more  
spines on either side  
before the apex.
9. Supra-anal lamina,  
(♂) scarcely em-  
arginate at apex,  
(♀) shorter than  
its breadth at  
base . . . . . *P. melanaria*, Er.
- 9'. Supra-anal lamina,  
(♂) deeply em-  
arginate at apex,  
(♀) longer than  
its breadth at base. *P. analis*, Sauss.  
*?P. pseudatrata*, Tepp.
- 8'. Supra-anal lamina  
(♂) not spined . . . . . *P. aterrima*, Er.
- 6'. Supra-anal lamina, (♂)  
triangular, (♀) triangular  
and considerably exceed-  
ing the cerci.
7. Lateral margins of 7th  
abdominal tergite  
serrate or denticulate.
8. These margins denti-  
culate . . . . . *P. ferox*, sp. n.
- 8'. These margins serrate.
9. Lateral margins of  
6th abdominal ter-  
gite serrate . . . . . *P. armata*, Tepp.
- 9'. Lateral margins of  
6th abdominal ter-  
gite not serrate . . . . . *P. rufofusca*, Tepp.
- 7'. Lateral margins of 7th  
abdominal tergite not  
serrate.

- 8. Lateral margins of supra-anal lamina (♂) serrate or minutely denticulate.
- 9. Posterior angle of 9th abdominal tergite bispinous . . . *P. bifida*, Sauss.
- 9'. Posterior angle of 9th abdominal tergite not bispinous. *P. atrata*, Er.
- 8'. Lateral margins of supra-anal lamina (♂) not serrate nor denticulate.
  - 9. Large species (exceeding 30 mm.). *P. invisa*, Walk.
  - 9'. Small species . . . *P. consobrina*, Sauss.
- 5'. Vertex of head orange-rufous *P. ruficeps*, Shelf.
- 4'. Thoracic tergites transversely seriate-punctate . . . . . *P. punctata*, Br.
- 3'. Dorsal surface distinctly scabrous.
  - 4. Lateral margin of 7th abdominal tergite not serrate . . . . . *P. variolosa*, Bol.
  - 4'. Lateral margin of 7th abdominal tergite serrate.
    - 5. Larger (27-31 mm.), antennæ fuscous, lateral margins of thorax not paler than disc . . . . . *P. scabra*, Br.
    - 5'. Smaller (19-23 mm.), antennæ rufous, lateral margins of thorax paler than disc . . . *P. scabrella*, Tepp.
- 2'. Tegminal rudiments present.
- 3. Tegminal rudiments on their inner side only half separated from the mesonotum.
- 4. Coxae margined with testaceous.
  - 5. Lateral margins of 7th abdominal tergite not serrate. *P. coxalis*, Walk.
  - 5'. Lateral margins of 7th abdominal tergite serrate . . . *P. biglumis*, Sauss.
- 4'. Coxae not margined with testaceous.
  - 5. Legs bright rufous . . . . . *P. rufipes*, sp. n.

- 5'. Legs piceous or dark castaneous.
6. Small species (less than 16 mm.).
7. 7th abdominal tergite with posterior margin subsinuate . . . . *P. biloba*, Sauss.
- 7'. 7th abdominal tergite with posterior margin not subsinuate . . . . *P. perplexa*, sp. n.
- 6'. Larger species . . . . *P. curiosa*, Shelf.
- 3'. Tegminal rudiments on their inner side completely separated from the mesonotum.
4. An orange spot on each side of the 7th abdominal tergite. . . *P. bicolor*, Kirby.
- 4'. No orange spots on the 7th abdominal tergite.
5. Apex of tegminal rudiments obliquely truncate . . . *P. novae-seelandiae*, Br.
- 5'. Apex of tegminal rudiments tapering.
6. Coxae bordered with flavotestaceous.
7. Castaneous, robust species . . . *P. castanea*, Br.
- 7'. Piceous, narrower and smaller . . . . . *P. obscura*, Tepp.
- 6'. Coxae unicolorous.
7. Meso- and meta-notum minutely scabrous . . . *P. scabriuscula*, Tepp.
- 7'. Meso- and meta-notum smooth, nitid, with shallow punctures.
8. Small species (14 mm.) . . . *P. rufoterminalata*, Br.
- 8'. Larger species.
9. Castaneous . . . . *P. pseudocastanea*, Tepp.
- 9'. Piceous.
10. Metanotum with two deeply impressed points . . . *P. ceratodi*, Krauss.
- 10'. Metanotum without these points.
11. Posterior margin of 7th ab-



dominal tergite not dentate.

12. Legs piceous. *P. glabra*, Walk.

12'. Legs castaneous . *P. conjuncta*, Shelf.

11'. Posterior margin of 7th abdominal tergite dentate . *P. morosa*, Shelf.

Species incertae sedis . . . . . *P. provisionalis*, Tepp.

1'. Not uniform piceous or castaneous.

2. Castaneous or piceous with lateral flavo-testaceous or white borders, abdomen not transversely banded.

3. Tegminal rudiments absent.

4. Pale lateral borders not extending beyond 2nd abdominal tergites, or if extending so far much narrowed.

5. Small species (15 mm.) . . . *P. inclusa*, Walk.

5'. Larger species.

6. Disc of pronotum not variegated with paler colour . *P. albomarginata*, Br.

6'. Disc of pronotum variegated with paler colour.

7. Coxae and femora castaneous; supra-anal lamina (♂) with two large spines at apex . . . . . *P. brunnea*, Tepp.

7'. Coxae and femora testaceous, supra-anal lamina (♂) without large spines at apex . . . . . *P. variegata*, Shelf.

4'. Pale lateral borders extending at least to 5th abdominal tergite.

5. Terminal abdominal sternites not armed with spines . . . *P. obscuripes*, Tepp.

5'. Terminal abdominal sternites armed with spines . . . *P. spenceri*, sp. n.

3'. Tegminal rudiments present.

4. Pale lateral borders not extending on to abdomen or

- represented on abdomen by a series of spots.
5. Pale lateral borders not extending inward to posterior margin of pronotum.
6. Sub-genital lamina (♂) with a spine at base of genital styles . . . . . *P. soror*, Br.
- 6'. Sub-genital lamina (♂) without such spine.
7. Posterior tibiae of ♂ expanded and flattened . . . . . *P. semivitta*, Walk.
- 7'. Posterior tibiae of ♂ not expanded and flattened. . . . . *P. communis*, Tepp.
- 5'. Pale lateral border extending inward to posterior margin of pronotum . . . . . *P. subbifasciata*, Tepp.
- 4'. Pale lateral borders extending on to abdomen.
5. Pale lateral borders not extending beyond 5th abdominal tergite . . . . . *P. liturata*, Sauss.
- 5'. Pale lateral borders extending to 7th abdominal tergite. . . . . *P. circumducta*, Walk.
- Species incertae sedis . . . . . *P. 6-guttata*, Walk.  
*P. balteata*, Tepp.  
*P. latizona*, Tepp.
- 2'. Ferruginous or transversely banded.
3. Tegminal rudiments absent.
4. Posterior angles of 9th abdominal tergite rounded . . . . . *P. coolgardiensis*, Tepp.
- 4'. Posterior angles of 9th abdominal tergite spiniform . . . . . *P. aposematica*, sp. n.
- 3'. Tegminal rudiments present . . . . . *P. hartmeyer*, Shelf.
- Species incertae sedis . . . . . *P. zebra*, Tepp.

1. *P. grandis*, Sauss.

*Polyzosteria melanaria*, var. *grandis*, Saussure, Mém. Soc. Sc. Phys. Nat. Genève, xxiii, p. 110 (1873).

This is a distinct species; though the form of the supranal lamina (♂) is almost the same as in *melanaria*, the margins of the abdominal tergites are more scabrous, the

stigmatic dots are more prominent, the coxæ are not bordered with testaceous, and the size is much larger.

VICTORIA, Melbourne (Geneva Mus., type), Western districts (Adelaide Mus.); S. AUSTRALIA, Adelaide (Oxford Mus.).

2. *P. melanaria*, Er. (Pl. VII, figs. 3a, 3b, 4.)

*Periplaneta melanaria*, Erichson, Arch. Naturg., viii, p. 247 (1842.)

There has been some confusion over this and the following species. I am much indebted to Dr. Th. Kuhlitz for comparing specimens with Erichson's type in the Berlin Museum; the following is a description of the species:—

Piceous, nitid, impunctate. Body depressed and rather narrow. Antero-lateral margins of pronotum very slightly incrassated. Antennæ piceous in basal third, remainder rufo-castaneous. Tegminal rudiments absent. Supra-anal lamina, (♂) trigonal with 3-4 pairs of lateral spines, apex slightly emarginate and more or less rufo-fimbriate, (♀) triangular, cucullate, broader at base than its length, apex emarginate, the notch being rounded, margins dentate. Sub-genital lamina (♂) quadrate, posteriorly widely emarginate, a minute spine at the base of the genital styles which are slender and acuminate. Cerci longer than the supra-anal lamina in ♂, of equal length in ♀. Coxæ bordered with testaceous. Tibiæ and tarsi dark castaneous or piceous.

Length (♂ types) 25-30.5 mm., (♀ types) 28-28.5 mm.; pronotum 7 mm. × 10 mm.

TASMANIA (Berlin Mus., types; Oxford Mus.).

3. *P. analis*, Sauss.

*Polyzosteria analis*, Saussure, Rev. Zool. (2), xvi, p. 306 (1864).

*Polyzosteria melanaria*, Brunner von Wattenwyl, Nouv. Syst. Blatt., p. 210 (1865).

*Periplaneta invisæ*, Walker, Cat. Blatt. Brit. Mus., p. 137 (1868) (♂ only).

*Periplaneta ruficornis*, Walker, Cat. Derm. Salt. Brit. Mus. V. Suppl. Blatt., p. 38 (1871).

This is the mainland representative of *melanaria* and it may be necessary eventually to merge it in that species.

It differs in the following details which, though small, appear to be constant:—

Supra-anal lamina, (♂) with apex rather deeply though narrowly notched, the spines scarcely projecting but curved round close to the lateral margins, (♀) longer than breadth at base, apical emargination V-shaped, the apex of the V filled up by membranous tissue. Cerci shorter, tibiae and tarsi brighter castaneous.

NEW SOUTH WALES (Oxford Mus.); Tarangower (Vienna Mus.); VICTORIA, Narre Warren (Melbourne Mus.); WESTERN AUSTRALIA, Swan River (British Mus.); "BOMBAY" (British Mus. type of *ruficornis*).

The type of  *analis*  appears to be lost; *ruficornis* is absolutely identical with specimens in the Melbourne Museum which differ only from Oxford Museum examples in the castaneous margins to the thoracic tergites, castaneous abdominal disc and brighter castaneous tibiae and tarsi; these are mere colour varieties structurally identical with uniformly piceous specimens. The locality Bombay is probably erroneous or the unique specimen was an accidental importation from Australia. If it is eventually proved that  *analis* , Sauss., is strictly conspecific with  *melanaria* , Er., then *ruficornis*, Walk., must be applied to this species.

4. *P. pseudatrata*, Tepp.

*Platyzozeria pseudatrata*, Tepper, Tr. R. Soc. S. Australia, xvii, p. 86 (1893).

Known to me only from the description, which applies equally well to *P. melanaria* and *P. analis*.

CENTRAL AUSTRALIA (Adelaide Mus., type).

5. *P. aterrima*, Er. (Pl. VII, figs. 5 and 6.)

*Periplaneta aterrima*, Erichson, Arch. Naturg., viii, p. 248 (1842).

*Periplaneta glabra*, Tepper, Tr. R. Soc. S. Australia, xvii, p. 107 (1893).

*Syntomaptera tepperi*, Kirby, Ann. Mag. Nat. Hist. (7), xii, p. 374 (1903).

Specimens of *Syntomaptera glabra* determined by Tepper in the Melbourne Museum are indistinguishable from *P. aterrima*, Er. I am again indebted to Dr. Kuhlitz for

help in determining this species and for sketches (reproduced here) of Erichson's types. The species may be re-described as follows:—

Piceous, nitid, impunctate, rather depressed. Antennae rufous, except a few basal joints which are piceous. Tegminal rudiments absent. Supra-anal lamina, (♂) sub-quadrate, exceeded by the cerci and sub-genital lamina, posterior margin scarcely emarginate, angles not rounded, fimbriate, margins not serrate, (♀) trigonal, rather shorter than cerci, apex very slightly emarginate, margins serrate. Sub-genital lamina (♂) scabrous, quadrate. Coxae unicolorous, legs piceous.

Length (type ♂) 12 mm., (type ♀) 16 mm.; pronotum 4 mm. × 6 mm.

TASMANIA (Berlin Mus., types; Oxford Mus.; Vienna Mus.); NEW SOUTH WALES, Sydney (*W. W. Froggatt*); VICTORIA (Melbourne Mus.); SOUTH AUSTRALIA, Northern territory (Adelaide Mus.).

6. *P. ferox*, sp. n. (Pl. VII, figs. 7a, 7b.)

♂. Piceous, nitid, impunctate, laterally finely scabrous. Lateral margins of thoracic tergites slightly incrassated. Tegminal rudiments absent. Angles of abdominal tergites 5–9 produced as acute spines, lateral margins of tergites 6 and 7 strongly denticulate. Supra-anal lamina sharply triangular, apex terminating in two spines, margins serrate. Cerci short, acuminate. 6th and 7th sternites with a complete row of spines on their posterior margins, these spines on the 4th and 5th sternites confined to the lateral parts of the posterior margins. All the sternites finely tuberculate laterally. Sub-genital lamina quadrate, scabrous, genital styles stout, spiniform, exceeding the cerci in length. Legs unicolorous, piceous.

Total length 33 mm.; pronotum 8 mm. × 12 mm.

CENTRAL AUSTRALIA (*Spencer-Gillen Expedition*), (Melbourne Mus., type; Oxford Mus.).

7. *P. armata*, Tepp. (Pl. VII, figs. 8, 9.)

*Platyzozeria armata*, Tepp., Tr. R. Soc. S. Australia, xvii, p. 84 (1893).

Dark castaneous, nitid, minutely punctate, laterally finely scabrous. Antennae rufous, except for castaneous basal joint. Pronotum with impressions and inconspicuous rugosities. No tegminal rudiments.

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Angles of abdominal tergites 6-8 produced as blunt spines. Lateral margins of tergites 6 and 7 denticulate-serrate. Supra-anal lamina, (♂) sharply triangular terminating in two spines, each with a small spine at its base and a smaller one further back, (♀) triangular, apex deeply cleft, lateral margins with 7 teeth. Sub-genital lamina (♂) quadrate. Posterior margin faintly emarginate, scabrous, genital styles stout, acuminate, slightly incurved. Disc of abdomen beneath piceous, scabrous. Coxae and femora rufo-castaneous, tibiae castaneous.

Total length (♂) 35 mm., (♀) 36 mm.; pronotum 9.5 mm. × 16 mm.

WEST AUSTRALIA, Fraser Range (Adelaide Mus., types); Mt. Robinson, Coolgardie (*Michaelsen* and *Hartmeyer*), (Hamburg Mus.; Oxford Mus.).

8. *P. rufofusca*, Tepp.

*Platyzoasteria rufofusca*, Tepper, t. c., p. 84 (1893).

Unknown to me, except from the description. The form of the supra-anal lamina in the ♀ appears to distinguish it from the preceding species.

SOUTH AUSTRALIA, Gilbert River (Adelaide Mus., type).

9. *P. bifida*, Sauss. (Pl. VII, fig. 10.)

*Polyzosteria bifida*, Saussure, Mém. Soc. Sci. Phys. Nat. Genève, xxiii, p. 110, Pl. X, f. 37 (1873).

The species resembles *P. invisa*, Walk., but is readily distinguished by the form of the supra-anal and sub-genital laminae in the male, the angle of the 9th tergite moreover is bispinous, a character not met with in other species of the genus.

QUEENSLAND (Geneva Mus., type).

There is one example in the Oxford Museum from the Burr collection labelled "Brazil," the locality is evidently incorrectly given.

10. *P. atrata*, Er. (Pl. VIII, fig. 14.)

*Periplaneta atrata*, Erichson, Arch. Naturg., viii, p. 248 (1842).

Dr. Kuhlitz has favoured me with a drawing of the supra-anal lamina of the ♂ type; it is triangular, emarginate at the apex and serrated laterally, it is consequently very like the supra-anal lamina of *P. melanaria* ♀.

The types measure 22–23 mm. in length. Specimens from Melbourne and W. Australia have the thoracic tergites margined with rufo-castaneous and the tibiae partly rufo-castaneous but otherwise appear to be the same as the typical form.

TASMANIA (Berlin Mus., types); NEW SOUTH WALES, Tarangower (Vienna Mus.); VICTORIA, Melbourne (Melbourne Mus.); WESTERN AUSTRALIA, Boorabbin (*Michaelsen* and *Hartmeyer*), (Hamburg Mus.; Oxford Mus.).

11. *P. invis*a, Walk. (Pl. VIII, figs. 15, 16.)

*Periplaneta invis*a, Walker, Cat. Blatt. Brit. Mus., p. 137 (1868), (♀ only).

Piceous, nitid, impunctate, margins of segments rather scabrous. Antennae in basal third piceous, remainder rufo-castaneous. No tegminal rudiments. Abdominal stigmatic dots very distinct. Supra-anal lamina, (♂) triangular, apex deeply notched, a short spine on either side of the notch, (♀) triangular, longer than in *P. melanaria*, cucullate, apex deeply emarginate, lateral margins 4-dentate. Cerci longer than supra-anal lamina in ♂, shorter in ♀. Subgenital lamina (♂) quadrangular, scabrous without a spine at base of styles.

Length (♂) 33.5 mm., (♀) 31 mm.; pronotum 8 mm. × 1♀-13 mm.

WESTERN AUSTRALIA, Swan River (Oxford Mus., ♂ type; British Mus., ♀ type); NEW SOUTH WALES, Gosford (*W. W. Froggatt*) (Oxford Mus.).

12. *P. consobrina*, Sauss.

*Polyzosteria consobrina*, Saussure, Rev. Zool. (2) xvi, p. 306 (1864).

The identity of this species is very uncertain and the type appears to be lost; it may be merely a larval form of *invis*a or identical with *atrata*, the latter appears to be more likely.

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13. *P. ruficeps*, Shelf.

*Polyzosteria ruficeps*, Shelford, [*in*] Fauna Südwest Austral., ii, Lief. 9, Blattidae, p. 134, Pl. XIII, fig. 3 (1909).

WESTERN AUSTRALIA, Moora (*Michaelsen* and *Hartmeyer*), (Hamburg Mus., type).

14. *P. punctata*, Br. (Pl. VII, fig. 11, Pl. VIII, figs. 17a, 17b.)

*Polyzosteria punctata*, Brunner von Wattenwyl, *Nouv. Syst. Blatt.*, p. 211 (1865).

The nearest ally of this species is perhaps *aterrima*, Er., but *punctata* is narrower. The seriatly arranged shallow punctures on the thoracic tergites are distinctive; the supra-anal lamina is scabrous and the lateral margins of the 7th abdominal tergite are slightly serrate.

NEW SOUTH WALES, Sydney (Vienna Mus., type).

15. *P. variolosa*, Bol. (Pl. VII, fig. 13.)

*Polyzosteria variolosa*, Bolivar, *Ann. Soc. ent. France* (6) ii, p. 460 (1882).

In the female the supra-anal lamina is produced, cucullate, posteriorly widely emarginate, with acute angles, lateral margins entire.

NEW CALEDONIA, Noumea (*Bolivar*); ÎLE DES PINS (Oxford Mus.).

16. *P. scabra*, Br.

*Polyzosteria scabra*, Brunner von Wattenwyl, *Nouv. Syst. Blatt.*, p. 213 (1865).

*Polyzosteria tarsalis*, Walker, *Cat. Blatt. Brit. Mus.*, p. 162 (1868).

NEW SOUTH WALES, Sydney (Vienna Mus., type of *scabra*), Port Hacking (*W. W. Froggatt*), (Oxford Mus.); "AUSTRALIA" (British Mus., type of *tarsalis*).

17. *P. scabrella*, Tepp.

*Platyzozeria scabrella*, Tepper, *Tr. R. Soc. S. Australia*, xvii, p. 88 (1893).

This should be readily recognisable from the description; it can be distinguished from the preceding species by its smaller size, the rufous antennae and by the wide emargination of the sub-genital lamina of the ♂. The supra-anal lamina of the ♂ is subquadrate with rounded angles, there are three short teeth on either side near the apex.

SOUTH AUSTRALIA, various localities (Adelaide Mus., types); NEW SOUTH WALES, Gunnedah (*W. W. Froggatt*), (Oxford Mus.).



18. *P. coxalis*, Walk.

*Polyzosteria coxalis*, Walker, Cat. Derm. Salt. Brit. Mus. V. Suppl. Blatt., p. 35 (1871).

♂. Above rufo-castaneous, abdominal tergites with lateral piceous blotches increasing in size distally. Below piceous with disc of abdomen castaneous. Head rufo-castaneous. Thorax smooth, nitid; abdominal tergites somewhat scabrous. Tegminal rudiments semi-articulated. Lateral angles of 8th tergite not spinously produced but lobiform as in *Cosmozosteria* and yellow. Supra-anal lamina quadrate, posteriorly widely emarginate, posterior angles slightly produced, lateral margins serrate. Cerci scarcely exceeding the lamina. Sub-genital lamina quadrate, a minute spine at base of genital styles. Coxae bordered with yellow, femora rufous, tibiae castaneous.

Length 20 mm. ; pronotum 6 mm. × 9 mm.

BOMBAY (British Mus., type).

19. *P. biglumis*, Sauss.

*Polyzosteria biglumis*, Saussure, Rev. Zool. (2) xvi, p. 305 (1864).

*Polyzosteria subaptera*, Brunner von Wattenwyl, Nouv. Syst. Blatt., p. 212 (1865).

A very variable species both in colour, which ranges from piceous to castaneous, and in size. It can be distinguished by the semi-articulated tegmina, scabrous distal tergites and coxae margined with testaceous.

NEW SOUTH WALES (Oxford Mus.), Sydney (Stockholm Mus.); VICTORIA, Melbourne (Geneva Mus., type of *biglumis*); SOUTH AUSTRALIA, Adelaide (Vienna Mus., types of *subaptera*).

The examples in the Stockholm Museum are much larger than the type, the tegminal rudiments are slightly more articulated and the angles of the 8th abdominal tergites are yellow. The Oxford Museum specimens are intermediate between this form and the typical form.

20. *P. perplexa*, sp. n.

♂. Allied to *P. biglumis*, Sauss., but differing in the smaller size, rufous antennae, unicolorous coxae and in the almost entire absence of denticulations from the supra-anal lamina. The lateral margins of the 7th abdominal tergite are not serrate.

Length 13 mm. ; pronotum 4 mm. × 5.8 mm.

TASMANIA (Oxford Mus., type).

This may be merely a local variety of the preceding species and I only regard it provisionally as distinct.

21. *P. rufipes*, sp. n.

Piceous, nitid. A few minute punctures on the thoracic tergites, distal abdominal tergites minutely scabrous, especially in the ♀. Pro- and meso-notum laterally bordered with rufo-castaneous. Head piceous, antennae rufo-castaneous. Tegminal rudiments semi-articulated. Lateral margins of 7th abdominal tergite not serrate. Supra-anal lamina, (♂) trigonal, apex truncate, scarcely emarginate, lateral margins minutely serrate. Cerci exceeding the supra-anal lamina in both sexes. Sub-genital lamina (♂) subquadrate, a spine at the base of each genital style equal to half the length of the style. Coxae not bordered with testaceous, piceous, femora, tibiae and tarsi rufous. Posterior metatarsi rather longer than usual in this genus and armed beneath with a few spines.

Length 11-12.5 mm. ; pronotum 4 mm. × 6 mm.

WESTERN AUSTRALIA (Oxford Mus., types ♂ and ♀).

22. *P. biloba*, Sauss.

*Polyzosteria biloba*, Saussure, Mém., Soc. Sci. Phys. Nat. Genève, xx, p. 258, Pl. III, f. 20 (1869).

Known to me from the description only.

AMBOINA (Geneva Mus., type).

23. *P. curiosa*, Shelf.

*Platyzozeria curiosa*, Shelford, [*in*] Fauna Südwest Austral., ii, Lief. 9, Blattidae, p. 135, Pl. XIII, figs. 11, 12 (1909).

A very remarkable species. A specimen in the Oxford Museum I refer with some doubt to this species, since the legs are rufo-castaneous in colour and the cerci are shorter than the supra-anal lamina.

WESTERN AUSTRALIA, Northam (*Michaelsen* and *Hartmeyer*), (Hamburg Mus., type); "NEW HOLLAND" (Oxford Mus.).

24. *P. bicolor*, Kirby.

*Melanozosteria bicolor*, Kirby, Ann. Mag. Nat. Hist. (7) xii, p. 373 (1903).

A well-marked species.

TORRES STRAITS, Cornwallis Island (British Mus., type; Oxford Mus., co-type).

25. *P. novae-seelandiae*, Br. (Pl. VII, fig. 12.)

*Polyzosteria novae-seelandiae*, Brunner von Wattenwyl, *Nouv. Syst. Blatt.*, p. 218 (1865).

*Periplaneta fortipes*, Walker, *Cat. Blatt. Brit Mus.*, p. 137 (1868).

This can readily be recognised by the obliquely truncate and strongly punctate tegmina.

NEW ZEALAND (Vienna Mus., type of *novae-seelandiae*; British Mus., type of *fortipes*; Oxford Mus.).

Two or three species are included in the British Museum collection under the heading *fortipes* and the type is not indicated; I follow Kirby in regarding the species as synonymous with *novae-seelandiae* because Walker's New Zealand specimens are undoubtedly identical with Brunner's types. It is not often that the dreary pages of Walker's Catalogues contain any notes of bionomical interest but in his list of specimens of *fortipes* one is recorded as having been found under the bark of trees devouring bugs. The observation is of interest because it lends some support to the truth of the statement which has been made, though with some scepticism, that the detestable pest, *Periplaneta americana*, devours the loathsome bed bug.

26. *P. castanea*, Br. (Pl. VIII, figs. 18a, 18b.)

*Polyzosteria castanea*, Brunner von Wattenwyl, *Nouv. Syst. Blatt.*, p. 214 (1865).

*Platyzozeria avocaensis*, Tepper, *Tr. R. Soc. S. Australia*, xvii, p. 88 (1893).

*Platyzozeria exaspera*, Tepper, *op. cit.* xviii, p. 182 (1894).

I have seen examples of *avocaensis* and *exaspera* determined by Mr. Tepper himself; the former is the female of the latter and both are synonymous with *castanea*, the type of which I have also seen.

*P. castanea* shows distinct affinities with *Cosmozosteria*, the angles of the abdominal tergites except the 7th being scarcely produced. The cerci are very short in this species.

NEW SOUTH WALES, Tarangower, Sydney (Vienna Mus., types of *castanea*; Stockholm Mus. (*Godeffroy*); Oxford Mus. (*W. W. Froggatt*)), Avoca (Adelaide Mus., type of *avocaensis*); VICTORIA (Adelaide Mus., type of *exaspera*).

27. *P. obscura*, Tepp. (Pl. VIII, fig. 19.)

*Periplaneta obscura*, Tepper, Tr. R. Soc. S. Australia, xvii, p. 107 (1893).

With some doubt I refer two ♂♂ in the Hamburg and Oxford Museums to this species.

Piceous, nitid, impunctate except for a few faint punctures on the distal tergites. Antennae fuscous. Tegminal rudiments present, not quite completely articulated. Supra-anal lamina trigonal, apex truncate, rather deeply emarginate, lateral margins entire, faintly concave, exceeded by cerci. Sub-genital lamina quadrate, posterior margin concave, no spine at base of styles. Coxae narrowly bordered with testaceous. Legs piceous.

Length 20.1 mm. ; pronotum 5.1 mm. × 8 mm.

SOUTH AUSTRALIA, Northern Territory (Adelaide Mus., type); WEST AUSTRALIA, Fremantle (*Michaelsen* and *Hartmeyer*), (Hamburg Mus. ; Oxford Mus.).

The species which was originally described from a ♀ only cannot be recognised with any real certainty.

28. *P. scabriuscula*, Tepp. (Pl. VIII, fig. 20.)

*Periplaneta scabriuscula*, Tepper, op. cit., p. 108 (1893).

Piceous, nitid, dorsal surface with minute acute tubercles most marked on the middle abdominal tergites. Tegminal rudiments present and completely articulated. Posterior margin of 7th abdominal tergite sinuate, its posterior angles not very strongly produced. Supra-anal lamina, (♂) quadrate, lateral margins entire, posterior margin concave, rufo-fimbriate, (♀) triangular, cucullate, apex truncate, emarginate, lateral margins entire. Cerci exceeding the supra-anal lamina in both sexes. Sub-genital lamina (♂) quadrate. Coxae not bordered with testaceous ; legs castaneous.

Length 12-17 mm. ; pronotum 4.5 mm. × 7-7.5 mm.

SOUTH AUSTRALIA, various localities (Adelaide Mus., types); WEST AUSTRALIA (Hamburg Mus. and Oxford Mus. (*Michaelsen* and *Hartmeyer*)).

29. *P. rufoterminalata*, Br. (Pl. IX, fig. 30.)

*Polyzosteria rufoterminalata*, Brunner von Wattenwyl, Nouv. Syst. Blatt., p. 219 (1865).

Described from a ♀ only. It is characterised by the rows

of shallow punctures on the dorsal surface, the rufo-castaneous tegminal rudiments, the supra-anal lamina with entire margins and non-emarginate apex.

“NEW HOLLAND” (Vienna Mus., type).

30. *P. pseudocastanea*, Tepp.

*Platyzosteria pseudocastanea*, Tepper, Tr. R. Soc. S. Australia, xvii, p. 89 (1893).

Known to me only from the description; it appears to differ from *castanea*, Br., by the unicolorous coxae, and the scabrous supra-anal lamina (♂) with dentate lateral margins and emarginate apex.

S. AUSTRALIA, Tanunda, Ardrossan (Adelaide Mus., type).

31. *P. ceratodi*, Kr.

*Polyzosteria ceratodi*, Krauss, Denkschr. med.-nat. Ges. Jena, viii, p. 751 (1903).

Known to me only from the description.

QUEENSLAND, Burnett (*Semon*) (Jena University Mus., type).

32. *P. glabra*, Walk.

*Periplaneta glabra*, Walker, Cat. Blatt. Brit. Mus., p. 139 (1868).

♂. Piceous, nitid, impunctate, rather broad. Tegminal rudiments present and completely articulated. Supra-anal lamina quadrate, depressed in middle, lateral margins entire, posteriorly widely emarginate, exceeded by the cerci. Sub-genital lamina widely emarginate, a short blunt spine at the base of the long genital styles. Posterior margin of 7th abdominal tergite not dentate. Coxae not bordered with testaceous.

Length 20 mm.; pronotum 7 mm. × 10.9 mm.

“AUSTRALIA” (British Mus., type).

This species in its general facies closely resembles *Cutilia nitida*, Br., but can readily be distinguished from that by its tarsal structure.

33. *P. conjuncta*, Shelf.

*Platyzosteria conjuncta*, Shelford, [*in*] Fauna Südwest Austral., ii, Lief. 9, Blattidae, p. 136 (1909).

This can be distinguished from the preceding by the spines at the posterior angles of the supra-anal lamina (♂), from *obscura* by the form of the sub-genital lamina (♂), and from *scabriuscula* by the absence of scabrous points on the dorsal surface.

WEST AUSTRALIA, Collie (*Michaelsen* and *Hartmeyer*), (Hamburg Mus., types).

34. *P. morosa*, Shelf. (Pl. VIII, fig. 21.)

*Platyzosteria morosa*, Shelford, op. cit., p. 136 (1909).

Distinguished from the preceding by the form of the supra-anal lamina (♂); the species varies considerably in size.

SOUTH AUSTRALIA (Oxford Mus., types); WEST AUSTRALIA, S. Albany, Lion Mill, Mundaring Weir (*Michaelsen* and *Hartmeyer*), (Hamburg Mus.).

35. *P. provisionalis*, Tepp.

*Periplaneta provisionalis*, Tepper, Tr. R. Soc. S. Australia, xvii, p. 108 (1893).

This species cannot be recognised from the description; some specimens in the Melbourne Museum, identified by Mr. Tepper as *provisionalis*, are young larvae that cannot be referred with any certainty to this or to any other species of the genus.

SOUTH AUSTRALIA, Mount Bryan East (Adelaide Mus., type).

36. *P. inclusa*, Walk.

*Periplaneta inclusa*, Walker, Cat. Blatt. Brit. Mus., p. 140 (1868).

*Platyzosteria inclusa*, Shelford, [*in*] Fauna Südwest Austral., ii, Lief. 9, Blattidae, p. 137, Pl. XIII, fig. 4 (1909).

Piceous above, sometimes variegated with castaneous on the disc of the thorax, nitid, impunctate. Thorax margined laterally with testaceo-hyaline. Head and legs rufous. Antennae rufo-castaneous. No tegminal rudiments. Posterior angles of abdominal tergites

scarcely produced backwards in ♂. Supra-anal lamina, (♂) subquadrate, apex widely emarginate, lateral margins entire, (♀) cucullate, triangular, apex emarginate, lateral margins entire, exceeded by the cerci. Sub-genital lamina (♂) with posterior margin slightly produced.

Total length (♂) 14·8 mm., (♀) 16 mm. ; pronotum 4-4·8 mm. × 5-5·8 mm.

WEST AUSTRALIA, various localities (British Mus., type ; Oxford Mus. ; Hamburg Mus. (*Michaelsen* and *Hartmeyer*)).

37. *P. albomarginata*, Br. (Pl. VIII, fig. 22.)

*Polyzosteria albomarginata*, Brunner von Wattenwyl, *Nouv. Syst. Blatt.*, p. 212 (1865).

Brunner's description is drawn up from a larval specimen, the following is a description of the adult male :—

Piceous, nitid, impunctate. Antennae rufescent except at base. Thoracic tergites faintly carinate, laterally bordered with flavo-testaceous, the borders being outwardly margined rather broadly with piceous. Tegminal rudiments absent. Lateral margin of 7th abdominal tergite finely serrate. Supra-anal lamina triangular, apex incised, lateral margins serrate. Cerci equal in length to the lamina. Sub-genital lamina quadrate, scabrous, styles stout. Legs rufo-castaneous.

Length 34 mm. ; pronotum 9 mm. × 13·8 mm.

NEW SOUTH WALES, Sydney (Vienna Mus., type) ; WEST AUSTRALIA, Coolgardie (Hamburg Mus.), Kalgoorlie (coll. Froggatt.)

38. *P. brunnea*, Tepp.

*Platyzozeria albomarginata*, var. *brunnea*, Tepper, *Tr. R. Soc. S. Australia*, xvii, p. 86 (1893).

This appears to be quite distinct from the preceding, but I have seen no examples.

S. AUSTRALIA, Gilbert River, Kangaroo Is. ; CENTRAL AUSTRALIA, Barrow range (Adelaide Mus., types).

39. *P. variegata*, Shelf.

*Platyzozeria variegata*, Shelford, [*in*] *Fauna Südwest Austral.*, ii, Lief. 9, Blattidae, p. 137, Pl. XIII, fig. 14 (1909).

Distinguished from the two preceding species, its nearest allies, by the form of the supra-anal lamina (♂).

WEST AUSTRALIA, Boyanup (*Michaelsen and Hartmeyer*), (Hamburg Mus., type).

40. *P. obscuripes*, Tepp. (Pl. VIII, fig. 23.)

*Drymaplaneta obscuripes*, Tepper, Tr. R. Soc. S. Australia, xvii, p. 112 (1893).

I have seen no mature examples of this, and strongly suspect it of being the larva of one of the three preceding species. The larval condition of the ♀ sub-genital valves is employed by Tepper as one of the diagnostic characters of his genus *Drymaplaneta*!

SOUTH AUSTRALIA, West coast; WEST AUSTRALIA, Fraser range (Adelaide Mus., types), Swan river (Oxford Mus.).

41. *P. spenceri*, sp. n.

♂. Piceous, nitid, impunctate. Disc of abdomen beneath rufo-castaneous. Margined all round continuously with flavo-testaceous, outlined outwardly with piceous; the supra-anal lamina and cerci piceous or castaneous. Tegminal rudiments absent. Posterior angles of all the abdominal tergites very acutely produced, especially the 8th. Lateral margins of 6th tergite serrate, of 7th denticulate. Supra-anal lamina acutely triangular, terminating in a pair of diverging spines, lateral margins denticulate. Cerci not exceeding the supra-anal lamina. Terminal sternites laterally finely tuberculate. Posterior margin of 6th abdominal sternite strongly denticulate, posterior margins of the two preceding sternites laterally with smaller denticles. Sub-genital lamina small, sub-quadrate, styles very stout, incurved, equal to the cerci. Coxae narrowly bordered with testaceous. Legs piceous.

Length 28 mm.; pronotum 7 mm. × 10 mm.

CENTRAL AUSTRALIA (*Spencer-Gillen expedition*), (Melbourne Mus., type; Oxford Mus., co-type).

42. *P. soror*, Br. (Pl. VIII, figs. 24a, 24b.)

*Polyzosteria soror*, Brunner von Wattenwyl, Nouv. Syst. Blatt., p. 219 (1865).

*Periplaneta semicincta*, Walker, Cat. Blatt. Brit. Mus., p. 140 (1868).

This is the insular form of the next species; it can be



distinguished by its smaller size, more convex shape, the outer border of the flavo-testaceous thoracic margins not distinctly margined with castaneous, the genital styles with a spine at their base and by the supra-anal lamina (♀) being less emarginate at the apex. The species varies in size, New Caledonian examples being the smallest, Bornean examples the largest.

AMBOINA (Vienna Mus., type of *soror*); CERAM (British Mus.); NAVIGATOR'S IS. (Brit. Mus., type of *semicineta*); NEW CALEDONIA (Oxford Mus.); NEW HEBRIDES (Melbourne Mus.); TONGA (Stockholm Mus.); BORNEO (Oxford Mus.); FORMOSA (British Mus.).

43. *P. communis*, Tepp. (Pl. VIII, figs. 25a, 25b.)

*Drymaplaneta communis*, Tepper, Tr. R. Soc. S. Australia, xvii, p. 110 (1893).

*Methana antipodum*, Brancsik, Jahresh. Ver. Trencsin. Com. xix-xx, p. 58, Pl. I, fig. 4 (1897).

QUEENSLAND (Oxford Mus.); SOUTH AUSTRALIA, various localities (Adelaide Mus., type of *communis*; Oxford Mus., type of *antipodum*); WEST AUSTRALIA, Swan River (Oxford Mus.).

44. *P. semivitta*, Walk. (Pl. VIII, figs. 26a to 26f.)

*Periplaneta semivitta*, Walker, Cat. Blatt. Brit. Mus., p. 143 (1868).

Piceous or dark castaneous above, nitid, impunctate. Thoracic tergites laterally bordered with clear flavo-testaceous, outwardly narrowly margined with castaneous. Head testaceous, a castaneous band on vertex and a castaneous blotch on frons, antennae rufo-castaneous. Maxillary palpi (♂) with 1st and 2nd joint swollen. Labrum sub-bilobate. Tegminal rudiments present, subtruncate at apex. 1st abdominal tergite (♂) with a circular gland-opening fringed with rufous setae.\* Supra-anal lamina, (♂) quadrate, angles acute but not produced, posterior margin slightly emarginate, lateral margins entire, (♀) cucullate, triangular, apex deeply notched. Subgenital lamina (♂) trapezoidal, produced, apex widely emarginate, styles placed sub-laterally. Cerci surpassing the supra-anal lamina in both sexes. Coxae testaceous, blotched with castaneous. Femora rufo-castaneous, anterior pair paler; tibiae castaneous. Posterior tibiae (♂) very stout, flattened and expanded.

Total length (♂) 24, (♀) 25 mm.; pronotum 7 mm. × 9 mm.

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\* This is frequently hidden under the metanotum.

WESTERN AUSTRALIA, Swan River (British Mus., type); SOUTH AUSTRALIA, various localities (*Michaelsen* and *Hartmeyer*), (Hamburg Mus.; Oxford Mus.).

This is a somewhat anomalous form as shown by the curious secondary sexual characters of the male.

45. *P. sub-bifasciata*, Tepp.

*Drymaplaneta sub-bifasciata*, Tepp., Tr. Roy. Soc. S. Australia, xvii, p. 112 (1893).

Evidently described from a larva. There is an adult ♀ in bad condition and without label in the Oxford Museum; in this the lateral yellow border of the thoracic tergites is interrupted at the mesonotum by the tegminal rudiments, which are piceous. The species is readily recognisable by the production, along the hind-margins of the pro- and meta-notum, of the lateral yellow border.

SOUTH AUSTRALIA, Northern territory (Adelaide Mus., type).

46. *P. liturata*, Sauss.

*Polyzosteria liturata*, Saussure, Mém. Soc. Sci. Phys. Nat. Genève, xxiii, p. 108, Pl. X, fig. 36 (1873).

Known to me only from the description.

NEW GEORGIA (Geneva Mus., type).

47. *P. circumducta*, Walk.

*Periplaneta circumducta*, Walker, Cat. Blatt. Brit. Mus., p. 143 (1868).

*Drymaplaneta submarginata*, Tepp., Tr. R. Soc. S. Australia, xvii, p. 111 (1893).

Closely allied to *P. soror*, Br., but the flavo-testaceous border runs completely round the body including the anterior margin of the pronotum and so much as is visible of the 8th abdominal tergite. Supra-anal lamina (♂) quadrate, margins entire, posteriorly not emarginate. A small spine at base of styles.

? *LOC.* (British Mus., type of *circumducta*); SOUTH AUSTRALIA, Kangaroo Is., Mount Lofty range (Adelaide Mus., type of *submarginata*).

48. *P. sexguttata*, Walk.

*Periplaneta sexguttata*, Walker, Cat. Blatt. Brit. Mus.,  
p. 141 (1868).

This is a very young larva.

"AUSTRALIA" (British Mus., type).

49. *P. balteata*, Tepp.

*Platyzozeria balteata*, Tepper, Tr. R. Soc. S. Australia,  
xvii, p. 91 (1893).

I have been quite unable to recognise this and the next species; their generic position is problematical.

50. *P. latizona*, Tepp.

*Platyzozeria latizona*, t. c., p. 92 (1893).

SOUTH AUSTRALIA, Mount Bryan East (Adelaide Mus.,  
type).

51. *P. coolgardiensis*, Tepp. (Pl. VIII, fig. 27.)

*Platyzozeria coolgardiensis*, Tepper, op. cit., xix, p. 159  
(1894).

♂. Rufo-testaceous, impunctate, opaque. Disc of thoracic tergites, a band on each abdominal tergite, disc of abdomen beneath, tibiae and tarsi castaneous or rufo-castaneous. Tegminal rudiments absent. Posterior angles of abdominal tergites 2-5 scarcely produced, of tergites 6-7 strongly produced, of tergite 9 sub-lobiform. Lateral margins of 6th and 7th abdominal tergites finely serrate. Supra-anal lamina triangular terminating in two slender spines, barely exceeding the cerci in length. Subgenital lamina trapezoidal, posteriorly very slightly emarginate, styles stout, acuminate. Posterior metatarsi not spined beneath; its pulvillus apical.

Length 24 mm.; pronotum 6 mm. × 10 mm.

WEST AUSTRALIA, Coolgardie (Adelaide Mus., type),  
Kalgoorlie (*W. W. Froggatt*), (Oxford Mus.).

The above description is drawn up from a specimen determined by Mr. Tepper and kindly presented to the Oxford Museum by Mr. Froggatt. The species is an anomalous one, but seems to fit sufficiently into the genus *Platyzozeria*.

52. *P. aposematica*, sp. n. (Pl. IX, fig. 29.)

♀. Pale ferruginous above, disc of pro- and mesonotum, posterior margins of abdominal tergites, 9th tergite, supra-anal lamina and cerci, piceous. Abdomen beneath piceous with the disc castaneous; legs castaneous. Tegminal rudiments absent. Lateral margins of 6th and 7th abdominal tergites serrate, posterior angles strongly produced. Posterior angles of 9th tergite spiniform. Supra-anal lamina triangular, apex notched, lateral margins denticulate. Cerci of equal length with the lamina. Ultimate and penultimate sternites laterally scabrous, posterior margins laterally finely dentate.

Length 40 mm.; pronotum 9.6 mm. × 13 mm.

CENTRAL AUSTRALIA (*Spencer-Gillen Expedition*), (Melbourne Mus., type).

It is rather remarkable that the three Central Australian species described here should show the same tendency to spinosity of the terminal abdominal segments.

53. *P. hartmeyeri*, Shelf.

*Platyzosteria hartmeyeri*, Shelford [*in*] Fauna Südwest Austral., ii, Lief. 9, Blattidae, p. 138 (1909).

WEST AUSTRALIA, Boorabbin (Hamburg Mus., type).

54. *P. zebra*, Tepp.

*Polyzosteria zebra*, Tepper [*in*] Horn Exped. Centr. Australia, ii, p. 362 (1896).

I am unable to determine the correct systematic position of this species; the original description is quoted herewith:—

“♀. Yellow, banded with piceous, stout. Vertex, a band between and below the antennae, base of clypeus, and a longitudinal stripe reddish-piceous. Antennae and palpi reddish. Pronotum scarcely hooded, not much reflexed laterally, almost smooth, shining, disc indistinctly impressed with very faint dark spots; hind angles subacute; hind margin concave. Meso- and metanotum similar, each side with small shallow pits, a dark band rather broad in the middle and convex behind, short; hind margin of metanotum slightly and angularly produced in the middle. Abdomen almost smooth, except a few scattered pits, dark basal band narrow, not extending to lateral margin, posterior angles rectangular or shortly produced as a small tooth. Legs bicolorous; coxae pale testaceous,

anterior border, base and a short stripe in the middle reddish-brown; femora with inner side pale testaceous, remainder reddish; tibiae and tarsi reddish-piceous; arolia large. Abdomen ventrally pale yellowish, each segment with a narrow dark basal band extending to lateral margin. Cerci as long as lamina, slender, pale yellow, terminating in a short spine.

"Total length 35 mm.; pronotum 9 mm. × 19 mm."

CENTRAL AUSTRALIA.

#### Genus 4. LEPTOZOSTERIA, Tepp.

*Leptozosteria*, Tepp., Tr. R. Soc. S. Australia, xvii, p. 96 (1893).

*Characters*. "Body very flat and thin, elongate. Integument soft. Supra-anal lamina of male triangular, terminating in an acute apical spine. Colour pale with dark bands."

The only species of this genus which I have seen is *L. secunda*, Tepp., and that is undoubtedly conspecific with *Cutilia triangulata*, Br. (q. v.). The only important character in Teppér's generic diagnosis is the form of the male supra-anal lamina, and as there are many objections to founding new genera on male secondary sexual characters alone, I expect that it will eventually be necessary to sink *Leptozosteria* as a synonym of *Platyzozeria* or of *Cutilia*.

##### 1. *L. prima*, Tepp.

*Leptozosteria prima*, Tepp., t. c., p. 96 (1893).

CENTRAL AUSTRALIA, Cordilho Downs (Adelaide Mus., type).

#### Genus 5. CUTILIA, Stål.

*Cutilia*, Stål, Oefv. Vet. Akad. Förh., xxxiv (10), p. 36 (1877).

*Characters*. Closely allied to *Platyzozeria*, Br., but the posterior metatarsus long and biserially spined beneath, its pulvillus apical; remaining tarsal joints unarmed beneath, their pulvilli occupying the entire joints. Tegminal rudiments present. In all but one species the posterior angles of the distal abdominal tergites strongly produced backwards. Supra-anal lamina (♂) quadrate.

Type of the genus—*C. nitida*, Br.

Stål founded the genus on *C. tartarea*, Stål, which is synonymous with *C. nitida*, Br. The genus is a link

between the *Polyzosteria*-group and the *Blatta*-group, on account of the tarsal structure (Pl. IX, fig. 40b).

## KEY TO THE SPECIES.

1. Piceous or castaneous.
  2. Piceous. Legs piceous. Broad convex species . . . . . *C. nitida*, Br.
  - 2'. Castaneous. Legs testaceous. Narrow, sub-depressed species . . . . . *C. melanesiae*, sp. n.
- 1'. Testaceous or ferruginous.
  2. Disc of pronotum with three fuscous markings arranged in a triangle . . . *C. triangulata*, Br.
  - 2'. Pronotum with more or less distinct fuscous lateral vittae.
    3. Species exceeding 13 mm. in length.
      4. Posterior angles of distal abdominal tergites (♂) produced . . . . . *C. heydeniana*, Sauss.
      - 4'. Posterior angles of distal abdominal tergites (♂) not produced . . . *C. sedilloti*, Bol.
    - 3'. Species not exceeding 13 mm. in length . . . . . *C. brunni*, Alfk.

1. *C. nitida*, Br.

*Polyzosteria nitida*, Brunner von Wattenwyl, Nouv. Syst. Blatt., p. 214 (1865).

*Periplaneta polita*, Walker, Cat. Blatt. Brit. Mus., p. 139 (1868).

*Cutilia tartarea*, Stål, Oefv. Vet. Akad. Förh., xxxiv (10), p. 36 (1877).

?*Blatta aterrima*, Escholtz, Entomographien, p. 89 (1822).

This species, which is very variable in size, has a wide range outside Australia; the record of its occurrence in Australia is doubtful. I do not know whether Escholtz's type is preserved and his species may not perhaps have the slightest affinity with *nitida*, for the description is too slight for it to be possible to judge of that.

FORMOSA (British Mus., type of *polita*); PHILIPPINES (Stockholm Mus., type of *tartarea*; British Mus.); BORNEO (Oxford Mus.; Paris Mus.); TERNATE (British Mus.); AMBOINA (Vienna Mus., type of *nitida*; Oxford Mus.); NEW GUINEA (Oxford Mus.; Brussels Mus.; Melbourne Mus.);

TORRES STRAITS (British Mus.); NEW SOUTH WALES, Sydney (Oxford Mus.).

2. *C. melanesiac*, sp. n.

♂ Above castaneous, nitid, impunctate. Head, legs and antennae bright testaceous. A broad castaneous stripe down the middle of the face. Tibial spines castaneous. Posterior borders of thoracic tergites slightly produced in the middle. Posterior angles of abdominal tergites moderately produced. Supra-anal lamina trigonal, margins entire, apex truncate, fimbriate, scarcely emarginate, considerably exceeded by the cerci. Sub-genital lamina subquadrate, styles moderate, a well-marked spine at the base of each. Posterior metatarsus exceeding the succeeding joints in length.

Length 19 mm. ; pronotum 6 mm. × 8 mm.

TORRES STRAITS (British Mus., type).

Readily distinguished by the bright testaceous legs.

3. *C. triangulata*, Br.

*Polyzosteria triangulata*, Brunner von Wattenwyl, Ann. Mus. Civ. Genova, ser. 2a, xiii, p. 33 (1893).

*Leptozosteria secunda*, Tepper, Tr. R. Soc. S. Australia, xviii, p. 183 (1894).

*Polyzosteria triangulata*, Krauss, Denkschr. med.-nat. Ges. Jena, viii, p. 750, Pl. LXVII, fig. 1 (1903).

Stål in 1877 quotes this species as belonging to the genus *Cutilia* but gives no description of it. Brunner in a footnote (*l.c.*) alludes to the species but does not give a detailed diagnosis of it; if his remarks on the species beginning—"le metatarse un peu plus long que les autres articles réunis," etc. etc., are reckoned as a diagnosis then the name *triangulata* can stand, but if not then this name must be replaced by *secunda*, Tepp. This is a matter for priority-cranks to wrangle over, but it is not of the least importance. As Krauss gives a good description and figure of the species under the name *triangulata* and as this name is more appropriate than *secunda* I have no hesitation in adopting it.

QUEENSLAND, Rockhampton (Vienna Mus., type), Bowen (*Godeffroy*) (Stockholm Mus.), Cooktown (Adelaide Mus., type of *secunda*), Endeavour river (Oxford Mus.); THURSDAY IS. (Jena University Mus.).

4. *C. heydeniana*, Sauss.

*Periplaneta heydeniana*, Saussure, Rev. Zool. (2) xvi, p. 317 (1864).

*Polyzosteria heydeniana*, Saussure, Mém. Soc. Sci. Phys. Nat. Genève, xx, p. 256 (1869).

*Periplaneta marginifera*, Walker, Cat. Blatt. Brit. Mus., p. 144 (1868).

WEST AUSTRALIA, King George's Sound (British Mus., type of *marginifera*; Oxford Mus.; Geneva Mus., type of *heydeniana*; Paris Mus.), Albany (Hamburg Mus.).

5. *C. sedilloti*, Bol.

*Polyzosteria sedilloti*, Bolivar, Ann. Soc. Ent. France (6) ii, p. 459 (1882).

In the ♂ the posterior angles of the posterior abdominal tergites are rounded and they are not much produced in the ♀.

NEW ZEALAND (coll. Bolivar, type; Oxford Mus.).

6. *C. brunni*, Alfken.

*Platyzozeria brunni*, Alfken, Abh. Ver. Bremen, xvii, p. 142 (1901).

Known to me only from the description. It is apparently to be distinguished by its small size, but it must be noted that *sedilloti* itself varies considerably in size, a specimen in the Oxford Museum from the North island of New Zealand being smaller than specimens from the South island.

CHATHAM IS. (Bremen Mus., type).

Genus 6. ZONIOPLOCA, Stål.

*Zonioploca*, Stål, Bih. Svensk. Akad. ii (13), p. 13 (1874).

*Knephasia*, Tepper, Tr. R. Soc. S. Australia, xvii, p. 99 (1893).

*Characters*. Ocelli absent. Lateral margins of pronotum incassated. Dorsal surface granulate, or with shallow punctures. Tegminal rudiments absent. Posterior angles of abdominal tergites 5-7 strongly produced. Supra-anal lamina, (♂) quadrate, angles obtuse, lateral margins entire, (♀) triangular, apex emarginate. Sub-genital lamina (♂) trapezoidal, styles lateral. Posterior



metatarsus unarmed beneath, equal to the remaining joints in length, its pulvillus apical.

Type of the genus—*Z. alutacea*, Stål.

KEY TO SPECIES.

1. Dorsal surface granulate ; smaller species.
  2. Tibiae unicolorous, testaceous . . . . *Z. medilinea*, Tepp.
  - 2'. Tibiae castaneous on dorsal aspect, testaceous on ventral aspect.
    3. Pro- and mesonotum with lateral fuscous vittae, abdomen above transversely banded with fuscous and olivaceous . . . . . *Z. alutacea*, Stål.
    - 3'. Pro- and mesonotum without lateral fuscous vittae, abdomen above unicolorous, testaceous . . . . *Z. pallida*, Shelf.
- 1'. Dorsal surface with large shallow punctures ; robust species.
  2. Femora and tibiae purple . . . . . *Z. eastii*, Tepp.
  - 2'. Femora and tibiae rufo-testaceous . . *Z. robusta*, sp. n.

1. *Z. medilinea*, Tepp.

*Knephasia medilinea*, Tepper, Tr. R. Soc. S. Australia, xvii, p. 100 (1893).

Readily distinguished by the dark median line, extending from the posterior border of the pronotum to near the apex of the abdomen.

VICTORIA, Lillimur ; SOUTH AUSTRALIA, Sedan, Northern territory (Adelaide Mus., types) ; WEST AUSTRALIA, Mt. Robinson (Hamburg Mus.; Oxford Mus.).

2. *Z. alutacea*, Stål.

*Zonioploca alutacea*, Stål, Bih. Svensk. Akad. ii (13), p. 13 (1874).

*Platyzosteria ardrossanensis*, Tepper, Tr. R. Soc. S. Australia, xvii, p. 92 (1893).

Tepper's description of *ardrossanensis* corresponds perfectly with *alutacea*, the type of which has been kindly lent to me by Dr. Y. Sjösted of Stockholm.

"AUSTRALIA" (Stockholm Mus., type of *alutacea*) ; QUEENSLAND (Oxford Mus.) ; SOUTH AUSTRALIA, Ardrossan (Adelaide Mus., type of *ardrossanensis*) ; WEST AUSTRALIA, Albany (Deutsche Entom. National Museum).

3. *Z. pallida*, Shelf. (Plate IX, figs. 28a and 28b.)

*Zonioploca pallida*, Shelford, [in] Fauna Südwest Austral. ii, Lief. 9, Blattidae, p. 138, Pl. XIII, fig. 7 (1909).

This species varies considerably in size, in the extent of the granulation of the dorsal surface and some examples are paler than others.

WEST AUSTRALIA, various localities (Oxford Mus., types; Hamburg Mus.).

4. *Z. castii*, Tepp.

*Anamesia castii*, Tepper, Tr. R. Soc. S. Australia, xvii, p. 92 (1893).

Known to me only from the description.

CENTRAL AUSTRALIA (Adelaide Mus., type).

5. *Z. robusta* sp. n.

♀. Testaceous, nitid. Head castaneous, mouth-parts and antennae testaceous. Dorsum with large shallow punctures, thoracic tergites rugose laterally and with a lateral castaneous vitta, a castaneous spot at the base of the meso- and metanotum in the middle line. The punctures on the abdominal tergites rufo-castaneous; margins of 6th and 7th tergites very faintly serrate. Supra-anal lamina trigonal, sub-cucullate, apex emarginate. Cerci not exceeding the lamina, slender, flattened. Abdomen beneath impunctate, pale testaceous, penultimate tergite and valves rufous. Legs rufo-testaceous.

Length 35 mm.; pronotum 10 mm. × 16.5 mm.

CENTRAL AUSTRALIA (*v. Leonhardi*), (Senckenberg Mus., type).

Genus 7. COSMOZOSTERIA, Stål.

*Cosmozosteria*, Stål, Bih. Svensk. Vet. Akad. ii (13), p. 13 (1874).

*Characters*. Ocelli present. Tegminal rudiments absent. Abdomen broader than thorax. Posterior angles of abdominal tergites 5-6 not, or scarcely produced, of tergite 7, produced. Angles of 9th abdominal tergite lobiform. Dorsal surface of abdomen scabrous. Supra-anal and sub-genital laminæ (♂) quadrate. Cerci short. Posterior metatarsus very short, unarmed beneath, its pulvillus occupying the greater part of the joint.

Type of the genus—*C. bicolor*, Sauss.

The genus is not very well marked off from *Platyzosteria* but the species here included in it have all a well-marked facies which is quite distinct from that of *Platyzosteria* species.

KEY TO THE SPECIES.

- 1. Unicolorous castaneous, except the angles of 9th abdominal tergite . . . *C. froggatti*, sp. n.
- 1'. Banded, margined or spotted with ochreous.
  - 2. Posterior margins of thoracic tergites ochreous.
    - 3. Abdominal tergites unicolorous . . . *C. zonata*, Walk.
    - 3'. Abdominal tergites spotted with ochreous.
      - 4. Meso- and metanotum not bordered laterally with ochreous . . . . . *C. maculimarginata*, Tepp.
      - 4'. Meso- and metanotum bordered laterally with ochreous . . . . . *C. bicolor*, Sauss. var.
  - 2'. Posterior margins of thoracic tergites not ochreous.
    - 3. Abdominal tergites with transverse ochreous streaks.
      - 4. Thoracic tergites with triangular lateral ochreous markings . . . . . *C. gloriosa*, sp. n.
      - 4'. Thoracic tergites laterally banded with ochreous . . . *C. picta*, Tepp.
    - 3'. Abdominal tergites with small lateral ochreous spots.
      - 4. Thoracic tergites with complete lateral borders of ochreous . . . . . *C. bicolor*, Sauss.
      - 4'. Thoracic tergites with incomplete lateral borders of ochreous . . . . . *C. lateralis*, Walk.

1. *C. froggatti*, sp. n.

♂ and ♀. Uniform castaneous above, except the angles of the 9th abdominal tergite which are orange; margins of thoracic

tergites sometimes rather paler than the disc. Antennae rufescent. Thoracic tergites smooth, impunctate. Abdominal tergites rather scabrous. Supra-anal lamina, ( $\sigma$ ) quadrangular, angles spiniform, deflexed, posterior margin straight, surpassed by sub-genital lamina which is quadrate, posteriorly widely emarginate, angles spiniform, with styles lateral, ( $\varphi$ ) trigonal, sub-cucullate, apex rounded not emarginate, margins faintly crenulate. Cerci (mutilated in  $\sigma$ ) barely exceeding the supra-anal lamina ( $\varphi$ ). Coxae margined with ochreous, posterior metatarsus short.

Length ( $\sigma$ ) 25 mm., ( $\varphi$ ) 27 mm.; pronotum 8 mm.  $\times$  12-13 mm.

QUEENSLAND, Lolworth (coll. Froggatt, type  $\sigma$ ), Peak Downs (Stockholm Mus., type  $\varphi$ ).

The  $\varphi$   $\varphi$  are paler than the male.

2. *C. zonata*, Walk. (Pl. IX, figs. 31, 32.)

*Polyzosteria zonata*, Walker, Cat. Blatt. Brit. Mus., p. 159 (1868).

*Polyzosteria quadrifascia*, Walker, t. c., p. 160 (1868).

*Polyzosteria pectoralis*, Walker, t. c., p. 160 (1868).

*Platyzozeria trifasciata*, Tepper, Tr. R. Soc. S. Australia, xvii, p. 91 (1893).

Piceous (*quadrifascia*) or castaneous (*zonata*). Anterior margin of pronotum ochreous (*quadrifascia*) or unicolorous with disc (*trifasciata*); posterior margins of thoracic tergites narrowly or broadly (*zonata*) ochreous. Thoracic tergites minutely punctate with some smooth spaces. Dorsal surface of abdomen scabrous, posterior angles of 2nd to 5th tergites not produced, of 6th slightly produced, of 7th strongly produced, of 9th lobiform ( $\sigma$ ) or spiniform ( $\varphi$ ) and sometimes orange in colour. Lateral margins of 7th tergite serrate, more strongly in  $\sigma$  than in  $\varphi$ . Abdomen beneath finely scabrous, lateral margins of 7th sternite ( $\sigma$ ) denticulate, of 6th sternite ( $\varphi$ ) serrate. Supra-anal lamina, ( $\sigma$ ) quadrate, posteriorly non-emarginate and rufo-fimbriate, posterior angles produced as strong, deflexed spines, ( $\varphi$ ) triangular, cucullate, apex emarginate, laterally serrate. Sub-genital lamina ( $\sigma$ ) trapezoidal, posteriorly widely emarginate, exceeding the supra-anal lamina, posterior angles spinously produced, styles lateral. Cerci orange or piceous exceeding the supra-anal lamina ( $\sigma$ ) but not the sub-genital lamina, acutely pointed. Coxae margined with testaceous.

Length ( $\sigma$ ) 21 mm., ( $\varphi$ ) 25.5 mm.; pronotum 6.5-7.5 mm.  $\times$  10-13.1 mm.

QUEENSLAND (British Mus., type of *quadrifascia*; Oxford Mus.; Melbourne Mus.); SOUTH AUSTRALIA, Northern territory (British Mus., type of *pectoralis*; Oxford Mus.; Adelaide Mus., type of *trifasciata*; Melbourne Mus.), Port Essington (British Mus., type of *zonata*; Oxford Mus.).

3. *C. maculimarginata*, Tepp.

*Platyzosteria maculimarginata*, Tepper, Tr. R. Soc. S. Australia, xix, p. 160 (1895).

Known to me only from the description; it may be only a varietal form of the preceding.

N. QUEENSLAND (Adelaide Mus., type).

4. *C. bicolor*, Sauss. (Pl. IX, fig. 33.)

*Polyzosteria bicolor*, Saussure, Rev. Zool. (2) xvi, p. 307 (1864); Mém. Soc. Sci. Phys. Nat. Genève, xx, p. 259 (1869).

*Polyzosteria ligata*, Brunner von Wattenwyl, Nouv. Syst. Blatt., p. 220 (1865).

*Platyzosteria subzonata*, Tepper, Tr. R. Soc. S. Australia, xviii, p. 181 (1894).

This is another species that in coloration is very variable; the form *subzonata* has the posterior margins of the thoracic tergites narrowly bordered with ochreous but is otherwise indistinguishable from the type form. Structurally the species differs from *C. zonata*, Walk., as follows:—The abdomen is less scabrous, none of the abdominal tergites or sternites are laterally serrate, the posterior angles of the 7th abdominal tergite are scarcely produced, the supra-anal lamina (♂) has minute, non-deflexed spines at the posterior angles, (♀) with the margins entire.

“AUSTRALIA” (Geneva Mus., type of *bicolor*); QUEENSLAND (Oxford Mus.), Port Curtis (Vienna Mus., type of *ligata*), Stradbroke Is. (coll. *Froggatt*); VICTORIA (Adelaide Mus., type of *subzonata*); NEW SOUTH WALES, Darling river (Oxford Mus.; Melbourne Mus.).

5. *C. gloriosa*, sp. n.

♀. Dark castaneous; thoracic tergites with large triangular flavid blotches situated near their posterior angles. Abdominal

tergites 1-7 with transverse narrow flavid streaks extending from the outer margins inward, 3 to 4 minute brown spots in each streak.

Dorsal surface minutely shagreened and with large punctures on the meso-, metanotum and abdominal tergites. Posterior angles of 6th abdominal tergite scarcely produced, of 7th strongly produced. (Cerci and supra-anal lamina mutilated.) Ventral surface castaneous, apex of valves and margins of coxae flavo-testaceous.

Length 25.2 mm.; pronotum 8.9 mm. × 14 mm.

QUEENSLAND, Cooktown (Melbourne Mus., type).

The species is allied to *C. picta*, Tepp., but is I believe quite distinct.

6. *C. lateralis*, Walk.

*Polyzosteria lateralis*, Walker, Cat. Blatt. Brit. Mus., p. 154 (1868).

*Polyzosteria ferruginca*, Walker, t. c., p. 158 (1868).

♀. Rufo-castaneous, thoracic tergites minutely shagreened, abdomen above very scabrous. Pronotum on the antero-lateral margins only ochreous, meso- and metanotum with an ochreous spot at the anterior angles. Abdominal tergites 2-6 with small ochreous spots, laterally situated. Posterior angles of tergites 6-7 produced, of 9th tergite lobiform, ochreous. Supra-anal lamina trigonal, lateral margins serrate, apex not emarginate, exceeded by the cerci which are tipped with ochreous. Thoracic tergites beneath testaceous, outwardly margined with castaneous, abdominal sternites 1-6 with lateral ochreous spots. Coxae margined with testaceous.

Length 21 mm. ; pronotum 7.2 mm. × 12 mm.

*Hab.* "AUSTRALIA" (British Mus., types ; Oxford Mus.).

7. *C. picta*, Tepp.

*Platyzozeria* (?) *picta*, Tepper, Tr. R. Soc. S. Australia, xviii, p. 182 (1894).

Known to me only from the description.

QUEENSLAND, Cooktown (Adelaide Mus., type).

Genus 8. ANAMESIA, Tepp.

*Anamesia*, Tepper, Tr. R. Soc. S. Australia, xvii, p. 69 (1893).

*Pseudolampra*, Tepper, t. c., p. 96 (1893).

*Characters.* Ocelli present or absent. Pronotum with margins not reflexed nor incrassated. Tegminal rudiments absent. Dorsal surface of abdomen not scabrous, with shallow punctures. Posterior angles of none of the abdominal tergites produced, angles of 9th abdominal tergite often lobiform. Cerci short, flattened. Supra-anal lamina, (♂) quadrate, (♀) trigonal, sub-cucullate. Tibiae with spines on outer aspect tri-seriately arranged. Posterior metatarsus shorter than remaining joints, not spined beneath, its pulvillus occupying the greater part of the joint.

Type of the genus—*A. frenchii*, Tepp.

The foregoing description is drawn up after an examination of *A. frenchii*, Tepp., *A. polyzona*, Walk., a new form, and a larva of *Pseudolampra punctata*, Tepp. Mr. Froggatt at my request very kindly sent to Mr. Tepper an example identified by me as *A. frenchii*, and Mr. Tepper, having compared the specimen with his own type, pronounces them to be identical. *P. punctata*, Tepp., and *P. rothei*, Tepp., are undoubtedly congeneric with *frenchii* and it is not easy to understand why the genus *Pseudolampra* was ever erected. The most important character of *Anamesia* is the obtuse angulation of the 7th abdominal tergite; it is possible that all of the Tepperian species do not conform to this character, in which case they must be referred to other genera. The following key is quite provisional and too much reliance must not be placed on it.

KEY TO THE SPECIES.

- 1. Not unicolorous but banded or margined with paler colour.
  - 2. Posterior margins of abdominal tergites ochreous.
    - 3. Posterior margins of thoracic tergites ochreous . . . . . *A. polyzona*, Walk.
    - 3'. Posterior margins of thoracic tergites not ochreous . . . . . *A. lambii*, Tepp.
  - 2'. Posterior margins of abdominal tergites not ochreous.
    - 3. Abdomen bordered laterally with ochreous . . . . . *A. frenchii*, Tepp.
    - 3'. Abdomen not bordered laterally with ochreous . . . . . *A. lindsayi*, Tepp.
- 1'. More or less unicolorous.
  - 2. Pronotum unicolorous testaceous . . . . . *A. walkeri*, sp. n.
  - 2'. Pronotum with fuscous maculae.





margins are minutely serrate; in the female the lamina is constructed as in *polyzona* ♀. The species varies in colour; in some examples the pale border is broad and the legs are testaceous, in others the pale border is narrow and the legs are castaneous.

NORTH QUEENSLAND (Adelaide Mus., type); WEST AUSTRALIA, Day Dawn (*Michaelsen* and *Hartmeyer*), (Hamburg Mus.), Lawlers (coll. *Froggatt*).

4. *A. lindsayi*, Tepp.

*Anamesia lindsayi*, *Tepper*, t. c., p. 71 (1893).

Known to me only from the description.

WEST AUSTRALIA, Fraser range (Adelaide Mus., type).

5. *A. walkeri*, sp. n.

♂. Unicolorous testaceous. Head, dorsal surface and abdominal sternites finely punctate. Eyes very wide apart, equally distant with the antennal sockets. Supra-anal lamina quadrate, margins entire, apex truncate, non-emarginate, fimbriate, surpassed by the subgenital lamina which is quadrate, produced, posteriorly very slightly emarginate, with styles from near the base. Cerci short, blunt, exceeding both laminae.

Length 21.2 mm.; pronotum 7.1 mm. × 11 mm.

NEW S. WALES, Sydney (Oxford Mus., type).

This is a somewhat remarkable species, superficially resembling very closely *Zonioploca pallida* mihi, but distinguished by the non-incrassated margins of the pronotum, non-produced angles of the abdominal tergites, absence of granules on the dorsal surface and by the unicolorous legs. The distance of the eyes apart shows that much reliance cannot be placed on this character for purposes of discriminating between Old and New World Blattinae. I have much pleasure in naming this interesting species after my friend and colleague, Commander J. J. Walker, R.N., who presented the unique example to the Oxford Museum.

6. *A. punctata*, Tepp.

*Pseudolampra punctata*, *Tepper*, Tr. R. Soc. S. Australia, xvii, p. 97 (1893).

WEST AUSTRALIA, Fraser range (Adelaide Mus., type); SOUTH AUSTRALIA, Tennant's Creek (*Deutsche Ent. Nat. Mus.*).

7. *A. rothei*, Tepp.

*Pseudolampra rothei*, Tepper, t. c., p. 98 (1893).

SOUTH AUSTRALIA, Sedan (Adelaide Mus., type).

8. ? *A. ornata*, Tepp.

*Pseudolampra ornata*, Tepper, t. c., p. 98 (1893).

SOUTH AUSTRALIA (Adelaide Mus., type).

9. ? *A. circumcincta*, Walk.

*Polyzosteria circumcincta*, Walker, Cat. Derm. Salt. Brit. Mus. V. Suppl. Blatt., p. 36 (1871).

A young larva, possibly of *A. frenchii*.

AUSTRALIA (British Mus., type).

10. ? *A. fulvornata*, Tepp.

*Anamesia* (?) *fulvornata*, Tepper, Tr. R. Soc. S. Australia, xviii, p. 177 (1894).

Mr. Tepper himself is doubtful of the systematic position of this species.

VICTORIA, Howbunan (Adelaide Mus., type).

Genus 9. DESMOZOSTERIA, Shelf.

*Desmozosteria*, Shelford, [*in*] Fauna Südwest Austral., ii, Lief. 9, Blattidae, p. 139 (1909).

*Characters.* Allied to *Zonioploca*, but the angles of none of the abdominal tergites backwardly produced. Lateral margins of the pronotum incassated. Tegminal rudiments absent. Dorsal surface punctate or smooth. Supra-anal lamina (♂) quadrate, margins entire, (♀) trigonal, cucullate. Cerci short, flattened. Posterior metatarsus very short, not spined beneath.

Type of the genus *D. michaelsoni*, Shelf.

The genus stands in the same relation to *Zonioploca* that *Anamesia* does to *Cosmozosteria*.

KEY TO THE SPECIES.

1. Thoracic tergites uniformly punctate . . . *D. grosse-punctata*, sp. n.
- 1'. Thoracic tergites not uniformly punctate, or smooth.
2. Thoracic tergites smooth . . . . . *D. michaelsoni*, Shelf.
- 2'. Thoracic tergites laterally finely punctate.
3. Castaneous banded with ochreous . . . *D. cincta*, sp. n.
- 3'. Rufescent . . . . . *D. rufescens*, Shelf.

1. *D. grosse-punctata*, sp. n.

♀. Above piceous; lateral and posterior margins of all the tergites, anterior margin of pronotum, bright ochreous. Thoracic tergites deeply and closely punctate, abdominal tergites smooth. Beneath uniformly flavo-testaceous. Vertex, antennae except the basal joints, maxillary palpi, upper border of femora, the tibiae and tarsi, piceous. Anterior and lateral margins of pronotum, lateral margins of meso- and metanotum strongly incrassated, the posterior angles strongly produced backwards. Supra-anal lamina faintly scabrous, trigonal, margins entire, apex not emarginate, not exceeded by the cerci which are ochreous above and castaneous below.

Length 23.5 mm.; pronotum 7.3 mm. × 10.1 mm.

Habitat unknown (Oxford Mus., type).

A very distinct species, undoubtedly Australian in origin.

2. *D. michaelsoni*, Shelf.

*Desmozosteria michaelsoni*, Shelford, op. cit., p. 139, Pl. XIII, fig. 9 (1909).

WEST AUSTRALIA, Boorabbin (*Michaelson* and *Hartmeyer*), (Hamburg Mus., type).

3. *D. cincta*, sp. n.

♀. Above nitid, castaneous, posterior margins of all the tergites and the lateral margins of the thoracic tergites ochreous; beneath sordid testaceous. Occiput and vertex of head castaneous; antennae with basal joint castaneous, remainder piceous, maxillary palpi piceous. Lateral margins of thoracic tergites strongly incrassated, discs finely punctate, posterior margins convex. Supra-anal lamina sub-quadrate, angles rounded, non-emarginate, barely exceeded by the cerci which are testaceous. Femora and tibiae rufo-castaneous on the dorsal aspect, testaceous on the ventral aspect.

Length 26.6 mm.; pronotum 8.4 mm. × 12 mm.

CENTRAL AUSTRALIA (*v. Leonhardi*), (Senckenberg Mus., type).

Superficially the insect closely resembles *Anamesia polyzona*, Walk.

4. *D. rufescens*, Shelf.

*Desmozosteria rufescens*, Shelford, op. cit., p. 140 (1909).

WEST AUSTRALIA, Denham (*Michaelson* and *Hartmeyer*), (Hamburg Mus., type; Oxford Mus.).

## Genus 10. TEMNELYTRA, Tepp.

*Temnelytra*, Tepper, Tr. R. Soc. S. Australia, xvii, p. 38 (1893).

*Characters.* Body flattened and depressed. Antennae longer than the body. Pronotum anteriorly parabolic, posteriorly truncate, exposing the large scutellum. Tegmina quadrate or sub-quadrate, extending to the 1st abdominal tergite. Wings entirely absent. 1st abdominal tergite (♂) with scent-gland opening. Posterior angles of distal abdominal tergites produced (*T. undulivitta*, Walk., ♂ is an exception). Supra-anal lamina, (♂) quadrate, margins entire, (♀) triangular, apex emarginate. Cerci longer than the lamina in both sexes. Posterior metatarsus very short, spined beneath.

Type of the genus—*T. truncata*, Br.

This is a well-defined genus. The obtuse angles of the distal abdominal tergites in *T. undulivitta*, Walk. (♂), is paralleled in the genus *Cutilia* by *C. sedilloti*, Bol. (♂), also a New Zealand species. The species *abbreviata* included by Mr. Tepper in this genus is a true species of *Temnopteryx* (sub. fam. *Phyllodromiinae*); I have seen the type, which is in the Melbourne Museum.

## KEY TO THE SPECIES.

1. Pronotum with fuscous vittæ . . . *T. undulivitta*, Walk.  
 1'. Pronotum without fuscous vittæ.  
 2. Tegmina quadrate . . . . . *T. truncata*, Br.  
 2'. Tegmina with outer angles hebetate *T. subtruncata*, Tepp.

1. *T. undulivitta*, Walk. (Pl. IX, fig. 36.)

*Periplaneta undulivitta*, Walker, Cat. Blatt. Brit. Mus., p. 144 (1868).

♂. Rufo-testaceous. A band between the eyes and two stripes down the face, castaneous. Antennae rufo-testaceous. Pronotum with the disc rather darker than the margins, an undulate castaneous vitta on each side, extending on to the tegmina, which are quadrate, their venation obsolete. Abdomen fusco-castaneous, margins and two spots on each side rufo-testaceous. Posterior angles of abdominal tergite not backwardly produced. Supra-anal lamina quadrate, posterior angles acute, posteriorly widely emarginate. Cerci very short and blunt. Sub-genital lamina quadrate, styles as long as cerci, lateral. Legs testaceous.

♀. Similar, abdomen above testaceous with lateral castaneous spots

on tergites 2-5, tergites 6 and 7 castaneous. Supra-anal lamina triangular, apex emarginate, castaneous at base, rest testaceous. Posterior angles of abdominal tergites backwardly produced. Cerci longer and more acuminate.

Length (♂) 15 mm., (♀) 14 mm.; tegmina, (♂) 4 mm., (♀) 3.5 mm.; pronotum 5 mm. × 6 mm.

NEW ZEALAND (British Mus., type; Vienna Mus.).

2. *T. truncata*, Br. (Pl. IX, figs. 37a and 37b.)

*Polyzosteria truncata*, Brunner von Wattenwyl, *Nouv. Syst. Blatt.*, p. 217 (1865).

*Temnelytra harpuri*, Tepper, *Tr. R. Soc. S. Australia*, xvii, p. 39 (1893).

I have seen specimens in the Melbourne Museum identified by Mr. Tepper, and there can be no doubt of the specific identity of *truncata* and *harpuri*.

NEW SOUTH WALES (Vienna Mus., type of *truncata*), Goulburn Range (Melbourne Mus.); VICTORIA, Gippsland (Melbourne Mus.; Oxford Mus.); SOUTH AUSTRALIA, Kangaroo Is. (Adelaide Mus., type of *harpuri*).

3. *T. subtruncata*, Tepp.

*Temnelytra subtruncata*, Tepper, *op. cit.*, xix, p. 164 (1895).

Distinguished by the darker colour and by the form of the tegmina, which are shorter in the ♀ than in the ♂, scarcely extending beyond the middle of the metanotum.

VICTORIA, Fernshaw (Melbourne Mus., types; Oxford Mus.).

Genus II. SCABINA, nov.

*Characters.* Eyes and antennal sockets equally far apart. Ocelli present. Antennae robust. Pronotum parabolic, posteriorly truncate, exposing the scutellum. Tegmina quadrate, corneous, not extending beyond the 1st abdominal tergite. Wings rudimentary, squamiform. Posterior angles of abdominal tergites strongly produced backwards. Supra-anal lamina (♂) quadrate, entire. Cerci exceeding the lamina. Styles long, slender. Posterior metatarsus shorter than succeeding joint, not spined beneath, its pulvillus apical.

Type of the genus—*S. antipoda*, Kirby.

The genus is very close to *Eurycotis* and *Pelmatosilpha* of

the New World, but all the species of those genera that I have been able to examine have the posterior metatarsus spined beneath.

1. *S. antipoda*, Kirby.

*Pelmatosilpha* (?) *antipoda*, Kirby, Ann. Mag. Nat. Hist., ser. 7, xii, p. 376 (1903).

To Kirby's description may be added:—

Tegmina with outer margins incrassate and sinuate. Wings squamiform, scarcely exceeding the metanotum. Supra-anal lamina with non-serrate margins, apex non-emarginate. Styles not lateral in position.

Length 25 mm. ; tegmina 7.5 mm. ; pronotum 8.9 mm. × 12 mm.

QUEENSLAND (British Mus., type ; Oxford Mus., co-type).

Genus 12. METHANA, Stål.

*Methana*, Stål, Oefv. Vet. Akad. Förh. xxxiv (10), p. 36 (1877).

*Wodongia*, Tepper, Tr. R. Soc. S. Australia, xix, p. 155 (1895).

*Characters.* Antennae longer than body. Pronotum anteriorly parabolic, almost covering vertex of head, posteriorly very obtusely angled. Scutellum not exposed. Tegmina and wings fully developed, at least as long as the abdomen, generally longer. Supra-anal lamina (♂) quadrate, margins not serrate, (♀) triangular, apex emarginate. Cerci long, acuminate. Femora heavily spined. Posterior metatarsus about equal in length to remaining joints, biserially spined beneath, its pulvillus apical ; remaining joints of tarsus with large pulvilli, not spined beneath.

Type of the genus : *M. marginalis*, Sauss.

KEY TO THE SPECIES.

1. Uniform castaneous.
  2. Large species, exceeding 30 mm. in total length . . . . . *M. magna*, sp. n.
  - 2'. Smaller species, less than 30 mm. in total length . . . . . *M. convexa*, Walk.
- 1'. Not uniform castaneous.
  2. Pronotum testaceous with fuscous vittae. *M. curvigera*, Walk.
  - 2'. Pronotum castaneous with flavo-testaceous margins.

- 3. Posterior margin of pronotum not bordered with flavo-testaceous.
- 4. Disc of pronotum immaculate . . . *M. marginalis*, Sauss.
- 4'. Disc of pronotum with two ochreous maculae . . . . . *M. soror*, Sauss.
- 3'. Posterior margin of pronotum bordered with flavo-testaceous.
- 4. Tegmina laterally margined with flavo-testaceous . . . . . *M. papua*, Shelf.
- 4'. Tegmina uniform castaneous . . . *M. hosei*, sp. n.
- Species of doubtful position . . . . . *M. pallipalpis*, Serv.

1. *M. magna*, sp. n.

♂ and ♀. Castaneous, nitid. Head sordid testaceous, vertex, a band between the antennal sockets, a W-shaped band at base of clypeus, castaneous. Antennae with basal joint testaceous, remainder castaneous. Pronotum with sides deflexed, posteriorly truncate. Tegmina and wings exceeding apex of abdomen. Supra-anal lamina (♂) quadrate, fimbriate, margins entire, (♀) triangular, apex widely emarginate. Cerci very long, acuminate. Genital styles (♂) very long and slender. Coxae and front legs testaceous, mid femora rufo-testaceous with castaneous lines, mid-tibiae and tarsi and hind legs castaneous. Posterior metatarsus a trifle shorter than remaining joints, its pulvillus large.

♂ and ♀. Total length 40-41 mm. ; length of body, 34-35 mm. ; of tegmina, 30-31 mm. ; pronotum 10.5 mm. × 15 mm.

BORNEO, Sarawak (*Shelford*) (Oxford Mus., ♂ and ♀ types).

The species bears a close superficial resemblance to *Periplaneta valida*, Br., the type of which I have seen, but can readily be distinguished by the structure of the tarsi.

2. *M. convexa*, Walk.

*Periplaneta convexa*, Walker, Cat. Derm. Salt. Brit. Mus., Suppl. Blatt., p. 152 (1869).

*Methana rufescens*, Kirby, Ann. Mag. Nat. Hist., ser. 7, xii, p. 374 (1903).

♂. Rufo-castaneous, nitid. Head rufo-castaneous or piceous ; mouth-parts testaceous. Tegmina and wings not extending much beyond the apex of the abdomen. Supra-anal lamina produced, quadrate, margins entire, apex not emarginate. Sub-genital lamina

trapezoidal, styles very long and slender. Cerci long and acuminate. Legs rufo-castaneous.

Total length 23-24.5 mm.; length of body 19-21 mm.; length of tegmina, 16.5-19 mm.; pronotum 7 mm.  $\times$  9 mm.

QUEENSLAND, Moreton Bay (British Mus., type of *convexa*); NEW SOUTH WALES, Sydney, Home Bush (*W. W. Froggatt*), (British Mus., type of *rufescens*; Oxford Mus.).

I have compared the types and found them identical. Kirby gives the species identified by Brunner as *pallipalpis*, Serv., as a synonym of *rufescens*, but in Brunner's species the supra-anal lamina ( $\delta$ ) is described as "profondément découpée," whereas in *rufescens* this is not the case; this is too important a character to be ignored.

3. *M. curviger*a, Walk.

*Periplaneta curviger*a, Walker, Cat. Blatt. Brit. Mus., p. 134 (1868).

QUEENSLAND, Moreton Bay (British Mus., type).

4. *M. marginalis*, Sauss.

*Periplaneta marginalis*, Saussure, Rev. Zool. (2), xvi, p. 319 (1864).

*Periplaneta ligata*, Brunner von Wattenwyl, Nouv. Syst. Blatt., p. 234 (1865).

"AUSTRALIA" (Paris Mus., type of *marginalis*); QUEENSLAND, Port Curtis (Vienna Mus., type of *ligata*); NEW SOUTH WALES, Hunter River (Oxford Mus.).

5. *M. soror*, Sauss.

*Periplaneta soror*, Saussure, Rev. Zool. (2), xvi, p. 319 (1864),

*Periplaneta biquadrata*, Walker, Cat. Blatt. Brit. Mus., p. 134 (1868).

*Periplaneta oculata*, Walker, Cat. Derm. Salt. Brit. Mus., Suppl. Blatt., p. 152 (1869).

*Wodongia lunata*, Tepper, Tr. R. Soc. S. Australia, xix, p. 155 (1895).

This differs from the preceding species by the greater distance apart of the eyes, the immaculate head and the pale legs. The colouring of the pronotum varies a good



deal, sometimes the two maculae on the disc becoming confluent as in *lunata*.

"AUSTRALIA" (Paris Mus., type of *soror*; British Mus., type of *biquadrata*; Oxford Mus., type of *oculata*); VICTORIA, Wodonga (Melbourne Mus., type of *lunata*).

6. *M. papua*, Shelf.

*Methana papua*, Shelford, Mém. Soc. ent. Belg., xv, p. 234 (1908).

BRITISH NEW GUINEA, Astrolabe District (Genoa Mus., ♂ type; Brussels Mus., ♀ type).

7. *M. hosci*, sp. n.

♀. Head, body and legs piceous, front coxae and a large blotch on the posterior coxae testaceous. Pronotum sub-quadrate, sides strongly deflexed, bordered all round with ochreous, the border being very broad on the postero-lateral and posterior margins, its inner margin sinuate. Tegmina and wings uniform castaneous, extending considerably beyond the apex of the abdomen. Supra-anal lamina triangular, cucullate, apex triangularly emarginate. Cerci moderate.

Total length 29 mm.; length of body 24 mm.; length of tegmina 23 mm.; pronotum 7.9 mm. × 9 mm.

BORNEO, Sarawak, Baram District (*C. Hose*), (Oxford Mus., type).

8. ? *M. pallipalpis*, Serv.

*Kakerlac pallipalpis*, Serville, Hist. Nat. Ins. Orth., p. 71 (1839).

? *Periplaneta pallipalpis*, Brunner von Wattenwyl, Nouv. Syst. Blatt., p. 238 (1865).

As the type of this species is lost, its systematic position is quite uncertain. Brunner states (Ann. Mus. Civ. Genova, ser. 2a xiii, p. 36 (1893) that the species as identified by him belongs to the genus *Methana*.

JAVA; SUMATRA (*de Haan*); AUSTRALIA (*Brunner*).

Genus 13. PARAMETHANA, Shelf.

*Paramethana*, Shelford, Sjöstedt's Kilimandjaro-Meru Exp., Blattodea, p. 31 (1907).

*Characters*.—Differs from *Methana* in the short tegmina and wings which do not extend beyond the fifth abdominal tergite and

in the discoidal pronotum. Third antennal joint nearly three times longer than the second.

Type of the genus—*P. robusta*, Shelf.

*P. robusta*, Shelf.

*Paramethana robusta*, Shelford, *l. c.*, p. 31, Pl. II, fig. 7 (1907).

GERMAN EAST AFRICA, Lower Meru (Stockholm Mus., type; Oxford Mus.).

#### XI. REVISION OF THE GENUS *Gyna*, BR., WITH A DESCRIPTION OF A NEW GENUS.

The genus *Gyna* was formed in 1865 (Brunner, *Nouv. Syst. Blatt.*, p. 266) for the reception of some species of African *Blattidae* that previously had been placed in *Panchlora*; since that date a number of species have been added by various authors, and as many of the species are closely allied, cryptically coloured forms, presenting few salient features of taxonomic importance, their identification has been attended with considerable difficulty. Fortunately I have been able to examine and compare nearly all the types, and my grateful thanks are due to Dr. H. Dohrn of Stettin, Dr. Y. Sjöstedt of Stockholm, Dr. F. Römer of Frankfort-à-M., Dr. K. Holdhaus of Vienna, Dr. Giglio-Tos of Cagliari and Dr. M. Bedot of Geneva for the loan of the valuable specimens in their charge; without this friendly co-operation a satisfactory revision of the genus was out of the question. I have received for determination large collections of African *Blattidae* from various continental Museums, and as all—but especially the West African collections—are very rich in examples of this particular genus I am confident that I have in my possession at present a greater amount of material for the revision of the genus than has ever before been gathered together. The tropics of West Africa may be regarded as the head-quarters of the genus, for no less than 18 out of the 23 known species occur there; there are 4 East African and only 2 South African species. In my account of the *Blattidae* collected by Dr. Y. Sjöstedt on his Kilimandjaro-Meru expedition I gave my reasons for believing that the genera *Trichomera*, Kirby, and *Apotrogia*, Kirby, were based on larval forms of *Gyna* and I still see no reason to modify that

opinion. The West-African collections before me contain quantities of examples that could be referred equally well to either of Mr. Kirby's genera but I have never yet seen an adult example that could be referred to them. The erect pubescence of *Trichomera insignata* persists in many species of *Gyna*, and the structural differences between *Trichomera* and *Apotrogia* on the one hand and *Gyna* on the other are such as we are thoroughly familiar with in the larvae and adults of other genera of Blattidae.

The species of *Gyna* can be divided into two sections; in one section the pronotum is smooth and nitid, rich castaneous in colour, with ochreous margins; in the other section the pronotum is testaceous but the disc is occupied with a piceous or castaneous lyrate marking that under the lens presents an appearance as if it had been chiselled out of the surface of the pronotum; the form and extent of the marking is very variable and presents few characters of importance in classifying the species. *G. hyalina* may be regarded as intermediate in character between the two sections of the genus and *G. capucina* in its pronotal colour and sculpture occupies an isolated position. The distance apart of the eyes on the vertex in the male is a character of some importance and full use has been made of it in the following synoptical key. Another character that can be employed, though with caution, to separate species with lyrate markings on the pronotum, is the presence or absence of a circular rufescent macula on the discoidal field of the tegmina. The posterior part of the pronotum and the tegmina in some species (e. g. *G. maculipennis* and *G. fervida*) present a peculiar mottled appearance, which is due to the irregular deposition of opaque testaceous pigment between the two layers of chitin, the chitin itself being quite transparent. De Bormans (Ann. Soc. ent. Belg., xxv, p. 21, 1881) figures the ootheca of *G. caffrorum*; from his figure and description I believe that the ootheca is merely a membranous sac and that the species of this genus are viviparous or ovo-viviparous like the Epilamprinae whose place in Africa is so largely taken by the species of *Gyna*. Karny (Jenaische Denkschriften, xiii, p. 382, 1908) has suggested that the ulnar rami of the wings in a species described by him as *Gyna stridulans* have the power of producing a rattling noise when the insect flies. He sees a resemblance between this part of the wing in the cock-

roach and the anterior field of the wings of certain Acrididae and Locustidae which he has proved to produce a rattling noise during flight with the wings alone, neither the legs nor the tegmina taking any part in the operation (Stett. Ent. Zeit. 1908, pp. 112-119). This rattling or rustling noise is of course to be distinguished from the true stridulation produced by insects at rest. The wing-structure of *Gyna stridulans* (= *caffrorum*, Stål) is by no means exceptional, for not only have the other species of the genus a similar wing-venation but other genera present similar features; it would be interesting to learn from observations in the field if any Blattidae produce a rattling noise when flying.

## Genus GYNA, Br.

*Gyna*, Brunner von Wattenwyl, *Nouv. Syst. Blatt.*, p. 266 (1865).

*Trichomera*, Kirby, *Ann. Mag. Nat. Hist.*, ser. 6, xviii p. 257 (1896).

*Apctrogia*, Kirby, *op. cit.*, ser. 7, v, p. 281 (1900).

## KEY TO THE SPECIES.

1. Pronotum with anterior half castaneous, posterior half ochreous . . . *G. capucina*, Gerst.
- 1'. Pronotum not as above.
2. Pronotum with disc castaneous, margins flavo-testaceous or ochreous.
3. Tegmina flavo-marginate throughout the greater part of their length.
4. Eyes (♂) touching or nearly touching on vertex of head.
5. Larger (19-20 mm. in total length) . . . . . *G. scutelligera*, Walk.
- 5'. Smaller (15 mm. in total length) . . . . . *G. costalis*, Walk.
- 4'. Eyes (♂) wide apart . . . . . *G. castanea*, sp. n.
- 3'. Tegmina not flavo-marginate throughout the greater part of their length.
4. Tegmina castaneous with 4 ochreous maculae . . . . . *G. gloriosa*, Stål.

- 4'. Tegmina with basal two-fifths castaneous, remainder testaceous . . . *G. jocosa*, Shelf.
- 2'. Pronotum testaceous or flavo-testaceous with lyrate chiselled markings on the disc.
3. Lyrate markings on disc of pronotum obsolescent. (Bright flavous species) . . . *G. laticosta*, Walk.
- 3'. Lyrate markings on disc of pronotum not obsolescent.
4. Small species (not exceeding 22 mm.).
5. Eyes nearly touching on vertex of head . . . *G. oblonga*, Borg.
- 5'. Eyes not nearly touching on vertex of head.
6. Frons strongly striate . . . *G. nigrifrons*, Bol.
- 6'. Frons not strongly striate . . . . . *G. peringueyi*, sp. n.
- 4'. Larger species.
5. Antennae bifasciated with ochreous.
6. Mediastinal field of tegmina opaque testaceous . . . . . *G. centurio*, Dohrn.
- 6'. Mediastinal field concolorous with rest of tegmina . . . . . *G. sculpturata*, sp. n.
- 5'. Antennae not bifasciated with ochreous.
- ♂ ♂
6. Eyes touching or nearly touching on vertex of head.
7. Tegmina with rufescent macula in centre of disc.
8. Antennae rufous or fuscous . . . . . *G. aetola*, sp. n.
- 8'. Antennae piceous, nitid.
9. Distance apart of eyes on vertex

- of head greater  
than thickness  
of 1st antennal  
joint.
10. Larger species  
(30 mm. in  
length) . . . *G. maculipennis*, Schaum.
- 10'. Smaller  
species (22-  
24 mm. in  
length) . . . *G. kasungulana*, Gig.-Tos.
- 9'. Distance apart  
of eyes on vertex  
of head less than  
thickness of 1st  
antennal joint . . . *G. lurida*, Sauss.
- 7'. Tegmina immaculate. *G. incommoda*, sp. n.
- 6'. Eyes wide apart on  
vertex of head.
7. Smaller species (20  
mm. in length) . . .
8. Tegmina with rufes-  
cent macula on  
disc . . . . . *G. fervida*, Sauss.
- 8'. Tegmina without  
rufescent macula  
on disc . . . . . *G. aestuans*, Sauss.
- 7'. Larger species (30  
mm. in length).
8. Tegmina with rufes-  
cent macula on  
disc . . . . . *G. caffrorum*, Stål.
- 8'. Tegmina without  
rufescent macula  
on disc . . . . . *G. aurivillii*, Borg.  
♀ ♀
6. Eyes close together on  
vertex of head . . . . . *G. hyalina*, sp. n.
- 6'. Eyes wide apart on  
vertex of head.
7. Tegmina without rufes-  
cent macula on disc.
8. Lyrate markings of  
pronotum not  
fused . . . . . *G. incommoda*, sp. n.

- 8'. Lyrate markings of pronotum fused . *G. aurivillii*, Borg.
7. Tegmina with rufescent macula on disc.
8. Supra-anal lamina short, rounded . *G. lurida*, Sauss.
- 8'. Supra-anal lamina produced, subquadrate, subbilobate.
9. Antennæ rufous or fuscous. Distance apart of eyes equals length of 1st antennal joint.
10. Rufescent macula on disc of tegmina large. *G. fervida*, Sauss.
- 10'. Rufescent macula on disc of tegmina small, occasionally absent . . *G. aetola*, sp. n.
- 9'. Antennae piceous, nitid. Distance apart of eyes greater than length of 1st antennal joint.
10. Anterior part of wings heavily suffused with a dark castaneous . . *G. caffrorum*, Stål.
- 10'. Anterior part of wings not as above . *G. maculipennis*, Schaum
- Doubtful species . . . . . *G. colini*, Rochebr.

1. *G. capucina*, Gerst.

*Gyna capucina*, Gerstaecker, Mitt. Ver. Neuropomm. u. Rugen, xiv, p. 72 (1883).

*Gyna maculipennis*, Brunner von Wattenwyl, Nouv. Syst. Blatt., p. 268, Pl. VI, fig. 30 (1865).

A common and well-marked species that occurs in most collections from West Africa. There is a variety with the pronotum anteriorly margined with ochreous.

KAMERUN (Greifswald Mus., type; Oxford Mus.; Berlin Mus.; Vienna Mus.); FERNANDO PO (Genoa Mus.); FRENCH CONGO (Genoa Mus.).

2. *G. scutelligera*, Walk.

*Panchlora scutelligera*, Walker, Cat. Blatt. Brit. Mus., p. 32 (1868).

♂. Head testaceous with frons castaneous; antennae fuscous. Eyes almost touching on vertex. Pronotum with the disc castaneous, broadly margined all round with flavo-testaceous. Tegmina castaneous, outwardly margined almost to apex with flavo-testaceous. Wings suffused with rufo-castaneous, ulnar vein with 10 rami, 7 being incomplete. Abdomen rufo-testaceous, supra-anal lamina sub-quadrate, apex not emarginate, exceeded by the sub-genital lamina which is small and furnished with 2 styles. Cerci moderate. Legs rufo-testaceous.

Total length 19.5 mm.; length of body 15 mm.; length of tegmina 17 mm.; pronotum 6.3 mm. × 7.5 mm.

GAMBIA (British Mus., type); PORTUGUESE GUINEA, Bolama (*L. Fea*), (Genoa Mus.).

3. *G. costalis*, Walk.

*Panchlora costalis*, Walker, Cat. Blatt. Brit. Mus., p. 35 (1868).

♂. Eyes nearly touching on vertex of head. Head rufo-testaceous; antennae testaceous at base, remainder fuscous. Pronotum margined broadly all round with testaceous, disc castaneous at base, apex hyaline, outer margin testaceo-hyaline. Wings hyaline, costal margin faintly suffused with ochreous, ulnar vein with 10 rami, 7 of which are incomplete. Abdomen and legs flavo-testaceous. Supra-anal lamina sub-quadrate, not surpassing the sub-genital lamina, which is small and slightly asymmetrical.

Total length 15 mm.; length of body 13 mm.; length of tegmina 12 mm.; pronotum 4 mm. × 6 mm.



"WEST AFRICA" (British Mus., type); TOGO (Berlin Mus.).

The species is to be distinguished by the broad testaceous margin running all round the pronotum and by the apical three-fifths of the tegmina being hyaline, the castaneous colouring of the tegmina occupies the basal two-fifths, and is produced along the marginal field towards the apex.

4. *G. castanea*, sp. n.

♂. Differs from *scutelligera* and *costalis* by the greater distance apart of the eyes on the vertex of the head. Head rufo-testaceous, vertex between the eyes, which are nearly 1 mm. apart, castaneous. Pronotum with disc castaneous, margins broadly flavo-testaceous, at the postero-lateral angles the castaneous almost reaches the outer border of the pronotum. Tegmina dark castaneous, flavo-marginate almost to their apex. Wings suffused with castaneous. Abdomen and legs as in the preceding species.

Total length, 16 mm.; length of body 14.8 mm.; length of tegmina 14 mm.; pronotum 5 mm. × 6 mm.

TOGO, Bismarckburg (*L. Conradt*), (Berlin Mus.).

5. *G. gloriosa*, Stål.

*Blatta gloriosa*, Stål, Oefv. Vet.-Akad. Förh., xii, p. 351 (1856).

*Panchlora africana*, Saussure, Rev. Zool. (2), xvi, p. 342 (1864).

*Gyna africana*, Saussure, Mém. Soc. Sci. Phys. Nat. Genève, xx, p. 275 (1869).

*Gyna pomposa*, Brunner von Wattenwyl, Nouv. Syst. Blatt., p. 269 (1865).

A common species ranging from Sierra Leone to the Congo.

6. *G. jocososa*, Shelf.

*Gyna jocososa*, Shelford, Mém. Soc. ent. Belg., xv, p. 234 (1908).

CONGO FREE STATE (Brussels Mus., type; British Mus.).

7. *G. laticosta*, Walk.

*Panchlora laticosta*, Walker, Cat. Blatt. Brit. Mus., p. 33 (1868).

*Gyna buchholzi*, Gerstaecker, Mitt. Ver. Neuvorpomm u. Rügen, xiv, p. 72 (1883).

? *Apotrogia angolensis*, Kirby, Ann. Mag. Nat. Hist., ser. 7, v, p. 281 (1900); Distant's Ins. Transvaal, p. 21, Pl. I, fig. 11 (1900).

A handsome species, readily distinguished by the obsolescent markings on the pronotum and by its primrose-yellow colour.

KAMERUN (Greifswald Mus., type of *buchholzi*; Oxford Mus.; Berlin Mus.; coll. Bolivar); FERNANDO PO (Greifswald Mus.); ANGOLA (British Mus., type of *laticosta*).

8. *G. oblonga*, Borg.

*Gyna oblonga*, Borg, Bih. Svensk. Vet.-Akad. Handl., xxviii, Afl. 4, No. 10, p. 21, Pl. II, fig. 1 (1902).

The form and extent of the markings on the pronotum varies considerably; a reliable character is presented by the oblique fascia at the apex of the tegmina, which is present in all the specimens of both sexes that I have seen.

KAMERUN (Stockholm Mus., type; Oxford Mus.; Berlin Mus.; coll. Bolivar).

9. *G. nigrifrons*, Bol.

*Gyna nigrifrons*, Bolivar, J. Sci. Lisboa (2) i, p. 77 (1889).

BENGUELLA (Lisbon Mus., type); Loanda (coll. Bolivar).

10. *G. peringueyi*, sp. n.

♂. Testaceous. Eyes on vertex 1 mm. apart. Vertex and frons not striate. Four stripes on the vertex, the vertex between the eyes, a macula between the antennal sockets, two spots on the clypeus, castaneous; antennae castaneous at base, remainder fuscous. Pronotum faintly striate posteriorly, lyrate markings clearly defined. Tegmina mottled with testaceous, no rufescent macula on disc, a piceous spot between radial and mediastinal veins. Wings slightly infuscated, ulnar vein with 11 rami, 7 being incomplete. Abdomen testaceous mottled with castaneous; supra-anal and sub-genital laminae of usual shape. Legs pale testaceous, posterior metatarsi elongate.

Total length 20 mm.; length of body 17 mm.; length of tegmina 18 mm.; pronotum 5.1 mm. × 6.8 mm.

BENGUELLA (Cape Town Mus., type).

11. *G. centurio*, Dohrn.

*Gyna centurio*, Dohrn, Stettin Ent. Zeit., xlix, p. 129 (1888).

A very distinct species on account of the opaque testaceous or flavous macula in the mediastinal field of the tegmina.

KAMERUN (Stettin Mus., type; Oxford Mus.).

12. *G. sculpturata*, sp. n.

♂. Testaceous, the pigment evenly distributed. Eyes almost touching on vertex; a castaneous band between the ocelli. Antennae piceous, 4-6 joints beyond the middle and 4 joints immediately before the apex ochreous. Pronotum more strongly produced posteriorly than usual, the process transversely striate, its apex and border very narrowly piceous, disc with the usual lyrate marking. Tegmina rather narrow, with variable piceous mottlings in the anal field and at the apex, usually a piceous macula in the middle of the disc, a line along the mediastinal vein at base and the anal vein piceous, mediastinal area and costal margin beneath castaneous. Wings hyaline, with the marginal field flavid, becoming castaneous at apex, ulnar vein with 12 rami, 7 being incomplete. Abdomen above and beneath and the legs flavo-testaceous. Supra-anal lamina sub-bilobate, considerably exceeding the sub-genital lamina which is small and asymmetrical, styles slender. Cerci small, 11-jointed.

♀. Similar, but much larger. Tegmina unicolorous, abdomen beneath and legs rufo-castaneous. Distance of eyes apart rather less than length of 1st antennal joint. Supra-anal lamina bilobed, exceeding the sub-genital lamina which is ample, produced, with sinuate margins.

♂. Total length 26 mm.; length of body 19 mm.; length of tegmina 19 mm.; pronotum 6.2 mm. × 7.6 mm.

♀. Total length 39 mm.; length of body 33 mm.; length of tegmina 33 mm.; pronotum 12 mm. × 13 mm.

KAMERUN (Berlin Mus., ♂ type; Deutsches Entom. Nat. Mus.; coll. Bolivar); BENIN (Oxford Mus., ♀ type); TOGO (Berlin Mus.).

13. *G. actola*, sp. n.

♂. Eyes touching on vertex of head. Frons castaneous and concave, vertex striate; antennae castaneous at base, remainder fuscous. Pronotum striate posteriorly and anteriorly, with the usual lyrate marking on disc. Tegmina rufo-testaceous, mottled, a piceous spot

between the mediastinal and radial veins, a rufescent macula on the disc. Wings with marginal field flavous, ulnar vein with 11 rami, 7 being incomplete. Abdomen rufo-testaceous; supra-anal lamina sub-quadrate, apex distinctly emarginate, sub-genital lamina of usual shape. Legs concolorous with abdomen, posterior metatarsi moderately elongate.

♀. Differs only in the greater distance apart of the eyes, larger size, sub-bilobate supra-anal lamina and ample, semi-orbicular sub-genital lamina.

♂. Total length 25–26 mm.; length of body 20–22 mm.; length of tegmina 19–22 mm.; pronotum 6·1 mm. × 8 mm.

♀. Total length 30 mm.; length of body 28 mm.; length of tegmina 25·5 mm.; pronotum 10 mm. × 11·8 mm.

FRENCH GUINEA, Kouroussa (Oxford Mus., ♂ type; Paris Mus.); PORTUGUESE GUINEA, Bolama (*L. Fea*), (Genoa Mus.), ♀ type.

This is a species that hitherto I have referred to *G. aestuans*, Sauss., but on examining the type of that species I find that it is different from the French and Portuguese Guinea examples here described.

14. *G. maculipennis*, Schaum.

*Panchlora maculipennis*, Schaum, Ber. Akad. Berlin, 1853, p. 776; Peters, Reise Mossamb., Zool. v, p. 109, Pl. VII, fig. 1 (1862).

*Gyna vetula*, Brunner von Wattenwyl, Nouv. Syst. Blatt., p. 267 (1865).

Distinguished by the piceous antennae, the tegmina mottled with testaceous and the contiguous eyes in the male.

GERMAN EAST AFRICA (Vienna Mus., type of *vetula*; Berlin Mus.; Stockholm Mus.); MOZAMBIQUE (Berlin Mus., type of *maculipennis*); RHODESIA (Oxford Mus.).

15. *G. kazingulana*, Gig.-Tos.

*Gyna kazingulana*, Giglio-Tos, Boll. Mus. Torino xxii, No. 563, p. 3 (1907).

This is little more than a local race of the preceding species, it is smaller in size but otherwise scarcely differs. The type specimen has the pronotum heavily suffused with castaneous, but this is not the case in an example

from Kilimandjaro which I am unable otherwise to distinguish from the type.

UPPER ZAMBESI, Kazungulu (Turin Mus., type); Kili-  
mandjaro (Buda-Pesth Mus.).

16. *G. lurida*, Sauss.

*Gyna lurida*, Saussure, Abh. Senckenb. Ges., xxi,  
p. 581 (1899).

The female is to be distinguished from that of *maculipennis* by the different form of the supra-anal lamina.

ZANZIBAR (Senckenberg Mus., types; Vienna Mus.).

The last three species are so closely allied, that the following tabulation of the differences between the males will help towards their identification.

	<i>maculipennis.</i>	<i>kazungulana.</i>	<i>lurida.</i>
Length of body	19 mm.	15·2 mm.	15 mm.
Distance apart of eyes	Equals thickness of first antennal joint	Equals thickness of first antennal joint	Almost touching
Colour of head	Rufo-castaneous	Rufo-castaneous	Piceous
Colour of antennae	First two joints castaneous, remainder piceous	First two joints castaneous, remainder piceous	Piceous to base
Frons above clypeus	Smooth	Striate	Strongly striate
Supra-anal lamina	Sub-quadrate, apex faintly emarginate	Sub-quadrate, apex distinctly emarginate	Trigonal, apex faintly emarginate

17. *G. incommoda*, sp. n.

♂. Pale flavo-testaceous. Antennae fuscous, castaneous at base. Eyes nearly touching on vertex. Frons and face rufous. Posterior part of pronotum hyaline, lyrate markings rufo-castaneous. Tegmina moderately broad, outer margin sinuate, uniform flavo-testaceous becoming hyaline towards apex. Wings with anterior part suffused with flavid, ulnar vein with 14 rami, 9 being incomplete.

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Margins of pronotum beneath and mediastinal area of tegmina beneath bright rufo-castaneous. Abdomen and legs rufo-testaceous. Supra-anal lamina sub-quadrate, apex slightly emarginate, barely exceeded by the sub-genital lamina which is asymmetrical and furnished with two styles.

♀. Similar but rather darker in colour, distance of eyes apart rather greater than length of 1st antennal joint. Antennae piceous, castaneous at base. Posterior part of pronotum concolorous with anterior part. Tegmina broader, their outer margin very sinuate. Wings with anterior part suffused with rufo-castaneous.

♂. Total length 22 mm.; length of body 16 mm.; length of tegmina 20 mm.; pronotum 6·8 mm. × 8 mm.

♀. Total length 28 mm.; length of body 21 mm.; length of tegmina 25 mm.; pronotum 8·5 mm. × 10·9 mm.

SOMALILAND, Brava (Genoa Mus., types ♂ and ♀);  
GERMAN E. AFRICA, Lake Jipe, Katona (Budapest Mus.).

The species is perhaps most nearly related to *G. lativcosta*, Walk., but is distinguished by the well-defined lyrate markings on the pronotum. The specimen from Katona is rather larger than the type ♀, but otherwise is identical.

#### 18. *G. fervida*, Sauss.

*Panchlora fervida*, Saussure, Rev. Zool. (2) xvi, p. 341 (1864).

*Panchlora lata*, Walker, Cat. Blatt. Brit. Mus., p. 31 (1868).

*Panchlora spurcata*, Walker, op. cit., p. 34 (1868).

? *Trichomera insignata*, Kirby, Ann. Mag. Nat. Hist., ser. 6, xviii, p. 257, Pl. XII, f. 5 (1896).

♂. Testaceous. Distance apart of eyes on vertex of head equal to length of 1st antennal joint; frons with castaneous macula; neither vertex nor frons striate. Antennae rufo-fuscous, basal third rufo-testaceous. Pronotum with clearly defined lyrate marking. Tegmina rather broad, mottled with testaceous, a macula on disc and a curved fascia at apex, rufescent; the piceous spot between radial and mediastinal veins obsolescent or absent. Wings hyaline, the marginal field flavo-testaceous, ulnar vein with 10 rami, 7 being incomplete. Abdomen and legs rufo-testaceous; supra-anal lamina sub-quadrate, apex not emarginate, barely surpassing the sub-genital plate which is small and slightly asymmetrical. Tarsi rather short.

♀. Similar, but eyes a little farther apart; tegmina broader;

anterior part of wings suffused with castaneous, ulnar vein with 11 rami; supra-anal lamina sub-bilobate; sub-genital lamina semi-orbicular, ample.

♂. Total length 20 mm.; length of body 17 mm.; length of tegmina 16 mm.; pronotum 6 mm. × 8 mm.

♀. Total length 27 mm.; length of body 24 mm.; length of tegmina 22 mm.; pronotum 8.5 mm. × 10 mm.

SENEGAMBIA (Paris Mus., type of *fervida*); GAMBIA (British Mus., type of *lata*); TOGO (Berlin Mus.); BENIN (Oxford Mus.); GABOON (British Mus., type of *spurecata*); CONGO FREE STATE (Brussels Mus.).

19. *G. aestuans*, Sauss.

*Panchlora aestuans*, Saussure, Mém. Soc. Sci. Phys. Nat. Genève, xvii, p. 159, Pl. I, f. 20 (1864).

♂. Differs from *fervida* by the smaller distance apart of the eyes, the strongly striate vertex, the more heavily marked frons, the piceous antennae, the concolorous tegmina without macula or fascia, the supra-anal lamina with slightly emarginate apex.

Length of body 17.3 mm.; length of tegmina 20 mm.; pronotum 7 mm. × 9 mm.

SENEGAL (Geneva Mus., type).

20. *G. caffrorum*, Stål.

*Panchlora caffrorum*, Stål, Oefv. Vet.-Akad. Förh. xiii, p. 167 (1856).

*Epilampra conspicua*, Walker, Cat. Blatt. Brit. Mus., p. 67 (1868).

*Panchlora scripta*, Walker, op. cit., p. 183 (1868).

*Gyna fervida*, Bormans, Ann. Soc. ent. Belg., xxv, p. 21, Pl. I, f. B. (1881).

*Gyna stridulans*, Karny, Denkschr. med.-nat. Ges. Jena, xiii, p. 382, Pl. XXI, f. 28, Pl. XXII, ff. 29-32 (1908).

To be distinguished from *G. maculipennis* by the eyes being nearly 1 mm. apart in the ♂; the vertex is striate and the pronotum is usually heavily marked. Dr. Karny has kindly compared a specimen of *caffrorum* with his species and informs me that they are practically identical.

NATAL (Stockholm Mus., type of *caffrorum*); "SOUTH

AFRICA" (British Mus., type of *scripta*; Oxford Mus., *Borman's example*); LAKE N'GAMI (*Castelnau*), (British Mus., type of *conspicua*; Oxford Mus.); S.W. AFRICA, Amboland (*G. Schinz*), (Senckenberg Mus.); GERMAN S.W. AFRICA, Otjosundu (Berlin Mus., type of *stridulans*).

21. *G. aurivillii*, Borg.

*Gyna aurivillii*, Borg, Bib. Svensk. Vet.-Akad. Handl., xxviii, Afd. 4, No. 10, p. 20, Pl. II, f. 5 (1902).

This is very close to the preceding species, but the eyes in the ♂ are closer together and in both sexes the tegmina have no rufescent macula on the disc of the tegmina, there is however a conspicuous piceous spot between the radial and mediastinal veins which is reduced or absent in *caffrorum*. The fusing of the lyrate markings on the vertex is a variable character.

♂. Total length 27 mm.; length of body 23 mm.; length of tegmina 24 mm.; pronotum 8.4 mm. × 9.4 mm.

KAMERUN (Stockholm Mus., type; Berlin Mus.).

22. *G. hyalina*, sp. n.

♀. Clear testaceo-hyaline, head and antennae, abdomen and legs rufo-castaneous. Eyes close together on vertex (less than 1 mm. apart). Pronotum anteriorly and posteriorly faintly striate, lyrate markings on disc castaneous and fused together. Tegmina moderately broad, immaculate, mediastinal field at base, mediastinal and anal veins castaneous. Wings with costal margin suffused with flavid, ulnar vein with 17 rami, 11 being incomplete. Supra-anal lamina deeply bilobate, sub-genital lamina of the usual form. Formula of apical spines of the femora,  $\frac{1}{2}$ ,  $\frac{1}{2}$ ,  $\frac{1}{2}$ ; no genicular spine on front femora.

Total length 24 mm.; length of body 17.8 mm.; length of tegmina 20 mm.; pronotum 6.9 mm. × 8 mm.

CONGO FREE STATE, Iringui (Musée du Congo); VICTORIA NYANZA, Bugala, Sesse Archipelago (*E. Bayon*), (Genoa Mus.).

Readily distinguished by the peculiar hyaline appearance of the pronotum and tegmina; also by the approximation of the eyes, an unusual feature in the females of this genus.



23. *G. colini*, Rochebr.

*Gyna colini*, Rochebrune, Bull. soc. philomath., ser. 7, vii, p. 176 (1883).

The description is useless for purposes of identification, and I cannot obtain the type.

SENEGAMBIA.

Genus PSEUDOGYNA, nov.

Allied to *Gyna*, Br., but differs as follows:—pronotum posteriorly less strongly produced; tegmina and wings not exceeding apex of abdomen; cerci very short and obscurely articulated; posterior metatarsus very long, considerably exceeding the succeeding joints, biserially spined beneath.

The genus is intermediate between *Gyna* and *Phenacisma*.

*P. intermedia*, sp. n.

♀. Head piceous, genae and mouth-parts testaceous. Eyes rather wide apart. Pronotum testaceous with a discoidal piceous lyrate marking, posteriorly produced but much less so than in *Gyna* and *Phenacisma*. Tegmina not quite extending to apex of abdomen, castaneous, mediastinal field testaceous, venation well marked, mediastinal vein piceous. Wings of equal length with tegmina, anterior part semi-coriaceous, posterior part slightly reduced, ulnar vein ramose. Abdomen mottled with testaceous and piceous; supra-anal lamina quadrate, apex emarginate; sub-genital lamina semi-orbicular, ample. Legs castaneous.

Length 25 mm.; length of tegmina 19.5 mm.; pronotum 7.1 mm. × 10 mm.

N.E. RHODESIA, Hills near Fort Jameson, 4,000–5,000 ft. (*S. A. Neave*), (Oxford Mus.).

In colouring the species is very like the next.

Genus PHENACISMA, Karsch.

*Phenacisma semialata*, sp. n. (Pl. IX, fig. 38.)

♀ Allied to *P. peltata*, Karsch, but smaller and less convex, tegmina coriaceous not semi-corneous, more rounded at apex, anal vein well marked, wings larger. Head piceous, a band between the

eyes and the mouth-parts rufo-testaceous. Eyes rather wide apart. Antennae piceous. Pronotum as in *peltata*, but discoidal lyrate marking larger. Tegmina suffused with castaneous, not extending beyond apex of abdomen. Wings much reduced, coriaceous, veins thickened, ulnar vein with 12 rami, vena dividens giving off transverse venules, posterior part of wing not folding in fan-like manner. Abdomen testaceous, mottled with fuscous, supra-anal lamina quadrate, apex slightly emarginate. Cerci very short, sub-genital lamina semi-orbicular, ample. Coxae testaceous, legs castaneous, posteriori arsi as in *P. peltata*.

Length 23 mm.; length of tegmina 19 mm.; length of wings 10 mm.; pronotum 8 mm. × 11.2 mm.

N.E. RHODESIA, E. Loangwa district, Petauke 2,400 ft. (*S. A. Neave*), (Oxford Mus.).

In *P. peltata*, Karsch, the wings are reduced to minute corneous scales from which the venation has disappeared, these scales represent only the anterior parts of the wings; *semialata* in its wing-structure is a connecting link between *Pseudogyna* and *peltata*.

The genus *Gynopeltis*, Gerst. (sub-fam. *Perisphaeriinae*) in the male sex is very like *Gyna*, Br., but may be distinguished by the shortly produced, trigonal supra-anal lamina, exceeded by the sub-genital lamina and by a hooked lappet, which is the left posterior angle of the 8th abdominal sternite, projecting from beneath the 7th abdominal sternite on the left side; there is only one style and this is minute. In *G. cryptospilo*, Wlk. [= *picta*, Gerst.] the front femora have four or five spines on the anterior margin beneath. The females of the genus are entirely apterous.

The following species appears to be new:—

*Gynopeltis neavei*, sp. n. (Pl. IX, fig. 39.)

♂ Testaceous; head with vertex and an irregular band between the ocelli castaneous. Eyes .75 mm. apart; antennae piceous. Pronotum with a lyrate piceous marking on the disc as in the genus *Gyna*. Tegmina testaceous, rather narrow, outer margin sinuate, a line at base of mediastinal vein and the anal vein piceous, disc indistinctly suffused with castaneous, the part of the right tegmen overlapped by the left, castaneous. Wings with anterior part suffused with flavid, ulnar vein with 12 rami, 7 being incomplete. Abdomen above rufo-testaceous, beneath testaceous. Cerci rather

stout, incurved. Legs testaceous, piceous above, front femora unarmed on anterior margin beneath.

Total length 27 mm. ; length of body 22 mm. ; length of tegmina 24 mm. ; pronotum 6.2 mm. × 8mm.

N.E. RHODESIA, East Loangwa district, Petauke 2,400 ft. (*S. A. Neave*), (Oxford Mus.).

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EXPLANATION OF PLATES VII-IX.

[See *Explanation facing the PLATES*.

JUNE 4, 1909.



V. *Birds as a Factor in the Production of Mimetic Resemblances among Butterflies.* By GUY A. K. MARSHALL, F.Z.S.

[Read March 3rd, 1909.]

THE question whether birds do, or do not, prey upon butterflies to any appreciable extent is one which has from time to time engaged the attention of Entomologists for some years past. For it has been contended that the validity of the theories of mimicry enunciated by H. W. Bates and Fritz Müller, as applied to butterflies, must largely depend upon the production of adequate evidence to show that these insects are liable to habitual attacks upon the part of birds. Nor is it possible to deny the reasonableness of such a contention, as soon as we endeavour to reconstruct mentally the processes which must have been at work if those theories be true.

#### DEFENCES OF BUTTERFLIES.

In their imago state butterflies appear to be among the most defenceless of insects, for their comparatively large size and diurnal habits render them more or less conspicuous objects when on the wing, even though their actual colouring may be dull and obscure. They have, however, three principal lines of defence: (1) rapid or tortuous flight; (2) procryptic under-side coloration, combined with the appropriate instincts for seeking concealment; and (3) the possession of nauseous qualities rendering them distasteful to a large proportion of their enemies.

The existence of these latter qualities has now been experimentally proved beyond the possibility of cavil, and we are probably justified in assuming that they occur in all species of Danainae, Ithomiinae, Heliconinae, and Acraeinae. They have also been shown to exist in certain isolated genera of Nymphalinae, Lipteninae, Pierinae, and Papilioninae; but there does not appear to be any real justification for the speculative assumption that they are of general occurrence in these and other subfamilies.

Wherever undoubted distastefulness has been demonstrated by experiment, we find that the species are invariably characterised by a slow, sailing or laboured flight; moreover they do not (except in a very few instances) exhibit any procryptic coloration on the under-surface. Thus the acquisition of unpalatability, which is probably a more specialised form of defence, leads to a partial or complete abandonment of the other two methods. This is only what we should anticipate in accordance with Wallace's law of warning coloration. For distastefulness loses a great part of its protective value unless accompanied by coloration or habits which make for conspicuousness and thus advertise the unpleasant qualities of the insect.

But the diminution of activity in flight can have significance only in relation to winged enemies; that is to say, either birds or predaceous insects. Of the latter the only ones of general occurrence which are known to attack butterflies are Asilid flies, wasps and dragonflies. With regard to Asilidae, Professor Poulton has clearly shown in his admirable paper on predaceous insects (*Trans. Ent. Soc. Lond.*, 1906, p. 363) that these flies are apparently indiscriminate in their attacks on other insects and do not appear to be deterred by any nauseous qualities. There seems to be a certain amount of evidence to show that the same is true of wasps, including Belt's record of the wasp which stocked its nest with *Heliconii*; and probably this applies to dragonflies also, though there is very little evidence at present as to the nature of their food (cf. Poulton, *l.c.* p. 399). But conspicuous colouring and slow movements can be of no utility against enemies which devour with equal avidity both nauseous and normal forms; indeed, rather the reverse. It is therefore difficult to avoid the conclusion that the modification of flight which is so constantly correlated with unpalatability in butterflies must have a particular significance in regard to the attacks of birds.

#### THE INFLUENCE OF LIZARDS ON MIMICRY.

That certain species of lizards will in a wild state eat butterflies is well established, and it has often been suggested that these reptiles play a considerable part in the production of butterfly mimicry. Yet the evidence

in this direction does not seem to be altogether satisfactory as it stands at present. In South Africa, at all events, the vast majority of lizards live only on the ground or among rocks, and personally I have never met with any truly arboreal species. Yet it is among the tree-frequenting butterflies that warning colours and mimicry find their highest development; nor can I call to mind any undoubtedly mimetic butterfly which normally settles on rocks or on the ground, with the exception of a few species such as *Aterica galene* or *Papilio echerioides*, which only frequent dense forests—localities in which ground lizards are, so far as my own experience goes, conspicuous by their entire absence. Indeed, the habits of the South African Danaines and their many mimics are such as to render it antecedently improbable that they are normally liable to be preyed upon by lizards. It is possible that the conditions are quite different in other tropical countries, but the question does not appear to have been investigated from this point of view, and further observations are to be desired.

#### OBJECTIONS TO THE VIEW THAT BIRDS ATTACK BUTTERFLIES.

It is now about twelve years ago that this question was discussed at some length at a meeting of this Society (Proc. Ent. Soc., 1897, pp. xiii–xxvi) as the outcome of an interesting paper by Dr. Dixey on the subject of mimetic attraction. Judging by the views advanced during this discussion, as well as those published by other observers, it would appear that a considerable majority of entomologists are of opinion that on the whole butterflies suffer but little from the attacks of birds.

The supporters of these adverse views who are most usually cited in criticisms directed against the theories of mimicry are Scudder (whose experience is confined to N. America), Packard (N. America), Pryer (Japan and Borneo), Piepers (Java) and Skertchley (Borneo). But in regard to Scudder it must be noted that, though he has seen but few cases of birds pursuing butterflies in N. America, yet he readily admits that such occurrences are probably much more frequent in tropical countries (*Butterfl. of Eastern U.S.*, II, p. 1612). Similar negative evidence has more recently been put forward by Sir George Hampson,

from India (Proc. Ent. Soc., 1897, p. xxxviii); Commander J. J. Walker and Col. Yerbury (*l.c.* p. xxxix); J. C. Kershaw, from S. China (Trans. Ent. Soc., 1905, p. 6); Paul Hahnel, from Tropical S. America ("Iris," 1890, pp. 310-321); while Packard has quoted the opinions of a number of his North American correspondents to the same effect, and has generally reviewed the whole subject in a sense adverse to the theory of mimicry in a very able paper entitled "Origin of Markings of Organisms" (Proc. Amer. Phil. Soc., 1904, pp. 393-450), a paper which has been excellently criticised in our Proceedings for 1906 (p. xxxvii) by Eltringham.

The evidence adduced by these authors is necessarily of a purely negative character, being always to the effect that each of them has collected or observed butterflies for a shorter or longer period and yet has not seen any, or at most very few, cases of birds eating butterflies. In dealing with the theories of mimicry most of them are content with a purely destructive criticism, and make no attempt to explain the mass of facts which has now been accumulated by Professor Poulton and his correspondents. Others, such as Hahnel, Skertchley, Eimer, etc., have attempted to suggest alternative theories to explain these striking phenomena. Unfortunately some of the critics have not even taken the trouble to grasp the real nature of the suggestions which they criticise (this is especially true of Fritz Müller's views); and while they unite in condemning the theories of mimicry on the ground that they involve too many assumptions for which there is no experimental evidence, it is noticeable that this criticism applies with even greater force to their own hypotheses, quite apart from the far graver objections which may be raised against all of them. The vague suggestion that mimetic resemblances are all due to the direct action of a similar environment furnishes an excellent example of the ill-digested and wholly inadequate conceptions which pass current among many entomologists who have not made themselves acquainted with the mere rudiments of the subject. But it is not my purpose to discuss these questions here. For in the first place, I am by no means prepared to accept the fundamental assumption which underlies all these alternative interpretations, namely, that at the present time the influence of birds upon butterfly coloration is a negligible quality; and secondly, because



the grave difficulties in the way of accepting any explanation of mimetic resemblances other than Natural Selection have already been very clearly set forth in an admirable paper by Professor Poulton (*Journ. Linn. Soc. Zool.*, xxvi, pp. 558-612), which has been recently reproduced in his book "*Essays on Evolution*," and which it would be well for any would-be critics of the theory of mimicry to "read, mark, learn and inwardly digest" before putting pen to paper.

But to revert to the question of birds, it is clear that the above negative statements have been generally accepted without proper consideration. When a naturalist who has spent some time in the tropics expresses a decided opinion to the effect that birds do not normally eat butterflies, because he has never observed them doing so, it is incumbent upon us, before accepting his evidence as having any real scientific value, to satisfy ourselves that he has made a systematic and thorough investigation of the subject, and that his views are not based merely on casual and inadequate observations. For in a matter of this kind there is grave danger that absence of evidence may be due simply to lack of observation. If a collector maintains that birds do not eat butterflies, we are justified in asking him for a full list of the other insects which he *has* seen captured by birds. And I venture to think that a closer inquiry of this kind would reveal the fact that most of the negative evidence which has been brought up against the Selectionist interpretation of mimicry is really of little worth.

#### SOME REASONS FOR THE PAUCITY OF EVIDENCE.

There can be no question that the published records of birds attacking butterflies are limited in number, though perhaps more numerous than generally supposed. If then we believe that such attacks are really of comparatively frequent occurrence in certain regions, how are we to account for the fact that so few observations have been recorded? Certain aspects of this question were dealt with by Mr. Trimen in his Presidential Address to this Society in 1897 (*Proc. Ent. Soc.*, p. lxxxix), when he said: "I am persuaded that . . . the dearth of evidence is due to the neglect of well-directed and sustained observation. Little can be gained by merely noting such cases as

happen to force themselves on the collector's attention; the collector must resolutely set himself to search out and keep watch upon what really takes place. Seeing that there is no record of any naturalist's having seriously taken up the investigation of this matter in the field, I think that very much positive evidence could hardly be expected, and that what has been published goes far in the direction of proving that birds must still be reckoned among the principal enemies of butterflies." We must likewise bear in mind that *ex hypothesi* we may expect the attacks of birds to be comparatively infrequent in all those places where mimetic resemblances among butterflies are rare or absent. It is in the region of tropical forests, where both birds and insects are plentiful, that this phenomenon attains its greatest frequency and its highest perfection; but it is precisely in such localities that adequate observations are most lacking. The few entomologists who visit these favoured spots are, not unnaturally, too much preoccupied in the task of mere collecting to be able to devote themselves to long and possibly tedious observations of this kind. And only those who have actually tried it can realise how much time and patience is requisite to obtain even small results, unless the conditions for observation are very exceptionally favourable. Still there can be little doubt that in suitable localities even the busiest collector might add at least a few crumbs to our store of knowledge if he would but keep his eyes open for such occurrences and carefully note the details at the time. In this connection I may quote the remarks of that excellent observer, Dr. Franz Doflein, of the Munich University, who, in his interesting book on his travels in the East, has made some valuable contributions to the present subject ("Ostasienfahrt," 1906, pp. 440-446). He there says: "From the observations which I made in the jungles of Ceylon it is quite incomprehensible to me how naturalists who have spent years and tens of years in the tropics can deny this fact [that butterflies are frequently attacked by birds]. I can only suppose that during their wanderings they pay no special attention to such occurrences, so that when on their return they take part in theoretical discussions, they search their memories and their note-books in vain for records of such observations."

As an instance of the manner in which such facts

may be easily overlooked, I may refer to the case of the kestrel in England. I have searched in vain through many books on British Ornithology for any record that this bird eats butterflies; nor is it even mentioned in Naumann's "Vögel Deutschlands" (1822), which contains much more information of this kind than most modern works. Yet in the "Entomologist" for 1903 (p. 68) there is a most interesting account by Mr. Parkinson Curtis of the behaviour of a kestrel which he observed for some hours on the Ballard Down, near Swanage. The bird was seen to stoop on several occasions at something on the ground, but always rose again without carrying off anything. Most entomologists would have troubled themselves no further about the matter, but, fortunately, Mr. Curtis was prompted to make a closer investigation, and by carefully stalking the bird he found that it was pouncing upon butterflies which it tore to pieces on the ground. In the course of an hour he counted about thirty-six specimens which were captured in this manner, and the bird was observed to continue the pursuit for at least five hours. Nor is this merely an isolated case, for Mr. Curtis has confirmed his observation in every succeeding summer; moreover we have the evidence of Mr. Colthrup that he has seen the kestrel feeding on *Polyommatus corydon* (see p. 352) in 1906 and 1907 on Beachy Head. It is therefore probable that further enquiry will show this to be quite a usual habit of the kestrel which has hitherto been overlooked; and it seems quite conceivable that dozens of entomologists may have collected on Beachy Head and Ballard Down and have remained in ignorance of the destruction of butterfly life which may have been going on in their very presence. Again I can find no record of butterflies being eaten by the Garden Warbler (*Sylvia hortensis*), with the exception of the one published by Professor Kennel (see p. 344), who observed a pair which fed their young almost exclusively on butterflies all day long. It would be unreasonable to suppose that this must be an abnormal case; it seems far more likely that this Warbler does often capture butterflies, but that naturalists have failed to observe the fact, or else failed to record their observations. A final instance may be referred to, namely, the Pigmy Falcons (*Microhierax*) of the East. My lamented friend, the late Col. C. T. Bingham, who lived for many

years in Burma, where these birds are not uncommon, only once observed a butterfly to be seized by one of them. It might be argued that if so admirable and skilled an observer, in the course of a long experience, saw this happen only on a single occasion, the pursuit of butterflies must be an unusual habit with these birds. But fortunately, we have some indirect evidence on this point which aptly illustrates how extremely misleading such an argument may be. These hawks nest in holes in trees, the bottom of the hole being lined with a thick pad composed chiefly of insect remains mixed with rotten wood. Now three different observers have found nests in which this pad consisted largely, or even principally, of butterflies' wings, thus rendering it extremely probable that the Falconets do prey upon these insects to a very considerable extent.

But if records of birds taking butterflies are scarce, it must be borne in mind that the same thing applies to almost all orders of insects. For example, although Coleoptera are very largely eaten by birds, yet it must be admitted that our knowledge of that fact is not really based on direct observation of capture, but is derived from an examination of the contents of birds' stomachs; and it is probable that the number of authentic records of capture would be even less in the case of beetles than in butterflies. If it be urged that the small size of most Coleoptera renders their recognition difficult under such conditions, let us turn to the dragonflies, which afford a very fair parallel to butterflies, so far as size and habits are concerned. Here again my examination of the literature of the subject shows that the observed cases of capture, or even pursuit, are extremely few; and personally, during fifteen years of field experience in South Africa I cannot recollect to have ever seen a bird pursue a dragonfly. But I am by no means prepared to assume from these facts that birds never, or very rarely, attack dragonflies; rather do I believe that this dearth of evidence is simply due, as it certainly is in my case, to the fact that no attention has been paid to this line of inquiry. This belief is borne out by the knowledge that where birds' stomachs have been critically examined the occurrence of dragonflies has been noted in quite a number of cases. An exhaustive examination of the insect remains found in the stomachs of wild birds, must, in most cases, afford the only satisfactory testimony as to what constitutes their normal food; but no such in-

vestigation has ever been undertaken in those tropical regions where mimicry among butterflies is most prevalent, and where we should therefore expect to find the greatest destruction by birds. Moreover, this line of inquiry is unfortunately much less satisfactory in the case of butterflies than in most other insects, owing to the fact that birds so frequently snip off the wings before eating them, thus rendering their recognition almost impossible; and there can be little doubt that the presence of butterflies in birds' stomachs must have been overlooked through this cause. Thus it is rather to ornithologists that we must look for any material addition to our knowledge of this subject; and an attempt to carefully identify the food brought to their young by insectivorous birds would probably yield much valuable information.

Enough has now been said to show that the assumption that birds seldom attack butterflies is certainly premature; and for my part, I am convinced that when the subject has been more fully and systematically investigated that assumption will prove to be entirely unfounded.

We may now turn to the list of available records. So far as concerns those already published, I believe it to be fairly complete, though a certain number must inevitably have escaped my attention. For the remainder I have to offer my hearty thanks to the following friends and correspondents, who have very kindly furnished me with a number of valuable unpublished observations: Mr. Parkinson Curtis, Professor C. B. Davenport, Dr. F. A. Dixey, Dr. F. Doflein, Mr. C. H. B. Grant, Colonel N. Manders, Mr. S. A. Neave, Father O'Neil, Professor E. B. Poulton, Mr. R. Shelford, Mr. C. F. M. Swynnerton and Professor August Weismann.

The number of Observations is unfortunately still too small to justify any broad generalisations from the results shown, but a few salient points may be noted.

The paucity of records in the case of Lycaenidae and Hesperidae is probably due to the comparatively small size of these insects, which would thus render them difficult to identify under such conditions. The great majority of the evidence is furnished by the Nymphalinae and Pierinae, and of these the latter subfamily is always easily first. This is in accordance with Bates' experience on the Amazons. For he says: "I could not, from their excessive scarcity, ascertain on the spot that the *Leptalides*

were thus picked out. I noticed, however, that other genera of their family (Pieridae) were much persecuted" (Trans. Linn. Soc., xxiii, 1862, p. 511). And in the same region Paul Hahnel noted that Pierines were more attacked by birds than any other butterflies ("Iris," 1890, p. 193). These facts render it difficult to accept the view, advocated by Dr. Dixey and Professor Poulton, that the Pierinae probably constitute a generally unpalatable group.

As might have been expected, the number of instances in which birds have been observed to eat butterflies of the dominant distasteful groups, such as Danainae or Acraeinae, is comparatively small. Were these insects as liable to be consumed as the Nymphalinae and Pierinae, it seems likely, owing to their conspicuous appearance and avoidance of concealment, that far more such cases would have been forced upon the attention of casual observers.

Again, it may be noted that many observers have testified to the fact that it is by no means an easy task for a bird to capture a butterfly in full flight, this being true even of such adepts as the Bee-Eaters. My own experience is entirely in accord with this opinion; and we may perhaps find here an explanation why a bird may often be seen sitting apparently impassive and uninterested in the butterflies which are flying in the vicinity; the lack of interest being due to the knowledge that open pursuit is of little avail. It seems likely that attacks will in general be made only under specially favourable conditions, such as, when the butterfly passes very close to the bird's perch, or when the attention of the insect is distracted during feeding, courting, ovipositing, etc. We are, therefore, probably justified in supposing that flight does really afford an important protection to butterflies against the attacks of birds. On the other hand, it has been suggested that flight is probably of minor importance in this connection, and that birds do not commonly pursue butterflies simply because the vast majority of these insects possess distasteful qualities to a greater or less extent. This view I am quite unable to accept, for various reasons which need not be discussed here; nor can it be said to find support in the following records, which indeed furnish strong evidence against it. For several observers, including Prof. Weismann, have testified that butterflies bred in confinement and then released

are specially liable to attack by birds on account of their weak flight (cf. Palaearctic records, 4. *g.*; 10. *d.* and *e.*; 28. *e.*). The point might be decided experimentally by releasing a large number of butterflies whose wings had been partly cut off, then turning loose uninjured specimens of the same species and noting any difference in the attitude of the birds towards them. I have suggested to several of my friends in the tropics that they should undertake such experiments, which might, moreover, prove extremely valuable as a means of ascertaining the likes and dislikes of wild birds under natural conditions.

Finally, it may be interesting to note that the Indian Bee-Eaters appear for the most part to cut off the wings of butterflies which they capture before eating them; whereas the African species, so far as I can ascertain, appear to swallow them whole. It is not easy to understand the reason of this discrepancy in habits in closely allied species.

With reference to the following records it must be noted that where authors have given long lists of insects preyed on by certain birds, for the sake of brevity only those parts which refer to butterflies have been cited. This is especially the case in the Nearctic records from Gentry's "Life Histories of the Birds of E. Pennsylvania," and also in the Palaearctic records from Naumann's "Vögel Deutschlands."

#### RECORDS FROM THE PALAEARCTIC REGION.

1. *Corvus monedula*, Briss. (Jackdaw). Observed to catch a white butterfly: The Editor, "Country-Side," 1903, p. 290.
2. *Sturnus vulgaris*, L. (Starling). (*a*) "I have often seen them chasing butterflies" (England): R. Fortune, in Watson's "Ornithology in Relation to Agriculture" (1893), p. 139.—(*b*) A starling observed to catch a white butterfly: The Editor, "Country-Side," 1903, p. 290.
3. *Oriolus galbula*, L. (Golden Oriole). "It then [in May] feeds principally on woodland insects, . . . catching cockchafers, butterflies and also large thick-bodied moths, etc.": Naumann, "Vögel Deutschlands," ii, p. 179 (1822).

4. *Passer domesticus*, L. (Sparrow). (a) "I have frequently seen the common sparrow chase and capture such butterflies as *V. urticae* and *P. rapae*": T. G. B. (Cambridge), "Nature," iii, 1870, p. 166.—(b) "I have noticed . . . three sparrows for some time chase and eventually capture a female *Epinephile janira*": R. Trimen, Proc. Ent. Soc. L., 1897, p. xci (England).—(c) "I have certainly observed sparrows catching butterflies": W. Caspari, Soc. Ent. Zurich, xvi, 1901, p. 34 (Switzerland).—(d) A sparrow observed "chasing a specimen of *Vanessa urticae*, at Whitstable, which it captured": C. W. Colthrup, "Entomologist," 1903, p. 173.—(e) "I can remember having once witnessed a sparrow chase and catch a fine specimen of *Argynnis adippe*": C. Floersheim, "Ent. Record," 1906, p. 36.—(f) "In my garden at Munich a *Vanessa c.-album* was pursued and captured by a sparrow, on the 3rd July, 1906": Dr. Franz Doflein (*in litt.*).—(g) "In the experiments in rearing Vanessidae in Battersea Park [London] a few summers ago . . . the sparrows at once found out the difference between those reared under glass and the wild ones, and soon exterminated them": E. T. Daubeny, "Nature Notes," Oct., 1905, p. 197.—(h) "June 7, 1906. Kensington Gardens [London]. In the wide grassy space east of the palace, passing down to the Serpentine, I saw a large *Vanessa* (looking like *V. polychloros*) flying in the sunshine. It was pursued by a sparrow, which made two ineffectual attempts to catch it and then desisted. The chase was immediately taken up by another sparrow, and pursuer and pursued disappeared from view among the trees": Dr. F. A. Dixey (*in litt.*).—(i) At Fawley, near Southampton, on the 13th June, 1907, I myself saw a sparrow catch and eat a *Pieris rapae*.—(j) "The sparrow, I have frequently observed, attacks *Pieris brassicae* and *P. rapae* on the wing, but is not very successful as a rule. I can only remember two instances of capture. I have also seen it on three occasions attack *Macroglossa stellatarum*, but in every case unsuccessfully": W. Parkinson Curtis (in a letter to Prof. Poulton, dated 22, ix, 1905).—(k) "Colonel Coussmaker remarked to me that he had seen sparrows taking butterflies, including the common 'whites,' far more frequently than any



- other birds; probably, I imagine, because commoner than any other birds": C. F. M. Swynnerton (letter dated 1, viii, 1907).—(l) "For the first time in my life I saw this summer a sparrow pursue and catch a Large Tortoiseshell that was flying round an elm tree": O. H. Latter (in a letter to Prof. Poulton, dated 31, xii, 1902).—(m) A sparrow observed to eat a *Pieris rapae*, of which it cut off the wings: L. H. Harris, "Country-Side," 1907, p. 140.—(n) "Small Tortoiseshell chased by a sparrow, which only succeeded in taking a piece out of one wing": J. R. Harding, "Country-Side," 1907, p. 209 (England).—(o) "Last year I bred a large number of the large white butterfly, which emerged from the pupae this year. On letting some of the butterflies go, two of them were immediately seized by house sparrows, which only ate the body and left the four wings behind. On two other days the same thing happened. In all, four were killed in this way, and they were all males": G. Blackburn, "Country-Side," 1907, p. 211 (England).—(p) "Sparrow seen to take a peacock butterfly in full flight": J. J. Towns, "Country-Side," 1907, p. 307 (England).—(q) "From interesting and numerous letters in answer to the question whether birds eat butterflies, I find that thirty-eight correspondents have seen the sparrow catch and in most cases devour common white butterflies. . . . Five correspondents have seen the sparrow eat the brimstone; two have seen it catch, or partly eat, the meadow-brown; two the small blue; one a large fritillary; and one a tortoiseshell": The Editor, "Country-Side," 1903, p. 290 (England).—(r) Prof. E. Pénard of Geneva saw a bird, probably a sparrow, persistently pursue and at the third attempt capture a white butterfly (probably a species of *Pieris*): Prof. E. B. Poulton, "Essays on Evolution," p. 282, note.
5. *Acanthis cannabina*, L. (Linnet). To my astonishment a linnet (Hänfling), which was singing on a tree-top, suddenly became silent and swooping down adroitly captured an *antiopa*: B. Slevogt, Soc. Ent. Zurich, xvii, 1901, p. 82 (Switzerland).
  6. *Parus* sp. (Tit). (a) "Captures with astonishing accuracy the butterflies which flit about the trees": W. Caspari, "Soc. Ent. Zurich," 1901, p. 34.—(b) A

- tit observed to eat a white butterfly: The Editor, "Country-Side," 1903, p. 290 (England).
7. *Parus major*, L. (Great Tit). "I have seen a great titmouse capture the White Butterfly (*Pieris rapae*) on the wing": W. Eagle Clarke, quoted by Prof. Poulton, "Nature," lxx, p. 465 (England).
  8. *Motacilla sp.* (Wagtail). (a) A good account of the pursuit and final capture of a Small Tortoiseshell (*Vanessa urticae*, L.) by this bird. The observer infers from the method used by the bird "that it was not a mere attack brought on by curiosity, but the result of experience, which had taught it that the body and not the wings was the desired tit-bit": H. J. Turner, "Ent. Record," 1904, p. 335 (England).—(b) A wagtail observed to catch a white butterfly: The Editor, "Country-Side," 1903, p. 290 (England).
  9. *Pratincola rubetra*, L. (Whinchat). "On another evening, August 16th, 1907, at Beachy Head, I watched a pair of furze-chats picking specimens of [*Polyommatus*] *corydon* off grass stems and taking them to a small tree. On going to the tree to investigate, the two birds flew off together with a brood of young ones. Under the tree on the ground were about thirty or forty wings of male *corydon*": C. W. Colthrup, "The Country-Side," March 21, 1908, p. 267.
  10. *Phoenicurus phoenicurus*, L. (Redstart). (a) "They take flies, gnats, small butterflies and all sorts of small two- and four-winged insects, partly on the wing and partly at rest": Naumann, "Vög. Deut.," ii, p. 519.—(b) "It feeds on flies, gnats, small butterflies and various other kinds of small coleopterous and other insects, caterpillars, etc.": H. Dresser, "Birds of Europe," ii, p. 281.—(c) "I have also repeatedly observed in my own country [Switzerland] how the Redstart (Rotschwänchen), which seems to have a special liking for butterflies, would catch 'Whites' on the wing and take them to the nest": Prof. L. Kathariner, "Biol. Centralb.," 6. xviii, 1898, p. 681.—(d) The author states that every year he was in the habit of releasing hundreds of butterflies (especially *Vanessae*) bred in temperature experiments, and that the birds of the neighbourhood would then congregate and pursue the insects, whose flight was still weak. He notes that a pair of red-

starts were especially active in their attacks. On the other hand *Arctia caja* was never touched: C. Frings, "Soc. Ent. Zurich," 1900, p. 76 (Switzerland).—(e) "About fifteen years ago I bred numbers of *Vanessa io* and *urticae* every summer; I released many of the thousand specimens of butterflies that I obtained. Every summer I began by letting the insects fly out of the window of my work-room. But very soon this was noticed by the birds in the garden which surrounds the Institute, and then a redstart used generally to station itself on a neighbouring bush or tree and carry off most of the butterflies which were released. I often saw the bird fly quite close to the open window, seize a butterfly, turn quickly round and fly away again. Then it would tear off the wings and one would find afterwards many wings of *V. io* and *urticae* lying on the ground. . . . In dull weather most of the butterflies did not fly away, but remained sitting on the window-ledge. Then the bird (*Ruticilla phoenicura* or *tithys*) would come right up to the ledge. . . . My assistant Dr. Schleiss once released, instead of myself, a number of *urticae* from the window. The redstart appeared immediately, and in a short time he saw lying on the garden path about thirty wings of *Van. urticae*" (Freiburg in Breisgau): Prof. August Weismann (in a letter to Prof. E. B. Poulton, dated 14, ii, 1909).

11. *Accentor modularis*, L. (Hedge Sparrow). "On the May 15 [1907] I saw a hedge sparrow capture a freshly emerged *Pieris rapae* ♂ and devour it. The specimen was insufficiently dried to be strong on the wing, and was captured whilst indulging in a first unsteady flight. The occurrence took place at Broadstone, Dorset": W. Parkinson Curtis (letter to Prof. Poulton, dated 29, v, '07).
12. *Erithacus rubecula*, L. (Robin). (a) "I can certify to the fact of robins chasing and catching large white butterflies on the wing and swallowing them whole": H. Fox, "Nature," lxi, 1899, p. 152 (England).—(b) "I saw a male robin once strike at *Pyrameis atalanta*, but, on the butterfly turning, he made no further attempt": C. Floersheim, "Ent. Record," 1906, p. 36.—(c) "I had [September 1900] a number of *Colias edusa* ♀ sleeved in a small hand-frame with clover to

induce them to lay eggs, but they came to an untimely end. I saw a robin industriously pecking at the muslin covering the frame, and shortly after being disturbed he returned, started again where he had weakened the muslin, and forcing his way in, slew and ate all the *Colias edusa*. The *edusa* were visible through the muslin and were walking about on the clover. . . . The same robins this spring destroyed some female *cardamines* under similar circumstances": W. Parkinson Curtis (in a letter to Prof. Poulton, dated 22, ix. 1905).—(d) The robin has been seen to chase, catch or eat common white butterflies by five correspondents; while two have seen it take blue butterflies: The Editor, "Country-Side," 1903, p. 290 (England).

13. *Turdus viscivorus*, L. (Missel Thrush). Observed to catch a white butterfly: The Editor, "Country-Side," 1903, p. 290.
14. *Acrocephalus palustris*, Bechst. (Marsh Reed Warbler). "They seek many kinds of insects, such as . . . small dragon flies, Phryganidae, Tineidae and small butterflies": Naumann, "Vög. Deut." iii, p. 640.
15. *Acrocephalus schaenobaenus*, L. (Sedge Warbler). A pair of Sedge Warblers was observed of which "each had a butterfly in its mouth, and with my field-glasses I was able to identify the species as a Meadow-Brown (*E. janira*) and a Small White (*P. rapae*): O. H. Latter, "Nature," lx, 1899, p. 520 (England).
16. *Sylvia hortensis*, Bechst. (Garden Warbler). In 1895 at Dorpat, in Russia, Prof. Kennel observed a pair of Garden Warblers (Grasmücken) "which fed their five young all day long almost exclusively with *Vanessa urticae*, and occasionally with a few *Parnassius amemosyne* [*mnemosyne*] and *apollo*, the latter being a very scarce species in the neighbourhood." He subsequently adds that *Pieris rapae* was also used as food by these birds: Prof. J. Kennel, "Biol. Centralb.," xviii, 1898, p. 810.
17. *Sylvia curruca*, L. (Lesser White-throat). "But they also eat various insect-eggs, small pupae, many small two- and four-winged insects, different species of green plant-lice (*Aphis*, Linn.), small butterflies and so forth": Naumann, "Vög. Deut." ii, p. 457.
18. *Phylloscopus trochilus*, L. (Willow Wren). Observed

- to catch a white butterfly: The Editor, "Country-Side," 1903, p. 290.
19. *Regulus regulus*, L. (Golden-crested Wren). The Goldcrest (Goldhänchen) also captures butterflies which flit about the trees: W. Caspari, "Soc. Ent. Zur.," xvi, p. 34.
  20. *Troglodytes troglodytes*, L. (Wren). This bird was observed to persistently enter a house and carry off a considerable number of hibernating *Vanessa urticae*: A. Elliott, "Ann. Scot. Nat. Hist." 1900, p. 53 (Scotland).
  21. *Lanius minor*, Gm. (Lesser Grey Shrike). (a) Its food "consists of butterflies, various beetles, grasshoppers and other insects": Naumann, "Vög. Deut." ii, p. 20.—(b) A *Papilio podalirius*, L. was found in the stomach of one *Lanius minor*: E. Csiki, "Aquila," xi, 1904, p. 278.
  22. *Lanius auriculatus*, Müll. (Woodchat Shrike). "It feeds on beetles, grasshoppers, butterflies, dragonflies, and various other insects which it catches on the wing": Naumann, "Vög. Deut.," ii, p. 27.
  23. *Lanius collurio*, L. (Red-backed Shrike). (a) "It also catches with dexterity flying beetles, butterflies, grasshoppers, and so forth": Naumann, *l. c.* p. 35.—(b) "On July 2, 1896, on Patcham Railway Embankment, near Brighton, I found a *Pieris rapae* ♂ impaled on a sharp sedge by a red-backed shrike. It was pinned neatly through the centre of the thorax and was running round on the pivot thus formed when I investigated it": W. Parkinson Curtis (letter to Prof. Poulton, dated 22, ix, 1905).
  24. *Muscicapa grisola*, L. (Spotted Flycatcher). (a) "It feeds on flies, especially of the Linnean genera *Musca* and *Conops*, on gadflies, gnats, crane-flies, butterflies, small grasshoppers, small dragonflies and various other insects": Naumann, *l. c.* ii, p. 220.—(b) "I have seen the common flycatcher take butterflies more than once. I can well remember how gracefully one swept from the bough of a chestnut and caught a *Lasiommata aegeria* in its flight": R. C. R. Jordan, "Ent. Mo. Mag.," xxiv, 1887, p. 86.—(c) "I have seen the common spotted flycatcher pursue a butterfly and miss it, giving up the pursuit (H. S. Wise)": Lilian Vesey, "Nature," lxxv, 1902, p. 392.—(d) "I was chasing a Clouded Yellow (*Colias edusa*, F.) . . . when, much

to my chagrin, a Spotted Flycatcher (*Muscicapa grisola*) darted from a fence and caught it": A. H. Hamm, "Nature," lxxv, 1902, p. 366 (England).—(e) "On July 21st [1904] we saw at Evian-les-Bains (France) a spotted flycatcher catch a brown butterfly, almost certainly *Epinephele jurtina*": Alfred Sich, "Entom. Rec.," 1904, p. 268.—(f) "After a storm a grey flycatcher darted at a flying white butterfly (Cabbage White?). At the second attack it seemed to have damaged the butterfly's wings, for the latter, in spite of all its fluttering, came nearer to the ground. It was only at the third attempt that the bird succeeded in catching the butterfly, which it immediately swallowed whole": A. Hölscher, "Ill. Zeits. Ent.," 1899, p. 91 (Osnabrück).—(g) "Aug. 23, 1903. Fellows' Garden, Wadham College [Oxford]. Saw a flycatcher seize and fly off with a white butterfly on the wing. After being carried for a little distance the butterfly escaped and was chased by the flycatcher, which made four or five ineffectual attempts at recapture, at each of which I distinctly heard the snap of the bird's beak. The chase disappeared behind trees, and I did not see the result; my impression is that the butterfly escaped": Dr. F. A. Dixey (*in litt.*).—(h) "Aug. 28, 1903. Grounds of Alexandra Palace, Muswell Hill, near London. Saw a flycatcher settled with what appeared to be a white butterfly in its beak. In a short while I saw the wings detached and fall to the ground, but on searching afterwards I failed to find them. The grass was long and there was a good deal of undergrowth": Dr. F. A. Dixey (*in litt.*).—(i) "A small tortoiseshell butterfly, which had been weakened by fluttering in a window, on being liberated was at once pounced upon and eaten by a flycatcher": E. T. Daubeny, "Nature Notes," October 1905, p. 197.—(j) "This summer (1905) a pair of Flycatchers (*Muscicapa grisola*) nested in a garden belonging to a friend of mine. I saw this bird catch, kill and eat *Pieris rapae* ♂. One specimen only was attacked, and this happened to pass close to the bird's favourite seat": W. Parkinson Curtis (letter to Prof. Poulton, 22, ix, '05).—(k) "On July 30 [1907], as I was walking with Col. Coussmaker [in Surrey], I saw a flycatcher (*M. grisola*) swoop low over the grass and return to its

perch with a 'meadow-brown' in its bill. The butterfly was held by the wings only, body outwards, and the bird had hardly reached the perch when the insect escaped and disappeared behind some foliage, with the flycatcher again in hot pursuit": C. F. M. Swynnerton (in a letter dated 1, viii, 1907).—(l) "Mrs. Blackburn [of Barrow Hill, Henfield] made the remark that their 'meadow-browns' (*janira*) were so caught and eaten by the flycatchers as to be quite scarce; when one of them appeared it was generally snapped up, and sometimes two flycatchers would help each other in the capture. The common white butterflies (*rapae*, etc.), were sometimes, but rarely, attacked": F. Merrifield (in a letter to Prof. Poulton, dated 7, viii, 1907).—(m) "I was walking round the paddock [New Barnet, Herts.] yesterday when a large cabbage butterfly came flying across it. There were three Flycatchers (*M. grisola*) in sight. The butterfly passed the first without being attacked, but settled in the grass just in front of the second and about ten yards from it. The bird, which had been watching it, continued to do so for two or three seconds longer and then flew down at it, but failed to secure the butterfly, and rising, turned and again swooped down on the spot. This time it hovered for a few seconds while hunting for the butterfly, but the latter had evidently got well down under the grass, and the flycatcher returned to its perch discomfited": C. F. M. Swynnerton (letter dated 16, viii, 1907).—(n) "Mrs. Watt-Smyth told me that two or three weeks ago, when she was walking in the garden here [New Barnet] with my sister and cousin, they saw a flycatcher capture a white butterfly": C. F. M. Swynnerton (letter dated 19, viii, '07).—(o) "Spotted flycatchers seen on August 1st near Canterbury catching and eating meadow-brown butterfly": F. C. Snell, "Country-Side," 1907, p. 290.—(p) "On an Arabian burial ground, below Las Glacières Blida [in Algeria], I saw at noon a small brown bird (doubtless the grey flycatcher, which is plentiful there) catch a specimen of *Pieris rapae* on the wing": Dr. Karl Jordan (in a letter to Prof. Poulton, dated 21, ix, 1908).—(q) "A water wagtail [Dr. Longstaff informs me that this is an error, and that the bird was a grey

- flycatcher] has this year built a nest in the *Ampelopsis vitchii* on my house at Putney. Miss C. A. Dixon was sitting in the garden on July 19 watching the bird go every few minutes to feed its young, and on one occasion noticed that it carried a white butterfly in its beak. On July 25 the same lady saw the bird snap at a white butterfly but miss it": Dr. G. B. Longstaff, "Ent. Mo. Mag.," 1904, p. 211.—(r) "On one other occasion the owner of that lawn saw a bird try to catch a butterfly. He was astonished to see more than one bird chasing what he took to be a small meadow-brown. At last a flycatcher knocked the insect to the ground almost at my friend's feet. He picked it up and found a white-letter hairstreak (*T. w-album*), a butterfly which he did not know was to be found in the neighbourhood": H. P. R., "Country Life," March 14, 1908, p. 384 (England).—(s) The flycatcher has been seen to chase, catch or eat common white butterflies by five correspondents: The Editor, "Country-Side," 1903, p. 290 (England).
25. *Muscicapa collaris*, Bechst. (White-collared Flycatcher). "It feeds on flies, gnats . . . butterflies and other insects on the wing": Naumann, "Vög. Deut.," ii, p. 329 (1822).
  26. *Muscicapa atricapilla*, L. (Pied Flycatcher). "It also eats small grasshoppers, butterflies, etc., in times of scarcity, even worms": Naumann, *l. c.* p. 237.
  27. *Muscicapa parva*, Bechst. (Red-breasted Flycatcher). "It feeds, like the other flycatchers, on flies, gnats, small butterflies and so forth": Naumann, *l. c.* p. 274.
  28. *Hirundo rustica*, L. (Swallow). (a) "They subsist on a great number of genera and species of small insects, as flies, *Stomoxys* (Stechfliegen) . . . small Lepidoptera, as: Tineidae, Pyralidae, Tortricidae, Alucitidae, numerous small beetles and so forth; and in times of need they will also eat small butterflies (the larger ones are not eaten, as their wings are mostly too broad), small Noctuidae, and the smallest dragonflies": Naumann, *l. c.* vi, p. 61.—(b) "In the month of March during the northern migration of swallows, a small butterfly, *Thestor ballus* (one of the Lycaenidae), is out in great abundance on the plains. When walking across the grass, the swallows, which keep flying very close to the leeward of you, instantly



catch any unfortunate *ballus* that flies up; but they seem to be unable to take them on the ground, perhaps from the protective colouring of their green under-wings they cannot see them when at rest; but anyway the swallow is an annoyance to the butterfly collector": Lt.-Col. Irby, "Ornith. of the Straits of Gibraltar," p. 94 (1895, 2nd ed.).—(c) "In England I have noticed a swallow hunting one of the common 'Whites' (apparently *Pieris brassicae*): R. Trimen, Proc. Ent. Soc. L., 1897, p. xci.—(d) "I have several times had opportunities of observing that white butterflies were captured on the wing by swallows": M. Spaeth, "Ill. Zeits. Ent.," 1899, p. 124 (Germany).—(e) "A good many years ago I released a large number of 'Camberwell Beauties' (Trauermäntel). The Swallows collected in a row in front of the window in order to snap up the butterflies. I do not believe that 20 per cent. of the latter reached the adjoining wood, towards which they all directed their course. The same thing happened in the case of some 'Purple Emperors' (Schillerfaltern) a few years later. 'Tortoiseshells' (Füchse) and 'Peacocks' (Tagpfau) were entirely unmolested by swallows . . . *Melitaea* and *Argynnis* were taken": W. Caspari, Soc. Ent. Zurich, xvi, p. 34.—(f) Observed to capture *Lycæna argiolus* on the wing: Prof. E. B. Poulton, "Nature," lxxv, 1902, p. 343.—(g) "Mr. W. Holland tells me that about the middle of June 1901 he saw a swallow swoop down from a great distance and catch a white butterfly (almost certainly *Pieris rapae*) flying in front of the [Oxford] Museum": Prof. Poulton, *l. c.*—(h) "Further, I have often seen birds catch butterflies in Hongkong, Cochin China and Europe, but neither birds nor butterflies were identified. The birds were in many cases swallows": Dr. F. Doflein (in a letter dated 12, iv, 1907).—(i) "Mortehoe, N. Devon. W. Bonner saw a swallow 'spike and carry off' a brown butterfly (he thinks *H. janira*). Aug. 23, 1894. Reported to me the same day": Dr. F. A. Dixey (*in litt.*).—(j) "On the afternoon of July 7, 1901, H. G. Dixey kicked up a specimen of *H. janira* in the Parks, Oxford. As it rose it was taken by a swallow. This was seen by J. Dixey, H. G. Dixey and R. N. Dixey, and reported

to me the same day": Dr. F. A. Dixey (*in litt.*).—(k) "I have seen butterflies attacked by the Barn Swallow (*H. rustica*) and the Swift—*P. rapae* in both cases": W. Parkinson Curtis (letter to Prof. Poulton, 22, ix, '05).—(l) A swallow was observed to capture a *Colias edusa*: W. Buckler, "Ent. Mo. Mag.," July 1877, p. 40.—(m) "Some years ago I saw a swallow trying to seize a red admiral flying": G. E. Johnson, "Country-Side," 1907, p. 141 (England).—(n) The swallow has been observed to chase, catch or eat common white butterflies by four correspondents; "two readers have seen the swallow take meadow-browns (Mr. J. Higgs, of Maryborough, noting seven specimens taken in seven minutes), and one each have noticed the capture of a peacock butterfly, a painted lady and a tortoiseshell": The Editor, "Country-Side," 1903, p. 290 (England).

29. *Cypselus apus*, L. (Swift). (a) "All sorts of beetles, gadflies, butterflies and moths, . . . serve to fill its rapidly digesting, and therefore always hungry, stomach": Naumann, "Vög. Deut.," vi, p. 130.—(b) Cf. *Hirundo rustica* (k).
30. *Caprimulgus europaeus*, L. (Nightjar). "And further the flower-beetles, dragonflies, butterflies and Diptera, which sit at rest in the evenings, do not escape it": Naumann, *l.c.* vi, p. 153.
31. *Merops apiaster*, L. (Bee-Eater). Prof. Kathariner records that on May 6, 1895, at Angora in Asia Minor, the butterfly *Thais cerisyi* was flying in great numbers, when suddenly a swarm of Bee-Eaters appeared, and "without paying any attention to me, began to make a terrible clearance among the butterflies. One heard continuously the snapping of their beaks, and in the shortest space of time there was not a butterfly to be seen. Those that were not eaten had hidden under the herbage": L. Kathariner, "Biol. Centralb.," xviii, 1898, p. 681.
32. *Cuculus canorus*, L. (Cuckoo). (a) An example of *Aporia crataegi* found in the stomach of one bird: E. Csiki, "Aquila," xi, 1904, p. 309.—(b) "Although its principal food consists of caterpillars, yet it often takes both butterflies and moths, and even lepidopterous pupae and eggs are not despised": J. A. Link, "Mon. Deut. Ver. Schutze Vög.," 1889, p. 439.

33. *Falco tinnunculus*, L. (Kestrel). (a) This bird was seen (near Swanage, Dorset) to capture numerous butterflies (*Argynnis aglaia* and *Melanargia galatea*) by pouncing on them when settled on the ground. The observer "found by counting that the bird caught about thirty-six specimens in an hour, and it was hard at it for at least five hours": W. Parkinson Curtis, "Entomol.," 1903, p. 68.—(b) "I would say that my note on the Kestrel in the 'Entomologist' in 1903 has been confirmed by repeated observations at the same place, and presumably on the same pair of birds every year since. In July 1904 I was a month at Swanage and was at least a dozen times on the Down in daylight, when the Kestrel was at its old game of slaughtering *Argynnis aglaia* and *M. galatea*. Last season (July 1905) *aglaia* was scarce and the attacks were confined almost wholly to *semele* and *galatea*; at least, the wings I saw mostly belonged to those species": W. Parkinson Curtis (letter to Prof. Poulton, 22, iv, '05).—(c) I have recently received several further communications from Mr. Parkinson Curtis with regard to his extremely interesting and valuable observations on the feeding habits of the Kestrel. On Aug. 8, 1907, he wrote: "On August 3 I had to go near the Ballard Down, so walked to the place where I had generally seen the Kestrel; it was doing precisely the same thing as I have previously recorded and at about the same average rate." On Sept. 2 he wrote: "On Sept. 1st I was collecting on Studland Hill and Nine Barrow Down, that is about 2½ miles from the Kestrels I have sent you a note about. I saw three Kestrels catching butterflies; they were at it, off and on, from 11.30 a.m. to 3.45 p.m., but I could not get near enough to see what they were catching. That they were catching butterflies, all three, I am certain from the manner of hawking, and their movements on the ground; but there was no cover for me to approach them, so I cannot give you any precise details, except one female *semele* which I put up and which flew in the direction of one Kestrel and was promptly captured." In reply to inquiries, Mr. Curtis informed me that Pierines of all kinds were very scarce on the Downs frequented by the Kestrel, and he had not actually seen any

attacked. Lycaenidae, Hesperidae and *Coenonympha* he considered to be too small for the Kestrels, and he had only on one occasion observed the capture of a female *Hesperia actaeon*.—(d) "At Beachy Head in the past summer and in 1906 I watched a Kestrel feeding on this species [*Polyommatus corydon*]. It hovered just over the grass stems and picked them off one after the other while at rest": C. W. Colthrup, "Country-Side," 1908, p. 267.

34. *Falco subbuteo*, L. (Hobby). The stomach of a specimen contained "the body of a small Locustid, a middle-sized butterfly and about 120 brownish-black ants (*Formica fusca*, L.)": Prof. Salzmann, "Mon. Deutsch Ver. Schutz Vög.," 1906, p. 511.

35. Birds not identified:—

(a) A bird captured and ate a specimen of *Argynnis adippe*: Colthrup, "Entom." 1903, p. 173 (England).

—(b) "During many years of entomological work I have on only ten occasions actually observed birds pursuing species of *Vanessa* or *Pieris* under natural conditions": C. Frings, "Soc. Ent. Zurich," xv, 1900, p. 76.—(c) "I have frequently seen birds catch and devour the unprotected species [of butterflies] on the wing": A. G. Butler, "Nature," iii, 1870, p. 166 (England).

—(d) "In this country it was not an uncommon sight to see the *Pontia* pursued by birds, and sometimes escaping by means of their tortuous or dodging flight": H. W. Bates, Proc. Ent. Soc. L., 1864 (3), ii, p. 22 (England).—(e) "Evidence of the attacks of birds was supplied by Mr. Fred Birch in a specimen of *Thecla quercus* from Lancashire (August 1898). A bird was seen to dart at the spot where the butterfly was settled, and the insect, when captured, exhibited symmetrical injuries, such as would be caused by a snip taken out of both wings when in contact in the position of rest": Prof. E. B. Poulton, "Oxford Univ. Gazette," 1905, p. 566.—(f) "No one has been able to adduce any examples of a bird eating a butterfly, beyond a few cases where the food was either the 'meadow-brown or large heath (*E. janira* or *E. tithonus*), or the green hairstreak'—out of thousands of observers, entomologists and ornithologists": H. P. R., "Country Life," March 14, 1908, p. 384. [The evidence here collected sufficiently demonstrates

the inaccuracy of this dogmatic statement.—G. A. K. M.]—(g) “My assistant Dr. Kuhn saw a small bird (?) seize a *Vanessa C-album* on the wing” (Freiburg im Breisgau): Prof. Aug. Weismann (letter to Prof. Poulton, dated 14, ii, 1909).

The following list gives a summary of those butterflies which have been exactly or approximately identified, together with the birds which have pursued or eaten them—

#### PALAEARCTIC BUTTERFLIES.

##### SATYRINÆ.

- Melanargia galatea*, L.—Falco tinnunculus (33, a, b).  
*Epinephele janira*, L.—Passer domesticus (4, b, q); Acrocephalus schaenobaenus (15); Muscicapa grisola (24, k, l, o); Hirundo rustica (28, i, j, n).  
*E. tithonus*, L.—Bird (35, f).  
*E. jurtina*, L.—Muscicapa grisola (24, e).  
*Hipparchia semele*, L.—Falco tinnunculus (33, b, c).  
*Pararge egeria*, L.—Musc. grisola (24, b).

##### NYMPHALINÆ.

- Argynnis* sp.—Passer domesticus (4, q).  
*A. adippe*, L.—Passer domesticus (4, e); Bird (35, a).  
*A. aglaia*, L.—Falco tinnunculus (33, a, b).  
*Melitaea* sp.—Hirundo rustica (28, e).  
*Pyrameis atalanta*, L.—Erithacus rubecula (12, b);  
Hirundo rustica (28, m).  
*P. cardui*, L.—Hirundo rustica (28, n).  
*Vanessa io*, L.—Passer domesticus (4, p); Phoenicurus phoenicurus (10, e); Hirundo rustica (28, n).  
*V. antiopa*, L.—Acanthis cannabina (5); Hirundo rustica (28, e).  
*V. polychloros*, L.—Passer domesticus (4, h, l).  
*V. urticae*, L.—Passer domesticus (4, a, d, n, q); Motacilla, sp. (8, a); Phoenicurus phoenicurus (10, e); Sylvia hortensis (16); Troglodytes troglodytes (20); Muscicapa grisola (24, i); Hirundo rustica (28, n).  
*Polygonia C-album*, L.—Passer domesticus (4, f); Bird (35, g).  
*Vanessidi*.—Pass. domesticus (4, g); Phoenicurus phoenicurus (10, d); Bird (25, b).  
*Apatura iris*, L.—Hirundo rustica (28, e).

## LYCAENINAE.

- Polyommatus icarus*, Rott.—*Passer domesticus* (4, *g*).  
*P. corydon*, Poda.—*Falco tinnunculus* (33, *d*); *Pratincola rubetra* (9).  
*Cyaniris argiolus*, L.—*Hirundo rustica* (28, *f*).  
*Thestor ballus*, F.—*H. rustica* (28, *b*).  
*Callophrys rubi*, L.—Bird (35, *f*).  
*Thecla quercus*, L.—Bird (35, *e*).  
*T. w-album*, Knoch.—*Muscicapa grisola* (24, *r*).  
*Lycaeninae*.—*Erithacus rubecula* (12, *d*).

## PIERINAE.

- Aporia crataegi*, L.—*Cuculus canorus* (32, *a*).  
*Pieris* spp.—*Corvus monedula* (1); *Sturnus vulgaris* (2, *b*); *Passer domesticus* (4, *k, q, r*); *Parus* sp. (6, *b*); *Motacilla* sp. (8, *b*); *Phoenicurus phoenicurus* (10, *c*); *Erithacus rubecula* (12, *d*); *Turdus viscivorus* (13); *Phylloscopus trochilus* (18); *Muscicapa grisola* (24, *f, g, h, n, q, s*); *Hirundo rustica* (28, *d, n*); Bird (35, *b, d*).  
*P. rapae*, L.—*Passer domesticus* (4, *a, i, j, m*); *Parus major* (7); *Accentor modularis* (11); *Acrocephalus schaenobaenus* (15); *Sylvia hortensis* (16); *Lanius collurio* (23, *b*); *Muscicapa grisola* (24, *j, l, p*); *Hirundo rustica* (28, *g, k*); *Cypselus apus* (28, *k*).  
*P. brassicae*, L.—*Passer domesticus* (4, *j, o*); *Erithacus rubecula* (12, *a*); *Muscicapa grisola* (24, *m*); *Hirundo rustica* (28, *e*).  
*Euchloë cardamines*, L.—*Erithacus rubecula* (12, *c*).  
*Colias edusa*, F.—*Erithacus rubecula* (12, *c*); *Muscicapa grisola* (24, *d*); *Hirundo rustica* (28, *l*).  
*Gonepteryx rhamni*, L.—*Passer domesticus* (4, *q*).

## PAPILIONINAE.

- Thais cerisyi*, Godt.—*Merops apiaster* (31).  
*Parnassius apollo*, L.—*Sylvia hortensis* (16).  
*P. mnemosyne*, L.—*Sylvia hortensis* (16).  
*Papilio podalirius*, L.—*Lanius minor* (21, *b*).

## RECORDS FROM THE ETHIOPIAN REGION.

1. *Motacilla capensis*, L. (Cape Wagtail). (*a*) "I not only obtained an Arctiid moth (*Binna madagascariensis*), which I surprised one of these birds in the act of kill-

- ing, but also saw another actually pursuing a butterfly belonging to the genus *Acraea*": W. L. Distant, "Naturalist in the Transvaal," p. 70.—(b) Seen to "take moths and *P. [Pieris] hellica*": J. P. Mansel Weale, "Nature," iii, p. 508 (Cape Colony).
2. *Motacilla* sp. (Wagtail). Prof. Yngve Sjöstedt, of Stockholm, informs me that although he paid no special attention to this subject, he well remembers to have observed birds of this genus pursuing and capturing butterflies in the beds of rivers on the Cameroon Mountain in West Africa.
  3. *Nectarinia* sp. (Sunbird). "Mrs. Barber informs me that *Pyrameis cardui* is a frequent victim among the butterflies with which the Sunbirds (*Nectariniae*) feed their young": R. Trimen, "S. Afr. Butterf.," i, p. 34, note (Cape Colony).
  4. *Apalis thoracica*, Shaw (Bar-throated Warbler). On June 7, 1903, near Salisbury, Rhodesia, I myself saw one of those birds catch an *Acraea nohara-halali*, Mshl., which it ate with apparent relish.
  5. *Pratincola torquata*, L. (South African Stonechat). "In March [1900] I saw a *Pratincola torquata* in chase of *Tarucus plinius*": C. F. M. Swynnerton, Trans. Ent. Soc. Lond., 1902, p. 358 (Gazaland).
  6. *Lanius collaris*, L. (Fiscal Shrike). "At the Cape I have seen *Fiscus collaris*, the common shrike of the colony, seize in succession several *Papilio lyaeus* on the wing": R. Trimen, Proc. Ent. Soc., 1897, p. xci.
  7. *Bradyornis mariqueensis*, Sm. (Marico Wood-Shrike). "Feb. 27, 1898. Saw a Marico wood-shrike dart down from a tree and catch a *Sarangesa eliminata*, Holl., which was sitting with outspread wings on a small plant": G. A. K. Marshall, Tr. Ent. Soc. 1902, p. 357 (Rhodesia).
  8. *Pachyprora molitor*, Hahn and K. (White-flanked Flycatcher). (a) "March 6, 1898. Saw a flycatcher (*Pachyprora molitor*) make several futile attempts to catch a *Tarucus plinius*, which was circling round the bush on which it sat." G. A. K. Marshall, *l. c.* p. 357 (Rhodesia).—(b) On June 7, 1903, near Salisbury, Rhodesia, I saw one of these birds eat a small Lycaenid (probably *Tarucus telicanus*) and a small Hesperid (probably *Baoris detecta*).
  9. *Trochocercus albonotatus*, Sharpe (White-spotted Fly-

- catcher). "On April 3 one of these birds was seen by Odendaal to dart out from the trees at the edge of Chirinda at a butterfly (*Mylothris*) flying past a few feet away, but to turn back on reaching it without an attempt at capture": C. F. M. Swynnerton, "Ibis," 1908, p. 98 (Mashonaland).
10. *Terpsiphone perspicillata* Sw. (S. African Paradise Flycatcher). (a) "I have seen *Tchitrea cristata* darting at *P.* [*Mylothris*] *agathina*": J. P. Mansel Weale, "Nature," iii, p. 508 (Cape Colony).—(b) "I would notice that I have seen a *Tchitrea cristata* capture a [*Papilio*] *merope* ♂, and chase a *P. nircus*, and I have little doubt that this bird is most destructive to bush-frequenting Rhopalocera": J. P. Mansel Weale, Proc. Ent. Soc., 1874, p. 132 (Cape Colony).—(c) "March 28, 1897. While out collecting at Malvern, Durban, Natal, I saw a Paradise Flycatcher catch a specimen of *Eronia cleodora*": G. A. K. Marshall, Trans. Ent. Soc., 1902, p. 357.—(d) "While watching an *Atella phalantha* hovering over a bush of its food-plant, a Paradise Flycatcher darted past, and with a loud snap of its beak, tried to catch the butterfly in its swoop:" G. A. K. Marshall, *l. c.* (Rhodesia).
11. *Dicrurus afer*, Licht. (African Drongo). (a) "I have little doubt that . . . *Dicrurus musicus*, Vieill., is most destructive to bush-frequenting Rhopalocera": J. P. Mansel Weale, Proc. Ent. Soc. 1874, p. 132 (Cape Colony).—(b) "December 1, 1898. C. F. M. Swynnerton saw a drongo (*Buchanga assimilis*) fly past him with a white butterfly in its beak, probably *C. florella*": G. A. K. Marshall, *l. c.* p. 357 (Rhodesia).—(c) A drongo observed to attack a tattered *Belenois* (either *mesentina* or *severina*): G. A. K. Marshall, *l. c.* p. 357 (Rhodesia).—(d) "Gorongozo Dist., Portuguese E. Africa, May 1907. Although this species was common, I only once noticed it take butterflies, when one caught a small brown species that was passing where it was perched": C. H. B. Grant (note from diary).—(e) "I have on several occasions seen the common Drongo (*D. afer*) make more or less successful darts at passing butterflies" (N.E. Rhodesia): S. A. Neave (letter dated 19, ii, 1909).
12. *Dicrurus* sp. (Drongo). Colonel N. Manders tells me that in the harbour of Nossi Be, Madagascar, in 1907,



- he observed a drongo pursuing a butterfly (*Hypolimnas drucei*, Butl.) which it failed to capture.
13. *Dicrurus ludwigi*, Smith (Lesser Drongo). "16, viii, 1908. In the same locality as yesterday, viz., the edge of a patch of dense forest, saw a Lesser Drongo (*D. ludwigi*), catch a damaged *Catopsilia florella*": S. A. Neave (note from diary; N.E. of Lake Bangweolo).
  14. *Hirundo monteiri*, Hartl. (Monteiro's Swallow). "13, vi, 1908. N.E. of Lake Bangweolo. Saw a large swallow, probably *H. monteiri*, capture a *Teracolus* ? *evenina* which appeared to have been previously injured": S. A. Neave (note from diary).
  15. *Hirundo* sp. (Swallow). "I think I told you long ago of having found the wings of a lot of butterflies, chiefly *P. corinneus*, below the branch of a tree on which some swallows were constantly settling": C. F. M. Swynnerton, Tr. Ent. Soc., 1902, p. 358 (Gazaland).
  16. *Cypselus caffer*, Licht. (S. African Swift). Observed to "take small moths from the grass and dart at *Terias rahel* [*brigitta*, Cram.] on our open flats": J. P. Mansel Weale, "Nature," iii, p. 508. (Cape Colony.)
  17. *Dicrocercus hirundineus*, Licht. (Swallow-tailed Bee-Eater). "11, x, '07. I watched to-day for about half-an-hour a specimen of the Swallow-tailed Bee-Eater (*D. hirundineus*) hawking butterflies. As far as I could see he took nothing but Pierines, *C.* [*Catopsilia*] *florella* mostly, but one or two *B.* [*Belenois*] nr. *dentigera*, and one *Terias*" (N.W. Rhodesia): S. A. Neave (in a letter to Prof. Poulton).
  18. *Merops persicus*, Pall. (Blue-cheeked Bee-Eater). (a) "In the vicinity of every hole were numbers of pellets, formed of the wings and other indigestible parts of dragon-flies, butterflies, beetles, etc.": S. Stafford Allen, "Ibis," 1862, p. 359 (On the Nile).—(b) Mr. C. F. M. Swynnerton has recently sent me a butterfly which was taken from the stomach of one of these birds at Chibababa, Portuguese E. Africa, on December 11, 1906. The insect is an *Acraea*, belonging to the group represented by *A. hortia*, L., but is too much damaged for exact identification. The same gentleman notes the dexterity of these birds in catching insects, but states: "Yet I saw one strike

- deliberately at a *Belenois* (of which the rapid erratic flight must be very puzzling to a bird) and miss it. I have noticed the same difficulty on the part of *Dicrurus afer*" ("Ibis," 1908, p. 398).
19. *Merops apiaster*, L. (European Bee-Eater). (a) I have recently received from Mr. C. F. M. Swynnerton the two front wings of an Hesperid (either a *Baoris* or *Platylesches*), which were taken from a stomach of this bird near Chirinda (3500 ft.), Gazaland, on March 26, 1907.—(b) "I have found a specimen of *Mylothris agathina* in the crop of the common 'Abelharuco' (*Merops apiaster*)": Dr. F. Creighton Wellmann, "Ann. Soc. Ent. Belg.," 1908, p. 148 (Angola).
  20. *Merops rubricoides*, Desm. and P. (Carmine-throated Bee-Eater). Mr. C. H. B. Grant has kindly supplied me with the two following observations noted in his diary when in S.E. Africa.—(a) "Near Beira (Jan. 1907) I saw three of these birds together perched on the top of a dead tree, and when walking up to shoot them I distinctly saw one fly out and take a brown butterfly that was passing."—(b) "When travelling up the Zambesi from Tambara to Tette (Aug. 1907), a small flock of these birds was hawking over the water, and twice or three times I saw them catch white butterflies, of which there were quite a number about."
  21. *Merops* sp. "All kinds of insects form the prey of these birds. Once I shot one with its mouth so stuffed with butterflies that it appeared to me marvellous that it had not choked": Capt. Boyd Alexander, "From the Niger to the Nile," vol. ii, p. 29 (N. Nigeria). [The bird was doubtless collecting food for its young, G. A. K. M.]
  22. *Merops boehmi*, Reichen. (Böhm's Bee-Eater). "15, viii, 1908. Saw a Böhm's Bee-Eater make one or two attempts to catch butterflies, chiefly Pierines, but did not see him actually take one": S. A. Neave (note from diary; N.E. of Lake Bangweolo).
  25. *Melittophagus meridionalis*, Sharpe (Little Bee-Eater).—(a) "I noticed one bird catch a white butterfly, but small coleopterous insects seem to form the chief part of their prey." Dr. A. Stark, in Stark and Selater's "Birds of S. Africa," iii, p. 69 (Natal).—(b) Mr. Swynnerton has sent me the stomach of one of these birds which he shot in Melssetter District,

Mashonaland, in October 1906. This contained two flies of the genus *Pyrgota* and one of the genus *Sarcophaga*, one beetle (*Onthophagus aeruginosus*, Roth.) and one butterfly (*Precis* sp.), far too much damaged for exact identification.—(c) “Luombwa R., near S.E. boundary of the Congo Free State. 13, xii, 1907. Saw a little Bee-Eater (*M. meridionalis*) catch and eat what appeared to be *Atella phalantha*, though it may possibly have been its mimic *Pseudargynnis hagemone*, as they are impossible to distinguish on the wing”: S. A. Neave (note from Diary).—(d) “Besides the above I have on several occasions seen *M. meridionalis* make more or less successful darts at passing butterflies”: S. A. Neave (letter dated 19, ii, 1909).

24. *Melittophagus bullockoides*, Smith (White-fronted Bee-Eater). At Chibababa, in Portuguese E. Africa, Mr. Swynnerton watched these birds hawking insects. “During the whole time that I was watching, perhaps a quarter of an hour, I saw the birds fly out six times after butterflies of some size, including Pierines, probably *Catopsilia florella* and *Belenois severina* or *B. mesentina*, as these seemed to be the only white butterflies which were flying over the water. In these six attempts the butterfly was caught outright only twice; on two other occasions, after much dodging, it got away and the bird returned to its perch; while on two remaining occasions, on one bird missing the insect, several others promptly flew out (the first time seven or eight, and the second time three) to join in the sport, the butterfly being eventually captured, each time after some little darting about and confusion. Besides this, on quite a number of occasions, I saw a bird aim at or catch what I took to be a Lycaenid, the others going out to its aid in the same manner three or four times”: C. F. M. Swynnerton, “Ibis,” 1908, p. 399. [He shot one bird and sent me the stomach, which contained a specimen of *Acraea rabbiae*, Ward, G. A. K. M.]
- 25 *Eurystomus afer*, Lath. (Yellow-billed Roller). “Masembeti, near Beira, Nov. 1906. This bird was sitting on a very tall dead tree, and I saw it take a large reddish or brown butterfly on the wing”: C. H. B. Grant (note from diary).

26. *Coracias caudatus*, L. (Lilac-breasted Roller). "Rollers (*Coracias caudata*) are great hawkers of flying insects, especially of butterflies": H. A. Bryden, "Nature and Sport in S. Africa," p. 64.
27. *Coracias* sp. "I may here say that I have on one occasion seen a Roller (*Coracias*) in West Africa capture on the wing a Pierine, probably *Terias senegalensis*": Dr. F. Creighton Wellman, "Ann. Soc. Ent. Belg.," 1908, p. 148.
28. *Ispidana natalensis*, Smith (Natal Kingfisher). "These birds feed entirely on butterflies and insects caught on the wing": T. Ayres, in Sharpe's "Monogr. Kingfishers," p. 146 (Natal).
29. *Haleyon chalcuti*, Stanley (Striped Kingfisher). (a) "Its food consists entirely of Coleoptera, Orthoptera, Lepidoptera and flies. . . . It captures insects on the wing": von Heuglin, quoted in Sharpe's "Monogr. Kingfishers," p. 184 (N.E. Africa).—(b) "Nov. 23, 1908. "Saw a Bush Kingfisher catch and eat two butterflies, viz. *Junonia cebrene* and *Catopsilia florella*, both of which were captured when feeding." G. A. K. Marshall, Tr. Ent. Soc., 1902, p. 357 (Rhodesia).
30. *Coccytes cafer*, Licht. (Levaillant's Cuckoo). "Dec. 15, 1898. Remains of *Papilio demodocus* found in the stomach of a cuckoo (*Coccytes cafer*)": G. A. K. Marshall, *l. c.* (Rhodesia).
31. *Falco subbuteo*, L. (Hobby), "Swynnerton shot a hobby which had in its stomach an almost complete *Terias*": G. A. K. Marshall, *l. c.* (Rhodesia).
32. Birds not identified:—  
 (a) "Empandeni, Plumtree, Rhodesia. On Feb. 31 of this year (1907) I was passing through a native field and saw a brownish bird about the size of a starling dart out of a tree and seize a *Pieris* or *Teracolus* (I could not be certain which, as the butterfly was flying rather high and I was not near enough to identify it) in its beak and fly back to the tree with it. I was near enough to be absolutely certain of this. It was the first time I had ever witnessed anything of the sort, and so far I have not seen a repetition of any such attack": Father O'Niel, S. J. (*in litt.*).—  
 (b) "This *Salamis* was settled on the under-side of a leaf when a bird made a dart at it and took the piece out of the wings. May 12, 1902, Stella Bush, Dur-

ban": note by F. Muir on a specimen of *S. anacardii* (= *parhassus*, Drury) in the Oxford Museum. Prof. Poulton, to whom I am indebted for this record, says, that a huge piece, probably over one-third, is taken symmetrically out of both hind-wings.—(c) "I have only once seen a bird attempt the capture of a butterfly, and that was a shrike, which is common here, trying to catch a newly emerged *Charaxes*": Rev. K. St. Aubyn Rogers, in a letter to Prof. Poulton dated Taveta, B. E. Africa, July 5, 1905.—(d) "On May 18, 1908 [at Durban, Natal], I followed up a ♀ *Charaxes neanthes* and obtained eighteen ova, and should have got more, but the fly was then captured by a bird." G. F. Leigh (in a letter to Prof. Poulton, dated 12, ix, 1908).—(e) Mr. F. Muir "expressed surprise that any doubts should have been raised. He had frequently observed such attacks at Delagoa Bay and other places on the East Coast of Africa, and had seen birds waiting in trees or bushes and darting out at butterflies as they approached": Prof. E. B. Poulton, "Essays on Evolution," p. 282, note.

The following is a summary of the butterflies attacked:—

ETHIOPIAN BUTTERFLIES.

ACRAEINAE.

- Acraea* sp.—*Motacilla capensis* (1, a); *Merops persicus* (18, b).  
*A. rabbaiae*, Ward.—*Melittophagus bullockoides* (24).  
*A. nohara-halali*, Mshl.—*Apalis thoracica* (4).

NYMPHALINAE.

- Atella phalantha*, Drury.—*Terpsiphone perspicillata* (10, d): *Melittophagus meridionalis* (23, c).  
*Pyrameis cardui*, L.—*Nectarinia* sp. (3).  
*Precis* sp.—*Melittoph. meridionalis* (23, b).  
*P. hierta-cebrene*, Trim.—*Halcyon chelicuti* (29, b).  
*Salamis parhassus*, Drury.—Bird (32, b).  
*Hypolimnas dubius-drucci*, Butl.—*Dicrurus* sp. (12).  
*Charaxes* sp.—Bird (32, c).  
*C. neanthes*, Hew.—Bird (32 d).

LYCAENINAE.

- Tarucus telicanus*, Lang.—*Pratincola torquata* (5); *Pachypora molitor* (8, a, b).

## PIERINAE.

- Mylothris* sp.—*Trochocercus albonotatus* (9; butterfly refused).  
*M. agathina*, Cram.—*Terpsiphone perspicillata* (10, *a*);  
*Merops apiaster* (19, *b*).  
*Belenois* spp.—*Merops persicus* (18, *b*); *Dicrurus afer* (11, *c*).  
*B.* near *dentigera*, Butl.—*Dicrocercus hirundineus* (17).  
*Synchloe helice*, L.—*Motacilla capensis* (1, *b*).  
*Eronia cleodora*, Hubn.—*Terpsiphone perspicillata* (10, *c*).  
*Catopsilia florella*, F.—*Dicrurus afer* (11, *b*); *Dicrurus ludwigi* (13); *Dicrocercus hirundineus* (17); *Halcyon chelicuti* (29, *b*).  
*Teracolus ? evenina*, Wallg.—*Hirundo monteiri* (14).  
*Terias* sp.—*Dicrocercus hirundineus* (17); *Falco subbuteo* (31).  
*T. brigitta*, Cram.—*Cypselus caffer* (16).  
*T. senegalensis*, Boisd.—*Coracias* sp. (27).  
*Pierinae*.—*Merops nubicoides* (20, *b*); *Merops boehmi* (22); *Melittophagus meridionalis* (23, *a*); *M. bullockoides* (24); Bird (32, *a*).

## PAPILIONINAE.

- Papilio demodocus*, Esp.—*Coccytes cafer* (30).  
*P. dardanus-cenca*, Stoll.—*Terpsiphone perspicillata* (10, *b*).  
*P. niveus-lyacus*, Doubl.—*Lanius collaris* (6); *Terps. perspicillata* (10, *b*).  
*P. pylades-angolanus*, Goeze.—*Hirundo* sp. (15).

## HESPERIIDAE.

- Sarangesa eliminata*, Holl.—*Bradyornis mariquensis* (7).  
*Baoris detecta*, Trim.—*Pachyprora molitor* (8, *b*).  
*HesperIIDae*.—*Merops apiaster* (19, *a*).

## RECORDS FROM THE INDO-MALAYAN REGION.

1. *Copsychus saularis*, L. (Dhaya! Bird). "I remember once seeing at Dehra Dun a Dhya! or Magpie-Robin take a disabled *Catopsilia* I threw out for it": Frank Finn, "Nature," lxi, 1899, p. 55 (India).
2. *Pycnonotus* sp. (Bulbul). "The Hon. Mr. Justice Newton, who assiduously collected and took notes

upon the Lepidoptera of Bombay, informed me that the *Charaxes psaphon* of Westwood was continuously persecuted by the Bulbul": A. G. Butler, "Nature," iii, 1870, p. 165, note.

3. *Pycnonotus sinensis*, Gm. (Green Bulbul). Observed to attack butterflies in Southern China, "but generally miss them": J. C. Kershaw, Tr. Ent. Soc. Lond. 1905, p. 6.
4. *Otocampsa fuscicaudata*, Gould (Red-whiskered Bulbul). "This afternoon I was sitting under the veranda with my head within about 5 ft. of a red-whiskered bulbul's nest containing two young birds about five days old. One of the parent birds arrived with the very last butterfly I should have expected it to have any dealings with, viz. *Acraca violae*. . . I noticed that the butterfly was well in the bird's bill, firmly held, with the wings in considerable disarray. The body must have been fairly well crushed, so that the bulbul must have been fully alive to the flavour. I put my head within about 3 ft. of the nest to see how the young birds took it. The bird went down and pushed the butterfly well into the youngster's throat, and it was swallowed immediately, wings and all, and the young bird settled quietly down without seeming in the slightest degree upset": H. L. Andrewes (in a letter to Prof. Poulton, dated 19, iii, '08, Nilgiri Hills, S. India).
5. *Artamus monachus*, Bp. (Swallow-Shrike). "It feeds on insects, butterflies on the wing, grasshoppers, etc. (Meyer)": Meyer and Wigglesworth, "Birds of Celebes," ii, p. 435.
6. *Artamus fuscus*, Vieill. (Ashy Swallow-Shrike). "I am not certain as to the date on which I saw the Ashy Swallow-Shrike catching specimens of the *Euploea*, *Crastia core*. . . . At least six specimens of the *Crastia* were captured by the shrike, all of which it carried away to a branch high up in a big tree, but I could not see whether they were eaten": Col. J. W. Yerbury, Tr. Ent. Soc. Lond., 1902, p. 360.
7. *Tephrodornis pondicerianus*, Gm. (Indian Wood-Shrike). "Moths and small butterflies form a considerable portion of its food": Capt. Legge, "Birds of Ceylon," ii, p. 374.
8. *Chibia hottentotta*, L. (Hair-crested Drongo). "Salween

River, 17, v, 78. . . . This tree [*Bombax malabaricum*] was in flower and was crowded with birds of all kinds, chiefly mainas, kingcrows and parrots. I noticed among them two or three hair-crested Drongos (*Chibia hottentotta*), and was rather surprised to see one of these suddenly dart from the tree and give chase to a white butterfly (*Appias hippo*) that was flitting about some willow-like bushes. The bird swooped at the butterfly several times and chased it, but so far as I could see did not succeed in catching it": Lt.-Col. C. T. Bingham, note from diary (Burma).

9. *Dicrurus ater*, Herm. (King-Crow).—(a) "It feeds . . . occasionally on moths and butterflies": Jerdon, "Birds of India," i, p. 428.—(b) "Delhi, 11, vii, 75. . . . While I was watching a *Papilo erithonius* [= *demoleus*, L.] flew past and the King-Crow gave chase, snapped at it, but the butterfly dodged, the bird twisted, and after making two or three more attempts caught it and flew with it to a small keekur tree (*Acacia*). For some time the King-Crow sat holding the butterfly, then he began to champ it and seemed to make two or three attempts at swallowing. A villager, however, coming through the grass close past the tree frightened the bird and it dropped the butterfly. I picked the insect up, but though still alive it was much injured and unable to fly": Lt.-Col. C. T. Bingham (note from diary).—(c) This bird was observed to catch butterflies in India: Major Nurse, "Journ. Bombay, N. H. Soc.," ix, 1895, p. 337.—(d) The common King-Crow (*Dicrurus ater*, I believe) invariably captures butterflies on the wing; I have seen these birds scores of times do this. Their usual prey seems to be a small deep yellow butterfly with black on the tip of the wings, but I have occasionally seen other butterflies so captured by them. . . . With reference to my previous letter I would say that the butterfly referred to was the *Terias silhetana* or *Terias laeta*, probably both": A. E. Mackay, "Nature," lxx, 1902, pp. 247 and 486 (India).—(e) "In the other case the butterfly, *Euthalia garuda*, had been slightly crippled by some accident, which a King-Crow detected at once, but it had some trouble to catch it": E. H. Aitken, "J. Bomb. N. H. Soc.," xvi, 1904, p. 156 (India).—(f) Observed to attack butterflies in Southern China, but generally



- miss them: J. C. Kershaw, Tr. Ent. Soc., 1905, p. 6.—  
 (g) "Sept. 23, 1885. Road up Thundiani, near Kala  
 Pani Bungalow. Saw a young King-Crow, *Dicrurus*  
*ater*, stoop at a big blue *Papilio*, either *P. polyctor* or  
*P. arcturus*, and miss it. The bird did not repeat the  
 attempt": Col. J. W. Yerbury, Tr. Ent. Soc., 1902,  
 p. 359.—(h) "Sept. 2, 1886. Road up Thundiani,  
 near top of the hill. Saw a young King-Crow stoop  
 at a specimen of *Vanessa kaschmirensis*, and after  
 missing it once take it at the second attempt. Did  
 not notice whether the insect was eaten": Col.  
 Yerbury, *l. c.*—(i) "Going through some fairly open  
 jungle [in Burma] close to the main road I put up a  
*Melanitis zitenius*, which fluttered across the road  
 and was swooped at by a King-Crow (*Dicrurus*), but  
 missed": Lt.-Col. C. T. Bingham, Tr. Ent. Soc., 1902,  
 p. 363.—(j) Observed to hawk *Catopsilia* in Burma:  
 Lt.-Col. Bingham, *l. c.* p. 363.
10. *Dicrurus* sp. (Drongo). "On a forest path a *Danaus*  
*septentrionalis* flew along before me with its slow,  
 flapping motion, when suddenly an apparently young  
 Dicrurid—these birds are bitter enemies of butterflies  
 —darted at it from a twig where it had been on the  
 watch, but when about two feet away shook itself  
 and then, without seizing the insect, returned to its  
 perch": E. Haase, "Res. on Mimicry," p. 99 (Siam).
  11. *Dicrurus longicaudatus*, Jerd. (Long-tailed Drongo).  
 This bird was observed to seize a large butterfly  
 (*Teinopalpus imperialis*, Hope) on the wing: G. C.  
 Dudgeon, "J. Bomb., N. H. Soc.," ix, 1895, p. 337  
 (India).
  12. *Dicrurus leucopygialis*, Blyth (White-vented Drongo).  
 "Mr. Lewis also gives *Buchanga leucopygialis* as a  
 very active hunter of butterflies on the wing": R.  
 Trimen, Proc. Ent. Soc., 1897, p. xci (Ceylon).
  13. *Dicrurus* sp. On two occasions in Java an "*Edolius*?  
 sp." was seen to eat a *Euploea rafflesii*, Moore (Piepers):  
 A. S. Packard, "Proc. Am. Phil. Soc.," 1904, p. 412.
  14. *Buchanga* sp. (Drongo). "*Buchana* [sic] sp., a small  
 species, was very common on a small island near  
 Bangkok during the flying season of the *Catopsiliae*,  
 and I have observed it as it was busy in capturing  
 these insects." Haase also states that Dicruridae in  
 general "appear to be special enemies of these

- insects [butterflies]": E. Haase, "Researches on Mimicry," (transl.), ii, p. 101.
15. *Pericrocotus flammeus*, Forst. (Orange Minnivet). "Its diet consists of small butterflies and various winged insects, some of which it will occasionally take on the wing": Capt. Legge, "Birds of Ceylon," ii, p. 365.
  16. *Terpsiphone princeps*, Temm. (Black-tailed Paradise Flycatcher). Observed to attack butterflies but generally miss them, in Southern China: J. C. Kershaw, Trans. Ent. Soc., 1905, p. 6.
  17. *Terpsiphone paradisi*, L. (Indian Paradise Flycatcher). Observed to catch *Neptis accris*, *Ixias marianne* and *Eurema* [*Terias*] *hecabe*, Jan. 1905, at Vavuniya Vilankulam, North Ceylon: Dr. F. Doflein (letter dated 12, iv, '07).
  18. Flycatcher (not identified). "Often and often I have had opportunities of observing females of *Clerome faunula* fall a prey to flycatchers when sailing round the tops of trees with their slow fluttering flight": A. Grubauer, "Soc. Ent. Zurich," xvii, 1902, p. 123 (Malay Peninsula).
  19. *Passer montanus*, L. (Tree Sparrow). (a) "Twice also have I seen a sparrow attack an *Amathusia phidippus*, L.": Piepers, quoted by Packard, "Proc. Am. Phil. Soc.," 1904, p. 412 (Java).—(b) "I have observed *Hesperia thrax* and other Hesperidae and *Catopsiliae*, which were struck down and devoured by sparrows": E. Haase, "Researches on Mimicry" (transl.), ii, p. 101 (Siam).—(c) Observed to attack butterflies, but generally miss them, in Southern China: J. C. Kershaw, Trans. Ent. Soc. Lond., 1905, p. 6.—(d) "I have more than once noticed the common Burmese sparrow (*Passer montanus*) trying to catch some little moth. On one occasion I watched the insect, which had escaped, settle, and caught it. It proved to be a *Zizera* sp.?" : Lt.-Col. C. T. Bingham (note from diary).
  20. *Acridotheres tristis*, L. (Common Mynah). (a) "Kaw-karaik, 18, iv, 1891. Saw a maina (*A. tristis*) while feeding on the ground in front of my bungalow make a sudden jump upwards to catch a passing *Papilio*; what species the latter was I did not see": Lt.-Col. C. T. Bingham (note from diary).—(b) "I may mention that not long ago I saw here in Calcutta a

- Common Mynah with a white butterfly in its bill": F. Finn, "Nature," lxi, 1899, p. 55.
21. A Trogon (not identified). "The other day I saw a small Trogon dart at a *Terias* unsuccessfully": S. B. J. Skertchley, "Ann. Mag. N. H." (6) iii, 1889, p. 478 (Borneo).
22. *Merops viridis*, L. (Indian Bee-Eater). (a) Observed to catch butterflies in India: Major Nurse, "J. Bomb. Soc.," xv, p. 349.—(b) "Col. Swinhoe informs me that in India he has on several occasions seen *Merops viridis* catch and eat butterflies, and that he has also witnessed many cases of other birds pursuing them": R. Trimen, Proc. Ent. Soc. Lond., 1897, p. xc.—(c) "Mr. F. Lewis, of the Ceylon Forest Service, . . . has seen *Merops viridis* occasionally take small white and yellow butterflies (*Terias* spp.)": R. Trimen, *l. c.* xci.—(d) "In the cases [of birds attacking butterflies which] he had witnessed, the *Euploecae* and *Danaidae* were caught as often as any others, but usually escaped eventually from the beak of the bird and flew away none the worse owing to the toughness of the integuments. The only bird he had observed frequently to pursue butterflies was the Common Indian Bee-Eater, which he had seen hawking *Pieridae*, and among them *Teracolus*": Sir G. Hampson, Proc. Ent. Soc. Lond., 1897, p. xxxviii (India).—(e) "Another bird that frequently catches these butterflies [*Terias silhetana* and *T. lacta*] on the wing is the Indian Bee-Eater (*Merops viridis*)": A. E. Mackay, "Nature," lxxv, 1902, p. 486 (India).—(f) "In one case a Bee-Eater caught a *Danais*, but dropped it as soon as it had tasted it, and the *Danais* flew away little the worse": E. H. Aitken, "J. Bomb. Soc.," xvi, 1904, p. 156 (India).—(g) *Terias hecabe* and *Papilio pammon* "seemed to be the principal victims of the graceful green Bee-Eaters. . . . They never missed their prey, and always brought their quarry back to the same spot to be dis-winged before being swallowed, the ground under their watch-towers being thickly strewn with gaily painted shreds of unfortunate butterflies and bees": E. L. Arnold, "On the Indian Hills," i, pp. 247, 248 (1881).—(h) Col. N. Manders informs me that in the year 1900 in Ceylon he observed a Bee-Eater of this species capture a *Charaxes psaphon*.

23. *Merops philippinus*, L. (Philippine Bee-Eater). (a) "Mr. F. Lewis, of the Ceylon Forest Service, . . . has seen *M. philippinus* occasionally take small white and yellow butterflies (*Terias* spp.)": R. Trimen, Proc. Ent. Soc. Lond., 1897, p. xci.—(b) "Frequently capture *Catopsiliae*, especially when these butterflies are travelling in thousands along the river-valleys" (F. Lewis): R. Trimen, *l. c.* (Ceylon).—(c) "They feed even on butterflies, which I have seen this species frequently capture": Jerdon, "Birds of India," I, p. 208 (2nd ed. 1877).—(d) "Nov. 14, 1891. On the Kandy Road between Trinkomali and Kanthalai; butterflies in great numbers sitting on the wet mud by the roadside; chiefly Pierinae (*Catophaga*), but a few *P[apilio] nominus* with them. These butterflies rose in clouds as one drove past. A Bee-Eater, *Merops philippinus*, kept flying in front of my carriage and taking specimens of these butterflies as they rose. The bird seemed to select the yellow females, which are rare, the white females being to them probably in the proportion of 100 to 1. . . . These Bee-Eaters were often seen catching Pierinae; in fact, it seems to have occurred so often that I ceased to record the fact": Col. J. W. Yerbury, Trans. Ent. Soc., Lond., 1902, p. 360.—(e) "I noticed clouds of butterflies, chiefly *Catopsilia*, migrating, crossing the Salween from east to west in a continuous stream. These were being persistently hawked by the *Merops*, mixed with which were some king-crows": Lt.-Col. C. T. Bingham, Trans. Ent. Soc. Lond., 1902, p. 363 (Burma).
24. *Merops viridis*, L., *M. philippinus*, L., and *Melittophagus swinhoei*, Hume. (a) Some Bee-Eaters ("which of the three species mentioned in my book was not sufficiently determined") were seen to capture *Papilio erithonius*, *P. hector* and *Precis iphita*, at Anaradhapura, Ceylon, in Jan. 1905: Dr. F. Doflein (letter dated 12, iv, 1907).—(b) At Vavuniya Vilankulam, North Ceylon, in Jan. 1905, all these three Bee-Eaters were observed to capture some of the following butterflies, *Papilio erithonius*, *P. hector*, *Hypolimnas bolina*, *H. misippus*, *Eronia spiculifera*, and *Hebomoia glaucippe*: Dr. Doflein, *l. c.*
25. *Merops apiaster*, L. (European Bee-Eater). Seen to capture a Lycaenid, probably *Polyommatus (Lampides)*

- baeticus*: Major Nurse, "Journ. Bomb. Soc.," xv, p. 349 (India).
- 25 bis. *Merops leschenaulti*, Vieill. (Leschenault's Bee-Eater). "These birds never eat the wings of butterflies. You see one of them swoop on to a butterfly close at hand; then you hear a little click of the bill, and as the bird flies off the pair of wings come slowly fluttering to the ground": W. Davison, "Stray Feathers," vi, 1878, p. 68.
26. *Melittophagus swinhoci*, Hume (Swinhoe's Bee-Eater). (a) "Frequently capture *Catopsiliae*, especially when these butterflies are travelling in thousands along the river-valleys" (F. Lewis): R. Trimen, Proc. Ent. Soc. 1897, p. xci (Ceylon).—(b) "The butterflies hawked and eaten by the Bee-Eaters belong to the following species, *Papilio erithonius*, *P. sarpedon*, *Charaxes athamas*, *Cyrestis thyodamas*, and *Terias hecabe*. A meagre list, for I am certain I saw the Bee-Eaters swoop for and catch *Prioneris*, *Hebomoia*, *Junonia* and *Precis*. I also particularly noticed that the birds never went for a *Danaïs* or *Euploea*, or for *Papilio macareus* and *P. xenocles*, which are mimics of *Danaïs*, though two or three species of *Danaïs*, four or five of *Euploea*, and the two above-mentioned mimicking *Papilios* simply swarmed along the whole road": Lt.-Col. C. T. Bingham, Trans. Ent. Soc., 1902, p. 362 (Burma).
27. *Coracias indicus*, L. (Indian Roller). Observed catching butterflies in India: Major Nurse, "J. Bomb. Soc.," xv, p. 349.
28. *Coracias affinis*, McCl. (Burmese Roller). "Ataran River, 30, ii, 1881. Saw a *Coracias affinis* fly to a tree holding a *Cyrestis thyodamas* in its mouth" Lt.-Col. C. T. Bingham (note from diary).
29. *Halcyon smyrnensis*, L. (White-breasted Kingfisher). (a) "Very common, feeding indiscriminately on fresh- or salt-water fish, crabs, beetles and butterflies. I have seen them capture these last in the manner of flycatchers (Muscicapidae), darting from a sprig and seizing them in the air": E. L. Layard, "Ann. Mag. N. H." (2) xii, 1853, p. 172 (Ceylon).—(b) "I have observed one launch out from a high tree, in the manner described by Layard, on a butterfly": Capt. Legge, "Birds of Ceylon," i, p. 300 (1878).

30. *Microhierax fringillarius*, Drap. (Black-legged Falconet). (a) On 25 March, 1877, in Tenasserim, a nest of this species was found in a hole in a tree. "At the bottom of the hole, which was about eighteen inches deep, was a soft pad composed of flies and butterflies' wings, mixed with small pieces of rotten wood": J. Davidson, quoted by A. O. Hume, "Stray Feathers," v, 1877, p. 81.—(b) This Falconet was observed hawking *Papilio empedocles* at Sarawak, Borneo, in Sept. 1897: R. Shelford (*in litt.*).—(c) "Though feeding on birds, as a rule smaller, but undoubtedly occasionally larger than itself, the chief food probably of this little Falcon is insects of various sorts, dragonflies, beetles and butterflies. I say butterflies, for, although I have never found the distinguishable remains of butterflies in those I have examined, I have no doubt that they do capture butterflies largely, and of all sizes, for the nest of a pair that I found at Bankasoon [Burma] consisted of a pad composed entirely of insect-wings, and the mass of these were those of butterflies": W. Davison, "Stray Feathers," vi, 1878, p. 5.
31. *Microhierax coeruleus*, L. (Red-legged Falconet). (a) This bird was observed on March 20, 1881, in Burma, to capture and eat a *Papilio sarpedon*: Lt.-Col. C. T. Bingham, Trans. Ent. Soc., 1902, p. 364.—(b) From a nest of this species found in Burma in March 1878, the following butterflies' wings were taken—*Mycalces perscus*, *Precis orithya*, *Symphacdra dirtea* ♀, *Charaxes* sp.; *Papilio erithonius*, *Papilio caunus*, and some unidentified species of Lycaenidae: Lt.-Col. Bingham, *l. c.* p. 365.—(c) Another nest of the same species, also found in Burma, contained "a fairly firm pad of chips of wood, a few leaves, with an upper stratum quite two inches thick, composed almost entirely of the wings of cicadas, with a few butterfly and moth wings interspersed therein": Lt.-Col. Bingham, "Zoologist" (4), 1901, p. 224.
32. Birds not identified:—
- (a) A specimen of the Lycaenid, *Panchala apidanus*, was certified by Mr. Godfery to have been mutilated by a bird: W. L. Distant, "Rhop. Malayana," p. 274.—(b) "I have never seen a bird seize one of the often very common, slow-moving and fearless, reddish-brown

Danaids; while the Pieridae, and especially the *Catopsiliae*, were often pursued by birds a long distance": E. Haase, "Researches on Mimicry" (transl.), ii, p. 23, note.—(c) A bird was seen to seize a butterfly, *Elymnias undularis* ♂, just as the observer was on the point of capturing it with his net: Prof. E. A. Minchin, Proc. Ent. Soc. L., 1904, p. xxxvii. (India.)—(d) "During five years I have, perhaps, seen a dozen attacks on butterflies by birds, and only seen them captured two or three times": J. C. Kershaw, Trans. Ent. Soc., 1906, p. 6 (S. China).—(e) "In Ceylon a bird was seen to make a swoop at a male *Catophaga paulina*, but missed it": Dr. G. B. Longstaff, Trans. Ent. Soc., 1905, p. 135.—(f) "I have often seen birds catch butterflies in Hongkong, Cochin-China, and Europe, but neither birds nor butterflies were identified": Dr. F. Doflein (letter dated 22, iv, 1907).—(g) "Hangtharaw River, 12, iv, 1881 [Burma]. On the march to-day I found under a tree by a stream quite a number of the wings of butterflies, chiefly Lycaenidae. These had apparently been sheared off by some bird that had fed on the flies. *Lampides* and *Nacaduba* abounded on the sandy banks": Lt.-Col. Bingham (note from diary).—(h) "I could never observe that this species [*Ornithoptera darsius*, Gray] was captured by the birds, though the much larger black and white *Papilio polymnestor*, Cram., often fell a prey to them, and nearly all those on the wing were damaged." It is then suggested that the *Ornithoptera* derives its immunity from the fact that its larva feeds on the poisonous *Aristolochia*. "But be that as it may, we always observe that this butterfly is uninjured, in spite of its slow, lazy and almost unwieldy flight among the birds; while the strong, quickly flying *Papilios*, *hector*, *erithonius*, *agamemnon*, *montanus*, *polytes*, etc., are seized": Dr. F. Doflein, "Ostasienfahrt," p. 444 (Ceylon).

## INDO-MALAYAN BUTTERFLIES.

## DANAINAE.

*Danaida* sp.—*Merops viridis* (22, f; butterfly rejected).  
*Tirumala septentrionis*, Butl.—*Dicrurus* sp. (10; butterfly refused).

*Euploea core*, Cram.—*Artamus fuscus* (6).  
*E. rafflesii*, Moore.—*Dicrurus* sp. (13).

## SATYRINAE.

*Mycalesis perseus*, F.—*Microhierax coerulescens* (31, b).  
*Melanitis zitenius*, Hbst.—*Dicrurus ater* (9, i).  
*Elymnias undularis*, Drury.—Bird (32, c).

## AMATHUSIINAE.

*Melanocyma faunula*, Westw.—Flycatcher (18).  
*Amathusia phidippus*, Joh.—*Passer montanus* (19, a).

## ACRAEINAE.

*Acraea violae*, F.—*Otocampsa fuscicaudata* (4).

## NYMPHALINAE.

*Pyrameis kaschmirensis*, Koll.—*Dicrurus ater* (9, h).  
*Precis*, spp.—*Melittophagus swinhoei* (26, b).  
*P. orithya*, L.—*Microhierax coerulescens* (31, b).  
*P. iphita*, Cram.—*Merops* sp. (24, a).  
*Hypolimnas bolina*, L.—*Merops* sp. (24, b).  
*H. misippus*, L.—*Merops* sp. (24, b).  
*Cyrestis thyodamas*, Boisd.—*Melittophagus swinhoei* (26, b); *Coracias affinis* (28).  
*Neptis eurynome*, Westw.—*Terpsiphone paradisi* (17).  
*Euthalia garuda*, Moore.—*Dicrurus ater* (9, e).  
*Symphaedra dirtaea*, F.—*Microhierax coerulescens* (31, b).  
*Charaxes* sp.—*Microhierax coerulescens* (31, b).  
*C. psaphon*, Westw.—*Pycnonotus* sp. (2); *Merops viridis* (22, h).  
*Eulepis athamas*, Drury—*Melittophagus swinhoei* (26, b).

## LYCAENINAE.

*Lampides baeticus*, L.—*Merops apiaster* (25).  
*Zizera* sp.—*Passer montanus* (19, d).  
*Panchala apidanus*, Cram.—Bird (32, a).  
*Lycacnidae*.—*Microhierax coerulescens* (31, b).

## PIERINAE.

*Prioneris* sp.—*Melittophagus swinhoei* (26, b).  
*Ixias marianne*, Cram.—*Terpsiphone paradisi* (17).  
*Appias hippo*, Cram.—*Chibia hottentotta* (8).  
*Catophaga* sp.—*Merops philippinus* (23, d).



*C. paulina*, Cram.—Bird (32, e).

*Catopsilia* spp.—*Copsychus saularis* (1); *Dicrurus ater* (9, j); *Buchanga* sp. (14); *Passer montanus* (19, b); *Merops philippinus* (23, b, e); *Melittophagus swinhoei* (26, a).

*Terias*, spp.—*Trogon* (21); *Merops viridis* (22, e); *M. philippinus* (23, a).

*T. hecabe*, L.—*Terpsiphone paradisi* (17); *Merops viridis* (22, g); *M. philippinus* (23, b).

*T. laeta*, Boisd. (or *silhetana*, Wall.)—*Dicrurus ater* (9, d); *M. viridis* (22, e).

*Teracolus* sp.—*M. viridis* (22, d).

*Hebomoia glaucippe*, L.—*Merops* sp. (24, b); *Melittophagus swinhoei* (26, b).

*Pareronia ceylanica*, Feld.—*Merops* sp. (24, b).

*Pierinae*—*Acridotheres tristis* (20, b); *Merops viridis* (22, d).

#### PAPILIONINAE.

*Teinopalpus imperialis*, Hope.—*Dicrurus longicaudatus* (11).

*Papilio* sp.—*Acridotheres tristis* (20, a).

*P. hector* L.—*Merops* sp. (24, a, b).

*P. demoleus*, L.—*Dicrurus ater* (9, b); *Merops* sp. (24, a, b); *Melittophagus swinhoei* (26, b); *Microhierax coerulescens* (31, b).

*P. polymnestor*, Cram.—Bird (32, h).

*P. polytes*, L.—*Merops viridis* (22, g).

*P. caunus*, Westw.—*Microhierax coerulescens* (31, b).

*P. polyctor*, Boisd. (or *arcturus*, Westw.)—*Dicrurus ater* (9, g).

*P. nomius*, Esp.—*Merops philippinus* (23, d).

*P. sarpedon*, L.—*Melittophagus swinhoei* (26, b); *Microhierax coerulescens* (31, a).

*P. empedocles*, F.—*Microhierax fringillarius* (30, b).

#### HESPERIIDAE.

*Casyapa thrax*, L.—*Passer montanus* (19, b).

#### RECORDS FROM THE NEARCTIC REGION.

1. *Turdus migratorius*, L. (American Robin). Observed to attack and devour a large brown butterfly, but the wings were not eaten: G. A. Soper, "Nature," lxi, 1900, p. 49 (New Jersey).

2. *Turdus mustelinus*, Gm. (American Wood-Robin). *Colibris philodice*, *Pieris rapae* and *P. brassicae* are eaten by this bird: Gentry, "Life-Histories of Birds of E. Pennsylvania," 1876, i, p. 16.
3. *Sialia sialis*, L. (Blue-bird). "They [an immense concourse of *Terias lisa*, Boisd.] did not stay long upon the islands [Bermudas], however, only a few days, but during that time thousands must have fallen victims to the vigorous appetites of the blue-bird (*Sialia sialis*, Baird), and black-bird (*Mimus carolinensis*, Gray), which were continually preying upon them": J. M. Jones, "Psyche," i, p. 122.
4. *Mimus polyglottus*, L. (Mocking-bird). (a) "In Florida, as we have been informed by Mrs. Annie T. Slosson, the mocking-bird frequently chases butterflies": A. S. Packard, "Proc. Am. Phil. Soc. 1904," p. 401.—(b) "Diptera, mosquitoes, butterflies, larvae of non-irritating properties, earthworms and berries of divers kinds constitute their dietary": Gentry, "Life-Histories of Birds of E. Pennsylvania," i, p. 27.
5. *Mimus carolinensis*, L. (Cat-bird). Observed to prey largely on *Terias lisa*, Boisd. (v. *Sialia sialis*).
6. *Telmatodytes palustris*, Baird (Long-billed Marsh Wren). Its food comprises among other things "many of the Noctuidae and Lycaenidae in the condition of imagoes": Gentry, *op. cit.* i, p. 89.
7. *Myiodioctes pusillus*, Wils. (Green Black-capped Fly-catcher). Stomachs contained *Colibris philodice*: Gentry, *l. c.* i, p. 168.
8. *Setophaga ruticilla*, L. (American Redstart). (a) Stomachs contained Lycaenidae: Gentry, *l. c.* i, p. 173.—(b) "The redstart feeds exclusively on an insect diet, consisting chiefly of flies, spiders, plant-lice, butterflies, beetles and different larvae": Dr. B. H. Warren, "Birds of Pennsylvania" (2nd ed.), p. 191.
9. *Dendroeca virens*, Gm. (Black-throated Green Warbler). Observed to have pursued and probably captured a *Pieris*, "apparently *Pieris rapae*": A. S. Packard, "Proc. Am. Phil. Soc.," 1904, p. 397 (U.S.A.).
10. *Geothlypis trichas*, L. (Maryland Yellow-throat). "Prof. C. V. Weed, of Durham, N.H., writes that he saw an *Antiopa* butterfly in the mouth of a Maryland Yellow-throat": A. S. Packard, *l. c.* p. 401.
11. *Pyrranga rubra*, Sw. (Scarlet Tanager). (a) A butterfly

- found in one stomach: Dr. B. H. Warren, "Birds of Pennsylvania," p. 251.—(b) In stomachs of this bird were found "many of the Satyridae, Lycaenidae and Tortricidae": Gentry, *l. c. i*, p. 180.
12. *Hirundo erythrogaster*, Bodd. (American Swallow). Stomachs contained Lycaenidae: Gentry, *l. c. i*, p. 187.
  13. *Progne subis*, Baird (American Purple Martin). "Mr. Otto Widman, who has observed the feeding habits of purple martins, found that the parent birds carried to their nestlings dragonflies, butterflies and moths, grasshoppers, beetles and flies": S. D. Judd, "Yearb. Dept. Agric. Washing.," 1897, p. 417.
  14. *Tachycineta bicolor*, Vieill. (American White-bellied Swallow). Stomachs contained *Pieris rapae* and *Colibris philodice*: Gentry, *l. c. i*, p. 189.
  15. *Cotile riparia*, L. (Sand Martin). Stomachs contained Lycaenidae: Gentry, *l. c. i*, p. 196.
  16. *Stelgidopteryx serripennis*, Aud. (Rough-winged Swallow). Stomachs contained *Colibris philodice*, the smaller *Argynnis* and Lycaenidae: Gentry, *l. c. i*, p. 197.
  17. *Vireo olivaceus*, L. (Red-eyed Vireo). "Prof. F. E. L. Beal found in the stomachs of some nestling birds, tree-hoppers, assassin bugs [Reduviidae], spiders, sphinx caterpillars and butterflies": S. D. Judd, "Yearb. Dept. Agric. Washing.," 1897, p. 416.
  18. *Vireo flavifrons*, Vieill. (Yellow-throated Vireo). Observed to have eaten *Thecla humuli*, Harr. and *Argynnis bellona*, F.: Gentry, *l. c. i*, p. 221.
  19. *Vireo solitarius*, Wils. (Blue-headed Vireo). Eats "small Lepidoptera, both diurnal and nocturnal": Gentry, *l. c. i*, p. 226.
  20. *Vireo noveboracensis*, Gm. (White-eyed Vireo). Devours *Argynnis myrina* and *Thymele (Eudamus) tityrus*, F.: Gentry, *l. c. i*, p. 231.
  21. *Lanius ludovicianus*, L. (Loggerhead Shrike). "Its food consists chiefly of grasshoppers, crickets, Coleopterous and other insects, including butterflies and moths, which it will pursue and capture on the wing": Dr. Bachman, quoted by Baird, Brewer and Ridgway, "Birds of N. America," i, p. 419.
  22. *Melospiza fasciata*, Gm. (Song Sparrow). (a) Observed to feed on *Thecla humuli*, Harr.: Gentry, *l. c. i*, p. 287.—(b) Observed (with Chipping and Savannah sparrows) to catch and eat a few *Vanessa milberti*, *Pieris*

- rapae* and *Brenthis myrina*: Caroline G. Soule, quoted by Packard, *l. c.* p. 399 (U.S.A.).
23. *Spizella socialis*, Wils. (Chipping Sparrow). (a) Eats *Thecla humuli*, Harr.: Gentry, *l. c.* i, p. 300.—(b) "Chipping Sparrows, in my experience, will chase almost any butterfly and often kill kinds they do not seem to eat." Also recorded (with Savannah and Song Sparrows) as catching and eating a few *Vanessa milberti*, *Pieris rapae* and *Brenthis myrina*: Caroline G. Soule quoted by Packard, *l. c.* pp. 399 and 400 (U.S.A.).
24. *Passer domesticus*, L. (Sparrow). (a) Observed to capture a *Pieris rapae* on two occasions: L. H. Joutel and Prof. J. B. Smith, quoted by Packard, *l. c.* p. 399 (U.S.A.).—(b) In the investigation carried out in America on the food of the European Sparrow the following notes of attacks on butterflies are recorded: *Papilio turnus*, once; *Vanessa antiopa*, once; Yellow butterfly (? *Colias*), once; Cabbage butterfly, twice; Butterflies (kind not specified), 14 reports: W. B. Barrows, "The English Sparrow, U.S. Dept. Agr., Div. Econ. Ornith.," Bull. i," 1889, p. 102.
25. *Passerculus*, sp. (Savannah Sparrow). Observed (with Chipping and Song Sparrows) to catch and eat a few *Vanessa milberti*, *Pieris rapae* and *Brenthis myrina*: Caroline G. Soule, quoted by Packard, *l. c.* p. 399.
26. *Carduelis carduelis*, L. (Goldfinch). "I have seen thistle-finches attack [*Papilio turnus* and [*Argynnis cybele*, but not eat them": Caroline G. Soule, *l. c.* p. 399 (U.S.A.).
27. *Molothrus pecoris*, Gm. (Cow-bird). Stomachs contained *Colias philodice*: Gentry, *l. c.* i, p. 356.
28. *Agelaius phoeniceus*, L. (Swamp Blackbird). Stomachs contained Lycaenidae: Gentry, *l. c.* i, p. 360.
29. *Sturnella magna*, L. (American Meadow Lark). Among other food "*Colias philodice* and many of the Lycaenidae, Tortricidae, are in great demand": Gentry, *l. c.* i, p. 365.
30. *Icterus spurius*, L. (Orchard Oriole). Stomachs contained Lycaenidae: Gentry, *l. c.* i, p. 371.
31. *Icterus baltimore*, L. (Baltimore Oriole). Stomachs contained "many of the Lycaenidae and Tortricidae": Gentry, *l. c.* i, p. 377.
32. *Tyrannus tyrannus*, L. (King-bird). (a) The young

birds are fed on *Colias philodice* and *Pieris oleracea*: Gentry, *l. c.* ii, p. 33.—(b) Observed to catch *Pieris rapae*: W. Dearden, quoted by Packard, "Proc. Am. Phil. Soc.," 1904, p. 401 (U.S.A.).—(c) "Last summer a pair of King-birds built their nest on a low limb of a tree close to our door. They consumed and fed to their young a great many butterflies, especially the Rape butterfly": Mrs. Mary Treat, quoted by Packard, *l. c.* p. 403.—(d) "Fyles states that he once lost a specimen [of *Oeneis jutta* (Arctic Satyr)] through a King-bird (*Tyrannus tyrannus*) which 'gave chase to the butterfly, and after much doubling and twisting, caught it and disposed of it effectually': S. H. Scudder, "Butt. of E. Un. St. and Canada," i, p. 155.—(e) "On Center Island in the town of Oyster Bay [U.S.A.], in August 1902, I saw a King-bird (*Tyrannus tyrannus*) chase a *Colias*. I stood still and watched it for nearly a minute. It seemed to have great difficulty in getting the insect, and I could hear the beaks snap in the air in their unsuccessful attempts to close upon the insect. The persistence of the bird and the difficulty of the operation of catching the butterfly impressed me very much at the time": Prof. C. B. Davenport (letter dated 8, ii, 1909).—(f) "Summer before last I saw at a distance a bird, I think it was a King-bird but could not make out certainly, chasing one of the Pieridae, either a *Colias* or a *Pieris*, in the valley near the Laboratory [Long Island, New York]. These are all the cases I have in mind, but I have gained the impression that the thing was so common as not to deserve more careful noting": Prof. C. B. Davenport (*ibid.*).

33. *Myiarchus crinitus*, L. (Crested Flycatcher). (a) Butterflies found in the stomach of one specimen: Dr. B. H. Warren, "Birds of Pennsylvania," p. 191.—(b) Observed to eat *Colias philodice*, *Pieris oleracea* and Lycaenidae; from direct observation it was noted that "hosts of Lepidoptera, both larvae and imagoes, are devoured": Gentry, *l. c.* ii, p. 40.
34. *Empidias fuscus*, Gm. (Pewee). (a) The young are fed on *Colias philodice* and Lycaenidae: Gentry, *l. c.* ii, p. 52.—(b) Observed to catch *Pieris rapae*, or a similar species: F. P. Drowne, quoted by Packard, "Pr. Am. Phil. Soc.," 1904, p. 401 (Virginia).—(c) Observed

- to catch a small butterfly: W. Dearden, quoted by Packard, *l. c.* (U.S.A.).
35. *Contopus virens*, L. (Wood Pewee). (*a*) Stomachs contained insects, including butterflies: Dr. B. H. Warren, "Birds of Pennsylv.," p. 194.—(*b*) Observed to eat *Colias philodice*, *Argynnis myrina*, *Grapta interrogationis*, *Chrysophanus americanus*, other Lycaenidae and Satyrinae: Gentry, *l. c.* ii, pp. 64 and 65.
  36. *Empidonax acadicus*, Gm. (Small Green-crested Flycatcher). (*a*) Stomachs contained Satyrinae and Lycaenidae: Gentry, *l. c.* ii, p. 67.—(*b*) "Its food consists of insects during spring and summer, such as moths, wild bees, butterflies, and a variety of small kinds": J. J. Audubon, "Ornith. Biogr.," ii, p. 257.
  37. *Chordeiles virginianus*, Gm. (Virginian Goatsucker). Stomachs contained *Argynnis aphrodite*, *Pyrameis cardui*, *Chrysophanus americanus*, and many of the Satyrinae and Lycaenidae; the young are fed also on *Pieris oleracea*: Gentry, *l. c.* ii, pp. 95 and 96.
  38. *Chaetura pelagica*, L. (Spine-tailed Swift). The young are fed on Lycaenidae, etc.; the old birds also eat *Argynnis aphrodite* and *Pyrameis cardui*: Gentry, *l. c.* ii, pp. 101 and 102.
  39. *Coccyzus americanus*, L. (Yellow-billed Cuckoo). (*a*) "They feed on insects such as caterpillars and butterflies, as well as on berries": J. J. Audubon, "Ornith. Biography," i, p. 19.—(*b*) Stomachs contained *Pieris rapae* and Lycaenidae: Gentry, *l. c.* ii, p. 118.
  40. *Coccyzus erythrophthalmus*, Wils. (Black-billed Cuckoo). Stomachs contained Lycaenidae: Gentry, *l. c.* ii, p. 114.
  41. *Dendrocopus villosus*, L. (Hairy Woodpecker). Stomachs contained Lycaenidae: Gentry, *l. c.* i, p. 130.
  42. *Melanarpes erythrocephalus*, L. (Red-headed Woodpecker). Stomachs contained Lycaenidae: Gentry, *l. c.* ii, p. 153.
  43. *Falco sparverius*, L. (American Kestrel). (*a*) Stomachs contained "a few of the Papilionidae and Sphingidae": Gentry, *l. c.* ii, p. 252.—(*b*) A butterfly was found in the stomach of a bird shot at Cataract Creek, Arizona: Dr. A. K. Fisher, "Hawks and Owls of the U. S.," 1893, p. 126 (U. S. Dept. Agr., Div. Econ. Ornith., Bull. iii.).
  44. *Falco communis*, Gm. (Peregrine). Stomachs contained Papilionidae: Gentry, *l. c.* ii, p. 242.

45. *Accipiter fuscus*, Gm. (Sharp-shinned Hawk). Stomachs contained "many of the larger Papilionidae and Sphingidae": Gentry, *l. c.* ii, p. 240.
46. *Accipiter cooperi*, Bonap. (Cooper's Hawk). Stomachs contained Papilionidae: Gentry, *l. c.* ii, p. 235.
47. Birds not identified:—
- (a) "I have on several occasions seen butterflies captured by birds and have seen dragon-flies dart after them": C. V. Riley "3rd Missouri Report," 1871, p. 167.—(b) "Mr. Otto Luggler of Chicago, while on the U. S. Lake Survey, once saw a bird dart after an *archippus* [= *plexippus*] butterfly, seize it and immediately drop it without devouring the body": C. V. Riley, *l. c.* p. 169, note.—(c) "But butterflies are certainly sometimes eaten with us, for several cases are on record where capture has been seen, and I have myself noted one instance where *Euphœades troilus* was unquestionably captured at no great distance from me by a bird. . . . Nearly all the prominent instances that have been mentioned have been taken from the tropics, where I have no doubt the perfect butterflies form a not inconsiderable portion of the food of many birds": S. H. Scudder, "Butterflies of Eastern U. S. and Canada," p. 1612.—(d) "*Turnus* [= *Papilio glaucus*, L.] has many enemies, birds and dragonflies by day, and probably small owls and others by night": Edwards, quoted by Scudder, *l. c.* ii, p. 1303.

#### NEARCTIC BUTTERFLIES.

##### DANAINAE.

*Anosia plexippus*, L.—Bird (47, *b* ; butterfly rejected).

##### SATYRINAE.

*Oeneis jutta*, Hübn.—*Tyrannus tyrannus* (32, *d*).

*Satyrinae*.—*Pyrranga rubra* (10, *b*) ; *Contopus virens* (35, *b*) ; *Empidonax acadicus* (36, *a*) ; *Chordeiles virginianus* (37).

##### NYMPHALINAE.

*Argynnis* spp.—*Stelgidopteryx serripennis* (16).

*A. aphrodite*, F.—*Chordeiles virginianus* (37) ; *Chaetura pelagica* (38).

*A. cybele*, F.—*Carduelis carduelis* (26).

- Brenthis myrina*, Cram.—Vireo noveboracensis (20);  
 Melospiza fasciata (22, *b*); Spizella socialis (23);  
 Passerculus sp. (25); Contopus virens (35, *b*).  
*Brenthis bellona*, F.—Vireo flavifrons (18).  
*Polygonia interrogationis*, F.—Contopus virens (35, *b*).  
*Vanessa milberti*, Godt.—Melospiza fasciata (22, *b*);  
 Spizella socialis (23); Passerculus sp. (25).  
*V. antiopa*, L.—Geothlypis trichas (10); Passer domesticus (24, *b*).  
*Pyramcis cardui*, L.—Chordeiles virginianus (37); Chaetura pelagica (38).

## LYCAENINAE.

- Heodes hypophleas*, Boisd.—Contopus virens (35, *b*);  
 Chordeiles virginianus (37).  
*Thecla melinus*, Hübn.—Vireo flavifrons (18); Melospiza fasciata (22, *a*); Spizella socialis (23).  
*Lycaeninae*.—Telmatodytes palustris (6); Setophaga ruticilla (8, *a*); Pyrranga rubra (11); Hirundo erythrogaster (12); Cotile riparia (15); Stelgidopteryx serripennis (16); Agelaius phoeniceus (28); Sturnella magna (29); Icterus spurius (30); I. baltimore (31); Myiarchus crinitus (33, *b*); Empidias fuscus (34, *a*); Contopus virens (35, *b*); Empidonax acadicus (36, *a*); Chordeiles virginianus (37); Chaetura pelagica (38); Coccyzus americanus (39, *b*); Coc. erythrophthalmus (40); Dendrocopus villosus (41); Melanerpes erythrocephalus (42).

## PIERINAE.

- Pieris rapae*, L.—Turdus mustelinus (2); Dendroeca virens (9); Tachycineta bicolor (14); Melospiza fasciata (22, *b*); Spizella socialis (23); Passer domesticus (24, *a*, *b*); Passerculus sp. (25); Tyrannus tyrannus (32, *b*, *c*); Empidias fuscus (34, *b*); Coccyzus americanus (39, *b*).  
*P. brassicae*, L.—Turdus mustelinus (2).  
*P. oleracea*, Harr.—Tyrannus tyrannus (32, *a*); Myiarchus crinitus (33, *b*); Chordeiles virginianus (37).  
*Colias* sp.—T. tyrannus (32, *c*).  
*C. philodice*, Godt.—Turdus mustelinus (2); Myiodictes pusillus (7); Tachycineta bicolor (14); Stelgidopteryx serripennis (16); Molothrus pecoris (27); Sturnella magna (29); Tyrannus tyrannus (32, *a*);



*Myiarchus crinitus* (33, *b*); *Empidius fuscus* (34, *a*);  
*Contopus virens* (35, *b*).

*Terias lisa*, Boisd.—*Sialia sialis* (3); *Mimus carolinensis*  
(5).

*Pierinae*.—*Passer domesticus* (24, *b*); *T. tyrannus* (32, *f*).

#### PAPILIONINAE.

*Papilio glaucus*, L.—*Passer domesticus* (24, *b*); *Carduelis carduelis* (26); Birds (47, *d*).

*P. troilus*, L.—Bird (47, *c*).

*Papilioninae*.—*Falco sparverius* (43); *Falco communis*  
(44); *Accipiter fuscus* (45); *Accipiter cooperi* (46).

#### HESPERIIDAE.

*Epargyreus tityrus*, F.—*Vireo noveboracensis* (20).

#### RECORDS FROM THE NEOTROPICAL REGION.

*Vireo olivaceus*, L. (Red-eyed Vireo). "I have seen one in eager, but unsuccessful pursuit of a butterfly (*Terias*): P. H. Gosse, "Birds of Jamaica," p. 194.

*Muscivora regia*, Gm. "Feeds principally, and perhaps exclusively, upon butterflies. . . . M. Jelski's opinion, that the crest of these birds [which is said to resemble a flower—G. A. K. M.] serves as a lure for butterflies, appears to me to be correct": Stolzmann, quoted by Taczanowski, "Ornithologie du Pérou," ii, p. 296.

*Pachyrrhamphus versicolor*, Hartl. "In their stomachs I have found butterflies, larvae and rather hard bugs": Jelski, quoted by Taczanowski, *l. c.* p. 367 (1884).

*Galbula* sp. (Jacamar). (*a*) "It feeds entirely on insects . . . and as soon as a fly, butterfly or moth passes by, it darts at it and returns to the branch it had just left": C. Waterton, "Wanderings in S. America," p. 123 (1839).—(*b*) "Pöppig states in regard to the closely-related Galbulidae 'that in the forests there is no difficulty in recognising the favourite perch of a *Galbula*, for the wings of the largest and most splendid butterflies, whose bodies alone are eaten, cover the ground for some steps around'": E. Haase, "Researches on Mimicry" (transl.), ii, p. 101.

*Brachygalba melanosterna*, Scl. (Black-chested Jacamar). Natterer records that in Brazil this bird sits on the twigs of the highest trees and hunts for butterflies: Von Pelzeln, "Sitzb. K. Akad. Wiss. Wien," xx, 1856, p. 518.

*Malacoptila fusca*, Gm. (White-breasted Softwing). "The Prince von Wied found in the stomach of *Monastes fusca*, a Bucconid, 'a large butterfly which crumpled up together filled almost the whole stomach': E. Haase, *l.c.* p. 101.

*Nyctibius aethereus*, Wied. "These wide-mouthed birds are a particular enemy of various large and beautiful Lepidoptera, as I have been able to fully satisfy myself. They consume these insects in quantities, and the traces of their meals may be found in the large rejected wings which lie about in numbers on the ground in the Brazilian forests . . . Thus may be found the largest and most beautiful of the Brazilian Lepidoptera, [*Morpho*] *menelaus*, [*Caligo*] *idomeneus*, *Phalaena agrippina* [*Noctua strix*, L.], and many others": Max. Prinz zu Wied, "Beitr. z. Naturgesch. von Brasilien," iii (1), p. 309, (1830).

Sandpiper. The butterflies which often collect in large numbers in damp places were not observed to be attacked by insectivorous birds "except certainly by the Sandpipers (Strandläufern), which, like the lizards, are never particular": P. Hahnel, "Iris," 1890, p. 317 (Amazons).

Birds not identified:—

- (a) "I observed a pair of birds that were bringing butterflies and dragonflies to their young, and although the *Heliconii* swarmed in the neighbourhood and are of weak flight so as to be easily caught, the birds never brought one to their nest": T. Belt, "Naturalist in Nicaragua," p. 316.—(b) Of a Brazilian bird called "Suruquá," the author states that "its principal food consists of butterflies and other soft-bodied insects": T. P. Bigg-Wither, "Pioneering in S. Brazil," i, p. 292.—(c) "No other group of butterflies is so much sought after by birds as the Pieridae, and these freebooters have often snatched away from me at my very side the most beautiful and perfect specimens. The unerring accuracy of their flight filled me with wonder on every occasion, and I was glad to pay for the exhibition by the loss of a specimen. Once, however, I was even more astonished, when I witnessed the lucky escape of a hunted butterfly. On this occasion it was no Pierid, but a great *Caligo*, which I had aroused and which one of these highwaymen

pursued forthwith. With incredible agility this huge insect managed to evade all the attacks of the closely pursuing bird, escaping out of one bush into another. It was an even race, which I watched with the deepest interest, until at last the hunted creature saved itself in a thicket of tangled branches and the wearied bird desisted from further pursuit": Paul Hahnel, "Iris," 1890, p. 193 (Venezuela).

RECORDS FROM THE AUSTRALIAN REGION.

*Sisura inquieta*, Lath. (Restless Flycatcher). "The food of this species consists chiefly of insects of various kinds, principally flies, small moths and butterflies, captured more frequently while on the wing": A. J. North, "Nests and Eggs of Birds of Australia," p. 136.

*Microeca fascians*, Lath. (Brown Flycatcher). "Its food consists principally of flies, small moths and butterflies, captured while on the wing": A. J. North, *op. cit.*, p. 150.

*Petroeca leggei*, Shafer (Scarlet-breasted Robin). "Its food consists of insects, principally small moths, butterflies, beetles, etc.": A. J. North, *op. cit.*, p. 164.

The paucity of records from the Neotropical Region is very striking and much to be deplored, for such information as we have seems to indicate that the destruction of butterflies by birds must occur there on a considerable scale. It is curious that not one of those excellent observers, Wallace, Bates, Fritz Müller or Belt, has given us a single record of attack in which either bird or butterfly was identified. Possibly they may have considered, like some other naturalists whom I have consulted, that the phenomenon was of such frequent occurrence as not to require special noting. It is to be hoped that the publication of this paper may do a little towards dispelling that idea. We want heaps more evidence before we can arrive at any sound conclusions as to the exact relations which exist between butterflies and their bird enemies. The publication of isolated cases is of little value; the evidence to carry weight must be in bulk. I propose to continue collecting it, and shall be very grateful to any correspondents who may be kind enough to assist me with any further records. Communications may be addressed to 6 Chester Place, Hyde Park Square, London, W.



VI. *New Malayan Rhynchota.* By W. L. DISTANT.

[Read April 7th, 1909.]

## PLATE X.

THE following descriptions refer to Malayan Rhynchota recently acquired by the British Museum. Since Snellen van Vollenhoven published his "Essai d'une Faune Entomologique de L'Archipel Indo-Néerlandais," we know much more of the beautiful Rhynchota of this prolific region, and here we must acknowledge the excellent work of Stål, as well as the descriptive industry of Walker, while other more recent writers have added to our knowledge. We still, however, know only a fragment of the Malayan Rhynchotal fauna in comparison with our much fuller enumeration of the Lepidoptera—especially the Rhopalocera, of the same region.

## HETEROPTERA.

## Family PENTATOMIDÆ.

## Genus PŒCILOCORIS.

*Poecilocoris*, Dall., Trans. Ent. Soc., v, p. 100 (1848).Type, *P. druræi*, Linn.*Poecilocoris croesus*, sp. n. (Plate X, fig. 1.)

Head purplish-brown, the lateral lobes sanguineous; antennae with joints 1, 2, 3 bluish-black; 4, 5 black; pronotum sanguineous, with two very large discal purplish spots which are centrally only divided by a narrow line, on each spot anteriorly is a transverse narrow green fascia; scutellum for rather more than half its length purplish, posteriorly containing a prominent transverse metallic-green fascia, a more obscure basal transverse fascia of the same colour but centrally obsolete, apical area sanguineous, containing two central purplish spots; body beneath with the sternum purplish-red suffused with metallic-green, the area of the odoriferous apertures opaque black, abdomen purplish-red, with prominent black spots near the stigmata; legs with a bluish or greenish lustre; rostrum black.

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*Var.* Head almost entirely purplish-brown; ground colour of pronotum more reddish-ochraceous than sanguineous; scutellum altogether purplish, not sanguineous behind the transverse metallic-green fascia, but containing an oblique sanguineous spot on each lateral margin.

Antennae with the first joint not nearly reaching apex of head, a little longer than the second which is shortest, third shorter than fourth; head sparingly punctate, the punctures mostly in longitudinal patches; pronotum with the two large dark spots thickly, coarsely punctate, remaining area more sparingly and finely punctate, about two transverse series of punctures before anterior margin; scutellum thickly punctate; rostrum reaching the posterior coxae.

Long. 16 to 17 mm. Exp. pronot. angl. 10 to 10½ mm.

*Hab.* NIAS ISLANDS: Hili Madjedja (*Mitschke*, Brit. Mus.).

Allied to *P. dives*, Guér.

#### Genus ALCIMOCORIS.

*Alcimus*, Dall., List. Hem. I., p. 218 (1851); *nom. praecoc.*

*Alcimocoris*, Bergr., Rev. d'Ent. x., p. 214 (1891), *nom. nov.*

Type, *A. lineolatus*, Dall.

*Alcimocoris marapokensis*, sp. n. (Plate X, fig. 3, a.)

Head black, a small central spot near base and a sublateral longitudinal fascia posteriorly obliquely directed to eyes, reddish-ochraceous, the surface sparingly and irregularly granulose and punctate; pronotum with the anterior area black, opaque, laterally, posteriorly reddish-ochraceous, and with a broad transverse sub-anterior space enclosed by reddish-ochraceous lines which are connected with eyes and posteriorly and centrally are produced in two unconnected short longitudinal lines, all these pale margins and lines are bordered by linear series of punctures, basal two-thirds of pronotum black, very coarsely punctate, and with reticulate reddish-ochraceous markings, the lateral margins very strongly and longly produced transversely and a little upwardly, with two longitudinal grooves above, and notched above before apices which are acute; scutellum black, somewhat finely punctate, with six longitudinal and more or less broken reddish-ochraceous lines; corium black, coarsely punctate, base of costal margin, a subcostal marginal line, claval margins, and a somewhat broken central curved line, ochraceous or reddish-ochraceous; body beneath black, coarsely punctate, the lateral and incisural margins, other transverse raised lines and

particularly a central one to under surface of produced lateral angles, reddish-ochraceous; legs black, apices of femora ochraceous; rostrum black, reaching the intermediate coxae; antennae brownish, second and third joints almost subequal in length.

Long.  $8\frac{1}{2}$  mm. Exp. pronot. angl. 14 mm.

*Hab.* BRIT. N. BORNEO: Dent Province, Mt. Marapok (Brit. Mus.).

Allied to *A. lineolatus*, Dall., but with the frontal angles longer and less recurved.

#### Genus RHYNCHOCORIS.

*Rhynchocoris*, part. Westw. in Hope Cat. I, p. 29 (1837).

Type, *R. humeralis*, Thunb.

*Rhynchocoris bicolor*, sp. n. (Plate X, fig. 2.)

Black; broad anterior margin to pronotum—posteriorly straight and almost on a level with the anterior margins of the lateral angles,—base and apex of scutellum, body beneath and legs bright ochraceous; antennae black, first joint streaked beneath with pale ochraceous, fourth joint longer than either second or third which are subequal in length (fifth mutilated in specimens now before me); head transversely wrinkled and punctate, apical inner margins, of the lateral lobes and a central longitudinal spot at base, pale ochraceous; pronotum, excluding the pale anterior margin, thickly coarsely punctate, the anterior marginal area smooth with a submarginal series of punctures laterally and anteriorly, the lateral angles outwardly straightly acutely produced, their extreme apices slightly recurved backward; scutellum coarsely punctate, more slightly and less punctate on the ochraceous base and apex; corium very thickly punctate; connexivum ochraceous spotted with black at the incisures; two lateral marginal lines on each side of head beneath; rostrum extending to the middle of the abdomen; mesosternal process large, compressed, extending a little beyond the anterior coxae, apices of tibiae and tarsal joints and the tarsal claws black; stigmata and the posterior marginal segmental angulations, black.

Long. 19 to 23 mm. Exp. pronot. angl. 13 to 16 mm.

*Hab.* CELEBES: Menado (Brit. Mus.).

#### Genus EMBOLOSTERNA.

*Embolosterna*, Stål., En. Hem. I, p. 66 (1870).

Type, *E. taurus*, Westw.

*Embolosterna unicolorus*, sp. n. (Plate X, fig. 4, a.)

Above olivaceous-brown, more distinctly olivaceous on head, margins and lateral angles of pronotum, and lateral margins of corium; antennae black; membrane cupreous; body beneath pale castaneous, sternum and a patch on each side of basal area of abdomen thickly palely ochraceously pilose; second and fourth joints of antennae longest and subequal in length, third much longer than first; pronotum thickly finely punctate; anterior and lateral margins and produced lateral angles much more coarsely punctate, the latter transversely and very slightly forwardly produced, their apices truncate; scutellum sparingly coarsely punctate, the apical area foveately impressed; sternal process strongly anteriorly produced, compressed above and anteriorly rounded, and extending to the latitude of the apex of the head; femora strongly spined at apices.

Long. ♂. 27 mm. Exp. pronot. angl. 20 mm.

*Hab.* BORNEO; Brunei (Brit. Mus.).

## Genus AMISSUS.

*Amissus*, Stål., Trans. Ent. Soc. Lond. (3), 1. p. 595, 1863.

Type, *A. atlas*, Stål.

*Amissus testaceus*, sp. n. (Plate X, fig. 5.)

Testaceous-red; head with the lateral margins, apical margins (narrowly) and the basal marginal area, black; antennae ochraceous, apical half of the first joint black; tibiae and apices of femora black, tarsi ochraceous, tarsal claws black; membrane brownish-ochraceous; head as long as anterior tibiae, the lateral margins robustly reflexed, apical margin sinuately truncate; pronotum with the lateral angles anteriorly and less outwardly produced, their apices level with the apical latitude of the head, their anterior margins coarsely shortly serrate for about half their length from base, their apices subangularly rounded, their upper surface sparsely coarsely punctate, disk of pronotum sparingly punctate, more thickly punctate before the anterior margin and much less punctate on basal marginal area, a darker opaque transverse narrow fascia between the anterior bases of the pronotal angles and more narrowly continued along the inner margins of the produced angles, posterior margin convexly produced over base of scutellum; scutellum very sparingly punctate, its apex moderately longitudinally sulcately impressed; corium very thickly finely punctate; rostrum slightly passing the anterior coxae; mesosternum centrally broadly elevated



and widely emarginate anteriorly; mesosternum broadly centrally elevated and posteriorly broadly sinuate; femora spined at inner apical margins.

Long. ♀. 44 mm. Exp. pronot. angl. 29 mm.

*Hab.* MALACCA (Brit. Mus.).

Allied to *A. atlas*, Stål., but apart from the different colour of body and legs it differs by the larger size, straighter and more angular apex of scutellum; fourth joint of antennae distinctly longer than second—about as long as second in *A. atlas*, mesosternal process anteriorly more widely emarginate, etc.

A second specimen is contained in my own collection from the Malay Peninsula, and in this the veins to the corium and the claval veins are distinctly paler in hue.

#### SANGANUS, gen. nov.

Broadly subovate, abdomen apically broadly truncate; head small, about as long as broad including eyes, lateral lobes much longer than central lobe, obliquely narrowing to apex; ocelli much nearer eyes than to each other; rostrum about reaching middle of mesosternum, basal joint very slightly passing base of head, apical joint small and incrassate; antennae four-jointed, fourth joint about as long as second; pronotum about twice as broad as long, the lateral angles forwardly and slightly outwardly produced, posterior margin subtruncate; scutellum much broader than long, the apex prominently narrowed and produced; abdomen broad, posteriorly broadly truncate, connexivum exposed for about one-third of base of lateral margin of hemelytra; prosternum centrally longitudinally sulcate; mesosternum with a central flat process which for half its length is centrally sulcate, metasternum with a central angulate process behind the intermediate coxae, not prominently raised; legs of moderate length, femora and tibiae almost equally long, the tibiae straight; femora apically spined.

Type, *S. jenseni*, Dist.

This genus is allied to *Oxylobus*, Stål., and apparently includes the *Pyeanum westwoodii*, Voll., a species only known to me by its figure.

*Sanganus jenseni*, sp. n. (Plate X, fig. 6.)

♂. Body above ochraceous; connexivum, abdomen beneath and legs black; sternum piceous-brown; antennae with the first and fourth joints piceous; the second and third castaneous-brown,

second and fourth about equal in length, third distinctly incrassate at apex, and a little longer than first; head smooth, the lateral lobes transversely striate; pronotum very coarsely and somewhat sparsely darkly punctate, the lateral angles flatly, subconically, anteriorly, porrectly produced, their apices subangularly rounded and reaching the latitude of the apex of the head, two transverse curved cicatrices, each containing a few black punctures, situate on the anterior area; scutellum sparingly coarsely darkly punctate, moderately transversely wrinkled, the apex stramineous, wrinkled but impunctate; corium very thickly finely punctate; membrane cupreous in hue; pro- and mesonota centrally longitudinally dull ochraceous, and with their margins dull ochraceous; rostrum piceous, the basal joint ochraceous.

♀. Larger and broader than ♂, with the upper surface of the abdomen and the connexivum dark castaneous, not black.

Long. ♂. 28, ♀. 34 mm. Exp. pronot. angl. ♂. 17, ♀. 20 mm.

*Hab.* EAST BORNEO: Sanga Sanga (*H. D. Jensen*, Brit. Mus.).

Allied to *S. westwoodii*, Voll., but posterior angles of abdomen not acutely produced; pronotal angles more strongly produced, colour different, etc.

## Family COREIDAE.

### Genus PETILLIA.

*Petillia*, Stål., Hem. Afr. II, p. 2 (1865).

Type, *P. tragus*, Fabr.

#### *Petillia picturata*, sp. n.

Castaneous thickly clothed with bright golden pubescence; head above with two broad lateral black fasciae; antennae black; pronotum moderately transversely constricted at about one-fourth from anterior margin, in front of this constriction two blackish spots, behind them two broad longitudinal castaneous fasciae reaching base, a short castaneous fascia before each lateral angle, and an obscure central carinate line which is castaneous towards base; scutellum castaneous with a central golden tomentose line; corium with the venation castaneous; membrane metallic-olivaceous; rostrum and anterior and intermediate legs pale sanguineous; base of second joint and extreme apex to rostrum, black; posterior femora thickly golden pubescent, with a broad central annulation and the apex castaneous, posterior

tibiae and tarsi castaneous; antennae with the basal joint longest, about as long as pronotum, second longer than third and about equal in length to fourth joint; pronotum with the lateral angles broad, moderately produced, with an apical recurved spine, the lateral and posterior lateral margins strongly coarsely serrate; rostrum slightly passing the anterior coxae; anterior and intermediate femora moderately incrassate with a double series of short black spines beneath, the apical spines longer and more prominent, posterior femora very strongly incrassate, armed beneath with a double series of short strong black spines of which the two central pairs are most prominent; posterior tibiae compressed and dilated inwardly, broader and angulate near base; three strong spines, gradually decreasing in length beyond middle, one on each side of apex; basal joint of posterior tarsi more or less ochraceous.

Long. ♂ 30 mm. Exp. pronot. angl. 11 mm.

Hab. N. NIAS; Kalim Bungo (*Mitschke*, Brit. Mus.).

Allied to *P. calcar*, Dall.

## Family PHYMATIDAE.

### Genus CARCINOHELIS.

*Carcinocheles*, Fieb. Europ. Hem., p. 34 (1861).

Type, *C. alutaceus*, Handl.

*Carcinochelis ornatus*, sp. n. (Pl. X, fig. 9.)

Black; apices of the lateral lobes to head, eyes, anterior margin, anterior lateral margins and a broad central longitudinal fascia to pronotum, connexivum, body beneath and legs ochraceous, posterior half of the central fascia to pronotum and the scutellum testaceous-red; head beneath, anterior femora (excluding base), anterior tibiae (excluding apex), stigmata, apical lateral margins to abdomen and apex of anal appendages, black; head granulose, ante-ocular area shorter than post-ocular area (antennae mutilated in typical specimen); pronotum with the lateral angles broadly, acutely, horizontally produced, the margins shortly spinously serrate, the anterior lateral margins concavely sinuate, transversely impressed before middle; a curved raised line on each side of disk, beyond which the surface is more or less granulose; scutellum a little longer than broad, moderately narrowed to apex, which is rounded; connexivum evenly rounded, not angulate, its margin thickly, shortly, spinously serrate, its apical third black.

Long. 7 mm.

*Hab.* BRIT. NORTH BORNEO; Dent Province, Mt. Marapok (Brit. Mus.).

Besides the distinct coloration, the narrow scutellum, longer than broad, is distinctive of this species.

### Family REDUVIIDAE.

#### Genus TRIBELOCEPHALA.

*Tribelocephala*, Stål., Ofv. Vet-Ak. Forh. 1853, p. 263.

Type, *T. boschjesmana*, Stål.

*Tribelocephala gigantea*, sp. n. (Pl. X, fig. 10a.)

Velvety chocolate-brown; antennae (excluding basal joint), a small spot near apex of clavus, second and third joints of rostrum (excluding base of second), the tarsi and apices of tibiae very pale ochraceous; antennae pilose with the first joint about as long as head, of which the central lobe correctly projects beyond its apex, the surface covered with short, robust, adpressed hairs; pronotum with the anterior lobe moderately sculptured, profoundly centrally longitudinally depressed, posterior lobe obscurely, finely, reticulately ridged, with a prominent central longitudinal carination, the lateral margins strongly sinuate and longly pilose, the lateral angles subprominent and rounded; membrane not quite reaching the abdominal apex; body beneath and legs opaque, thickly shortly pilose; abdomen beneath centrally longitudinally sulcate; rostrum only slightly passing base of head.

Long. ♂. 23 mm.

*Hab.* M. NIAS, Kalim Bungo (*Mitschke*, Brit. Mus.).

## HOMOPTERA.

### Family CICADIDAE.

#### Genus CRYPTOTYMPANA.

*Cryptotympana*, Stål., Ann. Soc. Ent. Fr., 1861, p. 613.

Type, *C. pustulata*, Fabr.

*Cryptotympana niasana*, sp. n.

Body above black, more or less shortly ochraceously pilose; posterior margin of pronotum brownish-ochraceous; mesonotum with

two obscure central obconical spots, their outer margins more or less ochraceously pilose, the basal margin, cruciform elevation, two small spots in front of same and a larger elongate spot in front of each anterior angle, castaneous; body beneath and legs black; head beneath (excluding face) sternum and lateral margins of opercula and abdomen thickly shortly ochraceously pilose; legs black, the intermediate and posterior tibiae and tarsi (excluding bases and apices) castaneous; tegmina and wings hyaline, the basal areas of both broadly fuscous-brown; tegmina with the costal membrane greenish-ochraceous, basal cell and post-costal area black; bases of the first and second apical areas infuscated, the venation greenish on basal third, remainder more or less fuscous, the apical margin palely infuscated; wings with a pale spot in the apex of anal area of the basal fuscous-brown coloration, the veins greenish on basal, fuscous on apical half, apical margin palely infuscate; rostrum reaching the intermediate coxae; opercula reaching or slightly passing the posterior margin of first abdominal segment, their inner margins overlapping for about half their length, and then obliquely directed outwardly to apex which is broadly subangularly rounded; lateral margins reflexed, nearly straight, very slightly sinuate.

Long. excl. tegm. ♂. 38 mm. Exp. tegm. 111 mm.

*Hab.* N. NIAS, G. Madjeja (*Mitschke*, Brit. Mus.).

Allied to the Chinese species *C. mandarina*, Dist., but with the opercula shorter, broader and with their apical inner margins obliquely straight, not sinuate; abdomen shorter, colour of tegmina different, etc.

#### Genus PRASIA.

*Prasia*, Stål., Trans. Ent. Soc. Lond. (3), I, p. 574 (1863).

Type. *P. faticina*, Stål.

*Prasia tincta*, sp. n.

♂. Body above pale virescent, body beneath, with legs, more pale ochraceous; tegmina and wings hyaline; tegmina faintly suffused on about basal third with very pale virescent, the veins, costal membrane and post-costal area more pronounced virescent; wings with the veins pale virescent; head about as long as broad, angularly produced in front where there is a slight longitudinal impression; ocelli and eyes more or less testaceous; pronotum with the incisures deep and prominent, an almost concolorous central longitudinal fascia which is a little amplified near anterior margin and more strongly amplified at posterior margin; mesonotum with four

obscure almost concolorous obconical spots, the two central spots much the smaller and not extending more than half across the disk; base of abdomen profoundly longitudinally sulcated; tympana entirely exposed; opercula rudimentary, the cavities exposed; abdomen short, compressed, the lateral areas very broad, the dorsal surface narrow and convexly depressed to apex; rostrum with its apex black and reaching the intermediate coxae.

Long. excl. tegm. ♂. 25 mm. Exp. tegm. 75 to 76 mm.

*Hab.* S. CELEBES; Bua-Kraeng (*Fruhstorfer*, Brit. Mus.).

Allied to *P. fatiloqua*, Stål.

#### Genus LEMBEJA.

*Perisnoneura*, Dist., Proc. Zool. Soc. Lond., 1883, p. 189,  
*nom. pracocc.*

*Lembeja*, Dist., Mon. Orient. Cicad., pp. 103 and 147 (1892),  
*nom. nov.*

Type. *L. maculosa*, Dist.

*Lembeja sanguinolenta*, sp. n.

♀. Head, pronotum and mesonotum dull reddish, finely and sparingly yellowish pilose, abdomen above and body beneath pale ochraceous, more or less shaded with rosaceous; first and second joints of antennae, face, clypeus, rostrum and legs sanguineous; apex of rostrum and the tarsal claws, black; tegmina semi-hyaline thickly finely mottled with pale sanguineous, the veins mostly reddish-ochraceous with somewhat darker spot-like markings; the costal membrane, post-costal area and basal and outer margins darker sanguineous; wings semi-hyaline, the veins sanguineous; mesonotum with two long central pale margined obconical spots; abdomen short, robust; tympana prominently exposed; opercula rudimentary; face strongly compressed, the lateral areas robustly transversely striate.

Long. excl. tegm. 23 mm. Exp. tegm. 84 mm.

*Hab.* S. CELEBES; Bua-Kraeng (*H. Fruhstorfer*, Brit. Mus.).

*Lembeja robusta*, sp. n.

♂ and ♀. Head, pronotum, mesonotum, sternum, rostrum and legs fuscous-brown; abdomen and tibiae brownish-ochraceous, more or less irregularly suffused with fuscous; tegmina pale purplish-brown, the veins more or less ochraceous-brown; wings dull hyaline,

the veins brownish-ochraceous; head a little longer than breadth between eyes, centrally sulcate between the ocelli, in the ♀ this sulcation distinctly black; pronotum with the furrows profound and with a central longitudinal sulcation the edges of which, particularly in ♀, are distinctly ridged, between the furrows the surface is somewhat rugulose; mesonotum obscurely, longitudinally mottled with brownish-ochraceous; abdomen above in both sexes distinctly centrally longitudinally ridged; front compressed, finely centrally longitudinally sulcate; rostrum almost reaching apex of intermediate coxae; opercula in ♂, small only extending slightly over the anterior edge of the cavities, obliquely directed inwardly, their apices narrowed and rounded.

Long. excl. tegm. ♂ and ♀. 26 mm. Exp. tegm. 75 to 76 mm.

*Hab.* BRITISH NEW GUINEA; Ekeikei (*Pratt*, Brit. Mus.).

A short robust species and peculiar by the pale purplish-brown tegmina.

*Lembeja crassa*, sp. n. (Pl. X, fig. 7 a.)

♀. Body and legs dull ochraceous; head and pronotum (excluding basal margin and posterior lateral angles) brownish-ochraceous; tegmina subhyaline, talc-like, finely wrinkled, veins, costal membrane and post costal area ochraceous, the veins beyond basal area spotted with fuscous, inner posterior basal margin rosy-brown, about apical half of tegmina and apical half of clavus, thickly, minutely spotted with fuscous; wings hyaline, the veins mostly ochraceous, the extreme base rosy-brown; body short and broad; head longitudinally sulcate between the ocelli; pronotum moderately centrally longitudinally sulcate, the incisures profound; face very strongly laterally compressed, the lateral transverse striations weak; rostrum reaching the intermediate coxae, its apex black; abdomen above moderately round, not prominently centrally longitudinally ridged.

♀. Long. excl. tegm. ♀. 32 mm. Exp. tegm. 92 to 102 mm.

*Hab.* GERMAN NEW GUINEA; K. Wilhelms-Land, Bongu (Brit. Mus.). BRITISH NEW GUINEA; Dilo (Coll. Dist.).

## Family CERCOPIDAE.

### Genus PHILAGRA.

*Chalepus*, Walk., List. Hom. III, p. 731 (1851), *nom praeocc.*  
*Philagra*, Stål., Trans. Ent. Soc. Lond. (37 I, p. 593 (1862)).

Type. *P. hastata*, Walk.

*Philagra flavosparsa*, sp. n. (Plate X, Fig. 8 a.)

Head, pronotum and scutellum chocolate-brown, very finely and shortly pilose; eyes dull greyish; abdomen above and beneath and sternum chocolate-brown; head beneath, lateral and posterior margins of sternal segments, margins of abdominal segments, and the legs dark ochraceous; tegmina dull chocolate-brown, thickly sprinkled with small pale ochraceous irregularly shaped spots, the costal margin dark ochraceous; wings subhyaline, pale fuliginous, the veins darker; head longly porrectly produced, about twice as long as pronotum, centrally and laterally ridged, towards apex slightly upwardly recurved; tegmina a little more in length than twice the greatest breadth, the costal margin strongly arched, the apex subacute; pronotum with a central, more or less distinct, longitudinal impression.

Long. excl. tegm. 14 to 16 mm. Exp. tegm.  $23\frac{1}{2}$  to 25 mm.

*Hab.* NIAS ISLANDS.; Kalim Bungo and Gunong Sitoli  
(*Mitschke*, Brit. Mus.).

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#### EXPLANATION OF PLATE X.

[See *Explanation facing the PLATE.*]



VII. *On the Origin and Ancestral Form of Myrmecophilous Coleoptera.* By H. ST. J. DONISTHORPE, F.Z.S.

[Read April 7th, 1909.]

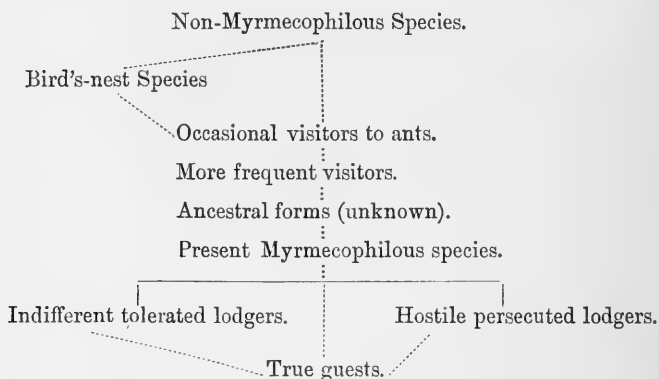
I AM working at a paper on how the eggs of Myrmecophilous Coleoptera get laid in new ants' nests, which I hope to publish soon; but it occurred to me that it might be as well to publish first, as a preliminary paper, some notes on how beetles first acquired the myrmecophilous habit—that is to say, on the origin of the ancestral form of ants'-nest beetles. Of course the ancestral form of any species of truly Myrmecophilous Coleoptera is lost, and unknown to-day, but it appears to me that by studying the habits of those species which are occasionally and not always found with ants, but more generally elsewhere, we may learn how the ancestral forms of regularly myrmecophilous beetles first acquired their present habit of life. When we speak of the ancestral form here, we do not mean that of the present known ants' guests, but of the Myrmecophilous habit itself, and the probable or possible ancestral form of future generations of those species which this paper embraces.

\* It is of course quite certain that the ants must have been evolved long before their guests, and granted this, then the guests themselves must have acquired their habit by degrees, by developing and using the different means, we see to-day in the regular guests, of defence against the ants, and to please and be of use to them. If we study the species about to be mentioned we shall see they exhibit great variety both in the extent to which they are found with ants, and also in their relations to their hosts. Some have advanced much further along the road towards being regular guests. Even in the true myrmecophilous species, we can trace to-day evolution and development at work—for example the forms or races of *Dinarda* in relation to their different hosts (Zool., 1908, pp. 68-71), the development of *Hetaerius* into a true guest from being

\* See "Some Notes on Myrmecophilous Spiders." Donisthorpe, Zool., 1908, p. 420.

an indifferently treated lodger (Wasmann, Zeitsch. f. wissenschaft, Insekten, 1905, Heft 8, p. 330, and Wheeler, New York Ent. Soc., 1908, iii, p. 135, etc.). There is also a wonderful beetle, *Myrmecchusa mirabilis*, described by Father Wasmann, which is intermediate between the genera *Lomechusa* (true guests), and *Myrmecdonia* (hostile persecuted lodgers). This looks as if a *Myrmecdonia*-like species had acquired some of the habits, hairiness, etc., of a *Lomechusa*.

The following table may represent the evolution of the myrmecophilous species, according to the facts and views expressed in this paper.



I will now deal with the species of Coleoptera which are occasionally, or often found with ants, or in ants' nests in Britain, but more generally away from them, and give all the records and evidence, on such occurrences, of which I am aware, of each of them.

#### *Aleochara ruficornis*, L.

This species is widely distributed in Britain, but always rare. Janson (Ent. Ann., 1857, p. 93) writes—"I have likewise taken, by brushing herbage in the neighbourhood of the nests of *Formica fusca*, the rare *Aleochara ruficornis*, and have little or no doubt it is a truly myrmecophilous insect, although not hitherto recorded as such." Again (*l. c.* 1858, p. 81)—"Dr. Power found, this spring, an individual of this scarce species, beneath dead leaves, in the vicinity of a nest of *Formica rufa*, a few yards distant

from the spot in which I captured the specimen mentioned in last year's Annual." Fowler (Col. Brit. Isles, ii. 1888, p. 11)—"In moss near nests of *Formica rufa* or *fusca*, by sweeping, running on pathways, etc." Linnell (Reigate List, 1898, p. 5) records it "In a sandpit at Redstone near nests of *Formica rufa*."

I took it in the runs of *Lasius fuliginosus*, in company with several species of *Myrmedonia*, at Wellington College, in September, 1905.

"Occurs in moss near nests of *Formica rufa* in Bishop's Wood, Truro" (Vic. Hist. Cornwall, 1906, p. 190).

"Near nests of *Formica rufa* and *F. fusca*, Charlton" (Vic. Hist. Kent, 1908, p. 131).

We thus see that this species shows a partiality towards the company of ants, which may represent the first steps towards a regular myrmecophilous habit.

### *Microglossa pulla*, Gyll.

This widely distributed species is recorded by Fowler (*l. c.* p. 24). "In holes of the sand-martin, etc., occasionally by sweeping, also in carrion . . . Mickleham in company with *Formica fuliginosa* (Power); . . . according to Mulsant and Rey it is found in old trees with ants and also in the nests of finches and quails, and with hedgehogs." The records with sand-martins may refer to *M. ruficollis*. Brewer took it in a nest of *L. fuliginosus* in Headley Lane. It is certainly frequently associated with *Lasius fuliginosus*, in the nests of which ant I always took it at Oxshott in the spring and autumn, and also at Wellington College, where Dr. Joy has likewise met with it. It is found right in the nest of the ants. Father Wasmann gives *L. fuliginosus* and *brunneus* as its hosts, but remarks that it is more or less doubtful if it should count as truly myrmecophilous (Krit. Verz. d., Myr. u. Ter. Art., 1894, p. 71), and gives it as the regular guest of *L. fuliginosus* in Dutch Limburg in April and October (Tijdschr. voor Entom., xxxiv, 1891, p. 60).

Dr. Joy, in a valuable paper on Coleoptera occurring in the nests of Mammals and Birds (E. M. M., 1907, p. 240), writes of this beetle—"This species, I discovered last year, is specially attached to the nests of tits, flycatchers, etc., and this year I have been able to trace its life-history, at any rate in part. I have taken it also on several occasions in the fresh nests of the starling. The beetle enters the

nest as soon as the bird begins to build, about the middle of April, and when the full clutch of eggs is laid, about three weeks later, as many as thirty or more specimens may often be found in a single nest. It is, in fact, quite a common species, as I have only once failed to find it in the nest of a tit, a bird familiar enough in any wooded district. I have not succeeded in finding the beetles pairing, but no doubt the eggs are laid soon after the nest is entered, for when it is examined immediately after the young have flown a large number of fully grown larvae may be shaken out of it; this would be about a month after the last bird's egg is laid. Shortly after this the larvae congregate into a suitable spot (under the lid of a nesting-box in one case, and at the very bottom of a nest in another), and there spin small whitish cocoons packed together in the same plane. The insect remains in the pupal stage for about sixteen days, and then, when properly mature, eats its way out of its cocoon and immediately leaves the nest. It is hard to guess what is the history of the imago after this. Certainly it is found not very rarely on carrion, etc., and there may be a second brood produced in such situations; but I am inclined to think that this is not the case, but that the beetles hibernate till the following spring." I have thought it best to quote word for word what Dr. Joy has written about this and the next species, and then discuss its relation to our subject.

*Microglossa gentilis*, Märk.

"Found by Mr. F. Smith, at Hampstead, in company with *Formica fuliginosa*" (Janson, Ent. Ann., 1860, p. 101).

Crotch recorded it in nests of the same ant at Cambridge and Weston-super-Mare (Zool., 1862, p. 8139), E. C. Rye mentions that it was taken commonly by Power at Birdbrook, and by Brewer and Power at Mickleham, always with *Formica fuliginosa* (Ent. Ann., 1866, p. 49).

Fowler (*l. c.* p. 25) writes—"In the runs of *Formica fuliginosa*; rare, but probably often overlooked, as it doubles itself up and will lie for a quarter of an hour without stirring; . . . Dr. Power has taken it in considerable numbers by carefully blowing away the sand, and watching the ant-runs." B. G. Rye found it in numbers in a nest of *Lasius fuliginosus* at Brent Knoll in Somerset in 1897. I have taken it in some numbers in a nest of

*Lasius fuliginosus* at Oxshott in February, March, and April. Harwood recorded it with the same ant at Colchester (E. M. M., 1899, p. 72). "In the company of ants, Bishops Wood, Truro" (Vic. Hist. Cornwall, 1906, p. 190).

Joy (*l. c.* p. 241)—"This is the characteristic beetle of the owls' nest, where it may be found at any time of the year, and I have twice taken single specimens in starlings' nests. Although it has been before taken in owls' nests, it is better known as the occasional inhabitant of the nest of *Lasius fuliginosus*. *Microglossa pulla* has also the double habitat; in the case of the latter there can be little doubt that the chief host is a bird, and I think it is also with *M. gentilis*. However, it is a curious fact that *M. gentilis* has the habit, like a *Myrmedonia*, of curling itself into the shape of an S and lying 'possum' for a long time, and it is fairly commonly found in the ants' nest. *M. pulla* has also this habit, but it is not so pronounced, and it is a more irregular visitor to the ants' nests." He then proceeds to point out that *M. nidicola*, the sandmartins' nest species, and which has not been found with ants either here or abroad, has not the habit of curling up, but always runs away when disturbed; these facts also bear out my own experience.

Father Wasmann gives *Lasius fuliginosus* as the normal host of this species, and as the regular guest of this ant in Dutch Limburg, where he took it in March, April, May, June, July, September, October and November. It thus appears that it cannot be the same specimens of these two beetles which are found in the birds' nests and the ants' nests, as we see that they are found at the same time in both, and are therefore not double hosted in the sense that they pass one part of their life with the one and the rest with the other. It looks as if at some distant period two sets of their ancestors had branched off into different modes of life; it might be that a bird's nest was in the tree inhabited by ants, and the beetles found it a congenial atmosphere, and then inherited the habit to seek birds' nests, others remaining myrmecophilous.

Again, the more pronounced myrmedonia habit of the more regular inhabitant of ants' nests is very suggestive. *M. pulla*, however, may have chosen birds' nests at an earlier period, and may be losing the habit as it becomes more fixed as a birds'-nests species. On the other hand, as other species in the genus *Microglossa* are found almost

exclusively in birds' nests, the myrmecophilous habit may be the more recent, and *M. pulla* have taken to it more recently than *M. gentilis*.

*Oxyptoda haemorrhoea*, Mann.

This little beetle, which is widely distributed, is found "in moss, haystack refuse, etc.; also found frequently in nests of *Formica rufa*" (Fowler, *l. c.* p. 35). It has been recorded with *F. rufa* from Guestling (Collett); Colchester (Harwood); Hampstead and Highgate (Janson); Erith (Waterhouse); Wellington College, Bradfield, etc. (Joy); Wigmore Woods (Walker); Bentley Woods (Morley); Egbaston and Sutton (Blatch); Knowle (Ellis); Scarborough (Wilkinson); Corbridge-on-Tyne and Chopwell Woods (Bagnall); Scotland, "in nests of *F. rufa*," local Forth, Dee and Moray (Sharp, *Scot. Nat.* ii. 1873-4, p. 191); Aviemore (Beare). I have taken it with the same ant at Weybridge, New Forest, etc., with *Lasius fuliginosus* at Weybridge, with *Formica exsecta* at Bournemouth in some numbers, and with *F. sanguinea* at Nethy Bridge, Inverness-shire.

Wasmann gives *F. rufa*, *pratensis*, *truncicola*, and *exsecta* as its normal hosts. Although often occurring without ants, still I think this insect has firmly established itself as an ants' nest species, in spite of the fact that some one told me a little while ago that because it was abundant in his garden in London, it could have nothing to do with ants.

*Myrmecodia haworthi*, Steph.

"Very rare; in company with *F. fuliginosa*; taken in the vicinity of the nests by sweeping, also from under dead leaves and moss" (Fowler, *l. c.* p. 55). Mr. Gorham took a specimen with *Lasius fuliginosus* near Southend, he lost the tube it was in, and went back to the nest and found another specimen. Most of the few recent captures have been taken running on paths, etc.

*Myrmecodia collaris*, Pk.

Fowler writes (*l. c.* p. 56)—"In company with various ants, or in their vicinity, at roots of grass, in moss, etc., in marshy places; it does not, however, appear at all certain that this and the preceding are necessarily associated with

ants." These two species, in common with the other *Myrmedonias*, feed on ants. Mons. L. Mesinin records that a specimen of *collaris* he put into a bottle with two ants, immediately seized and killed one of them (E. M. M., viii, 1876, p. 64). Wasmann writes—"The species of the Genus *Zyras* (*haworthi*, Steph., and *collaris*, Pk.) are indeed like *Myrmoccia*, *Myrmedonia* and *Astilbus*, ant-eaters, and live in preference in the neighbourhood of ants. As regular myrmecophiles they are, however, not to be counted. The same of *Myrmedonia limbata*." I took *M. collaris* and its larvae in some numbers in a nest of *Myrmica laevinodis* in Wicken Fen. The nest was in a heap of cut sedge, and contained ♀♀, many ♂♂, larvae and pupae, and the beetles and their larvae were in the nest among the ants.

This species is often found in moss and sphagnum, but ants often occur in such places, and as the beetles feed on ants they require to be near their nests. We can see how these two beetles, feeding on ants, and living in the neighbourhood of ants' nests, might become more regular inhabitants of the nests like the other *Myrmedonias*, some of which, *M. humeralis* for example, is often found in the runs and outside the nests.

#### *Myrmedonia limbata*, Pk.

"In nests of *Formica flava* and *fusca*, and has also been recorded as associated with *F. fuliginosa*; also found under stones, in moss, etc., near the nests" (Fowler, l. c. p. 56).

It has been taken with *Lasius fuliginosus* at Chobham (Saunders); Guestling (Collett); Croydon (Shepherd); Wellington College (Joy); with *Lasius flavus* at Dover (Morley); Guestling (Collett); Chattenden and Oxford district (Walker); Northumberland (Bold); Scotland, Tweed (Sharp); with *Formica fusca* in Kent (Shepherd); in ants' nest in moss, Lundy Island (Joy); in ants' nests, Isle of Man (Bailey).

I have taken it with *Formica sanguinea* at Woking, with *Lasius fuliginosus* in plenty at Wellington College, with *Myrmica scabrinodis* at Doddington, Kent, and Bembridge, Isle of Wight, and in nest of a *Myrmica* at Cannock Chase. I found in my experiments with this species it was not able to defend itself against the ants as perfectly as the more regular nest-frequenting *Myrmedonias* do. We

will discuss this more fully when we have dealt with *Astilbus*. I pointed out ("Some Experiments with Myrmecophilous Coleoptera," Ent. Rec., 1901, p. 351) that "This beetle exhibits an exactly parallel case to *Astilbus*. It will be remembered they are not so truly myrmecophilous (not invariably being found with ants) as are the other species of *Myrmedonia*."

*Astilbus canaliculatus*, F.

This very widely distributed species is found "In runs of *Formica flava* and other ants, also under stones in haystack refuse, decaying seaweed, moss, etc." (Fowler, *l. c.* p. 59). It also feeds on ants. Bold in 1848 wrote—"Often tenanting the nests of ants, and preying on the inmates" (Col. North. and Durham, p. 134). Messrs. Lucante and Bleuse recorded that it captured and killed ants (E. M. M., 1876, xiii, p. 65). I took a specimen at Chiddingfold running with a dead *Myrmica* in its mouth, and Walker took it under similar circumstances at Tubney. I have kept specimens alive for months in small plaster nests by giving them ants out of my different observation nests, which they always devoured. It has been recorded with *Lasius flavus* at Mickleham (F. Smith); with *Lasius fuliginosus* at Chobham (Saunders); Wellington College (Joy); Guestling (Collett); with *Formica rufa*, Chobham (Saunders); Scotland (White); with *Myrmica lacvinodis*, Guestling (Collett); in ants' nests, Isle of Man (Bailey); Lundy Island (Joy).

I have taken it with *Lasius flavus* at Sevenoaks, Hastings, Eastbourne, Portland, etc.; with *Formica sanguinea* at Weybridge; with *F. fusca* and *L. niger* at Portland; and with *Leptothorax acervorum* at Fairlight, etc., etc. In experimenting with the defence of this beetle against ants (*l. c.*), I found that if an ant was forced to seize an *Astilbus* it does not let go, as with *Myrmedonia*. The *Astilbus* exhibits the same form of defence (*i. e.* thrusting the tail in the ant's face and giving off the *Myrmedonia* smell), but it is evidently not so perfectly developed. We can imagine, that as it developed the glands which secrete the smell given off, it would be able to inhabit the nests with greater impunity and gradually to become a more regular guest. No doubt some such steps as these have taken place with the other *Myrmedonias*.



*Callicerus rigidicornis*, Er.

This species which, though rare, is very widely distributed, has not heretofore been regarded as myrmecophilous. It has, however, been taken with *Lasius fuliginosus* at Chobham (Saunders) and Wellington College (Joy); in the runs of *Formica rufa* at Woking in 1907 and 1908 (Champion); and I have taken it with *Lasius niger* in the New Forest. My friend, Dr. Joy, having taken it on various occasions with *L. fuliginosus*, tells me that, from its behaviour with the ants he considers it shows true Myrmecophilous habits. This looks as if the species is taking the first steps towards a myrmecophilous life.

A species of *Callicerus* is recorded with *Aphaenogaster barbara* in Palestine.

On the genus *Homalota*, Father Wasmann writes—  
“Many species of the Genus *Homalota* (in the old sense) live as occasional guests with ants, especially with *F. rufa*, and still more with *L. fuliginosus*. Most often one finds *Liogluta nitidula*, Kr., with the last genus.”

*Homalota nitidula*, Kr.

“Occasionally in the nests of *F. fuliginosa*, also in dead birds” (Fowler).

“The type of this species occurs very rarely in the South of England, sometimes in the nest of *Formica fuliginosa*” (Sharp, Trans. Ent. Soc. Lond., 1869, p. 130).

With *Lasius fuliginosus* at Knowle (Ellis, Ent. Rec., 1908, p. 57).

*Homalota oblongiuscula*, Sharp.

Taken by Dr. Power at Mickleham with *Lasius fuliginosus*.

*Homalota exarata*, Sharp.

“A few specimens found by Dr. Power and Mr. Brewer in Tilgate Forest in the nests of *Formica fuliginosa* are all I have seen” (Sharp, *l. c.* p. 187).

This species is treated as a synonym of *hepatica*, Er., by Ganglbauer and the last European Catalogue. With what reason we know not, as Sharp includes both species in his monograph. These are all the records I can find of the last three species with ants.

*Homalota sodalis*, Er.

I have taken this species on several occasions in nests of *Formica rufa* at Weybridge between 1896 and 1908, and with the same ant at Oxshott in 1907. *H. myrmecobia*, Kr., which comes next to it in Ganglbauer (ii, p. 186), is recorded by him with *F. rufa* and *pratensis*.

*Homalota analis*, Gr.

This little species, which is very abundant and widely distributed throughout the kingdom, is frequently found with ants. I have found it in nests of *Formica rufa* at Weybridge in plenty, Oxshott, etc., with *F. exsecta*, not uncommon at Bournemouth, and with a *Myrmica* at Porlock. Mr. Day records it with *F. rufa* from Keswick.

*Lamprinus saginatus*, Gr.

"At roots of grass and in moss in damp places, especially heaths; it has occurred in ants' nests in France" (Fowler, *l. c.* p. 198).

It has been recorded with *Lasius flavus* and *Myrmica ruginodis* at Tubney and with *Formica fusca* in the New Forest (Walker); with *Ponera contracta* at Charing (Chitty); and in moss with ants at Lundy Island (Joy). I have taken it in a nest of *Formica sanguinea* at Weybridge. This species is regarded as truly myrmecophilous on the Continent, though apparently not in Britain, so it must be dealt with in this paper. Most of our captures are in moss and at roots of grass. I suspect often with ants, or in the neighbourhood of their nests, though not so recorded. Wasmann gives as its hosts, *Myrmica laevinodis*, *ruginodis* and *scabrinodis*, *Formica rufa* and *Lasius fuliginosus*. He has found the larvae in the nests and has kept the beetle in his observation nests. He shows that it eats the ants' eggs, and that its shape protects it from its hosts when attacked (*Zeitschr. für wissenschaftl. Insectenbiologie*, 1905, p. 420). This perhaps shows us how a *Tachyporus* species living in the neighbourhood of ants' nests might eventually become a myrmecophilous insect.

*Heterothops quadripunctula*, Brit. Cat. (nec Gr., *nigra*, Kr.?).

"In haystack, flood and other refuse; also occasionally in nest of *Lasius fuliginosus*" (Fowler, *l. c.* p. 225).

Harwood took it with *Formica rufa* at Colchester. I have taken it with the same ant at Weybridge, and on several occasions with *Lasius fuliginosus* at Wellington College. I am not quite satisfied if the species I have taken with ants is the same as *H. nigra*, Kr., which Dr. Joy has shown is abundant and widely distributed in moles' nests. My specimens appear to be a little larger, and the puncturation more alutaceous, and consequently less shining. In any case it shows a tendency towards the myrmecophilous habit.

*Quedius mesomelinus*, Marsh.

I once took this common insect in plenty in a nest of *Lasius fuliginosus* at Chiddingfold, and sparingly with the same ant at Oxshott. Mr. Ellis found an injured specimen in a nest of *Formica rufa* at Knowle. I have shown by experiment it was unable to protect itself when introduced into nests of *Formica rufa*. *Quedius brevis* is a purely myrmecophilous beetle, occurring with both the above ants; *Quedius microps* has been recorded with the former by Crotch, and abroad, *Quedius puncticollis* occurs in wasps' nests, and Joy has shown that *Q. longicornis* and *vexans* are inhabitants of moles' nests. We can easily imagine a descendant of *Quedius mesomelinus* as an ants'-nest species.

*Staphylinus stercorarius*, Ol.

The following records of this widely distributed species occurring with ants are to be found. Bold recorded taking a fine series in the nests of a *Myrmica* at South Shields (Col. North. and Durham, 1871, p. 37).

Walker took it on several occasions with *Myrmica ruginodis* at Rannoch, and I have found it with *Lasius flavus* at Blackgang and Sandown, Isle of Wight, and with *Myrmica scabrinodis* near the Forth Bridge. Although generally found away from ants, these cases point to a distinct tendency to inhabit ants' nests. Fowler also records *Staphylinus latebricola* as sometimes in company with *Formica rufa*.

*Othius myrmecophilous*, Kies.

"In moss, dead leaves, etc., sometimes, as its name implies, in company with ants (*Formica fuliginosa*, etc.), but this is by no means always the case, and in fact appears

to be rather the exception than the rule" (Fowler, *l. c.* p. 296). It has been taken with *Formica rufa*, at Knowle and Bewdley (Ellis); Corbridge-on-Tyne (Bagnall); I have taken it with the same ant at Weybridge and Oxshott, with *Lasius fuliginosus* at Tilgate Forest, Walton, and Wellington College, with *Formica exsecta* at Bournemouth, and with *F. sanguinea* at Nethy Bridge, Inverness-shire. I am inclined to think it occurs more often with ants than is supposed, and that it has made considerable steps towards becoming a true ants'-nest dweller. Ganglbauer records it sometimes with *L. fuliginosus* and *F. congerens*.

*Leptinus testaceus*, Müll.

As this little blind beetle has been taken in the nest and runs of *Lasius fuliginosus* at Mickleham (Rye), Tilgate Forest (Champion), and Guestling (Collett), it must be mentioned here. It occurs more frequently in nests of bees, birds, moles and small rodents.

Father Wasmann writes of the *Scydmaenidae*—"Many species of this family are occasionally ants' guests, without belonging regularly to their company. Proportionately few are strongly myrmecophilous. The food of the *Scydmaenidae* appears to consist chiefly of mites. Their ant-like appearance ('Ant-beetles,' Müller and Kunze) has perhaps at best a biological signification in the larger *Scydmaenia*, whether on account of protection from insect feeders, or for intercourse with ants is not yet known."

*Scydmaenus godarti*, Latr.

"Under bark, in rotten wood, in company with ants; rarely under dead leaves; Buddon Wood, Leicestershire, in nests of *Formica rufa*; Sherwood Forest, in rotten wood, with ants" (Fowler, *iii*, p. 77).

In April 1905, Messrs. Bouskell, Chitty and I, all found it in nests of *Formica rufa* at Buddon Wood. The specimens taken by Bouskell and myself were in the centre of a nest, running about quite at home in the midst of the ants, and moving the antennae rapidly in true myrmecophilous manner. The ants paid no attention to them. I consider this species is practically established here as an ant guest.

*Scydmaenus pusillus*, Müll.

It has been recorded with *Formica rufa*, at Buddon

Wood (Fowler), Stoke Wood, Devon (Parfitt); and I have taken it with *L. fuliginosus* at Tilgate Forest. Both this species and the last seem to be rare on the Continent and are not recorded with ants.

*Eruthia plicata*, Gyll., has also been recorded from ants' nests here, and Ganglbauer writes "also in nests of *Formica rufa* and *exsecta*." I am inclined to doubt if many of the British records are the true *plicata*, Gyll., at all.

*Trichonyx sulcicollis*, Reich.

It was taken by Douglas and Scott in old elm stumps at Lee in company with ants, but most of the records in this country appear to be away from ants. Mons. Bedell records it with *Ponera contracta* near Paris, and Herr Reitter with *Lasius brunneus*. Our other species, *T. märkeli*, is almost always taken with ants, and I suspect that this species also is truly myrmecophilous.

*Ptenidium turgidum*, Th., and *P. gressneri*, Er., have both been recorded with ants. Fowler writes of the former, "in rotten wood, usually in company with ants," and of the latter, "in rotten wood, chiefly in company with *Formica fuliginosa*." I have taken *gressneri* in a nest of *Lasius fuliginosus* in Sherwood Forest, but both these species are much more generally found away from ants.

*Hister marginatus*, Er., was taken by Harwood with both *Formica rufa* and *Lasius fuliginosus* at Colchester. Dr. Joy, however, has shown it is a moles'-nest species, where it is often abundant, and widely distributed.

*Dendrophilus punctatus*, Hbst.

"In dead animals, rotten wood, etc., and also in the nests of *Formica fuliginosa*" (Fowler, iii, p. 207).

Janson recorded it with *F. rufa* (Ent. Ann., 1857, p. 95). I took it with the same ant at Weybridge, and have bred it out of my observation nests of *Lasius fuliginosus* from Wellington College, and *Formica exsecta* from Bournemouth. It is frequently found in birds' nests; Joy treats of it in his Class B (those species which are commonly found in the nests and breed there, but also are found and breed elsewhere), and writes (E. M. M., 1906, p. 246), "found in almost any old nest, even if it is quite dry."

Wasmann gives *Lasius fuliginosus* as its host, and writes, "Although this species is often taken also in hornets' nests, in earth, etc., I still hold it in preference as myrmecophilous." *Dendrophilus pygmaeus* is purely myrmecophilous; the hardness of the body in the *Histeridae* protect them from the attacks of the ants, and it is evident that a certain number of species are experimenting in a myrmecophilous life.

*Abraeus globosus*, Hoffm.

"In rotten wood of beech, ash, etc. . . . Mickleham, in nests of *F. fuliginosa*" (Fowler).

Crotch recorded it as not rare with *Lasius fuliginosus* at Weston-super-Mare, but most abundant in Cambridgeshire, and he writes, "Though I have no doubt this species is a truly myrmecophilous insect, it has a great partiality for fungus" (Zool., 1862, p. 8140).

Kraatz recorded it with *Formica rufa* (Stett. Ent. Zeitz., 1851, p. 170), and Von Hagens with *Lasius brunneus* (Berl. Ent. Zeitschr., 1855, p. iii). Perris described the larva of this species from a nest of *Lasius fuliginosus* (Ann. Soc. Linn. Lyon., xii, 1876, p. 16).

It is much more frequently found in rotten wood away from ants; I have taken it in rotten trees in the New Forest, Tewkesbury and Enfield, but never with ants. If it were not for the records with *F. rufa*, etc., one might imagine that *Lasius fuliginosus* had selected a tree already occupied by the beetle, but even so, this might represent the beginning of a myrmecophilous life.

*Cetonia aurata*, L.

This species is only occasionally found with ants. Indeed, Father Schmitz, in a paper on "Some Traditional Errors in Zoological Literature" (Natur u. Offenbarung. Band 54, 1908, p. 99), points out that the larvae of *Cetonia aurata* is repeatedly quoted as living in the nests of the wood ant, when really *Cetonia cuprea*, F. (*floricola*, Hbst., *aenea*, Gyll.), is intended, and that Wasmann has only found the former on one or two occasions with ants. The following genuine records, however, occur here.

Janson recorded the larvae with *F. rufa* (Ent. Ann., 1856, p. 151); F. Smith writes, 'I have found the *Cetonia aurata*

in nests (of *F. rufa*) which I have met with in Yorkshire" (Trans. Ent. Soc. Lond., 1844, p. 101).

Shipp recorded (E. M. M., 1892, p. 288) finding two cocoons in a nest of the wood-ant on Shotover Hill, near Oxford, and on opening one of them he found a perfect insect in it.

Professor Poulton took several larvae and a perfect insect in a nest of *Formica rufa*, in the New Forest, which he sent to me, and I introduced them into my observation nest of that ant, and bred perfect insects from these larvae. (See "Myrmecophilous habits of *Cetonia aurata*," Ent. Rec., 1904, p. 301.) *Cetonia floricola* is truly myrmecophilous in its early stages, and I think the study of *C. aurata*, when found with ants, shows us exactly how the former became so. These beetles are too hard for the ants to injure, the skin of the larvae also is too tough, and they brush off the ants by burying themselves in the débris of the nest when attacked, as I have shown. With *floricola*, Mr. Lloyd recorded that when at Rannoch, he had exposed their larvae, they were fiercely attacked by the ants. (E. M. M., 1892, p. 310).

There are of course other records of non-myrmecophilous Coleoptera with ants, most of them no doubt of chance occurrence, but some more frequently, still enough has been written here to illustrate our subject. In conclusion I should like to say that I am collecting all the British records of species found with ants, and shall be much obliged if any one can tell me of any of those species mentioned here which I have omitted.





VIII. *On the Colonisation of New Nests of Ants by Myrmecophilous Coleoptera.* By H. ST. J. DONISTHORPE, F.Z.S.

[Read June 2, 1909.]

IN a letter, dated January 19th, 1876, to Professor Forel, Charles Darwin wrote—"I hope you will allow me to suggest an observation, should any opportunity occur, on a point which has interested me for some years—viz., how do the Coleoptera which inhabit the nests of ants colonise a new nest? Mr. Wallace, in reference to the presence of such Coleoptera in Madeira, suggests that their ova may be attached to the winged female ants, and that these are occasionally blown across the ocean to the island. It would be very interesting to discover whether the ova are adhesive, and whether the female Coleoptera are guided by instinct to attach them to the female ants; or whether the larvae pass through an early stage, as with *Sitaris* or *Meloe*, or cling to the bodies of the females. This note obviously requires no answer. I trust that you continue your most interesting investigations on ants." ("More Letters of Charles Darwin," 1903, vol. ii, p. 11.)

Professor Poulton, when calling my attention to the passages quoted above, suggested that I should endeavour to answer this question. The following paper is the result.

In this, the hundredth anniversary of the birth of the illustrious Darwin, it is especially appropriate to bring together all the available evidence bearing on the subject. This question shows, as usual, Darwin's wonderful insight into the most interesting and arresting problems in natural history, and his clearness of thought in at once putting his finger on the most important point in them.

This paper only deals with such species as are truly myrmecophilous in their habits, that is to say, those which are almost invariably found with ants, and not those which are more often found elsewhere. With the latter I have dealt in a previous paper (Trans. Ent. Soc. Lond., 1909, p. 397).

The actual seeking of new nests, and oviposition in them by ants'-nest beetles, are almost impossible to

observe in the wild state. Exception may perhaps be found in such species as *Cetonia floricola*, and *Clythra quadripunctata*, which only inhabit the nests in the larval and pupal states. The methods of colonisation are furthermore very different according as the different species of beetles belong to the different categories of true guests, hostile persecuted lodgers, or indifferently treated lodgers. The first of these supplying their hosts with a sweet secretion and fed by them, naturally come into much closer relationship with the ants than any of the others. In order to give anything like a satisfactory answer to Darwin's question we really require to study the whole life history of ants'-nest beetles and their connection with their hosts.

When an ants' nest is disturbed a scene of apparent chaos ensues: the ants all rush about, some attacking the intruder, others hurrying off into safety, with their brood, and with the true guests and their larvae. Their other guests likewise endeavour to escape: some "feign death," while others seek the interior of the nest. It is obvious that in such a scene we can gain no insight into the normal procedure of a fresh colonisation, and are therefore forced to rely on evidence obtained from observation nests, and experiments on ants'-nest beetles, and on beetles bred in such nests; on their pairing habits, and on when and where one finds the beetles, their larvae, etc. It is necessary to consider all records of true myrmecophilous beetles found at large, away from ants' nests; and of all specimens found with ants other than their usual hosts. These latter examples will afford evidence that the beetles not only have not returned to the nest in which they were bred, but have not even sought the same species of ants. The rarity of such records tends to prove that ants'-nest beetles are as a rule very constant in associating with their regular hosts. I would also remark that it is most important that all records of ants'-nest beetles should be accompanied by full and accurate data, stating the number of specimens taken, the exact date, and the species of ant with which the beetle occurred. Without these facts the subject cannot be investigated with any hope of success.

Many species no doubt simply fly direct to a new nest, either to deposit their eggs in it, or from the necessity of pairing with other individuals of their own species. Besides this they may reach new nests by the following

means:—(1) by leaving a nest in company with their hosts when the latter seek a new one, the true guests being perhaps \* carried by, or riding on the ants, the other species running along with them; (2) by a nest being captured by another colony which may kill off the original holders, and live in their domicile, or during the so-called slave-making raids, when the marauders not only capture and carry off the brood of the other ant, but also the beetle larvae in the nest; (3) by attaching themselves to winged female ants they might be carried out during the marriage flight and thus come to inhabit the new nest founded by this female. In other cases when the ants fall to the ground, the guests might enter some neighbouring nest, or be taken in by its ants. There is finally Wallace's suggestion in the letter to Darwin referred to above—that the ants'-nest beetles occurring in Madeira might have been introduced as ova attached to winged queen ants occasionally blown over to the island.

In order to test the above hypotheses I propose to consider the evidence afforded by some of the ants'-nest beetles which occur in Britain.

*Homoeusa acuminata*, Märk.

Normal hosts.—*Lasius niger*, L., and *L. fuliginosus*, Ltr. Wollaston took this species in a nest of *Formica fusca*, L. near Bromley, in 1856 (Zool. 1856, p. 5178), and several specimens again in 1857.

Chitty and I took a few specimens with the same ant at Doddington, Kent, May 12th, 1901 (E. M. M. 1902, p. 74).

I took a specimen at Mickleham in a mixed nest of *Lasius flavus* and *niger* under a stone May 27th, 1900. As it is unusual for these ants to live together, they were probably encroaching on each other, and eventually the one might exterminate the other. Should *L. flavus* have been the victor, we might thus account for a specimen occurring in a nest of this ant.

O. E. Janson took a specimen running on a bank at the

\* A. R. Wallace, in a letter to Darwin (*l. c.* p. 19) remarks: . . . "it may well be that the ova, or larvae, or imagoes of the beetles are not carried systematically by the ants, but only occasionally, owing to some exceptional circumstances. This might produce a great effect in distribution, yet be so rare as never to come under observation."

base of a fence in the London district on May 16th, 1857 (Zool. 1857, p. 1768).

A specimen was swept near Tonbridge, by Horner (E. M. M., 1885, xxii, p. 88).

Chitty took two specimens in the spring of 1894, near Doddington, in cart-ruts, full of water, and I took another specimen in the same cart-ruts in May 1901 (E. M. M., 1902, p. 74).

We see by this that *Homocusa* leaves the nests in the spring, probably for pairing and to seek new nests. Father Hugger has seen the pairing of this beetle in an observation nest of *L. niger* (Wasmann). It is very like a *Dinarda* in its habits and belongs to the indifferently treated lodgers. Father Wasmann has occasionally seen the licking of the beetle by its hosts, *L. niger*, and shows that when introduced into strange nests of the same ant it is at least tolerated.

*Oxyopoda vittata*, Märk.

Normal host.—*Lasius fuliginosus*, Ltr.

Father Wasmann once found it in some numbers with *Lasius brunneus*, in a tree in company with other guests of *L. fuliginosus*. The *brunneus* must have taken possession of a tree that had been occupied by the latter ant. He also took a single specimen in October and a single specimen in November with *Formica rufa* in Dutch Limburg, and has seen it in some numbers flying far from a nest of *L. fuliginosus*.

Dr. Sharp records it as very rare in Scotland, and away from ants. ("Scot. Nat." II, 1873-4, p. 189.)

Walker has taken it by sweeping at Witham Park. ("Oxford List, 1906," p. 13.) It belongs to the indifferently tolerated lodgers, as do the next 8 species mentioned.

*Oxyopoda formiceticola*, Märk.

Normal host.—*Formica rufa*, L.

Wasmann records a single specimen taken with *F. fusca* in August in Dutch Limburg. I have bred this species in *F. rufa* observation nests.

*Thiasophila angulata*, Er.

Normal hosts.—*Formica rufa*, L., and *pratensis*, De G.

I took a single specimen in company with *Lasius fuliginosus* at Oxshott on May 16th, 1900. I have shown that

this beetle protects itself against the ants if attacked, as also the next species. Wasmann took one specimen in a nest of *Formica sanguinea* in May in Dutch Limburg, and has also caught it on the wing.

[NOTE.—*Formica pratensis*, De G. (*congerens*, Nyl.), appears to be very rare in Britain; it has been recorded from Bournemouth, Holnest, Porlock, Exmouth, Rannoch and elsewhere in Scotland. Possibly some of these records are in error as Saunders only gives Bournemouth and Rannoch. I have never been able to find it, but I have found nests of the subspecies *rufa-pratensis*, Forel, at Nethy Bridge, which have the colouring of *pratensis* without its hairiness.]

*Thiasophilina inquilina*, Märk.

Normal host.—*Lasius fuliginosus*, Ltr.

Dr. Power took a specimen with *Formica rufa* at Burnham Beeches on June 21st, 1857.

*Ilyobates glabriventris*, Rye (*bonnairei*, Fvl.).

This species appears to be very rare both here and on the Continent. It was taken sparingly by Dr. Power with *Lasius fuliginosus* at Mickleham in May and June 1863, in the runs of the ants in company with *Homocusa acuminata*. (E. M. M., I, 1865, p. 212.) Wasmann took it with *Lasius brunneus* in July in Dutch Limburg and remarks, "perhaps a regular guest of the ant"; also with *Lasius alienus* in Vienna. Sklitzky records it with *Lasius niger* in Bohemia.

Fauvel described it from a specimen taken by M. Bonnaire in Compiègne, but does not record how it was captured. ("Bul. Soc. Normandie," IX, 1865, p. 287.)

Mr. Elliman swept two specimens in a moist wood near the Chiltern Hills on June 6th, 1897, and remarks that the atmosphere at the time was remarkably still and warm. (E. M. M., 1897, p. 279.)

We now come to the genus *Dinarda*. Father Wasmann tells me their eggs are deposited in the soil of the nests, the larvae emerging there. The copulation of *Dinarda* is the same as that of *Lomechusa* and *Atemeles*.

*Dinarda märkeli*, Kies.

Normal host.—*Formica rufa*, L.

Wasmann records a single specimen in a nest of *Formica sanguinea* in May in Dutch Limburg.

I have bred this species in my observation nests of

*Formica rufa*, and have shown that it protects itself when introduced to strange *rufas*, or when attacked in the nest, as also do the other species.

*Dinarda dentata*, Gr.

Normal host.—*Formica sanguinea*, Ltr.

One specimen was taken by W. C. Jackson in a nest of *Formica exsecta* at Bournemouth. ("Ent. Rec.," 1905, p. 272.)

Wasmann found a single example in August with *F. rufibarbis* in Dutch Limburg, and has found the species running about away from ants. Douglas and Scott once found at Shirley in September 1863, "a quantity of *Formica sanguinea* running close together in one direction, and side by side with them, in nearly equal number, *Dinarda dentata*." (E. M. M., 1900, p. 11.) No doubt the ants were seeking a new habitation and the beetles had left the old nest with them. Father Wasmann found this ant in the act of leaving its nest, carrying cocoons and each other, accompanied by their slaves, *F. fusca*, also carrying cocoons, etc. Over 100 *D. dentata* were on the top of the nest in a state of excitement, running in and out of the entrances and following the ants.

Professor Wheeler records that in the neighbourhood of Würzburg he came upon a colony of *F. sanguinea* in the act of moving to a new nest. The ants were laden with their larvae and were marching along a dusty road and in their midst two *Dinarda dentata* were running. ("Journal für Psychologie und Neurologie," Leipzig, 1908, p. 435.)

I have bred this species in numbers in my observation nest of *Formica sanguinea*, the larvae of the beetles being very plentiful at times.

*Dinarda hagensi*, Wasm.

Normal host.—*Formica exsecta*, Nyl.

I have also bred this species in my observation nest of its host, *Formica exsecta*, from Bournemouth.

*Dinarda pygmaea*, Wasm.

Normal host.—*Formica rufibarbis*, F., var. *fusco-rufibarbis*, For.

I have found the larva of this beetle in company with the imago in the nest of this ant at Whitsand Bay.

*Lomechusa strumosa*, F.

Normal host.—*Formica sanguinea*, Ltr.

Wasmann found it in some numbers in one nest of *Formica rufa* in Dutch Limburg in May 1897, and a single specimen with *F. rufibarbis* v. *fusco-rufibarbis*, on May 14th, 1897. Sir Hans Sloane captured a specimen on Hampstead Heath in 1710. Dr. Leach took one when travelling in the mail coach between Cheltenham and Gloucester about 1820.

One got up and flew away off the sheet I was using when examining a nest of *F. sanguinea* at Woking.

Roger records that on warm days one often sees *Lomechusa* out and walking about.

Sahlberg caught it on the wing.

Wasmann remarks that although not double-hosted like *Atemeles*, it often changes its habitation.

I have described and figured the copulation of this beetle, and I found in my observation nest that a number of specimens collected together outside the nest for this purpose, and afterwards the ♀♀ immediately entered the nest.

Father Wasmann has recorded that they collect together at pairing time, and that he once found 63 specimens sitting on the top of a nest, 6 pairs being *in cop.*, and that some days later they dispersed to other nests.

I once found under a turf at Woking a small number of *sanguinea* ♂♂, two ♀♀, and several *Lomechusa*, all evidently about to move together.

Father Wasmann has shown that the eggs of this beetle are laid on the eggs of very young larvae of the ants, and that the eggs are very like the ants' eggs and that the larvae is at most only one or two days in the egg.

The species of the genus *Atemeles* are, like *Lomechusa*, true guests, being fed\* and licked by their hosts; they differ, however, in being double hosted, that is to say, their summer hosts are ants of the genus *Formica*, in which nests their eggs are laid and their larvae bred, so these ants may be called the larval hosts; their winter

\* It is a very interesting fact, first pointed out by Father Wasmann, that when an *Atemeles* desires to be fed, it not only asks an ant, by tapping with its antennæ, as does *Lomechusa*, but it further imitates the actions of its hosts, by stroking the side of the head of the ant with its front foot. Any one has only to keep *Atemeles* alive to satisfy himself on this point.

hosts are ants of the genus *Myrmica*, which may be called the beetle hosts. The beetles thus have to make a double migration, one in the early part of the year from *Myrmica* to *Formica* nests, and again in summer or autumn from *Formica* to *Myrmica*. Consequently one would expect to find *Atemeles* at large more often than other regular guests, and this is exactly what does happen. The pairing time is about May, and takes place in *Formica* nests, it is the same as that of *Lomechusa*. Father Wasmann has demonstrated that the eggs of *Atemeles* are laid on the eggs of the ants, from which they are undistinguishable even with a lens. The young larvæ hatch very soon and devour the ants' eggs. Another interesting point is that the beetles go into quarantine before they enter the other hosts' nest, after leaving the one. This is several days when leaving *Myrmica*, as they remain hidden in and near the new *Formica* nest; Wasmann has often proved this in observation nests, etc. When going from *Formica* to *Myrmica* the period is much longer, as they are not found with the latter before the end of August or the beginning of September, though they have long before disappeared from the *Formica* nests. Having been bred in the latter nests, the nest aura is no doubt more pronounced in the beetles of the summer migration.

*Atemeles emarginatus*, Pk.

Primary hosts.—*Myrmica scabrinodis*, Nyl., *laevinodis* Nyl., *ruginodis*, Nyl., and *sulcinodis*, Nyl.

Secondary host.—*Formica fusca*, L.

F. Smith once recorded he took a specimen which ran out of a nest of *F. rufa*. (Trans. Ent. Soc. Lond., 1842, p. 151.)

The record in Parfitt's "Col. Devon, 1867," p. 22, "in nests of *F. rufa*, Plymouth, Reading," is no doubt incorrect, as it is recorded in the "Ent. Annual" for 1858, p. 83, as taken by Reading in nests of *Myrmica rubra* near Plymouth.

Penzance district in nests of *F. rufa*. ("Vic. Hist. Cornwall," 1906, p. 190.)

Here again I expect the ant was incorrectly recorded.

Mayr once found a single specimen with *F. rufa*, and Westhoff one with *Tetramorium caespitum*.

I took a specimen by sweeping near a nest of *Formica rufa* on May 15th, 1894, at Guestling.



Champion took a specimen running across a path at Bonchurch, I. of W., in July. (E. M. M., 1887, p. 137.)

Harwood recorded the capture of a specimen in dead leaves near Colchester during the early part of the year. (E. M. M., 1898, p. 64.)

A specimen is recorded running on a chalky pathway. (Vic. "Hist. Herts., 1902," p. 90.)

J. H. Keys took a specimen on his collar at South Brent in May 1903.

Walker records one by sweeping at Headington Wick Copse in June ("2nd Oxford List, 1907," p. 53), and another in a sand-pit in the New Forest in July. (E. M. M., 1907, p. 206.)

E. A. Butler swept a specimen in August at Luccombe, in the I. of Wight.

Forel has shown that when *Formica sanguinea* and *Polyergus rufescens* make slave raids on *Formica fusca*, they not only carry off the cocoons of the latter, but also the larvae of the *Atemeles*.

#### *Atemeles paradoxus*, Gr.

Primary hosts.—*Myrmica ruginodis*, Nyl., *laevinodis*, Nyl., and *scabrinodis*, Nyl.

Secondary hosts.—*Formica rufibarbis*, F., and var. *fusco-rufibarbis*, For.

Fowler took a specimen on the cliffs near Sandown, being carried by an ant much smaller than itself, in April. (E. M. M., 1884, XXI, p. 18.) The ant was, I believe, *Lasius niger*.

H. W. Bates recorded this beetle with *Formica flava* at Sheet Hedges Wood in Leicestershire. ("Zool., 1944," p. 700.) The beetle was, however, *emarginatus*, and the ants were most probably *Myrmicas*.

Wasmann remarks that this and the last species are often found at large, running and flying.

#### *Myrmedonia funesta*, Gr.

Normal host.—*Lasius fuliginosus*, Ltr.

A specimen was taken in a fungus in Birch Wood by Curtis on May 6th, 1821. ("Zool. 1855," p. 4603.)

One captured by Linnell on Red Hill Common in 1855. ("Reigate List, 1898," p. 12.)

Wasmann once found it in some numbers moving with *Lasius fuliginosus* to a new nest at Exaeten.

Species of the genus *Myrmedonia* belong to the hostile persecuted lodgers and prey on ants. I have shown that this and other species protect themselves if attacked when introduced into new nests, and to strange ants, by the secretion which they give off.

*Myrmedonia humeratis*, Gr.

Primary host.—*Lasius fuliginosus*, Ltr.

Secondary hosts.—*Formica rufa*, L., and *pratensis*, De G.

Scott took it in moss at Renfrew. ("Zool. 1852," p. 3462.)

Linnell records one example at Redstone in 1855, which had probably strayed from a nest of *F. rufa*, of which there were several at that time in Redstone Wood ("Reigate List, 1898," p. 12.)

A specimen was taken by Blatch under a stone in a dry ditch at Hunstanton. (E. M. M., 1882, XIX, p. 139.)

Walker records it in faggots in the Blean Woods. (E. M. M., 1898, p. 208.)

Wasmann mentions it running on roads.

The pairing which I have recorded is like that of *Lomechusa*. ("Ent., Rec., 1908," p. 283.)

I have taken the larvae in company with the beetle and *F. rufa* near Knowle.

*Myrmedonia cognata*, Märk.

Normal host.—*Lasius fuliginosus*, Ltr.

A single specimen was taken by O. E. Janson on the stump of a felled tree at Hampstead on June 3rd, 1855. ("Ent. Ann., 1857," p. 72.)

One example was taken by Wasmann with *Lasius niger* in May in Dutch Limburg. He found several specimens with *Lasius brunneus* in a tree in company with other guests of *L. fuliginosus*.

On March 25th, 1886, he found specimens moving with *L. fuliginosus* at Exaeten from an old nest to a new one.

I have bred this species in my *L. fuliginosus* observation nest.

*Myrmedonia lugens*, Gr.

Normal host.—*Lasius fuliginosus*, Ltr.

A single specimen was taken in July with *L. brunneus*

by Wasmann in Dutch Limburg. He also took one at Exaeten moving with *L. fuliginosus* to a new nest.

G. R. Waterhouse took it at Sydenham in the spring of 1856 away from ants.

Champion records it on the wing at Woking in June. (E. M. M., 1906, p. 255.)

*Myrmedonia laticollis*, Märk.

Normal host.—*Lasius fuliginosus*, Ltr.

Wasmann has found it with *L. brunneus* in a tree with other guests of *L. fuliginosus*.

Champion records it on the wing at Woking in June. (E. M. M., 1906, p. 255.)

I have taken the larvae in plenty in a nest of *L. fuliginosus* at Wellington College, and have bred the beetle in numbers in my observation nest of that ant.

Wasmann records that he has seen various species of *Myrmedonia* flying in some numbers.

*Notothecta flavipes*, Gr.

Normal hosts.—*Formica rufa*, L., and *pratensis*, De G.

A single specimen was taken by Wasmann with *F. sanguinea* in May in Dutch Limburg. I took a specimen on the wing at Budleigh Salterton on January 22nd, 1896, it being a very warm, sunny day; and swept another in Darenth Wood on June 18th, 1908.

I have bred it in my *F. rufa* observation nest, and have shown it protects itself when attacked.

*Notothecta confusa*, Märk.

Normal host.—*Lasius fuliginosus*, Ltr.

I took a single specimen with *F. rufa* at Oxshott. ("Ent. Rec., 1905," p. 272.) These two species belong to the indifferently treated lodgers.

*Quedius brevis*, Er.

Normal hosts.—*Formica rufa*, L., and *Lasius fuliginosus*, Ltr.

A single specimen was taken in a nest of *F. sanguinea* at Woking by Champion (E. M. M. 1906, p. 255), and another with the same ant by H. W. Ellis at Bewdley. ("Ent. Rec., 1908," p. 57.)

Tuck took it in bees' nests at Tostock in 1896. ("Suffolk

List, 1899," p. 31.) I took a specimen in a sand-pit at Weybridge on 29th April, 1895. W. E. Sharp found a specimen under the bark of a tree near a nest of *F. rufa* at Burnham Beeches. ("Vic. Hist., Bucks., 1905," p. 76.) I found the larvae in some numbers in a nest of *Lasius fuliginosus* at Wellington College. I have bred it in my observation nest of *F. rufa* (two specimens came out of the nest this year, one on January 28th, and the second on February 19th), and have shown it protects itself from the ants.

This and the next species belong to the hostile persecuted lodgers.

*Xantholinus atratus*, Heer.

Normal hosts.—*Formica rufa*, L., *pratensis*, De G., and *Lasius fuliginosus*, Ltr.

Linnell records a specimen taken crawling in the sand of the cutting at Reigate tunnel in April 1865, and two specimens in a sand-pit at Dorking in April 1867. ("Reigate List, 1878," p. 44.)

The only British record with *L. fuliginosus* is that of Mr. H. W. Ellis at Knowle. ("Ent. Rec.," 1908, p. 57.)

*Claviger testaceus*, Preys.

Primary host.—*Lasius flavus*, De G.

Secondary hosts.—*Lasius alienus*, Först., and *niger*, L.

It was once found in a nest of *Tapinoma erraticum* by Von Hagens. Strübing found four specimens in a nest of *L. niger*, which appeared to have belonged to *L. flavus* and to have been taken by the former ants, a few specimens of the latter being still in the nest. The first specimen taken in Britain was captured by Professor Westwood in Oxfordshire on August 30th, 1838, in a nest of *L. flavus*. It was attached to a winged ♂ on the under-side. This suggests a possible method of being taken out of the old nest.

Although Müller in 1818 gave some account of the habits of the curious beetles of the genus *Claviger*, showing them to be true guests, etc. ("Germar's Mag.," III, pp. 57-112), nothing is known to this day of their true life history, of how and where the eggs are laid, or even of their larvae! The problem has been investigated by Janet, Wasmann, Hetschko, Schmitz and others without

success. I have kept many examples alive in my observation nests of *L. flavus* and *L. niger*, but have never been able to breed it. I saw it fed and licked by its hosts, and also feed on their larvae. I saw specimens riding on each other, but this does not imply copulation, as, as many as five or more Clavigers will all ride mounted on each other, the bottom one carrying them all; numbers also ride on their hosts.

At Portland, where I found it in numbers, I also saw specimens riding on each other in the nests. I introduced specimens there from *L. flavus* nests to *L. niger* nests and vice versâ, both near to each other and at a distance, and they were always accepted by the ants. I also obtained similar results in my observation nests at home, including *F. rufa*. Last year, however, specimens which I had taken with *L. flavus* at Dartmouth, introduced into an observation nest of *Tetramorium caespitum*, were attacked and killed by the ants.

Father Schmitz found that *C. longicornis* was received by most of the ants he introduced it to, except *F. rufibarbis* and *sanguinea*, which killed it.

When a nest is disturbed the ants often pick up the Clavigers and carry them into safety. Father Schmitz showed that *C. longicornis* was carried riding on the ants (*L. umbratus*), when he allowed them to enter a new nest. Professor Hetschko records *C. testaceus* as often attached to the winged ♀ ants, and suggests they may be spread to other and new nests through the marriage flight. He found the beetles could live away from ants when fed with dead flies, etc. Wasmann had already pointed out that they also fed on the ants' larvae. The beetles appear to hibernate in the nests.

It is very doubtful if the larva described by L. von Heyden ("Jahrb. Nass. Ver. Naturk," 1876-77, p. 201) is that of *Claviger* at all.

#### *Dendrophilus pygmaeus*, L.

Normal hosts.—*Formica rufa*, L., and *pratensis*, De G

Stephens recorded this species as taken in plenty in sand-pits on Hampstead Heath and gravel-pits in Coombe Wood. ("Mand." III, 1830, p. 160.)

I have bred specimens in my *F. rufa* observation nest, and have found the pupa in a nest of that ant at Hays Woods

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in May. The shape and hardness of this and the next species protect them from the ants. They belong to the indifferently treated guests, though *Myrmetes* is sometimes licked by its hosts.

*Myrmetes piceus*, Pk.

Normal hosts.—*Formica rufa*, L., and *pratensis*, De G.

Wasmann took a single specimen in a nest of *F. sanguinea*, which contained *rufa* as slaves in Dutch Limburg. I have bred this species in my *F. rufa* observation nest many times, and on May 10th, 1909, I noticed a pair *in cop.* in a small *Formica* observation nest, and also the licking of a specimen by an ant.

*Amphotis marginata*, F.

Normal host.—*Lasius fuliginosus*, Ltr.

Taken on the wing in the summer of 1906 at Woking by Champion. (E. M. M., 1906, p. 255.)

*Cetonia floricola*, Hbst.

Normal hosts (for larvae and pupa).—*Formica rufa*, L., and *pratensis*, De G.

A single larva was found by Wasmann in May in a nest of *Formica sanguinea*, and another with *L. fuliginosus* in Dutch Limburg. Wasmann has pointed out that the ♀ *Cetonia* lays her eggs in the ants' nests, and that she is attacked by the ants.

Rupertsberger describes the entrance of a ♀ *Cetonia* which he saw fly up, into a nest of *F. pratensis*, to lay her eggs. ("Wien Ent. Zeitg.," 1893, p. 249.)

Weaver recorded that the larvae lived in the nests of *F. rufa* in Scotland. (Trans. Ent. Soc. Lond., Nov. 1st, 1852.)

Lloyd records finding larvae and pupæ in nests of *F. rufa* at Rannoch. (E. M. M., 1892, p. 310.)

I found the empty pupa cases in the nests at Rannoch in June 1900, and larvae in some numbers in a *rufa* nest at Nethy Bridge last May.

W. Evans bred the beetle from larvae taken in *F. rufa* nests, Upper Forth. ("Ann. Scot. Nat. Hist.," 1903, p. 95.)

*Clythra 4-punctata*, L.

Normal host (for larva and pupa).—*Formica rufa*, L.

The larvae and pupae of this beetle are common in nests of *F. rufa*.

Father Wasmann records the seeking of nests by the beetles to lay eggs at Exaeteñ.

I have described the copulation of this beetle and also the eggs, young larvae, etc., and have shown that the ♀ lets fall her eggs on to the *rufa* nests, and that the ants pick them up and carry them into the galleries.

Besides the lists and periodicals mentioned in the above notes, I have consulted the following papers which bear on the subject:—

WASMANN, E. (S.J.).

- (1) "Über die Lebensweise einiger Ameisengäste."  
I. Tl.—Deutsch. Ent. Ztschr., 1886, I, pp. 49–66.
- (2) "Über die Lebensweise einiger Ameisengäste."  
II. Tl.—Deutsch. Ent. Ztschr., 1887, I, pp. 108–122.
- (5) "Beitrage zur Lebensweise der Gattungen *Atemeles* und *Lomechusa*."  
Tijdschr. v. Entom., XXXI, pp. 245–328.
- (11) "Vergleichende Studien über Ameisengäste und Termitengäste."  
Tijdschr. v. Entom. XXXIII, pp. 27–97.
- (17) "Eine neue Clavigeride aus Madagaskar . . . mit biologischen Bemerkungen."  
Stett. Ent. Ztg., 1891, pp. 3–10.
- (18) "Verzeichnis der Ameisen und Ameisengäste von Holländisch-Limburg."  
Tijdschr. v. Entom. XXXIV, pp. 39–64.
- (20) "Vorbemerkung zu den internationalen Beziehungen der Ameisengäste."  
Biol. Zentralbl., XI, 1891. No. 11, pp. 331–343.
- (34) "Zur Lebens- und Entwicklungs-geschichte von *Atemeles pubicollis*, mit einem Nachtrag über *Atemeles emarginatus*."  
Deutsch. Ent. Ztschr., 1894, II, pp. 281–283.
- (38) "Kritisches Verzeichnis der Myrmekophilen und termitophilen Arthropoden." Berlin, 1894.
- (45) "Zur Biologie von *Lomechusa strumosa*."  
Deutsch. Ent. Ztschr., 1895, II, p. 294.
- (70) "Zur Biologie der *Lomechusa*-Gruppe."  
Deutsch. Ent. Ztschr., 1897, II, pp. 275–277.

- (75) "Zur Morphologie und Biologie der Lomechusa-Gruppe."  
Zool. Anzeig., 1897, No. 546, pp. 463-471.
- (83) "Erster Nachtrag zu der Ameisengäste von Hollandish-Limburg."  
Tijdschr. v. Entom., XLI, 1898, pp. 1-18.
- (105) "Weitere Nacträge zum Verzeichnis der Ameisengäste von Hollandish-Limburg."  
Tijdschr. v. Entom., XLII, 1899, pp. 158-171.
- (109) "Über *Atemeles pubicollis* und die Pseudogynen von *Formica rufa*."  
Deutsch. Entom. Ztschr., 1899, II, pp. 407-409.
- (131) "Neue Bestätigungen der Lomechusa-Pseudogynentheorie."  
Verh. Deutsch. Zool. Ges., 1902, pp. 98-108.
- (146) "Ursprung und Entwicklung der Sklaverei bei den Ameisen."  
Biol. Zentralbl., XXV, 1905, No. 4-9.
- (149) "Zur Lebensweise von *Atemeles pratensoides*."  
Ztschr. wissensch. Insektenbiol., II, 1906, Heft. 1 and 2.
- (162) "Weitere Beiträge zum sozialen Parasitismus und der Sklaverei bei den Ameisen."  
Biol. Zentralblatt., 1908. No. 8-13.
- (164) "Die psychischen Fähigkeiten der Ameisen."  
Second Edt., Stuttgart, 1909.
- (166) "Nachtrag zu: Weitere Beiträge zur sozialen Parasitismus und der Sklaverei bei den Ameisen."  
Biol. Zentralblatt., XXVIII, No. 22, pp. 726-731.

HETSCHKÓ, ALFRED.

- "Zur Biologie von *Claviger testaceus*, Preysl."  
Berliner. Entomolog. Zeitschrift, Bd. XLI, 1896,  
Heft. I, pp. 45-50.

RUPERTSBERGER, MATHIAS.

- "Coleopterologische Kleinigkeiten aus meinem Tagebuche."  
Wien. Ent. Ztg., 1893, pp. 247-249.

SCHMITZ, H. (S.J.).

- "*Claviger longicornis*, Müll., sein Verhältnis zur *Lasius umbratus*."  
Allgem. Zeits. für Entomologie, 1908, Heft. 3,  
4 and 5.



DONISTHORPE, HORACE, ST. J.

- (10) "On the Origin of, and Progression in, the study of Myrmecophilous Coleoptera."  
Trans. Leicester Lit. and Phil. Soc., 1901, Pt. I, pp. 3-15.
- (11) "On Some Experiments with Myrmecophilous Coleoptera."  
Ent. Rec., 1901, pp. 351-352.
- (13) "The Life History of *Clythra 4-punctata*, L."  
Trans. Ent. Soc. Lond., 1902, Pt. I, pp. 11-23.
- (15) "Further Experiments with Myrmecophilous Coleoptera, etc."  
Ent. Rec., 1903, pp. 11-12.
- (16) "Notes on the Myrmecophilous Habits of *Cetonia aurata*, L."  
Ent. Rec., 1904, p. 301.
- (25) "The Life History and Occurrence as British of *Lomechusa strumosa*, F."  
Trans. Ent. Soc. Lond., 1907, Pl. IV (Jan. 1908), pp. 415-520.

In conclusion, I must express my best thanks to Father Wasmann for his kind help in letters, and by pointing out which of his papers I should find most useful to consult on this subject; and to Professor Poulton for kind suggestions and revising some of this paper for me.



IX. *On Some New and Little-known Neotropical Lycaenidae.*  
By HAMILTON H. DRUCE, F.L.S., etc.

[Read June 2nd, 1909.]

PLATE XI.

THE following short paper contains an account of some new and little-known forms of butterflies belonging to the *Lycaenidae*, which have been placed in my hands for examination by Mr. H. J. Adams, and which were obtained by his collectors, Messrs. Watkins and Tomlinson, in the years 1902, 1903, 1904, in Peru.

To these I have added a description of a small but very distinct species from the Argentine, and some remarks on several described forms.

*Thecla melidor*, sp. nov. (Plate XI, fig. 4.)

♂. Allied to *T. atys*, Cr.\* Upper-side with brands as in that species; ground colour of wings bluer.

Under-side. Both wings irrorated with green at the base, no dark band closing the cell of the fore-wing. A long red streak on costa of hind-wing extending almost half way to the apex, in place of the red basal spot of *T. atys*. A red spot beyond the pale spot below the red streak, which spot is not found in *T. atys*; a long red streak running down the inside of the submedian nervure—this is short in *T. atys*. The ground colour is greyer.

The abdomen is vermilion below and blackish above.

Expanse, 2½ inch.

*Hab.* RIO COLORADO, Peru, 2,500 ft. (*Watkins and Tomlinson.*)

TYPE, Mus. Adams. Captured in August.

Allied also to *T. bacis*, Godm. and Salv.,† and *T. vulnerata*, Staud.‡

\* *Papilio atys*, Cr., Pap. Exot. iii, t. 259, figs. E, F (1782).

† *Thecla bacis*, G. and S., B.C.A., Lep. Rhop., vol. ii, p. 21, Pl. XLIX, figs. 20-22 (1887).

‡ *Thecla bacis*, v. *vulnerata*, Staud., Exot. Schmett., p. 285, Pl. XCVII.

*Thecla adamsi*, sp. nov. (Plate XI, fig. 2.)

♂. Upper-side. Both wings shining bluish-green, shading to purple towards apex of fore-wing. Costa, apex and outer-margin of fore-wing narrowly black; apex and outer-margin of hind-wing narrowly black, abdominal margin grey. Anal angle rather broadly black with a narrow white line running from the abdominal margin just below the lobe to the lower median nervule. Cilia of fore-wing black, of hind-wing white, tipped with black. Tails black tipped with white.

Under-side. Ground colour of both wings chocolate-brown, bluish on basal and discal areas of fore-wing and pale brown along inner margin of same wing, both wings crossed by three irregular pale blue lines, the innermost of which is most clearly defined on both wings. On the hind-wing these lines are angled towards the abdominal margin. In addition to these lines there is a short blue line closing the cell of the fore-wing and a longer blue line just below the costa rather before the middle. Cilia of fore-wing brown, of hind-wing white, tipped with brown. An anteciliary blue line from the apex where it is faint, to the abdominal margin below the lobe, which is deep black. Thorax green above, brown below. Abdomen brown on both surfaces. Legs brown, spotted with white.

Expanse, 2 inch.

*Hab.* PICHIS ROAD, Peru, 3,000 ft. (*Watkins and Tomlinson*).

TYPE, Mus. Adams.

This insect is somewhat like *T. havila*, Hew.,\* but is without the large double brand which is so well marked a character of that species, and on the under-side has a blue mark closing the cell, and differently arranged lines.

*Thecla ematheon*. (Plate XI, fig. 5.)

*Papilio ematheon*, Cr., Pap. Ex. ii, t. 163, F.G. (1779).

*Hab.* PERENÉ RIVER, Peru, 2,000 ft. (*Watkins and Tomlinson*).

This beautiful and distinct species has never been recorded since it was described and figured by Cramer, now more than a hundred years ago.

Mr. Adams' specimen, which undoubtedly represents

\* *Thecla havila*, Hew., Ill. Diur. Lep. Lyc., p. 76, Pl. XXX, figs. 23, 24 (1865). ♂. The Godman collection contains a ♀ which has broader black margins and duller blue areas on the upper-side than the ♂.

Cramer's insect, has the discal areas of the fore-wing above, adjoining the large black patch, suffused with purple when seen in some lights.

Cramer records it from Surinam, which, if correct, seems to point to a very extended range.

Hewitson wrote that he was hoping to receive it from Cayenne, but he never obtained a specimen.

It is perhaps allied to *T. undulata*, Hew.,\* and *T. busa*, G. and S.,† but the anal area is less pronounced, and the tail is less spatulate than in either of these species.

*Thecla gibberosa tomlinsoni*. (Plate XI, fig. 3.)

*Thecla gibberosa*, Hew. Ill. Diur. Lep. Lyc., p. 85, Pl. XXXIII, figs. 48, 49 (1867).

♂. Upper-side differs from the typical form by the whole of the fore-wing being suffused with brilliant shining blue and the hind-wing with grey blue, thus obliterating the white areas. Under-side as typical form.

♀. Both surfaces as typical form.

*Hab.* CHANCHAMAYO, Peru, and RIO COLORADO, Peru, 2,500 ft. (*Watkins and Tomlinson*). Mus. Adams. Captured in September.

*T. gibberosa* has the linear patch on the fore-wing below as described in *T. numen*, P. Z. S., 1907, p. 574.

*Thecla amatista*, Dognin.

*Thecla amatista*, Dognin, Anns. Soc. Ent. Belg., 1895, p. 106.

*Thecla candor*, H. H. Druce, P. Z. S., 1907, p. 578, Pl. XXXIII, fig. 1.

*Hab.* ECUADOR, PERU.

On a recent visit to Paris M. Dognin has kindly shown me the types of the three *Theclas* described by him, and I find that two of them are identical with forms recently described and figured by myself. The third, *T. faga*, is a small brown insect which seems to me better placed in the genus *Scolitantides*. We possess specimens of it from

\* *Thecla undulata*, Hew., Ill. Diur. Lep. Lyc., p. 81, t. 32, figs. 41, 42 (1867).

† *Thecla busa*, G. and S., B.C.A., Lep. Rhop., vol. ii, p. 26, Pl. LI, figs. 1, 2 (1887).

Cuzco, Peru, and La Paz, Bolivia. It has remarkably long palpi, especially in the ♀, which are thickly clothed with hairs, as noted by M. Dognin.

*Thecla alatus*, H. H. Druce. (Plate XI, fig. 13.)

*Thecla alatus*, H. H. Druce, P. Z. S., 1907, p. 579.

*Hab.* PERU.

I have figured the type which is contained in Mr. Godman's collection. Although allied to *T. culminicola*, Staud., it is distinguished by the paler blue areas, the broader brown margins and the plain cilia. This insect inhabits very high altitudes.

*Thecla culminicola*, Staud.

*Thecla culminicola*, Staud. Iris, vii, Pl. II, fig. 6, 1894.

*Hab.* SAN MATEO, Peru.

TYPE, Mus. Adams.

Mr. Adams' specimen, a ♂ with a small pale brand at the end of the cell of the fore-wing above, agrees well with Staudinger's figure, and has very clearly defined black and white chequered cilia to both wings on both surfaces.

*Thecla paphlagon*, Feld. (Plate XI, fig. 1.)

*Pseudolycoena paphlagon*, Feld., Reis., Nov. Lep., p. 249, Pl. XXXI, figs. 10-11 (1865).

*Hab.* CHANCHAMAYO, Peru, 2,000-7,500 ft.

TYPE, Mus. Adams.

The ♂ figured is larger, and of a darker shade of blue than the ♂ described by me in P. Z. S., 1907, p. 594, and has the black hairs along the submedian nervure of hind-wing above, much as in *Thecla ochrus*, G. and S.

*Thecla piplea*, G. and S.

*Thecla piplea*, G. and S., P. Z. S., 1896, p. 516.

*Thecla subobscura*, Lathy, Abstr. P. Z. S., 1904, No. 5, p. 19, P. Z. S., 1904, vol. i, p. 452.

*Hab.* ST. VINCENT. DOMINICA. W. Indies.

Mr. Lathy has kindly lent me the type of his *T. subobscura*, which I find does not differ in any way from the previously described *T. piplea*.

*Thecla purpurantes*. (Plate XI, fig. 12.)

*Thecla purpurantes*, H. H. Druce, P. Z. S., 1907, p. 597,  
Pl. XXXV, fig. 7 ♂.

♀. Upper-side paler than ♂, blue areas slightly less extensive and more cerulean in hue. Under-side as ♂, but paler.

*Hab.* SAN REMON, Peru, 3,000 ft. (*Watkins and Tomlinson*.)

TYPE, Mus. Adams.

Captured in August.

*Thecla crepundia*, sp. nov. (Plate XI, fig. 6.)

♂. Upper-side dull olivaceous-brown, the basal areas of both wings dull indigo-blue which appears shining when held at an angle. Cilia of both wings brown, whitish towards apex of hind-wing. Under-side: fore-wing olivaceous-brown, paler along inner margin, broadly tipped with creamy-white crossed by brown nervules; basal area shining greyish-blue. Shoulders very narrowly bright red. Hind-wing creamy-white, basal and anal areas clouded with brownish; all the veins distinctly dark brown. A large red basal spot. Thorax and abdomen black above, white below. Legs black. Palpi white, terminal joint black. Antennae black, annulated with white.

Expanse, 1 m.

*Hab.* RIO COLORADO, Peru, 2,500 ft. (*Watkins and Tomlinson*.)

TYPE, Mus. Adams.

This curious little insect is allied to *Thecla miranda*, G. and S.,\* and *Thecla schausi*, G. and S.,† and belongs to a group that is very little known. Besides other differences it has only one red basal spot on the under-surface, and that on the hind-wing. The figure is drawn  $1\frac{1}{2}$  times natural size to better show the details of coloration.

*Thecla phrosine*, sp. nov. (Plate XI, fig. 7.)

♀. Upper-side dull smoky-brown. Cilia of fore-wing pale brown, of hind-wing pure white, tipped with grey at the anal angle. Under-

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\* *Thecla miranda*, G. and S., B.C.A., Lep. Rhop., vol. ii, p. 99 (1887).

† *Thecla schausi*, *ibid.*, p. 98, Pl. LVIII, figs. 22, 23 (1887).

side ; both wings pure white, discal area of fore-wing very faintly bluish-grey. Fore-wing with an ultra-median band composed of rich brown dots, commencing on the costa and reaching below the first median nervule. Hind-wing with a central circular band composed of larger rich brown blotches from the costa to the inner margin. A submarginal row of brown dots. A clearly defined, black, anteciliary line common to both wings. Cilia of both wings pure white. Thorax and abdomen olivaceous-brown above, pure white below. Palpi white, terminal joint black. Legs white with black spots. Antennae black, annulated with white.

Expanse, 1 inch.

*Hab.* CHANCHAMAYO, Peru, 2,000-7,500 feet.

TYPE, Mus. Adams.

Not closely allied to any with which I am acquainted, but possibly belonging to the group containing *Thecla aura*, G. and S.\* The figure is drawn  $1\frac{1}{2}$  times natural size.

*Thecla vesper*, sp. nov. (Plate XI, fig. 8.)

♂. Upper-side. Both wings uniform rich shining blue with even deep black borders and a black spot at the end of the cell of the fore-wing adjoining the costal border. Cilia of both wings black ; lobe orange with some white hairs above and below. A faint white anteciliary line between the lobe and the lower median nervure. Under-side ashen-grey. Fore-wing with a clearly defined dark brown, nearly straight, ultra-median line bordered outwardly with a fine white line. Some submarginal shades between the median nervules. Hind-wing with a rich brown, broader, much broken line, reaching from the costa, near the apex, to the abdominal margin, where it is angled, outwardly bordered with a white line. A large reddish-orange patch at the anal angle and another near the margin, between the tails, containing a black pupil. Some whitish submarginal shades and a fine anteciliary black line. Cilia of fore-wing brown ; of hind-wing whitish, tipped with grey. Tails black, tipped with pure white.

Expanse,  $1\frac{1}{2}$  inch.

*Hab.* CHANCHAMAYO, Peru, 2,000-7,500 feet.

TYPE, Mus. Adams.

Not nearly allied to any species with which I am

\* *Thecla aura*, G. and S., B.C.A., Lep. Rhop., vol. ii, p. 60, Pl. LV, figs. 21, 22 (1887).



acquainted, but perhaps belonging to the same group as *T. thama*, Hew.\*

*Thecla joya*, Dognin.

*Thecla joya*, Dognin, Anns. Soc. Ent. Belg., 1895, p. 106.

*Thecla callao*, H. H. Druce, P. Z. S., 1907, p. 611, Pl. XXXVI, fig. 11.

*Hab.* ECUADOR, PERU.

*Thecla gamma*, sp. nov. (Plate XI, fig. 9.)

Upper-side. Both wings dull greyish-brown; inner-marginal area of fore-wing and basal, discal and anal areas of hind-wing pale dull greyish-blue. Cilia of both wings reddish-orange tipped with brown and chequered with white at the apex of the fore-wing. Under-side, ground colour brown. Fore-wing; a white mark closing the cell; apical and outer-marginal areas laved with white and speckled with dark red scales as also is the costa near the base. Hind-wing with a broad central pure white band commencing on the costa and reaching the inner margin just above the lobe where it is broken and less clearly defined. A pure white  $\gamma$ -shaped marking near the base surrounded by dark red. The outer-marginal half of the wing as well as the costa is thickly speckled with red scales. A red anteciliary line common to both wings. Cilia brown. Thorax and abdomen blue above, white below.

Expanse,  $\frac{2}{3}$  inch.

*Hab.* TUCUMAN, Argentine Republic (*P. Girard*).

TYPE, Mus. Druce.

Appears to be nearest to *T. sanguinalis*, Burm.,† of which we have a good series from Paraguay, but is quite distinct. I am unable to state positively the sex of the specimen described, but believe it to be a ♀. It has no trace of any differently placed scales at the end of the cell of the fore-wing. The figure is drawn  $1\frac{1}{2}$  times natural size.

*Thecla heodes*, sp. nov. (Plate XI, fig. 10 ♂, 11 ♀.)

♂. Upper-side. Fore-wing orange with the costa, apex and outer-margin rather narrowly brown; the inner-margin narrowly,

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\* *Thecla thama*, Hew., Ill. Diur. Lep., p. 189, Pl. LXXV, figs. 591, 592 (1877).

† *Thecla sanguinalis*, Burm., Lep. Répub. Argent, Pl. VIII, fig. 12 (1879).

and the basal area broadly, suffused, with greyish-white scales. Hind-wing brown; the outer-marginal area orange and the inner-marginal and basal areas suffused with greyish-white. An outer-marginal series of pale-blue patches placed on the nervules, which are brown. Cilia of both wings pale-brown. Under-side pale brown sprinkled with white scales; fore-wing with the discal area orange and a short band placed beyond the cell, composed of three confluent dark brown spots much as in *T. quadrimaculata*, Hew., but nearer to the apex. Hind-wing with an ultra-median linear dark brown irregular band commencing on the costa and reaching to the inner margin. Cilia grey.

♀. Upper-side brown with the median interspaces of the discal area brownish-orange. Hind-wing brown with the inner-marginal areas slightly dusted with bluish-white scales and a submarginal row of rather large dark brown spots inwardly crowned with orange. Under-side paler than in ♂, the short band on fore-wing placed lower down and the band on the hind-wing almost obsolete. Cilia, thorax and abdomen concolorous with wings.

Expanse, ♂  $1\frac{1}{2}$  inch. ♀  $1\frac{3}{16}$  inch.

*Hab.* ♂ URAMARCA, ♀ SAN MARCAS, Department of Ancachs, N. Peru.

TYPES, Mus. Adams.

Differs from *T. quadrimaculata*, Hew.,\* and its allies by the ♂ wanting the prominent patch of dark scales at the end of the cell of the fore-wing, and by the whitish shining basal areas on the upper-side.

Although the under-sides of the two specimens described present considerable differences, I think there is no doubt that they are sexes of one species.

\* *Thecla quadrimaculata*, Hew., Ent. Mo. Mag., 1874, p. 106; Ill. Diur. Lep., p. 208, figs. 695, 696 (1877).

#### EXPLANATION OF PLATE XI.

[See *Explanation facing the PLATE.*]

X. *A description of the Superior Wing of the Hymenoptera, with a view to giving a simpler and more certain Nomenclature to the Alary System of Jurine.* By CLAUDE MORLEY, F.Z.S.

[Read June 2nd, 1909.]

IT is with the hope of introducing something approaching uniformity into the very diversified names at present in use for the various wing cells and nervures of *Hymenoptera* that I lay this paper before the Society.\* The front wing alone is dealt with, since the lack of uniformity in the hind one renders any attempt to generalize upon its nervures unprofitable. It was mainly on two accounts that I have been led to study the subject—first, because I had myself committed (*loc. cit. post*) such egregious errors of nomenclature that they cried for redress; and second, because so much attention is now, at length, being accorded the Order that the psychological moment for attempting uniformity appears to have arrived.

Respecting the origin of the neuration, it is quite impossible to say anything of the least exact value. I had hoped to have discovered something to this purpose by an examination of the Order's palaeontology, but am satisfied that nothing is to be deduced therefrom.† Nor is it at all

\* My intimate friend, Mr. Ernest A. Elliott, F.Z.S., F.E.S., upon looking through the MS., writes to me: "You start with a 'hope of introducing uniformity,' and it is to be supposed that you want every one to use the terms proposed by you, or rather to accept your statement that this cell or that nervure is so-and-so, but no attempt is made to show why this set of names is better than any other, or more appropriate." This is most fair criticism; but I do not claim this set of names to be better or more appropriate than any other: I choose them purely for their simplicity, and all I aim at is uniformity in their adoption.

† Dr. Heer has described a single small wing from the Lias of the Swiss Alps as "Hymenopterous," but it more probably belonged to some other Order of insects, since no others have been discovered therein, even in localities where *Neuroptera*, etc., have occurred in plenty. The first authentic remains are in the Mesozoic Upper Oolite, whence five distinct species are recorded, three of which are referred to the genus *Apiaria* and one, doubtfully, to *Bombus*.

The chalk yields nothing; but in the Middle Eocene leaf-beds of  
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evident which families are to be regarded as of the oldest and most recent creation or development, unless we adopt the (to me inconsequent) theory that those of few species and aberrant conformation be such, in which case the

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Bournemouth some (apparently undescribed) *Hymenoptera* remains were found in the seventies.

It is, however, in the Upper Eocene—in the days when mammals first began to become the dominant animals, though long before man's creation—that we find fossils in any numbers. A collection of thirty-five wings was discovered at Gurnard Bay in the Isle of Wight, and of these Frederick Smith (Proc. Geol. Soc. Lond., Dec. 19, 1877) referred "the great majority" to the recent genera *Myrmica* and *Formica*. From strata of the same period near Aix, in Provence, eleven genera of *Hymenoptera*, representing such diverse families as the *Tenthredinidae*, *Ichneumonidae*, *Chalcididae*, *Formicidae*, and *Vespidae* were taken in 1829.

The Lower Miocene has produced only a single species of *Vespidae* from Switzerland, with *Apidae* and *Formicidae* from Rhenish Prussia. *Hymenoptera* began to take their rank as the most prolific Order in the Middle Miocene, whence, in the marls of Croatia, eighty-five species have been described by Heer, of which number fifty-seven appertain to the *Formicidae*, twenty-two to the *Ichneumonidae* (always, doubtless, *sensu latissimo*), and the remainder to the *Vespidae*, *Apidae*, and *Sphegidae*. The lacustrine Upper Miocene of Oeningen also has furnished eighty species (though this time against 508 beetles and 133 *Hemiptera*), with the "great majority" resting among the *Ichneumonidae*, *Formicidae* and *Apidae*. From the Tertiary strata of North America, Scudder has described *Ichneumonidae*, *Chalcididae*, *Formicidae* and *Myrmicidae*; and Heer, from the fragmentary Spitzbergen fossils, has brought forward two other species, *Hymenopterites deperditus* and *Myrmicium boreale*.

It is disappointing to find no *Hymenoptera* whatever in the Pleistocene beds, since these, like so many of the contemporary beetles, might be expected to represent forms still familiar to us; but elytra of Coleoptera will survive where the delicate tissues of bees and ichneumons comminute in such unstable deposits as boulder clay and brick earth.

Thus we see that after two groups of *Aculeata* comes an influx of most of the primary forms existing to-day and representing the three great sections—*Phytophaga*, *Entomophaga* and *Aculeata*. Then *Aculeata*, again, mingling in the superior Miocene with only *Ichneumonidae*, though Tertiary *Chalcididae* occur in America. When we consider the periods of time of these formations and the utter inadequacy of our knowledge, it is very plain that no reliable conclusions are to be drawn therefrom; and this is conclusively illustrated by the sudden appearance of all the main groups together *en bloc*, arguing long antecedent periods through which they had "evolved" into so similar a state to their present form that their families and often genera could thus be assigned. The *Hymenoptera* and *Lepidoptera* are usually regarded as the "youngest," *i. e.* most recently "evolved," Orders of insects; but I believe this to be simply owing to the destructible nature of their tegument.

*Evanidae*, as regarded by Mr. Bradley, would doubtless form one of the archaic types.

In the following catalogue of the wing cells and nervures I have attempted to synonymize the names applied to the various divisions by all the authors with whom I am myself familiar, and I will at once say that my sole object has been to arrive at a simple system, which is equally applicable to all sections of the Order. That I have neglected the works of many authors upon *Aculeata* and *Tenthredinidae* I am fully aware, and my excuse is that I am entirely persuaded that the simple venational structure was, as one would in the nature of things expect to be the case, the earliest form, and that from which the complex neuration of the sawflies on the one hand and bees on the other have sprung. Jurine attempted to bring the whole Order into line by tracing the venational development from his *Psilus* (nec *Galesus*, Curtis), through *Chalcis*, *Codrus*, *Omalus*, and the Aculeates, up to *Hylotoma*, of which "the wing is filled with its greatest complement of areolets." I am of opinion we shall arrive at a more natural system by tracing two branches, or better three, for the links with the sawflies appear quite lost, and these correspond peculiarly exactly with the *Entomophaga* (excluding *Phytophaga*) and *Aculeata* of Westwood, or, as modern authors are pleased to term them, *Ichneumonidea* and *Vespoidea*.

My conception of the ancestral wing of all *Hymenoptera* is a compound of those of *Bracon* and *Phygadeuon*. A comparison of these will reveal the actual conformity of their structure, though the nervures are so differently disposed that at first sight they appear entirely distinct. In the former, venation is entirely obsolete on the disc, failing to connect the cubital cells, *inter se*, in any way; and, in common with all Braconids, the second recurrent nervure is wanting. In the latter it is again the cubital nervure which is deficient, but this time at its base; it is continuous with the first recurrent nervure, its point of origin being indicated by the "nervelet" or "ramellus" only. This combination will give us the following neuration, traceable more or less in its entirety throughout the Order, as will be seen by the preceding wings, which are numbered in conformity with the following diagram. Additional nervures occur in the *Tenthredinidae*, and the number of cubital cells is multiplied in the *Aculeata*, of

which Shuckard regarded *Gorytes mystaceus* as possessing the most perfect type of Hymenopterous neuration.

From the diagram it will be seen that there are three BASAL cells, besides the PARASTIGMA, so rarely

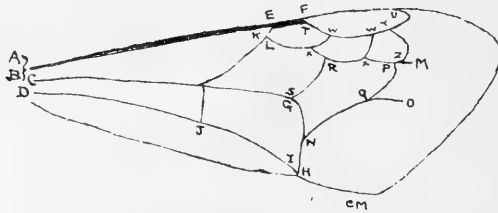


FIG. 1.—*Bombus terrestris*, Linn. (ACULEATA).

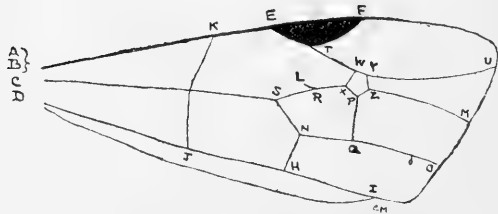


FIG. 2.—*Phygadeuon scoticus*, Marsh (ENTOMOPHAGA).

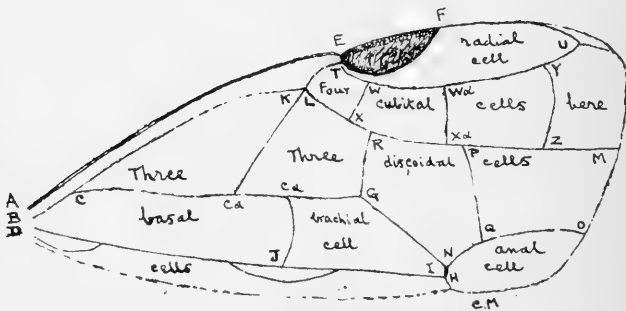


FIG. 3.—*Hylotoma ustulata*, Linn. (PHYTOPHAGA).

referred to in descriptions, though well developed in the phytophagous group, and, as remarked by Jurine, in Chalcis. The STIGMA is always a conspicuous object, never corneous in other Orders, and but feebly developed in the Neuroptera. The RADIAL cell is one of the most con-

stant. Lastly we come to the variable group of cells constituting Kirby and Spence's area intermedia, of which the areolae mediae vary in shape and constancy much more than the areolae apicales, though the latter are often pellucid or wanting. Here are three distinct longitudinal series of cells: those immediately beneath the radial are the CUBITAL and vary in number; beneath them are the DISCOIDAL; and approximating the inner margin of the wing are the ANAL at the apex and the BRACHIAL on its basal side. I have been at some trouble to satisfy myself upon the true relationship of the brachial cell; usually it has been considered to constitute one of the discoidal cells; but I am strongly of opinion that it belongs to the area basalis rather than to the area intermedia; in any case it

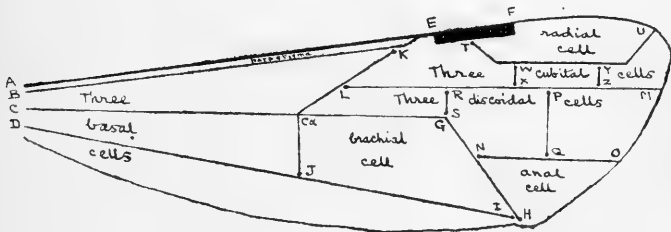


FIG. 4.—Diagrammatic Wing.

must not be commingled with the discoidal, but stand alone, in which case Thomson's name becomes most appropriate.

These cells are constituted by the intersection of the wing tissues by sustaining "nervures," in reality true circulatory veins. The front margin of the wing is always bounded by a strong sustaining COSTA, which may or may not be united with an adjacent and parallel POSTCOSTA. The corneous STIGMA is a strong muscle to sustain the more slender veins and assist in folding the wing. From some part of it the RADIUS runs in a curve to or near the apex of the wing. From the base two other elongate nervures extend to beyond the centre of the wing; the POSTICUS simply sustains the whole lower margin to the sinus, but the MEDIUS is the central nervure and usually goes direct to my point G; beyond this it has usually been regarded as distinct under the name of discoidal vein, etc., but I find that in the very great majority of cases it is

undoubtedly entire. Through the centre of the medius runs a transverse nervure, termed the *BASALIS*, which is not always continuous, but sometimes coalescent for a greater or less distance with the medius. From the supra-basal a nervure runs more or less straightly to the external margin of the wing in a direction somewhat parallel with the radius; this is the *CUBITUS*, and it is attached to the radius by one or more transverse nervures, termed the *INTERCUBITI*, since they divide up the cubital cell into two or more sections. Parallel with the cubitus and below it is the *ANALIS*, also extending to the outer margin, but rising at some point on the externo-medius. Lastly, one or two *RECURRENT* nervures are seen, of which the first always runs from the point G in the medius to some point on the cubitus, and the second, when present, from some point on the analis to the cubitus further from the base than the first.

Thus we find but nine main nervures and two series of transverse (the intercubiti and recurrenti) in a typical wing. It is, consequently, remarkable to what extent these have been renamed by the various authors, and gives one some idea of the chaos from which the law of priority—unfortunately inapplicable here—has saved zoological nomenclature.

#### SYNONYMIC CATALOGUE OF TERMS.

##### COSTA (A-E).

Le bord externe, Jur.  
 Costa, Latr. et auctt.  
 Nervus costalis, Fall., Dahlb.  
 Bord extérieur, Lep.  
 Neura costalis, K. & S.  
 Margo anticus, radius, Gr.  
 Ire nervure humérale, Wesm.  
 Radius supérieur, Lep.  
 vorderrand, Först.

##### POSTCOSTA (B-E).

cubitus, Jur.  
 Postcosta, Latr., Thoms.  
 Nervus auxillaris, Fall.  
 Neura postcostalis, K. & S.  
 Cubitus supérieur, Lep.  
 Subcostal nervure, Cam.  
 Postcostal nervure, Saund.

##### STIGMA (E-F).

Le point ou carpe, Jur.  
 Punctum costale, Fall.  
 Stigma, Grav.  
 Stigmate, Wesm.  
 Le point épais, Lep.  
 Randmal, Först.

##### RADIUS (T-U).

Radius, Lep., Wesm., etc.  
 Radialader, Först.  
 Nervus marginalis, Thoms.  
 Radial nervure, Marsh.  
 Marginal nervure, Saund.

##### POSTICUS (D-I).

Neura analis, K. & S.  
 3me nervure humérale, Wesm.



- 2nde nervure intermédiaire, Lep.  
 Hinterader or vena postica, Först.  
 Brachium, Thoms., Schm.  
 Accessory nervure, Cam.  
 Pobrachial nervure, Marsh.  
 Anal nervure, Marsh., Shuck.  
 Posterior nervure, Saund., Morl.  
 Brachius et humerus, Morice.  
 Submedian or anal, Kief.  
 Anal vein, Bradley.
- MEDIUS (C-G-I).**  
 C-Ca. Nervure brachiale, Jur.  
 Nervus internus, Latr.  
 Cubitus, K. & S.  
 Nervus radians, Dahlb.  
 2nde nervure humérale, Wesm.  
 1re nervure intermédiaire, Lep.  
 Mittalader, vena media, Först.  
 C-G. Median, Berth., Morl.  
 Cubitus, Thoms., Schm.  
 Median nervure, Cam., Kief.  
 Praebrachial, Marsh.  
 Medius, Morice.  
 Externo-medial, Bradley.  
 G-I. Humeralquerader, Först.  
 N. recurrens interior, Thoms.  
 Median nervure, Cam., Schm.  
 Anal nerve, Morice.  
 First recurrent, Morl.  
 First discoidal, Kief.  
 Ca-I. Discoidal vein, Bradley.  
 Discoidal nervure, Shuck.
- BASALIS (J-K).**  
 Basal nervure, Saund., Morl.  
 J-Ca. Nervus connectens, Dahlb.  
 Die 1 humeralquerader, Först.  
 N. transversus ordinarius, Thoms.  
 Pobrachial transverse, Marsh.  
 Medio-discoidal, Marsh.  
 Areal nerve, Morice.  
 Transverse median, Kief.  
 Nervulus, Schm.  
 Transverse median, Bradley.
- Ca-K. Grundader, vena basalis, Först.  
 Vena basalis, Thoms.  
 Praebrachial transverse, Marsh.  
 Margino-discoidal, Marsh.  
 Discoidal nerve, Morice.  
 Basal nervure, Kief.  
 Nervus basalis, Schm.  
 Externo-medial (part), Shuck.  
 Basal vein, Bradley.
- CUBITUS (L-M).**  
 Cubitus, Lep., Wesm., Bradley, etc.  
 Cubitus inférieur, Lep.  
 Cubital nervure, Shuck., Cam.  
 Cubitalader, Först.  
 Isto. nervus spurius, Thoms., Schm.

INTERCUBITI (W-X ; Y-Z).	Nervus parallelus, Schm.
Nervi transversi, Fall.	Subdiscoidal vein, Bradley.
Nervus connectens, Dahlb.	
Transverso-cubital n., Shuck., Kief.	RECURRENTES (R-S ; P-Q).
Transverse cubital n., Marsh.	Nervures recurrentes, Jur.
Intercubital transverse, Marsh.	Anastomoses medii alae, Latr.
Submarginal nervures, Saund., Morl.	Nervi recurrentes, Dahlb.
Cubital nerves, Morice.	Recurrent nervures, Shuck., Cam., etc.
Transverse cubitus, Bradley.	Disco-cubitalader und Die 2 discoidalquerader, Först.
ANALIS (N-O).	Ramellus super. cubiti et N. recurrens exterior, Thoms.
Nervure parallele, Wesm.	Interior discoidal, Marsh.
Subdiscoidal nervure, Shuck.	Medial nerves, Morice.
Mittalader (part), Först.	Internal cubital and Second recurrent, Morl.
2o. nervus spurius, Thoms.	Transverso-discoidal, Kief.
Second recurrent (part), Cam.	Nervus discoidalis et N. recurrens secundus, Schm.
Anal nervure, Marsh., Morl.	Recurrent veins, Bradley.
Posterior nervure, Marsh.	
Medius (apex of), Morice.	
Discoidal nervure, Kief.	

The principal authors upon Hymenopterous Neuration are: (1) *Jurine*—Nouvelle Méthode de Classer les Hyménoptères, 1807 (*cf.* also his Observations sur les ailes des Hyménoptères, in the Mém. Ac. Turin, 1820, p. 117); (2) *Latreille*—Genera Crustaceorum et Insectorum, iv, 1807; (3) *Fallen*—Specimen novam Hymenoptera disponendi methodum exhibens, 1813; (4) *Lépeletier de St. Fargeau*—Encyclop. Méthodique, v, 10, 45 (partie Insectes, 1825); and in his Histoire Naturelle des Insectes Hyménoptères, 1836; (5) *Kirby and Spence*—Introduction to Entomology, vol. iv, 1826; (6) *Gravenhorst*—Ichneumonologia Europaea, 1829; (7) *Nees von Esenbeck*—Monographia Hymenopterorum, 1834; (8) *Dahlbom*—Exercitationes Hymenopterologicae, 1831; (9) *Wesmael*—Monographie Braconides de Belgique, in Nouv. Mém. Ac. Bruxelles, 1835-38; (10) *Shuckard*—A Description of the Superior Wing of the Hymenoptera, with a view to give a fuller and more certain Development to the Alary System of Jurine, in the Trans. Ent. Soc. 1836, pp. 208-14; (11) *Förster*—Monographie der Gattung Campoplex Grav., in the Verh. z.-b. Ges. Wien, 1868, p.

874 (*cf.* also his Ueber den systematischen Werth des Flügelgeäders bei den Insekten und insbesondere bei den Hymenopteren, in Programm der Realschule J. O. zu Aachen für 1876-77); (12) *Thomson*—Opuscula Entomologia, v, 1873, p. 455, etc.; (13) *Cameron*—British Phytophagous Hymenoptera, 1882; (14) *Marshall*—Monograph of Brit. Braconidae, in Trans. Ent. Soc. 1885 [N.B.—The Horismology in this fine work is based on Halliday's somewhat intricate Tabula Orismologica alarum ad Ichneumonidas imprimis applicata (Ent. Mag. 1838, p. 209), wherein are synonymized the terms used by Nees, Lacordaire, Jurine, Lepeletier and his own earlier papers; Bridgman and Fitch have also attempted to utilize these terms when dealing with the Ichneumonidae (sensu stricto) in Entom. 1880, p. 29]; (15) *Marshall*—André's Braconides d'Europe, 1888; (16) *Saunders*—Hym. Aculeata of the Brit. Isles, 1896; (17) *Morice*—Konow's Nomenclature for the Tenthredinidae, in Ent. Month. Mag. 1903, p. 47; (18) *Morley*—Ichneumonologia Britannica, vol. i, 1903; (19) *Kieffer*—André's Proctotrypidae d'Europe, 1904 (*cf.* also André, Spp. des Hym. d'Europe et d'Algérie, etc., vol. i, 1879, p. lxii, *et seqq.*); (20) *Schmiedeknecht*—Die Hymenopteren Mitteleuropas, 1907, p. 542 (*cf.* also Mayr's Formicina Austriaca, in Verh. z.-b. Ges. 1855, p. 273; and Ernst Adolph's Ueber Insectenflügel and Zur Morphologie der Hymenopterenflügel, in Nova Acta Leop Akad., 1870, p. 231; 1879, p. 293; and 1883, p. 41); (21) *Bradley*—On Evaniidae, in Trans. Amer. Ent. Soc. 1908, p. 101 (*cf.* also Comstock and Needham's Wings of Insects, in Amer. Nat. 1898 et 1899, and Macgillivray's Study, in Proc. U.S. Nat. Mus. 1906, p. 569; but also *cf.* Woodworth's excellent Wing Veins of Insects, in Californian Univ. Bull. 1906, pp. 1-152).



XI. *New Genera of British Mymaridae (Haliday)*. By  
 FRED. ENOCK, F.L.S., F.E.S., F.R.M.S.

[Read October 6th, 1909.]

PLATES XII—XV.

It is with no small amount of pleasure that I am able to bring before the notice of entomologists eight genera of Mymaridae, new to science.

Perhaps before entering into particulars I may be allowed to say that, with one or two exceptions, no entomologist has taken up the study of this much-neglected family of insects, since the year 1833, when Andrew Haliday first established it. We are not, therefore, surprised to find that in our own Entomological Society there are members who are quite unaware of its existence, so I may be excused for saying that this small family is composed, so far as we know, of microscopic *Hymenoptera*, whose larvae are ovivorous in their habits.

Possibly their microscopic size has been the cause of the neglect and want of interest shown by British entomologists. Haliday, after arranging the few species into seven genera, seems to have given up their study and passed on his manuscript to Mr. Francis Walker, who in 1846 increased the genera to twelve and the species to thirty-five. ("Annals and Magazine of Natural History," vol. xvii, p. 49, 1846.)

Following this in 1847, Foerster still further increased the genera to fifteen and number of species doubtful—the additional genera being found in Germany—but neither Haliday, Walker nor Foerster published any illustrations, only short descriptions from which it was impossible to identify many of the species referred to.

Such was my own experience when in 1872 I commenced my own observations from a simple exhibit by Mr. Frederick Fitch at the Quekett Microscopical Club. Under the microscope was shown "A Fairy Fly in a Spider's Web." It was illuminated on a black background, which gave it the most wonderful appearance, every limb, each

tiny hair and the long cilia resembling brilliant silver. It was a most fascinating object to any one, and speaking for myself, I had never before seen anything to compare with its delicate fairy-like structure. I then and there determined to know more about its relatives. Next day I searched the spiders' webs in my garden at Holloway and found quite a number of several species, which I mounted in Canada balsam.

During August and September of that year, 1879, I obtained from the same source, and running up windows in houses and conservatories, some dozens of specimens—which our fellow member and then Secretary, Mr. E. A. Fitch, named for me and set me in the right track for further information—but this was too soon exhausted, and though I made great efforts to discover what had become of Haliday's and Walker's MSS. I utterly failed—but went on adding to my collection.

On removal in 1882 to Woking I very soon found I was in the land of plenty for *Mymaridae*, which simply swarmed on the windows of the house and in a very small conservatory—where I caught seven of the new genera which I am introducing for the first time to-night.

In 1895, *at last*, I heard that Haliday's Type Collection of *Mymaridae* was in possession of the Dublin Museum, and which, by the great kindness of Dr. Scharf, I was permitted to examine at my leisure, "all that was left of them," less than one hundred.

It was a most disappointing examination, for of the special type wanted not one was to be found—only the very commonest species remained, and they were so encrusted with dirt and crystals of sorts that it was utterly impossible to identify species. Before returning the collection, I made most careful drawings under the microscope of the *wings* of every specimen which *had* wings left, as I consider they will prove to be the best guide to classifying the species. I must not dismiss Haliday's Collection without mention of one specimen, which Haliday has named *Panthus*, showing a peculiarity of the marginal branch. Dr. Scharf gave me permission to remove this specimen from the card, and mount it in Canada balsam, and when under the microscope I was enabled to identify it with Walker's description of the genus *Limacis*, the balsam bringing out the number of joints in antennae and tarsi in its own peculiar way.

The microscopic drawings, though tedious to do, brought out valuable characters which I considered would be of the greatest help whenever I could spare time to begin my monograph—which I have long considered my duty to do—and follow out the hope expressed by Francis Walker, who (in the "Entomologist" for 1872-73, vol. vi) wrote: "From the number of specimens which I have observed, I believe that the *Mymaridae* are considerably more numerous than what has been recorded. Their exquisite elegance would appear to advantage in highly magnified figures of each kind, and one of the 'coming race' of entomologists will do well to investigate their successive epochs of life and to publish his discoveries with illustrations." Ever since I read this, I have felt that this message appealed peculiarly to myself, as I had been so long engaged in microscopic work, as well as microscope drawing, but owing to increasing weakness of sight I was obliged to give up drawing the *Mymaridae*, but, like many other apparent disappointments, this turned out for the best, as it riveted my attention to photography, more especially photo-micrography, which I have since proved is the only means whereby the microscopic structure and form of the wings of the *Mymaridae* can be truthfully shown, the extreme minuteness of the species rendering them most apt subjects for photo-micrography, for no drawings can be trusted for minute structural detail.

For the past three years I have received the most valuable help in the way of carded specimens and naming the genera, from our late President, Mr. C. O. Waterhouse, who has, I am delighted to say, become captivated by these Fairy Flies, and with whom I look to both capturing many new species as well as co-operating in my monograph on our British *Mymaridae*, which are to be found almost everywhere and anywhere, in the most unlikely places, such as the corners of a top sash bar in a conservatory at Holloway where, ten years ago, I captured a male *Doriclytus*, new to Great Britain, and last August, another new genus on the self-same pane of glass, as well as a female *Doriclytus*. These facts prove that there is no royal road to success. Only additional *workers* are needed to bring out the many unrecorded genera and species which are waiting to be captured and recorded.

At some future time I hope to bring before the Entomological Society some of the facts in the life-history

of such species as I have been enabled to work out in the past thirty years.

### STETHYNIUM, n. gen.

*Tarsi* 4-jointed; abdomen sessile. *Antennae* of male 13 joints, the female 11 joints, including the club, composed of three joints. Scape twice as long as broad, having a number of circular concavities. *Wings* broad and symmetrically curved on costa and inner margin. *Cilia* very long.

#### *Stethynium triclavatum*, n. sp. (Pl. XII, figs. 1-5.)

General colour, light testaceous. *Antennae* of the male, 13 jointed. The scape much swollen on the outer side, twice as long as broad, with a number of circular concavities. The pedicel cup-shaped, as broad as long. The 3rd as long as the 2nd. The 4th to the 13th of about equal length. The 12th and 13th joints forming a narrow club. The whole of the antennae testaceous. *Antennae* of the female 11 joints in all, including the club of 3 joints. The scape testaceous, becoming darker. The outer side much swollen, the surface pitted with a number of circular concavities. The pedicel equal in length and breadth, the 3rd and 5th joints the same length and cylindrical, the 4th slightly longer, the 6th, 7th and 8th a little shorter and broader. The club equal in length to the 2nd, 3rd and 4th, combined, is composed of 3 joints, the second articulation commencing at right angles from the upper side to the centre, then turning off in a curve towards the tip, emerging at the lower side about three-quarters the length of the club. The 2nd articulation emerging just before the tip, giving the three joints somewhat of a flabellate appearance.

The *head* is broader than the thorax, which is longer than the abdomen.

The *wings* of the male are 0·8 mm. long by 0·23 mm. broad. The longest *cilia* 0·23 mm. Those of the female are 0·7 mm. long by 0·2 mm. broad. The curves of both male and female wings are symmetrical, uniting in an obtuse angle.

The ovipositor projecting just beyond the tip of the abdomen.  
Length 0·7 mm.

*Hab.* WOKING: September 1885 (*Fred. Enock*); SOMERSET (*Dr. Gooch*).

This species somewhat resembles some of the *Anagri* in its colour and form, but is quite distinct in the number of



the joints in the antennae of the female, as well as the decided form of the wings.\*

### CLERUCHUS, n. gen.

*Tarsi* 4-jointed. The abdomen sub-sessile. The antennae of the male 13 joints; of the female 9 joints. The scape is very long. The apical joint forming an elongated elliptical club.

The scape springing from a very decided ridge, projecting from between the eyes; giving the head a somewhat flattened appearance.

The *wings* are almost destitute of surface hair, with the exception of a central row running from the base to the tip. The cilia are very long and slender. The anterior wings are narrow, parallel from near the base to just before the apex, where they gently curve down. The posterior wings a very little shorter than the anterior, and about half the width and parallel.

The *ovipositor* projecting beyond, and the tip rising above the abdomen.

### *Cleruchus pluteus*, n. sp. (Pl. XII, figs. 6-10.)

General colour, smoky brown; the *head* and front part of the *thorax* darker.

The *antennae* of the male, 13-jointed, are dark brown, the joints slightly increasing in length to the apex: those of the female, nine in number, are brown, paler at the base. The scape very long and compressed, curved and tapering to the base, which springs from a projecting ridge between the eyes. The pedicel is short and broad, the 3rd joint very short, the 4th almost twice as long as the 3rd, the 4th, 5th and 6th equal in length, the 7th and 8th a trifle shorter and broader.

The club the same length as the scape.

The *wings* smoky brown, 0.6 mm. in length by 0.075 mm. in

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\* Mr. Waterhouse has furnished me with the following note on the colour of a fresh male specimen of this genus, apparently referable to the same species, taken by him in Richmond Park on Oct. 23rd on *Juncus glaucus*—

“*Head* pale dirty yellow, the ridge between the eyes nearly black; the three large ocelli are also nearly black. *Thorax* light smoky brown, with a pale dirty yellow dorsal line. The metanotum has the appearance of being slightly excavated, with a pale yellow membrane across it. *Abdomen* rather darker brown than the thorax. Legs pale yellow, the apical joint of the tarsi pale fuscous. *Antennae* pale dirty yellow, the basal joint clear yellow.

“Length 0.75 mm.”

width, the longest cilia 0·2 mm. The *legs* somewhat short, the femora compressed.

Length 0·6 mm.

*Hab.* WOKING: July 1885; LOUGHTON: July 1897 (*Fred. Enock*); BURNHAM BEECHES: 1908 (*C. O. Waterhouse*).

#### PARALLELAPTERA, n. gen.

*Tarsi* are 4-jointed. The *abdomen* sessile. The antennae of the male 11 joints, of the female 8 joints.

The *wings* are without any surface hairs and almost parallel; the posterior wings are the same length as the anterior.

The *ovipositor* projecting beyond the apex of the abdomen.

*Parallelaptera panis*, n. sp. (Pl. XIII, figs. 1-5.)

*Head* dark brown; the thorax and abdomen lighter. The *antennae* of the male 11 joints, of the female 8 joints—testaceous. The scape somewhat slender; the pedicel the same width as the scape in the centre; the 3rd and 4th joints the same length, cylindric, the 5th joint much longer, the 6th longer than the 5th and the 7th equal to the 3rd, 4th and 5th combined. The club equal to the 6th and 7th combined and having two ridges running down half its length, and twice as broad as the funicular joints. The base and tip slightly pointed; the sides parallel; the eyes dark. The *thorax* longer than the abdomen. The *wings* quite clear of all surface hair, rounded on the outer margin, the anterior *wing* is 0·45 mm. long by 0·33 mm. broad, the sides almost parallel. The cilia long, the longest 0·2 mm. The *tarsi* much longer than tibiae.

Length 0·6 mm.

*Hab.* WOKING: September 1885 (*Fred. Enock*).

This and the preceding new genus are quite distinct in the shape of the wings from any of those hitherto recorded.

#### ERYTHMELUS, n. gen.

The *tarsi* are 4-jointed; the *abdomen* sessile; the *antennae* of the male 13 joints, of the female 9 joints. The scape is long, the same length as the club, which is pointed. The *wings* are straight on the costa, and very much swollen on the inner margin. The anterior wing is 0·65 mm. in length by 0·16 mm. in width; the longest cilia 0·16 mm. The *ovipositor* projecting just beyond the apex of the abdomen.

*Erythmelus goochi*, n. sp. (Pl. XIII, figs. 6-10.)

The *head* and *thorax* black; the sides yellowish. The *legs* and basal half of *abdomen* yellowish; the apical half black. The *antennae* of the male are 13-jointed and of one length and width throughout, with 4 longitudinal ridges. The *thorax* very long. The *antennae* of the female are 9-jointed; the scape is very long; the pedicel much broader than the scape; the 3rd and 4th joints the same length; the 5th a very little broader and longer; the 6th and 7th broader but same length; the 8th equal to the 5th and 6th together. The club long and pointed, only slightly broader than the 8th and equal in length to the 2nd to 6th combined. The *thorax* is long, but shorter than the abdomen. The *tarsi* of the front legs are much longer than the tibiae, the middle tarsi and tibiae about the same length; the hind tibiae and tarsi are longer than the others. The *wings* are 0.65 mm. long by 0.16 mm.; from the widest point to the apex the surface is slightly hairy; the longest cilia 0.16 mm., the *ovipositor* projecting a little beyond the apex.

Length 0.8 mm.

*Hab.* SOMERSET (*Dr. Gooch*); HOLLOWAY, LONDON, N.: August 1908 (*F. Enock*).

## DICOPUS, n. gen.

The *tarsi* 5-jointed; the *abdomen* sessile. The *antennae* of the female 10 joints. The scape compressed with three angular projections on the upper edge, the space between the first and second gently sinuate, the basal projection not so prominent as the others. The *wings* 0.4 mm. in length and 0.05 mm. in width. The cilia very long, the longest 0.23 mm. The *ovipositor* very minute and short, just level with tip of abdomen.

The male is at present unknown.

*Dicopus minutissima*, n. sp. (Pl. XIII, figs. 11, 12, 13.)

General colour, testaceous; the *head* slightly broader than the *thorax*; the *antennae* of the female pale testaceous, the scape compressed with three angular projections on the upper edge, the space between the first and second gently sinuate, the basal projection not so prominent as the other. The pedicel half as long as the scape, as broad as the scape across the prominences—the 3rd and 4th joints are about equal length. The 5th and 6th equal length, the 7th, 8th and 9th shorter, but broader. The club equal in length to the 6th, 7th, 8th and 9th combined. The *wings* are very delicate and oar-

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shaped; the anterior 0·4 mm. long by 0·05 mm. broad; the cilia of great length; the longest 0·23 mm. The *legs* light testaceous, the tibiae longer than the tarsi, the tarsal joint minute and of equal length. The *ovipositor* just level with the tip of the abdomen.

Length 0·4 mm.

*Hab.* WOKING: September 1885 (*Fred. Enock*).

#### ENAESIUS, n. gen.

The *tarsi* are 4-jointed, the abdomen sessile; the *antennae* of the male are 13-jointed; of the female 9-jointed. The scape long, narrow and hairy. The wings 0·85 mm. in length, by 0·175 wide; the basal quarter of the anterior wings devoid of surface hairs. The *ovipositor* level with apex of abdomen.

#### *Enaesus agilis*, n. sp. (Pl. XIV, figs. 1-5.)

General colour, almost black or dark brown; the *antennae* of the male 13-jointed, brown throughout; of the female 9-jointed, the scape very long; the pedicel about the same length as the 3rd, 4th, 5th and 7th joints the same length, the 6th and 8th a little longer, the club increasing in width from the base, the tip rounded. In the male the 3rd to the 12th joint inclusive, are of the same length—the 13th slightly shorter—all of one width. The *head* is about the same width as the thorax, the eyes rounded; the wings 0·85 mm. long by 0·175 broad; straight on the costa and much swollen on the inner margin; the longest cilia 0·175 mm.; the apical half covered with coarse surface hairs. The *legs* of the male have dark brown femora in the centre, the front tibiae testaceous, the trochanters very long and cylindrical. The femora of the front legs of the female are brown changing to testaceous at the base and tips; the middle legs with the basal half of the tibiae testaceous, brown at the tips, the tarsi testaceous to brown. The hind femora brown, testaceous at the tips and trochanters; the tibiae testaceous, brown at the base, the tarsi brown. The abdomen of the female testaceous at the base; the rest dark brown; the *ovipositor* level with the tip.

Length 1 mm.

*Hab.* WOKING: September 1885 (*Fred. Enock*); BROAD-STAIRS: 1908 (*C. O. Waterhouse*); RICHMOND PARK: August (*Fred. Enock*); 1909, I. OF WIGHT (*C. O. Waterhouse*).

#### *Enaesus laticeps*, n. sp.

General colour, brown; the *antennae* of the female 9-jointed (the male not yet known), the scape very long; light testaceous, t e

pedicel about the same length as the 3rd joint. The 3rd, 4th, 5th and 7th the same length; the 6th and 8th longer, the club long, shuttle shape, brown. The head very wide, 0·2 mm. by 0·125 mm. The eyes rounded; the *thorax* narrower than the head; the *wings* 0·85 mm. long, by 0·175 mm. broad, straight on the costa, and much swollen on the inner margin; the longest cilia 0·175 mm., the apical half covered with coarse surface hairs. All the femora slightly darker in the centre, the other parts light testaceous. The *abdomen* testaceous at the base, the rest brown; the *ovipositor* level with the tip.

Length 0·9 mm.

*Hab.* WOKING: September 1885 (*Fred. Enoch*).

### STEPHANODES, n. gen.

The *tarsi* 4-jointed; the *abdomen* petiolate. The *antennae* of the male 13-jointed, of the female 9-jointed; the scape in both sexes asperate. The *wings* 1·3 mm. long and 0·31 wide; cilia short, the longest 0·11 mm. Inner margins of eyes bounded by carinae which run three-quarters round the eyes, and smoothing down level at the lower margin. The *ovipositor* level with the tip of the abdomen.

*Stephanodes elegans*, n. sp. (Plate XIV, figs. 6–11.)

General colour, intense black.

The *tarsi* 4-jointed. The *abdomen* petiolate. The *head*, *thorax* and *abdomen*, smooth and shining; intense black. The *head* almost square with well-rounded corners, slightly depressed between the antennae; the margins of the eyes, except on the outside, surrounded by a small carina, running out level above and below the eyes, which are rounded the same curve as the cheeks. The *antennae* of the male 13 joints. Scape asperate in both sexes. The pedicel half the length of the scape; light testaceous; the 3rd joint about the same colour as scape—brown; the 4th to 13th very dark brown and joints of equal length. The scape and pedicel of the female similar to the male; the 3rd joint a little longer than the 2nd, the 4th darker and longer; the 5th and 6th shorter and darker, the 7th and 8th short, dark and thicker, the club darker, and twice as broad as the 8th and longer than the 7th and 8th combined. The *thorax* oval; the petiole testaceous. The *wings* 1·3 mm. long by 0·31 mm. broad. The cilia very short; the longest cilia 0·11 mm. The outer margin almost semicircular. The surface evenly covered with short hairs. The front *tarsi* longer than *tibiae*; the 4th joint brown; the 1st joint equal to 2nd, 3rd and 4th combined, the middle and hind *tibiae* a

little longer than the tarsi. The *ovipositor* just level with the tip of the abdomen.

Length 1.15 mm.

*Hab.* WOKING: July 1885 (*Fred. Enock*); SOMERSET (*Dr. Gooch*); BURNHAM BEECHES: 1907 (*C. O. Waterhouse*).

This species at first sight resembles a *Cosmocoma*, but the totally different "gait" from the insects of that genus gave us the first impression that it was something new, which the peculiar asperate scape and carina confirmed. This beautiful species is one of the most elegant and fairy-like in its movements.

### OOPHILUS, n. gen.

The *tarsi* 4-jointed; the abdomen sub-sessile. The *antennae* of the male 13-jointed, those of the female 11 joints. The *wings* large and ample, 1.35 mm. long  $\times$  0.5 mm. broad; the cilia very short, the longest 0.1 mm. The *ovipositor* very long, projecting 0.25 mm. beyond the tip of the abdomen.

#### *Oophilus longicauda*, n. sp. (Plate XV, figs. 1-6.)

The general colour black.

The *head* slightly narrower than the *thorax*; the *antennae* of the male 13-jointed, black and 1.65 mm. long. The *scape* very long and compressed, centre is black, the base and tip yellowish; the 4th to 11th joints of equal length and thickness, the 12th and 13th a little shorter; the pedicel yellowish in the female; the club longer than the *scape*; the joints 3 to 11 gradually increasing in length and breadth; the club 0.2 long, the lower edge serrated. The *thorax* slightly broader than the head. The *wings* broad, 1.35 mm. long  $\times$  0.5 broad, of a milky colour, the outer margin very slightly flattened. The cilia very short, the longest 0.1 mm., the inner margin straight, the surface covered with short hairs; the *femora* of the female compressed, with yellow tips and bases, black in the middle. Front tibiae shorter than tarsi. The *abdomen* long and tapering to tip; the *ovipositor* very long, powerful, projecting 0.25 mm. beyond the apex.

Length 1.6 mm.

*Hab.* RICHMOND PARK, SURREY: July (*Fred. Enock* and *C. O. Waterhouse*) 1908.

### DORICLYTUS, Förster, *Linnaea Ent.*, II, 1847, p. 226.

The *tarsi* 4-jointed; the abdomen petiolate. The *antennae* of the male 13-jointed, of the female 9-jointed; the wings 1.13 mm. long

by 0.275 broad, the cilia long. The tarsi of the front, middle and hind legs longer than tibiae, those of the hind pair are the longest, viz. tibiae 0.35 mm., tarsi 0.5 mm. The *ovipositor* projecting beyond the tip of the abdomen, which is pointed at the base and tip.

*Doriclytus vitripennis*, Förster.

General colour black. The *antennae* of the male 13-jointed, of the female 9-jointed. The joints of the male are long and narrow. From the 3rd to the 12th of about the same length, the 13th a little shorter, the scape long and slender, the pedicel about half the length of the scape, and of a slightly lighter colour. The *antennae* of the female varying in colour from the pedicel which is light testaceous to the club, of intense black; the 3rd joint is the shortest and narrowest, the club as long as the 3rd and 4th combined. The *head* is wider than the *thorax*. The *wings* long and curved on the costa and inner margin, the curve of the outer margin forming an obtuse finish. The anterior wing is 1.13 mm. long  $\times$  0.275 broad. The longest cilia 0.23 mm., the surface covered with short hairs. The *legs* form good characteristics of this genus, all the tarsi being much longer than the tibiae—those of the hind legs are 0.5 mm. long, against 0.35 mm. of the tibiae. The front edge of the tibiae of the front legs is armed with sharp projections, surmounted by a fine hair; the femora and tibiae are black, with testaceous tips and bases; the tarsi light testaceous, the 4th joint brown and the 1st much the longest. The trochanters black, the coxae yellowish. The petiole is testaceous. The *ovipositor* projecting slightly beyond the tip of the *abdomen*, which is pointed both at the base and tip.

Length 1 mm.

*Hab.* HOLLOWAY, LONDON, N.: ♂ July 1897; ♀ July 1908 (*Fred. Enock*).

Both species caught on the same pane of glass, with an interim of eleven years.

This genus, new to Great Britain, was first established by Förster in 1847.

It is near to *Cosmocoma*, but the very long tarsi separate it from that genus.

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EXPLANATION OF PLATES XII—XV.

[See *Explanation accompanying the PLATES.*]





XII. *On a new genus and species of Noctuidae from Britain.* By Sir GEORGE F. HAMPSON, BART., F.Z.S., etc.

[Read October 6, 1909.]

PLATE XVI.

Genus PEUCEPHILA, nov.

Type, *P. eissoni*.

*Proboscis* fully developed; *palpi* obliquely upturned, the second joint extending to about middle of frons and fringed with long hair in front, the third short; frons smooth; *eyes* large, round, strongly hairy, not overhung by cilia; *antennae* of female ciliated; *head* and *thorax* thickly clothed with hair and hair-like scales, the prothorax with large, sharp, triangular crest; the metathorax with spreading crest; *tibiae* fringed with hair above and without spines; *abdomen* with dorsal series of hairy crests. *Fore-wing* with the apex rectangular, the termen evenly curved, crenulate; veins, 3 and 5 from near angle of cell; 6 from upper angle; 9 from 10 anastomosing with 8 to form the areole; 11 from cell. *Hind-wing* with veins 3·4 from angle of cell; 5 obsolescent from middle of discocellulars; 6·7 from upper angle; 8 anastomosing with the cell near base only.

PEUCEPHILA EISSONI, sp. n.

♀. Head and thorax grey mixed with dark brown; antennae whitish; abdomen flesh-pink, greyish at base, the crests dark brown mixed with grey; palpi, pectus, and ventral surface of abdomen flesh-pink; legs brownish ochreous, the tarsi with fuscous bands. Fore-wing flesh-pink tinged with brown, the costal area suffused with grey-white leaving the costal edge pinkish, the veins streaked with grey-white, the terminal area whitish with pinkish patches in the interspaces, especially towards apex; traces of a wavy brown subbasal line from costa to submedian fold; ante-medial line blackish at costa, then indistinct, brown, oblique, sinuous; claviform small, blackish filled in with grey scales; orbicular and reniform grey-white defined by blackish, incompletely above and below, the former small, round, the latter somewhat quadrate and with some flesh-colour in its upper part; traces of a sinuous dark medial line

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oblique from costa to reniform and inwardly oblique from lower angle of cell to inner margin; postmedial line blackish, bent outwards below costa, then obsolescent, dentate and produced to short black streaks on the veins, excurved to vein 4, then oblique; subterminal line whitish, obsolescent towards costa and dentate to termen at veins 4+3, some dark suffusion before it; cilia pink with slight whitish line at middle and whitish tips. Hind-wing ochreous white with a slight fuscous tinge at upper angle of cell, short postmedial black streaks on veins 7 to 2, and a fuscous tinge on subterminal area between veins 4 and 2; cilia tinged with reddish ochreous except at tips. Underside of both wings ochreous white, the costal and terminal areas strongly tinged with flesh-pink, a postmedial series of short black streaks on the veins.

*Hab.* SCOTLAND, Aberdeen (*L. G. Esson*), 1 ♀ type. *Exp.* 40 mill. VII.

The unique female was taken at sugar in July of this year on the trunk of a pine in a pine-wood eight miles from Aberdeen by Mr. L. G. Esson, a most energetic and careful naturalist, who is to be much congratulated on his interesting discovery, and who, it is to be hoped, will next year turn up other specimens of this fine addition to the British fauna. The specimen is obviously only just emerged from the pupa, and its coloration irresistibly suggests that it habitually rests on the trunks of pine-trees. It belongs to the *Hadeninae*, the hairy-eyed subfamily of the *Noctuae trifinae*, and is a development from *Perigrappa* and *Monima* (*Taeniocampa*), differing from both in having a dorsal series of abdominal crests and from the latter in having a sharp triangular pro-thoracic crest; from *Miselia* (*Mamestra*) it differs in having the sharp triangular pro-thoracic crest and its hairy scaling; in coloration it somewhat reminds one of *Panolis flammea*. Apart from its structure there does not seem to be any British species of which it could possibly be an aberration, whilst the specimen itself has no appearance of abnormality. The suggestion that it is a hybrid between two genera, of which *Miselia* would be one and some form with sharp pro-thoracic crest and hairy scaling the other parent appears to me much more improbable than that a new British *Noctua* should be discovered, and I conclude that the species is either indigenous or perhaps imported, probably in the egg stage on some exotic conifer; I have, however, failed to find any described species from any part of the

world to which it could belong, and have worked up the whole group in vol. v of the British Museum Catalogue of Moths. The type has been kindly purchased by the Hon. L. W. and N. C. Rothschild and presented to the British Museum.

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EXPLANATION OF PLATE XVI.

[*See Explanation facing the PLATE.*]



XIII. *A list of Chrysidids taken by the writer in two visits to Jaffa, Jerusalem and Jericho, with descriptions of new species.* By the Rev. F. D. MORICE, M.A., F.E.S.

[Read October 6th, 1909.]

THE Chrysidids enumerated below were taken (with one exception) by myself while visiting Palestine with Professor Dr. Schmiedeknecht in April 1899 and again, exactly ten years later, in March–April 1909. As many of the species are considered rarities I have thought that a list with precise dates and localities of capture may be of some use to future collectors or students of *Hymenoptera* from that district. It is possible that the list may not be quite complete, as I have given away a certain number of specimens as duplicates and am not sure that I have always kept record of these. But as far as it goes I believe it to be correct; and at least one specimen of each species has been determined or verified for me by the Vicomte R. du Buysson, so that the names here given may safely be trusted.

Our first visit to Palestine lasted only a fortnight (April 6–20, 1899), of which a week was spent at Jericho. In 1909 we were in Palestine for a full month (March 22 to April 20) and devoted three entire weeks (March 26 to April 16) to Jericho. But on this occasion the conditions of weather, etc., were far less favourable for collecting Chrysidids than on our previous visit, so that the four weeks of 1909 produced not very many more species and probably fewer individual specimens than the fortnight of 1899. In all I seem to have found 28 species or named varieties, 13 of which occurred in 1899 only, 19 in 1909 only, and the remainder (15) in both years.

Naturally a large proportion of these Palestine Chrysidids occur also in Egypt, but it is rather curious that among them is no representative of the genera *Hedychrum*, *Chrysogona* and *Stilbum*—all which occur (and the last at least abundantly) in the Delta. Nor do my captures include any *Notozus*; and several of our commonest European species of *Chrysis*, such as *succincta*, *cyanea* and

even *ignita*, are also absent from my list. Many of these vacancies would doubtless have been filled up if I had remained in the country for another month. But to collect Chrysidids even for a month in *any* district without encountering a single *ignita* is, I should think, a most unusual experience.

As to the names of the localities quoted, Jaffa, Jerusalem and Jericho explain themselves, but each name covers a radius of two or three miles round the actual town. Ain Dilb is a pretty valley among the hills between Jerusalem and Jaffa, not far from Kolonieh. Khan Hadrur (the so-called "Inn of the Good Samaritan") is halfway between Jerusalem and Jericho. I collected there, only for half-an-hour or so each time, on three out of the four short halts made by the carriages which conveyed us from Jerusalem to Jericho and back—on the fourth occasion the weather made collecting impossible. The insects indicated as from "Bethlehem" were taken during an excursion through that place from Jerusalem to Marsaba, and their actual place of capture may have been anywhere along the route.

## LIST.

- CLEPTES *syriacus*, Buys. Khan Hadrur, 26, iii, '09.  
 ELLAMPUS *auratus*, L., var. *abdominalis*, Buys. Jericho, 11, iv, '99.  
 PHILOCTETES *deflexus*, Ab. Jericho, 11–15, iv, '99.  
 „ *chobauti*, Buys. Jericho, 11, iv, '99.  
 HOLOPYGA *fervida*, F. Jericho, 28, iii, '09.  
 „ *gloriosa*, F., var. *viridis*, Guer. Jericho, 5, iv, '09.  
 „ „ var. *punctatissima*, Dhlb. Jericho, 4–15, iv, '99; 13–26, iv, '09.  
 „ „ var. *ignicollis*, Dhlb. Jericho, 11, iv, '99.  
 HEDYCHRIDIUM *femoratum*, Dhlb., var. *miricolor*, VAR. NOV., Jericho, 28, iii, '09.

In this curious variety the abdomen is coloured much as in typical *H. roseum*, i. e. it is scarcely metallic and more resembles pink coral. The head and thorax are coloured as in normal *femoratum*, but their surfaces (above) slightly more shining, the puncturation being more irregular and not quite so close.

SPINOLIA *dournovi*, Rad. Bethany, 9, iv, '99; Jericho, 10, iv, '99.

„ *herodiana*, n. sp. Jericho, 27, iii, '09. Five ♀♀ about burrows of *Odynerus* (*Hoplopus*) *variegatus*, F., near the stream coming from “Elisha's fountain.”

This is evidently a true *Spinolia*, though its neuration is abnormal in that Genus, the radial cell not being more “open” at the apex than in several species of *Chrysis*.

SPINOLIA HERODIANA, n. sp. ♀.

Statura formaque *S. dournovi*, Rad., sed *tota* (supra subterque!) cupreo-fulgens, nonnusquam (praecipue in thorace postice) sub quadam incidentia lucis viridi suffusa (nusquam autem caeruleo); capite (facie pure viridi excepta), pleuris, sternis, tegulis, antennarum pedumque basibus concoloribus, tarsis tibiisque flavescens;

Clypei nitidissimi margine apicali (ut in *Sp. rugosa*, Buyss.) evidenter exciso; abdominis apice fere simplici, haud spinuloso, lateribus vix angulatis, item serie ante-apicali fossularum fere nulla; abdominis dorso in medio longitudinaliter carinato, et colore ibidem plus minusve obfusato (violaceo vel plumbeo);

Differt ab omnibus Spinoliis hactenus descriptis nervo radiali alae anticae haud post inflexionem suam fere statim terminato sed continuato ita ut ad marginem alae multo propius accedat!

Long. corp. 7-8 mm.

EUCHROEUS *doursi*, Grib. Jericho, iv, '99; 6, iv, '09.

CHRYSIS *rebecca*, n. sp. Ain Dilb, 18, iv, '09.

This insect superficially resembles *C. cyanea*, but belongs to another of Dahlbom's “Phalanxes,” the apex of the abdomen being simple or very slightly emarginate in the centre (not at all tridentate). It differs in other points of structure, and especially in the “genae,” which are much shorter and not convergent.

CHRYSIS REBECCA, n. sp. ♀.

Parva (long. corp. 6 mm.), viridis, hic illic aureo-micans, antennarum pedumque basibus concoloribus, tarsis nigris; dorsi areis nonnullis plus minusve caerulescentibus;

Genis mediocribus, longitudine articuli antennarum 4<sup>ti</sup>; articulo hoc 5<sup>to</sup> que simul sumptis articulo 3<sup>ti</sup>o nonnihil longioribus; cavitate

faciali tenuiter striolata, superne a fronte (hac crasse punctata ac prominente sed vix transversim carinata) subarcuatim terminata; punctis thoracis segmentique abdominis 1<sup>mi</sup> crassis rugosisque sed non profundis, huius segmentis 2<sup>do</sup> 3<sup>tio</sup> que tenuius irregulariter punctulatis; postscutello normali, subgibboso;

Abdominis serie ante-apicali fossularum (quattuor decem) bene impressa ac distinctissima; margine ipso apicali integerrimo, subtruncato, in medio lenissime intus sinuato, lateribus obtusissime angulatis ♀.

- C. incrassata*, Spin., var. *gratiosa*, Mocs. Jericho, iii, '09.  
 „ *djelma*, Buys. Jerusalem, 24, iii, '09.  
 „ *varicornis*, Spin. Bethlehem, 8, iv, '99; Ain Dilb, 18, iv, '09.  
 „ *erigone*, Mocs. Jerusalem, 10, iv, '09.  
 „ *pustulosa*, Ab. Jericho, 11, iv, '99; 28, iii, '09.  
 „ *pelopocicida*, Buys. Jerusalem, 19, v, '96.

This specimen was not taken by myself; but as it is in my collection, and bears a definite date, I mention it.

- C. osiris*, Buys. Jaffa, 20, iv, '99. (Three ♀♀ visiting snail-shells occupied by cells of *Osmia ligulicornis*, Friese, on the dunes between Jaffa and Sarona. The bee occurred again 22, iv, '09, but I could not rediscover the Chrysid.)  
 „ *ignifrons*, Brullé (= *aurifrons*, Dhlb.). Bethlehem, 8, iv, '99; Bethany, 9, iv, '99; Jerusalem, 10, iv, '99; Jerusalem, 24, iii, '09; Jericho, 31, iii, '09; Ain Dilb, 18, iv, '09.  
 „ *osmia*, Thoms. Jericho, iv, '09.  
 „ *kohli*, Mocs. Khan Hadrur, 18, iv, '99; Jericho, 5, 15, iv, '09.  
 „ *joppensis*, Ab.—Buys. Jericho, 16, iv, '99.  
 „ *uniformis*, Dhlb. Jerusalem, 24, iii, '09.  
 „ *oraniensis*, Luc. Jerusalem, 25, iii, '09.  
 „ *cirtana*, Luc. Bethlehem, 8, iv, '99.  
 „ *Lydiae*, Mocs. Jerusalem, 10, iv, '99; 24, iii, '09.  
 „ *angustifrons*, Ab. Jericho, 12–16, '09; 6, iv, '09.  
 „ *dichroa*, Dhlb. Bethlehem, 8, iv, '99; Bethany, 9, iv, '99; Jerusalem, 10, iv, '99; Jerusalem, 19–25, iii, '09.  
 „ *barbata*, Buys. (The type specimen!) Jerusalem, 10, iv, '99.



- C. atechka*, Buys. On umbellifers in a garden between Jericho and the Jordan ford, 14, iv, '09.  
 „ *saussurei*, Chevr. Same place as the last, 14, iv, '09.  
 „ *elegans*, Lep. Jericho, 12-18, iv, '99; 27, iii, '09; 6, 7, iv, '09.

In several of the ♂♂ the abdomen is brightly tinted with greenish gold, in others it is as usual deep-red.

- C. versicolor*, Spin. Jericho, 17, iv, '99; 3, 4, iv, '09.  
 „ *bihamata*, Spin. Jericho, 6, iv, '09.  
 „ *palliditarsis*, Spin. Jericho, 11, iv, '99.  
 „ *annulata*, Ab.-Buys. Three ♂♂ on umbellifers in garden between Jericho and the Jordan ford, 14, iv, '09.  
 „ *viridula*, L. (= *bidentata*, L.). Bethany, 9, iv, '99; Jerusalem, 10, iv, '99; Jericho, 15, iv, '99; Jericho, 26, iii, '09, 13, iv, '09.

The specimens do not belong to any of the remarkable Mediterranean varieties, but are just like rather small normal British specimens.

- C. thalhammeri*, Mocs. One ♀ on umbellifers in garden between Jericho and the Jordan ford, 14, iv, '09.  
 „ *amasina*, Mocs. Jericho, 31, iii, '09.  
 „ *verna*, Dhlb. Jericho, 31, iii, '09.  
 „ *mutabilis*, Buys. Jericho 11-17, iv, '99; 27-31, iii, '09, 2, iv, '09.  
 „ *incisa*, Ab.-Buys. Jerusalem, 10, iv, '99.  
 „ *rufitarsis*, Brullé (= *angulata*, Dhlb.). 10-15, iv, '99; 6-13, iv, '09.  
 „ *facialis*, Ab.-Buys. Jerusalem, 10, iv, '99.  
 PARNOPEs *schmiedeknechti*, Mocs. Bethany, 9, iv, '99  
 Jerusalem, 10, iv, '99.



XIV. *An Account of some Experiments on the Edibility of certain Lepidopterous Larvae.* By H. ELTRINGHAM, M.A., F.Z.S.

[Read October 6th, 1909.]

FOR a considerable period, following on the first enunciation of the theories of Batesian and Müllerian mimicry and common warning colours, the criticism that these theories were based on small practical evidence was to some extent justified. Such criticism, however, did not in any way invalidate the theories in question. It had also the highly salutary effect of acting as a stimulus, not only to the upholders but also to the opponents of these theories, to carry out practical experiments with a view to obtaining actual evidence bearing on some of the points involved.

It is a matter of common knowledge amongst those who have studied these subjects, that the experiments which have been recorded all tend to support the now well-known theories of mimicry which had their origin in the celebrated arguments published nearly fifty years ago by Mr. H. W. Bates. Amongst the many points to be elucidated, one of the most important was the proof of the comparative inedibility of many insects. For much valuable evidence on this head we are indebted to the experiments of Mr. Jenner Weir, Mr. A. G. Butler, Prof. Weismann, Mr. F. Finn, and especially to those of Prof. Poulton and Mr. G. A. K. Marshall, and it can no longer be said with justice that the hypothesis of the comparative distastefulness of most warningly coloured insects rests on insufficient evidence.

Arising out of the foregoing experiments, one of the results obtained by Prof. Poulton\* was as interesting as it was unexpected. Whilst in accordance with anticipation, warningly coloured larvae were found to be distasteful, and cryptic larvae edible, one instance was discovered in which a larva (that of *Mania typica*), though exceedingly

\* Proc. Zool. Soc. 1887, Experimental Proof of the Value of Colour and Markings in Insects in Reference to their Vertebrate Enemies.

well protected by its colour and habits, proved to be distasteful to the lizards which were being used for the purpose of the experiments. The importance of this result is fully discussed by the author,\* who points out that we have here an instance in which the distasteful qualities are present as an accidental and useless character, but providing an excellent example of how the distasteful properties of many forms may have existed prior to the development of warning colours, conditions being thus favourable to the development of the latter in the event of any change being brought about in the larval habits.

It was in the hope of perhaps discovering another case of a similar character, that I decided to carry out some experiments with the only insectivorous creatures which were available, viz. lizards, and with such larvae as I was able to obtain.

Two green lizards (probably *Lacerta viridis*) were installed in a fairly large vivarium, and their number was subsequently increased by the addition of three more of the same small variety, and two fine examples of the larger Channel Islands form. There were also two orange and black salamanders, but these proved to have such poor appetites that they provided very little information.

The general results of feeding the lizards with various insects confirmed those already obtained by other observers, though there were some unimportant exceptions. The larva of *Pieris brassicae* is recorded by Prof. Weismann as having been refused by his lizards. I found that on some occasions it was eaten, though with considerable hesitation and usually when the animal was hungry. One of the salamanders refused it after examining it carefully for some time. Earthworms were eaten with avidity, and "blue-bottles" (*Calliphora vomitoria*) were always taken with evident relish. The larva of *Spilosoma lubricipeda* was generally refused, though the lizards took considerable interest in it. One lizard followed the larva round the cage for some time, feeling it with its tongue, but the hairs always put it off, and it was finally abandoned. A young larva not so hairy was eaten on one occasion after some trouble with the hairs, a fact which seems to suggest that the protection is mechanical and not due to actual distastefulness. A "devil's coach-horse" (*Ocyrops olens*) was eaten, though the operation took a considerable time,

\* *L. c.*, p. 241, *et seq.*

and once the beetle appeared to nip the lizard with its mandibles, as it dropped it suddenly and went through surprising contortions.

The imago of *P. rapae* was eaten with apparent relish, as also that of *Plusia gamma*. Green and greenish-brown larvae of cryptic habits were eaten, as also were the extremely cryptic geometrid larvae of *Amphidasys betularia* and *Selenia lunaria*. A bee was attacked and dropped, though the salamanders ate bees with impunity. The most interesting results were obtained with the larvae of *Boarmia rhomboidaria*. This larva was found in large numbers feeding on ivy. Probably few British larvae have attained to a more perfect development of cryptic form, colour and habit than this species. It resembles so perfectly the twigs of the ivy that it is frequently only possible to detect it by the sense of touch. If thrown down it will often lie perfectly straight and motionless, when it is practically indistinguishable from a small piece of stick. According to the general rule it would be expected that this larva when detected would prove to be as palatable as *betularia*, *lunaria*, and other similar forms. My experiments, however, proved that quite the opposite is the case. I was interested to discover whether this unpalatability could be traced to any definite secretion, such as potassium hydroxide. A crushed larva gave a slight alkaline reaction with litmus paper, so I boiled a considerable number of the larvae and tested the filtered solution. The alkalinity was, however, so slight that it seemed unnecessary to pursue the examination in this direction, and it appeared probable that the food-plant might be directly responsible for the chemical reaction. This again proved not to be the case, as the crushed shoots of ivy were found to be slightly acid.

As the larva in question will eat other plants than ivy it occurred to me to try the effect of a change of food-plant on its edible properties. I found that after being fed on apple for from two to three days and onwards, the distasteful properties disappeared and the apple-fed larvae were eaten without any hesitation.

I herewith append notes from my journal made at the time of each experiment, in order that those interested may judge of the results for themselves.

August 29.—A salamander ate an earthworm, then a bee (without apparently being stung), and then another

worm. It then very carefully inspected a larva of *P. brassicae*, started backwards slightly, and finally refused to look at it.

One lizard ate a small worm, then part of a larger one; it then examined a larva of *brassicae* and seized it, holding it in its mouth by a very small grip of the skin for about three minutes, then it bit it harder and put it out. Then it picked it up very doubtfully and swallowed it very slowly. The other lizard, which had had nothing for at least two days, seized the same kind of larva and swallowed it, apparently without compunction; it then rubbed its nose against the glass of the cage for some time, and once appeared to writhe on the floor. Later on it was offered another of the same larvae, but it would have nothing to do with it. It then turned round and bit the other lizard twice, though the object of this manœuvre was not apparent.

August 30.—One of the lizards tried to eat a larva of *rhomboidaria*, but left it after two attempts.

August 31.—A lizard after some hesitation appeared to swallow one of these larvae, but a moment later vomited it up again, ran violently round the cage, and then drank some water. A few hours later it bit another, but put it out and rubbed its nose on the pebbles.

September 1.—The other lizard behaved in exactly the same way this morning. The first lizard was given a larva of *Spilosoma lubricipeda*. It followed it all round the cage feeling it with its tongue, but though it evidently wanted to try it the hairs put it off, and it finally abandoned it. After this neither lizard would eat anything.

September 2.—One lizard examined a larva of *S. lubricipeda*, but the hairs put it off. Then each lizard ate a worm, and one subsequently ate a larva of *P. brassicae* rather slowly, putting it out once but finally swallowing it. Later in the day one lizard attacked a "devil's coach-horse" (*Ocyypus olens*). It took about half-an-hour to eat it, continually dropping it and picking it up again. Once it dropped it suddenly and went through the most violent contortions, rubbing its head sideways and half burying itself under the gravel. Whatever the cause of this may have been, it again picked up the beetle and began to swallow it; apparently it had the greatest difficulty in doing so, as it shook it out of its mouth several times. Ultimately, however, it got it down.

September 3.—One lizard ate three blue-bottles and a *P. rapae*. The other one ate a green caterpillar (probably *Hadena oleracea*). Neither would touch a larva of *rhomboidaria*. Later on the first lizard ate another *P. rapae*, and the second ate two brownish-green larvae taken off chrysanthemum plants.

September 5.—Lizards had nothing to eat yesterday. This morning one of them ate a blue-bottle, and I then offered it a larva of *rhomboidaria*. It seized it by the tail and held it in its mouth for a short time, then worried it furiously. As soon as it got a little more into its mouth it dropped it and began rubbing its mouth violently on the floor of the cage. Afterwards it would not look at it again. The larva was still alive and the other lizard came and looked at it, but either smelt it or recognized its appearance, as it would not bite it. The first lizard immediately afterwards ate a "blue-bottle," and about two hours later a small earthworm. The manner in which it swallowed these was very different to that in which it treated the caterpillar. There was no hesitation, and the worm was gulped down very rapidly.

(Note.—These lizards ate larvae of *P. brassicae* but slowly, and as though not greatly appreciating them.)

Later in the day one lizard ate four "blue-bottles" and a *P. rapae*. The salamander ate three bees. The lizard snapped up a bee but dropped it again suddenly, as though stung, and would not look at another.

September 7.—Lizard ate two "blue-bottles," a brownish-green larva from the chrysanthemums, and a "gamma" moth.

The other lizard ate a larva of *rhomboidaria* which had been fed on apple for two days. While it was eating it the other lizard chased it round and round the cage. A second apple-fed larva was refused by both lizards. Later on one lizard ate a worm but tasted and refused a wood-louse.

September 8.—First lizard would not look at an apple-fed *rhomboidaria* larva, but the other one ate it, rather slowly at first. An ivy-fed one was then offered, but neither lizard would touch it. The first lizard then ate two "blue-bottles."

September 9.—Five more lizards arrived.

One of the original pair ate an ivy-fed caterpillar with some hesitation, afterwards drinking water. One of the

new lizards, presumably hungry, was given an ivy-fed larva of *rhomboidaria*, it bit it and then dropped it, going through violent contortions and rubbing its nose on the pebbles. A little while later it was given a larva which had been fed on apple for four days. It ate it without any hesitation. It was then offered the ivy-fed larva which it had before refused, and after some hesitation it swallowed it, though evidently without any keenness. Another of the new lizards was then offered an ivy-fed larva. It bit it and dropped it suddenly, rubbing its nose on the pebbles. It then took another bite and put it out again, opening its jaws wide and then rubbing its nose on the floor. After a while it was induced to try an apple-fed example, which it swallowed rapidly after a short hesitation. The ivy-fed larva previously refused was then again offered, but it would not touch it.

One of the original lizards ate a larva of *betularia* and one of *lunaria*, but smelt and refused an ivy-fed *rhomboidaria*.

September 10.—A large lizard ate an ivy-fed larva with considerable hesitation, putting it out four times. This lizard had had nothing to eat for some days. After this it ate another ivy-fed larva with rather less hesitation. A third was seized by it and another lizard. They fought over it furiously, and the caterpillar was pulled in two and each swallowed its own piece. The competition apparently had something to do with the result, as immediately after the second lizard bit another larva and dropped it, rubbing its nose violently. A third lizard came up and examined the larva, when the other seized it again but dropped it like a hot coal. Another lizard twice examined and refused one of these larvae.

September 11.—A lizard ate rapidly and without hesitation two larvae of *betularia* and a "green-bottle." An ivy-fed *rhomboidaria* was then offered, but it examined it carefully and refused to touch it.

September 12.—An ivy-fed larva was offered to one of the lizards. It seized it at once and nearly managed to swallow it, but suddenly ejected it and rubbed its nose violently on the pebbles. After this it would not even eat a "blue-bottle," and an apple-fed *rhomboidaria* was disregarded. One of the large lizards was given a *rhomboidaria* larva which had been fed on apple for about a week. It seized it and ate it at once. It was then



given another taken from the ivy. It seized it at once and gave it two bites, dropped it and rubbed its nose on the pebbles. The original two lizards were offered ivy-fed caterpillars, but after inspection they would not touch them. They appear to have learnt that they are not good to eat. Another lizard seized an ivy-fed larva, but after two bites dropped it and rubbed its nose. It subsequently ate a "blue-bottle." Another lizard ate a young larva of *lubricipeda*, though the hairs bothered it a good deal at first, the lizard being apparently either pricked or tickled. An older and more hairy larva was examined, but refused on account of the hairs. Greenish larvae (probably *Hadena oleracea*) were eaten without hesitation.

September 13.—During a short sunny interval one of the large lizards came out and tasted an ivy-fed larva, but dropped it after two bites and rubbed its nose. It would not eat anything else after this.

Soon after the last-named date I was called abroad for a time, and was therefore unable to continue the experiments. Nevertheless it appears to me that extremely interesting conclusions may reasonably be drawn therefrom. It should be remembered that the mere bald statement that a lizard did or did not eat a certain insect scarcely supplies that conviction which the actual carrying out of the experiments conveys. The behaviour of the reptiles when dealing with their food gives a vivid impression of the degree of relish with which each particular morsel is consumed, and I am quite convinced by carefully watching the lizards that ivy-fed larvae of *Boarmia rhomboidaria* are extremely distasteful, and I am equally persuaded that when fed for a time on apple those distasteful qualities are removed. Ivy-fed larvae were tasted and refused with disgust seventeen times, and eaten five times. Even on the mere figures the evidence of distastefulness is ample, but in the cases where the larva was eaten, it was consumed with hesitation and evident lack of relish, whilst once it was eaten under stress of competition, the influence of which is hinted at by the example of the lizard which had tasted and refused the larva making a second attempt to eat it when threatened with interference by another of the reptiles. In strong contrast to this behaviour is the fact that apple-fed larvae were eaten in every case in which they were tasted, such hesitation as was shown being due to association with the

appearance of the previously discarded ivy-fed example whilst an apple-fed specimen was in no case rejected and again seized, but always swallowed uninterruptedly and without any of the characteristic nose-rubbing and other contortions which accompanied the dealings with those fed on ivy. From these facts it seems quite reasonable to conclude that when feeding on apple this highly cryptic larva remains as edible as are most other insects which are well protected by their colour, shape, and habits. The caterpillar is even better protected on ivy owing to the density of the foliage and the irregularity of the twigs, and yet when on that plant it becomes extremely distasteful, and furnishes an exactly similar case to that of *Mania typica*, discovered and described by Prof. Poulton. We thus have further evidence that the distasteful qualities of larvae may have arisen in similar accidental ways, and the difficulty of those "first steps" in evolutionary changes are still further decreased. We can see how a cryptic larva which occurs on a certain food-plant might be sought out and discovered by its enemies, and if the latter were sufficiently numerous and persistent, the insect might be exterminated. If, however, the larva can adapt itself to a change of food, it may gain some respite until again discovered. This may bring about a great change in the creature's method of defence. Its new food-plant endows it with inedible properties, and thus the insect has a further opportunity of developing a new mode of protection along different lines. To extend such reasoning, it seems not impossible that a purely Batesian mimic might become a Müllerian mimic by the same method. Batesian mimics are much associated with their models during life, and the instinct which guides a butterfly to lay its eggs on the right food-plant is not invariably infallible. Thus ova of an inedible species deposited on a new food-plant might conceivably give rise to larvae which survived and produced distasteful butterflies; and whilst the fact of such an occurrence may remain unproved, its evident possibility should serve to remind us once more of the complicated conditions under which butterflies in common with other creatures maintain their existence in the struggle for life.

(Note.—I am indebted to my friend, Commander J. J. Walker, for kindly identifying the Geometrid larvae above described.)

XV. *On the Characters and Relationships of the less-known groups of Lamellicorn Coleoptera, with descriptions of new species of Hybosorinae, etc.* By GILBERT J. ARROW, F.E.S.

[Read October 6th, 1909.]

IN the *Lamellicornia*, as in other groups of animals, the forms which throw most light upon the problems of origin and phylogeny are those which are least numerous and obtrusive, and which, unless they happen to be individually rare, have no special attraction for the general collector. The super-family *Lamellicornia* is so multitudinous, and contains such an abundance of forms which attract attention by their beauty, size, or strangeness of aspect, that the groups in which these qualities are deficient have been very generally neglected, and the classification of some of the most primitive and interesting families has remained practically unstudied since Erichson, in 1848, published the most important contribution which has been made to the subject of Lamellicorn classification.

Erichson's division of all the *Scarabaeidae* into two great series, according as the posterior abdominal spiracles are situated in the dorsal part of the ventral segments (*Pleurosticti*) or in the membranes connecting the dorsal and ventral segments (*Laparosticti*), has been universally adopted, although his criterion has never been actually applied to some of the minor groups, and the position and relations of several have been accepted as they were assigned by him, although it is precisely in regard to these that the scheme detailed in his "Insecten Deutschlands" was least carefully elaborated. Some of the groups do not belong to the German fauna, and in any case the forms known to Erichson were so few that it was not possible to ascertain what features were fixed and fundamental, and what characteristic only of species or genera. In endeavouring to distinguish these groups by reference to the formulae devised by Erichson and adopted by his successors, I have found these formulae of little use and have been obliged to investigate their mutual relation-

ships anew, by means of the much larger materials now available.

The division of the *Scarabaeidae* into *Laparosticti* and *Pleurosticti* according to the situation of the spiracles, although useful, does not correspond to any sharp natural line of cleavage. There are not only two, but several types, which pass one into the other, so that the point selected for the line of division must be more or less arbitrary, and if fixed with reference to this single character alone may be quite unnatural. It has long been recognized that the *Laparostict* type is normally accompanied by a more primitive condition of the labium, which has a free bilobed ligula, while in the *Pleurosticts* the ligula is indistinguishable, or almost indistinguishable, from the mentum. This is a test sometimes difficult to apply, and of little use in the case of those genera in which the organs of the mouth are partially atrophied. A more obvious distinction, and one which seems to me to be of some significance, is found in the conformation of the hinder part of the abdomen. In typical *Pleurosticts* this is large, highly chitinous and rigid above, but in *Laparosticts* it is less bulky, the dorsal part is scarcely chitinized, and, except in the most highly specialized groups (*e. g.* the *Coprinae*), not at all rigid. In all *Lamellicornia* the last dorsal segment is very strongly chitinized, and in the *Pleurostict* sub-families the one preceding it is closely connected with it, large, rigid and continuous at the sides with the penultimate ventral segment, forming a solid ring, in which the last spiracle is situated. In the *Laparosticts* this segment is not completely rigid, or if it is so is not continuous with the corresponding ventral segment.

Certain insects of peculiar conformation, the most important of which are the *Glaphyrinae*, have been attached by some systematists to one and by others to the other of these great divisions. In the case of the *Glaphyrinae* there has been a general agreement since Erichson to treat them as *Laparosticts*, but Leconte and Horn in their *Coleoptera of North America* compromised matters by placing a very large portion of the *Lamellicornia* in an intermediate third division called *Melolonthinae*, which he divided into *Laparostict Melolonthinae* and *Pleurostict Melolonthinae*, the former consisting of the *Glaphyrini* and another little anomalous group, the

*Oncerini*. It is strange that the actual location of the abdominal spiracles in the *Glaphyrinae* appears never to have been really observed, for it is of a unique type which contradicts all the suggested affinities of the insects in question. The abdomen is bulky, and the propygidium forms with the penultimate ventral segment a complete horny ring, in the dorsal part of which a spiracle is placed; but this spiracle is not the last, for, quite contrary to rule, another is found on each side of the last dorsal segment near, but a little distant from, the anterior angle. This curious fact appears to me to indicate that this tergite is not the homologue of the pygidium of all other *Lamellicornia*, but rather of the penultimate tergite, for the spiracle is not an additional one, the total number being the normal one of six. According to Lacordaire, the *Lamellicornia* possess seven abdominal spiracles, but the first of these is found in the membrane connecting the abdomen and metathorax, and is almost always different from, and not placed in line with, the other six. I therefore prefer to consider that as a metathoracic spiracle and to count six as belonging to the abdominal segments. Of these the pygidial spiracle of the *Glaphyrinae* forms the sixth, the preceding one is situated in the dorsal part of the penultimate segment, and the four anterior ones I have found in *Amphicoma vulpes* in the membrane connecting dorsal and ventral plates, and in *Amphicoma papaveris* in the dorsal plates themselves. As these two species are undoubtedly very nearly related the difference is evidently here of little significance. The position of the last two spiracles and their complete exposure indicate that the *Glaphyrinae* have a nearer relationship to the Pleurostictids than to the Laparostictids, but the remarkable peculiarity described places them in a very isolated position.

The *Oncerini*, associated with the above group by Leconte and Horn, consist of three or four minute species, of which *Chnarvnanthus* is the principal genus, and the only one of the three described which is known to me. This was placed by Lacordaire among the *Melolonthinae* together with the European *Chasmatopterus*, and I can discover no reason at all for Leconte and Horn's view. The abdomen is of the normal Pleurostictid type, although the ventral segments, except the last, are completely consolidated. The spiracles are very difficult to see owing to their very small size, but by microscopical.

preparations I have ascertained that they also are in the normal situation for the *Melolonthinae*, i.e. the three posterior are in the dorsal part of the ventral segments, the sutures of which in this part are still visible.

Two peculiar genera, *Aclopus* and *Phaenognatha*, were placed by Erichson in the *Glaphyridae*, but removed to the *Melolonthinae* by Lacordaire on the ground that the situation of the spiracles is of the Pleurostict type. By a preparation of the abdomen of *Aclopus brunneus*, I found the spiracles to be completely Laparostict; but, in a paper published since the present one took shape, Dr. Ohaus (Deutsche ent. Zeits., 1909, p. 427) has made the highly interesting announcement that, while this is so in the male, in the female the four last spiracles are actually situated in the chitin of the ventral segments; that is, the species is Pleurostict in this sex. All the examples of *Phaenognatha* and *Aclopus* hitherto described are males, although Burmeister incorrectly considered both sexes to be represented among the specimens of *Aclopus* he described, and Lacordaire's account shows that, in spite of his statement as to the spiracles, he knew only the male. The female is wingless and clumsily built, and there is little doubt that this is the case in both genera, and that, as in *Pachypus*, all the females are very retiring and inert. Dr. Heller considers the group to be rather closely related to *Pachypus*; but although I believe all agree in being near the primitive Lamellicorn stock, it is likely that the resemblance is in part due to similarity in the mode of life. There are wide differences in the structure of the antennae and head, and the greatly exerted labium and mandibles connect the *Aclopinæ* with the *Geotrupidinæ* and allied groups. There is certainly no special affinity with either the *Glaphyrinæ* or *Melolonthinæ*, and the propriety of regarding them as an independent and rather isolated sub-family can hardly be questioned.

An interesting feature of the genus *Aclopus*, and, no doubt, a primitive one, is the existence of apparently sensory hairs upon the dorsal surface of the prothorax. This is perfectly free from hairs, except for one or two long ones standing upright on each side and arising from a couple of small pits, one on each side of the middle. These pits are always visible, even when in roughly-used specimens the hairs have been lost. Somewhat similar hairs are found on the head or thorax in certain *Carabidæ*

*Phytophaga*, etc., but so far as I know they are not found in any other *Lamellicornia*.

The distribution of the *Aclopinæ* is exceedingly interesting. Until recently only three species have been recognized, but although difficult to distinguish they will have to be considerably multiplied. *Aclopus* is peculiar to South America, while *Phaenognatha* consists of various Australian species (all but one of them described later in the present paper), and one or more from South America so closely related to them as to be quite fittingly placed in the same genus.

The proper systematic position of the remarkable Californian genus *Pleocoma* has been the subject of a prolonged controversy, and its structure has been pretty thoroughly investigated. Leconte and Horn claimed it as an undoubted Laparostict allied to the *Geotrupinæ*; while Gerstaecker placed it with equal confidence in the *Pleurosticti* near *Pachypus*. The latter writer was wrong in declaring the spiracles to be situated in the chitinous rings; but I believe his view of the affinities of the genus was not altogether unjustified, and that although the two theories quoted above appear quite irreconcilable, it is not necessary to entirely reject either. I believe both *Pleocoma* and *Pachypus* to be among those ancient survivals which are destructive of all clear-cut systems, but which throw most valuable light upon phylogeny. Dr. Horn has himself pointed out that *Pleocoma* has the spiracles so placed as to make it doubtful whether it is Laparostict or not. They are indeed surrounded by membrane, but so placed as to appear as though this encroached upon the horny segments. Both *Pleocoma* and *Pachypus* have the very un-Melolonthine feature of possessing a horn in the male sex, the former upon the head and the latter upon the thorax; but both have also the entirely Melolonthine characteristic of a many-leaved antennal club. The number of joints in the club is invariably three in the whole of the *Scarabaeidae*, except in many *Melolonthinæ* and these two genera. On the other hand, *Pleocoma* appears to have very little in common with the *Geotrupinæ*, except the total number of eleven joints to the antenna, which if there were any similarity in these organs themselves would certainly be a very important fact, for this number of joints, general in other Coleoptera, occurs in no other *Lamellicornia* so far as

is known. It is remarkable that, while the Laparostict condition must certainly be regarded as more primitive than the Pleurostict, all the least primitive forms of the antenna are found in the Laparostict division, and one of the most highly modified types of all (*Lethrus*) occurs in the family in which alone (except in *Pleocomma*) the primitive number of eleven joints still exists.

It is interesting to find the habits of *Pleocomma* practically identical with those of *Pachyppus*, the females of both being wingless and remaining always below the surface of the ground, where they are sought out by beevies of males. *Clitopa* and other *Melolonthine* genera have similar habits, but there is no resemblance whatever to those of the *Geotrupinae*.

In view of all the facts it seems to me that both *Pleocomma* and *Pachyppus*, although by no means closely related, are probably more nearly related to each other than to any other known forms, and that, while they are best classed among the *Laparosticti*, they are scarcely less related to the *Pleurosticti*.

Prof. Kolbe has added to the Lamellicorn series the family *Synteliidae*, consisting of the small genus *Syntelia*, which he regards as forming a link with the Staphylinid series through the *Histeridae*. But the latter family is probably one of the latest branches of that series and *Syntelia* is in many respects by no means primitive. The antennae are of a well-developed Clavicorn type, and if there is any special relationship between the two great series, which is as yet very hypothetical, I think the *Synteliidae* are more naturally placed on the Staphylinid side. If I am right, however, in regarding the genera I have just discussed (those with many-lamellated antennae) as the most primitive Lamellicornia, then the ancestry of the series should probably be traced in quite another direction. I may point out, as of some significance, that the Lamellicornia are invariably characterized by having only a single articulated spine to the front tibia. In the *Synteliidae*, *Histeridae*, *Silphidae*, etc., there are two.

The following Table indicates what appear to me to be the primary subdivisions of the Laparostict *Scarabacidae*—

Antennal club of more than 3 joints.

Antennae 11-jointed . . . . .	PLEOCOMINAE.
Antennae 8-jointed . . . . .	PACHYPODINAE.



Antennal club of 3 joints.

- | Labrum and mandibles horizontally extruded, flattened.
  - α Eyes divided in front.
    - Labrum as long as mandibles . . . . . ACLOPINAE.
    - Labrum shorter than mandibles.
      - Antennae 11-jointed . . . . . GEOTRUPINAE.
      - Antennae 10-jointed.
        - Antennal club telescopic, joints cupuliform . . . . . HYBOSORINAE.
        - Antennal club simple, lamellate.
          - Stridulating plate in hind coxal cavity . . . . . TAUROCERASTINAE.
          - Stridulating plate on hind coxa . . . . . ORPHININAE.
          - Antennae 9-jointed . . . . . CHIRONINAE.
    - α Eyes entire . . . . . OCHODAEINAE.
  - | Labrum and mandibles not horizontally extruded.
    - 1 Antennae 10-jointed.
      - Labrum very small . . . . . IDIOSTOMINAE.
      - Labrum large . . . . . TROGINAE.
    - 1 Antennae 8- or 9-jointed.
      - Hind tibia 2-spined: mid-coxae contiguous . . . . . APHODIINAE.
      - Hind tibia 1-spined: mid-coxae separate . . . . . COPRINAE.

In this scheme of classification, most of the diagnostic characters introduced by Erichson and adopted by Lacordaire and all later systematists have been abandoned. The number of visible ventral segments in the abdomen was employed for a primary division by Erichson; and although both Lacordaire and Westwood remarked that it was scarcely of sufficient weight for the purpose, neither ventured to reject it, and the occurrence of five segments only has remained the criterion of the *Troginæ* and led to the wide separation of genera very nearly allied. The visibility or otherwise of the metasternal epimera, similarly used for the separation of the Laparostict sub-families, is, like the number of recognizable ventral segments, subject to gradual transition and no more capable of application as a sharp dividing line. My study has thus led to a certain fresh delimitation of frontiers and re-arrangement of the component genera of certain sub-families, especially the *Hybosorinæ* and *Troginæ*, which it is necessary to define.

Two genera, *Anaides* and *Chaetodus*, placed together in the *Trogidae* by Westwood, were separated by Lacordaire, and the second transferred to the *Hybosoridae*. *Phaeochroops*, of Candèze, which has distinct affinities with both these genera, and in which the fusion of the ventral segments, regarded as characteristic of the *Hybosorinae*, reaches its maximum, is placed in the *Troginae* on account of the number of those segments externally visible. *Liparochrus* again, which has the faculty of folding the body so characteristic of the small *Troginae*, has the antennal club of the very different form found in the *Hybosorinae*, and the asymmetrical front claws of the male, which I believe are found in no other Laparostictids except the Hybosorine genus *Phaeochrous*, also occur in *Liparochrus*. It is obviously unnatural to interpose between these closely-related genera the great groups of *Coprinae* and *Aphodiinae*, as proposed by Erichson, or even the *Geotrupinae*, as Lacordaire has done, and indeed in my opinion it is impossible to refer them to different sub-families.

The genus *Trox* is a peculiar and rather isolated one which, except in the form of the abdomen and elytra, has few points of resemblance to those mentioned above. In the structure of the head, antennae, organs of the mouth, prothorax, scutellum and legs it is entirely different. Its only near ally is *Cryptogenius*, a genus with a slight superficial resemblance to *Anaides*, of which the second known species is described at the end of this paper. The essential characters of the *Troginae* are also found in the curious contractile-bodied group of the *Acanthocerini*. The following genera, which have been assigned to the *Troginae*, I propose to transfer to the *Hybosorinae*, viz. *Liparochrus*, *Anaides*, *Phaeochroops*, *Phaeochridius* and *Pantolasius*.

These two sub-families are most easily grouped according as (1) the antennal club is simple, the head more or less angular in front, and the labrum and mandibles not extended horizontally (*Troginae*); or (2) the joints of the antennal club are cup-shaped and telescope one within the other, the head quadrate or elliptical in front, and the labrum and mandibles horizontal, flattened and plainly visible from above (*Hybosorinae*).

In the *Troginae* the first joint of the antenna is greatly enlarged, more or less bent, and usually projects

beyond the articulation with the second joint; the clypeus has a free edge all round, and the organs of the mouth are bunched together and not visible from above. The labrum is thick and more or less vertical, and the mandibles are stout and not projecting. The elytra are very ample, and the abdomen is always deeply sunk within them. The claws are simple and symmetrical, and the sexes are alike externally.

The *Hybosorinae* have the first joint of the antenna only slightly enlarged and of normal form, the club globular with the joints fitting one within the other. The clypeus is flat, not pointed, and not covering the labrum and mandibles, which appear to form a continuation of it. The labrum is transverse, and lies upon the base of the mandibles, which are exposed at the front and sides. The front tibiae are generally finely serrate along the outer edge, with three larger and sharper teeth. The claws are simple or toothed, and sometimes the front claws of the male are unsymmetrical. The two sexes often differ considerably.

Sub-family.—*HYBOSORINAE*.

Professor Kolbe has called attention to the absence of this group from the Australian region, but the inclusion of the genus *Liparochrus* supplies this deficiency. In addition to the genera I have already transferred to the group must be mentioned *Aporolaus*, of Bates, which is very closely related to *Dicraeodon*, Erichson, and indeed if other species are found it will probably be necessary to unite all under the latter name. "*Coelodes*, No. 2," of Bates, in the Biol. Centr.-Americana, is a species of *Dicraeodon*.

*Hybosorus rufulus*, described in a fragmentary manner by Castelnau, has always been an object of uncertainty. It was placed in the genus *Coelodes* in the Munich catalogue and in *Hapalonychus* by De Borre, who believed it to be identical with *H. Waterhousei*, Westw. I believe this to be right as regards the genus but not the species. I have examined female specimens from Haiti, determined, I think correctly, as *H. rufulus*, and associated with *H. Waterhousei*, of which only a single male from Cuba was described by Westwood. The other sex of that species I do not know, but the true male of *H. rufulus* is a very remarkable insect which has not

yet been described. Like the female it has head, prothorax and legs of a bright yellow colour and the elytra usually a little duller, but the claws have in the male a strong tooth near the middle, the labrum is larger, and the mandibles are broad and prominent, almost as in the males of *Phacochrous*. The front tibiae and tarsi are longer, and the tibiae have only two teeth instead of three. A very curious feature is the contraction of the hind tarsi, which are very short and thick. Finally, the hind tibiae bear at the end a tuft of very long hairs which actually extend beyond the tarsi. This curious genus is almost the only Lamellicorn genus which is apparently peculiar to the West Indian Islands.

The most salient characters of the *Hybosorinae* are frequently peculiar to the male, a fact unknown to Westwood, who relied chiefly upon these features in his synopsis of the genera (Trans. Ent. Soc. Lond., IV, 1847, p. 157). This is therefore useless and liable to mislead unless the sexual differences of the species under examination are known. As several recently described genera are yet unknown to me I cannot at present replace it with a fresh tabulation of the now much more numerous genera.

The genus *Phacochridius* consists of the two species *P. derausus*, Har., and *P. Haroldi*, Fairm., and the only character which has been mentioned as distinguishing it from *Phacochroops* is the existence of a transverse carina on the posterior tibiae. This is found in quite typical species of *Phacochroops* and therefore has no generic value; but there is a considerable difference in the shape of the pronotum, which is more or less quadrate in *Phacochroops*, while in *Phacochridius* there is no trace of hind angles, the margin forming a continuous curve from one front angle to the other. To this distinction may be added a peculiar sexual feature. In the female the puncturation of the elytra is interrupted on each side behind the scutellum, leaving a very conspicuous shining patch. I have found this constant in a considerable series of *P. Haroldi* from Batu I. in the Genoa Museum, and have ascertained by dissection that it is distinctive of the female sex. Harold described the same peculiarity as occurring in *P. derausus*, so that the type of that species is a female.

*Hypseloderus*, of Fairmaire, from the description is evidently not a member of the *Hybosorinae*. It probably belongs to the *Troginae*.

The following new species belong to this sub-family—

*Liparochrus dux*, sp. n.

Ovatus, niger, nitidus, valde convexus, pectore pedibusque breviter fulvo-setosis; capite distincte punctato, clypeo sat parvo, lateribus rugoso-punctato; prothorace laevissimo, omnino marginato, postice lato, angulis rotundato, basi leviter sinuato, medio prominulo, lateribus latis, punctis nonnullis vage impressis, angulis anticis productis, rotundatis; elytris post medium amplissimis, postice paulo productis, impunctatis, stria profunda suturali, alia marginali parisque 4 interpositis, primo solum ad marginem anticam attingente; corpore subtus pedibusque subtiliter striolatis, tibiis anticis extus serratis, dentibus duobus majoribus:

♂, pedum anticorum dentibus 2 tibialibus minutis haud acutis, unguiculo interno valde inflecto, dilatato: ♀, pedum anticorum dentibus 2 tibialibus acutissimis. Long. 18 mm. Lat. max. 10 mm.

*Hab.* S.E. NEW GUINEA: Moroka (1300 m.), Paumomu R. (*Loria*, 1892-3). In the British and Genoa Museums.

This and the following species are remarkable for their great size, their dimensions being far larger than those of any other Hybosorinae known. *L. dux* appears to resemble *L. papirus*, Lansb. (with *L. alternatus*, Macl., and *L. sulcatus*, Montr., the only non-Australian species at present known). It is extremely smooth and shining, and the elytra are a little attenuated behind, decorated with deeply impressed striae in pairs and entirely devoid of punctures. The front tibiae have only two external teeth in addition to the usual close serration.

*Liparochrus ingens*,\* Felsche, Deuts. Ent. Zeits., 1909, p. 764.

Nigro-piceus, nitidus, breviter ovatus, valde convexus, corpore subtus opaco, parce fulvo-setoso; capite subtiliter punctato, clypeo sat parvo; prothorace laevi, omnino marginato, extus minute punctato, lateribus bene arcuatis, angulis anticis productis, subacutis, posticis rotundatis, margine basali leviter sinuato; elytris sat brevibus, post medium latissimis, omnino sat irregulariter striatis, striis antice et latera versus vage punctatis, dorsi interstitiis partim tessellatis, pectore abdomineque crebre striolatis, opacis; tibiis anticis serratis, dentibus tribus majoribus:

\* Just before going to press I have received Herr Felsche's description of this species, to which I had given another name. By the author's kindness I have been able to examine the type.

♂, pedum anticorum dentibus majoribus minus gracilibus, unguiculo interno valde inflecto, dilatato.

Long. 15-17 mm. Lat. max. 10-10.5 mm.

*Hab.* S. NEW GUINEA: Irupara, Ighibirei (*L. Doria*, July, August 1889-90).

In the British and Genoa Museums.

This species is closely related to the preceding one, but rather more globose and less black and shining. The elytra are more closely striated, and upon the dorsal part the alternate interstices, and all the interstices towards the apex are broken into short elevations and depressions which produce a tessellated appearance. The front tibiae are armed with three moderately sharp teeth in addition to the fine serration.

*Liparochrus timidus*, sp. n.

Niger vel piceo-nigër, nitidus, late ovatus, capite transverse ruguloso, clypeo brevi, quadrato, antice laevissime emarginato; prothorace medio parcissime vix perspicue punctulato, lateribus modice dilatatis, haud crebre fere rugose punctatis, angulis anticis modice prominentibus, paulo rotundatis, posticis obtusis, scutello laevi, acuto; elytris profunde striatis striis geminatis, profundis, vix punctatis, interstitiis parcissime et minutissime punctulatis; tibiis anticis serratis, dentibus tribus magnis.

Long. 6.5-9 mm. Lat. max. 4.5-5.5 mm.

*Hab.* NORTH AUSTRALIA: Alexandria (Oct. to March).

A series of specimens collected by Mr. W. Stalker have been presented by Sir W. Ingram to the British Museum.

It is a black, globose and very shining species with the head rugose, the pronotum very finely and thinly punctured, and the elytra furnished with several pairs of deeply incised, not distinctly punctured striae, the interstices thinly and irregularly sprinkled with minute punctures. The shape and general appearance are as in *L. geminatus*, Westw., but *L. timidus* is larger on the average, and a little more elongate, with the pronotum much smoother and the elytra more deeply striated and more sparingly punctured.

The described species of the genus *Coelodes*, with the exception of *C. castaneus*, Westw., and *C. nigripennis*, Arrow, have the elytra punctured in double rows, with wide,

smooth intervals. The two following new species have them evenly punctured all over.

*Coelodes fumipennis*, sp. n.

Rufo-testaceus, elytris minus laetis, marginibus omnibus late et vage fumatis: subglobosus, capite fere laevi, clypeo leviter rugosulo; prothorace toto impunctato, lateribus fere rectis, baseos medio laevissime prominente; elytris undique sat regulariter seriato-punctatis, stria suturali profunda, punctata:

♂, prothorace antice laevissime impresso, marginis antici medio subacuminato.

Long. 6 mm. Lat. max. 4 mm.

*Hab.* AMAZONS: Para, Ega (*H. W. Bates*). British Museum.

This is easily recognized not only by the uniform fine puncturation of the elytra, but by its rather peculiar colouring, the head, prothorax, legs and lower surface being bright orange-testaceous, while the elytra are almost of the same colour in the middle of the back, but change imperceptibly to a smoky black at the margins.

*Coelodes punctipennis*, sp. n.

Laete testaceus, prothorace interdum paulo dilutiore, modice elongatus; capite rugosulo, postice medio laevi; prothorace impunctato, lateribus leviter arcuatis; elytris undique fortiter et regulariter seriato-punctatis, stria suturali profunda punctata:

♂, capitis vertice leviter transverse carinato; prothorace antice sat late impresso, marginis antici medio subacuminato.

Long. 5.5-6.5 mm. Lat. max. 3.5-4 mm.

*Hab.* ECUADOR: Canelos, Mirador (*Buckley*); Peru: Nauta (*H. W. Bates*).

This is more brightly coloured than *C. castaneus*, Westw., and the elytra are very strongly and uniformly punctured, whereas in Westwood's species they are very feebly and irregularly punctured.

*Chaetodus exaratus*, sp. n.

Rufo-piceus, nitidus, supra leviter cupreo-micans, longe ovatus, ubique parce sat fortiter ferrugineo-setosus; capite parce punctato, clypeo parvo elliptico; prothorace nitidissimo, marginibus antica

et lateralibus fortiter punctatis, disco utrinque parce et grosse punctato, angulis anticis acutis, posticis paulo arcuatis; elytris postice paulo productis, profunde striatis, striis pone partem anticam multo divisis, tenuissimis, interstitiis angustatis, carinatis, parcissime setiferis, corpore subtus minutissime striolato.

Long. 8-8.5 mm. Lat. max. 4.5 mm.

*Hab.* BRAZIL: Rio de Janeiro.

This is a rather large, slightly metallic species, very distinct from those hitherto described. The elytra are rather drawn out behind, so that the body does not appear broadly rounded there, and the striation is very close and deep. The striae are simple in the anterior part, but become broad and multiple, so that the interstices are narrowed to carinae, upon which are placed scanty hairs at intervals.

The British Museum collection contains, besides a specimen taken at Rio de Janeiro by the late Alexander Fry, one from Dejean's collection labelled *Adelops striatus*, Brazil: Sommer. It is quite different from *Chaetodus striatus*, de Borre.

*Phaeochroops peninsularis*, sp. n.

Longe pyriformis, fusco-brunneus, ubique longe rufohirtus; capite crebre et grosse punctato, clypeo parum elongato; prothorace dense et aequaliter sat grosse punctato, absque linea mediana laevi, antice angusto, angulis anticis acutis, lateribus postice leviter arcuatis, basi quam elytris ad humeros sensim angustiore; elytris sat subtiliter annulato-punctatis, utroque obsolete 3-costato, marginibus longe et dense ciliatis; tibiis anticis toto serratis, longe 3-dentatis, posterioribus sat gracilibus, haud carinatis; tarsis quam tibiis multo brevioribus.

Long. 13-14 mm. Lat. max. 7.5 mm.

*Hab.* MALAY PENINSULA: Perak (*W. Doherty*).

One specimen of each sex was taken by the collector.

It is a species extremely close to *P. gigas*, Arrow, and when describing that species I regarded them as identical. It is a little smaller, and the tarsi are noticeably shorter relatively, at least in the male, in which sex they are a little longer than in the female. The pronotum is rather more densely punctured, less shining, and without a smooth longitudinal line along the middle. Its sides are a little more rounded and very slightly incurved beyond the middle, so that the base is a little narrower than in



*P. gigas*. The prothorax and elytra have long marginal fringes of tawny hairs.

*Phacochroops opacicollis*, sp. n.

Longe pyriformis, fusco-brunneus, rufo-hirtus, elytris nitidis; capite dense punctato, clypeo sat brevi, prothorace densissime minute aequaliter punctato, erecte piloso, lateribus antice rectis, angulis acutissimis, postice subtiliter curvatis et late marginatis, angulis sat distinctis, basi ad elytrorum latitudinem (ad humeros) aequali, elytris sat longis, crebre punctatis, singulo obsolete 3-costato, costis breviter setosis, marginibus longe rufo-ciliatis, tibiis anticis minute serratis, longe 3-dentatis, posterioribus haud carinatis, tarsis sat gracilibus.

Long. 15 mm. Lat. max. 7.5 mm.

*Hab.* TENASSERIM: Plapoo, Mt. Mooleyit (*L. Fea*, April 1887).

In the British and Genoa Museums.

This species is like *P. peninsularis* and *gigas*, but a little more elongate and with a less conspicuous hairy clothing. The prothorax is exceedingly densely punctured and clothed with closer but shorter hairs, its sides being nearly straight, with a smooth shining margin, the posterior half of which is rather broad. The elytra are well punctured but very shining, and each has three slight costae which bear fine hairs. The lateral edges of both prothorax and elytra are furnished with long and close fringes. The legs are slender.

*Phacochroops vulpecula*, sp. n.

Pyriformis, fusco-brunneus, longe rufo-hirtus; capite fortiter punctato, clypeo sat longo; prothorace fortiter et aequaliter punctato, lateribus bene arcuatis, vix marginatis, angulis anticis acutis, posticis fere rectis, minute rotundatis; elytris modice nitidis, undique sat crebre annulato-punctatis, singulo leviter 3-costato, longe sat parce hirto, lateribus externis haud dense ciliatis, tibiis anticis sat grosse serratis et acute 3-dentatis, dente supero paulo retro-instructo, tibiis posterioribus haud carinatis.

Long. 12-13 mm. Lat. max. 6.5-7.5 mm.

*Hab.* MENTAWEI IS.: Sipora (*E. Modigliani*, May and June 1894).

In the British and Genoa Museums.

*P. vulpecula* is extremely close to *P. peninsularis*, Arrow, but the clypeus is longer and coarsely, but not rugosely,

punctured, the pronotum is rather more evenly and densely punctured, and the fringe of hairs at the sides of the elytra is considerably longer and thicker.

*Phaeochroops rattus*, sp. n.

Pyriformis, fusco-brunneus, sat breviter fulvo-hirtus; capite grosse fere rugose punctato, clypeo parvo, oculis prominentibus, laevibus; prothorace densissime punctato, transverso, lateribus vix curvatis, angulis omnibus acutis, posticis ad humeros exacte coadaptatis; elytris modice nitidis, fortiter fere confuse punctatis, singulo leviter anguste 3-costato et ad marginem internam magis elevato, marginibus externis vix ciliatis; tibiis anticis extus toto minutissime serratis et acute 3-dentatis, posterioribus medio obsolete carinatis; tarsis quam tibiis paulo brevioribus.

Long. 10 mm. Lat. max. 5.5 mm.

*Hab.* SUMATRA: Setinjak (1800 ft.), Si-Rambé (*E. Modigliani*, Dec. to March).

In the British and Genoa Museums.

Two specimens were found by the late Mr. Ericson in the first locality during January 1898, and a series was collected in the second by Sig. E. Modigliani from December 1890 to March 1891. It is a small species, with shorter and scantier pubescence than usual, and without lateral fringes to the prothorax and elytra. The clypeus is small and the eyes prominent, very finely faceted and shining, with the antecular ridges well developed and not very oblique. The prothorax is relatively rather short, the sides nearly straight behind, and the base rather broad, with prominent hind angles. The elytra are rather more coarsely punctured than in the other species. The legs are moderately slender and fringed, but not thickly, with short hairs.

*Phaeochroops niasianus*, sp. n.

Pyriformis, nigro-fuscus, parcissime setulosus; capite grosse punctato, clypeo parvo, oculis magnis, nitidis; prothorace brevi, dense et grosse punctato, lateribus postice laevissime arcuatis, angulis anticis acutis, posticis minute obtusatis, elytris dense, fere rugose punctatis, punctis haud profundis, singulo elytro leviter 3-costato, marginibus vix ciliatis.

Long. 9-10 mm. Lat. max. 5 mm.

*Hab.* NIAS I. (*H. Raap*, 1897-1898).

In the British and Genoa Museums.

This is closely similar to *P. rattus* and *P. batuensis*, but generally rather darker in colour, and distinguishable by the rather larger and more distinct punctures with which the pronotum is covered. It is also smaller than *P. rattus* and larger than *P. batuensis* and differs from the former by its very shining and finely faceted eyes and the more rounded sides of the pronotum, and from the latter by the finer and less deep puncturation of the elytra.

*Phaeochroops batuensis*, sp. n.

Pyriformis, fusco-rufus, haud dense fulvo-hirtus; capite grosse punctato, oculis nitidis, prothorace brevi, dense punctato, lateribus postice laevissime arcuatis; elytris grosse et profunde rugose punctatis, singulo lineis tribus longitudinalibus vix elevatis instructo, marginibus vix ciliatis.

Long. 8-9 mm. Lat. max. 4-5 mm.

*Hab.* BATU I. (*H. Raap*, 1896-1897).

In the British and Genoa Museums.

This is extremely close to *P. niasianus*, but a little smaller on the average and a shade lighter in colour, with longer and more evident pubescence upon the upper surface. The punctures of the prothorax are more numerous and those of the elytra deeper and rougher.

*Phaeochroops mentawaiensis*, sp. n.

Pyriformis, fusco-brunneus, sat parce fulvo-setosus; capite rugose punctato, clypeo brevi, oculis haud nitidis, grosse granulatis, prothorace brevi, dense punctato, postice lato, lateribus vix arcuatis, angulis posticis prominentibus; elytris dense et rugose punctatis, singulo lineis tribus longitudinalibus vix elevatis instructo, marginibus vix ciliatis.

Long. 9 mm. Lat. max. 5 mm.

*Hab.* MENTAWAI Is.: Sipora (*E. Modigliani*, May and June 1894).

In the British and Genoa Museums.

This species is at first sight exactly like *P. niasianus*, but the eyes are more coarsely faceted and not glossy, the clypeus is more finely and rugosely punctured, and the elytra are more coarsely and rugosely sculptured, with rather sharper costae.

*Phaeochrous dissimilis*, sp. n.

Piceo-niger, ore pedibus, prothoracis et elytrorum marginibusque brunnescentibus, abdomine ferrugineo; capite crebre punctato, prothorace nitido modice punctato, lateribus grosse et crebre punctatis, elytris crebre punctatis, seriebus tribus longitudinalibus regulariter quadristriato-punctatis, interstitiis crebre confuse punctatis :

♂, multo major, mandibulis modice prominentibus, rotundatis, capite subnitido, prothoracis lateribus latissimis, confluentur punctatis, elytris opacis, parte antica angusta nitida; lateribus cum pedibus longe rufo-hirtis, tibiarum anticarum dente supero minuto :

♀, sat nitida, capite rugoso, tibiis anticis fortiter 3-dentatis et serratis.

Long. 13-16 mm. Lat. max. 7.5-8.5 mm.

*Hab.* TENASSERIM, Moumein (*L. Fea*, May 1887).

In the British and Genoa Museums, and M. René Oberthür's collection.

This is the largest species of *Phaeochrous* I have seen, and the disparity between the sexes, always considerable in this genus, is very remarkable. The anterior half of the upper surface of the male is shining, and the posterior half (*i. e.* the whole of the elytra except a narrow anterior strip) entirely dull and sooty. The female is shining above and beneath, except upon the head, which is rugose. The elytra (in both sexes) are finely and densely punctured, and each has three longitudinal bands composed of four straight lines of punctures. The colour is rather dark with the abdomen reddish.

The claws of the male are blunt, with the basal appendage inconspicuous and the tooth of the outer claw reaching beyond the middle.

A similar sexual difference in the elytra is found in a West African species, *Phaeochrous dispar*, Qued.

*Phaeochrous pallidus*, sp. n.

Laete ferrugineus, sat parvus, prothorace distincte haud dense punctato, elytris fortiter et aequaliter crebre striato-punctatis, haud costatis :

♂, mandibulis latis, prominentissimis, capite nitido, modice punctato, tibiis anticis latis, tridentatis, dente tertio minuto, margine supra leviter crenulato, haud distincte serrato :

♀, capite fortiter rugose punctato, elytrorum interstitiis minute sat parce punctulatis.

Long. 9-10 mm. Lat. max. 4-5 mm.

*Hab.* SOUTH MYSORE: Nilgiri Hills (*H. L. Andrewes, Sir G. F. Hampson*); CEYLON.

Type in the British Museum.

*P. pallidus* is very much like *P. emarginatus*, Cast., but is of a bright mahogany colour and rather smaller than the normal size of that species. The pronotum is moderately sparsely punctured and the elytra finely and closely striate-punctate, with the intervals not elevated. In the males the front tibiae are rather broad and indistinctly serrate before and after the minute uppermost tooth, only three or four serrations being distinguishable above it. The mandibles are a little broader and more prominent than in *P. emarginatus*. In our single female specimen the elytra are very finely but distinctly punctulated in the interstices.

*Phaeochrous arabicus*, sp. n.

Piceus vel rufo-piceus, modice nitidus; capite crebre prothorace parce sed distincte punctato, elytris crebre striato-punctatis antice sat regulariter, postice confusus;

♂, mandibulis prominentissimis antice omnino arcuatis, tibiis anticis tri-dentatis, forcipis lobo dextro lanceolato, modice acuto, lobo sinistro lato, fere quadrato.

Long. 9-11 mm. Lat. max. 5-6 mm.

*Hab.* ARABIA: Yemen (*Millingen*). British Museum.

This species was contained in the bequest of the late Alexander Fry. It is intermediate between the Oriental and African groups, the elytra in the first being striate, while in the second they are more or less irregularly punctured. In *P. arabicus* the elytral punctures are arranged in longitudinal rows, some of which are lightly impressed, but towards the apices they become broken up.

*Phaeochrous nitidus*, sp. n.

Nigro-piceus, nitidus, ore, pedibus, corporeque subtus ferrugineis; prothorace irregulariter punctato; elytris creberrime confuse punctatis, punctorum seriebusque tribus longitudinalibus quadruplice instructis, tibiis anticis tridentatis et sat minute serratis:

♂, mandibulis prominentibus, capite fortiter punctato, prothorace haud late marginato, lateribus antice modice arcuatis; forcipis lobo dextro anguste lanceolato, haud distorto, sinistro brevi, basi vix dentato.

Long. 10.5-12 mm. Lat. max. 6-6.5 mm.

*Hab.* GERMAN E. AFRICA: Masailand, Kilimanjaro.

In the British Museum.

*P. nitidus* is another species very difficult to distinguish from *P. Beccarii*, but the puncturation is a little finer and the surface therefore rather more shining. The form also appears to be a trifle more elongate. In the male the prothorax is a little less dilated, the sides rather more rounded in front and less divergent behind. The examination of the genitalia, however, is the only means of discrimination which I have found really conclusive. To facilitate comparison I give here a short description of this part in the male of *P. Beccarii*, Har., of which by Dr. Gestro's kindness I have been able to examine the original specimens:—

Forcipsis lobo dextro longo, paulo contorto, apice lanceolato, basi paulo inflato, lobo sinistro sat brevi, basi fortiter dentato.

*Phaeochrous mashunus*, sp. n.

*P. madagascariensis*, Péring. (*nec* Westw.), Trans. S. Afr. Phil. Soc., 1900, p. 497.

Nigro-piceus, parum nitidus, ore, pedibus, corporeque subtus ferrugineis; prothorace sat distincte irregulariter punctato; elytris punctorum seriebus tribus longitudinalibus quadruplice instructis, interstitiis creberrime confuse punctatis, tibiis anticis tridentatis et sat minute serratis:

♂, mandibulis antice prominentissimis, subtruncatis, capite sat leviter punctato, prothorace sat late marginato; forcipsis lobo dextro breviter lanceolato, acutissimo, sinistro latissimo, basi minute dentato.

Long. 11·5-12·5 mm. Lat. max. 6-6·5 mm.

*Hab.* MASHONALAND: Salisbury (*G. A. K. Marshall*); NYASALAND (*Thelwall*).

Mr. Peringuey has described this under the name of *P. madagascariensis*, but although very like that (and all the species of *Phaeochrous* are extraordinarily alike) it still more closely resembles *P. Beccarii*, Har. It is a little smaller than the Madagascan species, and the puncturation is less fine and regular. From *P. Beccarii* it is distinguishable by the less distinct quadruple rows of punctures upon the elytra, which are a little more shining in the male. The mandibles in that sex are also more prominent and more quadrate externally.

*Phaeochrous amplus*, sp. n.

Ferrugineus, latus, sat nitidus, capite fortiter, prothorace distincte, punctatis, elytris crebre et toto irregulariter punctatis, absque lineis longitudinalibus distinctis:

♂, mandibulis haud prominentissimis, tibiis anticis distincte tridentatis; forcipis lobis duobus productis, dextro acuto, sinistro obtuso.

Long. 10–12 mm. Lat. max. 5·5–6·5 mm.

*Hab.* CAMEROONS: Mundame (*R. Rohde*). In the British Museum and German Entomological National Museum.

This is closely related to *P. gambiensis*, Westw., but both sexes are more shining, more strongly punctured on the head and thorax, and without smooth longitudinal lines upon the elytra. The male is a little broader, and the front tibiae, which in *P. gambiensis* have only two front teeth, are distinctly tridentate.

*Phaeochrous camerunensis*, sp. n.

Piceus, vel rufo-piceus, fere nitidus, capite prothoraceque ubique leviter punctatis; elytris fortiter irregulariter punctatis, lineis distinctis longitudinalibus, antice elevatis:

♂, mandibulis prominentissimis, tibiis anticis acute bidentatis; forcipis lobo dextro longo, contorto, apice acutissimo, uncinato, lobo sinistro brevissimo, lato.

Long. 10–12 mm. Lat. max. 5–6 mm.

*Hab.* CAMEROONS: Mundame (*R. Rohde*).

In the British Museum and the German Entomological National Museum.

It is rather darker-coloured and less broad than the previous species, with the head less punctured and the elytra more coarsely punctured, with distinct longitudinal lines, which are slightly elevated in front. It is exceedingly like *P. mashunus*, but a little less shining, less coarsely punctured, and the front tibia of the male has only two sharp teeth, as in *P. gambiensis*, Westw.

*Phaeochrous thomensis*, sp. n.

Rufus, capitis vertice elytrisque piceis, sat nitidus; capite prothoraceque parce punctatis, elytris sat crebre punctatis, lineis longitudinalibus modice distinctis:

♂, mandibulis prominentibus, subcircularibus; tibiis anticis

distincte 3-dentatis; forcipis lobis longitudine subaequalibus, dextro lanceolato, basi paulo inflato, sinistro obtuso.

Long. 10-11 mm. Lat. max. 6 mm.

*Hab.* W. AFRICA: ST. THOMÉ I., Vista Alegre (*L. Fea*, Oct. 1900). In the British and Genoa Museums.

This is another rather bright and shining species close to *P. amplus*, but less broad, with darker and less finely and uniformly punctured elytra.

*Hybochaetodus*, gen. nov.

Corpus breviter ovatum, convexum. Oculi haud prominentes, de supra visi vix perspicui. Clypeus semicircularis, fere ut latus quam caput. Labrum breve, porrectum, transversum. Mandibulae porrectae, falciformae, extus obtuse angulatae, apicibus acutis. Antennae breves, sat crassae. Prothorax lateribus arcuatus. Scutellum minutum, vix perspicuum. Corpus subtile grosse striolatum. Pedes haud longi. Tibiae anticae 3-dentatae, supra serratae.

*Hybochaetodus obscurus*, sp. n.

Niger vel piceus, capite pronotoque obscure cupreis, his grosse sat crebre punctatis, pronoti medio leviter sulcato, ante marginem posticam late et profunde triangulariter impresso, lateribus regulariter arcuatis, angulis anticis acutis, posticis obsoletis, singulo elythro carinis angustis circa 13 praebentibus, 4°, 7°, 10° et 13° paulo magis elevatis, integris, reliquis plus minusve interruptis, tibiis anticis acute 3-dentatis, supra serratis.

Long. 8 mm. Lat. max. 4 mm.

*Hab.* PERU: Vilcanota.

Two specimens were contained in the Berlin Entomological Museum, one of which has been presented to the British Museum.

The genus is a well-marked one allied to *Chaetodus*, but more ovate and not setose. The scutellum is much reduced and covered by the pronotum when the latter is not drawn forward. The mandibles are large and very acute, and when the tips meet a gap is left between mandibles and labrum. The pronotum is very strongly punctured and has a deep pit just before the base. The elytra are opaque and closely carinate, each third carina being very slightly more regular and pronounced than those intervening.



Sub-family.—*TROGINAE*.

I have said above that the only genus with any close relationship to the well-known and widespread genus *Trox* is *Cryptogenius*, known only by a single rare species. That species, *C. miersianus*, Westw., inhabits Colombia. A second species is here described which has been found in Brazil.

*Cryptogenius Fryi*, sp. n.

Fusco-brunneus, haud nitidus, angustus, sat depressus, undique grosse sat parce setosus; capite rugoso; prothorace crebre punctato, lateribus valde rotundatis, serratis, post medium abrupte inflexis, angulis posticis acutis, baseos medio obtuse angulato, elytris longitudinaliter strigose vermiculato, tuberculis paucis seriatim instructis, carina acuta integra laterali aliaque interna vestigiali antica, lateribus obsolete serratis; pedibus sat longis, femoribus anticis subtus fortiter mucronatis, tibiis omnibus serratis.

Long. 7.5 mm. Lat. max. 4 mm.

*Hab.* BRAZIL: Petropolis.

A single specimen was found in October 1851, by the late Alexander Fry.

This species has nearly the same size and shape as *C. miersianus*, but is a little shorter relatively, not so dark in colour (which may be only individual), and more finely and closely sculptured. There is a slight coppery lustre upon the femora and the front margin of the prothorax. The most remarkable feature is the very strong hooked tooth situated at the middle of the lower edge of the front femur and pointing outwards. The pronotum is very coarsely and closely punctured, and has not the strong oblique carinae of *C. miersianus*, and the elytra are entirely covered with fine irregularly broken up longitudinal striations.

It will perhaps not be out of place to record here that *Trox trisulcatus*, Curtis (Chili), of which the type is in the British Museum, is the very common and widespread species *T. scaber*, L.

Sub-family.—*IDIOSTOMINAE*.

I formed this sub-family in 1904 for a single new genus of which two species were described, both inhabitants of

Southern Patagonia. It appears that this curious group of beetles ranges over a much larger area of South America and perhaps contains many species. Two or three have been already described and placed in different genera of *Dynastinae*, a group to which, as I pointed out, they have a superficial resemblance. It will be useful to bring together the references, which are as follows—

Genus IDIOSTOMA, Arrow, Trans. Ent. Soc. Lond., 1904, p. 740.

*Landbecki*, Phil. (*Oryctes*), Stett. Ent. Zeit., 1873, p. 309, Pl. II, fig. 2; Anal. Univ. Santiago, 1887. Chili.

syn. *Paulseni*, Fairm. (*Phyllognathus*), Bull. Soc. Ent. France, 1885, p. 189.

*Medon*, Arrow, *l.c.* p. 741. Patagonia.

*rufum*, Arrow, *l.c.* S.W. Patagonia.

*simplicifrons*, Fairm. (*Phyllognathus*), *l.c.* Peru.

The two species of Fairmaire are very inadequately described, but M. Germain has stated that *I. Paulseni*, Fairm., and *I. Landbecki*, Phil., are identical, and that they belong to a new genus of *Orphnidae*. I have not seen M. Germain's paper, owing to the Chilian periodical not reaching this country, but my friend Dr. Ohaus has kindly given me this information and has also sent me for comparison with our specimens an example of *I. Landbecki* found by himself at San Isidro, Chili. It closely resembles *I. rufum*, but is rather more elongate and much less strongly punctured, while the maxillae have distinct inner and outer lobes, the inner one very short and both fleshy and unarmed.

#### Sub-family.—ACLOPINAE.

Only two genera of this peculiar group are known, *Aclopus*, containing two South American species, and *Phaenognatha*, containing one species from North Australia, to which Dr. Heller has recently added another from Argentina. This is not very similar superficially, but is so close in all essential points that, although a genus might well have been made for it, there is no incongruity in the course which Dr. Heller has preferred, while the interesting geographical distribution of these forms, supplying another instance of the special relationship of the Australian to the South American fauna, is emphasized.

In the British Museum there is a specimen of another Argentine species, not in sufficiently good condition for description, and a careful examination of all the Australian examples of *Phaenognatha* I have been able to bring together has led me to distinguish six species, all of which are now represented in the National collection. The species of *Aclopus* are still more numerous, but specimens in good condition are rare. I have described only one new species.

In comparing the mouth parts of *P. Jenseni* with those of *P. Erichsoni*, Hope, Dr. Heller has relied upon Westwood's figures, which are not in every particular accurate. The last joint of the maxillary palpus is not shorter than the preceding joint, but distinctly longer, as it is in *P. Jenseni*. The *Phaenognatha* from Rockhampton examined by Dr. Heller is not Hope's species but *P. aequistriata*, one of the forms here described.

The body is rather soft and plastic in these beetles, and owing to their rarity it is difficult to determine what features are most constant and significant from the systematic point of view. The genitalia are little chitinized and of very simple form, affording no assistance in the discrimination of the species. I have already mentioned that males only have so far been found, and so few of these exist in European collections that no satisfactory systematic study is yet possible. It is to be hoped that closer investigations by collectors will soon enable the present rather tentative survey to be superseded.

The following short diagnosis of the typical species is drawn from the type specimen in the Oxford Museum.

*Phaenognatha Erichsoni*, Hope.

Trans. Ent. Soc., Vol. IV, 1845, p. 113, Pl. VI, fig. 5.

Testaceo-rufa, elytris, margine antico excepto, nigris; corpus sat latum, clypeo prope marginem anticum cornu recurvato apice acuminato armato, prothorace lato, elytris sat brevibus, postice valde attenuatis, profunde geminato-striatis, striis punctatis, interstitiis alternis latis, irregulariter punctatis, apicibus intus subangulatis, tarsis posticis longissimis, unguibus minutis.

Long. 15 mm. Lat. max. 8-9 mm.

*Hab.* NORTH AUSTRALIA: Port Essington.

TRANS. ENT. SOC. LOND. 1909.—PART IV. (DEC.) L L

There is a second specimen of this species in the British Museum, taken by the ornithologist, Gould, at the same time as the Oxford example.

*Phaenognatha angusta*, sp. n.

Testaceo-rufa, elytrorum dimidio posteriore nigro; corpus sat angustum, fulvo-hirtum, clypei medio cornu bicuspidato armato, prothorace quam elytris paulo latiori, antice late fossato et fulvo-hirto, elytris sat longis, valde attenuatis, dorso profunde geminato-striatis, striis punctatis interstitiis alternis latis, irregulariter punctatis, tarsis posticis longissimis, subtus sat dense hirsutis, unguibus minutis.

Long. 14.5-16 mm. Lat. max. 8 mm.

*Hab.* N. QUEENSLAND.

This species has been confused with *P. Erichsoni* in the British Museum and other collections. It differs from it in the following particulars. It is narrower in shape, and the black patch is restricted to the hinder half of the elytra. The cephalic horn is placed at a distance from the margin of the clypeus, and is narrow, parallel-sided and two-cusped at the end.

*Phaenognatha tristis*, sp. n.

Nigra, nitida, corpore paulo elongato, subtus dense fulvo-hirto, clypeo prope marginem anticum cornu recurvato, sat lato, apice acuminato, armato; prothorace lato, antice late retuso et fulvo-hirsuto; elytris postice valde attenuatis, profunde geminato-striatis, interstitiis alternis latis, omnino irregulariter crebre punctatis; tarsis posticis longissimis, sat dense fulvo-pubescentibus, pilis decumbentibus, unguibus minutissimis.

Long. 17-19 mm. Lat. max. 9-10 mm.

*Hab.* N. QUEENSLAND: Mein.

This is the largest species I have seen of the genus. In addition to its size and dark colour, it differs from *P. Erichsoni*, which it most resembles, by its elytra being more produced behind. The hind tarsi are very long and thickly hairy. As in *P. Erichsoni*, the cephalic horn is produced to a point and the elytral striae are very distinctly paired, with the intervening spaces broad and strongly punctured.

*Phaenognatha aequistriata*, sp. n.

Testaceo-rufa, elytrorum apicibus nigris, corpore sat lato, subtus fulvo-hirto; clypei medio cornu brevi, apice truncato aut bicuspidato, armato; prothorace latissimo, antice leviter fere semicirculariter depresso et fulvo-hirsuto; elytris sat latis, postice modice attenuatis, profunde punctato-striatis, interstitiis fere aequalibus, subsuturali et humerali irregulariter punctatis; tarsis posticis longissimis, articulis longe erecte setosis, unguibus minutis.

Long. 15-16 mm. Lat. max. 8-9 mm.

*Hab.* QUEENSLAND. (Simson.)

A small specimen of this species in Herr Felsche's collection is from Rockhampton and another from Mackay.

This species has almost the same shape as *P. Erichsoni*, and the coloration of *P. angusta*. The cephalic horn is very short, tapering but not acuminate, and placed at a distance from the clypeal margin. The pubescent depression at the front of the pronotum is very slight, not wide, and its hind margin is not sharply defined. The elytra are rather broad, the striae nearly equidistant and the subsutural and humeral interstices irregularly, but not very strongly, punctured, and the intervening interstices not or scarcely punctured. The hind tarsi are very long, each joint having at its extremity a cirlet of long outstanding bristles, and the claws are not quite as small as in *P. angusta* and *Erichsoni*.

*Phaenognatha scutellata*, sp. n.

Rufo-castanea, scutello fere nigro elytris que testaceis, apicibus vage infuscatis, capite corporeque subtus sat longe fulvo-hirtis; capite omnino rugoso, lato, oculis parvis, sat distantibus, clypeo prominente, cornu a margine remoto, brevi, angusto; prothorace quam elytris vix latiore, lateribus irregulariter punctato, medio fere laevi, antice paulo retuso et pubescente; elytris profunde striatis, striis vage punctatis, interstitiis aequalibus, subsuturali et humerali irregulariter punctatis; tarsis posticis quam tibiis duplo longioribus, articulis extremitate setis longis instructis, unguibus gracilibus, longitudine vix ad articuli ultimi dimidium aequalibus.

Long. 10-11.5 mm. Lat. max. 5.5-6.5 mm.

*Hab.* QUEENSLAND.

The type specimen has been kindly presented to the National Collection by Mr. B. G. Nevinson, who has a

second example. It is a small species, similarly coloured to *P. Erichsoni*, but the scutellum is black, and the black apical patches of the elytra fade quite gradually in front. The horn upon the head is slender and distant from the front of the clypeus. The labrum is very prominent but not pointed, and the mandibles are rounded at the sides. The elytra are moderately broad at the shoulders and taper to the extremities. They are marked with deep and almost equidistant striae, and the subsutural and humeral intervals are slightly punctured. The hind tarsi are twice as long as the tibiae, the joints are circled with long, stiff, outstanding bristles, and the claws are moderately long but less than half the length of the claw-joint.

*Phaenognatha pusilla*, sp. n.

Nigra, vel piceo-nigra, supra nitida, capite corporeque subtus longe haud dense fulvo-hirtis; capite lato, oculis parvis, sat distantibus, clypeo prominente, granuloso, cornu postico, brevi, acuminato, a margine remoto; prothorace quam elytris vix latiore, undique irregulariter punctato, antice paulo retuso et dense pubescente; elytris profunde striatis, interstitiis subsuturali et humerali punctis nonnullis instructis; tarsis posticis quam tibiis duplo longioribus, articulis extremitate setis longissimis instructis, unguibus sat longis, gracilibus, longitudine ad articuli ultimi dimidium aequalibus.

Long. 8.5-10 mm. Lat. max. 5-6 mm.

*Hab.* N. AUSTRALIA: Alexandria (*W. Stalker*).

Two specimens have been presented to the Museum by Sir William Ingram.

It is a uniformly dark species. The eyes are rather small and distant and the cephalic horn is short and sharp and situated considerably behind the front margin of the clypeus. The labrum is narrow, rounded at the apex and not tapering, and the mandibles are uniformly curved externally and not sinuated. The anterior depression of the pronotum is divided in the middle by a slight longitudinal carina and the elytra are not long, moderately convex and deeply striated, the striae very coarsely but indistinctly punctured and the interstices smooth except the subsutural and humeral ones, which bear a few irregular punctures. The middle and hind tarsi are about twice the length of the tibiae, the claws are moderately long (more than half the length of the claw-joint), and the

tarsal joints have each a circle of outstanding bristles at the extremity, each bristle as long as the joint.

*Aclopus robustus*, sp. n.

Niger vel nigro-piceus, elongatus, robustus, femoribus tibiisque crassis, tarsis modice gracilibus; capite parvo, vertice late arcuatim impresso et confuse punctato, clypeo fere quadrato, grossissime punctato, labro sat lato, margine incrassato; prothorace haud longo, sat parce punctato; elytris convexis, fortiter crebre punctatis, postice attenuatis, lateribus arcuatis, costa suturali crassa; tibiis brevibus, anticis fortiter bidentatis, posterioribus dilatatis, tarsis sat longis, setis haud erectis.

Long. 10-11.5 mm. Lat. max. 4-5 mm.

*Hab.* RIO DE JANEIRO: Cantagallo; BAHIA.

One specimen in the British Museum was taken by the late Mr. A. Fry at Cantagallo, and Herr Felsche possesses two examples from Bahia.

It is a large, strongly-built species, and distinguished, in addition to its colour, by its short and flattened posterior tibiae and not excessively long tarsi. The elytra are more strongly punctured, more rounded at the sides and more tapered behind than in *A. brunneus*, Er., the clypeus is larger and rather rectangular, with a broad thickened margin, and the labrum is broad and has a similarly thickened anterior margin.





XVI. *Two remarkable forms of Mantid oothecae.* By  
R. SHELFORD, M.A., F.L.S., F.Z.S.

[Read October 20th, 1909.]

PLATE XVII.

IN a miscellaneous collection of insects formed by the late Mr. F. P. Pascoe and recently presented to the Hope Department, Oxford University Museum, by Miss Pascoe, was found a box containing five Mantid oothecae from Delagoa Bay. These specimens, together with an ootheca found at Chamicuros, Peruvian Andes, by the late Edward Bartlett and now in the Oxford Museum,\* are so unlike the usual type of Mantid egg-case, that descriptions and figures of them will not be without interest.

The East African specimens, which vary considerably in size (30 mm.—15 mm. in length  $\times$  14 mm.—12 mm. in diameter), are semi-transparent, bladder-like structures, elongate-oval to almost spherical in shape and straw-yellow in colour. Each is attached by a slender ring of parchment-like consistency to the twig of a plant. The substance forming the walls of an ootheca also resembles very thin parchment and is in direct continuity with the attaching ring; its surface is seen to be finely reticulated, an appearance that is due to the inclusion of air-bubbles in this dried and hardened secretion of the thecogenous glands. The oothecae are firmly attached and stand out from the twigs at varying angles. Along the middle line on the upper surface of the ootheca there runs a well-defined ridge. This ridge is made up of a double series of empty cells, 70 to 40 in number, open at the top but closed at the bottom, so that they do not communicate with the interior of the ootheca. The outer walls of these cells are higher than the inner walls, the ridge, consequently, when viewed from above, appears to be grooved; the inner cell-walls of one series interdigitate with the inner cell-walls of the other series in a perfectly regular and sym-

\* The South American specimen bears the label "♂, ♀ and nest," but I have not been able to find the insects in the Hope collection of Mantidae.

metrical way. When an ootheca is cut open a septum will be seen dividing the oothecal cavity almost completely into a right and left half; it extends inwards from immediately below the ridge on the upper surface of the oothecal wall towards the opposite wall, which, however, it does not reach. The septum is a homogeneous vesicular membrane of no great thickness but quite opaque; its free border is irregular in outline. The eggs are placed in 15 to 20 rows on either side of the septum with their long axis at right angles to it and with the heads of the embryos directed outwards; they form two compact masses which do not cover the whole of the septum but only about a third of its surface, extending from the free border towards the line of attachment. In one of the larger oothecae there are 136 eggs situated on one side of the septum and apparently an almost equal number are to be found on the other side. There is no information accompanying the specimens, so that it is not possible to say if they were made by a single or by more than one individual.

The South American specimen is rather different in appearance from the Delagoa Bay examples, though it is built on essentially the same plan. It is almost a perfect sphere, 15 mm. in diameter, hollow, dark green in colour and semi-transparent; its walls are quite smooth with the exception of inconspicuous reticulations, and there is no ridge as in the African specimens. The ootheca is borne on a slender tubular stalk, and no doubt this was originally attached to a twig, but it has been cut by the collector so that the method of attachment cannot be determined now. In the centre of this hollow sphere is an imperfectly spherical mass of densely vesicular material like dried foam in appearance. About 80 eggs are embedded in this mass, they are set close together with the anterior pole directed outwards and their arrangement is, roughly speaking, radiate. This central egg-mass is attached to the outer wall of the ootheca by a thin septum which incompletely divides the ootheca into two halves; the line of attachment of this septum corresponds to that of the septum in the East African oothecae and undoubtedly the two structures are homologous. A few fragile strands of dried foam help to moor the central egg-mass to the surrounding wall of the ootheca.

The accompanying diagrammatic figures of transverse

sections through the two oothecae, together with the photographs, should make clear anything that is at all obscure in the foregoing description.

These two forms of Mantid oothecae differ radically from all those that have previously been described on account of their hollow nature, whereby the enclosed mass of eggs

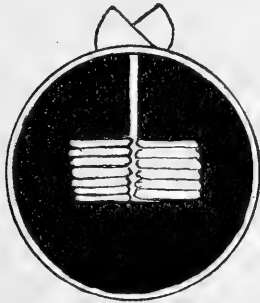


FIG. 1.—Diagrammatic transverse section of the ootheca from Delagoa Bay.

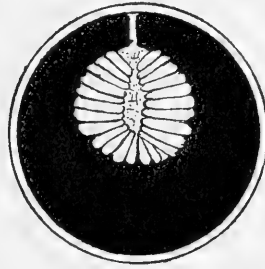


FIG. 2.—Diagrammatic transverse section of the ootheca from the Andes.

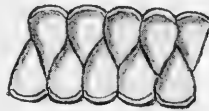


FIG. 3.—Portion of the grooved ridge of the Delagoa Bay ootheca viewed from above.

is surrounded by an empty air-space. Thanks to the admirable researches of Giardina\* we are acquainted with the structure and method of formation of the ootheca of the European Mantis, *M. religiosa*. In this species—and it is probable that in nearly all the *Mantinae* the structure of the ootheca is essentially similar—the eggs are enclosed in a double series of thin-walled cells; the cells, except a few at the anterior and posterior ends of the ootheca, are practically divided into an internal and an external half; the former contain the eggs, the latter are empty and together form a thick spongy layer protecting the inner core of eggs. Each egg-cell communicates with the exterior by a narrow passage, opening on the upper surface

\* Natural. Siciliano (N.S.), Anno II, and Giorn. Soc. Sci. Nat. Econ. Palermo, XXII (1899).

of the ootheca, which here presents a double series of imbricating scales; these scales are in reality the free ends of the lamellae which form the walls of the egg-cells and between them lie the passages to the interior of the egg-cells. The young larvae, when ready to emerge, have merely to push their way along the "canali di uscita," as Giardina terms them, in order to gain access to the outer world. This is a very bald description of an extremely complicated structure, but it suffices for my present purpose, and readers anxious for further details must consult Giardina's two memoirs. The nests of species of *Ameles* are described by the same authority; they chiefly differ from that of *Mantis religiosa* by the presence of a grooved ridge apparently very like that in the East African oothecae here described; at the bottom of the ridge occurs the double row of the openings of the "canali di uscita." The ridge, in fact, is strictly homologous with the double row of imbricating scales in the nest of *Mantis* and is formed by the free ends of the lamellae composing the walls of the egg-cells. I will return to this point later.

The ootheca of *Gongylus gongylodes* (sub-fam. *Empusinae*) has been described in some detail by Captain C. E. Williams in the Transactions of this Society for 1904, pp. 129-131, and I need not allude further to this excellent piece of work beyond remarking that the egg-cells are not protected by a surrounding spongy layer of empty cells but by a layer of hardened foam only  $\frac{1}{8}$  in. thick; the young larva "softens the end of the cell in which it lies, and this falls outwards as a small disc hanging by a silk thread," and the larva is now free to walk out of its prison. The ootheca of *Hymenopus bicornis* (sub-fam. *Harpaginae*) is very like that of *Gongylus* and the emergence of the larvae is effected in the same manner.

Turning now to the Blattidae, which are more nearly related to the Mantidae than is any other family of the Orthoptera,\* we find that the ootheca of a species such as *Blatta orientalis* is a chitinous capsule in which the eggs are tightly packed; when the larvae are ready to emerge either by their movements or perhaps by the action of a cephalic ampulla (cf. Mlle. Pavlova, Zool. Anz., 1895, p. 7)

\* Handlirsch (Die fossilen Insekten, p. 1290) regards the Blattidae and the Mantidae as orders of the sub-class *Blattaeformia*, and the Acridiidae + Locustidae + Gryllidae, the Phasmidae and the Dermaptera as orders of the sub-class *Orthopteroidea*.

the sides of the capsule are forced apart and the larvae are liberated.

But the larvae of the *Mantidae* that formed the remarkable oothecae described in this paper, when they throw off their egg membranes are in very different case, for they find themselves in a relatively vast and empty space, the walls of which are both tough and smooth. They can find no *point d'appui* whence they can exert pressure on the oothecal wall, and it is difficult to see how with their tender mandibles they can gnaw their way through this resistant tissue. At one time I was inclined to believe that the ridge on the East African oothecae was a line of dehiscence and marked, so to speak, the line of least resistance in the structure. But this is not so, the ridge is the toughest part of all, and even if it was a line of dehiscence, where is this line in the South American specimen? For the release of the larvae, then, either the bladder-like oothecae must crack open at the propitious moment, or, as appears more probable, the larvae are provided with some special organ that enables them to pierce or rasp a way through the walls of their prisons.

The grooved ridge on the East African ootheca deserves another word of notice. Superficially it resembles the grooved ridge on the ootheca of *Ameles* and might be regarded as formed in a similar way. But this cannot be so. The ridge of the ootheca of *Ameles* is the product of the free ends of the lamellae forming the walls of the egg-cells; as each cell is made and each egg laid a portion of the ridge is formed and its construction proceeds *pari passu* with the growth in size of the ootheca. It is plain, therefore, that each element or division of the ridge is in direct relation with an egg and egg-cell. The ridge in the African oothecae is, as stated, made up of a double series of compartments, but these compartments bear no relation to the internal structure of the ootheca. The septum is homogeneous and shows no trace of the segmental arrangement characteristic of the internal structure of the ootheca of other *Mantidae*. Moreover, the eggs not only lie at right angles to the direction of the ridge, instead of in the same plane as in *Ameles*, but are also much more numerous than the compartments of the ridge, and the number of rows in which they are arranged is less than the number of compartments. It seems, then, almost certain that this grooved ridge is functionless as

regards the emergence of the larvae, so that if it is the morphological equivalent of the grooved ridge in *Ameles* ootheca and of the imbricating scales of *Mantis* oothecae—and I am by no means convinced that this is the case—it is certainly not the physiological equivalent of those structures. The sequence of events in the construction of the African oothecae can, in the absence of direct observations, only be guessed at. The first part to be formed is evidently the attaching ring, then on this is built in a semi-circular sweep the grooved ridge, to which is fixed the septum with the eggs; the final stage in the process is probably the formation of the thin enveloping wall. Such may or may not be the sequence of events—an hour's observation of the living insect at work can upset the most closely-reasoned theory formed in the museum or laboratory. It is noteworthy that neither in the African nor South American oothecae are the eggs enclosed in separate cells.

Bilateral symmetry, which is so marked a characteristic of all Mantid oothecae, is clearly distinguishable in the African egg-cases here described, but is scarcely to be distinguished in the South American specimen owing to its spherical shape and to the radiate arrangement of the eggs; the position of the septum is the only feature that remains to show that this ootheca is derived from a bilaterally symmetrical form.

A much reduced figure of an ootheca from the Egyptian Sudan, closely resembling those described above from Delagoa Bay, is figured on Plate II of SitzB. Kais. Akad. Wiss. math. naturw. Klasse cxvi, Abt. 1 (1907); it was taken at Gondokoro by Dr. Fr. Werner. There is no mention of it in the text.

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#### EXPLANATION OF PLATE XVII.

[See *Explanation facing the PLATE.*]

DEC. 31, 1909.



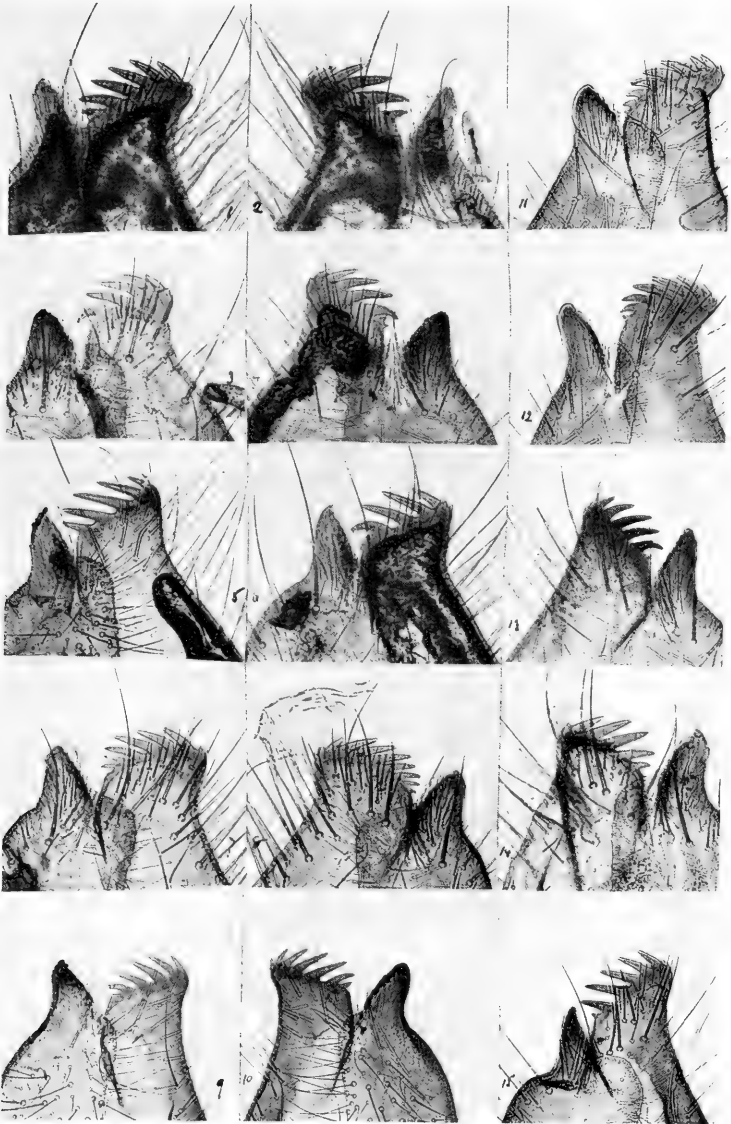
## EXPLANATION OF PLATE A.

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Variation in clasps of *Plebeius argus (aegon)*. Ends of clasps  
× 60 diams.

- FIGS. 1 and 2. Right and left clasps of a specimen from Bejar, Spain.  
,, 3 ,, 4. Right and left clasps of a specimen from Canales,  
Spain.  
,, 5 ,, 6. Right and left clasps of a specimen from Digne,  
France.  
,, 7 ,, 8. Right and left clasps of a specimen from Claremont,  
England.  
,, 9 ,, 10. Right and left clasps of a specimen from Kent (?),  
England.  
,, 11. One clasp from a Japanese specimen.  
,, 12. One clasp from a Japanese specimen (*micrargus*).  
,, 13. One clasp from an English specimen.  
,, 14. One clasp from an English specimen (Kent ?).  
,, 15. One clasp from an English specimen (Kent ?)



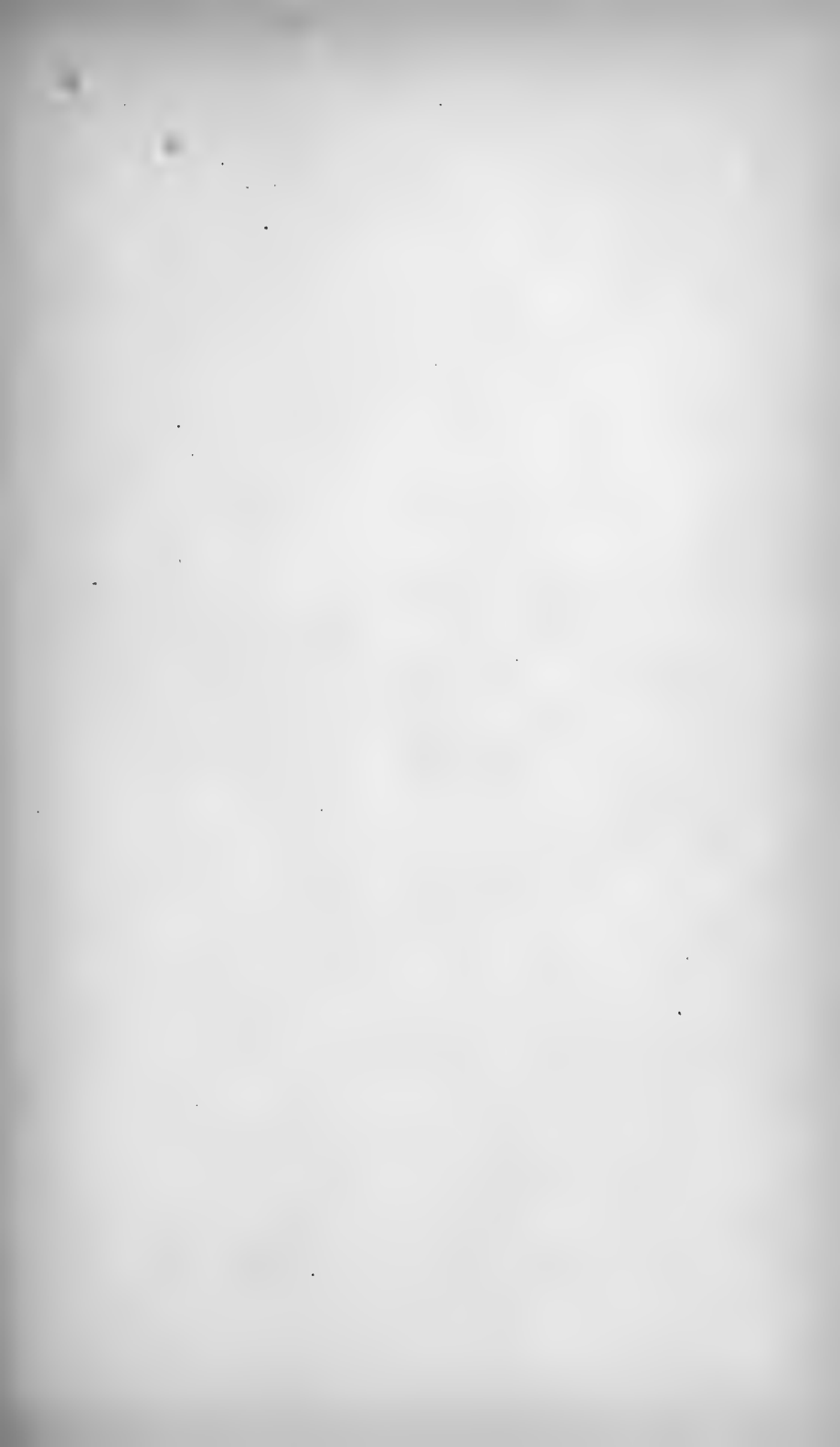


*Photo. A. E. Clark.*

*C. Hentschel.*

**PLEBEIUS ARGUS: VARIATION IN CLASPS.**





## EXPLANATION OF PLATE B.

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Ancillary appendages of species of *PLEBEIUS* to illustrate relationships of *P. argus* (*aegon*). (See Proc. p. xvii.)

- FIG. 1. Dorsum of *P. argus*,  $\times 30$ .  
 2. " " *P. argyrognomon*,  $\times 30$ .  
 3. End of clasp of *P. argyrognomon*,  $\times 100$ .  
 4. " " *P. scudderi*,  $\times 60$ .  
 5. Dorsum,  $\times 20$  }  
 6. End of clasp,  $\times 60$  } of *P. rutilans*.  
 7. Dorsum,  $\times 20$  }  
 8. End of clasp,  $\times 60$  } of *P. hyrcana*.  
 9. Dorsum,  $\times 20$  }  
 10. End of clasp,  $\times 60$  } of *P. pheres*.  
 11. Dorsum,  $\times 20$  }  
 12. End of clasp,  $\times 60$  } of *P. haberhaueri*.  
 13. Dorsum,  $\times 20$  }  
 14. End of clasp,  $\times 60$  } of *P. sieversi*.

N.B.—Note, in comparing, the greater enlargement of Fig. 3, to show the fine teeth, and that Figs. 1 and 2 are enlarged one and a half times more than Figs. 5, 7, 9, 11, and 13.

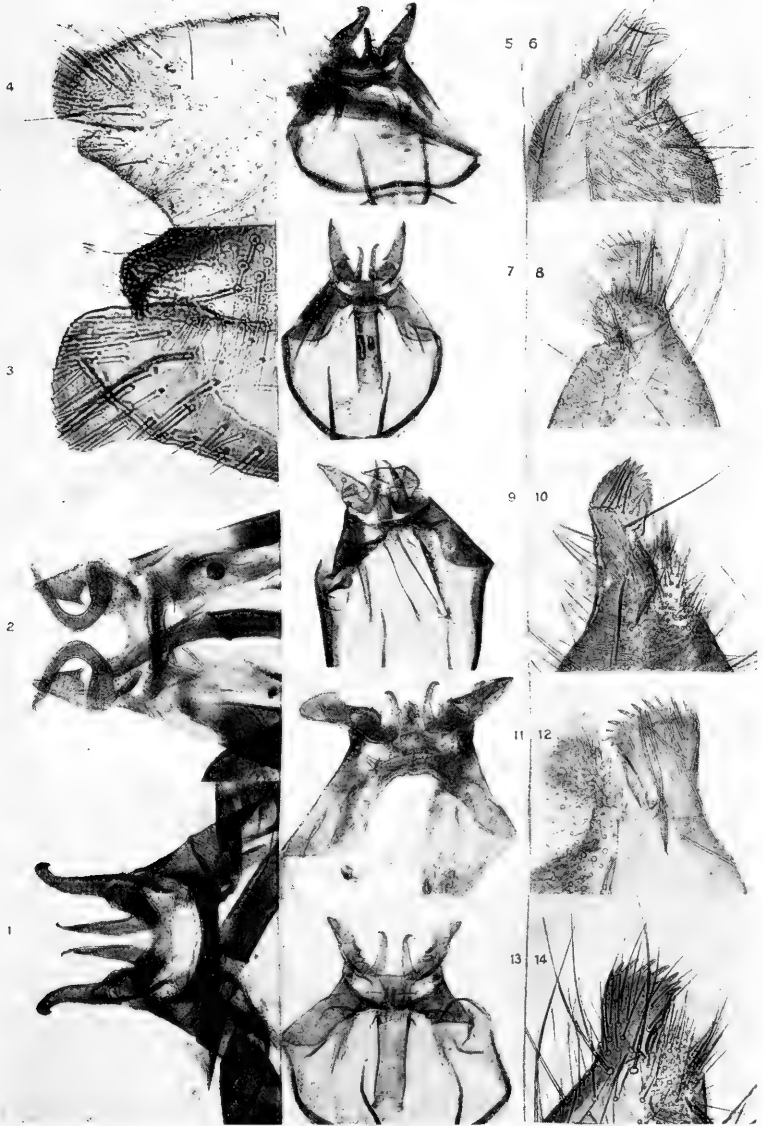
*Plebeius cleobis* and *eversmanni* are very similar to *P. argyrognomon*. *P. scudderi*, *melissa*, and *zephyrus* (*lycidas*) have dorsa something like that of *P. argus*, but ends of clasps similar to those of the *P. argyrognomon* group.

I have not met with any species with ends of clasps more definitely intermediate between those of *P. argus* and *P. argyrognomon* than those here figured.

All these species (with very various macroscopic characters) are rather intermediate between *P. argus* and *P. argyrognomon* than outside them. This is what makes it difficult to believe that the general similarity of those two species shows close relationship and is not rather due to approach from similar environment or other cause. Except *P. lycidas* they are the only European species of the genus, the only generally distributed species.

*Plebeius acmon* and some others are apparently outside the limits marked by *P. argus* and *P. argyrognomon*, and there are, I need hardly say, a few species I have not had an opportunity of examining.

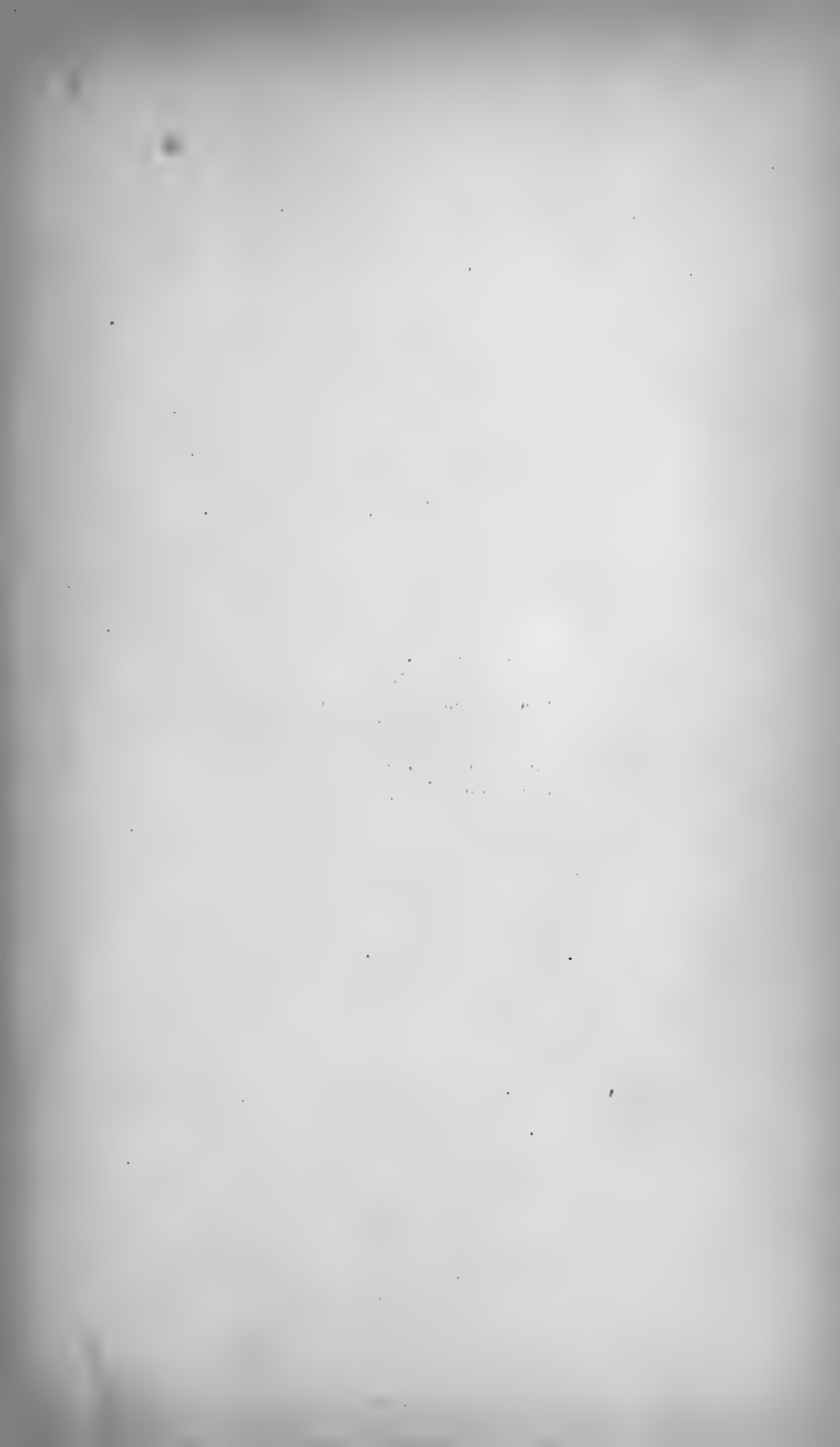
T. A. C.



*Photo, F. N. Clark.*

**ANCILLARY APPENDAGES OF PLEBEII.**





### EXPLANATION OF PLATE C.

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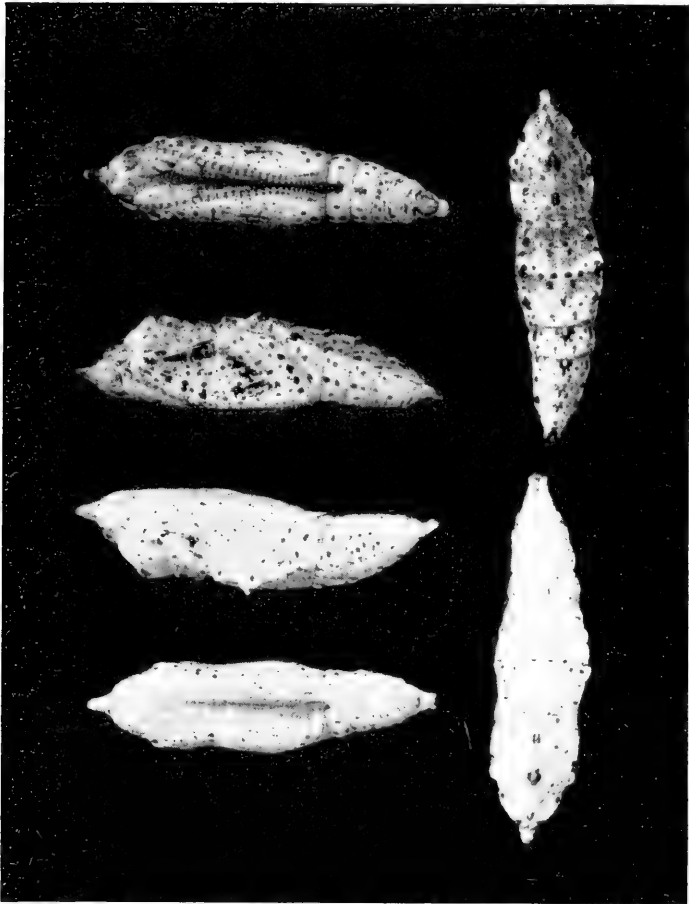
To illustrate colour differences in pupae of *P. brassicae* exposed to different temperatures at period of pupation (see Proceedings, p. lviii). All the *P. brassicae* were affected like those photographed. Pupae of *P. rapae* treated in the same way showed similar effects, but with decided exceptions.

3 upper figures at normal temperature.

3 lower figures at 86°.

Twice natural size.





*Photo, H. Main.*

**EFFECT OF TEMPERATURE ON PIERIS BRASSICAE  
AT PUPATION.**





## EXPLANATION OF PLATE D.

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### PLUME-SCALES OF PIERINAE.

- FIG. 1. BELENOIS THYSA—*f*, fimbriae; *l*, lamina; *s*, footstalk;  
*d*, disc.
2. EUCHLOE CARDAMINES.
  3. MYLOTHRIS AGATHINA.
  4. GANORIS RAPAE.

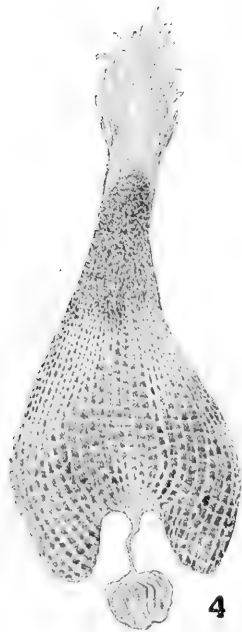
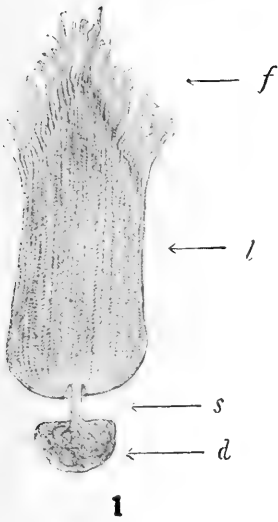
In these figures, magnified about 480 diameters, an attempt is made to represent in each case the characteristic sculpturing of the chitinous scale.

Noticeable points in *Belenois thysa* are (1) the bend in the footstalk, which as it leaves the lamina is directed first upwards and then downwards, and (2) the large comparative size and opacity of the accessory disc.

In *Euchloe cardamines* may be observed (1) the comparative bluntness of the apex, (2) the longitudinal ribbing of the lamina in relation with the fimbriae, and (3) the small size of the accessory disc.

The figure of the scale of *Mylothris agathina* shows the chitinous network of the lamina, and other remarkable features characteristic of the African *Mylothris*.

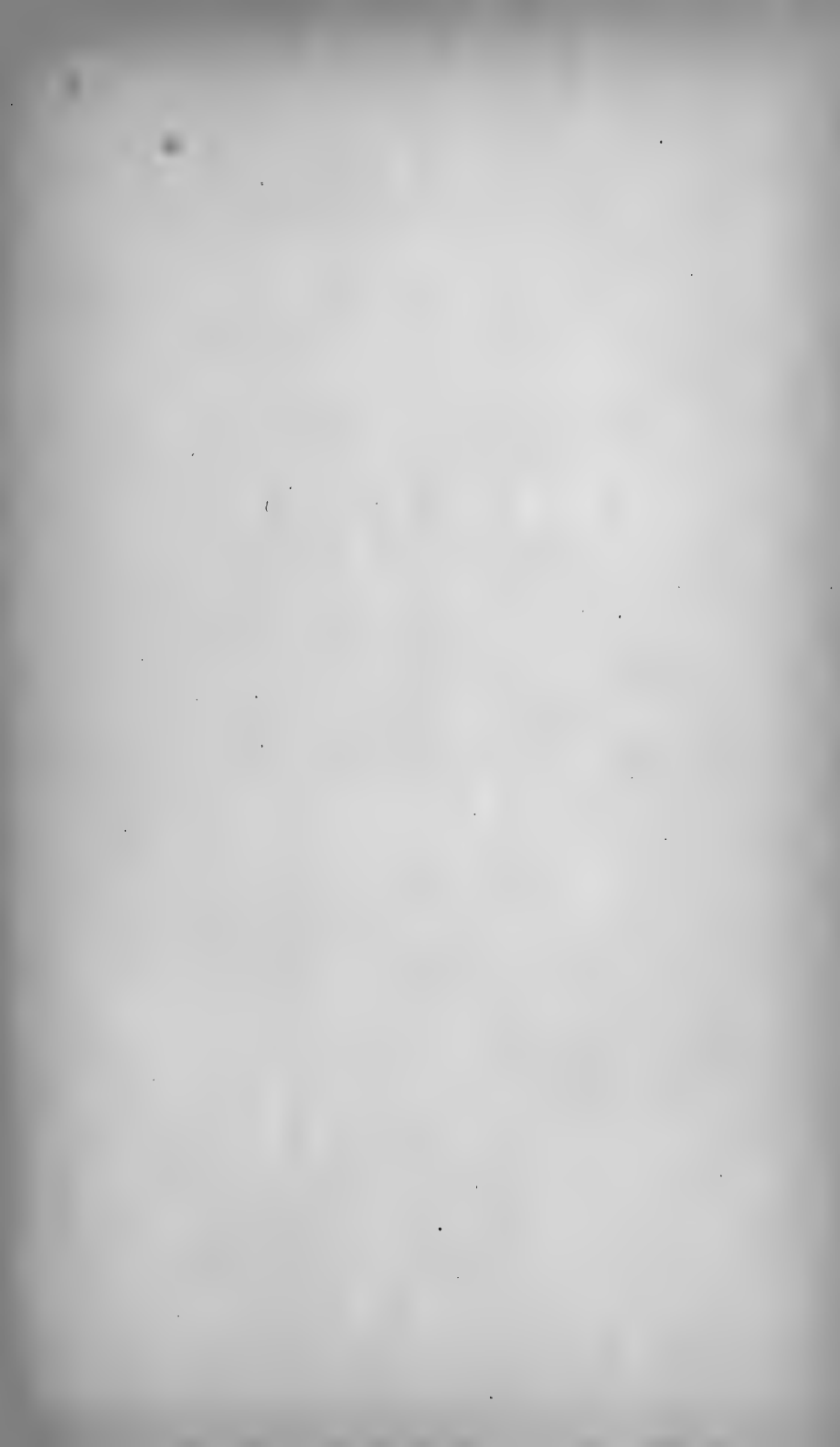
In *Ganoris rapae* should be noted the elegant contour of the scale, its elaborate and regular sculpturing, and the opacity arising from the accumulation of small granules near the apex.



*F. A. Dixey del.*

**PLUME-SCALES OF PIERINAE.**





## EXPLANATION OF PLATE E.

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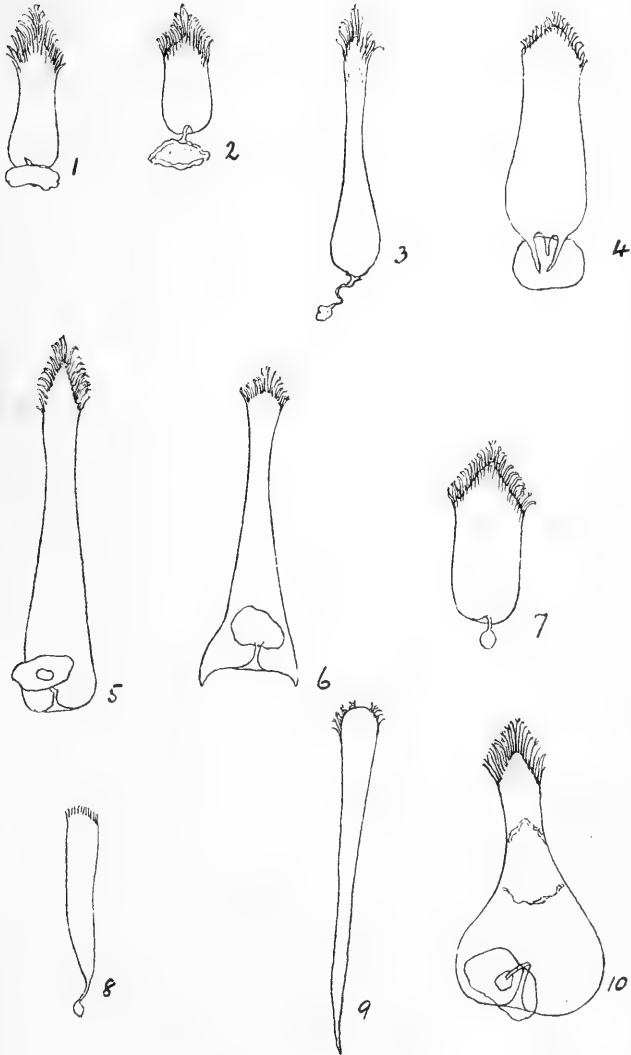
### PLUME-SCALES OF PIERINAE.

- |                                   |                            |
|-----------------------------------|----------------------------|
| FIG. 1. TERACOLUS PHLEGYAS.       | FIG. 6. LEUCERONIA PHARIS. |
| 2.       ,,       CHRYSONOME.     | 7.  ERONIA CLEODORA.       |
| 3.       ,,       ERIS.           | 8.  EUCHLOE EUPHENO.       |
| 4. PTYCHOPTERYX ( <i>Eronia</i> ) | 9.  DAPTONURA LYCIMNIA.    |
| LUCASII.                          | 10. PINACOPTERYX LILIANA.  |
| 5. NEPHERONIA PHOCAEA.            |                            |

The scales represented in this plate are drawn only in outline, and are magnified about 260 diameters.

The figures show the large size of the disc in the purple-tipped and *protomedia* groups of *Teracolus*; the curiously attenuated scent-scale of *T. eris*; the differences characterising the three kinds of "*Eronia*"; the remarkable and unique scale of "*Ptychopteryx*" (or "*Eronia*") *lucasii*; the peculiar hair-like plumule of *Euchloe eupheno*; the still more hair-like scent-scales of *Daptonura*; and the flask-shaped lamina with large oval or figure-of-eight-shaped disc found in *Pinacopteryx liliana*.





*F. A. Dixey del.*

**PLUME-SCALES OF PIERINAE.**





## EXPLANATION OF PLATE F.

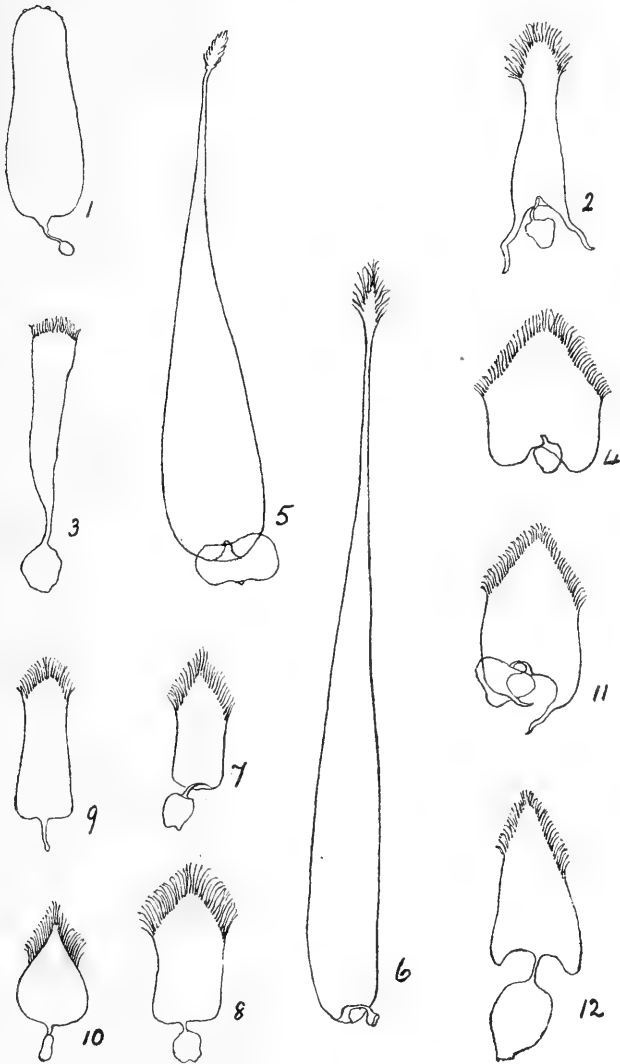
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### PLUME-SCALES OF PIERINAE.

- |                          |                                    |
|--------------------------|------------------------------------|
| FIG. 1. BELENOIS GIDICA. | FIG. 8. MYLOTHRIS LYPERA.          |
| 2. PEREUTE SWAINSONII.   | 9. LEPTOPHOBIA ARIPA.              |
| 3. EUTERPE TEREAS.       | 10. NYCHITONA DIONE.               |
| 4. CATASTICTA FLISA.     | 11. TACHYRIS PLACIDIA (fore-wing). |
| 5. DELIAS PANDEMIA.      | 12. TACHYRIS PLACIDIA (hind-wing). |
| 6. PIERIS PHALOE.        |                                    |
| 7. ,, PYLOTIS.           |                                    |

The figures in this, as in the preceding plate, are drawn only in outline, and are magnified about 260 diameters.

They illustrate the remarkable scent-scale, unique in its genus, of *Belenois gidica*; the extreme breadth in proportion to length found in the scent-scales of many species of *Catasticta*; the great difference in respect of these structures between the genera *Pereute* and *Euterpe*; the resemblance in lamina and difference in disc between *Delias* and a section of "*Pieris*" or *Perrhybris*; the likeness between another section of "*Pieris*" and the so-called American *Mylothris*; the wide difference between the latter and the African species related to *M. agathina* and *M. chloris* (compare Plate D, fig. 3). Other points to be noted are the minute disc of *Leptophobia*; the trowel-like outline of *Nychitona*; the relatively enormous accessory disc characteristic of the scales from the hindwing in species of the *celestina* group of *Tachyris*, and the other remarkable differences between scales from fore- and hind-wing respectively in *T. placidia*.



*F. A. Dixey del.*

**PLUME-SCALES OF PIERINAE.**





## EXPLANATION OF PLATE I.

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FIG. 1. Larva of *Hamanumida daedalus* (Fab.), viewed dorsally, on upperside of leaf of its food-plant, *Combretum guienzii*, Sond. (From specimen preserved in formalin.) *Hab.* Durban, Natal.

FIGS. 2, 2a. *Hoplitis phyllocampa*, n. sp., ♂ and ♀. *Hab.* Malvern, near Durban, Natal.

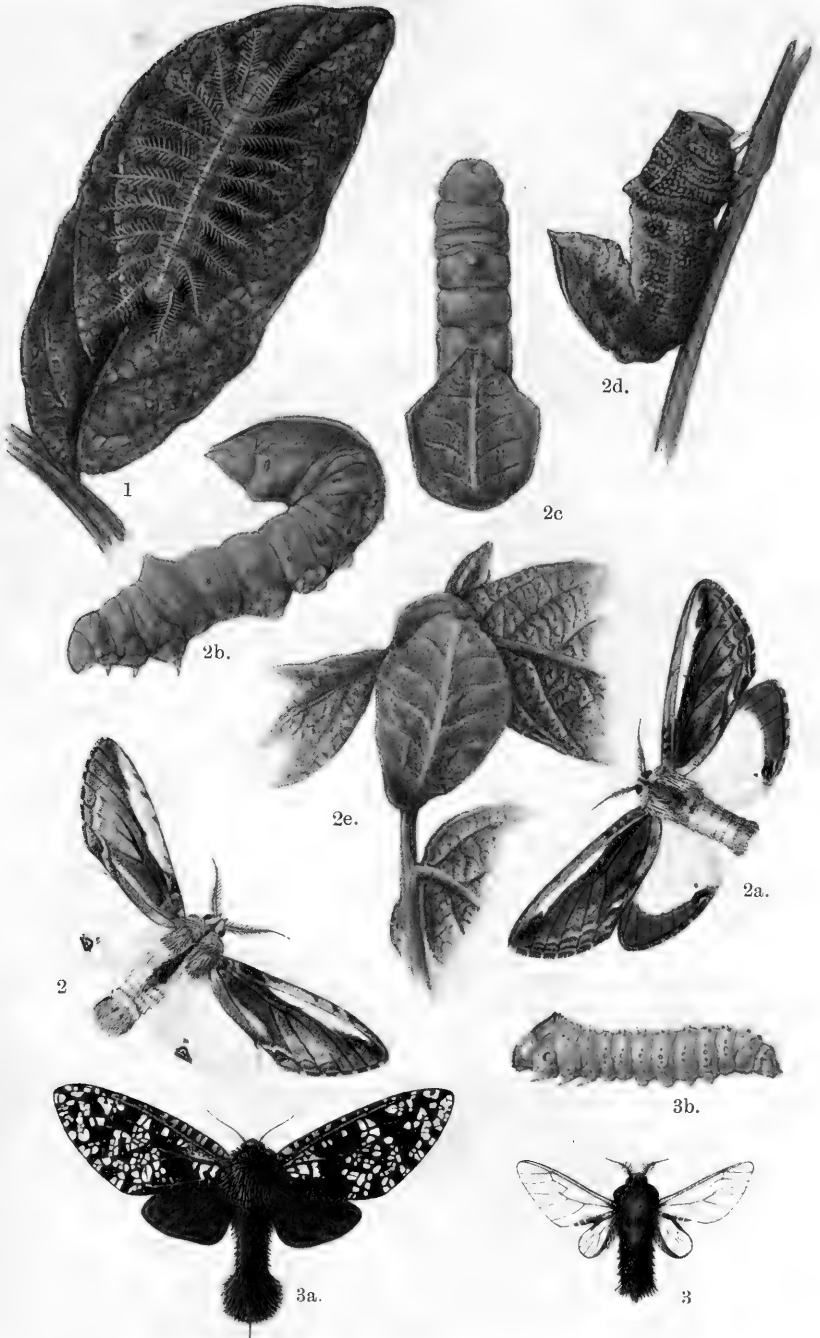
FIGS. 2b, 2c. Larva of *Hoplitis phyllocampa*, n. sp., viewed laterally, and also dorsally. (From specimen preserved in formalin.) *Hab.* Malvern, near Durban, Natal.

FIGS. 2d, 2e. Larva of *Hoplitis phyllocampa*, n. sp., viewed laterally, and also from behind and rather below, on stem of its food-plant, *Combretum guienzii*, Sond. (From photographs of living specimens taken by Mr. J. N. Burn, of Durban.) *Hab.* Malvern, near Durban, Natal.

FIGS. 3, 3a. *Eulophonotus myrmeleon*, Feld., ♂ and ♀. *Hab.* Durban, Natal.

FIG. 3b. Larva of *Eulophonotus myrmeleon*, Feld. (From specimen preserved in formalin.) *Hab.* Durban, Natal.





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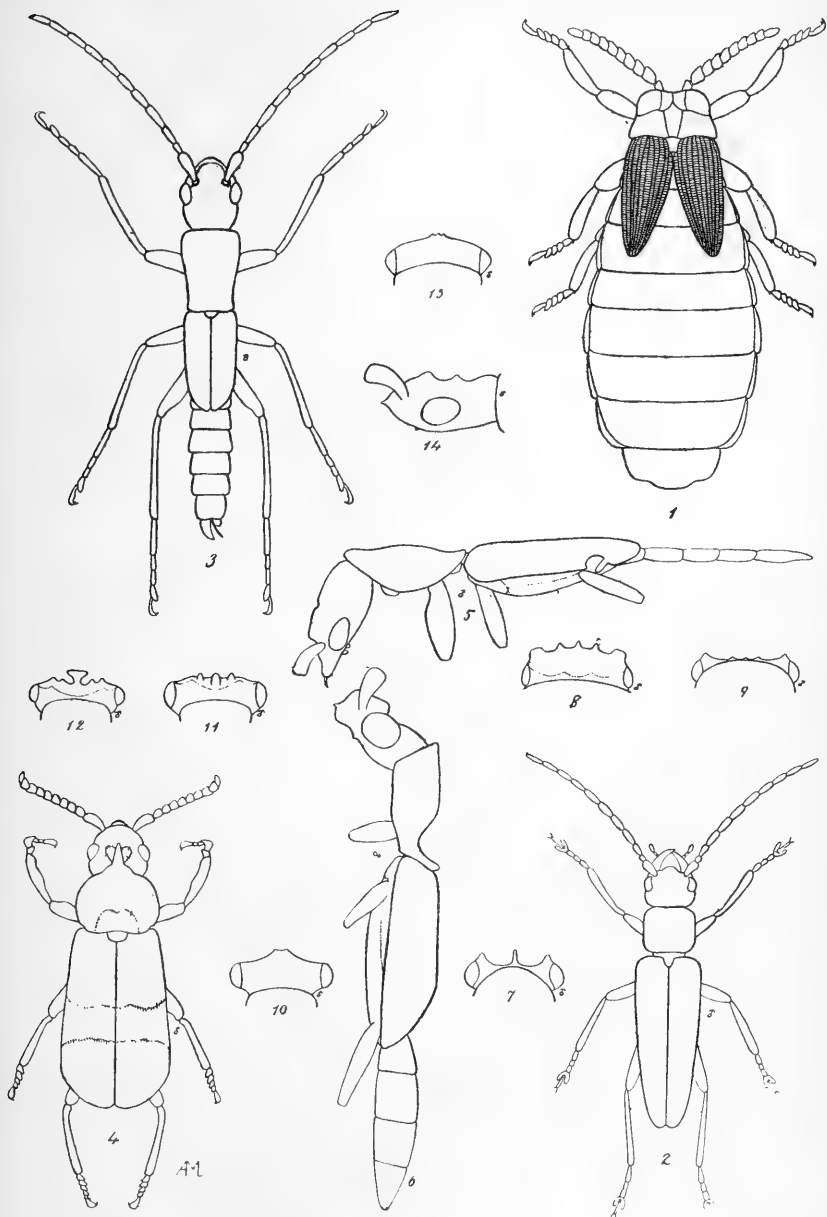




## EXPLANATION OF PLATE II.

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- FIG. 1. *Metriorrhynchus apterus*, Lea.  
 2. *Telephorus nobilitatus*, Er.  
 3. „ *kershawi*, Lea.  
 4. *Laius armicollis*, Lea.  
 5. *Carphurus pravus*, Lea.  
 6. *Neocarphurus sobrinus*, Lea.  
 7. *Helcogaster parallelus*, Lea. . . . . Head seen from behind.  
 8. „ *varius*, Lea. „ „ „  
 9. „ *niger*, Lea. „ „ „  
 10. „ *tuberculifrons*, Lea. „ „ „  
 11. „ *maculiceps*, Lea. „ „ „  
 12. „ *T-tuberculatus*, Lea. „ „ „  
 13. „ *helmsi*, Lea. „ „ „  
 14. „ „ „ . . . . . Head seen from the side.

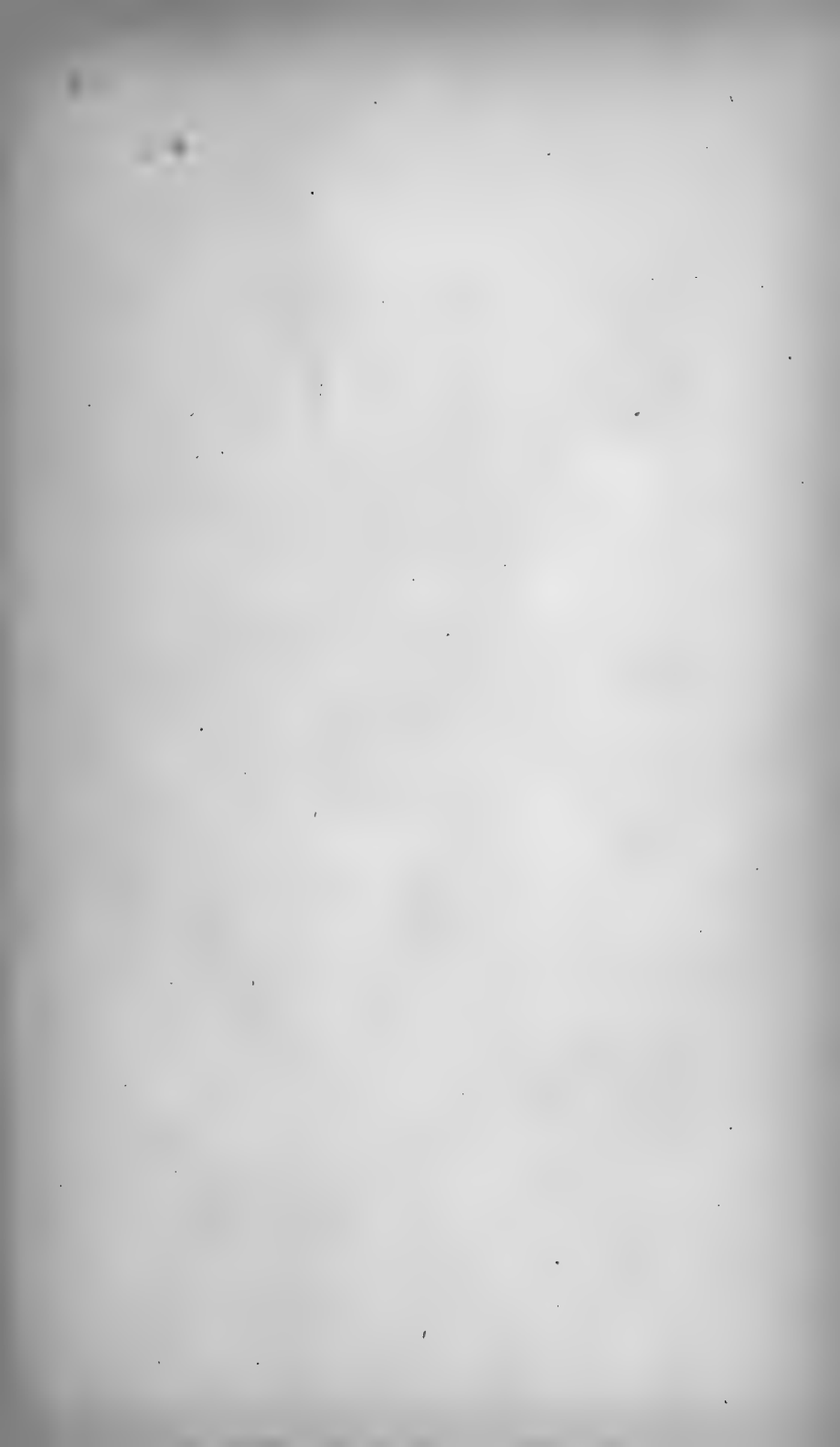


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**AUSTRALIAN AND TASMANIAN MALACODERMIDAE.**

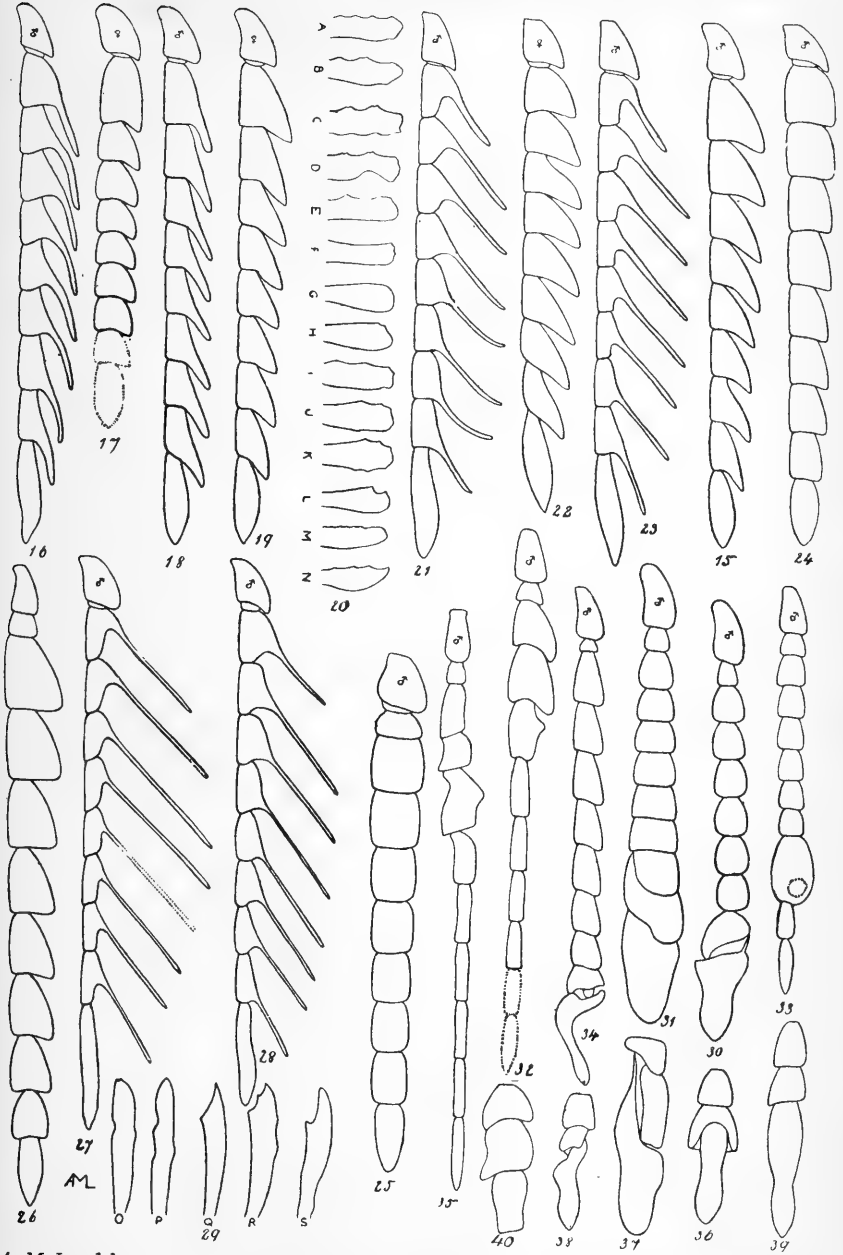




EXPLANATION OF PLATE III.

FIG.			
15.	<i>Metriorrhynchus atratus</i> , Fab.		Antenna.
16.	}	" <i>rhypidius</i> , W. S. Macl.	Antennae.
17.			
18.			
19.			
20.	"	" "	Antennal rami.
21.	}	" <i>testaceicollis</i> , Macl.	Antennae.
22.			
23.	"	<i>ramosus</i> , Lea.	Antenna.
24.	"	<i>constricticollis</i> , Lea.	"
25.	"	<i>heterodoxus</i> , Lea.	"
26.	<i>Pseudolychnus wallacei</i> , Lea.		"
27.	<i>Trichalus semiatratus</i> , Lea.		"
28.	" <i>flabellicornis</i> , Lea.		"
29.	" " "		Antennal rami.
30.	<i>Heteromastix gagaticeps</i> , Lea.		Antenna.
31.	"	<i>crassicornis</i> , Lea.	"
32.	"	<i>distortus</i> , Lea.	"
33.	"	<i>macleayi</i> , Lea.	"
34.	"	<i>laticollis</i> , Lea.	"
35.	"	<i>inflatus</i> , Lea.	"
36.	"	<i>gagaticeps</i> , Lea.	Terminal joints of antenna.
37.	"	<i>crassicornis</i> , Lea.	" " "
38.	"	<i>laticollis</i> , Lea.	" " "
39.	"	<i>decipiens</i> , Lea.	" " "
40.	"	<i>distortus</i> , Lea.	Joints 3, 4 & 5 of antenna.



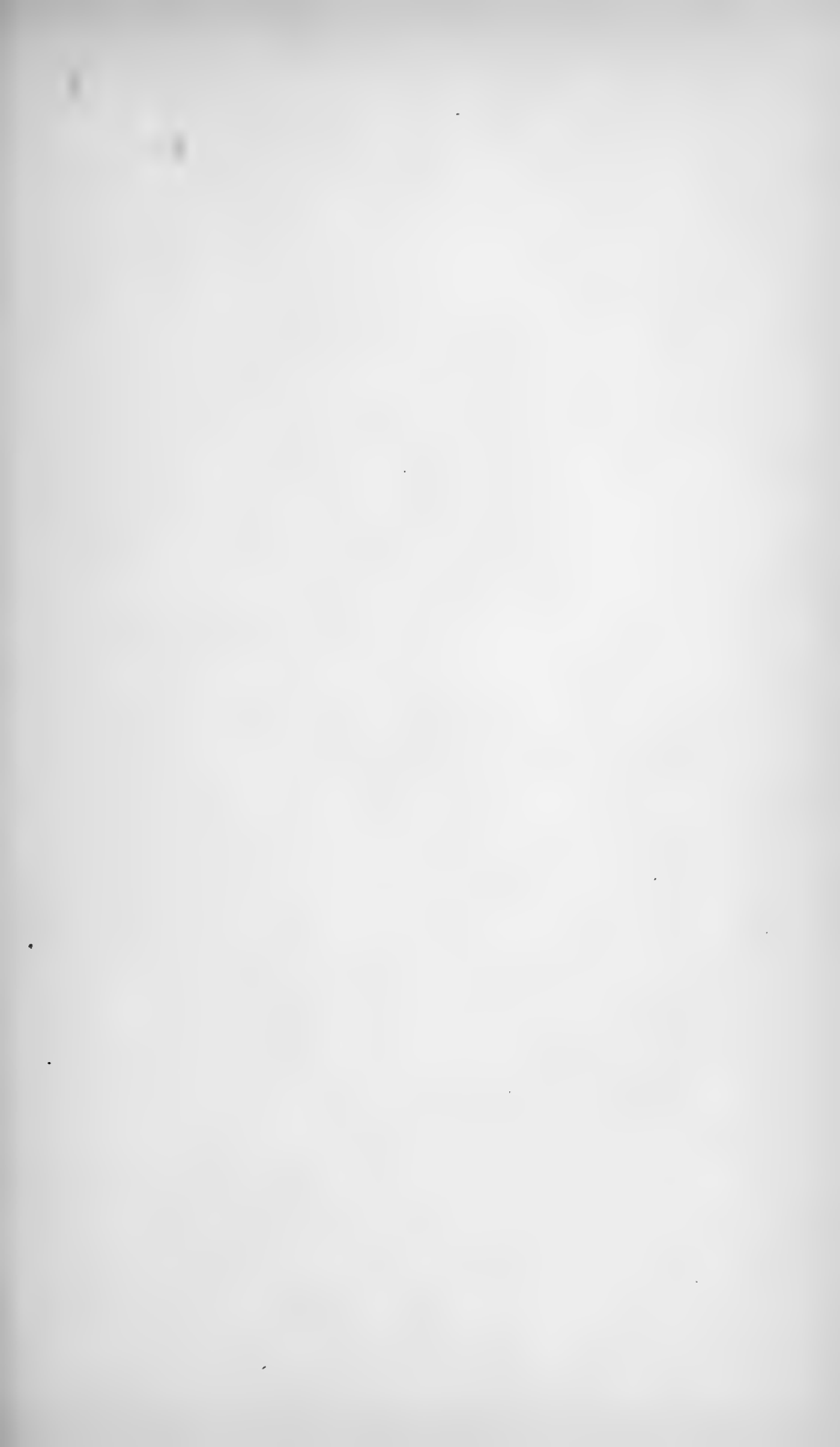


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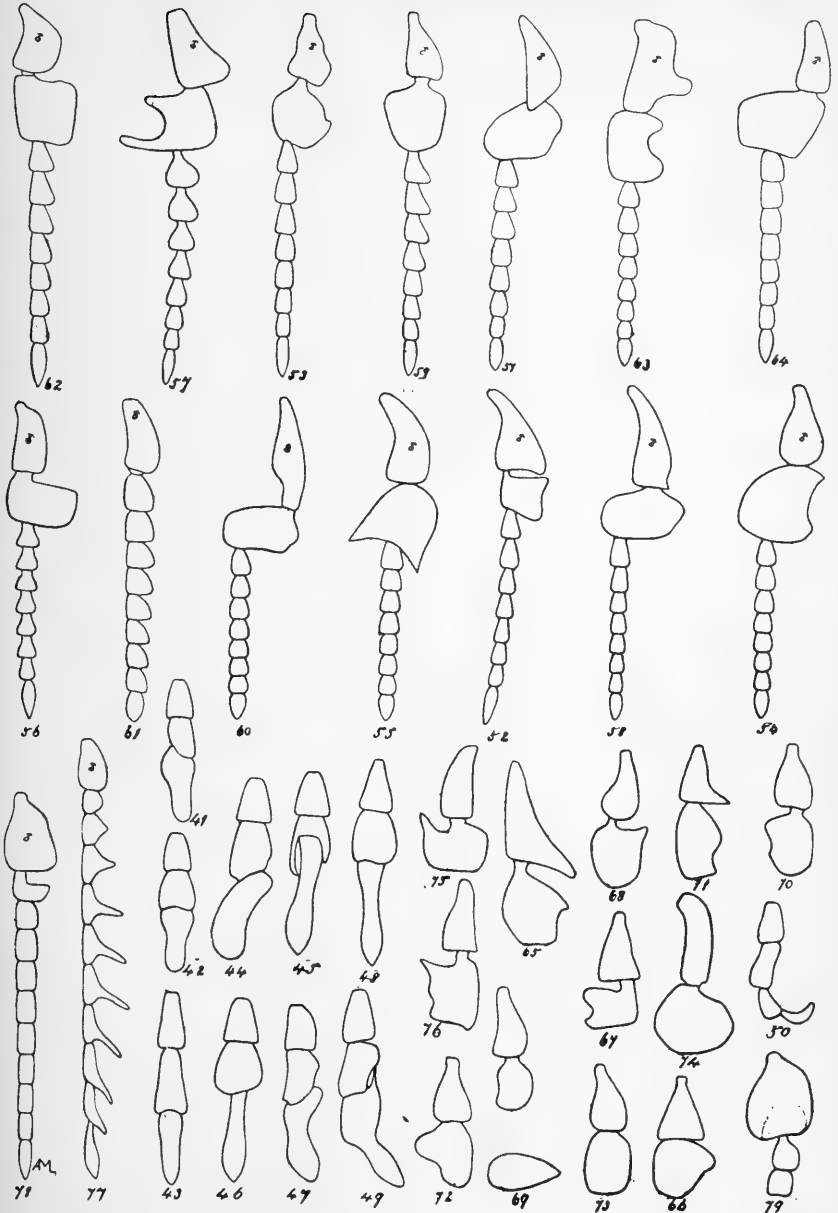




EXPLANATION OF PLATE IV.

FIG.			
41.	}	<i>Heteromastix bicolor</i> , Boh.	Terminal joints of antenna.
42.			
43.		var. <i>secundus</i> , Lea.	” ” ”
44.	}	”	<i>flavifrons</i> , Lea.
45.			
46.			
47.		”	<i>frater</i> , Lea.
48.	}	”	<i>pallipes</i> , Lea.
49.			
50.		<i>Laius armicollis</i> , Lea.	” ” ”
51.	”	<i>cinctus</i> , Redt.	Antenna.
52.	”	<i>conicicornis</i> , Blackb.	”
53.	”	<i>major</i> , Blackb.	”
54.	”	<i>sinus</i> , Lea.	”
55.	”	<i>pallidus</i> , Lea.	”
56.	”	<i>villosus</i> , Lea.	”
57.	”	<i>plagiaticollis</i> , Fairm.	”
58.	”	<i>carus</i> , Lea.	”
59.	”	<i>nidicola</i> , Lea.*	”
60.	”	<i>alleni</i> , Lea.	”
61.	”	<i>sculptus</i> , Lea.	”
62.	”	<i>orthodoxus</i> , Lea.	”
63.	”	<i>tarsalis</i> , Lea.	”
64.	”	<i>cavicornis</i> , Lea.	”
65.	”	<i>cinctus</i> , Redt.	Basal joints of antenna.
66.	”	<i>cynocephalus</i> , Lea.	” ”
67.	”	<i>rugiceps</i> , Lea.	” ”
68.	”	<i>intermedius</i> , Lea.	” ”
69.	”	<i>villosus</i> , Lea.	” ”
70.	”	<i>nodicornis</i> , Blackb.	” ”
71.	”	<i>planiceps</i> , Lea.	” ”
72.	”	<i>nidicola</i> , Lea.	” ”
73.	”	<i>orcicornis</i> , Lea.	” ”
74.	”	<i>tarsalis</i> , Lea.	” ”
75.	}	”	<i>cavicornis</i> , Lea.
76.			
77.		<i>Hypattalus dispar</i> , Lea.	Antenna.
78.		<i>Helcogaster foveicornis</i> , Lea.	”
79.	”	”	Basal joints of antenna.

\* The antennae of *nodicornis* and *cynocephalus* look much the same as this from certain directions.

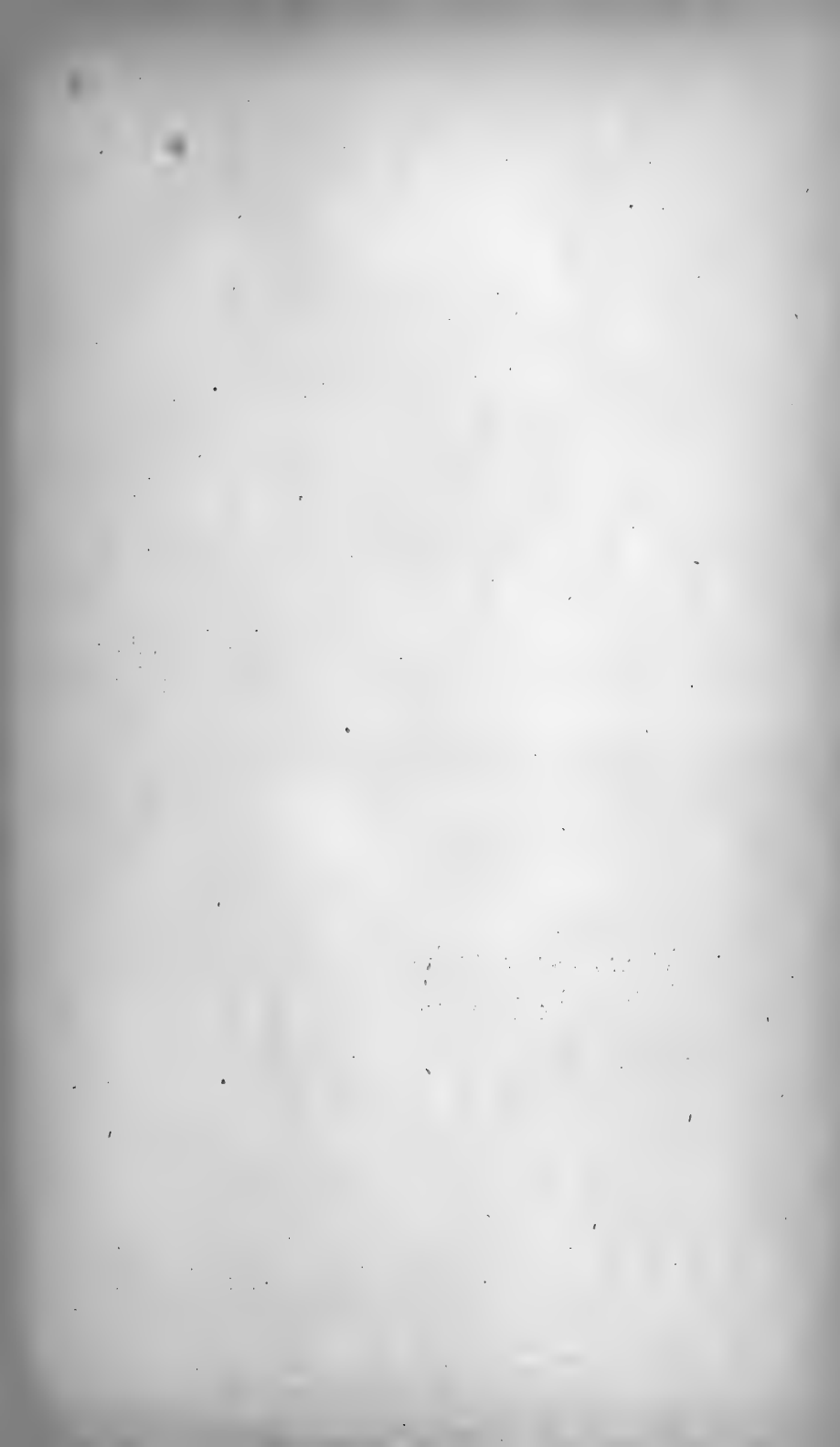


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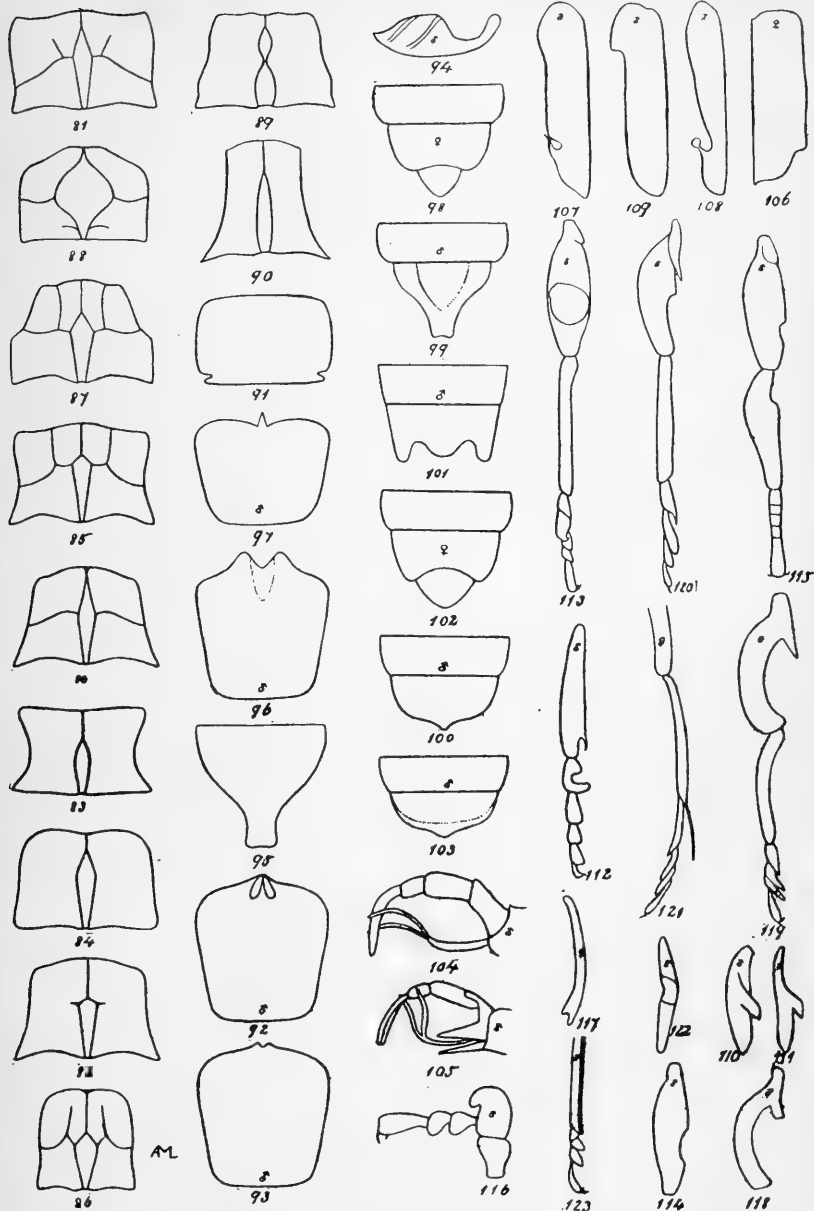




EXPLANATION OF PLATE V.

FIG.				
80.	<i>Metriorrhynchus ampliatus</i> , Macl.	Prothorax.		
81.	" <i>posticalis</i> , Macl.	"		
82.	" <i>basiflavus</i> , Lea.	"		
83.	" <i>constricticollis</i> , Lea.	"		
84.	" <i>triareolatus</i> , Lea.	"		
85.	" <i>costicollis</i> , Lea.	"		
86.	" <i>militaris</i> , Lea.	"		
87.	" <i>variipennis</i> , Lea.	"		
88.	" <i>heterodoxus</i> , Lea.	"		
89.	<i>Trichalus insignis</i> , Lea.	"		
90.	" <i>griffithi</i> , Lea.	"		
91.	<i>Heteromastix tenuis</i> , Lea.	"		
92.	<i>Carphurus pallidipennis</i> , Macl.	"		
93.	" <i>marginiventris</i> , Fairm.	"		
94.	" <i>rhytideres</i> , Lea.	Side view of prothorax.		
95.	<i>Neocarphurus chlorops</i> , Lea.	Prothorax.		
96.	<i>Helcogaster incisicollis</i> , Lea.	"		
97.	" <i>spinicollis</i> , Lea.	"		
98.	} <i>Luciola humilis</i> , Oliv.	Apical segments of abdomen.		
99.				
100.	" <i>pubica</i> , Oll.	"	"	"
101.	} " <i>platygaster</i> , Lea.	"	"	"
102.				
103.	<i>Atypella brevis</i> , Lea.	"	"	"
104.	} <i>Selenurus appendiculatus</i> , Lea.	"	"	"
105.				
106.	<i>Hypattalus mucronatus</i> , Lea.	Elytron.		
107.	<i>Carphurus cristatifrons</i> , Fairm.	"		
108.	" <i>blackburni</i> , Lea.	"		
109.	" <i>uncinatus</i> , Lea.	"		
110.	} <i>Metriorrhynchus tibialis</i> , Lea.	Hind, tibia.		
111.				
112.	<i>Heteromastix distortus</i> , Lea.	Front leg.		
113.	<i>Laius cinctus</i> , Redt.	"		
114.	"    "    "	Front femur.		
115.	<i>Laius alleni</i> , Lea.	Front leg seen from below.		
116.	" <i>tarsalis</i> , Lea.	Front tarsus.		
117.	<i>Hypattalus australis</i> , Fairm.	Hind tibia.		
118.	" <i>pulcherrimus</i> , Lea.	Front femur.		
119.	" <i>mucronatus</i> , Lea.	Front leg.		
120.	" <i>dentipes</i> , Lea.	"		
121.	<i>Hypattalus dentipes</i> , Lea.	Hind leg.		
122.	" <i>distortipes</i> , Lea.	Hind tibia.		
123.	<i>Carphurus elegans</i> , Lea.	Front tarsus.		





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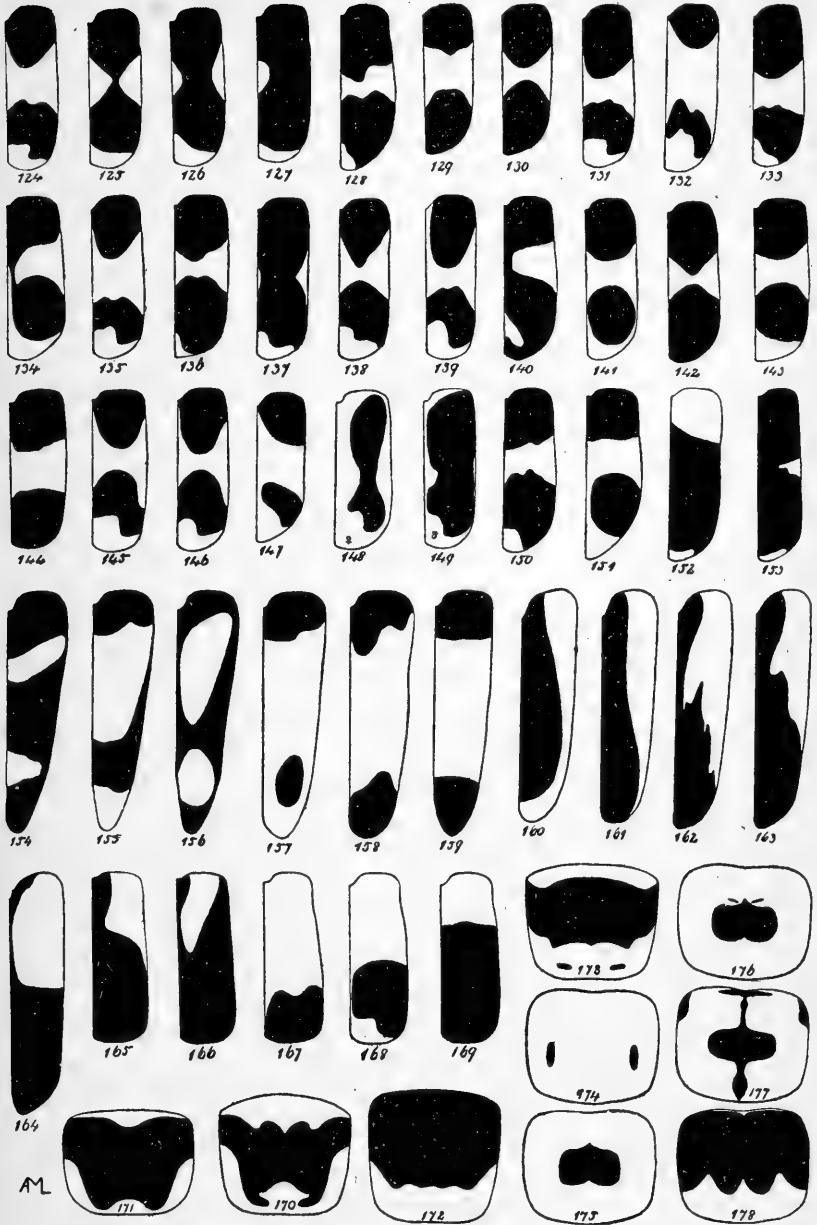


EXPLANATION OF PLATE VI.

FIG.		Elytron.
124.	<i>Laius verticalis</i> , W. S. Macl.	Elytron.
125.	} „ <i>tresignatus</i> , Germ.	„
126.		
127.		
128.	„ <i>bellulus</i> , Guer.	„
129.	} „ <i>cinctus</i> , Redt.	„
130.		
131.	„ <i>conicicornis</i> , Blackb.	„
132.	„ <i>major</i> , Blackb.	„
133.	„ <i>cycanocephalus</i> , Lea.	„
134.	„ <i>pallidus</i> , Lea, var.	„
135.	„ <i>rugiceps</i> , Lea.	„
136.	„ <i>intermedius</i> , Lea.	„
137.	} „ <i>villosus</i> , Lea.	„
138.		
139.	„ <i>plagiaticollis</i> , Fairm.	„
140.	„ <i>5-notatus</i> , Fairm.	„
141.	„ <i>carus</i> , Lea.	„
142.	„ <i>egenus</i> , Lea.	„
143.	„ <i>planiceps</i> , Lea.	„
144.	„ <i>sculptus</i> , Lea.	„
145.	} „ <i>orthodoxus</i> , Lea.	„
146.		
147.	„ <i>tarsalis</i> , Lea.	„
148.	} „ <i>flavopictus</i> , Lea.	„
149.		
150.	„ <i>cavicornis</i> , Lea.	„
151.	<i>Hypattalus alphabeticus</i> , Lea.	„
152.	„ <i>pulcherrimus</i> , Lea.	„
153.	„ <i>exilis</i> , Lea.	„
154.	<i>Selenurus variegatus</i> , Blackb.	„
155.	„ <i>annulatus</i> , Macl.	„
156.	„ <i>luteopictus</i> , Fairm.	„
157.	<i>Telephorus curvipes</i> , Lea.	„
158.	„ <i>mastersi</i> , Macl.	„

*Explanation of Plate VI.*

FIG.		
159.	<i>Telephorus imperialis</i> , Redt.	Elytron.
160.	<i>Metriorrhynchus disconiger</i> , Redt.	"
161.	" <i>nigrovittatus</i> , Lea.	"
162.	} " <i>triareolatus</i> , Lea.	"
163.		
164.	" <i>constricticollis</i> , Lea.	"
165.	<i>Helcogaster varius</i> , Lea.	"
166.	" <i>marginicollis</i> , Lea.	"
167.	<i>Carphurus atricapillis</i> , Lea.	"
168.	} " <i>elongatus</i> , Macl.	"
169.		
170.	<i>Selenurus tricolor</i> , Lea.	Prothorax.
171.	<i>Telephorus flavipennis</i> , Macl.	"
172.	" <i>imperialis</i> , Redt.	"
173.	" <i>curvipes</i> , Lea.	"
174.	} " <i>nobilitatus</i> , Lea.	"
175.		
176.		
177.		
178.		

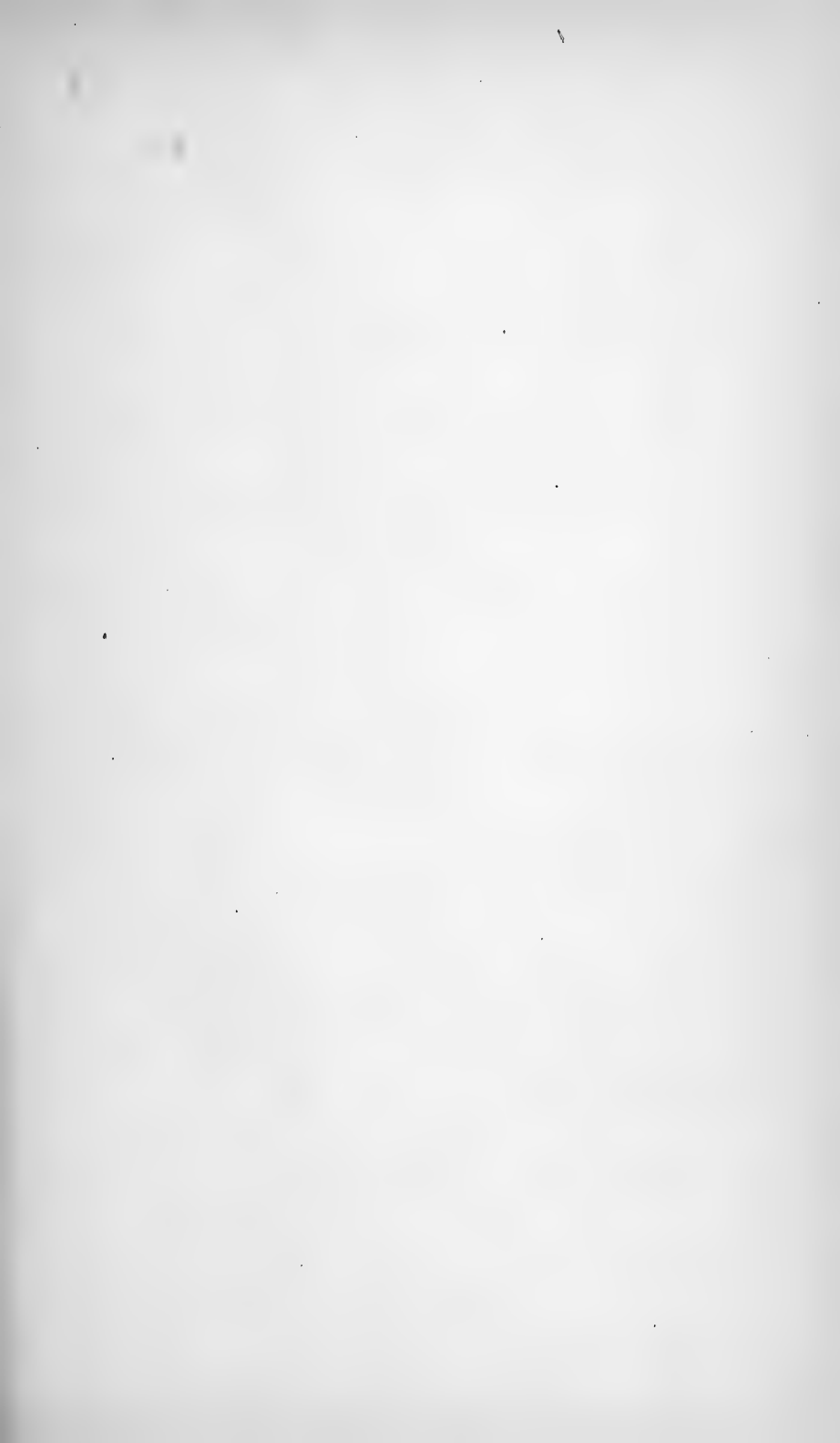


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AUSTRALIAN AND TASMANIAN MALACODERMIDAE.



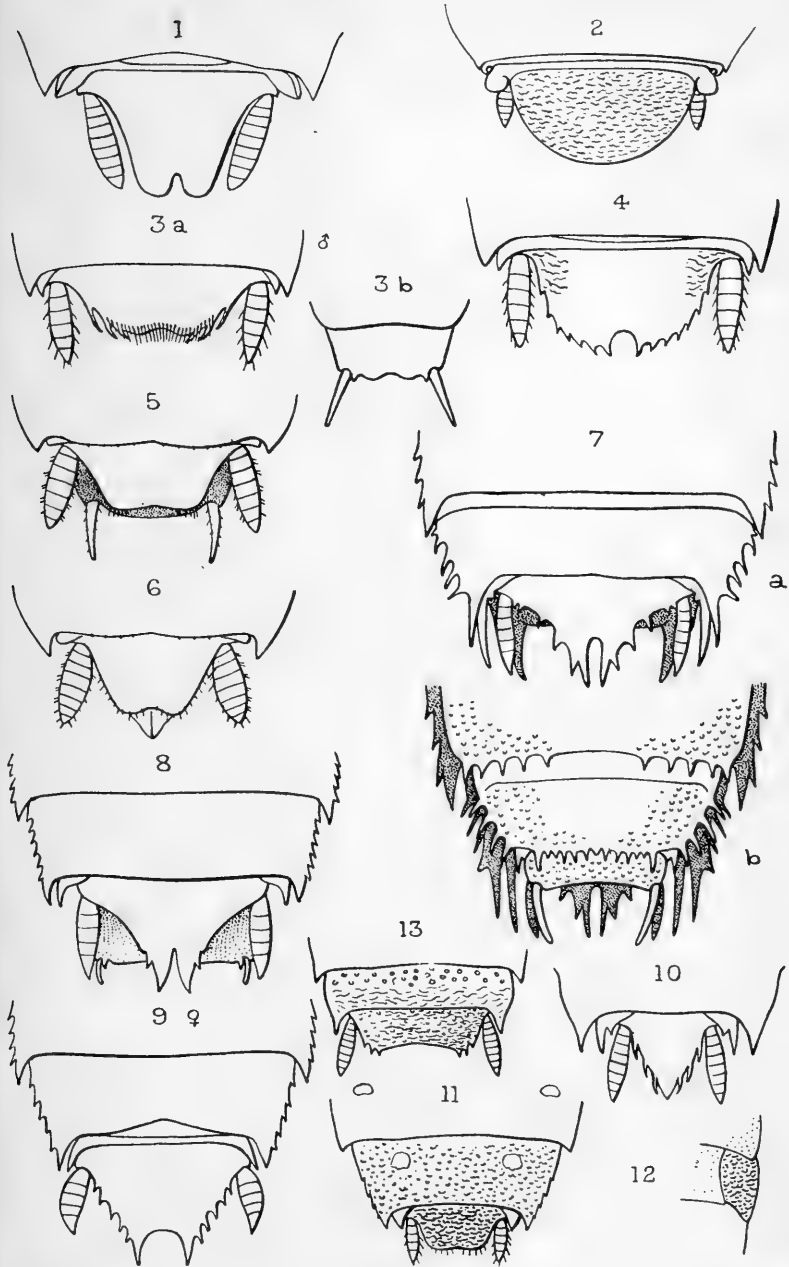


## EXPLANATION OF PLATE VII.

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- FIG. 1. *Polyzosteria pubescens*, Tepp., ♀.—Apex of abdomen, dorsal view.
2. *Euzosteria patula*, Walk., ♀.—Apex of abdomen, dorsal view.
3. *Platyzosteria melanaria*, Er., ♂.—Apex of abdomen, *a*, dorsal view, *b*, ventral view.
4. *Platyzosteria melanaria*, Er., ♀.—Apex of abdomen, dorsal view.
5. *Platyzosteria aterrima*, Er., ♂.—Apex of abdomen, dorsal view.
6. *Platyzosteria aterrima*, Er., ♀.—Apex of abdomen, dorsal view.
7. *Platyzosteria ferox*, sp. n., ♂.—Apex of abdomen, *a*, dorsal view, *b*, ventral view.
8. *Platyzosteria armata*, Tepp., ♂.—Apex of abdomen, dorsal view.
9. *Platyzosteria armata*, Tepp., ♀.—Apex of abdomen, dorsal view.
10. *Platyzosteria bifida*, Sauss., ♂.—Apex of abdomen, dorsal view.
11. *Platyzosteria punctata*, Br., ♀.—Apex of abdomen, dorsal view.
12. *Platyzosteria novae-seelandiae*, Br., ♂.—Left tegmen.
13. *Platyzosteria variolosa*, Bol., ♂.—Apex of abdomen, dorsal view.





*H. Knight del.*

*C. Hentschel.*

**AUSTRALIAN BLATTINAE.**





## EXPLANATION OF PLATE VIII.

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- FIG. 14. *Platyzosteria atrata*, Er., ♂.—Apex of abdomen, dorsal view.
15. *Platyzosteria invisiva*, Walk., ♂.—Apex of abdomen, dorsal view.
16. *Platyzosteria invisiva*, Walk., ♀.—Apex of abdomen, dorsal view.
17. *Platyzosteria punctata*, Br., ♂.—Apex of abdomen, *a*, dorsal view, *b*, ventral view.
18. *Platyzosteria castanea*, Br., ♂.—Apex of abdomen, *a*, dorsal view, *b*, ventral view.
19. *Platyzosteria obscura*, Tepp., ♂.—Apex of abdomen, dorsal view.
20. *Platyzosteria scabriuscula*, Tepp., ♂.—Apex of abdomen, dorsal view.
21. *Platyzosteria morosa*, Shelf., ♂.—Apex of abdomen, dorsal view.
22. *Platyzosteria albomarginata*, Br., ♂.—Apex of abdomen, dorsal view.
23. *Platyzosteria obscuripes*, Tepp., ♂ nymph.—Apex of abdomen, dorsal view.
24. *Platyzosteria soror*, Br., ♂.—Apex of abdomen, *a*, dorsal view, *b*, ventral view.
25. *Platyzosteria communis*, Tepp., ♂.—Apex of abdomen, *a*, dorsal view, *b*, ventral view.
26. *Platyzosteria semivitta*, Walk.—*a*, Apex of abdomen ♂ dorsal view, *b*, ditto ventral view, *c*, apex of abdomen ♀ dorsal view, *d*, maxillary palp ♂, *e*, maxillary palp ♀, *f*, posterior tibia ♂.
27. *Platyzosteria coolgardiensis*, Tepp., ♂.—Apex of abdomen, dorsal view.





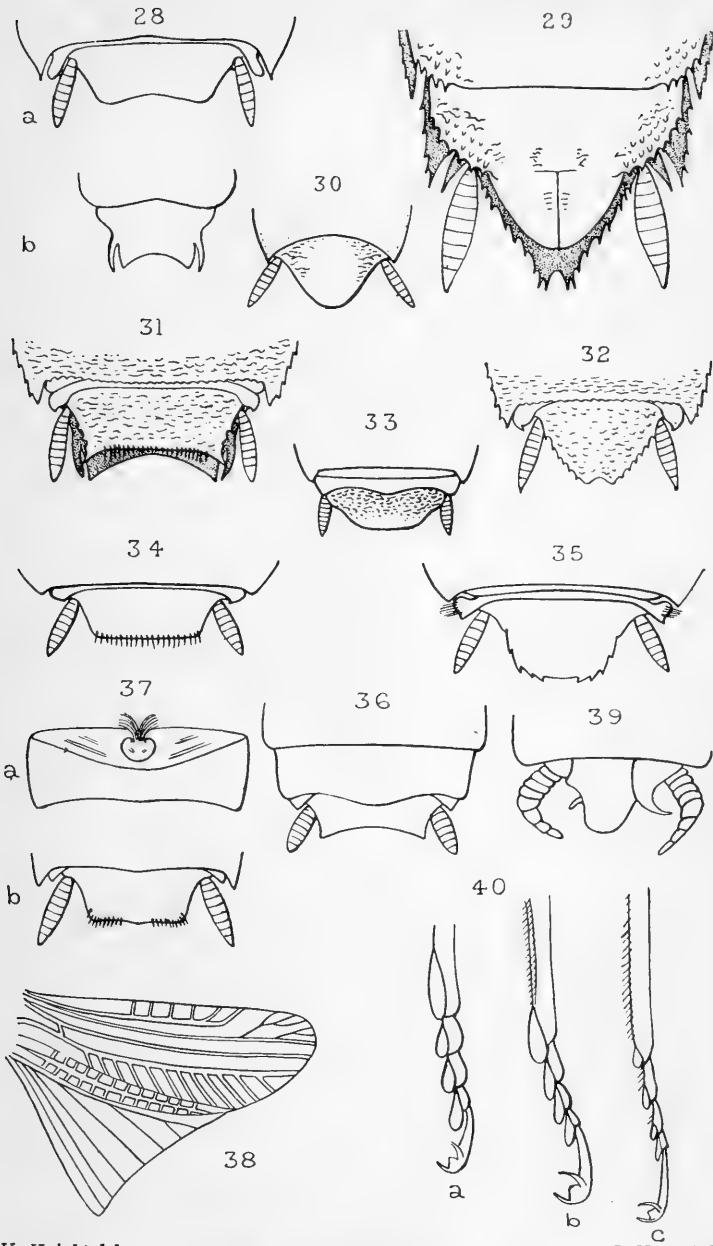


## EXPLANATION OF PLATE IX.

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- FIG. 28. *Zonioploca pallida*, Shelf., ♂.—Apex of abdomen, *a*, dorsal view, *b*, ventral view.
29. *Platyzozeria aposematica*, sp. n., ♀.—Apex of abdomen, ventral view.
30. *Platyzozeria rufoterminalata*. Br., ♀.—Apex of abdomen, dorsal view.
31. *Cosmozosteria zonata*, Walk., ♂.—Apex of abdomen, dorsal view.
32. *Cosmozosteria zonata*, Walk., ♀.—Apex of abdomen, dorsal view.
33. *Cosmozosteria bicolor*, Sauss., ♀.—Apex of abdomen, dorsal view.
34. *Anamesia polyzona*, Walk., ♂.—Apex of abdomen, dorsal view.
35. *Anamesia polyzona*, Walk., ♀.—Apex of abdomen, dorsal view.
36. *Temnellytra undulivitta*, Walk., ♂.—Apex of abdomen, dorsal view.
37. *Temnellytra truncata*, Br., ♂.—*a*, 1st and 2nd abdominal tergites, *b*, apex of abdomen, dorsal view.
38. *Phenacisma semialata*, sp. n., ♀.—Left wing.
39. *Gynopeltis neavei*, sp. n., ♂.—Apex of abdomen, dorsal view.
40. Posterior tarsus of, *a*, *Polyzozeria limbata*, *b*, *Cutilia nitida*, *c*, *Blatta orientalis*.





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AUSTRALIAN AND AFRICAN BLATTIDAE.

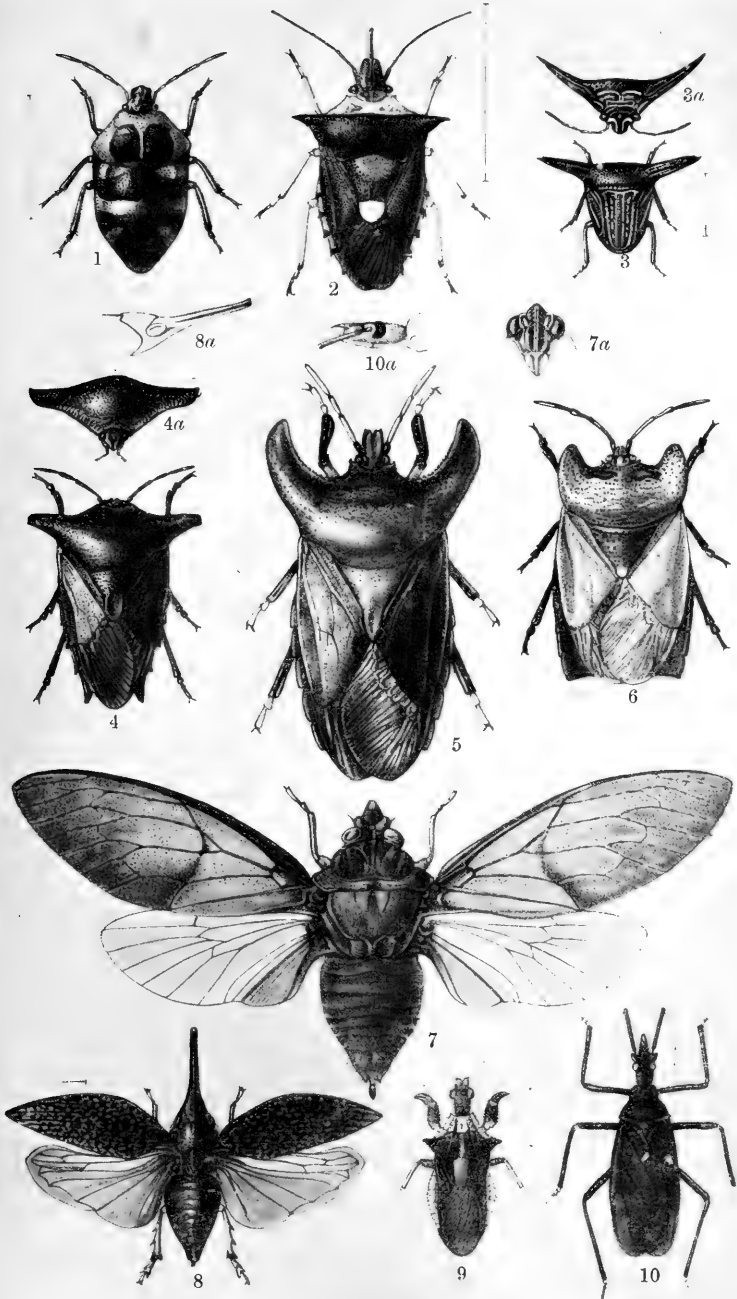




## EXPLANATION OF PLATE X.

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- FIG. 1. *Poecilocoris croesus*.  
2. *Rhynchocoris bicolor*.  
3a. *Alcimocoris marapokensis*.  
4a. *Embolosterna unicolorus*.  
5. *Amisus testaceus*.  
6. *Sanganus jenseni*.  
7a. *Lembeja crassa*.  
8a. *Philagra flavosparsa*.  
9. *Carcinochelis ornatus*.  
10a. *Tribelocephala gigantea*



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*C. Hentschel.*

**MALAYAN RHYNCHOTA.**



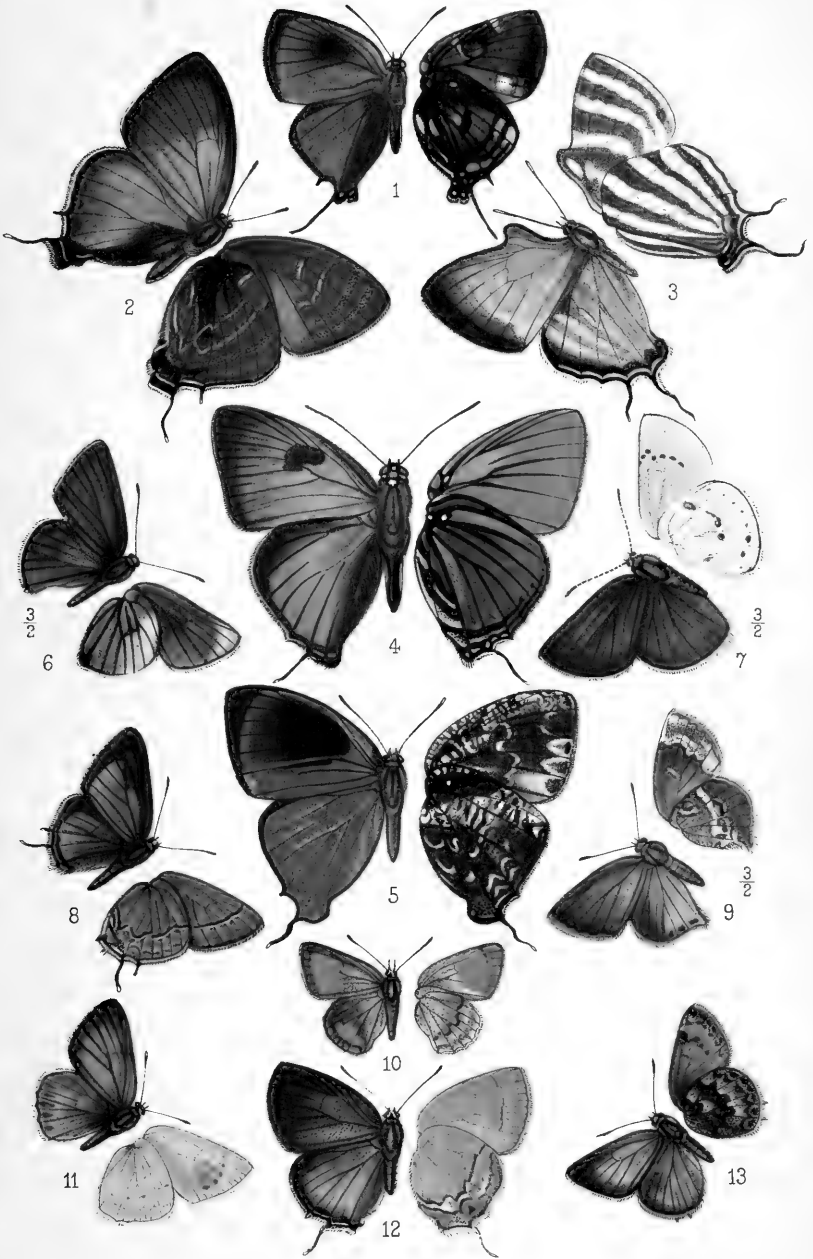


## EXPLANATION OF PLATE XI.

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- FIG. 1. *Thecla paphlagon*, Feld., ♂, p. 434.  
2. „ *adamsi*, sp. nov. ♂, p. 432.  
3. „ *gibberosa tomlinsoni*, ♂, nov. p. 433.  
4. „ *melidor*, sp. nov. ♂, p. 431.  
5. „ *ematheon*, Cr. ♂, p. 432.  
6. „ *crepundia*, sp. nov. ♂, p. 435. Magnified  $1\frac{1}{2}$ .  
7. „ *phrosine*, sp. nov. ♀, p. 435. Magnified  $1\frac{1}{2}$ .  
8. „ *vesper*, sp. nov. ♂, p. 436.  
9. „ *gamma*, sp. nov. ♀ (?), p. 437. Magnified  $1\frac{1}{2}$ .  
10. „ *heodes*, sp. nov. ♂, p. 437.  
11. „ „ sp. nov. ♀, p. 438.  
12. „ *purpurantes*, H. H. Druce, ♀, p. 435.  
13. „ *alatus*, H. H. Druce, ♂, p. 434.





H. Knight del. et lith.

West, Newman chr.

NEW AND LITTLE KNOWN NEOTROPICAL LYCAENIDAE.





## EXPLANATION OF PLATE XII.

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- FIG. 1. *Stethynium triclavatum*, ♂ × 33 diams.  
 „ 2. „ „ ♀ × 33 diams.  
 „ 3. „ „ antenna of ♂ × 45 diams.  
 „ 4. „ „ „ ♀ × 45 diams.  
 „ 5. „ „ wings of × 45 diams.  
 „ 6. *Cleruchus pluteus*, ♂ × 33 diams.  
 „ 7. „ „ ♀ × 33 diams.  
 „ 8. „ „ antenna of ♂ × 45 diams.  
 „ 9. „ „ „ ♀ × 45 diams.  
 „ 10. „ „ wings of × 45 diams.

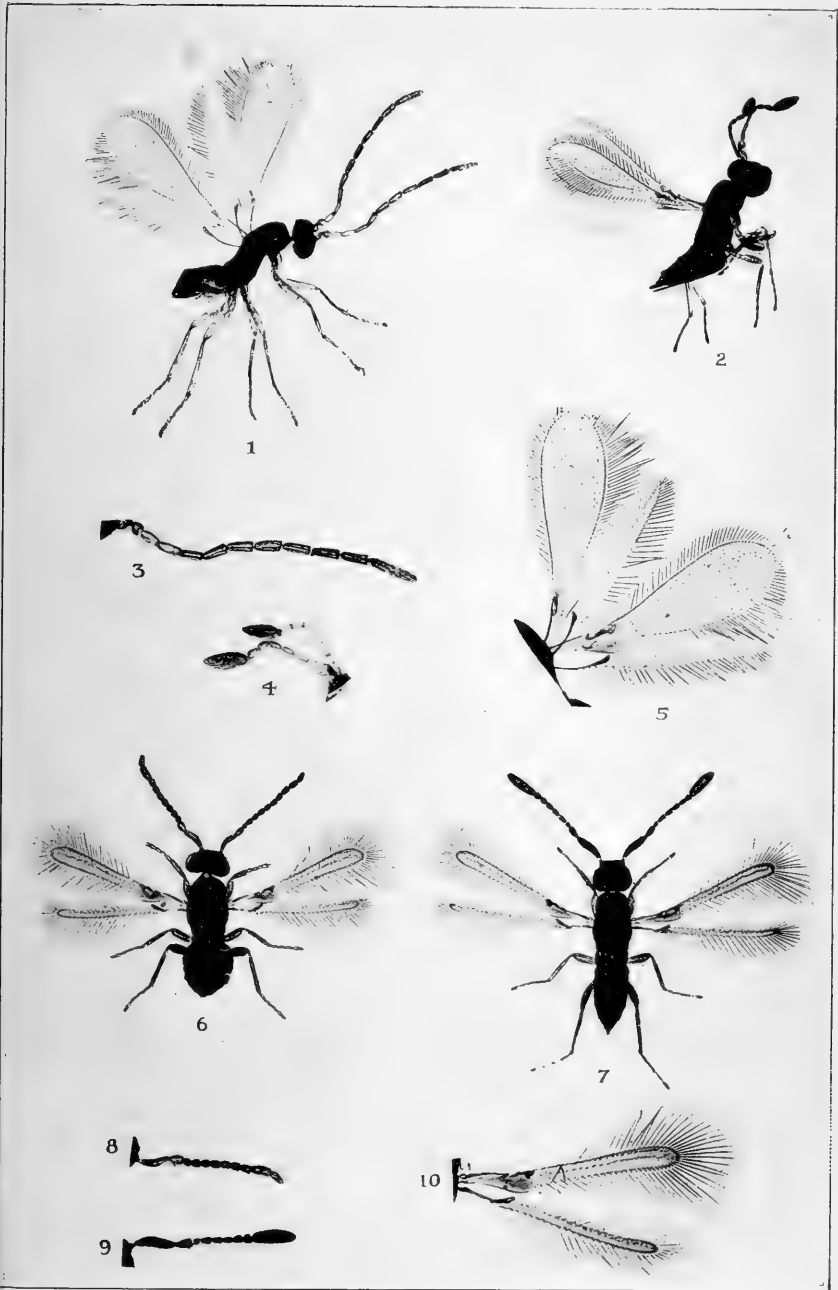


Photo-micro  
ad nat. F. Enock.

NEW BRITISH MYMARIDAE.





### EXPLANATION OF PLATE XIII.

- FIG. 1. *Parallelaptera panis*, ♂ × 33 diams.  
 " 2. " " ♀ × 33 diams.  
 " 3. " " antenna of ♂ × 45 diams.  
 " 4. " " " ♀ × 45 diams.  
 " 5. " " wings of × 45 diams.  
 " 6. *Erythmelus goochi*, ♂ × 33 diams.  
 " 7. " " ♀ × 33 diams.  
 " 8. " " antenna of ♂ × 45 diams.  
 " 9. " " " ♀ × 45 diams.  
 " 10. " " wings of × 45 diams.  
 " 11. *Dicopus minutissima*, ♀ × 33 diams.  
 " 12. " " antenna of ♀ × 45 diams.  
 " 13. " " wings of × 45 diams.



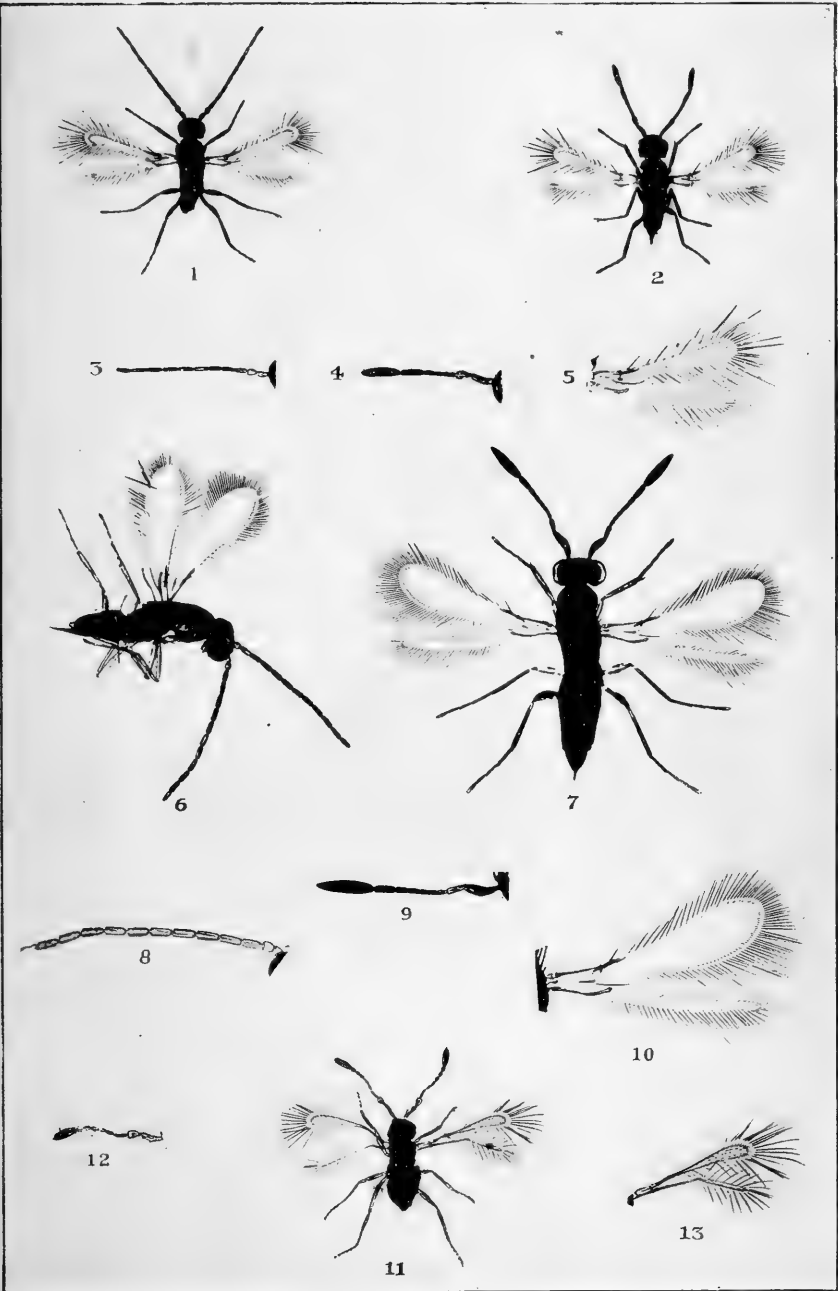


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NEW BRITISH MYMARIDAE.





## EXPLANATION OF PLATE XIV.

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- FIG. 1. *Enaesus agilis*, ♂ × 18 diams.  
" 2. " " ♀ × 18 diams.  
" 3. " " antenna of ♂ × 33 diams.  
" 4. " " " ♀ × 33 diams.  
" 5. " " wings of × 33 diams.  
" 6. *Stephanodes elegans*, ♂ × 18 diams.  
" 7. " " ♀ × 18 diams.  
" 8. " " antenna of ♂ × 33 diams.  
" 9. " " " ♀ × 33 diams.  
" 10. " " wings of × 33 diams.  
" 11. " " scape and carina of × 118 diams.

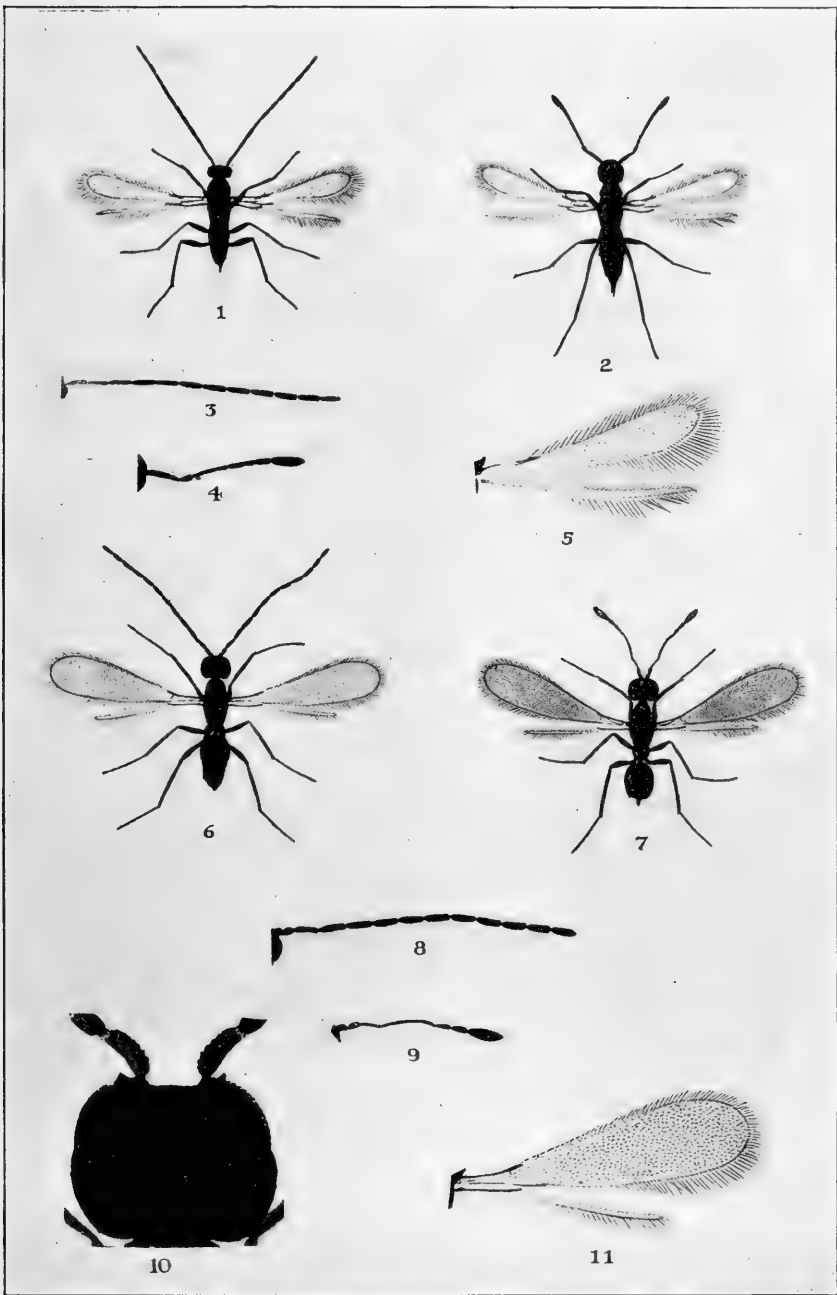


Photo-micro  
ad nat. F. Enock.

NEW BRITISH MYMARIDAE.



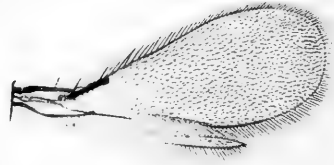
1900, 1901, 1902

EXPLANATION OF PLATE XV.

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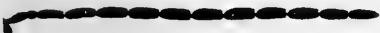
- FIG. 1. *Oophilus longicauda*, ♂ × 18 diams.  
" 2. " " ♀ × 18 diams.  
" 3. " " ♀ side × 18 diams.  
" 4. " " antenna of ♂ × 33 diams.  
" 5. " " " ♀ × 33 diams.  
" 6. " " wings of × 33 diams.





2

6



4



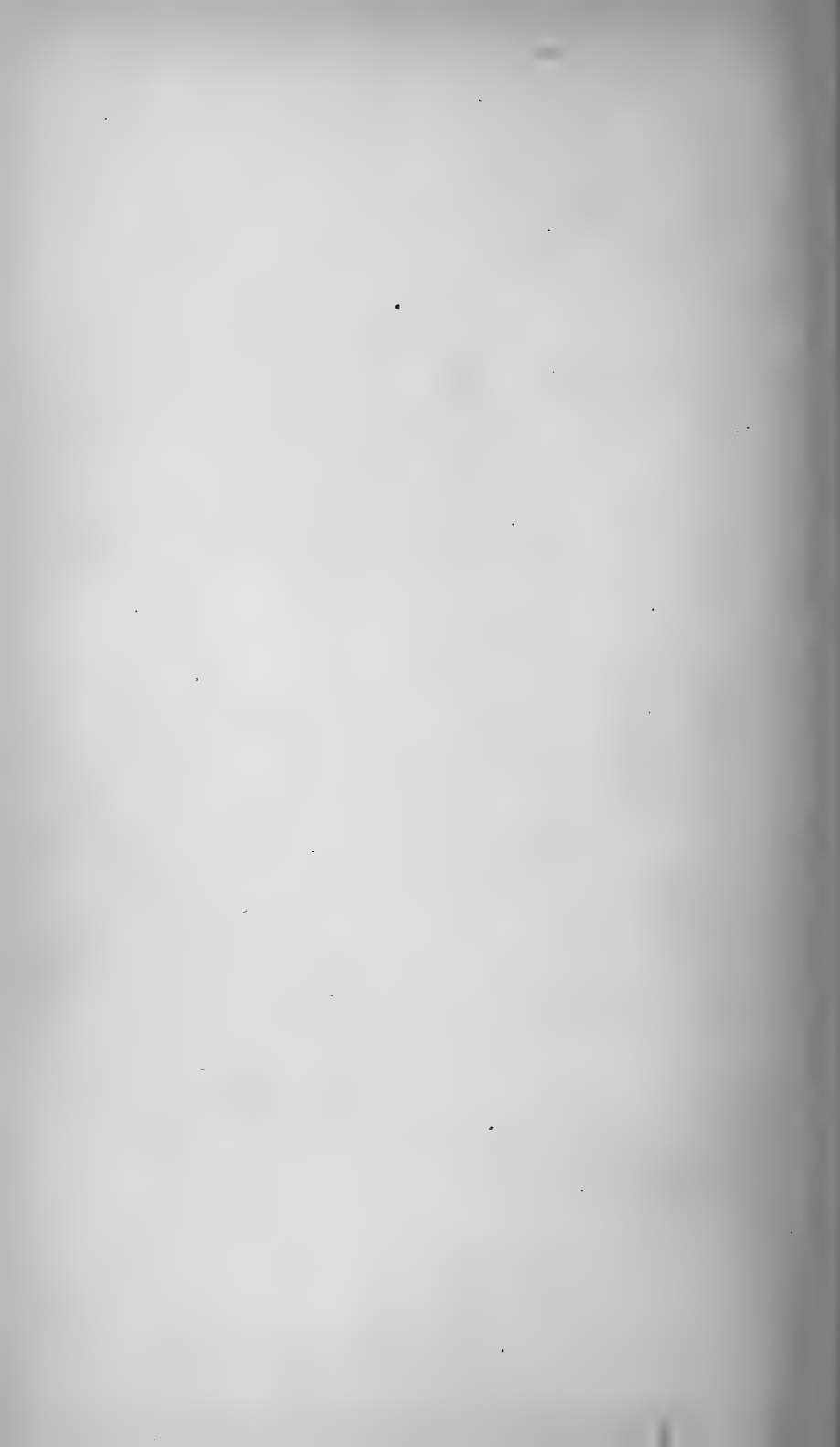
5



3

*Photo-micro  
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**NEW BRITISH MYMARIDAE.**



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## EXPLANATION OF PLATE XVI.

---

- FIG. 1. *Peucephila essoni*, ♀. Upper and under sides.
- |     |   |   |                                      |
|-----|---|---|--------------------------------------|
| 1a. | ” | ” | head enlarged.                       |
| 1b. | ” | ” | side view of head, body and abdomen. |
| 1c. | ” | ” | neurulation.                         |
| 1d. | ” | ” | legs.                                |



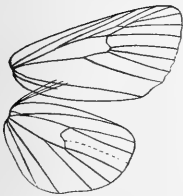
1b.



1a.



1.

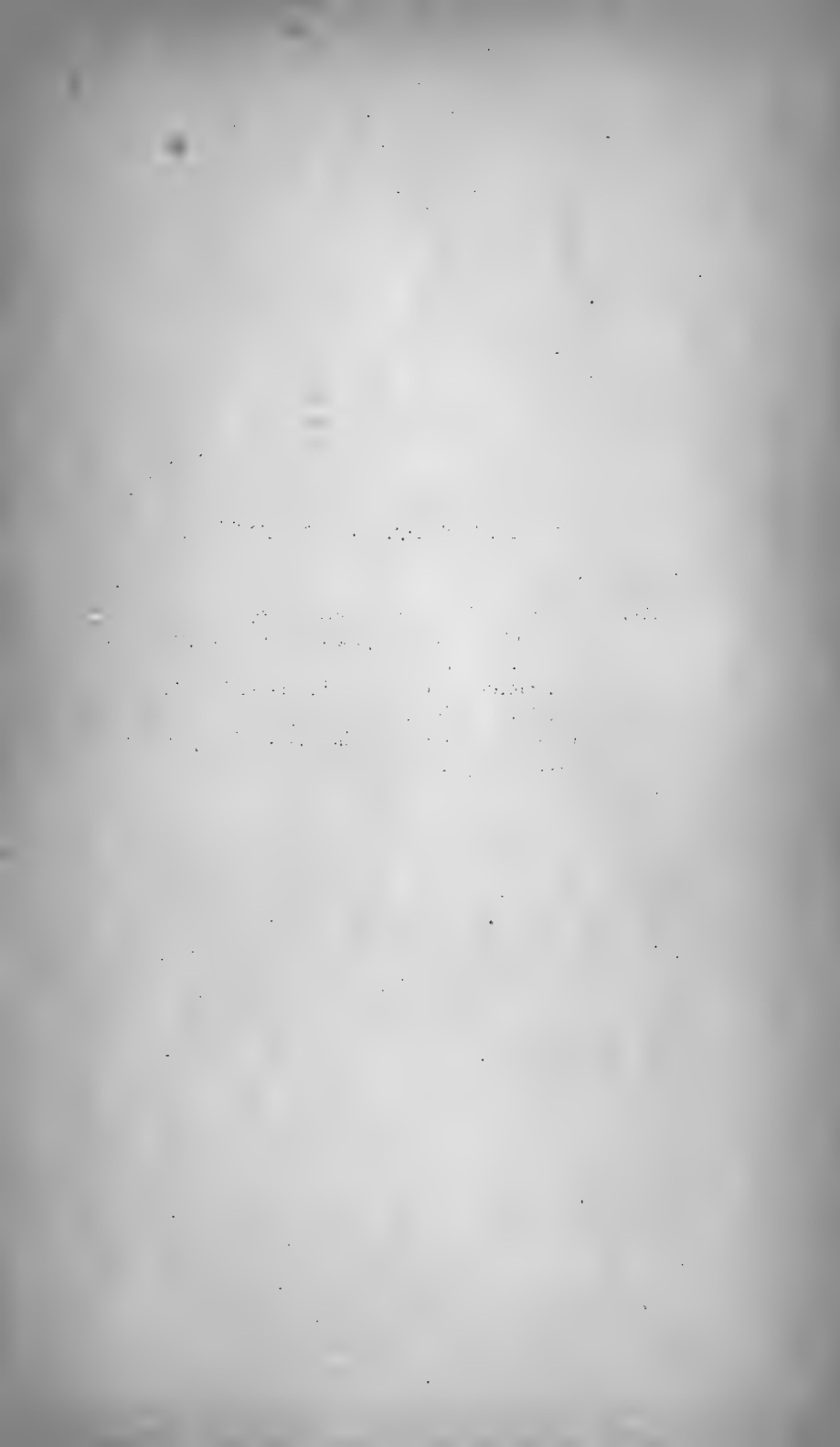


1c.



1d.





## EXPLANATION OF PLATE XVII.

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- FIG. 1. Oothecae of Mantid from Delagoa Bay.
- A. An ootheca cut open, showing the eggs and median septum.
  - B. Portion of oothecal wall removed from A.
  - C. Intact ootheca.
2. Ootheca of Mantid from the Andes split open to show the central egg-mass.





*Photo, A. Robinson.*

**MANTID OOTHECAE.**











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