J. HYM. RES.
Vol. 10(1), 2001, pp. 29–54

The Australian Species of *Pachyneuron* Walker (Hymenoptera: Chalcidoidea: Pteromalidae)

GARY. A. P. GIBSON

Systematic Entomology Section, Eastern Cereal and Oilseed Research Centre, Agriculture and Agri-Food Canada, Ottawa, Ontario, Canada K1A 0C6 (E-mail: gibsong@em.agr.ca)

Abstract.—Four species of *Pachyneuron* Walker are recognized from Australia: *P. aphidis* (Bouché 1834), *P. emersoni* Girault (1916), *P. nelsoni* Girault (1928) and ***P. rieki* Gibson, n. sp.** A lectotype is designated for *P. emersoni*. ***Pachyneuron kingsleyi*** Girault (1916) is formally synonymized with ***P. emersoni* (new synonymy)**. Males and females of the four species are differentiated by key features, illustrated, and compared with morphologically similar species present in other regions. *Pachyneuron emersoni* and *P. rieki* are restricted to Australia, *P. aphidis* and *P. nelsoni* are more widely distributed. World distribution is summarized for *P. aphidis* and *P. nelsoni* and Australian distribution and host records are compiled for all the species.

Pachyneuron Walker consists of about 50 recognized world species with the following distribution as listed by Noyes (1998): Afrotropical (4), Australasian (5), Oriental (8), Neotropical (11), Nearctic (12) and Palearctic (28). Szelényi (1942) gave a key to the Palearctic species, Graham (1969) to the European species and Kamijo and Takada (1973) to the Japanese species, but in other areas the species are unrevised and some distributional records listed in Noyes (1998) are questionable. Most species are hyperparasites of Aphididae or of other plant sucking Hemiptera (Coccoidea, Psylloidea) through their Braconidae (Ichneumonoidea) or Aphelinidae and Encyrtidae (Chalcidoidea) primary parasitoids, or are primary parasitoids or hyperparasitoids of the predators of these plant pests (Diptera: Syrphidae, Chamaemyiidae; Coleoptera: Coccinellidae; Neuroptera: Chrysopidae). Some species are also recorded as pupal parasitoids of mining or gall forming Diptera (Agromyzidae, Chloropidae, Cecidomyiidae) or as egg parasitoids of several families of Lepidoptera (apparently as hyperparasitoids), and there are rare records from other families of Diptera, Hymenoptera and Coleoptera (Noyes 1998).

Bouček (1988) listed four species of *Pachyneuron* from Australia, but suggested that *P. kingsleyi* Girault was probably only a form of *P. emersoni* Girault and estimated that there were probably five valid species. Based on the very few localities listed by Bouček (1988) for the species and the absence of other than the original publications of Girault on Australian *Pachyneuron*, the genus might be thought to be relatively rare and unimportant. However, three of the four recognized species are common and two are widely distributed throughout Australia (Figs. 49–51). I examined over 2,000 specimens for this study and the species undoubtedly are major factors in the population dynamics of Australian aphids and their syrphid predators. The purpose of this study is to differentiate the Australian species and to tabulate the known hosts and distribution of the species in Australia.

MATERIALS AND METHODS

Literature citations for W.H. Ashmead and A.A. Girault incorporate the paper numbers, between brackets following the

year of publication, that are used in their bibliographies by Crawford (1908) and Dahms (1978), respectively. Morphological terms and abbreviations used for structures mostly follow Gibson (1997). Newly used abbreviations and terms are: 'mvw' for 'marginal vein width', the maximum width of the marginal vein, and petiole 'body' (Fig. 22) for the more or less rectangular portion posterior to the constricted or tapered petiole 'neck' (Fig. 22) that articulates with the propodeal foramen. Measurements were made from dry-mounted specimens using an ocular micrometer with 100 divisions per centimetre and a binocular microscope with zoom magnification up to 225×. Specimens for scanning electron microscopy (SEM) were prepared following Bolte (1996); illustrations of *P. aphidis* were made from specimens from North America. The SEM micrograph negatives were converted into a digital format using a 35mm scanner. Photographs of forewings mounted in Canada Balsam on slides were taken using a digital camera mounted on a dissecting microscope. These digital images were enhanced using Adobe Photoshop™, and assembled into final plates using CorelDraw™. Distribution maps were generated using Biolink©. Only those localities whose position could be determined unequivocally were mapped so that the maps generally are less comprehensive than the listed records. Length of the sections summarizing material examined under 'Distribution' for each species was reduced using the following procedures: all specimens validating locality records are in ANIC unless otherwise indicated; locality records are listed in alphabetical order with different localities separated by a period, records with the same primary locality are separated by semicolons and the primary locality is omitted from the second and subsequent records; the sex and number of specimens examined are not given for the three common species; all collection dates have been standardized, including omitting the first two numerals of the year; and the four most frequent collectors, C.J. Burwell, J.C. Cardale, I.D. Naumann and J.S. Noyes are shortened to CJB, JCC, IDN and JSN, respectively. The study was based on specimens provided by the individuals and collections listed below; acronyms are used in the text to denote depositories of specimens; those collections denoted with an asterisk provided type material or other specimens of Nearctic and Palearctic species that were used to help establish correct nomenclature.

ANIC Australian National Insect Collection, CSIRO, Canberra, ACT (J. Cardale and S. Schmidt)

ASCU Agricultural Scientific Collections Unit, Orange Agricultural Institute, Orange, NSW (M. Fletcher and P. Gillespie)

BMNH* The Natural History Museum, London, England (J. Noyes)

CNCI* Canadian National Collection of Insects, Ottawa, ON, Canada

DPIQ Queensland Department of Primary Industries, Brisbane, QLD (J. Donaldson)

HFES* Hokkaido Forest Experiment Station, Bibai, Hokkaido, Japan (K. Kamijo)

MHNG* Muséum d'Histoire naturelle, Geneva, Switzerland (B. Merz)

QMBA Queensland Museum, Brisbane, QLD (C. Burwell)

UQIC University of Queensland Insect Collection, St. Lucia, QLD (G. Daniels)

USNM* United States National Entomological Collection, U.S. National Museum of Natural History, Washington, DC (E. Grissell)

WARI Waite Agricultural Research Institute, University of Adelaide, Glen Osmond, SA (A. Austin)

Pachyneuron Walker

Pachyneuron Walker, 1833: 371, 380. Type species: *Pachyneuron formosum* Walker, by monotypy.

Pachynevron Blanchard, 1840: 260, 266. Unjustified emendation.

Pachynevrum Agassiz, 1846: 778. Unjustified emendation.

Serimus Brèthes, 1913: 90. Type species: *Serimus argentinus* Brèthes, by monotypy. Synonymy by De Santis, 1957: 118.

Propachyneuronia Girault, 1917[327]: 102. Type species: *Encyrtus siphonophorae* Ashmead, by original designation. Synonymy by Gahan, 1918: 66.

Nepachyneuron Girault, 1917[330]: 9. Type species: *Pachyneuron eros* Girault, by original designation. Synonymy by Timberlake, 1926: 308.

Eupachyneuron Blanchard *in* Leiboff, 1948: 256. Type species: *Eupachyneuron bosqui* Blanchard, by monotypy. Synonymy by Bouček, 1988: 441.

Atrichoptilus Delucchi, 1956: 141–142. Type species: *Pachyneuron aeneum* Masi, by original designation. Synonymy by Bouček, 1965: 18.

Pachyneuron (*Serimus*); De Santis, 1975: 8–10. Change of status.

Diagnosis.—Head without distinct malar depression; clypeus with apical margin shallowly emarginate (Figs. 17, 18) to produced (Figs. 1, 2); gena and lower face excluding clypeus mostly isodiametric-reticulate (Fig. 18); torulus at or above lower orbit near middle of face (Figs. 1, 13, 16, 17, 25, 30, 47). Mandible with four teeth (Figs. 1, 2). Antenna 13-segmented with 2 or 3 anelli; scape of female, when appressed to head, extending to anterior ocellus; scape of male subequal in width or evenly tapered to apex (Figs. 9, 21, 33, 34, 45, 46). Pronotum visible in dorsal view, with pronotal carina (in regional species) (Figs. 3, 4, 14, 26, 37, 38). Mesonotum reticulate, the sculpture formed by raised ridges; mesoscutum with incomplete notauli (Figs. 3, 4); mesopleuron with upper mesepimeron shiny and much more finely sculptured than lower mesepimeron (Figs. 4, 38). Propodeum with supracoxal flange shorter than length of nucha (Fig.15). Metacoxa bare dorsobasally (Figs. 4, 38), outer surface smooth to coriaceous-reticulate, much more finely sculptured than reticulate femoral depression (Figs. 4, 38). Forewing with marginal vein noticeably thicker than stigmal or postmarginal veins and at least slightly widened distally, about as long as stigmal vein and at most 0.35 length of costal cell (Figs. 6, 24, 36, 48). Gaster variably distinctly petiolate (Figs. 11, 22, 27, 41); first gastral sternum with anterior margin unmodified, not produced into flange beneath petiole (Figs. 12, 28, 42); terga flat to low convex in critical-point dried female, often flat or collapsed in air-dried female.

Remarks.—Australian *Pachyneuron* can be identified to genus using the key of Bouček (1988). Individuals are most likely to be confused with specimens of the monotypic genus *Inkaka* Girault (Bouček 1988, figs. 767–769), but specimens of *I. quadridentata* (Girault) differ conspicuously by lacking a carinately margined pronotal collar, the pronotum being almost vertical and not visible in dorsal view. Individuals of *Inkaka* also have an obvious malar depression, the antennal toruli slightly below the level of the lower orbits, and a more elongate-slender marginal vein that is at least 0.4 times as long as the costal cell; in females the scape does not extend to the anterior ocellus, and in males the scape has two distinct subapical lobes on its anterior outer margin so as to appear emarginate subapically.

Coruna Walker and *Euneura* Walker are not yet recorded from Australia, but comprise species that are hyperparasites of aphids and that are morphologically similar to species of *Pachyneuron.* It probably is only a matter of time before species of one or both genera are accidentally introduced into Australia. Individuals of *Coruna* have sulcate notauli that extend to the transscutal articulation and therefore are easily distinguished from *Pachyneuron;* more subtle features differentiate *Euneura* from *Pachyneuron.* In *Euneura* the lower face is more extensively longitudinally striate-reticulate (Bouček 1988) and the supracoxal flange is longer than in *Pachyneu-*

ron (Kamijo and Takada 1973). Also, in *Euneura* the metacoxa and femoral depression are similarly reticulate, whereas in *Pachyneuron* the metacoxa is much more finely sculptured than is the femoral depression. Females of *Euneura* also have the metasoma strongly convex and hence more subcircular in cross section than do females of *Pachyneuron*, but this difference is less obvious in critical-point dried individuals.

KEY TO AUSTRALIAN SPECIES OF *PACHYNEURON* WALKER

1 *Both sexes*: propodeum uniformly coriaceous anterior to nucha, without plical furrow or ridges (Fig. 5); petiole body in dorsal view shiny, virtually smooth and strongly transverse (Fig. 11); clypeus medially convex and apically rounded to angulate (Figs. 1, 2). *Female*: flagellum with 3 anelli and 5 funicular segments (Figs. 7, 8). *Male*: antenna brown except possibly for extreme base of scape and legs with femora mostly infuscate ..... ***P. aphidis* (Bouché)**

– *Both sexes*: propodeum with variably distinct, more or less W-shaped complex of plicae and costulae anterior to nucha (Figs. 15, 29, 39); petiole body in dorsal view strongly reticulate to reticulate-rugose and often longer than wide (Figs. 22, 27, 41); clypeus medially flat to depressed and shallowly emarginate (Figs. 17, 18). *Female*: flagellum with 2 anelli and 6 funicular segments (Figs. 19, 20, 31, 32, 43, 44). *Male*: antenna with at least scape mostly or entirely yellow and legs yellow 2

2(1) *Female*: flagellum clavate with longitudinal sensilla along almost entire length of flagellar segments and with adpressed setae (Figs. 19, 31, 43) 3

– *Male*: flagellum filiform with longitudinal sensilla in apical half of flagellar segments and with semierect setae (Figs. 21, 33, 45) 5

3(2) Forewing with basal cell separated from speculum by oblique line of at least 7 setae on dorsal surface of basal fold and with 2 or more setae within basal cell near apex (Fig. 48); petiole body with 1–3 setae projecting anterolaterally from each side near middle (Fig. 41) ..... ***P. rieki* Gibson, new species**

– Forewing usually completely bare basally, but at most with 1 or 2 setae on dorsal surface of basal fold (Figs. 23, 24, 35, 36); petiole body without setae projecting from lateral margin (Figs. 22, 27) 4

4(3) Forewing without marginal fringe (Figs. 35, 36); marginal vein comparatively short and thick, length less than 2.5 times maximum width (Fig. 36), and postmarginal vein only slightly (less than 1.25 times) longer than stigmal vein (Fig. 36); propodeum reticulate-coriaceous anterior to nucha, similarly or even more strongly sculptured medially than laterally (Fig. 29) ..... ***P. nelsoni* Girault**

– Forewing with marginal fringe (Figs. 23, 24) and/or with relatively elongate-slender marginal vein at least 3.5 times as long as wide, and with postmarginal vein distinctly (at least 1.5 times) longer than stigmal vein (Fig. 24); propodeum with comparatively shiny, finely coriaceous to virtually smooth pentagonal or hexagonal region anterior to nucha (Fig. 15) ..... ***P. emersoni* Girault**

5(2) Forewing without marginal fringe (Figs. 35, 36); flagellar segments oblong, the middle segments less than 1.8 times as long as wide (Fig. 33); antenna uniformly yellowish or with flagellum light brown ..... ***P. nelsoni* Girault**

– Forewing with marginal fringe (Figs. 23, 24, 48); flagellar segments elongate, middle segments more than 1.8 times as long as wide (Figs. 21, 45); antenna usually with dark brown flagellum contrasting distinctly with yellow scape 6

6(5) Forewing with basal cell separated from speculum by oblique line of at least 7 setae on dorsal surface of basal fold (Fig. 48); head with lower face uniformly convex (Fig. 47); scape in profile with line of distinct setae along anterior margin (Fig. 46) ..... ***P. rieki* Gibson, new species**

– Forewing with basal cell and speculum uniformly bare (Figs. 23, 24) and/or head with lower face distinctly depressed or concave lateral to convex supraclypeal area and clypeus (Fig. 16); scape in profile without line of distinct setae along anterior margin (Fig. 21b) ..... ***P. emersoni* Girault**

Pachyneuron aphidis (Bouché)
(Figs. 1–12, 49)

Diplolepis Aphidis Bouché, 1834: 170. Syntypes; types lost according to Graham, 1969: 842. Sex described: both.

Pteromalus minutissimus Förster, 1841: 28. Lectotype male, designated by Delucchi, 1955: 138. Type data: Germany, bred on *Aphidius rosarum.* Type depository: Naturhistorisches Museum, Vienna. Sex described: male. Synonymy by Reinhard, 1859: 195.

Pachyneuron pruni Walker, 1850: 128. Lectotype female, designated by Graham, 1969: 842. Type data: Prussia. Type depository: BMNH. Sex described: female. Synonymy by Graham, 1969: 842.

Pachyneuron aphidis; Reinhard, 1859: 195. Change of combination.

Encyrtus siphonophorae Ashmead, 1886[36]: 131. Syntypes, female (examined). Type data: USA, Florida [Jacksonville] bred in 1881 from orange aphis (*Siphonophora citrifolii* Ashmead). Type depository: USNM, type no. 4860. Sex described: female. Synonymy by Bouček, 1988: 441, 442.

Pachyneuron aphidivora Ashmead, 1887[37]: 14. Syntypes, both sexes (examined). Type data: USA, Florida [Jacksonville], bred June 6 from the cabbage aphis (*Aphis brassicae* L). Type depository: USNM, type no. 2854. Sex described: female. Synonymy with *E. siphonophorae* by Girault, 1917[327]: 102. **Note:** According to Timberlake (1918: 402) Girault's synonymy is incorrect because notes of A.B. Gahan on the types, "taken when they were in a better state of preservation than at present, show that *aphidivorum* has only two ring-joints". However, although Ashmead described only females, both females and males are labelled as syntypes in the USNM collection and Gahan's note undoubtedly referred to a male.

Pachyneuron maidaphis Ashmead, 1888: 23. Syntypes, female (examined). Type data: USA, Florida [Lake City]. Type depository: USNM, type no. 26530. Sex described: female. Synonymy with *E. siphonophorae* by Girault, 1917[327]: 102.

Pachyneuron micans Howard, 1890: 246. Syntypes, female (examined). Type data: USA, Indiana, Lafayette, reared by Webster from *Siphonophora avenae.* Type depository: USNM, type no. 1467. Sex described: both. Synonymy with *E. siphonophorae* by Girault, 1917[327]: 102.

Pachyneuron gifuensis Ashmead, 1904[243]: 158. Syntypes, female (examined). Type data: [Japan], Gifu, bred by Y. Nawa [Oct. 1902] from an *Aphis.* Type depository: USNM, type no. 7190. Sex described: female. Synonymy by Kamijo & Takada, 1973: 57.

Serimus argentinus Brèthes, 1913: 91. Holotype male. Type data: Argentina: Buenos Aires. Sex described: male. Synonymy by De Santis, 1957: 119.

Pachyneuron lali Mani, 1939: 81. Holotype female, by original designation. Type data: India: Karnal (Punjab), 15.iii.1938, K. B. Lal, bred from *Aphis rumicis* L. on *Solanum nigrum.* Type depository: Indian Agricultural Research Institute, New Delhi. Sex described: female. Synonymy by Bouček *et al.*, 1978: 451. **Note**: purported description of male applies to female based on description of three anelli, see Bouček *et al.* (1978).

Pachyneuron ferrierei Mani, 1939: 83. Syntypes, male. Type data: India: Chaubatia, U.P., R.N.I., 22.viii.1935, parasitic on an aphid causing leaf curl. Type depository: Indian Agricultural Research Institute, New Delhi. Sex described: male. Synonymy by Bouček *et al.*, 1978: 45. **Note**: type series mistakenly stated as female (Bouček *et al.* 1978).

Eupachyneuron bosqui Blanchard *in* Leiboff, 1948: 256. Type status unknown. Type data: Argentina, La Pampa, reared from *Schyzaphis graminum.* Sex described: female. Synonymy with *P. aphidis* by Bouček, 1988: 442.

Pachyneuron minutissimum; Delucchi, 1956: 129, 137–139. Change of combination.

Pachyneuron triarticulata Mani & Saraswat, 1974: 98–100. Holotype female, by original desig-

nation. Type data: India: Northwest Himalaya, Dalhousie (Ahla catchment area, Khajjiar), M.S. Mani and party, 18 & 27.v.1971. Type depository: USNM, database no. 0700023. Sex described: female. Synonymy by Bouček *et al.*, 1978: 451.

Pachyneuron (Serimus) siphonophorae; De Santis, 1975: 9. Change of status.

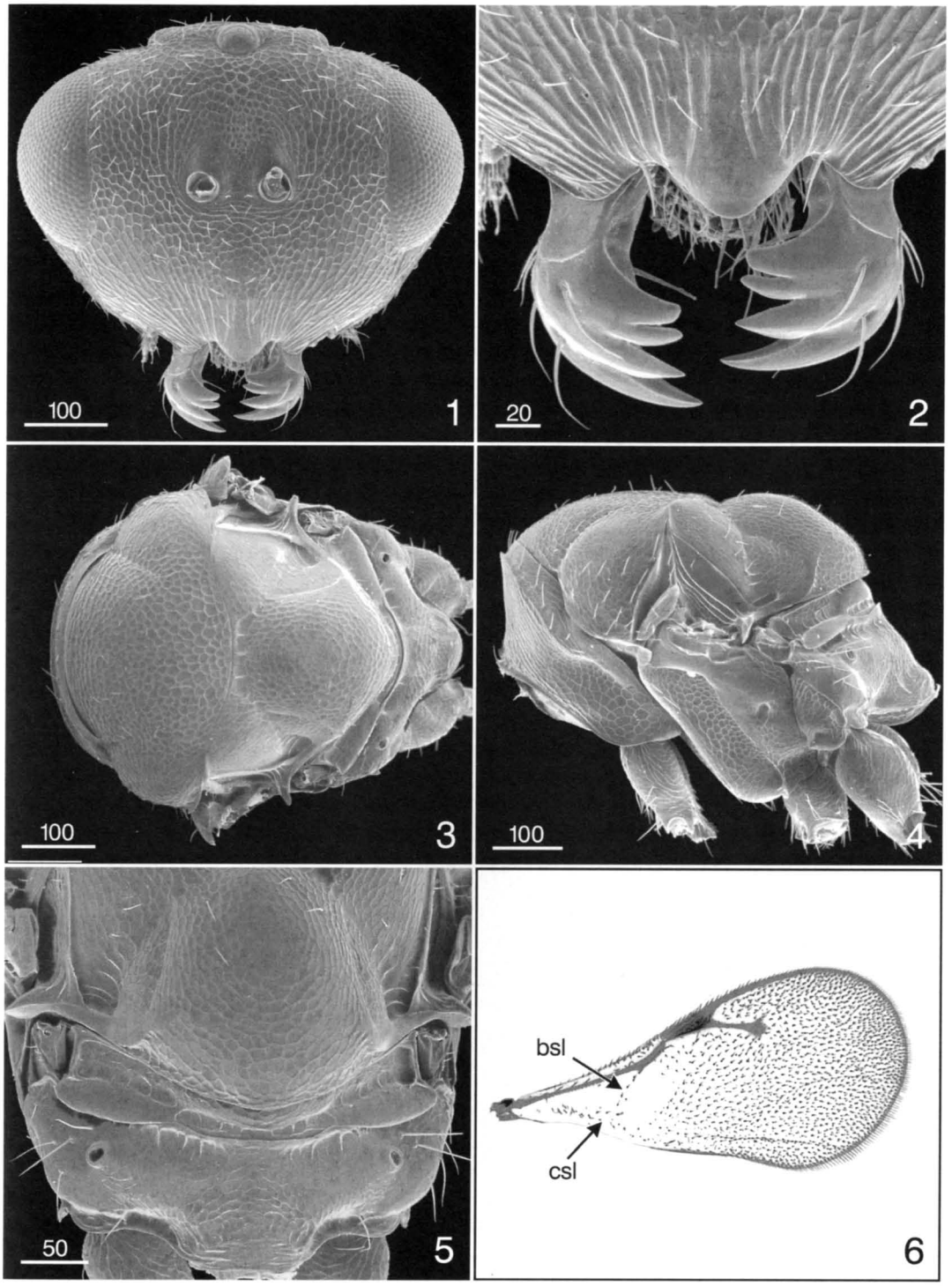
Pachyneuron aphidis; Bouček, 1988: 442.

Female.—Body brown to dark brown with variably distinct metallic green luster; antenna brown except extreme base of scape often yellowish; tegula yellow to brown; legs with femora variably darkly infuscate except apically yellowish, tibiae and tarsi yellowish or with tibiae lightly infuscate subbasally. Head with clypeus convex and apically rounded to angulate (Figs. 1, 2). Flagellum with 3 anelli (Fig. 8) and 5 funicular segments (Fig. 7); funicular segments subquadrate to oblong and with long, conspicuous, decumbent setae (Figs. 7, 8); longitudinal sensilla extending almost entire length of funicular segments, separated from each other by distance equal to 2–3 sensillar diameters (Fig. 8). Forewing (Fig. 6) with marginal fringe; with distinct discal setae; dorsally with basal cell apically delineated by oblique line of setae directed posterobasally from base of parastigma; ventrally with posterior margin of basal cell often delineated by longitudinal cubital setal line, and often with one to several setae on ventral surface near submarginal vein; speculum on dorsal surface open posteriorly; costal cell with distinct setae on ventral surface; veins with following ratios (n = 10): smv/mv = 2.70–3.28, mv/mvw = 2.75–3.58, pmv/mv = 1.57–2.12, pmv/st = 1.64–2.21. Mesonotum with highly convex, relatively slender scutellum (Figs. 3, 4). Propodeum (Figs. 3–5) strongly transverse, uniformly striate-coriaceous without median carina, costula, or plical carina except near nucha, but with paramedial transverse depressions basally; spiracle circular to slightly oval. Petiole without setae projecting from sides; in dorsal view body strongly transverse, shiny and virtually smooth (Fig. 11); in ventral view divided mediolongitudinally by white membranous region (Fig. 12).

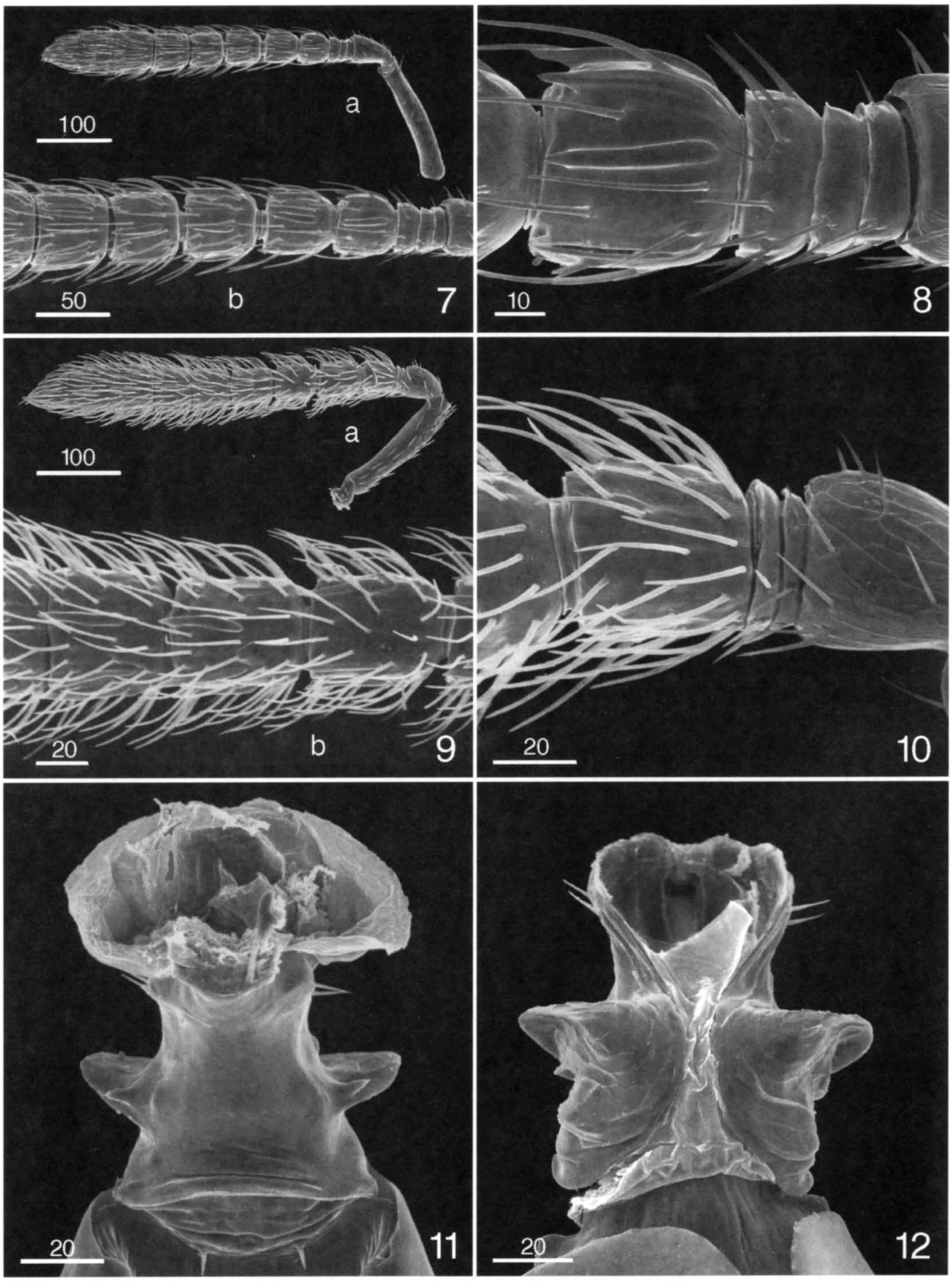
Male.—Similar to female except flagellum (Figs. 9, 10) with 2 anelli and 6 funicular segments; all segments, except possibly preclaval segment, longer than wide (at most about 1.8 times).

Distribution.—Pachyneuron aphidis is a cosmopolitan species that Noyes (1988) recorded from over 40 countries and all continents except Antarctica.

Australian distribution (Fig. 49) and host records based on label data of examined specimens are: **Australian Capital Territory**: Canberra, 2.xii.46, 18.vi.54, E.F. Riek; coll. 17.v.89, em. 25.v.89, *Diaeretiella rapae* ex. *Brevicoryne brassicae* on *Sisymbrium officinale*, V.F. Eastop; coll. 10.iii.89, em. 18.iii.89, *Aphidius sonchi* Marshall ex. *Hyperomyzus lactucae* (L.) on *Sonchus oleraceus*, V.F. Eastop. **New South Wales**: Glossodia, 20.vi.80, parasite of *Aphis nerii*, D. James. Katoomba, 2.xii.75, IDN (UQIC). Merungle Hill, 2.ii.66, on mature oranges, M.I. Nikitin (ASCU). Mootwingee Nat. Pk., Old Mootwingee Gorge, 5–8.xi.84, G.R. Brown & H.M. Holmes (ASCU). Newport, 18.iii.36, ex. *Aphis nerii* (ASCU). Rob Roy, 29.v.74, ex. ear of wheat, M. Greening (ASCU). Rydalmere, 7.vi.61, L.T. Woolcock; 22.ii.68, parasitized *Brevicoryne brassicae*, J.T. Hamilton (ASCU). Sydney, 20.v.49, ex. pumpkin aphids (ASCU). Tamworth, 1.xi.79, ex. *Trioxys complanatus* on spotted alfalfa aphid, N. Forrester. Ulladulla, 18.i.72, ex. aphid on *Cakile edentula*, M. Gray; 10.ii.81, *H. lactucae*; 17.ii.81. Warrumbungles Nat. Pk. via Coonabarabran, 17.xii.74, IDN (UQIC). Wellington, 23.ii.54, ex. *B. brassicae*. **Queensland**: Beerwah, 3.5 km NW (26.50S 152.56E), CJB (UQIC). Brisbane, Alan Fletcher lab., ix.82, ex. galls on *Rhopalomyia californica* Felt, P. McFadyen (QDPI). Bunya Mts. Nat. Pk. nr. Westcott Plain (26.52S 151.34E), 6–7.x.84, IDN & JCC. Camp Mt., 1.x.61, ex. *Aphis nerii* on *Asclepias curassiuica*, E.N. Marks (UQIC). Cecil Plains, D-Vac SIR-ATAC trial in cotton, 1981–82, P.D. Rossiter (QDPI). Gatton, 16.v.78, ex. *Merophyas divulsana*, B. Franzmann (QDPI); 5.v.81 (QDPI); D.P.I. Research Station, 1–7.ix.81, 7–14.ix.81, 21–28.ix.81 (QDPI). Helidon, 30.viii.79, ex. *Aphidius colemani* on *Aphis nerii*, B.A. Franzmann (QDPI). Lake Broadwater, 25 km SE Dalby (27.22S 151.06E), 2–3.iv.96, CJB (QMBA). Miles, 1 km W, Dogwood Ck., 7.x.74, I.D. Galloway (QMBA). Mt. Glorious (27.20S 152.46E), 27.ix.95, S.G. Evans (QMBA). Russell Pk. nr. Mt. Mowbullan (26.53S 151.37E), 7.x.84, IDN & JCC. Sanford, x.61, E. Warwick. Tenthill, 15.viii.79, ex. *Aphidius colemani* in



Figs. 1–6. *Pachyneuron aphidis*: 1, head, frontal (♀); 2, clypeus and mandibles (♀); 3, mesosoma, dorsal (♀); 4, mesosoma, lateral (♀); 5, scutellum-propodeum (♂); 6, forewing (♀). Scale bars = μm. Abbreviations: bsl = basal setal line, csl = costal setal line.



Figs. 7–12. *Pachyneuron aphidis*: 7, antenna (♀): 7a, entire, 7b, anelli and funicular segments; 8, basal flagellar segments, fl_1–fl_4 (♀); 9, antenna (♂): 9a, entire, 9b, middle funicular segments, fl_5–fl_7; 10, basal flagellar segments, fl_1–fl_3 (♂); 11, petiole, dorsal (♀); 12, petiole, ventral (♀). Scale bars = μm.

Aphis nerii, B.A. Franzmann (QDPI). Toowoomba, 16.v.75, ex. mummies on *Rhopalosiphum maidis*, H. Brier (QDPI); 15.x.79, ex. *Aphidius colemani* on *Aphis nerii*, B.A. Franzmann (QDPI). **South Australia**: Adelaide, Waite Institute, iv.88, hyperparasite of *Aphidius sonchi*, D. Martin (WARI). "Brecon", 10 km S Keith, 26.i.82, A.D. Austin (QDPI). Glen Osmond, Waite Ag. Res. Inst., coll. 24.iii.82, em. 30.iii.82, ex. pea aphid, D. Samoedl; W.A.R.I., 21.i.81, ex. *Trioxys*, SAA culture on lucerne, D. Samoedl; Waite Institute, vi.73, ex. *Brevicoryne brassicae* and *Myzus persicae*, C. Crawford. Pinnaroo, 25 km SSW (35.28S 140.47E), 20.x.89, 24.x.89, IDN & JCC; 49 km SW (35.42S 140.49E), 20.x.83, 24.x.83, IDN & JCC. **Victoria**: nr. Benalla, 9.ii.78, ex. *T. maculata*.

Hosts.—Noyes (1988) listed 115 species and 62 genera as hosts for *P. aphidis* in the following taxa: Diptera (Cecidomyiidae, Syrphidae), Hemiptera (Aphidoidea: Aphididae, Pemphigidae; Coccoidea: Coccidae, Kermesidae, Pseudococcidae; Psylloidea: Psyllidae), and Hymenoptera (Chalcidoidea: Aphelinidae, Encyrtidae; Ichneumonoidea: Braconidae). Based on label data, Australian primary and secondary hosts include Aphididae: *Acyrthosiphon pisum* (Harris), *Aphis nerii* (Fonscolombe), *Brevicoryne brassicae* (L.), *Nasonovia* (= *Hyperomyzus*) *lactucae* (L.), *Myzus persicae* (Sulzer), *Therioaphis maculata* (Buckton) and Braconidae: *Aphidius colemani* Viereck, *Aphidius sonchi* Marshall, *Diaeretiella rapae* (McIntosh), *Trioxys complanatus* (Pérez). There is also a single record from *Merophyas divulsana* (Walker) (Lepidoptera: Tortricidae) and an anomalous record of 'galls' on *Rhopalomyia californica* Felt.

Remarks.—*Pachyneuron aphidis* is the only species of *Pachyneuron* in Australia with a convex, apically rounded or angulate clypeus (Fig. 2). It is further differentiated from *P. nelsoni* and *P. emersoni* females by the presence of a basal setal line on the forewing (Fig. 6); however, specimens of *P. rieki* (Fig. 48) and rare *P. emersoni* males also have a forewing basal setal line. Females of *P. aphidis* are also unique within the genus because they have 3 anelli and 5 funicular segments, and the flagellum differs from those of other Australian species because it has conspicuous decumbent setae similar to males (Figs. 7, 8). Males are easily distinguished by their brown antennae, males of the other species have at least the scape yellow.

Because of a similar clypeus and propodeum, individuals of *P. aphidis* are morphologically most similar to *P. californicum* Girault (1917[322]), known only from America north of Mexico. However, in *P. californicum* the petiole is completely sclerotized ventrally (i.e., forming a complete tube, *cf.* Fig. 28) even though short as in *P. aphidis*, and the speculum is usually closed on the ventral surface by a line of setae along the cubital fold.

Pachyneuron emersoni Girault
(Figs. 13–24, 50)

Pachyneuron emersoni Girault, 1916[274]: 229–230. Lectotype female, complete (examined), here designated: "878 ", "Swan Riv, W. Austr.", "G. Compere Collector", "♀ Lectotype Bouček 1985". Type depository: USNM, type no. 19691. Paralectotypes, here designated: 1 point with mesosoma, same data as lectotype (USNM type no. 19691); 1 slide with parts of two male antennae under one cover slip and a crushed head, one female hind leg and two male hind legs under another cover slip (USNM type no. 19691); 1 point with mesosoma, same data as lectotype (QMBA type no. HY 3568); 1 point with pair of middle legs, same data as lectotype plus "from Icerya, California, Alex. Craw, import from Australia, G. Compere, July 1900" (QMBA type no. HY 3568). **Notes**: Although Bouček labelled the two USNM point-mounted specimens as lectotype and paralectotype he did not validate these designations through publication. Girault's original description stated that the USNM has "two females on tags plus the slide"; however the point-mounted USNM paralectotype is a male, based on leg structure and color. The male antennae on the slide may belong to this specimen but it is unknown to which specimen the other parts belong.

Pachyneuron kingsleyi Girault, 1916[274]: 230. Holotype female (examined). Type data: Australia: N.S.W., Brooklyn, 31 October 1914.

Type depository: QMBA, type no. HY 3569. Sex described: female. **New synonymy.**

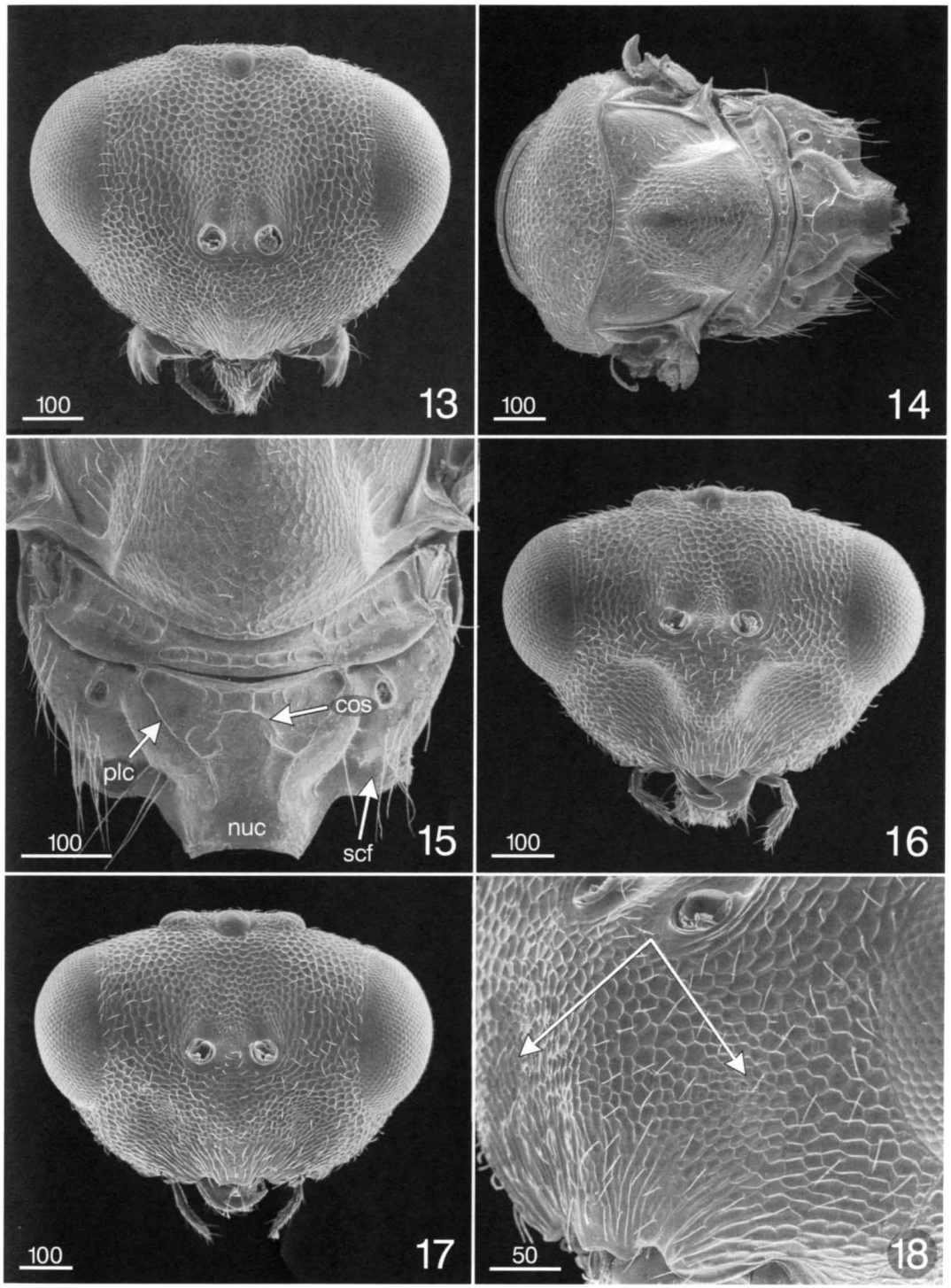
Pachyneuron emersoni; Dahms, 1983: 246; Bouček, 1988: 442.

Pachyneuron kingsleyi; Girault, 1927[416]: 335; Girault, 1929[431]: 319; Dahms, 1984: 738–739; Bouček, 1988: 442.

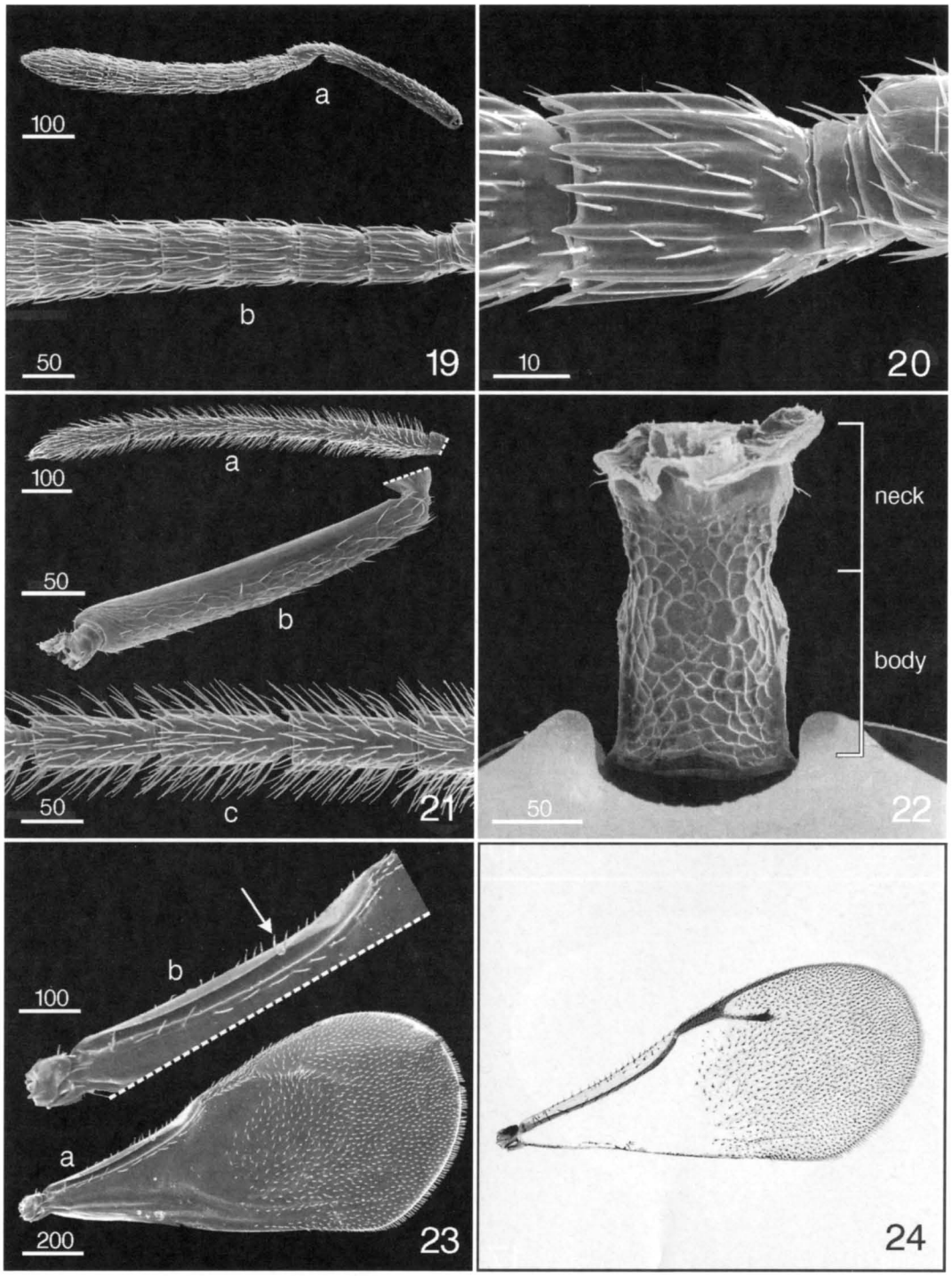
Female.—Body dark with variably distinct metallic green luster; antenna dark brown except with basal half to all of scape yellow; tegula yellow; legs with femora variably darkly infuscate except apically yellowish, tibiae and tarsi yellowish. Head with clypeus flat to slightly depressed and apically shallowly emarginate (Fig. 13). Flagellum compact-clavate, with 2 anelli (Fig. 20) and 6 funicular segments (Fig. 19); funicular segments slightly longer than wide basally to quadrate or slightly transverse apically and with appressed setae (Figs. 19, 20); longitudinal sensilla extending almost entire length of funicular segments, separated from each other by distance equal to 1–2 sensillar diameters (Fig. 20). Forewing (Figs. 23, 24) usually with marginal fringe; with distinct discal setae; dorsally without line of setae differentiating apex of basal cell from speculum (very rarely with 1 or 2 setae on basal fold); ventrally without line of setae along cubital fold; costal cell with distinct setae on ventral surface (Fig. 23b); veins with following ratios (n = 10): smv/mv = 2.94–3.60, mv/mvw = 3.63–4.86, pmv/mv = 1.32–1.64, pmv/stv = 1.55–1.80. Mesonotum with relatively low convex, broad scutellum (Fig. 14). Propodeum (Fig. 15) with posteriorly convergent, carinately margined plical ridges and usually less distinct, often irregularly ∩-shaped anteromedian carina or ridge (costula) near base, the ridges together differentiating a more or less W-shaped basal region with coriaceously sculptured anterolateral depressions from a mostly shiny and smooth to finely coriaceous pentagonal or hexagonal posteromedian region anterior to a coriaceous or medially smooth and shiny nucha, with the short region anterior to ∩-shaped ridge crenulate and the surface lateral to plical ridges finely coriaceous; spiracle distinctly oval. Petiole without setae projecting from sides (Fig. 22); in dorsal view distinctly (at least 1.75 times) longer than wide, with body slightly to distinctly longer than wide and uniformly reticulate (Fig. 22); in ventral view completely sclerotized with median furrow, the body distinctly longer than wide, finely coriaceous-reticulate and shiny.

Male.—Similar to female except as follows: body brighter metallic green or bluish green; legs uniformly bright yellow beyond coxae except metafemur sometimes lightly infuscate; head with lower face distinctly concave (Fig. 16) to very shallowly depressed (Figs. 17, 18) lateral to convex supraclypeal area and clypeus; scape entirely yellow or brownish apically, slightly expanded and flattened basally immediately above radicle, tapered apically and slightly curved, and in lateral view without distinct line of setae along anterior margin (Fig. 21b); flagellum usually dark brown, filiform; funicular segments elongate, middle segments more than 1.8 times as long as wide and all segments with very sparse longitudinal sensilla within apical half and with conspicuous, semierect setae about as long as width of segment (Figs. 21a, c); forewing always with marginal fringe; basal cell on dorsal surface sometimes delineated apically by line of up to 7 setae, with 1–3 setae sometimes also delineating extreme posteroapical angle of cell, and rarely with 1–3 setae within cell toward apex. Petiole usually without setae, rarely with single seta projecting anterolaterally from one side near middle.

Distribution (Fig. 50).—**Australian Capital Territory**: Bendora, 14.xii.60, D.H. Colless. Blundell's, 26.ix.30, 14.iv.31, L.F. Graham; 6.i.61, E.F. Riek. Brindabella Ra., Lees Spring (35.22S 148.49E), 24.xi.81, IDN; nr. Lees Spring, 24.xi.31, L.F. Graham; Mt. Ginini, 24.xi.81, IDN. Canberra, 14.ii.39, from cabbage, T.G. Campbell; 3.xii.39; 29.ix.46, 2.x.46, 6.viii.47, 15.vii.48, 8.xi.48, E.F. Riek; 25.xi.65, O.W. Richards; 10.v.66, ex. *Aphis craccivora*, D. Morgan; 18.i.80, on *Eucalyptus* blossom, IDN; 20.i.80, on *Baeckia* blossom,



Figs. 13–18. *Pachyneuron emersoni*: 13, head, frontal (♀); 14, mesosoma, dorsal (♀); 15, scutellum-propodeum (♀); 16, head, frontal (♂); 17, head, frontal (♂); 18, lower face (♂) (arrows point to regions of finer sculpture within depressions). Scale bars = μm. Abbreviations: cos = costula, nuc = nucha, plc = plica, scf = supracoxal flange.



Figs. 19–24. *Pachyneuron emersoni*: 19, antenna (♀): 19a, entire, 19b, anelli and funicular segments; 20, basal flagellar segments, fl_1–fl_3 (♀); 21, antenna (♂): 21a, entire, 21b, scape, 21c, middle funicular segments, fl_5–fl_7; 22, petiole, dorsal (♀); 23, forewing, SEM of dorsal surface: 23a, entire, 23b, submarginal vein and costal cell (arrow points to costal setae) (♂); 24, forewing, photograph (♀). Scale bars = μm.

IDN. Canberra, nr. airport, 7.iv.53, 14.iv.53, ex. syrphid pupa *Eucalyptus melliodora*, E. Lewis; 8.iv.53, ex. syrphid pupa under *Euc. maculosa*, E. Lewis. Canberra, Black Mt., 22.v.53, ex. syrphid pupa *Euc. blakelyi*, E. Lewis; 14.iii.67, 9–16.xi.79, 17–26.xi.79, D.H. Colless; 2–10.iv.68, 28–29.iv.68, light trap; 18.xi.79, Z. Liepa; 600m, 7–12.iii.80, dry sclerophyll, A. Newton & M. Thayer; iii, iv, v, vii, ix, x, 24.x-1.xi, xi.82, IDN & JCC. Canberra, Capital Hill, coll. 21.x.53, em. 21.xi.53, ex. syrphid pupa *Euc. blakelyi*, F. Wheelhouse; ex. curled leaf *E. melliodora*, 9.iii.53, E. Lewis. Canberra, Farrer, 27.xi.80, 7.xii.80, R. Rentz. Gibraltar Falls, 27.i.84, IDN. Gingera, 6.iii.52, E.F. Riek. Ginninderra, 22.iii.66, G. Grant. Molonglo, 8.iv.83, ex. syrphid pupa under *Euc. maculosa*, E. Lewis. Mt. Coree, 30.i.64, D.H. Colless; 2 mi E, 19.xi.68, JCC & S. Curtis. Mt. Franklin, 4 km N (32.27S 148.46E), 21.ii-10.v.77, D.C.F. Rentz. Mt. Gingera, 4.ii.65, D.H. Colless; 13.i.69, Z. Liepa; 21.ii.79, E.C. Zimmerman; 4.i.79, ex. lichen, R. Bartell. Picadilly Circus (35.22S 148.48E), 1240m, xii.84, J. Lawrence, T. Weir & M.L. Johnson; (35.22S 148.49E) 24.xi.81, JCC; 17 km SW (35.27S 148.48E), 24.xi.81, IDN & JCC; 3 km E, Blundell's Ck (35.22S 148.50), 850m, ii.84, xii.84, Weir, Lawrence & Johnson; ii.87, D.H. Colless; 6 km NW, Wombat Ck (35.19S 148.51E), 750m, xii.84, i.85, Weir, Lawrence & Johnson. Quenbeyan, 9.iii.53, ex. curled leaf *E. melliodera*, E.L. Raymond; 2.7 km NE, 670m, 5.iv.80, I.F.B. Common. Smokers Flat, 6 km E Corin Dam, 4.iv.80, J.F. Lawrence. Woods Reserve nr. Gibraltar Falls, 27.i.84, IDN. **New South Wales**: Alpine Creek, Kiandra, 9.xii.64, E.F. Riek. Arcadia, 10.ii.67, M.I. Nikitin (ASCU). Ardlethan, 31 km SE (34.37S 147.01E), 10.ii.92, CJB (UQIC). Bald Rock Nat. Pk., 30.xi.81, M.A. Schneider & G. Daniels (UQIC). Barrington Tops S.F., Dilgry River (31.53S 151.32E), 15–16.xi.81, T. Weir; Gloucester R (32.04S 151.41E), 12–14.xi.81, T. Weir & A. Calder; Moppy Lookout (31.54S 151.33E), 18.xi.81, T. Weir; 3km W Moppy Lookout (31.54S 151.31E), 18.xi.81, T. Weir & A. Calder; Polbius Swamp, 17.xi.81, T. Weir; Thunderbolt's Lkt (31.55S 151.30E), 18.xi.81, T. Weir & A. Calder. Batemans Bay, 4 N, 21.x.52, E.F. Riek. Bathurst, 1.v-21.v.62, R.D. Hughes; 23.ii.66, M.I. Nikitin (ASCU); 23.x.67 (ASCU); 26.x.68, N.C. Lloyd (ASCU). Billabong Ck nr. Conargo (35.17S 145.11E), 12–17.iv.78, JCC. Boolijah Ck via Sassafras, 22.xi.79, JCC. Braidwood, 13 km NNW (35.21S 149.44E), 5.xi.81, M.S. Upton. Brooklyn, 31.x.14 (QMBA). Broken Hill, 100 km SE (32.51S 141.37E), 3–13.x.88, E.D. Edwards. Brown Mt., 15.i.69, JCC & S.R. Curtis. Bungendore, 13 km E (35.15 S 149.35E), 6.xi.81, M.S. Upton. Cabbage Tree Ck, Clyde Mt., 22.ii.65, D.H. Colless. Cabramatta, 1.i.63, M. Nikitin (QMBA). Condobolin, 17.x.00 (ASCU). Congo, 8 km SE Moruya, 15.ii.82, M.S. Upton. Coonabarabran, 51 km N (30.50S 149.26E), 13.ii.92, CJB (UQIC). Daiers Gap (36.12S 148.43E), 1585m, 19.xii.73, 28.xii.73, 6.ii.74, 20.iii.74, ex. *Eucalyptus pauciflora, stellulata* and *perriniana* forest. Euroka, 4 km W Kempsey, 6.xii.78, A. Postle. Forbes, 12.xi.64, D.H. Collass. Fowlers Gap Res. Stn (31.05S 141.42E), 29.xi-2.xii.81, 8–9.xii.82, IDN & JCC. Gibraltar Ra., 15.i.79, rainforest margin, IDN. Grafton, 5.iv.36, *Dicochrosis punctiforalis* (ASCU). Halfway House, Putty Rd., 20.xii.73, IDN (UQIC). Hunter R, 3.6 km on Glennies Ck Railway Rd, 12–13.xii.78, A. Postle & C. Brennan. Klora nr. Moruya, 6.iii.66, Z. Liepa. Kosciusko, Sawpit Ck, 11.xii.60, D.H. Colless. Lake George nr. Collector, 23.x.76, Z. Bouček (QMBA, USNM). Lansdowne, 3 km N, xi.91, riparian rainforest, blossom *Waterhousia floribunda*, G. & T. Williams. Leeton, 2.ii.66, M.I Nikitin (ASCU). London Falls, 12.xii.48, C.E. Chadwick (ASCU). Macquarie Pass, 7 km ENE Robertson (34.34S 150.40E), 8.ii.84, IDN. Monga State Forest, (35.38S 149.54E), 3.xii.77, IDN; 18.ii.83, IDN & JCC. Monga, 5 km SW, 9.xi.81. Mootwingee Nat. Pk, Homestead Gorge (31.17S 142.18E), 7–13.x.88, E.D. Edwards. Mt. Dromedary nr. Narooma, 2100 ft, 4.ii.69, Upton, Taylor & Cardale. Mt. Kaputar Nat. Pk., 2.xii.76, E.M. Exley; Dawsons Spring (30.17S 150.10E), 1420m, 5–11.xii.87, moericke trap under flowering *Kunzea ambigua*, G.R. Brown (ASCU). Myalia Tank, 49 km NE Broken Hill (31.50S 141.57E), 3.xii.81, IDN & JCC. Narrabri E.F., 19.ix.60, M.I. Nikitin (ASCU). New England NP, Point Lookout, 22.i.79, temperate rainforest, IDN & JCC. Orange, 22.ii.66, 23.ii.66, 14.iii.66, M.I. Nikitin (ASCU). Orchard Hills, W. Sydney, 26.v.82, K. Helm. Parkes, 13.xi.64, D.H. Colless. Pigeon House Ra. via Nerriga, 25.x, 22.xi.79, IDN & JCC. Scaly Lookout, nr. Coffs Harbour, 6.ix.83, G. Daniels & M. Schneider (UQIC). Terrace, 13.xii.78, A. Postle. Tooloom Plateau via Urbenville, 10.xi.74, IDN (UQIC). Triangle, 150–200m, 5–7.x.79, aerial netting, R. Farrow; Research Station, 4.xi.79, aerial net. Wambool Common, 18 km ESE Bathurst, 4.iv.80, JCC. West Wyalong, 17 km S (34.05S 147.08E), 10.ii.92, CJB (UQIC). Yanco, 4.ii.60, M.I. Nikitin (ASCU). **Northern Territory**: Roe Creek, 11 km SW Alice Springs (23.46S 133.47E), 9.x.78, JCC. **Queensland**: Applethorpe, 15.x73, J. Rhodes (QDPI). Bald Mt. area via Emu Vale, 3500–4000', 27–31.i.72, S.R. Monteith. Biloela, 25 km E, 13.iii.76, E.M. Exley, on Ironbark (UQIC). Boonah, 29.xii.91, 17.vi.92, 18.vi.92 (UQIC); 16 km N (27.54S 152.41E), 18.ix.94, 18–19.v.96, 6–7.ix.97, CJB (QMBA). Brisbane, 22.iii.40, C.F. Ashby (QDPI); 19.iv.52, S. Barker (UQIC); 5.xii.77, *Eucalyptus*, K. Walker (UQIC); iv.78, ex. syrphid larva, B. Cantrell (QDPI); Acacia Ridge, 26.xii.76 (QMBA); Taringa (27.30S 152.58E), coll. ii.98, em. 12, 13.iii.98, ex. pupa *Dideopsis aegrota* on citrus, CJB (QMBA). Bunya Mts. Nat. Pk. nr. Westcott Plain (26.52S 151.34E), 6–7.x.84, IDN & JCC. Charleville, nr, 13.iv.89, P. Johnson (QMBA). Chinchilla, 6 km W, 5–15.iii.98, G. Lithgow (QMBA). Cooloola Nat. Pk., E Gympie, 18.x.78, I.D. Galloway (QDPI). Dayboro, 8.5 km SSE, Sampsonvale cemetery (27.16S 152.52), 3.ix.95, 12.x.1997, CJB (QMBA). Eidsvold (25.22S

151.07E), 11.x.84, IDN & JCC. Forest Hill, 18–19.xi.76, M. Tichon (UQIC). Gatton, 25.iii.80, P. Twine (QDPI); 11.v.81, 11.xi.81 (QDPI); D.P.I. Research Stn., 9–16.iii.81, 21–27.iv.81, 25.v-1.vi.81, 1–7.ix.81, 14–21.ix.81, 7–14.ix.81, 14–21.ix.81, 28.ix-5.x.81, 21.x.81 (QDPI). Gordonvale, ix.20, ex. puparia of cloudy-winged syrphid, A.P. Dodd (QDPI). Joalah Nat. Pk., Tamborine Mt. (27.56S 153.12E), 18–21.x.78, Lawrence & Weir. Lemington Nat. Pk, Mt. Bithongabel, 1400m (28.16S 153.10E), 23.x.78, Berlese moss & litter *Nothofagus moorei*, Lawrence & Weir. Mitchell, bank of Mitchell Riv., 9.x.74, I.D. Galloway (QDPI). Monto, 14 km NW, 12.iii.76, on *Eucalyptus*, E.N. Exley (UQIC). Mt. Beerwah via Glasshouse, 1800', 5.xii.65, T. Weir (UQIC). Mt. Glorious, 31.xii.79, IDN; 19–26.xi.79, 24–31.xii.79 (QDPI); 22.iii.79, 7.xii.81, E.C. Dahms (QMBA); 3.i.82, B. Cantrell (QDPI); 22.vi-18.x.82, 27.iv.89, 27.iv-26.x.89, 26.x-5.xii, 89, 1.ix-17.x.90, A. Hiller (QMBA); 17.x.90, E.C. Dahms & G. Sarnes (QMBA). Mt. Inkerman (19.45S 147.30E), 28.iv.97, CJB (QMBA). Mt. Nebo, xii.61, E. Warwick. Mt. Norman area via Wallangarra, 7–8.x.72, S.R. Monteith. Mt. Spurgeon, 2 km SSE (16.27S 145.12E), 1100m, 19–22.xi.97, CJB (QMBA). Mt. Superbus summit (28.14S 152.23E), 1270m, CJB (QMBA). Mt. Tamborine, x-xi.78, Sankowsky (QDPI); 3.iii.84, I.D. Galloway (QMBA). Ormiston, iii.61, ex. aphids, B.R. Champ (QDPI). Quilpie, 149 km E (26.33S 145.38E), 20.ix.90, M.P. Zalucki & G.V. Maynard (UQIC). Rathdowney (2nd Palen Ck. crossing from), 22.iii.75, I.D. Galloway (QDPI). Repulse Ck, 23 km NE Bauhinla Downs (24.24S 149.23E), 22–23.iv.81, IDN. Reyford, 26.v.78, E. Sinclair (QDPI). St. Lucia, University of Queensland, 12.xii.95, ex. pupa of Syrphidae on *Sonchus* sp., S.G. Evans (QMBA); 17.xii.95, adult ovipositing into pupa *Episyrphus viridaureus*, S.G. Evans (QMBA); 17.xii.95, ex. *Episyrphus* sp. pupa on *Sonchus oleraceus*, S. Evans (QMBA). Stanthorpe, 12 km SE, 3–30.xii.90, 3.iv-9.vi.91, G. Sarnes (QMBA); 47 km N, 9.xii.80, on *Eucalyptus*, E.M. Exley & J. King (UQIC). Taroom District (25.27S 150.03E), Boggomoss 21, 11.xi.96, CJB & S. Evans (QMBA). Thornlands, 1.xi.80, J.F. Donaldson (QDPI). Toowoomba, 28.ii.78, 29.ii.78, ex. Syrphidae pupa, B.A. Franzmann (QDPI). Whiskers, 7 km WNW Hoskistown (35.24S 149.23E), 29.xi.92, M.S. Upton. Wilson's Peak (nr), via Teviot Gap, 700–830m, 9.i.77, IDN (UQIC). Yatala, 24.xi-23.xii.81, among sugarcane, L.N. Robertson. Yerongpilly, 1–10.i.82, B. Cantrell (QMBA). **South Australia**: Adelaide, reared ex. *Melangyna viridiceps* (Macq.), M. Carver; 50 km S, Aldinga Scrub, 5–6.xii.86, JSN. Brookfield Cons. Pk. (34.21S 139.29E), 24–26.xi.92, IDN & JCC; SW corner, stop 29 (34.24S 139.26E), 20.x.92, Rentz, Roach & Harwood. Cowell, 32 km NNE (32.26S 137.03E), 28.xi.92, IDN & JCC; 43 km NNE (33.20S 137.06E), IDN & JCC. nr. Lake Eyre South (29.31S 137.16E), JCC. Lake Tungketta (33.46S 135.06E), 30.xi.92, IDN & JCC. Lock, 24 km NW (33.32S 135.30E), 30.xi.92, flowers *Eucalyptus*, IDN & JCC. Mernmerna, 33 km N Hawker (31.36S 138.23E), 17.ix.78, JCC. nr. Moonabbie Range (33.17S 137.10E), IDN & JCC. Oraparainna Ck, Dingley Dell Camp (31.21S 138.42E), 4–10, 7.xi.87, IDN & JCC. Orroroo (32.44S 138.37E), 11.xi.87, IDN & JCC. Parachilna Ck (31.08S 138.33E), 8.xi.87, IDN & JCC. Parra Wirra Rec. Pk, 50 km NE Adelaide, 9.xii.86, JSN. Penong, 10 km WNW (31.53S 132.54E), 14.x.81, IDN & JCC. nr. Pine Hill (33.22S 137.03E), 28.xi.92, IDN & JCC. Pinnaroo, 18 km SSW (35.25S 140.49E), 20.x.83, 24.x.83, IDN & JCC; 25 km SSW (35.28S 140.47E), 20.x.83, 24.x.83, IDN & JCC; 49 km SW (35.42S 140.49E), 20, 24.x.83, IDN & JCC. Port Lincoln, 4 km SW (34.45S 135.49E), 29.xi.92, IDN & JCC. Willmington, 2 km SSE (32.39S 138.06E), 11.xi.87, IDN & JCC. **Tasmania**: Bronte Lagoon, 13.i.84, L. Masner (CNCI). Bronte Pk., 12 km NNE (42.02S 146.33E), 2.ii.83, IDN & JCC. Buckland, 5 km W (42.37S 147.39E), 27.i.83, IDN & JCC. Claytons, Bathurst Harbour (43.22S 146.08E) 15.i.91, Nielson & Edwards. Condominium Ck, 5 km WSW Anne (42.58S 146.22E), 11.xii.81, IDN & JCC. Cranbrook, 14 km ESE (42.04S 148.13E), 28.i.83, IDN & JCC. Denson rivulet, N of Bicheno (41.48S 148.15E), 6.ii.92, CJB (UQIC). Derwent Bridge, 9 km WSW (42.10S 146.08E), 21.i.83, IDN & JCC; 18 km SW (42.13S 146.02E), 22.i.83, IDN & JCC. Elephant Pass (41.38S 148.13E), 28.i.83, IDN & JCC. Fentonbury, 1 km W (42.39S 146.45E), 12.xii.81 Franklin R. (42.13S 146.01E), 2.ii.83, IDN & JCC. Frodshams Pass (42.49S 146.23E), 24–25.i.83, IDN & JCC; 7 km S (42.53S 146.22E), 25.i.83, IDN & JCC; 5 km SW (42.50S 146.19E), 24.i.83, IDN & JCC; 8 km SW (42.49S 146.18E), 24.i.83, IDN & JCC. Hellyer Gorge, 2.ii.67, E.F. Riek. Herrick, 1 km NE (41.06S 147.53E), 29–30.i.83, IDN & JCC. Kingston, 1 km NE, 26.xii.79, JCC. Mayfield Beach (42.15S 148.00E), 6.ii.92, CJB (UQIC). Miena, 6 km W (41.59S 146.39E), 20.i.83, IDN & JCC. Montumana, 3 km SE (40.58S 145.33E), 19.i.83, IDN & JCC. Mt. Barrow via Launcestron, 800–1000m, 1.xii.76, IDN (UQIC). Mt. Doris (41.52S 146.03E), 7.ii.90, coniferous heath, IDN. Mt. Mueller, 5 km NW (42.46S 146.25E), 11.xii.81, IDN. Mt. Wellington, Shoobridge Bend (42.54S 147.15E), 5.ii.83, IDN & JCC. Nelson R. (42.06S 145.44E), 22.i.83, IDN & JCC. Nunamara, 10 km ENE (41.22E 147.24E), 11.i.83, IDN & JCC; 8 km NE, Barrow Ck (41.21S 147.22E), IDN & JCC; 11 km NE, Mt. Barrow (41.23S 147.25E), 11.i.83, IDN & JCC. Oxford, 4 kmW (42.34S 147.50E), 27.i.83, IDN & JCC. Pellon Hut, 3 km S Mt. Oakleigh (41.50S 146.03E), iii.91, *Leptospermum* scrub and vicinity, IDN; 30.xi-8.i.91, open forest; 5–10.ii.90, rainforst, IDN. Poatina, 9 km SW (41.48S 146.52E), 20.i.83, IDN & JCC; Headrace Adit (41.49S 146.54E), 20.i.83, IDN & JCC. Scottsdale, 9 km E (41.10S 147.38E), IDN & JCC. The Lea (42.56S 147.19E), 5.ii.83, IDN & JCC. Wayatinah, 3 km NE (42.22S 146.29E), 15, 23.i.83, IDN & JCC. Weldborough, 4 km SE (41.14S 147.56E), 13.i.83, IDN & JCC. **Victoria**: Acheron Gap, c. 15 km NNE

Warburton, 830m, malaise *Nothofagus*, D. Pollock & L. Reichert. Archeron Way via Warburton, 300–480m, 16.xii.75, IDN (UQIC). Beech Forest, 10 mi E, 1.i.67, Z. Liepa; via Colac, 6.i.66, T. Weir (UQIC); Coutts Rd., 480m, 11.xii.75, IDN (UQIC). Belgrave, 25, 26.xii.26, A.P. Dodd (QDPI). Bogong Plains, 5–6000 ft, i.28, F.E. Wilson (QDPI). Bruthen, 26.ii.80, IDN & JCC; 9 km N (37.38S 147.53E), 8.ii.92, CJB (UQIC). Cann Valley H'way, 7 km SW N.S.W. border, 25.ii.80, IDN & JCC. Dinner Plain, 11 km from Hotham Heights, 27.ii.80, IDN & JCC. Hattah, 12 km NW (34.39S 142.14E), 19.x.83, IDN & JCC. Jim Jack Ck, 12 km WSW Omeo, 27.ii.80, IDN & JCC. Kiata, 8 km SSW (36.26S 141.46E), 23.x.83, IDN & JCC. Kinglake N. Pk. nr. Melbourne, 31.i.77, Bouček (USNM). Lake Crosby (35.03S 141.44E), 23.x.83, IDN & JCC. Lind Nat. Pk, Growler Ck, 26.ii.80, IDN & JCC. Mitre, 11km NE (36.38S 141.48E), 22.x.83, IDN & JCC; 12.5 km NNE (36.37S 141.49E), 22.x.83, IDN & JCC. Mitta Mitta Ck, 25 km NNW Omeo, 28.ii.80, IDN & JCC. Mt. Arapiles (36.46S 141.50E), 21.x.83, IDN & JCC. Mt. Donna Buang, 1250m, 14–17.i.80, *Eucalyptus* woodland, A. Newton & M. Thayer (CNCI); via Healesville, 4080 ft, 10.i.66, T. Weir (UQIC); via Warburton, 1200m, 8.xii.76, IDN (UQIC). Mt. Sabine via Barramunga, 580m, 11.xii.75, IDN (UQIC, QDPI). Omeo, 12 km NNW, 28.ii.80, IDN & JCC; 18 km NW, 28.ii.80, IDN & JCC. Pirita, 13 km S (34.29S 141.54E), 18.x.83, IDN & JCC. Rye, 27.ii.89, ex. *Dialectica* sp. A on *Cynoglossum australe*, R. Sheperd. Yapest, 10 km NW (35.41S 142.02E), 23.x.83, IDN & JCC. Yarrara, 15 km S (34.33S 141.25E), 18.x.83, IDN & JCC. **Western Australia**: Boranup Karri Forest, 20 km S Margareb River, 11–13.xii.90, A.D. Austin (WARI). Cape Arid NP, 30.xii.86–31.i.87, JSN; Yokinup Bay area, 31.xii.86–3.i.87, JSN. Cape Le Grand Nat. Pk. (33.58S 122.07E), 10.i.87, 11.i.87, G. & A. Daniels (UQIC). Condingup, c. 55 km E Esperance, 31.xii.86, JSN. Dongara, 30 km S., 19.xii.86, JSN. Esperance, 4.i.87, JSN. Fitzgerald Riv. Nat. Pk., Quaalup area, 6–9.i.87, JSN. John Forest NP, c. 25 km E. Perth, 23–27xii.86, 24–28.xii.86, JSN. Ludlow (33.37S 115.29E), 2.xi-23.xii, S.J. Curry. Nedlands, 10.iv.41, from syrphid pupa on rose leaf, K.R. Norris. Needilup, 29 km NE (33.54S 119.04E), 30.x.84, A.A. Calder. Noongar, 2 km SW (31.21S 118.57E), IDN & JCC. Pithara, 2 km SSW (30.24S 116.40E), 26.ix.81, IDN & JCC. Porongorup Nat. Pk., 1.87, JSN. Ravensthorpe, 4.i.87, JSN. Stirling Range Nat. Pk., i.87, JSN. Swan River, G. Compere (QMBA); Red Gum Spring, 23 km ENE Cranbrook, 20–22.xii.90, A.D. Austin (WARI). Walpole-Nornalup Nat. Pk., 17–21.i.87, JSN; Nornalup, 5 km SE, 17–18.xii.90, A.D. Austin (WARI); Nornalup, 2 km W (34.59S 116.48E), 17.i.93, E.D. Edwards. Yanchep Nat. Pk., c. 50 km N Perth, 20.xii.86, JSN; c. 65 km N Perth, 21.xii.86, JSN. Yellowdine, 21 km NE (31.17S 119.53E), 10.x.81, IDN & JCC.

Hosts.—Label data indicate *Aphis craccivora* (Koch) (Aphididae) and puparia of *Dideopsis aegrota* (Fabricius), *Episyrphus viridaureus* Wiedemann and *Melangyna viridiceps* (Macquart) (Diptera: Syrphidae) as hosts of *P. emersoni*. There is also one anomalous record from *Dialectica* sp. (Lepidoptera: Gracillaridae).

Remarks.—*Pachyneuron emersoni* is distinguished by a combination of features that are given in the key and description. I have seen females, most commonly from Western Australia, that lack a marginal fringe and therefore resemble *P. nelsoni*. In some instances one or more short regions of the wing margin retain setae so absence may simply be due to abrasion; however, either the setae are for some reason more readily lost from females from western Australia or presence or absence of the setae is variable for *P. emersoni* in western Australia. Females without a marginal fringe are differentiated from *P. nelsoni* females by their conspicuously longer marginal and postmarginal veins (*cf.* Figs. 24 and 36), smoother and shinier medial area on the propodeum (*cf.* Figs. 15 and 29), and more elongate petiole that in dorsal view is uniformly reticulate (*cf.* Figs. 22 and 27). All males of *P. emersoni* that I have seen have a marginal fringe but those from western Australia often have the lower face only inconspicuously depressed lateral to the supraclypeal area (Fig. 17), much less so than for typical specimens from eastern and southern Australia (Fig. 16). The western Australian males are thus more like males of *P. rieki*, but they do not have the setal patterns of the forewing basal fold or the scape as described for *P. rieki* males. Also, even though the facial region may be only indistinctly depressed (Fig. 17), there is still a noticeable difference in the reticulate sculpture compared with that near the eye, the cells being smaller and often more obliquely oriented in the depressed regions (Fig. 18). I have also seen rare males of *P. emersoni* from eastern Australia and Tasmania that have a single petiolar seta

projecting from one side, but these males have the lower face distinctly depressed lateral to the supraclypeal area and the basal fold bare.

Individuals of *P. emersoni* are morphologically very similar to those of *P. formosum* Walker (1833) in Europe and *P. albutius* Walker (1843) in America north of Mexico. However, the propodeum is uniformly reticulate in *P. formosum* females and reticulate with a network of oblique, irregular carinae in *P. albutius* females. Females of both species lack the more or less W-shaped complex of plicae and costulae and the smoother posteromedian region characteristic of *P. emersoni* females (Fig. 15). Males of *P. formosum* and *P. albutius* also have the lower face essentially evenly convex and uniformly reticulate.

Bouček (1988) previously suggested that *P. kingsleyi* was only a form of *P. emersoni* but did not formally synonymize the names. The female lectotype is complete, but the antennae are mounted on a slide under a separate cover slip from the head and antennae of the USNM male paralectotype (Dahms 1983).

Pachyneuron nelsoni Girault
(Figs. 25–36, 51)

Pachyneuron nelsoni Girault, 1928[421]: 2. Holotype female (examined). Type data: Australia: N. Q., Gordonvale [= Nelson], Feb. 1920, Dodd. Type depository: QMBA, type no. T.9324. Sex described: female.

Pachyneuron aeneus Masi, 1929: 229–231. Holotype female. Type data: Libya (North Africa): Oasis of Giarabub, iii.1927. Type depository: Museo Civico di Storia Naturale, Genoa. Sex described: female. Synonymy by Bouček, 1988: 442.

Atrichoptilus aeneus; Delucchi, 1956: 141–142. Change of combination.

Pachyneuron aeneum; Bouček, 1965: 16–18. Change of combination.

Pachyneuron nelsoni; Dahms, 1986: 324–325; Bouček, 1988: 442.

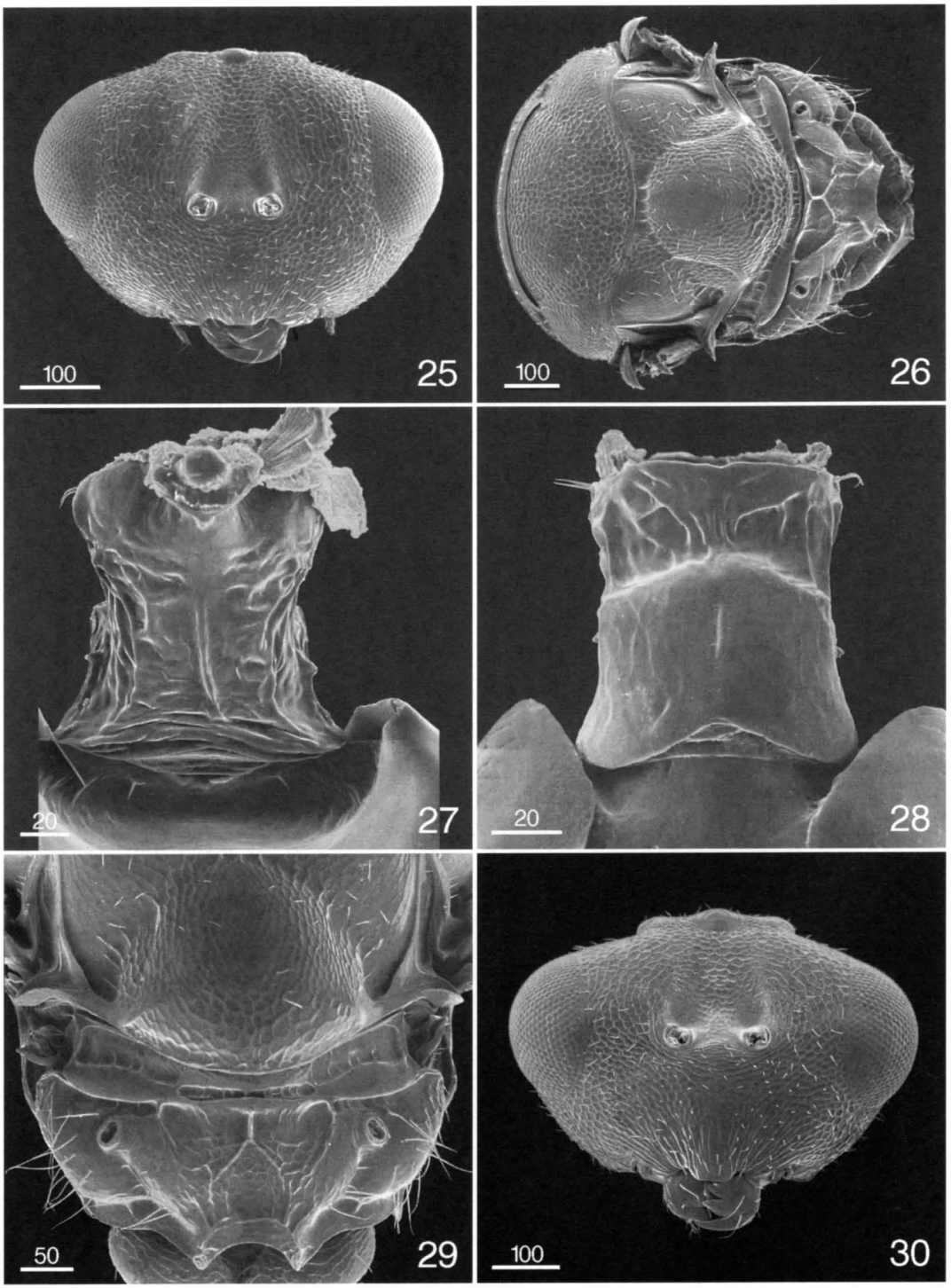
Female.—Body dark with variably distinct metallic green luster; antenna brown except basal half to all of scape yellow; tegula yellow; legs with femora variably darkly infuscate except apically yellowish, tibiae and tarsi yellowish. Head with clypeus flat to slightly depressed and apically shallowly emarginate (Fig. 25). Flagellum compact-clavate, with 2 anelli (Fig. 32) and 6 funicular segments (Fig. 31); funicular segments quadrate or slightly longer than wide basally to slightly transverse apically and with adpressed setae (Figs. 31, 32); longitudinal sensilla extending almost entire length of funicular segments, separated from each other by distance equal to 1–2 sensillar diameters (Fig. 32). Forewing (Figs. 35, 36) without marginal fringe; with relatively inconspicuous, white, often spicule-like discal setae; dorsally without line of setae differentiating apex of basal cell from speculum; ventrally without line of setae along cubital fold; costal cell with inconspicuous white setae on ventral surface (Fig. 35b); veins with following ratios (n = 10): smv/mv = 4.33–5.00, mv/mvw = 1.64–2.22, pmv/mv = 1.25–1.78, pmv/stv = 1.04–1.10. Mesonotum with relatively low convex, broad scutellum (Fig. 26). Propodeum (Figs. 26, 29) with posteriorly convergent, carinately margined plical ridges and /\-shaped to inverted Y-shaped carinae differentiating a more or less W-shaped anterolateral region and a pentagonal posteromedian region, with all surfaces similarly coriaceous-reticulate or with pentagonal region more distinctly reticulate; spiracle distinctly oval. Petiole without setae projecting from sides (Figs. 27, 28); in dorsal view slightly (up to about 1.3 times) longer than wide, with often indistinctly differentiated, transverse to quadrate, rugose-reticulate body often having median carina or some longitudinal carinae (Fig. 27); in ventral view completely sclerotized with median furrow, the body quadrate to slightly transverse, finely longitudinally coriaceous and shiny (Fig. 28).

Male.—Similar to female except as follows: body brighter metallic green or bluish green; antenna almost uniformly yel-

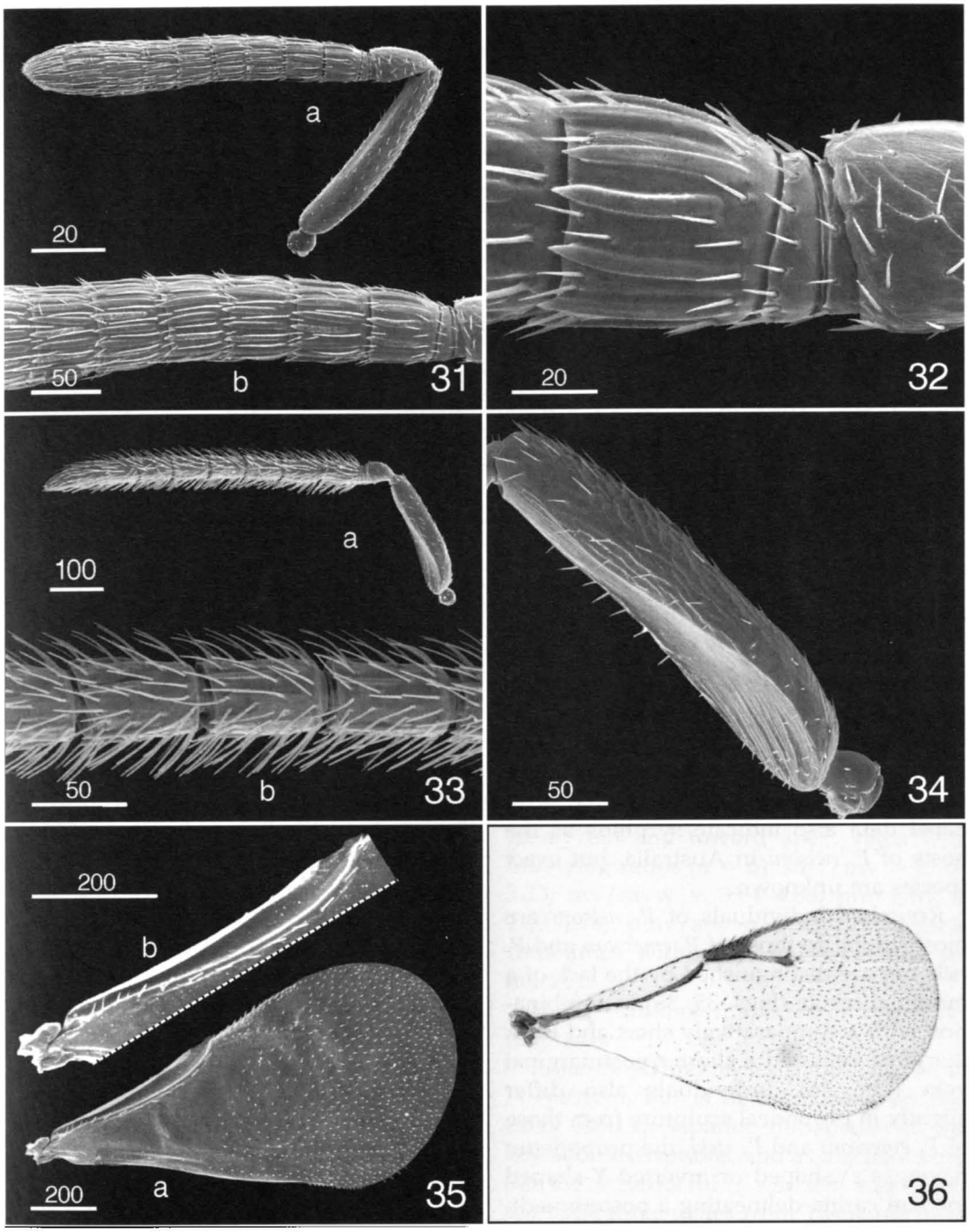
lowish or with flagellum light brown; legs uniformly bright yellow beyond coxae; scape (Fig. 34) thickest basally and tapered toward apex, with anterior surface flat to slightly concave over at least basal two-thirds and in lateral view with variably distinct line of setae along both outer and inner anterior margins; flagellum filiform; funicular segments oblong, middle segments at most 1.75 times as long as wide and all segments with very sparse longitudinal sensilla within apical half of each segment and with conspicuous, semierect setae about as long as width of segment (Fig. 33). Forewing with marginal vein up to 2.6 times as long as wide and postmarginal vein up to 1.4 times as long as stigmal vein; sometimes with 1 or 2 short setae on dorsal surface of basal fold and sometimes with a few short, inconspicuous setae on dorsal surface within basal cell. Propodeum often more uniformly reticulate with fine or indistinct plical and /\-shaped carinae (Fig. 29).

Distribution.—Noyes (1998) recorded *P. nelsoni* from the following regions and countries: Afrotropical (Libya), Australasian (Australia), Oriental (India), and Palearctic (Moldova, Russia, Turkey). The species was additionally recorded from Yugoslavia and Azerbaijan by Bouček (1977: 46), who stated that it is circummediterranean. Bouček (1988) stated that it is widespread in southern Europe, dry countries of Africa and south Asia, and established (probably introduced) in Australia.

Australian distribution (Fig. 51) records based on label data of examined specimens are: **Australian Capital Territory**: Brindabella Range, Mt. Ginini (35.32S 148.46E), 24.xi.81, IDN. Canberra, 23.xii.30, W.K. Hughes. **New South Wales**: Bowning, nr, 9.xii.69, on *Eucalyptus*, JCC. Fowlers Gap Res Stn (31.05S 141 42E), 29.xi-2.xii.81, on *E. camaldulensis* flowers, JCC; 8–9xii.82, JCC. Leeton, 3.ii.66, M.I Nikitin (ASCU). Mootwingee Nat. Pk., Old Mootwingee Gorge, 5–8.xi.84, G.R. Brown & H.M. Holmes (ASCU). Myalla Tank, 49 km NE Broken Hill (31.50S 141.57E), 3.xii.81, IDN & JCC. Orange, 22.ii.66, M.I. Nikitin (ASCU); Agric. Res. Stn., 18.viii.93, on apple blossom, K. Harding & A. Nicholas (ASCU). Triangle, 5–7.x.79, aerial netting 150m, 200–300m, R. Farrow; i-iii.85, S.G. Martin, ex. lucerne (ASCU); Research Station, 1.xi79, 4.xi.79, aerial net. Wambool Common, 19 km ESE Bathurst, 17.iv.81, JCC. **Northern Territory**: Alice Springs, 20.ix.78, ex. syrphid pupa, L. Rodunz; 7 km NW (23.38S 133.52E), 8.xi.79, JCC; 10 km NE (23.37S 133.54E), 6.xi.79, IDN; 35 km E (23.41S 134.13E), 25.ix.78, JCC; 39 km E (23.41S 134.15E), 25.ix, 5.x.78, JCC; 40 km E (23.41S 134.16E), 5.x.78, JCC; 53 km NE (23.35S 134.22E), 6.x.78, JCC; 56 km SE (24.11S 134.01E), 3.x.78, JCC. Ayers Rock, 195 km E on Lacsiters Highway, 5.xi.92, P. Dangerfield (WARI). **Queensland**: Bramston Beech (17.21S 146.01E), 14.xii.91, CJB (UQIC). Brigalow Development area, Moura, P.D. Rossiter [S. almum, 21.iv.66] (QDPI). Chinchilla, 6 km W, 9–17.x.87, G. Lithgow (QMBA). Connors River (22.11S 149.03E), 8.v.80, IDN & JCC. Eulo, 32 km W (28.09S 144.43E), 28.x.91, G. Daniels, on *Flindersia maculosa* (UQIC). Gatton College Cawes, 30.xi.67, ex. syrphid pupa, B. Teakle (QDPI). Gordonvale, 20.ii.20, A.P. Dodd (QMBA). Holts Ck, 8 km N Musselbrook Camp (18.33S 138.11E), 20.v.95, IDN. Miles, 28 km S, 23.ix, D.H. Colless. Mount Inkerman (19.45S 147.30E), 28.iv.1997, CJB (QMBA). Taroom District (25.27S 150.03E), Boggomoss 21, 11.xi.66, CJB & S. Evans (QMBA). Townsville, Ross River, Hermit Pk. (19.18S 146.49E), 4.xii.91, CJB (UQIC). Warwick, 9 km S, 13.i.81, J. & C.R. King, on *Angophora costata* (UQIC). **South Australia**: Agnes Ck, 44 km NW Granite Downs (26.38S 133.16E), 21.ix.78, JCC. Aldinga Scrub, 50 km S Adelaide, 5–6.xii.86, JSN. Brookfield Cons. Pk. (34.21S 139.28E), 24xi.92, 26.xi.92, IDN & JCC. Ceduna, 21 km NW (31.56S 133.24E), 14.x.81, IDN & JCC; 32 km NW (31.56S 133.24E), 14.x.81, IDN & JCC. nr. Coffin Bay (34.38S 135.27E), 29.xi.92, IDN & JCC. Cowell, 43 km NNE (33.20S 137.06E), 28.xi.92, IDN & JCC. Edwards Creek (28.20S 135.50E), 19.ix.78, JCC. Elliston, 1 km SE (33.40S 134.54E), 30.xi.92, IDN & JCC. nr. Lake Eyre South (29.31S 137.16E), 18.ix.78, JCC. nr. Moonabbie Range (33.17S 137.10E), 28.xi.92, IDN & JCC. Nooltana Creek, 13 km NW Hawker (31.47S 138.21E), 16.ix.78, JCC. Oraparinna Ck, Dingly Dell Camp (31.21S 138.42E), 7.xi, 4–10.xi.87, IDN & JCC. Parachilna Ck (31.08S 138.33E), 8.xi.87, IDN & JCC. Penong, 10 km WNW (31.53S 132.54E), 14.x.81, IDN & JCC. Pinnaroo, 18 km SSW (35.25S 140.49E), 20 & 24.xi.83; 25 km SSW (35.28S 140.47E), 20 & 24.xi.83, IDN & JCC; 49 km SW (35.42S 140.49E), 20 & 24.xi.83, IDN & JCC. Taylorville, 12 km ESE (34.08S 140.06E), 12.xi.87, IDN & JCC. William Creek, 27 km SE (29.05S 136.31E), 19.ix.78, JCC. Wilmington, 2 km SSE (32.39S 138.06E), 11.xi.87, IDN & JCC. Yorke Peninsula, 20.ix.81, aerial netting, R.A. Farrow. **Tasmania**: Frodshams Pass, 1 km S (42.50S 146.22E), 11.xii.81, IDN. **Victoria**: Hattah, 7 km SE (34.50S 142.18E), 19.x.83, IDN & JCC; 12 km NW (34.39S 142.14E), 19.x.83, IDN



Figs. 25–30. *Pachyneuron nelsoni*: 25, head, frontal (♀); 26, mesosoma, dorsal (♀); 27, petiole, dorsal (♀); 28, petiole, ventral (♂); 29, scutellum-propodeum (♀); 30, head, frontal (♂). Scale bars = μm.



Figs. 31–36. *Pachyneuron nelsoni*: 31, antenna (♀): 31a, entire, 31b, anelli and funicular segments; 32, basal flagellar segments, fl_1–fl_3 (♀); 33, antenna (♂): 33a, entire, 33b, middle funicular segments, fl_5–fl_7; 34, scape (♂); 35, forewing, SEM of dorsal surface: 35a, entire, 35b, submarginal vein and costal cell (♂); 36, forewing, photograph (♀). Scale bars = μm.

& JCC. Kiata, 8 km SSW (36.26S 141.46E), 23.x.83, IDN & JCC. Lake Crosby (35.03S 141.44E), 23.x.83, IDN & JCC. Mitre, 11 km NE (36.38S 141.48E), 22.x.83, IDN & JCC; 12 km NE (36.37S 141.48E), 22.x.83, IDN & JCC; 12.5 km NNE (36.37S 141.49E), 22.x.83, IDN & JCC. Mt. Arapiles (36.46S 141.50E), 21.x.83, IDN & JCC. Pirita, 13 km. S (34.29S 141.54E), 18.x.83, IDN & JCC. Princetown, 5 km NW, 27.xi.77, J.F. Donaldson (QDPI). Yapest, 10 km NW (35.41S 142.02E), 23.x.83, IDN & JCC. Yarrara, 15 km S (34.33S 141.25E), 18.x.83, IDN & JCC. **Western Australia**: Cocklebiddy, 23 km ESE (32.08S 126.18E), 12.x.81, IDN & JCC. Fitzgerald Riv. Nat. Pk., Quaalup area, 6–9.i.87, JSN. Geraldton, 31.xii.75, R. Storey & E.M. Exley (UQIC). Kalgoorlie, 1.xi.47, swept nr. lucerne. Ludlow (33.37S 115.29E), 4.xi-22.xii.80, S.J. Curry. Madura, 11 km E (31.55S 127.09E), 13.x.81, IDN & JCC. 'Marun' CALM Site, 8/4 Prince Frederick Harbour (15.00S 125.21E), 6–11.vi.88, IDN. Mt. Magnet, 17.xii.86, JSN. Mt. Singleton, 15 km NE (29.21S 117.20E), 28–29.ix.81, IDN & JCC. Noongar, 2 km SW (31.21S 118.57E), 9.x.81, IDN & JCC. Norseman, 47 km SSW (32.35S 121.34E), 19.ix.81, IDN & JCC. Paynes Find, 5 km SW (29.18S 117.39E), 29.ix.81, IDN & JCC. Perenjori, 18.xii.86, JSN. Ravensthorpe, 46 km W, 4.i.87, JSN. Yanchep N.P, 20–21.xii.86, J.S.N; c. 50 km N Perth, on *Eucalyptus*, 20.xii.86, JSN.

Hosts.—Noyes (1988) gave Syrphidae (Diptera) as the hosts of *P. nelsoni*, but without listing any species; Bouček (1977: 46) listed *Episyrphus* (= *Epistrophe*) *balteatus* (DeGeer) as an example syrphid host. Label data also indicate syrphids as the hosts of *P. nelsoni* in Australia, but exact species are unknown.

Remarks.—Individuals of *P. nelsoni* are most similar to those of *P. emersoni* and *P. rieki* but are distinguished by the lack of a marginal fringe (Figs. 35, 36) in combination with a comparatively short and thick marginal vein and a shorter postmarginal vein (Fig. 36). Individuals also differ slightly in propodeal sculpture from those of *P. emersoni* and *P. rieki*, the propodeum having a ∧-shaped or inverted Y-shaped median carina delineating a posteromedian pentagonal region that is similarly or even more conspicuously sculptured than is the basolateral W-shaped region (Figs. 26, 29). Individuals of *P. emersoni* and *P. rieki* usually have the posteromedian region more broadly ∩-shaped, shiny, and almost smooth (Figs. 15, 39, 40). The petiole (Fig. 27) is also shorter than in *P. emersoni* (Fig. 22) or *P. rieki* (Fig. 41), but because of its length it is often mostly concealed by the base of the gaster. Antennal features further differentiate males of *P. nelsoni* from those of *P. emersoni* and *P. rieki*, the scape having a flat to shallowly concave anterior surface that is broad basally and tapered apically (Fig. 34), and the flagellar segments being comparatively short (Fig. 33) and usually similarly light-colored as the scape.

The specimen from near Chinchilla, Queensland (QMBA) is a gynandromorph, having the head and antennae of a male but the metasoma of a female.

Doğanlar (1986) differentiated *P. nelsoni* (as *P. aeneum*) from other European species of *Pachyneuron* based on structure of the hypopygium and described the new species *P. erzurumicum*, from Turkey, as lacking a marginal fringe. He differentiated the latter species from *P. aeneum* based on differences in dimensions of the forewing venation and flagellar segments. Huang and Liao (1987) also described a new species from China, *P. aciliatum*, as lacking a marginal fringe. They compared the species with *P. grande* Thomson but did not differentiate it from *P. nelsoni*, though they illustrated a forewing with seven setae on the basal fold, three setae within the basal cell, and with distinct discal setae.

Pachyneuron rieki Gibson, new species
(Figs. 37–49)

Type material.—*Holotype*, female (ANIC): Australian Capital Territory: Flea Ck, 25.viii.1950, E.F. Riek. *Allotype*, male (ANIC): same data as holotype. *Paratypes* (ANIC, UQIC, CNCI): **Australian Capital Territory**: 7 females, 13 males, same data as holotype, the series associated with an unidentified syrphid larva (1 female and 2 males used for SEM). **Tasmania**: Lake St. Clair (42.06S 146.10E), 750m, 25–27.i.1980, Lawrence & Weir (1 female). Mt. Doris (41.52S 146.03E), 7.ii.1990, coniferous

heath, IDN (1 male); 1 km ENE Mt. Ossa (41.52S 146.03E), iii.1991, IDN (2 males).

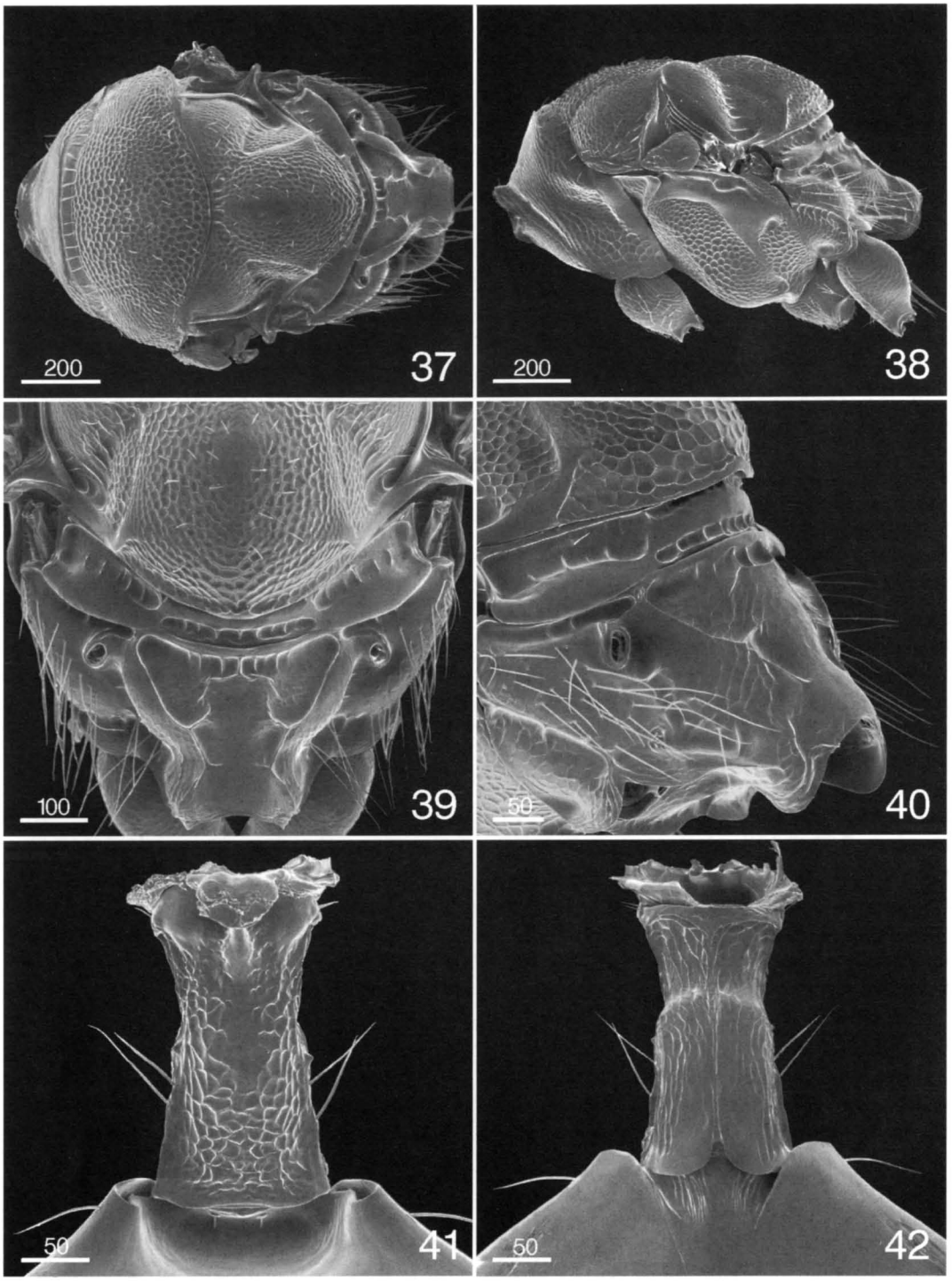
Etymology.—Named in honour of Edgar F. Riek, who reared most of the type series.

Female.—Body dark with metallic green luster; antenna dark brown except scape yellow; tegula yellow; legs with all except apex of femora brown, otherwise yellowish beyond coxae. Head with clypeus flat and apically shallowly emarginate (Fig. 47). Flagellum compact-clavate, with 2 anelli (Fig. 44) and 6 funicular segments (Fig. 43); funicular segments distinctly longer than wide basally to quadrate apically and with adpressed setae (Figs. 43, 44); longitudinal sensilla extending most of length of funicular segments, separated from each other by distance equal to about 2 sensillar diameters (Fig. 44). Forewing (Fig. 48) with marginal fringe; with distinct discal setae; dorsally with oblique line of 7–13 setae on basal fold differentiating apex of basal cell from speculum and with 2–5 setae near apex of basal cell; ventrally without line of setae along cubital fold; costal cell with distinct setae on ventral surface; veins with following ratios (n = 3): smv/mv = 3.33–3.45, mv/mvw = 4.83–5.00, pmv/mv = 1.60–1.76, pmv/stv = 1.65–1.76. Mesonotum with relatively low convex, broad scutellum (Figs. 38, 39). Propodeum (Figs. 39, 40) with posteriorly convergent, carinately margined plical ridges and less distinct, sometimes irregularly ∩-shaped anteromedian carina or ridge (costula) near base (Fig. 39), the ridges together differentiating a more or less W-shaped basal region with coriaceously sculptured anterolateral depressions from a mostly shiny and smooth to finely coriaceous pentagonal or hexagonal posteromedian region anterior to a coriaceous or medially smooth and shiny nucha, with the short region anterior to ∩-shaped ridge crenulate and the surface lateral to plical ridges finely coriaceous (Fig. 40); spiracle distinctly oval. Petiole near middle with 1–3 setae projecting anterolaterally from each side (Figs. 41, 42); in dorsal view about twice as long as wide, with distinctly longer than wide, uniformly reticulate body (Fig. 41); in ventral view completely sclerotized with median furrow, the body distinctly longer than wide, finely longitudinally coriaceous and shiny (Fig. 42).

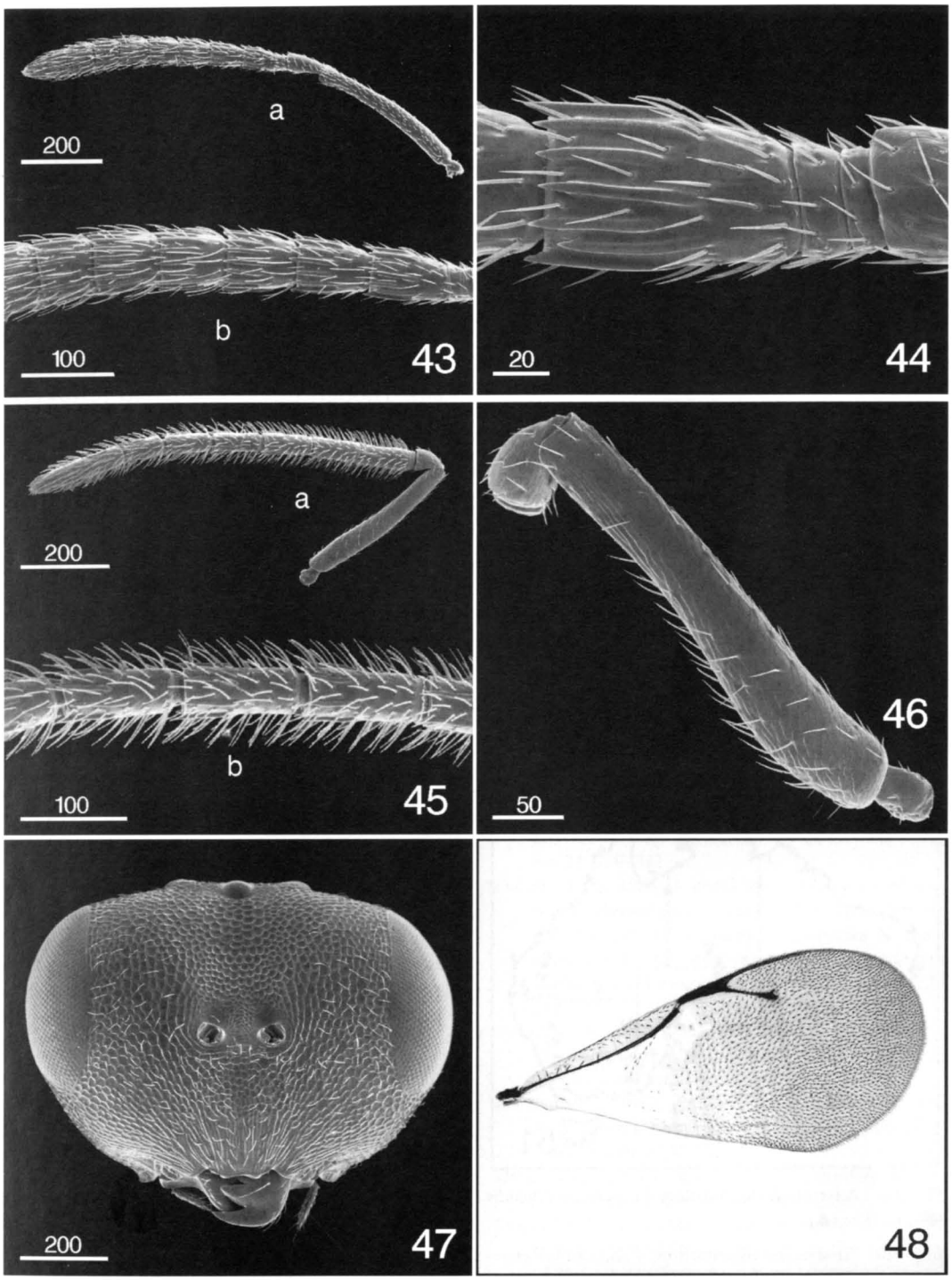
Male.—Similar to female except as follows: body brighter metallic green or bluish green; legs uniformly bright yellow beyond coxae; scape entirely yellow, slightly expanded basally immediately above radicle, tapered subapically and slightly curved, with line of distinct setae along anterior margin (Fig. 46); pedicel sometimes yellow except brownish dorsally; flagellum dark brown, filiform; funicular segments elongate, the middle segments at least twice as long as wide and all segments with very sparse longitudinal sensilla within apical half and with conspicuous, semierect setae about as long as width of segment (Fig. 45); forewing with basal fold similarly setose as in female but sometimes also with 1–3 setae delineating posteroapical angle of basal cell and with up to 10 setae within cell behind submarginal vein and toward apex; veins with following ratios (n = 6): smv/mv = 2.70–3.23, mv/mvw = 3.84–4.86, pmv/mv = 1.30–1.74, pmv/stv = 1.52–1.79; petiole sometimes without lateral setae (see remarks).

Hosts.—Unknown species of Syrphidae (Diptera).

Remarks.—This species is most similar to *P. emersoni,* but is distinct based on features used to separate the species in the key and descriptions, and as discussed under the remarks for *P. emersoni* and *P. nelsoni.* The three males from Tasmania have a slightly shorter petiole than the reared males from ACT and apparently lack lateral petiolar setae, though these may have been lost during preparation, which included critical-point drying. The three Tasmanian males also have somewhat shorter submarginal and postmarginal



Figs. 37–42. *Pachyneuron rieki*: 37, mesosoma, dorsal (♀); 38, mesosoma, lateral (♀); 39, scutellum-propodeum (♀); 40, apex of scutellum-propodeum, posterolateral (♂); 41, petiole, dorsal (♀); 42, petiole, ventral (♀). Scale bars = μm.



Figs. 43–48. *Pachyneuron rieki*: 43, antenna (♀): 43a, entire, 43b, anelli and funicular segments; 44, basal flagellar segments, fl_1–fl_3 (♀); 45, antenna (♂): 45a, entire, 45b, middle funicular segments, fl_5–fl_7; 46, scape (♂); 47, head, frontal (♂); 48, forewing (♀). Scale bars = μm.

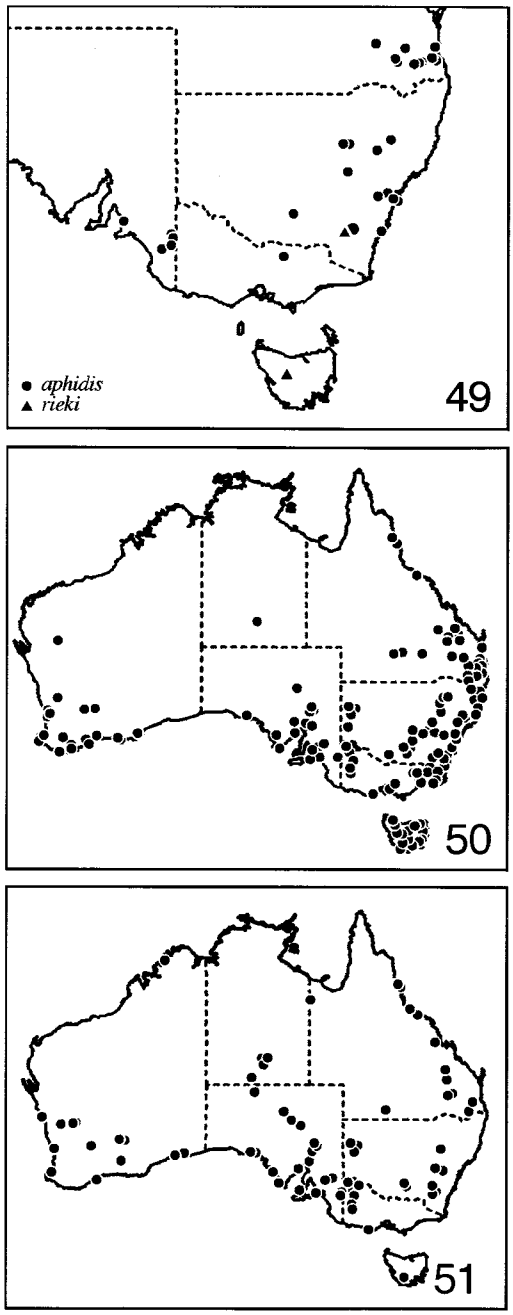


Fig. 49. Australian distribution: *Pachyneuron aphidis* (●), *P. rieki* (▲).

Fig. 50. Australian distribution, *Pachyneuron emersoni.*

Fig. 51. Australian distribution, *Pachyneuron nelsoni.*

veins than do the ACT males (smv/mv = 2.70–2.86 vs. 2.94–3.23 and pmv/mv = 1.30–1.43 vs. 1.53–1.74; n = 3), whose venation is more similar to that of measured females. However, there are insufficient specimens of both sexes to accurately estimate true variability in any of the measured structures.

Graham (1969) differentiated *P. umbratum* Delucchi (subsequently synonymized with *P. groenlandicum* (Holmgren) by Hedqvist, 1977) from *P. formosum* based on the presence of 2–12 setae on the basal vein. Though this is similar to *P. rieki, P. groenlandicum* lacks the petiolar setae characteristic of *P. rieki* and has an evenly reticulate propodeum. An unidentified species from America north of Mexico has petiolar setae and often a setose basal vein similar to *P. rieki,* but differs in propodeal sculpture, having the plical region more or less evenly reticulate or with some irregular, oblique carinae similar to *P. albutius.*

CONCLUSIONS

Without a world species revision it is premature to hypothesize about the phylogenetic relationships of the Australian fauna of *Pachyneuron.* However, *P. emersoni, P. nelsoni* and *P. rieki* all share a posteromedially differentiated propodeal plical region that is delineated by a more or less W-shaped complex of plicae and costulae (Figs. 15, 29, 39). This structure distinguishes the species from other morphologically similar species, such as *P. formosum* and *P. albutius* from the Nearctic and Palearctic regions, respectively, which have the propodeal plical region more or less uniformly reticulate. Although polarity is uncertain, the similar propodeal structure suggests that *P. emersoni, P. nelsoni* and *P. rieki* are closely related and may have speciated in Australia, which would not support the hypothesis that *P. nelsoni* was introduced into Australia recently (Bouček 1988). *Pachyneuron nelsoni* is also one of the most widely distributed species in Australia and the only species

yet recovered from northern Western Australia. (Fig. 51). The distribution pattern does not suggest a recent introduction. *Pachyneuron aphidis* is certainly much more distantly related to the other species and undoubtedly represents a separate introduction into Australia, probably accidentally by man into New South Wales based on present distribution (Fig. 49) and the earliest collection records.

ACKNOWLEDGMENTS

This study was conducted primarily during a work transfer to the Australian National Insect Collection (CSIRO, Canberra), and I gratefully acknowledge their assistance and the use of their collection and facilities. The individuals and institutions listed under material and methods are thanked for the loan of material on which the study was based. Ms. J. Read (ECORC) generated all the illustrations, including dissecting and preparing the specimens for SEM and photography, producing the images, and preparing the illustratory plates. Drs. John Huber and James O'Hara are gratefully acknowledged for critically reviewing the manuscript.

LITERATURE CITED

Agassiz, L. 1846. *Nomenclator Zoologicus, continens nomina systematica generum Animalium tam viventium quam fossilium.* Fasc. 9. Hymenoptera. Solothurn. 36 pp.

Ashmead, W. H. 1886[36]. Studies on the North American Chalcididae, with descriptions of new species from Florida. (Paper no. 7). *Transactions of the Entomological Society of America* 13: 125–135.

Ashmead, W. H. 1887[37]. Report on insects injurious to garden crops in Florida. *United States Department of Agriculture, Division of Entomology Bulletin* 14: 9–29.

Ashmead, W. H. 1888. Entomological section. *Bulletin of the Florida Agricultural Experiment Station, Gainesville* 2: 12–27.

Ashmead, W. H. 1904[243]. Descriptions of new Hymenoptera from Japan.—II. *Journal of the New York Entomological Society* 12(3): 146–165.

Blanchard, M. E. 1840. *Histoire naturelle des Insectes.* III. Paris. 672 pp. + 155 pls.

Bolte, K. B. 1996. Techniques for obtaining scanning electron micrographs of minute arthropods. *Proceedings of the Entomological Society of Ontario* 127: 67–87.

Bouček, Z. 1965. A review of the chalcidoid fauna of the Moldavian S.S.R., with descriptions of new species (Hymenoptera). *Acta Faunistica Entomologica Musei Nationalis Pragae* 11(97): 5–37.

Bouček, Z. 1977. A faunistic review of the Yugoslavian Chalcidoidea (parasitic Hymenoptera). *Acta entomologica Jugoslavica* 13, supplement: 1–145.

Bouček, Z. 1988. *Australasian Chalcidoidea (Hymenoptera). A Biosystematic Revision of Genera of Fourteen Families, with a Reclassification of Species.* CAB International, Wallingford. 832 pp.

Bouček, Z., B. R. Subba Rao, and S. I. Farooqi. 1978. A preliminary review of Pteromalidae (Hymenoptera) of India and adjacent countries. *Oriental Insects* 12(4): 433–468.

Bouché, P. F. 1834. *Naturgeschicte der Insekten, besonders in hinsicht ihrer ersten Zustande als Larven und Puppen.* Berlin. v + 216 pp.

Brèthes, J. 1913. Himenópteros de la América meridional. *Anales del Museo Nacional de Historia Natural de Buenos Aires* 24: 35–160.

Crawford, J. C. 1908. The entomological writings of William Harris Ashmead, with an index to the new genera described by him. *Proceedings of the Entomological Society of Washington* 10: 131–155.

Dahms, E. C. 1978. A checklist of the types of Australian Hymenoptera described by Alexandre Arsene Girault: I. Introduction, Acknowledgments, Biography and localities. *Memoirs of the Queensland Museum* 19: 127–190 + 15 pls.

Dahms, E. C. 1983. A checklist of the types of Australian Hymenoptera described by Alexandre Arsene Girault: II. Preamble and Chalcidoidea species A-E with advisory notes. *Memoirs of the Queensland Museum* 21(1): 1–255.

Dahms, E. C. 1984. A checklist of the types of Australian Hymenoptera described by Alexandre Arsene Girault: III. Chalcidoidea species F-M with advisory notes. *Memoirs of the Queensland Museum* 21: 779–842.

Dahms, E. C. 1986. A checklist of the types of Australian Hymenoptera described by Alexandre Arsene Girault: IV. Chalcidoidea species N-Z and genera with advisory notes plus addenda and corrigenda. *Memoirs of the Queensland Museum* 22: 319–739.

Delucchi, V. 1956(1955). Beiträge zur Kenntnis der Pteromaliden (Hym., Chalcidoidea). *Zeitschrift für angewandte Entomologie* 38(2): 122–156.

De Santis, L. 1957. Anotaciones sobre Calcidoideos Argentinos (Hymenoptera). *Notas del Museo de La Plata, Zoologia* 19(173): 107–119.

De Santis, L. 1975. Nota sobre calcidoideos neotropicos (Hymenoptera). *Neotropica* 21(64): 8–10.

Doğanlar, M. 1986. Morphological studies of the hypopygium and its importance to the taxonomy of the genera *Pachyneuron* and *Euneura* (Hymenoptera: Pteromalidae), with description of a new species of *Pachyneuron* from Turkey. *Fen Bilimleri Dergisi,* 4: 23–32.

Förster, A. 1841. *Beiträge zur monographie der Pteromalinen Nees.* 1 Heft. Aachen. 46 pp. + 1 pl.

Gahan, A. B. 1918. *Propachyneuron* Girault (Hymenoptera, Chalcidoidea). *Proceedings of the Entomological Society of Washington* 20: 66.

Gahan, A. B. 1924(1923). Types of two chalcid-flies misidentified. *Proceedings of the Entomological Society of Washington* 25(9): 185–188.

Gibson, G. A. P. 1997. Chapter 2. Morphology and Terminology. Pages 16–44 *in* Gibson, G. A. P., J. T. Huber, and J. B. Woolley (eds). *Annotated Keys to the Genera of Nearctic Chalcidoidea (Hymenoptera).* National Research Council Canada, Research Press, Ottawa. 794 pp.

Girault, A. A. 1916[274]. Australian Hymenoptera Chalcidoidea. General supplement. *Memoirs of the Queensland Museum* 5: 205–230.

Girault, A. A. 1917[322]. The North American species of *Pachyneuron* with three new species (chalcid-flies). *Psyche* 24: 88–90.

Girault, A. A. 1917[327]. A new genus or subgenus of pachyneurine chalcid-flies. *Psyche* 24: 102.

Girault, A. A. 1917[330]. *Descriptiones Hymenopterorum Chalcidoidicarum variorum cum observationibus V.* Private publication, Glendale. 16 pp.

Girault, A. A. 1927[416]. Notes on and descriptions of chalcid wasps (Chalcididae) in the South Australian Museum. *Records of the South Australian Museum* 3: 309–338.

Girault, A. A. 1928[421]. *A prodigeous discourse on wild animals.* Private publication, Brisbane. 3 pp.

Girault, A. A. 1929[431]. Notes on, and descriptions of, chalcid wasps in the South Australian Museum. Concluding paper. *Transactions and Proceedings of the Royal Society of South Australia* 53: 309–346.

Graham, M. W. R. de V. 1969. The Pteromalidae of North-Western Europe (Hymenoptera: Chalcidoidea). *Bulletin of the British Museum (Natural History), Entomology Supplement* 16: 1–908.

Hedqvist, K.-J. 1977. Notes on Chalcidoidea XI (Hymenoptera). A new species of *Habrocytus* Thomson from Sweden and a lectotype selection for *Pteromalus groenlandicus* Holmgren. *Entomologica Scandinavica* 8: 237–238.

Howard, L. O. 1890. Some new parasites of the grain plant louse. *Insect Life* 2: 246–248.

Howard, L. O. 1891. The habits of *Pachyneuron*. *Proceedings of the Entomological Society of Washington* 2: 105–109.

Huang, D. and D. Liao. 1987. A new species of *Pachyneuron* (Hymenoptera: Chalcidoidea: Pteromalidae). *Entomotaxonomia* 10(1–2): 19–21.

Kamijo, K. and H. Takada. 1973. Studies on aphid hyperparasites of Japan, II. Aphid hyperparasites of the Pteromalidae occurring in Japan (Hymenoptera). *Insecta Matsumurana, n.s.* 2: 39–76.

Leiboff, R. O. 1948. Aparición de un parásito poco frecuente del pulgón verde de los cereales en la Pampa Central. *Revista Argentina de Agronomía* 15(4): 256–257.

Mani, M. S. 1939. Descriptions of new and records of some known chalcidoid and other hymenopterous parasites from India. *Indian Journal of Entomology* 1: 69–99.

Mani, M. S. and G. G. Saraswat. 1974. Part III. Pages 85–107 *in*: Mani, M. S., O. P. Dubey, B. K. Kaul, and G. G. Saraswat. Descriptions of some new and new records of some known Chalcidoidea (Hymenoptera) from India. *Memoirs of the School of Entomology, St. Johns's College,* no. 3. 377 pp.

Masi, L. 1929. Risultati zoologici della Missione inviata dalla R. Società Geografica Italiana per l'esplorazione dell'Oasi di Giarabub (1926–1927). Hymenoptera Chalcididae. *Annali del Museo Civico di Storia Naturale Giacomo Doria. Genova* 53: 195–240.

Noyes, J. S. 1998. *Catalogue of the Chalcidoidea of the World.* CD-Rom. Amsterdam, The Netherlands: Expert Center for Taxonomic Information.

Reinhard, H. 1859. Die Battläusen lebenden Pteromalinen. *Stettiner Entomologische Zeitung* 20: 191–197.

Szelényi, G. 1942. Über die Chalcididen-Gattung *Pachyneuron* Walk. (Hymen.). *Zentralblatt für das gesamte Forstwesen* 68: 93–105.

Timberlake, P. H. 1918. Notes on some of the immigrant parasitic Hymenoptera of the Hawaiian Islands. *Proceedings of the Hawaiian Entomological Society* 3(5): 399–404.

Timberlake, P. H. 1926. New species of Hawaiian chalcid-flies (Hymenoptera). *Proceedings of the Hawaiian Entomological Society* 6(2): 305–321.

Walker, F. 1833. Monographia Chalcidum. *Entomological Magazine* 1: 367–384.

Walker, F. 1843. Description des Chalcidites trouvées au Bluff de Saint-Jean, dans la Floride orientale, par MM.E. Doubleday et R. Foerester. *Annales de la Société Entomologique de France* (2) 1: 145–162.

Walker, F. 1850. Notes on Chalcidites, and descriptions of various new species. *Annals and Magazine of Natural History* (2) 5: 125–133.