

***Eustochomorpha* Girault, *Neotriadomerus* gen. n., and *Proarescon* gen. n. (Hymenoptera, Mymaridae), early extant lineages in evolution of the family**

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Abstract

Eustochomorpha Girault, with one described species, *E. haeckeli* Girault, from Australia is redescribed. *Neotriadomerus* Huber, **gen. n.**, is described, together with seven new species, all from Australia: *N. burwelli* Huber, **sp. n.**, *N. crassus* Huber, **sp. n.**, *N. darlingi* Huber, **sp. n.**, *N. gloriosus* Huber, **sp. n.**, *N. longiovipositor* Huber, **sp. n.**, *N. longissimus* Huber, **sp. n.** (one of the largest species of Mymaridae), and *N. powerae* Huber, **sp. n.** *Proarescon* Huber, **gen. n.**, is described for *P. primitivum* (Huber), **comb. n.**, transferred from *Borneomymar* Huber, and *P. similis* Huber, **sp. n.**, from Thailand. The previously unknown male of *Borneomymar madagascar* Huber is described and the genus is redescribed from critical point dried and slide mounted specimens. Triadomerini, **stat. n.**, is proposed to include six genera: *Borneomymar*, *Eustochomorpha* and *Neotriadomerus*, and the Cretaceous *Carpenteriana* Yoshimoto, *Macalpinia* Yoshimoto and *Triadomerus* Yoshimoto. Aresconini is proposed to include five (possibly six) genera: *Arescon* Enock, *Kikiki* Huber and Beardsley, *Proarescon* Huber and *Tinkerbella* Huber and Noyes, and the Cretaceous *Myanmymar* Huber and, tentatively, also *Enneagmus* Yoshimoto. The two tribes are proposed as being the earliest lineages in Mymaridae, with *Neotriadomerus* and *Triadomerus* being sister genera to the remaining extant and extinct genera, respectively.

Keywords

Taxonomy, Chalcidoidea, fairyfly, new genera, Australia, Thailand, earliest lineages

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Introduction

Eustochomorpha Girault (Hymenoptera: Mymaridae) includes a single species, *E. haeckeli* Girault (Girault 1915). Anneck and Doult (1961) included *Eustochomorpha* in a world key, basing its placement in the key only on Girault's, succinct but accurate original description; they did not locate the type. Dahms (1984) provided notes on the holotype and only known specimen but otherwise the genus remained unknown. Based mainly on two specimens collected in Western Australia *Eustochomorpha* is re-described. Specimens of an undescribed genus, apparently related to *Eustochomorpha*, were found in various collections and are described. A third genus is proposed for *Borneomymar primitivum* Huber (Huber 2002). A key is given to these genera and their

included species. Several other genera are included because they may well be closely related. An attempt to place the Cretaceous fossils of Mymaridae in context with the extant fauna is made.

Methods

This study is based on about 35 specimens on card-mounts, point-mounts and slides. Slides of the specimens were prepared as described in Huber (2015). Morphological terms used in the descriptions are mostly as defined in Gibson (1997) and Huber (2012, 2015). All measurements of specimens are given in micrometers and, depending on specimen length and preparation, taken with an ocular micrometer attached to a Nikon compound microscope at 200 \times magnification or a Leitz-Wetzlar binocular microscope at 64 \times and 160 \times magnification. Because of rounding errors, it appears that the ratios are slightly incorrect compared to those calculated using the absolute measurements (micrometers) but, in fact, those calculated from the ocular micrometer readings before converting to micrometers are more accurate, so are given in the descriptions. Photographs of slide mounts were taken with a ProgRes C14^{plus} digital camera attached to a Nikon Eclipse E800 compound microscope, and a selection of the resulting layers combined electronically in Zerene StackerTM. Card- or point mounted specimens were photographed with a Leica DFC 500 camera mounted on a Leica Z16 APO Zoom macroscope or on the Nikon compound microscope. Abbreviations used in the descriptions are: fl_x for funicle segment, gt_x for gastral tergum and mps for multiporous plate sensilla. Because the number and position of setae and the type of sculpture on species within a given genus of Mymaridae is usually quite similar the sculpture and setation are described in detail under the single species in *Eustochomorpha*, the single new species under one of the new genera and, to avoid repetition, under the genus name for the new genus containing seven new species. The number and position of setae is described for one side of the body only. So when observing a specimen in dorsal view the total number of setae on a particular structure is twice that described. The setae of appendages (antenna, mouthparts, wings, legs, genitalia) are usually excluded because they are numerous and often similar; only obviously different ones are mentioned, where informative. In general, the position of body setae, particularly on the mesosoma, is fairly stable and consistent within and even among genera, though setal shape, length and thickness may vary. Specimens are deposited in the following institutions:

- | | |
|-------------|--|
| ANIC | Australian National Insect Collection, Canberra, Australian Capital Territory, Australia; |
| CAS | California Academy of Sciences, San Francisco, California, USA; |
| CNC | Canadian National Collection of Insects, Arachnids and Nematodes, Ottawa, Ontario, Canada; |
| NZAC | New Zealand Arthropod Collection, Auckland, New Zealand; |

QMBA	Queensland Museum, Queensland, Brisbane, Queensland, Australia;
QDPC	Queensland Primary Industries Insect Collection, Brisbane, Queensland, Australia;
QSBG	Queen Sirikit Botanic Garden, Chiang Mai, Chiang Mai, Thailand;
ROM	Royal Ontario Museum, Toronto, Ontario, Canada;
UCRC	Entomology Research Museum, University of California, Riverside, California, USA.

Results

Eustochomorpha Girault, 1915

Figs 1–31

Type species. *Eustochomorpha haeckeli* Girault, by monotypy.

Diagnosis. Female. Antenna with funicle 8-segmented and clava 2-segmented (Figs 3, 7, 14). Venation about $0.9\times$ fore wing length. Postmarginal vein distinct, uniformly thick and about $0.7\times$ marginal vein length, with at least 2 short, socketed setae (Fig. 8, apical one indicated by arrow, Fig. 20c). Hypochaeta possibly present (Fig. 20a), originating on the parastigma instead of on the costal cell. Ovipositor strongly extending posteriorly beyond gastral apex but not extending anteriorly under mesosoma (Figs 2, 4, 28, 30).

Description. Female. Body $\approx 1280\text{--}1290\ \mu\text{m}$ in length, excluding section of ovipositor exerted beyond apex of hypopygium. **Colour.** Generally brown (Fig. 4), with a few metallic reflections (an artefact of lighting?) on gaster. Gaster at base and most parts of legs lighter brown to white. Wings hyaline, with venation light brown. **Head.** Head about $1.7\times$ as wide as long, $1.3\times$ as wide as high and $1.4\times$ as high as long; in lateral view with anterior surface convex, receding strongly from ventral margin of eye to mouth opening, and bulging medially compared to laterally (at preorbital groove); posterior surface slightly, evenly convex (Fig. 4). Face about as wide as high (Fig. 5), without subantennal grooves; preorbital groove ventral to torulus straight then, more ventrally, slightly curving medially to ventrolateral margin of mouth opening. Torulus in slight triangular depression about $2.0\times$ as high as torulus width and separated by $1.5\times$ torulus width from transverse trabecula (Fig. 5). Vertex in lateral view (Fig. 11) sloping obliquely to transverse trabecula to form an obtuse angle with face, and vertex posteriorly merging smoothly into occiput medially but separated laterally from occiput by short transverse vertexal suture. Ocellar triangle raised slightly above level of rest of vertex, the mid ocellus almost vertical, the lateral ocelli oblique, facing posterolaterally; ocelli with POL about $2.0\times$ LOL and about 1.26 OOL. Transverse trabecula separated at each apex from supraorbital trabecula (Fig. 5); preorbital trabecula (apparently absent because not sclerotized) short, extending to inner orbit at about dorsal margin of torulus (Fig. 5); supraorbital trabecula in 2 subequal sections, the posterior sections slightly converging and the sutures outside posterior sections continuing onto

occiput as the occipital grooves (short lines each appearing as posterior extension of supraorbital suture and strongly converging towards occipital foramen) (Fig. 6) separating occiput medially from temple dorsolaterally. Occiput separated from vertex by vertexal suture, this only present laterally behind lateral ocelli (Fig. 12). Eye large with numerous (about 100) small facets, in lateral view slightly higher than wide (10:9) and clearly separated dorsally from back of head (temple about $0.3\times$ eye width). Ocular apodeme fairly long, crooked, needle-like. Malar sulcus absent (Fig. 11). Gena at level of ventral margin of eye wider than malar space. Occiput entire, not separated by transverse groove into upper and lower portions (Fig. 6a). **Mouthparts.** Labrum with 2? setae; mandible with 3 teeth. **Antenna.** Scape about $2.6\times$ as long as wide, with radicle distinct from rest of scape and about $0.25\times$ total scape length (Fig. 13); pedicel about $2.1\times$ as long as wide, almost as wide and about $0.7\times$ as long as entire scape; funicle 8-segmented; clava 2-segmented (Figs 3, 7, 14), $1.08\times$ as wide as apical funicle segment and $0.32\text{--}0.36\times$ as long as entire funicle. **Mesosoma.** Mesosoma about $2.2\times$ as long as wide, $2.3\times$ as long as high and $1.1\times$ as wide as high. Pronotum entire (Figs 9, 12, 15), in dorsal view clearly visible, medially about $0.3\times$ as long as mesoscutum; collar almost horizontal, with a shallow median longitudinal impression and prominent angular shoulders; neck shorter than collar, posteriorly strongly sloping up to collar; in lateral view, pronotum rectangular, slightly overlapping anterior margin of mesoscutum, with lateral surface merging smoothly into dorsal surface, with a shallow, oblique impression for femur. Spiracle (Figs 17, 18) apparently slightly stalked, at posterolateral angle of pronotum in a slight depression and facing dorsolaterally. Propleura near anterior apex not quite abutting, then gap widening slightly more anteriorly. Prosternum rhomboidal, incompletely divided medially by faint longitudinal groove posteriorly. Mesoscutum about $1.7\times$ as long as scutellum, in dorsal view with shallow, thin, slightly diverging notauli apparently absent posteriorly (Figs 9, 15, 16), in lateral view mesoscutum (Fig. 4) almost flat except anteriorly. Scutellum slightly wider than long; anterior scutellum about $3\times$ as long as narrowly trapezoidal, transverse frenal depression and separated from it by a shallow, curved frenal depression (Figs 9, 16); campaniform sensilla small, slightly closer to lateral margins of anterior scutellum than to each other, with apex of large, cone-shaped fenestra projecting anteriorly between them (Fig. 9). Axilla slightly advanced, the transscutal articulation laterally forming an obtuse angle with median section (Fig. 16); axillula long and narrow, separated from anterior scutellum by posteriorly recurved axillular groove; mesophragma widely convex posteriorly, extending to posterior apex of propodeum. Prepectus probably spindle-shaped (Fig. 17, partly hidden by fore leg); mesopleuron somewhat rectangular, with shallow depression separating mesepisternum from mesepimeron (Fig. 17). Metanotum with distinct lens-shaped dorsellum (only visible Fig. 9, a cleared, slide mount) and lateral panel length (toward hind wing articulation) about half length of dorsellum (Fig. 16). Metapleuron triangular, with a narrow anterior extension almost to base of hind wing, the margin at junction with mesopleuron deeply concave and posterior margin straight and vertical. Propodeum with a complete longitudinal groove medially, in lateral view weakly sloping, almost in same plane as dorsellum, in dorsal view with faint median

longitudinal groove. Propodeal spiracle facing dorsolaterally in a slight depression and separated from anterior margin of propodeum by about its own diameter. **Wings.** Fore wing (Figs 4, 8, 19) wide, with completely transparent membrane sparsely scattered with minute microtrichia. Venation complete; submarginal vein with 1 subbasal seta and about 16 bullae, the most apical one at level of proximal macrochaeta (Fig. 8); parastigma, $0.5\times$ submarginal vein length; marginal vein present, its length (from distal macrochaeta) about $2.0\times$ length of parastigma; stigmal vein short but distinct, curving away from wing margin (Fig. 20) then closely paralleling it, with 4 apical campaniform sensilla (Fig. 21b); postmarginal vein present, about $0.8\times$ as long and as thick as marginal vein, with 4 microchaetae along anterior margin; hypochaeta absent (Fig. 8) but one similar to it originating on parastigma (Fig. 20a); proximal campaniform sensillum near posterior margin of marginal vein just beyond apical macrochaeta (far removed from the 4 campaniform sensilla on stigmal vein). Hind wing (Fig. 8) with membrane not extending to base of wing, relatively wide medially, tapering gradually almost to a point apically. Fore wing membrane with one irregular row of microtrichiae basally and two or three distally. **Legs.** Profemur and metafemur narrow (Fig. 17), metafemur widest, about $2\times$ as wide as mesofemur. Tarsi 5-segmented. Calcar (moveable protibial spur) apparently without setae along outer margin, and with the inner tine about $0.5\times$ as long as outer tine. Middle and hind legs with tarsomere 1 shorter than tarsomere 2. **Metasoma.** About $2.2\times$ as long as wide, $2.3\times$ as long as high and $0.9\times$ as wide as high; its length, excluding exerted part of ovipositor, about $2.0\times$ that of mesosoma (Fig. 4). Petiole ring-like, about $0.3\times$ as long as wide. Gastral terga apparently with fine longitudinal wrinkles except gt_7 ; gt_1 shorter than remaining terga and apparently gt_6 the longest tergum, gt_7 apically acutely triangular. Cercus a distinctly raised, longer than wide, peg-like plate, with 4 setae (Figs 22, 25). Gt_6 with spiracle minute (apparently absent). Hypopygium extending posteriorly well beyond level of cercus (Figs 4, 23, 25). Ovipositor sheath exerted beyond gastral apex by about one third of its total length and abruptly upturned apically, apparently without subapical seta (Figs 22, 24).

Male. Unknown.

Hosts and habitat. Hosts are unknown. The holotype was collected in forest (Girault 1915).

Eustochomorpha haeckeli Girault

Figs 1–31

Eustochomorpha haeckeli Girault 1915: 156 (original description); Annecke and Doutt, 1961: 4, 14 (key, diagnosis); Dahms, 1984: 675 (holotype data); Lin et al., 2007: 33 (diagnosis in part, figs 129–131).

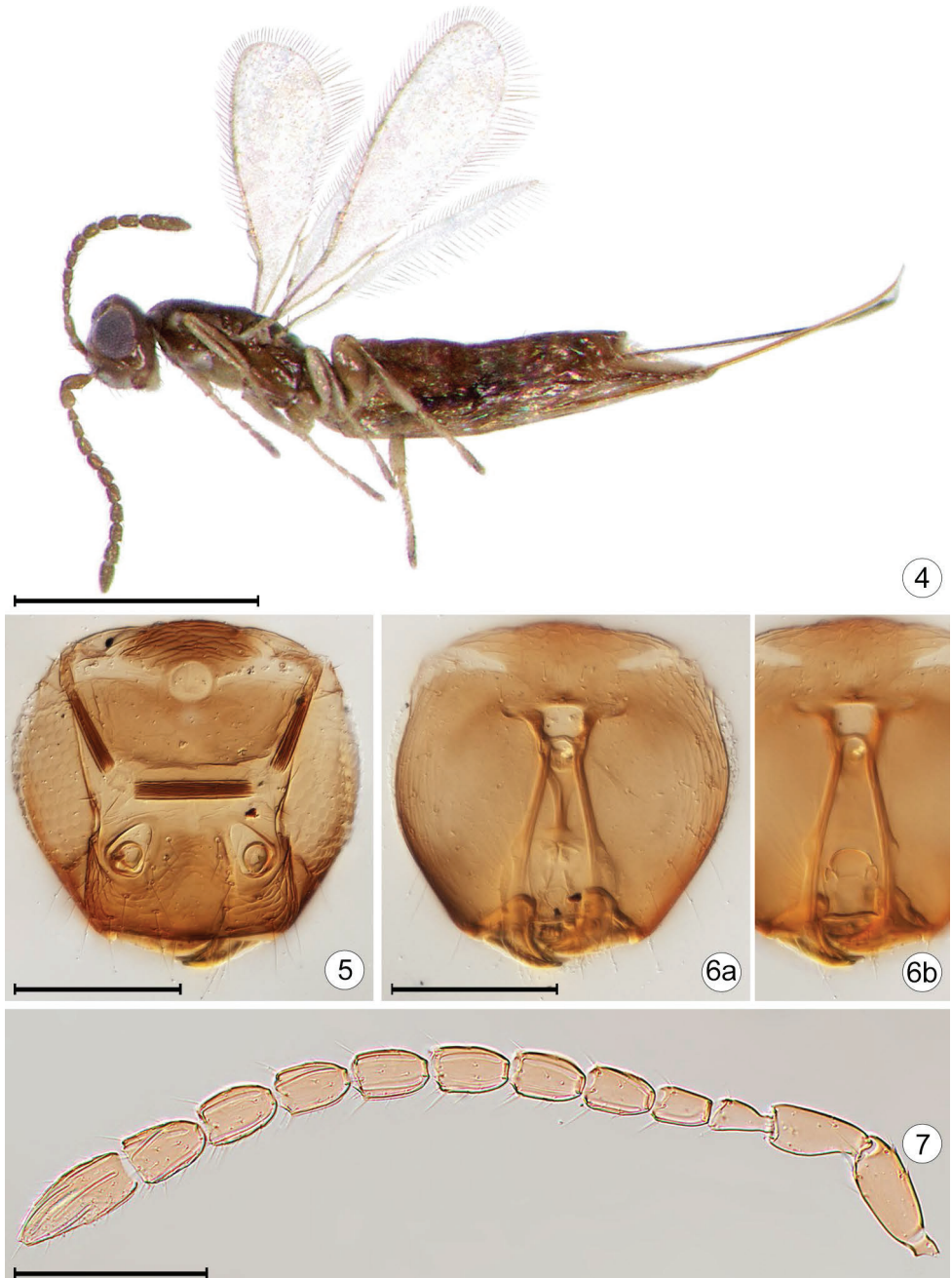
Type material. Holotype female (QMBA) on slide labelled as shown (Fig. 1). The holotype (Fig. 2) is in uncleared in Canada balsam under 1 coverslip fragment between two other fragments and is poorly mounted more or less dorsoventrally with legs



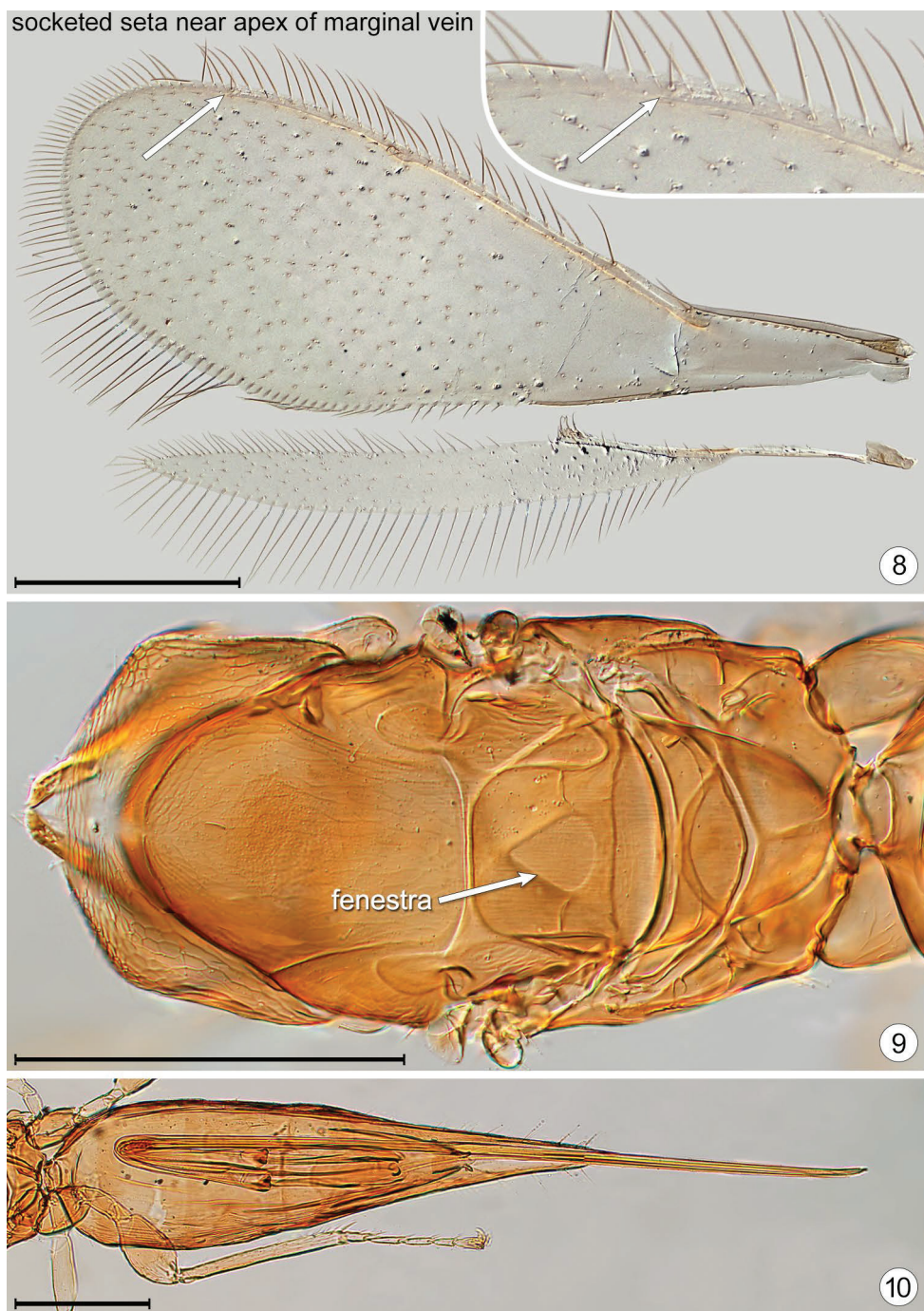
Figures 1–3. *Eustochomorpha haeckeli*, holotype female. **1** type slide, specimen under middle cover slip **2** body + legs **3** antenna. Scale bar = 100 µm.

mostly folded up against body; left antenna with clava missing; right antenna (Fig. 3) detached beyond pedicel and positioned next to left (very faint) hind wing; other hind wing detached and its membranous portion hidden under head; right fore wing folded over and partly hidden by legs. Except for estimated body length, measurements of the holotype are not given in the species description below (my measurements were inaccurate when I borrowed the specimen).

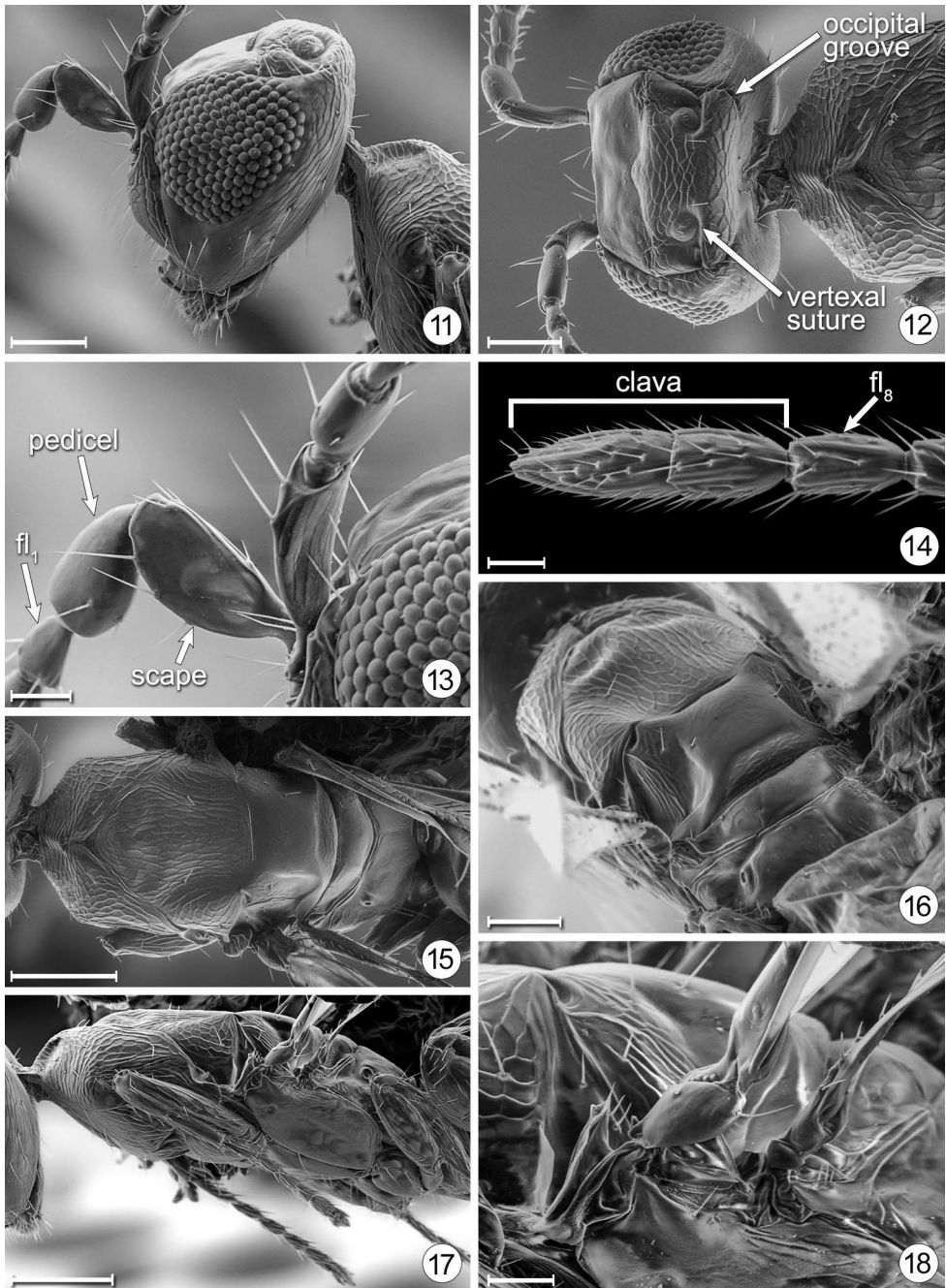
Diagnosis. Female. Among extant genera, *E. haeckeli* is distinguished from the first new genus described below, having a 2-segmented clava (3-segmented in the first new genus), and the ovipositor strongly exserted posteriorly beyond apex of gaster and not extending anteriorly under the mesosoma. It differs from the second new genus described below by the postmarginal vein shorter than the marginal vein (postmarginal vein longer than marginal vein in the second new genus), hypochaeta absent (hypochaeta present in the second new genus), and it differs from *Borneomyrmar* by its 2-segmented clava (1-segmented in *Borneomyrmar*).



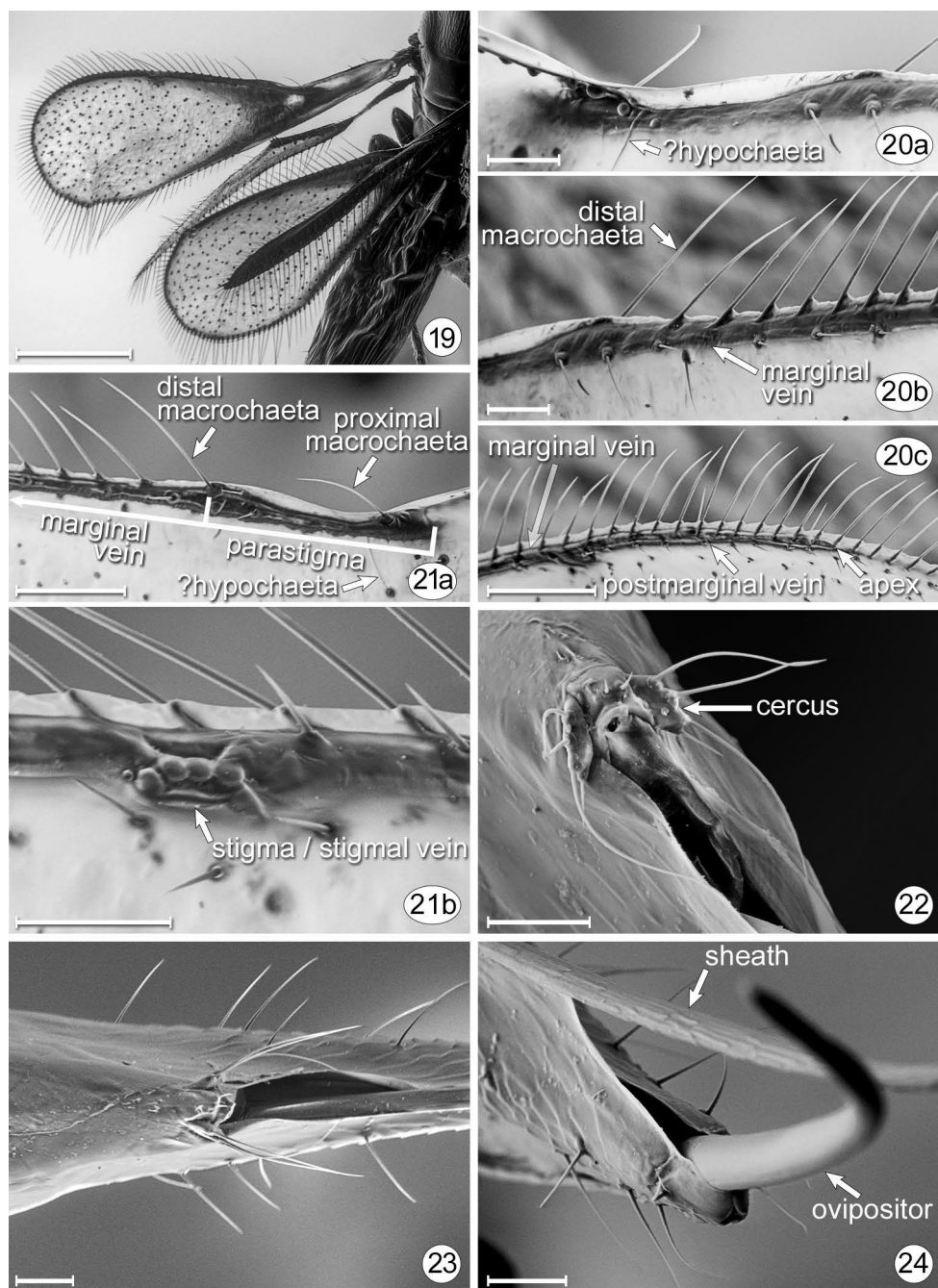
Figures 4–7. *Eustochomorpha haeckeli*, female. **4** habitus (Australia, WA, Stirling Range National Park) **5** head, anterior; **6a** head, posterior **6b** tentorium **7** antenna. Scale bar for **4** = 500 μm ; **5–7** = 100 μm .



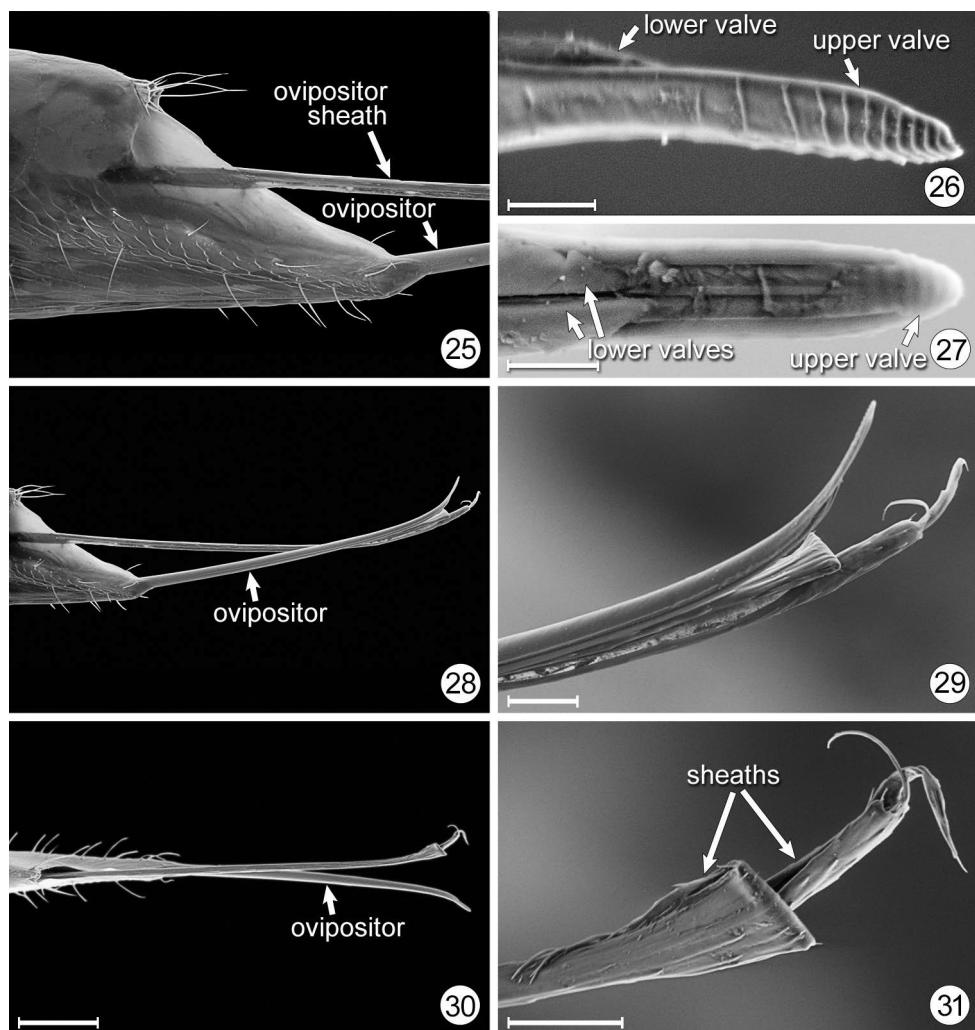
Figures 8–10. *Eustochomorpha haeckeli*, female. **8**, wings **9** mesosoma, dorsal **10** metasoma, dorsal. Scale bar = 200 μ m.



Figures 11–18. *Eustochomorpha haeckeli*, female. **11** head + prothorax, lateral **12** head + prothorax, dorsal **13** base of antenna, lateral (right antenna) and ventral (left antenna) **14** apex of antenna **15** mesosoma, dorsal **16** mesosoma, posterolaterodorsal **17** mesosoma, lateral **18** base of wings + mesosoma, lateral (medial portion). Scale bar for **11**, **12**, **16** = 50 μ m; **13**, **14**, **18** = 20 μ m; **15**, **17** = 100 μ m.



Figures 19–24. *Eustochomorpha haeckeli*, female. **19** wings **20a** parastigma, ventral **20b** base of marginal vein, ventral **20c** apex of marginal vein, stigma + postmarginal vein, ventral **21a** parastigma, dorsal **21b** stigma, dorsal **22** gaster apex showing cerci, posterolaterodorsal **23** gaster apex showing cerci, dorsal **24** gaster apex, posterolaterodorsal. Scale bar for **19** = 200 μ m; **20a**, **20b**, **21b**, **22–24** = 20 μ m; **20c**, **21a** = 50 μ m.



Figures 25–31. *Eustochomorpha haeckeli*, female. **25** gaster apex, lateral **26** ovipositor apex, dorsal **27** ovipositor apex, ventral **28** ovipositor + sheaths, lateral **29** apex of ovipositor + sheaths, lateral **30** ovipositor + sheaths, dorsal **31** apex of sheaths (one sheath folded over on itself). Scale bar for **25** = 50 μ m; **26, 27** = 5 μ m; **28, 30** = 100 μ m; **29, 31** = 20 μ m.

Description. Female. Body length \approx 1280 (critical point dried specimen, Stirling Range National Park). **Colour.** Body mainly brown (Fig. 4). Ocellar triangle, mesothorax and fine longitudinal line laterally on gaster darker brown. Base of gaster, especially basal sterna, legs except metacoxa and metafeur and apical tarsomere of all legs, flagellum and mouthparts except mandibles, and a faint transverse band at level of anterior ocelli lighter brown to white. **Head.** Width 202. Face with weak reticulate sculpture medially, stronger laterally (Fig. 5), with setae distributed as follows: 3 medial to torulus and 8 ventral to torulus, the 2 submedially above mouth margin the shortest. Vertex smooth

anterior to mid ocellus and reticulate posterior to mid ocellus (Fig. 5), with 2 setae on anterior orbit lateral to transverse trabecula and 2 setae on dorsal orbit, in angle between eye and posterior section of supraorbital trabecula; ocellar triangle with 2 short setae lateral to mid ocellus and 1 short setae just posteromedial to lateral ocellus. Malar area apparently with 3 setae. Gena and occiput laterally longitudinally reticulate (Fig. 6a), the reticulations on occiput shallower and transverse medially; occiput with 2 short setae submedially above occipital foramen, about 9 setae sublaterally and laterally; tentorium with two very short dorsal arms (Fig. 6b). **Antenna.** Fl₁–fl₈ respectively with 0, 1, 2, 2, 2, 3, 3, 3 mps; clava 1 with 3 (4?) mps on first segment and 5 (6?) mps on second segment (Figs 3, 7). Length/width measurements (n=1): scape 70/27, pedicel 55/26, fl₁ 33/18, fl₂ 32/20, fl₃ 39/25, fl₄ 40/25, fl₅ 44/25, fl₆ 42/25, fl₇ 42/24, fl₈ 42/26, clava 112/31 (first segment 42, second segment 69). **Mesosoma.** Width 200 and length 415. Pronotum with reticulate sculpture, with 3 short setae along posterior margin and 3 towards anterior margin. Propleuron faintly, longitudinally reticulate, with 2 seta about midway between anterior and posterior apices. Prosternum smooth, with 1 seta submedially almost at anterior margin and 1 setae laterally midway between anterior and posterior margins. Mesoscutum faintly longitudinally reticulate, with 1 setae along inner margin midway between anterior and posterior apices of notaulus, and 1 setae at lateral angle of side lobe. Anterior scutellum smooth, with 1 setae on lateral margins level with campaniform sensillum; frenum faintly reticulate. Axilla reticulate, and with 1 seta at anteromedian angle and 1 dorsally on longitudinally reticulate lateral panel; axillula smooth. Metanotum smooth medially, faintly reticulate laterally, with 2 short setae along anterior margin of relatively wide lateral panel. Propodeum smooth, with 2 propodeal setae close together. **Wings.** Fore wing length (n=1) 723, width 259, length/width 2.98, longest marginal setae 72. Marginal vein with about 11 microchaetae along its length; cubital line with few setae extending to level of distal apex of retinaculum. Hind wing length 685, width 57, longest marginal setae 68. **Legs.** Femora and tibiae of all legs with faint longitudinal reticulation. Protibia at mid length with 2 short pegs. **Metasoma.** Petiole 54 wide, 18 long. Gaster 212 wide, 597 long (to apex of apical tergum), with a few short setae on most terga, the terga difficult to distinguish from one another (anterior and posterior margins not distinct) and apparently with fine longitudinal wrinkles at least laterally; gt₁ shorter than remaining terga, apparently with 1 lateral setae, gt₂ and gt₆ apparently with 1 submedian seta; gt₃ – gt₅ with about 4 submedian to sublateral setae in an irregular transverse row; gt₇ acutely triangular, with a small apical seta. Cercus with the first two cerci subequal in length, the third the longest and the fourth the shortest (Fig. 25). Hypopygium weakly sclerotized (almost transparent) dorsally and extending beyond gastral apex by ≈180, with a submedian and lateral row of about 8 setae. Ovipositor length 1074, its exerted part (posterior to hypopygium apex) 360.

Male. Unknown.

Material examined. Two females, collected in Malaise traps in combination with yellow pan traps underneath. AUSTRALIA. **Western Australia:** Yanchep National Park, 20–21.xii.1986, J.S. Noyes (1♀ on slide, CNC); Stirling Range National Park, 11–15.i.1987, J.S. Noyes (1♀ on point, BMNH).

***Neotriadomerus* Huber, gen. n.**

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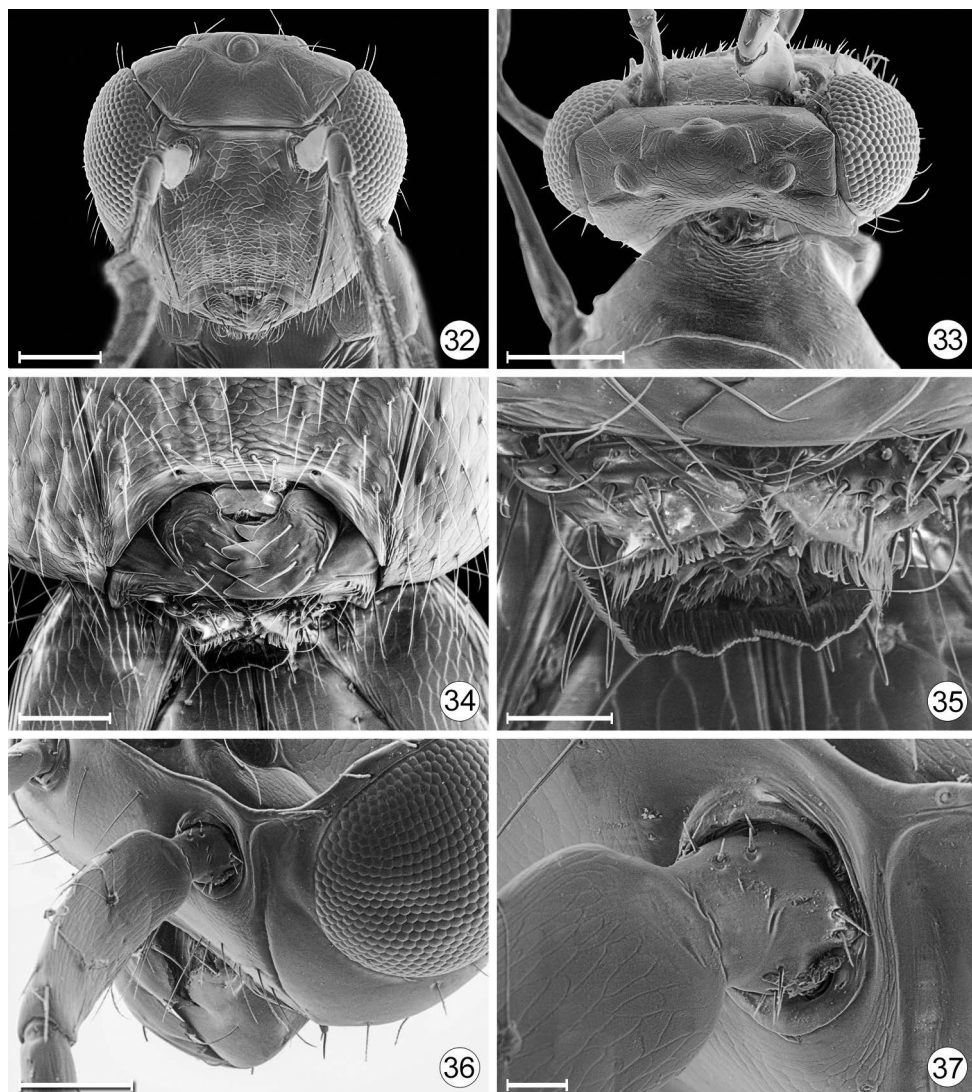
Figs 32–152

Eustochomorpha: Lin et al., 2007: 33 (diagnosis in part, figs 132–134).

Type species. *Neotriadomerus longiovipositor* Huber, by present designation.

Diagnosis. Female. Antenna with funicle 8-segmented and clava 3-segmented (Figs 39, 69). Venation about 0.85–0.90× fore wing length. Postmarginal vein distinct, uniformly thick and about 1.3–1.6× marginal vein length (Figs 70, 122). Hypochaeta present or, apparently, sometimes absent. Ovipositor strongly extending anteriorly under mesosoma (Figs 59, 74) at least to level of hind wing base but not or only slightly extending posteriorly beyond apex of gaster (Figs 75, 77). **Male.** Similar to female, but flagellum with 11 relatively wide segments (Figs 40–43, 82, 95), each with several mps; the segments progressively becoming narrower towards flagellar apex, fl_{11} sometimes only a little over half as wide as fl_1 . Genitalia encapsulated, with thick walls (Figs 124, 143) and, in lateral view, paramere thick (Figs 65, 66).

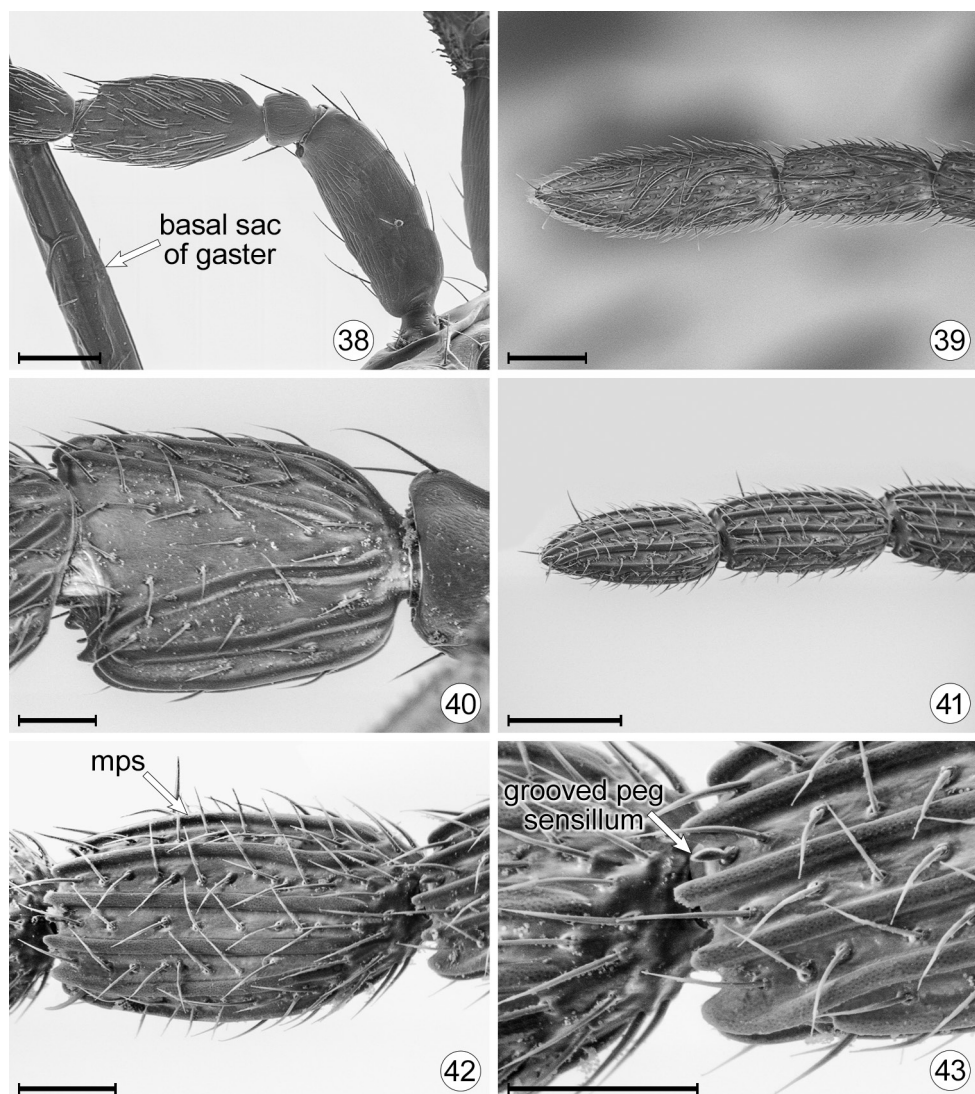
Description. Female. Body 1380–5500 in length, excluding basal sac of gaster (enclosing anterior extension of ovipositor). **Colour.** Generally brown (Figs 81, 128, 144, 146, 147) to dark brown, scape and pedicel, legs in part and sometimes basal sac of gaster lighter brown to yellowish. Wings hyaline, the venation light brown. **Head.** Head about 2.0–2.9× as wide as long, about 1.2–1.6× as wide as high and about 1.3–2.3× as high as long; in lateral view with anterior surface almost flat, at most barely receding ventral to eye, slightly depressed medially compared to laterally at preorbital groove; posterior surface in lateral view slightly convex except slightly indented at postorbital groove (Figs 33, 45). Face about 1.2–1.3× as wide as high (Fig. 32), in lateral view almost flat, barely receding from ventral margin of eye to mouth opening; subantennal grooves absent; preorbital groove ventral to level of torulus straight all the way to lateral margin of mouth opening. Torulus in somewhat circular depression about 1.2× as high as torulus width and separated by less than 0.4× torulus width from transverse trabecula (Fig. 33). Vertex in lateral view usually almost in same plane as face, but sometimes almost horizontal and forming a right angle with face, and vertex posteriorly forming an almost right angle with occiput and separated from it laterally by a short transverse vertexal suture extending to or just medial to posterior ocellus but absent between posterior ocelli (Fig. 33). Ocellar triangle almost flat or raised slightly above level of rest of vertex, the mid ocellus oblique to almost vertical, lateral ocelli oblique, facing laterally or posterolaterally; ocelli with POL about 2.0× LOL and about 1.7–1.8× OOL (varying slightly with species); ocellar area (in cleared slide mounts) with frontofacial suture (seen as white lines) between mid and lateral ocellus, frontal suture (seen as white lines) from mid ocellus to corner of transverse trabecula, and sometimes also a median longitudinal line from mid ocellus to middle of transverse trabecula (Fig. 116). Transverse trabecula apparently separated (Fig. 67) or not (Figs 36, 37) from supraorbital trabecula; preorbital trabecula short, extending to about level of



Figures 32–37. *Neotriadomerus* spp. **32** *N. gloriosus* female head, anterior **33** *N. darlingi* male head + pronotum, dorsal **34** *N. gloriosus* lower face + mouthparts, anterior **35** *N. gloriosus* maxillae + labium, anterior **36** *N. longissimus* head, scape and mandibles, dorsoanterolateral **37** *N. longissimus* radicle, anterolateral (and showing 3-way junction of transverse, supraorbital and preorbital trabeculae). Scale bar for **32, 33, 36** = 100 μ m; **34** = 50 μ m; **35, 37** = 20 μ m.

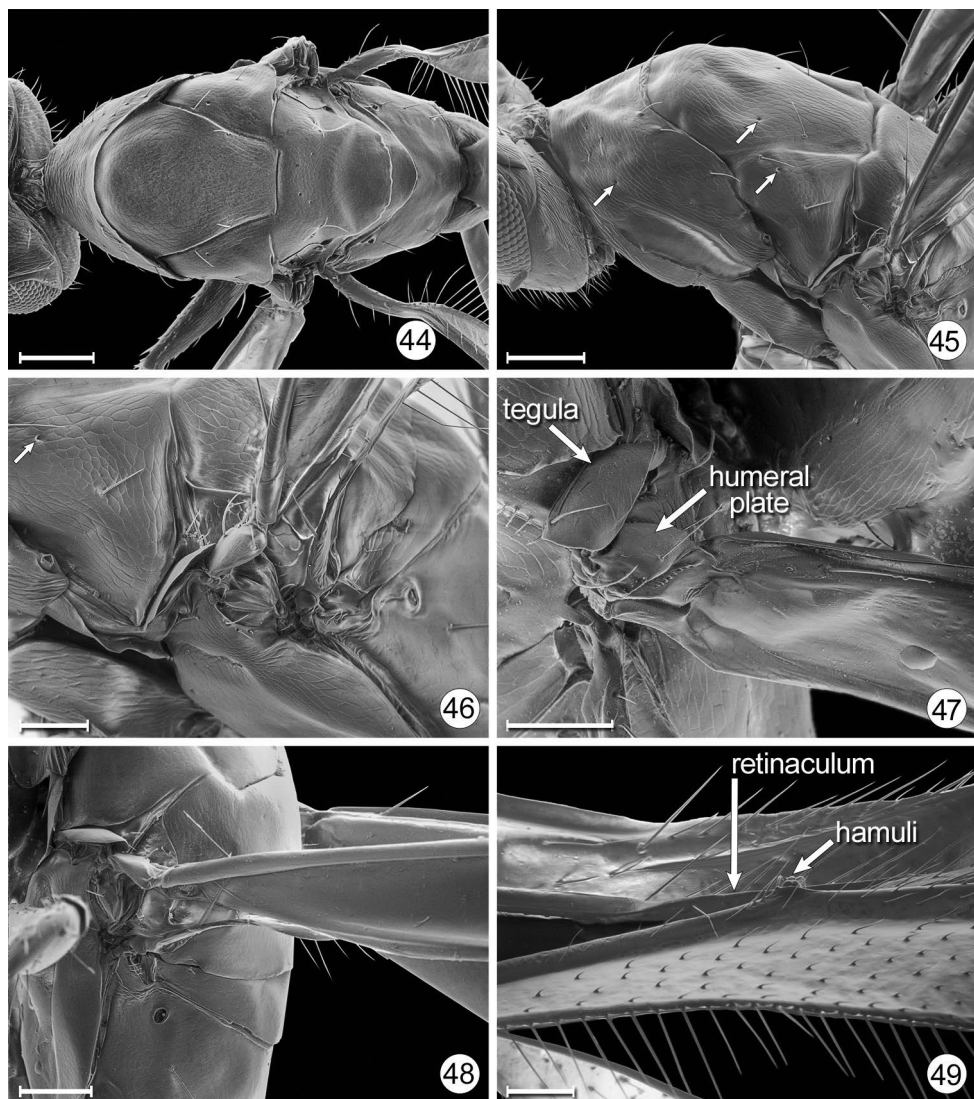
dorsal margin of torulus; supraorbital trabecula in 2 equal or unequal sections, the anterior sections diverging posteriorly, the posterior, sometimes longer, sections slightly converging, and the sutures outside posterior sections continuing onto occiput as short, almost parallel lines, the occipital grooves, ventrally to level of foramen, thus separating occiput medially from temple laterally (Fig. 68). Eye large with numerous small facets,

in lateral view at most about $1.4\times$ as high as wide and clearly but narrowly separated dorsally from back of head (temple in lateral view at most about $0.25\times$ eye width). Ocular apodeme short, straight, and thin (Fig. 119, inset). Malar sulcus absent. Gena at level of ventral margin of eye at most as wide as length of malar space. Head posteriorly with curved postorbital groove extending across head above dorsal margin of occipital foramen to posterior margin of eye (Fig. 68) and separating occiput/temple dorsally from gena/postgena ventrally. **Mouthparts.** Labrum with 4 or 6 setae; mandible with 4 uneven teeth, the ventral one the longest (Fig. 34). **Antenna.** Scape about $3.0\text{--}3.9\times$ as long as wide, with radicle distinct from rest of scape and about $0.24\text{--}0.29\times$ total scape length; pedicel about $1.1\text{--}1.6\times$ as long as wide, $0.72\text{--}1.09\times$ as wide and about $0.36\text{--}0.42\times$ as long as entire scape; funicle 8-segmented (Fig. 69); clava 3-segmented (Fig. 39), $1.07\text{--}1.22\times$ as wide as apical funicle segment and $0.18\text{--}0.23\times$ as long as entire funicle. **Mesosoma.** About $1.8\text{--}2.4\times$ as long as wide, $2.4\text{--}2.8\times$ as long as high and $1.0\text{--}1.3\times$ as wide as high (card- or point-mounted specimens, air- or critical-point dried). Pronotum entire, in dorsal view clearly visible, medially about $0.3\text{--}0.6\times$ as long as mesoscutum; collar almost horizontal, medially flat to slightly convex and without evident shoulders (Fig. 44); neck not or barely differentiated from collar; in lateral view, pronotum with lateral surface merging smoothly into dorsal surface, with a shallow, oblique ventroanterior impression margined by an oblique groove posteriorly for reception of femur (when fore leg folded against body). Spiracle (Fig. 46) very slightly stalked, at posterolateral angle of pronotum in a slight depression and facing posterodorsally. Propleura near anterior apex not quite abutting then widening more anteriorly towards the cervical sclerites (Fig. 141). Prosternum rhomboidal, almost completely divided medially by longitudinal groove (Fig. 141). Mesoscutum about $1.1\text{--}1.6\times$ as long as scutellum, in dorsal view with narrow, distinctly diverging notauli (Fig. 44) appearing in slide mounts wider and shallower near transscutal articulation (Fig. 72), in lateral view almost flat except anteriorly (Figs 45, 81). Scutellum slightly longer than wide (at widest point on frenalum), the anterior scutellum narrower and slightly shorter to slightly longer than transversely biconvex frenalum and separated from it by an evenly curved frenal line; campaniform sensilla as far apart from each other as to lateral margin of anterior scutellum and slightly farther apart than their distance to transcutal articulation, with apex of cone-shaped fenestra not extending to level of campaniform sensilla. Axilla slightly advanced, the transscutal articulation laterally almost in line with median section, and about as wide anteriorly as width of anterior scutellum at transcutal articulation; axillar pit separated from anterior scutellum by curved axillular groove; mesophragma convex posteriorly, extending to posterior apex of propodeum (Fig. 72, faintly visible under propodeum). Prepectus rather rectangular, at widest point about $0.8\times$ as wide as long. Mesopleuron somewhat spindle shaped, with shallow oblique depression separating mesepisternum from mesepimeron and almost straight groove extending from anterior margin to mesocoxal insertion (Fig. 92). Metanotum with distinct biconvex (slide mount, Fig. 87) or somewhat triangular (SEM, Figs 44, 48) dorsellum and lateral panel length at hind wing articulation about one-third to half length of dorsellum. Metapleuron quadrangular, with almost straight sides (Figs 56, 123). Propo-



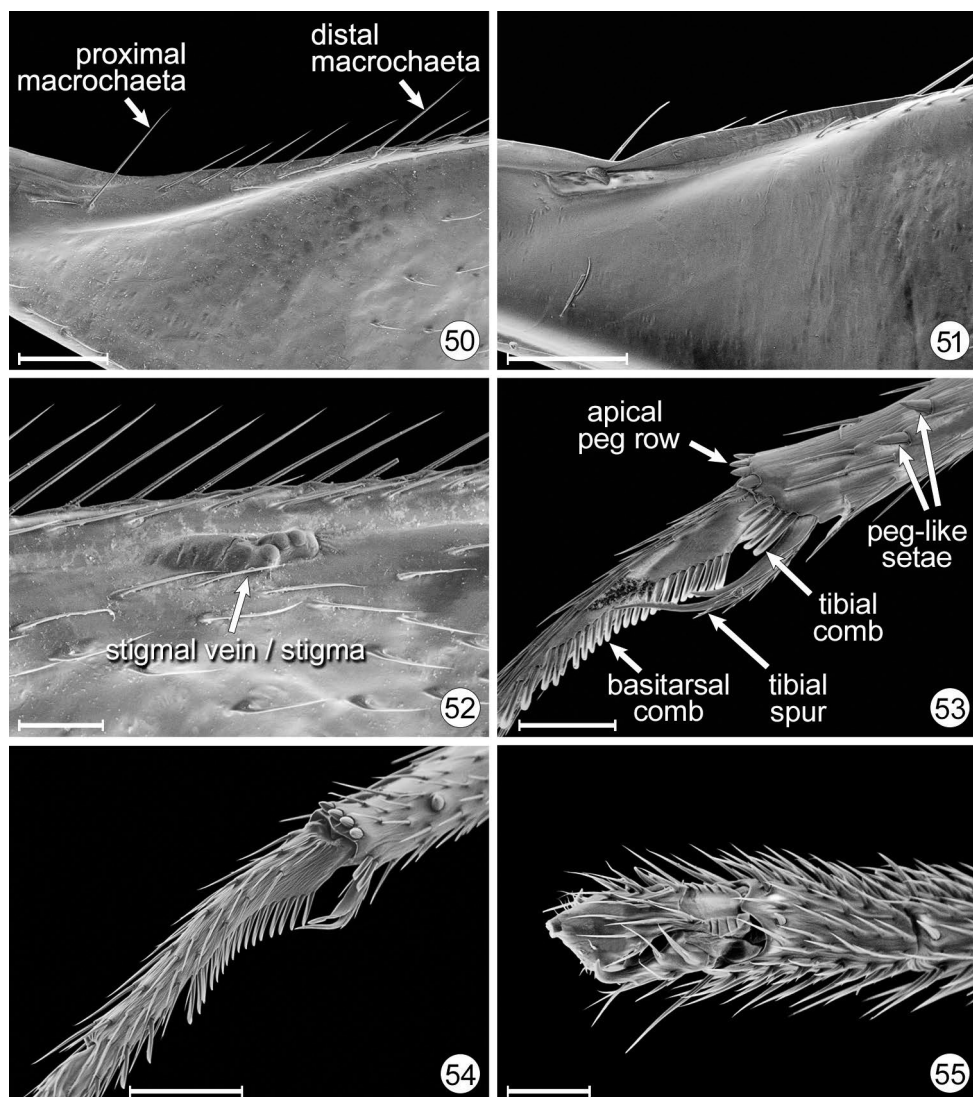
Figures 38–43. *Neotriadomerus* spp. **38** *N. longissimus* female scape–base of fl_2 , lateral **39** *N. sp.* female fl_8 + clava, lateral **40** *N. darlingi* male apex of pedicel–base of fl_2 , lateral **41** *N. darlingi* male fl_{11} – fl_{13} , lateral **42** *N. darlingi* male fl_{11} , lateral **43** *N. darlingi* male apex of fl_{11} , lateral. Scale bar for **38** = 100 μ m; **39**, **41** = 50 μ m; **40**, **42**, **43** = 20 μ m.

deum in lateral view weakly sloping, almost in same plane as dorsellum and in dorsal view flat medially, without median or submedian grooves or other ornamentation (Figs 44, 46, 56, 72). Propodeal spiracle facing dorsolaterally, separated from anterior margin of propodeum by much less than half its own diameter. **Wings.** Fore wing (Fig. 113) about 2.6–3.7 \times as long as wide, evenly and densely covered with microtrichia from wing apex proximally to at most about level of distal macrochaeta but almost without



Figures 44–49. *Neotriadomerus* spp. **44** *N. darlingi* mesosoma, dorsal **45** *N. sp.* mesosoma, dorsolateral (arrows indicate pores) **46** *N. sp.* base of left wings (ventral) and surrounding mesosoma, dorsolateral **47** *N. darlingi* fore wing base, dorsal **48** *N. longissimus* fore wing base, ventral **49** *N. sp.*, hind wing attachment to fore wing, ventral. Scale bar for **44, 45, 48** = 100 μ m; **46, 47, 49** = 50 μ m.

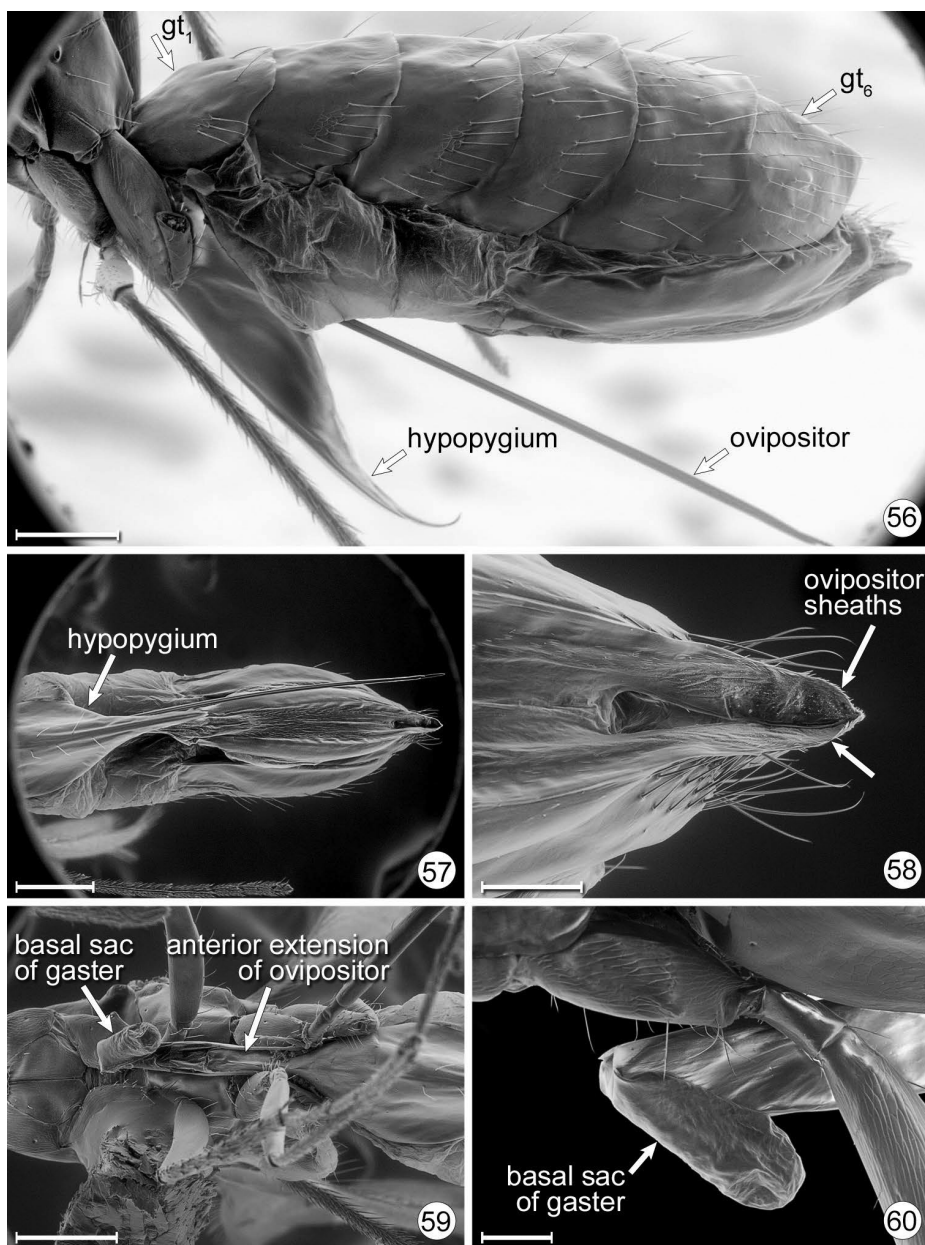
microtrichia behind submarginal vein (Figs 48, 113) and parastigma (Figs 50, 51) and just behind much or all of marginal vein (Fig. 70); an oblique and usually distinct setal line extending more or less horizontally from apical margin of wing to about halfway towards base of marginal vein; cubital line ending proximally either at about same level as remaining microtrichiae or extending to base of parastigma; marginal setae short, the longest not more than about 0.13 \times wing width (Fig. 70). Venation complete (Fig.



Figures 50–55. *Neotriadomerus* spp. **50** *N. darlingi* male parastigma, dorsal **51** *N. longissimus* female parastigma, ventral **52** *N. darlingi* male stigmal vein, dorsal **53** *N. longissimus* female calcar, lateral **54** *N. sp.* female calcar, dorsolateral **55** *N. sp.* female pretarsus, dorsolateral. Scale bar for **50**, **53**, **54** = 50 μ m; **51** = 100 μ m; **52**, **55** = 20 μ m.

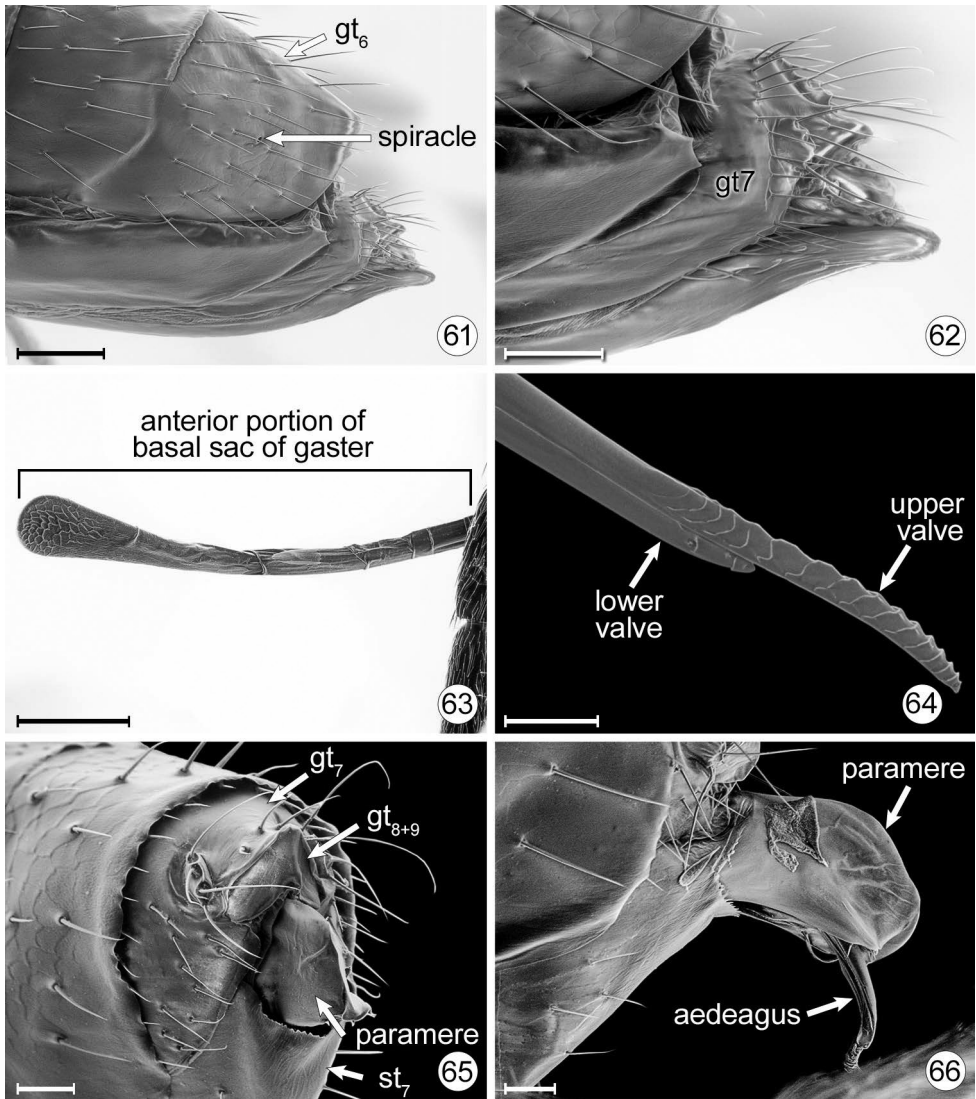
122); submarginal vein with 1 proximal seta; parastigma (from distal macrochaeta to base) about $0.5\text{--}0.7\times$ submarginal vein length; marginal vein length (from distal macrochaeta to junction of stigmal and postmarginal veins) about $1.2\text{--}1.5\times$ parastigma length; stigmal vein short but distinct, about $0.15\text{--}0.17\times$ marginal vein length, curving away from wing margin then closely paralleling it (Fig. 122), with 4 apical campaniform sensilla (Fig. 52); postmarginal vein about $1.3\text{--}1.6\times$ as long and as thick as mar-

ginal vein, with a few microchaetae along anterior margin; hypochaeta usually present, occasionally apparently absent (broken off?), much closer to proximal than distal macrochaeta; proximal campaniform sensillum near posterior margin of marginal vein just apical to distal macrochaeta. Hind wing with membrane not extending to base of wing, relatively wide medially, with a rounded apex, uniformly covered with microtrichia almost to base of membrane (Figs 49, 70). **Legs.** Profemur and mesofemur narrow; metafemur widest, about $1.4\times$ as wide as mesofemur (Figs 77, 92). Tarsi 5-segmented. Calcar (moveable protibial spur) with setae along outer margin, and with inner tine about $0.4\times$ as long as outer tine (Figs 53, 54). Pretarsus normal (Fig. 55). Mid and hind legs with tarsomere 1 at least as long as tarsomeres 2 + 3. **Metasoma.** Petiole usually ring-like, about $0.4\text{--}0.5\times$ as long as wide (Fig. 72) but in one (the largest) species $0.7\text{--}1.0\times$ as long as wide. Gaster $1.18\text{--}3.25\times$ as long as mesosoma. Gaster with gt_1 and gt_6 usually slightly the longest terga (Figs 56, 73, 89, 92). Cercus distinctly raised as a thin flap above surface of gt_7 (Fig. 62) with 4 setae about equal in length (Fig. 65). Hypopygium distinct (Fig 56), extending about $0.3\text{--}0.6\times$ length of gaster, sometimes as far as level of spiracle. Ovipositor sheath barely projecting posteriorly beyond apex of gaster but strongly projecting anteriorly (inside basal sac of gaster) from at least middle of mesosoma (Fig. 74) to well in front of head (Fig. 126), apparently with 1 subapical seta. **Body sculpture and setation.** Sculpture generally uniform and so faint that body often appearing almost smooth and shiny (Figs 81, 82, 126–129, 144–147). Head with engraved, slightly transverse (longitudinal on gena and postgena) or almost isodiametric reticulations becoming raised and slightly imbricate ventrally on face and on occiput (Figs 32–34). Mesosoma with faint isodiametric to elongate reticulations either transverse, mainly on pronotum, or longitudinal, mainly on scutellum. Metasoma apparently without sculpture (Figs 56–62) except anterior apex of basal sac of gaster in at least one species. Head with few to numerous setae on face ventral to toruli, and on gena (Figs 32–34) but one (Fig. 36) or two (Fig. 32) just medial to torulus. Vertex with 2 setae, 1 between mid and lateral ocelli and 1 more laterally. Eye orbit with 3 setae dorsoanteriorly and 3 dorsally and posterodorsally. Occiput with 1 submedial seta dorsally and, more ventrally, 1 seta sublaterally and 1 seta submedially. Gena/postgena with several setae. Pronotum with about 3 setae along posterior margin and about 5 shorter setae anteriorly. Propleuron with a few small scattered setae (Figs 44, 116). Prosternum (Fig. 141) with 1–3 setae mainly in anterior half. Mesosoma with a few short setae (not treated here) around insertions of wings and some longer setae as follows. Mesoscutum with 1 adnotaular seta in posterior half of midlobe, 1 anteromedial and 1 posterolateral seta on lateral lobe and a few small pits (Figs 44–46). Anterior scutellum with 1 seta at lateral margin just anterior to axillular groove (represented by a curved medial edge at junction with frenum). Axilla with 1 anteromedial seta and 1 lateral seta. Propodeum with 2 or, occasionally, 3 propodeal setae laterally behind spiracle. Petiole apparently with 1 minute seta ventrally on anterior margin. Gaster with setae on terga increasing in number from gt_1 to gt_6 but apparently none on sterna except 1 or 2 short ones laterally on basal sac of gaster and longer ones on hypopygium (Fig. 56). Gt_1 with about 3 lateral and 1 dorsal in 1 row; gt_2 and gt_3 with a few more lateral and dorsal in 1 row;



Figures 56–60. *Neotriadomerus* spp. **56** *N. sp.* metasoma, lateral **57** *N. sp.* metasoma, ventral **58** *N. sp.* apex of metasoma, ventral **59** *N. sp.* mesosoma and ovipositor sac, ventral **60** *N. sp.* apex of ovipositor sac, lateral. Scale bar for **56, 57, 59** = 200 μ m; **58, 60** = 50 μ m.

gt₄–gt₆ with even more in 2 or more irregular rows, those around spiracle often shorter; gt₇ with about 10 setae in one row. Hypopygium with about 4 ventral setae. Cerci with 4 fairly long curved setae.



Figures 61–66. *Neotriadomerus* spp. **61** *N.* sp. apex of gaster, lateral **62** *N.* sp. gt_7 + ovipositor apex, lateral **63** *N. longissimus* ovipositor sac, lateral **64** *N.* sp. male ovipositor apex, lateral **65** *N. darlingi* apex of gaster, posterolateral **66** *N. powerae* male genitalia, lateral. Scale bar for **61** = 100 μ m; **62** = 50 μ m; **63** = 200 μ m; **64–66** = 20 μ m.

Male. Similar to female. Body 1280–2560 in length (males still unknown for the largest species). Flagellum with 11 relatively wide segments (Figs 40–43, 95). Gaster (card- or point mounted specimens) narrower than mesosoma, laterally compressed, with posterior apex in dorsal view wider and in lateral view usually higher than anterior apex (at petiole). Sculpture and setation of male similar to female but with fewer setae

on gt_6 . Genitalia encapsulated, with thick walls; aedeagal apodemes evenly curved anteriorly towards each other, and shorter than aedeagus; paramere shorter than aedeagus and high in lateral view, with 3 or 4 short apical and ventral setae.

Etymology. The name is masculine. The prefix *Neo* is Greek for new or recent, young, + *Triadomerus*, apparently the closest related genus.

Distribution. *Neotriadomerus* species occur only in Australia where seven are described (below) and as many as four others are illustrated (Figs 144–152) but not named. No fossil species are known.

Hosts and habitat. Hosts are unknown. The estimated ovipositor length, when fully extended, is about 12 mm for the largest species of *Neotriadomerus*. This suggests that its host might be eggs of Orthoptera laid quite deeply inside plant tissue or in soil. Perhaps only Orthoptera, but possibly Coleoptera or Cicadidae, would have eggs long enough to host a developing female parasitoid (5.9 mm long) of this species. Specimens of *Neotriadomerus* have been collected in a variety of habitats in all Australian states except Victoria and Tasmania. Some specimens have been collected at light, suggesting they may be active at night. Noyes and Valentine (1989: 28, and figs 49, 50) discussed *Australomyrmar* Girault, illustrated two of the largest species, and suggested that eggs of Orthoptera or Cicadidae might be their hosts. Several specimens (NZAC, UCRC) of the species shown in Noyes and Valentine fig. 50, are ≈ 55 mm long excluding the posteriorly exerted section of the ovipositor and the longest one is 6.9 mm (NZAC) (S. Triapitsyn, D. Ward, personal communication). A much smaller, undescribed specimen (CNC) of *Australomyrmar*, was reared from an unidentified taxon of Tettigoniidae from *Pinus radiata* D. Don (Pinaceae) in Chile. I suggest here that Orthoptera might also be the hosts of *Neotriadomerus*.

Key to species of *Neotriadomerus*. Females.

- 1 Body 5000 long; ovipositor at least 5900 long, extending anteriorly under mesosoma to well beyond level of head (Fig. 126); mandible massive (Fig. 36).....*N. longissimus* sp. n.
- Body at most about 2600 long; ovipositor at most 2240 long, extending under mesosoma at most to level of head (Figs 114, 115); mandible much smaller (Figs 32, 33, 67) **2**
- 2(1) Fore wing with cubital line of setae extending proximally to base of parastigma, i.e., clearly proximal to other microtrichia on wing surface (Figs 70, 79, 103, 132)..... **3**
- Fore wing with cubital line of setae extending proximally only to apex of parastigma, about level with other microtrichia on wing surface (Figs 86, 113) **9**
- 3(2) Fl_1 with 2 mps; fl_2 with about 4 (5?) mps (Fig 69).....*N. burwelli* sp. n.
- Fl_1 with at least 4 mps; fl_2 with at least 6 mps (Figs 78, 102, 131)..... **4**
- (3) Fl_2 with 2 barely overlapping whorls of mps (Figs 144, 147)..... **5**
- Fl_2 with 1 whorl of mps (Fig. 102)..... **6**

- 5(4) Fl₈ length/width 2.6 (Fig. 144) ***N. sp. 1***
 – Fl₈ length/width 2.2 (Fig. 147) ***N. sp. 3***
 6(4) Fl₁ about 0.7× as long as fl₂ (Fig. 102); remaining funicle segments longer and narrower, with fl₂ and fl₈, respectively, 2.5× and 2.0× as long as wide ***N. gloriosus sp. n.***
 – Fl₁ at least 0.9× as long as fl₂ (Figs 78, 131); remaining funicle segments shorter and wider, with fl₂ and fl₈, respectively, at most 2.1× and 1.9× as long as wide **7**
 7(6) Fl₂–fl₇ each slightly more than 2.0 × as long as wide; clava about 3.2× as long as wide ***N. powerae sp. n.***
 – Fl₂–fl₇ each at most 1.6× as long as wide; clava about 2.6× as long as wide (Fig. 78) **8**
 8(7) Fl₂–fl₃ each about 1.6× as long as wide ***N. crassus sp. n.***
 – Fl₂–fl₃ each almost quadrate ***N. sp. 2***
 9(2) Ovipositor extending anteriorly under mesosoma to level of head (Figs 114, 115), at least . about 3.6× as long as metatibia; funicle with at least 9 mps on each segment (Fig. 112) ***N. longiovipositor sp. n.***
 – Ovipositor extending anteriorly under mesosoma to level of apex of procoxa (Fig. 92), at most about 2.8× as long as metatibia; funicle with 6 mps on each segment (Fig. 85) ***N. darlingi sp. n.***

Key to species of *Neotriadomerus*. Males.

Males of *darlingi*, *longiovipositor* and *powerae* are known and almost certainly correctly associated with the corresponding females; males are unknown for *N. burwelli*, *N. crassus*, *N. gloriosus* and *N. longissimus*. Two unnamed males are also keyed; one (sp. 4) is not definitely associated with a female and the other (sp. 1) is definitely associated with a female.

- 1 Fore wing with cubital line of setae extending at least to base of parastigma, clearly proximal to other microtrichia on wing surface (Fig. 139) **2**
 – Fore wing with cubital line of setae extending at most to apex of parastigma (level with distal macrochaeta), about level with other microtrichia on wing surface (Fig. 95) **4**
 2(1) Fl₆ wider, its length/width about 1.8 (Fig. 150) ***Neotriadomerus sp. 4***
 – Fl₆ narrower, its length/width at least 2.0 (Fig. 138) **3**
 3(2) Fl₆ about 2.0 ***N. powerae sp. n.***
 – Fl₆ about 3.5 ***N. sp. 1***
 4(1) Flagellomeres each with 2 barely overlapping whorls of shorter mps (Fig. 121) ***N. longiovipositor sp. n.***
 – Flagellomeres each with 1 whorl of longer mps (Fig. 95) ***N. ?darlingi sp. n.***

***Neotriadomerus burwelli* Huber, sp. n.**

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Figs 67–75

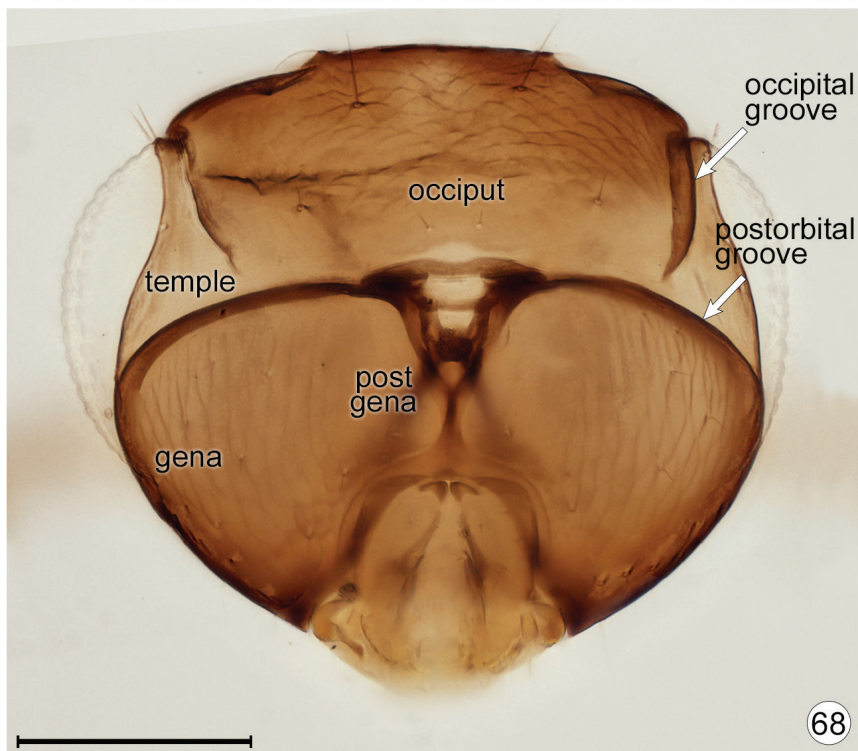
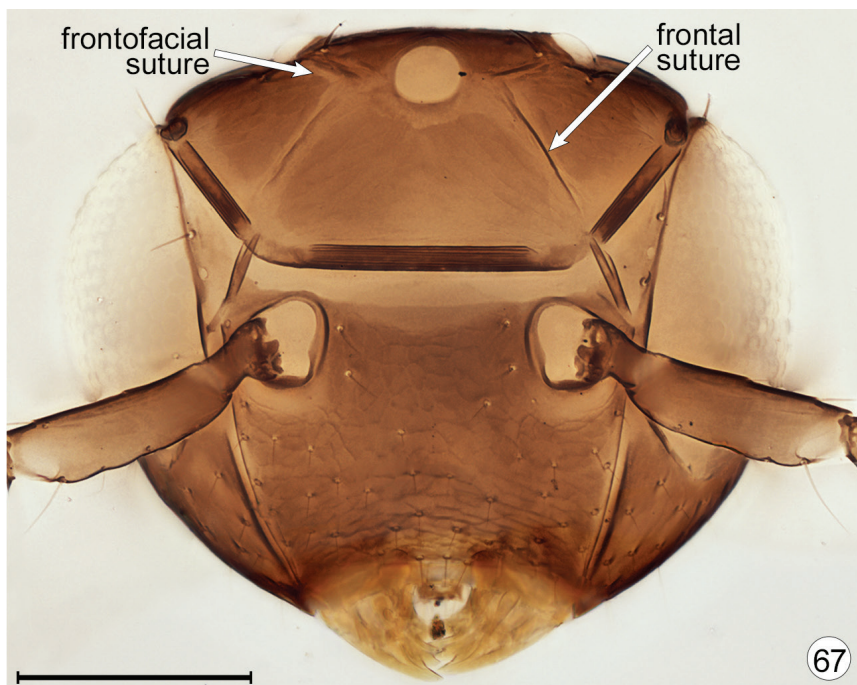
Type material. Holotype female (QMBA) on slide (Fig. 71) labelled: 1. “Mahogany forest, 1200m Mt Moffatt Nat. Pk, C. Qld 24°56'S, 148°04'E 24-26 Feb 1996 C.J. Burwell mv lamp”. 2. “Holotype *Neotriadomerus burwelli* Huber ♀”.

Diagnosis. *Neotriadomerus burwelli* differs from the other small (body length less than 2600) species of *Neotriadomerus*, as follows: fore wing with cubital line extending proximally to base of parastigma (Fig. 70); fl_1 with 2 mps, fl_2 with 4 mps and almost 2× as long as fl_1 , and fl_2 – fl_5 each at least 2.0× as long as wide and with at most 6 long mps in 1 whorl (Fig. 69); ovipositor 2.7× as long as metatibia and extending anteriorly under mesosoma as far as apex of procoxa (Fig. 74).

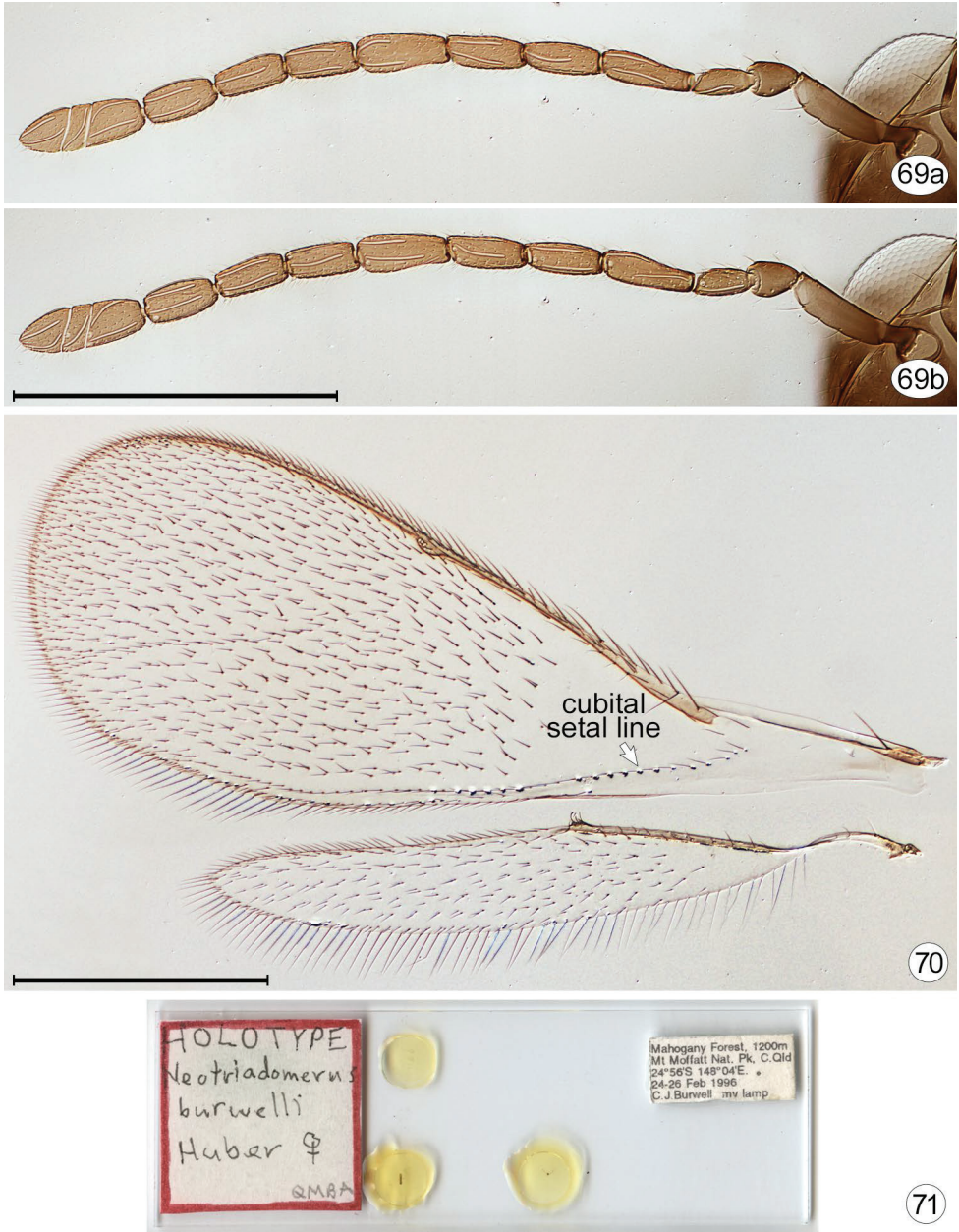
Description. Female. Body length ≈ 1590 (holotype). **Colour.** Holotype body almost uniformly dark brown; legs brown, with trochantelli, base and apex of femora and entire protibia, base and apex of meso- and metatibiae, and tarsi except tarsomere 5 paler, almost white; tarsomere 5 brown. **Head.** Head width 305 (Figs 67, 68). **Antenna.** fl_1 about 0.5 as long as fl_2 , with 2 mps; fl_2 the longest funicle segment, with 4 mps; fl_3 – fl_7 with 4–6 mps; fl_8 with 7? mps. Clava with about 12 mps, 5 on first, 2 on second and 5 on third segment (Fig. 69). Antennal measurements ($n=1$), length/width (ratio of flagellar segments): scape 119/20 (3.91), pedicel 50/31 (1.62), fl_1 63/27 (2.32), fl_2 82/29 (2.82/3.10 [left and right antenna different]), fl_3 77/28 (2.80), fl_4 73/30 (2.46), fl_5 79/28 (2.79/2.36 [left and right antenna different]), fl_6 70/30 (2.38), fl_7 70/31 (2.27), fl_8 69/34 (2.00); entire clava 118/41 (2.89), with segments 1–3 length [measured along dorsal margin] 44, 21, and 54. **Mesosoma.** Width 250, length 514. **Wings.** Fore wing length 1074, width 386, length/width 2.78, longest marginal setae 60; cubital line extending to just proximal to base of parastigma (Fig. 70). Hind wing length 862, width 118, longest marginal setae ≈ 66. **Legs.** Protibia with 5 short pegs along its length and a transverse row of 4 abutting pegs apically (as in Fig. 53). **Metasoma.** Metasoma in dorsal view 300 at widest point, gradually widening from petiole to about 0.6 of gaster length towards apex, then more abruptly narrowing to cerci (Fig. 73). Gaster length 745, about 1.45× as long as mesosoma; gt_1 – gt_7 lengths about 220: 105: 100: 100: 130: 98 (Fig. 73); hypopygium (apex difficult to see) extending about 0.7× length of gaster. Ovipositor sheath length 1041, 2.64× metatibia length (394) and extending anteriorly to just anterior apex of procoxae (Fig. 74) and posteriorly slightly beyond apex of gaster (Figs 73, 75).

Male. Unknown.

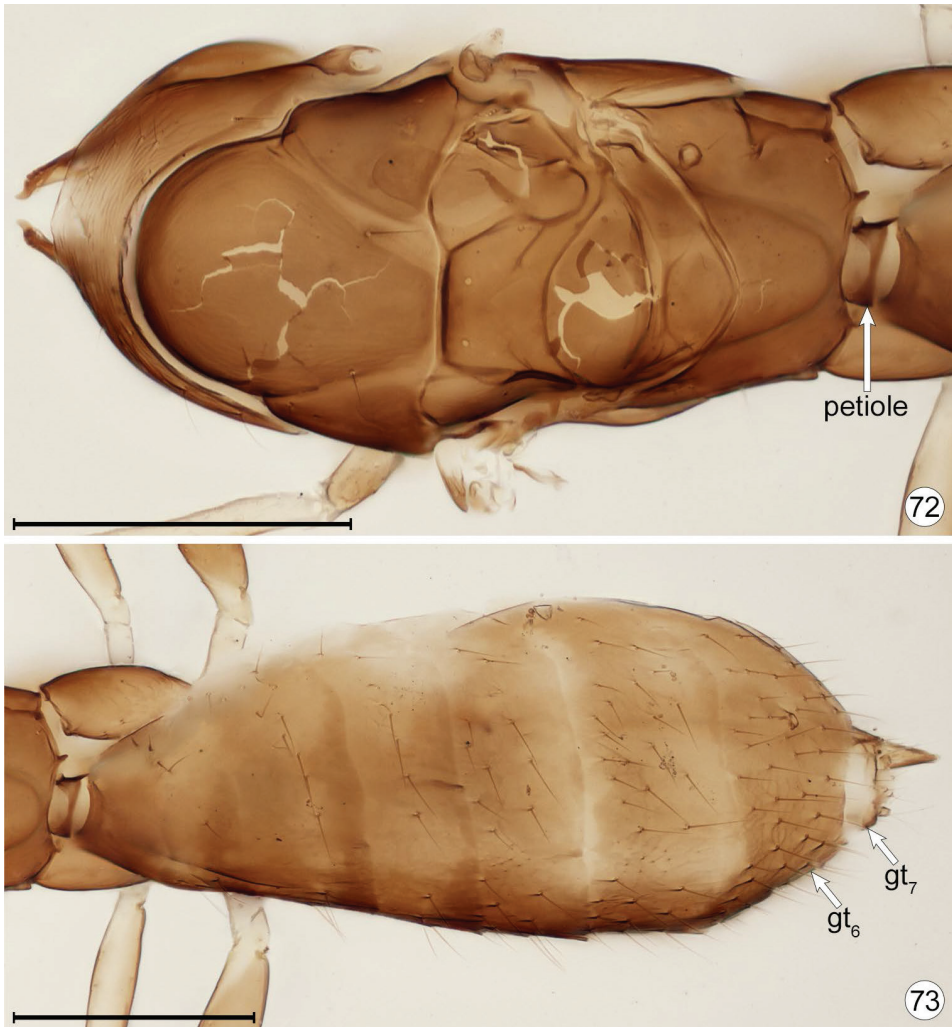
Etymology. The species is named after Chris Burwell, curator of insects at the Queensland Museum, who collected the only known specimen of this species.



Figures 67, 68. *Neotriadomerus burwelli*, holotype. **67** head, anterior **68** head, posterior. Scale bar = 100 μ m.



Figures 69–71. *Neotriadomerus burwelli*, holotype. **69a** right antenna, medial **69b** same antenna, lateral (as seen through antenna) **70** wings **71** holotype slide. Scale bar = 300 μ m.



Figures 72, 73. *Neotriadomerus burwelli*, holotype. **72** mesosoma, dorsal **73** metasoma, dorsal. Scale bar = 300 μ m.

***Neotriadomerus crassus* Huber, sp. n.**

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Figs 76–80

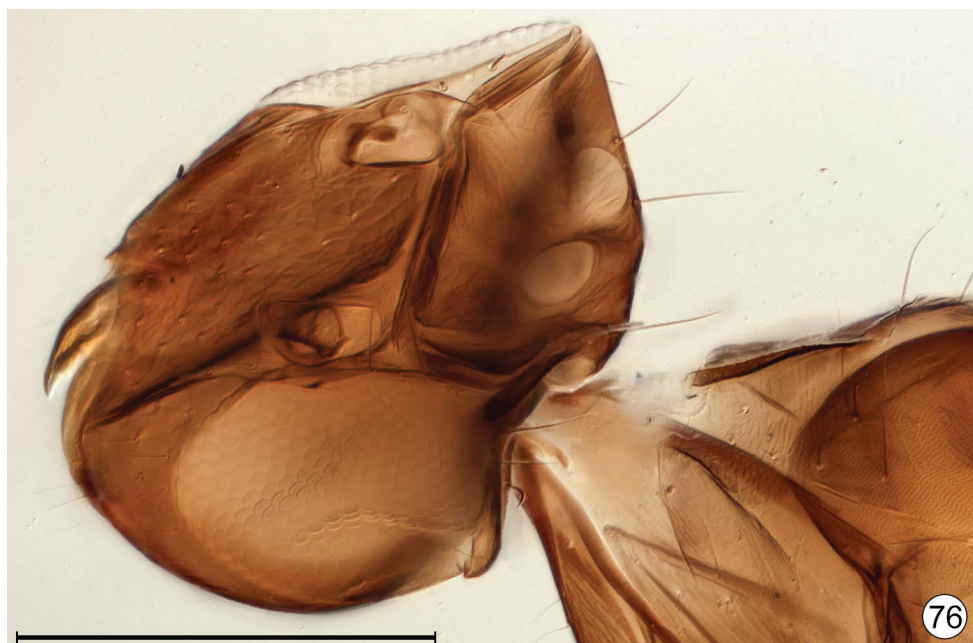
Type material. Holotype female (ANIC) on slide (Fig. 80) labelled: 1. “Black Mountain, ACT 28-29 Mar. 1968 light trap”. 2. “*Neotriadomerus crassus* ♀ lateral holotype”.

Diagnosis. *Neotriadomerus crassus* differs from the other small (body length less than 2600) species of *Neotriadomerus* as follows: fore wing with cubital line extending proximally to about base of parastigma (Fig. 79); fl_1 – fl_8 relatively short, each at most 1.65 \times as long as wide and with at least 8 mps (Fig. 78).

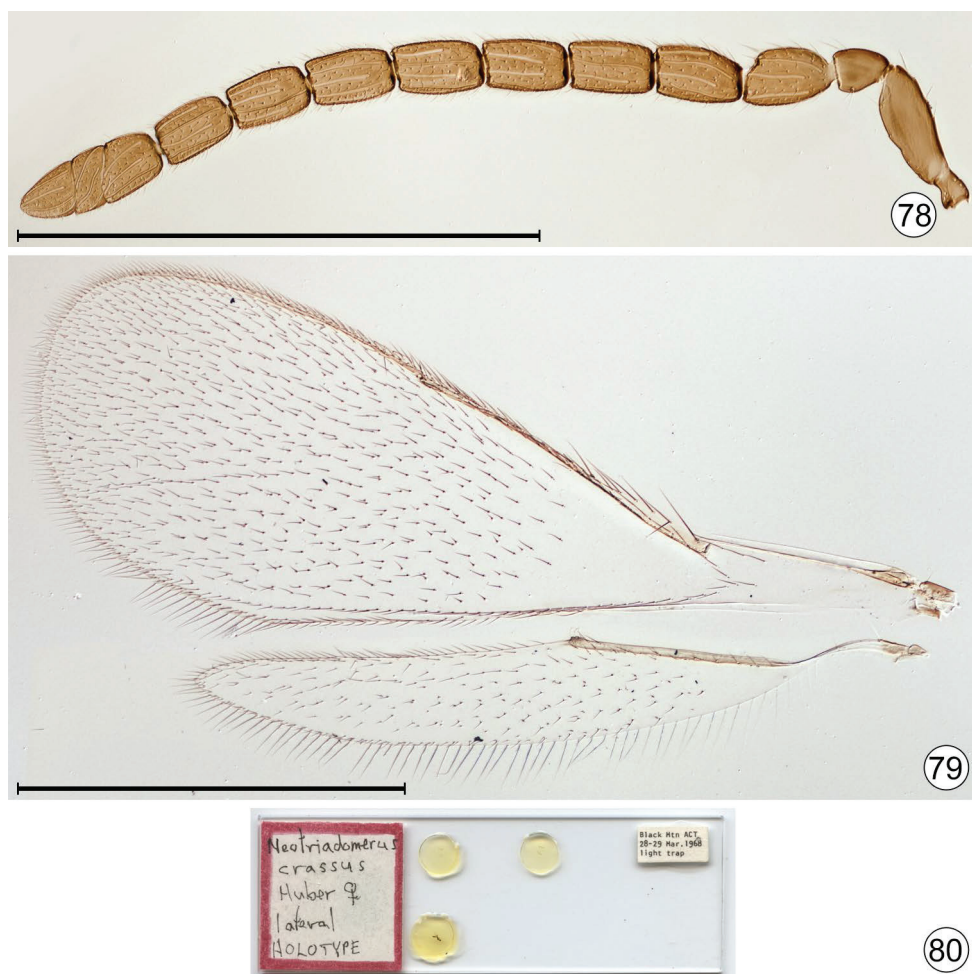


Figures 74, 75. *Neotriadomerus burwelli*, holotype. **74** mesosoma, ventral **75** metasoma, ventral (seen through body). Scale bar = 300 μ m.

Description. Female. Body length \approx 1685 (holotype). **Colour.** Body almost uniformly dark brown; legs brown, with trochantelli, base and apex of femora and entire protibia, base and apex of meso- and metatibiae, and tarsi except tarsomere 5 of all legs and metatarsomere 1 paler, almost white; tarsomere 5 brown and metatarsomere 1



Figures 76, 77. *Neotriadomerus crassus*, holotype. **76** head + anterior of mesosoma, dorsolateral **77** mesosoma + metasoma (ovipositor broken off near base of hypopygium), dorsolateral. Scale bar for **76** = 200 μm ; **77** = 500 μm .



Figures 78–80. *Neotriadomerus crassus*, holotype. **78** antenna **79** wings **80** type slide. Scale bar = 500 μ m.

light brown. **Head.** Width not measurable (Fig. 76). **Antenna.** Fl₁ slightly longer than fl₂, apparently with 8 mps; fl₂–fl₈ with 8 mps (possibly 9 or 10 on fl₇ and fl₈); clava with about 22 mps, 8 on first, 6 on second and 8 on third segment (Fig. 78). Antennal measurements (n=1), length/width (ratio of flagellar segments): scape 145/47 (3.10), pedicel 58/42 (1.37), fl₁ 86/56 (1.53), fl₂ 84/52 (1.60), fl₃ 82/50 (1.63), fl₄ 81/50 (1.63), fl₅ 86/53 (1.62), fl₆ 82/51 (1.59), fl₇ 78/50 (1.57), fl₈ 76/48 (1.58); entire clava 143/55 (2.59), with segments 1–3 length [measured along dorsal margin], 46, 35, and 64. **Mesosoma.** Width not measurable, length 580. **Wings.** Fore wing length 1154, width 397, length/width 2.91, longest marginal setae 46; cubital line extending to just proximal to base of parastigma (Fig. 79). Hind wing length 942, width 130, longest marginal setae 66. **Legs.** Protibia with 6 short, thick pegs along its length and transverse row of 4 abutting pegs apically (as in Fig. 53). **Metasoma.** Metasoma (Fig. 77) in lateral view 224 at highest point, gradually widening from petiole to about 0.6 of

gaster length towards apex, then more abruptly narrowing to cerci. Gaster length 765, about $1.63\times$ as long as mesosoma; gt_1 – gt_6 lengths about ≈ 156 , ≈ 94 , 87, 112, 118, 152; hypopygium (Fig. 77, positioned at right angle to metasoma) extending about $0.7\times$ length of gaster, extending to about halfway towards apex of tergum 5. Ovipositor broken and partly missing, with estimated length (from basal loop to posterior apex of sheath) ≈ 864 , about $2.11\times$ metatibia length (410), extending anteriorly to about level of apex of mesocoxae and extending posteriorly slightly beyond apex of gaster (Fig. 77).

Male. Unknown.

Etymology. The species name, *crassus*, is Latin for thick or stout, referring to the fairly short, thick funicle segments in females.

***Neotriadomerus darlingi* Huber, sp. n.**

<http://zoobank.org/12B05D86-1539-4CA9-B5F8-6895EA2E6952>

Figs 33, 40–44, 47, 50, 52, 65, 81–99

Type material. Holotype female (ANIC) on slide (Fig. 84), labelled: 1. “Australia: Sth Aust. 32 km N. Renmark, 263m 33°53'S, 140°43'E, 15.ii-15.iv.2000, DC Darling”. 2. “Bookmark Biosphere Rsv. Malaise trps (4) Amalia Dam xeric mallee scrub ROM 2000040”. 3. “*Neotriadomerus darlingi* Huber Holotype ♀ dorsal”.

Paratypes. 3 females, 1 male. AUSTRALIA. **South Australia:** Same locality data as holotype (1 ♀ and 1 ♂, ROM, CNC); 35 km N Renmark, 263m, 33°52'48"S; 140°43'30"E, 11-14.ii.2000, D.C. Darling, Bookmark Biosphere Reserve, Malaise trap, Amalia Dam, mallee vegetation, ROM 2000030 (1 ♀, ANIC). **Western Australia:** 85 km E. Southern Cross, Boorabbin National Park, 28.xii.1986, J.S. Noyes (1 ♀, BMNH).

Two males with the following data questionably belong to this species so are not labelled as paratypes. They were collected from South Australia, Brookfield Conservation Park, 34.21°S, 139.29°E, 17 & 18.ii.1992, J. Cardale, A. Roach, light trap (2 ♂, ANIC) and one is illustrated (Figs 93–99). Both sexes need to be collected together from Brookfield Conservation Area to be more certain of their conspecificity with the holotype.

Diagnosis. *Neotriadomerus darlingi* differs from the other small (body length less than 2600) species of *Neotriadomerus* as follows: fore wing with cubital line extending proximally to about level of other microtrichia (Fig. 86); funicle segments with at most 6 mps (Fig. 85); ovipositor 2.57 – $2.74\times$ as long as metatibia (Fig. 92).

Description. Female. Body length 1420–1560 ($n=2$, card-mounted paratypes). **Colour.** Body (Fig. 81) almost uniformly dark brown; fore leg yellow except procoxa brownish basally, ventral surface of profemur and tarsomere 5 brown; middle and hind legs lighter brown with trochantelli, base and apex of femora and entire protibia, base and apex of meso- and metatibiae, and tarsi except tarsomere 5 paler, almost white; metafemur medially and tarsomere 5 brown; ovipositor sheath with lighter band subapically (Figs 81, 88, 89). **Head.** Width ≈ 320 – 346 (card-mounted) and 358 (slide



Figure 81. *Neotriadomerus darlingi*, paratype female, habitus lateral (35 km N. Renmark, 263 m, 11–14. ii.2000). Scale bar = 1000 μ m.

mounted specimen from WA, Figs 90, 91). **Antenna.** Fl_1 slightly shorter than to almost equal to fl_2 , with 5 mps (Fig. 85); fl_2-fl_8 with 6 mps. Clava with 10 or 11 mps, 5 or 6 on first, 2 on second and 4 on third segment. Antennal measurements ($n=2$, first

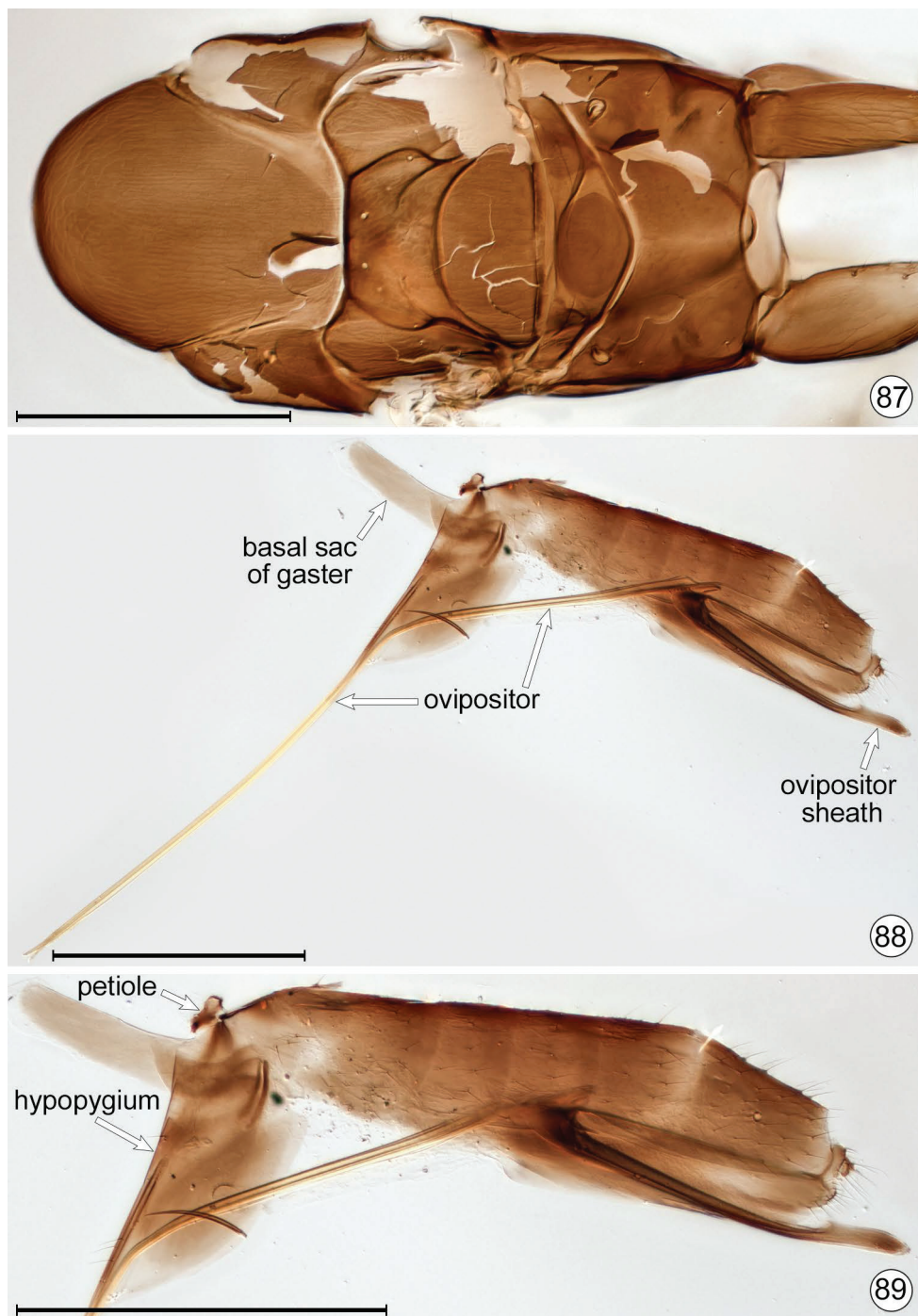


Figure 82. *Neotriadomerus darlingi*, paratype male, habitus dorsal (35 km N. Renmark, 263 m, 15.ii–15. iv.2000). Scale bar = 1000 μ m.

number is for the holotype, a slightly smaller specimen), length/width (ratio of flagellar segments): scape 124–126/37–40 (3.37–2.51), pedicel 50–56/39–41 (1.29–1.36), fl₁ 70–74/38–45 (1.85–1.65), fl₂ 80–75/34–40 (2.36–1.88), fl₃ 77–76/34–38 (2.26–1.97), fl₄ 78–75/35–38 (2.24–1.96), fl₅ 79–76/33–38 (2.39–2.01), fl₆ 76–74/33–37 (2.28–2.20), fl₇ 77–78/34–39 (2.23–2.13), fl₈ 76/34–40 (2.25–1.89); entire clava 141–142/39–42 (3.63–3.40), with segments 1–3 length [measured along dorsal margin], 48–50, 25, and 67–68. **Mesosoma.** Width 225 (holotype), length 628–656, with 2 propodeal setae (Fig. 87). **Wings.** Fore wing length 1045–1118, width 383–412, length/width 2.71–2.73, longest marginal setae \approx 51–61; cubital line extending to just proximal to base of parastigma (Fig. 86). Hind wing length \approx 870–890, width 121–140, longest marginal setae \approx 58–62. **Legs.** Protibia with 4 or 5 short, thick pegs along its length and a transverse row of 2 or 3 abutting pegs apically. **Metasoma.** Metasoma in lateral view 255–360 at highest point, gradually widening from petiole to about 0.4–0.7 of gaster length towards apex, then more abruptly narrowing to cerci (Fig. 89). Gaster length (holotype, second measurement) 776–858, 1.18–1.36 \times as long as mesosoma; gt₁–gt₇ lengths about \approx 162–170, \approx 136–144, 98–126, 113–177, 132–186,



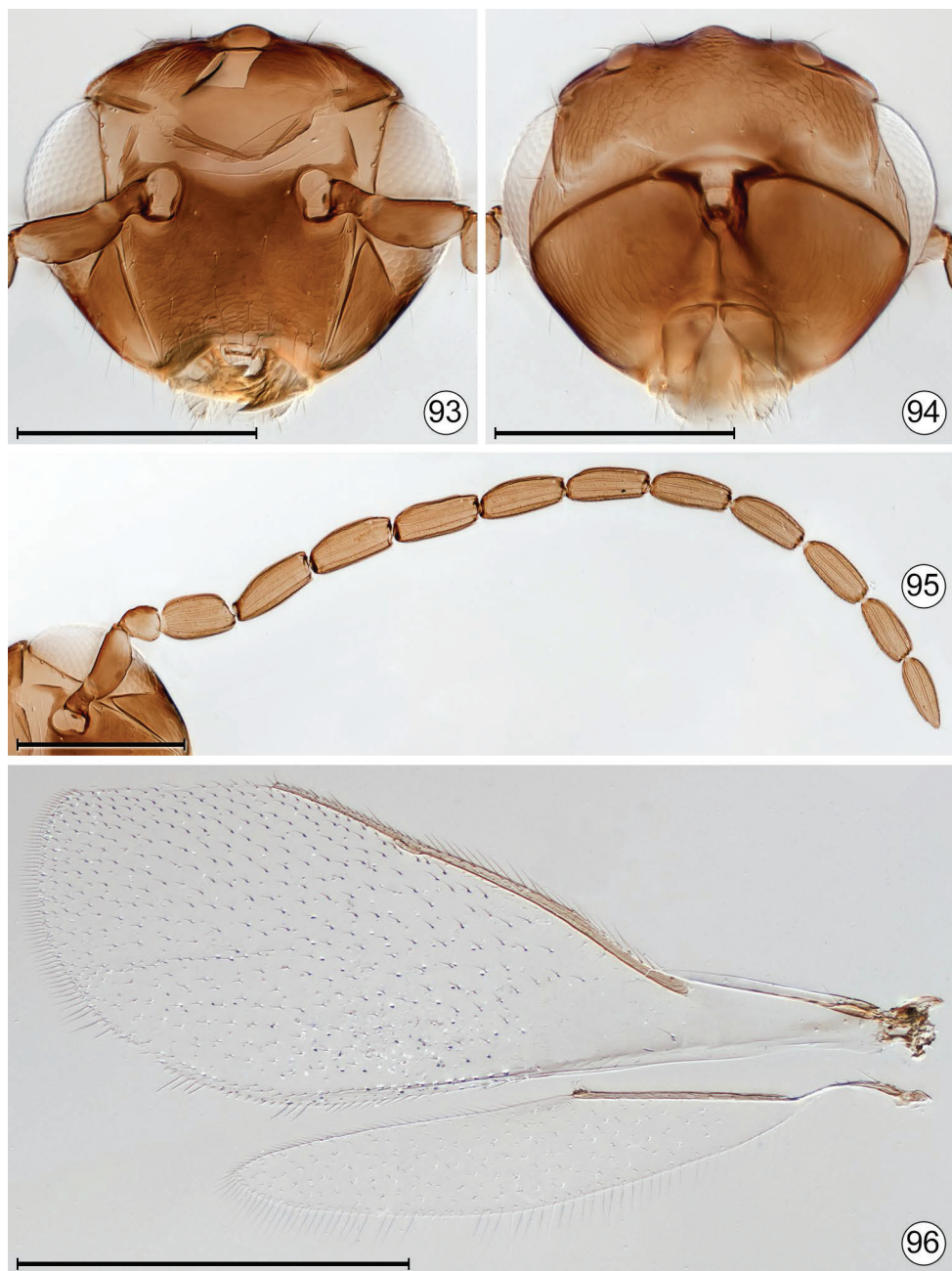
Figures 83–86. *Neotriadomerus darlingi*, holotype. **83** head, anterolateral **84** type slide **85** antenna **86** wings. Scale bar = 200 μ m.



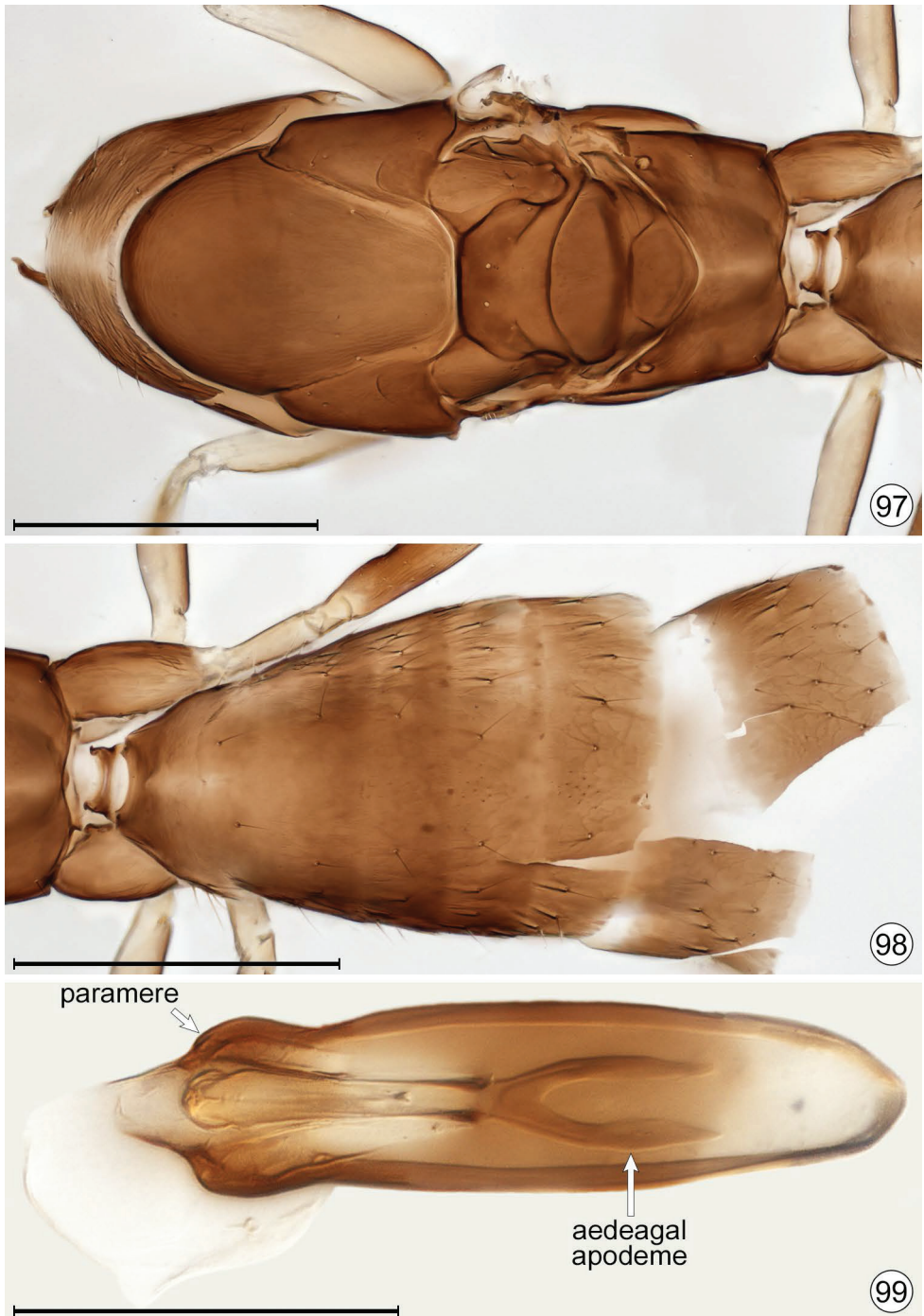
Figures 87–89. *Neotriadomerus darlingi*, holotype. **87** mesosoma, dorsal **88** metasoma, lateral, with ovipositor unsheathed **89** metasoma enlarged, lateral. Scale bar for **87** = 200 μm ; **88, 89** = 500 μm . Note: 88 and 89 are flipped horizontally (gaster apex pointing left in holotype slide).



Figures 90–92. *Neotriadomerus darlingi*, paratype female (Boorabbin National Park). **90** head, anterior **91** head, posterior **92** mesosoma, legs and metasoma, lateral. Scale bar for **90, 91** = 200 μm ; **92** = 500 μm .



Figures 93–96. *Neotriadomerus? darlingi*, paratype male (Brookfield Conservation Area). **93** head, anterior **94** head, posterior **95** antenna **96** wings. Scale bar for **93–95** = 200 μm ; **96** = 500 μm .



Figures 97–99. *Neotriadomerus* ?*darlingi*, paratype male (Brookfield Conservation Area). **97** mesosoma, dorsal **98** metasoma, dorsal (gt, broken off) **99** genitalia, dorsal. Scale bar for **97, 98** = 300 μ m; **99** = 100 μ m.

209–146, 53–58; hypopygium extending about $0.6\times$ length of gaster, about to apex of tergum 4. Ovipositor sheath length ≈ 946 –1050, about 2.57 – $2.74\times$ metatibia length (368–383), extending anteriorly to apex of procoxa (or anterior margin of frenum) and extending posteriorly to a little beyond apex of gaster (Figs 88, 89, 92).

Male. Body length 1330 (point-mounted paratype) and 1230 (slide-mounted specimen, Brookfield Conservation Area). Colour as for female but with legs almost entirely brown (Fig. 82). **Head.** If correctly associated, as for female (Figs 93, 94). **Antenna.** Fl_1 with about 13 mps and about $1.5\times$ as wide as fl_{11} with about 7 mps (Fig. 95); total length of flagellum 475. Antennal measurements length/width (slide-mounted specimen): scape 120/41 (2.90), pedicel 47/43 (1.09), fl_1 92/53 (1.75), fl_2 105/48 (2.24), fl_3 108/48 (2.24), fl_4 104/44 (2.38), fl_5 109/43 (2.54), fl_6 100/42 (2.41), fl_7 98/41 (2.39), fl_8 97/43 (2.24), fl_9 96/41 (2.35), fl_{10} 86/39 (2.22), fl_{11} 92/35 (2.64); fl_6 with about 11 mps. **Mesosoma.** Length 620, width 290 (Fig. 97). **Wings.** If correctly associated, as for female (Fig. 96). **Metasoma.** Pedicel length/width 30/75 (Fig. 98). Gaster length ≈ 785 . Genitalia with capsule thick-walled, aedeagal apodeme thick and shorter than aedeagus; paramere thick and apically curved medially (Fig. 99).

Etymology. The species is named after Chris Darling, curator of Entomology at the Royal Ontario Museum, Toronto, who collected the type series.

***Neotriadomerus gloriosus* Huber, sp. n.**

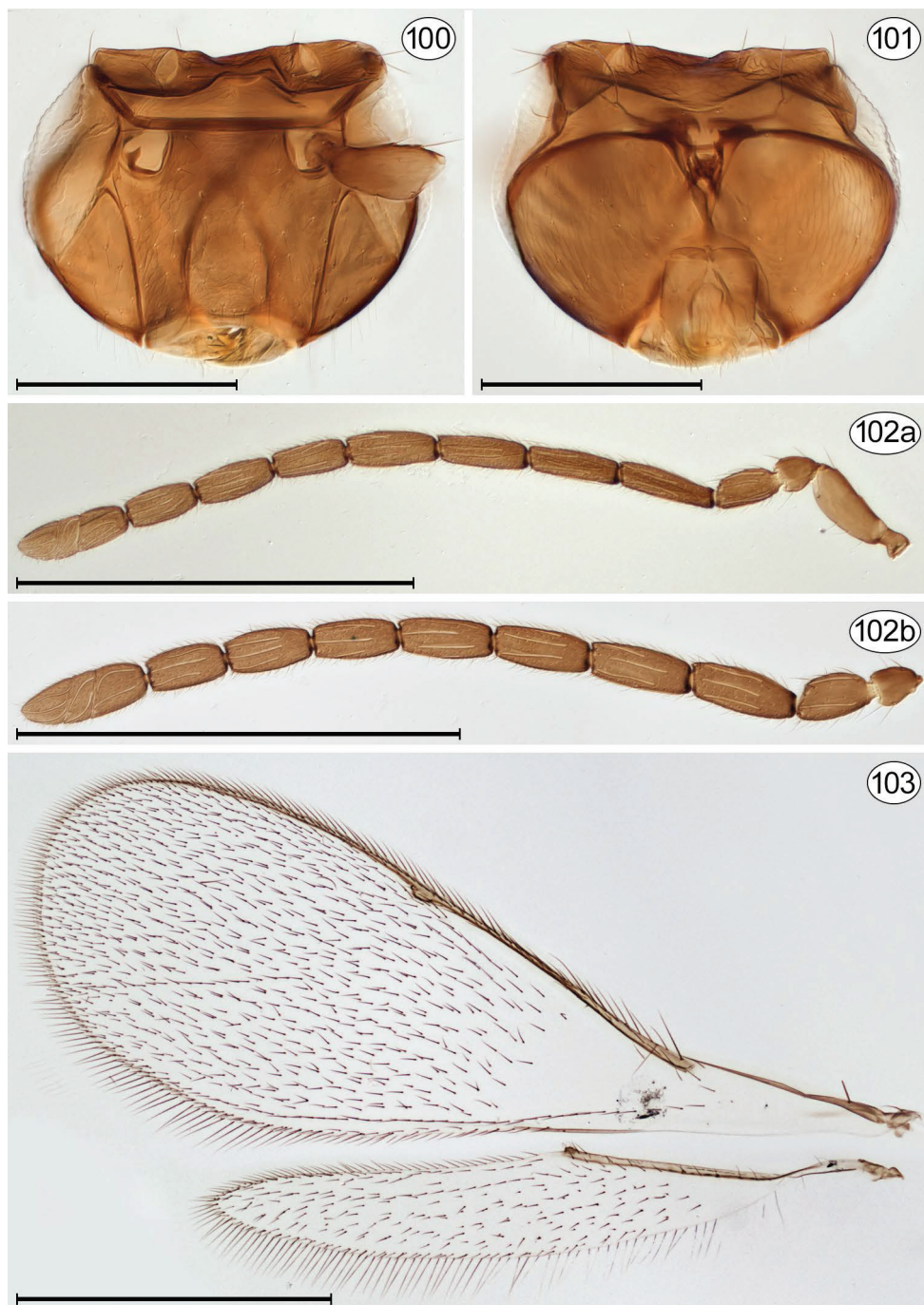
<http://zoobank.org/33067489-E0B9-488E-9AAD-591B903E3F00>

Figs 32, 34, 35, 100–107

Type material. Holotype female (QMBA) on slide (Fig. 107), labelled: 1. “Mt. Glorious, S.E. Qld. Hiller March 1982 Malaise trap”. 2. “*Neotriadomerus gloriosus* Huber ♀ dorsal holotype”.

Diagnosis. *Neotriadomerus gloriosus* differs from the other small (body length less than 2600) species of *Neotriadomerus*, as follows: fore wing with cubital line extending to just proximal to base of parastigma (Fig. 103); fl_2 – fl_5 each at least $2.0\times$ as long as wide and with at most 6 long mps in 1 whorl (Fig. 102).

Description. Female. Body length ≈ 1840 (holotype). **Colour.** Holotype body almost uniformly dark brown; legs brown, with trochantelli, base and apex of femora and entire protibia, and base and apex of meso- and metatibiae, and tarsi except tarsomere 5 paler, almost white; tarsomere 5 brown. **Head.** Head width 374 (Figs 100, 101). **Antenna.** Fl_1 about $0.7\times$ as long as fl_2 , with 4 mps; fl_2 slightly the longest funicle segment, with 8 mps; fl_3 – fl_8 with 8 (9? on fl_8) mps; clava with about 18 mps, 8 on first, 4 on second and 6 (8?) on third segment (Fig. 102). Antennal measurements ($n=1$), length/width (ratios of flagellar segments, different for each antenna so left antenna, except scape of right antenna, measured—the left antenna has narrower funicle segments): scape 152/49 (3.10), pedicel 57/43 (1.32), fl_1 91/50 (1.84), fl_2 118/48 (2.47), fl_3 114/46 (2.48), fl_4 111/46 (2.43), fl_5 105/46 (2.29), fl_6 99/45 (2.21), fl_7 99/47 (2.09), fl_8 92/46 (1.98); entire clava 148/52 (2.82), with segments 1–3 length



Figures 100–103. *Neotriadomerus gloriosus*, holotype. **100** head, anterior **101** head, posterior **102a** right antenna **102b** left antenna **103** wings. Scale bar for **100**, **101** = 200 μm ; **102**, **103** = 500 μm .



Figures 104–107. *Neotriadomerus gloriosus*, holotype. **104** mesosoma, dorsal **105** metasoma, lateral **106** metasoma, median plane **107** type slide. Scale bar = 200 μ m.

[measured along dorsal margin] 56, 28, and 64. **Mesosoma.** Width 324, length 711, with 2 propodeal setae (Fig. 104). **Wings.** Fore wing length 1367, width 486, length/width 2.81, longest marginal setae 77; cubital line extending to just proximal to base of

parastigma (Fig. 103). Hind wing length 1109, width 157, longest marginal setae 78. **Legs.** Protibia with 6 or 7 short, thick pegs along its length and a transverse row of 4 abutting pegs apically (as in Fig. 53). **Metasoma.** Metasoma height in lateral view 225 (excluding lowered hypopygium) (Figs 105, 106). Gaster length 1002, about 1.41× as long as mesosoma; gt_1 – gt_7 lengths about 170: 166: 151: 118: 130: 209 [measurement of a tergum excludes the telescoped portion inside another (more anterior) tergum]; hypopygium extending posteriorly to about level of spiracle. Ovipositor sheath length 1274, $\approx 2.54\times$ metatibia length (≈ 502), extending anteriorly to about level of apex of procoxa and extending posteriorly only slightly beyond apex of gaster (Fig. 105, 106) [apparently extending more than normal because ovipositor not at its normal resting position, i.e., filling entire length of basal sac of gaster, whose almost membranous apex is distinctly folded over (Fig. 105, arrow)].

Male. Unknown.

Etymology. The species is named after the type locality, Mt. Glorious National Park.

***Neotriadomerus longiovipositor* Huber, sp. n.**

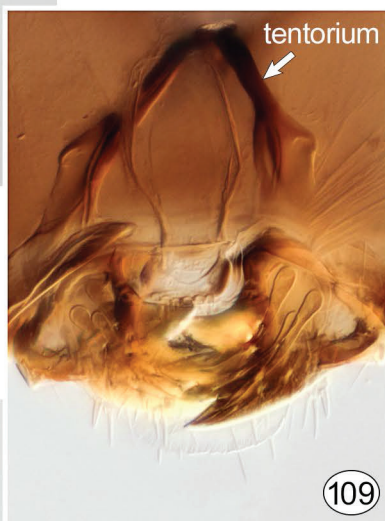
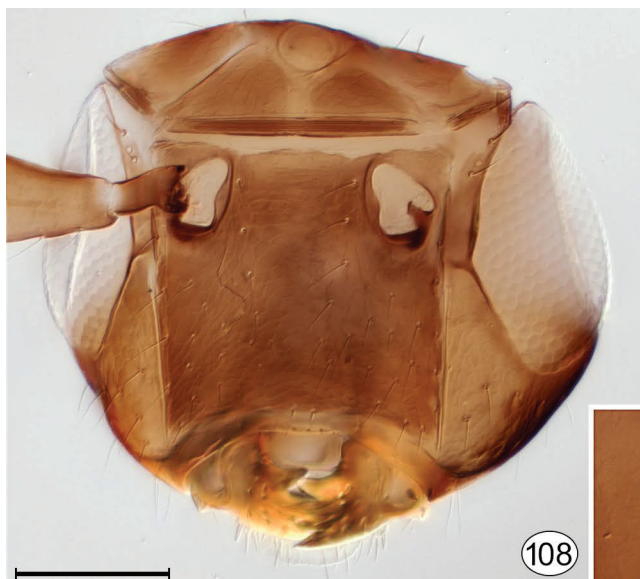
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Figs 108–125

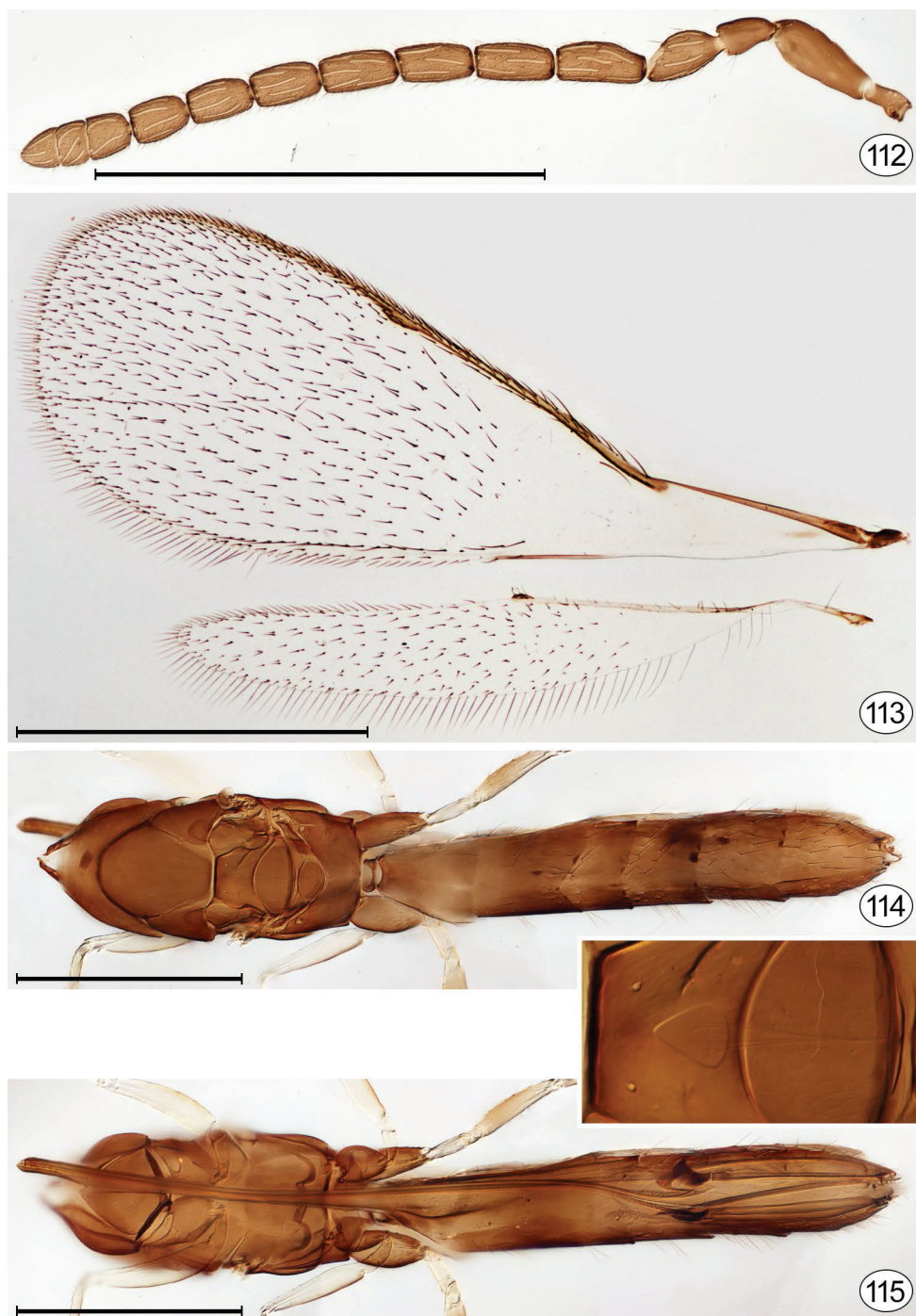
Type material. Holotype female (ANIC) on slide (Fig. 111) labelled: 1. “15.17S 145.10E 5Km WbyN Rounded Hill nr Hope Vale Mission Q 7 Oct. 1980 J.C. Cardale ex ethanol”. 2. “Neotriadomerus longiovipositor Huber Holotype ♀ dorsal”.

Paratypes. 4 females, 4 males, 1 deformed male (gynandromorph?). AUSTRALIA. **Queensland:** Batavia Downs, 12.40°S; 142.39°E, 22.vi–23.viii.1992, P. Zborowski & J. Cardale, flight interception trap (1♂, ANIC); NW of Chillagoe near historical mine site, 17°08'40"S; 144°30'16"E, 30.iii.1992, E.C. Dahms & G. Sarnes (1♂, QMBA); 18.5 km W. Gordonvale, 13.xi.1979, E.C. Dahms, J.B. Woolley & J. LaSalle, open forest (1♀, QDPC); Heathlands, 11.45°S; 142.35°E, 15–26.i.1992, I. Naumann, T. Weir, at light (1♀, ANIC); Millstream Falls National Park, 17.41°S; 145.26°E, 24–25.v.1980, I.D. Naumann, J.C. Cardale (1 deformed ♂, ANIC); 5 km W. by N. Rounded Hill near Hope Vale Mission, 15.17°S, 145.10°E; 7–10.v.1981, I.D. Naumann (1♀, ANIC); 15.16°S; 144.59°E 14 km W. by N. Hope Vale Mission. 8–18.x.1980, J.C. Cardale, collected at light (1♂, ANIC); Ross River reservoir, 10 km S. Townsville, 19° 27'S; 146° 44'E, 27.xi.1991, C.J. Burwell (1♂, QMBA); near Swamp Mitchell Plateau airfield, 14.47°S; 125.49°E, 18.v.1983, I.D. Naumann, J.C. Cardale (1♀, ANIC).

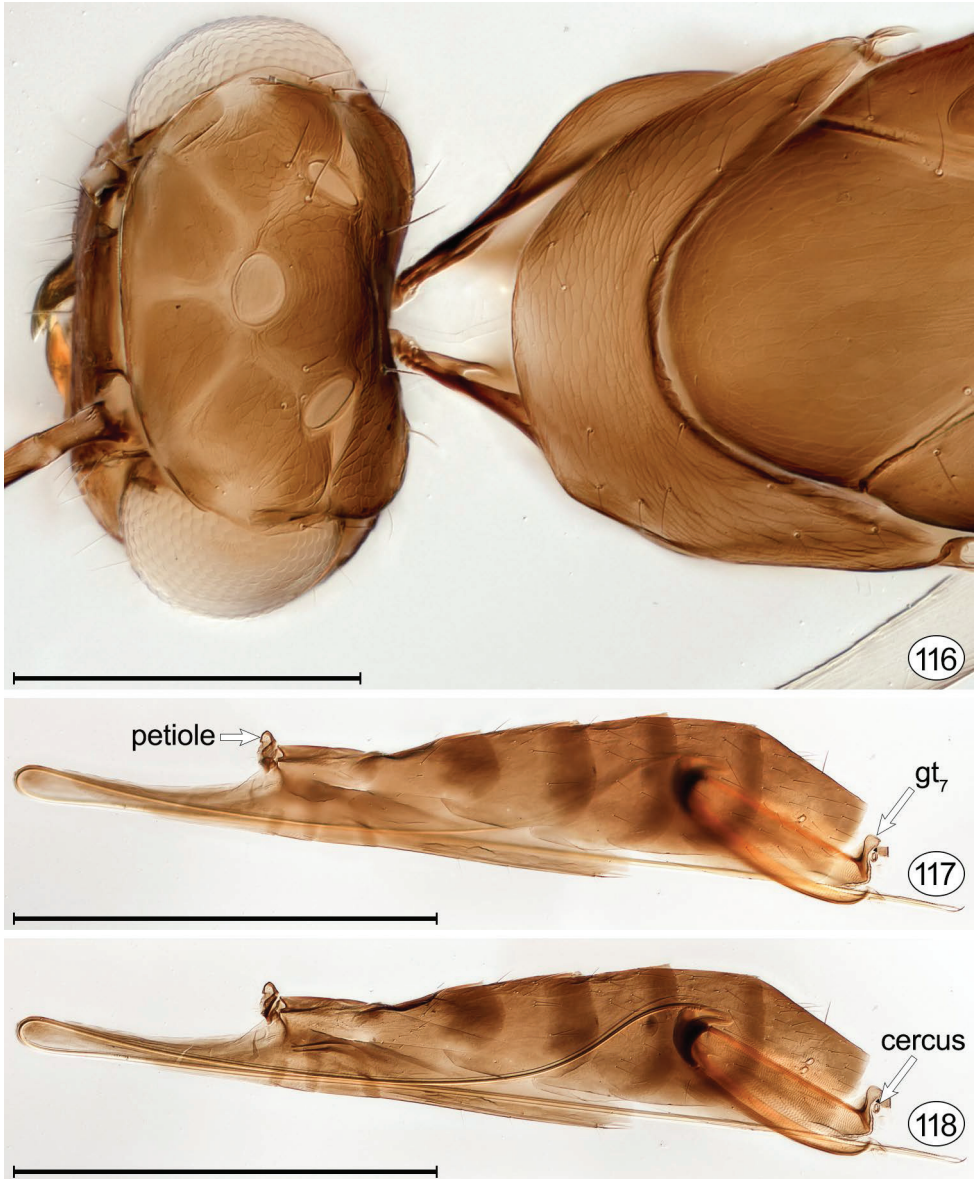
Diagnosis. *Neotriadomerus longiovipositor* differs from the other small (body length less than 2600) species of *Neotriadomerus*, as follows: fore wing with cubital line extending proximally to about level of other microtrichia (Fig. 113); ovipositor extending anteriorly under mesosoma at least to level of head (Figs 114, 115); funicle segments with mps in two widely overlapping whorls (Fig. 112). Male flagellomeres with mps in two scarcely overlapping whorls (Fig 121).



Figures 108–111. *Neotriadomerus longiovipositor*, holotype. **108** head, anterior **109** mouthparts and tentorium **110** head, posterior **111** holotype slide. Scale bar = 200 μ m.

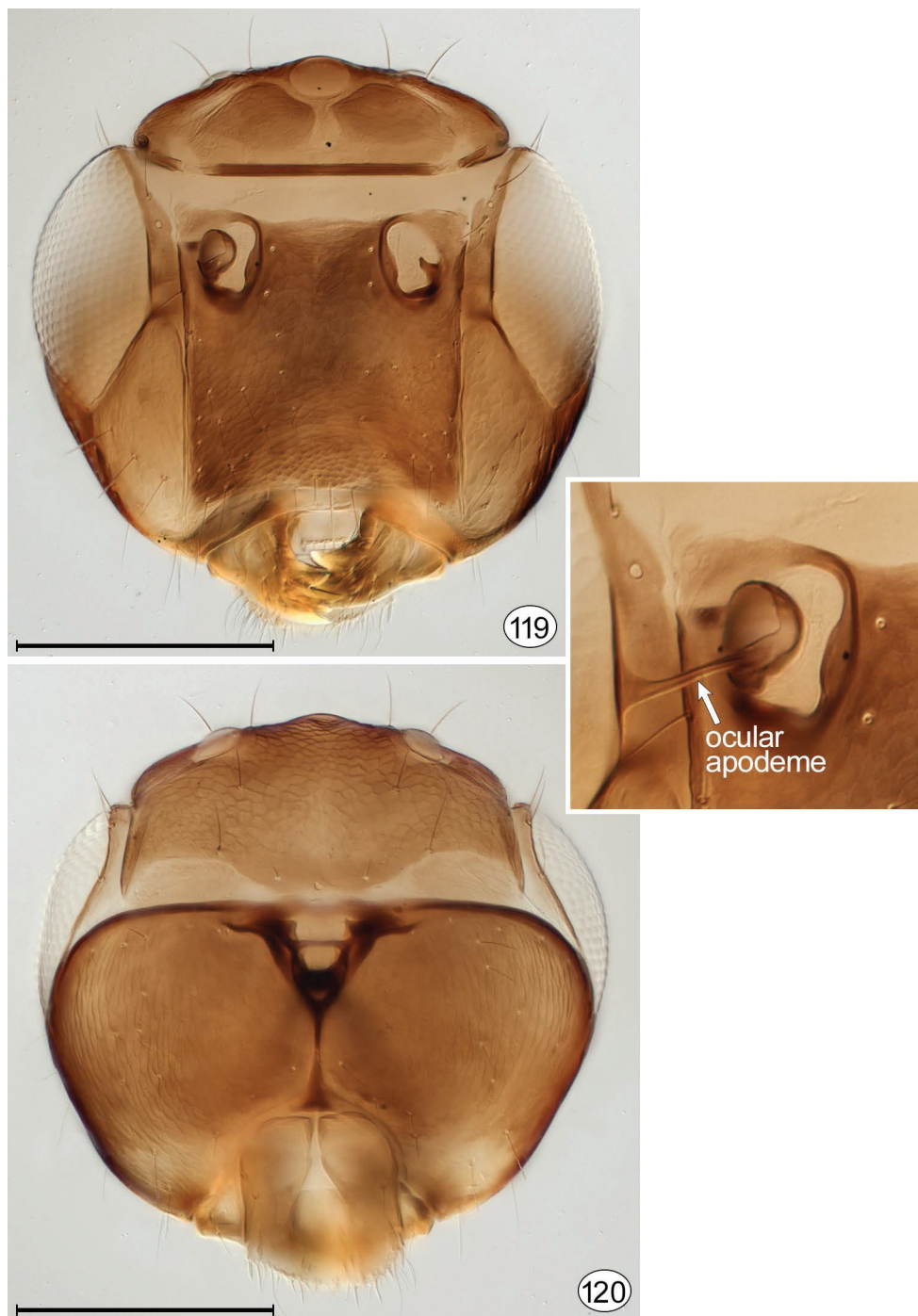


Figures 112–115. *Neotriadomerus longiovipositor*, holotype. 112 antenna 113 wings 114 mesosoma + metasoma, dorsal (inset shows fenestra of scutellum) 115 mesosoma + metasoma, ventral as seen dorsally through body. Scale bar = 500 μm .

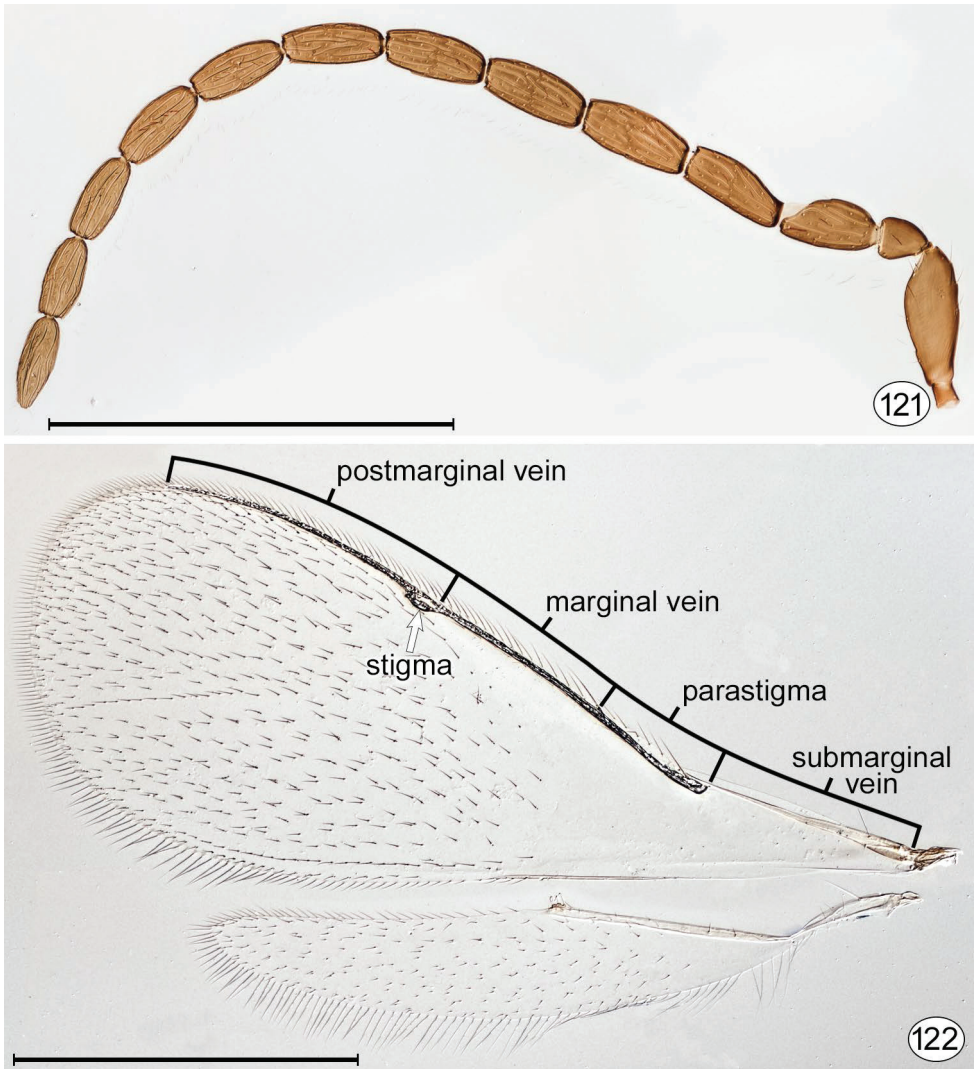


Figures 116–118. *Neotriadomerus longiovipositor*, female paratypes. **116** head + anterior of mesosoma, dorsal (near Swamp Mitchell Plateau Airfield) **116** metasoma, lateral (18.5 km W. Gordonvale) **117** metasoma, median plane **118** metasoma, lateral. Scale bar for **116** = 200 μm ; **117**, **118** = 1000 μm .

Description. Female. Body length \approx 1700–2250 (n=6). **Colour.** Body (before slide mounting one specimen) uniformly shiny black except mouthparts brown; antenna dark brown but scape and pedicel ventrally slightly lighter; pro- and mesocoxa dark brown except extreme apices yellowish, metacoxa dorsally almost black; the rest of each leg yellowish except for femur ventrally of fore- and mid leg, entire femur ex-



Figures 119, 120. *Neotriadomerus longiovipositor*, male paratype (14 km W. by N. Hope Vale Mission).
119 head, anterior (inset shows ocular apophysis or apodeme) **120** head, posterior. Scale bar = 200 μ m.



Figures 121, 122. *Neotriadomerus longiovipositor*. **121** male antenna, paratype (14 km W. by N. Hope Vale Mission) **122** wings. Scale bar = 500 μ m.

cept extremities of hind leg, and apical tarsomere of all legs brown. **Head.** Head width 344–412 (Figs 108, 110). **Antenna.** fl_1 slightly shorter than fl_2 , with 8 (9?) mps; fl_2 slightly the longest funicle segment, with 9–12 mps; fl_3 – fl_8 with 9–12 (13?) mps; clava with 22 mps, 8 on first, 6 on second and 8 on third segment (Fig. 112). Antennal measurements ($n=4$), length/width (ratio of flagellar segments): scape 174–194/47–65 (2.99–3.78), pedicel 57–66/40–46 (1.30–1.67), fl_1 85–104/44–57 (1.83–1.95), fl_2 88–108/45–52 (1.88–2.19), fl_3 80–109/43–52 (1.72–2.11), fl_4 72–84/44–47 (1.65–1.97), fl_5 70–102/42–47 (1.66–2.19), fl_6 68–97/43–50 (1.56–1.94), fl_7 65–96/41–44 (1.54–2.17), fl_8 63–64/42–46 (1.41–1.49); entire clava 126–128/49/53 (2.43–2.59),



Figures 123, 124. *Neotriadomerus longiovipositor*, male paratype (14 km W. by N. Hope Vale Mission). **123** mesosoma, legs + metasoma, lateral **124** genitalia, lateral. Scale bar for **123** = 1000 μm ; **124** = 200 μm .

with segments 1–3 length [measured along dorsal margin] 40–46, 29–31, and 50–60 (the paratype from 18.5 km W. Gordonvale was the largest specimen but had fl₈ and clava missing from both antennae so the maximum lengths in the ranges given above

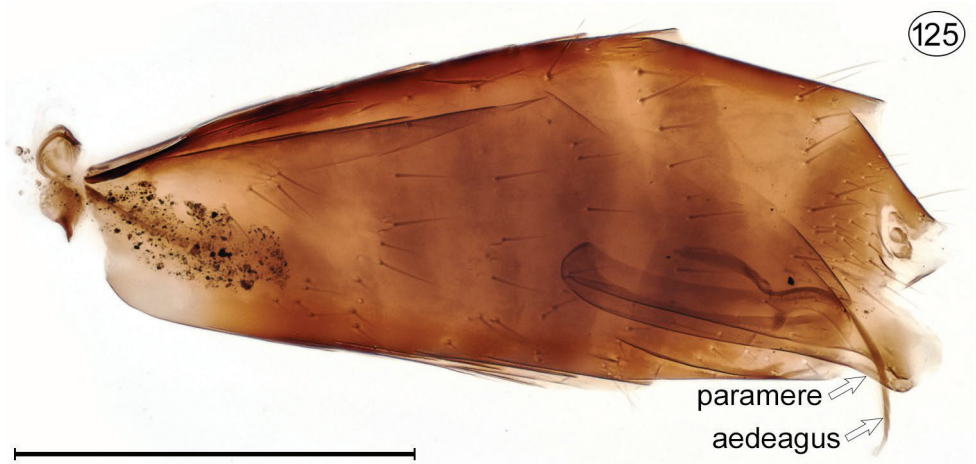


Figure 125. *Neotriadomerus longiovipositor*, male paratype (near historical mine site, NW of Chillagoe). Gaster, median plane showing genitalia. Scale bar = 300 μ m.

for those segments are smaller than they should be). **Mesosoma.** Mesosoma length 617–678, width 317–327 ($n=3$, slide mounts), height ≈ 280 (critical point dried paratype). **Wings.** Fore wing length ($n=3$) 1118–1208, width 407–432, length/width 2.71–2.80, longest marginal setae ≈ 54 –62; cubital line extending to just proximal to base of parastigma (Fig. 113). Hind wing length ≈ 914 –1052, width 120–136, longest marginal setae ≈ 50 –67. **Legs.** Protibia with 5 or 6 (on specimen with only 2 on one leg) short, thick pegs along its length and a transverse row of 3 or 4 abutting pegs apically (as in Fig. 53). **Metasoma.** Metasoma height in lateral view ≈ 480 (including slightly lowered hypopygium, critical point dried paratype) or 320–400 (three slide mounted paratypes). Gaster length 918–1453, about 1.49 – $2.12\times$ as long as mesosoma; gt_1 – gt_7 lengths about 204–244, 190–236, 136–266, 130–207, 114–209, 218–320, ≈ 24 –59 [measurement of a tergum excludes the telescoped portion inside another (more anterior) tergum]; hypopygium extending posteriorly to about apex of gt_3 to halfway between anterior and posterior margin of gt_4 . Ovipositor length 1445–2238, ≈ 3.58 – $4.82\times$ metatibia length (≈ 380 –472) and extending anteriorly to level of head or beyond (Figs 114, 115) and not extending posteriorly beyond apex of gaster (Figs 114, 115), except in one paratype (Figs 117, 118).

Male. Colour. As for female. **Head.** Head (Figs 119, 120) width 380–436 ($n=4$). **Antenna.** Measurements, length/width ($n=3$): scape 170–214/56–67, pedicel 57–68/46–52, flagellar segments: fl_1 117–122/55–63, fl_2 109–134/52–58, fl_3 103–136/50–62, fl_4 105–130/47–56, fl_5 102–125/48–55, fl_6 98–127/50, fl_7 96–120/48–52, fl_8 89–120/44–53, fl_9 84–112/45–48, fl_{10} 76–104/42–48, fl_{11} 90–118/36–43; total flagellar length 1068–1349; fl_6 length/width ratio 1.98–2.54, with about 17–19 mps in two slightly overlapping whorls (Fig. 121). **Mesosoma.** Mesosoma length 780–860, about 0.80 – $1.22\times$ as long as metasoma length (680–1020); propodeum with 2 propodeal setae, rarely 3 on one side. **Wings.** Fore wing (Fig. 122) length ($n=3$) 1191–1320, width

446–495, length/width, 2.56–2.67, longest marginal setae 58–68; cubital line extending to about level of other microtrichia. Hind wing length 921–1024, width 132–158, longest marginal setae 52–65. **Metasoma.** Petiole length 35–36, width 70–76 (n=2). Gaster length 780–860; gt_1 – gt_5 each with a row of about 5 lateral and dorsal setae on each side (apparently without dorsal setae on gt_1), and gt_6 with about 6 long dorsal setae on each side and about 20 short lateral setae (Fig. 123). Genitalia (Fig 124, 125) with paramere in lateral view higher than wide and blunt apically, with 2 short apicoventral setae close together and 2 or 3 short subapical setae more widely spaced.

Etymology. The name is a noun in apposition, referring to the long ovipositor (the second longest in the genus) that extends anteriorly to the head.

***Neotriadomerus longissimus* Huber, sp. n.**

<http://zoobank.org/B79EB1F3-8092-4382-96C7-A966E9549C50>

Figs 36–38, 48, 51, 53, 63, 126, 127

Type material. Holotype female (ANIC) on point labelled: 1. “Blundells ACT 27 Feb 1951 H M Cage”. 2. “Holotype Neotriadomerus longissimus Huber ♀”.

Paratype. 1 female. AUSTRALIA. **Queensland:** Brisbane Forest Park, 27°25'04"S; 152°49'48"E, 23–29.x.1998, N. Power, dry sclerophyll, MT (1♀, CNC).

Diagnosis. *Neotriadomerus longissimus* differs from other species of *Neotriadomerus* as follows: body 5000—almost twice the length of any other species (Fig. 126); head cuboidal, with vertex horizontal, almost at right angle to the face (Fig. 126); mid ocellus almost in contact with the transverse trabecula; mandible massive (Fig. 36); gaster with basal sac extending anteriorly well anterior to head (Figs 38, 63, 126, 127).

Description. Female. Body length 5000–5450 (n=2, card and point-mounted holotype and paratype), excluding basal sac of gaster (5900–6300 if this included).

Colour. Holotype body black except for brown mandibles, scutellum, and most of middle segments of metasoma; legs and apex of anterior extension of ovipositor brownish yellow; paratype body (Figs 126, 127) uniformly brown, except for almost black head and scape brown, legs mostly yellow except for partly or almost entirely brown coxae and metafemur, anterior extension of ovipositor from level of head almost white (Figs 126, 127). **Head.** Head width 640–690. Vertex horizontal, forming almost right angle with face, with ocelli in anterior half and mid ocellus in contact with transverse trabecula. Eye almost circular, slightly narrower ventrally than dorsally. Gena at dorsal and ventral margins of eye almost equally wide. Mandible massive, extending ventral to head by at least half face height. **Antenna.** Each funicle segment in lateral view at least twice its width as in dorsal view, with about 25–30 short mps in 3 more or less overlapping whorls (Fig. 38). Clava with about 10 mps on each segment. Antennal measurements (n=2), length/width (ratio of flagellar segments): scape 297–317/109–119 (2.58–2.91), pedicel 54–69/59–69 (1.08–1.07), fl_1 228/109–119 (1.92–2.09), fl_2 262–267/89–109 (2.45–2.94), fl_3 248–257/89–99 (2.60–2.78), fl_4 238–248/79 (3.00–3.13), fl_5 228/69–74 (3.07–3.29), fl_6 198–218/69 (2.86–3.14), fl_7 178–198/69



Figures 126, 127. *Neotriadomerus longissimus*, paratype, lateral (Brisbane Forest Park). **126** habitus, lateral **127** anterior body, enlarged. Scale bar for **126** = 2000 μm ; **127** = 1000 μm .

(2.57–2.86), fl_8 168–178/69 (2.23–2.57), entire clava 267/64–69 (3.86–4.05), with segments 1–3, respectively, 109, 69 and 89–99 long. **Mesosoma.** Mesosoma length 110–120. **Wings.** Fore wing length (n=2) 2460–2790, width 670–845, length/width 3.30–3.72, longest marginal setae 100; cubital line of setae extending halfway between apex and base of parastigma (about midway between level of proximal and distal macrochaetae). Hind wing length 1970–1790, width 205–230, longest marginal setae 100–130. **Metasoma.** Metasoma (paratype only) in dorsal view thin, 260 at its widest (near apex) and 80 at its narrowest, its length (near middle) 345 and 390 (holotype and paratype), 3.18–3.25× as long as mesosoma; in lateral view 435 high (near apex) and 205 (near middle); gt_1 – gt_7 lengths (paratype only) 715: 690: 155: 715: 740: 435: 80; hypopygium extending about 0.3× length of gaster. Ovipositor sheath length (n=2) 5900–6300, 6.23–7.9× metatibia length (795–950) and extending anteriorly to well in front of head but barely extending posterior to apex of gaster (Fig. 126).

Male. Unknown.

Etymology. The species name, *longissimus*, is Latin for longest, referring the extremely long gaster.

***Neotriadomerus powerae* Huber, sp. n.**

<http://zoobank.org/AEDF1141-A5A7-48EF-935A-A47373FE4329>

Figs 128–143

Type material. Holotype female (ANIC) on slide (Fig. 130) labelled: 1. “Australia: Qld. Brisbane Forest Park, 27°25'04"S 152°49'48"E 29.xi-5.xii.1997, dry sclerophyll, N. Power, Mt”. 2. “Neotriadomerus powerae Huber ♀ dorsal holotype”.

Paratypes. 1 female, 3 males. AUSTRALIA. **Queensland:** Same data as holotype but 14–20.iii.1998 (1♀ and 1♂, CNC), 28.xi.1998 (1♂, ANIC), 26.ix-2.x.1999 (1♂, ANIC). The collector stated that the specimens were collected in a Malaise trap set across a creek bed running through the base of an occasionally flooded gully between two sections of dry sclerophyll.

Diagnosis. *Neotriadomerus powerae* differs from other small (body length less than 2600) species of *Neotriadomerus* as follows: fore wing with cubital line extending to just proximal to base of parastigma (Fig. 132); fl_2 – fl_7 each just over twice as long as wide, with at least 8 mps and clava with 6 mps on each segment (Fig. 131).

Description. Female. Body length ≈ 1560 (holotype). **Colour.** Body (Fig. 128) almost uniformly dark brown; legs brown, with trochantelli, base and apex of femora and entire protibia, and base and apex of meso- and metatibiae, and tarsi except tarsomere 5 paler, almost white; tarsomere 5 brown. **Head.** Head width 363 (holotype). **Antenna.** Fl_1 almost as long as fl_2 , with 8 mps; fl_2 about equal to fl_3 or following funicle segments except fl_7 or fl_8 , with 8 mps; fl_3 – fl_6 with 8 mps, fl_7 and fl_8 apparently with 9 or 10 mps. Clava with 18 mps, 6 on first, 6 on second and 6 on third segment (Fig. 131). Antennal measurements (n=1), length/width (ratio of flagellar segments):



Figure 128. *Neotriadomerus powerae*, paratype female habitus, dorsal (Brisbane Forest Park). Scale bar = 1000 μm .

scape $\approx 138/44$ (≈ 3.15), pedicel $54/43$ (1.27), fl_1 $84/48$ (1.77), fl_2 $88/43$ (2.07), fl_3 $90/44$ (2.06), fl_4 $88/42$ (2.10), fl_5 $88/40$ (2.19), fl_6 $89/40$ (2.23), fl_7 $86/42$ (2.05), fl_8 $82/43$ (1.91); entire clava $151/47$ (3.23), with segments 1–3 length [measured along dorsal margin] 50, 37, and 64. **Mesosoma.** Width 284, length 578, with 3 propodeal setae (Fig. 133). **Wings.** Fore wing length 1173, width 417, length/width 2.81, longest marginal setae 52. Hind wing length 940, width 130, longest marginal setae 62. **Legs.** Protibia with 5 short, thick pegs along its length and a transverse row of 4 abutting pegs apically (as in Fig. 53). **Metasoma.** Metasoma height in lateral view 270. Gaster length 865, about $1.5\times$ as long as mesosoma; gt_1 – gt_7 lengths about 169: 106: 99: 113: 162: 170 (Figs 134, 135) [measurement of a tergum excludes the telescoped portion inside another (more anterior) tergum]; hypopygium (difficult to see) extending posteriorly to level of apex of tergum 5. Ovipositor sheath length 1113, $\approx 2.73\times$ metatibia



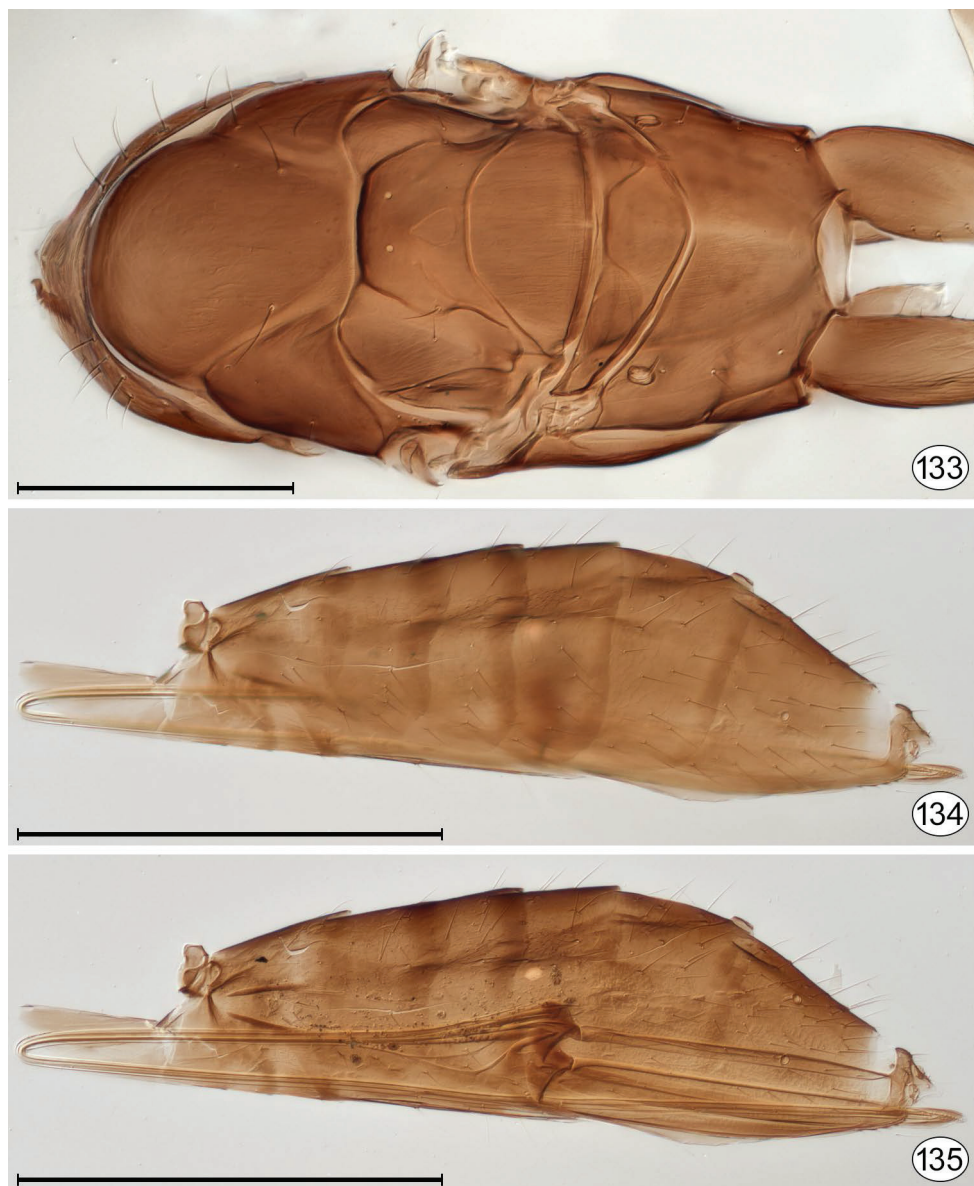
Figure 129. *Neotriadomerus powerae*, paratype male habitus, lateral (Brisbane Forest Park). Scale bar = 1000 μm .

length (≈ 51), extending anteriorly to about level of apex of procoxa and extending posteriorly slightly beyond apex of gaster (Figs 134, 135).

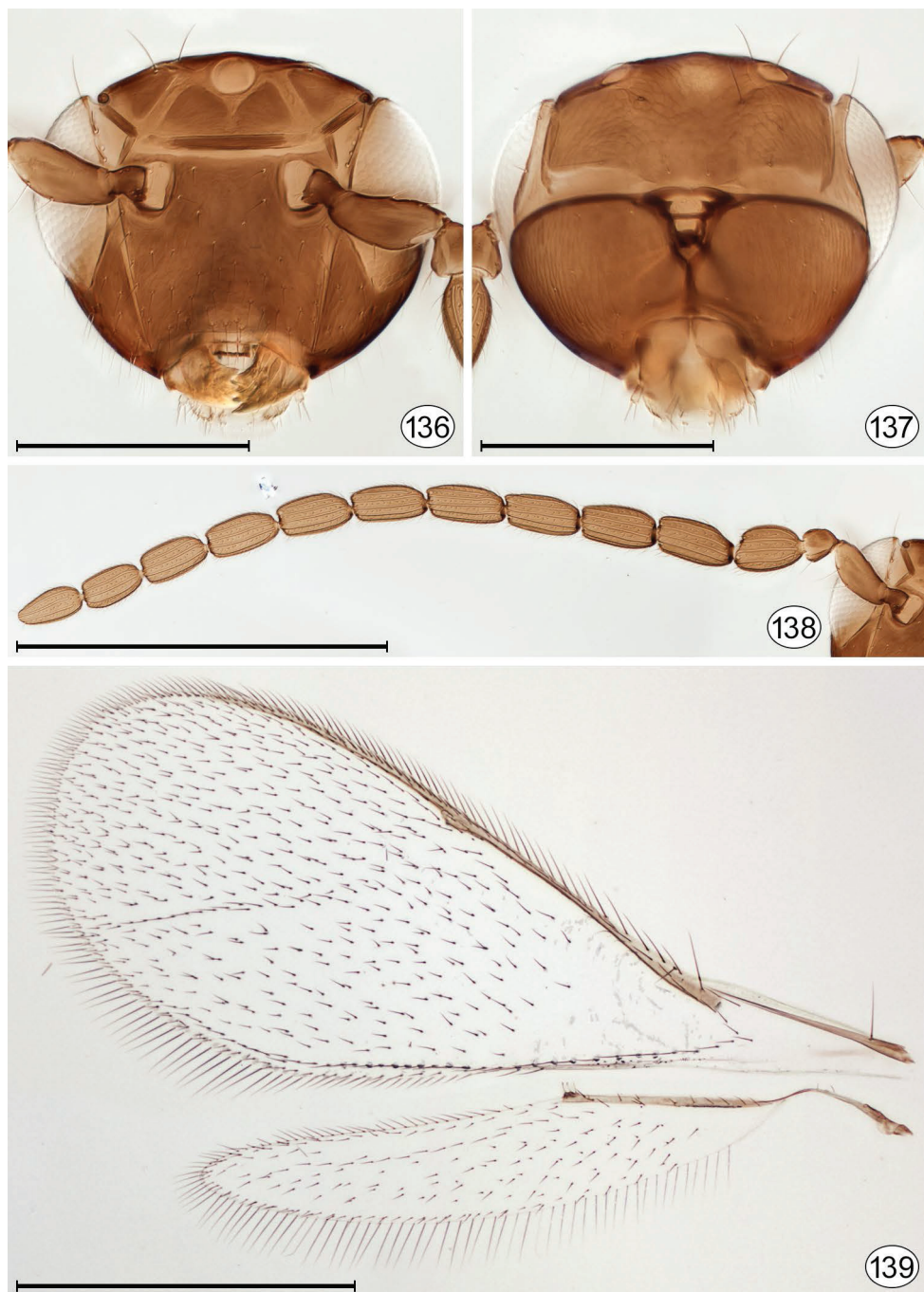
Male. Colour. As for female (Fig. 129). **Head.** Head (Figs 136, 137) width 346 ($n=1$). **Antenna.** Measurements, length/width: scape 124/45, pedicel 49/43, flagellar segments: fl₁ 97/62, fl₂ 108/54, fl₃ 104/56, fl₄ 102/50, fl₅ 108/50, fl₆ 102/50, fl₇ 98/53, fl₈ 99/51, fl₉ 94/50, fl₁₀ 86/47, fl₁₁ 90/45; total flagellar length 1089; fl₆ length/width



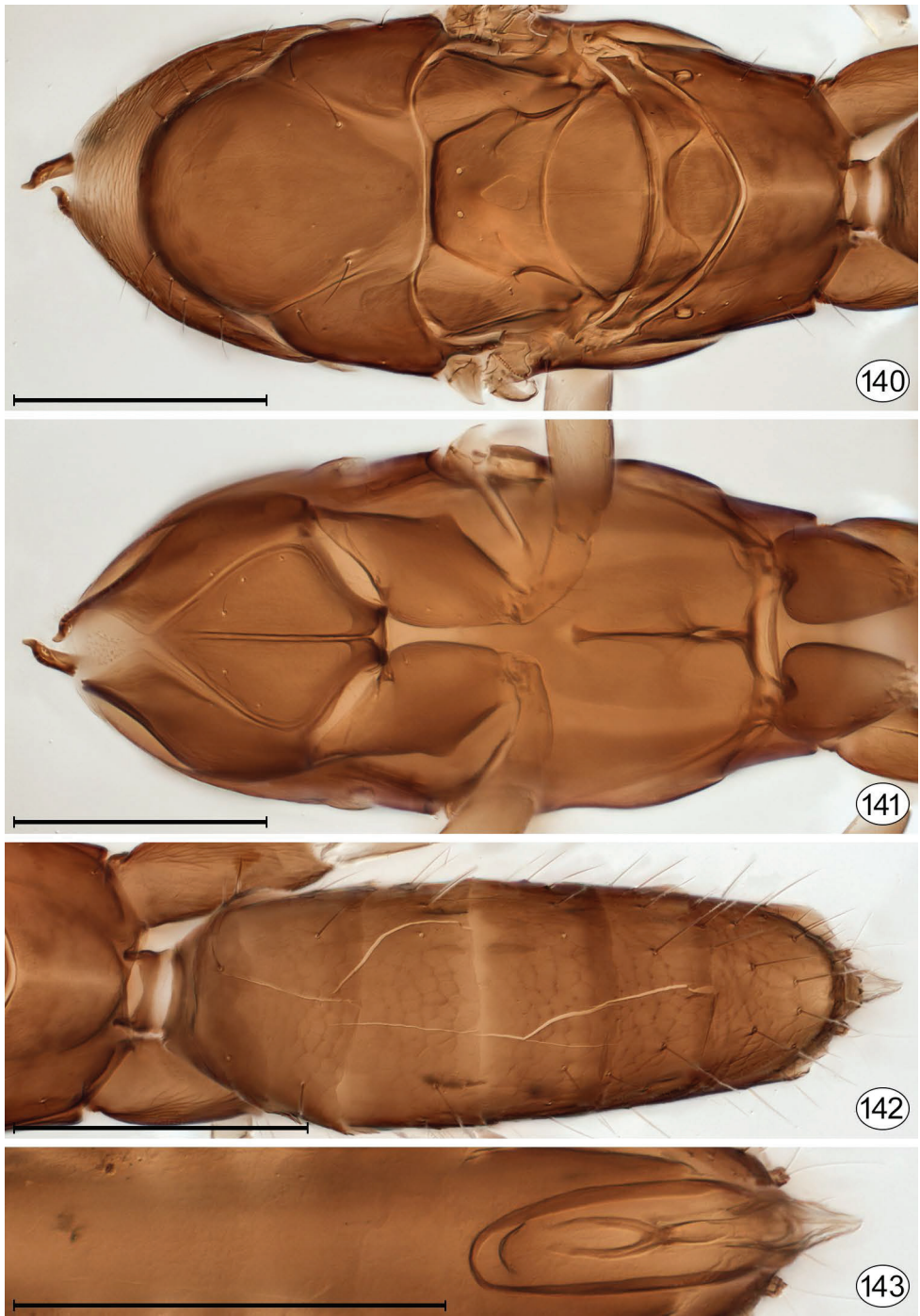
Figures 130–132. *Neotriadomerus powerae*, holotype. **130** type slide **131** head + antenna, anterior **132** wings. Scale bar = 500 μ m.



Figures 133–135. *Neotriadomerus powerae*, holotype. **133** mesosoma, dorsal **134** mesosoma, lateral **135** mesosoma, median plane. Scale bar for **133** = 200 μm ; **134**, **135** = 500 μm .



Figures 136–139. *Neotriadomerus powerae*, male paratype (Brisbane Forest Park). **136** head, anterior **137** head, posterior **138** antenna **139** wings. Scale bar for **136**, **137** = 200 μm ; **138**, **139** = 500 μm .



Figures 140–143. *Neotriadomerus powerae*, male paratype (Brisbane Forest Park). **140** mesosoma, dorsal **141** mesosoma, ventral **142** metasoma, dorsal **143** genitalia, dorsal seen through gaster. Scale bar = 200 μm .

2.04, with 12 mps (Fig. 138). **Mesosoma.** Mesosoma length 610, about 1.24× as long as metasoma length (494); propodeum with 3 propodeal setae (Fig. 140). **Wings.** Fore wing length (n=1) 1043, width 386, length/width 2.70, longest marginal setae 76; cubital line extending to just proximal to base of parastigma (Fig. 129). Hind wing length 834, width 132, longest marginal setae 62. **Metasoma.** Petiole length 13, width 29. Gaster length 468; gt_1 – gt_5 with 1 long dorsal setae and 4 long lateral setae on each side and gt_6 with about 5 long dorsal setae, 3 long lateral setae, and about 20 short lateral setae on each side (Fig. 142). Genitalia as in Fig. 143.

Etymology. The species is named after Narelle Power, who ran a Malaise trap for many months in Brisbane Forest Park.

Neotriadomerus sp. 1.

Figs 144, 145

Material examined. AUSTRALIA. **Australian Capital Territory:** 3 km E. Piccadilly Circus, Blundells Creek, 35.22°S, 148.50°E, 850m, xii.1984, Weir, Lawrence, Johnson (1♀ and 1♂, ANIC).

Comment. The female (Fig. 144) and male (Fig. 45) almost certainly are conspecific, with body lengths 2460 and 2480, respectively. Female antenna with 2 widely overlapping whorls of mps (each segment with about 10? mps); male antenna with 2 narrowly overlapping whorls of mps (each segment with about 20? mps). This species most resembles *N. longiovipositor* but differs in that the cubital line of setae extends proximal to base of parastigma, unlike in *N. longiovipositor*.

Neotriadomerus sp. 2

Fig. 146

Material examined. AUSTRALIA. **Western Australia:** 29 km SE by E of Coolgardie, 31.07°S, 121.24°E, 5.v.1983, E.S. Nielsen, E.D. Edwards (1♀, ANIC).

Comment. Body length 1380. Female antenna with 1 whorl of mps on each segment and the shortest and widest funicle segments (Fig. 146) of any *Neotriadomerus* species; fore wing with cubital line of setae extending to base of parastigma.

Neotriadomerus sp. 3

Fig. 147

Material examined. AUSTRALIA. **New South Wales:** Kosciusko National Park, Leather Barrel Creek, 0.8 km SW. Picnic Area, 36°32'S, 148°11'E, 1080m, 7–21. ii.1993, A. Newton, M. Thayer, open Eucalyptus forest (gum + *delegatensis*) with shrubby understory, window trap (1♀, ANIC).



Figures 144, 145. *Neotriadomerus* sp. 1 (Australia, ACT, 3 km E. Piccadilly Circus, Blundells Creek, 35.22°S, 148.50°E, 850m, xii.1984. **144** female habitus, dorsolateral **145** male habitus, dorsal. Scale bar = 1000 μ m.



Figure 146. *Neotriadomerus* sp. 2, female habitus, lateral (Australia, WA, 29 km SE by E of Coolgardie, 31.07°S, 121.24°E, 5.v.1983). Scale bar = 1000 μ m.

Comment. Body length 1920; fore wing with cubital line of setae extending to base of parastigma. This specimen is similar to the female from Blundells Creek but fl_1 is even shorter than fl_2 so it is provisionally treated as distinct.

Neotriadomerus sp. 4

Figs 148–152

Material examined. AUSTRALIA. **Northern Territory:** 12 km WNW Ross River, Tourist Camp, 23.32°S, 134.23°E, 13.v.1978, J.C. Cardale (1♂, ANIC).

Description. Male. Body length \approx 1330. **Colour.** Body almost uniformly dark brown; legs brown, with trochantelli, base and apex of femora and tibiae, and tarsi except tarsomere 5 paler; tarsomere 5 brown. **Antenna.** Measurements, length/width: scape 139/46, pedicel length/width 52/46, flagellar segment length: fl_1 100/68, fl_2 94/67, fl_3 97/61, fl_4 100/56, fl_5 100/56, fl_6 98/54, fl_7 96/54, fl_8 96/53, fl_9 92/50, fl_{10} 87/46, fl_{11} 94/37; total flagellar length 1053; fl_6 length/width 1.81, with 11 (12?) mps

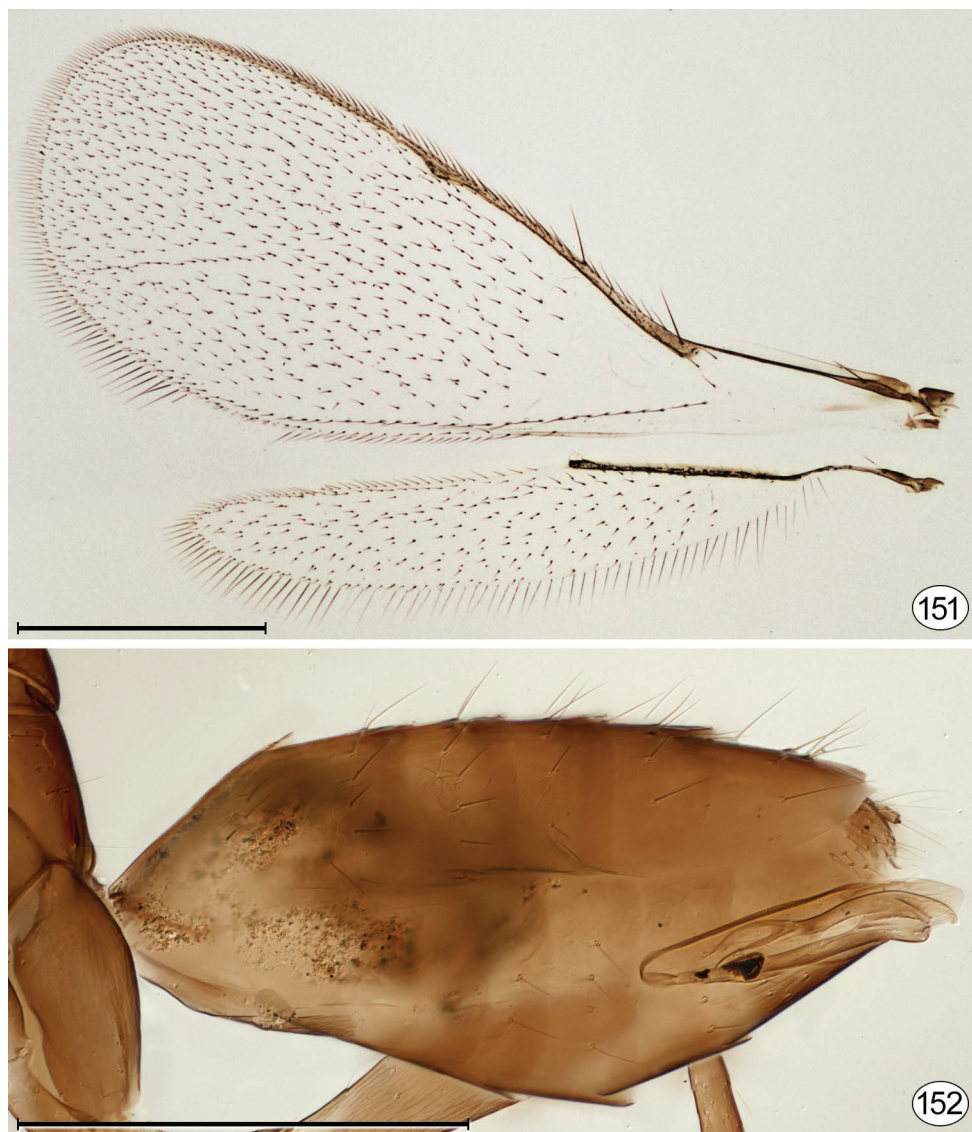


Figure 147. *Neotriadomerus* sp. 3, female habitus, lateral (Australia, NSW, Kosciusko National Park, Leather Barrel Creek, 0.8 km SW. Picnic Area, 36°32'S, 148°11'E, 1080m, 7–21.ii.1993). Scale bar = 1000 μ m.

(Fig. 150). **Mesosoma.** Mesosoma (Figs 148, 149) length 640, 1.16 \times as long as metasoma length; propodeum with 3 propodeal setae (Fig. 149). **Wings.** Fore wing length 1077, width 398, length/width 2.71, longest marginal setae 60; cubital line extending to just proximal to base of parastigma (Fig. 151). Hind wing length 900, width 138,



Figures 148–150. *Neotriadomerus* sp. 4, male (Australia, NT, 12 km WNW Ross River, Tourist Camp). **148** head and anterior mesosoma, lateral **149** mesosoma, lateral **150** antenna. Scale bar for **148**, **149** = 200 μm ; **150** = 400 μm .



Figures 151–152. *Neotriadomerus* sp. 4, male (same data as **148–150**). **151** wings **152** metasoma, lateral. Scale bar = 300 μ m.

longest marginal setae 64. **Metasoma.** Gaster length 517, with setae present on sterna but fewer than on terga (Fig. 152). Genitalia length 220 (Fig. 152).

Comment. The flagellar segments are wider than those of *N. darlingi* (Figs 82, 95?), *N. longiovipositor* (Fig. 121), and *N. powerae* (Figs 129, 138) and *N. sp. 1*; the number and distribution of mps are most similar to *N. darlingi* or *N. powerae* and the propodeum has 3 setae as in *N. powerae*. The condensed description given above may help associate the male with a conspecific female when they are collected, preferably together with more males.

***Proarescon* Huber, gen. n.**

<http://zoobank.org/9D52630E-F7D4-4DE0-A3D1-0469F28531E2>

Figs 153–176

Type species. *Borneomymar primitivum* Huber, by present designation.

Diagnosis. Female. Antenna with funicle 8-segmented (in *Arescon* 5-segmented) and clava 1-segmented, gradually narrowing apically to a point (Figs 156, 166). **Both sexes.** Fore wing with microtrichia more densely spaced except for oval area along posterior margin (in *Arescon* with microtrichia usually more sparsely spaced, as shown in Triapitsyn [2016]).

Description. Female. Body 635–720 in length (critical point dried). **Colour.** Body generally light brown with some areas yellow to creamy white; darker brown are mouth margin, trabeculae, ocellar triangle, clava except apex, dorsellum, meso- and metapleuron, propodeum, and gt_4 – gt_5 (Figs 165, 168, 170). Wings hyaline except for light brown behind venation (Fig. 169 and Huber 2002, fig. 5). **Head.** Head about 1.50–1.59× as wide as long, about 1.29–1.35× as wide as high, and 1.17–1.18× as high as long; in lateral view with anterior surface slightly convex, flat at level of toruli, then evenly curved to mouth margin; posterior surfaces convex and evenly curved from vertex to mouth margin. Face about 0.9× as wide as high; subantennal groove absent; preorbital groove ventral to level of torulus straight then more ventrally curving slightly medially to lateral margin of mouth opening (Figs 153, 171–male). Torulus in slight triangular depression about 1.7× as high as torulus width and separated by about 2.0× its width from transverse trabecula (Fig. 171–male). Vertex in lateral view horizontal, forming a right angle with face, posteriorly almost at right angle with occiput and separated from it by medially divided transverse vertexal suture extending behind posterior ocelli almost from eye to eye; occiput separated from gena by a short, oblique posterior extension of supraorbital suture extending from lateral apex of vertexal suture and curving ventrally to dorsolateral corner of occipital foramen. Ocellar triangle small, slightly raised, with mid ocellus almost vertical and lateral ocelli oblique and facing posteriorly; ocelli with POL about 1.0× LOL and about 0.67× LOL; ocelli on stemmaticum (Fig. 154)—seen as white lines in cleared slide mounts (Fig. 165)—these are, respectively, a short, transverse groove in front of mid ocellus, continuing anterolaterally as the frontal suture to midpoint of supraorbital trabecula (apparently divided medially by an unsclerotized area), a groove between the lateral margins of mid and lateral ocelli—the frontofacial suture, and a medially divided transverse groove behind the lateral ocelli, the vertexal suture, extending almost from eye to eye. Transverse trabecula darkly sclerotized medially and at each apex apparently not separated from supraorbital trabecula; preorbital trabecula extending ventrally about halfway between dorsal and ventral margins of torulus to where torulus nearest to eye; supraorbital trabecula in 2 almost equal sections, the anterior sections diverging posteriorly, the posterior sections parallel (Fig. 165). Eye large with numerous small facets, in lateral view about as high as wide and clearly separated dorsally from back of head (temple about 0.3× eye width). Ocular apodeme long and straight, needle-like. Malar sulcus present. Gena at level of ventral margin of eye slightly wider than malar space. Occiput separated from temple by occipital groove

(Fig. 165) but otherwise not separated from gena/postgena. **Mouthparts.** Labrum with 1? seta; mandible with 4 uneven teeth (Fig. 153). **Antenna.** Scape 3.4–4.7× as long as wide, with radicle distinct from rest of scape and about 0.36–0.37× total scape length; pedicel about 2.0× as long as wide, almost as wide as and 0.26–0.27× as long as entire scape; funicle 8-segmented; clava 1-segmented, 0.98–1.10× as wide as apical funicle segment and 0.41–0.63× as long as entire funicle (Figs 156, 166, and Huber 2002, fig. 6). **Mesosoma.** About 1.7× as long as wide, 1.8× as long as high and 1.2× as wide as high. Pronotum entire (Fig. 157), in dorsal view clearly visible, medially about 0.5× as long as mesoscutum, with collar bell-shaped in lateral view pronotum sloping down towards junction with head and neck almost absent (not separable), and lateral panel somewhat rectangular and overlapping anterior margin of mesoscutum, with lateral surface merging smoothly into dorsal surface, with a shallow, oblique groove for femur. Spiracle (Fig. 157) flat with surface of pronotum, facing posterodorsally, and apparently slightly closer to anterior apex of notaulus than to posterolateral angle of pronotum. Propleura near anterior apex not quite abutting, then gap widening slightly more anteriorly. Prosternum rhomboidal and completely divided medially by faint longitudinal groove. Mesoscutum about 1.8× as long as scutellum, in dorsal view with shallow, thin, slightly diverging notauli a little wider and shallower posteriorly (Figs 157, 158, 168), in lateral view almost flat. Scutellum slightly wider than long, the anterior scutellum about 0.9× as long as frenal and separated from it by a shallow, medially straight frenal depression (Fig. 157); campaniform sensilla about as far from each other as to lateral margin of anterior scutellum; fenestra small, almost circular, and posterior to campaniform sensilla (Fig. 168, inset). Axilla distinctly advanced, the transscutal articulation laterally forming a distinct angle with median section (Fig. 168); axillula short, separated from anterior scutellum by concave axillular groove; mesophragma fairly narrowly convex posteriorly, extending to posterior apex of propodeum. Prepectus apparently narrowly triangular; mesopleuron somewhat rectangular, with shallow depression separating mesepisternum from mesepimeron. Metanotum with distinct triangular (Fig. 159) or lens-shaped (Fig. 168, in cleared slide mounts) dorsellum and lateral panel length toward hind wing articulation about one third length of dorsellum. Metapleuron triangular, the margin at junction with mesopleuron almost straight and posterior margin straight and vertical. Propodeum without carinae, with 1 propodeal seta (Fig. 159). **Wings.** Fore wing wide, with microtrichia on most of membrane beyond and partly behind venation to level of second macrochaeta except for a bare area medially along posterior margin (Fig. 169). Venation complete; submarginal vein with 1 proximal macrochaeta but no distal seta; parastigma 0.73× submarginal vein length; marginal vein present, its length about 1.42× parastigma length, with a second macrochaeta about midway between first distal macrochaeta and stigmal vein; stigmal vein distinct, about 0.28× length of marginal vein, with anterior margin of stigma parallel or converging with wing margin and with 4? apical campaniform sensilla in a line; postmarginal vein present, apparently about 1.1× as long and almost as thick as marginal vein; hypochaeta fairly close (about 0.3× length of parastigma) to proximal macrochaeta; proximal campaniform sensillum near posterior margin of parastigma just next to first distal macrochaeta. Hind wing normal (Fig. 169). **Legs.** Profemur slightly wider than meso- and metafemora; metafemur

about $1.2\times$ mesofemur width. Tarsi 5-segmented. Calcar (moveable protibial spur) with about 2 setae along outer margin, and with inner tine about $0.45\times$ outer tine length. Middle and hind legs with tarsomere 1 as long as tarsomere 2. **Metasoma.** $1.95\times$ as long as wide, $2.18\times$ as long as high and $1.12\times$ as wide as high; its length, excluding exerted part of ovipositor, about $1.37\times$ that of mesosoma. Petiole ring-like, about $0.36\times$ as long as wide. Gastral terga about equal in length except gt_6 slightly longer (Figs 162, 170). Cercus flat, with 4 setae, the second-most dorsal one longest (Figs 162, 170). Hypopygium short, extending about one-third ovipositor length (Fig. 170). Ovipositor sheath exerted beyond gastral apex by about $0.2\times$ total sheath length, with 1 subapical seta.

Male. Body length ≈ 585 (slide mounted paratype). **Colour.** Similar to female but with slightly more extensive brown on mesosoma (Fig. 173), and metasoma with brown apically instead of medially (Fig. 175). **Head.** As for female, mandible with 4 teeth (Fig. 171). **Antenna.** Scape ($n=1$) about $3.00\times$ as long as wide, with radicle about $0.35\times$ scape; pedicel $1.28\times$ as long as wide; flagellum 11-segmented, with fl_1 shorter and wider than other segments, fl_2-fl_{11} subequal, each flagellomere with 4 mps (Fig. 172). **Mesosoma.** As for female (Figs 159, 160, 173). **Wings.** Fore wing (Fig. 174) with proximal campaniform sensillum near posterior margin of marginal vein about midway between first and second distal macrochaeta. **Metasoma.** Petiole length/width 0.38 ; gaster about $0.82\times$ as long as mesosoma (Fig. 162). Genitalia with long parameres and apparently no digiti (Figs 163, 164, 176).

Etymology. The genus is masculine. The prefix, *pro-* is Latin for in front of, earlier or first, + *Arescon*, apparently the most closely related genus.

Key to species of *Proarescon*. Females.

- 1 Clava $4.7\times$ times as long as wide, with ventral margin distinctly concave (Figs 156, 166); fore wing with cubital line extending proximally to about level of second distal macrochaeta (Fig. 169), not much further towards wing base than remaining microtrichia on wing surface.... ***P. similis* Huber, sp. n.**
- Clava less than $3.5\times$ as long as wide, with ventral margin almost straight (Huber 2002, fig. 6); fore wing with cubital line extending proximally almost to level of proximal macrochaeta, distinctly further towards wing base than remaining microtrichia on wing surface (Huber 2002, fig. 5).....
.....***P. primitivus* (Huber)**

Proarescon primitivus (Huber), comb. n.

Figs 153–176

Borneomymar primitivum Huber, 2002: 49 (description, figs 5, 6).

Comment. In Huber (2002) the female and male symbols in the material examined sections were inadvertently either deleted or were replaced by a question mark. All

the specimens of the three species mentioned in that chapter were females except for 2 males on points and 2 males on slides of *Borneomymar discus* Huber from Malaysia, Sarawak, Gunung Buda. The brief description below complements the original description, which did not include antennal segment widths or hind wing measurements.

Description. Female. Body length 634 (paratype). **Antenna.** Length/width measurements (holotype): scape 184/35, pedicel 50/26, fl₁ 16/13, fl₂ 16/12, fl₃ 23/16, fl₄ 26/16, fl₅ 29/18, fl₆ 62/25, fl₇ 59/26, fl₈ 63/31, clava 120/35. **Wings.** Fore wing length 583, width 154, length/width 3.78, longest marginal setae 122. Hind wing length 560, width 23, longest marginal setae 90.

Material examined. THAILAND: Chanthaburi, Khao Kitchakut Nat. Park, Khao Prabaht Peak, 12°50.45'N 102°9.81'E, 875m, 27.ii-6.ii.2009, MT, Suthida and Charoenchai, #4046 (1♀, CNC).

***Proarescon similis* Huber, sp. n.**

<http://zoobank.org/7CEE8233-FC3D-4B9D-AB79-CCEFA137E27D>

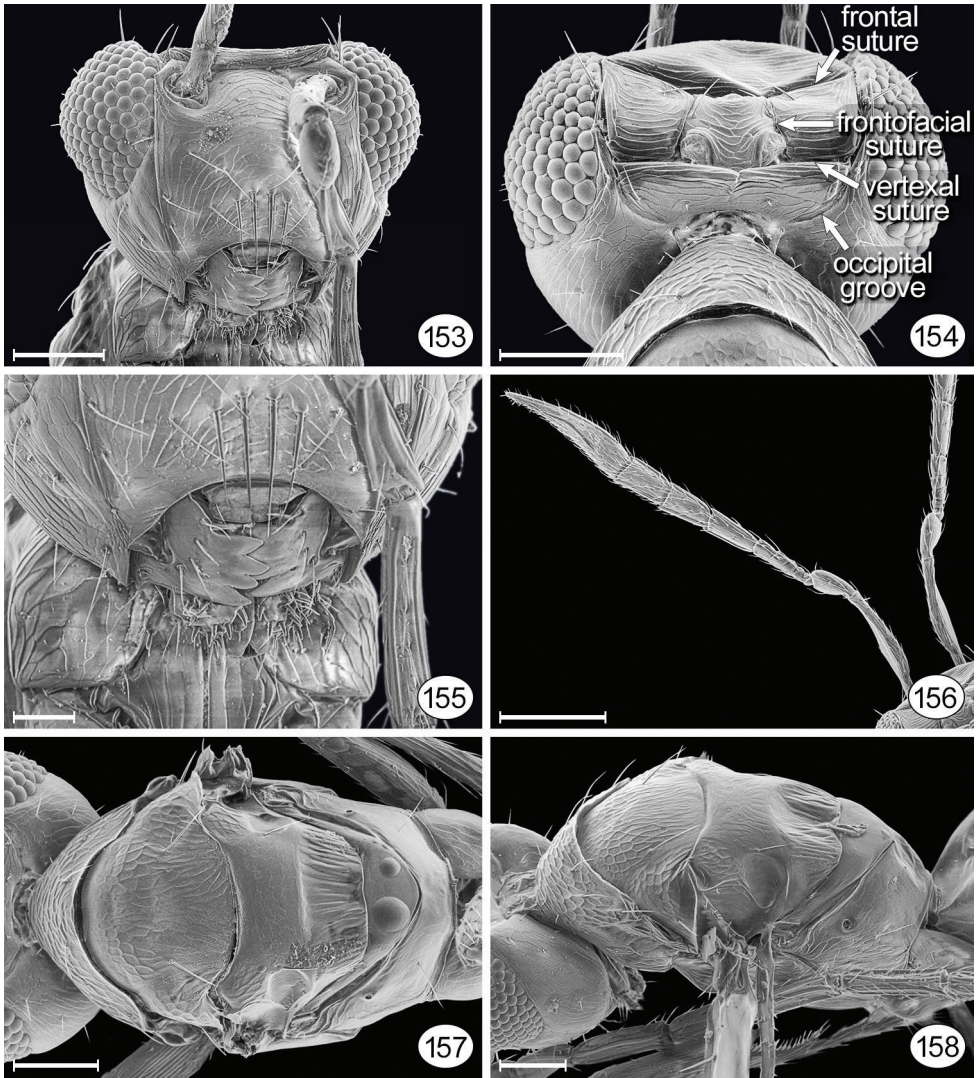
Figs 153–176

Type material. Holotype female (QSBG) on slide (Fig. 167) labelled: 1. “*Proarescon similis* Huber ♀ dorsal Holotype”. 2. “Thailand: Surat Thani, Khao Sok Nat. Park, Klong Morg Unit, 87 m, 8°53.725'N 99°38.025'E, MT 10-17.ii.2009, Phongphan, #3937”.

Paratypes. 1 female and male. **THAILAND. Nakhon Si Thammarat.** Namtok Yong Nat. Park, TV aerial, 966m 8°14.262'N; 99°48.289'E, 15-22.ix.2008, Malaise trap, Paiboon, #3540 (1♂ on slide, QSBG); Namtok Yong Nat. Park, Klong Jang waterfall, 8°16.283'N; 99°38.702'E, 154m, Malaise trap, 23.ii-2.iii.2009, S. Samnaokan, #4665 (1♂, CNC). **Surat Thani.** Khao Sok Nat. Park, 122m, 8°54.555'N; 98°30.522'E, Malaise trap, 13-20.i.2009, Pongphan, #3914 (1♀, CNC).

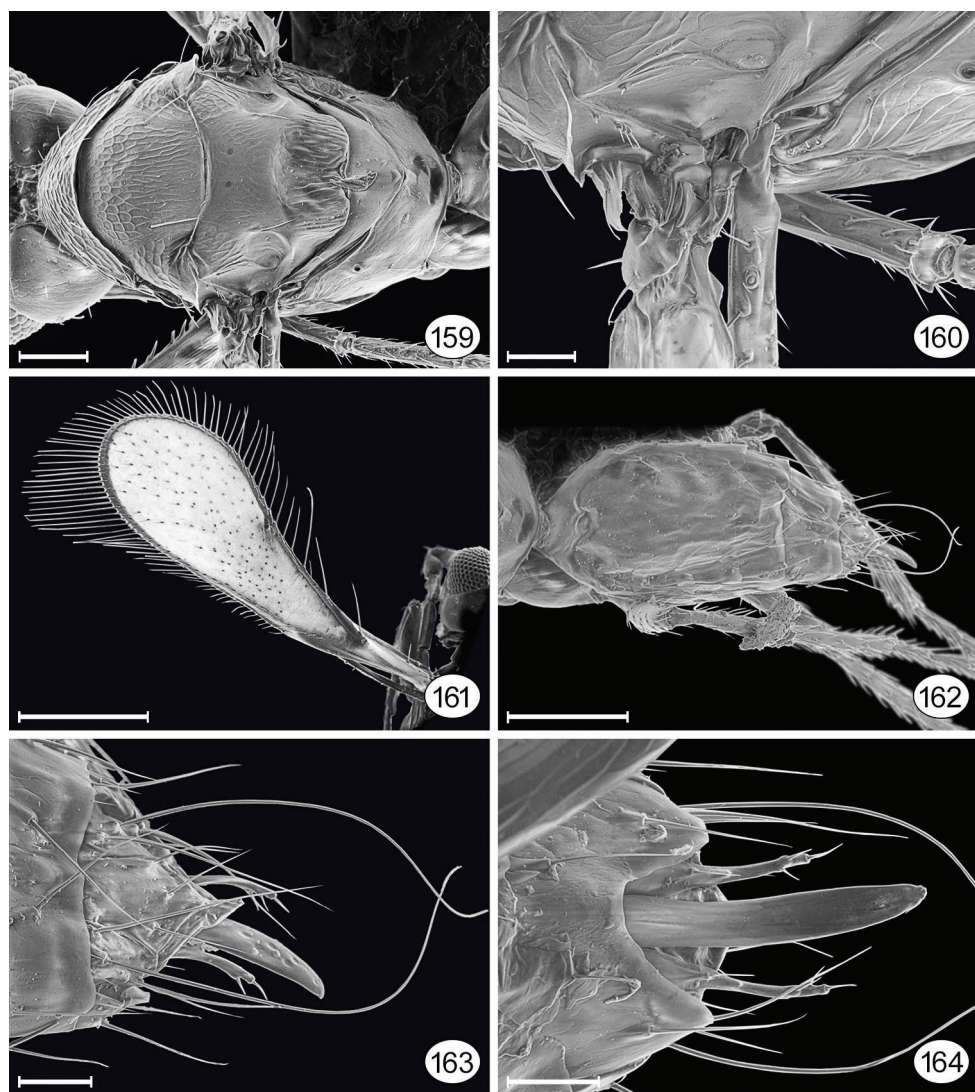
Diagnosis. Female. Clava 4.7× times as long as wide, with ventral margin distinctly concave (in *P. primitivus*, clava about 3.4× as long as wide, with ventral margin almost straight); fore wing with cubital line not extending proximally beyond first apical macrochaeta, barely proximal to remainder of microtrichia (in *P. primitivus*, cubital line extending proximally almost to level of proximal macrochaeta, distinctly proximal to other microtrichia).

Description. Female. Body length 740 (holotype), 634 (paratype on card). **Head.** Head width 182 (holotype). Face with weak elongate reticulate sculpture, vertical laterally becoming horizontal medially, with thin setae distributed on each side as follows: 2 medial to torulus and 7 ventral to torulus, the 2 setae submedially above mouth margin longer and thicker than the others (Fig. 153). Vertex with transverse elongate reticulate sculpture, with 1 or 2 setae on orbit of eye lateral to transverse trabecula and 2 setae between eye and posterior section of supraorbital trabecula and 1 seta lateral to posterior apex of vertexal suture; ocellar triangle (inside stemmaticum) with 1 seta between mid and lateral ocelli and 1 setae lateral to mid ocellus but outside triangle



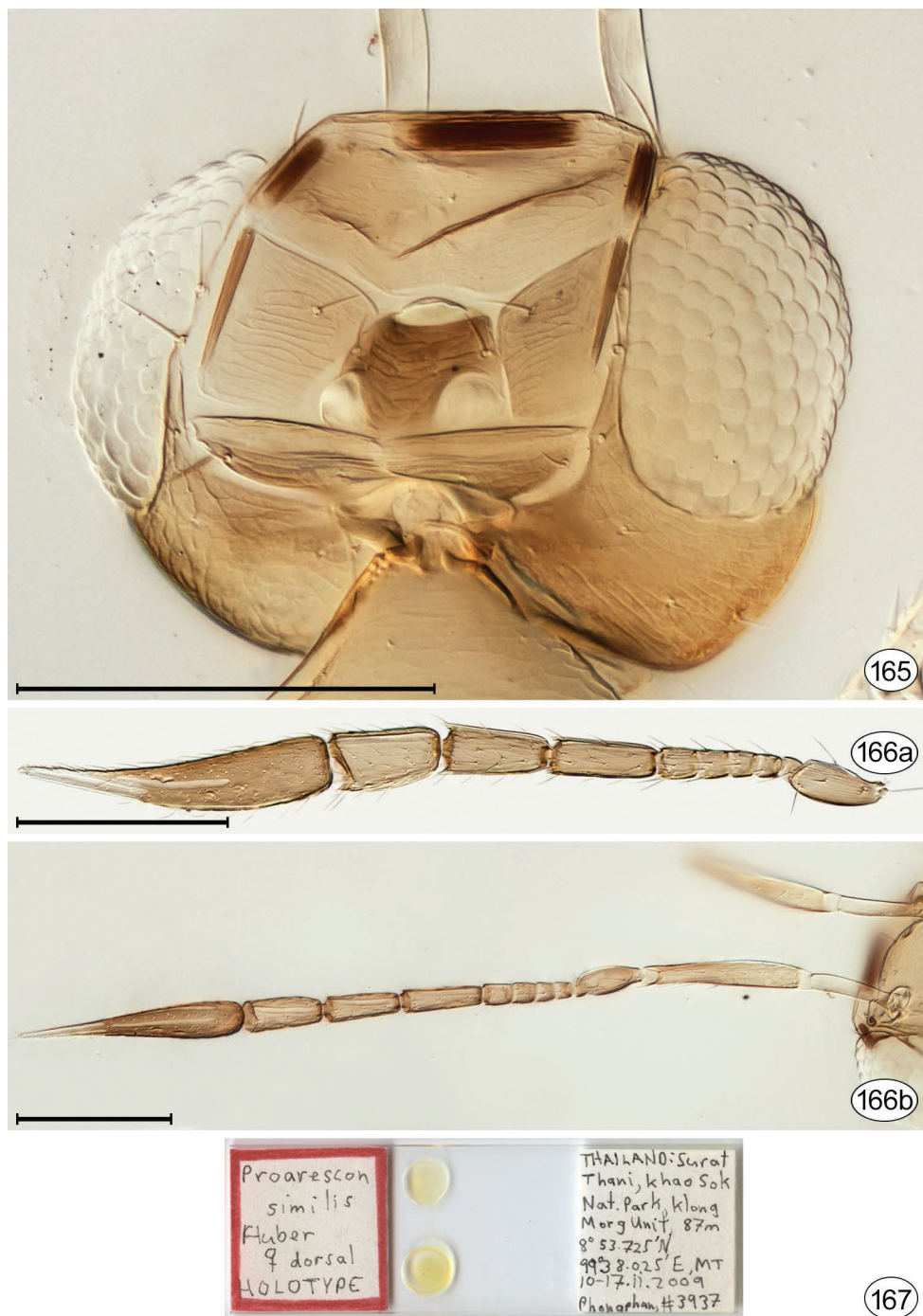
Figures 153–158. *Proarescon similis*. **153** male head, ventroanterior **154** female head and pronotum, posterodorsal **155** male lower face and prosternum **156** female antennae **157** female mesosoma, dorsal **158** male mesosoma, dorsolateral. Scale bar for **153**, **154**, **157**, **158** = 50 μ m; **155** = 20 μ m; **156** = 100 μ m.

(Fig. 165). Malar space with 2 setae. Occiput with engraved transverse reticulate sculpture, with 1 short setae submedially and 1 sublaterally above occipital foramen. Gena with longitudinally reticulate sculpture laterally, becoming isodiametric around foramen, and with about 5 setae sublaterally and laterally. **Antenna.** Fl₁–fl₅ without mps, Fl₆–fl₈ each with 2 mps; clava with 6 mps. Length/width measurements: scape 166/–, pedicel 39/–, fl₁ 11/12, fl₂ 13/12, fl₃ 12/13, fl₄ 15/14, fl₅ 18/16, fl₆ 50/16, fl₇ 51/21, fl₈ 54/31, clava 143/30. **Mesosoma.** Width 156 and length 287. Pronotum with raised transverse to isodiametric reticulate sculpture, with 3 long setae near posterior margin

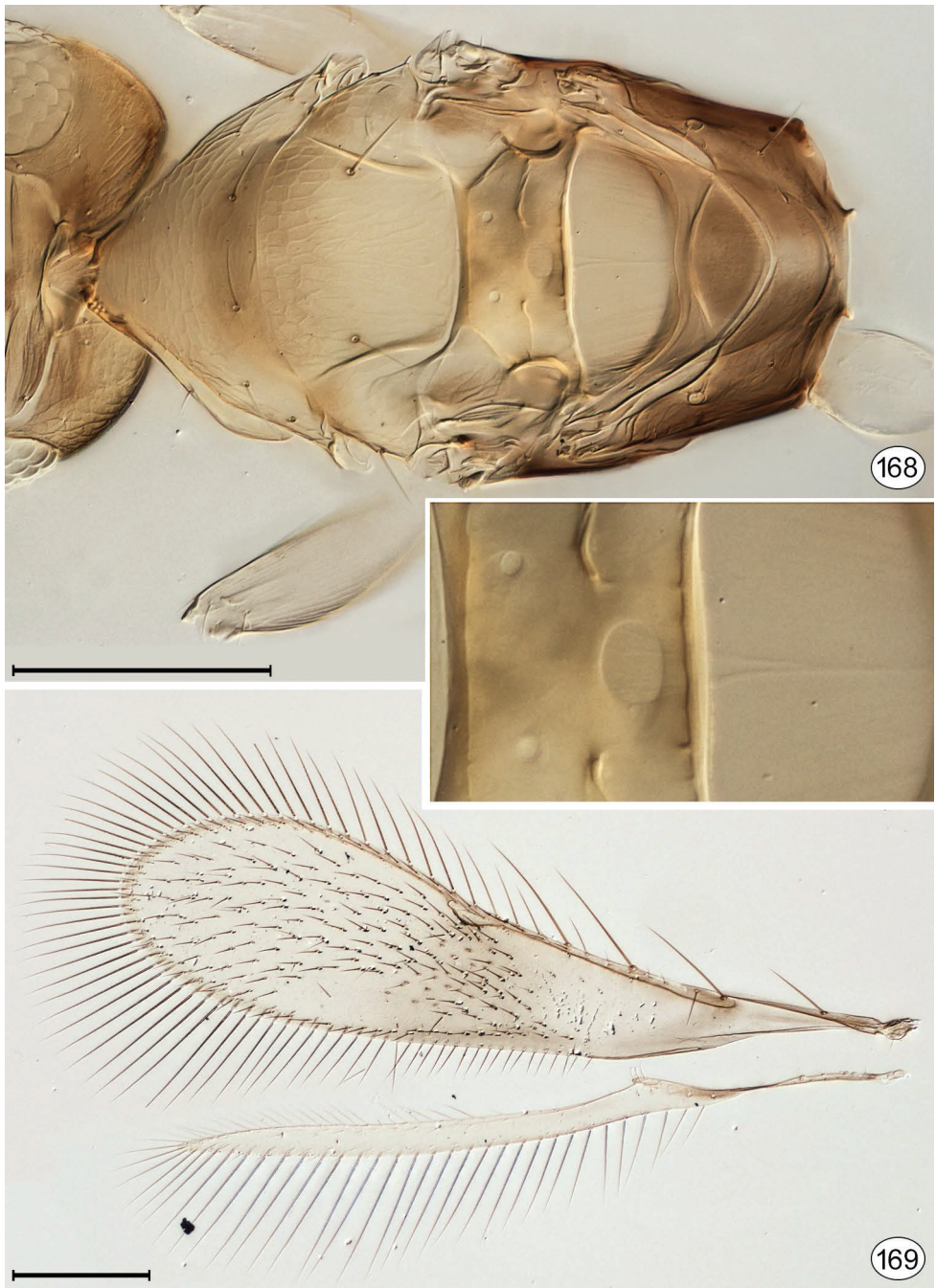


Figures 159–164. *Proarescon similis*, male. **159** mesosoma, dorsal **160** base of wings + axilla, dorsal **161** fore wing, dorsal **162** mesosoma, laterodorsal **163** apex of gaster + genitalia, dorsolateral **164** apex of gaster + genitalia, ventral. Scale bar for **159** = 50 μ m; **160**, **163**, **164** = 20 μ m; **161** = 200 μ m; **162** = 100 μ m.

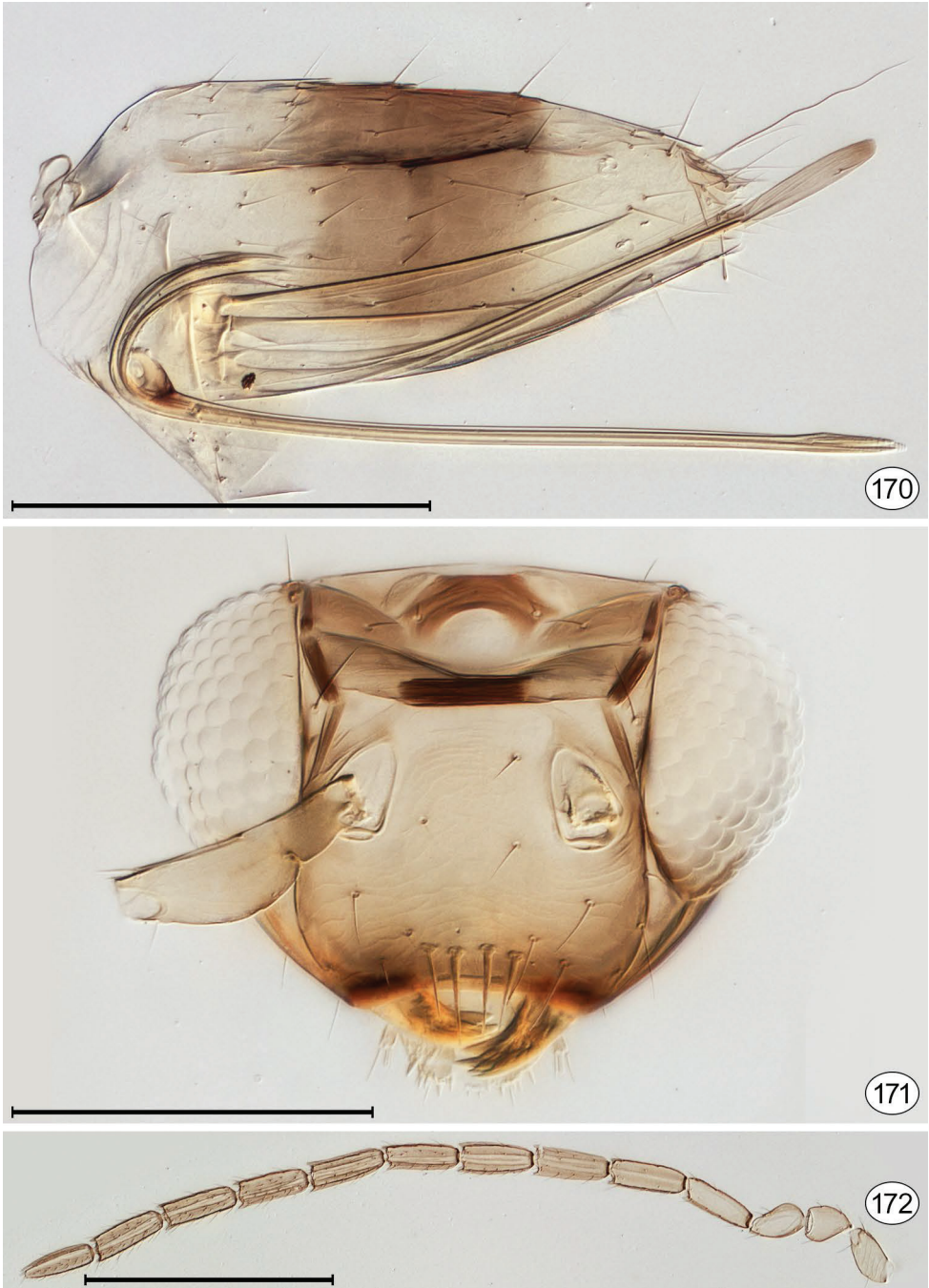
and 2 short setae towards anterior margin. Propleuron faintly, longitudinally reticulate, with 1 seta medially and 1 seta laterally about midway between anterior and posterior apices. Prosternum apparently smooth, with 1 seta submedially almost at anterior margin. Mesoscutum with sculpture isodiametric anteriorly and on lateral lobes to longitudinally reticulate posteriorly on midlobe, with 1 setae along inner margin midway between anterior and posterior apices of notaulus, and 1 setae at lateral angle of lateral lobe. Anterior scutellum smooth, with 1 setae laterally at dorsal margin of axillula, and with campaniform sensilla about 2 \times their diameter from transscutal articulation



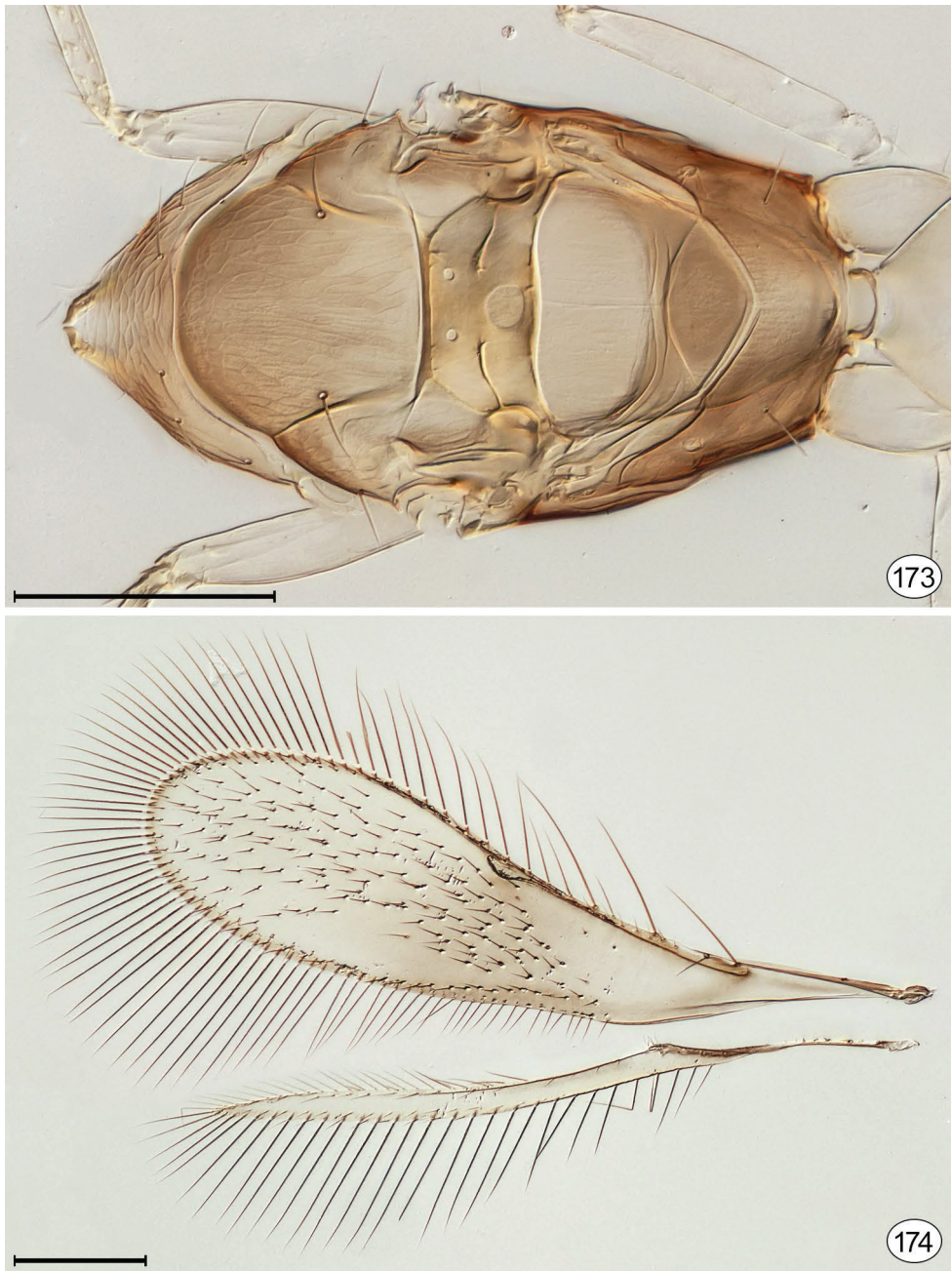
Figures 165–167. *Proarescon similis*, holotype. **165** head, dorsal **166a** antenna without scape, lateral **166b** antenna, dorsal **167** type slide. Scale bar = 100 μ m.



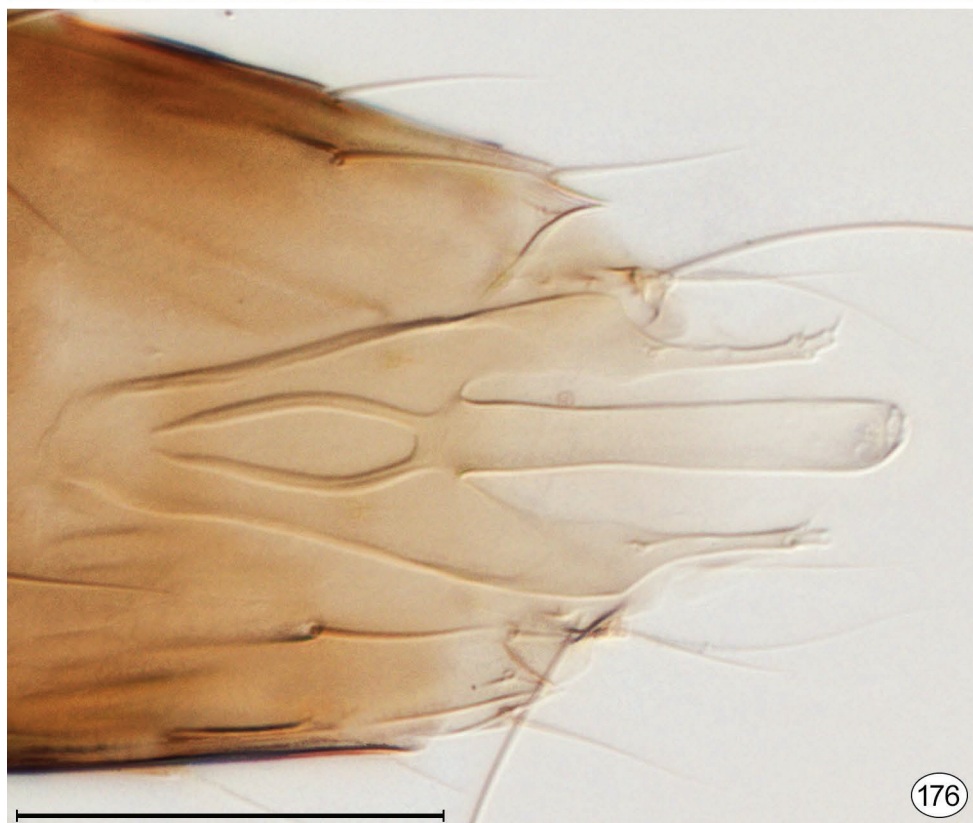
Figures 168, 169. *Proarescon similis*, holotype. **168** metasoma, dorsal (inset: enlargement of central area of scutellum showing fenestra) **169** wings. Scale bar = 100 μm .



Figures 170–172. *Proarescon similis*. **170** holotype metasoma, lateral **171** male paratype head, anterior **172** male paratype antenna. Scale bar for **170**, **172** =200 μm ; **171** =100 μm .



Figures 173, 174. *Proarescon similis*, male paratype. **173** mesosoma, dorsal **174** wings. Scale bar = 100 μm .



Figures 175, 176. *Proarescon similis*, male paratype. **175** metasoma, dorsal **176** genitalia, dorsal (seen through body). Scale bar for **175** = 100 μm ; **176** = 50 μm .

and about $7\times$ their diameter from each other; fenestra small, transversely oval and posterior to campaniform sensilla; frenum with faint, longitudinal wrinkles. Axilla with isodiametric reticulations and with 1 seta dorsally on apparently smooth lateral panel; axillula smooth. Metanotum smooth with 1 short seta on anterior margin closer to lateral apex of lateral panel than to dorsellum and 2 minute setae on anterior margin at apex of lateral panel. Propodeum apparently smooth medially, with faint engraved longitudinal reticulations laterally, with 1 propodeal setae midway between spiracle and posterior margin. **Wings.** Fore wing length ($n=1$) 563, width 146, length/width 3.86, longest marginal setae 107; cubital line of setae extending halfway towards base of parastigma, about midway between level of proximal and distal macrochaetae. Hind wing length 542, width 26, longest marginal setae 104. **Legs.** Femora and tibiae of all legs at most with faint longitudinal reticulation. Protibia with about 14 short, thick pegs along its length. **Metasoma.** Petiole width 26, length 11. Gaster (Fig. 170) height 155, length 352, apparently without sculpture (Figs 162, 163) and with 2 short setae on gt_1 and 3–6 longer lateral and dorsal setae on remaining terga. Cercus with 4 setae, the first seta about $2\times$ as long as the remaining setae. Hypopygium about $0.35\times$ gaster length. Ovipositor 380 long, its exerted part (56) about $0.2\times$ entire sheath length, with 1 subapical seta.

Male. Colour. As in generic description. **Head.** Head width 192 ($n=1$). **Wings.** Fore wing length ($n=1$) 563, width 146, length/width, 3.88, longest marginal setae 107. Hind wing length 542, width 26, longest marginal setae 114. **Antenna.** Measurements ($n=1$): scape length/width 74/22, pedicel length/width 30/37, flagellar segment length: fl_1 44, fl_2 59, fl_3 62, fl_4 61, fl_5 60, fl_6 60, fl_7 64, fl_8 61, fl_9 61, fl_{10} 62, fl_{11} 58; total flagellar length 652; fl_6 length/width 2.73, with 4 mps (Fig. 172). **Metasoma.** Gaster (Fig. 175) apparently without sculpture, with setae dorsolaterally and laterally and a few minute spicules medially on gt_4 and gt_5 . Genitalia (Figs 163, 164, 176) with curved aedeagal apodeme about $0.6\times$ as long as aedeagus; paramere thin, with 3 subapical and apical setae.

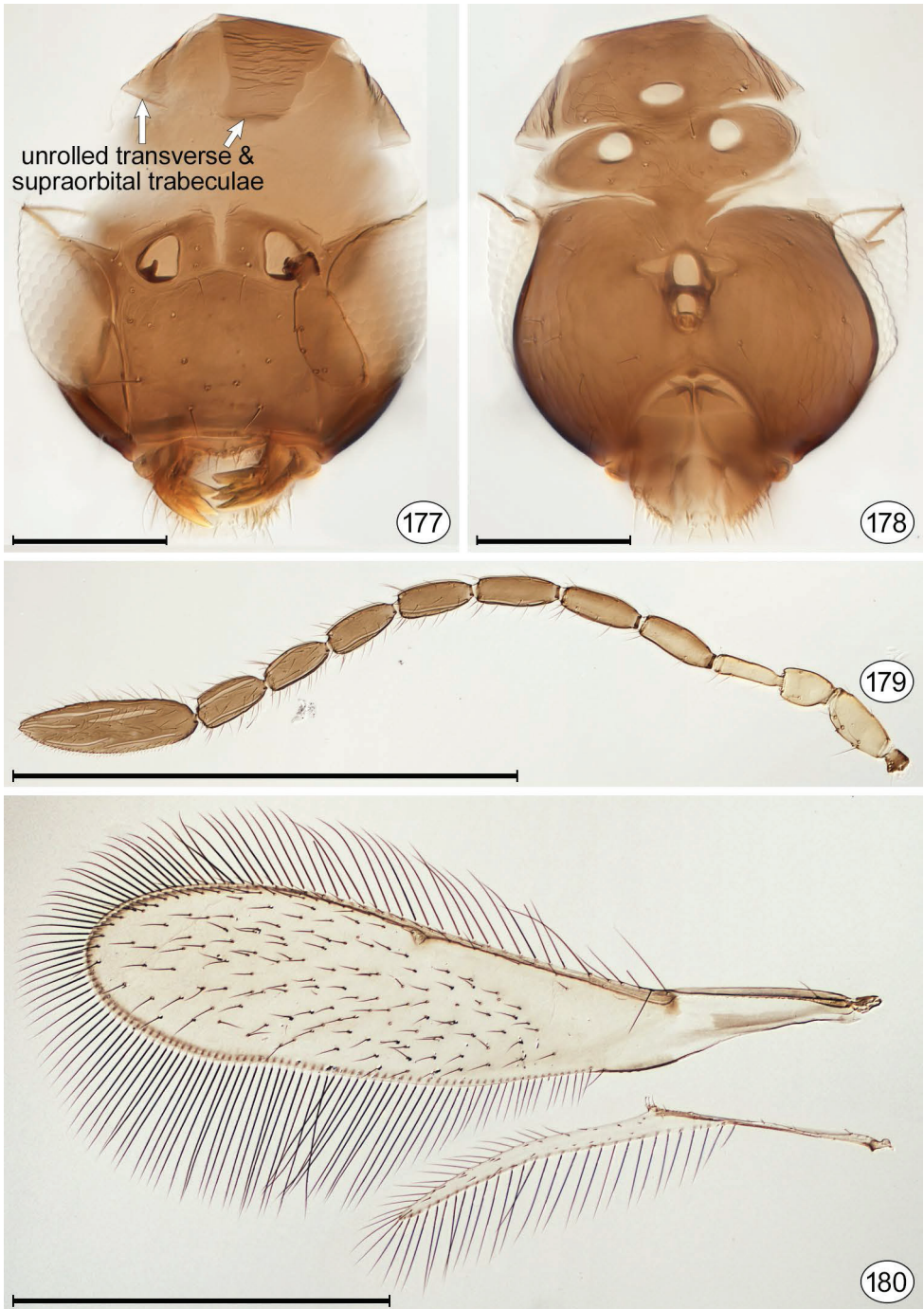
Etymology. The species name, *similis*, is Latin for similar, referring to the similarity of this species to the only other described species in *Proarescon*.

***Borneomymar* Huber**

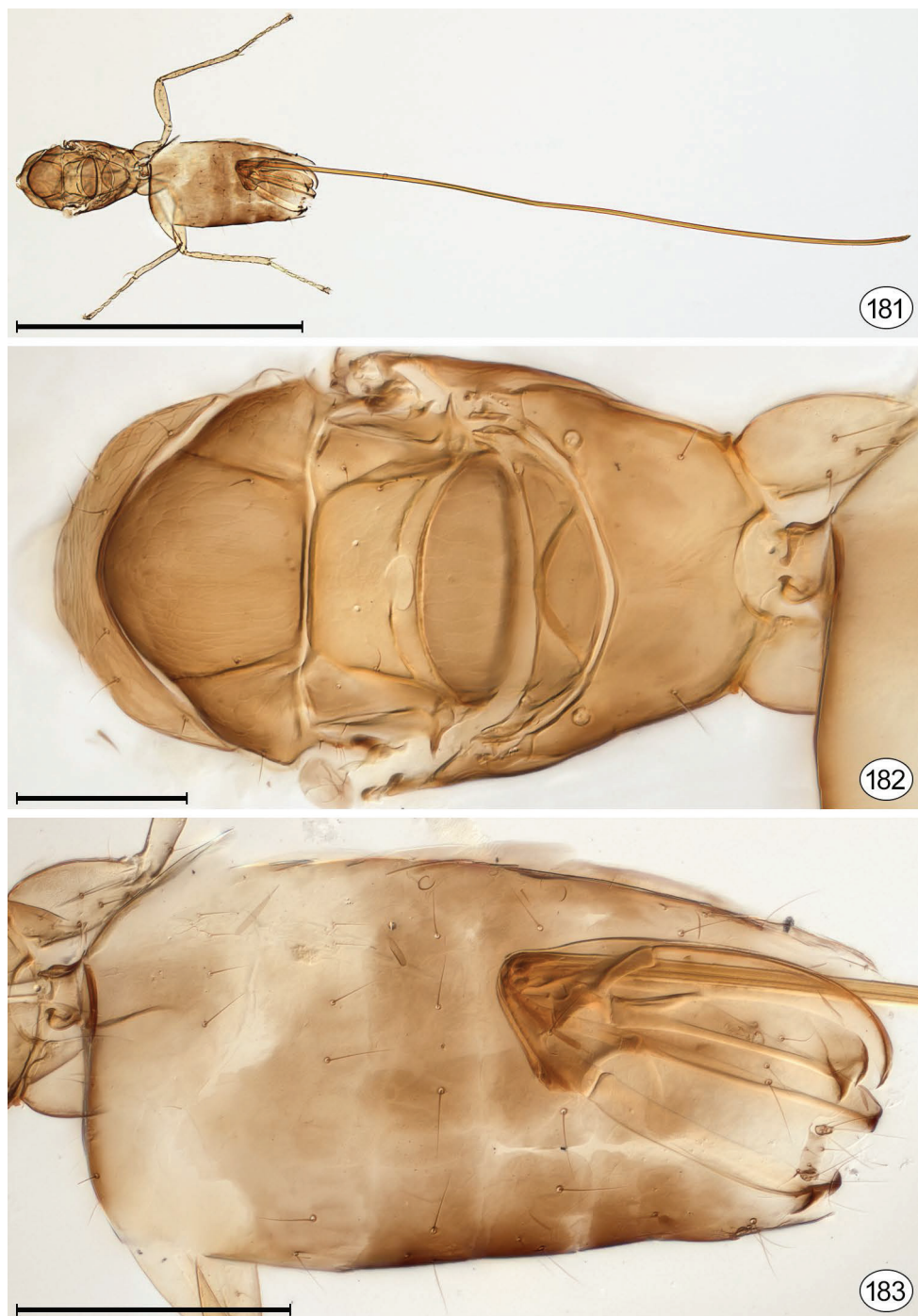
Figs 176–187

Type species. *Borneomymar discus* Huber 2002: 45, by original designation.

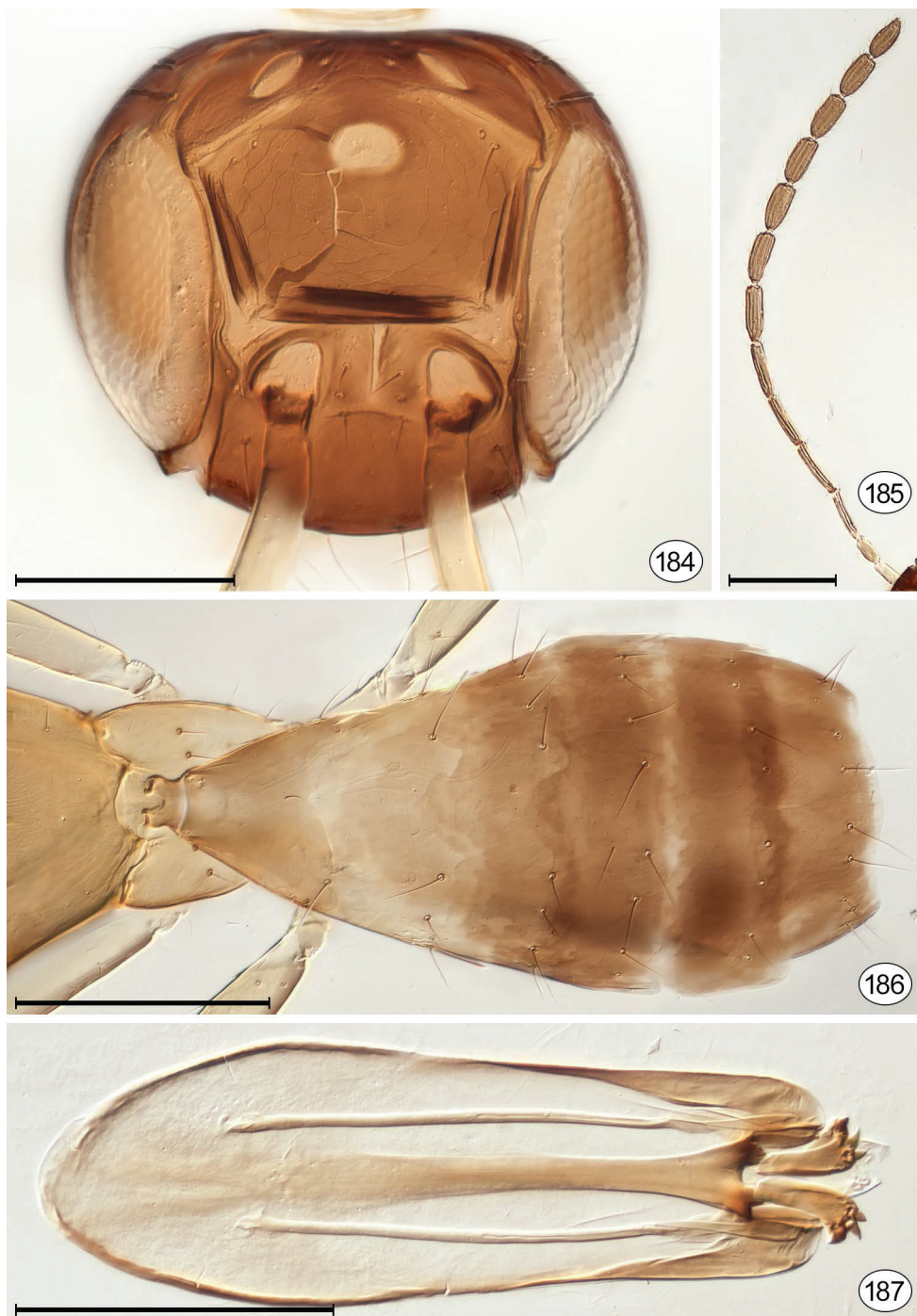
Diagnosis. Female. Head without stemmaticum (Fig. 178); occipital groove almost transverse (Fig. 178). Antenna with funicle 8-segmented, only fl_4 – fl_8 with mps, and clava 1-segmented (Fig. 179); mandible with 3 teeth; fore wing length 1006, width 235, length/width 4.28, longest marginal setae 203 (Fig. 180); venation $\approx 0.75\times$ wing length (apex of postmarginal vein difficult to determine); submarginal vein $2.03\times$ as long as parastigma, parastigma with hypochaeta much closer to proximal than to distal macrochaeta; marginal vein $1.94\times$ as long as parastigma; postmar-



Figures 177–180. *Borneomymar madagascar*, female. **177** head, anterior (vertex detached anteriorly, with trabeculae unrolled) **178** head, posterior **179** antenna **180** wings. Scale bar for **177**, **178** = 100 μm ; **179**, **180** = 500 μm .



Figures 181–183. *Borneomymar madagascar*, female. **181** body (without head), habitus, dorsal **182** mesosoma, dorsal **183** metasoma, dorsal (slightly twisted). Scale bar for **181** = 1000 μm ; **182**, **183** = 100 μm .



Figures 184–187. *Borneomymar madagascar*, male. **184** head, dorsal **185** antenna, dorsal, twisted laterally after fl₄ **186** metasoma (gt₇ missing) **187** genitalia, dorsal. Scale bar for **184**, **187** = 100 μ m; **185**, **186** = 200 μ m.

ginal vein $\approx 0.95\times$ as long as marginal vein; hind wing length 648, width 32, longest marginal setae 122; ovipositor extremely long, projecting posterior to apex of hypopygium by $\approx 2.2\text{--}2.4\times$ body length (Fig. 181). **Male.** Similar to female except for gaster (Fig. 186) and antenna. Head (Fig. 184). Fore wing length 1134, width 303, length/width 3.74, longest marginal setae 220; hind wing length 797, width 32, longest marginal setae 32. Antenna with flagellum 11-segmented, all segments with several mps (Fig. 185); genitalia (Fig. 187), encapsulated, with long aedeagal apodeme and digitus with 3 teeth.

***Borneomymar madagascar* Huber**

Figs 176–187

Borneomymar madagascar: Huber, 2002: 48 (original description); Engel et al. 2013: 2 (comparison with a fossil species).

Diagnosis. This species differs from, *B. discus* Huber, the only other extant species now included in the genus, as follows: radicle about as long as wide, scape $2.84\times$ as long as wide (in *B. discus* radicle much longer than wide, scape $5.86\times$ as long as wide); fore wing uniformly hyaline (Fig. 180) (in *B. discus* fore wing with distinct brown areas); gaster in lateral view about as $0.5\times$ as high as long (almost circular in *B. discus*).

Description. Female. Body length 922–998 ($n = 4$, critical point dried specimens, measured to apex of hypopygium), ovipositor length $\approx 2022\text{--}2330$ (not completely straight so probably slightly longer). Head (Fig. 184) width 266. Antenna measurements ($n = 1$), length/width (ratio): scape 101/36 (2.84), pedicel 56/35 (1.59), fl_1 68/20 (3.35), fl_2 81/30 (2.73), fl_3 82/29 (2.81), fl_4 86/30 (2.85), fl_5 79/32 (2.43), fl_6 76/34 (2.25), fl_7 72/32 (2.27), fl_8 74/34 (2.20), clava 176/52 (3.40); $fl_2\text{--}fl_8$ each apparently with 3 mps, clava with 12 mps (Fig. 179; hypopygium extending distinctly beyond posterior apex of gaster. **Male.** Body length ≈ 1315 (excluding gt_7 , removed to extract genitalia). Head (Fig. 184) width 262. Antenna measurements ($n = 1$, slide mounted), length/width [scape– fl_4 are vertical so width cannot be measured]: scape 104/-, pedicel 56/-, fl_1 106/-, fl_2 108/-, fl_3 106/-, fl_4 108/-, fl_5 111/ ≈ 35 , fl_6 101/38, fl_7 92/42, fl_8 96/41, fl_9 94/41, fl_{10} 91/39, fl_{11} 88/35; total flagellar length 1102; fl_6 length/width 2.66, with 9? mps.

Material examined. MADAGASCAR. **Antananarivo.** Botanic garden near entrance to Andasibe National Park, 1025 m, $18^\circ55.58'S$; $48^\circ24.47'E$, 1-5.xi.2001, R. Harin'Hala, tropical forest, Malaise trap, lot # 007164 (1♀ on slide, CAS). **Diego-Suarez.** Montagne d'Ambre National Park, 975 m, $12^\circ31'S$; $49^\circ11'E$, 4-19.iii.2001, M. Irwin, E. Schlinger, R. Harin'Hala, Malaise trap, lot # 007149 (1♂ on slide, CAS). **Fianarantsoa.** Massif de Andringitra, 975m, $21^\circ57'50"S$; $46^\circ55'59"E$, 7-19.xii.1999, M.E. Irwin et al., Malaise trap (4♀ on cards, CNC, UCRC).

Tribe Triadomerini stat. n.

Notes. Yoshimoto (1975) treated the Cretaceous amber fossils from Canada and classified *Triadomerus* Yoshimoto in his new subfamily Triadomerinae, *Carpenteriana* Yoshimoto and *Macalpinia* Yoshimoto in Mymarinae, and *Enneagmus* Yoshimoto in Trichogrammatidae. He defined his Triadomerinae as “having the submarginal and marginal veins distinctly separated at the junction of the fore wing and antennae 13-segmented in the female”. Poinar and Huber (2011) keyed the Cretaceous genera of Mymaridae, adding only *Myanmymar* Huber from Burmese amber to bring the number of genera to five, including *Enneagmus*, which Huber (2005) had reclassified in Mymaridae.

I treat Yoshimoto's Triadomerinae as a tribe, defined as follows, based mainly on extant genera and species: mandible with 3 (*Borneomymar*, *Eustochomorpha*) or 4 teeth; pronotum entire; fore wing wide, with marginal setae much shorter than wing width; venation more than 85% of wing length, with marginal vein present and longer than submarginal vein, and with postmarginal vein present and longer than marginal vein; hypochaeta, when present, closer to proximal than to distal macrochata; hind wing wide with marginal setae shorter than wing width; tarsi 5-segmented, with tarsomere 1 distinctly longer than any of the others; petiole clearly shorter than wide, ring like. **Female.** Antenna with flagellum at most 11 segmented (funicle 8-segmented and clava 1–3-segmented); ovipositor usually greatly exerted beyond either posterior (*Borneomymar*, *Eustochomorpha*) or anterior (*Neotriadomerus*) apex of body but in the extinct genera not projecting either anteriorly or posteriorly. **Male.** Antenna 11-segmented, the flagellomeres each with several mps; genitalia encapsulated, with short, thick parameres, apparently without digiti (in *Neotriadomerus*) but thinner walled and with digiti (in *Borneomymar*)

Triadomerini is treated here as the sister clade to the remainder of Mymaridae. The only apomorphy that defines the tribe is reduction in number of flagellar segments (at most 11) relative to Rotoitidae, whose species have a 12-segmented flagellum in females of both included extant genera. An additional diagnostic feature of the extant species of Triadomerini is the exerted cerci on a distinct prominence, similar to that of Torymidae. The occurrence of elevated cerci, number of teeth in mandibles, and several other features cannot definitely be determined from the fossil specimens studied. The lack of a hypochaeta apparently occurs in *Triadomerus* and *Eustochomorpha* and apparently also in at least one of the *Neotriadomerus* species.

Triadomerus is known only from Cretaceous amber from present day western Canada (Yoshimoto 1975). *Eustochomorpha* and *Neotriadomerus* species are confined to Australia, and extant *Borneomymar* species occur in the islands of Borneo and Madagascar whereas the one extinct *Borneomymar* species is from Eocene amber from the Baltic region (Engel et al. 2013). *Macalpinia* and especially *Carpenteriana* doubtfully belong in Triadomerini but perhaps are better classified here than elsewhere. Even though *Carpenteriana* has 7-segmented funicle and an entire clava its fore wing vena-

tion appears to be similar to *Macalpinia*. *Macalpinia* has an 8-segmented funicle and 3-segmented clava, as in *Triadomerus* and *Neotriadomerus*, so on the basis of this feature is classified fairly well in the tribe even though it appears to have no postmarginal vein and apparently only 4-segmented tarsi (tarsi are difficult to see; they may, in fact, be 5-segmented). Thus, I classify six genera in Triadomerini: four genera definitely—*Borneomymar*, *Eustochomorpha*, *Neotriadomerus*, *Triadomerus*, and two genera tentatively—*Carpenteriana* and *Macalpinia*.

Tribe Aresconini

Notes. Viggiani (1988) proposed Aresconini for *Arescon* Walker and defined the tribe on the characteristic male genitalia, i.e., encapsulated, with relatively long, narrow parameres but apparently no digiti. Based on mainly extant genera and species, Aresconini is defined by the following features: mandible with 4 teeth; pronotum entire; venation long but postmarginal vein usually short; funicle in females 4-, 5- or 8-segmented; clava entire or 2-segmented; male genitalia usually with long parallel-sided parameres. I classify members of the extant genera *Kikiki* Huber and Beardsley (Huber and Beardsley 2000), *Tinkerbella* Huber & Noyes (Huber & Noyes 2013), *Proarescon* (this paper), and the extinct genus *Myanmymar* (Poinar and Huber 2011) in the tribe based on similarities in head features, fore wing shape or venation, and male genitalia where known.

Arescon is almost worldwide (Triapitsyn 2016) whereas *Proarescon* is only in southeastern Asia. Lin et al. (2007) and Huber (2009) had first classified *Kikiki* in the *Alaptus* group of genera then, with *Tinkerbella* described as a separate genus (Huber and Noyes 2013), in the *Anagrus* group of genera. In both cases, similarities in various features were used to justify their placement. Now, however, I believe these two genera are best classified in Aresconini. The male genitalia of *Kikiki* have fairly long and thick parameres (Huber and Noyes 2013, fig. 35), the vertex has a distinct stemmaticum (Huber and Noyes 2013, figs 12, 41), the fore wing has a long venation, and the mandible has 4 teeth, all features that occur also in *Arescon* and *Proarescon*. *Kikiki* may be almost worldwide (Australia, India, northern South America, Hawaiian Islands) and *Tinkerbella* is so far known only from Costa Rica (Huber and Noyes 2013). *Enneagmus* may fit in Aresconini better than in Triadomerini because of its apparently short venation, and 4-segmented funicle and 3-segmented tarsi as in *Kikiki*. The 3-segmented clava may simply be an ancestral feature, reduced to two segments in *Kikiki* and *Tinkerbella*. However, the short venation, apparently much less than half the wing length is unlike the other genera in Aresconini. Thus, six genera are here classified in Aresconini: *Arescon*, *Enneagmus*, *Kikiki*, *Myanmymar*, *Proarescon*, and *Tinkerbella*. If *Minutoma* Kaddumi (Kaddumi 2005) is indeed a mymarid, it may also belong here; its small body length is comparable to that of *Tinkerbella*.

See Poinar and Huber (2011) for key to the extinct Cretaceous genera.

- Huber (2002) treated *Triadomerus* (extinct) and *Eustochomorpha* (extant) as sister genera to the remaining extant genera of Mymaridae based, in females (males are unknown), on an 8-segmented funicle and 3- or 2-segmented clava, respectively, i.e., 11 or 10 flagellar segments in total. In *Neotriadomerus*, males are known and have the same number of flagellar segments as in females, i.e., 11, and this is considered to be as the most plesiomorphic feature possible in Mymaridae. *Macalpinia* and *Triadomerus* also have an 8-segmented funicle and 3-segmented clava. Species in all other genera (all extant only, except for one fossil *Borneomymar* species) whose males are known have a different number of segments between females and males, with at least one less segment in females compared to males. But because males of the species of most extant genera have an 11-segmented flagellum, it is probably safe to assume that males in the extinct genera also have an 11-segmented flagellum, as in females. On this basis, *Triadomerus*, *Macalpinia* and *Neotriadomerus* are treated as the sister clade to other genera within Triadomerini and to all remaining genera of Mymaridae, both extinct and extant. At present the relationships among these three genera cannot be determined but, among extant genera only, *Neotriadomerus* is clearly the sister genus to the all remaining genera, including *Eustochomorpha*. Loss of one claval segment in *Eustochomorpha*, to give a 10-segmented flagellum in its females, makes this the sister genus to the remaining genera of extant Mymaridae other than *Neotriadomerus*.

Conclusions

The distribution of the extinct and extant genera that can definitely be placed in Mymaridae encompasses a time span of almost 100 my. Kaddumi (2005) classified *Minutoma*, found in 120–135 my Cretaceous amber from the Zarqa River basin, in Mymaridae but Huber in Heraty et al. (2013: 2) suggested it might be better placed in Tetracampidae; its clava appears to be 4-segmented. But if it is a member of Mymaridae then the family extends back into the early Cretaceous, well after the beginning of the breakup of Pangea into Laurasia in the north and Gondwana in the south, beginning 200 million years ago. The present centre of diversity of Mymaridae is in the Australasian region, particularly Australia and New Zealand, but the fossil evidence shows that the family was already quite diverse in the Cretaceous and that the origin of Mymaridae is not necessarily there. In Triadomerini, all the Cretaceous genera (known only from Laurasia) eventually became extinct whereas *Eustochomorpha* and *Neotriadomerus* are extant in Australia (part of Gondwana). *Borneomymar*, in contrast, is represented by two extant species in the islands of Borneo and Madagascar (both part of Gondwana) and one extinct species from Baltic amber, i.e., from Laurasia (Engel et al. 2013). In Aresconini, the only extinct genus is *Myanmymar* (Laurasia?); all the rest are extant and, except for *Proarescon* and *Tinkerbella*, widespread.

The widespread distribution of Mymaridae already existed at least 80 my ago (described taxa from Canadian and Burmese Cretaceous amber) and the family is currently worldwide, except for Antarctica. Two scenarios may explain this: 1) The family may have evolved before the breakup of Pangea, 200–180 million years ago, and was already widespread throughout the supercontinent wherever suitable hosts occurred, which would suggest a Jurassic origin; 2) The family is more recent, having originated in only part of Pangea, probably Gondwana, and some species then spread to Laurasia after the two parts became well separated from each other. This is quite possible because Mymaridae are small and easily carried long distances on wind and some would have survived the trip. Mymaridae as a recognizable taxon may therefore be a lot older than the present evidence shows, going back well into the early Cretaceous.

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