

A Key to the Australian Genera of Eumeninae (Hymenoptera: Vespidae)

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ABSTRACT. An illustrated identification key to the genera of potter wasps occurring in Australia is presented. Hitherto there has been no published key to these genera, making routine identification impossible, and allowing taxonomic study of these wasps to be carried out only by specialists. This has greatly inhibited biological study of these wasps, which are known to exhibit interesting behavioural ecology. For the same reason, their use as biological control agents has scarcely been investigated. And as a result, the conservation status of any of the species is unknown. Our aim is that this key should begin to rectify this situation.

Introduction

Potter wasps or mud wasps are common elements of the Australian Hymenoptera. Comprising the subfamily Eumeninae of the family Vespidae, they are by far the most species rich part of that family worldwide (nearly 4,000 species; see Pickett & Carpenter, 2010: table 1). Some Australian species can be quite abundant locally, and the mud nests of some of the larger species are a familiar sight. Because they provision their nests with caterpillars (Fig. 49), they are potential biological control agents. Aspects of their behaviour, including nest construction and mating systems, have attracted the interest of evolutionary biologists (Smith & Alcock, 1980; Matthews & Matthews, 2004, 2009, 2010).

Nearly 300 species are described from Australia, but the fauna is far from well known, with many undescribed species.

A better understanding of the fauna is greatly hampered by the lack of a basic identification key to the genera. There has been no key to the genera since the only worldwide monograph of the Vespidae, de Saussure (1852–1858), which is now of course well out of date. When Giordani Soika (1962) broke up the old, broad concept of the genus *Odynerus* Latreille, 1802, the key he provided was characteristically limited almost entirely to the genera he described or in which he described new species (and was in Italian). The key did not include such common Australian taxa as *Abispa* Mitchell, 1838, or *Paralastor* de Saussure, 1856, so it does not even correspond to a key to the tribe Odynerini in the sense of Hermes *et al.* (2014). Giordani Soika (1969) published a key to Australian genera of the tribe Zethini (as subfamily Discoeliinae; also in Italian), but there has never been a modern key to genera of the tribe Eumenini, let alone a key including all three tribes.

Keywords: potter wasps; mud wasps; identification key; taxonomy; Hymenoptera; Vespidae; Eumeninae

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A key to all the Australian genera is presented here. The generic classification is quite different from that in the catalogue by Cardale (1985); the differences are explained in the new catalogue of Australian Eumeninae (Carpenter & Brown, 2021). There has even been one further change since the new catalogue was published: Lopes *et al.* (2021) have more recently reduced *Ischnocoelia* Perkins, 1908, to a subgenus of *Zethus* Fabricius, 1804. Besides those changes, the key includes one genus, *Pseumenes* Giordani Soika, 1935, which has not been hitherto recorded from Australia. This is based on an apparently undescribed species seen by one of us (JMC). The key does not include another genus, *Pachodynerus* de Saussure, 1870, of which one species has

been found nesting in the Brisbane airport. Should the genus become widely established in Australia, it would key out to couplet 30, and, like the genus *Epsilon* de Saussure, 1855, it has a projecting submarginal carina. It is easily distinguished from that genus by possessing a humeral carina running obliquely on the pronotum (see figs. 52 and 57 in Carpenter & Garcete-Barrett, 2003).

The current generic classification of Australian potter wasps is as fragmented as generic taxonomy of this group elsewhere in the world (see discussion in Carpenter & Cumming, 1985), and we do not necessarily agree with it. But progress in the taxonomy of these wasps cannot be made without a basic means of identification.

Key to genera

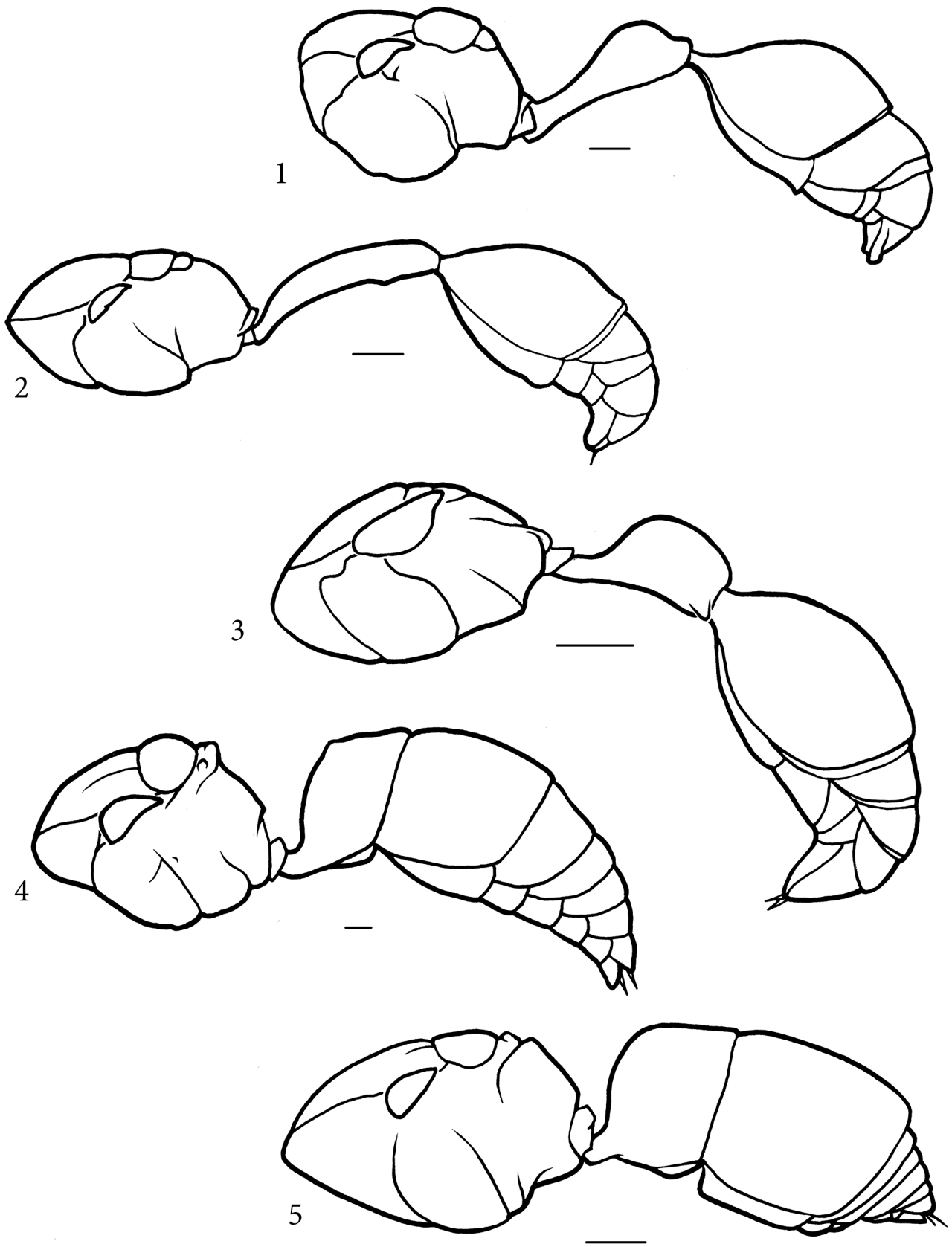
Terminology largely follows Carpenter & Cumming (1985). The metasomal terga and sterna are abbreviated as TI, SI, etc. Tribal assignments are according to the concepts of Hermes *et al.* (2014).

- | | | | |
|---|--|--|---|
| 1 | Midtibia with 2 spurs | tribe Zethini | 2 |
| — | Midtibia with 1 spur | | 7 |
| 2 | Metasomal segment I more than twice as long as high in profile,
with height half or less that of II (Figs 1–2); propodeal orifice
narrowly rounded dorsally (Figs 12–13) | | 3 |
| — | Metasomal segment I less than twice as long as high in profile,
with height half or more than that of II (Fig. 3); propodeal orifice
more or less pointed dorsally (Fig. 14) | | 5 |
| 3 | Hindwing jugal lobe absent | <i>Australozethus</i> Giordani Soika | |
| — | Hindwing jugal lobe present | | 4 |
| 4 | Submarginal carina projecting as pointed lobe above propodeal
valvula (Fig. 2); propodeum with median longitudinal carina;
palpal formula 6–4 | <i>Elimus</i> de Saussure | |
| — | Submarginal carina not projecting as pointed lobe above
propodeal valvula (Fig. 1); propodeum without median long-
itudinal carina; palpal formula 3–3 | <i>Zethus</i> Fabricius (subgenus <i>Ischnocoelia</i> Perkins) | |
| 5 | Tegula enormous, as large as disc of scutellum (Fig. 3) | <i>Macrocalymma</i> Perkins | |
| — | Tegula smaller than disc of scutellum (Figs 4–5) | | 6 |
| 6 | Propodeal valvula elongate and rectangular to subrectangular
(Fig. 13) | <i>Deuterodiscoelius</i> Dalla Torre | |
| — | Propodeal valvula not elongate (Fig. 14) | <i>Pachycoelius</i> Giordani Soika | |

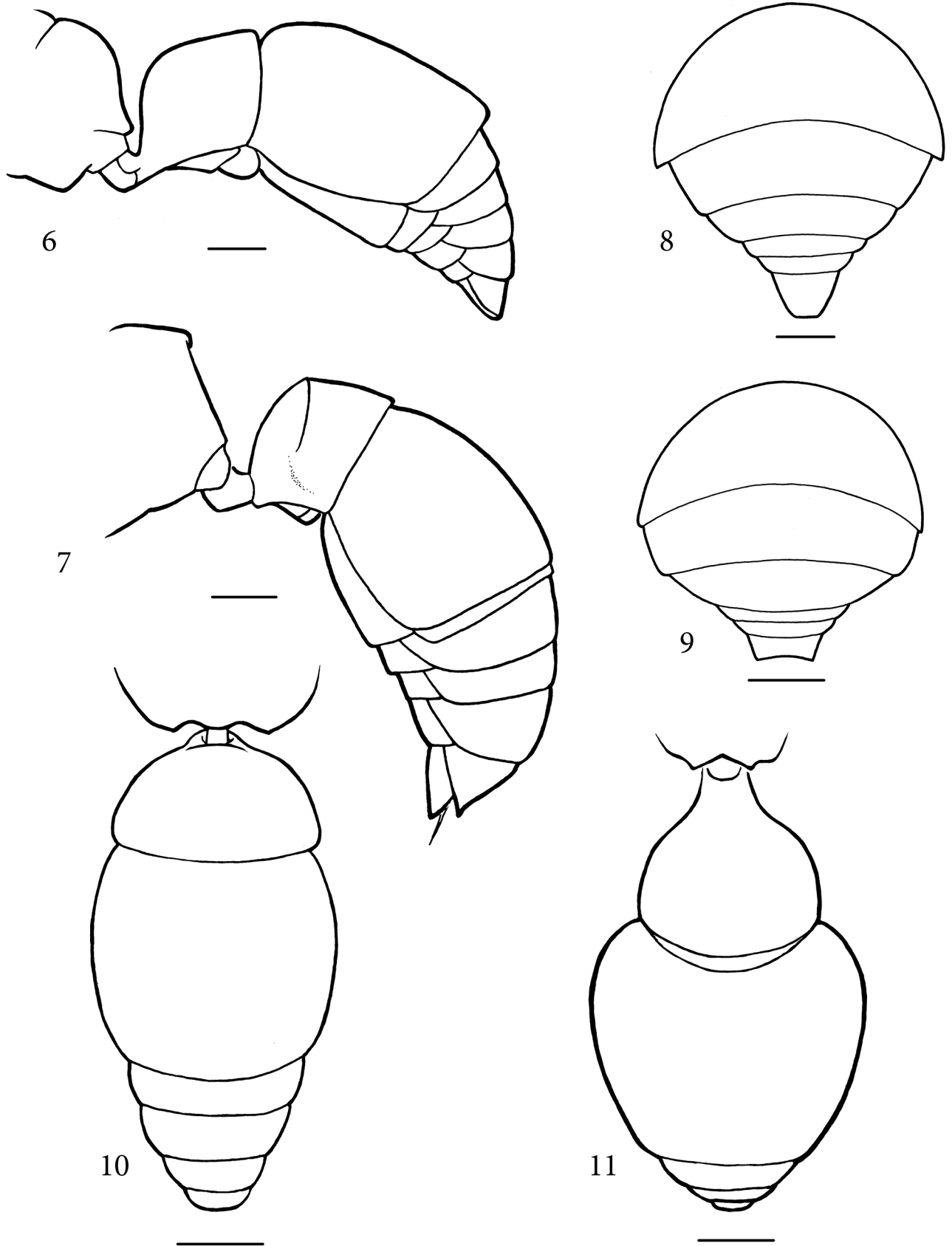
- 7 Metasoma petiolate: segment I with height half or less that of II in profile, and at least twice as long as high, usually longer (Figs 1–2), in dorsal view with width half or less that of II, and at least twice as long as wide (Fig. 27) 8
- Metasoma not petiolate: segment I with height more than half that of II in profile, much less than twice as high as wide (Figs 4–7), in dorsal view with width more than half that of II, much less than twice as long as wide (Figs 10–11, 19–20) tribe Odynerini (part) 12
- 8 Propodeum dorsally with elongate fovea from which carina runs to orifice, with more or less dentiform projections above valvulae (Figs 27–28); tegula with narrow posterior lobe which equals length of parategula (Fig. 16) tribe Odynerini (part) 9
- Propodeum without elongate fovea or dentiform projections; tegula convex posteriorly not equalling length of parategula (Fig. 15) tribe Eumenini 10
- 9 TI with transverse carina basally; epicnemial carina present (Fig. 29); female with cephalic foveae (Fig. 46) *Ectopioglossa* Perkins
- TI not carinate; epicnemial carina absent; female without cephalic foveae *Pseumenes* Giordani Soika
- 10 TII with translucent apical lamella, clearly separated from disc by preapical thickening (Figs 2–3) *Eumenes* Latreille
- TII without apical lamella 11
- 11 TI with section after spiracles shorter than section before spiracles *Delta* de Saussure
- TI with section after spiracles longer than section before spiracles (Fig. 49) *Phimenes* Giordani Soika
- 12 Forewing with second submarginal cell petiolate or nearly so (Fig. 22); male antenna with number of articles variable, usually fewer than 13 *Paralastor* de Saussure
- Forewing with second submarginal cell not petiolate (Figs 21, 23); male antenna usually with 13 articles 13
- 13 Propodeum with basal acarinarium formed by deep, polished fossae (Figs 19–20) 14
- Propodeum without deep fossae 15
- 14 Acarinarium formed by deep median cavity and two small, lateral fossae (Fig. 20); metasomal segment I subcylindrical, in dorsal view petiolate for nearly half its length before expanding abruptly to a width slightly more than half that of segment II (Figs 11, 20) *Acarozumia* Bequaert
- Acarinarium formed by two submedian fossae (Fig. 19); metasomal segment I sessile, in dorsal view about as wide as II (Figs 10, 19) *Acarodynerus* Giordani Soika

15	Metanotum tuberculate (Figs 37–40); if lateral tubercles weak then propodeum with blunt dorsolateral ridges behind metanotum (Fig. 37)	16
—	Metanotum without tubercles (Figs 35–36)	18
16	Metanotum trituberculate (Fig. 38); forewing with prestigma more than 4× the length of the pterostigma (Fig. 21)	<i>Abispa</i> Mitchell
—	Metanotum bituberculate (Fig. 37, 39–40); prestigma much shorter relative to pterostigma, usually less than length of latter (Fig. 23)	17
17	Propodeum with blunt dorsolateral ridges behind metanotum (Fig. 37); SII in profile truncate anteriorly (Fig. 5); axillary fossa in dorsal view oval, wide (Fig. 39)	<i>Diemodynerus</i> Giordani Soika
—	Propodeum without superior ridges; SII in profile flat or evenly convex anteriorly (Figs 6–7); axillary fossa in dorsal view narrower than long, slit-like (Fig. 40)	<i>Pseudabispa</i> van der Vecht
18	Tegula with posterior margin not reaching tip of parategula (Fig. 17); forewing with prestigma ≥ half the length of the pterostigma, measured along posterior part, usually nearly equal; axillary fossa in dorsal view narrower than long, often slit-like (Fig. 40)	19
—	Tegula with posterior margin equalling or exceeding tip of parategula posteriorly (Figs 16, 18); forewing with prestigma < half the length of the pterostigma, measured along posterior part (Fig. 23); axillary fossa in dorsal view at least as wide as long (Fig. 39), oval	23
19	Colour bright metallic; metasomal segment I subcylindrical, in dorsal view petiolate for about half its length before expanding abruptly to a width slightly more than half that of segment II (Fig. 11)	<i>Eudiscoelius</i> Friese
—	Colour not bright metallic; metasomal segment I sessile, about as wide as II (Fig. 10)	20
20	Scutum posteriorly and scutellum mesally impunctate; metanotum somewhat compressed medially; male midfemur basally emarginate (Fig. 25)	<i>Rhynchium</i> Spinola
—	Scutum and scutellum punctate; metanotum not compressed medially; male midfemur not basally emarginate	21
21	Metanotum flat; propodeal dorsum raised shelf-like to same level (Fig. 30); male SVII with one or two tubercles	<i>Allorhynchium</i> van der Vecht
—	Metanotum angled; propodeal dorsum not at same level (Fig. 29); male SVII without tubercles	22
22	Propodeum with transverse dorsal carinae; TI with faint transverse carina at anterior declivity (Fig. 7); clypeus widely emarginate (Fig. 41)	<i>Pararrhynchium</i> de Saussure
—	Propodeum and TI without carinae; clypeus not widely emarginate (Fig. 42)	<i>Anterhynchium</i> de Saussure

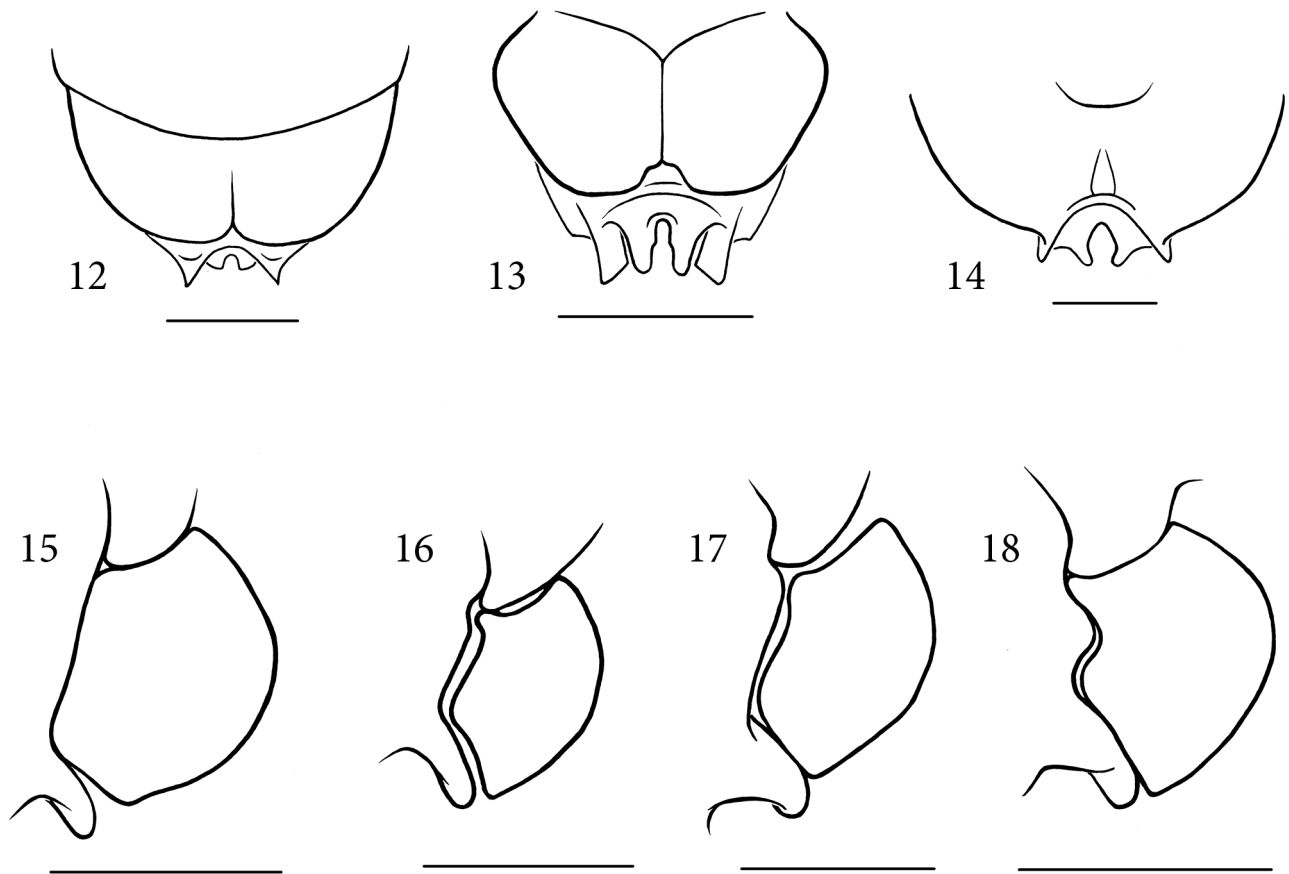
- 23 TI with two transverse carinae; anterior face of pronotum with two small, close set, deeply impressed medial foveae (Fig. 24) *Subancistrocerus* de Saussure
- TI without two transverse carinae, occasionally with one; anterior face of pronotum without two close set, deeply impressed foveae 24
- 24 Female with cephalic foveae in raised, transversely oval area that is wider than ocellar triangle and densely setose (Fig. 45); male SVII with apex depressed, subtruncate (Fig. 9); male midfemur often toothed medially (Fig. 26) *Pseudalastor* Giordani Soika
- Female cephalic foveae if in raised area, then narrower than ocellar triangle (Fig. 46); male SVII rounded apically (Fig. 8) and male midfemur not toothed 25
- 25 Vertex with low, elongate tubercles above eyes (Figs 47–48) *Parifodynerus* Giordani Soika
- Vertex without tubercles (Figs 45–46) 26
- 26 Female with cephalic foveae in raised oval area that is narrower than ocellar triangle (Fig. 46); male antennal hook minute, articles globose (Fig. 43) *Flammodynerus* Giordani Soika
- Female cephalic foveae not in raised area; male antennal hook well developed (Fig. 44) 27
- 27 Metasomal segment I subsessile, in dorsal view narrower than II (Fig. 11) 28
- Metasomal segment I sessile, in dorsal view about as wide as II (Fig. 10) 29
- 28 Metanotum convex, forming smooth surface with propodeum (Fig. 32) *Leptomenoides* Giordani Soika
- Metanotum dorsally angled (Fig. 31) *Antamenes* Giordani Soika
- 29 Metanotum flat or smoothly convex; propodeum with dorsal surface at about same level as metanotum (Fig. 35), dorsal teeth may be present (Fig. 36) *Stenodyneriellus* Giordani Soika
- Metanotum angled; propodeum not raised shelf-like to same level, without dorsal teeth 30
- 30 Propodeum depressed medially, with lateral teeth (Figs 36–37); female with one cephalic fovea; usually smaller species *Australodynerus* Giordani Soika
- Propodeum usually unarmored, if with teeth not so depressed; female with two cephalic foveae; usually larger species 31
- 31 Tegula long, with posterior lobe covering parategula and pointing medially *Knemodynerus* Blüthgen
- Tegula shorter, with posterior lobe not covering parategula, never pointing medially 32
- 32 Propodeum with submarginal carina projecting as rounded lobe above valvula (Fig. 33) *Epsilon* de Saussure
- Propodeum with submarginal carina not differentiated from valvula (Fig. 34) *Euodynerus* Dalla Torre



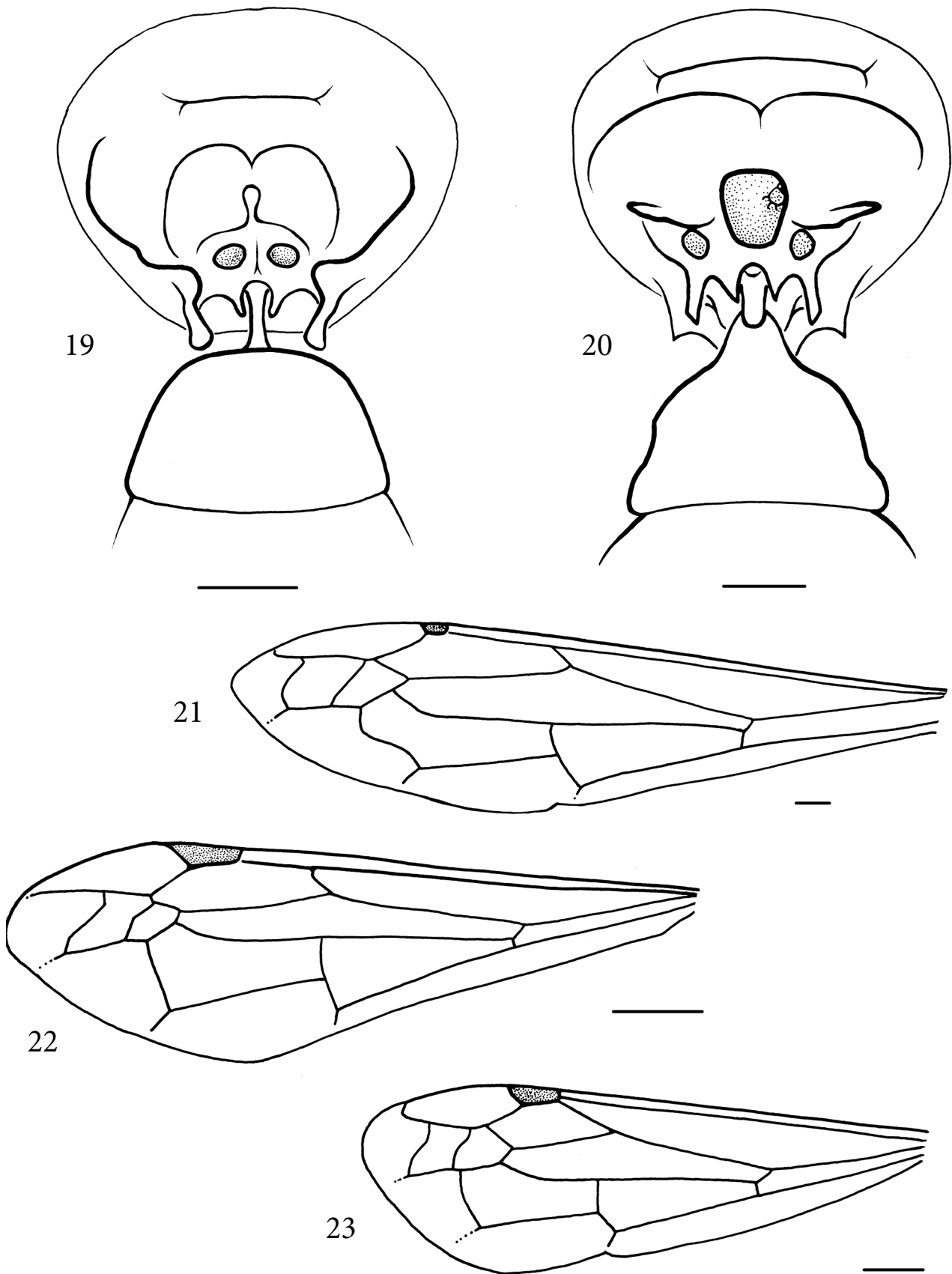
Figures 1–5. Lateral views of mesosoma and metasoma: (1) *Australozethus continentalis* Giordani Soika; (2) *Elimus mackayensis* Meade-Waldo; (3) *Macrocalymma smithianum* Perkins; (4) *Abispa ephippium* (Fabricius); (5) *Diemodynerus pseudacarodynerus* Giordani Soika. Scale = 1.0 mm.



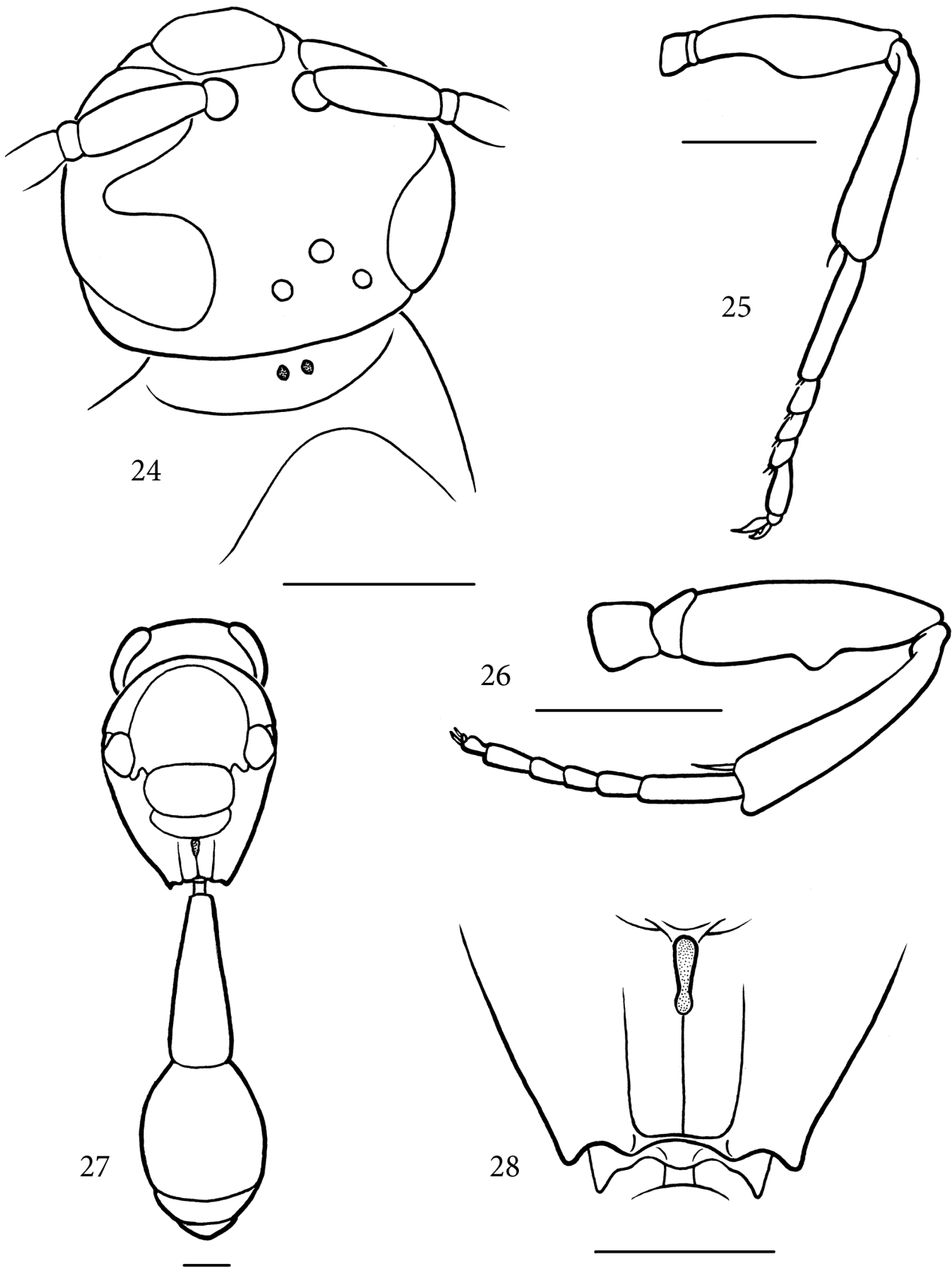
Figures 6–11. Lateral views of metasoma: (6) *Acarodynerus dietrichianus* (de Saussure); (7) *Pararrhynchium* sp. Dorsal views of male metasomal segments II–VII: (8) *Parifodynerus alariformis* (de Saussure); (9) *Pseudalastor* sp. Dorsal views of metasoma: (10) *Stenodyneriellus bicoloratus* (de Saussure); (11) *Eudiscoelius jacinthae* (Gribodo). Scale = 1.0 mm.



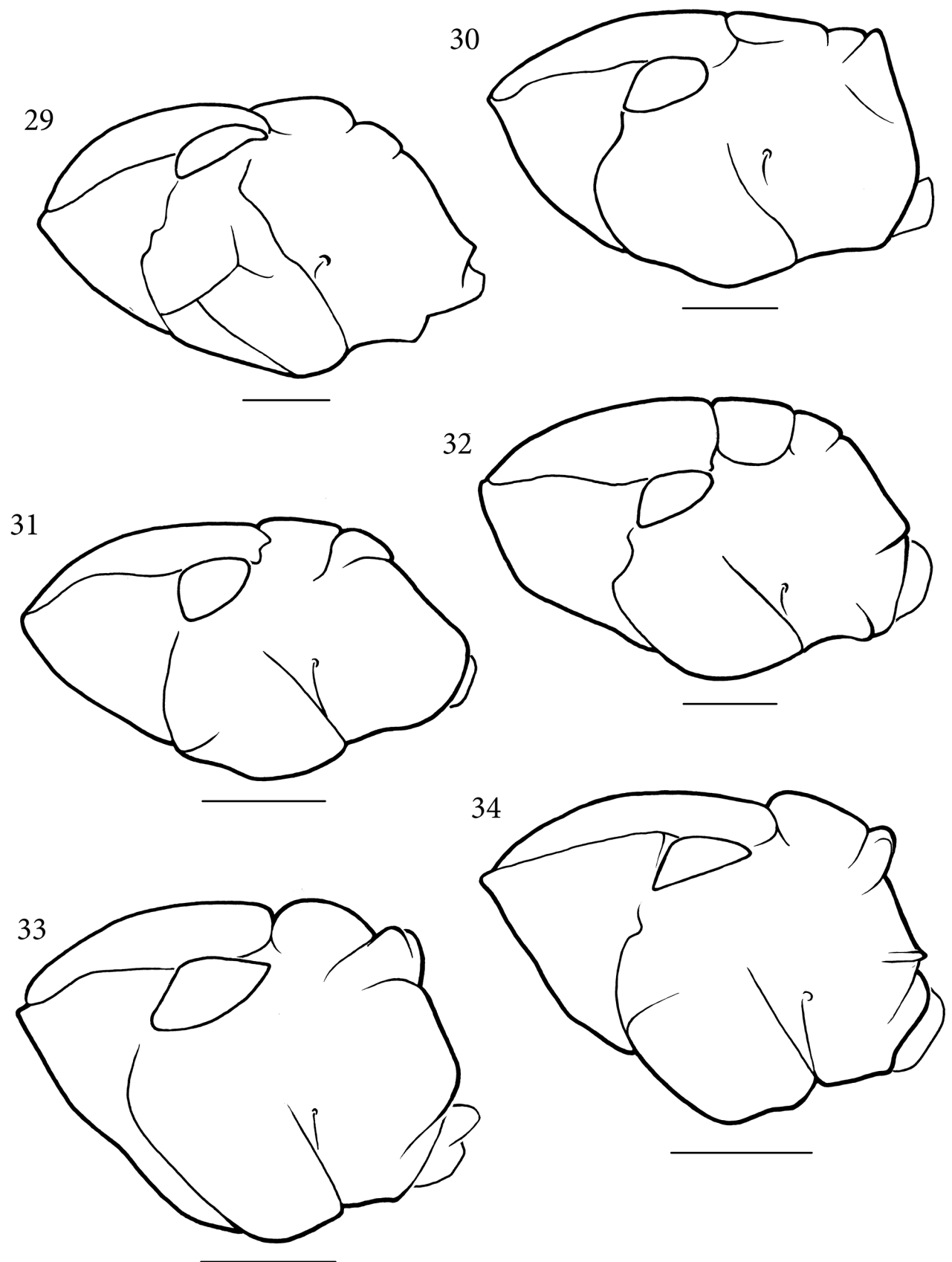
Figures 12–18. Posterior views of propodeum: (12) *Elimus australis* de Saussure; (13) *Zethus (Ischnocoelia) fulvus* (von Schulthess); (14) *Pachycoelius* sp. Tegula: (15) *Phimenes incola* (Giordani Soika); (16) *Ectoploglossa polita australensis* (Meade-Waldo); (17) *Rhynchium superbum* de Saussure; (18) *Parifodynerus alariformis* (de Saussure). Scale = 1.0 mm.



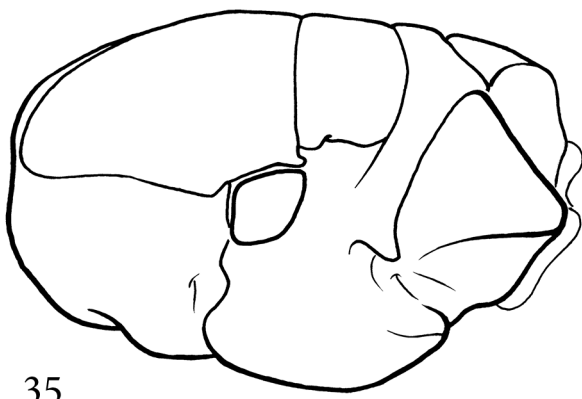
Figures 19–23. Posterior views of propodeum: (19) *Acarodynerus acarophilus* Giordani Soika; (20) *Acarozumia amaliae* (de Saussure). Forewings: (21) *Abispa ephippium* (Fabricius); (22) *Paralastor* sp.; (23) *Diemodynerus pseudacarodynerus* (Giordani Soika). Scale = 1.0 mm.



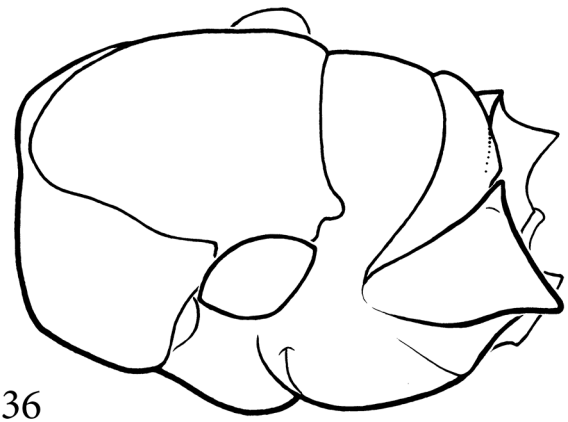
Figures 24–28. (24) Dorsal views of head and pronotum, *Subancistrocerus monsticornis* (Giordani Soika). Male midlegs: (25) *Rhynchium superbum* de Saussure; (26) *Pseudalastor* sp. (27–28) *Ectopioglossa polita australensis* (Meade-Waldo): (27) dorsal view; (28) posterior view of propodeum. Scale = 1.0 mm.



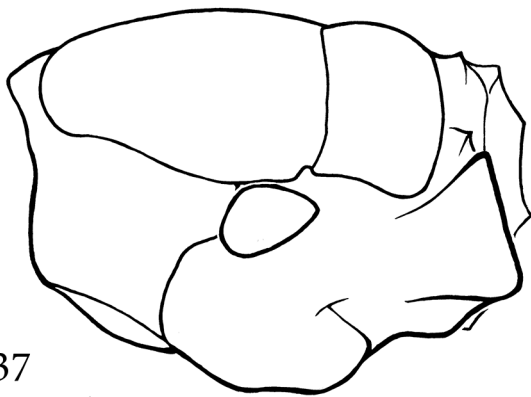
Figures 29–34. Lateral views of mesosoma: (29) *Ectopioglossa polita australensis* (Meade-Waldo); (30) *Allorhynchium argentatum* (Fabricius); (31) *Antamenes hostilis* Giordani Soika; (32) *Leptomenoides mackayensis* Giordani Soika; (33) *Epsilon laboriosum* (Smith); (34) *Euodynerus angulatus* (de Saussure). Scale = 1.0 mm.



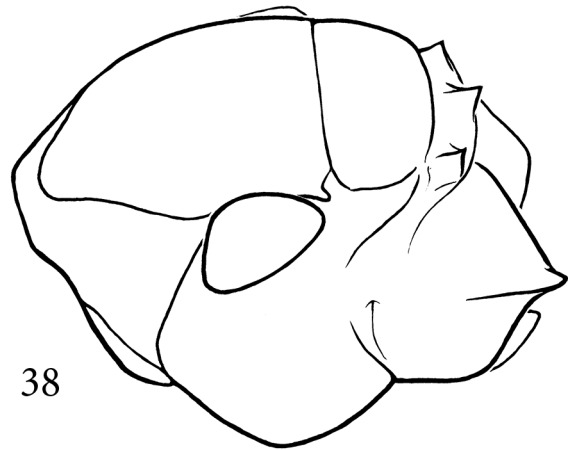
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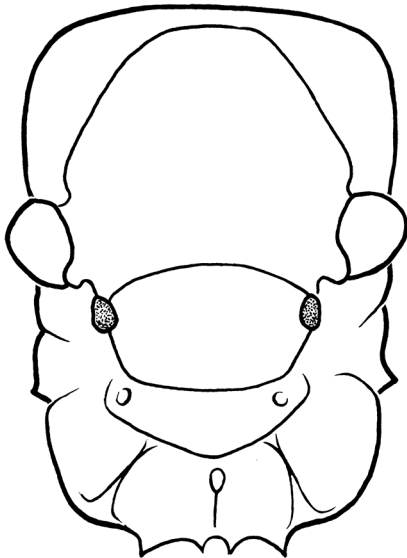
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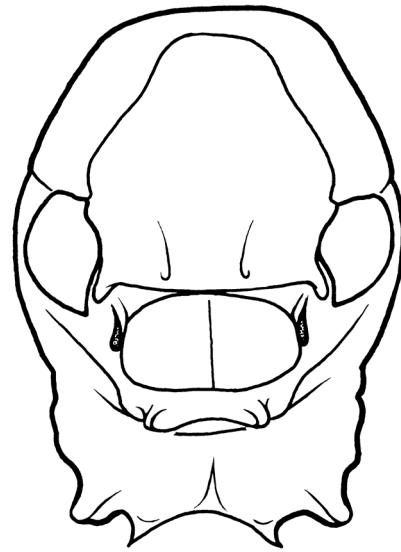
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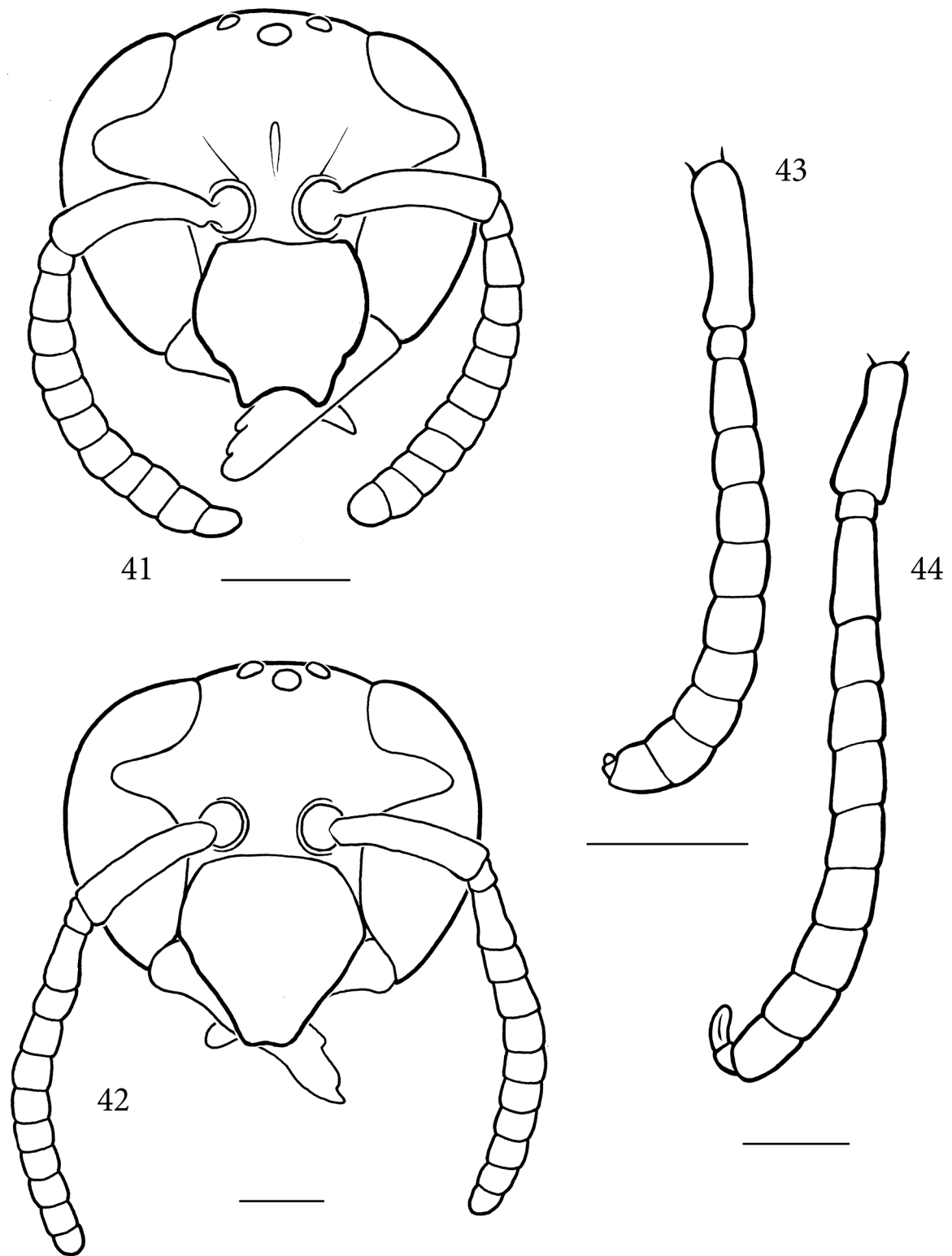


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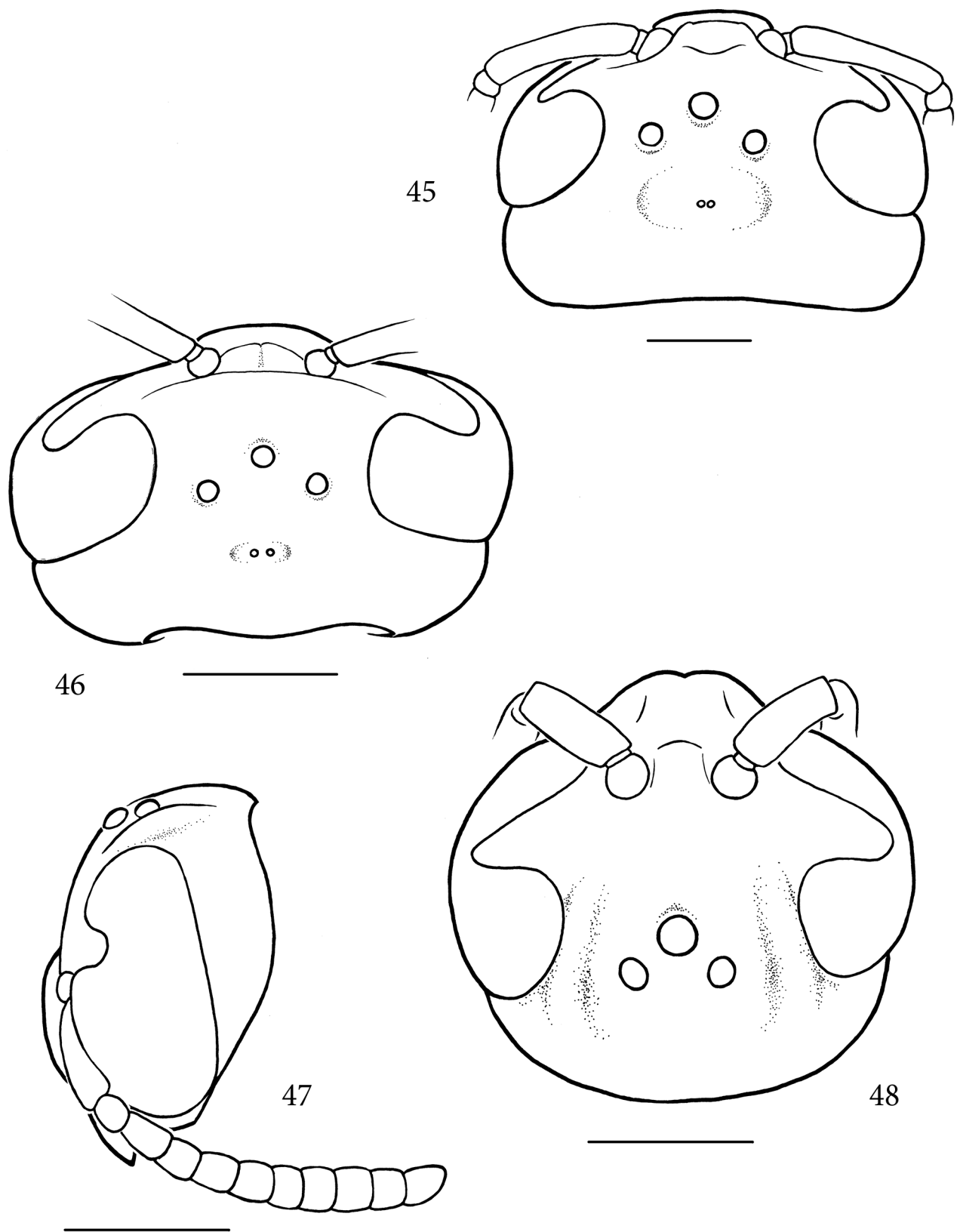


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Figures 35–40. Oblique dorsal views of mesosoma: (35) *Stenodyneriellus bicoloratus* (de Saussure); (36) *Stenodyneriellus occidentatus* (Giordani Soika); (37) *Diemodynerus diemensis* (de Saussure); (38) *Abispa ephippium* (Fabricius). Dorsal views of mesosoma: (39) *Diemodynerus pseudacarodynerus* (Giordani Soika); (40) *Pseudabispa paragioides* (Meade-Waldo). Scale = 1.0 mm.



Figures 41–44. Frontal views of head: (41) *Pararrhynchium* sp.; (42) *Anterhynchium flavolineatum* (Smith). Male antennae: (43) *Flammodynerus flammiger* (de Saussure); (44) *Deuterodiscoelius pseudospinosus* (Giordani Soika)? Scale = 1.0 mm.



Figures 45–48. Dorsal views of head: (45) *Pseudalastor cavifemur* Giordani Soika; (46) *Ectopioglossa polita australensis* (Meade-Waldo); (47–48) *Parifodynerus alariformis* (de Saussure): (47) lateral view of head; (48) dorsal view of head. Scale = 1.0 mm.



Figure 49. *Phimenes arcuatus* (Fabricius), with prey and nest.

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