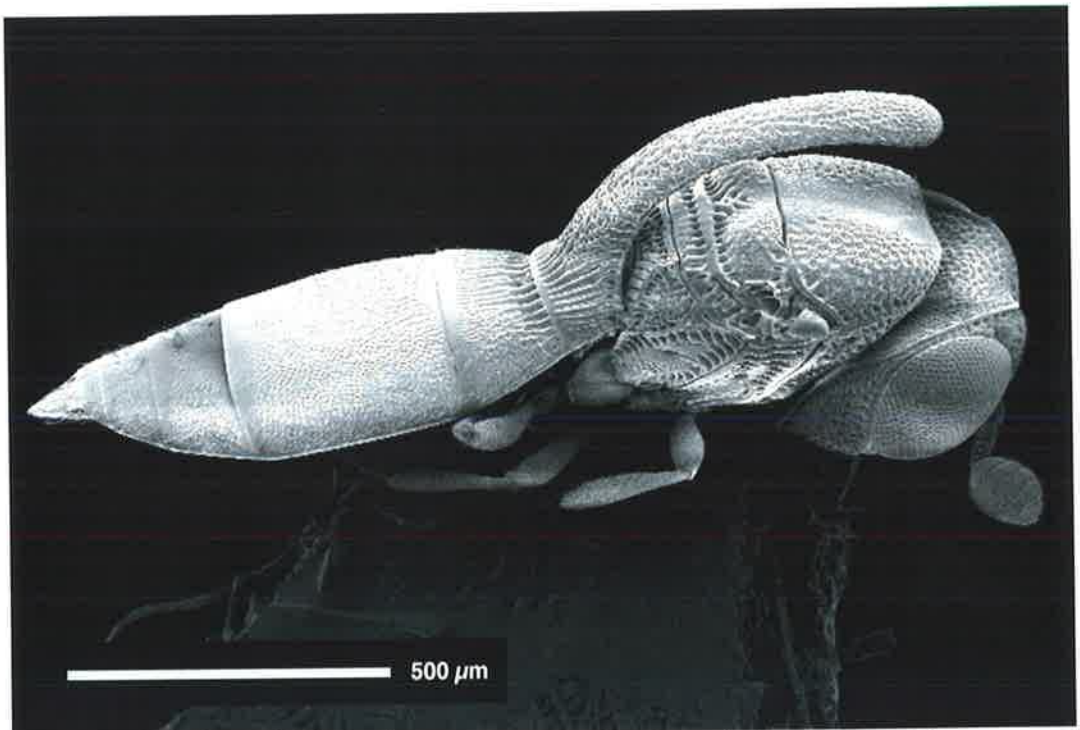
SYSTEMATICS AND PHYLOGENY OF THE BAEINI (HYMENOPTERA: SCELIONIDAE), WITH SPECIAL REFERENCE TO AUSTRALASIAN FAUNA



Dorso-lateral view of *Ceratobaeus megacerus* sp. nov. (wings removed).

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A thesis submitted for the Degree of Doctor of Philosophy in the
Faculty of Agricultural and Natural Resource Sciences at
The University of Adelaide

August 1998

To my wife, Mussarat

for all her love, patience and care

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Summary

Members of the tribe Baeini are endoparasitoids of spider eggs and they are considered to play an important role in regulating spider populations, with some species being responsible for up to 30-40% of egg mortality. Baeines are often highly speciose, with 20-30 species being collected at numerous point localities during this study. This diversity is undoubtedly related to the species richness of spiders at the same sites, given that baeine wasps also appear to be highly host specific. Taxonomically, these wasps are well-known at the generic level, but at species level the group is poorly documented, and the Australian fauna is largely undescribed. Prior to this study there were 86 described species for the Australasian region. The monophyly of Baeini is supported by several characters including their host group, the compact four-segmented antennal clava in females, the mandible being tridentate, and the antennal scape not reaching to the level of the vertex. However, the monophyly of genera are less clear. This study focuses on phylogenetic relationships among genera of Baeini and taxonomy and relationships of *Ceratobaeus* Ashmead, the largest genus in Australasia.

A brief literature review describes the history of taxonomic studies on the group and, in particular, the genus *Ceratobaeus*. This section also reviews the biology of the Baeini and role of Hymenoptera in biodiversity studies.

A detailed treatment of the external morphology of the genus is presented and explains characters and terminology used in the taxonomic revision and phylogenetic analysis. A section on methods then follows and describes the techniques used for collection and identification of material, the use of the field emission scanning electron microscopy (FESEM), and electronic editing of images. A detailed discussion of the methods adopted for phylogenetic analyses, and the workings of the parsimony program PAUP, is also presented.

Two series of analyses were conducted, one for relationships among genera of Baeini and the other for exemplar species of *Ceratobaeus*. For generic level relationships, 49 in-group taxa were selected, including 27 species of Australasian *Ceratobaeus*, as well as an additional 19 taxa from six other Australasian genera and three species of uncertain generic status. *Sparasion* and *Nixonia* were used as out-groups. A data matrix was compiled using MacClade (version 3.07) for these 51 taxa and 35 informative characters. Four of these characters were treated quantitatively while the others were divided into discrete states. The data matrix was analysed using the Random addition sequence of PAUP with 300 replications and TBR branch swapping algorithm. The

resultant trees were further analysed by using successive weighting according to the maximum value of the rescaled consistency index (RC) with all multi-state characters transformed into additive binary characters.

These analyses show the largest genera, *Idris* Foerster and *Ceratobaeus*, are polyphyletic. However, three smaller genera are putatively monophyletic and have identifiable synapomorphies: *Baeus* Haliday is apterous, with a fusiform body and the metanotum greatly reduced; *Odontacolus* Kieffer has a laterally compressed metasomal horn and pedunculate metasoma, and *Hickmanella* Austin has long sparse pilosity covering the body. The status of *Mirobaeus* Dodd and *Mirobaeoides* Dodd are less clear but they fall within a tight clade containing the majority of reduced-winged taxa. Femoral spines, a character previously used to diagnose *Mirobaeoides*, was found to be homoplasious, as were wing reduction, presence of metasomal horn, and a fused antennal clava. Although these results are somewhat preliminary, they indicate that baeine genera are in urgent need of more broad-ranging phylogenetic studies on a world wide basis.

Although *Ceratobaeus* is shown not to be monophyletic, it is one of the most easily recognised genera of Scelionidae because of the presence of a cylindrical metasomal horn in females. This horn provides a space for the elongate, internally retractable ovipositor, and its size and morphology are undoubtedly linked to the radiation of the genus in exploiting different hosts and, ultimately, to their high degree of host specificity. For this reason *Ceratobaeus* is maintained as a genus of convenience until generic boundaries within the Baeini are better resolved and a stable classification can be proposed.

Relationships among species of *Ceratobaeus* were examined for 55 exemplar species. *Sparasion*, *Nixonia* and the most basal species of *Idris* from the generic level analysis were used as out-groups. An analysis using 48 informative characters was conducted, 46 of which were the same as in the generic level analysis. Ten characters were treated quantitatively while the remaining 38 were divided into discrete states. The heuristic analysis was largely unresolved because of the high level of homoplasy and so a successive weighting analysis was conducted. This analysis generated almost completely resolved tree, and the resultant monophyletic clades were used to determine a species-group classification. Twenty-eight such groups are proposed with the remaining 79 species (not included in the analysis) being assigned to these species-groups based on the synapomorphies for each clade.

Ceratobaeus is revised for the Australasian region, with a total of 133 species being recorded and described for the Australasian region, of which 101 are recognised as new. Illustrated keys to species-groups and species based on females are presented and, where possible, notes on their biology and host relationships are also provided.

The results of this study are discussed in regard to the inadequacy of morphological data to determine phylogenetic relationships within the Baeini, and their potential as a target taxon for biodiversity studies. Although this study has by no means exhausted the likelihood of finding characters useful for phylogenetic analysis, it is also clear from this work that morphological characters will probably not fully resolve relationships within this tribe because of the extremely high level of homoplasy. In this respect the role of other data sets, such as those generated by molecular systematics, is discussed as a means of solving generic level relationships with the tribe, and scelionids in general.

DECLARATION

This thesis contains no material that has been accepted for the award of any other degree or diploma in any university and to the best of knowledge and belief, this thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

I consent to this thesis being made available for photocopying and loan if accepted for the award of the degree, providing that acknowledgement is made of any reference to work therein.

One published paper is included as part of this thesis written by M. Iqbal and A. D. Austin. This work was proposed by A. D. Austin, but the research conducted towards it was solely my responsibility.

August 1998 Muhammad Iqbal

Acknowledgements

When I decided to start a PhD in Australia, I realised that it is going to be an exercise in multi-dimensional learning. The systematics and cladistic studies of tiny parasitic wasps was just one aspect of my learning, along with many new aspects of a different culture. I would like to thank my sponsoring agency, AusAID for providing me the opportunity to study in Australia.

I am extremely thankful to my principal supervisor, Andy Austin, Associate Professor in Crop Protection, for all his efforts to guide me throughout this long period of my project. He was always a keen listener, and helped to inject new ideas and dimensions into the project. He advised and supported me in many fields which were not necessarily part of my project. I also want to extend special thanks for his correcting many 'millions' of grammatical mistakes.

I am highly thankful to Paul Dangerfield, my co-supervisor. He was always there to listen to my problems and advise me. He also taught me many research techniques and a few computer games as well. Besides being an excellent teacher, he is also a good friend. He gave such tremendous support to my family that now we are afraid of a cultural shock back in Pakistan. Thank you Paul for all your love and care.

My thanks also go to Professor Otto Schmidt my second co-supervisor for regularly asking about the progress of my project and encouraging me. I am also thankful to Lubo Masner who sent me much needed literature and unpublished material. He was always ready with advice for me during this project. My thanks also to Mark Harvey who provided help in deciding the names for new species and sorting material from pitfall traps in Perth.

The micrographs and line drawings 4.1-4.3, 6.2, 6.5-6.8, 6.10-6.13, 6.15, 6.17-6.22, 6.36, 6.62, 6.63, 6.83, 6.105, 6.113, 6.167, 6.122, 6.252, 6.263 and 6.299 are taken from Austin (1981b, 1984a, 1984c, 1988 and 1995) and Galloway and Austin (1984) and were originally taken or drawn by Associate Professor Austin. I thank him sincerely for access to these illustrations.

I wish to thank John Terlet, Marilyn Henderson and Lyn Waterhouse from CEMMSA, The University of Adelaide, for their assistance with scanning electron microscopy. I would also like to thank the Curators or Collection Managers of the institutions from which material was obtained: Ian Naumann and Jo Cardale (ANIC); John Noyes (BMNH); Lubo Masner (CNCI); John Donaldson (QDPC); Eric Matthews (SAMA), and Terry Houston and Mark Harvey (WAMP).

My thanks to colleagues, John Jennings, Azhar Saeed, Gwen Mayo and Graham Lewis, for their suggestions and help during this project. I also want to extend my thanks to John and Beth Roberts, and Peter and Diana Clarke, who provided social support to my family and made our stay in Adelaide a sweet memory.

Lastly, I would like to thank my family, my brother Allah Ditta and his family, who always encouraged me to achieve higher goals; to my daughter Zeba, for adding joy and pleasure in my life and accepting the fact that 'Dadda has to go to work after dinner'. At last, the most important part of my life, my wife Mussarat, who was always there to listen to my worries, fears and excitements as well about the project. My long hours of working made her too responsible for caring for everything including Zeba and myself. Thank you Mussie for your wonderful role in this project.

Chapter 1

Introduction

Like the other mega-diverse orders of insects, the Hymenoptera comprise a large number of functional groups, including herbivores (exposed leaf-feeders, leaf miners, gall formers, seed feeders, pollen and nectar feeders, and xylophagous species), predators, parasitoids (both ecto- and endoparasitoids), and hyperparasitoids (Gauld & Bolton 1996). However, it is one functional group, the parasitoids, that is responsible for the species richness of the order. Parasitoids exploit arthropods as a food source for their developing larvae and they have radiated into this almost unlimited resource, producing a phenomenal number of species, probably several hundred thousand world-wide.

One group of small scelionid parasitoids, the Baeini, many of which are less than 1 mm in length, endoparasitically attack the eggs of spiders (Austin 1985). They are ubiquitous in most habitats and are postulated to be important regulating agents of spider populations (Austin 1984a). The tribe is one of the most easily recognised groups of scelionid wasps, because of the strongly clavate antenna in females, and the often elongate metasomal horn of some genera (i.e. *Ceratobaeus* Ashmead and *Odontacolus* Kieffer). Baeines are found parasitising spider eggs in leaf-litter, the tree canopy, desert areas, and even the intertidal zone. They are usually highly speciose at any given locality, and this diversity is undoubtedly related to the species richness of spider at the same sites, given that baeine wasps also appear to be highly host specific. Spiders are becoming a preferred indicator group for measuring invertebrate biodiversity, habitat disturbance, community structure and biogeographic relationships (e.g. Churchill 1997). Assessing the species richness of baeine wasps at the same time may then provide a useful comparison between trophic levels, i.e. between spiders and their parasitoids. One of the attributes that lend scelionid wasps to this purpose is that, although small in size, they are relatively easy to identify. However, before such comparisons are possible, a much better understanding of their systematics, diversity and host relationships will be required.

Taxonomically, baeine wasps are well-known at the generic level (Galloway & Austin 1984), but at species level the group is poorly documented, and the Australasian fauna is largely undescribed. A recent survey based on examination of material in collections (Iqbal & Austin 1997) shows that the number of described species conservatively represents only about 20-25% of the estimated total number for Australia. Current research aimed at revising the genus *Ceratobaeus* for Australasia has recognised 133 species, of which only 32 are previously described. A least one other genus, *Idris* Foerster, is of comparable size to *Ceratobaeus*, while the remaining five genera combined (*Baeus* Haliday, *Hickmanella* Austin, *Mirobaeus* Dodd, *Mirobaeoides* Dodd, *Odontacolus*) are probably as speciose again. Further, a recent study of the baeine fauna around Perth (Iqbal & Austin 1997) indicate that they show some level of endemism on a small scale. This strongly suggests that areas of the continent that have not been collected or only poorly surveyed are likely to yield many new species. Hence, the estimate for the total number of baeine species in Australia of 500 is likely to be accurate, if not conservative.

Phylogenetically, the monophyly of the Baeini is supported by several characters, none of which are unequivocal except for their host group (i.e. no other genera in the family parasitise spider eggs). These include the terminal four segments of the female antenna being fused into a compact clava, the mandible being tridentate, and the antennal scape not reaching to the level of the vertex (Austin & Field 1997). However, the monophyly of most genera is questionable. A major revision of baeine classification is therefore required, necessitating more broad-ranging studies of the world fauna. A number of genera are putatively monophyletic and have identifiable synapomorphies: *Baeus* is apterous, with a fusiform body and has the metanotum greatly reduced; *Odontacolus* and *Cyphacolus* Priesner have a laterally compressed metasomal horn and pedunculate metasoma, while *Hickmanella* has long sparse pilosity covering the body. The status of *Mirobaeus* and *Mirobaeoides* is unclear in that several undescribed species, nominally assigned to these genera, form intermediates between several of the above genera, all of which fall within *Idris* and *Ceratobaeus* on phylogenetic relationships.

Morphologically, baeine wasps show extreme levels of sexual dimorphism. The females of *Baeus* and *Mirobaeoides* are apterous with a compact, fusiform body, adapted to burrowing through litter or soil where their hosts reside (Austin 1986), while males are fully winged, not compact in shape and are never found in these habitats. Females of *Ceratobaeus* and *Odontacolus* have a metasomal horn which is extremely elongate in many species (Figs. 6.202, 6.203, 6.205) while it is completely lacking in males (Galloway & Austin 1984). Generally, the males of all baeines are very similar, they are not readily assigned to genera, and lack distinguishing characters. Hence, the taxonomy of the group is based almost solely on the female sex, as is the case for many other parasitic wasp families, where morphological diversity is linked to functional characters associated with host finding and oviposition.

The main aim of this study was to undertake a cladistics analysis of phylogenetic relationships among genera of Australasian Baeini and among species of *Ceratobaeus*. Two data matrices were constructed by coding 50 potentially informative morphological characters for females. One data matrix was used to determined relationships among genera while the other was used to search for possible relationships among species of Australasian *Ceratobaeus*. The data matrices were analysed using a computer-based algorithm to determine the most parsimonious hypotheses.

Secondly, the study aimed to revise the taxonomy of Australasian *Ceratobaeus*. Usually a research project of this type (i.e. a systematics Ph.D) deals with a group of insects which has a limited number of species (usually about 30). These small groups are easy to handle for the time available and allow for detailed studies on morphological characters, biology and geographic relationships. However, this study took a different approach by dealing with a group of insect which is highly species rich. A major aim of this project was to target a group of "real" importance, and this necessitated the need to develop procedures for dealing with a large number of species. In this respect computerised (digital) imaging was very effective for recording results from scanning electron microscopic examination of species, scoring characters for the phylogenetic analysis, and preparing photographic plates.

The present study is organised so that Chapter 2 reviews the literature pertinent to all parts of the project, Chapter 3 covers the methods employed for phylogenetic and taxonomic studies, Chapter 4 discusses the general morphology of the Baeini, Chapter 5 details the results of the phylogenetic analyses for the relationships among genera and species of *Ceratobaeus*, while Chapter 6 revises the Australasian fauna of the genus *Ceratobaeus* by providing descriptions and keys. Finally, in Chapter 7, the General Discussion, several facets of the project have been selected for broader analysis and discussions.

Chapter 2

Literature Review

2.1. Introduction

The Parasitic Hymenoptera are one of the most species rich and abundant components of terrestrial ecosystems. Literally hundred of species may be collected in almost any habitat. Scelionids are important regulating agents as egg-parasitoids of grasshoppers, locusts, crickets, bugs and spiders. This chapter will review the literature related to the taxonomy and biology of the Baeini (*sensu* Austin 1986), and use of Hymenoptera in biodiversity studies. There is no published literature regarding phylogenetics of this tribe except for Austin & Field (1997), whose study is reviewed in this chapter.

2.2. Higher level classification of the Baeini

The first suprageneric groups for the Scelionidae were proposed by Ashmead (1893) who divided the then subfamily into four tribes which he later (1903) elevated to subfamily rank, *viz.* Baeinae, Scelioninae, Teleasinae and Telenominae. Kieffer (1926) suggested five subfamilies for the Scelionidae, treating the Platygastrinae as one of them. No significant contributions were then made until Kozlov (1970) who, by following Ashmead (1903), divided the family into four subfamilies, *viz.* Baeinae, Scelioninae, Teleasinae and Telenominae. The subfamily Baeinae was characterised by the female having 7-segmented (rarely 8-segmented) antennae with a stout unsegmented clava, and the male having 11-segmented (rarely 12-segmented) antennae, with segments 11 and 12 fused and divided only by a suture. Within the subfamily Baeinae, he recognised three tribes, Thoronini Kozlov, Idrini Kozlov and Baeini Ashmead.

Masner (1976a) made the most significant contribution to the higher classification of the Baeini (Baeini + Idrini). He described four new tribes, *viz.* Nixoniini, Sparasionini, Cremastobaeini and Doddiellini and recognised only three subfamilies, the Telenominae, Teleasinae and Scelioninae, having included the Baeinae within the Scelioninae as two tribes (Baeini and Idrini). The genera *Ceratobaeoides* Dodd, *Ceratobaeus*, *Cyphacolus*, *Dissacolus* Kieffer, *Dyscritobaeus* Perkins, *Idris*, *Odontacolus* and *Pseudobaeus* Perkins were placed in the tribe Idrini, while *Aneurobaeus* Kieffer, *Angolobaeus* Kozlov, *Apobaeus* Masner, *Baeus* and *Paraneurobaeus* Risbec were retained in the tribe Baeini. Further, he placed three genera, *Echthrodesis* Masner, *Mirobaeoides* and *Mirobaeus* in the Embidobiini Kozlov on the basis of morphological similarities with the embiid parasitoids in this tribe, even though the former genera parasitise spider eggs. Masner (1979) discussed and assessed the importance of pleural characters in scelionids. Two new terms, 'netrion' and 'mesopleural carina' were proposed but these structures affect little the taxonomic limits and classification of the Baeini.

Galloway & Austin (1984) followed the classification of Masner (1976a) in their synopsis of the Australian Scelioninae, recording 48 genera for the continent, and 303 described species. These authors also discussed the host relationships of the various tribes and the link between some morphological characters and particular host groups (see below). Austin (1986) synonymised the Idrini with the Baeini because there were some taxa which represent intermediates between these two tribes, especially in regard to the relative sizes of the first three metasomal tergites and the degree to which the metasoma broadly fits against the mesosoma. More recently, Johnson (1992) has compiled a detailed catalogue of the world Proctotrupoidea excluding Platygastridae. This work usefully provides an easy reference guide to all the described genera and species of Baeini and the relevant literature (Tables 2.1 and 2.2).

While revising the diapriid subfamily, Ambositrinae, Naumann (1982) found that 66% of Australian species had females with reduced-wings while 11% were polymorphic for wing length. He found that changes in several mesosoma characters were linked with wing reduction, *viz*. the pronotal collar is more elongate and the notauli are absent in apterous species, and the mesoscutellar foveae and lateral excavations become progressively weaker with reducing wing length. Reduction in the size of the eyes and ocelli, and paler colour in reduced-winged species were also observed. The fusion of sclerites and shape of the mesosoma were correlated with the absence of wings and, consequently, the absence of flight muscles (Reid 1941). Richards (1951) reported similar morphological changes during study of reduced-winged Sphaeroceridae (Diptera). Galloway and Austin (1984) discussed wing reduction within the Scelionidae. They stated that the pronotum remains unchanged in shape and size in reduced-wing forms, but the mesosoma tends to become shorter and broader, the notauli more likely to be absent, and the foveae normally present between the scutum and scutellum in winged forms, are reduced in micropterous forms. Galloway (1978) found wing length to be a reliable character in distinguishing species of *Duarina* Dodd while Huggert (1979) argued that colour and shape of wings are intraspecifically variable for European species of *Idris*. Such intraspecific differences have not been recorded during the present study on the Australasian Baeini. Austin (1990) concluded that a sessile mesosoma and metasoma and general rounded streamline shape of the body seem to have evolved independently in several lines within the Baeini and Gryonini, as well as in the platygastrid genus *Parabaeus* Kieffer. Such genera are often recorded from litter or similar cryptobiotic niches, and presumably this morphology represents an adaptation to moving through the confines of such a restricted habitat.

2.3. Generic and species level taxonomy of the Baeini

The Baeini (*sensu* Austin 1986) are currently characterised by following morphological character, following Masner (1976), Galloway & Austin (1984), Austin (1986) and Austin & Field (1997): Head usually wider than mesosoma, rarely narrower than mesosoma; mandibles tridentate; eyes usually large, rarely reduced; lateral ocelli usually touching eye margins, rarely not touching eye margins or distance from eyes > 1OD; female antennae 7- to 11-segmented with a compact or 4-segmented clava; male antennae 8- to 12-segmented; female wingless to fully-winged; male usually fully-winged, hind wings with complete submarginal vein reaching frenal hooks; female metasoma sessile to petiolate; male metasoma petiolate; laterotergites either free or incised into submarginal groove; female with 7 tergites and 6 sternites, T7 external; male with 7 tergites and 7 sternites; ovipositor contained within a sclerotised membranous tube connected to posterior metasoma only by elongated muscles and apodemes.

Little recent work has been undertaken on the species level taxonomy of the Baeini outside of the Australasian region, except for Huggert (1979), Masner (1980) and Masner & Denis (1996). Huggert (1979) revised the West Palearctic species of *Idris* and synonymised four genera, *viz. Acolus* Foerster, *Megacolus* Priesner, *Ceratobaeus* and *Pseudobaeus*, and split it into two subgenera, *Idris (Idris)* and *Idris (Ceratobaeus)*. Masner (1980) provided an illustrated key to scelionid genera of the Holarctic region, recognising 67, of which 32 were common between the Nearctic and the Palearctic regions. Of these, 22 contain 12 or more described species. Masner & Denis (1996) described 10 new species of *Idris* from the Nearctic region under a proposed new species group, the *melleus*-group. Other significant works at species level are Mani (1939, 1973, 1975), Mukerjee (1978, 1981, 1993) and Mani & Mukerjee (1976), who collectively described 35 species from India; Kozlov & Lê (1987) who described 13 species from Vietnam; Risbec (1950, 1956a, 1957) who described five species from Africa, and Ashmead (1893) who described 12 species from North America.

Table 2.1. Summary of the world genera of the tribe Baeini, and their currently recognised synonyms (after Johnson 1992).

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1. *Aneurobaeus* Kieffer
Aneurobaeus Kieffer 1912b, pp. 87, 91.

2. *Angolobaeus* Kozlov
Angolobaeus Kozlov 1970, p. 218.

3. *Apobaeus* Masner
Apobaeus Masner 1964, p. 149.
Tetrabaeus Ogloblin 1957, p. 436. Preoccupied by *Tetrabaeus* Kieffer (1912a).

4. *Baeus* Haliday
Baeus Haliday 1833, p. 270.
Hyperbaeus Foerster 1856, p. 144. Unnecessarily proposed replacement name.
Psilobaeus Kieffer 1926, 132, pp. 133, 146. Synonymised by Masner (1965).
Anabaeus Ogloblin 1957, p. 440. Proposed as subgenus of *Baeus*.

5. *Ceratobaeus* Ashmead
Ceratobaeus Ashmead 1893, pp. 167, 175.

6. *Cyphacolus* Priesner
Cyphacolus Priesner 1951, p. 126.

7. *Echthrodesis* Masner
Echthrodesis Masner 1968, p. 197.

8. *Hickmanella* Austin
Hickmanella Austin 1981, p. 303.

9. *Idris* Foerster
Idris Foerster 1856, pp. 102, 105.
Acoloides Howard 1890, p. 269. Synonymised by Masner (1961).
Acolus auctorum nec Foerster
Pseudobaeus Perkins 1910, p. 620. Synonymised by Huggert (1979).
Dissacolus Kieffer 1926, 132, p. 155. Synonymised by Austin (1981a).
Megacolus Priesner 1951, p. 121. Synonymised by Masner (1961).
Philoplanes Muesebeck & Walkley 1956, p. 384. Synonymised by Masner (1961).
Tasmanibaeus Hickman 1967, p. 27. Synonymised by Masner (1976a).
Tasmanacolus Hickman 1967, p. 30. Synonymised by Masner (1976a).

10. *Mirobaeoides* Dodd
Mirobaeoides Dodd 1914b, pp. 59, 74.
Notoscelio Hickman 1967, p. 35. Synonymised by Austin (1981a).
Psyllobaeus Austin 1984, p. 121. Synonymised by Austin (1981a).

11. *Mirobaeus* Dodd
Mirobaeus Dodd 1914b, pp. 59, 79.

12. *Neobaeus* Austin
Neobaeus Austin 1988, p. 174.

13. *Odontacolus* Kieffer
Odontacolus Kieffer 1910, p. 294.
Ceratobaeoides Dodd 1913b, p. 337. Synonymised by Austin (1981a).

14. *Paraneurobaeus* Risbec
Paraneurobaeus Risbec 1956b, p. 821.

2.3.1. The Australasian fauna

Walker (1839) described the first species of scelionid wasp from Australia, *viz.*, *Scelio gobar*, from material collected by Charles Darwin. Most taxonomic work on the scelionids of Australia was carried out by A. P. Dodd during 1913-1933. Dodd (1913a) described *Idris minuta* (the first Australian baeine) from north Queensland along with many other new species of scelionids. Soon after he described a new genus, *Ceratobaeoides*, from Queensland (Dodd 1913b) and recorded seven new species of Baeinae (Dodd 1914a). His most comprehensive work on the Baeini (Dodd 1914b) provided a key to genera and description of 25 new species under the genera, *Ceratobaeus, Acolus, Acoloides* Howard, *Odontacolus, Pseudobaeus, Baeus* and *Mirobaeoides.* He subsequently described six additional new baeines from Australia in a series of papers (Dodd 1914c, 1915a, 1915b, 1926).

Girault also contributed to the knowledge of Australian baeines and described four species under *Baeus*, *Pseudobaeus* and *Odontacolus* (Girault 1926, 1928, 1933). More than thirty years transpired before Hickman (1967) described 12 species from Tasmania, all of which were reared from the eggs of known spiders. This work, importantly provided the first host records for any Australian species. Galloway (1976) produced a check-list to the 37 genera and 239 species of Australian Scelioninae but excluded the tribes Baeini and Idrini. This work resulted in changes to the generic placement for 79 species.

A. D. Austin has made the most recent contributions to the systematics of the Australasian baeines. In a complementary paper to Galloway (1976), Austin (1981a) listed the 62 Australian species in the tribes Baeini, Idrini and Embidobiini and noted a number of taxonomic changes, in particular the synonymy of three genera, *Ceratobaeoides*, *Dissacolus* and *Notoscelio* Hickman with *Odontacolus, Idris* and *Mirobaeoides*, respectively. He also transferred the genus *Mirobaeoides* from the Embidobiini to the Baeini. Austin (1981a) followed Masner's (1976) classification and proposed 28 new combinations, and in the same year described a new genus, *Hickmanella* (Austin 1981b). This genus was characterised by having 11-segmented antennae in the female (5 funicle segments and a distinctively 4-segmented club) and an expanded keel-like carina on the frons. Austin (1984a) described three new species of *Ceratobaeus* from south-eastern Australia, *viz. C. intrudae, C. platycornutus* and *C. rieki* and redescribed five previously ill-defined species, *viz. C. clubionus* Austin, *C.*

Table 2.2. Distribution of the genera of Baeini (*sensu* Austin 1986, Austin & Field 1997) and number of described species (after Johnson 1992).

Genus	No. of species	Distribution
Aneurobaeus Kieffer	2	Oriental
Angolobaeus Kozlov	1	Afrotropical
Apobaeus Masner	1	Neotropical
Baeus Haliday	20	Cosmopolitan
Ceratobaeus Ashmead	58	Cosmopolitan
Cyphacolus Priesner	1	Palearctic
Echthrodesis Masner	1	Afrotropical
Hickmanella Austin	4	Australasian
Idris Foerster	116	Cosmopolitan
Mirobaeoides Dodd	15	Australasian
Mirobaeus Dodd	2	Australasian
Neobaeus Austin	1	Australasian
Odontacolus Kieffer	6	Cosmopolitan
Paraneurobaeus Risbec	1	Afrotropical
Total	**229**	

cuspicornutus Austin, *C. masneri* Austin, *C. setosus* Dodd and *C. lamponae* (Hickman). Information on the biology and distribution of the above species was also provided. The new genus *Psyllobaeus* based on *P. pecki* was described from Lord Howe Island by Austin (1984c). This genus was considered unique within the Baeini because both sexes (not just females) were apterous, and this condition in males was proposed as an adaptation to living on a small isolated island. More recently this species was synonymised with *Mirobaeoides*, the apterous male being proposed to be only of specific importance (Austin 1995).

More recently, Austin (1986) revised the genus *Mirobaeoides*, which he diagnosed on the presence of specialised femoral spines on the hind legs, and described 10 new species. A key to separate these species and information on their relationships, distribution and biology were also presented. Austin (1988) described a new genus and species, *Neobaeus novazealandensis,* from New Zealand. Collection data indicated that the species inhabits moss-covered ground throughout the North and South Islands. The genus was proposed to be closely related to the cosmopolitan and highly apomorphic *Baeus*, but differed in its retention of several apparently primitive characters and the micropterous form of the male. He also transferred *Mirobaeus* from the tribe Embidobiini to the Baeini because of its apparent similarity to other baeine genera and its association with spiders. In this paper the genera *Baeus*, *Hickmanella*, *Ceratobaeus* and *Mirobaeus* were also recorded from New Zealand for the first time, and a provisional key to New Zealand baeine genera was also provided. Austin (1995) described six new species from Western Australia, and proposed the retention of *Ceratobaeus* as a separate genus from *Idris*, which Huggert (1979) had previously to subgeneric status. Johnson (1992) followed Huggert (1979) and maintained it as a subgenus in his world catalogue of scelionid species. However, Austin (1984b, 1995) and Galloway & Austin (1984) have argued against this change and suggested keeping these genera separate because of apparent differences in the shape of the first metasomal tergite (T1) in males and females, form of the propodeum, and length of the ovipositor (Austin 1983). Masner & Denis (1996) proposed *Ceratobaeus* as a junior synonym of *Idris* on the basis that some species show a transitional development of the hump or horn on T1. They also postulated that various Nearctic "*Ceratobaeus*" species with a projection on T1 did not constitute a monophyletic unit but are related to various species (i.e. *Idris*) that lack this character state. Austin & Field (1997) proposed two ovipositor characters to distinguish these genera; firstly, the length of ovipositor which is less than 0.8 x length of the metasoma in *Idris* and more than 1.0 x length of metasoma in *Ceratobaeus* even in species with a small horn, e.g. *C. clubionus* and *C. masneri*; secondly, the length of proximal arms is less than 0.1 x length of ovipositor in *Ceratobaeus* while it is always more than 0.15 x in *Idris*. They also discussed the characters that define the Baeini including their host group, the compact four-segmented antennal clava in females, the mandible being tridentate with a convex outer face, and the antennal scape not reaching the level of the vertex. Of these characters only the host group (spider eggs) were proposed to be synapomorphous for the tribe. Austin & Field (1997) transferred *Echthrodesis* from the Embidobiini to the Baeini on the basis of these characters, which then meant that all scelionids known to parasitise spider eggs were contained within the one tribe.

There are currently 86 described species of Baeini in the Australasian region, while it is estimated that 400 species may be present (Table 2.3). These figures clearly show that there is a substantial bias in described baeine fauna given that there are only 229 species described world-wide. If the world fauna is proportional to that of the described and estimated number of species for the Australasian fauna, then the total number of species in the Baeini is in excess of 1,100 species.

Table 2.3. Recorded and estimated species of Australasian Baeini (after Iqbal & Austin 1997).

Genus	Recorded species	Estimated species
Baeus Haliday	3	20
Ceratobaeus Ashmead	31	150
Hickmanella Austin	4	10
Idris Foerster	27	150
Mirobaeoides Dodd	15	25
Mirobaeus Dodd	2	15
Neobaeus Austin	1	5
Odontacolus Kieffer	3	25
Total	**86**	**400**

The taxonomic limits of baeine genera are not clear and their phylogenetic status is not resolved. There are 14 genera world-wide which can be grouped into three complexes, i.e. *Baeus* complex, *Odontacolus* complex and *Idris-Ceratobaeus* complex. The *Baeus* complex includes five genera, *Aneurobaeus*, *Angolobaeus*, *Baeus*, *Neobaeus* and *Paraneurobaeus* and can be defined by one synapomorphy, laterotergites broad, free and excised. They also share two other characters, i.e. aptery in females and T2 being the largest tergite. *Aneurobaeus* is known only from two species, the holotype (*A. apterus*) which is apparently lost and a fossil species (*A. collaris*), described by Brues (1940). The illustrations in the original description of the holotype by Kieffer (1926) show that it is a *Baeus* species except for the presence of T1 which can be due to tilt of the specimen. *Angolobaues* is very close to *Baeus* and is distinguished by presence of lobes on the head, a character known to be of only specific importance in other scelionid genera (Johnson 1980). *Baeus* is the largest genus with 20 described species world-wide. *Neobaeus* is monotypic and separated from *Baeus* by four primitive characters, i.e. the metanotum being visible, the large size of T1, the 4-segmented clava and the 2-segmented maxillary palp. *Paraneurobaeus*, based on *P. arachnevora* is also monotypic and was misinterpreted by Risbec (1956b). He described the antennal clava as having many segments but examination of the holotype shows that it is in fact the lines of hair transversely across the clava, made more obvious due to artifact of a poor slide preparation (A. D. Austin pers.comm). It clearly is a junior synonym of *Baeus*.

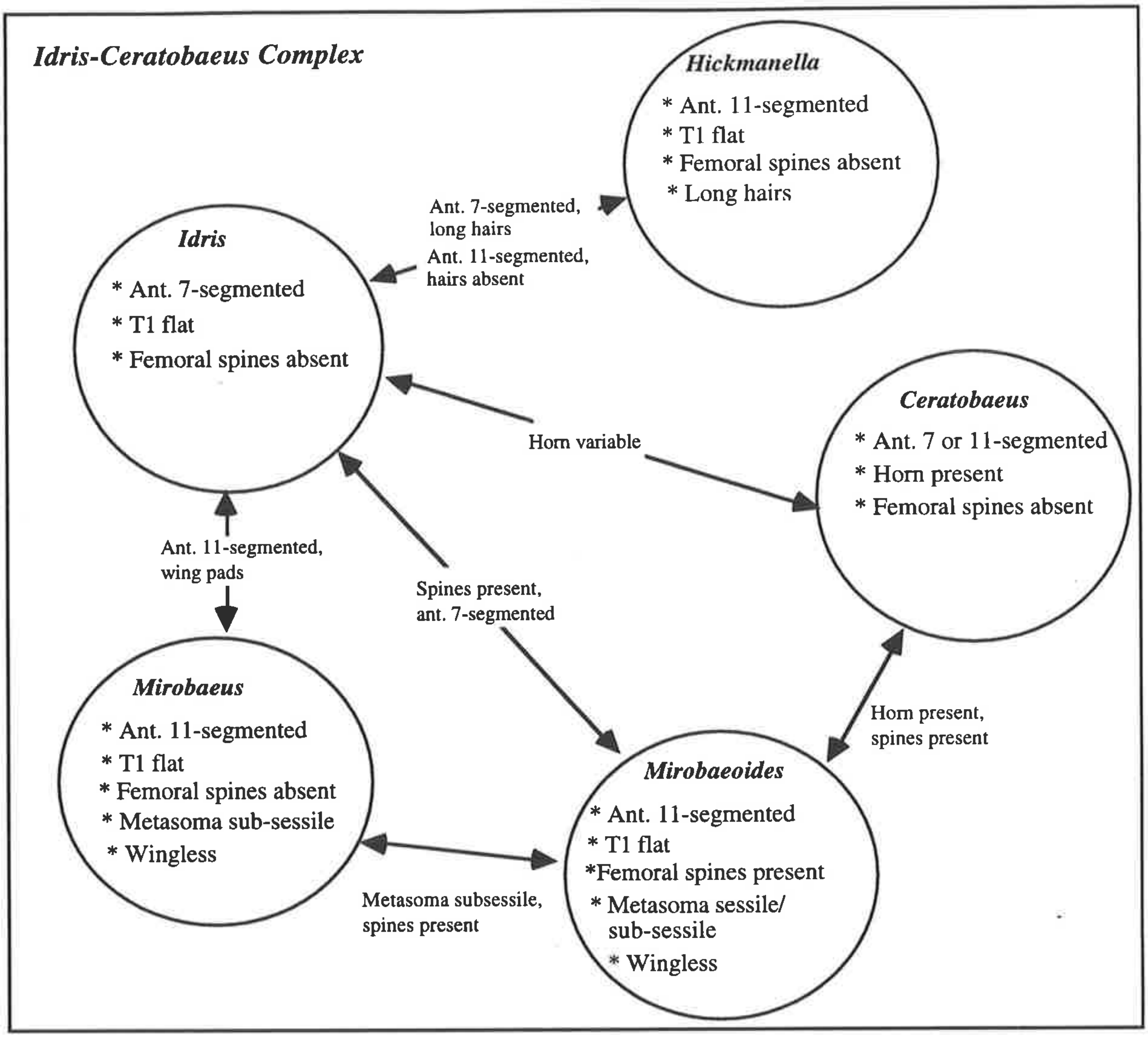


Fig. 2.1. Generic boundaries within the Australasian members of the *Idris-Ceratobaeus* complex of genera. Characters inside circles are currently used to diagnose genera while those between the circles reveal the existence of intermediate taxa that cannot be easily placed within any genus as currently diagnosed.

The *Odontacolus* complex contains two genera which are closely related, *Cyphacolus* and *Odontacolus*. This complex has at least two synapomorphies, the metasomal horn being laterally compressed and the propodeal lamellae being long, broad and projecting either side of the metasomal horn. The *Idris-Ceratobaeus* complex is the largest assemblage of taxa with seven genera included, *Apobaeus*, *Ceratobaeus*, *Echthrodesis*, *Hickmanella*, *Idris*, *Mirobaeoides* and *Mirobaeus*. There is no synapomorphy for this complex, and generally they are defined by their lack of derived states which characterise the other two groups. *Apobaeus*, *Echthrodesis*, *Mirobaeoides* and *Mirobaeus* are wingless genera, while *Ceratobaeus*, *Hickmanella* and *Idris* almost always fully-winged, although a few reduced-winged species are known. The generic boundaries in this group are poorly defined and only three genera have putative synapomorphies: *Hickmanella* has long hairs covering the head and mesosoma; *Mirobaeoides* has a pair of spines on the hind femora and *Ceratobaeus* by the presence of a cylindrical horn on T1. However, preliminary examination of many undescribed species that exist in Australasian collections reveals numerous taxa that show intermediate characters between the currently recognised genera, as shown in figure 2.1. This confusion of generic status within *Idris-Ceratobaeus* complex clearly highlights the need of a comprehensive study on the systematics of the Baeini which can provide a framework for further research their use in biodiversity research.

2.4. Biology of the Baeini

There is very little published information available on the biology of baeine wasps except for host check-lists (Auten 1925; Eason *et al.* 1967; Austin 1985). Female baeines deposit their eggs inside the eggs of spiders usually after penetrating the egg sac (Brandon 1972; Fitton *et al.* 1987). Every genus recorded from Australia has been reared from spider eggs (Austin 1985), with hosts documented for about 25 species. This corresponds to about half of the world's published host records (Table 2.4). At the species level, available host records indicate the majority of baeines may be monophagous, while some may be specific to a host genus or to a particular microhabitat (Austin 1984a, 1885). Austin (1985) analysed the function of spider egg sacs and concluded that these structures reduce or prevent mortality by parasitoids and predators. He recorded 17 families of spiders which are parasitised by baeine wasps. Members of genera with a metasomal horn on T1 possess a long ovipositor which they extend through the spider's egg sacs, while other genera which lack a horn burrow through the wall of the egg sacs (Fig. 2.2) (Austin 1985). Austin (1984b) studied the fecundity, development and host relationship of *Ceratobaeus* species. Members of this genus enter the nest of their host spider and oviposit into eggs through the thin silk egg sac. He observed that males emerge prior to females and mate with their siblings. In Australia, oviposition activity was limited to temperatures above 15°C. Superparasitism was virtually absent and appeared to occur only rarely from accidental secondary ovipositions. The three species studied overwintered as adults under bark, did not feed and oviposited as soon as host eggs become available in spring. Downes (1994) studied the seasonality of *C. setosus* Dodd, a species which is winter active in the warm climate of tropical Queensland. However, in the higher latitudes of the Northern Hemisphere baeines may overwinter in host eggs. Unfortunately no studies have been yet undertaken to confirm this proposition.

Table 2.4. List of known hosts of Baeini species from Australia (after Austin 1985).

Baeini species	Host species	Spider family
Baeus saliens (Hickman)	*Microctenonyx subitaneus* (Pick.-Camb)	Linyphiidae
Baeus sp.	*Araneus* sp.	Araneidae
	Argiope aethera (Walck.)	Araneidae
	Celaenia sp.	Araneidae
	Cyrtophora moluccensis (Doleschall)	Araneidae
	Steatoda livens (Simon)	Theridiidae
Ceratobaeus ater (Hickman)	*Trite albopilsa* (Keyserling)	Salticidae
Ceratobaeus clubionus Austin	*Clubiona cycladata* Simon	Clubionidae
	Clubiona sp.	Clubionidae
Ceratobaeus cuspicornutus Austin	*Clubiona cycladata* Simon	Clubionidae
	Clubiona sp.	Clubionidae
Ceratobaeus flavipes (Hickman)	*Stiphidium facetum* Simon	Stiphidiidae
Ceratobaeus intrudae Austin	*Intruda* sp.	Gnaphosidae
Ceratobaeus lamponae (Hickman)	*Lampona cylindrata* (L. Kock)	Gnaphosidae
Ceratobaeus masneri Austin	*Clubiona cycladata* Simon	Clubionidae
	Clubiona robusta L. Koch	Clubionidae
	Clubiona sp.	Clubionidae
	Hemicloea sp.	Gnaphosidae
Ceratobaeus setosus Dodd	*Ixeuticus robustus* (L. Koch)	Amaurobiidae
Ceratobaeus turneri (Dodd)	*Supnna picta* (L. Koch)	Clubionidae
Hickmanella holoplatysa Austin	*Holoplatys* sp.	Salticidae
Hickmanella intrudens (Hickman)	*Breda jovialis* (L. Koch)	Salticidae
Idris flavipes Dodd	*Theridion* sp.	Theridiidae
Idris helpidis (Hickman)	*Helpis* sp.	Salticidae
Idris ixeutici (Hickman)	*Ixeuticus martius* (Simon)	Amaurobiidae
	Ixeuticus robustus (L. Koch)	Amaurobiidae
Idris niger (Hickman)	*Argoctenus nebulosus* Simon	Ctenidae
Idris scutellaris (Dodd)	*Lycosa godefforyi* L. Koch	Lycosidae
Idris spadix (Hickman)	*Dipoena* sp.	Theridiidae
Idris theridii (Hickman)	*Theridion properum* Keyserling	Theridiidae
Idris sp.	*Argyrodes colubrinus* (Keyserling)	Theridiidae
	Breda jovialis (L. Koch)	Salticidae
	Tharpyna sp.	Thomisidae
Mirobaeoides atra (Hickman)	*Oxyopes mundulus* L. Koch	Oxyopidae
Mirobaeus pilosus (Hickman)	*Stiphidium facetum* Simon	Stiphidiidae
Odontacolus sp.	*Clubiona cycladata* Simon	Clubionidae

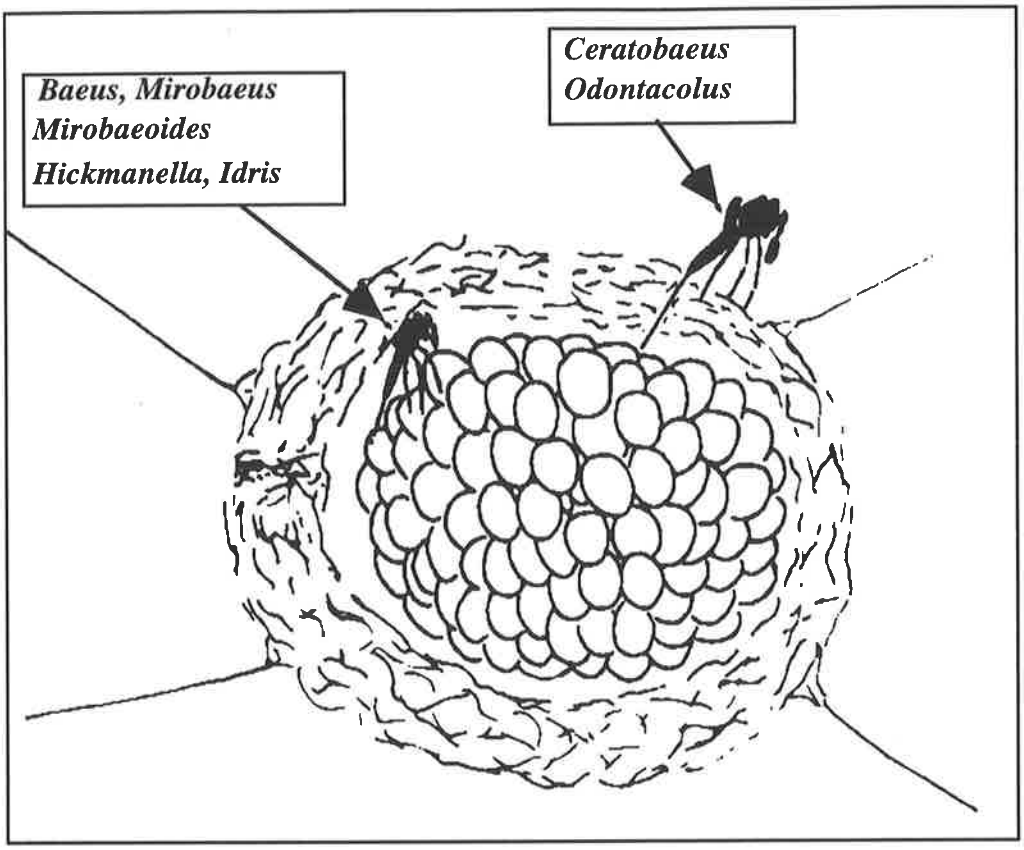


Fig. 2.2. Oviposition strategy of different baeine genera; those with a metasomal horn extend their long ovipositor from outside the spider egg sac, while genera without a metasomal horn burrow through the egg sac and parasitise the host eggs while in direct contact with them.

The ovipositor system of *Ceratobaeus* species and, indeed all Scelionidae, is different from other parasitic Hymenoptera (Austin 1983, Field & Austin 1994, Austin & Field 1997). It is invaginated into the body cavity, detached from the terminal segment of the metasoma, and is contained within a sclerotised membranous tube connected to the posterior metasoma only by

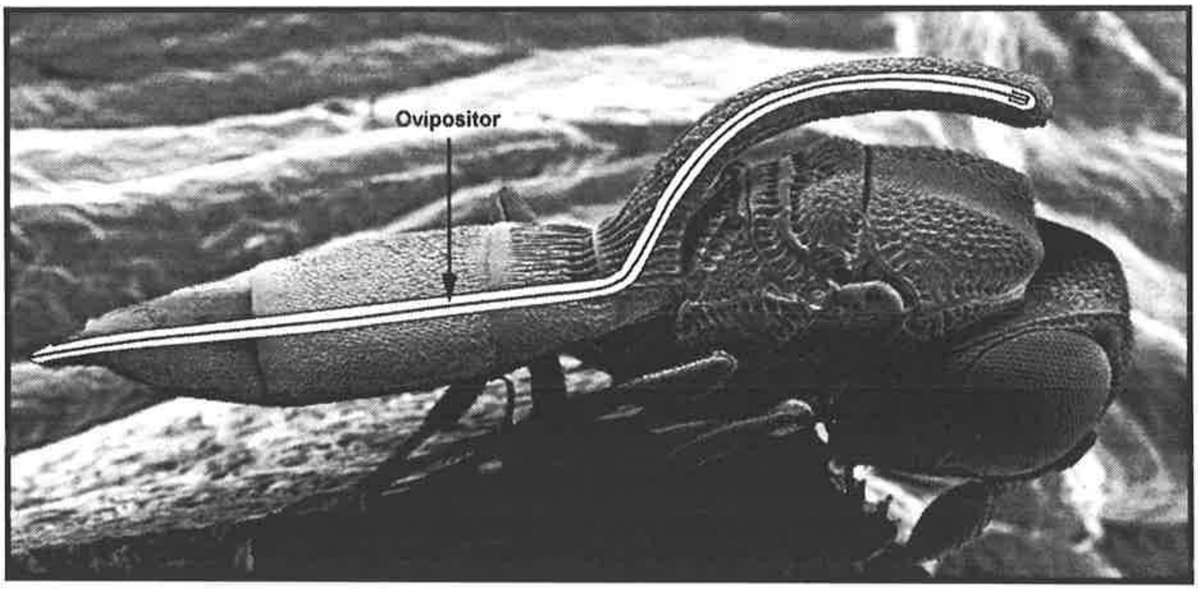


Fig. 2.3. The ovipositor invaginated inside the metasomal horn of *Ceratobaeus megacerus* sp. nov.

elongated muscles and apodemes. The presence of a metasomal horn provides a recess for the ovipositor (Fig. 2.3), so that the longer the metasomal horn, the longer is the ovipositor relative to total body length. This specialised arrangement is an adaptation to allow the ovipositor to reach otherwise inaccessible hosts, such as spider eggs surrounded by the silk barrier of the egg sac (as shown Fig. 2.2).

2.5. Hymenoptera in biodiversity studies

A broad definition of biodiversity is given by Reid & Miller (1989) who state "Biodiversity is the variety of the world's organisms, including their genetic diversity and the assemblages they form. It is a blanket term for the natural biological wealth that undergirds human life and well-being. The breadth of the concept reflects the interrelatedness of genes, species and ecosystems."

In recent years comprehensive surveys of invertebrates using multiple trapping techniques have shown that the Hymenoptera is one of, if not the most, species rich ordinal taxa of animals (LaSalle & Gauld 1992, 1993). This is particularly obvious from surveys in tropical forests (Askew 1990; Naumann *et al.* 1991; Noyes 1989a, 1989b) but generally it applies across most terrestrial habitats (LaSalle & Gauld 1993). There is accumulating evidence that the Hymenoptera is the largest order of insects. Gaston (1991) concluded after examining various estimates for the total number of species of arthropod groups that the Hymenoptera is the most diverse order in several temperate regions. Stork (1991) found that the Hymenoptera was the most species rich order in tree canopies in tropical forests in Borneo.

The Hymenoptera comprise a large number of functional groups (Gauld & Bolton 1996). However, it is one functional group, the parasitoids, that is responsible for the species richness of the order. Parasitoids exploit arthropods as hosts for their developing larvae and they have radiated into this almost unlimited resource, producing a phenomenal number of species. It is this biology, associated with their high degree of host specificity, that has lent them to being utilised as biological control agents of insects. LaSalle (1993) discussed the importance of parasitic Hymenoptera in biodiversity research while Altieri *et al.* (1993) have reviewed their importance in agroecosystems. The parasitic Hymenoptera can provide better biological control due to their ability to operate in a density dependent manner in regulating populations of the host species (Huffaker & Messenger 1964; Huffaker *et al.* 1976, 1984).

Pimm & Lawton (1978) stated that parasitoids provide more levels in food chains than other life styles due to a greater stability of these interactions. Waage (1991) pointed out the link between biological control and biodiversity and suggested that a large reservoir of parasitoid diversity is necessary to check the population of future pest species. Huffaker (1971) argued for the introduction of multiple parasitoids species for biological control to obtain the best species or the best combination of species for the habitat. DeBach & Rosen (1991) also argued for the introduction of more than a single species of parasitoid because phytophagous insects are usually attacked by an assemblage of parasitoids (May 1988; Hawkins 1993; Memmott & Godfray 1993). The use of pesticides generally has a more adverse effect on populations of parasitoids than on phytophagous insects (Brown 1978; DeBach & Rosen 1991). Altieri & Letourneau (1982, 1984) discussed the importance of adjacent vegetation in determining the diversity of parasitoids and their effectiveness in agroecosystems. Carroll (1978) found that mixed cropping of corn and sweet potatoes had 75% more species of hymenopterous parasitoids than their monocultures. Altieri & Todd (1981) reached similar conclusions with corn and soyabean mixed cropping. However, Price *et al.* (1980) stated that in some cases increased plant diversity could reduce parasitoid efficiency due to host searching problems for parasitoids. More recently, parasitoids have been used to analyse biodiversity and community ecology (Hawkins 1994; Hawkins & Sheehan 1994).

Bees and aculeate wasps have also been used in many biodiversity studies (see Gess & Gess 1993; O'Toole 1993) but majority of these studies are for Europe or North America. Westrich (1985, 1989a, 1989b) pointed about the decline in the wild bee fauna of Germany while Williams (1986, 1988, 1989a 1989b) discussed the decline of long-tongued bumblebees in Britain due to intensive agriculture. Grebennikov (1972) stated that in the 40 years preceding 1972, bumblebees in the former Soviet Union declined by 300 times. Ruszkowski *et al.* (1988) found that diversity of bumblebees declined in agricultural areas of Poland due to insecticide applications, while Celli & Molle (1984) concluded the same results for native bees, honeybees and syrphid flies in Italy. Fye (1972) discussed the effect of forest disturbance on native bees and wasps in Canada. Gauld *et al.* (1990) and Day (1992) cited many examples of the decline of aculeate Hymenoptera.

Ants are the most commonly used group of Hymenoptera for biodiversity research. This has occurred more in Australia than any other region where they have been used as bio-indicators (Anderson 1991; Anderson & Yen 1992; Majer 1983, 1985, Majer & Beetson 1996; Rossbach & Majer 1983; Yeatman & Greenslade 1980; York 1994), and to assess the overall biodiversity and conservation value of ecosystems (Anderson 1983, 1985, 1988, 1997; Anderson & Clay 1996; Hinkley & New 1997; Jackman & Fox 1996; Keals & Majer 1991; Majer 1993; Majer & Brown 1986; Majer *et al.* 1984; Miller & New 1997).

In Australia various invertebrate groups have been considered as target groups in biodiversity research but lack of taxonomic knowledge has limited research to only a few groups, e.g. ants, springtails and spiders. The parasitic Hymenoptera have not been used in this respect but their ecological importance dictate that they should be. Members of the Baeini as endoparasitoids of spider eggs, are often the dominant component of the scelionid fauna in many habitats and they play an important role in regulating spider populations. Given that spiders are becoming a preferred group as ecological indicators, to assess such aspects as general species richness, habitat disturbance, faunal community structure and biogeographic relationships (Churchill 1997; Harvey *et al.* 1997; Main 1997), a comparable knowledge of the distribution patterns, richness and levels of endemism of baeine wasps may allow such ecological questions to be examined and compared between trophic levels, i.e. between spiders and their parasitoids. This project aims to address this imbalance by providing a stable phylogenetic and taxonomic framework for such biodiversity research.

Chapter 3

Materials and Methods

3.1. General methods

Material was borrowed from Australian and world insect collections as listed in Table 3.2. Specimens were arranged with colour-coded labels to keep track of specimens from each collection. Label data as well as published information were used to compile information on geographic distributions and host relationships of species. External morphology was studied using a Zeiss DR stereomicroscope with 16x/16 eye-pieces, and 2x, 4x, and 8x objective lenses. Detailed study of minute characters, such as eye setae and sculpturing was undertaken under scanning electron microscope (see section 3.3 below).

A 100 division calibrated ocular micrometer was used to measure body characters. Drawings of body parts were undertaken freehand after measuring the proportions of various structures with the ocular micrometer. Line drawings and micrographs were then scanned using a Umax Astra 1200S scanner. The imaging software Adobe Photoshop was used to edit and arrange figures and images saved on the hard disc of the scanning electron microscope. Final plates were printed using a Xerox Acolour 936 printer.

3.2. Collecting techniques

Malaise, pitfall and yellow pan traps were set up at various sites in the Adelaide region at various times during the project, as well as during a specific field trip to Kangaroo Island (February 1995). Baeine wasps were sorted from alcohol storage, and specimens were mounted on points. A pilot project was also conducted to study Baeini diversity from the urban Perth area (Iqbal & Austin 1997). Four sites around Perth were selected, which represented areas of remnant native vegetation and were used in a more extensive study by Harvey *et al.* (1997). These sites were located at Bold Park, Perth Airport, Tuart Hill and the Talbot Road Reserve, and they generally comprise open *Eucalyptus-Banksia* woodland. The collecting method at these sites was three or four grids, each with 10 two-litre plastic ice-cream containers charged with concentrated (95%) ethylene glycol and run for 12 months. Specimens were removed from traps about every six weeks; they were then washed, transferred to 70% ethanol and sorted under a stereomicroscope, point-mounted and labelled.

Masner (1976) found that yellow pans were the best traps for collecting scelionids while Noyes (1982) concluded that net sweeping is the most efficient method for collecting chalcidoids. Masner & Goulet (1981) tried flight intercept traps with the walls coated with contact insecticide for flying Hymenoptera and found it very effective. Noyes & Valentine (1989) discussed efficiency of different collecting methods for chalcidoids and concluded that selection of trapping techniques should be dictated by the target group of insects, habitat type and weather conditions. During the current study, data recorded for all available specimens of Australasian baeine wasps show that flight intercept trapping, including Malaise traps, is the commonest way that members of this group have been actively collected (Table 3.1). This proved to be the best method to collect winged baeines, but it also collected the largest number of specimens of wingless *Baeus* and *Mirobaeus*. Pitfall traps proved efficient for *Mirobaeoides*, as well as *Baeus* and *Hickmanella*, followed by flight intercept trapping. These results match with Noyes (1989) who found that Malaise traps were the most efficient for collecting scelionids followed by yellow pan traps and hand sweeping. He also found that yellow pans were the more effective inside closed forest relative to other traps.

Table 3.1. Comparison of collecting techniques shown on data labels of Australasian specimens of Baeini (n=7,178) (FIT=flight Intercept traps, including Malaise trap; YPT=yellow pan traps, Other=pyrethrum spray; Berlese funnel, suction trap etc.).

	Technique						
Genus	Unknown	FIT	Reared	Pitfall	Netting	YPT	Others
Baeus							
% of specimens	7.0	43.2	5.2	26.2	-	14.2	4.2
Number of specimens	40	247	30	150	-	81	24
Ceratobaeus							
% of specimens	45.2	31.9	7.9	6.4	4.6	2.4	1.6
Number of specimens	745	524	129	105	75	39	45
Hickmanella							
% of specimens	20.0	24.4	24.4	2.9	2.9	11.2	14.2
Number of specimens	14	17	17	2	2	8	10
Idris							
% of specimens	27.7	46.1	7.6	6.3	3.9	3.3	5.1
Number of specimens	1090	1811	299	249	155	130	200
Mirobaeoides							
% of specimens	11.3	29.4	2.0	43.8	3.0	3.1	7.4
Number of specimens	72	188	13	280	19	20	47
Mirobaeus							
% of specimens	13.3	58.4	-	3.3	3.3	1.7	20.0
Number of specimens	8	35	-	2	2	1	12
Odontacolus							
% of specimens	28.6	52.3	4.1	5.0	0.9	-	9.1
Number of specimens	69	126	10	12	2	-	22
Total (all genera)							
% of specimens	28.4	41.1	6.9	11.1	3.6	3.9	5.0
Number of specimens	2038	2948	498	800	255	279	360

3.3. Scanning electron microscopy

Any specimens covered in dirt or waxy material were cleaned in a dilute pure soap solution (5%), soaked and rinsed thoroughly in distilled water and dehydrated in an alcohol series. Clean specimens were then mounted on card-points with water based seccotine glue, and cards were then secured to SEM stubs with carbon-based plasticine (Leitz-C-Plast). Specimens were coated using a CSC (Commonwealth Scientific Corporation) Mini Coater Model 200. The current was set at approximately 10-15 milliamps for 3-4 min creating a gold thickness of approximately 300-400 angstroms. Specimens were examined under a Phillips XL30 field emission electron scanning microscope (FESEM) using secondary electron imaging at 10 kv and a spot size of three. Sometimes uneven coating provided problems with charging and poor image quality. When this occurred specimens were examined at a lower voltage (i.e. 2-5 kv) or the specimens were re-coated.

If fewer than five specimens were available of any species, they were examined uncoated under the same Phillips XL30 FESEM at 1.0 kv and a spot size of four. However, in these cases the images obtained were generally of poorer quality.

Images were saved directly as TIFF files on the attached computer and later examined in detail in the laboratory on a Power Macintosh (Power PC) 7500/100.

3.4. Terminology

Terms used for general morphology are explained in Chapter 4. Terminology for surface sculpturing follows Eady (1968) and Harris (1979). Names for some of the new species described in Chapter 6 were derived using Brown (1954) and Reed (1988).

3.5. Abbreviations

Abbreviations used in the text for institutions follow Arnett *et al.* (1997) (Table 3.2). People responsible for institutional loans are listed in the Acknowledgements section. Abbreviations were also used for some common collectors in the text to save space and avoid repetitions (Table 3.2).

Table 3.2. Abbreviations used for institutional collections and collectors.

Abbreviation	Collection/Collector
ANIC	Australian National Insect Collection, Canberra.
BMNH	The Natural History Museum, London.
CNCI	Canadian National Collection, Ottawa.
QDPC	Queensland Department of Primary Industries, Brisbane.
SAMA	South Australian Museum, Adelaide
WAMP	Western Australian Museum, Perth.
WARI	Duncan Swan Insect Collection, The University of Adelaide, Adelaide.
IDN	I. D. Naumann (Collector)
JCC	J. C. Cardale (Collector)
JL	J. Lawrence (Collector)
MLJ	M-L. Johnson (Collector)
PZ	P. Zborowski (Collector)
TW	T. Weir (Collector)

3.6. Phylogenetic analyses

3.6.1. Software and computer

The following software was used for preparing this thesis and for data analysis. Microsoft Word 5.1a (1987-1993) was used for word processing and for creation of tables and figures. Microsoft Excel 4.0 was used to manipulate morphometric data and create graphs for the quantitative characters (see Appendices A1 and A2). PAUP (Phylogenetic Analysis Using Parsimony) version 3.1.1 (Swofford 1993) as well as various test versions of PAUP* 4.0 for Power Macintosh and UNIX were used for all parsimony-based phylogenetic analyses, while MacClade 3.07 (Maddison & Maddison 1997) was employed to input the data matrix in spreadsheet format and to trace character distribution on trees. AutoDecay 2.9.8 (Eriksson 1997) was used to calculate decay values or Bremer support (Bremer 1994) and the resulting trees were viewed and printed using TreeView 1.4 (Page 1997). A Power Macintosh (Power PC) 7500/100 with 100 MHz speed, 32 MB RAM and 603 processor was used to run all PAUP analyses.

3.6.3. Treatment of characters

Where possible characters were divided into binary characters to avoid hierarchical linkage and the problem of scoring of non-applicable states (Pleijel 1995; Wilkinson 1995). All quantitative characters and three qualitative multi-state characters were treated as ordered (see section 5.3.3).

Quantitative (morphometric) characters comprise continuous measurements, and such data are always difficult to divide into discrete states. However, they can also provide a substantial amount of phylogenetic information. Quantitative characters were coded using both gap and segment coding (Chappill 1989). At least 10 specimens were measured or, in cases where fewer specimens were available, all specimens were measured. Gap coding was used when there were obvious gaps present in the character distribution among taxa (Character 44, 48 and 49). The procedure adopted for gap coding is explained here using character 49 (ratio of metasoma length : width) as an example (Table 3.3). The length and width of the metasoma were measured and the mean value calculated for each species. If only a single specimen was available its measurement was used in place of the mean. A table of mean values for all taxa was then prepared (to 2 decimal places) in ascending order. There were three significant gaps

Table 3.3. Data for character 49 (ratio of metasoma length : width) which was divided into four states (C) using gap coding. Means are arranged in ascending order and different states recognised where significant gaps are recognised between means.

Taxa	Mean	C	Taxa	Mean	C
Mirobaeus bicolor	0.93	0	*Genus sp. 2*	1.79	0
Idris flavicornis	0.98	0	*Ceratobaeus azhari*	1.80	0
Hickmanella intrudens	1.08	0	*Ceratobaeus setosus*	1.82	0
Mirobaeoides scutellaris	1.10	0	*Ceratobaeus giraulti*	1.83	0
Mirobaeoides tasmanicus	1.12	0	*Ceratobaeus litopterus*	1.86	0
Baeus leai	1.13	0	*Ceratobaeus eumorphus*	1.96	0
Genus sp. 3	1.23	0	*Ceratobaeus leai*	2.00	0
Baeus seminulum	1.23	0	*Ceratobaeus laeviventris*	2.00	0
Idris helpidid	1.31	0	*Ceratobaeus marrooyourula*	2.00	0
Hickmanella holoplatysa	1.31	0	*Ceratobaeus grahami*	2.40	1
Ceratobaeus moongacutta	1.32	0	*Ceratobaeus ater*	2.41	1
Idris pulchar	1.32	0	*Ceratobaeus varicornis*	2.42	1
Genus sp. 1	1.34	0	*Ceratobaeus iota*	2.43	1
Idris theridii	1.36	0	*Ceratobaeus kabirae*	2.46	1
Ceratobaeus fieldi	1.48	0	*Ceratobaeus pipayourula*	2.46	1
Idris sp. 1	1.48	0	*Ceratobaeus fasciatus*	2.47	1
Idris sp. 2	1.48	0	*Ceratobaeus intrudae*	2.51	1
Odontacolus longiceps	1.50	0	*Ceratobaeus mirabilis*	2.62	1
Odontacolus sp. 1	1.54	0	*Ceratobaeus oimus*	2.63	1
Idris niger	1.57	0	*Ceratobaeus cuspicornutus*	2.77	1
Idris seminitidus	1.59	0	*Ceratobaeus cornutus*	2.85	1
Mirobaeoides pecki	1.59	0	*Sparasion sp.*	3.72	2
Mirobaeoides barbarae	1.64	0	*Nixonia sp.*	3.80	2
Ceratobaeus clubionus	1.68	0	*Ceratobaeus elongatus*	3.81	2
Ceratobaeus yousufi	1.72	0	*Ceratobaeus rieki*	6.20	3
Ceratobaeus naumanni	1.79	0			

recognised in the distribution of means and different states were assigned to taxa by considering these gaps as boundaries to separate states. The data were then graphed in order to show the gaps (see Appendix A2.1).

For continuous data, segment coding was adopted. The mean values of measurements were arranged in ascending order and then one standard deviation value was added to the minimum mean value in the table. All taxa equal or less than the added value were coded with one state. The procedure adopted for segment coding is explained here using character 50 (ratio of length of T3 : T2) as an example (Table 3.4). The length of T3 and T2 were measured and the mean value calculated for each species. A table of mean values for all taxa was then prepared in ascending order, and the standard deviation (SD) calculated for all means combined. The standard deviation (0.57 in this case) was then added to the minimum mean

Table 3.4. Data for character 50 (ratio of length of T3 : T2) which was divided into states using segment coding. Resultant values (RV) after adding the SD (0.57) to the first and subsequent means, and the state (C) for which each species was allotted.

Taxa	Mean	RV	C	Taxa	Mean	RV	C
Ceratobaeus moongacutta	0.76		**0**	*Ceratobaeus cornutus*	2.00		**2**
Ceratobaeus umasensis	0.80		**0**	*Ceratobaeus cuspicornutus*	2.00		**2**
Nixonia sp.	1.00		**0**	*Ceratobaeus alveus*	2.00		**2**
Sparasion sp.	1.00		**0**	*Ceratobaeus azhari*	2.10		**2**
Ceratobaeus moonga	1.17		**0**	*Ceratobaeus raniae*	2.10		**2**
Ceratobaeus minyamea	1.31		**0**	*Ceratobaeus clavisegmentus*	2.18		**2**
Ceratobaeus platycornutus	1.33		**0**	*Ceratobaeus ogmocerus*	2.18		**2**
Ceratobaeus berryae	1.33	1.33	**0**	*Ceratobaeus giraulti*	2.19		**2**
Ceratobaeus gwenae	1.37		**1**	*Ceratobaeus flaviventris*	2.19		**2**
Ceratobaeus iota	1.45		**1**	*Ceratobaeus cardaleae*	2.20		**2**
Ceratobaeus kaikai	1.46		**1**	*Ceratobaeus pachycerus*	2.21		**2**
Ceratobaeus mirabilis	1.53		**1**	*Ceratobaeus yousufi*	2.23		**2**
Ceratobaeus clubionus	1.54		**1**	*Ceratobaeus marrooyourula*	2.23		**2**
Ceratobaeus proipetye	1.55		**1**	*Ceratobaeus kabirae*	2.28		**2**
Ceratobaeus zebae	1.67		**1**	*Ceratobaeus intrudae*	2.29		**2**
Ceratobaeus turneri	1.71		**1**	*Ceratobaeus mahmoodi*	2.30		**2**
Ceratobaeus australicus	1.73		**1**	*Ceratobaeus naumanni*	2.38		**2**
Ceratobaeus laeviventris	1.76		**1**	*Ceratobaeus bouceki*	2.46		**2**
Ceratobaeus manii	1.79		**1**	*Ceratobaeus schmidti*	2.47	2.47	**2**
Ceratobaeus elongatus	1.80		**1**	*Ceratobaeus kentae*	2.60		**3**
Ceratobaeus faunus	1.81		**1**	*Ceratobaeus extraordinarius*	2.61		**3**
Ceratobaeus setosus	1.83		**1**	*Ceratobaeus pipayourula*	2.61		**3**
Ceratobaeus rieki	1.89		**1**	*Ceratobaeus eumorphus*	2.67		**3**
Ceratobaeus fieldi	1.89		**1**	*Idris* sp. 2	2.71		**3**
Ceratobaeus grahami	1.90	1.90	**1**	*Ceratobaeus oimus*	2.86		**3**
Ceratobaeus fasciatus	1.92		**2**	*Ceratobaeus litopterus*	2.86		**3**
Ceratobaeus masneri	1.92		**2**	*Ceratobaeus athysanus*	2.97	3.04	**3**
Ceratobaeus ater	1.94		**2**	*Ceratobaeus flavipes*	3.25		**4**
Ceratobaeus varicornis	1.96		**2**	*Ceratobaeus leai*	3.35	3.61	**4**

(0.76) in the table, and all mean values less than or equal to the resultant value (1.33) were coded into this segment (the first one being 0). The standard deviation was added again to this value (1.33) and all the mean values less than or equal to the resultant value (1.90) were given the next code (1). This process is continued until the last mean value (3.35) was assigned to a segment (state 4) (Table 3.4). The data were then graphed in order to show the segments (see Appendix A2.2).

3.6.4. Options tested for parsimony analyses

The parsimony based program PAUP can be used to search for the most parsimonious tree for a particular data set in several ways: using 1) exact methods of search, namely 'Exhaustive' 2) 'Branch and Bound', or 3) 'Heuristic' methods. 'Exhaustive' searches for all possible tree topologies and evaluates each one to find all of the optimal trees for a data matrix. This method is therefore not feasible for large data matrices because the search time becomes impossible. For a data matrix of 10 taxa, it creates over two million strictly bifurcating trees (Swofford & Begle 1993). 'Branch and bound' provides an exact method for searching a large data matrix, because it discards trees without evaluating them, if their length exceeds an upper bound (Wiley *et al.* 1991). However, this method is still very time consuming and it sometimes fails with very large data matrices (such as in this study), again because the analysis time becomes too large. The 'heuristic' method is currently the only realistic method for very large data sets. However, it has the disadvantage of searching for local optima in the data rather than a global optimum, and so it is never certain whether the optimum tree(s) is found, or not. An 'heuristic' search finds an initial tree by stepwise addition, and this tree is subjected to rearrangements that attempt to find shorter trees. This process is called branch swapping. Due to the size of the data matrix in this study, only the 'heuristic' search option could be used. The 'heuristic' option also has four addition sequences, i.e. 'As is', 'Closest', 'Simple' and 'Random', for the stepwise addition, and two branch swapping algorithms, i.e. SPR and TBR.

The addition sequences 'Simple', 'Closest' and 'As is' provide a different starting point for branch swapping, while the 'Random' addition sequence potentially provides a different starting point for each replication of branch swapping. The trees can be searched only in any single island by using 'Simple', 'Closest' and 'As is'. However, the 'Random' addition sequence initiates branch swapping repeatedly from different starting trees and this increases the probability of finding trees from more than one island or, hopefully, all islands. Even when there is only one island, 'Random' addition sequence can be used to avoid the problem of entrapment in local optima (Swofford & Begle 1993).

In SPR (subtree pruning and regrafting) a subtree is pruned and then regrafted to a different location. In TBR (tree bisection and reconnection) branch swapping, the tree is bisected along a branch and the subtrees are then reconnected by joining a pair of branches, one from each subtree. TBR is a relatively new feature available in PAUP's repertoire of branch swapping options and is reported to be more effective than SPR (Swofford & Begle 1993).

In order to find the effect of different addition sequences and branch swapping algorithms, a series of preliminary analyses were conducted. Different combinations of four addition sequences, 'As is', 'Closest', 'Simple' and 'Random' were tested with two branch swapping algorithms, SPR and TBR. Results of this comparison using data set assembled for the Baeini (Chapter 5), showed that tree length remained the same for all combinations, but the

Table 3.5. Effect of different addition sequences and branch swapping algorithms on the data set developed for the Baeini (Chapter 5) (L=tree length; N=number of trees saved; CI=consistency index; RI=retention index; RC=rescaled consistency index).

	L	N	CI	RI	RC	f-ratio (strict)
As is - SPR	152	35	0.276	0.658	0.182	0.443
As is - TBR	152	41	0.276	0.658	0.182	0.466
Closest - SPR	152	35	0.276	0.658	0.182	0.443
Closest - TBR	152	41	0.276	0.658	0.182	0.466
Simple - SPR	152	35	0.276	0.658	0.182	0.443
Simple - TBR	152	41	0.276	0.658	0.182	0.466
Random - SPR	152	41	0.276	0.658	0.182	0.466
Random - TBR	152	41	0.276	0.658	0.182	0.466

number of trees saved was different (Table 3.5). 'Random' addition sequence with 300 replications and TBR branch swapping algorithm produced the maximum number of shortest trees. There was no difference in the indices calculated for the various addition sequences and branch swapping algorithms except the f-ratio for the strict consensus trees. Considering the advantages of the 'Random' addition sequence and the TBR branch swapping, the combination 'Random-TBR' was used in all analyses undertaken during this study.

Uninformative characters (constant and autapomorphic) were excluded before undertaking all analyses presented in Chapter 5. Characters were weighted equally irrespective of the number of states. Ten trees were held at each step to minimise the effect of ties early in the stepwise addition process.

Trees were rooted using the out-group taxa discussed in section 5.2, so that the in-group was always monophyletic. The strict consensus tree was used to summarise information when more than one most parsimonious tree was obtained from any data set (Anderberg & Tehler 1990). The strict consensus tree contains only those monophyletic groups that are common to all competing trees, while nodes that disagree are collapsed to polytomies.

Data matrices were further also analysed using successive weighting of characters. Successive weighting (Farris 1969) employs a *a posteriori* weighting of characters according to their performance on the most parsimonious trees in a given data set. The basic idea is to penalise characters which are homoplastic and weight characters that fit the tree well and are therefore phylogenetically useful (Swofford & Begle 1993). Carpenter (1988) suggests that successive weighting allows the characters of a given data set to sort themselves based on their phylogenetic reliability. However, the use of successive weighting procedures have been criticised by some authors. Swofford & Olsen (1990) characterised successive weighting as circular in logic. Carpenter (1994) argues against this criticism and states that initial and final cladograms can indeed differ. Farris (1969) showed decreasing differences between the "correct" and estimated trees with successive weighting, under a variety of simulations.

Successive weighting is being used by many systematists to obtain better resolution by allowing characters to be weighted according to their phylogenetic reliability (Brower 1997; Swenson & Bremer 1997; Sullivan *et al.* 1997). Due to the fact that a large number of characters used for the Baeini were homoplastic and, as a result, the strict consensus trees were not well-resolved, it was decided to use successive weighting as a method of further exploring the topology of resulting trees and, in the case of *Ceratobaeus*, determining a species-group classification.

In this study when using the successive weighting option, the characters were reweighted according to the maximum value of their rescaled consistency index (RC). RC is the product of consistency index (CI) and retention index (RI). For these analyses, it was necessary to change all multistate characters into additive binary characters. The most parsimonious trees were loaded in the additive binary matrix, reweighted according to maximum value of RC, with a base weight of 1000, and the data set reanalysed. The trees saved from this analysis were reweighted again and searched for the shortest possible trees. This process was repeated until a constant tree topology was generated each time.

3.6.5. Tree fitness measures

PAUP can calculate and display several indices that measure the 'fit' of characters to a particular tree that, in turn, can be used to interpret and/or explain the results of an analysis. The consistency index (CI) (Kluge & Farris 1969) is a direct measure of homoplasy in a tree. CI is a measure of how well a data matrix fits a particular tree topology. Data matrices with little or no homoplasy will have higher CI values (1.0 being the highest possible), whereas those that show considerable homoplasy will have low values (Wiley *et al.* 1991). CI is a measure of m/s, where m is the minimum amount of change that the character may show on any conceivable tree, and s is the number of steps required by the character (Swofford & Begle 1993). The retention index (RI), proposed by Farris (1989) for a single character, is $(g-s)/(g-m)$, where g is the maximum possible amount of change that a character can acquire on any conceivable tree. He also proposed that the rescaled consistency index (RC) is the product of the CI and RI (Swofford & Begle 1993).

The f-ratio, introduced as the f-value by Farris (1972), has been discussed by Brooks *et al.* (1986). It can be used to choose the 'best' tree from those that have the same CI, as it is sensitive to the distribution of characters among taxa. The f-ratio has a value between one and zero, with the 'best' tree having a value of zero. As only the strict consensus or successive weighting trees were used to interpret relationships among taxa during this study, the 'best' tree based on a better f-ratio was not selected.

Rohlf's consensus index (Rohlf's CI) (Rohlf 1982) is a measure of the overall agreement of all trees included in the consensus tree. It is automatically calculated by PAUP and can be used as a measure of significance for the consensus trees obtained.

Bootstrap analysis (Felsenstein 1985) samples the original data set with replacement to construct a series of bootstrap replicates of the same size as the original data set. The taxa are held constant and the characters are sampled with replacement to build a new series of data sets. These are then subject to heuristic search and a majority-rule consensus is constructed for all the bootstrap trees. Two different search methods were tested for heuristic search. Firstly, 100 bootstrap replicates were searched by 'Random' addition sequence with five replicates in each bootstrap. Another analysis was conducted by using 10,000 bootstrap replicates and saving a single tree in each bootstrap using 'fast' swap option of PAUP* 4.0 (Swenson & Bremer 1997). The difference between results of these options was not significant, and the second option was used for all bootstrap analyses in this study.

Bremer support (also termed decay index) defines the number of extra steps required to collapse a particular node in the consensus tree (Bremer 1994). AutoDecay 2.9.8 was used to construct a command file for topological constraints. This command file was then run in PAUP for heuristic search and the Bremer support values extracted by using AutoDecay. These values were then plotted on the strict consensus tree using TreeView 1.4. Total support (T) is the sum of all Bremer support values for a consensus tree, while total support index (TI) is total support divided by the length of the most parsimonious tree(s).

Chapter 4

Morphology of the Baeini

4.1. Introduction

This chapter describes the general morphology of baeine scelionids to support the selection of characters used in the phylogenetic analyses (Sections 5.3), and those used in the taxonomic revision of Australasian *Ceratobaeus* (Chapter 6). The external morphology of scelionids has been previously discussed by various authors, most recently by Masner (1979, 1980), Galloway & Austin (1984), and Masner & Denis (1996). Abbreviations here are given in brackets (Table 4.1). The morphology of the adults only is described here. Characters related to male genitalia were not used in this study as they are generally similar for genera and most species, unlike the situation for other groups of scelionids (e.g. *Telenomus* Haliday-Johnson 1984) where male genitalia is an important species level character.

A list of terms and their abbreviations are given in Table 4.1. Terminology and measurements taken for various parts of the body and wing venation are illustrated in Figures 4.1-4.9.

4.2. Adult morphology

4.2.1. Head

The head of baeine wasps in anterior view is generally triangular (Fig. 4.7) but can vary from oval (Fig. 6.68) to elongate in shape (Figs 6.16). In one species of *Ceratobaeus*, it is heart shape due to a dorsal groove on the vertex which accommodates a very long horn (Fig. 6.201). The head is usually wider than mesosoma in dorsal view. The **vertex** and **occiput** vary in sculpturing from smooth to rugulose-punctate, as does the **frons** (Fig. 4.7). Head width (HW) varies with respect to the head length (HL) and head height (HH). The **ocelli** (OC) form a triangle on the vertex, the **lateral ocelli** (LO) usually touch the eye margins or the distance from the outer margin of the lateral ocellus to the edge of the eye (OOL) is less than the diameter of the lateral ocelli (OD) (Fig. 4.7). The **eyes** are usually large in baeine wasps but in a few species they are reduced and their height (EH) is less than half of the height of head (HH) (Fig. 6.50). There are always hairs present in eyes but in some species the are so small so that the eyes appear hairless. In these cases the hairs are only visible under the scanning electron microscope (SEM) (Fig. 6.160). In other species these hairs are quite long and easily visible under a stereo-microscope (Fig. 4.7). The cheeks and lower frons area can be smooth (Fig. 6.172) or have striations (Fig. 6.263). The **frontal carina** (FC) is a longitudinal median ridge on the frons running from the interantennal process toward the **median ocellus** (MO). Frontal carina length varies from absent or rudimentary (Fig. 6.172) to complete and reaching the median ocellus (Fig. 6.13). The **speculum** (SP) is a smooth, shining area on the lower frons above the interantennal process. Its development varies from being absent (Fig. 6.172) to present with sharply defined margins (Fig. 6.50).

Table 4.1. Abbreviations used for terminology.

Abbreviation	Term	Abbreviation	Term
General terminology		SM	submarginal vein
AC	axillar crenulae	SP	speculum
B	basal vein	ST	stigmal vein
BR	bristles on submarginal vein	T1	metasomal tergite 1
C	antennal clava	T2	metasomal tergite 2
Eh	eye hairs	T3	metasomal tergite 3
F1	funicle segment 1	T4	metasomal tergite 4
F2	funicle segment 2	T5	metasomal tergite 5
F3	funicle segment 3	T6	metasomal tergite 6
F4	funicle segment 4	T7	metasomal tergite 7
F9	funicle segment 9	TG	tegula
F10	funicle segment 10		
FC	frontal carina	**Measurements**	
FH	frenal hooks	CL	length of clava
HS	humeral sulcus	CW	width of clava
LO	lateral ocellus	EH	height of eye
LT	lateral tergites	F1L	length of F1
M	marginal vein	HH	height of head
MD	mandible	HL	length of head
MF	marginal fringe	HW	width of head
MH	metasomal horn	ML	length of metasoma
MN	metanotum	OD	diameter of lateral ocellus
MO	median ocellus	OOL	distance between lateral ocellus and eye
MP	metapleuron		
MS	scutum	SL	length of scutum
NT	notauli	SW	width of scutum
P	pedicel	T2L	length of T2
PL	propodeal lamellae	T2W	width of T2
PM	postmarginal vein	T3L	length of T3
PN	pronotum	T3W	width of T3
PR	propodeum	WL	length of fore wing
S	scape	WW	width of fore wing
SC	scutellum		
SF	scutellar foveae		

The number of antennal segments is variable between the sexes. Females have a 7- or 11-segmented antennae, with the four terminal segments forming a compact clava (Fig. 6.102). The number of **funicle segments** can vary from four (Fig. 6.17) to five (Fig. 6.19). The length to width ratio of the **first funicle segment** (F1) varies from being as long as wide (Fig. 6.17) to more than 4 times longer than wide (Fig. 6.298). The **antennal clava** (C) of females can be completely fused and appear unsegmented (Fig. 4.2) or show clear sutures between the four segments (Fig. 6.18). The length to width ratio of the antennal clava is also variable. Male antennae are 8- to 12-segmented and are usually moniliform (Fig. 6.20) or can be faintly subclavate (Fig. 4.4). F9 and F10 are fused in many species (Fig. 4.3) or they can be freely articulated (Fig. 6.20).

4.2.2. Mesosoma

In dorsal view the mesosoma is usually slightly elongate, and rounded at the anterior and posterior margins (Fig. 4.8). The highest and most visible part of the mesosoma comprises the **scutum** (MS) and **scutellum** (SC), though the **dorsal pronotum** (PN) is sometimes visible at the antero-lateral margins of the scutum. The **humeral sulcus** (HS) is located at the posterolateral corner of scutum, medial to the **tegula**. It can be smooth (Fig. 6.2) or crenulate (Fig. 6.15). The scutum often has the **notauli** (NT) absent (Fig. 6.10), or they can range from being faint (Fig. 4.8) to long and deeply grooved (Fig. 6.15). In some species of 'long horn' *Ceratobaeus*, the scutum can have a deep longitudinal medial groove (Fig. 6.205) or can be strongly emarginate (Fig. 6.203). The surface of the scutum is usually granulate-coriaceous or punctate, and has a sparse covering of pilosity. The length to width ratio of the scutum is variable. The dorsal scutellum is usually triangular in shape in full-winged taxa (Fig. 4.8) but can be reduced to a narrow strip in wingless species (Fig. 6.2). The **axillar crenulae** (AC) are present in many species at the anterolateral corners of the scutellum. The **scutellar rim** can project over the dorsellum in some taxa. The posterior margin of the scutellum sometimes has a row of foveae (SF) (Fig. 4.9) and may have a medial indentation to accommodate the metasomal horn in some female *Ceratobaeus* (Fig. 6.103). The lateral scutellum is mostly crenulate (Fig. 4.9) but is sometimes smooth. The **metanotum** (MN) is concealed in some wingless taxa (Fig. 6.7) while it is usually visible dorsally in most fully winged species (Fig. 4.9). The **propodeum** (PR) is always reasonably narrow. The dorsal **propodeum lamellae** (PL) can be curved horizontal medially and blunt (i.e. without teeth) (Fig. 6.27), or expanded into broad flanges (Fig. 6.15), or obliquely vertical and narrowly pointed dorsally (Fig. 6.161).

The lateral mesosoma is composed of the lateral **pronotum**, **propleuron**, **mesopleuron** and **metapleuron**. The metapleuron is divided into a visible **metepimeron** and **metepisternum**.

4.2.3. Wings

Wing development is variable within the Baeini. Some genera are completely wingless in that the membranous part of the wing is missing. However, the wing bases are always represented by tiny sclerites (Fig. 6.2). In reduced-winged forms the membranous part varies in length among species, extending no further than the posterior margin of T1 (Fig. 6.70) or reaching as far as T4 (Fig. 6.199), or various points in between. These reduced-winged species also show reduction in the wing venation and in many species only the submarginal and the marginal veins are present.

Fore wing (Fig. 4.5). There are only four tubular veins present, i.e. **submarginal** (SM), **marginal** (M), **postmarginal** (PM) and **stigmal** (ST) veins. The postmarginal vein is often absent, and very rarely all four veins are blurred and can appear absent (Fig. 6.291). A **basal vein** (B) is sometimes present as a pigmented band. The length of postmarginal vein varies in length with respect to the stigmal vein: it can be absent (Fig. 6.286) to as long as the stigmal vein (Fig. 6.292). The length of **bristles** (BR) on the submarginal vein may vary from being rudimentary and not reaching the anterior margin of the wing (Fig. 6.290) to long and reaching well beyond the anterior margin (Fig. 6.288). The development of **marginal fringe** (MF) is also variable and can be completely absent (Fig. 6.290) to very long (Fig. 6.285). The length (WL) to width (WW) ratio is also variable, so that the wing can appear broad to narrow. The intensity and pattern of infuscation of the fore wing differs among species: it can be evenly infuscate and varying from light to dark; it can have dark transverse bands on the apical margin and/or at the middle (Fig. 6.289); or it can be completely hyaline (Fig. 6.290).

The *hind wing* (Fig. 4.6) does not show any infuscate pattern although sometimes it may be uniformly darkened. The submarginal vein is complete and reaches to the **frenal hooks**.

4.2.4. Legs

The legs are generally uniform across the tribe but can vary from being slender to slightly more robust. The presence or absence of a pair of **femoral spines** (Fig. 6.8) is the most notable character associated with the legs of some species.

4.2.5. Metasoma

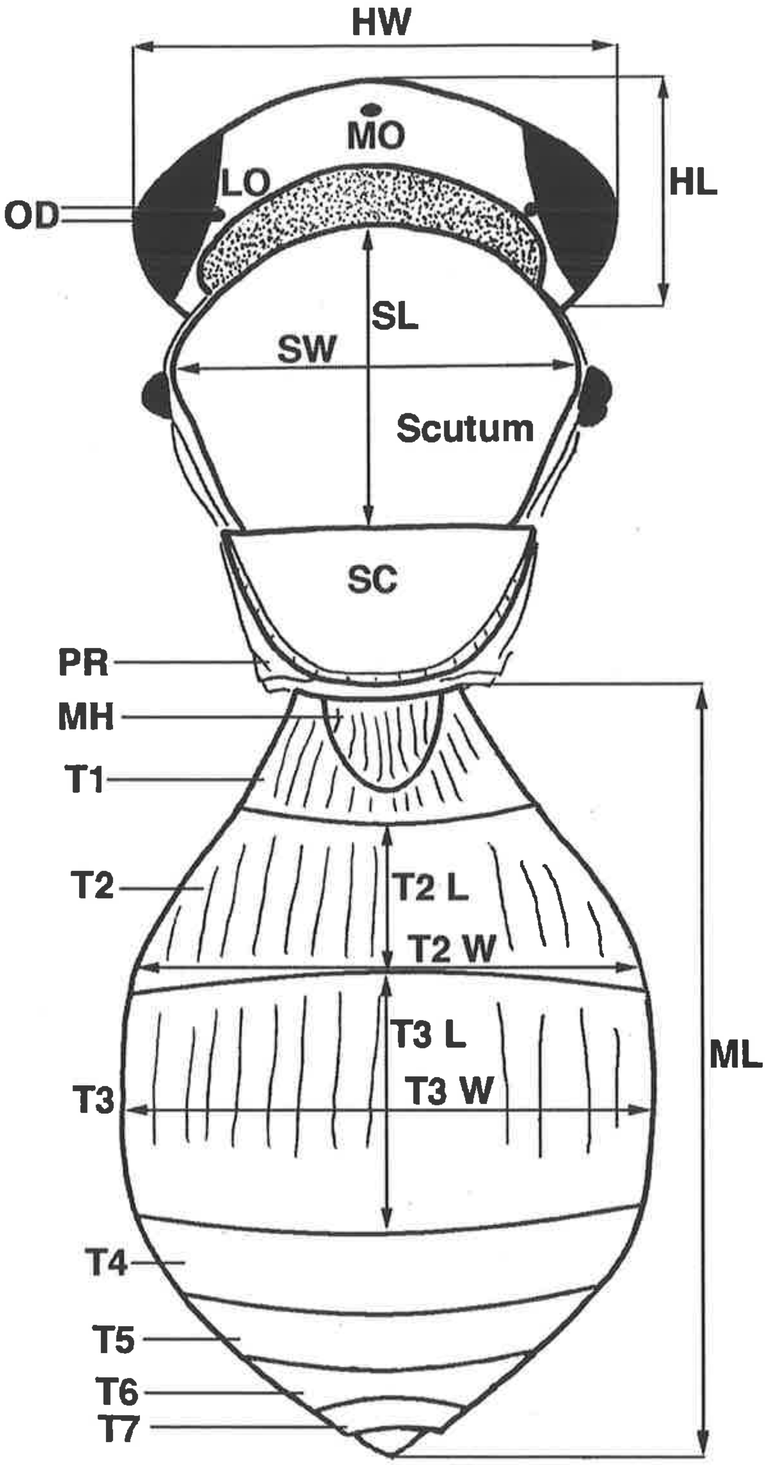
The metasoma of female baeine wasps is quite variable in size and shape (Fig. 4.1). It can be from short and compact (Fig. 6.2) to narrow and elongate (Fig. 6.299). The metasoma can appear well separated from the mesosoma and petiolate in form (Fig. 6.10), or broad and closely abutted to the mesosoma so that the propodeum is partly hidden (sub-sessile) (Fig. 6.9) or completely hidden (sessile) except for small lateral area of the propodeum (Fig. 6.2). Reduced-winged species usually have a sessile or sub-sessile metasoma while the majority of fully winged species have the posterior mesosoma fully visible. The tergites are reflexed ventrally along the lateral margins and are referred to as the laterotergites (Fig. 6.3). These can be incised into a lateral groove on the sternites or they can be free and broad (Fig. 6.3). The **first metasomal tergite** (T1) has many forms within the Baeini. T1 can be narrow and much shorter than the **second metasomal tergite** (T2) or it can be almost as long as T2. T1 can be flat or the dorsal surface developed into a **metasomal horn** (MH). The shape and size of the metasomal horn is highly variable among species. It can be slightly raised into a small hump (Fig. 6.77), more elongate and reaching the level of the scutellum (Fig. 6.49), or it can be greatly elongate and reach to the scutum or head (Fig. 6.202). It may be laterally compressed (e.g. *Odontacolus*-Fig. 6.15) or virtually cylindrical in cross-section (most *Ceratobaeus*-Fig. 6.239). The apex on the metasomal horn can be narrow and pointing (Fig. 6.104) or it can be flat and broad (Fig. 6.107).

The second metasomal tergite (T2) is usually longer than T1, but can be shorter than (Fig. 6.10), as long as (Fig. 6.9), or much longer than the third metasomal tergite (T3) (Fig. 6.7). The anterior margin of T2 sometimes has a row of foveae (Fig. 6.7). The sculpturing of T2 varies from smooth to striate and rarely may be reticulate or punctate. The **third metasomal tergite** (T3) usually has the same sculpturing pattern as T2. T4-T7 are usually smooth with a transverse row of sparse hairs medially or have hairs scattered sparsely over each tergite. Some times these tergites can be finely sculptured.

The metasoma of males is similar to that of females except T1 is virtually always flat (Fig. 6.11), or at most has the anterior margin slightly inflected dorsally. Also, the metasoma is free and well-separated from the mesosoma, except in only rare apterous species where it is sub-sessile or sessile.

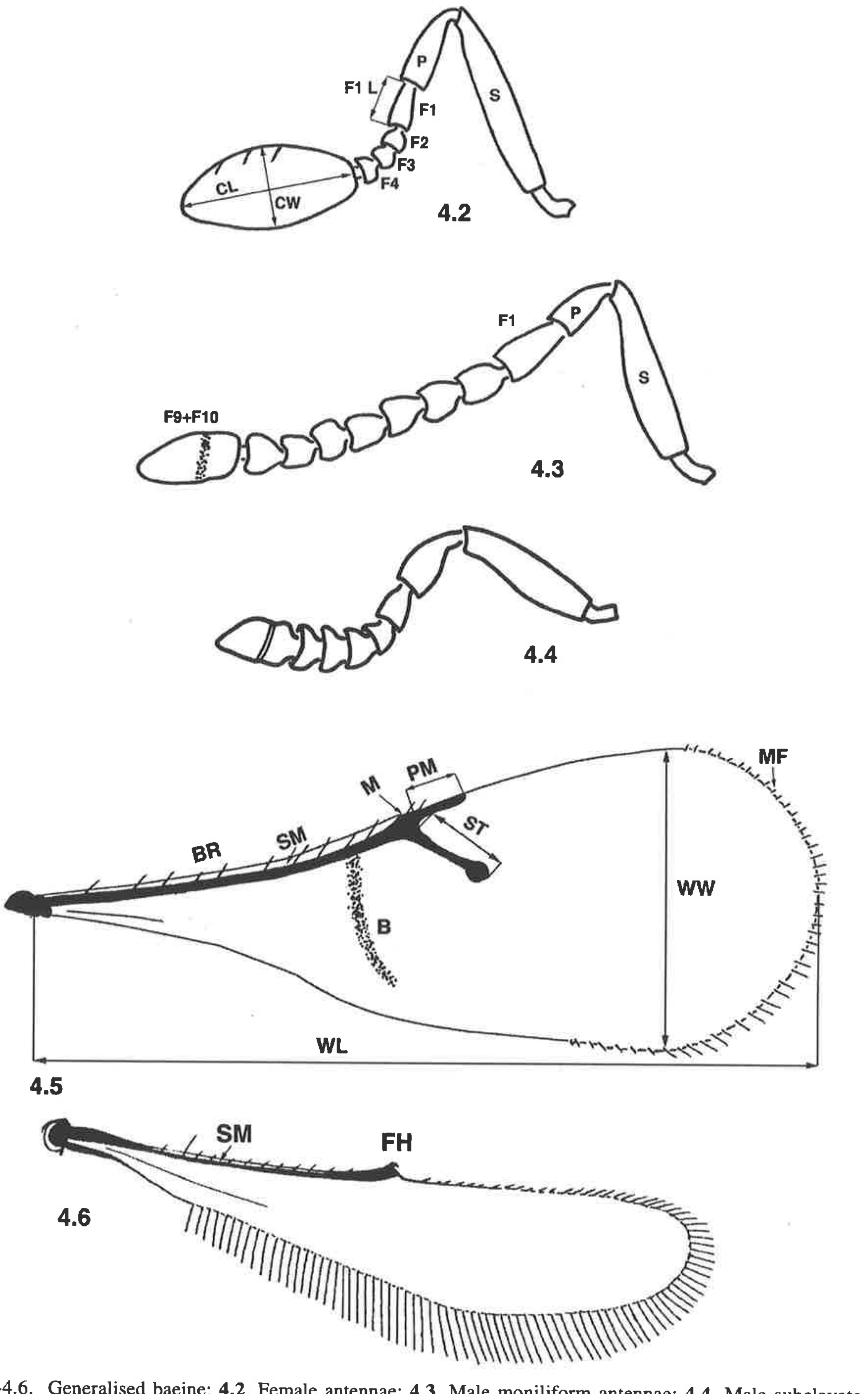
4.2.6 genitalia

Austin (1983) described the ovipositor system of several members of the Baeini in detail and showed from dissections that it is extended and retracted by antagonistic muscles. Austin & Field (1997) examined the ovipositor system of *Baeus* and showed that like many other baeines, it has an elongate ovipositor, almost as long as the metasoma (also see section 2.4). Genera with a horn on T1 (i.e. *Ceratobaeus*, *Odontacolus* and *Cyphacolus*) have a much longer ovipositor than the ventral length of the metasoma, as the horn acts a recess for the internally retracted ovipositor shaft (Fig. 2.3). Most baeines have a straight ovipositor, but in *Odontacolus* and *Cyphacolus* it is looped back on itself inside the laterally compressed horn and is almost twice the ventral length of the metasoma. In genera without a metasomal horn (e.g. *Idris*, *Hickmanella* and *Mirobaeus*) the ovipositor can vary from short (0.5 x ventral metasomal length) to moderately elongate (0.9 x ventral metasomal length).

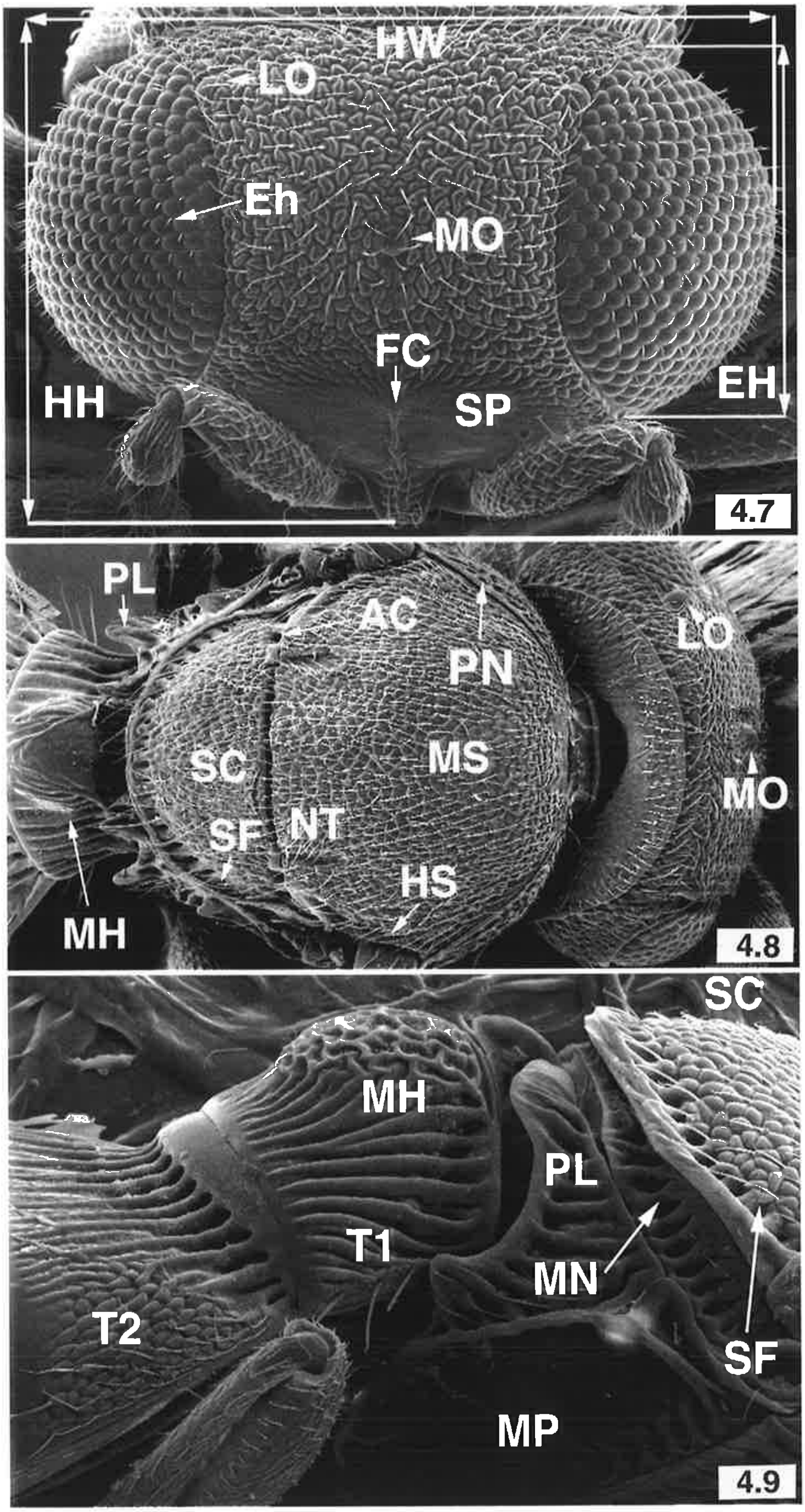


4.1

Fig. 4.1. Generalised baeine, dorsal view. LO lateral ocellus, MH metasomal horn, MO median ocellus, PR propodeum, SC scutellum, T1 metasomal tergite 1, T2 metasomal tergite 2, T3 metasomal tergite 3, T4 metasomal tergite 4, T5 metasomal tergite 5, T6 metasomal tergite 6, T7 metasomal tergite 7, HL length of head, HW width of head, ML length of metasoma, OD diameter of lateral ocellus, SL length of scutum, SW width of scutum, T2L length of T2, T2W width of T2, T3L length of T3, T3W width of T3.



Figs. 4.2-4.6. Generalised baeine: **4.2**, Female antennae; **4.3**, Male moniliform antennae; **4.4**, Male subclavate antennae; **4.5**, Fore wing; **4.6**, Hind wing. B basal vein, BR bristles on submarginal vein, C antennal clava, F1 funicle segment 1, F2 funicle segment 2, F3 funicle segment 3, F4 funicle segment 4, F9 funicle segment 9, F10 funicle segment 10, FH frenal hooks, M marginal vein, MF marginal fringe, P pedicel, PM postmarginal vein, S scape, SM submarginal vein, ST stigmal vein, CL length of clava, CW width of clava, F1L length of F1, WL length of fore wing, WW width of fore wing.



Figs 4.7-4.9. General baeine morphology: **4.7**, Gen. & sp. indet., head (anterior view); **4.8**, *Ceratobaeus australicus* (Dodd), head and mesosoma (dorsal view); **4.9**, *C. parvicornutus* Dodd, scutellum, T1 and T2 (lateral view). AC axillar crenulae, Eh eye hairs, FC frontal carina, HS humeral sulcus, LO lateral ocellus, MH metasomal horn, MN metanotum, MO median ocellus, MP metapleuron, MS scutum, PL propodeal lamellae, PN pronotum, PR, propodeum, SC scutellum, SF scutellar foveae, SP speculum, T1 metasomal tergite 1, T2 metasomal tergite 2, EH height of eye, HH height of head, HW width of head.

Chapter 5

Phylogenetics of the Baeini

5.1. Introduction

This chapter examines the relationships among genera of the Baeini and among species of *Ceratobaeus*. It discusses the selection of taxa, characters and their states, and the ordering of these characters. The relationships among genera has previously not be examined using cladistic methods and the monophyly of several taxa have been questioned (see Chapter 2). To better resolve these relationships, two sets of analysis were undertaken; 1) to test the monophyly of *Ceratobaeus* and its relationships to other genera and 2) to determine relationships among Australasian species of *Ceratobaeus* and to recognise monophyletic species-groups. For the generic level analysis, 51 taxa were selected, including two out-groups, and 35 potentially informative morphological characters were coded for these taxa (Appendix A3.1). For the species level analysis of *Ceratobaeus*, a data matrix of 58 taxa and 48 characters was constructed (Appendix A3.2). PAUP 3.1.1 (Swofford 1993), various test versions of PAUP* 4.0 (Swofford 1998), MacClade 3.07 (Maddison & Maddison 1997), AutoDecay 2.9.8 (Eriksson 1997) and TreeView 1.4 (Page 1997) were used to analyse these matrices, as discussed in Chapter 3.

5.2. Selection of taxa

5.2.1. Taxa for relationships among genera

Exemplar taxa from all baeine genera represented in the Australasian fauna along with the type-species of these genera comprised the in-group (Table 5.1). Species of *Ceratobaeus* included were selected to cover the apparent morphological variation evident among species. Twenty-seven species of *Ceratobaeus* were included, some of which are new species, along with eight species of *Idris*, four species of *Mirobaeoides*, and two species each of *Hickmanella*, *Odontacolus* and *Baeus*. The only species included from the genus *Mirobaeus* was the type species, *M. bicolor* Dodd. Three additional species were also included that could not be reliably placed into existing genera (labelled Genus sp. 1, sp. 2 and sp. 3), in an attempt to determine their phylogenetic status.

Out-group taxa were selected based on the procedures outlined by Watrous & Wheeler (1981). Masner (1976a) discussed relationship among the tribes of Scelioninae and considered Nixoniini and Sparasionini to be the most primitive. Further, in a study on the

Table 5.1. List of in-group and out-group taxa used in analyses for relationships among genera of Baeini (*=type species for genus).

In-group taxa

Genus *Ceratobaeus*

1. *Ceratobaeus cornutus* Ashmead*
2. *Ceratobaeus moongacutta* sp. nov.
3. *Ceratobaeus naumanni* sp. nov
4. *Ceratobaeus leai* Dodd
5. *Ceratobaeus litopterus* sp. nov.
6. *Ceratobaeus giraulti* Dodd
7. *Ceratobaeus elongatus* Dodd
8. *Ceratobaeus mirabilis* Dodd
9. *Ceratobaeus rieki* Austin
10. *Ceratobaeus cuspicornutus* Austin
11. *Ceratobaeus varicornis* Dodd
12. *Ceratobaeus fasciatus* Dodd
13. *Ceratobaeus kabirae* sp. nov
14. *Ceratobaeus ater* (Hickman)
15. *Ceratobaeus laeviventris* (Dodd)
16. *Ceratobaeus pipayourula* sp. nov.
17. *Ceratobaeus eumorphus* sp. nov.
18. *Ceratobaeus marrooyourula* sp. nov.
19. *Ceratobaeus setosus* Dodd
20. *Ceratobaeus intrudae* Austin
21. *Ceratobaeus yousufi* sp. nov.
22. *Ceratobaeus oimus* sp. nov.
23. *Ceratobaeus kentae* sp. nov.
24. *Ceratobaeus azhari* sp. nov.
25. *Ceratobaeus fieldi* sp. nov.
26. *Ceratobaeus clubionus* Austin
27. *Ceratobaeus grahami* sp. nov.

Genus *Idris*

28. *Idris flavicornis* Foerster*
29. *Idris helpidis* (Hickman)
30. *Idris niger* (Hickman)
31. *Idris pulchar* (Dodd)
32. *Idris seminitidus* (Dodd)
33. *Idris theridii* (Hickman)
34. *Idris* sp. 1
35. *Idris* sp. 2

Genus *Hickmanella*

36. *Hickmanella intrudens* (Hickman)*
37. *Hickmanella holoplatysa* Austin

Genus *Odontacolus*

38. *Odontacolus longiceps* Kieffer*
39. *Odontacolus* sp. 1

Genus *Mirobaeoides*

40. *Mirobaeoides tasmanicus* Dodd*
41. *Mirobaeoides barbarae* Austin
42. *Mirobaeoides pecki* (Austin)
43. *Mirobaeoides scutellaris* Austin

Genus *Mirobaeus*

44. *Mirobaeus bicolor* Dodd*

Genus *Baeus*

45. *Baeus seminulum* Haliday*
46. *Baeus leai* Dodd

Genus Unknown

47. Genus sp. 1
48. Genus sp. 2
49. Genus sp. 3

Out-group taxa

50. *Nixonia* sp.
51. *Sparasion* sp.

scelionid ovipositor system Austin & Field (1997) examined the relationships among tribes and, using a limited data set, found that *Sparasion* fell outside a clade comprising all other scelionids. Based on these studies a member of each of *Sparasion* and *Nixonia* were used as out-group taxa in this study.

Table 5.2. List of in-group and out-group taxa used in analyses for relationships among species of *Ceratobaeus*.

In-group taxa

1. *Ceratobaeus cornutus* Ashmead (type species)
2. *Ceratobaeus clavisegmentus* Austin
3. *Ceratobaeus moongacutta* sp. nov.
4. *Ceratobaeus naumanni* sp. nov.
5. *Ceratobaeus leai* Dodd
6. *Ceratobaeus flavipes* (Hickman)
7. *Ceratobaeus litopterus* sp. nov
8. *Ceratobaeus giraulti* Dodd
9. *Ceratobaeus athysanus* sp. nov.
10. *Ceratobaeus mirabilis* Dodd
11. *Ceratobaeus elongatus* Dodd
12. *Ceratobaeus extraordinarius* sp. nov.
13. *Ceratobaeus rieki* Austin
14. *Ceratobaeus cuspicornutus* Austin
15. *Ceratobaeus platycornutus* Austin
16. *Ceratobaeus gwenae* sp. nov
17. *Ceratobaeus varicornis* Dodd
18. *Ceratobaeus proipetye* sp. nov.
19. *Ceratobaeus fasciatus* Dodd
20. *Ceratobaeus faunus* (Girault)
21. *Ceratobaeus ogmocerus* sp. nov
22. *Ceratobaeus kabirae* sp. nov.
23. *Ceratobaeus ater* (Hickman)
24. *Ceratobaeus schmidti* sp. nov.
25. *Ceratobaeus minyamea* sp. nov.
26. *Ceratobaeus laeviventris* (Dodd)
27. *Ceratobaeus raniae* sp. nov.
28. *Ceratobaeus pipayourula* sp. nov.
29. *Ceratobaeus manii* sp. nov.
30. *Ceratobaeus turneri* sp. nov.
31. *Ceratobaeus eumorphus* sp. nov
32. *Ceratobaeus pachycerus* sp. nov.
33. *Ceratobaeus mahmoodi* sp. nov.
34. *Ceratobaeus flaviventris* Dodd
35. *Ceratobaeus marrooyourula* sp. nov.
36. *Ceratobaeus setosus* Dodd
37. *Ceratobaeus masneri* Austin
38. *Ceratobaeus intrudae* Austin
39. *Ceratobaeus umasensis* sp. nov.
40. *Ceratobaeus australicus* (Dodd)
41. *Ceratobaeus alveus* sp. nov.
42. *Ceratobaeus yousufi* sp. nov.
43. *Ceratobaeus moonga* sp. nov.
44. *Ceratobaeus bouceki* sp. nov.
45. *Ceratobaeus oimus* sp. nov.
46. *Ceratobaeus iota* sp. nov.
47. *Ceratobaeus zebae* sp. nov.
48. *Ceratobaeus kentae* sp. nov.
49. *Ceratobaeus azhari* sp. nov.
50. *Ceratobaeus fieldi* sp. nov.
51. *Ceratobaeus clubionus* Austin
52. *Ceratobaeus berryae* sp. nov.
53. *Ceratobaeus cardaleae* sp. nov.
54. *Ceratobaeus grahami* sp. nov.
55. *Ceratobaeus kaikai* sp. nov.

Out-group taxa

56. *Sparasion* sp.
57. *Nixonia* sp.
58. *Idris* sp. 2

5.2.2. Taxa for relationships among species of *Ceratobaeus*

Fifty-five species of *Ceratobaeus* were selected from the 133 recognised for the Australasian region (see Chapter 6) to cover the range of variation exhibited by the genus (Table 5.2). Of the 55 species of *Ceratobaeus*, 27 are the same as those included in the data matrix for relationships among genera while 28 are additional to this analysis. *Sparasion* sp. and *Nixonia* sp. were again used as out-groups, along with a species of *Idris* (*Idris* sp. 2) which came out basal to all *Ceratobaeus* species in the generic level analysis (Fig. 5.2).

5.3. Characters used in phylogenetic analyses

Fifty morphological characters were selected as potentially informative for both phylogenetic analyses. Characters were selected that had previously been used in the literature to define genera as well as several new ones examined during this study. Ten characters were treated as quantitative while others could be divided into discrete (qualitative) states. Not all characters were used in both analyses: characters 5, 11, 17, 22, 24, 28, 32, 38, 39, 41-43 and 45-47 were excluded from the generic level analysis, while characters 31 and 40 were not used in the analysis of *Ceratobaeus* species. All other were used in both analysis (see Appendices A3.1 and A3.2). Characters have been scored only for females as this sex displays substantially more morphologically variability than males. Males from different genera are very similar to each other and generally lack characters informative at higher taxonomic levels. Further, it has not been possible to associate the sexes for most species of Baeini. Forty qualitative characters were divided into discrete states, with 38 being treated as binary, while characters 1 and 2 were divided into three states.

5.3.1. Qualitative characters

Character 1. Attachment of metasoma to mesosoma: The first metasomal tergite of baeines can be small relative to the metasoma and attached low on the propodeum, or it can be broad and closely abutted against the mesosoma so that the propodeum is partly hidden (sub-sessile) or almost completely hidden (sessile). Both the out-groups, *Sparasion* sp. and *Nixonia* sp. have T1 small and free of the metasoma. This character is treated as ordered given that the fully sessile condition could only have evolved through ancestors with the intermediate condition. It was treated as three states for the generic level analysis but as binary for the analysis of *Ceratobaeus* species, given that the third state is not present in the latter group. **0)** metasoma relatively small and not broadly abutted against mesosoma (Fig. 6.10), **1)** metasoma sub-sessile against mesosoma (Fig. 6.9), **2)** metasoma sessile against mesosoma (Fig. 6.2).

Character 2. Frontal carina: The frontal carina is a longitudinal median carina on the frons, extending from the interantennal process to the median ocellus. It is treated as an ordered character here. **0)** frontal carina absent or rudimentary (Fig. 6.68), **1)** frontal carina fine or strong but not reaching to median ocellus (Fig. 6.130), **2)** frontal carina reaching to median ocellus (Fig. 6.13).

Character 3. Sculpturing on cheek and lower frons: The cheeks and lower frons above the base of the mandible are sometimes striate or otherwise are smooth. **0)** cheek and lower frons smooth (Fig. 6.68), **1)** cheek and lower frons striate (Fig. 6.268).

Character 4. Speculum development: The speculum is the smooth shining area extending over the lower frons above the interantennal process. **0)** speculum present (Fig. 6.50), **1)** speculum absent, i.e. frons uniformly sculptured (Fig. 6.172).

Character 5. Speculum margin: The margins of the speculum can be abrupt and sharply defined in some taxa, or more diffuse and irregularly defined. **0)** speculum with sharp margin (Fig. 6.50), **1)** speculum with irregular margin (Fig. 6.78).

Character 6. Funicle segment number: The antennae of female scelionids can have four or more funicle segments. *Sparasion* sp. and *Nixonia* sp. have more than five funicle segments, while members of the Baeini can have four or five. **0)** five or more funicle segments (Fig. 6.18), **1)** four funicle segments (Fig. 6.17).

Character 7. Antennal clava: The antennal clava of female Baeini comprises four expanded terminal segments, a synapomorphy for the tribe Baeini which is shared with Thoronini and some platygastrids (e.g. *Aphanomerus* Perkins, *Helava* Masner & Huggert, *Parabaeus* and

Tetrabaeus), where the antennal clava often comprises four elements (Austin & Field 1997). An antennal clava is not developed in *Sparasion* sp. and *Nixonia* sp. **0)** distinct antennal clava present (Fig. 6.17), **1)** antennal clava absent (as for Fig. 6.20).

Character 8. Antennal clava segmentation: Usually the antennal clava in baeines is fused and the sutures between the segments are very faint. However, in some the clava is clearly four-segmented, and dividing sutures are wide and obvious. This character was coded as missing data for *Sparasion* sp. and *Nixonia* sp. **0)** antennal clava segmented (Fig. 6.61), **1)** antennal clava appearing fused (Fig. 6.102).

Character 9. Eyes pilosity: Examination of the eyes under stereo light microscopy (x40-80) indicates that some species lack eye setae, however SEM shows that eye setae are present in all species. **0)** eyes with long hairs (easily visible under light microscopy) (Fig. 6.6.25), **1)** eyes with minute hairs (visible only under SEM) (Fig. 6.201).

Character 10. Eye size: Eye height seen in lateral view is usually more than half the height of the head but in some species the eyes are much smaller. **0)** eyes size normal, height more than half that of head (Fig. 6.198), **1)** eyes small, height less than half that of head (Fig. 6.50).

Character 11. Position of lateral ocelli: Usually the lateral ocelli are close to or touching the eye margins but sometimes the lateral ocelli are more distant from the eyes. **0)** lateral ocelli touching eyes or less than 1OD from eye margin (Fig. 6.38), **1)** lateral ocelli more than 1OD from eye margin (Fig. 6.47).

Character 12. Axillar sculpturing: Axillar crenulae are a series of pits present in the antero-lateral corners of the scutellum. **0)** axillar crenulae present (Fig. 6.99), **1)** axillar crenulae absent (Fig. 6.195).

Character 13. Humeral sulcus: The humeral sulcus is developed as a series of crenulae in the postero-lateral corners of the mesoscutum, medial of the tegula. **0)** humeral sulcus smooth (Fig. 6.69), **1)** humeral sulcus crenulate (Fig. 6.62).

Character 14. Notauli development: Notauli are present in the form of two grooves on the posterior scutum in some species of Baeini. **0)** scutum with notauli (Fig. 6.63), **1)** scutum lacking notauli (Fig. 6.135).

Character 15. Wings development: Most baeine species have membranous wings, whether they are fully developed or reduced in size. However, some species have them reduced to tiny sclerites, referred to here as "wingless". **0)** wings developed (Fig. 6.62), **1)** wingless (Fig. 6.9).

Note that species coded (1) for character 15, are coded as missing data for character 16-21.

Character 16. Degree of wing development: Usually the wings are fully developed and reaching to the distal metasoma. However, some are brachypterous with the wings only reaching to T2 at the most. **0)** wings fully developed (Fig. 6.279), **1)** brachypterous (Fig. 6.70).

Character 17. Fore wing banding: The fore wings are usually uniform in colour but some species have the wings with dark transverse bands. **0)** fore wings of uniform colour (Fig. 6.285), **1)** fore wings with dark transverse bands (Fig. 6.287).

Character 18. Wing venation: The submarginal, marginal and stigmal veins are tubular and usually clear, but in a few species the veins are blurred and appear to be absent. **0)** wing venation tubular and clear (Fig. 6.290), **1)** wing venation blurred (Fig. 6.291).

Character 19. Bristles on submarginal vein: The bristles on the submarginal vein of the fore wings are usually long and reach beyond the anterior margin of the wing. However, in some species they can be absent, or very short and not reaching the anterior margin. These bristles are also present in brachypterous species. **0)** bristles on submarginal vein absent or short (Fig. 6.290), **1)** bristles on submarginal vein long, reaching beyond anterior margin of wing (Fig. 6.291).

Character 20. Fore wing marginal fringe: A marginal fringe of setae is present on the outer and posterior edge of the fore wings. However, sometimes this setal fringe is absent. **0)** fore wing marginal fringe present (Fig. 6.289), **1)** fore wing marginal fringe absent (Fig. 6.290).

Character 21. Basal vein development: The basal vein is absent in many species, but is sometimes represented by an infuscated (pigmented) line or band. **0)** basal vein present and pigmented (Fig. 6.280), **1)** basal vein absent (Fig. 6.279).

Character 22. Scutellar posterior rim projection: The posterior rim of the scutellum projects posteriorly over the dorsellum in some species or the rim may be level with the dorsellum. **0)** posterior rim of the scutellum projecting over dorsellum (Fig. 6.39), **1)** posterior rim of the scutellum not projecting over dorsellum (Fig. 6.105).

Character 23. Scutellum posterior margin: The posterior rim of the scutellum usually has a row of foveae or it may be completely smooth. **0)** scutellar rim with single row of foveae (Fig. 6.99), **1)** scutellar rim smooth (Fig. 6.273).

Character 24. Scutellum posterior margin medial groove: Sometimes there is a broad medial groove on the posterior scutellum so that the border is emarginate. This groove apparently provides a recess for the metasomal horn when it is flexed forwards. In other species, a groove is absent in dorsal view and the posterior margin is rounded or straight although it may also be inflected upwards. **0)** posterior scutellum without excavation (sometimes margin inflected upwards) (Fig. 6.27), **1)** posterior scutellum excavated and forming groove (Fig. 6.139).

Character 25. Metanotum exposure: The metanotum is visible postero-dorsally in most species, but when the metasoma is sub-sessile and broadly abutted against the mesosoma, the metanotum is hidden at least in the medial part. **0)** metanotum visible medially (Fig. 6.85), **1)** metanotum concealed medially (Fig. 6.2).

Character 26. T1 development: Some baeines have a metasomal horn developed on the first tergite (T1) in females, as do a number of other scelionid and platygastrid genera (see Chapter 2). The horn occurs most commonly in fully winged species, but also occurs rarely in wingless taxa where T1 can be expanded into a broad hump. Other members of the tribe have the dorsal surface of T1 flattened. **0)** T1 flat (Fig. 6.10), **1)** T1 with a broad hump or horn (Fig. 6.15).

<u>Note</u> that species coded (0) for character 26, are coded as missing data for character 27-32.

Character 27. Metasomal horn length: The metasomal horn varies in length from a low hump to a horn extending beyond the head. Species where the horn does not reach the level of scutellum are here referred to as "short horn" species and those where it reaches the scutellum or is longer, as "long horn" species. **0)** metasomal horn reaching to or past level of posterior margin of scutellum (Fig. 6.107), **1)** metasomal horn not reaching posterior margin of scutellum (Fig. 6.77).

Character 28. Metasomal horn curvature: The metasomal horn can be straight or curved forwards. The latter state is partly linked to horn length in that long-horn species often have the horn curved, but not in all cases. Some long-horn species have it straight, while some short-horn species have the horn curved. **0)** metasomal horn straight (Fig. 6.28), **1)** metasomal horn curved forward (Fig. 6.141).

Character 29. Metasomal horn shape: The metasomal horn can be broad at the base and hump-like while in other species it is uniform in width. **0)** metasomal horn uniformly slender (Fig. 6.197), **1)** metasomal horn broad at base (Fig. 6.197).

Character 30. Distal metasomal horn shape: The distal end of the metasomal horn is usually convex and narrow but in a few species it is flattened and broad. **0)** distal metasomal horn convex and narrowly rounded (Fig. 6.115), **1)** distal metasomal horn flattened (Fig. 6.112).

Character 31. Metasomal horn lateral shape: The metasomal horn can be compressed laterally or approximately circular in cross-section at its mid-point. **0)** metasomal horn circular in cross-section (Fig. 6.206), **1)** metasomal horn compressed laterally (Fig. 6.15).

Character 32. Colour of metasomal horn: The metasomal horn is usually the same colour as the metasoma but in some species it can be very much darker (e.g. metasoma yellow with a black horn). **0)** colour of metasomal horn same as metasoma (Fig. 6.299), **1)** colour of metasomal horn distinctly different from metasoma (Fig. 6.304).

Character 33. Effect of metasomal horn on scutellum: If the metasomal horn reaches the level of the scutellum, it is usually curved forwards medially to create an indentation or groove in the posterior margin. This indentation is variable and usually depends on the size and shape of the metasomal horn. If the metasomal horn is not curved forward then the scutellum often lacks an indentation. **0)** posterior scutellum rounded or straight in dorsal view (Fig. 6.56, 6.76, 6.79, 6.85), **1)** posterior scutellum indented medially (Fig. 6.69, 6.103, 6.149, 6.204).

Character 34. Scutum groove/indentation: Some species have an incomplete or percurrent longitudinal medial groove on the scutum or the posterior margin is strongly emarginate. As discussed in characters 24 and 33, these modifications provide a recess for the metasomal horn. **0)** scutum normal (Fig. 6.214), **1)** scutum with medial groove or deep emargination (Fig. 6.107, 6.111, 6.203, 6.205).

Character 35. Propodeal lamellae: The apical (dorsal) part of the propodeal lamellae can be sharply pointed or more blunt. **0)** dorsal propodeal lamellae blunt (Fig. 6.173), **1)** dorsal propodeal lamellae sharply pointed (Fig. 6.166).

Character 36. Hind femoral spines: A pair of spines on the distal hind femora are present in some baeine species. **0)** distal hind femur simple (Fig. 6.2), **1)** distal hind femur with two spines (Fig. 6.8).

Character 37. T2 anterior margin sculpturing: The anterior margin of the second metasomal tergite (T2) can be smooth or striated with a series of foveae. **0)** T2 anterior margin striate (Fig. 6.9), **1)** T2 anterior margin smooth (Fig. 6.7).

Character 38. T3 sculpturing: The third metasomal tergite may be striate or have some other type of sculpturing or be smooth. **0)** T3 striate (Fig. 6.299), **1)** T3 smooth or with other sculpturing (Fig. 6.2, 6.9, 6.10).

Character 39. Colour of metasoma: The body colour is uniform for the majority of species but in some the colour of the metasoma is distinctly different from the head and mesosoma (e.g. metasoma yellow, head and mesosoma black). **0)** metasoma, mesosoma and head of uniform colour, **1)** metasoma colour distinctly different from head and mesosoma.

Character 40. Laterotergite position: The laterotergites of the metasoma can be narrow and inserted into a submarginal groove on the sternites or free and exposed. **0)** laterotergites free (Fig. 6.3), **1)** laterotergites inserted into submarginal groove (Fig. 6.113).

5.3.1.2. Quantitative characters

Ten characters could not be divided into discrete states and were therefore treated as quantitative and coded by gap and segment coding (see section 3.6.2). Four characters (44, 48, 49 and 50) were score differently for the generic level analysis versus the *Ceratobaeus* species. See Chapter 4 for further details on how some character states were measured.

Character 41. Body length: Body size was measured from the head (not including the antennae) to the apex of metasoma in dorsal view (see Appendix A2.2.1). **0)** body length ≤ 1.98 mm, **1)** body length 1.99 - 3.29 mm, **2)** body length 3.3 - 5.91 mm, **3)** body length ≥ 5.92 mm.

Character 42. Head width : length ratio: Head width was measured in dorsal view and length in lateral view, at the widest point (usually through the middle of the eye) (see Appendix A2.2.2). **0)** head ≤ 1.78 x as wide as long, **1)** head 1.79 - 2.16 x as wide as long,

2) head 2.17 - 2.54 x as wide as long, **3)** head 2.55 - 2.92 x as wide as long, **4)** head 2.93 - 3.3 x as wide as long, **5)** head ≥ 3.4 x as wide as long.

Character 43. Head height : width ratio: Head height was measured in lateral view to the ventral margin of the gena (see Appendix A2.2.3). **0)** head ≤ 74 x as high as wide, **1)** head 0.75 - 0.81 x as high as wide, **2)** head 0.82 - 0.88 x as high as wide, **3)** head 0.89 - 0.95 x as high as wide, **4)** head ≥ 0.96 x as high as wide.

Character 44. First funicle segment (F1) length : width ratio: **For generic level analysis.** (see Appendix A2.1.1) **0)** first funicle segment ≤ 2 x as long as wide (Fig. 6.17), **1)** first funicle segment 3 - 3.5 x as long as wide (Fig. 6.298), **2)** first funicle segment ≥ 4 x as long as wide (Fig. 6.298). **For *Ceratobaeus* species analysis.** (see Appendix A2.2.4) **0)** first funicle segment ≤ 1.68 x as long as wide, **1)** first funicle segment 1.69 - 2.36 x as long as wide, **2)** first funicle segment 2.37 - 3.04 x as long as wide, **3)** first funicle segment 3.05 - 3.72 x as long as wide, **4)** first funicle segment ≥ 3.73 x as long as wide.

Character 45. Antennal clava length : width ratio: (see Appendix A2.2.5) **0)** antennal clava ≤ 2.09 x as long as wide, **1)** antennal clava 2.1 - 2.47 x as long as wide, **2)** antennal clava 2.48 - 2.85 x as long as wide, **3)** antennal clava 2.86 - 3.23 x as long as wide, **4)** antennal clava 3.24 - 3.61 x as long as wide, **5)** antennal clava ≥ 3.62 x as long as wide.

Character 46. Scutum length : width ratio: (see Appendix A2.2.6) **0)** scutum ≤ 0.44 x as long as wide, **1)** scutum 0.45 - 0.57 x as long as wide, **2)** scutum 0.58 - 0.7 x as long as wide, **3)** scutum 0.71 - 0.83 x as long as wide, **4)** scutum ≥ 0.84 x as long as wide.

Character 47. Forewing length : width ratio: (see Appendix A2.2.7) **0)** fore wing ≤ 2.28 x as long as wide, **1)** fore wing 2.29 - 2.56 x as long as wide, **2)** fore wing 2.57 - 2.84 x as long as wide, **3)** fore wing 2.85 - 3.12 x as long as wide, **4)** fore wing 3.13 - 3.4 x as long as wide, **5)** fore wing 3.41 - 3.68 x as long as wide, **6)** fore wing ≥ 3.69 x as long as wide.

<u>Note</u> that brachypterous species are coded as missing data for character 47 and 48.

Character 48. Postmarginal vein : stigmal vein ratio: In comparison to the stigmal vein, the postmarginal vein ranges from being almost absent to longer than the stigmal vein. **For generic level analysis:** (see Appendix A2.1.2) **0)** postmarginal vein ≤ 0.72 x as long as stigmal vein (Fig. 6.290), **1)** postmarginal vein 1 - 1.1 x as long as stigmal vein (Fig. 6.292), **2)** postmarginal vein ≥ 2 x as long as stigmal vein. **For *Ceratobaeus* level analysis:** (see Appendix A2.2.8) **0)** postmarginal vein ≤ 0.47 x as long as stigmal vein, **1)** postmarginal vein 0.48 - 0.83 x as long as stigmal vein, **2)** postmarginal vein 0.84 - 1.19 x as long as stigmal vein, **3)** postmarginal vein 1.2 - 1.55 x as long as stigmal vein, **4)** postmarginal vein ≥ 1.56 x as long as stigmal vein.

Character 49. Metasoma length : width ratio: **For generic level analysis:** (see Appendix A2.1.3) **0)** metasoma ≤ 2.05 x as long as wide (Fig. 6.304), **1)** metasoma 2.4 - 2.85 x as long as wide, **2)** metasoma 3.72 - 3.81 x as long as wide, **3)** metasoma ≥ 5 x as long as wide (Fig. 6.299). **For *Ceratobaeus* species analysis:** (see Appendix A2.2.9) **0)** metasoma ≤ 2.03 x as long as wide, **1)** metasoma 2.04 - 2.74 x as long as wide, **2)** metasoma 2.75 - 3.45 x as long as wide, **3)** metasoma 3.46 - 4.16 x as long as wide, **4)** metasoma ≥ 4.16 x as long as wide.

Character 50. T3 : T2 ratio: This character refers to the relative length of T3 and T2 measured in the dorsal mid-line. **For generic level analysis:** (see Appendix A2.1.4) **0)** T3 ≤0.96 x as long as T2, **1)** T3 0.97 - 1.85 x as long as T2, **2)** T3 1.86 - 2.74 x as long as T2, **3)** T3 2.75 - 3.63 x as long as T2, **4)** T3 ≥3.64 x as long as T2. **For *Ceratobaeus* species analysis:** (see Appendix A2.2.10) **0)** T3 ≤ 1.33 x as long as T2 (Fig. 6.2), **1)** T3 1.34 - 1.9 x as long as T2, (Fig. 6.9) **2)** T3 1.91 - 2.47 x as long as T2 (Fig. 6.10), **3)** T3 2.48 - 3.04 x as long as T2, **4)** T3 ≥ 3.05 x as long as T2 (Fig. 6.302).

5.3.3. Ordering and scoring of characters

Characters 44, 48, and 49 were coded for the generic level analysis by using gap coding because there were enough gaps present in the character distribution among taxa. All quantitative characters for the *Ceratobaeus* species analysis and character 50 for generic level analysis were coded using segment coding (Appendix A1.1 & A1.2).

5.4. Results of analysis of relationships among genera

With *Sparasion* treated as the reference taxon parsimony analysis generated 41 shortest trees of length 152 steps (consistency index 0.276, total support index 0.355) for the data set in Appendix A3.1. The resulting strict consensus tree (Fig. 5.1) is not well resolved, but significantly has enough structure to indicate that *Ceratobaeus* is not monophyletic. Members of *Ceratobaeus* are mostly contained within two clades (nodes 16 and 17) while *C. moongacutta*, and *C. yousufi* fall out elsewhere (nodes 1 and 14). The relationship of *C. naumanni* and *C. leai* are unclear, but it is possible that in a more fully resolved tree they may come out as sister species to nodes 16 and/or 17. To further investigate the relationships among genera, successive weighting was applied as discussed in section 3.6.4.

Successive weighting resulted in 6 trees of length 25,833. The strict consensus tree (Fig. 5.2) shows a more resolved set of relationships compared to Fig. 5.1, and again *Ceratobaeus* is not monophyletic. All *Ceratobaeus* with the exception of *C. moongacütta* are contained within a single clade (Node 5), along with all representatives of *Odontacolus*, *Baeus*, *Mirobaeus*, *Mirobaeoides* and the three undetermined genera. This node is supported by one character (Character 26: T1 with a hump or horn) which is reversed for *B. leai, B. seminulum, M. pecki, M. scutellaris, M. tasmanicus, M. bicolor* and Genus sp. 3. Representative species of *Odontacolus* (node 7), *Hickmanella* (node 2) and *Baeus* (node 14) fall out as monophyletic. *Hickmanella* spp. are supported by a synapomorphic character (Character 2: frontal carina reaching to median ocellus) while *Odontacolus* spp. are monophyletic and defined by one synapomorphy (Character 31: metasomal horn compressed laterally). *Mirobaeoides* is not monophyletic but all species are contained within a well-defined clade (node 13) that comprises all representatives *Baeus*, *Mirobaeus* and *Mirobaeoides* along with three species of undetermined generic status. This clade contains all reduced-winged and apterous baeines, with the exception of *C. leai, C. naumanni, Idris flavicornis* and *Idris* sp. 1 (all of which have reduced wings). It is supported by two parallel characters (Character 1: sub-sessile or sessile attachment of the metasoma, and Character 16: brachypterous/wingless). *Baeus* is supported by one synapomorphy (Character 40:

laterotergite free). Two reduced-winged *Ceratobaeus* spp. (*C. naumanni* and *C. leai*) come out basally to all other reduced-winged species (node 12).

Idris spp. with the exception of one species (*Idris* sp. 2) are contained within two clades (Node 3 and 4), which are also resolved in the parsimony analysis (Fig. 5.1). Node 3 contains two species and is supported by two parallel characters (Character 9: eyes with rudimentary hairs, and Character 19: bristles on submarginal vein rudimentary); while node 4 contains five species and is supported by two parallel characters (Character 9: eyes with long hairs and Character 19: bristles on submarginal vein long). Node 6 contains 14 *Ceratobaeus* spp. along with the two *Odontacolus* spp. and is supported by one character (Character 3: cheeks and lower frons striate) which is reversed for *C. pipayourula, C. eumorphus, C. giraulti, C. fieldi, C. clubionus* and *O. longiceps*. Node 11 contains the remaining 12 species and is supported by one character (Character 3: cheeks and lower frons smooth) which is reversed for *M. tasmanicus, C. leai, C. naumanni* and *C. ater*. Node 10 contains five species and is supported by one parallel character (Character 19: bristles on submarginal vein rudimentary). *C. moongacutta* is basal to *Hickmanella* at node 1 in both trees (Figs 5.1 and 5.2) and is supported by three homoplastic characters (Character 6: five funicle segment; Character 8: antennal clava segmented and Character 14: scutum with notauli). However, *C. setosus* as the sister taxon to *Odontacolus* spp. in Fig. 5.2 is replaced by *C. yousufi* in Fig. 5.1.

Nodes 16 and 17 are the two major clades in Fig. 5.1 containing the majority of *Ceratobaeus* spp. These clades contain many of the *Ceratobaeus* spp. contained within the clades denoted at nodes 11 and 6 respectively, but with several differences. Node 16 contains 11 *Ceratobaeus* spp. and is supported by one parallel character (Character 49: metasoma ≥ 2.4 x as long as wide), while node 17 contains 12 species and is supported by one character (Character 13: humeral sulcus crenulate) with reversal for *C. setosus*.

5.4.1. Effect of constraining all *Ceratobaeus* species

To further explore the phylogenetic status of *Ceratobaeus*, an analysis was conducted enforcing the topological constraint of making members of this putative genus monophyletic. This analysis resulted in 11,506 shortest trees of length 155 (Fig. 5.3), three steps longer than the length of most parsimonious trees (Fig. 5.1). The relationships for the other baeine genera remain largely unchanged.

5.4.2. Effect of constraining specific morphological characters

The effect of constraining specific morphological characters was examined to determined their effect on both tree length and topology. Of 35 characters, four were selected because of their prominence in the literature as being important as generic level characters. These were wing reduction in females, presence of femoral spines on the hind legs, presence of a metasomal horn (or hump) on T1, and a fused (unsegmented) antennal clava. Aptery is an apomorphic state and a diagnostic character for several genera, including *Baeus*, *Mirobaeus* and *Mirobaeoides*. However, wing reduction also occur in all other genera, including *Ceratobaeus* and *Idris*, but is apparently unknown in *Odontacolus*. The presence of femoral spines on the hind legs is a synapomorphy for *Mirobaeoides*. However, during this study one species (with hump on T1), Genus sp. 1, which is not easily accommodated in this genus, was also found to possess femoral spines. The metasomal horn on T1 is a diagnostic character for *Ceratobaeus* and *Odontacolus* but some dorsal expansion of T1 into a hump is also known in at least one species of *Mirobaeoides*, *M. barbarae*. The formation of a compact antennal clava is an apomorphic state for some members of Baeini. In *Mirobaeus*, *Mirobaeoides* and *Hickmanella* the clava is clearly segmented while in *Baeus* and the great majority of *Idris* and *Ceratobaeus* it is compact and appears unsegmented. The clava of female *Odontacolus* is intermediate between these states, but was here coded as compact.

Four separate analyses were conducted by constraining taxa containing each of these character states. The search options are as discussed in section 3.6.4.

5.4.2.1. Wing reduction constraint

When all taxa coded for wing reduction (Characters 15 and 16 - apterous and brachypterous) were constrained into a monophyletic clade, the resultant shortest trees were two steps longer than the most parsimonious trees (Fig. 5.1). The strict consensus tree (Fig. 5.4) of the 12 shortest trees shows that *C. naumanni* and *C. leai* fall into the constrained clade, while the remaining species of *Ceratobaeus* are paraphyletic below this, but with *Odontacolus* also included among them. As in previous analyses, *Odontacolus, Hickmanella* and *Baeus* are monophyletic while *Idris* forms three clades towards the base of the tree. The indices for these trees are given in Table 5.3.

5.4.2.2. Femoral spine constraint

Constraining those taxa that possess femoral spines involved four additional steps and generated 95 trees. The strict consensus tree (Fig. 5.5) show that all *Ceratobaeus* except *C. moongacutta*, are grouped into one clade along with *Odontacolus*.

Table 5.3. Effect of constraining important morphological characters on the phylogenetic analysis of the Baeini (L=tree length; N=number of trees saved; CI=consistency index; RI=retention index; RC=rescaled consistency index)

	L	N	CI	RI	RC	f-ratio (strict)
Most parsimonious (without constraint)	152	41	0.276	0.658	0.182	0.466
***Ceratobaeus* constraint**	155	11506	0.271	0.649	0.176	0.536
Wing reduction constraint	154	12	0.273	0.652	0.178	0.695
Femoral spines constraint	156	95	0.269	0.646	0.174	0.404
Unsegmented clava constraint	157	14	0.268	0.643	0.172	0.678
Metasomal horn constraint	156	1090	0.269	0.646	0.174	0.561
Exclusion of characters 15 and 16	147	83	0.272	0.655	0.178	0.613
Exclusion of characters 1, 15 and 16	144	140	0.264	0.642	0.169	0.501

5.4.2.3. Metasomal horn constraint

Forcing the monophyly of all taxa with a metasomal horn or hump developed on T1 resulted in four addition steps and generated 1,090 shortest trees of length 156 (Fig. 5.6). This clade constrained all species of *Ceratobaeus* and *Odontacolus* along with *M. barbarae* and two species of undetermined generic status (Genus sp. 1 and sp. 2). The relationships within this group are largely unresolved.

5.4.2.4. Unsegmented antennal clava constraint

Constraining those taxa that possess an unsegmented antennal clava involved five extra steps and produced 14 shortest trees. The constrained clade (Fig. 5.7) contained

Odontacolus, *Baeus*, all *Ceratobaeus* spp. except *C. moongacutta* and *C. naumanni*, and all *Idris* spp. except *Idris* sp. 2.

As all the constraints generated trees at least two steps longer, they provide a significantly poorer explanation of the relationships among the taxa included. The shortest trees were found when the data set was analysed without applying any constraints and therefore they provide the most parsimonious hypothesis for the relationships among taxa of Baeini.

5.4.3. Effect of excluding all wing development related characters

Because of the possibility that wing reduction may be more homoplasious than is evident in the parsimonious and successive weighting analyses (Figs 5.1 and 5.2), the wing characters (Characters 15 and 16) were excluded and the data set reanalysed. A subsequent analysis also excluded Character 1 (metasoma attachment) on the basis that this character is, intuitively, strongly linked to wing reduction in some Hymenoptera (see Chapter 2). Analysis with Characters 15 and 16 excluded produced 83 trees of length 147. The strict consensus tree (Fig. 5.8) shows that the basal nodes are largely comb-like in structure and that *Ceratobaeus* is still polyphyletic. The genera *Baeus* and *Mirobaeoides*, *Hickmanella* and *Odontacolus* come out as monophyletic as previously. Analysis with Characters 1, 15 and 16 excluded resulted 140 trees of 144 length. The strict consensus tree (Fig. 5.9) was even more comb-like than in Fig. 5.8, with relationships among *Mirobaeoides* and *Idris* spp. collapsing completely and *Ceratobaeus* spp. distributed among six separate clades. The exclusion of these characters, although an interesting exercise, has not shed any further light on the relationships discussed above.

5.4.4. Conclusions of analysis of relationships among genera

It should be stressed that this analysis was primarily undertaken to determine the relationship of *Ceratobaeus* relative to other currently recognised genera, not to test the monophyly (or otherwise) of these genera. If this was the case then more exemplar species of these genera would have been included. Clearly the results of both the parsimony analysis and successive weighting show that *Ceratobaeus* is polyphyletic. However, given that *Ceratobaeus* spp. can be identified by the presence of a cylindrical metasomal horn on T1, compared with the laterally compressed horn of *Odontacolus*, and the preliminary nature of the phylogenetic analyses undertaken here, it is proposed to maintain *Ceratobaeus* as a genus of convenience until its relationship can be more conclusively determined. This study has focused almost exclusively on the Australian fauna and although the Baeini are highly diverse for this region, relationships for the group will need to be undertaken on a world-wide basis, so as to include putative genera and species-groups from other regions. This will undoubtedly involve problems with the size of the data matrix, which at present would be difficult to analyse.

5.5. Results of analysis of relationships among species of *Ceratobaeus*

With *Sparasion* sp. treated as the reference taxon parsimony analysis generated 1,188 shortest trees of length 366 steps (consistency index 0.171 and total support index 0.172) for the data matrix in Appendix A3.2. A large proportion of the strict consensus tree (Fig. 5.10) is comb-like but several major clades are recognised. Significantly, *Ceratobaeus moongacutta* comes out basal to all other *Ceratobaeus* spp., as it did in the successive weighting analysis (Fig. 5.11). However, *Idris* sp. 2 falls within the in-group, contrary to the previous analysis.

Because of the apparent level of homoplasy in the data set indicated by a consistency index of 0.171 and to further explore the relationships among *Ceratobaeus* spp., the data was re-analysed by applying successive weighting according to maximum value of rescaled consistency index (RC). This analysis generated 6 shortest trees of length 30,079 (consistency index 0.174). The strict consensus tree (Fig. 5.11) shows a more resolved set of relationships compared to Fig. 5.10 and this tree was used to infer likely relationships and recognise putative species-groups. Again *C. moongacutta* comes out below *Idris* sp. 2 (node 1). This node is highly supported with a bootstrap value 97 and Bremer value 9. It is defined by two synapomorphies (Character 7: distinct antennal clava present in females, and Character 43: head ≤ 0.96 as high as wide). Node 2 contains all *Ceratobaeus*, except three species with segmented antennal clava and is supported by two synapomorphies (Character 6: four funicle segments, and Character 8: antennal clava appearing to be fused).

Node 3 contains 19 species and is supported by one parallel character (Character 33: scutellum indented medially); node 4 contains four species and is supported by one parallel character (Character 19: bristles on submarginal vein absent or rudimentary); node 5 contains five species and is supported by one parallel character (Character 2: frontal carina not reaching to median ocellus); node 6 contains six species and is defined by one parallel character (Character 48: metasoma $\leq$ 2.03 x as long as wide); node 8 contains five species and is supported by one parallel character (Character 27: metasomal horn not reaching posterior margin of scutellum); while node 9 contains five species and is supported by a synapomorphic character (Character 2: frontal carina reaching to median ocellus) and a parallel character (Character 35: dorsal propodeal lamellae sharply pointed).

The tree derived from successive weighting was used to divide *Ceratobaeus* into 28 monophyletic species-groups (Fig. 5.12) which are diagnosed and discussed in more detail in Chapter 6. Given that only 55 species were included in this analysis, less than half of the Australasian species, the remaining species have been assigned to these species-groups based on the sequential characters at each node, starting at the base of the tree. The number in brackets in Fig. 5.12 represent the number of additional species contained in each species-group.

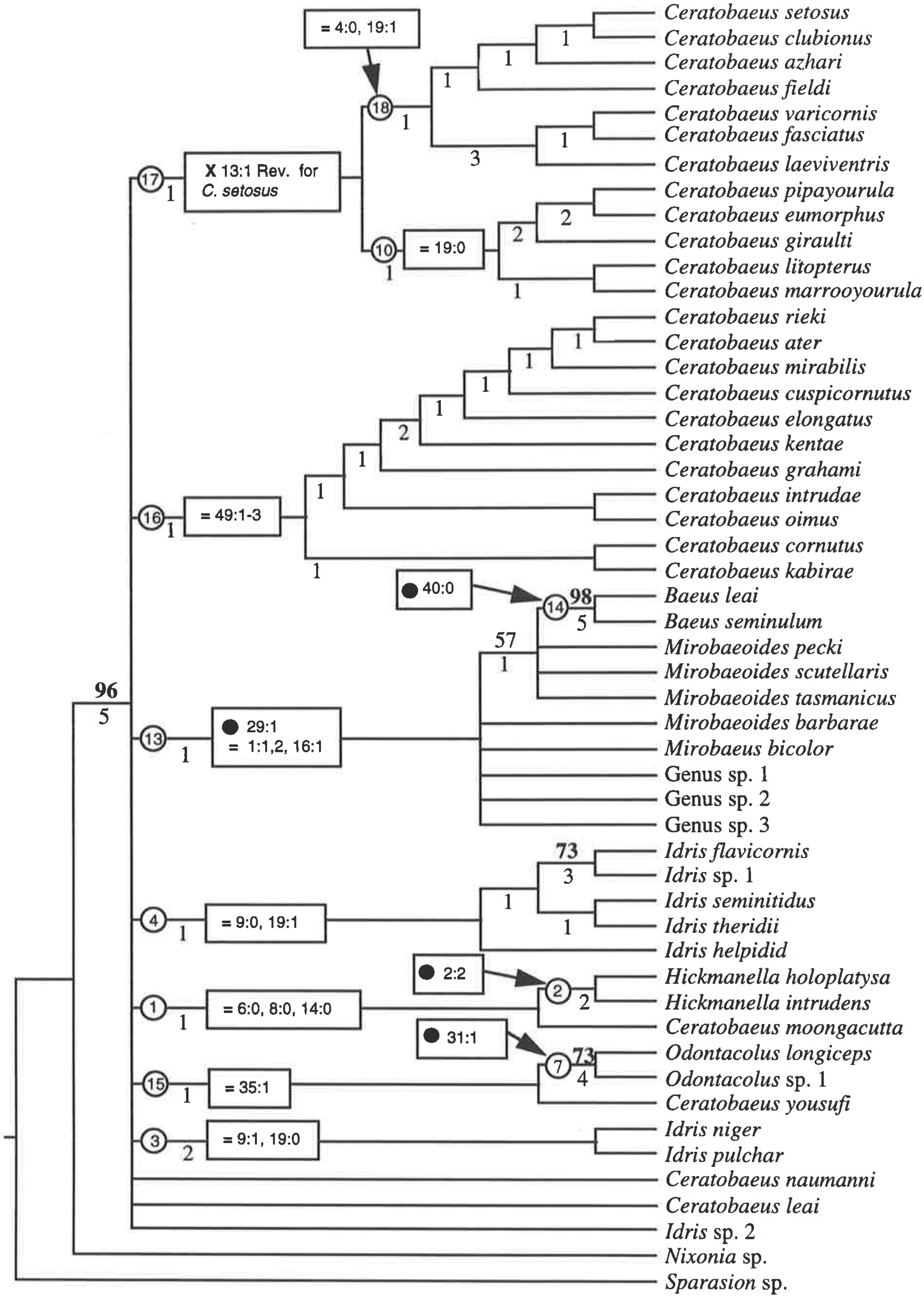


Fig. 5.1. Strict consensus of 41 trees of length 152 (CI=0.276; RI=0.658; RC=0.182; f-ratio=0.604; total support=54 and total support index=0.355). Bootstrap values are given above and decay (Bremer) values below the nodes. ● synapomorphy; = homoplasy; **X** reversal. Numbers in circles denoting nodes are the same as in the successively weighted tree (Fig. 5.2).

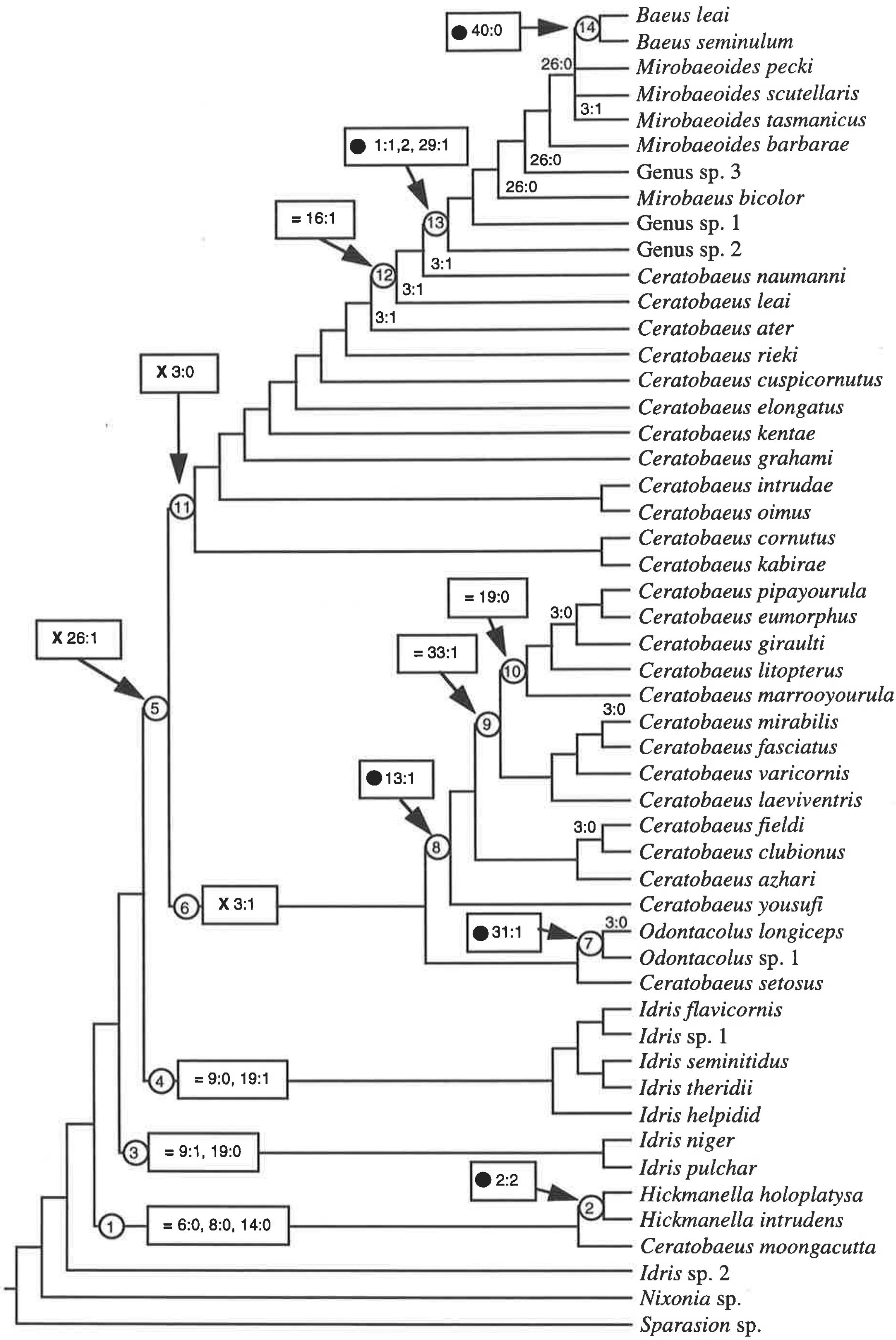


Fig. 5.2. Strict consensus of six trees (length=25833) generated by successive weighting of characters according to the maximum value of rescaled consistency index; (CI=0.252; RI=0.649; RC=0.163; f-ratio= 1.021). ● synapomorphy; = homoplasy; **X** reversal.

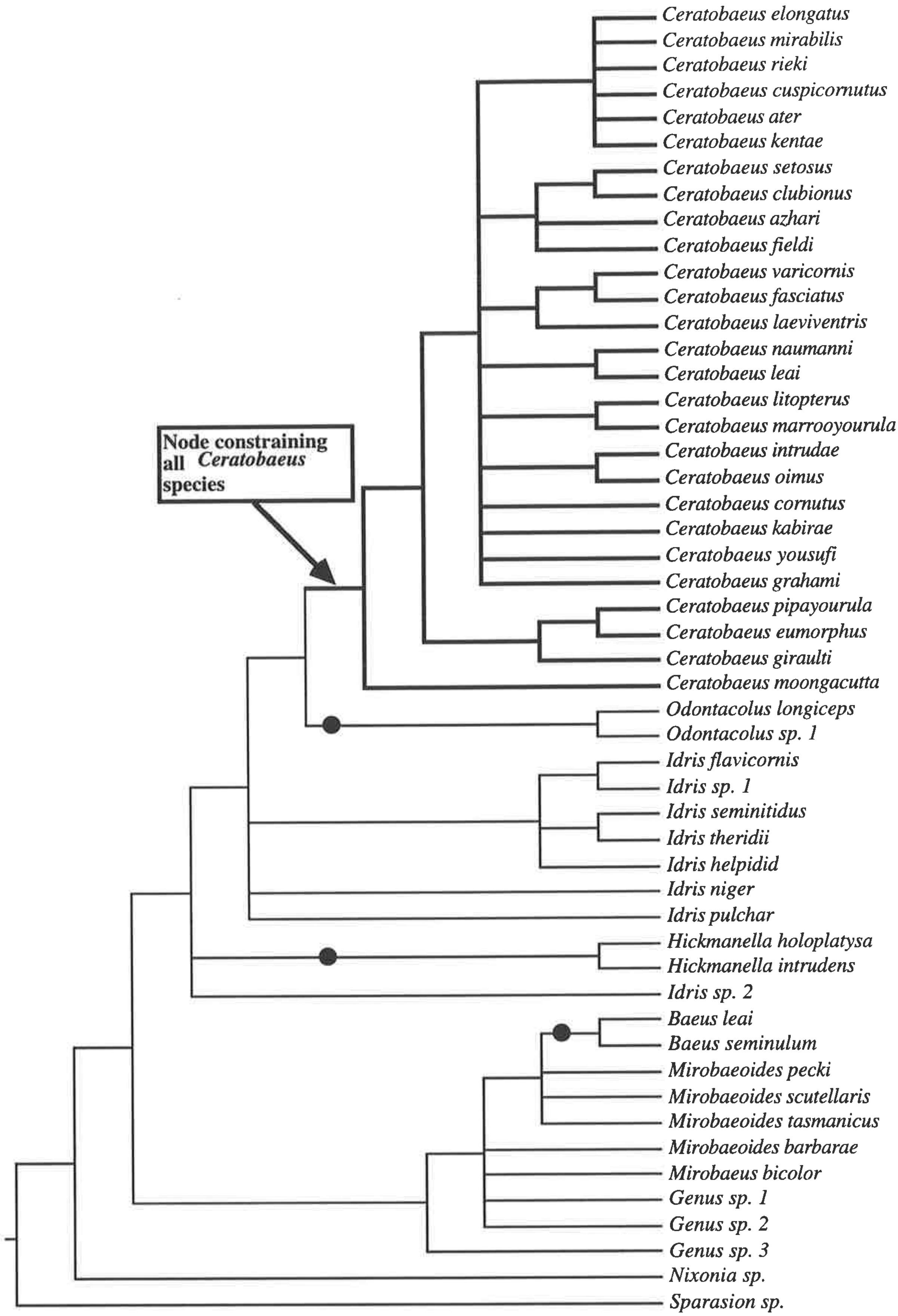


Fig. 5.3. Strict consensus of 11506 trees (length=155) constraining all *Ceratobaeus* species into a monophyletic clade (CI=0.271; RI=0.649; RC=0.176; f-ratio=0.742). ● shows monophyletic genera.

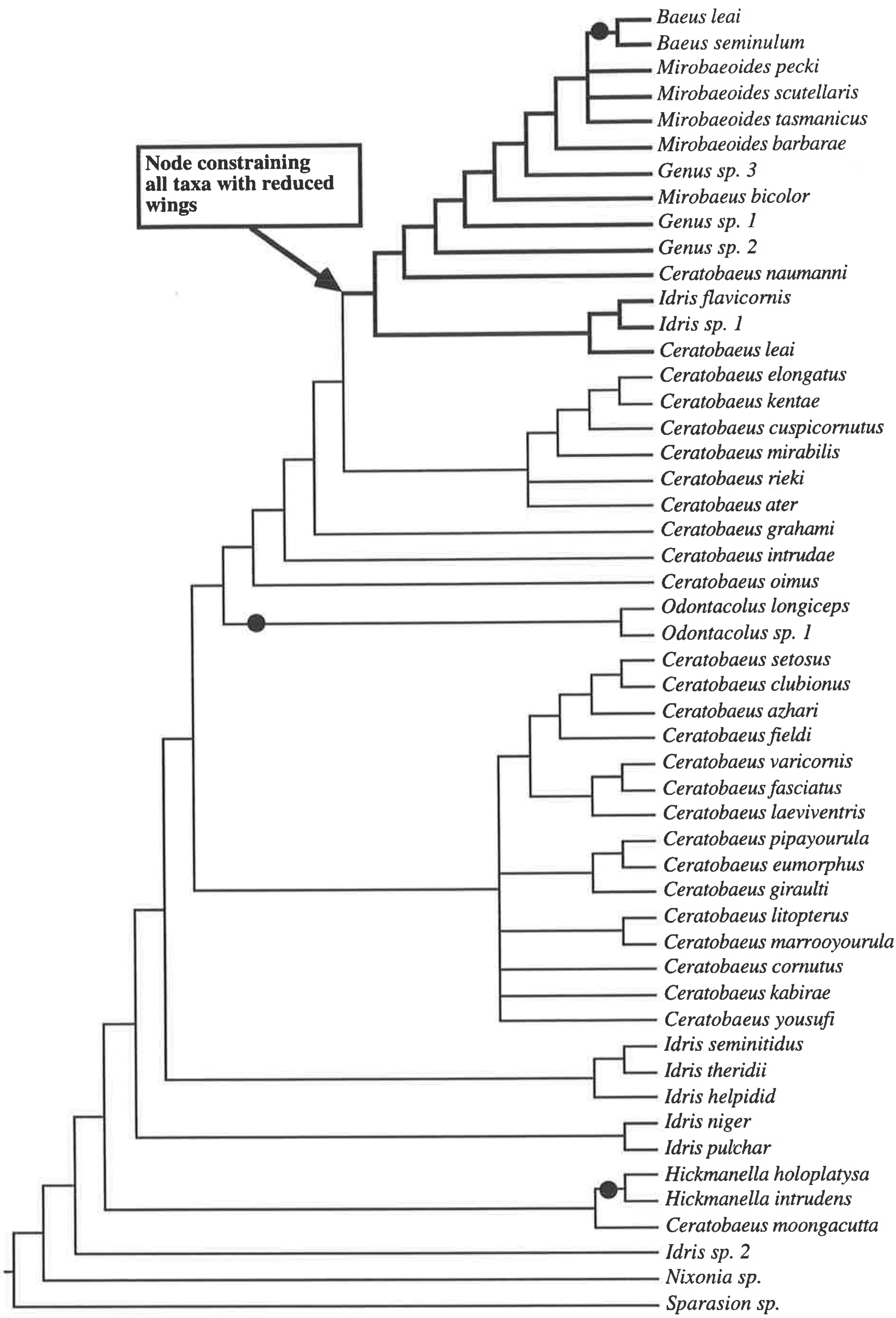


Fig. 5.4. Strict consensus of 12 trees (length = 154) constraining all taxa with reduced wings (CI=0.273; RI=0.652; RC=0.178; f-ratio=0.861). ● shows monophyletic genera.

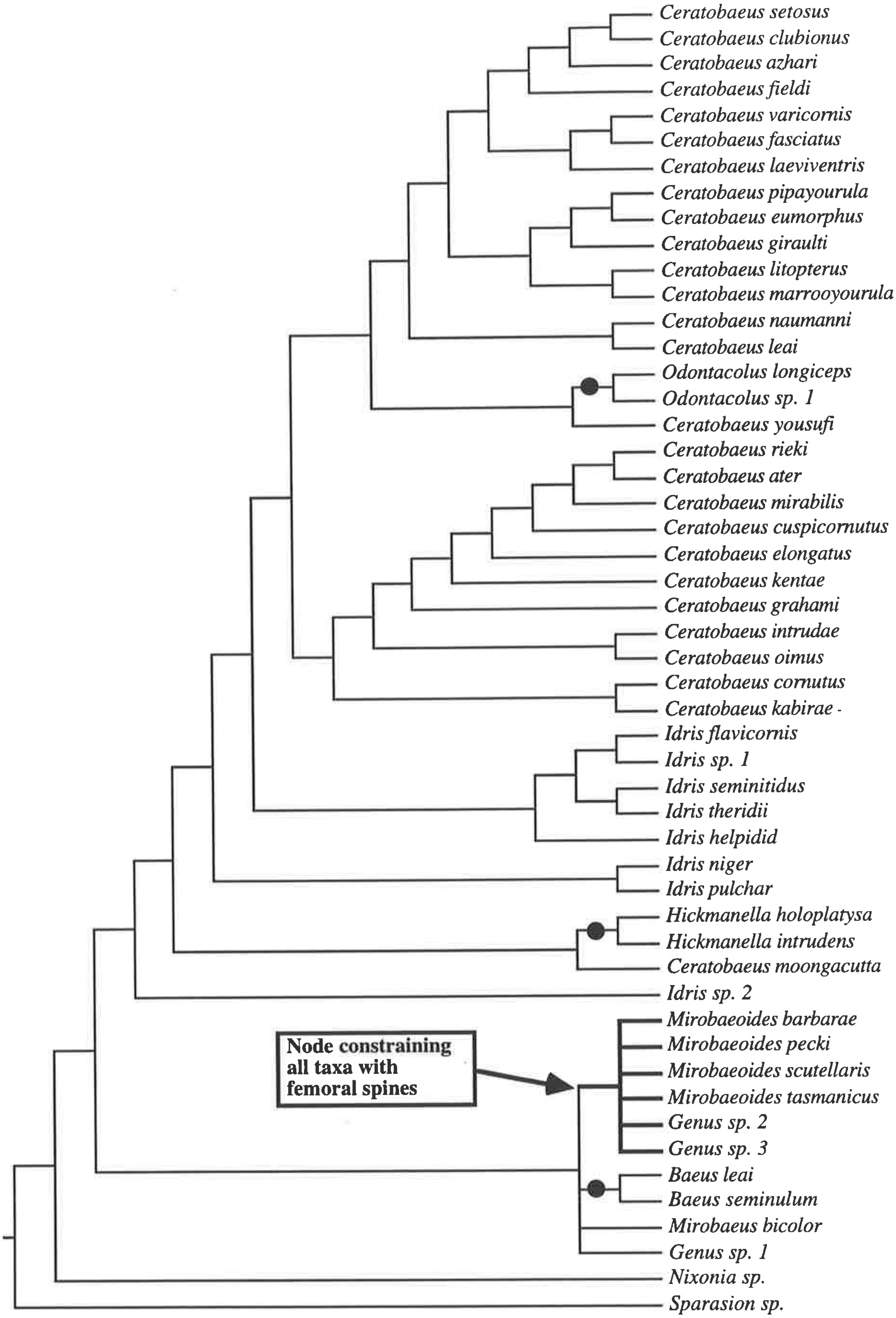


Fig. 5.5. Strict consensus of 95 trees (length = 156) constraining all taxa with femoral spines (CI=0.269; RI=0.646; RC=0.174; f-ratio=0.558). ● shows monophyletic genera.

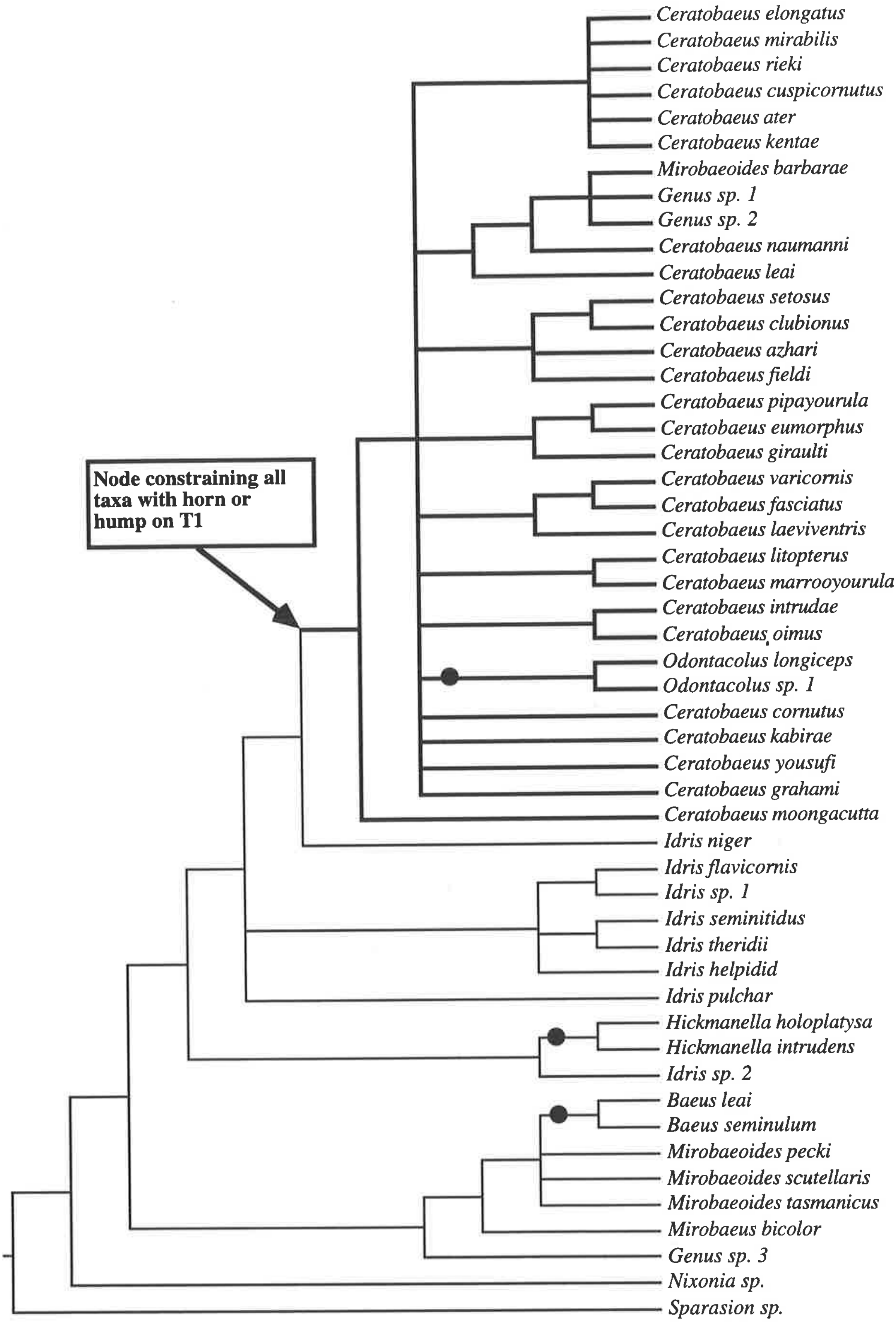


Fig. 5.6. Strict consensus of 1090 trees (length = 156) constraining all taxa with horn or hump on T1 (CI=0.269; RI=0.646; RC=0.174; f-ratio=0.697). ● shows monophyletic genera.

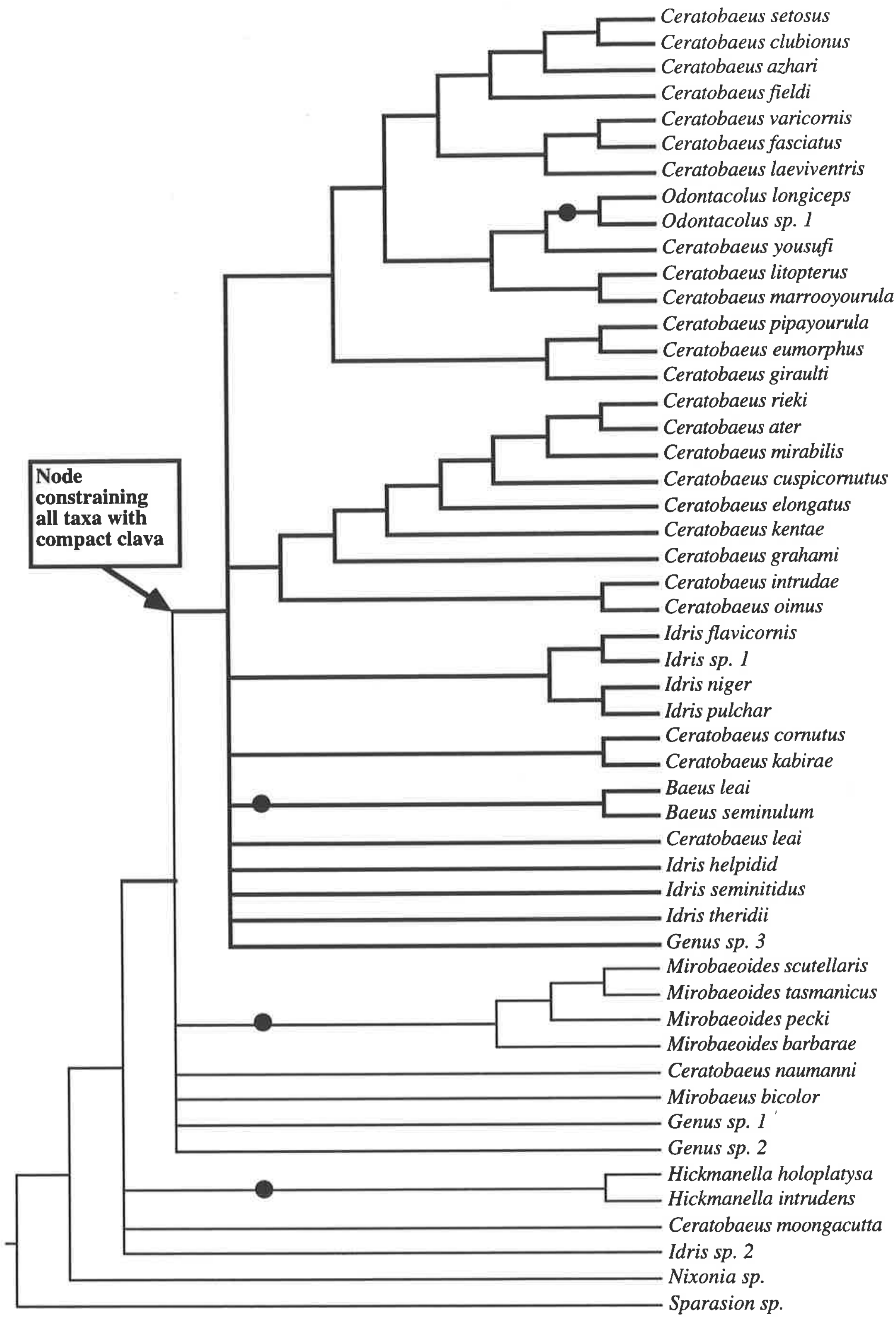


Fig. 5.7. Strict consensus of 14 trees (length = 157) constraining all taxa with compact clava (CI=0.268; RI=0.643; RC=0.172; f-ratio=0.823). ● shows monophyletic genera.

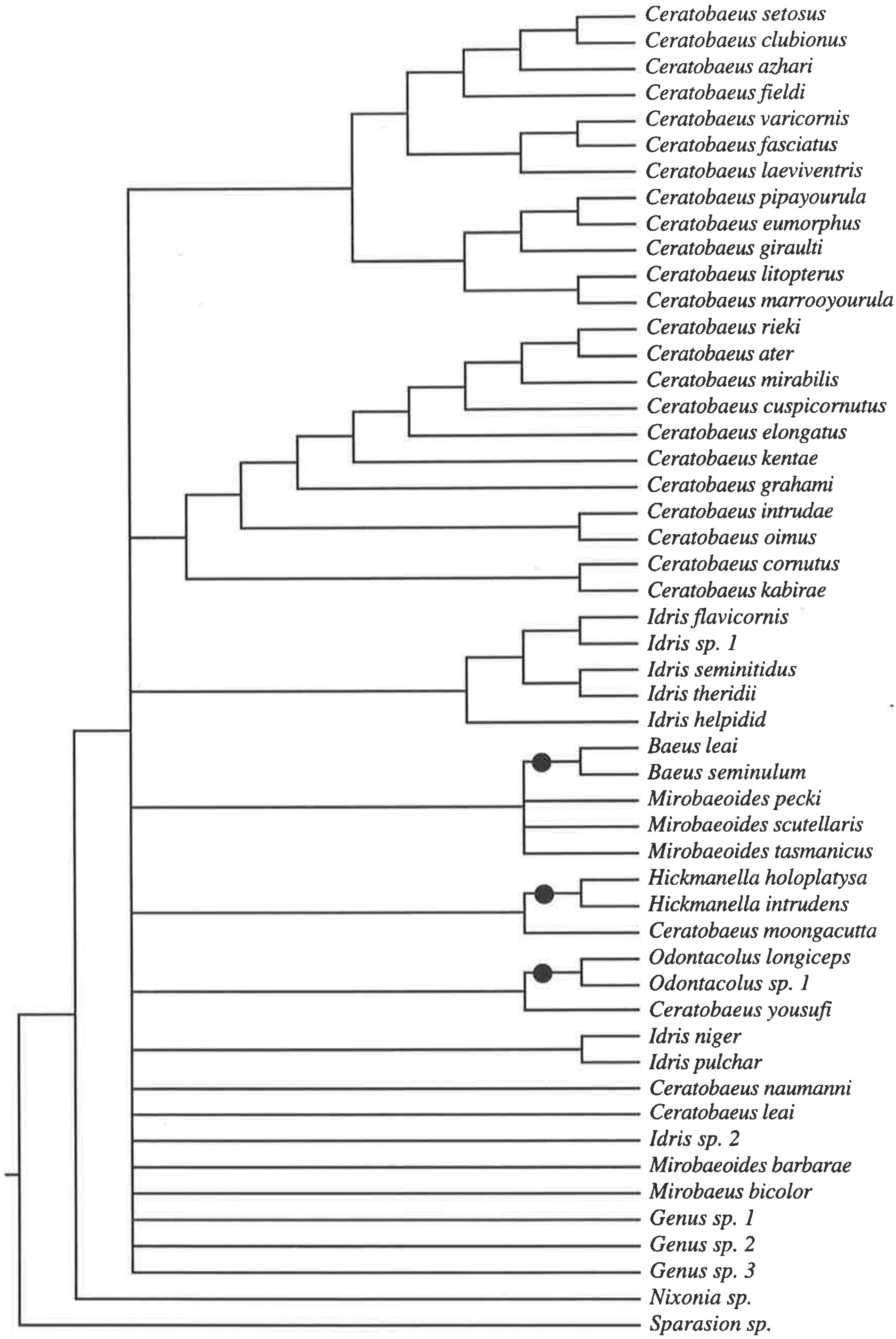


Fig. 5.8. Strict consensus of 83 trees (length = 147) excluding wing development characters (Characters 15, 16) (CI=0.272; RI=0.655; RC=0.178 and f-ratio=0.613). ● shows monophyletic genera.

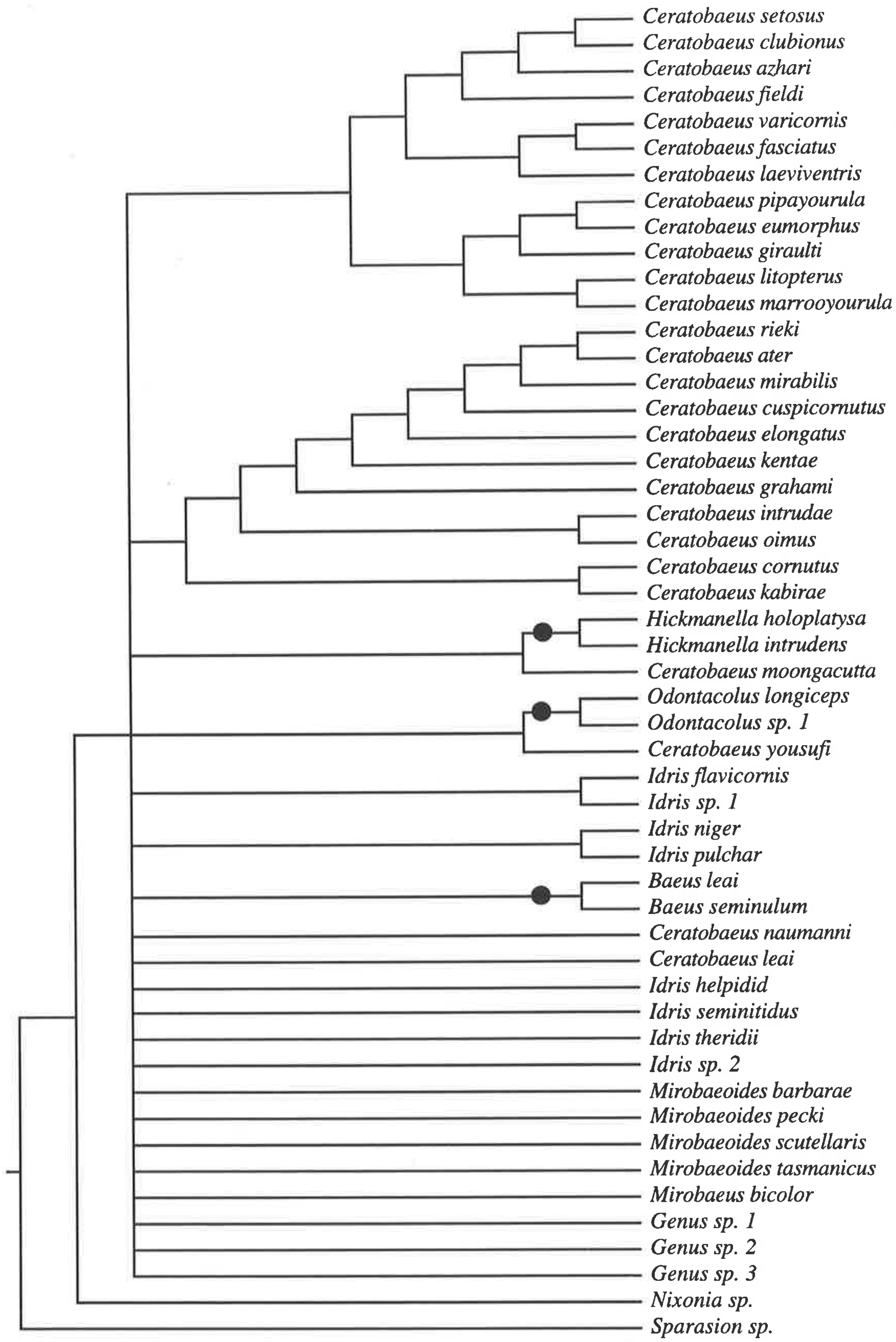


Fig. 5.9. Strict consensus of 140 trees (length = 144) excluding wing development and metasoma attachment characters (Characters 1, 15, 16) (CI=0.264; RI=0.642; RC=0.169; f-ratio=0.501). ● shows monophyletic genera.

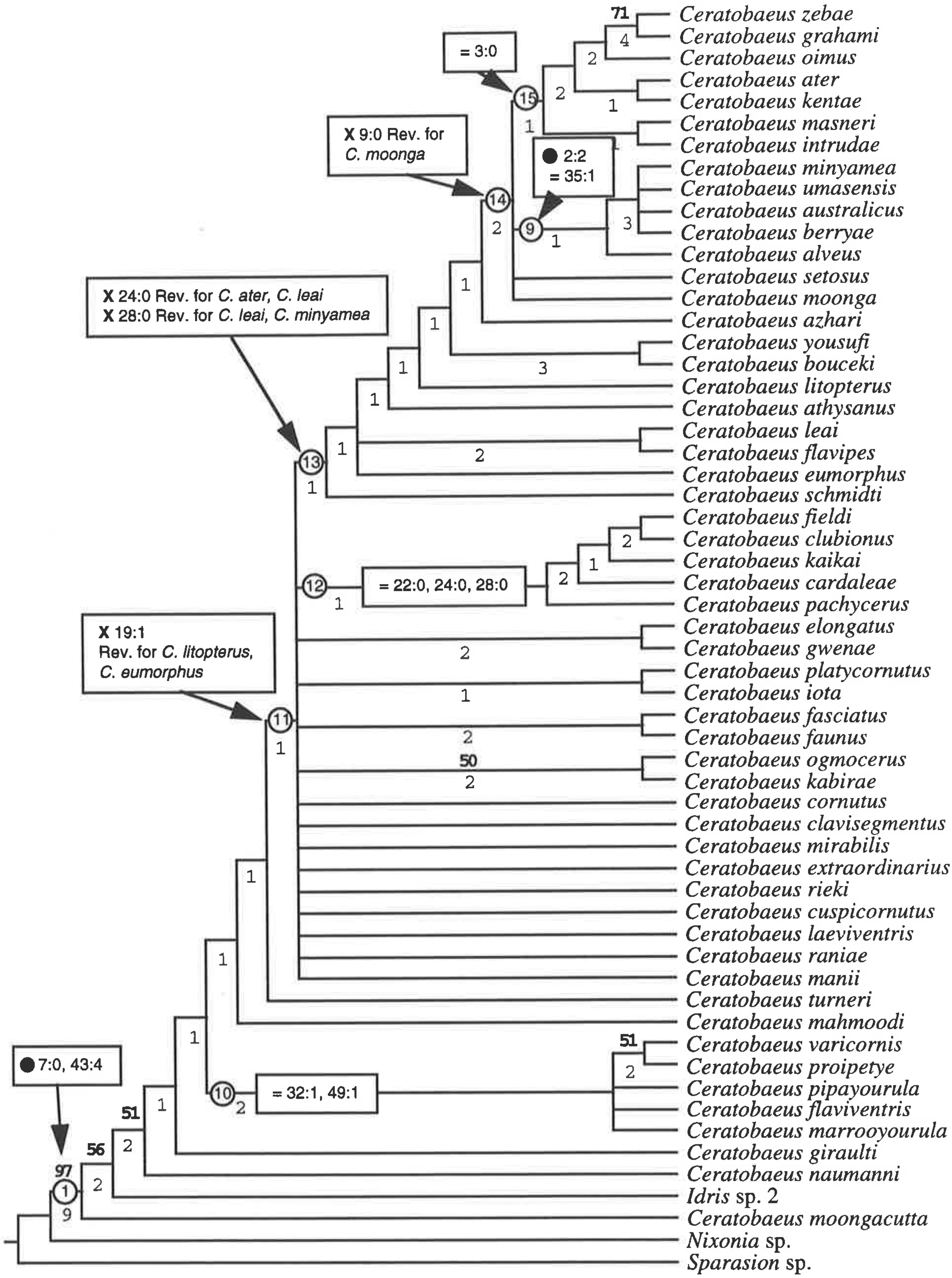


Fig. 5.10. Strict consensus of 1,188 trees of length 366 showing relationship among *Ceratobaeus* species. (CI=0.171; RI=0.509; RC=0.087; f-ratio=0.912; total support=63; total support index=0.172. Bootstrasp values are given above the line and Bremer (decay) values below. ● synapomorphy; = homoplasy; **X** reversa). Numbers in circles denoting nodes are the same as in the successively weighted tree (Fig. 5.11).

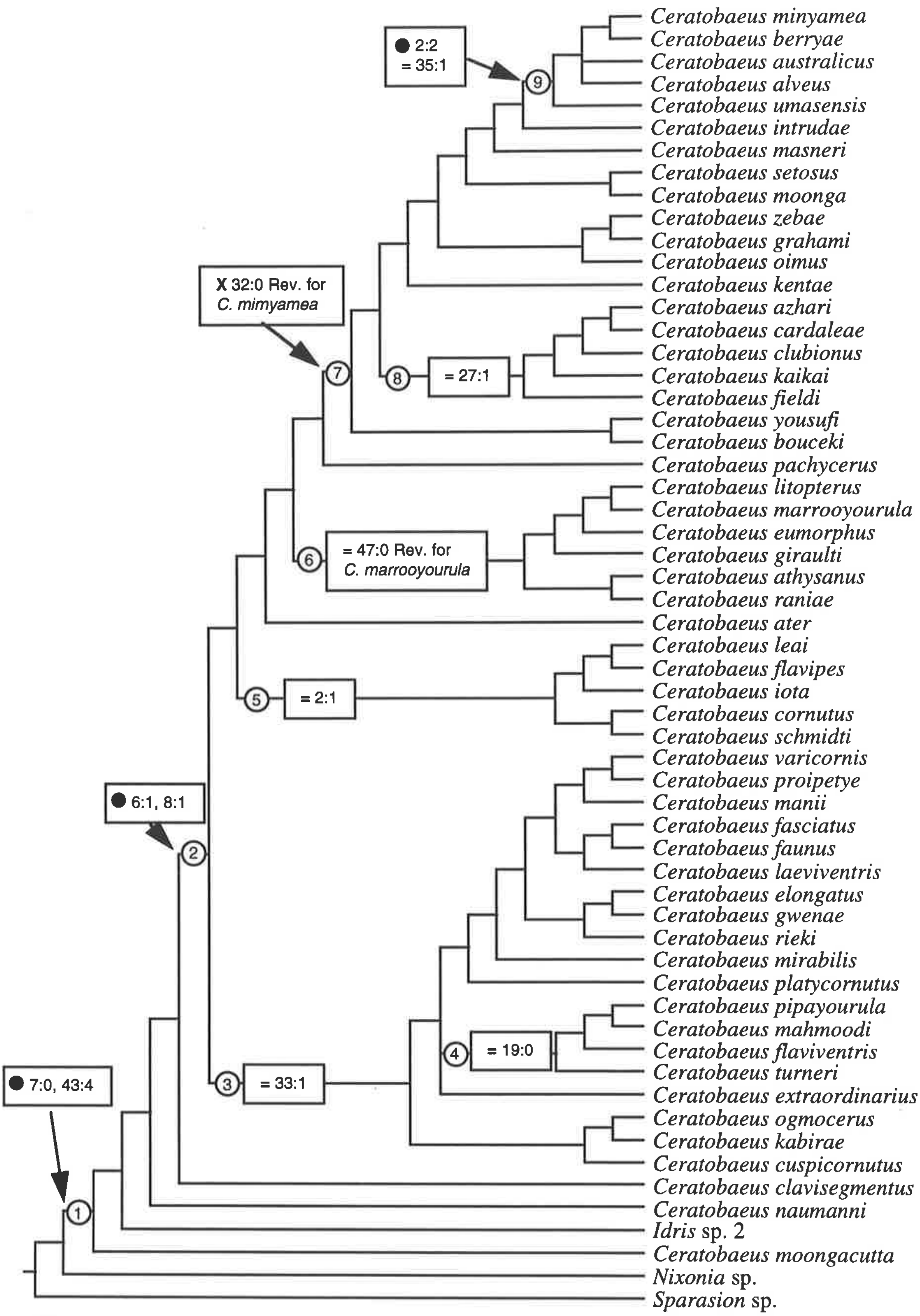


Fig. 5.11. Strict consensus of six trees of length 30079 generated by successive weighting of characters according to the maximum value of rescaled consistency index showing relationship among *Ceratobaeus* species. (CI=0.174; RI=0.498; RC=0.087 and f-ratio=0.685. ● synapomorphy; = homoplasy; **X** reversal.

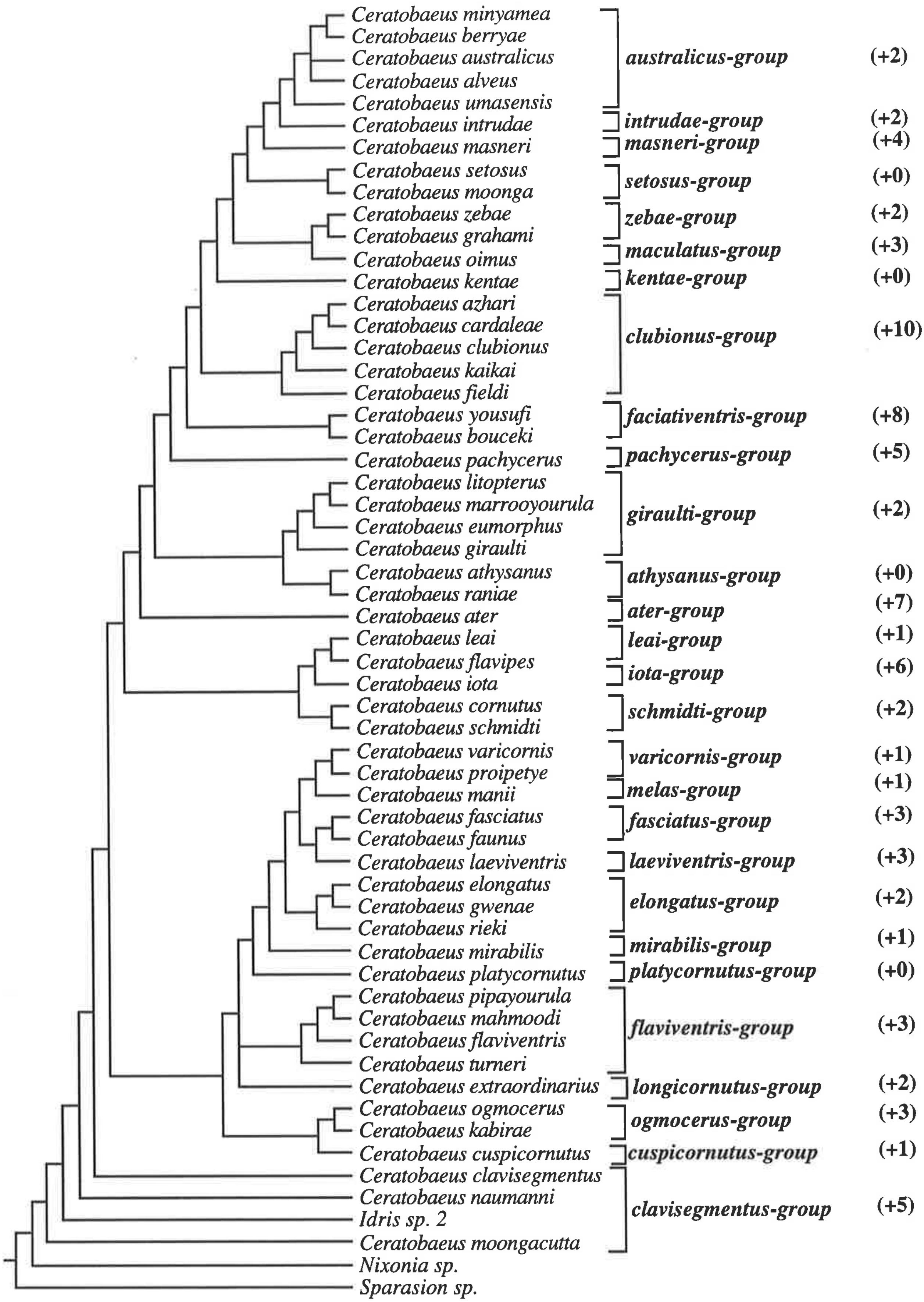


Fig. 5.12. Strict consensus of six successively weighted trees showing the 28 species-groups of *Ceratobaeus*. The numbers in brackets indicate the additional species included in each group (see text for explanation).

Chapter 6

Taxonomic Treatment of *Ceratobaeus* Ashmead

6.1. Introduction

This chapter presents a taxonomic revision of the genus *Ceratobaeus* for the Australasian region. Following the results of the phylogenetic analysis presented in Chapter 5, the genus is treated as a single taxonomic entity, even though it is clear from the analysis that it is not monophyletic. The Australasian species are divided into 28 species-groups according to their phylogenetic relationships presented in section 5.5. In this chapter, the distinguishing characters of the genus are documented and discussed, and keys to species-groups and species are included. A revision comprising descriptions of all species from the region, along with information on their distribution and general comments on their relationships and biology if known are presented. A key to the Australasian genera of the Baeini is also presented so that *Ceratobaeus* can be recognised from other genera in the tribe.

6.2. The Australasian Baeini

The Australasian baeine fauna is diverse at generic and species level (see section 2.3) possibly more so than in any other zoogeographical region. Obvious from this study is that numerous species represent intermediates between currently recognised genera. For instance new species have been recognised in collections which superficially look like *Ceratobaeus* but possess femoral spines, a character reported to be unique to *Mirobaeoides*. Other species can be nominally attributed to *Idris*, but the slightly sub-sessile metasoma and presence of wings, although they are substantially shortened, indicate that can be equally accommodated in *Mirobaeus*. The basis of this problem lies in the fact that, like *Ceratobaeus*, the genus *Idris* as presently diagnosed is polyphyletic, and various elements of this huge taxon have been split off as small recognisable genera. However, although the limits of some genera are not particularly clear, the vast majority of baeine species in Australia can be identified based on current concepts incorporated in the following key which separates *Ceratobaeus*, *Baeus*, *Mirobaeoides*, *Mirobaeus*, *Neobaeus*, *Hickmanella*, *Idris* and *Odontacolus*. The key is modified from Galloway & Austin (1984) and Austin (1988) and includes changes to the limits of several genera because of the description of new species by Austin (1984, 1985, 1995), as well as changes made to *Ceratobaeus* during this study (see section 6.3). The males of several genera are very similar and they can be difficult to identify without being associated with corresponding females at the time of collecting or rearing.

Key to the Australasian genera of Baeini

1. Antennae 7- to 11-segmented with a well-developed clava comprising four separate segments or appearing completely fused (Figs 6.17-6.19) [♀♀] 2
   Antennae 10- to 12-segmented, without clava, funicle segments of approximately equal size, without a clava (Fig. 6.20) [♂♂] 9

2. Laterotergites free and wide, not incised into a submarginal groove along sternites (Fig. 6.3) 3

Laterotergites narrow, incised into submarginal groove (Fig. 6.10) 4

3. Antennae 7-segmented with four funicle segments (Fig. 6.17) .... *Baeus* Haliday ♀
Antennae 11-segmented with five funicle segments [known only from New Zealand] (Figs 6.5, 6.18) .... *Neobaeus* Austin ♀

4. Hind femora with pair of proximal spines (Fig. 6.8); metasoma sessile; T2 usually larger than T3 (Fig. 6.7) [known only from mainland Australia and Tasmania] .... *Mirobaeoides* Dodd ♀
Hind femora without pair of proximal spines; metasoma petiolate or sub-sessile; T3 usually largest tergite, sometimes T3 and T2 subequal 5

5. T1 with dorsal hump or horn (Fig. 6.15) 6
T1 flat or virtually so, sometimes anterior margin inflected upwards (Fig. 6.12) 7

6. Head elongate in anterior aspect, long in buccal region (Fig. 6.16); propodeum with 2 broad elongate blunt teeth which extend either side of horn; T1 with horn compressed from sides (Fig 6.15) .... *Odontacolus* Kieffer ♀
Head subtriangular in anterior aspect, only very rarely elongate (Fig. 6.23); propodeum nearly always with vertical carinate lamellae either side of horn which are developed apically into short or elongate teeth (Figs 6.43, 6.161); T1 with hump or horn which is cylindrical or slightly flattened in apical part (Figs 6.27, 6.107, 6.202) .... *Ceratobaeus* Ashmead ♀

7. Head and dorsal mesosoma covered with long hairs; frontal carina strong and reaching median ocellus (Fig 6.13) .... *Hickmanella* Austin ♀
Head and dorsal mesosoma covered with small hairs; frontal carina usually weak and not reaching median ocellus 8

8. Antennae 7-segmented with four funicle segments; wings present, but may be reduced to small narrow flaps .... *Idris* Foerster ♀
Antennae 11-segmented with five funicle segments; wings completely absent (Fig. 6.9) .... *Mirobaeus* Dodd ♀

9. Laterotergites free and wide, not incised into a submarginal groove along sternites (Fig. 6.3) 10
Laterotergites narrow, incised into submarginal groove (Fig. 6.10) 11

10. Wings fully developed; fore wings narrow with parallel margins (Fig. 6.22); metasoma petiolate (Fig. 6.6) .... *Baeus* Haliday ♂

Wings reduced, micropterous; metasoma sub-sessile (Fig. 6.6) .... *Neobaeus* Austin ♂

11. Head elongate in anterior aspect, long in buccal region (Fig 6.16); antenna subclavate (Fig. 4.4) .... *Odontacolus* Kieffer ♂
Head subtriangular in anterior aspect, only very rarely elongate; antenna moniliform (Figs 6.20, 6.21) 12

12. Propodeum posteriorly either flattened, indented, or excavated to form cavity, with near vertical or diverging lamellae; T1 anterodorsally inflected (Fig. 6.14) .... *Ceratobaeus* Ashmead ♂
Propodeum posteriorly neither flattened, indented, nor excavated; T1 flat, rarely anterodorsally inflected (Fig. 6.11) 13

13. Head and dorsal mesosoma covered with long hairs; frontal carina strong and reaching median ocellus (Fig 6.13) .... *Hickmanella* Austin ♂
Head and dorsal mesosoma covered with small hairs; frontal carina usually weak and not reaching median ocellus 14

14. Antennae 11- to 12-segmented, rarely 10-segmented; F9 and F10 approximate (Fig. 6.21) .... *Idris* Foerster ♂
Antennae 12-segmented; F9 and F10 not approximate but freely articulated (Fig. 6.20) .... *Mirobaeus* Dodd ♂

6.3. Genus *Ceratobaeus* Ashmead

Ceratobaeus Ashmead, 1893: 167; Kieffer 1926: 139; Masner 1976a: 65; Huggert 1979: 7; Austin 1981a: 83; 1984: 22; Galloway & Austin: 90; Austin 1995: 257 (see Johnson 1992: 402 for complete extra-limital bibliography).

Type species
Ceratobaeus cornutus Ashmead 1893, by original designation.

Diagnosis
Head in anterior view usually subtriangular, rarely elongate and broad at buccal region; speculum sometimes present; cheek and lower frons smooth or striate; eyes usually large in size, rarely reduced; frontal carina usually present but short, rarely long and reaching to median ocellus; lateral ocelli usually continuous with margin of eyes, or distance from eyes < 1OD, rarely greater than this; ♀ antennae usually 7-segmented with 4 funicle segments and large compact clava, rarely 11-segmented with 5 funicle segments and 4-segmented clava; ♂ antennae 12-segmented; in dorsal view head usually wider than mesosoma, rarely narrower than mesosoma.

Mesosoma with notauli rarely present; posterior mesosoma in ♀ usually excavated, indented to form cavity or flattened for reception of metasomal horn; cavity or flattened area sometimes present in ♂ but reduced compared with ♀; scutum rarely with medial groove to accommodate horn; propodeum nearly always with vertical carinate lamellae either side of horn which are developed apically into short or elongate teeth; nearly always macropterous, rarely brachypterous (♀ only); submarginal, marginal and stigmal veins usually tubular, rarely spectral or blurred; postmarginal vein often present, short to long; basal vein usually absent, sometime present as pigmented lines.

Metasoma elongate in ♀, less so in ♂; T1 expanded into hump or cylindrical horn in ♀; ♂ without hump or horn, but anterior T1 inflected dorsally; T3 usually largest tergite, rarely T2 equal or longer than T3.

Comments

The diagnosis above has been revised to accommodate the many new species from the Australasian region. The following characters are additional to Masner (1976a), Austin (1984a), Galloway & Austin (1984) and Austin (1995): head rarely elongate and broad in buccal region; eyes rarely reduced; lateral ocelli rarely with distance from eyes > 1OD; head rarely narrower than mesosoma; scutum rarely with a groove to accommodate horn; submarginal, marginal and stigmal veins rarely spectral or blurred; T2 rarely equal to longer than T3.

As discussed in Chapter 5, *Ceratobaeus* is undoubtedly not a monophyletic group. However, given that it has also not been possible to break up the genus into stable monophyletic units, it seems most practical to maintain *Ceratobaeus* as a valid genus for the time being. It can then be used to accommodate existing and newly described species, without further confusing the classification of the tribe. As defined here *Ceratobaeus* can be easily recognised by females of the genus possessing the dorsal hump or horn on T1 and the excavation or flattening of the propodeum (and usually the metanotum) to accommodate the horn. The propodeum is usually bordered laterally by two vertical carinae, which represent a modification of the horizontal carinate surface on the propodeum found in most *Idris* species. In several species of *Ceratobaeus* that have a long curved horn, the scutellum is also indented. The length of the horn and metasoma are closely correlated with that of the internally retractable ovipositor. Those species with either a long horn and/or a long metasoma have a corresponding more elongate ovipositor compared with species that have a short horn and metasoma. Presumably these differences have evolved in response to varying accessibility of the host eggs (see section 2.4). In a few Australasian species, the medial cavity of the scutellum extends onto the scutum and the curved horn almost reaches the head. *Odontacolus* also has T1 developed as a horn, but in this genus it is near vertical and considerably compressed at the sides so as to be ellipsoidal in cross-section.

Males of *Ceratobaeus* and *Idris* are especially difficult to distinguish, however, *Ceratobaeus* usually has a moderate dorsal inflection of the anterior margin of T1 and the propodeum is sometimes slightly excavated or flattened and bordered by diverging carinae.

The more developed the horn and posterior mesosoma in females of *Ceratobaeus*, the more obvious are these characters expressed in males (Fig. 6.14). In both sexes of *Idris*, T1 is flat, the propodeum is never excavated, and the raised carinae curve horizontally to meet mid dorsally. However, in some *Idris* species the anterior margin of T1 can be inflected dorsally, and male *Ceratobaeus* for species which only have a hump or short horn on T1 can have the lateral carinae curving into a more horizontal position. In these cases, males are very difficult to identify (Austin 1981a).

Huggert (1979) placed *Ceratobaeus* as a subgenus of *Idris* and this change was maintained by Johnson (1992) in his world catalogue of scelionid species. However, Austin (1984b, 1995) and Galloway & Austin (1984) have argued against this change. Masner & Denis (1996) proposed *Ceratobaeus* as a junior synonym of *Idris*, while Austin & Field (1997) recorded two ovipositor characters which differ in these two genera, namely the length of ovipositor and length of metasoma However, no authors previous to this study have undertaken a phylogenetic analysis to test the relationships between these genera. As shown in Chapter 5, both genera are polyphyletic and so there is as much justification for recognising both genera for the purposes of providing a working classification, until the relationships among the baeine on a world-wide basis can be properly resolved.

Distribution

Ceratobaeus has an almost world-wide distribution, but in other regions, such as the Nearctic and Palearctic, the genus is often not commonly encountered compared with *Idris*. By comparison, the Australasian fauna is rich in *Ceratobaeus* species which are known from virtually all mainland habitats. Most species have restricted distributions and are associated with particular climatic zones. An earlier preliminary study (Iqbal & Austin 1997) has shown that there is virtually no overlap in baeine species composition among four distant (well-collected) sites in Australia, and that these sites harbour at least 20-30 species, many of which belong to *Ceratobaeus*. Endemism examined at a more local level (sites of remnant vegetation within 20km of each other around Perth), showed that approximately 30% of baeine species are unique to a given site (Iqbal & Austin 1997).

Comprehensive distributional data for a much greater number of *Ceratobaeus* species were compiled during the later part of this study and they show a similar pattern of high endemism at the regional level compared with Iqbal & Austin (1997). Of the 133 Australasian species, 1~~8~~18 are recorded from Australia; of these 118, 66% are endemic to a single region, with the largest number associated with the tropical forests of north Queensland (38) and the south-east margin of the continent (21) (Fig. 6.1). The lowest number of species occurs in the north-west (3), central (3), south-west (7) and Tasmania (4), but these are also the poorest collected. Although the north-west has only three endemic species, a further eight are shared exclusively with north Queensland, while the latter area has a further 10 species in common only with the south-east. The small number of species shared with the central arid areas are those which are widely distributed across the continent. In addition, the tropical north shares two species in common with New Guinea and one species with New Zealand.

Table 6.2. Classification of Australasian *Ceratobaeus* by species-group.

The *ater*-group
C. ashmeadi sp. nov.
C. ater (Hickman)
C. flavicorpus Dodd
C. greensladeae sp. nov.
C. harveyi sp. nov.
C. huggerti sp. nov.
C. lamponae (Hickman)
C. saeedi sp. nov.

The *athysanus*-group
C. athysanus sp. nov.
C. raniae sp. nov.

The *australicus*-group
C. ajmali sp. nov.
C. alveus sp. nov.
C. australicus (Dodd)
C. berryae sp. nov.
C. minyamea sp. nov.
C. normani sp. nov.
C. umasensis sp. nov.

The *clavisegmentus*-group
C. boolool sp. nov.
C. clavisegmentus Austin
C. mainae Austin
C. moongacutta sp. nov.
C. narteol sp. nov.
C. naumanni sp. nov.
C. noyesi sp. nov.
C. pita sp. nov.

The *clubionus*-group
C. aureus Dodd
C. azhari sp. nov.
C. cardaleae sp. nov.
C. clubionus Austin
C. fieldi sp. nov.
C. fionae sp. nov.
C. flavios Dodd
C. gallowayi sp. nov.
C. goobita sp. nov.
C. gorayaran sp. nov.
C. kaikai sp. nov.
C. mansoori sp. nov.
C. marroocutta sp. nov.
C. parvicornutus Dodd
C. weemayourula sp. nov.

The *cuspicornutus*-group
C. ayeshae sp. nov.
C. cuspicornutus Austin

The *elongatus*-group
C. elongatus Dodd
C. gwenae sp. nov.
C. phallocerus sp. nov.
C. rieki Austin sp. nov.
C. wattora sp. nov.

The *fasciativentris*-group
C. balli sp. nov.
C. bouceki sp. nov.
C. fasciativentris Dodd
C. gullanae sp. nov.
C. hardyi sp. nov.
C. jenningsi sp. nov.
C. moonae sp. nov.
C. rabiae sp. nov.
C. undeneya sp. nov.
C. yousufi sp. nov.

The *fasciatus*-group
C. doddi sp. nov.
C. fasciatus Dodd
C. faunus (Girault)
C. moki sp. nov.
C. zafari sp. nov.

The *flaviventris*-group
C. cabon sp. nov.
C. evelineae sp. nov.
C. flaviventris Dodd
C. mahmoodi sp. nov.
C. nephocerus sp. nov.
C. pipayourula sp. nov.
C. turneri (Dodd)

The *giraulti*-group
C. buntor sp. nov.
C. eumorphus sp. nov.
C. giraulti Dodd
C. johnsenae sp. nov.
C. litopterus sp. nov.
C. marrooyourula sp. nov.

The *intrudae*-group
C. intrudae Austin
C. nasiri sp. nov.
C. saliki sp. nov.

The *iota*-group
C. iota sp. nov.
C. markusi sp. nov.
C. matong sp. nov.
C. michaeli sp. nov.
C. mussiae sp. nov.
C. ramishi sp. nov.
C. umari sp. nov.

The *kentae-group*
C. kentae sp. nov.

The *laeviventris*-group
C. laeviventris (Dodd)
C. nailae sp. nov.
C. sabrii sp. nov.
C. taylori sp. nov.

The *leai*-group
C. flavipes (Hickman)
C. leai Dodd
C. minyayunde sp. nov.

The *longicornutus*-group
C. extraordinarius sp. nov.
C. longicornutus Dodd
C. megacerus sp. nov.

The *maculatus*-group
C. acrotonus sp. nov.
C. maculatus Dodd
C. oimus sp. nov.
C. ziai sp. nov.

The *masneri*-group
C. amiti sp. nov.
C. anjumi sp. nov.
C. haqi sp. nov.
C. masneri Austin
C. stegastocerus sp. nov.

The *melas*-group
C. manii sp. nov.
C. melas sp. nov.

The *mirabilis*-group
C. mirabilis Dodd
C. toheedi sp. nov.

The *ogmocerus*-group
C. kabirae sp. nov.
C. luboi sp. nov.
C. moola sp. nov.
C. ogmocerus sp. nov.
C. yasini sp. nov.

The *pachycerus*-group
C. bethae sp. nov.
C. dillonae sp. nov.
C. feckneri sp. nov.
C. leysonae sp. nov.
C. muniri sp. nov.
C. pachycerus sp. nov.

The *platycornutus*-group
C. platycornutus Austin

The *schmidti*-group
C. schmidti sp. nov.
C. systenus sp. nov.
C. usmani sp. nov.

The *setosus*-group
C. moonga sp. nov.
C. setosus Dodd

The *varicornis*-group
C. grandis Dodd
C. proipetye sp. nov.
C. varicornis Dodd

The *zebae*-group
C. anmarae sp. nov.
C. grahami sp. nov.
C. kiefferi sp. nov.
C. zebae sp. nov.

This concentration of baeine diversity in the east and north-east at least partly corresponds to regional patterns of spider diversity (Raven 1988). However, one would predict a much great level of species richness and endemism in baeines for the south-west part of the continent and Tasmania, based on the data for spiders. More concentrated collecting in these areas may yet reveal this to be the case.

Of the larger species groups, one appears to be restricted to a particular climatic zone. The *zebae*-group is only recorded from the tropical rainforests of north Queensland. All other species groups are more widely distributed than this.

6.4. Key to females of the Australasian species-groups of *Ceratobaeus*

1. Antennal clava clearly segmented, with 5 funicle segments (Fig. 6.72) .... *clavisegmentus*-group
   Antennal clava compact, segments appearing fused, with 4 funicle segments (Fig. 6.102) 2

2. Frontal carina complete, reaching to median ocellus (Fig. 6.57) .... *australicus*-group
   Frontal carina absent or incomplete, not reaching to median ocellus 3

3. Brachypterous (Fig. 6.195) .... *leai*-group
   Wings fully-developed (Fig. 6.279) 4

4. Metasomal horn not curved forwards (Fig. 6.28) 5
   Metasomal horn curved forwards (Fig. 6.202) 16

5. Posterior margin of scutellum usually rounded, sometimes almost straight 6
   Posterior margin of scutellum indented medially 13

6. Posterior margin of scutellum smooth (Fig. 6.273) .... *zebae*-group
   Posterior margin of scutellum with single row of foveae (Fig. 6.39) 7

7. Metasomal horn not reaching posterior margin of scutellum (Fig. 6.83) .... *clubionus*-group
   Metasomal horn reaching posterior margin of scutellum 8

8. Colour of metasomal horn darker than rest of metasoma (Fig. 6.304) .... *maculatus*-group
   Colour of metasomal horn same as rest of metasoma 9

9. Colour of metasoma lighter than head and mesosoma .... *kentae*-group
Colour of metasoma same as head and mesosoma 10

10. Propodeal lamellae sharply pointed dorsally (Fig. 6.120) 11
Propodeal lamellae blunt (Fig. 6.262) 12

11. Eyes appearing hairless (minute hairs present and visible only under SEM) (Fig. 6.128) .... *fasciativentris*-group
Eyes with long hairs (Fig. 6.25) .... *intrudae*-group

12. Cheek and lower frons striate (Fig. 6.263) .... *setosus*-group
Cheek and lower frons smooth (Fig. 6.220) .... *masneri*-group

13. Bristles on fore wing submarginal vein absent or rudimentary, not reaching beyond anterior margin (Fig. 6.290) .... *giraulti*-group
Bristles on fore wing submarginal vein long, reaching beyond anterior margin (Fig. 6.288) 14

14. Eyes with long hairs .... *ater*-group
Eyes appearing hairless (minute hairs present and visible only under SEM) 15

15. Colour of metasomal horn darker than rest of metasoma .... *athysanus*-group
Colour of metasomal horn same as rest of metasoma .... *pachycerus*-group

16. Bristles on fore wing submarginal vein absent or rudimentary, not reaching beyond anterior margin (Fig. 6.290) .... *flaviventris*-group
Bristles on fore wing submarginal vein long, reaching beyond anterior margin (Fig. 6.288) 17

17. Wings with transverse dark bands (Fig. 6.287) 18
Wings uniform in colour 19

18. Frontal carina present, reaching at least 0.3 distance to median ocellus (Fig. 6.34) .... *fasciatus*-group
Frontal carina rudimentary or absent (Fig. 6.240) .... *ogmocerus*-group

19. Metasoma 3.4 x as long as wide (Fig. 6.299) .... *elongatus*-group
Metasoma < 3.0 x as long as wide 20

20. Scutum indented with longitudinal groove or pushed forward to accommodate greatly elongated metasomal horn (Fig. 6.227) 21

Scutum not indented, metasomal horn not reaching level of scutum 22

21. Basal vein pigmented (as for Fig. 6.280) .... *mirabilis*-group
Basal vein faint and spectral or absent .... *longicornutus*-group

22. Apex of metasomal horn flattened (as for Fig. 6.107) .... *platycornutus*-group
Apex of metasomal horn narrowly rounded 23

23. Speculum present (Fig. 6.264) 24
Speculum absent (Fig. 6.172) 26

24. First funicle segment > 2.4 x as long as wide (Fig. 6.298) .... *varicornis*-group
First funicle segment < 2.0 x as long as wide 25

25. Basal vein faint and spectral or absent .... *laeviventris*-group
Basal vein pigmented (as for Fig. 6.280) .... *melas*-group

26. Basal vein pigmented (Fig. 6.285) .... *cuspicornutus*-group
Basal vein faint and spectral or absent 27

27. Colour of metasomal horn darker than rest of metasoma .... *schmidti*-group
Colour of metasomal horn same as rest of metasoma .... *iota*-group

6.5. Species-groups of *Ceratobaeus*

6.5.1. The *ater*-group

Diagnosis

Head in anterior view subtriangular in shape; speculum sometimes present; cheek and lower frons smooth or striate; eyes normal in size and with long hairs; frontal carina short to moderately long but never reaching more than 0.6 distance to median ocellus; lateral ocelli continuous with margin of eyes or distance from eyes < 1OD; antennal clava compact, segments appearing fused, with 4 funicle segments; first funicle segment < 2.0 x as long as wide; in dorsal view head moderately broad, slightly wider than mesosoma; notauli present or absent; axillar crenulae present; humeral sulcus smooth or crenulate; scutum not indented; posterior margin of scutellum indented medially, smooth or with single row of foveae; propodeal lamellae blunt to sharply pointed dorsally; wings fully developed; submarginal, marginal and stigmal veins tubular; basal vein faint and spectral or pigmented; fore wings with or without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; metasomal horn slender, reaching posterior margin of scutellum, not curved forward, apex narrowly rounded, same colour as or darker than rest of metasoma; metasoma < 3.0 x as long as wide, same colour as or lighter than head and mesosoma.

Comments

The major distinguishing characters of this species-group are the eyes with long hairs, the posterior margin of the scutellum indented medially, the bristles on the submarginal vein of fore wing long, reaching beyond anterior margin, and the metasomal horn not curved forward. This group contains eight species, *C. ashmeadi* sp. nov., *C. ater* (Hickman), *C. flavicorpus* Dodd, *C. greensladeae* sp. nov., *C. harveyi* sp. nov., *C. huggerti* sp. nov., *C. lamponae* (Hickman) and *C. saeedi* sp. nov.

6.5.1.1. *Key to females of the* **ater**-*group*

1. Basal vein pigmented (Fig. 6.280) 2
   Basal vein faint and spectral (Fig. 6.279) 5

2. Head, mesosoma and metasomal horn black, antennae and metasoma yellow 3
   Body more uniform in colour, without strongly contrasting colour pattern 4

3. Notauli present; posterior margin of scutellum smooth (Fig. 6.33) .... *C. harveyi* sp. nov.
   Notauli absent; posterior margin of scutellum with single row of foveae (Fig. 6.30) .... *C. greensladeae* sp. nov.

4. Speculum present (Fig. 6.25) .... *C. ater* (Hickman)
   Speculum absent .... *C. huggerti* sp. nov.

5. Body yellow; postmarginal vein short, never reaching > 0.3 length of stigmal vein (Fig. 6.281) 6
   Body black; postmarginal vein as long as stigmal vein (Fig. 6.279) 7

6. Propodeal lamellae sharply pointed dorsally (Fig. 6.37) .... *C. saeedi* sp. nov.
   Propodeal lamellae blunt (Fig. 6.28) .... *C. flavicorpus* Dodd

7. Propodeal lamellae blunt (Fig. 6.36) .... *C. lamponae* (Hickman)
   Propodeal lamellae sharply pointed dorsally (Fig. 6.24) .... *C. ashmeadi* sp. nov.

6.5.1.2. ***Ceratobaeus ashmeadi*** sp. nov. (Figs 6.23, 6.24, 6.279, 6.305)

Type material:

Holotype: ♀, **Australia, New South Wales:** "Australia: NSW, Styx River St. For., Falls Rd., 22km SE Wollomombi, 99m, 15.xii.1994, K. MacGregor, FIT" (CNCI).

Female

Length: 1.8 mm; body black.

Head: Upper frons, vertex and occiput finely granulate, with scattered punctures and associated long hairs; speculum present, with irregular margins; cheeks and lower frons striate; frontal carina reaching about 0.6 distance to median ocellus.

Mesosoma: Scutum L:W = 2.9:4.5, surface finely granulate, with scattered small punctures and associated hairs; notauli absent; humeral sulcus crenulate; surface of scutellum finely granulate, posterior margin smooth; propodeal lamellae sharply pointed dorsally; fore wings L:W = 10.2:3.6, with one transverse dark band; stigmal vein long, postmarginal vein as long as stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 8.5:5.0; surface of metasomal horn granulate-coriaceous except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn), T2 and T3 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.7:3.1; T4-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *ater*-group by the colour of the body, presence of the speculum, shape of the propodeal lamellae, length of the postmarginal vein, and the spectral basal vein. I have much pleasure in naming it after Dr. William Ashmead. *C. ashmeadi* is known only from Styx River State Forest in New South Wales (Fig. 6.305).

6.5.1.3. ***Ceratobaeus ater*** (Hickman) (Figs 6.25 - 6.27, 6.280, 6.306)

Odontacolus ater Hickman, 1967: 20.
Ceratobaeus ater; Austin 1981a: 83.
Idris (Ceratobaeus) aterrminus Huggert, 1981: 241.
Idris aterrminus; Johnson 1992: 404.

Type material:

Holotype: ♀, **Australia, Tasmania:** "Bred from eggs of spider *Trite albopilosa* (Keys.), East Risdon, Tasmania, 20/12/1967, V.V. Hickman" (ANIC).

Other specimens examined:

Tasmania: 6♀, same data as holotype (WARI); 3♀, 41.59S 148.07E, 5km ENE Cranbrook, 28.i.1983, IDN & JCC (ANIC); 1♀, 40.58S 148.01E, 1km SSE Gladstone, 29.i.1983, IDN & JCC (ANIC); 1♀, 41.15S 146.36E, 5km EbyS Harford, 19.i.1983, IDN & JCC (ANIC); 1♀, 41.06S 147.53E, 1km EbyN Herrick, 29-30.i.1983, IDN & JCC (ANIC); 2♀, 42.56S 147.19E, The Lea, 5.ii.1983, IDN & JCC (ANIC); **New South Wales:** 1♀, Pilliga scrub, via Coonabarabran, 15.xii.1976, IDN (ANIC); **Australian Capital Territory:**

1♀, 35.35S 149.00E, Honeysuckle Ck., 1-10.iv.1985, IDN & JCC (ANIC); **South Australia:** 3♀, 35.21S 139.29E, Brookfield C. P., 24-26.xi.1992, IDN & JCC (ANIC); 1♀, 33.22S 137.03E, nr. Pine Hill, 28.xi.1992, IDN & JCC (ANIC); 1♀, Wilpena Pound Gap, 5-6.xi.1987, IDN & JCC (ANIC); **Western Australia:** 1♀, 33.23S 121.40E, 19km SSW Grass Patch, 19-20.ix.1981, IDN & JCC (ANIC); 5♀, Kalbarri N. P., 12-18.xii.1986, J.S. Noyes (WARI); 1♀, 32.40S 118.11E, 3km ENE Kulin, 8.x.1981, IDN & JCC (ANIC); 1♀, Walpole Nornalup N. P., 17-21.i.1987, J.S. Noyes (WARI); 1♀, 13km S Norseman, 29.xii.1986, J.S. Noyes (WARI); 1♀, Perth, Wembely, 19.xi.1982, Boucek (BMNH); 1♀, Melaleuca Park, 30km N Perth, 18.xi.1982, Boucek (WARI); 1♀, 30.24S 116.40E, 2km SSW Pithara, 26.ix.1981, IDN & JCC (ANIC); 2♀, 33.36S 119.55E, 10km WbyS Ravensthorpe, 21.ix.1981, IDN & JCC (ANIC); 1♀, Stirling Range N. P., 11-15.i.1987, J.S. Noyes (WARI); 1♀, 31.17S 119.30E, 15km NW Yelowdine, 10.x.1981, IDN & JCC (ANIC).

Female

Length: 1.2-1.6 mm; body black, except antennae and legs including coxae which are brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum present, with irregular margins; cheeks and lower frons smooth; frontal carina rudimentary.

Mesosoma: Scutum L:W = 2.4:2.9, surface finely granulate, with scattered small punctures and associated hairs; notauli absent; humeral sulcus smooth; surface of scutellum finely granulate, posterior margin with single row of foveae; propodeal lamellae blunt; fore wings L:W = 8.3:2.9, without transverse dark bands; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein pigmented.

Metasoma: L:W = 6.8:2.9; surface of metasomal horn smooth except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.2:2.3; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *ater*-group by the colour of the body, presence of the speculum, and pigmentation of the basal vein. *C. ater* is known from New South Wales, Australian Capital Territory, Tasmania, South Australia and south-western Western Australia (Fig. 6.306).

6.5.1.4. ***Ceratobaeus flavicorpus*** Dodd (Figs 6.28, 6.29, 6.81, 6.307)

Ceratobaeus flavicorpus Dodd, 1914b: 61, 66; Kieffer 1926: 140, 144; Austin 1981a: 84.
Idris flavicorpus; Johnson 1992: 408.

Type material:

Holotype: ♀, **Australia, Queensland:** "Sweeping grass on edge of jungle, Nelson, N. Q., 31.xii.12, A.P. Dodd" (SAMA).

Other specimens examined:

Queensland: 1♀, Acacia Ridge, Brisbane, 12.xii.1976, no collector (QDPC); 1♀, Tingalpa, Brisbane, 1-2.ii.1974, P.B. Edwards (QDPC); 2♀, Upper Clayton Gully, 400-600m, nr. Cunningham's Gap, 25.iv.1974, IDN (QDPC).

Female

Length: 1.3 mm; body yellow.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated hairs; speculum present, with irregular margins; cheeks and lower frons finely striate; frontal carina reaching about 0.3 distance to median ocellus.

Mesosoma: Scutum L:W = 1.9:3.0, surface finely granulate, with scattered small punctures and associated hairs; notauli absent; humeral sulcus crenulate; surface of scutellum finely granulate, posterior margin smooth; propodeal lamellae blunt; fore wings L:W = 7.3:2.4, without transverse dark bands; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 5.3:3.0; surface of metasomal horn rugulose except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.1:2.0; T3-T5 finely granulate-coriaceous with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *ater*-group by the colour of the body, shape of the propodeal lamellae, length of the postmarginal vein, and the spectral basal vein. *C. flavicorpus* is known only from eastern Queensland (Fig. 6.307).

6.5.1.5. ***Ceratobaeus greensladeae*** sp. nov. (Figs 6.30, 6.31, 6.308)

Type material:

Holotype: ♀, **Australia, Western Australia:** "Yarragil 4PL via Dwellingup, W.A., 16-23.xi.1981, A. Pastle, Malaise trap" (QDPC).

Female

Length: 1.1 mm; body black, except for antennae, legs including coxae and metasoma (excluding metasomal horn) which are yellow.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated hairs; speculum absent; cheeks and lower frons smooth; frontal carina rudimentary.

Mesosoma: Scutum L:W = 1.7:2.5, surface finely granulate, with scattered small punctures and associated hairs; notauli absent; humeral sulcus crenulate; surface of scutellum finely granulate, posterior margin with single row of foveae; propodeal lamellae blunt; fore wings L:W = 7.0:2.3, without transverse dark bands; stigmal vein long, postmarginal vein short, about 0.3 length of stigmal vein, basal vein pigmented.

Metasoma: L:W = 4.7:2.4; surface of metasomal horn smooth except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn), T2 and T3 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.9:1.9; T4-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *ater*-group by the colour of the body, absence of the notauli, and pigmentation of the basal vein. I have much pleasure in naming it after Dr. Penelope Greenslade, Division of Entomology, CSIRO, Canberra. *C. greensladeae* is known only from south-western Western Australia (Fig. 6.308).

6.5.1.6. ***Ceratobaeus harveyi*** sp. nov. (Figs 6.32, 6.33, 6.309)

Type material:

Holotype: ♀, **Australia, Western Australia:** "W. AUST: Stirling Range N.P., 11-15.i.1987, J.S. Noyes, M.T./ P.T." (ANIC).

Paratype: **Western Australia:** 1♀, same data as holotype (ANIC).

Female

Length: 1.7-1.8 mm; body black, except for antennae, legs including coxae and metasoma (excluding metasomal horn) which are yellow.

Head: Upper frons, vertex and occiput finely granulate, with scattered punctures and associated long hairs; speculum absent; cheeks and lower frons smooth; frontal carina reaching about 0.3 distance to median ocellus.

Mesosoma: Scutum L:W = 2.4:3.5, surface finely granulate, with scattered small punctures and associated hairs; notauli present, reaching 0.2 the distance to anterior margin of scutum; humeral sulcus smooth; surface of scutellum finely granulate, posterior margin smooth; propodeal lamellae blunt; fore wings L:W = 10.1:3.5, without transverse dark bands; stigmal vein long, postmarginal vein short, about 0.3 length of stigmal vein, basal vein pigmented.

Metasoma: L:W = 9.0:3.9; metasomal horn with longitudinal striations except smooth apex; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.9:2.5; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *ater*-group by the colour of the body, presence of short notauli, and pigmentation of the basal vein. I have much pleasure in naming it after Dr. Mark Harvey, Western Australian Museum, Perth. *C. harveyi* is known only from Stirling Range in south-western Western Australia (Fig. 6.309).

6.5.1.7. ***Ceratobaeus huggerti*** sp. nov. (Figs 6.34, 6.35, 6.310)

Type material:

Holotype: ♀, **New Caledonia:** "NEW CALEDONIA: Mt Koghis Aublerge, 500m, 26.vii-13.viii.1978, S. & J. Peck, MT, rainf." (CNCI).

Paratype: **New Caledonia:** 1♀, Noumea, Mt. Koghis, 27.iii-4.iv.1985, A.D. Austin (WARI).

Female

Length: 1.0-1.1 mm; body dark brown to black, except for antennae and legs which are yellow.

Head: Upper frons, vertex and occiput finely granulate, with scattered punctures and associated long hairs; speculum absent; cheeks and lower frons smooth; frontal carina rudimentary.

Mesosoma: Scutum L:W = 1.9:2.7, surface finely granulate, with scattered small punctures and associated hairs; notauli absent; humeral sulcus smooth; surface of scutellum finely granulate, posterior margin with single row of foveae; propodeal lamellae blunt; fore wings L:W = 7.5:2.3, without transverse dark bands; stigmal vein long, postmarginal vein short, about 0.3 length of stigmal vein, basal vein pigmented.

Metasoma: L:W = 5.0:2.8; T1 (including metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.1:2.1; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *ater*-group by the colour of the body, absence of the speculum, and pigmentation of the basal vein. I have much pleasure in naming it after Dr. Lars Huggert, Department of Systematics, Zoological Institute, Lund, Sweden. *C. huggerti* is known only from New Caledonia (Fig. 6.310).

6.5.1.8. ***Ceratobaeus lamponae*** (Hickman) (Figs 6.36, 6.311)

Odontacolus lamponae Hickman, 1967: 18.
Ceratobaeus lamponae; Masner 1976a: 66; Austin 1981a: 84; Austin 1984a: 27.
Idris lamponae; Johnson 1992: 410.

Type material:

Holotype: ♀, **Australia, Tasmania:** "Bred from eggs of spider *Lampona cylindrata* (L. Koch), Domain, Hobart, Tasmania, 9/3/1967, V.V. Hickman" (ANIC).

Other specimens examined:

South Australia: 11♀, 1♂, 5km S Mylor, 29.iii.1979, A.D. Austin (QDPC).

Female

Length: 1.6-1.8 mm; body black, except for antennae, legs including coxae and metasoma which are dark brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; cheeks and lower frons smooth; frontal carina rudimentary.

Mesosoma: Scutum L:W = 2.3:3.1, surface finely granulate, with scattered small punctures and associated hairs; notauli absent; humeral sulcus crenulate; surface of scutellum finely granulate, posterior margin with single row of foveae; propodeal lamellae blunt; fore wings L:W = 9.2:3.1, without transverse dark bands; stigmal vein long, postmarginal vein as long as stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 6.7:3.3; surface of metasomal horn coriaceous except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.4:2.3; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Differing from female in the following: scutellum more rounded; wings reaching well pass posterior metasoma; anterior T1 inflected dorsally.

Comments

This species can be separated from other species in the *ater*-group by the colour of the body, absence of the speculum, shape of the propodeal lamellae, length of the postmarginal vein, and the spectral basal vein. *C. lamponae* is known from Tasmania and South Australia (Fig. 6.311).

6.5.1.9. ***Ceratobaeus saeedi*** sp. nov. (Figs 6.37, 6.312)

Type material:

Holotype: ♀, **Australia, Western Australia:** "14.52S 125.50E, W. A., "The Crusher" CALM Site 9/1, 4km SbyW Mining Camp Mitchell Plateau, 2-6 June 1988, I.D. Naumann" (ANIC).

Paratypes: **Western Australia:** 2♀, same data as holotype (ANIC, WARI); **South Australia:** 1♀, 31.20S 138.37E, Trezona Camp, Brachina Ck., 4-10.xi.1987, IDN & JCC (ANIC).

Female

Length: 1.2-1.3 mm; body yellow.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; cheeks and lower frons smooth; frontal carina reaching about 0.6 distance to median ocellus.

Mesosoma: Scutum L:W = 1.9:2.8, surface granulate, with scattered small punctures and associated hairs; notauli absent; humeral sulcus crenulate; surface of scutellum granulate, posterior margin with single row of foveae; propodeal lamellae sharply pointed dorsally; fore wings L:W = 7.2:2.4, without transverse dark bands; stigmal vein long, postmarginal vein short, about 0.3 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 5.5:2.9; surface of metasomal horn coriaceous except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.8:2.5; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *ater*-group by the colour of the body, shape of the propodeal lamellae, length of the postmarginal vein, and the spectral basal vein. I have much pleasure in naming it after Dr. Muhammad Saeed. *C. saeedi* is known from north-western Western Australia and South Australia (Fig. 6.312).

6.5.2. The *athysanus*-group

Diagnosis

Head in anterior view subtriangular in shape; speculum absent; cheek and lower frons smooth or striate; eyes normal in size and appearing hairless (minute hairs present and visible only under SEM); frontal carina short, never reaching more than 0.3 distance to median ocellus; lateral ocelli continuous with margin of eyes or distance from eyes < 1OD; antennal clava compact, segments appearing fused, with 4 funicle segments; first funicle segment < 2.0 x as long as wide; in dorsal view head moderately broad, slightly wider than mesosoma; notauli absent; axillar crenulae present; humeral sulcus crenulate; scutum not indented; posterior margin of scutellum indented medially, with single row of foveae; propodeal lamellae blunt to sharply pointed dorsally; wings fully developed; submarginal, marginal and stigmal veins tubular; basal vein faint and spectral; fore wings without transverse dark bands and marginal fringe present or absent; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; metasomal horn slender, reaching posterior margin of scutellum, not curved forward, apex narrowly rounded, colour darker than rest of metasoma; metasoma < 3.0 x as long as wide, same colour as or lighter than head and mesosoma.

Comments

The major distinguishing characters of this species-group are the eyes appearing hairless, the posterior margin of the scutellum indented medially, the bristles on the submarginal vein of fore wing long, reaching beyond anterior margin, and the metasomal horn not curved forward, colour darker than rest of the metasoma. This group contains two species, *C. athysanus* sp. nov. and *C. raniae* sp. nov.

6.5.2.1. *Key to females of the* athysanus-*group*

1. Surface of metasomal horn reticulate-coriaceous except for few basal longitudinal striations (Fig. 6.39); metasoma with dark transverse bands on posterior margins of all terga .... *C. athysanus* sp. nov.

   Surface of metasomal horn with faint longitudinal striations (Fig. 6.41); metasoma uniformly yellow .... *C. raniae* sp. nov.

6.5.2.2. *Ceratobaeus athysanus* sp. nov. (Figs 6.38, 6.39, 6.313)

Type material:

Holotype: ♀, **Australia, Australia Capital Territory:** "35.22S 148.50E, Blundella Ck., 3km E of Piccadilly Circus, 850m, ACT, Apr. 1984, Weir, Lawrence, Johnson" (ANIC).

Paratypes: **Australian Capital Territory:** 2♀, same data as holotype (ANIC); 1♀, 35.22S 148.50E, Blundella Ck., 3km E Piccadilly Circus, 850m, iii.1984, TW, JL & MLJ (ANIC); 4♀, 35.22S 148.50E, Blundella Ck., 3km E Piccadilly Circus, 850m, i.1985, JL, TW & MLJ (ANIC); 1♀, 35.22S 148.50E, Blundella Ck., 3km E Piccadilly Circus, 850m, ii.1985, JL, TW & MLJ (ANIC); 4♀, 35.22S 148.50E, Blundella Ck., 3km E Piccadilly Circus, 850m, iv.1985, JL, TW & MLJ (ANIC); 1♀, 35.22S 148.50E, Blundella Ck., 3km E Piccadilly Circus, 850m, ix.1985, JL, TW & MLJ (ANIC); 1♀, 35.22S 148.50E, Blundella Ck., ii.1987, D. H. Colless (ANIC); 1♀, 32.22S 148.48E, Piccadilly Circus, 1240m, v.1984, JL, TW & MLJ (ANIC); 1♀, 35.19S 148.51E, Wombat Ck., 750m, 6km E Piccadilly Circus, iii.1985, JL, TW & MLJ (ANIC).

Female

Length: 1.4-1.6 mm; body yellow to light brown, except for antennae, head, metasomal horn and posterior margins of all metasomal terga which are dark brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; cheeks and lower frons striate; frontal carina rudimentary.

Mesosoma: Scutum L:W = 2.2:3.3, surface granulate, with scattered small punctures and associated hairs, these punctures more concentrated in anterior half; surface of scutellum granulate; propodeal lamellae sharply pointed dorsally; fore wings L:W = 8.4:2.5, marginal fringe absent; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein.

Metasoma: L:W = 6.6:3.5; surface of metasomal horn reticulate-coriaceous except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.0:2.8; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

The name 'athysanus' is a Greek word meaning 'without fringe'. *C. athysanus* is known from Australian Capital Territory (Fig. 6.313).

6.5.2.3. ***Ceratobaeus raniae*** sp. nov. (Figs 6.40, 6.41, 6.314)

Type material:

Holotype: ♀, **Australia, Queensland** "AUSTRALIA: Qld., Gordonvale nr. Mulgrave River, s. s., 30.iii.1991, J.D. Pinto, riv. for." (CNCI).

Female

Length: 1.1 mm; body black, except for antennae legs including coxae and metasoma (excluding metasomal horn) which are yellow.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; cheeks and lower frons smooth; frontal carina reaching about 0.3 distance to median ocellus.

Mesosoma: Scutum L:W = 2.3:2.9, surface finely granulate, with scattered small punctures and associated hairs, surface of scutellum finely granulate; propodeal lamellae blunt; fore wings L:W = 8.3:2.5, marginal fringe present; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein.

Metasoma: L:W = 5.3:2.8; surface of metasomal horn with faint longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.7:1.8; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

I have much pleasure in naming it after Ms. Rani Nazir. *C. raniae* is known only from Gordonvale in north Queensland (Fig. 6.314).

6.5.3. The *australicus*-group

Diagnosis

Head in anterior view subtriangular in shape; speculum present; cheek and lower frons striate; eyes reduced or normal in size, with long hairs; frontal carina complete, reaching to median ocellus; lateral ocelli sometimes continuous with margin of eyes; antennal clava compact, segments appearing fused, with four funicle segments; first funicle segment < 2.0 x as long as wide; in dorsal view head as wide as or slightly wider than mesosoma; notauli present or absent; axillar crenulae present; humeral sulcus smooth or crenulate; scutum not indented; posterior margin of scutellum either rounded or indented medially, with single row of foveae; propodeal lamellae sharply pointed dorsally; wings fully developed; submarginal, marginal and stigmal veins tubular; basal vein faint and spectral; fore wings without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; metasomal horn slender or broad at base, sometimes reaching posterior margin of scutellum, straight or curved forward, apex narrowly rounded, same colour as or darker than rest of metasoma; metasoma < 3.0 x as long as wide, same colour as or lighter than head and mesosoma.

Comments

The major distinguishing character of this species-group is the frontal carina complete and reaching to the median ocellus. This group contains seven species, *C. ajmali* sp. nov., *C. alveus* sp. nov., *C. australicus* (Dodd), *C. berryae* sp. nov., *C. minyamea* sp. nov., *C. normani* sp. nov. and *C. umasensis* sp. nov.

6.5.3.1. *Key to females of the* **australicus***-group*

1. Eyes normal in size; lateral ocelli continuous with margin of eyes or distance from eyes < 1OD (Fig. 6.57) .... *C. umasensis* sp. nov.
   Eyes size reduced; lateral ocelli not continuous with margin of eyes or distance from

eyes > 1OD (Fig. 6.50) 2

2. Posterior margin of scutellum indented medially (Fig. 6.51) ...... *C. minyamea* sp. nov.
Posterior margin of scutellum rounded (Fig. 6.49) 3

3. Metasomal horn not reaching posterior margin of scutellum .... *C. berryae* sp. nov.
Metasomal horn reaching posterior margin of scutellum 4

4. Body length > 1.0 mm 5
Body length < 0.9 mm 6

5. Body dark brown .... *C. ajmali* sp. nov.
Head and mesosoma light brown, metasoma yellow .... *C. australicus* (Dodd)

6. Body colour yellow .... *C. normani* sp. nov.
Head and metasoma brown, metasoma yellow to light brown .... *C. alveus* sp. nov.

6.5.3.2. ***Ceratobaeus ajmali*** sp. nov. (Figs 6.42, 6.43, 6.315)

Type material:

Holotype: ♀, **Australia, Queensland:** "11.45S 142.35E, Heathlands, QLD, 18.viii-ix.1992, Flight Intercept trap, P. Zborowski & L. Miller" (ANIC)

Paratypes: **Queensland**: 1♀, same data as holotype (ANIC); 2♀, 12.40S 142.39E, 3km W Batavia Downs, 23.xi-11.xii.1992, PZ & W. Dressier (ANIC); 1♀, 12.40S 142.39E, 3km W Batavia Downs, 23.xi-11.xii.1992, PZ & A. Calder (ANIC); 3♀, 200m. Landsburough Shire, 8.iii.1984, L. Masner (CNCI, WARI); **Papua New Guinea:** 1♀, Morobe Prov., Wau Ecol. Inst., 11-28.viii.1983, S. & P. Miller (CNC); 1♀, Laloki, CSIRO Screw Worm Lab., iv.1987, S. Bakker (ANIC).

Female

Length: 1.2-1.3 mm; body dark brown, except for scape, funicle segments and legs including coxae which are brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated hairs; eye size reduced; lateral ocelli not touching eye margins or distance from eyes > 1OD; in dorsal view head as wide as mesosoma.

Mesosoma: Scutum L:W = 1.8:2.8, surface finely granulate, with scattered small punctures and associated hairs; notauli present, reaching 0.3 the distance to anterior margin of scutum; humeral sulcus smooth; surface of scutellum finely granulate, posterior margin moderately rounded, fore wings L:W = 7.3:2.3; stigmal vein long, postmarginal vein slightly longer than stigmal vein.

Metasoma: L:W = 6.2:3.4; in lateral view metasomal horn straight, reaching posterior margin of scutellum, surface with faint longitudinal striations; rest of T1 (other than metasomal horn), T2 and T3 longitudinally striate, with fine granulate sculpturing; medial

length of T2:T3 = 1.7:1.8; T4-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *australicus*-group by the length and colour of the body, the reduced eyes, and the rounded posterior margin of the scutellum. I have much pleasure in naming it after Dr. Rana Ajmal. *C. ajmali* is known from north Queensland and Papua New Guinea (Fig. 6.315).

6.5.3.3. ***Ceratobaeus alveus*** sp. nov. (Figs 6.44 - 6.46, 6.316)

Type material:

Holotype: ♀, **Papua New Guinea:** "Papua New Guinea: Awar, Bush St., 24.vii.1982, P. Grooteart" (CNCI).

Paratype: **Papua New Guinea:** 1♀, same data as holotype (CNCI).

Female

Length: 0.8-0.9 mm; body light brown, except for scape, funicle segments, legs including coxae and metasoma which are yellow.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated hairs; eye size reduced; lateral ocelli not touching eye margins or distance from eyes > 1OD; in dorsal view head as wide as mesosoma.

Mesosoma: Scutum L:W = 1.3:2.0 surface finely reticulate, with scattered small punctures and associated hairs; notauli present, reaching 0.3 the distance to anterior margin of scutum; humeral sulcus smooth; surface of scutellum finely reticulate, posterior margin moderately rounded, fore wings L:W = 5.1:1.7; stigmal vein long, postmarginal vein slightly longer than stigmal vein.

Metasoma: L:W = 3.7:2.2; in lateral view metasomal horn straight, reaching posterior margin of scutellum, surface strigate with few basal longitudinal striations; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.7:1.5; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *australicus*-group by the length and colour of the body, the reduced eyes, and the rounded posterior margin of the scutellum.

The name 'alveus' is a Latin word meaning 'furrows' referring to presence of the notauli. *C. alveus* is only known from Papua New Guinea (Fig. 6.316).

6.5.3.4. ***Ceratobaeus australicus*** (Dodd) (Figs 6.47 - 6.49, 6.317)

Odontacolus australicus Dodd, 1914b: 72; Kieffer 1926: 145.
Ceratobaeus australicus; Austin 1981a: 84.
Idris australicus; Johnson 1992: 405.

Type material:

Holotype: ♀, **Australia, Queensland:** "Nelson, 10.vii.1913, A.P. Dodd, sweeping" (SAM).

Other specimens examined:

Queensland: 1♀, Hugh Nelson Rd, 21km S of Atherton, 1.xii.1983-9.i.1984, Storey & Brown (QDPC); 6♀, Wongabel S. F., 6km S Atherton, 1.xii.1983-9.i.1984, Storey & Brown (QDPC, WARI); 8♀, Black Mt. Rd., 17.6km N Kuranda, 1500 ft., 30.xii.1970, J.G. Brooks (ANIC); 7♀, 4km NNW Kuranda, 10.xii.1984-15.i.1985, Storey & Halfgapp (QDPC); 8♀, Wongabel S. F., 6km S Atherton, 9.i-10.ii.1984, Storey & Brown (QDPC); 3♀, Wongabel S. F., 6km S Atherton, 10.xi.1983-1.xii.1983, Storey & Brown (QDPC); 6♀, Wongabel S. F., 6km S Atherton, 13.iii-1.v.1984, Storey & Brown (QDPC); 1♀, Kuranda S. F., Kuranda Range, Black Mountain Rd. 5.4km from highway, 14.xi.1979, E.C. Dalms, J.B. Woolley & J. LaSalle (QDPC); 1♀, 16.30S 145.25E, Rex Range Lookout via Julatten, 9.xi-2.xii.1981, no collector (QDPC); 7♀, 6km SW Kuranda, 10.xii.1984-15.i.1985, Storey & Halfpapp (QDPC); 3♀, 6km SW Kuranda, 2.x-6.xi.1984, Storey & Halfpapp (QDPC); 2♀, 16.54S 145.34E, 19km NE Mareeba, 20.xii.1984-7.i.1985, Storey & Titmarsh (QDPC); 1♀, Wongabel S. F., 6km S Atherton, 3.ix-1.xi.1984, Storey & Brown (QDPC); 1♀, Hugh Nelson Rd 21km S Atherton, 13.iii-1.v.1984, Storey & Brown (QDPC); 2♀, 7.5km NNW Kuranda, 20.ii-20.iii.1985, Storey & Halfpapp (QDPC); 1♀, Mossman Gorge N. P., 6km SW Mossman, 50m, 11.vii.1982, S. & J. Peck (ANIC); 5♀, 16.44S 145.34E, Kuranda Black Mt. Rd., 390m, 22.vi.1971, Taylor Feehan, rainforest (ANIC); 2♀, 11.51S 142.38E, 12km SSE Heathlands, 22.x-22.xi.1992, PZ & A. Calder (ANIC); 4♀, 11.51S 142.38E, 12km SSE Heathlands, 21.viii-21.ix.1992, PZ & A. Calder (ANIC); 2♀, Julatten, 29.ix-5.x.1987, A. Walford-Huggins (ANIC); 5♀, Black Mountain Rd. Julatten, 21.xi-13.xii.1987, A. Walford-Huggins (ANIC); 3♀, 17.17S 145.39E, Lake Echam, 15.ii-2.iii.1988, D.C.F. Rentz (ANIC); 3♀, 17.17S 145.39E, Lake Echam, 2-16.iii.1988, D.C.F. Rentz (ANIC); 1♀, 17.17S 145.39E, Lake Echam, 29.iii-31.v.1988, D.C.F. Rentz (ANIC); 1♀, 17.17S 145.29E, Atherton (CSIRO labs), 25.i.1988, D.C.F. Rentz (ANIC); 1♀, Crystal Cascades, Cairns, 19.ix.1967, D.H. Colless (ANIC); 1♀, 16.46S 145.36E, Kuranda Black Mt. Rd., 330m, 22.vi.1971, Taylor Feehan (ANIC); 2♀, Mossman Gorge, 30m, 23.ii.1984, L. Masner (CNCI); 1♀, 17.17S 145.29E, Atherton (CSIRO labs), 11.iii.1988, D.C.F. Rentz (ANIC); 1♀, Bramston Beach via Innisfall, 18.ix-11.xi.1987, A. Walford-Huggins (ANIC); 1♀, 15.03S 145.09E, 3km NE Mt. Webb, 30.iv-3.v.1981, IDN (ANIC); 1♀, Craighoyle nr. Rockhampton, 10.v.1984, K.G. Asher (ANIC); 1♀, 11.45S 142.35E, Heathlands, 18.viii-17.ix.1992, PZ & L. Miller (ANIC); 1♀, 11.45S 142.35E, Heathlands, 15-26.i.1992, IDN & TW (ANIC); 1♀, 11.45S 142.35E, Heathlands, 2.iii-5.iv.1993, PZ (ANIC); 1♀, 11.45S 142.35E, Heathlands, 26.i-29.ii.1992, P. Feehney (ANIC); 3♀, Kuranda S. F., 5.3km N on Black Mt. Rd., 21.iv.1990, J. Heraty (CNCI); 1♀, 3km N on Black Mt. Rd., 21.iv.1990, J. Heraty (CNCI); 1♀, 17km NE Mt. Malloy, 20.xii.1986, H. & A. Howden (CNCI); 1♀, Gordonvale, xii.1920, A.P. Dodd (ANIC); **Western Australia:** 11♀, 14.49S 125.50E, Mining Camp, Mitchell Plateau, 9-19.v.1983, IDN & JCC (ANIC); 1♀, 14.25S 126.38E, 12km S Kalumburu Mission, 7-11.vi.1988, TW (ANIC); 2♀, 14.52S 126.50E, 4km SbyW Mining Camp, Mitchell Plateau, 2-6.vi.1988, IDN (ANIC); 1♀, 15.00S 125.21E, Prince Frederick Harbour, 2-6.vi.1988, IDN (ANIC); **Northern Territory:** 1♀, 20km E Humpty Doo Fogg Dam, 31.xii.1993-7.i.1994, S. & J. Peck (CNCI).

Female

Length: 1.1-1.2 mm; body brown, except for scape, funicle segments, legs including coxae and metasoma (except metasomal horn) which are yellow to light brown.

Head: Upper frons, vertex and occiput granulate, with scattered minute punctures and associated hairs; eye size reduced; lateral ocelli not touching eye margins or distance from eyes > 1OD; in dorsal view head as wide as mesosoma.

Mesosoma: Scutum L:W = 1.7:2.9, surface finely granulate, with scattered small punctures and associated hairs; notauli present, reaching 0.3 the distance to anterior margin of scutum; humeral sulcus smooth; surface of scutellum finely granulate, posterior margin moderately rounded, fore wings L:W = 7.3:2.5; stigmal vein long, postmarginal vein slightly longer than stigmal vein.

Metasoma: L:W = 5.8:3.5; in lateral view metasomal horn straight, reaching posterior margin of scutellum; T1 (including metasomal horn), T2 and T3 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.2:2.0; T4-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *australicus*-group by the length and colour of the body, the reduced eyes, and the rounded posterior margin of the scutellum. *C. australicus* is broadly distributed across the north half of the continent (Fig. 6.317).

6.5.3.5. ***Ceratobaeus berryae*** sp. nov. (Figs 6.50, 6.51, 6.318)

Type material:

Holotype: ♀, **Australia, Queensland:** "26.34S 152.55E, Qld, Wappa Reservoir, 29.xii.1991, J.A. Berry, pan traps" (ANIC).

Female

Length: 1.0 mm; body dark brown, except for antennae and legs including coxae which are yellow.

Head: Upper frons, vertex and occiput finely punctate, with scattered minute punctures and associated minute hairs; eye size reduced; lateral ocelli not touching eye margins or distance from eyes > 1OD; in dorsal view head as wide as mesosoma.

Mesosoma: Scutum L:W = 1.3:2.3, surface finely granulate, with scattered small punctures and associated hairs; notauli present, reaching 0.2 the distance to anterior margin of scutum; humeral sulcus crenulate; surface of scutellum finely granulate, posterior margin moderately rounded, fore wings L:W = 6.2:1.9; stigmal vein long, postmarginal vein slightly longer than stigmal vein.

Metasoma: L:W = 5.0:3.0; in lateral view metasomal horn straight, not reaching posterior margin of scutellum; T1 (including metasomal horn) and T2 longitudinally striate; medial length of T2:T3 = 1.2:1.6; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *australicus*-group by the reduced eyes, the rounded posterior margin of the scutellum, and the metasomal horn not reaching level of the posterior margin of scutellum. I have much pleasure in naming it after the collector, Dr. Jo Berry, Landcare Research, New Zealand. *C. berryae* is known from south eastern Queensland (Fig. 6.318).

6.5.3.6. ***Ceratobaeus minyamea*** sp. nov. (Figs 6.52 - 6.54, 6.319)

Type material:

Holotype: ♀, **Australia, Queensland:** "State Forest near Caloundra Turnoff, S. E. Q., 8.iii.1984, I.D. Galloway" (QDPC).

Paratypes. **Queensland**: 2♀, same data as holotype (QDPC, WARI); 1♀, 26.58S 152.58E, Beerburrum S. F., 28.xii.1991, J.A. Berry (ANIC); 1♀, Brookfield nr. Brisbane, 23.xii.1982, Boucek (BMNH); 1♀, Camp Mountain, 22-29.xii.1979, Marks (QDPC); 1♀, Lake Eacham N. P., 25.v.1980, IDN & JCC (ANIC); 4♀, Landsborough Shire, 200m, 8.iii.1984, L. Masner (CNCI); 2♀, Mt. Glorious, 15.xii-1979-14.i.1980, no collector (QDPC); 1♀, Mt. Glorious, 15-24.xii.1979, no collector (QDPC); 1♀, Qld, Mt. Glorious, 26.xi-10.xii1979, no collector (QDPC); 1♀, Qld, Mt. Glorious, 10-15.xii.1979, no collector (QDPC); 2♀, 630m Mt Glorious, 28.ii-9.iii.1984, L. Masner (CNCI), 1♀, Mt. Tamborine, xi.1978-i.1979, Agard (QDPC); 1♀, Mt. Tamborine, no date, A.P. Dodd (ANIC); 2♀, 28.15S 152.28E, The Head nr. Wilsons Peak, 13.x.1984, IDN & JCC (ANIC); **New South Wales:** 2♀, 28.48S 152.59E, Richmond Range S. F., 600m, 13-14.ii.1983, TW & A. Clader (ANIC, WARI); 2♀, 28.29S 152.24E, Tooloom Plateau 14km W Urbenville, 4-14.x.1984, IDN & JCC (ANIC).

Female

Length: 1.5-1.6 mm; body dark brown, except for antennae, legs including coxae and posterior T1 (base of metasomal horn) which are yellow to brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; eye size reduced; lateral ocelli not touching eye margins or distance from eyes > 1OD; in dorsal view head almost equal to mesosoma.

Mesosoma: Scutum L:W = 2.1:3.5, surface granulate, with scattered small punctures and associated hairs; notauli present, reaching 0.3 the distance to anterior margin of scutum; humeral sulcus crenulate; surface of scutellum granulate, posterior margin indented medially; fore wings L:W = 9.3:3.3; stigmal vein long, postmarginal vein slightly longer than stigmal vein.

Metasoma: L:W = 7.4:4.2; in lateral view metasomal horn curved forward, reaching posterior margin of scutellum, surface rugulose; rest of T1 (other than metasomal horn), T2 and T3 longitudinally striate; medial length of T2:T3 = 1.6:2.1; T4-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *australicus*-group by the reduced eyes and the indented posterior margin of the scutellum. The name 'minyamea' is an aboriginal word meaning 'small eyes'. *C. minyamea* is known from south-east Queensland and north New South Wales (Fig. 6.319).

6.5.3.7. ***Ceratobaeus normani*** sp. nov. (Figs 6.55, 6.56, 6.320)

Type material:

Holotype: ♀, **Malaysia, Sarawak:** "Sarawak, Mt Santubong nr. Kuching rainforest, 5.vi.1968, R.W. Taylor" (ANIC).

Paratype: **Malaysia, Sabah:** 1♀, mi 45 Lobuk red ex Sandakan (Lungmanis), 12-13.vi.1968, R.W. Taylor, rainforest (ANIC).

Female

Length: 0.8-0.9 mm; body yellow.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; eye size reduced; lateral ocelli not touching eye margins or distance from eyes > 1OD; in dorsal view head as wide as mesosoma.

Mesosoma: Scutum L:W = 1.3:2.2, surface granulate, with scattered small punctures and associated hairs; notauli present, reaching 0.2 the distance to anterior margin of scutum; humeral sulcus smooth; surface of scutellum granulate, posterior margin moderately rounded, fore wings L:W = 5.4:1.6; stigmal vein long, postmarginal vein slightly longer than stigmal vein.

Metasoma: L:W = 4.0:2.3; in lateral view metasomal horn straight, reaching posterior margin of scutellum; T1 (including metasomal horn), T2 and T3 longitudinally striate; medial

length of T2:T3 = 0.9:1.3; T4-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *australicus*-group by the length and colour of the body, the reduced eyes, and the rounded posterior margin of the scutellum. I have much pleasure in naming it after Dr. Norman Johnson, The Ohio State University, Columbus, U.S.A. In Mani & Sharma's (1982) key to the Indian species of *Ceratobaeus* it runs to *C. marattensis* Mani & Mukerjee but differs in the length and colour of the body. In Kozlov & Lê's (1987) key to the Vietnamese species of *Ceratobaeus* , it runs to *C. oringus* Kozlov & Lê but differs by the presence of notauli. *C. normani* is known from Sabah and Sarawak, Malaysia (Fig. 6.320).

6.5.3.8. ***Ceratobaeus umasensis*** sp. nov. (Figs 6.57, 6.58, 6.321)

Type material:

Holotype: ♀, **Malaysia, Sabah:** "Sabah, Umas nr. Tawau rainforest, 20.vi.1968, leafmould berlesate, R.W. Taylor, acc 68.626" (ANIC).

Female

Length: 1.2 mm; body light brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; eye size normal; lateral ocelli continuous with margin of eyes; in dorsal view head moderately broad, slightly wider than mesosoma.

Mesosoma: Scutum L:W = 2.0:3.2, surface granulate, with scattered small punctures and associated hairs, these punctures more concentrated in anterior half; notauli present, reaching 0.2 the distance to anterior margin of scutum; humeral sulcus smooth; surface of scutellum granulate, posterior margin moderately rounded, fore wing L:W = 7.1:2.3; stigmal vein long, postmarginal vein slightly longer than stigmal vein.

Metasoma: L:W = 6.0:3.2; in lateral view metasomal horn straight, reaching posterior margin of scutellum, with longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.5:1.2; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *australicus*-group by the normal eyes and the lateral ocelli continuous with margin of eyes. In Mani & Sharma's (1982) key to the Indian species of *Ceratobaeus* it runs to *C. nigrituberculatus* Mukerjee but differs in the striate sculpturing of the metasomal horn and the postmarginal vein slightly longer than stigmal vein. In Kozlov & Lê's (1987) key to the Vietnamese species of *Ceratobaeus* , it runs to *C. oringus* Kozlov & Lê but differs by the normal eyes and the presence of notauli. *C. umasensis* is known only from Umas, Malaysia (Fig. 6.321).

6.5.4. The *clavisegmentus*-group

Diagnosis

Head in anterior view oval or subtriangular in shape; speculum sometimes present; cheek and lower frons smooth or striate; eyes normal in size, appearing hairless (minute hairs present and visible only under SEM); frontal carina short to moderately long but never reaching more than 0.5 distance to median ocellus; lateral ocelli continuous with margin of eyes or distance from eyes < 1OD; antennal clava clearly 4-segmented, with 5 funicle segments; first funicle segment < 2.0 x as long as wide; in dorsal view head moderately broad, slightly wider than mesosoma; notauli present or absent; axillar crenulae present; humeral sulcus smooth or crenulate; scutum not indented; posterior margin of scutellum either indented medially to accommodate metasomal horn or rounded, with single row of foveae; propodeal lamellae blunt to sharply pointed dorsally; brachypterous or wings fully developed; submarginal, marginal and stigmal veins tubular; basal vein faint and spectral or pigmented; fore wings without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing rudimentary to long; metasomal horn slender, reaching posterior margin of scutellum, curved forward, apex narrowly rounded, same colour as or darker than rest of metasoma; metasoma < 3.0 x as long as wide, same colour as or lighter than head and mesosoma.

Comments

The major distinguishing characters of this species-group are the antennal clava clearly four-segmented and 5 funicle segments present between the scape and the clava. This group contains eight species, *C. boolool* sp. nov., *C. clavisegmentus* Austin, *C. mainae* Austin, *C. moongacutta* sp. nov., *C. narteol* sp. nov., *C. naumanni* sp. nov., *C. noyesi* sp. nov. and *C. pita* sp. nov.

6.5.4.1. *Key to females of the* clavisegmentus-*group*

1. Brachypterous (Figs 6.69, 6.70) .... *C. naumanni* sp. nov.
   Wings fully developed (Fig. 6.63) 2

2. Posterior margin of scutellum rounded or straight (Fig. 6.65) 3
Posterior margin of scutellum indented medially (Fig. 6.60) 5

3. Notauli reaching 0.7 distance to anterior margin of scutum (Fig. 6.63) .... *C. mainae* Austin
Notauli, if present, not reaching beyond 0.3 distance to anterior margin of scutum (Fig. 6.62) 4

4. Head dark brown, mesosoma and metasoma yellow .... *C. moongacutta* sp. nov.
Body brown .... *C. pita* sp. nov.

5. Speculum absent (Fig. 6.71) 6
Speculum present (Fig. 6.66) 7

6. Body black, notauli reaching 0.2 distance to anterior margin of scutum; propodeal lamellae sharply pointed dorsally (Fig. 6.62) .... *C. clavisegmentus* Austin
Head and mesosoma black, metasoma brown, notauli reaching 0.3 distance to anterior margin of scutum; propodeal lamellae blunt (Fig. 6.73) .... *C. noyesi* sp. nov.

7. Cheeks and lower frons striate (as for Fig. 6.263); wings evenly infuscate .... *C. boolool* sp. nov.
Cheeks and lower frons smooth (Fig. 6.66); wings hyaline .... *C. narteol* sp. nov.

6.5.4.2. ***Ceratobaeus boolool*** sp. nov. (Figs 6.59 - 6.61, 6.322)

Type material:

Holotype: ♀, **Australia, New South Wales:** "31.54S 151.36E, Cobark For Pk Barrington Tops, 11.ii.1984, NSW, I.D. Naumann, ex ethanol" (ANIC).

Paratype. **New South Wales:** 1♀, 31.54S 151.33E, Moppy Lookout, Barrington Tops S. F., 18.xi.1981, TW (ANIC).

Female

Length 1.5-1.6 mm; body black, except for legs and metasoma which are dark brown, wings evenly infuscate.

Head: In anterior view subtriangular in shape; upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum present, with irregular margin; cheeks and lower frons finely striate; frontal carina reaching about 0.3 distance to median ocellus.

Mesosoma: Scutum L:W = 2.4:3.4, surface finely granulate, with scattered small punctures and associated hairs; notauli present, reaching 0.2 distance to anterior margin of scutum; humeral sulcus crenulate; axillar crenulae present; surface of scutellum finely granulate, posterior margin indented medially, with single row of foveae; propodeal lamellae sharply pointed dorsally; wings fully developed; fore wings L:W = 10.0:3.6; bristles on submarginal vein of fore wing rudimentary, not reaching beyond anterior margin; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 7.8:3.8; surface of metasomal horn smooth except for few basal longitudinal striations; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 2.0:2.9; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *clavisegmentus*-group by the presence of the speculum, the striate cheeks and the lower frons, the indented posterior margin of the scutellum, and the wings evenly infuscate. The name 'boolool' is an aboriginal word meaning 'dark colour'. *C. boolool* is known only from Barrington Tops, New South Wales (Fig. 6.322).

6.5.4.3. ***Ceratobaeus clavisegmentus*** Austin (Figs 6.62, 6.323)

Ceratobaeus clavisegmentus Austin, 1995: 258.

Type material:

Holotype: ♀, **Australia, Western Australia:** "W. Aust: Walpole Nornalup N. P., 17-21.i.1987, J.S. Noyes, M.T./ P.T." (ANIC).

Other specimens examined:

Western Australia: 2♀, same data as holotype (WARI).

Female

Length 1.3-1.4 mm; body black, except for legs and metasoma which are dark brown, wings hyaline.

Head: In anterior view subtriangular in shape; upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; cheeks and lower frons finely striate; frontal carina reaching about 0.3 distance to median ocellus.

Mesosoma: Scutum L:W = 1.8:3.0, surface finely granulate, with scattered small punctures and associated hairs; notauli present, reaching 0.2 distance to anterior margin of scutum; humeral sulcus crenulate; axillar crenulae present; surface of scutellum finely granulate, posterior margin indented medially, with single row of foveae; propodeal lamellae sharply pointed dorsally; wings fully developed; fore wings L:W = 4.0:1.5; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; stigmal vein long, postmarginal vein about 0.5 length of stigmal vein, basal vein pigmented.

Metasoma: L:W = 7.6:3.3; surface of metasomal horn smooth except for few basal longitudinal striations; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.1:2.4; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *clavisegmentus*-group by the absence of the speculum, the indented posterior margin of the scutellum, and shape of the propodeal lamellae. *C. clavisegmentus* is known only from Walpole Nornalup National Park in south-western Western Australia (Fig. 6.323).

6.5.4.4. ***Ceratobaeus mainae*** Austin (Figs 6.63, 6.324)

Ceratobaeus mainae Austin, 1995: 258.

Type material:

Holotype: ♀, **Australia, Western Australia:** "W. Aust: Walpole Nornalup N. P., 17-21.i.1987, J.S. Noyes, MT/ PT (ANIC)".

Other specimens examined:

Western Australia: 3♀, same data as holotype (WARI); 1♀, Mt. Cooke, 13-28.i.1991, M.S. Harvey & J.M. Waldock (WARI).

Female

Length 1.3-1.4 mm; body black, except for scape, funicle segments, legs including coxae and posterior T1 (base of metasomal horn) which are brown, wings hyaline.

Head: In anterior view subtriangular in shape; upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; cheeks and lower frons smooth; frontal carina reaching about 0.3 distance to median ocellus.

Mesosoma: Scutum L:W = 1.8:3.0, surface finely granulate, with scattered small punctures and associated hairs; notauli present, and well-developed, reaching 0.7 the distance to anterior margin of scutum; humeral sulcus crenulate; axillar crenulae present; surface of scutellum finely granulate, posterior margin straight, with single row of foveae; propodeal lamellae sharply pointed dorsally; wings fully developed; fore wings L:W = 4.0:1.5; bristles on submarginal vein of fore wing rudimentary, not reaching beyond anterior margin; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 7.6:3.3; surface of metasomal horn smooth except for few basal longitudinal striations; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.1:2.4; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Differing from female in the following: antennae 12-segmented; metasoma oval in shape; T1 virtually flat except for upturned anterior margin, longitudinally striate.

Comments

This species can be separated from other species in the *clavisegmentus*-group by the presence of the well-developed notauli and the straight posterior margin of the scutellum. *C. mainae* is known only from Walpole Nornalup National Park in south-western Western Australia (Fig. 6.324).

6.5.4.5. ***Ceratobaeus moongacutta*** sp. nov. (Figs 6.64, 6.65, 6.325)

Type material:

Holotype: ♀, **Australia, Queensland:** "Clacherty Rd Julatten, N Qld, 4-25.ii.1983, A. Walford-Huggins" (QDPC).

Female

Length 1.1 mm; body yellow, except for head and antennal clava which are dark brown, wings hyaline.

Head: In anterior view subtriangular in shape; upper frons, vertex and occiput finely reticulate, with scattered minute punctures and associated minute hairs; speculum present, with irregular margins; cheeks and lower frons smooth; frontal carina reaching about 0.3 distance to median ocellus.

Mesosoma: Scutum L:W = 1.7:2.5, surface finely reticulate, with scattered small punctures and associated hairs; notauli present, reaching 0.3 the distance to anterior margin of scutum; humeral sulcus smooth; axillar crenulae present; surface of scutellum finely reticulate, posterior margin rounded, with single row of foveae; propodeal lamellae blunt; wings fully developed; fore wings L:W = 6.2:2.0; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; stigmal vein long, postmarginal vein short, about 0.3 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 3.8:2.5; surface of metasomal horn smooth except for basal areolate sculpturing; rest of T1 (other than metasomal horn), T2 and T3 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.7:1.7; T4-T5 finely coriaceous, with smooth posterior margins.

Male

Unknown.

Comments

This species can be separated from other species in the clavisegmentus-group by the colour of the body and the rounded posterior margin of the scutellum. The name 'moongacutta' is an aboriginal word meaning 'black head'. *C. moongacutta* is known only from Julatten, north Queensland (Fig. 6.325).

6.5.4.6. ***Ceratobaeus narteol*** sp. nov (Figs 6.66, 6.67, 6.326)

Type material:

Holotype: ♀, **Australia, South Australia:** "34.21S 139.29, SA, Brookfield Cons. Pk., 24-26.xi.1992, I. Naumann, J. Cardale, yellow trays" (ANIC).

Female

Length 1.4 mm; body black, except for scape, funicle segments, legs including coxae and posterior T1 (base of metasomal horn) which are brown, wings hyaline.

Head: In anterior view subtriangular in shape; upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum present; cheeks and lower frons smooth; frontal carina reaching about 0.3 distance to median ocellus.

Mesosoma: Scutum L:W = 2.4:3.5, surface finely granulate, with scattered small punctures and associated hairs; notauli present, reaching 0.2 distance to anterior margin of scutum; humeral sulcus crenulate; axillar crenulae present; surface of scutellum finely granulate, posterior margin indented medially, with single row of foveae; propodeal lamellae sharply pointed dorsally; wings fully developed; fore wings L:W = 9.7:2.8; bristles on submarginal vein of fore wing rudimentary, not reaching beyond anterior margin; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 7.6:3.3; surface of metasomal horn smooth except for few basal longitudinal striations; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.7:2.8; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *clavisegmentus*-group by the presence of the speculum, the smooth cheeks and the lower frons, the indented posterior margin of the scutellum, and the hyaline wings. The name 'narteol' is an aboriginal word meaning 'small pieces'. *C. narteol* is known only from Brookfield Conservation Park in South Australia (Fig. 6.326).

6.5.4.7. ***Ceratobaeus naumanni*** sp. nov. (Figs 6.68 - 6.70, 6.327)

Type material:

Holotype: ♀, **Australia, Tasmania:** "41.22S 145.35E, Wandle R 10km NNE Waratah, TAS, 1.ii.1983, I.D. Naumann & J.C. Cardale, ex ethanol" (ANIC).

Paratypes: **Tasmania:** 3♀, same data as holotype (ANIC, WARI); 1♀, 42.50S 146.23E, 2km S Frodshams Pass, 24.i.1983, IDN & JCC (ANIC); 1♀, 42.13S 146.01E, Franklin R., 22.i.1983, IDN & JCC (ANIC); 1♀, 41.14S 147.56E, 4km SE Weldborough, 29.i.1983, IDN & JCC (ANIC); 1♀, 41.16S 145.37E, Hellyer Gorge, 17.i.1983, IDN & JCC (ANIC); 1♀, 41.23S 147.25E, Mt Barrow 11km EbyN Nunamara, 30.i.1983, IDN & JCC (ANIC); 1♀, 42.10S 146.08E, 9km WSW Derwent Bridge, 21.i.1983, IDN & JCC (ANIC); 1♀, 43.06S 146.43E, Tahune Forest Park, 3.ii.1983, IDN & JCC (ANIC); 1♀, Mt. Margona, 4.iv.1989, J. Diggle & P. Greenslade (WARI); 1♀, Savage R Pipeline Nothafagus, 20.iv.1989, P. Greenslade (WARI).

Female

Length 1.0-1.4 mm; body brown, except for posterior part of T1 (base of metasomal horn) which is yellow, wings hyaline.

Head: In anterior view oval in shape; upper frons, vertex and occiput smooth, with scattered minute punctures and associated hairs; speculum present, with irregular margin; cheeks and lower frons striate; frontal carina reaching about 0.5 distance to median ocellus.

Mesosoma: Scutum L:W = 1.2:2.3, surface finely reticulate, with scattered small punctures and associated hairs; notauli absent; humeral sulcus smooth; axillar crenulae present; surface of scutellum finely reticulate, posterior margin indented medially, smooth; propodeal lamellae blunt; brachypterous, wings only reaching up to T1.

Metasoma: L:W = 5.8:3.3; surface of metasomal horn smooth except for basal reticulate sculpturing; rest of T1 (other than metasomal horn) and T2 longitudinally striate; medial length of T2:T3 = 1.1:2.7; T3-T5 coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *clavisegmentus*-group by the reduced wings. I have much pleasure in naming it after one of the collectors, Dr. Ian Naumann, Australian National Insect Collection, Canberra. *C. naumanni* is known only from Tasmania (Fig. 6.327).

6.5.4.8. ***Ceratobaeus noyesi*** sp. nov. (Figs 6.71 - 6.73, 6.328)

Type material:

Holotype. ♀, **Australia, Western Australia:** "W. Aust: Walpole Nornalup N. P., 17-21.i.1987, J.S. Noyes, M.T./ P.T." (ANIC).

Female

Length 1.3 mm; body black, except for legs and metasoma which are dark brown, wings hyaline.

Head: In anterior view subtriangular in shape; upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; cheeks and lower frons smooth; frontal carina reaching about 0.5 distance to median ocellus.

Mesosoma: Scutum L:W = 1.9:2.6, surface finely granulate, with scattered small punctures and associated hairs; notauli present, reaching 0.3 distance to anterior margin of scutum; humeral sulcus crenulate; axillar crenulae present; surface of scutellum finely granulate, posterior margin indented medially, with single row of foveae; propodeal lamellae blunt; wings fully developed; fore wings L:W = 8.0:2.5; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 6.5:2.9; surface of metasomal horn smooth except for few basal longitudinal striations; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.5:2.2; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *clavisegmentus*-group by the colour of the body, absence of the speculum, the indented posterior margin of the scutellum, and shape of the propodeal lamellae. I have much pleasure in naming after the collector, Dr. John Noyes, Natural History Museum, London, U.K. *C. noyesi* is known only from Walpole Nornalup National Park in south-western Western Australia (Fig. 6.328).

6.5.4.9. ***Ceratobaeus pita*** sp. nov. (Figs 6.74, 6.75, 6.329)

Type material:

Holotype: ♀, **Australia, Queensland:** "QLD.: Biggera Waters, Gold Coast, 24-26 Dec. 1991, P.C. Dangerfield, M.T." (ANIC).

Paratypes: **Queensland:** 1♀, 26.51S 152.57E, Beerwah, 28.ix-29.x.1986, B.K. Cantrell (QDPC); 1♀, 16km up Davies Ck. Rd via Mareeba, 4-13.iii.1983, Storey & Titmarsh (QDPC); **New South Wales:** 1♀, Coocumbac Is. N. R. Taree, 1-7.xii.1994, G. & T. Williams (WARI).

Female

Length 0.9-1.0 mm; body brown, except for scape, funicle segments, legs including coxae and posterior T1 (base of metasomal horn) which are yellow, wings hyaline.

Head: In anterior view subtriangular in shape; upper frons, vertex and occiput finely reticulate, with scattered minute punctures and associated minute hairs; speculum absent; cheeks and lower frons smooth; frontal carina reaching about 0.3 distance to median ocellus.

Mesosoma: Scutum L:W = 1.7:2.3, surface finely reticulate, with scattered small punctures and associated hairs; notauli absent; humeral sulcus smooth; axillar crenulae present; surface of scutellum finely reticulate, posterior margin moderately rounded, with single row of foveae; propodeal lamellae blunt; wings fully developed; fore wings L:W = 5.6:1.9; bristles on submarginal vein of fore wing rudimentary, not reaching beyond anterior margin; stigmal vein long, postmarginal vein about 0.5 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 3.3:2.4; surface of metasomal horn smooth except for basal areolate sculpturing; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.7:1.6; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *clavisegmentus*-group by the colour of the body, presence of the short notauli, and shape of the posterior margin of the scutellum. The name 'pita' is an aboriginal word meaning 'spear with four points', referring to four-segmented clava. *C. pita* is known from the eastern Australia (Fig. 6.329).

6.5.5. The *clubionus*-group

Diagnosis

Head in anterior view subtriangular in shape; speculum sometimes present; cheek and lower frons smooth or striate; eyes normal in size and with rudimentary to long hairs; frontal carina short to moderately long but never reaching more than 0.6 distance to median ocellus; lateral ocelli continuous with margin of eyes or distance from eyes < 1OD; antennal clava compact, segments appearing fused, with 4 funicle segments; first funicle segment < 2.0 x as long as wide; in dorsal view head as wide as or slightly wider than mesosoma; notauli present or absent; axillar crenulae sometimes present; humeral sulcus smooth; scutum not indented; posterior margin of scutellum rounded, with single row of foveae; propodeal lamellae blunt to sharply pointed dorsally; wings fully developed; submarginal, marginal and stigmal veins tubular; basal vein faint and spectral or pigmented; fore wings with or without transverse dark bands, marginal fringe present or absent; bristles on submarginal vein of fore wing rudimentary to long; metasomal horn narrow or broad at base, not reaching posterior margin of scutellum, not curved forward, apex narrowly rounded, same colour as rest of metasoma; metasoma < 3.0 x as long as wide, same colour as or lighter than head and mesosoma.

Comments

The major distinguishing characters of this species-group are the posterior margin of the scutellum rounded, and the metasomal horn not reaching posterior margin of the scutellum. This group contains 15 species *C. aureus* Dodd, *C. azhari* sp. nov., *C. cardaleae* sp. nov., *C. clubionus* Austin, *C. fieldi* sp. nov., *C. fionae* sp. nov., *C. flavios* (Dodd), *C. gallowayi* sp. nov., *C. goobita* sp. nov., *C. gorayaran* sp. nov., *C. kaikai* sp. nov., *C. mansoori* sp. nov., *C. marroocutta* sp. nov., *C. parvicornutus* Dodd and *C. weemayourula* sp. nov.

6.5.5.1. *Key to females of the* clubionus-*group*

1. Notauli present (Fig. 6.82) 2
   Notauli appearing absent (not visible under light microscope) (Fig. 6.79) 3

2. Eyes with long hairs (as for Fig. 6.76) .... *C. gorayaran* sp. nov.
   Eyes appearing hairless (minute hairs present and visible only under SEM) (Fig. 6.81) .... *C. cardaleae* sp. nov.

3. Head and metasoma black, metasoma yellow .... *C. marroocutta* sp. nov.
   Body more uniform in colour, without strongly contrasting colour pattern 4

4. Body colour yellow 5
   Body brown to black 10

5. Propodeal lamellae sharply pointed dorsally (Fig. 6.99) 6
   Propodeal lamellae blunt (Fig. 6.83) 7

6. Eyes with long hairs (Fig. 6.98) .... *C. parvicornutus* Dodd
   Eyes appearing hairless (minute hairs present and visible only under SEM) (Fig. 6.95) .... *C. mansoori* sp. nov.

7. Eyes with long hairs (Fig. 6.76) .... *C. aureus* Dodd
   Eyes appearing hairless (minute hairs present and visible only under SEM) (Fig. 6.94) 8

8. Speculum present (Fig. 6.90); body length < 0.9 mm .... *C. goobita* sp. nov.
   Speculum absent; body length > 1.0 mm 9

9. Fore wings marginal fringe absent (as for Fig. 6.290) .... *C. flavios* (Dodd)
   Fore wings marginal fringe present (as for Fig. 6.279) .... *C. kaikai* sp. nov.

10. Basal vein pigmented (Fig. 6.283) .... *C. clubionus* Austin
Basal vein faint and spectral 11

11. Eyes with long hairs 12
Eyes appearing hairless (minute hairs present and visible only under SEM) 13

12. Head and mesosoma covered with long hairs (Figs 6.88, 6.89); bristles on submarginal vein of fore wing long, reaching beyond anterior margin (Fig. 6.279) .... *C. gallowayi* sp. nov.
Head and mesosoma covered with small hairs (Fig. 6.86); bristles on submarginal vein of fore wing short, not reaching beyond anterior margin (Fig. 6.284) .... *C. fionae* sp. nov.

13. Postmarginal vein almost as long as stigmal vein (Fig. 6.282) .... *C. azhari* sp. nov.
Postmarginal vein < 0.5 length of stigmal vein (as for Fig. 6.280) 14

14. Metasoma yellow with transverse dark bands (Fig. 6.300) .... *C. weemayourula* sp. nov.
Metasoma uniform in colour .... *C. fieldi* sp. nov.

6.5.5.2. ***Ceratobaeus aureus*** Dodd (Figs 6.76, 6.77, 6.330)

Ceratobaeus aureus Dodd, 1914a: 88; Kieffer 1926: 140, 144.
Acoloides aureolus Dodd, 1914b: 71; Kieffer 1926: 166, 169.
Ceratobaeus aureus; Austin 1981a: 83.
Idris aureolus; Johnson 1992: 405.

Type material:

Holotype: ♀, **Australia, Queensland:** "On window, Nelson, near Cairns, North Queensland, i.1913, A. P. Dodd" (SAMA).

Other specimens examined:

Queensland: 5♀, 9.3km NE Ellis Beach, 50m, 30.iv.1990, J. Heraty (CNCI); 2♀, 9.3km NE Ellis Beach, 10m, 1.v.1990, J. Heraty (CNCI); 1♀, 20.9km NE Ellis Beach, 29.iv.1990, J. Heraty (CNCI); 1♀, Emmett Ck., 40km S Townsville, 17.iv.1974, J.F. Donaldson (QDPC); 1♀, Gordonvale, 8km W, 14.i.1991, J.D. Pinto (CNCI); 1♀, 15.16S 144.59E, 14km WbyN of Hope Vale Mission, 7-10.v.1981, IDN (ANIC); 1♀, Edge Ck., Mt. Elliot N. P. Townsville, 8.iv.1976, I.D. Galloway (QDPC); **Western Australia:** 1♀, 14.49S 125.50E, Mining Camp, Mitchell Plateau, 9-19.v.1983, IDN & JCC (ANIC).

Female

Length: 1.0-1.1 mm; body yellow.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum present, with irregular margins; cheeks and lower frons smooth; eyes with long hair; frontal carina rudimentary; in dorsal view head moderately broad, slightly wider than mesosoma.

Mesosoma: Scutum L:W = 1.6:2.5, surface finely granulate, with scattered small punctures and associated hairs; notauli absent; axillar crenulae present; surface of scutellum finely granulate; propodeal lamellae blunt; fore wings L:W = 6.3:2.0, without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 4.7:2.6; metasomal horn broad at base; T1 (including metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.7:1.7; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *clubionus*-group by the colour of the body, the eyes with long hairs, absence of the notauli and, shape of the propodeal lamellae. *C. aureus* is distributed across the north half of the continent (Fig. 6.330).

6.5.5.3. ***Ceratobaeus azhari*** sp. nov. (Figs 6.78 - 6.80, 6.282, 6.331)

Type material:

Holotype: ♀, **Australia, Queensland:** "Windsor Tbld., 35km NNW Mt Carbine, N. Qld., 25-26.iv.1982, 1050m, Monteith, Yeates & Cook, Pyrethrum knockdown" (QDPC).

Paratypes: **Queensland:** 10♀, same data as holotype (QDPC, WARI); 1♀, Windsor Tableland via Mt Carbine, 1050m, 12.xi-26.xii.1983, Monteith, Yeates & Cook (QDPC); 3♀, Windsor Tableland via Mt Carbine, 1050m, 26.xii.1983-24.i.1984, Monteith, Yeates & Cook (QDPC); 1♀, Bellenden Ker Range, Summit TV Stn., 1560m, 17.x-15.xi.1981, no collector (QDPC); 1♀, 17.03S 145.36E, 16km up Davies Ck. Rd., via Mareeba, 2.x-6.xi.1984, R. I. Storey (QDPC); 1♀, 17.37S 145.34E, Massey Ck., 1000m, 1.xii.1994-3.i.1995, PZ (ANIC); 1♀, Mt. Bartle Frere, Sth. Peak Summit, 1620m, 6-8.xi.1981, no collector (QDPC); 1♀, 17.06S 145.36E, Mt. Edith, 1050m, 1.xii.1994-3.i.1995, PZ (ANIC); 1♀, 17.06S 145.37E, Mt. Edith, 1050m, 3.i-4.ii.1995, PZ (ANIC).

Female

Length: 1.7-1.8 mm; head and mesosoma brown, antennae and legs yellow, metasoma dark brown.

Head: Upper frons, vertex and occiput finely punctate, with scattered minute punctures and associated minute hairs; speculum present, with irregular margins; cheeks and lower frons striate; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina reaching about 0.6 distance to median ocellus; in dorsal view head moderately broad, slightly wider than mesosoma.

Mesosoma: Scutum L:W = 2.9:4.1, surface finely punctate, with scattered small punctures and associated hairs; notauli absent; axillar crenulae present; surface of scutellum finely punctate; propodeal lamellae sharply pointed dorsally; fore wings L:W = 11.4:4.0, with a transverse dark band, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; stigmal vein long, postmarginal vein as long as stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 8.0:4.3; metasomal horn slender, surface granulate except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.6:3.4; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *clubionus*-group by the eyes appearing hairless, absence of the notauli, the length of the postmarginal vein, and the spectral basal vein. I have much pleasure in naming it after Dr. Azhar Saeed, University of Agriculture, Faisalabad, Pakistan. *C. azhari* is known only from north Queensland (Fig. 6.331).

6.5.5.4. ***Ceratobaeus cardaleae*** sp. nov. (Figs 6.81, 6.82, 6.332)

Type material:

Holotype: ♀, **Australia, Queensland:** "12.44S 143.14E, QLD, 3km ENE Mt. Tozer, 28.vi-4.vii.1986, J. C. Cardale, Malaise trap/ ethanol" (ANIC).

Paratype: **Queensland:** 1♀, Maroochy Hort. Res. Stn., Nambour, 22.iii-3.iv.1985, no collector (QDPC).

Female

Length: 0.7 mm; body brown, except for scape, funicle segments, legs including coxae and metasoma which are yellow.

Head: Upper frons, vertex and occiput coriaceous, with scattered minute punctures and associated minute hairs; speculum present, with irregular margins; cheeks and lower frons smooth; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina rudimentary; in dorsal view head moderately broad, slightly wider than mesosoma.

Mesosoma: Scutum L:W = 1.2:1.7, surface finely reticulate, with scattered small punctures and associated hairs; notauli present, reaching 0.2 the distance to anterior margin of scutum; axillar crenulae present; surface of scutellum finely reticulate; propodeal lamellae blunt; fore wings L:W = 5.2:1.5 without transverse dark bands, marginal fringe present;

bristles on submarginal vein of fore wing long, reaching beyond anterior margin; stigmal vein long, postmarginal vein about 0.5 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 3.0:1.5; metasomal horn broad at base; T1 (including metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.5:1.1, T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *clubionus*-group by the eyes appearing hairless and presence of the notauli. I have much pleasure in naming it after the collector, Dr. Jo Cardale, Australian National Insect Collection, Canberra. *C. cardaleae* is known from Queensland (Fig. 6.332).

6.5.5.5. ***Ceratobaeus clubionus*** Austin (Figs 6.83, 6.283, 6.333)

Ceratobaeus clubionus Austin, 1983: 151; Austin 1984a: 23.
Idris clubionis; Johnson 1992: 406. Spelling mistake.

Type material:

Holotype: ♀, **Australia, South Australia:** "5km south of Mylor, S. Aust., 18.ii.1979, A.D. Austin, ex eggs *Clubiona* sp." (ANIC).

Paratypes: **South Australia:** 4♀, 1♂, 5km S Mylor, S Aust., 29.iii.1979, A.D. Austin, ex eggs *Clubiona* sp. (QDPC).

Other specimens examined:

South Australia: 19♀, 3♂, same data as holotype (QDPC); 1♀, Mortlock Exp. Stn., 18km SE Clare, 23-26.xi.1987, A.D. Austin (WARI).

Female

Length: 1.3-1.4 mm; body black, except for scape, funicle segments, legs including coxae and posterior T1 (base of metasomal horn) which are brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum present, with irregular margins; cheeks and lower frons smooth; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina rudimentary; in dorsal view head moderately broad, slightly wider than mesosoma.

Mesosoma: Scutum L:W = 2.4:3.3, surface finely granulate, with scattered small punctures and associated hairs; notauli absent; axillar crenulae present; surface of scutellum finely granulate; propodeal lamellae blunt; fore wings L:W = 8.5:3.0, without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; stigmal vein long, postmarginal vein short, about 0.3 length of stigmal vein, basal vein pigmented.

Metasoma: L:W = 6.7:4.0; metasomal horn broad at base; T1 (including metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.3:2.0; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Differing from female in the following: antennae 12-segmented; wings reaching well past posterior metasoma; anterior T1 inflected dorsally, striations reaching to anterior margin.

Comments

This species can be separated from other species in the *clubionus*-group by the colour of the body, absence of the notauli, and pigmentation of the basal vein. *C. clubionus* is known from South Australia (Fig. 6.333).

6.5.5.6. ***Ceratobaeus fieldi*** sp. nov. (Figs 6.84, 6.85, 6.334)

Type material:

Holotype: ♀, **Australia, Queensland:** "Wongabel S. F., 6km S Atherton, N. Qld, 9.i-10.ii.1984, Storey & Brown, Malaise trap" (QDPC).

Paratypes: **Queensland:** 5♀, same data as holotype (QDPC); 1♀, 10.53S 142.24E, Bamaga, 5-12.xii.1986, Houston & Sadler (QDPC).

Female

Length: 0.9-1.1 mm; body dark brown, except for scape, funicle segments, legs including coxae and metasoma which are brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum present, with irregular margins; cheeks and lower frons smooth; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina reaching about 0.3 distance to median ocellus; in dorsal view head moderately broad, slightly wider than mesosoma.

Mesosoma: Scutum L:W = 1.1:2.1, surface finely granulate, with scattered small punctures and associated hairs; notauli absent; axillar crenulae present; surface of scutellum finely granulate; propodeal lamellae blunt; fore wings L:W = 6.2:2.2 without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; stigmal vein long, postmarginal vein about 0.5 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 4.4:1.9; metasomal horn broad at base; T1 (including metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.8:1.5; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *clubionus*-group by the colour of the body, the eyes appearing hairless, the absence of the notauli, the length of the postmarginal vein, the spectral basal vein, and shape of the propodeal lamellae. I have much pleasure in naming it after Dr. Scott Field, Hebrew University of Jerusalem, Israel. *C. fieldi* is known only from north Queensland (Fig. 6.334).

6.5.5.7. ***Ceratobaeus fionae*** sp. nov. (Figs 6.86, 6.87, 6.284, 6.335)

Type material:

Holotype: ♀, **Australia, Queensland:** "11.45S 142.35E, Heathlands QLD, 18.viii-ix.1992, flight intercept trap, P. Zborowski & L. Miller" (ANIC).

Female

Length: 1.3 mm; body brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum present, with irregular margins; cheeks and lower frons smooth; eyes with long hairs; frontal carina rudimentary; in dorsal view head moderately broad, slightly wider than mesosoma.

Mesosoma: Scutum L:W = 1.7:2.9, surface finely granulate, with scattered small punctures and associated hairs; notauli absent; axillar crenulae present; surface of scutellum finely granulate; propodeal lamellae blunt; fore wings L:W = 7.1:2.4, without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing rudimentary, not reaching beyond anterior margin; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 6.6:3.0; metasomal horn broad at base; T1 (including metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.0:2.5; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *clubionus*-group by the colour of the body, the eyes with long hairs, absence of the notauli, the spectral basal vein and the short bristles on the submarginal vein. I have much pleasure in naming it after Ms. Fiona Fisher. *C. fionae* is known only from north Queensland (Fig. 6.335).

6.5.5.8. ***Ceratobaeus flavios*** (Dodd) (Fig 6.336)

Acolus flavios Dodd 1914b: 68; Kieffer 1926: 158, 165.
Ceratobaeus flavios (Dodd); Austin 1981: 84.
Idris flavios (Dodd); Johnson 1992: 408.

Type material:

Holotype: ♀, **Australia, Queensland:** "from shop window, Ayr, N. Q. 6.xi.1912 A.A. Girault" (SAMA).

Female

Length: 1.5 mm; body yellow.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; cheeks and lower frons smooth; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina rudimentary; in dorsal view head moderately broad, slightly wider than mesosoma.

Mesosoma: Scutum L:W = 2.1:3.5, surface finely granulate, with scattered small punctures and associated hairs; notauli absent; axillar crenulae present; surface of scutellum finely granulate; propodeal lamellae blunt; fore wing L:W = 8.0:3.0, without transverse dark bands, marginal fringe absent; bristles on submarginal vein of fore wing rudimentary, not reaching beyond anterior margin; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 6.5:3.4; metasomal horn broad at base; T1 (including metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.0:2.3; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *clubionus*-group by the colour of the body, absence of the speculum, the eyes appearing hairless, absence of the notauli , shape of the propodeal lamellae, and absence of the marginal fringe of the fore wing. *C. flavios* is known only from north Queensland (Fig. 6.336).

6.5.5.9. ***Ceratobaeus gallowayi*** sp. nov. (Figs 6.88, 6.89, 6.337)

Type material:

Holotype: ♀, **Australia, Western Australia:** "W. A.: Bold Park site BP 1, wet pitfalls, 31.57'11S 115.45'50E, 24.ix-18.xi.1993, J. W. Waldock *et al.*" (WAMP).

Female

Length: 0.9 mm; body brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered punctures and associated long hairs; speculum absent; cheeks and lower frons smooth; eyes with long hairs; frontal carina rudimentary; in dorsal view head as wide as mesosoma.

Mesosoma: Scutum L:W = 1.4:2.5, surface finely granulate, with scattered small punctures and associated hairs, these punctures more concentrated in anterior half; notauli absent; axillar crenulae present; surface of scutellum finely granulate; propodeal lamellae blunt; fore wings L:W = 5.1:1.7, without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; stigmal vein long, postmarginal vein short, about 0.3 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 4.2:2.5; metasomal horn broad at base; T1 (including metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.9:1.5; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *clubionus*-group by the colour of the body, the eyes with long hairs, absence of the notauli, the spectral basal vein, and long bristles on the submarginal vein. I have much pleasure in naming it after Dr. Ian Galloway, Department of Primary Industries, Indooroopilly. *C. gallowayi* is known only from Bold Park, Perth in south-western Western Australia (Fig. 6.337).

6.5.5.10. ***Ceratobaeus goobita*** sp. nov. (Figs 6.90, 6.91, 6.338)

Type material:

Holotype: ♀, **Australia, Northern Territory:** "N. T., Baroalba Ck. springs, 19km NEbyE of Mt. Cahill, 16.xi.1972, J. E. Feehan" (ANIC).

Female

Length: 0.8 mm; body yellow.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum present, with irregular margins; cheeks and lower frons smooth; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina rudimentary; in dorsal view head moderately broad, slightly wider than mesosoma.

Mesosoma: Scutum L:W = 1.2:2.0, surface finely granulate, with scattered small punctures and associated hairs; notauli absent; axillar crenulae present; surface of scutellum finely granulate; propodeal lamellae blunt; fore wings L:W = 4.5:1.5, without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing rudimentary, not reaching beyond anterior margin; stigmal vein long, postmarginal vein short, about 0.3 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 3.7:2.2; metasomal horn broad at base; T1 (including metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.5:1.5; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *clubionus*-group by the colour of the body, presence of the speculum, the eyes appearing hairless, absence of the notauli, and shape of the propodeal lamellae. The name 'goobita' is an aboriginal word meaning 'small'. *C. goobita* is known only from Northern Territory (Fig. 6.338).

6.5.5.11. ***Ceratobaeus gorayaran*** sp. nov. (Figs 6.92, 6.339)

Type material:

Holotype: ♀, **Australia, Queensland:** "13.44S 143.20E, QLD, 11km WbyN Bald Hill McIlwaith Ra., 500m, 26.vi-13.vii.1989, I. Naumann, rainforest, Malaise trap/ ethanol" (ANIC).

Paratypes: **Queensland:** 2♀, same data as holotype (ANIC).

Female

Length: 0.7-0.9 mm; body dark brown, except for scape, funicle segments, legs including coxae and posterior T1 (base of metasomal horn) which are yellow.

Head: Upper frons, vertex and occiput finely coriaceous, with scattered minute hairs; speculum absent; cheeks and lower frons smooth; eyes with long hairs; frontal carina rudimentary; in dorsal view head moderately broad, slightly wider than mesosoma.

Mesosoma: Scutum L:W = 1.3:1.8, surface finely reticulate, with scattered small punctures and associated hairs; notauli present, reaching 0.2 the distance to anterior margin of scutum; axillar crenulae absent; surface of scutellum finely reticulate; propodeal lamellae blunt; fore wings L:W = 5.8:2.0, without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; stigmal vein long, postmarginal vein as long as stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 3.4:1.8; metasomal horn broad at base; T1 (including metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.7:1.2; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *clubionus*-group by the eyes with long hairs and presence of the notauli. The name 'gorayaran' is an aboriginal word meaning 'long hairs' referring to long fore wings marginal fringe. *C. gorayaran* is known only from north Queensland (Fig. 6.339).

6.5.5.12. ***Ceratobaeus kaikai*** sp. nov. (Figs 6.93, 6.94, 6.340)

Type material:

Holotype: ♀, **Australia, Queensland:** "Aurukun, N. Qld., 19.iv.1983, D-vac, J. F. Donaldson" (QDPC).

Female

Length: 1.0 mm; body yellow.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; cheeks and lower frons smooth; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina rudimentary; in dorsal view head moderately broad, slightly wider than mesosoma.

Mesosoma: Scutum L:W = 1.5:2.3, surface finely granulate, with scattered small punctures and associated hairs; notauli absent; axillar crenulae present; surface of scutellum finely granulate; propodeal lamellae blunt; fore wings L:W = 6.5:2.0, without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 4.5:2.3; metasomal horn broad at base; T1 (including metasomal horn) and anterior T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.8:1.7; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *clubionus*-group by the colour of the body, absence of the speculum, the eyes appearing hairless, absence of the notauli, shape of the propodeal lamellae and presence of the fore wings marginal fringe. The name 'kaikai' is an aboriginal word meaning 'light' referring to the colour of the body. *C. kaikai* is known only from north Queensland (Fig. 6.340).

6.5.5.13. ***Ceratobaeus mansoori*** sp. nov. (Figs 6.95, 6.96, 6.341)

Type material:

Holotype: ♀, **Australia, South Australia:** "31.21S 138.42E, SA, Oraparinna Ck. Dingly Dell Camp, near Water, 4-10.xi.1987, I. Naumann, J. Cardale, Malaise trap/ ethanol" (ANIC).

Female

Length: 1.2 mm; body yellow.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; cheeks and lower frons smooth; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina rudimentary; in dorsal view head moderately broad, slightly wider than mesosoma.

Mesosoma: Scutum L:W = 1.8:2.7, surface finely granulate, with scattered small punctures and associated hairs; notauli absent; axillar crenulae present; surface of scutellum finely granulate; propodeal lamellae sharply pointed dorsally; fore wings L:W = 6.8:2.2, without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 4.7:3.0; metasomal horn broad at base; T1 (including metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.7:2.0; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *clubionus*-group by the colour of the body, the eyes appearing hairless, and shape of the propodeal lamellae. I have much pleasure in naming it after Dr. Mansoor ul Hassan, University of Agriculture, Faisalabad, Pakistan. *C. mansoori* is known only from South Australia (Fig. 6.341).

6.5.5.14. ***Ceratobaeus marroocutta*** sp. nov. (Figs 6.97, 6.342)

Type material:

Holotype: ♀, **Australia, Queensland:** "Australia: Qld, 20.6km N Toowoomba, 14.iv.1990, J. Heraty, H020 pine/ eucal." (CNCI).

Female

Length: 1.1 mm; body black, except for antennae, legs including coxae and metasoma which are yellow.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; cheeks and lower frons smooth; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina rudimentary; in dorsal view head moderately broad, slightly wider than mesosoma.

Mesosoma: Scutum L:W = 2.0:2.5, surface finely granulate, with scattered small punctures and associated hairs; notauli absent; axillar crenulae present; surface of scutellum finely granulate; propodeal lamellae blunt; fore wings L:W = 7.0:2.2, without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing rudimentary, not reaching beyond anterior margin; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 4.9:2.9; metasomal horn broad at base; T1 (including metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.8:1.7; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *clubionus*-group by the colour of the body and absence of the notauli. The name 'marroocutta' is an aboriginal word meaning 'black head'. *C. marroocutta* is known only from south-eastern Queensland (Fig. 6.342).

6.5.5.15. *Ceratobaeus parvicornutus* Dodd (Figs 6.98, 6.99, 6.343)

Ceratobaeus parvicornutus Dodd, 1914b: 62; Kieffer 1926: 140, 144; Austin 1981a: 85.
Idris parvicornutus; Johnson 1992: 413.

Type material:

Holotype: ♀, **Australia, Queensland:** "On widow, Nelson, N. Q., i.1912, A.A. Girault" (SAMA).

Other specimens examined:

Queensland: 2♀, 12.43S 142.42E, 7km S Batavia Down, 19.vi-22.vii.1992, PZ & E. Nielsen (ANIC); 5♀, 12.43S 142.42E, 7km S Batavia Down, 22.vi-23.viii.1992, PZ & JCC (ANIC); 1♀, 12.39S 142.42E, 4km NE Batavia Down, 22.viii-16.ix.1992, PZ & L. MILLER (ANIC); 1♀, 12.43S 142.42E, 7km S Batavia Down, 22.v-17.vi.1993, PZ & IDN (ANIC); 1♀, 11.39S 142.27E, Cockatoo Ck., 13.vii-12.viii.1993, PZ & J. Balderson (ANIC); 1♀, 13.57S 143.12E, Coen, 16.vii-16.viii.1993, PZ & J. Balderson, (ANIC); 1♀, 11.51S 142.38E, SSE Heathlands, 26.i-1.iii.1992, P. Feehney (ANIC); 1♀, 11.45S 142.35E, Heathlands, 18.ix-21.x.1992, PZ & TW (ANIC); 1♀, 11.45S 142.35E, Heathlands, 21.x-22.xi.1992, PZ & A. Calder (ANIC); 1♀, 11.45S 142.35E, Heathlands, 2.iii-5.iv.1993, PZ (ANIC); 1♀, 11.45S

142.35E, Heathlands, 23.v-18.vi.1993, PZ & IDN (ANIC); 1♀, Julatten, 20-29.x.1987, A. Walford-Huggins (ANIC); 1♀, Julatten, 21-30.xi.1987, A. Walford-Huggins (ANIC); 2♀, Julatten, 30.xi-13.xii.1987, A. Walford-Huggins (ANIC); 1♀, 18.35S 138.03E, Murrays Spring, 8km WbyN Musselbrook Camp, 9-20.v.1995, IDN (ANIC); 3♀, 13.39S 142.40E, 2km N Rokeby, 13.ix-26.x.1993, PZ & D. Rentz (ANIC); 1♀, 13.39S 142.40E, 2km N Rokeby, 15.vii-15.viii.1993, PZ & J. Balderson (ANIC); 3♀, 15.39S 144.31E, Split Rock, 24.viii-21.ix.1992, PZ & L. MILLER (ANIC).

Female

Length: 1.2-1.5 mm; body yellow.

Head: Upper frons, vertex and occiput finely punctate, with scattered minute punctures and associated minute hairs; speculum absent; cheeks and lower frons finely striate; eyes with long hairs; frontal carina reaching about 0.6 distance to median ocellus; in dorsal view head moderately broad, slightly wider than mesosoma.

Mesosoma: Scutum L:W = 2.2:3.4, surface finely punctate, with scattered small punctures and associated hairs; notauli appearing absent under light microscope but visible under SEM; axillar crenulae absent; surface of scutellum finely punctate; propodeal lamellae sharply pointed dorsally; fore wings L:W = 8.0:2.7, without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; stigmal vein long, postmarginal vein short, about 0.3 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 6.1:3.8; metasomal horn slender, surface granulate except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.9:2.5; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *clubionus*-group by the colour of the body, the eyes with long hairs, absence of the notauli and shape of the propodeal lamellae. *C. parvicornutus* is known only from north Queensland (Fig. 6.343).

6.5.5.16. ***Ceratobaeus weemayourula*** sp. nov. (Figs 6.100, 6.101, 6.300, 6.344)

Type material:

Holotype: ♀, **Papua New Guinea:** "Papua New Guinea: Awar, Village st. 1228, 6.vi.1982, P. Grootaert" (CNCI).

Female

Length: 1.0-1.4 mm; body brown, except for scape, funicle segments, legs including coxae, T1 (including metasomal horn) and middle of T3 which are yellow.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum present, with irregular margins; cheeks and lower frons smooth; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina rudimentary; in dorsal view head moderately broad, slightly wider than mesosoma.

Mesosoma: Scutum L:W = 1.7:2.5, surface finely granulate, with scattered small punctures and associated hairs; notauli absent; axillar crenulae present; surface of scutellum finely granulate; propodeal lamellae blunt; fore wings L:W = 6.5:2.1, without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 6.1:2.6; metasomal horn broad at base; T1 (including metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.1:2.0; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *clubionus*-group by the colour of the body, eyes appearing hairless, absence of the notauli, shape of the propodeal lamellae, length of the postmarginal vein, and the spectral basal vein . The name 'weemayourula' is an aboriginal word meaning 'small horn'. *C. weemayourula* is known only from Papua New Guinea (Fig. 6.344).

6.5.6. The *cuspicornutus*-group

Diagnosis

Head in anterior view subtriangular in shape; speculum absent; cheek and lower frons smooth; eyes normal in size and appearing hairless (minute hairs present and visible only under SEM); frontal carina rudimentary; lateral ocelli continuous with margin of eyes or distance from eyes < 1OD; antennal clava compact, segments appearing fused, with 4 funicle segments; first funicle segment < 2.0 x as long as wide; in dorsal view head moderately broad, slightly wider than mesosoma; notauli absent; axillar crenulae present; humeral sulcus smooth; scutum not indented; posterior margin of scutellum indented medially, smooth; propodeal lamellae blunt; wings fully developed; submarginal, marginal and stigmal veins tubular; basal vein pigmented; fore wings without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; metasomal horn slender, reaching posterior margin of scutellum, curved forward, apex narrowly rounded, same colour as or darker than rest of metasoma; metasoma < 3.0 x as long as wide, same colour as head and mesosoma.

Comments

The major distinguishing characters of this species-group are the basal vein pigmented, the metasomal horn curved forward, the apex narrowly rounded and the metasoma < 3.0 x as long as wide. This group contains two species, *C. ayeshae* sp. nov. and *C. cuspicornutus* Austin.

6.5.6.1. *Key to females of the* cuspicornutus*-group*

1. Scutellum with a groove, 0.1 x as long as wide (Fig. 6.105) .... *C. cuspicornutus* Austin
   Scutellum without a groove, 0.3 x as long as wide (Fig. 6.103) ..... *C. ayeshae* sp. nov.

6.5.6.2. *Ceratobaeus ayeshae* sp. nov. (Figs 6.102 - 6.104, 6.345)

Type material:

Holotype: ♀, **Australia, South Australia:** "34.19S 139.30E, S.A., Brookfield Cons. Pk., 4-20 Feb. 1992, J. Stelman, S. Williams, Site 1 Malaise trap" (ANIC).

Paratypes: **Queensland:** 1♀, 26.40S 150.19E, 13km E Miles, 8.x.1984, IDN (ANIC); 1♀, Brisbane, no date, A.P. Dodd (ANIC); **Tasmania:** 1♀, 41.58S 145.28E, Ewart Ck., 16.i-2.ii.1983, IDN & JCC (ANIC); 1♀, 40.58S 148.01E, 1km SSE Gladstone, 6.ii.1983, IDN & JCC (ANIC).

Female

Length: 1.3-1.6 mm; body dark brown to black, except for antennae and legs including coxae which are brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs.

Mesosoma: Scutum L:W = 1.8:2.3, surface finely granulate, with scattered small punctures and associated hairs; scutellum without a groove, 0.3 x as long as wide, surface finely granulate; fore wings L:W = 7.5:2.3; stigmal vein long, postmarginal vein short, about 0.3 length of stigmal vein.

Metasoma: L:W = 7.0:2.6; surface of metasomal horn smooth except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.3:2.5; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

I have much pleasure in naming it after Ms. Ayesha Ajmal. *C. ayeshae* is known from south-eastern Australia including Tasmania (Fig. 6.345).

6.5.6.3. ***Ceratobaeus cuspicornutus*** Austin (Figs 6.105, 6.285, 6.346)

Ceratobaeus cuspicornutus Austin, 1983: 151; Austin 1984a: 25.
Idris cuspicornutus; Johnson 1992: 406.

Type material:

Holotype: ♀, **Australia, South Australia:** "5km south of Mylor, S. Aust. 18.ii.79 A.D. Austin" (ANIC).

Paratypes: **South Australia:** 2♀, 1♂, same data as holotype (QDPC).

Other specimens examined:

South Australia: 6♀, 1♂, 5km S Mylor, 18.ii.79, A. D. Austin (QDPC); **Tasmania:** 1♀, 41.21S 147.22E, Barrow Ck., 8km NE Nunamara, 12.i-6.ii.1983, IDN & JCC (ANIC).

Female

Length: 1.5-1.8 mm; body black, except for antennae, legs including coxae and metasoma (excluding metasomal horn) which are brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs.

Mesosoma: Scutum L:W = 1.8:2.8, surface finely granulate, with scattered small punctures and associated hairs; scutellum with a groove, 0.1 x as long as wide, surface finely granulate; fore wings L:W = 8.8:2.6; stigmal vein long, postmarginal vein short, about 0.3 length of stigmal vein.

Metasoma: L:W = 11.0:3.4; surface of metasomal horn smooth except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.5:3.0; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Differing from female in the following: antennae 12-segmented; posterior mesosoma not excavated but flat; wings reaching well past posterior metasoma.

Comments

C. cuspicornutus is known from Tasmania and South Australia (Fig. 6.346).

6.5.7. The *elongatus*-group

Diagnosis

Head in anterior view subtriangular to elongate and broad in buccal region; speculum sometimes present; cheek and lower frons smooth; eyes normal in size and with rudimentary or long hairs; frontal carina short, never reaching more than 0.3 distance to median ocellus; lateral ocelli continuous with margin of eyes or distance from eyes < 1OD; antennal clava compact, segments appearing fused, with 4 funicle segments; first funicle segment < 2.0 x as long as wide; in dorsal view head moderately broad, slightly wider than mesosoma; notauli absent; axillar crenulae present or absent; humeral sulcus smooth or crenulate; scutum sometimes indented; posterior margin of scutellum indented medially, smooth; propodeal lamellae blunt; wings fully developed; submarginal, marginal and stigmal veins tubular; basal vein faint and spectral or pigmented; fore wings without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; metasomal horn slender, reaching posterior margin of scutellum, curved forward, narrow or flattened apex, same colour as rest of metasoma; metasoma > 3.4 x as long as wide, same colour as or lighter than head and mesosoma.

Comments

The major distinguishing characters of this species-group are the metasomal horn curved forward and the metasoma > 3.4 x as long as wide. This group contains five species, *C. elongatus* Dodd, *C. gwenae* sp. nov., *C. phallocerus* sp. nov., *C. rieki* Austin and *C. wattora* sp. nov.

6.5.7.1. *Key to females of the* elongatus-*group*

1. Apex of metasomal horn narrowly rounded (Fig. 6.115) 2
   Apex of metasomal horn flattened (Fig. 6.112) 3

2. Upper frons, vertex and occiput coriaceous (Fig. 6.114); basal vein pigmented .... *C. wattora* sp. nov.
   Upper frons, vertex and occiput granulate; basal vein faint and spectral .... *C. rieki* Austin

3. Scutum indented(Fig. 6.107) ; head in anterior view subtriangular (Fig. 6.106) 4
   Scutum not indented (Fig. 6.109); head in anterior view elongate and broad in buccal region (Fig. 6.108) .... *C. gwenae* sp. nov.

4. Head, mesosoma and metasomal horn black, metasoma dark brown .... *C. phallocerus* sp. nov.
   Head, mesosoma and metasomal horn brown, metasoma yellow to light brown ....

6.5.7.2. ***Ceratobaeus elongatus*** Dodd (Figs 6.106, 6.107, 6.347)

Ceratobaeus elongatus Dodd, 1914a: 89; Dodd 1914b: 64, 65; Kieffer 1926: 139, 143; Austin 1981a: 84.

Idris elongatus; Johnson 1992: 407.

Type material:

Holotype: ♀, **Australia, Queensland:** "Sweeping in forest, Nelson, N. Q., 11 August 1913, A.P. Dodd" (SAMA).

Other specimens examined:

Queensland: 1♀, Wongabel S. F., 6km S Atherton, 10.ii-13.iii.1984, no collector (QDPC); 1♀, Kuranda, 2.xii.1982, Boucek (WARI); 1♀, 15.29S 145.16E, Mt. Cook N. P., Cooktown, 11-12.x.1980, JCC (ANIC); 1♀, 15.04S 145.07E, Mt. Webb N. P., 27-30.iv.1981, IDN (ANIC); **Western Australia:** 1♀, 14.49S 125.50E, Mining Camp, Mitchell Plateau, 9-19.v.1983, IDN & JCC (ANIC).

Female

Length: 1.9-2.0 mm; body dark brown, except for scape, funicle segments, legs including coxae and metasoma (excluding metasomal horn) which are yellow to light brown.

Head: In anterior view subtriangular in shape; upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated hairs; speculum absent; eyes with long hair; frontal carina reaching about 0.3 distance to median ocellus.

Mesosoma: Scutum L:W = 1.2:2.6, indented, surface granulate, with scattered small punctures and associated hairs; humeral sulcus smooth; axillar crenulae absent; surface of scutellum granulate; fore wings L:W = 9.0:3.0; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein pigmented.

Metasoma: L:W = 9.0:2.2; apex of metasomal horn flattened, surface smooth except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.5:2.7; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *elongatus*-group by the colour of the body, the head subtriangular in anterior view, the indented scutum, and the flattened apex of the metasomal horn. *C. elongatus* is known from north Queensland and north-western Western Australia (Fig. 6.347).

6.5.7.3. ***Ceratobaeus gwenae*** sp. nov. (Figs 6.108, 6.109, 6.348)

Type material:

Holotype: ♀, **Australia, Queensland:** "Conway Range, nr. Proserpine, QLD., 2.xii.76, Boucek" (ANIC).

Paratype: **Queensland:** 1♀, Pebbly Beach, Cook Highway, 12.vii.1976, J.F. Donaldson" (QDPC).

Female

Length: 1.8-1.9 mm; head and mesosoma black, scape, funicle segments and legs including coxae yellow, metasoma dark brown.

Head: In anterior view elongate and broad in buccal region; upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum present, with irregular margins; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina rudimentary.

Mesosoma: Scutum L:W = 1.4:3.1, not indented, surface finely granulate, with scattered small punctures and associated hairs; humeral sulcus crenulate; axillar crenulae present; surface of scutellum finely granulate; fore wings L:W = 9.3:2.8; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 9.6:2.7; apex of metasomal horn flattened, surface smooth except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.9:2.6; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *elongatus*-group by the head subtriangular in anterior view, the normal scutum, and the flattened apex of the metasomal horn. I have much pleasure in naming it after Ms. Gwen Mayo, The University of Adelaide, South Australia. *C. gwenae* is known only from north Queensland (Fig. 6.348).

6.5.7.5. ***Ceratobaeus phallocerus*** sp. nov. (Figs 6.110 - 6.112, 6.349)

Type material:

Holotype: ♀, **Papua New Guinea:** "PAPUA NEW GUINEA: Morobe Prov., Wau Mt., Kaindi, 1150-2300, 16-26.x.1992, Y. Basset" (CNCI).

Paratypes: **Papua New Guinea:** 2♀, Morobe Prov., Wau Mt., Kaindi, 1150-2300, 28.vii-7.viii.1992, Y. Basset (CNCI); 1♀, Morobe Prov., Wau Mt., Kaindi, 1150-2300, 7-17.viii.1992, Y. Basset (CNCI); 1♀, Morobe Prov., Wau Mt., Kaindi, 1150-2300, 20.i-1.ii.1993, Y. Basset (CNCI); 1♀, Morobe Prov., Wau Mt., Kaindi, 1150-2300, 1-14.v.1993, Y. Basset (CNCI).

Female

Length: 1.9-2.3 mm; head and mesosoma black, antennae, legs including coxae and posterior T1 (base of metasomal horn) yellow, metasomal horn dark brown, metasoma dark brown with yellow shading on border of all terga.

Head: In anterior view subtriangular in shape; upper frons, vertex and occiput finely granulate, with scattered punctures and associated long hairs; speculum absent; eyes with long hair; frontal carina rudimentary.

Mesosoma: Scutum L:W = 0.3:3.2, indented, surface finely granulate, with scattered small punctures and associated hairs; humeral sulcus smooth; axillar crenulae absent; surface of scutellum finely granulate; fore wings L:W = 10.0:2.8; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein pigmented.

Metasoma: L:W = 11.2:2.9; apex of metasomal horn flattened, surface smooth except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 2.3:2.4; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *elongatus*-group by the colour of the body, the head subtriangular in anterior view, the indented scutum, and the flattened apex of the metasomal horn. The name 'phallocerus' is a Greek word meaning 'penis-shape horn'. *C. phallocerus* is known only from Papua New Guinea (Fig. 6.349).

6.5.7.5. ***Ceratobaeus rieki*** Austin (Figs 6.113, 6.299, 6.350)

Ceratobaeus rieki Austin, 1984a: 32.
Idris rieki; Johnson 1992: 414.

Type material:

Holotype: ♀, **Australia, New South Wales:** "10 ml E. Trangie, 20.x.1949, E.F. Riek" (ANIC).

Female

Length: 2.1-2.3 mm; head and mesosoma black, antennae and metasoma dark brown, legs including coxae light brown.

Head: In anterior view subtriangular in shape; upper frons, vertex and occiput granulate with long hairs; speculum present, with irregular margins; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina rudimentary.

Mesosoma: Scutum L:W = 1.6:3.2, not indented, surface finely granulate, with scattered small punctures and associated hairs; humeral sulcus smooth; axillar crenulae present; surface of scutellum finely granulate; fore wings L:W = 9.4:3.2; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 18:3.0; metasomal horn narrow apically, surface with faint longitudinal striations; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.8:2.4; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *elongatus*-group by the sculpturing of the upper frons, the vertex and the occiput, the spectral basal vein, and the narrowly rounded apex of the metasomal horn. *C. rieki* is known only from Trangie in New South Wales (Fig. 6.350).

6.5.7.6. ***Ceratobaeus wattora*** sp. nov. (Figs 6.114, 6.115, 6.351)

Type material:

Holotype: ♀, **New Caledonia:** "NEW CALEDONIA, Mt Mou summit, 24 May 1984, G. Monteith & D. Cook, Q.M. BERLEASATE No. 660, 22.04S 166.21E, Rainforest, 1200 m Moss on trees & rocks" (QDPC).

Female

Length: 1.9-2.1 mm; head and mesosoma black, antennae and metasoma dark brown, legs including coxae light brown.

Head: In anterior view subtriangular in shape; upper frons, vertex and occiput coriaceous with long hairs; speculum present, with irregular margins; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina rudimentary.

Mesosoma: Scutum L:W = 1.4:2.4, not indented, surface finely granulate, with scattered small punctures and associated hairs; humeral sulcus smooth; axillar crenulae present; surface of scutellum finely granulate; fore wings L:W = 9.0:2.6; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein pigmented.

Metasoma: L:W = 11.0:2.4; metasomal horn narrow apically, surface with faint longitudinal striations; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.8:2.8; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *elongatus*-group by the sculpturing of the upper frons, the vertex and the occiput, pigmentation of the basal vein, and the narrowly rounded apex of the metasomal horn. The name 'wattora' is an aboriginal word meaning 'long'. *C. wattora* is known only from New Caledonia (Fig. 6.351).

6.5.8. The *fasciativentris*-group

Diagnosis

Head in anterior view subtriangular in shape; speculum sometimes present; cheek and lower frons smooth or striate; eyes normal in size and appearing hairless (minute hairs present and visible only under SEM); frontal carina short to moderately long but never reaching more than 0.7 distance to median ocellus; lateral ocelli continuous with margin of eyes or distance from eyes < 1OD; antennal clava compact, segments appearing fused, with 4 funicle segments; first funicle segment < 2.0 x as long as wide; in dorsal view head moderately broad, slightly wider than mesosoma; notauli absent or present; axillar crenulae present; humeral sulcus smooth or crenulate; scutum not indented; posterior margin of scutellum rounded, with single row of foveae; propodeal lamellae sharply pointed dorsally; wings fully developed; submarginal, marginal and stigmal veins tubular; basal vein faint and spectral; fore wings with or without transverse dark bands and marginal fringe present or absent; bristles on submarginal vein of fore wing rudimentary to long; metasomal horn reaching posterior margin of scutellum, not curved forward, apex narrowly rounded, same colour as rest of metasoma; metasoma < 3.0 x as long as wide, same colour as head and mesosoma.

Comments

The major distinguishing characters of this species-group are the eyes appearing hairless, the posterior margin of the scutellum rounded, the propodeal lamellae sharply pointed dorsally, and the metasomal horn not curved forward. This group contains 10 species, *C. balli* sp. nov., *C. bouceki* sp. nov., *C. fasciativentris* Dodd, *C. gullanae* sp. nov., *C. hardyi* sp. nov., *C. jenningsi* sp. nov., *C. moonae* sp. nov., *C. rabiae* sp. nov., *C. undeneya* sp. nov. and *C. yousufi* sp. nov.

6.5.8.1. *Key to females of the* fasciativentris*-group*

1. Fore wings marginal fringe absent (as for Fig. 6.290) .... *C. fasciativentris* Dodd
   Fore wings marginal fringe present (Fig. 6.286) 2

2. Paired dark brown patches on antero-lateral corners of T3 and T4 (Fig. 6.301) ....
   .... *C. bouceki* sp. nov.

No such patches on metasoma 3

3. Body colour yellow 4
Body colour brown to black 5

4. In lateral view metasomal horn almost square in shape (Fig. 6.122) ....
.... *C. hardyi* sp. nov.
In lateral view metasomal horn broadly rounded dorsally (Fig. 6.129) ....
.... *C. undeneya* sp. nov.

5. Notauli present (Fig. 6.125); T3 striate .... *C. moonae* sp. nov.
Notauli absent (Fig. 6.126); T3 without striation 6

6. Metasomal horn with longitudinal striations (Fig. 6.120) 7
Metasomal horn without longitudinal striations (Fig. 6.127) 8

7. Fore wings with a transverse dark band (Fig. 6.286) .... *C. gullanae* sp. nov.
Fore wings without transverse dark bands .... *C. balli* sp. nov.

8. Metasomal horn broadly rounded (Fig. 6.131) .... *C. yousufi* sp. nov.
Metasomal horn long and slender (Fig. 6.127) 9

9. In lateral view metasomal horn square, surface of apex smooth (Fig. 6.124) ....
.... *C. jenningsi* sp. nov.
In lateral view metasomal horn elongate, with uniform sculpturing (Fig. 6.127) ....
.... *C. rabiae* sp. nov.

6.5.8.2. ***Ceratobaeus balli*** sp. nov. (Figs 6.116, 6.117, 6.352)

Type material:

Holotype: ♀, **Solomon Islands:** "SOLOMON IS: New Gorgia, Munda, 0-100m, xi.1980, N.H.L. Krauss" (CNCI).

Female

Length: 1.3 mm; body brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; cheeks and lower frons smooth; frontal carina reaching about 0.3 distance to median ocellus.

Mesosoma: Scutum L:W = 1.7:2.7, surface finely granulate, with scattered small punctures and associated hairs; notauli absent; humeral sulcus crenulate; surface of scutellum finely granulate; fore wings L:W = 7.0:2.3, without transverse dark bands; marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; stigmal vein long, postmarginal vein about 0.5 length of stigmal vein.

Metasoma: L:W = 6.2:2.7; in lateral view metasomal horn elongate; T1 (including metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.3:2.0; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *fasciativentris*-group by the colour of the body, absence of the notauli, presence of the fore wings marginal fringe, and sculpturing of the metasomal horn. I have much pleasure in naming it after Mr. Steve Ball, The University of Adelaide, South Australia. *C. balli* is known only from Solomon Island (Fig. 6.352).

6.5.8.3. ***Ceratobaeus bouceki*** sp. nov. (Figs 6.118, 6.301, 6.353)

Type material:

Holotype: ♀, **Papua New Guinea:** "PAPUA N. GUINEA Mt Hagen, 25km E, 19.xii.82, Boucek" (ANIC).

Female

Length: 1.7 mm; body yellow with paired dark brown patches on antero-lateral corners of T3 and T4.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; cheeks and lower frons finely striate; frontal carina reaching about 0.6 distance to median ocellus.

Mesosoma: Scutum L:W = 2.8:4.0, surface finely granulate, with scattered small punctures and associated hairs; notauli absent; humeral sulcus crenulate; surface of scutellum finely granulate; fore wings L:W = 11.2:3.8, with two transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein.

Metasoma: L:W = 9.0:3.7; in lateral view metasomal horn elongate; T1 (including metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.3:3.2; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *fasciativentris*-group by the presence of the fore wings marginal fringe and shading of the metasoma. I have much pleasure in naming it after the collector, Dr. Zdenek Boucek, The Natural History Museum, London, U.K. *C. bouceki* is known only from Papua New Guinea (Fig. 6.353).

6.5.8.4. *Ceratobaeus fasciativentris* Dodd (Fig 6.354)

Ceratobaeus fasciativentris Dodd, 1914b: 63, 66; Kieffer 1926: 140, 143; Austin 1981a: 84.
Idris fasciativentris; Johnson 1992: 407.

Type material:

Holotype: ♀, **Australia, Queensland:** "On window, Proserpine, N. Q., 4.xi.1912, A. A. Girault" (SAMA).

Female

Length: 1.6 mm; body yellow.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; cheeks and lower frons smooth; frontal carina rudimentary.

Mesosoma: Scutum L:W = 2.5:3.6, surface finely granulate, with scattered small punctures and associated hairs; notauli absent; humeral sulcus smooth; surface of scutellum finely granulate; fore wing L:W = 9.0:2.7, without transverse dark bands, marginal fringe absent; bristles on submarginal vein of fore wing rudimentary, not reaching beyond anterior margin; stigmal vein long, postmarginal vein short, about 0.3 length of stigmal vein.

Metasoma: L:W = 7.5:4.1; in lateral view metasomal horn elongate, surface smooth except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.3:2.7; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *fasciativentris*-group by the absence of the fore wings marginal fringe. *C. fasciativentris* is known only from north Queensland (Fig. 6.354).

6.5.8.5. ***Ceratobaeus gullanae*** sp. nov. (Figs 6.119, 6.120, 6.286, 6.355)

Type material:

Holotype: ♀, **Papua New Guinea:** "PAPUA NEW GUINEA, Laloki, CSIRO Screw Worm Lab., iv.1987, S. Bakker, flight intercept trap" (ANIC).

Female

Length: 1.3 mm; body brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum present, with irregular margins; cheeks and lower frons finely striate; frontal carina reaching about 0.3 distance to median ocellus.

Mesosoma: Scutum L:W = 1.7:2.9, surface finely granulate, with scattered small punctures and associated hairs; notauli absent; humeral sulcus crenulate; surface of scutellum finely granulate; fore wing L:W = 7.0:2.2, with a transverse dark band, marginal fringe present; bristles on submarginal vein of fore wing rudimentary, not reaching beyond anterior margin; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein.

Metasoma: L:W = 5.7:3.2; in lateral view metasomal horn elongate; T1 (including metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.8:2.3; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *fasciativentris*-group by the colour of the body, absence of the notauli, the fore wings with a transverse dark band, and sculpturing of the metasomal horn. I have much pleasure in naming it after Dr. Penny Gullan, Australian National University, Canberra. *C. gullanae* is known only from Papua New Guinea (Fig. 6.355).

6.5.8.6. ***Ceratobaeus hardyi*** sp. nov. (Figs 6.121, 6.122, 6.356)

Type material:

Holotype: ♀, **Australia, Queensland:** "12.41S 142.41E, QLD, 5km S Batavia Downs, 16.ix-24.x.1992, flight intercept trap, P. Zborowski & T. Weir (ANIC).

Paratypes: **Queensland:** 1♀, 12.40S 142.39E, 3km W Batavia Downs, 24.x-23.xi.1992, PZ & A. Calder (ANIC); 1♀, Gogango, 4.i.1931, A.P. Dodd (ANIC); 1♀, 11.45S 142.35E, Heathlands, 26.i-29.ii.1992, P. Feehney (ANIC); 1♀, Julatten, 26.xii.1986, R. Storey (CNCI); 1♀, Tolga, 12-24.xii.1986, J.D. Brown (CNCI); 1♀, Wongabel S. F., 6km S Atherton, 9.i-19.ii.1984, Storey & Brown (QDPC); 1♀, Wongabel S. F., 6km S Atherton, 10.xi-1.xii.1984, Storey & Brown (QDPC).

Female

Length: 1.0-1.4 mm; body yellow to light brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; cheeks and lower frons smooth; frontal carina reaching about 0.3 distance to median ocellus.

Mesosoma: Scutum L:W = 1.7:2.6, surface finely granulate, with scattered small punctures and associated hairs; notauli absent; humeral sulcus not crenulate; surface of scutellum finely granulate; fore wings L:W = 7.0:2.5, without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; stigmal vein long, postmarginal vein short, about 0.3 length of stigmal vein.

Metasoma: L:W = 6.8:3.0; in lateral view metasomal horn almost square in shape; surface granulate-striate except for few basal longitudinal striations; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.0:2.5; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *fasciativentris*-group by the colour of the body, presence of the fore wings marginal fringe, and shape of the metasomal horn. I have much pleasure in naming it after Mr. Jonathan Hardy, CSIRO, Adelaide. *C. hardyi* is known only from north Queensland (Fig. 6.356).

6.5.8.7. ***Ceratobaeus jenningsi*** sp. nov. (Figs 6.123, 6.124, 6.357)

Type material:

Holotype: ♀, **Australia, South Australia:** "S. Aust: Ferries Mcdonald C. P., M/T, 7-21.i.1996, J.T. Jennings" (ANIC).

Paratypes: **South Australia:** 4♀, same data as holotype (ANIC, WARI); 4♀, Aldinga scrub, 40km SSW Adelaide, 27.iii-9.iv.1987, P. Dangerfield (WARI); 10♀, Mt. Barker, xii.1993-i.1994, A. Austin (WARI); 1♀, Mt. Barker nr. summit, xii.1985, A.D. Austin (WARI); 1♀, Montacute via Adelaide, ix-x.1985, A.D. Austin (WARI); 3♀, 32.48S 138.10E, Mt. Remarkable nr. Mambray Ck. (Rangers Stn), 6-17.ii.1989, Austin & Dangerfield (WARI); 1♀, 5km S Mylor, 19.x.1980, A.D. Austin (WARI); **Queensland:** 1♀, Kuranda State Forest, 3km N on Black Mt. Rd., 21.iv-3.v.1990, J. Heraty (CNCI); **Western Australia:** 1♀, Walyunga N. P., 31.35S 116.15E, 24.xii.1986, J.S. Noyes (WARI).

Female

Length: 1.1-1.2 mm; body black, except metasoma which is dark brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; cheeks and lower frons smooth; frontal carina reaching about 0.6 distance to median ocellus.

Mesosoma: Scutum L:W = 1.6:2.4, surface finely granulate, with scattered small punctures and associated hairs; notauli absent; humeral sulcus not crenulate; surface of scutellum finely granulate; fore wings L:W = 6.5:2.4, without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein.

Metasoma: L:W = 6.1:2.5; in lateral view metasomal horn almost square in shape, surface granulate except for smooth apically, few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.0:2.1; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *fasciativentris*-group by the colour of the body, presence of the fore wings marginal fringe, and shape and sculpturing of the metasomal horn. I have much pleasure in naming it after the collector, Mr. John Jennings, The University of Adelaide, South Australia. *C. jenningsi* is broadly distributed across mainland Australia (Fig. 6.357).

6.5.8.8. ***Ceratobaeus moonae*** sp. nov. (Figs 6.125, 6.358)

Type material:

Holotype: ♀, **Australia, Queensland:** "Wongabel S. F., 6km S Atherton, N. Qld, 9.i-10.ii.1984, Storey & Brown, Malaise trap" (QDPC).

Paratype: **Queensland:** 1♀, Mt. Glorious, 19-26.xi.1979, no collector (QDPC).

Female

Length: 0.9-1.0 mm; body dark brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; cheeks and lower frons smooth; frontal carina rudimentary.

Mesosoma: Scutum L:W = 1.6:2.3, surface finely granulate, with scattered small punctures and associated hairs; notauli present, reaching 0.2 the distance to anterior margin of scutum; humeral sulcus not crenulate; surface of scutellum finely granulate; fore wings L:W = 6.4:1.9, without transverse dark bands; marginal fringe present, bristles on submarginal vein of fore wing long, reaching beyond anterior margin; stigmal vein long, postmarginal vein short, about 0.3 length of stigmal vein.

Metasoma: L:W = 4.5:2.5; in lateral view metasomal horn elongate; T1 (including metasomal horn), T2 and T3 longitudinally striate, with fine granulate sculpturing; medial

length of T2:T3 = 0.9:1.7; T4-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *fasciativentris*-group by the colour of the body, presence of the notauli, presence of the fore wings marginal fringe, and sculpturing of T3. I have much pleasure in naming it after Ms. Moona Saeed. *C. moonae* is known only from Queensland (Fig. 6.358).

6.5.8.9. ***Ceratobaeus rabiae*** sp. nov. (Figs 6.126, 6.127, 6.359)

Type material:

Holotype: ♀, **Australia, Australian Capital Territory:** "35.22S 148.50E, ACT, 850m, Blundells Ck., 3km E of Piccadilly Circus, i.1985, Lawrence, Weir, Johnson, flight intercept/ window trough trap" (ANIC).

Paratypes: **Australian Capital Territory:** 6♀, same data as holotype (ANIC, WARI); 1♀, 35.22S 148.50E, Blundells Ck. 3km E Piccadilly Circus, 850m, ii.1985, JL, TW & MLJ (ANIC); 2♀, 35.22S 148.50E, Blundells Ck. 3km E Piccadilly Circus, 850m, ii.1985, JL, TW & MLJ (ANIC); 1♀, 35.22S 148.50E, Blundells Ck., ii.1987, D.H. Colless (ANIC); 19♀, 2km SW Bulls Head Brindabella Range, 3.iv.1983, M.S. Harvey (ANIC); 1♀, 2km N Piccadilly Circus, 1250m, 19.i.1970, C.G. Brooks (ANIC); 3♀, 35.22S 148.48E, Picadilly Circus, 1240m, ii.1984, JL, TW & MLJ (ANIC); 2♀, 35.22S 148.48E, Picadilly Circus, 1240m, iiii.1984, JL, TW & MLJ (ANIC); 1♀, 35.22S 148.48E, Picadilly Circus, 1240m, iv.1984, JL, TW & MLJ (ANIC); 1♀, 35.22S 148.48E, Picadilly Circus, 1240m, vi.1984, JL, TW & MLJ (ANIC); 3♀, 35.19S 148.51E, Wombat Ck., 6km NE Piccadilly Circus, 750m, ii.1984, TW, JL & MLJ (ANIC); 1♀, 35.19S 148.51E, Wombat Ck., 6km NE Piccadilly Circus, 750m, iii.1984, TW, JL & MLJ (ANIC); 2♀, 35.19S 148.51E, Wombat Ck., 6km NE Piccadilly Circus, 750m, iv.1984, TW, JL & MLJ (ANIC); 1♀, 35.19S 148.51E, Wombat Ck., 6km NE Piccadilly Circus, 750m, 15.xi.1984, TW, JL & MLJ (ANIC); 1♀, 35.19S 148.51E, Wombat Ck., 6km NE Piccadilly Circus, 750m, xii.1984, TW, JL & MLJ (ANIC); 3♀, 35.19S 148.51E, Wombat Ck., 6km NE Piccadilly Circus, 750m, iii.1985, TW, JL & MLJ (ANIC); 1♀, 35.19S 148.51E, Wombat Ck., 6km NE Piccadilly Circus, 750m, iv.1985, TW, JL & MLJ (ANIC); **Victoria:** 33♀, Mt. Buffalo N. P., 900m, 18-19.i.1980, A. Newton & M. Thayer (CNCI); 1♀, Mitcham, xi.1982, C. Lai (CNCI).

Female

Length: 1.2-1.3 mm; body dark brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; cheeks and lower frons smooth; frontal carina reaching about 0.7 distance to median ocellus.

Mesosoma: Scutum L:W = 1.9:2.9, surface finely granulate, with scattered small punctures and associated hairs; notauli absent; humeral sulcus crenulate; surface of scutellum finely granulate; fore wings L:W = 7.5:2.4, without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein.

Metasoma: L:W = 6.0:3.0; in lateral view metasomal horn elongate, surface granulate except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.9:2.6; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *fasciativentris*-group by the colour of the body, absence of the notauli, presence of the fore wings marginal fringe, and shape and sculpturing of the metasomal horn. I have much pleasure in naming it after Ms. Rabia Farid. *C. rabiae* is known from south-eastern Australia (Fig. 6.359).

6.5.8.10. ***Ceratobaeus undeneya*** sp. nov. (Figs 6.128, 6.129, 6.360)

Type material:

Holotype: ♀, **Australia, Queensland:** "Julattan, N Qld., 29.x-21.xi.1987, A. Walford-Huggins, edge of forest along creek, intercept trap" (ANIC).

Paratypes: **Queensland:** 4♀, same data as holotype (ANIC, WARI); 1♀, Julattan, 10-29.ix.1987, A. Walford-Huggins (ANIC); 1♀, 12.41S 142.41E, 5km S Batavia Downs, 18.vi-22.vii.1992, PZ & E. Nielsen (ANIC); 1♀, 12.40S 142.39E, 3km W Batavia Downs, 16.ix-24.x.1992, PZ & TW (ANIC); 4♀, Indooroopilly, 17-21.xii.1984, no collector (QDPC); 1♀, Kuranda, 1000m, 21.ii.1984, L. Masner (CNCI); 1♀, Windsor Tableland via Mt. Carbine, 10.xi-26.xii.1983, Storey & Titmarsh (QDPC); 1♀, Mt. Glorious N. P., 630m, 28.ii.1984, L. Masner (CNCI); 1♀, Mt. Ossa nr. Mackay, 28.xi.1976, Boucek (BMNH); 3♀, 15.04S 145.07E, Mt. Webb N. P., 27-30.iv.1981, IDN (ANIC); 1♀, 15.39S 144.31E, Split Rock, 26.v-26.vii.1993, PZ & IDN (ANIC); 1♀, Rex Range Lookout, via Julatten, 9.xi-2.xii.1981, no collector (QDPC); **New South Wales:** 1♀, 30.29S 152.25E, Point Lookout, New England N. P., 12.ii.1984, IDN (ANIC); 1♀, Shoalhaven R., 30km W Nowra, 25.xii.1986, G.A. Holloway (ANIC); **South Australia:** 1♀, Adelaide, iv-vi.1986, G. Allen (WARI); **Western Australia:** 1♀, 14.52S 125.50E, 4km SW Mining Camp Plateau, 2-6.vi.1988, IDN (ANIC).

Female

Length: 1.0-1.2 mm; body yellow.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; cheeks and lower frons smooth; frontal carina reaching about 0.6 distance to median ocellus.

Mesosoma: Scutum L:W = 1.6:2.5, surface finely granulate, with scattered small punctures and associated hairs; notauli absent; humeral sulcus not crenulate; surface of scutellum finely granulate; fore wings L:W = 6.4:2.3, without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; stigmal vein long, postmarginal vein short, about 0.3 length of stigmal vein.

Metasoma: L:W = 5.5:2.7; in lateral view metasomal horn broadly rounded dorsally, surface granulate except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.8:2.0; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *fasciativentris*-group by the colour of the body, presence of the fore wings marginal fringe, and shape of the metasomal horn. The name 'undeneya' is an aboriginal word meaning 'wasp'. *C. undeneya* is broadly distributed across the continent excluding Tasmania (Fig. 6.360).

6.5.8.11. ***Ceratobaeus yousufi*** sp. nov. (Figs 6.130, 6.131, 6.361)

Type material:

Holotype: ♀, **Australia, Australian Capital Territory:** "35.22S 148.48E, Piccadilly Circus, 1240m, ACT, ii.1984, J. Lawrence, T. Weir, M-L. Johnson, coll." (ANIC).

Paratypes: **Australian Capital Territory:** 6♀, same data as holotype (ANIC, WARI); 4♀, 35.22S 148.48E, Piccadilly Circus, 1240m, iii.1984, JL, TW & MLJ (ANIC); 2♀, 35.19S 148.51E, Wombat Ck., 6km NE Piccadilly Circus 750m, iii.1984 TW, JL & MLJ (ANIC); 1♀, 35.19S 148.51E, Wombat Ck., 6km NE Piccadilly Circus 750m, iv.1985 JL, TW & MLJ (ANIC); 1♀, Mt. Ainslie, N. face, 650m, 11.viii.1970 (ANIC); 1♀, Black Mt., 600m, 7-12.iii.1980, A. Newton & M. Thayer (CNCI); **Queensland:** 1♀, 18.36S 138,08E, Musselbrook Camp, 8-21.v.1995, IDN (ANIC); **New South Wales:** 1♀, 30.29S 152.25E, Point Lookout, New England N. P., 12.ii.1984, IDN (ANIC); **South Australia:** 1♀, 31.20S 138.34E, Brachina Gorge, 4-10.xi.1987, IDN & JCC (ANIC); 1♀, 31.21S 138.37E, Oraparinna Ck. Dingly Dell Camp nr. Water, 4-10.xi.1987, IDN & JCC (ANIC); 1♀, 32.44S 138.37E, Orrorro, 11.xi.1987, IDN & JCC (ANIC); 6♀, Mt. Barker, xii.1993-i.1994, A. Austin (WARI).

Female

Length: 1.1-1.2 mm; body brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; cheeks and lower frons finely striate; frontal carina reaching about 0.6 distance to median ocellus.

Mesosoma: Scutum L:W = 1.7:2.6, surface finely granulate, with scattered small punctures and associated hairs; notauli absent; humeral sulcus crenulate; surface of scutellum finely granulate; fore wings L:W = 6.8:2.3 without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein.

Metasoma: L:W = 5.6:3.2; in lateral view metasomal horn broadly rounded, surface granulate except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.0:2.4; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *fasciativentris*-group by the presence of the notauli, presence of the fore wings marginal fringe, and shape of the metasomal horn. I have much pleasure in naming it after Professor Muhammad Yousuf, University of Agriculture, Faisalabad, Pakistan. *C. yousufi* is broadly distributed across the east half of the continent excluding Tasmania (Fig. 6.361).

6.5.9. The *fasciatus*-group

Diagnosis

Head in anterior view subtriangular in shape; speculum sometimes present; cheek and lower frons smooth or striate; eyes normal in size and with rudimentary or long hairs; frontal carina present, reaching at least 0.3 distance to median ocellus; lateral ocelli continuous with margin of eyes or distance from eyes < 1OD; antennal clava compact, segments appearing fused, with 4 funicle segments; first funicle segment < 2.0 x as long as wide; in dorsal view head moderately broad, slightly wider than mesosoma; notauli absent; axillar crenulae present; humeral sulcus smooth or crenulate; scutum sometimes indented; posterior margin of scutellum indented medially, smooth or with single row of foveae; propodeal lamellae blunt; wings fully developed; submarginal, marginal and stigmal veins tubular; basal vein faint and spectral; fore wings with transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; metasomal horn slender, reaching posterior margin of scutellum, curved forward, apex narrowly rounded, same colour as rest of metasoma; metasoma < 3.0 x as long as wide, same colour as head and mesosoma.

Comments

The major distinguishing characters of this species-group are the frontal carina present, reaching at least 0.3 distance to median ocellus, the fore wings with transverse dark bands, and the metasomal horn curved forward. This group contains five species, *C. doddi* sp. nov, *C. fasciatus* Dodd, *C. faunus* (Girault), *C. moki* sp. nov. and *C. zafari* sp. nov.

6.5.9.1. *Key to females of the* fasciatus-*group*

1. Eyes with long hairs 2
   Eyes appearing hairless (minute hairs present and visible only under SEM) 3

2. Scutum pushed forward; metasomal horn with oblige striations (Fig. 6.140) ....
   .... *C. zafari* sp. nov.
   Scutum not indented; metasomal horn without striations (Fig. 6.137) ....
   .... *C. faunus* (Girault)

3. Body black .... *C. moki* sp. nov.
   Body yellow 4

4. Metasoma with dark patches (Fig. 6.302) .... *C. fasciatus* Dodd
   Metasoma without patches .... *C. doddi* sp. nov.

6.5.9.2. ***Ceratobaeus doddi*** sp. nov. (Figs 6.132, 6.133, 6.287, 6.362)

Type material:

Holotype: ♀, **Australia, Queensland:** "Julatten, N QLD, 30Nov - 13Dec 1987, A. Walford-Huggins, rainforest edge on creek, intercept trap" (ANIC).

Paratype: **Queensland:** 1♀, Black Mt. Rd., Julatten, 21.xi-13.xii.1987, A. Walford-Huggins (ANIC).

Female

Length: 1.0-1.2 mm; body yellow.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; cheeks and lower frons smooth; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina reaching about 0.3 distance to median ocellus.

Mesosoma: Scutum L:W = 1.4:2.4, not indented, surface finely granulate, with scattered small punctures and associated hairs; humeral sulcus crenulate; surface of scutellum finely granulate, posterior margin with single row of foveae; fore wings L:W = 6.5:2.1, stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein.

Metasoma: L:W = 5.3:2.1; surface of metasomal horn smooth except for basal granulate sculpturing and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.9:2.1; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *fasciatus*-group by the colour of the body and the eye appearing hairless. I have much pleasure in naming it after Dr. Alan Dodd. *C. doddi* is known only from north Queensland (Fig. 6.362).

6.5.9.3. ***Ceratobaeus fasciatus*** Dodd (Figs 6.134, 6.135, 6.288, 6.303, 6.363)

Ceratobaeus fasciatus Dodd, 1914b: 62, 65; Kieffer 1926: 140, 143; Austin 1981a: 84.
Idris fasciatus; Johnson 1992: 407.

Type material:

Holotype: ♀, **Australia, Queensland:** "Sweeping in and on edge of jungle, Yungaburra, 2400 ft., 30.xii.1912, A.A. Girault" (SAMA).

Other specimens examined:

Queensland: 1♀, Bellenden Ker Range, 1km S Cable Tower, 6.x-17.xi.1981, no collector (QDPC); 2♀, Base Blackbutt Range, Benarkin, 10.xi.1974-11.i.1975, G.B. & S.R. Monteith (QDPC); 1♀, Top Blackbutt Range, Benarkin, no date, G.B. & S.R. Monteith (QDPC); 1♀, Brisbane, Yeerongolly, 1-10.i.1982, no collector (QDPC); 1♀, Casey Ck., 90m, via Imbil, 31.xii.1974-27.iii.1975, G.B. & S.R. Monteith (QDPC); 1♀, Indooroopilly, 12.i.1977, Z. Boucek (QDPC); 1♀, Julatten, 29.x-21.xi.1987, A. Walford-Huggins (ANIC); 1♀, Julatten, 30.xi-13.xii.1987, A. Walford-Huggins (ANIC); 1♀, Julatten, 26.xii.1986, R. Storey (CNCI); 1♀, 17.28S 145.29E, Longlands Gap, 1.vi-3.vii.1995, PZ (ANIC); 1♀, 17.37S 145.34E, Massey Ck., 1.xii.1994-3.i.1995, PZ (ANIC); 1♀, Mossman Gorge, 30m, 23.ii.1984, L. Masner (CNCI); 1♀, Windsor Tableland via Mt. Carbine, 26.xii.1983-24.i.1984, Storey & Halfpapp (QDPC); 1♀, 17.06S 145.37E, Mt. Edith, 4.ii-17.iii.1995, PZ (ANIC); 3♀, Mt. Glorious, 10-31.i.1982, no collector, (QDPC); 2♀, Mt. Glorious S. F., ii.1984, L. Masner (CNCI); 3♀, Mt. Glorious, i.1989, H. Howden (CNCI); 6♀, Mt. Glorious, ii.1989, H. Howden (CNCI); 1♀, Mt. Haig, 1150m, 4.ii-17.iii.1995, PZ (ANIC); 1♀, 16.35S 145.17E, Mt. Lewis, 30.x.1976, R.W. Taylor & TW (ANIC); 1♀, Mt. Mee via Samford, 8.i-20.iii.1975, G.B. & S.R. Monteith (QDPC); 3♀, Mt. Tamborine, 6.iii.1927, A.P. Dodd (ANIC); 1♀, Mt. Tamborine, 19-26.iv.1935, R.E. Turner (ANIC); 1♀, Mt. Tamborine, x.1977, no collector (QDPC); 1♀, Mt. Tamborine, ix-x.1978, no collector (QDPC); 3♀, Mt. Tamborine, x-xi.1978, no collector (QDPC); 3♀, Mt. Tamborine, xi.1978-i.1979, no collector (QDPC); 5♀, Mt. Tamborine, 21-ii-29.iii.1984, no collector (QDPC); **New South Wales:** 3♀, Victoria Park, via Alstonville, 25.xii.1974-22.iii.1975, G.B. & S.R. Monteith (QDPC); 1♀, Coocumbac Is. N. Res., Taree, 10-21.xi.1994, G. & T. Williams (ANIC); 1♀, 3 mi. SE Ettalong, 28.vi.1968, Upton & Mound (ANIC); 1♀, Toonumber S. F. via Grevillen, 26.xii.1974-31.iii.1975, G.B. & S.R. Monteith (QDPC); 2♀, Rotary Park, Lismore, 26.xii.1974-31.iii.1975, G.B. & S.R. Monteith (QDPC); 4♀, Styx Riv. S. F., W end thru road, 900m, 24km SE Wollomombi, 15.xii.1993-21.i.1994, K. MacGregor (CNCI); 1♀, Styx Riv. S. F., 2.3km SE Brushwood Rd., 960m, 29km SE Wollomombi, 3-18.i.1994, K. MacGregor (CNCI); 1♀, Styx Riv. S. F., W end thru road, Cedar Pit Floral Res., 3-18.i.1994, K. MacGregor (CNCI); 1♀, Styx Riv. S. F. W end thru Rd, Cedar Pit Floral Res., 3-15.i.1994, K. MacGregor (CNCI); 1♀, 37.04S 149.28E, 4km NE Mt. Wog Wog, i.1986, C.R. Margules

(ANIC); **Australian Capital Territory:** 1♀, Black Mt., 18-29.ii.1980, D.H. Colless (ANIC); 2♀, 35.22S 148.50E, Blundella Ck., 3km E Piccadilly Circus, 850m, ii.1984, TW, JL & MLJ (ANIC); 1♀, 35.22S 148.50E, Blundella Ck., 3km E Piccadilly Circus, 850m, xii.1984, TW, JL & MLJ (ANIC); 17♀, 35.22S 148.50E, Blundella Ck., 3km E Piccadilly Circus, 850m, i.1985, JL, TW & MLJ (ANIC); 5♀, 35.22S 148.50E, Blundella Ck., 3km E Piccadilly Circus, 850m, ii.1985, JL, TW & MLJ (ANIC); 1♀, 35.22S 148.50E, Blundella Ck., 3km E Piccadilly Circus, 850m, iv.1985, JL, TW & MLJ (ANIC); 3♀, 35.35S 149.00E, Honeysuckle Ck., 21-31.iii.1985, IDN & JCC (ANIC); 2♀, 35.35S 149.00E, Honeysuckle Ck., 11-22.iv.1985, IDN & JCC (ANIC); 1♀, 35.22S 148.48E, Piccadilly Circus, 1240m, xii.1984, JL, TW & MLJ (ANIC); 1♀, 35.19S 148.51E, Wombat Ck., 6km NE Piccadilly Circus, 750m, ii.1984, TW, JL & MLJ (ANIC); 2♀, 35.19S 148.51E, Wombat Ck., 6km NE Piccadilly Circus, 750m, iii.1984, TW, JL & MLJ (ANIC); 1♀, 35.19S 148.51E, Wombat Ck., 6km NE Piccadilly Circus, 750m, xii.1984, TW, JL & MLJ (ANIC); 1♀, 35.19S 148.51E, Wombat Ck., 6km NE Piccadilly Circus, 750m, 1.x-15.xi.1984, TW, JL & MLJ (ANIC); 2♀, 35.19S 148.51E, Wombat Ck., 6km NE Piccadilly Circus, 750m, i.1985, TW, JL & MLJ (ANIC); 1♀, 35.19S 148.51E, Wombat Ck., 6km NE Piccadilly Circus, 750m, iii.1985, TW, JL & MLJ (ANIC); 2♀, 35.19S 148.51E, Wombat Ck., 6km NE Piccadilly Circus, 750m, iv.1985, TW, JL & MLJ (ANIC); 1♀, 35.19S 148.51E, Wombat Ck., 6km NE Piccadilly Circus, 750m, v.1985, TW, JL & MLJ (ANIC); 2♀, 35.19S 148.51E, Wombat Ck., 6km NE Piccadilly Circus, 750m, x.1985, TW, JL & MLJ (ANIC); **Victoria:** 1♀, Wingan Inlet N. P., 23.v.1978, S. & J. Peck (ANIC); **Western Australia:** 1♀, Yarragil 4PL Catchment via Dwellingup, 11-18.xii.1980, A. Postle (QDPC); 1♀, Stirling Range N. P., 11-15.i.1987, J.S. Noyes (WARI); 1♀, Wilson's Valley, Kosciusko N. P., 13.v.1982, M.S. Harvey (WARI).

Female

Length: 2.0-2.4 mm; body yellow to light brown with dark brown patches on scutum and on borders of metasomal terga.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum present, with irregular margins; cheeks and lower frons finely striate; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina reaching about 0.6 distance to median ocellus.

Mesosoma: Scutum L:W = 2.4:4.1, not indented, surface finely granulate, with scattered small punctures and associated hairs; humeral sulcus crenulate; surface of scutellum finely granulate, posterior margin smooth; fore wings L:W = 11.8:3.2 stigmal vein long, postmarginal vein short, about 0.3 length of stigmal vein.

Metasoma: L:W = 11.3:4.2; surface of metasomal horn granulate-coriaceous except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 2.1:3.9; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *fasciatus*-group by the colour of the body and the eyes appearing hairless. *C. fasciatus* is broadly distributed across mainland Australia (Fig. 6.363).

6.5.9.4. ***Ceratobaeus faunus*** (Girault) (Figs 6.136, 6.137, 6.364)

Odontacolus faunus Girault, 1926b: 2; Gorth *et al.* 1979: 207.
Ceratobaeus faunus; Austin 1981a: 84.
Idris faunus; Johnson 1992: 407.

Type material:

Holotype: ♀, **Australia, Queensland:** "Jungle, Cedar Creek, Oct. 3 1921, A.A. Girault" (QMBA).

Other specimens examined:

Queensland: 1♀, 26.52S 151.34E, nr. Westcott Palin, Bunya Mts. N. P., 6-7.x.1984, IDN & JCC (ANIC); 1♀, Kuranda, xi.1914, A.P. Dodd (ANIC); 1♀, Mt. Glorious, ii.1989, H. Howden (CNCI).

Female

Length: 1.4-1.6 mm; body dark brown, except for scape, funicle segments, legs including coxae and posterior T1 (base of metasomal horn) which are light brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; cheeks and lower frons smooth; eyes with long hair; frontal carina reaching about 0.3 distance to median ocellus.

Mesosoma: Scutum L:W = 2.1:3.2, not indented, surface finely granulate, with scattered small punctures and associated hairs; humeral sulcus crenulate; surface of scutellum finely granulate, posterior margin with single row of foveae; fore wings L:W = 8.3:2.6, stigmal vein long, postmarginal vein almost as long as stigmal vein.

Metasoma: L:W = 6.8:3.4; surface of metasomal horn granulate-coriaceous except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.5:2.7; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *fasciatus*-group by the eyes with long hairs, the normal scutum, and sculpturing of the metasomal horn. *C. faunus* is known only from Queensland (Fig. 6.364).

6.5.9.5. ***Ceratobaeus moki*** sp. nov. (Figs 6.138, 6.139, 6.365)

Type material:

Holotype: ♀, **Australia, South Australia:** "S. Aust., Montacute via Adelaide, Sept-Oct. 1985, dry sclerophyll, M.T., A.D. Austin" (ANIC).

Paratypes: **South Australia:** 3♀, same data as holotype (WARI); 4♀, 34.21S 139.31E, Brookfield C. P., 4-20.ii.1992, J. Stelman & S. Williams (ANIC); 1♀, 31.21S 138.42E, Oraparinna Ck., Dingly Dell Camp, 4-10.xi.1987, IDN & JCC (ANIC); 1♀, Ferries Mcdonald C. P., 4-18.ii.1996 (WARI); 1♀, Ferries Mcdonald C. P., 26.xi-10.xii.1996 (WARI); 1♀, Mintaro, Mortlock Exp. Stn., 22-29.xi.1995 (WARI); 1♀, Mt. Barker nr. summit, iii-iv.1988, A.D. Austin (WARI); 1♀, 5km S Mylor, 17.ii.1980, A.D. Austin (WARI); 1♀, 5km S Mylor, 29.iii.1979, A.D. Austin (WARI); **Queensland:** 1♀, Mt. Glorious, i.1989, H. Howden (CNCI); **New South Wales:** 1♀, Kioloa S. F., 10km N Batemans Bay, 27.v-4.vi.1978, S. & J. Peck (CNCI); 1♀, Goulburn, 13.ii.1953, E. F. Riek (ANIC); 1♀, Monga S. F., i-ii.1984, L. Masner (CNCI); 2♀, Styx Riv. S. F., Falls Rd., 22km SE Wollomombi, 900m, 15.xii.1994, K. MacGregor (CNCI); 1♀, Royal N. P., 20km S Sydney, 5-14.vi.1978, S. & J. Peck (CNCI); 1♀, Trangie Res. Stn., 4.xi.1979, R. Furrow (ANIC); **Australia Capital Territory:** 1♀, 35.22S 148.50E, Blundella Ck., 3km E Piccadilly Circus, 850m, viii.1984, TW, JL & MLJ (ANIC); 1♀, Canberra, 8.ix.1946, E. F. Riek (ANIC); 3♀, 35.35S 149.00E, Honeysuckle Ck., 21-31.iii.1985, IDN & JCC (ANIC); 2♀, 35.35S 149.00E, Honeysuckle Ck., 1-10.iv.1985, IDN & JCC (ANIC); 2♀, 35.35S 149.00E, Honeysuckle Ck., 23.iv-8.v.1985, IDN & JCC (ANIC); 1♀, Lees Spring, 22.v.1960, E.F. Riek (ANIC); 3♀, 35.22S 148.48E, Piccadilly Circus, 1240m, iii.1984, JL, TW & MLJ (ANIC); 2♀, 35.22S 148.48E, Piccadilly Circus, 1240m, iv.1984, JL, TW & MLJ (ANIC); 1♀, 35.22S 148.48E, Piccadilly Circus, 1240m, v.1984, JL, TW & MLJ (ANIC); **Tasmania:** 1♀, 42.38S 147.38E, 7km SW Buckland, 27.i.1983, IDN & JCC (ANIC); 1♀, 41.58S 145.28E, Ewart Ck., 16.i-2.ii.1983, IDN & JCC (ANIC); 1♀, 42.50S 147.10E, Fairy Glen, iv.1984, M.A. Williams (WARI); **Western Australia:** 1♀, Walpole Nornalup N. P., 17-21.i.1987, J.S. Noyes (WARI); 1♀, 31.35S 116.15E, Walyunga N. P., 24.xii.1986, J.S. Noyes (WARI); 1♀, 32.49S 123.22E, Cape Arid N. P., Yokinup Bay area, 30.xii.1986-3.i.1987, J.S. Noyes (WARI).

Female

Length: 1.9-2.1 mm; body black, except for scape, funicle segments, legs including coxae and posterior T1 (base of metasomal horn) which are brown.

Head: Upper frons, vertex and occiput finely punctate, with scattered punctures and associated hairs; speculum absent; cheeks and lower frons finely striate; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina reaching about 0.3 distance to median ocellus.

Mesosoma: Scutum L:W = 3.0:4.3, pushed forward, surface coarsely punctate, with scattered small punctures and associated hairs; humeral sulcus crenulate; surface of scutellum punctate, posterior margin with single row of foveae; fore wings L:W = 11.5:3.8, stigmal vein long, postmarginal vein almost as long as stigmal vein.

Metasoma: L:W = 10.1:4.4; surface of metasomal horn granulate except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 2.1:3.8; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *fasciatus*-group by the colour of the body and the eyes appearing hairless. The name 'moki' is an aboriginal word meaning 'cloudy'. *C. moki* is broadly distributed across the south half of the continent including Tasmania (Fig. 6.365).

6.5.9.6. ***Ceratobaeus zafari*** sp. nov. (Figs 6.140, 6.141, 6.289, 6.366)

Type material:

Holotype: ♀, **Australia, Queensland:** "Windsor Tableland via Mt. Carbine, N. Qld, 26.xii.1983-24.i.1985, Storey & Halfpapp, MDPI FIT" (QDPC).

Paratypes: **Queensland:** 1♀, same data as holotype (QDPC); 1♀, Windsor Tableland via Mt. Carbine, 10.xi-26.xii.1983, Storey & Halfpapp (QDPC); 1♀, Demi, 7km SW Mossman, 1100m, 29.x.1983, D.K. Yeates & G.I. Thompson (ANIC).

Female

Length: 1.2-1.3 mm; body yellow, except for upper frons, vertex and scutum which are light brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum present, with irregular margins; cheeks and lower frons smooth; eyes with long hair; frontal carina reaching about 0.3 distance to median ocellus.

Mesosoma: Scutum L:W = 1.2:2.7, pushed forward, surface finely granulate, with scattered small punctures and associated hairs; humeral sulcus smooth; surface of scutellum finely granulate, posterior margin smooth; fore wings L:W = 8.0:2.3 stigmal vein long, postmarginal vein about 0.7 length of stigmal vein.

Metasoma: L:W = 5.9:2.6; metasomal horn with oblige striations meeting posteriorly in the middle; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.0:2.2; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *fasciatus*-group by the eyes with long hairs, the indented scutum and sculpturing of the metasomal horn. I have much pleasure in naming it after Mr. Muhammad Hussian Zafar. *C. zafari* is known only from north Queensland (Fig. 6.366).

6.5.10. The *flaviventris*-group

Diagnosis

Head in anterior view subtriangular in shape; speculum sometimes present; cheek and lower frons smooth or striate; eyes normal in size and with rudimentary or long hairs; frontal carina short to moderately long but never reaching more than 0.6 distance to median ocellus; lateral ocelli continuous with margin of eyes or distance from eyes < 1OD; antennal clava compact, segments appearing fused, with 4 funicle segments; first funicle segment < 2.0 x as long as wide; in dorsal view head moderately broad, slightly wider than mesosoma; notauli absent; axillar crenulae present; humeral sulcus smooth or crenulate; scutum not indented; posterior margin of scutellum indented medially, smooth or with single row of foveae; propodeal lamellae blunt to sharply pointed dorsally; wings fully developed; submarginal, marginal and stigmal veins tubular; basal vein faint and spectral or pigmented; fore wings without transverse dark bands and marginal fringe present or absent; bristles on submarginal vein of fore wing rudimentary, not reaching beyond anterior margin; metasomal horn slender, reaching posterior margin of scutellum, curved forward, apex narrowly rounded, same colour as or darker than rest of metasoma; metasoma < 3.0 x as long as wide, same colour as head and mesosoma.

Comments

The major distinguishing characters of this species-group are the bristles on submarginal vein of fore wing rudimentary, not reaching beyond anterior margin and the metasomal horn curved forward. This group contains seven species, *C. cabon* sp. nov., *C. evelineae* sp. nov., *C. flaviventris* Dodd, *C. mahmoodi* sp. nov, *C. nephocerus* sp. nov., *C. pipayourula* sp. nov. and *C. turneri* (Dodd).

6.5.10.1. *Key to females of the* flaviventris-*group*

1. Body yellow, metasomal horn black 2
   Body more uniform in colour, without strongly contrasting colour pattern 3

2. Metasoma 2.0 x as long as wide .... *C. flaviventris* Dodd
   Metasoma > 2.7 x as long as wide .... *C. nephocerus* sp. nov.

3. Body yellow .... *C. mahmoodi* sp. nov.
Body brown to black 4

4. Fore wings marginal fringe absent (as for Fig. 6.290) 5
Fore wings marginal fringe present (as for Fig. 6.289) 6

5. Propodeal lamellae sharply pointed dorsally; surface of metasomal horn granulate-coriaceous (Fig. 6.142) .... *C. cabon* sp. nov.
Propodeal lamellae blunt; apical 0.2 surface of metasomal horn smooth, basal 0.8 granulate-coriaceous (Fig. 6.150) .... *C. pipayourula* sp. nov.

6. Eyes with long hairs (Fig. 6.143); surface of metasomal horn granulate-coriaceous (Fig. 6.144) .... *C. evelineae* sp. nov.
Eyes appearing hairless (minute hairs present and visible only under SEM) (Fig. 6.151); apical 0.3 surface of metasomal horn smooth, basal 0.7 granulate-coriaceous (Fig. 6.153) .... *C. turneri*. (Dodd)

6.5.10.2. ***Ceratobaeus cabon*** sp. nov. (Figs 6.142, 6.367)

Type material:

Holotype: ♀, **Australia, Western Australia:** "W.A.: Bold Park site BP 3, wet pitfalls 31.55'30S 115.46'16E, 20 May - 20 July 1993, J.M. Waldock *et al.*" (WAMP).

Paratypes: **Western Australia:** 8♀, 31.55'30S 115.46'16E, Bold Park, 20.v-20.vii.1993, J.M. Waldock *et al.* (WAMP); 9♀, 31.55'30S 115.46'16E, Bold Park, 20.vii-24.ix.1993, J.M. Waldock *et al.* (WAMP); 3♀, 31.55'30S 115.46'16E, Bold Park, 24.ix-18.xi.1993, J.M. Waldock *et al.* (WAMP); 1♀, 31.55'30S 115.46'16E, Bold Park, 19.xi.1993-6.i.1994, J.M. Waldock *et al.* (WAMP); 3♀, 31.55'30S 115.46'16E, Bold Park, 6.i-18.iii.1994, M.S. Harvey & J.M. Waldock (WAMP); 2♀, 31.55'30S 115.46'16E, Bold Park, 18.iii-19.v.1994, M.S. Harvey & J.M. Waldock (WAMP); 1♀, Kalbarri N. P., 12-18.xii.1986, J.S. Noyes (WARI); 8♀, 31.57'40S 115.46'00E, Mt. Claremont, 24.vi-1.ix.1994, J.M. Waldock & A.F. Longbottom (WAMP); 2♀, Mt. Cooke, 13-28.i.1991, M.S. Harvey & J.M. Waldock (WARI); 1♀, 32.27S 121.41E, 30km SSW Norseman, 19.ix.1981, IDN & JCC (ANIC); 1♀, 31.58'05S 115.58'05E, Perth Airport, 10.v-24.vi.1993, J.M. Wadlock *et al.* (WAMP); 1♀, 31.58'05S 115.58'05E, Perth Airport, 24.ix-18.xi.1993, J.M. Wadlock *et al.* (WAMP); 2♀, 31.58'05S 115.58'05E, Perth Airport, 18.xi.1993-6.i.1994, J.M. Wadlock, K. Goodsell & J. Webb (WAMP); 1♀, 31.52'25S 116.03'03E, Talbot Rd. Reserve, 24.vi-28.vii.1993, J.M. Wadlock *et al.* (WAMP); 1♀, 32.38S 115.39E, Yanchep N. P., 20-21.iii.1986, J.S. Noyes (WARI); **South Australia:** 1♀, 34.19S 139.30E, Brookfield C. P., 2.xii.1991-2.i.1992, J. Stelman & S. Williams (ANIC); 1♀, 33.46S 135.06E, Lake Tungketta, 30.xi.1992, IDN & JCC (ANIC); 1♀, Mt. Barker nr. summit, xii.1985, A.D. Austin (WARI); 1♀, Mt. Barker, xii.1993-i.1994, A.D. Austin (WARI); 1♀, 31.21S 138.42E, Oraparinna Ck., Dingly Dell Camp, 4-10.xi.1987, IDN & JCC (ANIC).

Female

Length: 1.8-1.9 mm; body dark brown, except for scape, funicle segments, legs including coxae and posterior T1 (base of metasomal horn) which are brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum present, with irregular margins; cheeks and lower frons finely striate; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina reaching about 0.6 distance to median ocellus.

Mesosoma: Scutum L:W = 2.5:3.7, surface finely granulate, with scattered small punctures and associated hairs; humeral sulcus smooth; surface of scutellum finely granulate, posterior margin with single row of foveae; propodeal lamellae sharply pointed dorsally; fore wings L:W = 10.0:3.4, marginal fringe absent; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein pigmented.

Metasoma: L:W = 9.0:4.0; surface of metasomal horn granulate-coriaceous except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.3:3.2; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *flaviventris*-group by the colour of the body, absence of the fore wings marginal fringe, and shape of the propodeal lamellae. The name 'cabon' is an aboriginal word meaning 'large'. *C. cabon* is known from South Australia and Western Australia (Fig. 6.367).

6.5.10.3. ***Ceratobaeus evelineae*** sp. nov. (Figs 6.143, 6.144, 6.368)

Type material:

Holotype: ♀, **Australia, Queensland:** "12.39S 142.42E, QLD, 4km NE Batavia Downs, 16 Sep - 24 Oct 1992, flight intercept trap, P. Zborowski & T. Weir" (ANIC).

Paratypes: **Queensland:** 1♀, 12.40S 142.39E. 3km W Batavia Downs 16.ix-24.x.1992, PZ & TW (ANIC); 1♀, 15.39S 144.31E, Split Rock, 24.viii-21.ix.1992, PZ & L. Miller (ANIC).

Female

Length: 1.3-1.5 mm; body dark brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; cheeks and lower frons smooth; eyes with long hair; frontal carina reaching about 0.3 distance to median ocellus.

Mesosoma: Scutum L:W = 2.0:3.0, surface finely granulate, with scattered small punctures and associated hairs; humeral sulcus smooth; surface of scutellum finely granulate, posterior margin with single row of foveae; propodeal lamellae blunt; fore wings L:W = 7.3:2.3, marginal fringe present; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 6.9:3.2; surface of metasomal horn granulate-coriaceous except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.9:2.6; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *flaviventris*-group by the colour of the body, the eyes with long hairs, presence of the fore wings marginal fringe, and sculpturing of the metasomal horn. I have much pleasure in naming it after Dr. Eveline Bartowsky, The Australian Wine Research Institute, Adelaide. *C. evelineae* is known only from north Queensland (Fig. 6.368).

6.5.10.4. ***Ceratobaeus flaviventris*** Dodd (Figs 6.145, 6.146, 6.369)

Ceratobaeus flaviventris Dodd, 1914c: 126; Kieffer 1926: 139, 143; Austin 1981a: 84.
Idris flaviventris; Johnson 1992: 408.

Type material:

Holotype: ♀, **Australia, Queensland:** "Sweeping in forest, Gordonvale, N. Q., 14.viii.1914, A.A. Girault" (SAMA).

Other specimens examined:

Queensland: 1♀, 15.39S 144.31E, Split Rock, 27.iv-28.v.1993, PZ & A. Roach (ANIC); 1♀, Little Mitchell River nr. Yalkula, 28.iii.1976, I.D. Galloway (QDPC).

Female

Length: 1.8-1.9 mm; body yellow, metasomal horn black.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; cheeks and lower frons striate; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina rudimentary.

Mesosoma: Scutum L:W = 2.0:3.6, surface finely granulate, with scattered small punctures and associated hairs, these punctures more concentrated in anterior half; humeral sulcus crenulate; surface of scutellum finely granulate, posterior margin with single row of foveae; propodeal lamellae blunt; fore wings L:W = 10.0:2.8, marginal fringe present; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 7.5:3.3; surface of metasomal horn granulate-coriaceous except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.6:3.5; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *flaviventris*-group by the colour of the body and length of the metasoma. *C. flaviventris* is known only from north Queensland (Fig. 6.369).

6.5.10.5. ***Ceratobaeus mahmoodi*** sp. nov. (Figs 6.147, 6.370)

Type material:

Holotype: ♀, **Australia, Western Australia:** "14.52S 125.50E, W. A., "The Crusher" CALM Site 9/1, 4km SbyW Mining Camp Mitchell Plateau, 2-6 June 1988, I.D. Naumann" (ANIC).

Paratype: **Western Australia:** 1♀, 16.22S 126.12E, Charnley Riv., 2km SW Rolly Hill, 16-20.vi.1988, IDN (ANIC).

Female

Length: 1.4-1.6 mm; body yellow.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; cheeks and lower frons smooth; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina rudimentary.

Mesosoma: Scutum L:W = 2.1:3.2, surface finely granulate, with scattered small punctures and associated hairs; humeral sulcus crenulate; surface of scutellum finely granulate, posterior margin smooth; propodeal lamellae blunt; fore wings L:W = 8.8:2.6, marginal fringe absent; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 7.5:3.3; surface of metasomal horn granulate-coriaceous except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.2:2.7; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *flaviventris*-group by the colour of the body. I have much pleasure in naming it after Mr. Mahmood Ahmad, The University of Adelaide, South Australia. *C. mahmoodi* is known only from north-western Western Australia (Fig. 6.370).

6.5.10.6. ***Ceratobaeus nephocerus*** sp. nov. (Figs 6.148, 6.371)

Type material:

Holotype: ♀, **Australia, Queensland:** "15.39S 144.31E, Split Rock, 24 Aug - 21 Sep 1992, flight intercept trap, P. Zborowski & L. Miller (ANIC).

Paratypes: **Queensland:** 1♀, 12.40S 142.39E, Batavia Downs, 22.vi-23.viii.1992, PZ & JCC (ANIC); 1♀, 11.39S 142.27E, Cockatoo Ck. Crossing, 17km NW Heathlands, 15-26.i.1992, IDN & TW (ANIC).

Female

Length: 1.4-1.5 mm; body yellow, metasomal horn black.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum present, with irregular margins; cheeks and lower frons smooth; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina rudimentary.

Mesosoma: Scutum L:W = 2.2:3.0, surface finely granulate, with scattered small punctures and associated hairs, these punctures more concentrated in anterior half; humeral sulcus crenulate; surface of scutellum finely granulate, posterior margin with single row of foveae; propodeal lamellae blunt; fore wings L:W = 8.0:2.7, marginal fringe present; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 6.6:3.2; surface of metasomal horn granulate-coriaceous except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.9:2.5; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *flaviventris*-group by the colour of the body and length of the metasoma. The name 'nephocerus' is a Greek word meaning 'cloudy horn'. *C. nephocerus* is known only from north Queensland (Fig. 6.371).

6.5.10.7. ***Ceratobaeus pipayourula*** sp. nov. (Figs 6.149, 6.150, 6.372)

Type material:

Holotype: ♀, **Australia, Queensland:** "15.39S 144.31E, Split Rock, QLD, 24 Nov - 13 Dec 1992, Malaise trap, P. Zborowski &W. Dressler" (ANIC).

Paratypes: **Queensland:** 1♀, same data as holotype (ANIC); 1♀, 15.39S 144.31E, Split Rock, 24.viii-21.ix.1992, PZ & L. Miller (ANIC); 1♀, 15.39S 144.31E, Split Rock, 28.v-28.vi.1993, PZ & IDN (ANIC); 1♀, 15.39S 144.31E, Split Rock, 27.iv-28.v.1993, PZ & A. Roach (ANIC); 1♀, 18.36S 138.08E, Musselbrook Camp, 8-12.v.1995, IDN (ANIC).

Female

Length: 1.3-1.4 mm; body dark brown, except for scape, funicle segments, legs including coxae and metasoma (excluding metasomal horn) which are light brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; cheeks and lower frons smooth; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina reaching about 0.3 distance to median ocellus.

Mesosoma: Scutum L:W = 1.3:2.8, surface finely granulate, with scattered small punctures and associated hairs,; humeral sulcus crenulate; surface of scutellum finely granulate, posterior margin smooth; propodeal lamellae blunt; fore wings L:W = 7.3:2.3, marginal fringe present; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein pigmented.

Metasoma: L:W = 6.8:3.2; metasomal horn with apical 0.2 smooth, basal 0.8 granulate-coriaceous; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.9:2.4; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *flaviventris*-group by the colour of the body, and development of the fore wings marginal fringe, shape of the propodeal lamellae, and sculpturing of the metasomal horn. The name 'pipayourula' is an aboriginal word meaning 'bent horn'. *C. pipayourula* is known only from north Queensland (Fig. 6.372).

6.5.10.8. ***Ceratobaeus turneri*** (Dodd) (Figs 6.151 - 6.153, 6.373)

Ceratobaeoides (Ceratobaeus) turneri Dodd, 1920: 362.

Idris turneri; Masner 1965: 80.

Ceratobaeus turneri; Masner 1976a: 66; Austin 1981a: 85.

Idris turneri; Johnson 1992: 416.

Type material:

Holotype: ♀, **Australia, Queensland:** "N. Queensland. Kuranda, 1,100 ft., May 3-June 20, 1913. R.E. Turner, 1913-438." (BMNH).

Paratypes: **Queensland:** 1♀, Gatton, 9-16.ix.1981, no collector (QDPC); 1♀, 15km E Mareeba, 12.ii.1989, H. Howden (CNCI); 1♀, 15km NE Mareeba, 20.xii.84-7.i.1985, Storey & Titmarsh (QDPC), **New Zealand:** 12♀, 2♂, KA Kaikoura, Kowhai Bush 17.ii.87, B. Poulsen, reared ex eggs *Supunna picta* (Araneae: Clubionidae) (ANIC, WARI); 24♀, 12♂, KA Kaikoura, Kowhai Bush, 17.ii.1987, B. Poulsen (WARI).

Female

Length: 1.9-2.1 mm; body black, except for scape, funicle segments, legs including coxae and posterior T1 (base of metasomal horn) which are brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated hairs; speculum absent; cheeks and lower frons smooth; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina rudimentary.

Mesosoma: Scutum L:W = 2.7:3.7, surface granulate, with scattered small punctures and associated hairs; humeral sulcus crenulate; surface of scutellum granulate, posterior margin with single row of foveae; propodeal lamellae blunt; fore wings L:W = 11.0:3.4, marginal fringe present; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 10.6:4.0; metasomal horn with apical 0.3 smooth, basal 0.6 granulate-coriaceous; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 2.1:3.6; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Differing from female in the following: antennae 12-segmented; wings reaching well past posterior metasoma; mesosoma more round; metasoma oval in shape; T1 virtually flat except for upturned anterior margin, longitudinally striate.

Comments

This species can be separated from other species in the *flaviventris*-group by the colour of the body, the eyes appearing hairless, and presence of the fore wings marginal fringe. *C. turneri* is known from Queensland and New Zealand (Fig. 6.373).

6.5.11. The *giraulti*-group

Diagnosis

Head in anterior view subtriangular in shape; speculum sometimes present; cheek and lower frons smooth or striate; eyes normal in size and with rudimentary or long hairs; frontal carina short to moderately long but never reaching more than 0.6 distance to median ocellus; lateral ocelli continuous with margin of eyes or distance from eyes < 1OD; antennal clava compact, segments appearing fused, with 4 funicle segments; first funicle segment < 2.0 x as long as wide; in dorsal view head moderately broad, slightly wider than mesosoma; notauli absent; axillar crenulae present; humeral sulcus crenulate; scutum not indented; posterior margin of scutellum indented medially, smooth or with single row of foveae; propodeal lamellae blunt to sharply pointed dorsally; wings fully developed; submarginal, marginal and stigmal veins tubular or spectral; basal vein faint and spectral; fore wings without transverse dark bands and marginal fringe present or absent; bristles on submarginal vein of fore wing rudimentary, not reaching beyond anterior margin; metasomal horn slender, reaching posterior margin of scutellum, not curved forward, apex narrowly rounded, same colour as or darker than rest of metasoma; metasoma < 3.0 x as long as wide, same colour as head and mesosoma.

Comments

The major distinguishing characters of this species-group are the posterior margin of the scutellum indented medially, the bristles on the submarginal vein of fore wing rudimentary, not reaching beyond anterior margin and the metasomal horn not curved forward. This group contains six species, *C. buntor* sp. nov., *C. eumorphus* sp. nov., *C. giraulti* Dodd, *C. johnsenae* sp. nov., *C. litopterus* sp. nov., *C. marrooyourula* sp. nov.

6.5.11.1. *Key to females of the* **giraulti**-*group*

1. Fore wings submarginal, marginal and stigmal veins spectral or blurred (Fig. 6.291) ... . *C. litopterus* sp. nov.
   Fore wings submarginal, marginal and stigmal veins tubular (Fig. 6.290) 2

2. Metasomal horn with longitudinal striation (Fig. 6.166) ..... *C. marrooyourula* sp. nov.
   Metasomal horn without longitudinal striation 3

3. Fore wings marginal fringe absent (Fig. 6.290) 4
   Fore wings marginal fringe present (Fig. 6.291) 5

4. Body yellow; propodeal lamellae sharply pointed dorsally (Fig. 6.161) .... *C. johnsenae* sp. nov.

Body brown to black; propodeal lamellae blunt (Fig. 6.157) .... *C. giraulti* Dodd

5. Body length < 1.3 mm; body colour uniformly yellow .... *C. eumorphus* sp. nov.
Body length > 1.7 mm; body yellow, horn dark brown .... *C. buntor* sp. nov.

6.5.11.2. ***Ceratobaeus buntor*** sp. nov. (Figs 6.154, 6.155, 6.374)

Type material:

Holotype: ♀, **Australia, Queensland:** "11.45S 142.35E, Heathlands, QLD, 21 Oct.-22 Nov. 1992, Flight intercept trap, P. Zborowski & A. Calder" (ANIC).

Paratypes: **Queensland:** 1♀, same data as holotype (ANIC); 1♀, 16km up Davies Ck. Rd. via Mareeba, 4-13.iii.1983, Storey & Titmarsh (QDPC); 1♀, 18.36S 138.08E, Musselbrook Camp, 8-21.v.1996, IDN (ANIC); 1♀, Tolga, 12-24.xii.1986, J.D. Brown (CNCI); **Australian Capital Territory:** 1♀, Honeysuckle Ck., 21-31.iii.1985, IDN & JCC (ANIC); **South Australia:** 1♀, 31.56S 133.24E, 32km NWbyW Ceduna, 14.x.1981, IDN & JCC (ANIC); **Western Australia:** 1♀, 14.52S 125.50E, 4km SW Mining Camp, Mitchell Plateau, 2-6.vi.1988, IDN (ANIC); **Northern Territory:** 1♀, Jessie Gap, MacDonnell Rangers, 17km ESE Alice Spring, 22.xi.1992, A.D. Austin & P.C. Dangerfield (WARI).

Female

Length: 1.6-1.8 mm; body yellow , metasomal horn dark brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; cheeks and lower frons striate; eyes with long hair; frontal carina reaching about 0.6 distance to median ocellus.

Mesosoma: Scutum L:W = 2.5:3.6, surface finely granulate, with scattered small punctures and associated hairs; surface of scutellum finely granulate, posterior margin with single row of foveae; propodeal lamellae sharply pointed dorsally; fore wings L:W = 9.2:2.1, marginal fringe present; submarginal, marginal and stigmal veins tubular; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein.

Metasoma: L:W = 7.7:3.7; surface of metasomal horn granulate except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.0:3.1; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *giraulti*-group by the colour of the body and length, the submarginal, marginal and stigmal veins tubular, and presence of the fore wings marginal fringe. The name 'buntor' is an aboriginal word meaning 'big'. *C. buntor* is broadly distributed across mainland Australia (Fig. 6.374).

6.5.11.3. ***Ceratobaeus eumorphus*** sp. nov. (Figs 6.156, 6.375)

Type material:

Holotype: ♀, **Australia, Queensland:** "12.40S 142.39E, QLD, 3km W Batavia Downs, 16 Sep.-24 Oct. 1992, P. Zborowski & T. Weir, flight intercept trap" (ANIC).

Paratypes: **Queensland:** 9♀, same data as holotype (ANIC); 2♀, 12.40S 142.39E, 3km W Batavia Downs, 18.vi-22.vii.1992, PZ & E. Nielsen (ANIC); 1♀, 12.40S 142.39E, 3km W Batavia Downs, 22.vi-23.viii.1992, PZ & JCC (ANIC); 8♀, 12.40S 142.39E, 3km W Batavia Downs, 24.x-23.xi.1992, PZ & A. Calder (ANIC); 1♀, 12.40S 142.39E, 3km W Batavia Downs, 23.xi-11.xii.1992, PZ & W. Dressler (ANIC); 1♀, 12.40S 142.39E, 3km W Batavia Downs, 11.xii.1992-16.i.1993, PZ (ANIC); 1♀, 11.45S 142.35E, Heathlands, 21.x-22.xi.1992, PZ & A. Calder (ANIC); 1♀, 18.36S 138.08E, Musselbrook Camp, 8-21.v.1995, IDN (ANIC); 1♀, 15.39S 144.31E, Split Rock, 16.vii-18.viii.1993, PZ & J. Balderson (ANIC), 1♀, 15.39S 144.31E, Split Rock, 22.viii-21.ix.1992, PZ & L. Miller (ANIC), 1♀, 15.39S 144.31E, Split Rock, 16.ix-19.x.1993, PZ & D. Rentz (ANIC).

Female

Length: 1.1-1.2 mm; body yellow.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; cheeks and lower frons smooth; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina reaching about 0.3 distance to median ocellus.

Mesosoma: Scutum L:W = 1.5:2.6, surface finely granulate, with scattered small punctures and associated hairs; surface of scutellum finely granulate, posterior margin smooth; propodeal lamellae blunt; fore wings L:W = 6.6:2.2, marginal fringe present; submarginal, marginal and stigmal veins tubular; stigmal vein long, postmarginal vein short, about 0.2 length of stigmal vein.

Metasoma: L:W = 5.4:2.9; surface of metasomal horn rugulose-granulate except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.8:2.0; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *giraulti*-group by the colour of the body, the submarginal, marginal and stigmal veins tubular, and presence of the fore wings marginal fringe. The name 'eumorphus' is a Greek word meaning 'beautiful'. *C. eumorphus* is known only from north Queensland (Fig. 6.375).

6.5.11.4. ***Ceratobaeus giraulti*** Dodd (Figs 6.157, 6.158, 6.290, 6.376)

Ceratobaeus giraulti Dodd, 1914b: 62, 65; Kieffer 1926: 139, 143; Austin 1981a: 84.
Idris giraulti; Johnson 1992: 409.

Type material:
Holotype: ♀, **Australia, Queensland:** "Yungaburra, 2,400 ft., N. Qld., 30.xii.1912, A.G. Girault" (SAMA).

Other specimens examined:
Queensland: 1♀, Wongabel S. F., 6km S Atherton, 1.xii.1983-9.i.1984, Storey & Brown (QDPC); 1♀, Beerwah, 28.ix-29.x.1986, B.K. Cantrell (QDPC); 1♀, 3km N Black Mt. Rd., 21.iv.1990, J. Heraty (CNCI); 3♀, Branston Beach via Innisfall, 15.viii-11.xi.1987, A Walford-Huggins (ANIC); 1♀, Brisbane, xi.1931, A.P. Dodd (ANIC); 1♀, Brisbane, i.1979, Dahms (QDPC); 1♀, 26.51S 151.34E, Bunya Mt., 20-24.iv.1986, no collector (QDPC); 1♀, Camp Mt., 7-15.xii.1979, no collector (QDPC); 5♀, Julatten, 10.ix-21.xi.1987, A. Walford-Huggins (ANIC); 1♀, Black Mt. Rd., Jullaten, 5.ix-10.x.1987, A. Walford-Huggins (ANIC); 3♀, 16.30S 145.25E, Rex Range Lookout via Jullaten, 9.xi-22.xii.1981, no collector (QDPC); 1♀, Kuranda, xi.1919, A. P. Dodd (ANIC); 1♀, 11km SW Maleny, 15.iv.1990, J. Heraty (CNCI); 2♀, 18km up Davies Ck. Rd. via Mareeba, 18.i-2.ii.1983, Storey & Titmarsh (QDPC); 1♀, 16km up Davies Ck. Rd. via Mareeba, 18.ii-3.iii.1983, Storey & Titmarsh (QDPC); 1♀, 4km up Black Mt. Rd. via Kuranda, 26.x-8.xi.1983, Storey & Titmarsh (QDPC); 1♀, 15km NE Mareeba, 20.xii.1984, Storey & Titmarsh (QDPC); 2♀, 15.04S 145.07, Mt. Webb N. P., 27-30.iv.1981, IDN (ANIC); 1♀, 15.04S 145.07, Mt. Webb N. P., 28-30.ix.1980, IDN (ANIC); 1♀, 13.19S 142.40E, 2km N Rokeby, 13.ix-26.x.1993, PZ & D. Rentz (ANIC); 1♀, Tully Falls Rd., 31.iii.1978, I.D. Galloway (QDPC); **New South Wales:** 3♀, Cabbage Ck. Rd., 7 mi. NW Nelligen, 21.ii.1969, S. Misko (ANIC); 1♀, Currowan S. F., 120m, 10.i.1970, R.W. Taylor (ANIC); 1♀, 35.17S 145.11E, Billabong Ck. nr. Conarga, 12-17.iv.1978, JCC (ANIC); 2♀, 31.05S 141.42E, Fowlers Gap Res. Stn., 29.xi-9.xii.1982, IDN & JCC (ANIC); 1♀, Kioloa S. F., 10km N Batemans Bay, 10m, 27.v-4.vi.1978, S. & J. Peck (CNCI); 1♀, Shoalhaven R. 15km NW Braidwood, 14.i.1981, IDN (ANIC); 1♀, 31.44S 142.41E, Spring Ck., 68km WS Wilcannia, 10.xii.1982, JCC (ANIC); 1♀, Styx Riv. S. F., 900m, Falls Rd., 22km SE Wollomombi, 3-15.ii.1994, K. MacGregor (CNCI); 2♀, Styx Riv. S. F., 900m, Falls Rd., 22km SE Wollomombi, 16.ii-7.iii.1994, K. MacGregor (CNCI); 2♀, Styx Riv. S. F., 900m, Falls Rd., 22km SE Wollomombi, 15.xii.1993-2.i.1994, K. MacGregor (CNCI); **Australian Capital Territory:** 1♀, Black Mt, iv.1982, IDN & JCC (ANIC); 1♀, Black Mt, x.1982, IDN & JCC (ANIC); 1♀, Black Mt, 24.x-1.xi.1982, IDN & JCC (ANIC); 1♀, Black Mt, 22.xi.1982, IDN & JCC (ANIC); 2♀, Black Mt., 600m, 7-12.iii.1980, A. Newton & M. Thayer (CNCI); 1♀, 35.22S 148.50E, Blundella Ck., 3km E Piccadilly Circus, 850m, iii.1984, TW, JL & MLJ (ANIC); 1♀, 35.22S 148.50E, Blundella Ck., 3km E Piccadilly Circus, 850m, iii.1985, TW, JL & MLJ (ANIC); 1♀, 35.22S 148.50E, Blundella Ck., 3km E Piccadilly Circus, 850m, iv.1985, TW, JL & MLJ (ANIC); 1♀, Canberra, 18.viii.1950, E. F. Riek (ANIC); 3♀, 35.35S 149.00E, Honeysuckle Ck., 21-31.iii.1985, IDN & JCC (ANIC); 1♀, 35.35S 149.00E, Honeysuckle Ck., 11-22.iv.1985, IDN & JCC (ANIC); 1♀, Mt. Majura, 10.iv.1961, D.H. Colless (ANIC); 5♀, 35.22S 148.48E, Piccadilly Circus, 1240m, ii.1984, JL, TW & MLJ (ANIC); 3♀, 35.22S 148.48E, Piccadilly Circus, 1240m, iv.1984, JL, TW & MLJ (ANIC); 1♀, 35.22S 148.48E, Piccadilly Circus, 1240m, xii.1984, JL, TW & MLJ (ANIC); 1♀, 35.22S 148.48E, Piccadilly Circus, 1240m, 1.x-15.xi.1984, TW, JL & MLJ (ANIC); 1♀, 35.19S 148.51E, Wombat Ck., 6km NE Piccadilly Circus, 750m, ii.1984, TW, JL & MLJ (ANIC); 6♀, 35.19S 148.51E,

Wombat Ck., 6km NE Piccadilly Circus, 750m, iii.1984, TW, JL & MLJ (ANIC); 2♀, 35.19S 148.51E, Wombat Ck., 6km NE Piccadilly Circus, 750m, iv.1984, TW, JL & MLJ (ANIC); 2♀, 35.19S 148.51E, Wombat Ck., 6km NE Piccadilly Circus, 750m, i.1985, TW, JL & MLJ (ANIC); 1♀, 35.19S 148.51E, Wombat Ck., 6km NE Piccadilly Circus, 750m, ii.1985, TW, JL & MLJ (ANIC); 7♀, 35.19S 148.51E, Wombat Ck., 6km NE Piccadilly Circus, 750m, iii.1985, TW, JL & MLJ (ANIC); 3♀, 35.19S 148.51E, Wombat Ck., 6km NE Piccadilly Circus, 750m, iv.1985, TW, JL & MLJ (ANIC); 2♀, 35.19S 148.51E, Wombat Ck., 6km NE Piccadilly Circus, 750m, v.1985, TW, JL & MLJ (ANIC); 1♀, 35.19S 148.51E, Wombat Ck., 6km NE Piccadilly Circus, 750m, ix.1985, TW, JL & MLJ (ANIC); 1♀, Urlarra Forest, 9.iv.1961, D.H. Colless (ANIC); **Victoria:** 1♀, Lerderderg R. 3.8km WNW Blackwood, 13.viii.1982, M.S. Harvey (WARI); 1♀, Mitcham, i.1983, C. Lai (CNCI); 5♀, Mitcham, ii.1983, C. Lai (CNCI); 1♀, Mitcham, iv.1983, C. Lai (CNCI); **Tasmania:** 2♀, Dodges Ferry, 29.xii.1979, JCC (ANIC); 2♀, 41.58S 145.28E, Ewart Ck., 16.i-2.ii.1983, IDN & JCC (ANIC); 1♀, 40.58S 148.01E, 1km SSE Glandstone, 6.ii.1983, IDN & JCC (ANIC); 1♀, 42.56S 147.19E, The Lea, 5.ii.1983, IDN & JCC (ANIC); **South Australia:** 2♀, Adelaide, iv-vi.1986, G. Allen (WARI); 2♀, Bridgewater, 29.x.1978, A.D. Austin (WARI); 1♀, 31.20S 138.33E, Brachina Ck., 9.xi.1987, IDN & JCC (ANIC); 1♀, 31.21S 139.29E, Brookfield C. P., 17-20.ii.1991, JCC (ANIC); 1♀, 31.19S 139.30E, Brookfield C. P., 12.ix-20.x.1992, J. Stelman & S. Williams (ANIC); 3♀, 31.21S 139.29E, Brookfield C. P., 24-26.xi.1992, IDN & JCC (ANIC); 1♀, 31.21S 139.29E, Brookfield C. P., 1.xii.1992, IDN & JCC (ANIC); 2♀, Dingly Dell Camp, Oraparinna Ck., 7.xi.1987, IDN & JCC (ANIC); 1♀, Ferries Mcdonald C. P., 7-21.i.1996, J.T. Jennings (WARI); 1♀, Ferries Mcdonald C. P., 21.i-4.ii.1996, J.T. Jennings (WARI); 2♀, Ferries Mcdonald C. P., 4-18.ii.1996, J.T. Jennings (WARI); 1♀, Ferries Mcdonald C. P., 26.xi-10.xii.1995, J.T. Jennings (WARI); 1♀, Ferries Mcdonald C. P., 10-24.xii.1995, J.T. Jennings (WARI); 1♀, 31.31S 139.05E, Brächina Gorge, Flinders Ranges, 16.ii.1989, A.D. Austin & P.C. Dangerfield (WARI); 1♀, Waite Institute, Glen Osmond, 18.iv.1978, R. Laughlin (ANIC), 2♀, Waite Institute, Glen Osmond, 20-28.iii.1990, R. Wharton (ANIC), 1♀, Waite Institute, Glen Osmond, 27.ii-3.iii.1989, P. Dangerfield (ANIC), 2♀, 35.55S 136.55E, Kangaroo Is., Flinders Chase N. P., Gosse Wilderness Zone, i.1986, A.D. Austin (WARI); 1♀, 33.32S 135.30E, 24km WN Lock, 30.xi.1992, IDN & JCC (ANIC); 1♀, Mt. Barker nr. summit, iii-iv.1985, A.D. Austin (WARI); 2♀, Mt. Barker nr. summit, xii.1985, A.D. Austin (WARI); 4♀, 32.48S 138.10E, Mt. Remarkable nr. Mambray Ck., 6-17.ii.1989, A.D. Austin & P.C. Dangerfield (WARI); 1♀, Montacute via Adelaide, ix-x.1985, A.D. Austin (WARI); 1♀, 28.06S 140.26E, Della Rd. Bore 2, via Moomba, 13-15.ii.1989, A.D. Austin & P. C. Dangerfield (WARI); 13♀, 5km S Mylor, 17.ii.1980, A.D. Austin (WARI); 1♀, Myponga, 1.ii.1979, A.D. Austin (WARI); 1♀, 31.39S 132.06E, 19km NW Nundroo, 14.x.1981, IDN & JCC (ANIC); 2♀, 32.44S 138.37E, Orrorro, 11.xi.1987, IDN & JCC (ANIC); 1♀, Parra Wirra N. P., 50km N Adelaide, 9.xii.1986, J.S. Noyes (WARI); 1♀, 33.22S 137.03E, nr. Pine Hill, 28.xi.1992, IDN & JCC (ANIC); 1♀, 15km SSW Streaky Bay, 10-15.xi.1987, A.D. Austin (WARI); 1♀, 34.07S 140.04E, 9km ESE Taylorville, 12.xi.1987, IDN & JCC (ANIC); 1♀, 31.20S 138.37E, Trezona Camp, Brachina Ck., 7.xi.1987, IDN & JCC (ANIC); 2♀, Victor Harbour, 17.xi.1984, E.R. Datman (CNCI); **Western Australia:** 2♀, Avon Valley N. P., 50km N Perth, 25.xii.1986, J.S. Noyes (WARI); 1♀, 32.49S 132.22E, Cape Arid N. P., Yokinup Bay area, 30.xii.1986-3.i.1987, J.S. Noyes (WARI); 6♀, Kalbarri N. P., 12-18.xii.1986, J.S. Noyes (WARI); 1♀, 33.37S 115.29E, Ludlow, 4.xi-22.xii.1980, S.J. Curry (ANIC); 1♀, 19km W Muglinup Hway, 4.i.1987, J.S. Noyes (WARI); 2♀, Mt. Cooke, 28.i-17.ii.1991, J.M. Waldock (WARI); 1♀, 31.58S 115.58E, Perth Airport, 18.iii-19.v.1994, M.S. Harvey & J.M. Waldock (WAMP); 2♀, 31.58S 115.58E, Perth Airport, 24.ix-18.xi.1993, J.M. Waldock *et al.* (WAMP); 9♀, 30km E Perth, 24-28.xii.1986, J.S. Noyes (WARI); 1♀, Perth, Darling Rge, 16.xi.1982, Boucek (BMNH); 1♀, Parongarup N. P., 14.i.1987, J.S. Noyes (WARI); 7♀, Stirling Range N. P., 11-15.i.1987, J.S. Noyes (WARI); 1♀, Sues Bridge, 50km SW Nannup, 26.vii.1980, S. & J. Peck (CNCI); 1♀, 31.52S 116.03E, Talbot Road Reserve, 10.v-24.vi.1993, J.M. Waldock *et al.* (WAMP); 1♀, 31.52S 115.51E, Tuart Hill, 21.iii-19.v.1994, M.S. Harvey & J.M. Waldock (WAMP); 1♀, Walpole Nornalup N. P., 17-21.i.1987, J.S. Noyes (CNCI); 1♀, 31.35S 116.15E, Walyunga N. P., 24.xii.1986, J.S. Noyes (WARI); 1♀, Warren N. P., 2.xi.1984, J. & N. JL (ANIC).

Female

Length: 1.2-1.3 mm; body light brown to black.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; cheeks and lower frons smooth; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina rudimentary.

Mesosoma: Scutum L:W = 1.7:3.1, surface finely granulate, with scattered small punctures and associated hairs; surface of scutellum finely granulate, posterior margin with single row of foveae; propodeal lamellae blunt; fore wings L:W = 7.1:2.4, marginal fringe absent; submarginal, marginal and stigmal veins tubular; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein.

Metasoma: L:W = 5.7:3.0; surface of metasomal horn granulate except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.1:2.3; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *giraulti*-group by the colour of the body, absence of the fore wings marginal fringe, the submarginal, marginal and stigmal veins tubular, and the shape of the propodeal lamellae. *C. giraulti* is broadly distributed across Australia (Fig. 6.376).

6.5.11.5. ***Ceratobaeus johnsenae*** sp. nov. (Figs 6.159 - 6.161, 6.377)

Type material:

Holotype: ♀, **Australia, Queensland:** "19km NE Mareeba, Qld., 16.54S 145.34E, 20.xii.1984-7.i.1985, Storey & Titmarsh" (QDPC).

Paratypes: **Queensland:** 1♀, 15km N Mareeba, 20.xii.1984-7.i.1985 Storey & Titmarsh (QDPC); 1♀, Mt. Glorious, ii.1982, no collector (QDPC); 1♀, 17.10S 145.16E, Nr. Parade, 500m, 27.vi.1971, Taylor & Feehan (ANIC); **South Australia:** 2♀, 32.48S 138.10E, Mt. Remarkable nr. Mambary Ck. (Rangers Stn), 6-17.ii.1989, Austin & Dangerfield

(WARI); **Western Australia:** 1♀, 14.25S 126.38E, 12km S Kalumburu Mission, 7-11.vi.1988, TW (ANIC); 1♀, Kununurra, 19.iii.1970, R.J. Bartell (ANIC); 1♀, 14.35S 125.45E, Long Dingo, Mitchell Plateau, 9-19.v.1983, IDN & JCC (ANIC); 2♀, 14.52S 125.50E, 4km SW Mining Camp, Mitchell Plateau, 2-6.vi.1988, IDN (ANIC).

Female

Length: 1.6-1.7 mm; body yellow to light brown, metasomal horn darker than metasoma.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; cheeks and lower frons striate; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina reaching about 0.6 distance to median ocellus.

Mesosoma: Scutum L:W = 2.9:4.1, surface finely granulate, with scattered small punctures and associated hairs, these punctures more concentrated in anterior half; surface of scutellum finely granulate, posterior margin with single row of foveae; propodeal lamellae sharply pointed dorsally; fore wings L:W = 9.5:3.1, marginal fringe absent; submarginal, marginal and stigmal veins tubular; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein.

Metasoma: L:W = 7.6:4.3; surface of metasomal horn rugulose-granulate except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn), T2 and T3 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.0:3.0; T4-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *giraulti*-group by the colour of the body, the submarginal, marginal and stigmal veins tubular, absence of the fore wings marginal fringe, and shape of the propodeal lamellae. I have much pleasure in naming it after Ms. Anke Johnsen. *C. johnsenae* is broadly distributed across mainland Australia (Fig. 6.377).

6.5.11.6. ***Ceratobaeus litopterus*** sp. nov. (Figs 6.162, 6.163, 6.291, 6.378)

Type material:

Holotype: ♀, **Australia, New South Wales:** "34.43S 143.36E, Yanga Lake, N. S. W., 16.v.1994, T Weir, Ex bark of *Eucalyptus camaldulensis*" (ANIC).

Paratypes: **New South Wales:** 1♀, 32.51S 141.37E, 100km SW Broken Hill, 3-13.x.1988, E.D. Edwards (ANIC); 3♀, 31.05S 141.42E, Fawlers Gap Res. Stn., 29.xi-2.xii.1981, IDN & JCC (ANIC, WARI); **Queensland:** 2♀, 24.03S 139.03E, Sandringham Stn, 55km NW Bedourie, 1979-1980, S. Morton (ANIC); 1♀, Diggings Road, Eungella N. P., 9.v.1980, IDN & JCC (ANIC); 1♀, Weipa, 20.iv.1983, J.F. Donaldson (QDPC); **South Australia:** 1♀, 31.20S 138.35E, Brachina Ck., 8.xi.1987, IDN & JCC (ANIC); 1♀, 31.21S 138.42E, Dingly Dell Camp, Oraparinna Ck., 7.xi.1987, IDN & JCC (ANIC); 1♀, Waite Inst., Glen Osmond, 27.ii-3.iii.1989, P. Dangerfield (WARI); 3♀, 31.37S 129.33E, 32km SWbyW Koonalda, 17.ix.1981, IDN & JCC (ANIC); 1♀, Mt. Barker nr. summit, iii-iv.1988, Acacia scrub, A.D. Austin (WARI); 1♀, Parra Wirra N. P. 50km N Adelaide, 9.xii.1986, J.S. Noyes (WARI); 1♀, York Peninsula, 20.ix.1981, R.A. Farrow (ANIC); **Western Australia:** 1♀, 50km E Mullewa on Hway 123, 16.xii.1986, J.S. Noyes (WARI); 1♀, Perth, Wembley, 19.xi.1982, Boucek (BMNH).

Female

Length: 1.2-1.4 mm; body black.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated hairs; speculum absent; cheeks and lower frons finely striate; eyes with long hair; frontal carina reaching about 0.6 distance to median ocellus.

Mesosoma: Scutum L:W = 2.0:3.3, surface finely granulate, with scattered small punctures and associated hairs; surface of scutellum finely granulate, posterior margin with single row of foveae; propodeal lamellae sharply pointed dorsally; fore wings L:W = 8.3:3.0, marginal fringe present; the submarginal, marginal and stigmal veins spectral or blurred.

Metasoma: L:W = 6.8:3.6; surface of metasomal horn alveolate except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.0:2.8; T3-T5 finely granulate, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *giraulti*-group by the submarginal, marginal and stigmal veins spectral or blurred. The name 'litopterus' is a Greek word meaning 'simple wings'. *C. litopterus* is broadly distributed across mainland Australia (Fig. 6.378).

6.5.11.7. ***Ceratobaeus marrooyourula*** sp. nov. (Figs 6.164 - 6.166, 6.379)

Type material:

Holotype: ♀, **Australia, Queensland:** "11.51S 142.38E, QLD, 12km SSE Heathlands, 15-26 Jan. 1992, I. Naumann, T. Weir, Malaise trap/ ethanol, rainforest margin" (ANIC).

Paratypes: **Queensland:** 1♀, 11.51S 142.38E, 12km SSE Heathlands, 22.x-22.xi.1992, PZ & A. Calder (ANIC); 1♀, 11.45S 142.35E, Heathlands, 15-26.i.1992, IDN & TW (ANIC); 1♀, 11.45S 142.35E, Heathlands, 18.ix-21.x.1992, PZ & TW (ANIC); 3♀, 11.45S 142.35E, Heathlands, 21.x-22.xi.1992, PZ & A. Calder (ANIC).

Female

Length: 1.4-1.5 mm; body yellow, except metasomal horn and propodeum and metapleuron which are black.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum present, with irregular margins; cheeks and lower frons finely striate; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina reaching about 0.6 distance to median ocellus.

Mesosoma: Scutum L:W = 2.2:3.8, surface granulate, with scattered small punctures and associated hairs; surface of scutellum granulate, posterior margin with single row of foveae; propodeal lamellae sharply pointed dorsally; fore wings L:W = 8.3:2.7, marginal fringe present; submarginal, marginal and stigmal veins tubular; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein.

Metasoma: L:W = 7.5:3.5; T1 (including metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.3:2.9; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *giraulti*-group by the submarginal, marginal and stigmal veins tubular and the sculpturing of the metasomal horn. The name 'marrooyourula' is an aboriginal word meaning 'black horn'. *C. marrooyourula* is known only from north Queensland (Fig. 6.379).

6.5.12. The *intrudae*-group

Diagnosis

Head in anterior view subtriangular in shape; speculum sometimes present; cheek and lower frons smooth; eyes normal in size and with long hairs; frontal carina short to moderately long but never reaching more than 0.6 distance to median ocellus; lateral ocelli continuous with margin of eyes or distance from eyes < 1OD; antennal clava compact, segments appearing fused, with 4 funicle segments; first funicle segment < 2.0 x as long as wide; in dorsal view head moderately broad, slightly wider than mesosoma; notauli absent; axillar crenulae present; humeral sulcus smooth or crenulate; scutum not indented; posterior margin of scutellum rounded, with single row of foveae; propodeal lamellae sharply pointed dorsally; wings fully developed; submarginal, marginal and stigmal veins tubular; basal vein faint and spectral; fore wings with or without transverse dark bands, marginal fringe present or absent; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; metasomal horn slender, reaching posterior margin of scutellum, not curved forward, apex narrowly rounded, same colour as rest of metasoma; metasoma < 3.0 x as long as wide, same colour as head and mesosoma.

Comments

The major distinguishing characters of this species-group are the posterior margin of the scutellum rounded, the propodeal lamellae sharply pointed dorsally, and the metasomal horn not curved forward. This group contains three species, *C. intrudae* Austin, *C. nasiri* sp. nov. and *C. saliki* sp. nov.

6.5.12.1. *Key to females of the* intrudae-*group*

1. Fore wings and metasoma with transverse dark bands (Figs 6.293, 6.303) .... *C. nasiri* sp. nov.
   Fore wings and metasoma without transverse dark bands 2

2. Speculum present; postmarginal vein equal or longer than stigmal vein (Fig. 6.292) .... *C. intrudae* Austin
   Speculum absent (Fig. 6.170); postmarginal vein about 0.2 the length of stigmal vein (as for Fig. 6.297) .... *C. saliki* sp. nov.

6.5.12.2. ***Ceratobaeus intrudae*** Austin (Figs 6.167, 6.292, 6.380)

Ceratobaeus intrudae Austin, 1984a: 26.
Idris intrudae; Johnson 1992: 409.

Type material:

Holotype: ♀, **Australia, South Australia:** "South Australia: Mt. Compass, 4.ii.1979, A. D. Austin, ex egg *Intruda* sp." (ANIC).

Other specimens examined:

Australian Capital Territory: 3♀, 36.22S 148.50E, Blundella Ck., ii.1987, D.H. Colless (ANIC); 1♀, 36.22S 148.50E, 850m, Blundella Ck., 3km E Piccadilly Circus, i.1985, JL, TW & MLJ (ANIC); 1♀, 36.22S 148.50E, 850m, Blundella Ck., 3km E Piccadilly Circus, viii.1985, JL, TW & MLJ, (ANIC); 1♀, Black Mt. 20.xi.1979, IDN & JCC (ANIC).

Female

Length: 1.4-1.5 mm; body brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum present, with irregular margins; frontal carina reaching about 0.5 distance to median ocellus.

Mesosoma: Scutum L:W = 2.3:3.0, surface finely granulate, with scattered small punctures and associated hairs; humeral sulcus smooth; surface of scutellum finely granulate;

fore wings L:W = 8.4:2.5, without transverse dark bands, marginal fringe present; stigmal vein long, postmarginal vein almost as long as stigmal vein.

Metasoma: L:W = 7.0:3.3; metasomal horn with circular striated sculpturing apically, few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.2:2.8; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Differing from female in the following: antennae 12-segmented; wings reaching well past posterior metasoma; anterior T1 inflected dorsally, with longitudinal striations.

Comments

This species can be separated from other species in the *intrudae*-group by the colour of the body, presence of the speculum, shading of the fore wings, and length of the postmarginal vein. *C. intrudae* is known from South Australia and Australian Capital Territory (Fig. 6.380).

6.5.12.3. ***Ceratobaeus nasiri*** sp. nov. (Figs 6.168, 6.169, 6.293, 6.303, 6.381)

Type material:

Holotype: ♀, **Papua New Guinea:** "PAPUA N. G., Tangeu nr. Coroke, 144.29E 5.54S, T. Anderson, MT" (CNCI).

Paratype: **Papua New Guinea:** 1♀, same data as holotype (CNCI).

Female

Length: 1.1-1.3 mm; body dark brown, except for apex of metasomal horn and posterior T2 and T3 which are white.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum present, with irregular margins; frontal carina reaching about 0.6 distance to median ocellus.

Mesosoma: Scutum L:W = 2.1:2.6, surface finely granulate, with scattered small punctures and associated hairs; humeral sulcus smooth; surface of scutellum finely granulate; fore wings L:W = 7.3:2.2, with two transverse dark bands, marginal fringe present; stigmal vein long, postmarginal vein about 0.6 length of stigmal vein.

Metasoma: L:W = 5.6:2.7; T1 (including metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.1:2.1; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *intrudae*-group by the colour of the body and shading of the fore wings. I have much pleasure in naming it after Mr. Abdul Nasir, Cotton Research Station, Multan, Pakistan. *C. nasiri* is known only from Papua New Guinea (Fig. 6.381).

6.5.12.4. ***Ceratobaeus saliki*** sp. nov. (Figs 6.170, 6.171, 6.382)

Type material:

Holotype: ♀, **Australia, South Australia:** "S. Aust., Mt. Barker nr. summit, iii-iv.1988, Acacia scrub, M. T., A. D. Austin" (ANIC).

Female

Length: 1.2 mm; body dark brown to black, except for posterior T1 (base of metasomal horn) which is brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; frontal carina reaching about 0.3 distance to median ocellus.

Mesosoma: Scutum L:W = 2.0:3.0, surface finely granulate, with scattered small punctures and associated hairs; humeral sulcus crenulate; surface of scutellum finely granulate; fore wings L:W = 7.0:2.5, without transverse dark bands, marginal fringe absent; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein.

Metasoma: L:W = 5.3:3.1; surface of metasomal horn granulate except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.9:2.1; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *intrudae*-group by the colour of the body, shading of the fore wings, and length of the postmarginal vein. I have much pleasure in naming it after Mr. Salik Nawaz. *C. saliki* is known only from Mount Barker, South Australia (Fig. 6.382).

6.5.13. The *iota*-group

Diagnosis

Head in anterior view subtriangular to elongate and broad in buccal region; speculum absent; cheek and lower frons smooth; eyes normal in size and with rudimentary or long hairs; frontal carina short, never reaching more than 0.3 distance to median ocellus; lateral ocelli continuous with margin of eyes or distance from eyes < 1OD; antennal clava compact, segments appearing fused, with 4 funicle segments; first funicle segment < 2.0 x as long as wide; in dorsal view head moderately broad, slightly wider than mesosoma; notauli present or absent; axillar crenulae present; humeral sulcus smooth or crenulate; scutum not indented; posterior margin of scutellum indented medially, with single row of foveae; propodeal lamellae blunt; wings fully developed; submarginal, marginal and stigmal veins tubular; basal vein faint and spectral; fore wings without transverse dark bands, marginal fringe present or absent; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; metasomal horn slender, reaching posterior margin of scutellum, curved forward, apex narrowly rounded, same colour as rest of metasoma; metasoma < 3.0 x as long as wide, colour same as or lighter than head and mesosoma.

Comments

The major distinguishing characters of this species-group are the spectral basal vein and the metasomal horn being curved forward, the apex narrowly rounded. This group contains seven species, *C. iota* sp. nov., *C. markusi* sp. nov., *C. matong* sp. nov., *C. michaeli* sp. nov., *C. mussiae* sp. nov., *C. ramishi* sp. nov. and *C. umari* sp. nov.

6.5.13.1. *Key to females of the* iota-*group*

1. Eyes with long hairs (Fig. 6.183) 2
   Eyes appearing hairless (minute hairs present and visible only under SEM) (Fig. 6.176) 3

2. Colour of metasoma lighter than head and mesosoma ; in anterior view head elongate and broad in buccal region (Fig. 6.183) .... *C. umari* sp. nov.
   Colour of metasoma same as head and mesosoma; in anterior view head subtriangular in shape .... *C. mussiae* sp. nov.

3. Postmarginal vein as long as stigmal vein 4
   Postmarginal vein < 0.5 of stigmal vein 5

4. Body brown, except for scape, funicle segments, legs, scutellum and posterior T1 which are yellow .... *C. matong* sp. nov.
   Body uniformly yellow .... *C. markusi* sp. nov.

5. Fore wings marginal fringe present .... *C. iota* sp. nov.
   Fore wings marginal fringe absent 6

6. Body light brown, metasomal horn dark brown .... *C. michaeli* sp. nov.

Head and mesosoma black, metasoma dark brown .... *C. ramishi* sp. nov.

6.5.13.2. ***Ceratobaeus iota*** sp. nov. (Figs 6.172, 6.173, 6.383)

Type material:

Holotype: ♀, **Australia, Queensland:** "13.44S 143.20E, QLD, 11km WbyN Bald Hill McIlwraith Ra., 500m, 26June-13July 1989, I. Naumann, rainforest, Malaise trap/ ethanol" (ANIC).

Paratypes: **Queensland:** 10♀, same data as holotype (ANIC, WARI); 1♀, 13.44S 143.20E, 11km WbyN Bald Hill, McIlwraith Ra., 500m, 27.vi-12.vii.1989 IDN (ANIC); 1♀, 12.43S 143.17E, 9km ENE Mt. Tozer, 5-10.vii.1986, JCC (ANIC).

Female

Length: 0.6-0.7 mm; body dark brown, except for antennae, legs including coxae and metasoma (excluding metasomal horn) which are yellow.

Head: In anterior view subtriangular in shape; upper frons, vertex and occiput coriaceous with hairs; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina reaching about 0.3 distance to median ocellus.

Mesosoma: Scutum L:W = 1.1:1.7, surface coriaceous , with scattered small punctures and associated hairs; notauli present, reaching 0.2 the distance to anterior margin of scutum; humeral sulcus smooth; surface of scutellum finely coriaceous ; fore wings L:W = 5.1:1.6, marginal fringe present; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein.

Metasoma: L:W = 3.0:1.5; surface of metasomal horn smooth except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate,; medial length of T2:T3 = 0.7:1.0; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *iota*-group by the length of the eyes appearing hairless, presence of the fore wings marginal fringe, and length of the postmarginal vein. The name 'iota' is a Greek word meaning 'small'. *C. iota* is known only from north Queensland (Fig. 6.383).

6.5.13.3. ***Ceratobaeus markusi*** sp. nov. (Figs 6.174, 6.175, 6.384)

Type material:

Holotype: ♀, **Australia, Queensland:** "15.39S 144.31E, Split Rock, QLD, 18 Feb - 25 Apr 1993, Malaise trap, P. Zborowski" (ANIC).

Female

Length: 1.5 mm; body yellow.

Head: In anterior view subtriangular in shape; upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina rudimentary.

Mesosoma: Scutum L:W = 2.1:3.2, surface finely granulate, with scattered small punctures and associated hairs; notauli absent; humeral sulcus crenulate; surface of scutellum finely granulate; fore wings L:W = 8.9:2.7, marginal fringe present; stigmal vein long, postmarginal vein as long as stigmal vein.

Metasoma: L:W = 7.0:3.0; surface of metasomal horn granulate-coriaceous except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.3:2.6; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *iota*-group by the colour of the body, the eyes appearing hairless, and length of the postmarginal vein. I have much pleasure in naming it after Mr. Markus Beck, The University of Adelaide, South Australia. *C. markusi* is known only from Split Rock in north Queensland (Fig. 6.384).

6.5.13.4. ***Ceratobaeus matong*** sp. nov. (Figs 6.176, 6.177, 6.385)

Type material:

Holotype: ♀, **Australia, Queensland:** "11.51S 142.38E, QLD, 12km SSE Heathlands, 26 Jan-1 Mar 1992, P. Feehney, closed forest, MALAISE #3 #4" (ANIC).

Paratypes: **Queensland:** 2♀, same data as holotype (ANIC); 1♀, 11.51S 142.38E, 12km SSE Heathlands, 22.v-25.iv.1992, P. Feehney (ANIC); 1♀, 15.03S 145.09E, 3km NE Mt. Webb, 1-3.x.1980, TW (ANIC).

Female

Length: 1.6-1.8 mm; body brown, except for scape, funicle segments, legs including coxae, scutellum and posterior T1 (base of metasomal horn) which are yellow.

Head: In anterior view subtriangular in shape; upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina reaching about 0.3 distance to median ocellus.

Mesosoma: Scutum L:W = 2.1:3.2, surface finely granulate, with scattered small punctures and associated hairs; notauli absent; humeral sulcus crenulate; surface of scutellum finely granulate; fore wings L:W = 9.2:2.6, marginal fringe present; stigmal vein long, postmarginal vein as long as stigmal vein.

Metasoma: L:W = 9.0:3.0; surface of metasomal horn granulate-coriaceous except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.4:3.2; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *iota*-group by the colour of the body, the eyes appearing hairless, and length of the postmarginal vein. The name 'matong' is an aboriginal word meaning 'strong'. *C. matong* is known only from north Queensland (Fig. 6.385).

6.5.13.5. ***Ceratobaeus michaeli*** sp. nov. (Figs 6.178, 6.386)

Type material:

Holotype: ♀, **Australia, Queensland:** "AUSTRALIA: QLD., Mt. Glorious N. P., II.1989, H. Howden" (CNCI).

Paratypes: **Queensland:** 2♀, same data as holotype (CNCI).

Female

Length: 1.2-1.3 mm; body light brown, except metasomal horn and T4-T5 which are brown.

Head: In anterior view subtriangular in shape; upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina rudimentary.

Mesosoma: Scutum L:W = 1.5:2.7, surface finely granulate, with scattered small punctures and associated hairs; notauli absent; humeral sulcus crenulate; surface of scutellum finely granulate; fore wings L:W = 6.5:2.1, marginal fringe absent; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein.

Metasoma: L:W = 6.0:2.9; surface of metasomal horn granulate-coriaceous except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.8:2.4; T3-T5 finely granulate-coriaceous, with smooth posterior margins.

Male

Unknown.

Comments

This species can be separated from other species in the *iota*-group by the colour of the body, the eyes appearing hairless, absence of the fore wings marginal fringe, and length of the postmarginal vein. I have much pleasure in naming it after Mr. Michael Dangerfield. *C. michaeli* is known only from Mount Glorious in south-eastern Queensland (Fig. 6.386).

6.5.13.6. ***Ceratobaeus mussiae*** sp. nov. (Figs 6.179, 6.18, 6.387)

Type material:

Holotype: ♀, **New Zealand** "NEW ZEALAND: TO: Opepe Res., 16.8km SE Taupo, 680m, 6-8.IV.1980, podocarpus broadleaf, A. Newton, M. Thyser" (CNCI).

Female

Length: 0.9 mm; body dark brown, except for scape, funicle segments, legs including coxae and posterior T1 (base of metasomal horn) which are light brown.

Head: In anterior view subtriangular in shape; upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; eyes with long hair; frontal carina rudimentary.

Mesosoma: Scutum L:W = 1.1:2.2, surface finely granulate, with scattered small punctures and associated hairs; notauli absent; humeral sulcus crenulate; surface of scutellum finely granulate; fore wings L:W = 6.0:1.8, marginal fringe present; stigmal vein long, postmarginal vein short, about 0.3 length of stigmal vein.

Metasoma: L:W = 4.4:2.0; metasomal horn with faint longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.8:1.9; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *iota*-group by the colour of the body, the head subtriangular in anterior view, and the eyes with long hairs. I have much pleasure in naming it after Ms. Mussarat (Mussi) Iqbal. *C. mussiae* is known only from New Zealand (Fig. 6.387).

6.5.13.7. ***Ceratobaeus ramishi*** sp. nov. (Figs 6.181, 6.182, 6.388)

Type material:

Holotype: ♀, **Australia, South Australia:** "S. Aust., Ferries Mcdonald C. P., M/T, 21.i-4.ii.1996, J.T. Jennings" (ANIC).

Female

Length: 1.1 mm; body black, except for scape, funicle segments, legs including coxae and metasoma (excluding metasomal horn) which are dark brown.

Head: In anterior view subtriangular in shape; upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina rudimentary.

Mesosoma: Scutum L:W = 1.5:2.2, surface finely granulate, with scattered small punctures and associated hairs; notauli absent; humeral sulcus crenulate; surface of scutellum finely granulate; fore wings L:W = 6.2:2.1, marginal fringe absent; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein.

Metasoma: L:W = 5.0:2.5; surface of metasomal horn granulate-coriaceous except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.9:2.0; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *iota*-group by the colour of the body, the eyes appearing hairless, absence of the fore wings marginal fringe, and length of the postmarginal vein. I have much pleasure in naming it after Mr. Ramish Saeed. *C. ramishi* is known only from Ferries Mcdonald Conservation Park in South Australia (Fig. 6.388).

6.5.13.8. ***Ceratobaeus umari*** sp. nov. (Figs 6.183, 6.184, 6.389)

Type material:

Holotype: ♀, **New Caledonia:** "NEW CALEDONIA, Mt Mou summit, 24 May 1984, G. Monteith & D. Cook, Q. M. BERLESATE No. 660, 22.04S X 166.21E, Rainforest, 1200m, Moss on trees & rocks" (QDPC).

Paratype: **New Caledonia:** 1♀, Cold'Amieu, N. La Foa, 400m, 31.vii-7.viii.1978, S. & J. Peck, Malaise trap (CNCI).

Female

Length: 1.2-1.3 mm; body black, except for antennae, legs including coxae and metasoma (including metasomal horn) which are brown.

Head: In anterior view elongate and broad in buccal region; upper frons, vertex and occiput finely coriaceous, with scattered long hairs; eyes with long hair; frontal carina rudimentary.

Mesosoma: Scutum L:W = 1.7:2.5, surface finely granulate, with scattered small punctures and associated hairs, these punctures more concentrated in anterior half; notauli absent; humeral sulcus crenulate; surface of scutellum finely granulate; fore wings L:W =

8.5:2.9, marginal fringe present; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein.

Metasoma: L:W = 5.5:2.6; surface of metasomal horn smooth except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.1:2.0; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *iota*-group by the colour of the body, the head elongate in anterior view, and the eyes with long hairs. I have much pleasure in naming it after Mr. Umar Sohail. *C. umari* is known only from New Caledonia (Fig. 6.389).

6.5.14. The *kentae*-group

Diagnosis

Head in anterior view subtriangular in shape; speculum present; cheek and lower frons smooth; eyes normal in size and with long hairs; frontal carina short, reaching 0.4 distance to median ocellus; lateral ocelli continuous with margin of eyes or distance from eyes < 1OD; antennal clava compact, segments appearing fused, with 4 funicle segments; first funicle segment < 2.0 x as long as wide; in dorsal view head moderately broad, slightly wider than mesosoma; notauli absent; axillar crenulae present; humeral sulcus smooth; scutum not indented; posterior margin of scutellum rounded, with single row of foveae; propodeal lamellae blunt; wings fully developed; submarginal, marginal and stigmal veins tubular; basal vein pigmented; fore wings without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; metasomal horn slender, reaching posterior margin of scutellum, not curved forward, apex narrowly rounded, same colour as rest of metasoma; metasoma < 3.0 x as long as wide, colour lighter than head and mesosoma.

Comments

The major distinguishing characters of this species-group are the posterior margin of the scutellum rounded, the metasomal horn not curved forward, reaching posterior margin of scutellum, and the colour of the metasoma lighter than the head and the mesosoma. This group contains one species, *C. kentae* sp. nov.

6.5.14.1. ***Ceratobaeus kentae*** sp. nov. (Figs 6.185, 6.186, 6.390)

Type material:

Holotype: ♀, **Australia, Queensland:** "AUSTRALIA, S. E. Qld., O'Reilly's Guest House via Canungra, 2-22.iii.1980, Malaise trap edge rainforest" (QDPC).

Female

Length: 0.9 mm; body brown, except for antennae, legs including coxae, T1 and T2 which are white.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs.

Mesosoma: Scutum L:W = 1.5:2.1, surface finely granulate, with scattered small punctures and associated hairs; surface of scutellum finely granulate; fore wings L:W = 6.6:2.1; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 4.1:1.7; T1 (including metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.5:1.3; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

I have much pleasure in naming it after Ms. Jo Kent. *C. kentae* is known only from south-eastern Queensland (Fig. 6.390).

6.5.15. The *laeviventris*-group

Diagnosis

Head in anterior view subtriangular in shape; speculum present; cheek and lower frons smooth or striate; eyes normal in size and appearing hairless (minute hairs present and visible only under SEM); frontal carina short to moderately long but never reaching more than 0.6 distance to median ocellus; lateral ocelli continuous with margin of eyes or distance from eyes < 1OD; antennal clava compact, segments appearing fused, with 4 funicle segments; first funicle segment < 2.0 x as long as wide; in dorsal view head moderately broad, slightly wider than mesosoma; notauli present or absent; axillar crenulae present; humeral sulcus crenulate; scutum not indented; posterior margin of scutellum indented medially, with single row of foveae; propodeal lamellae blunt to sharply pointed dorsally; wings fully developed; submarginal, marginal and stigmal veins tubular; basal vein faint and spectral; fore wings without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; metasomal horn slender, reaching posterior margin of scutellum, curved forward, apex narrowly rounded, same colour as rest of metasoma; metasoma < 3.0 x as long as wide, same colour as head and mesosoma.

Comments

The major distinguishing characters of this species-group are the basal vein faint and spectral, the metasomal horn curved forward, and the metasoma < 3.0 x as long as wide. This group contains four species, *C. laeviventris* (Dodd), *C. nailae* sp. nov., *C. sabrii* sp. nov. and *C. taylori* sp. nov.

6.5.15.1. *Key to females of the* laeviventris-*group*

1. Notauli present (Fig. 6.193) 2
   Notauli absent (Fig. 6.187) 3

2. Eyes with long hairs (Fig. 6.193); head, mesosoma and horn black, metasoma brown .... *C. taylori* sp. nov.
   Eyes appearing hairless (minute hairs present and visible only under SEM) (Fig. 6.189); head and mesosoma light brown, metasoma yellow ..... *C. nailae* sp. nov.

3. Body yellow; cheeks and lower frons area smooth .... *C. sabrii* sp. nov.
   Body brown to black; cheeks and lower frons area striate .... *C. laeviventris* (Dodd)

6.5.15.2. ***Ceratobaeus laeviventris*** (Dodd) (Figs 6.187, 6.188, 6.391)

Odontacolus laeviventris Dodd, 1915b: 451.
Ceratobaeus laeviventris; Austin 1981a: 84.
Idris laeviventris; Johnson 1992: 410.

Type material:

Holotype: ♀, **Australia, Queensland:** "Sweeping on edge of jungle, 1.200 ft., Cairns district, Queensland, 20.ii.1915, A.P. Dodd" (SAMA).

Other specimens examined:

Queensland: 1♀, Wongabel S. F., 6km S Atherton, 9.i-10.ii.1984, Storey & Brown (QDPC); 1♀, O'Riellys Guest House via Canungra, 2.ii-1.iii.1980, no collector (QDPC); 1♀, Cooloola N. P., 30m, 7.iii.1984, L. Masner (CNCI); 1♀, Cooloola N. P., 6-7.iii.1984, I.D. Galloway (QDPC); 1♀, Eungella N. P., 30.xi.1976, Z. Boucek (BMNH); 1♀, Road to Mt. Macartney, Cathu S. F., 21.iv.1979, E. Dahms (QDPC); 2♀, Mt. Gloriuos, 24-31.xii.1979, no collector (QDPC); 1♀, Mt. Glorious N. P., ii.1989, H. Howden (CNCI); 2♀, Mt. Tamborine, 6.iii.1981, I.D. Galloway (QDPC); 1♀, Mt. Tamborine, x.1977, no collector (QDPC); 4♀, Paluma Dam, 12-13.v.1980, IDN & JCC (ANIC); 1♀, Tolga, 30.iii.1991, J.D. Pinto (CNCI); **New South Wales:** 1♀, 35.38S 149.54E, Monga S. F., 18.ii.1983, IDN & JCC (ANIC); 1♀, Royal N. P., 20km S Sydney, 5-14.vi.1978, S. & J. Peck (CNCI); 1♀, Tooloom scrub, 1000m, 14.ii.1984, L. Masner (CNCI).

Female

Length: 1.4-1.5 mm; body dark brown to black, except for scape, funicle segments and legs including coxae which are yellow to light brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered punctures and associated hairs; cheeks and lower frons striate; frontal carina reaching about 0.6 distance to median ocellus.

Mesosoma: Scutum L:W = 2.2:2.3, surface finely granulate, with scattered punctures and associated hairs; notauli absent; surface of scutellum finely granulate; propodeal lamellae blunt; fore wings L:W = 10.0:3.5; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein.

Metasoma: L:W = 6.5:3.0; metasomal horn slender surface coriaceous except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.4:2.5; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *laeviventris*-group by the colour of the body, striation on the cheeks and lower frons, and absence of the notauli. *C. laeviventris* is broadly distributed across eastern border of Australia (Fig. 6.391).

6.5.15.3. ***Ceratobaeus nailae*** sp. nov. (Figs 6.189, 6.190, 6.392)

Type material:

Holotype: ♀, **Australia, Queensland:** "26km up Tinaroo Ck. Rd. via Mareeba, N. E. Qld., 29.ix-11.xi.1983, Storey & Brown" (QDPC).

Female

Length: 1.4 mm; body light brown, except for scape, funicle segments, legs including coxae and metasoma which are yellow.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; cheeks and lower frons smooth; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina rudimentary.

Mesosoma: Scutum L:W = 1.6:2.5, surface finely granulate, with scattered small punctures and associated hairs; notauli present, reaching 0.2 the distance to anterior margin of scutum; humeral sulcus crenulate; surface of scutellum finely granulate; fore wings L:W = 8.0:2.3; stigmal vein long, postmarginal vein short, about 0.3 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 6.8:2.6; surface of metasomal horn smooth except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.2:2.5; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *laeviventris*-group by the colour of the body, the eyes appearing hairless, and presence of the notauli. I have much pleasure in naming it after Ms. Naila Khan. *C. nailae* is known only from north Queensland (Fig. 6.392).

6.5.15.4. ***Ceratobaeus sabrii*** sp. nov. (Figs 6.191, 6.192, 6.393)

Type material:

Holotype: ♀, **Australia, Queensland:** Windsor T'land via Mt Carbine, N. Qld., 10.xi-26.xii.1983, Storey & Titmarsh" (QDPC).

Paratypes: **Queensland:** 1♀, same data as holotype (QDPC); 1♀, 22km W of Gordonvale, 16.xi.1979, E. C. Dahms, J.B. Wooley & J. LaSalle (QDPC); 1♀, 7.5km NNW Kuranda, 20.ii-20.iii.1985, Storey & Halfpapp (QDPC); 1♀, no locality, no date, A.A. Girault (ANIC).

Female

Length: 1.4-1.7 mm; body yellow.

Head: Upper frons, vertex and occiput finely punctate, with scattered minute punctures and associated minute hairs; cheeks and lower frons smooth; frontal carina reaching about 0.6 distance to median ocellus.

Mesosoma: Scutum L:W = 2.7:3.6, surface punctate, with scattered punctures and associated hairs; notauli absent; surface of scutellum punctate; propodeal lamellae sharply pointed dorsally; fore wings L:W = 10.3:3.5; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein.

Metasoma: L:W = 7.0:3.9; metasomal horn slender surface coriaceous except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.5:2.9; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *laeviventris*-group by the colour of the body and the cheeks and the lower frons area smooth, and absence of the notauli. I have much pleasure in naming it after Mr. Altaf Sabri, University of Agriculture, Faisalabad, Pakistan. *C. sabrii* is known only from north Queensland (Fig. 6.393).

6.5.15.5. ***Ceratobaeus taylori*** sp. nov. (Figs 6.193, 6.194, 6.394)

Type material:

Holotype: ♀, **Australia, South Australia:** "S. Aust. Ferries Mcdonald C. P., M/T, 10-24.xii.1995, J.T. Jennings" (ANIC).

Paratypes: **South Australia:** 2♀, Ferries Mcdonald C. P., 26.xi-10.xii.1995, J.T. Jennings (WARI, ANIC); 1♀, Ferries Mcdonald C. P., 21.i-4.ii.1996, J.T. Jennings (ANIC); 1♀, 34.21S 139.29E, Brookfield C. P., 24-26.xi.1992, IDN & JCC (ANIC); 2♀, Mt. Barker nr. summit, xii.1985, A.D. Austin (WARI).

Female

Length: 1.0-1.1 mm; body black, except for scape, funicle segments, legs including coxae and posterior T1 (base of metasomal horn) which are brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated hairs; cheeks and lower frons smooth; eyes with long hair; frontal carina rudimentary.

Mesosoma: Scutum L:W = 1.2:2.1, surface finely granulate, with scattered small punctures and associated hairs; notauli present, reaching 0.2 the distance to anterior margin of scutum; humeral sulcus crenulate; surface of scutellum finely granulate; fore wings L:W = 5.5:2.0; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 4.5:2.2; metasomal horn with faint longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.7:1.5 T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *laeviventris*-group by the colour of the body, the eyes with long hairs, and presence of the notauli. I have much pleasure in naming it after Dr. Gary Taylor, The University of Adelaide, South Australia. *C. taylori* is known only from South Australia (Fig. 6.394).

6.5.16. The *leai*-group

Diagnosis

Head in anterior view subtriangular in shape; speculum absent; cheek and lower frons smooth or striate; eyes normal in size and with rudimentary to long hairs; frontal carina short to moderately long but never reaching more than 0.6 distance to median ocellus; lateral ocelli continuous with margin of eyes or distance from eyes < 1OD; antennal clava compact, segments appearing fused, with 4 funicle segments; first funicle segment < 2.0 x as long as wide; in dorsal view head moderately broad, slightly wider than mesosoma; notauli absent; axillar crenulae sometimes present; humeral sulcus smooth; scutum not indented; posterior margin of scutellum either indented medially or rounded, smooth or with single row of foveae; propodeal lamellae blunt; brachypterous; metasomal horn slender or broad at base, sometimes reaching posterior margin of scutellum, sometimes curved forward, apex narrowly rounded, same colour as rest of metasoma; metasoma < 3.0 x as long as wide, same colour as or lighter than head and mesosoma.

Comments

The major distinguishing character of this species-group is the wings reduced (brachypterous). This group contains three species, *C. flavipes* (Hickman), *C. leai* Dodd and *C. minyayunde* sp. nov.

6.5.16.1. *Key to females of the* leai-*group*

1. Posterior margin of scutellum indented medially (Fig. 6.197) .... *C. leai* Dodd
   Posterior margin of scutellum rounded (Fig. 6.195) 2

2. Head and mesosoma black, antennae and metasoma white; wings reaching anterior margin of T3 (Fig. 6.199) .... *C. minyayunde* sp. nov.
   Body brown; wings not reaching beyond T1 (Fig. 6.196) .... *C. flavipes* (Hickman)

6.5.16.2. ***Ceratobaeus flavipes*** (Hickman) (Figs 6.194, 6.196, 6.395)

Pseudobaeus flavipes Hickman, 1967: 23
Idris flavipes; Huggert 1979: 7.
Idris (Ceratobaeus) hickmani Huggert, 1981: 241.
Ceratobaeus flavipes; Austin 1981a: 84.
Idris hickmani; Johnson 1992: 409.

Type material:

Holotype: 1♀, **Australia, Tasmania:** "Bred from eggs of spider *Stiphidium facetum* Simon, Fern Tree, Tasmania, 4.xii.1945, V. V. Hickman" (ANIC).

Other specimens examined:

Tasmania: 2♀, 41.19S 147.56E, Intake Bridge, 13-29.i.1983, IDN & JCC (ANIC); **Queensland:** 1♀, 21.10S 148.31E, Broken R. 700m, Eungella N. P., 10-12.xi.1976, R.W. Taylor & T.A. TW (ANIC); 1♀, 21.09S 148.30E, Eungella N. P., 760m, 10.xi.1976, R.W. Taylor & T.A. TW (ANIC); 1♀, Sky Window Lookout, Eungella, W. Mackay, 8.iv.1976, I.D. Galloway (QDPC); 1♀, 28.16S 153.10E, Mt. Bithongabel, 1400m, Lamington N. P., 23.x.1978, JL & TW (ANIC); 5♀, Mt. Glorious N. P., 630m, 28.ii.1984, L. Masner (CNCI); 2♀, Mt. Glorious, i.1989, H. Howden (CNCI), 8♀, Mt. Glorious N. P., ii.1989, H. Howden (CNCI); 4♀, 630m, Mt. Glorious N. P., 630m, 28.ii-9.iii.1984, L. Masner (CNCI); 1♀, Mt. Glorious, 13-17.x.1986, A.D. Austin (WARI); 2♀, Mt. Glorious, 10-31.ii.1982, Hiller (QDPC); 1♀, Mt. Mee, via Samford, 8.i-20.iii.1975, G.B. & S.R. Monteith (QDPC); 1♀, 26.52S 151.35E, nr. Paradise Falls, Bunya Mt. N. P., 6.x.1984, IDN & JCC (ANIC); 3♀, Mt. Tamborine, xi.1978-i.1979, Agard (QDPC); 3♀, Mt. Tamborine, 21.ii-29.iii.1984, no collector (QDPC); 1♀, Mt. Tamborine, 6-17.iii.1981, no collector (QDPC); 1♀, Mt. Tamborine, no date, A.P. Dodd (ANIC); 1♀, 27.57S 153.11E, Guanaba Shelf, Tamborine Mt., xii.1992-i.1993, K.J. Lambkin (ANIC); 1♀, Maroochy Hort. Res. Stn., Nambour, 15-22.iii.1985, no collector (QDPC); 1♀, 28.14S 153.08E, Lamington N. P. (O'Reilley), 22-27.xi.1978, JL & TW (ANIC); 1♀, O'Reilly's Guest House via Canungra, 19.xi.1980, J.F. Grimshaw (QDPC); 1♀, Tungi Ck., Jimna, 27.xii.1974-29.iii.1975, G.B. & S.R. Monteith (QDPC); **New South Wales:** 2♀, 32.08S 151.27E, Allyn River Chichester S. F., 10-11.xi.1981, TW & A. Calder (ANIC); 1♀, Araluen Val. nr. Bells Ck., 1700ft., 9.iv.1967, Z. Liepa (ANIC); 16♀, Barrington Tops S.F., 1000m, 11.ii.1984, L. Masner (CNCI); 34♀, 31.54S 151.36E, Cobark Forest Park, Barrington Tops, 11.ii.1984, IDN (ANIC); 3♀, 32.04S 151.41E, Gloucester R. Barrington Tops N. P., 12-14.xi.1981, TW & A. Calder (ANIC); 1♀, 4-10m, Barrington Tops, Barrington House, 16.vi.1978, S. & J. Peck (CNCI); 1♀, Barrington Tops, Mt. Allyn, 17.vi-16.vii.1978, S. & J. Peck (CNCI); 1♀, Moppy Lookout, Barrington Tops S. F., 18.xi.1981, TW (ANIC); 1♀, Barrington House, 40km NW Dungog, 11.i-28.viii.1982, S. & J. Peck (ANIC); 1♀, 31.55S 131.30E, Thunderbolt Lookout, Barrington Tops S. F., 18.xi.1981, TW & A. Clader (ANIC); 5♀, Wiangaree S. F., 740m, Brindle Ck., 29.ii-3.iii.1980, A. Newton & M. Thayer (CNCI); 2♀, 28.22S 153.05E, Brindle Ck., Border Res. N. P., 14.ii.1984, IDN (ANIC); 1♀, Brukner Park, N. Coffs. Harb, 9-15.vii.1978, S. & J. Peck (ANIC); 5♀, 2km SSE Bundanoon, 550m, 3.iv.1982, L. Hill (ANIC); 1♀, Cabbage Tree Ck., 7 mi NW Nelligen, 250 ft., no date, no collector (ANIC); 4♀, Clyde Mt., 2450 ft., 4.xii.1967, Taylor & Brooks (ANIC); 1♀, Clyde Mt., 18km SE Braidwood, 28.v.1978, S. & J. Peck (CNCI); 7♀, Darrigo N. P., 1000m, 13.ii.1984, L. Masner (CNCI); 5♀, 30.22S 152.45E, Darrigo N. P., 13.ii.1984, IDN (ANIC); 1♀, Darrigo N. P., 700m, 1.vii.1978, S. & J. Peck (CNCI); 1♀, Skywindow Lookout, Eungella N. P., 8-9.v.1980, IDN & JCC (ANIC); 2♀, Fitzroy Falls, at foot, 31.i.1968, Upton & Mound (ANIC); 2♀, Kanangra Brook & Rocky Spur, Kanangra-Boyd N. P., 20.iii.1982, L. Hill (ANIC); 1♀, 33.58S 150.04E, Kanangra-Boyd N. P., Morong Ck., 1200m, 3.x.1982, L. Hill (ANIC); 1♀, Rotary Park, Lismore, no date, G.B. & S.R. Monteith (QDPC); 1♀, 35.35S 149.55E, Monga, 10.iii.1978, JL & TW (ANIC); 1♀, Monga, 27.ii.1968, Upton & Mound (ANIC); 1♀, Monga S. F., 21.i.1984, L. Masner (CNCI); 6♀, Mt. Brown, 50km W Bega, 1100m, 28.1.1984, L. Masner (CNCI); 1♀, Mt. Brown, nr. Nimmitabel, Rutherford Ck., 820m, 26.v.70, R.W. Taylor & R. Bartell (ANIC); 1♀, Mt. Brown, 2700ft, 5.i.1967, R.W. Taylor (ANIC); 1♀, Rutherford Ck., Brown Mt., 15.i.1969, S. R. Curtis (ANIC); 27♀, 34.34S 150.40E, Macquarie Pass, 7km ENE Robertson, 8.ii.1984, IDN (ANIC); 1♀, Nadgee S. F., Maxwell Ck., 13-19.ii.1987, 400m, D. Bickel (ANIC); 4♀, New England N. P., 1300-1500m, 13.i.1984, L. Masner (CNCI); 1♀, New England N. P., Toms Cabin, 1410m, 27.vi.1982, L. Hill (ANIC); 11♀, Point Lookout, New England N. P., 12.ii.1984, IDN (ANIC); 4♀, Point Lookout, New England N. P., 12-22.ii.1984, IDN (ANIC); 4♀, 30.30S 152.24E, Toms Cabin, New England N. P., 2-15.x.1984, IDN & JCC (ANIC); 2♀, Styx Riv. S. F., W end thru Rd, 980m, 24km SE Wollomombi, 15.xii.1993-2.i.1994, K. MacGregor (CNCI); 2♀, 28.29S 152.24E, Tooloom Plateau, 14km W Urbenville, 4-14.x.1984, IDN & JCC (ANIC); 2♀, Tooloom Scrub, 1000m, 14.ii.1984, L. Masner (CNCI); 1♀, Nothofagus Mt. via Woodenbong, 17.vi.1982, G. Monteith & G. Thompson (QDPC); **Australian Capital Territory:** 7♀, 35.22S 148.50E, Blundella Ck., 3km E Piccadilly Circus, 850m, ii.1984, TW, JL & MLJ (ANIC); 2♀, 35.22S 148.50E, Blundells Ck., 3km E Piccadilly Circus, 850m, iii.1984, TW, JL & MLJ (ANIC); 3♀, 35.22S 148.50E, Blundells Ck., 3km E Piccadilly Circus, 850m, iv.1984, TW, JL & MLJ (ANIC); 1♀, 35.22S 148.50E, Blundells Ck., 3km E Piccadilly Circus, 850m, x.1984, TW, JL & MLJ (ANIC); 6♀, 35.22S 148.50E, Blundells Ck., 3km E Piccadilly Circus, 850m, i.1985, TW, JL & MLJ (ANIC); 1♀, 35.22S 148.50E, Blundells Ck., 3km E Piccadilly Circus, 850m, iii.1985, TW, JL & MLJ (ANIC); 3♀, 35.22S 148.50E, Blundells Ck., 3km E Piccadilly Circus, 850m, iv.1985, TW, JL & MLJ (ANIC); 1♀, 35.22S 148.50E, Blundells Ck., 3km E Piccadilly Circus, 850m, v.1985, TW, JL & MLJ (ANIC); 2♀, 35.22S 148.50E, Blundells Ck., 3km E Piccadilly Circus, 850m, viii.1985, TW, JL & MLJ (ANIC); 1♀, 35.35S 149.00E, Honeysuckle Ck., 23.iv-8.v.1985, IDN & JCC (ANIC); 2♀, 35.19S 148.51E, Wombat Ck., 6km NE Piccadilly Circus, 750m, ii.1984, TW, JL & MLJ (ANIC); 2♀, 35.19S 148.51E, Wombat Ck., 6km NE Piccadilly Circus, 750m, iv.1984, TW, JL & MLJ (ANIC); 1♀, 35.19S 148.51E, Wombat Ck., 6km NE Piccadilly Circus, 750m, iii.1985, TW, JL & MLJ (ANIC); 1♀, 35.19S 148.51E, Wombat Ck., 6km NE Piccadilly Circus, 750m, v.1985, TW, JL & MLJ (ANIC); 5♀, 35.19S 148.51E, Wombat Ck., 6km NE Piccadilly Circus, 750m, 1.x-15.xi.1984, TW, JL & MLJ (ANIC); 1♀, 35.19S 148.51E, Wombat Ck., 6km NE Piccadilly Circus, 750m, viii.1985, TW, JL & MLJ (ANIC); 1♀, 35.22S 148.48E, Piccadilly Circus, 1240m, ii.1984, TW, JL & MLJ (ANIC); **Victoria:** 2♀, 750m, Acheron Gap, 16km N Warburton, 28-30.iv.1978, S. & J. Peck (CNCI); 1♀, 37.43S 145.42E, Cement Ck., 5km W Warburton, no date, JL & TW (ANIC); 1♀, Mt. Donna Buang, 1250m, 14-17.i.1980, A. Newton & M. Thayer (CNCI).

Female

Length: 0.9-1.1 mm; body yellow to dark brown.

Head: Upper frons, vertex and occiput granulate, with scattered minute punctures and associated minute hairs; cheeks and lower frons smooth; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina reaching about 0.4 distance to median ocellus.

Mesosoma: Scutum L:W = 1.4:2.1, surface granulate, with scattered small punctures and associated hairs; axillar crenulae absent; surface of scutellum granulate, posterior margin moderately rounded, with single row of foveae; wings not reaching beyond T1.

Metasoma: L:W = 5.3:3.1; in lateral view metasomal horn straight, reaching posterior margin of scutellum, with longitudinal striations; rest of T1 (other than metasomal horn) and anterior T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.8:2.5; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *leai*-group by the rounded posterior margin of the scutellum and the wings not reaching beyond T1. *C. flavipes* is distributed across south-eastern part of the continent including Tasmania (Fig. 6.395).

6.5.16.3. ***Ceratobaeus leai*** Dodd (Figs 6.197, 6.396)

Ceratobaeus leai Dodd, 1914a: 61; Kieffer 1926: 139, 141; Austin 1981a: 84.
Idris leai; Johnson 1992: 410.

Type material:

Holotype: 2♀, **Australia, Queensland:** "Mount Tamborine, Rotting leaves, A.M. Lea" (SAM).

Other specimens examined:

Queensland: 1♀, Mt. Tamborine, ix.1977, Agard (QDPC); 1♀, Mt. Tamborine, ix-x.1978, J. Grimshaw (QDPC); 1♀, Mt. Tamborine, 18.ii-2.iii.1984, I.D. Galloway (QDPC); 3♀, Mt. Tamborine, xi.1978-i.1979, Agard (QDPC); 7♀, Mt. Tamborine, 21.ii-29.iii.1984, no collector (QDPC); 1♀, Mt. Tamborine N. P., 700m, 3.iii.1984, L. Masner (CNCI); 1♀, Mt. Tamborine, (Marstella), 16-30.i.1982, no collector (QDPC); 4♀, Mt. Tamborine, 6.iii.1927, A.P. Dodd (ANIC); 3♀, Mt. Tamborine, iii.1926, A.P. Dodd (ANIC); 3♀, Mt. Tamborine, iv.1926, A.P. Dodd (ANIC); 1♀, 27.58S 153.11E, Joalah N. P., Tamborine Mt., 23.vii.1979, J.F. JL (ANIC); 1♀, 28.14S 153.08E, Lamington N. P. (O'Reillys), 22-27.xi.1978, JL & TW (ANIC); 1♀, O'Reillys Guest House via Canungra, 1.x-19.xi.1980, no collector (QDPC); 1♀, O'Reillys Guest House via Canungra, 3.ii-2.iii.1980, no collector (QDPC); 1♀, Pitfall 56, O'Reillys Guest House, 945m, Lamington, 28.ix.1975-31.i.1976, G.B. & S.R. Monteith (QDPC); 1♀, Lever's Plateau, 640-670m, via Rathdowney, 1.xi.1975, IDN (QDPC); **New South Wales:** 1♀, Beaury S. F., c.700m, 15-17.ii.1983, TW & A. Calder (ANIC); 1♀, Pitfall 43, Mt. Nardi, 2,500 via Nimbin, 25.xii.1974-22.iii.1975, G.B. & S.R. Monteith (QDPC); 8♀, 28.29S 152.24E, Tooloom Plateau 14km W Urbenville, 14.ii.1984, IDN (ANIC); 2♀, 28.22S 153.05E, Wiangaree S. F., 1050m, 10-12.ii.1983, TW & A. Calder (ANIC); 3♀, Wiangaree S. F., 600m Sheepstallion Ck., 29.ii-3.iii.1980, A. Newton & M. Thayer (CNCI); 1♀, Wiangaree S. F., 750m Brindle Ck., 29.ii-3.iii.1980, A. Newton & M. Thayer (CNCI).

Female

Length: 1.1-1.3 mm; body brown, except for scape, funicle segments, legs including coxae and posterior T1 (base of metasomal horn) which are light brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; cheeks and lower frons finely striate; eyes with long hairs; frontal carina reaching about 0.5 distance to median ocellus.

Mesosoma: Scutum L:W = 1.1:2.4, surface finely granulate, with scattered small punctures and associated hairs; axillar crenulae present; scutellum narrow, surface finely granulate, posterior margin indented medially, smooth; wings reaching up to middle of T2.

Metasoma: L:W = 5.7:3.2; in lateral view metasomal horn curved forward, reaching posterior margin of scutellum, surface strigate except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.7:2.4, T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *leai*-group by the indented posterior margin of the scutellum. *C. leai* is known from south-eastern Queensland and north-eastern New South Wales (Fig. 6.396).

6.5.16.4. ***Ceratobaeus minyayunde*** sp. nov. (Figs 6.198 - 6.200, 6.397)

Type material:

Holotype: ♀, **Australia, Queensland:** "Julatten, N Qld, 29.x-21xi.1987, A Walford-Huggins, edge of forest along creek, Intercept trap" (ANIC).

Paratypes: **Queensland:** 2♀, Mt. Lewis, 29.x.1980, Favior, Story, Strickland (QDPC); 1♀, Mt. Lewis, 20km SW Mossman, 900m, 26.vi-1.viii.1982, S. & J. Peck (ANIC); 1♀, Bartle-Frere NW Peak, 1440m, 24.ix.1981, G. Monteith (QDPC).

Female

Length: 1.2-1.3 mm; head, mesosoma, fore legs and apex of metasomal horn black, antennae, metasoma and basal metasomal horn white, mid and hind legs white with black shading on femora and tibiae.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; cheeks and lower frons smooth; eyes with long hairs; frontal carina reaching about 0.4 distance to median ocellus.

Mesosoma: Scutum L:W = 1.6:2.5, surface finely granulate, with scattered small punctures and associated hairs; axillar crenulae absent; surface of scutellum finely granulate, posterior margin moderately rounded, smooth; wings reaching up to T3.

Metasoma: L:W = 6.0:2.8; in lateral view metasomal horn straight, reaching posterior margin of scutellum; T1 (including metasomal horn) and anterior T2 longitudinally striate; medial length of T2:T3 = 1.1:2.3; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *leai*-group by the rounded posterior margin of the scutellum and the wings reaching anterior margin of T3. The name 'minyayunde' is an aboriginal word meaning 'small feather'. *C. minyayunde* is known only from north Queensland (Fig. 6.397).

6.5.17. The *longicornutus*-group

Diagnosis

Head in anterior view subtriangular to heart shape; speculum sometimes present; cheek and lower frons smooth; eyes normal in size and appearing hairless (minute hairs present and visible only under SEM); frontal carina rudimentary or absent; lateral ocelli continuous with margin of eyes or distance from eyes < 1OD; antennal clava compact, segments appearing fused, with 4 funicle segments; first funicle segment < 2.0 x as long as wide; in dorsal view head moderately broad, slightly wider than mesosoma; notauli absent; axillar crenulae present; humeral sulcus crenulate; scutum indented; posterior margin of scutellum indented medially, smooth or with single row of foveae; propodeal lamellae blunt; wings fully developed; submarginal, marginal and stigmal veins tubular; basal vein faint and spectral; fore wings without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; metasomal horn slender, reaching posterior margin of scutellum, curved forward, apex narrowly rounded, same colour as rest of metasoma; metasoma < 3.0 x as long as wide, same colour as head and mesosoma.

Comments

The major distinguishing characters of this species-group are the scutum indented, the basal vein faint and spectral, the metasomal horn curved forward, and the metasoma < 3.0 x as long as wide. This group contains three species, *C. extraordinarius* sp. nov., *C. longicornutus* Dodd and *C. megacerus* sp. nov.

6.5.17.1. *Key to females of the* **longicornutus**-*group*

1. Scutum pushed forward to accommodate metasomal horn (Fig. 6.203) .... *C. longicornutus* Dodd

   Scutum with a groove to accommodate metasomal horn (Fig. 6.205) 2

2. Metasomal horn reaching up to median ocellus and causing a groove in head (Fig. 6.202) .... *C. extraordinarius* sp. nov.

Metasomal horn reaching up to occipital carina and causing a groove in it (Fig. 6.205) .... *C. megacerus* sp. nov.

6.5.17.2. ***Ceratobaeus extraordinarius*** sp. nov. (Figs 6.201, 6.202, 6.398)

Type material:

Holotype: ♀, **Australia, South Australia:** "S. Aust., Roseworthy, 4-10.iii.91, J.T. Jennings, M. T." (ANIC).

Paratypes: **South Australia:** 1♀, Mt. Barker, xii-i.1994, A.D. Austin (ANIC); **New South Wales:** 1♀, Trangie, 27.xi.1982, R.A. Farroh (ANIC); **Australian Capital Territory:** 1♀, Canberra, 23.iii.1980, Short (WARI); **Western Australia:** 1♀, Cape Arid N. P., Yakinup Bay, 30.xii.1986-3.i.1987, J.S. Noyes (ANIC).

Female

Length: 1.5-1.8 mm; body brown.

Head: In anterior view heart shape with groove to accommodate metasomal horn; upper frons, vertex and occiput finely granulate, with scattered punctures and associated minute hairs; speculum absent.

Mesosoma: Scutum L:W = 2.2:3.3, with groove, surface granulate, with scattered punctures and associated hairs; surface of scutellum granulate, posterior margin with single row of foveae; fore wings L:W = 9.0:2.8; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein.

Metasoma: L:W = 8.0:3.3; metasomal horn reaching up to median ocellus, surface granulate-coriaceous except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.1:2.4; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *longicornutus*-group by the scutum with groove to accommodate metasomal horn and the metasomal horn reaching upto median ocellus. The name 'extraordinarius' is a Greek word meaning 'extra ordinary'. *C. extraordinarius* is broadly distributed across the south half of mainland Australia (Fig. 6.398).

6.5.17.3. ***Ceratobaeus longicornutus*** Dodd (Figs 6.203, 6.204, 6.399)

Ceratobaeus longicornutus Dodd, 1914b: 62, 66; Kieffer 1926: 140, 144; Austin 1981a: 85.
Idris longicornutus; Johnson 1992: 410.

Type material:

Holotype: ♀, **Australia, Queensland:** "Sweeping in forest, Nelson via Cairns, N. Q., 31.xii.1912, A.P. Dodd" (SAMA).

Other specimens examined:

Queensland: 1♀, 12.40S 143.00E, 13km EbyS Weipa, 15.viii-12.ix.1993, PZ & S. Shattuck (ANIC).

Female

Length: 1.6 mm; body light brown, except for scape, funicle segments, legs including coxae and metasoma (excluding apical 0.2 of metasomal horn) which are yellow.

Head: In anterior view subtriangular in shape; upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent.

Mesosoma: Scutum L:W = 0.4:2.3, pushed forward, surface granulate, with scattered small punctures and associated hairs; surface of scutellum granulate, posterior margin smooth; fore wings L:W = 7.5:2.1; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein.

Metasoma: L:W = 7.5:2.3; metasomal horn reaching up to scutum, surface smooth except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.2:1.9; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *longicornutus*-group by the scutum pushed forward by metasomal horn. *C. longicornutus* is known only from north Queensland (Fig. 6.399).

6.5.17.4. ***Ceratobaeus megacerus*** sp. nov. (Figs 6.205, 6.206, 6.400)

Type material:

Holotype: ♀, **Australia, Western Australia:** "14.49S 125.50E, Mining Camp Mitchell Plateau, 9-19 May 1983, WA, I.D. Naumann JCC, Malaise/ ethanol" (ANIC).

Paratypes: **Western Australia:** 2♀, same data as holotype (ANIC); **Queensland:** 2♀, 12.40S 142.39E, Batavia Downs, 22.vi-23.viii.1992, PZ & JCC (ANIC); 1♀, Edge Ck., Mt. Elliot N. P., S Townsville, 6.iv.1976, I.D. Galloway (QDPC).

Female

Length: 1.6-1.8 mm; body yellow.

Head: In anterior view subtriangular to heart shape; upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum present, with irregular margins.

Mesosoma: Scutum L:W = 2.1:3.5, with groove, surface granulate, with scattered small punctures and associated hairs; surface of scutellum granulate, posterior margin with single row of foveae; fore wings L:W = 9.5:2.8; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein.

Metasoma: L:W = 7.9:3.6; metasomal horn reaching up to occipital carina, surface granulate-coriaceous except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.9:2.9; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *longicornutus*-group by the scutum with groove to accommodate metasomal horn and the metasomal horn reaching upto occipital carina. The name 'megacerus' is a Greek word meaning 'large horn'. *C. megacerus* is known only from north Queensland and north-western Western Australia (Fig. 6.400).

6.5.18. The *maculatus*-group

Diagnosis

Head in anterior view subtriangular in shape; speculum sometimes present; cheek and lower frons smooth or striate; eyes normal in size and with rudimentary to long hairs; frontal carina rudimentary or absent; lateral ocelli continuous with margin of eyes or distance from eyes < 1OD; antennal clava compact, segments appearing fused, with 4 funicle segments; first funicle segment < 2.0 x as long as wide; in dorsal view head moderately broad, slightly wider than mesosoma; notauli absent; axillar crenulae present; humeral sulcus smooth or crenulate; scutum not indented; posterior margin of scutellum rounded, with single row of foveae; propodeal lamellae blunt to sharply pointed dorsally; wings fully developed; submarginal, marginal and stigmal veins tubular; basal vein faint and spectral; fore wings with or without transverse dark bands, marginal fringe present or absent; bristles on submarginal vein of fore wing rudimentary to long; metasomal horn slender, reaching posterior margin of scutellum, not curved forward, apex narrowly rounded, colour darker than rest of metasoma; metasoma < 3.0 x as long as wide, same colour as or lighter than head and mesosoma.

Comments

The major distinguishing characters of this species-group are the posterior margin of the scutellum rounded, and the metasomal horn not curved forward, colour darker than rest of the metasoma. This group contains four species, *C. acrotonus* sp. nov., *C. maculatus* Dodd, *C. oimus* sp. nov. and *C. ziai* sp. nov.

6.5.18.1. *Key to females of the* maculatus-*group*

1. Fore wings marginal fringe absent (as for Fig. 6.290) .... *C. acrotonus* sp. nov.
   Fore wings marginal fringe present (Fig. 6.294) 2

2. Fore wings with two transverse dark bands (Fig. 6.294) .... *C. oimus* sp. nov.
   Fore wings without transverse dark bands 3

3. T3 with two dark spots (Fig. 6.304) .... *C. maculatus* Dodd
   T3 without dark spots .... *C. ziai* sp. nov.

6.5.18.2. ***Ceratobaeus acrotonus*** sp. nov. (Figs 6.207, 6.208, 6.401)

Type material:

Holotype: ♀, **Australia, New South Wales:** "Australia: NSW Styx Riv. St. For., 900m, Falls Rd., 22km SE Wollomombi, 16.ii-7.iii.1994, K. MacGregor" (CNCI).

Paratypes: **New South Wales:** 6♀, Styx Riv. S. F., 900m, Falls Rd. 22km SE Wollomombi, 15.xii.1994, K. MacGregor (CNCI); 1♀, 30.29S 152.25E, Point Lookout, New England N. P., 12-22.ii.1984. IDN (ANIC).

Female

Length: 1.2-1.3 mm; body light brown, except for metasomal horn and posterior margins of T2-T5 which are dark brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; cheeks and lower frons finely striate; eyes appearing hairless (minute hairs present and visible only under SEM).

Mesosoma: Scutum L:W = 2.4:3.5, surface finely granulate, with scattered small punctures and associated hairs; humeral sulcus crenulate; surface of scutellum finely granulate; propodeal lamellae blunt; fore wings L:W = 7.0:2.3, without transverse dark bands, marginal fringe absent; bristles on submarginal vein of fore wing rudimentary, not reaching beyond anterior margin; stigmal vein long, postmarginal vein short, about 0.3 length of stigmal vein.

Metasoma: L:W = 5.5:3.5; surface of metasomal horn granulate except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.0:2.0; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *maculatus*-group by the absence of the fore wings marginal fringe. The name 'acrotonus' is a Greek word meaning 'muscular'. *C. acrotonus* is known only from north-eastern New South Wales (Fig. 6.401).

6.5.18.3. ***Ceratobaeus maculatus*** Dodd (Figs 6.304, 6.402)

Ceratobaeus maculatus Dodd, 1914a: 89; Dodd 1914b: 64, 66; Austin 1981a: 88.
Idris maculatus; Johnson 1992: 411.

Type material:

Holotype: ♀, **Australia, Queensland:** "Sweeping grass along streamlet in forest, Nelson, N. Q. 7.viii.1913, A.P. Dodd"" (SAMA).

Female

Length: 1.3 mm; body yellow, except for metasomal horn, antero-lateral corners of T3 and T4-T5 which are dark brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum present, with irregular margins; cheeks and lower frons smooth; eyes appearing hairless (minute hairs present and visible only under SEM).

Mesosoma: Scutum L:W = 2.2:3.6, surface finely granulate, with scattered small punctures and associated hairs; humeral sulcus crenulate; surface of scutellum finely granulate; propodeal lamellae blunt; fore wings L:W = 7.7:2.5, without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein.

Metasoma: L:W = 5.5:3.3; surface of metasomal horn smooth except for few basal longitudinal striations; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.0:2.2; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *maculatus*-group by the presence of two dark spots on T3. *C. maculatus* is known only from north Queensland (Fig. 6.402).

6.5.18.4. ***Ceratobaeus oimus*** sp. nov. (Figs 6.209, 6.210, 6.294, 6.403)

Type material:

Holotype: ♀, **Papua New Guinea:** "New Guinea, Slutmari, Sepik River, 16.iii.1964, D.A. Colless" (ANIC).

Paratypes: **Papua New Guinea:** 2♀, Morobe Prov. Wau Ecol. Inst., 11-28.viii.1983, S. & P. Miller (CNCI).

Female

Length: 1.6-1.8 mm; body yellow, except for pleural mesosoma, metasomal horn and anterior margins of T3 and T4 which are dark brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; cheeks and lower frons smooth; eyes with long hairs.

Mesosoma: Scutum L:W = 2.4:3.8, surface finely granulate, with scattered small punctures and associated hairs; humeral sulcus not crenulate; surface of scutellum finely granulate; propodeal lamellae sharply pointed dorsally; fore wings L:W = 9.0:2.9, with two transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; stigmal vein long, postmarginal vein short, about 0.3 length of stigmal vein.

Metasoma: L:W = 8.9:3.5; metasomal horn with transverse striation except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.1:3.2; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *maculatus*-group by the fore wings with two transverse dark bands. The name 'oimus' is a Greek word meaning 'stripes' referring to transverse striation on metasomal horn. *C. oimus* is known only from Papua New Guinea (Fig. 6.403).

6.5.18.5. ***Ceratobaeus ziai*** sp. nov. (Figs 6.211 - 6.213, 6.404)

Type material:

Holotype: ♀, **Australia, Queensland:** "Wongabel S. F., 6km S Atherton, N. Qld., 3.ix-1.xi.1984, Storey & Brown, FIT" (QDPC).

Female

Length: 1.1 mm; body brown, except for antennae, legs including coxae and metasoma (excluding metasomal horn) which are brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; cheeks and lower frons smooth; eyes appearing hairless (minute hairs present and visible only under SEM).

Mesosoma: Scutum L:W = 1.7:2.7, surface finely granulate, with scattered small punctures and associated hairs; humeral sulcus not crenulate; surface of scutellum finely granulate; propodeal lamellae blunt; fore wings L:W = 8.0:2.9, without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; stigmal vein long, postmarginal vein short, about 0.3 length of stigmal vein.

Metasoma: L:W = 5.2:2.9; surface of metasomal horn smooth except for few basal longitudinal striations; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.0:1.7; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *maculatus*-group by the presence of the fore wings marginal fringe and absence of dark spots on T3. I have much pleasure in naming it after Mr. Zia ul Qayyoom, University of Arid Agriculture, Rawalpindi, Pakistan. *C. ziai* is known only from north Queensland (Fig. 6.404).

6.5.19. The *masneri*-group

Diagnosis

Head in anterior view subtriangular in shape; speculum sometimes present; cheek and lower frons smooth; eyes normal in size and with rudimentary or long hairs; frontal carina short to moderately long but never reaching more than 0.6 distance to median ocellus; lateral ocelli continuous with margin of eyes or distance from eyes < 1OD; antennal clava compact, segments appearing fused, with 4 funicle segments; first funicle segment < 2.0 x as long as wide; in dorsal view head moderately broad, slightly wider than mesosoma; notauli absent; axillar crenulae present; humeral sulcus smooth or crenulate; scutum not indented; posterior margin of scutellum rounded, with single row of foveae; propodeal lamellae blunt; wings fully developed; submarginal, marginal and stigmal veins tubular; basal vein faint and spectral or pigmented; fore wings with or without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; metasomal horn slender, reaching posterior margin of scutellum, not curved forward, apex narrowly rounded, same colour as rest of metasoma; metasoma < 3.0 x as long as wide, same colour as head and mesosoma.

Comments

The major distinguishing characters of this species-group are the cheek and lower frons smooth, the posterior margin of the scutellum rounded, the propodeal lamellae blunt, and the metasomal horn not curved forward. This group contains five species, *C. amiti* sp. nov., *C. anjumi* sp. nov., *C. haqi* sp. nov., *C. masneri* Austin and *C. stegastocerus* sp. nov.

6.5.19.1. *Key to females of the* masneri-*group*

1. Eyes with long hairs (Fig. 6.220) 2
Eyes appearing hairless (minute hairs present and visible only under SEM) (Fig. 6.222) 3

2. Postmarginal vein almost equal to stigmal vein (Fig. 6.295); metasomal horn with striate sculpturing (Fig. 6.221) .... *C. masneri* Austin
Postmarginal vein 0.2 length of stigmal vein (as for Fig. 6.297); metasomal horn with faint striate sculpturing, except smooth at apex (Fig. 6.219) .... *C. haqi* sp. nov.

3. Posterior margin of scutellum projecting over metasomal horn (Fig. 6.222); fore wings with a transverse dark band (as for Fig. 6.297) .... *C. stegastocerus* sp. nov.
Posterior margin of scutellum not projecting over metasomal horn; fore wings without transverse dark bands 4

4. Body colour yellow; postmarginal vein about 0.2 length of stigmal vein .... *C. amiti* sp. nov.
Head and mesosoma black, metasoma dark brown; postmarginal vein almost equal to stigmal vein .... *C. anjumi* sp. nov.

6.5.19.2. ***Ceratobaeus amiti*** sp. nov. (Figs 6.214, 6.215, 6.405)

Type material:

Holotype: ♀, **Australia, Queensland:** "Australia: Qld, 30km N Mareeba, Oaky Ck., 26.iv.1990, J. Heraty, H035 open forest" (CNCI).

Female

Length: 0.9 mm; body yellow.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina rudimentary.

Mesosoma: Scutum L:W = 1.4:2.1, surface finely granulate, with scattered small punctures and associated hairs; humeral sulcus crenulate; surface of scutellum finely granulate; fore wings L:W = 5.0:1.7, without transverse dark bands; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 4.0:2.5; T1 (including metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.7:1.8; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *masneri*-group by the colour of the body, the eyes appearing hairless, the fore wing without transverse dark bands, and length of the postmarginal vein. I have much pleasure in naming it after Mr. Amit Ajmani. *C. amiti* is known only from north Queensland (Fig. 6.405).

6.5.19.3. ***Ceratobaeus anjumi*** sp. nov. (Figs 6.216, 6.217, 6.406)

Type material:

Holotype: ♀, **Australia, Queensland:** "Australia: Qld Cooloola N. P., 7.iii.1984, S. S., L. Masner" (CNCI).

Paratypes: **Queensland:** 1♀, same data as holotype (CNCI); **New South Wales:** 1♀, Pittwater, 16.iii.1930, A.P. Dodd (ANIC).

Female

Length: 0.9-1.0 mm; body black, except for legs including coxae and metasoma which are dark brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum present, with irregular margins; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina rudimentary.

Mesosoma: Scutum L:W = 1.6:2.4, surface finely granulate, with scattered small punctures and associated hairs; humeral sulcus smooth; surface of scutellum finely granulate; fore wings L:W = 6.5:2.2, without transverse dark bands; stigmal vein long, postmarginal vein almost equal to stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 4.7:2.4; surface of metasomal horn granulate except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.9:1.9; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *masneri*-group by the eyes appearing hairless, the fore wing without transverse dark bands, and length of the postmarginal vein. I have much pleasure in naming it after Dr. Anjum Sohail, University of Agriculture, Faisalabad, Pakistan. *C. anjumi* is known only from south-eastern Queensland (Fig. 6.406).

6.5.19.4. ***Ceratobaeus haqi*** sp. nov. (Figs 6.218, 6.219, 6.407)

Type material:

Holotype: ♀, **Australia, Queensland:** "QNSLD: Brisbane, Indooroopilly, xii.76, Boucek" (BMNH).

Female

Length: 1.1 mm; body black, except for antennae and legs including coxae which are yellow.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; eyes with long hair; frontal carina rudimentary.

Mesosoma: Scutum L:W = 1.7:2.5, surface finely granulate, with scattered small punctures and associated hairs; humeral sulcus crenulate; surface of scutellum finely granulate; fore wings L:W = 6.5:2.3, without transverse dark bands; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 5.0:2.6; metasomal horn with faint striate sculpturing, except smooth at apex, few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.8:1.8; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *masneri*-group by the eyes with long hairs, length of the postmarginal vein, and the metasomal horn sculpturing. I have much pleasure in naming it after Professor Manzoor ul Haq, University of Agriculture, Faisalabad, Pakistan. *C. haqi* is known only from Brisbane, Queensland (Fig. 6.407).

6.5.19.5. ***Ceratobaeus masneri*** Austin (Figs 6.220, 6.221, 6.295, 6.408)

Ceratobaeus masneri Austin, 1983: 143; Austin 1984a: 29.
Idris masneri; Johnson 1992: 411.

Type material:

Holotype: ♀, **Australia, South Australia:** "5km south of Mylor, S. Aust 18.ii.1979 A.D. Austin, ex egg *Clubiona* sp." (ANIC).

Paratypes: **South Australia:** 4♀, 1♂, same data as holotype (QDPC).

Other specimens examined:

South Australia: 6♀, 4♂, 5km S Mylor, 1.xii.1979, A.D. Austin (QDPC); 6♀, 2♂, 5km S Mylor, 20.i.1980, A.D. Austin (QDPC); 1♀, Bridgewater, Adelaide Hills, xii.1987, A.D. Austin (WARI).

Female

Length: 1.2-1.4 mm; body black, except for antennae, legs including coxae and metasoma which are brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum present, with irregular margins; eyes with long hair; frontal carina reaching about 0.5 distance to median ocellus.

Mesosoma: Scutum L:W = 1.7:2.5, surface finely granulate, with scattered small punctures and associated hairs, these punctures more concentrated in anterior half; humeral sulcus crenulate; surface of scutellum finely granulate; fore wings L:W = 7.2:2.2, without transverse dark bands; stigmal vein long, postmarginal vein about equal to stigmal vein, basal vein pigmented.

Metasoma: L:W = 5.5:3.3; T1 (including metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.2:2.3; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Differing from female in the following: antennae 12-segmented; wings reaching well past posterior margin of metasoma; anterior T1 expanded dorsally, only reaching 0.5 the height of propodeum.

Comments

This species can be separated from other species in the *masneri*-group by the eyes with long hairs and length of the postmarginal vein. *C. masneri* is known only from South Australia (Fig. 6.408).

6.5.19.6. ***Ceratobaeus stegastocerus*** sp. nov. (Figs 6.222, 6.223, 6.409)

Type material:

Holotype: ♀, **Australia, Queensland:** "16km up Davies Ck. Rd via Mareeba, Qld, 4-13.iii.1983, Storey, Titmarsh" (QDPC).

Paratypes: **Queensland:** 1♀, same data as holotype (QDPC); 1♀, 18km up Davies Ck. Rd via Mareeba, 18.i-2.ii.1983 Storey & Titmarsh (QDPC); 1♀, Samford, iii-iv.1962, E. Warwick (ANIC).

Female

Length: 1.1-1.3 mm; body yellow.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum present, with irregular margins; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina reaching about 0.6 distance to median ocellus.

Mesosoma: Scutum L:W = 1.9:3.0, surface granulate-punctate, with scattered small punctures and associated hairs; humeral sulcus crenulate; surface of scutellum granulate-punctate; posterior margin projecting over metasomal horn; fore wings L:W = 7.3:2.2, with a transverse dark band; stigmal vein long, postmarginal vein short, about 0.3 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 5.6:3.0; surface of metasomal horn granulate except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.9:2.2; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *masneri*-group by the eyes appearing hairless, the posterior margin of the scutellum projecting over metasomal horn, and the fore wing with a transverse dark band. The name 'stegastocerus' is a Greek word meaning 'covered horn'. *C. stegastocerus* is known only from Queensland (Fig. 6.409).

6.5.20. The *melas*-group

Diagnosis

Head in anterior view subtriangular in shape; speculum present; cheek and lower frons smooth or striate; eyes normal in size and with rudimentary or long hairs; frontal carina short, never reaching more than 0.3 distance to median ocellus; lateral ocelli continuous with margin of eyes or distance from eyes < 1OD; antennal clava compact, segments appearing fused, with 4 funicle segments; first funicle segment < 2.0 x as long as wide; in dorsal view head moderately broad, slightly wider than mesosoma; notauli present or absent; axillar crenulae present; humeral sulcus smooth or crenulate; scutum not indented; posterior margin of scutellum indented medially, with single row of foveae; propodeal lamellae blunt; wings fully developed; submarginal, marginal and stigmal veins tubular; basal vein pigmented; fore wings without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; metasomal horn slender, reaching posterior margin of scutellum, curved forward, apex narrowly rounded, same colour as rest of metasoma; metasoma < 3.0 x as long as wide, same colour as head and mesosoma.

Comments

The major distinguishing characters of this species-group are the basal vein pigmented, the metasomal horn curved forward, and the metasoma < 3.0 x as long as wide. This group contains two species, *C. manii* sp. nov. and *C. melas* sp. nov.

6.5.20.1. *Key to females of the* melas-*group*

1. Eyes with long hairs; metasomal horn with longitudinal striations (Fig. 6.226) .... *C. melas* sp. nov.
   Eyes appearing hairless (minute hairs present and visible only under SEM); metasomal horn without longitudinal striations (Fig. 6.224) .... *C. manii* sp. nov.

6.5.20.2. ***Ceratobaeus manii*** sp. nov. (Figs 6.224, 6.225, 6.410)

Type material:

Holotype: ♀, **Australia, Tasmania:** "41.58S 145.28E, Ewart Ck., TAS, 16Jan-2Feb 1983, I.D. Naumann, J.C. Cardale, Malaise/ ethanol" (ANIC).

Female

Length: 1.0-1.2 mm; body black, except for antennae, legs including coxae and metasoma (excluding metasomal horn) which are brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; cheeks and lower frons finely striate; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina reaching about 0.3 distance to median ocellus.

Mesosoma: Scutum L:W = 1.5:2.4, surface finely granulate, with scattered small punctures and associated hairs; notauli absent; humeral sulcus smooth; surface of scutellum finely granulate; fore wings L:W = 6.4:2.1; stigmal vein long, postmarginal vein short, about 0.3 length of stigmal vein.

Metasoma: L:W = 5.1:2.3; surface of metasomal horn smooth except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.9:1.7; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

I have much pleasure in naming it after Mr. Nauman (Mani) Ahmad. *C. manii* is known only from Ewart Creek in Tasmania (Fig. 6.410).

6.5.20.3. ***Ceratobaeus melas*** sp. nov. (Figs 6.226, 6.411)

Type material:

Holotype: ♀, **Australia, Queensland:** "Long Pocket, Brisbane, Qld 27.31S 153.00E, 18 Oct 1990, C.J. Burwell" (UQIC).

Paratype: **Queensland:** 1♀, same data as holotype (UQIC); 1♀, Plainland, 5.iv.1988, Pinto & Gordh (CNCI); 1♀, Eungella N. P., 31.xi.1976, Z. Boucek (BMNH).

Female

Length: 1.3-1.5 mm; body black, except for antennae and legs including coxae which are brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated hairs; cheeks and lower frons smooth; eyes with long hair; frontal carina rudimentary.

Mesosoma: Scutum L:W = 2.3:2.7, surface finely granulate, with scattered small punctures and associated hairs; notauli present, reaching 0.2 the distance to anterior margin of scutum; humeral sulcus crenulate; surface of scutellum finely granulate; fore wings L:W = 8.1:2.7; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein.

Metasoma: L:W = 6.8:3.4; T1 (including metasomal horn) and T2 longitudinally striate,; medial length of T2:T3 = 1.3:2.2; T3-T5 coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

The name 'melas' is a Greek word meaning 'black'. *C. melas* is known only from south-eastern Queensland (Fig. 6.411).

6.5.21. The *mirabilis*-group

Diagnosis

Head in anterior view subtriangular in shape; speculum sometimes present; cheek and lower frons smooth; eyes normal in size and appearing hairless (minute hairs present and visible only under SEM); frontal carina rudimentary or absent; lateral ocelli continuous with margin of eyes or distance from eyes < 1OD; antennal clava compact, segments appearing fused, with 4 funicle segments; first funicle segment < 2.0 x as long as wide; in dorsal view head moderately broad, slightly wider than mesosoma; notauli absent; axillar crenulae present; humeral sulcus smooth or crenulate; scutum indented; posterior margin of scutellum indented medially, smooth; propodeal lamellae blunt; wings fully developed; submarginal, marginal and stigmal veins tubular; basal vein pigmented; fore wings without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; metasomal horn slender, reaching posterior margin of scutellum, curved forward, apex narrowly rounded, same colour as rest of metasoma; metasoma < 3.0 x as long as wide, same colour as head and mesosoma.

Comments

The major distinguishing characters of this species-group are the scutum indented medially, the basal vein pigmented, the metasomal horn curved forward, and the metasoma < 3.0 x as long as wide. This group contains two species, *C. mirabilis* Dodd and *C. toheedi* sp. nov.

6.5.21.1. *Key to females of the* mirabilis*-group*

1. Speculum present; surface of metasomal horn smooth (Fig. 6.227) .... *C. mirabilis* Dodd

   Speculum absent (Fig. 6.229); surface of metasomal horn alveolate (Fig. 6.230) .... *C. toheedi* sp. nov.

6.5.21.2. ***Ceratobaeus mirabilis*** Dodd (Figs 6.227, 6.228, 6.412)

Ceratobaeus mirabilis Dodd, 1914b: 64, 65; Kieffer 1926: 139, 142; Austin 1981a: 85.
Idris mirabilis; Johnson 1992: 412.

Type material:

Holotype: ♀, **Australia, Queensland:** "Sweeping in forest, Pentland, N. Q., 4.i.1913, A.A. Girault" (SAMA).

Other specimens examined:

South Australia: 1♀, Adelaide, Mitcham, 10-13.ii.1986, G. Allen (WARI); 1♀, 31.31S 138.36E, Wilpena, 30.iv.1978, JCC (ANIC); **Western Australia:** 1♀, 32.26S 118.53E, 2km NW Wave Rock, 30.i.1993, E.D. Edwards & E.S. Nielsen (ANIC).

Female

Length: 1.5-1.6 mm; body black, except for scape, funicle segments and legs including coxae which are brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated hairs; speculum present, with irregular margins.

Mesosoma: Scutum L:W = 2.0:3.4, surface finely granulate, with scattered small punctures and associated hairs; humeral sulcus crenulate; surface of scutellum finely granulate; fore wings L:W = 9.4:2.9; stigmal vein long, postmarginal vein short, about 0.3 length of stigmal vein.

Metasoma: L:W = 7.6:3.3; surface of metasomal horn with faint transverse striations, for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.6:2.4; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

C. mirabilis is broadly distributed across mainland Australia (Fig. 6.412).

6.5.21.3. ***Ceratobaeus toheedi*** sp. nov. (Figs 6.229, 6.230, 6.413)

Type material:

Holotype: ♀, **Australia, South Australia:** "31.21S 138.42E, S.A., Dingly Dell Camp Oraparinna Ck., 7 Nov. 1987, I. Naumann, J. Cardale, ex ethanol" (ANIC).

Female

Length: 1.3 mm; head and metasoma black, antennae and legs brown, metasoma dark brown..

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated hairs; speculum absent.

Mesosoma: Scutum L:W = 2.0:2.9, surface finely granulate, with scattered small punctures and associated hairs; humeral sulcus smooth; surface of scutellum finely granulate; fore wings L:W = 7.5:2.4; stigmal vein long, postmarginal vein short, about 0.3 length of stigmal vein.

Metasoma: L:W = 6.0:2.8; surface of metasomal horn alveolate except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.2:2.4; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

I have much pleasure in naming it after Mr. Toheed Ahmad. *C. toheedi* is known only from Dingly Dell Camp in South Australia (Fig. 6.413).

6.5.22. The *ogmocerus*-group

Diagnosis

Head in anterior view subtriangular in shape; speculum sometimes present; cheek and lower frons smooth; eyes normal in size and with rudimentary or long hairs; frontal carina rudimentary or absent; lateral ocelli continuous with margin of eyes or distance from eyes < 1OD; antennal clava compact, segments appearing fused, with 4 funicle segments; first funicle segment < 2.0 x as long as wide; in dorsal view head moderately broad, slightly wider than mesosoma; notauli absent; axillar crenulae present; humeral sulcus smooth or crenulate; scutum sometimes indented; posterior margin of scutellum indented medially, with single row of foveae; propodeal lamellae blunt; wings fully developed; submarginal, marginal and stigmal veins tubular; basal vein faint and spectral; fore wings with transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; metasomal horn slender, reaching posterior margin of scutellum, curved forward, apex narrowly rounded, same colour as or darker than rest of metasoma; metasoma < 3.0 x as long as wide, same colour as head and mesosoma.

Comments

The major distinguishing characters of this species-group are the frontal carina rudimentary or absent, the fore wings with transverse dark bands, the bristles on the submarginal vein of fore wing long, reaching beyond anterior margin, and the metasomal horn curved forward. This group contains five species, *C. kabirae* sp. nov., *C. luboi* sp. nov., *C. moola* sp. nov., *C. ogmocerus* sp. nov. and *C. yasini* sp. nov.

6.5.22.1. *Key to females of the* ogmocerus-*group*

1. Scutum pushed forward to accommodate metasomal horn (Fig. 6.238); metasomal horn with transverse striation (Fig. 6.239) .... *C. ogmocerus* sp. nov.
   Scutum not indented; metasomal horn without transverse striation (Fig. 6.232) 2

2. Eyes with long hairs (Fig. 6.235) .... *C. moola* sp. nov.
   Eyes appearing hairless (minute hairs present and visible only under SEM) 3

3. Body yellow .... *C. luboi* sp. nov.
Body brown 4

4. Speculum absent (Fig. 6.231); surface of metasomal horn coriaceous (Fig. 6.232) .... *C. kabirae* sp. nov.
Speculum present (Fig. 6.240); surface of metasomal horn with faint longitudinal striations (Fig. 6.241) .... *C. yasini* sp. nov.

6.5.22.2. ***Ceratobaeus kabirae*** sp. nov. (Figs 6.231, 6.232, 6.414)

Type material:

Holotype: ♀, **Australia, Queensland:** "Nelson Range, QLD, 19km NW Millaa, 1080m, 24 June - 2 Aug. 1982, S. & J. Peck, SBP49" (ANIC).

Paratypes: **Queensland:** 1♀, Cooloola, 7.iii.1984, L. Masner (CNCI); 1♀, 26km up Tinaroo Ck. Rd. via Mareeba, 10-30.xi.1982, Morgan, Brown & Storey (QDPC); 1♀, Mt. Glorious N. P., ii.1989, H. Howden (CNCI); 1♀, Mt. Glorious, 17.xi.1976, Boucek (BMNH); **New South Wales:** 1♀, Barrington House, 40km NW Dungog, 11.vi-28.viii.1982, S. & J. Peck (ANIC).

Female

Length: 1.2-1.3 mm; body light brown, except for scape, funicle segments, legs including coxae and posterior T1 (base of metasomal horn) which are yellow.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; eyes appearing hairless (minute hairs present and visible only under SEM).

Mesosoma: Scutum L:W = 1.6:2.8, not indented, surface granulate, with scattered small punctures and associated hairs; humeral sulcus smooth; surface of scutellum finely granulate; fore wings L:W = 7.2:2.1; stigmal vein long, postmarginal vein about 0.5 length of stigmal vein.

Metasoma: L:W = 6.3:2.3; surface of metasomal horn coriaceous except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.0:2.3; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *ogmocerus*-group by the colour of the body, absence of the speculum, the eyes appearing hairless, and the normal scutum. I have much pleasure in naming it after Ms. Sadia Kabir. *C. kabirae* is known from Queensland and north New South Wales (Fig. 6.414).

6.5.22.3. ***Ceratobaeus luboi*** sp. nov. (Figs 6.233, 6.234, 6.415)

Type material:

Holotype: ♀, **Australia, Queensland:** "Julatten, N. Qld., 29Oct. - 21Nov. 1987, A. Walford-Huggins, edge of forest along creek, intercept trap" (ANIC).

Paratypes: **Queensland:** 1♀, same data as holotype (ANIC); 1♀, Julatten, 30.xi.-13.xii.1987, A. Walford-Huggins (ANIC); 1♀, Clacherty Rd. via Julatten, 9.i-2.ii.1987, R. Storey (CNCI); **Western Australia:** 1♀, 17.25S 124.38E, Augusts Is., 11-16.vi.1988, IDN (ANIC).

Female

Length: 1.4-1.9 mm; body yellow.

Head: Upper frons, vertex and occiput finely granulate, with scattered punctures and associated minute hairs; speculum present, with irregular margins; eyes appearing hairless (minute hairs present and visible only under SEM).

Mesosoma: Scutum L:W = 2.1:3.2, not indented, surface granulate, with scattered punctures and associated hairs; humeral sulcus smooth; surface of scutellum finely granulate; fore wings L:W = 9.2:2.7; stigmal vein long, postmarginal vein about 0.7 length of stigmal vein.

Metasoma: L:W = 8.0:3.5; surface of metasomal horn granulate-coriaceous except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.3:3.0; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *ogmocerus*-group by the colour of the body, the eye appearing hairless, and the normal scutum. I have much pleasure in naming it after Dr. Lubomir Masner, Agriculture Canada, Ottawa, Canada. *C. luboi* is known from north Queensland and north-western Western Australia (Fig. 6.415).

6.5.22.4. ***Ceratobaeus moola*** sp. nov. (Figs 6.235, 6.236, 6.296, 6.416)

Type material:

Holotype: ♀, **Papua New Guinea:** "PAPUA NEW GUINEA: Awar, bush 16.VIII.1982, P. Grootaert" (CNCI).

Paratypes: **Papua New Guinea:** 1♀, Morobe Prov., Wau Ecol. Inst., 11-28.viii.1983, S. & P. Miller (CNCI); 1♀, Morobe Prov., Wau Ecol. Inst., viii.1983, S. & P. Miller (CNCI).

Female

Length: 1.7-1.8 mm; body yellow, except for metasomal horn , anterior margin of T3 and T4-T5 which are dark brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; eyes with long hair.

Mesosoma: Scutum L:W = 2.1:3.5, not indented, surface finely granulate, with scattered punctures and associated hairs; humeral sulcus crenulate; surface of scutellum finely granulate; fore wings L:W = 9.7:3.1; stigmal vein long, postmarginal vein about 0.6 length of stigmal vein.

Metasoma: L:W = 8.9:3.3; surface of metasomal horn granulate-coriaceous except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.9:3.1; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *ogmocerus*-group by the eyes with long hairs and the normal scutum. The name 'moola' is an aboriginal word meaning 'shady'. *C. moola* is known only from Papua New Guinea (Fig. 6.416).

6.5.22.5. ***Ceratobaeus ogmocerus*** sp. nov. (Figs 6.237 - 6.239, 6.417)

Type material:

Holotype: ♀, **Australia, Queensland:** "17.06S 145.37E, QLD, GS2, Mt. Edith, 1050m, 31 May - 30 June 1995, P. Zborowski, FI trap, JCU (West)" (ANIC).

Paratypes: **Queensland:** 2♀, same data as holotype (ANIC); 1♀, 17.06S 145.37E, Mt. Edith, 1050m, 3.i-4.ii.1995, PZ (ANIC); 3♀, 17.06S 145.37E, Mt. Edith, 1050m, 4.ii-6.iii.1995, PZ (ANIC, WARI); 2♀, 17.06S 145.37E, Mt. Edith, 1050m, 6.iv-4.v.1995, PZ (ANIC); 1♀, 26km up Tinaroo Ck. Rd. via Mareeba, 10-30.xi.1982, Storey & Brown (QDPC); 2♀, 26km up Tinaroo Ck. Rd. via Mareeba, 16.iii-12.iv.1983, Storey & Brown (QDPC); 1♀, 26km up Tinaroo Ck. Rd. via Mareeba, 12.iv-9.vi.1983, Storey & Brown (QDPC).

Female

Length: 1.2-1.3 mm; body light brown, except for scape, funicle segments, legs including coxae and metasoma (excluding metasomal horn) which are yellow.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum absent; eyes with long hair.

Mesosoma: Scutum L:W = 1.8:2.8, pushed forward, surface finely granulate, with scattered small punctures and associated hairs; humeral sulcus smooth; surface of scutellum finely granulate; fore wings L:W = 7.1:2.3; stigmal vein long, postmarginal vein about 0.5 length of stigmal vein.

Metasoma: L:W = 6.3:2.8; metasomal horn with transverse striations except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.1:2.4; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *ogmocerus*-group by the scutum pushed forward to accommodate metasomal horn. The name 'ogmocerus' is a Greek word meaning 'horn with furrows'. *C. ogmocerus* is known only from north Queensland (Fig. 6.417).

6.5.22.6. ***Ceratobaeus yasini*** sp. nov. (Figs 6.240, 6.241, 6.297, 6.418)

Type material:

Holotype: ♀, **Australia, Western Australia:** "16.22S 125.12E, W. A., Charnley Riv. 2km SW Rolly Hill, CALM Site 25/2, 16-20 June 1988, I.D. Naumann" (ANIC).

Female

Length: 1.3-1.4 mm; body light brown, except for scape, funicle segments, legs including coxae, posterior T1 (base of metasomal horn) and T2 which are yellow.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; speculum present, with irregular margins; eyes appearing hairless (minute hairs present and visible only under SEM).

Mesosoma: Scutum L:W = 1.7:2.7, not indented, surface finely granulate, with scattered small punctures and associated hairs; humeral sulcus crenulate; surface of scutellum finely granulate; fore wings L:W = 7.0:2.2; stigmal vein long, postmarginal vein short, about 0.3 length of stigmal vein.

Metasoma: L:W = 6.0:2.3; metasomal horn with faint longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.4:1.8; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *ogmocerus*-group by the colour of the body, presence of the speculum, the eyes appearing hairless, and the normal scutum. I have much pleasure in naming it after Mr. Muhammad Yasin. *C. yasini* is known only from north-western Western Australia (Fig. 6.418).

6.5.23. The *pachycerus*-group

Diagnosis

Head in anterior view subtriangular in shape; speculum absent; cheek and lower frons smooth; eyes normal in size and appearing hairless (minute hairs present and visible only under SEM); frontal carina short to moderately long but never reaching more than 0.6 distance to median ocellus; lateral ocelli continuous with margin of eyes or distance from eyes < 1OD; antennal clava compact, segments appearing fused, with 4 funicle segments; first funicle segment < 2.0 x as long as wide; in dorsal view head moderately broad, slightly wider than mesosoma; notauli absent; axillar crenulae present; humeral sulcus crenulate; scutum not indented; posterior margin of scutellum indented medially, with single row of foveae; propodeal lamellae blunt to sharply pointed dorsally; wings fully developed; submarginal, marginal and stigmal veins tubular; basal vein faint and spectral or pigmented; fore wings without transverse dark bands, marginal fringe present or absent; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; metasomal horn slender, reaching posterior margin of scutellum, not curved forward, apex narrowly rounded, same colour as rest of metasoma; metasoma < 3.0 x as long as wide, same colour as head and mesosoma.

Comments

The major distinguishing characters of this species-group are the eyes appearing hairless, the posterior margin of the scutellum indented medially, and the metasomal horn not curved forward, same colour as rest of the metasoma. This group contains six species, *C. bethae* sp. nov., *C. dillonae* sp. nov., *C. feckneri* sp. nov., *C. leysonae* sp. nov, *C. muniri* sp. nov. and *C. pachycerus* sp. nov.

6.5.23.1. *Key to females of the* pachycerus-*group*

1. Postmarginal vein as long as stigmal vein (as for Fig. 6.296) .... *C. dillonae* sp. nov.
   Postmarginal vein < 0.5 length of stigmal vein (as for Fig. 6.297) 2

2. Fore wings marginal fringe absent (as for Fig. 6.290) .... *C. muniri* sp. nov.
   Fore wings marginal fringe present (as for Fig. 6.297) 3

3. Body yellow 4
Body brown to black 5

4. Propodeal lamellae sharply pointed dorsally; metasomal horn granulate-coriaceous except for few basal longitudinal striations (Fig. 6.246) .... *C. feckneri* sp. nov.
Propodeal lamellae blunt; metasomal horn with longitudinal striations (Fig. 6.251) .... *C. pachycerus* sp. nov.

5. Body black; speculum present (Fig. 6.242) .... *C. bethae* sp. nov.
Body brown; speculum absent (Fig. 6.247) .... *C. leysonae* sp. nov.

6.5.23.2. ***Ceratobaeus bethae*** sp. nov. (Figs 6.242, 6.243, 6.419)

Type material:

Holotype: ♀, **Australia, Tasmania:** "41.22S 147.24E, 10km ENE of Nunamara, TAS, 12 Jan-6 Feb 1983, I.D. Naumann & J.C. Cardale, Malaise/ ethanol" (ANIC).

Paratypes: **Tasmania:** 1♀, 42.37S 147.39E, 5km W Buckland, 27.i.1983, IDN & JCC (ANIC); 1♀, 41.14S 147.56E, 4km SE Weldborough, 13.i.1983, IDN & JCC (ANIC).

Female

Length: 1.2:1.4 mm; body black, except for antennae and legs including coxae which are dark brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered punctures and associated hairs; frontal carina rudimentary.

Mesosoma: Scutum L:W = 1.9:2.8, surface finely granulate, with scattered small punctures and associated hairs; surface of scutellum finely granulate; propodeal lamellae blunt; fore wings L:W = 7.5:2.4 marginal fringe present; stigmal vein long, postmarginal vein short, about 0.3 length of stigmal vein, basal vein pigmented.

Metasoma: L:W = 5.0:2.5; surface of metasomal horn smooth except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.9:1.4; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *pachycerus*-group by the colour of the body, presence of the speculum, presence of the fore wings marginal fringe, and length of the postmarginal vein. I have much pleasure in naming it after Ms. Beth Roberts. *C. bethae* is known only from Tasmania (Fig. 6.419).

6.5.23.3. ***Ceratobaeus dillonae*** sp. nov. (Figs 6.244, 6.420)

Type material:

Holotype: ♀, **Australia, South Australia:** "S. Aust., Mt. Barker nr. summit, Dec. 1985, Acacia scrub, M. T., A.D. Austin" (ANIC).

Paratype: **Australian Capital Territory:** 1♀, 35.22S 148.50E, 850m, Blundella Ck., 3km E Piccadilly Circus, i.1985, JL, TW & MLJ (ANIC).

Female

Length: 1.3-1.5 mm; body dark brown, except for antennae, legs including coxae and metasoma (excluding metasomal horn) which are brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; frontal carina rudimentary.

Mesosoma: Scutum L:W = 1.8:2.8, surface granulate, with scattered punctures and associated hairs, these punctures more concentrated in anterior half; surface of scutellum finely granulate; propodeal lamellae blunt; fore wings L:W = 7.6:2.6, marginal fringe present; stigmal vein long, postmarginal vein as long as stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 6.0:3.2; metasomal horn granulate-striate except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.1:2.1; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *pachycerus*-group by the length of the postmarginal vein. I have much pleasure in naming it after Ms. Natalie Dillon, The University of Adelaide, South Australia. *C. dillonae* is known from Australian Capital Territory and South Australia (Fig. 6.420).

6.5.23.4. ***Ceratobaeus feckneri*** sp. nov. (Figs 6.245, 6.246, 6.421)

Type material:

Holotype: ♀, **Australia, Queensland:** "15.39S 144E, Split Rock, QLD, 24 Nov-13 Dec 1992, Malaise trap, P. Zborowski & W. Dresslar" (ANIC).

Paratypes: **Queensland:** 1♀, 15.39S 144E, Split Rock, 28.v-26.vi.1993, PZ & IDN (ANIC); 1♀, 15.39S 144E, Split Rock, 24.viii-21.ix.1992, PZ & L. Miller (ANIC).

Female

Length: 1.1-1.3 mm; body yellow.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; frontal carina rudimentary.

Mesosoma: Scutum L:W = 1.8:2.6, surface finely granulate, with scattered small punctures and associated hairs; surface of scutellum finely granulate; propodeal lamellae sharply pointed dorsally; fore wings L:W = 6.9:2.3; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 5.5:2.7; surface of metasomal horn granulate-coriaceous except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.7:2.3, marginal fringe present; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *pachycerus*-group by the colour of the body, shape of the propodeal lamellae, presence of the fore wings marginal fringe, length of the postmarginal vein, and sculpturing of the metasomal horn. .I have much pleasure in naming it after Mr. Terry Feckner, The University of Adelaide, South Australia. *C. feckneri* is known only from Split Rock in north Queensland (Fig. 6.421).

6.5.23.5. ***Ceratobaeus leysonae*** sp. nov. (Figs 6.247, 6.248, 6.422)

Type material:

Holotype: ♀, **Australia, Queensland:** "Wongabel S. F., 6km S of Atherton, N Qld., 13.iii-1.iv.1984, Storey & Brown, F. I. T." (QDPC).

Paratypes: **Queensland:** 1♀, Wongabel S. F., 6km S Atherton, 10.xi-1.xii.1983, Storey & Brown (QDPC); 1♀, Jullaten, 29.x-21.xi.1987, A. Walford-Huggins (ANIC); 1♀, 16km up Davies Rd. via Mareeba, 6.xi-2.xii.1984, Storey & Halfpapp (QDPC).

Female

Length: 1.4-1.6 mm; body brown to dark brown, except for scape, funicle segments, legs including coxae and posterior T1 (base of metasomal horn) which are light brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; frontal carina reaching about 0.6 distance to median ocellus.

Mesosoma: Scutum L:W = 1.6:2.9, surface finely granulate, with scattered small punctures and associated hairs, these punctures more concentrated in anterior half; surface of scutellum finely granulate; propodeal lamellae sharply pointed dorsally; fore wings L:W = 8.0:2.5 marginal fringe present; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 6.5:3.5; surface of metasomal horn granulate-coriaceous except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.1:2.6; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *pachycerus*-group by the colour of the body, absence of the speculum, presence of the fore wings marginal fringe, and length of the postmarginal vein . I have much pleasure in naming it after Ms. Megan Leyson, The University of Adelaide, South Australia. *C. leysonae* is known only from north Queensland (Fig. 6.422).

6.5.23.6. ***Ceratobaeus muniri*** sp. nov. (Figs 6.249, 6.423)

Type material:

Holotype: ♀, **Australia, Tasmania:** "Tasmania: Collinsvale, 12.iii.1983, 300m, M.A. Williams, M. T." (ANIC).

Paratypes: **Tasmania:** 2♀, same data as holotype (WARI); 8♀, 42.50S 147.10E, Fairy Glen, iv.1984, M.A. Williams (ANIC, WARI);

Female

Length: 1.4-1.5 mm; body brown to dark brown, except for scape, funicle segments, legs including coxae and posterior T1 (base of metasomal horn) which are light brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; frontal carina reaching about 0.6 distance to median ocellus.

Mesosoma: Scutum L:W = 1.6:2.8, surface finely granulate, with scattered small punctures and associated hairs, these punctures more concentrated in anterior half; surface of scutellum finely granulate; propodeal lamellae sharply pointed dorsally; fore wings L:W = 7.9:2.6, marginal fringe absent; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 6.5:3.4; surface of metasomal horn granulate except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.0:2.6; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *pachycerus*-group by the presence of the fore wings marginal fringe and length of the postmarginal vein. I have much pleasure in naming it after Dr. Munir Ahmad, Botanic Gardens of Adelaide and State Herbarium, South Australia. *C. muniri* is known only from Tasmania (Fig. 6.423).

6.5.23.7. ***Ceratobaeus pachycerus*** sp. nov. (Figs 6.250, 6.251, 6.424)

Type material:

Holotype: ♀, **Australia, Queensland:** "15.16S 144.59E, 14Km WbyN of Hope Vale, Mission Q, 7-10 May 1981, I.D. Naumann, ex ethanol" (ANIC).

Paratypes: **Queensland:** 1♀, 3-4km S Port Douglas, 17.xi.1979, E.C. Dahmn, J.B. Wooley & J. LaSalle (QDPC).

Female

Length: 1.1-1.2 mm; body yellow.

Head: Upper frons, vertex and occiput finely granulate, with scattered punctures and associated hairs; frontal carina rudimentary.

Mesosoma: Scutum L:W = 1.6:2.6, surface finely granulate, with scattered small punctures and associated hairs; surface of scutellum finely granulate; propodeal lamellae blunt; fore wings L:W = 7.4:2.3, marginal fringe present; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 6.3:2.3; metasomal horn with longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.0:2.1; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *pachycerus*-group by the colour of the body, shape of the propodeal lamellae, presence of the fore wings marginal fringe, length of the postmarginal vein, and sculpturing of the metasomal horn. The name 'pachycerus' is a Greek word meaning 'thick horn'. *C. pachycerus* is known only from north Queensland (Fig. 6.424).

6.5.24. The *platycornutus*-group

Diagnosis

Head in anterior view subtriangular in shape; speculum absent; cheek and lower frons smooth; eyes normal in size and appearing hairless (minute hairs present and visible only under SEM); frontal carina short, reaching 0.3 distance to median ocellus; lateral ocelli continuous with margin of eyes or distance from eyes < 1OD; antennal clava compact, segments appearing fused, with 4 funicle segments; first funicle segment < 2.0 x as long as wide; in dorsal view head moderately broad, slightly wider than mesosoma; notauli absent; axillar crenulae present; humeral sulcus crenulate; scutum not indented; posterior margin of scutellum indented medially, smooth; propodeal lamellae blunt; wings fully developed; submarginal, marginal and stigmal veins tubular; basal vein faint and spectral; fore wings without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; metasomal horn slender, reaching posterior margin of scutellum, curved forward, flattened apex, same colour as rest of metasoma; metasoma < 3.0 x as long as wide, same colour as head and mesosoma.

Comments

The major distinguishing characters of this species-group are the metasomal horn with flattened apex, curved forward, and the metasoma < 3.0 x as long as wide. This group contains one species, *C. platycornutus* Austin.

6.5.24.1. ***Ceratobaeus platycornutus*** Austin (Figs 6.252, 6.425)

Ceratobaeus platycornutus Austin, 1984a: 30.
Idris platycornutus; Johnson 1992: 414.

Type material:

Holotype: ♀, **Australia, Australian Capital Territory:** "Canberra, 14.i.1980, A.D. Austin, ex egg Clubiona sp." (ANIC)

Paratypes: **Australian Capital Territory:** 4♀, 1♂, same data as holotype (QDPC).

Other specimens examined:

Western Australia: 1♀, 31.35S 116.15E, Walyunga N. P., 24.xii.1986, J.S. Noyes (WARI).

Female

Length: 1.8-1.9 mm; body black, except for scape, funicle segments, legs including coxae and metasoma (excluding metasomal horn) which are brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs.

Mesosoma: Scutum L:W = 2.3:3.5, surface finely granulate, with scattered small punctures and associated hairs; surface of scutellum finely granulate; fore wings L:W = 10.1:3.1; stigmal vein long, postmarginal vein short, about 0.3 length of stigmal vein.

Metasoma: L:W = 9.6:4.0; surface of metasomal horn smooth except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 2.3:3.0; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Differing from female in the following: antennae 12-segmented; wings reaching well past posterior metasoma; anterior T1 inflected dorsally; T1-T3 with longitudinal striations.

Comments

C. platycornutus is known from Australian Capital Territory and south-western Western Australia (Fig. 6.425).

6.5.25. The *schmidti*-group

Diagnosis

Head in anterior view subtriangular in shape; speculum absent; cheek and lower frons smooth; eyes normal in size and with rudimentary or long hairs; frontal carina short to moderately long but never reaching more than 0.6 distance to median ocellus; lateral ocelli continuous with margin of eyes or distance from eyes < 1OD; antennal clava compact, segments appearing fused, with 4 funicle segments; first funicle segment < 2.0 x as long as wide; in dorsal view head moderately broad, slightly wider than mesosoma; notauli absent; axillar crenulae present; humeral sulcus smooth or crenulate; scutum not indented; posterior margin of scutellum indented medially, with or without single row of foveae; propodeal lamellae blunt; wings fully developed; submarginal, marginal and stigmal veins tubular; basal vein faint and spectral; fore wings without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; metasomal horn slender, reaching posterior margin of scutellum, curved forward, apex narrowly rounded, colour darker than rest of metasoma; metasoma < 3.0 x as long as wide, same colour as or lighter than head and mesosoma.

Comments

The major distinguishing characters of this species-group are the speculum absent, the basal vein spectral, the metasomal horn curved forward, the apex narrowly rounded, colour darker than rest of the metasoma, and the metasoma < 3.0 x as long as wide. This group contains three species, *C. schmidti* sp. nov., *C. systenus* sp. nov. and *C. usmani* sp. nov.

6.5.25.1. *Key to females of the* schmidti-*group*

1. Eyes with long hairs (Fig. 6.253) 2
   Eyes appearing hairless (minute hairs present and visible only under SEM) (Fig. 6.258) .... *C. usmani* sp. nov.

2. Frontal carina incomplete, reaching about 0.6 distance to median ocellus; body dark brown, except for antennae, legs including coxae and metasoma (excluding metasomal horn) which are white to yellow .... *C. schmidti* sp. nov.
   Frontal carina rudimentary (Fig. 6.255); body dark brown to black, except for antennae, legs including coxae and metasoma (excluding metasomal horn) which are brown .... *C. systenus* sp. nov.

6.5.25.2. ***Ceratobaeus schmidti*** sp. nov. (Figs 6.253, 6.254, 6.426)

Type material:

Holotype: ♀, **Australia, Queensland:** "15.16S 144.59E, 14km WbyN of Hope Vale, Mission Q, 7-10May 1981, I.D. Naumann, ex ethanol (ANIC).

Paratypes: **Queensland:** 1♀, Wongabel S. F., 6km S Atherton, 10.xi-1.xii.1983, Storey & Brown (QDPC); 3♀, Upper Clayton Gully, 400-600m, nr. Cunningham's Gap, 25.iv.1974, IDN (QDPC); 1♀, 22km W Gordonvale, 13.xi.1979, E.C. Dahmn, J.W. Wooley, J. LaSalle (QDPC); 3♀, 15.04S 145.07, Mt. Webb N. P., 28-30.ix.1980, JCC (ANIC).

Female

Length: 1.1-1.2 mm; body dark brown, except for antennae, legs including coxae and metasoma (excluding metasomal horn) which are white to yellow.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated long hairs; eyes with long hair; frontal carina reaching about 0.6 distance to median ocellus.

Mesosoma: Scutum L:W = 1.9:2.8, surface finely granulate, with scattered small punctures and associated hairs; humeral sulcus smooth; surface of scutellum finely granulate, posterior margin with single row of foveae; fore wings L:W = 7.5:2.4; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein.

Metasoma: L:W = 6.2:2.2; surface of metasomal horn smooth except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.9:2.1; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *schmidti*-group by the colour of the body, the frontal carina reaching 0.6 distance to median ocellus, and the eyes with long hairs. I have much pleasure in naming it after Professor Otto Schmidt, The University of Adelaide, South Australia. *C. schmidti* is known only from north-eastern Queensland (Fig. 6.426).

6.5.25.3. ***Ceratobaeus systenus*** sp. nov. (Figs 6.255, 6.256, 6.427)

Type material:

Holotype: ♀, **Australia, Western Australia:** "W. AUST: Fitzgerald River N. P., Quaalup area, 5-9.i.1989, J.S. Noyes" (ANIC).

Paratypes: **Western Australia:** 2♀, Walpole Nornalup N. P., 17-21.i.1987, J.S. Noyes (ANIC, WARI); 1♀, 10km E Pinjarra, 22.i.1987, J.S. Noyes (CNCI).

Female

Length: 1.2-1.3 mm; body dark brown to black, except for antennae, legs including coxae and metasoma (excluding metasomal horn) which are brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; eyes with long hair; frontal carina rudimentary.

Mesosoma: Scutum L:W = 1.7:2.3, surface finely granulate, with scattered small punctures and associated hairs; humeral sulcus smooth; surface of scutellum finely granulate, posterior margin without single row of foveae; fore wings L:W = 7.8:2.3; stigmal vein long, postmarginal vein short, about 0.3 length of stigmal vein.

Metasoma: L:W = 5.8:2.4; surface of metasomal horn coriaceous except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.1:2.0; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *schmidti*-group by the colour of the body, the frontal carina rudimentary, and the eyes with long hairs. The name 'systenus' is a Greek word meaning 'pointed'. *C. systenus* is known only from south-western Western Australia (Fig. 6.427).

6.5.25.4. ***Ceratobaeus usmani*** sp. nov. (Figs 6.258, 6.259, 6.428)

Type material:

Holotype: ♀, **Australia, Australian Capital Territory:** "35.22S 148.48E, Piccadilly Circus, 1240m, ACT, Mar. '84, J. Lawrence, TW, M-L. Johnson, coll." (ANIC).

Female

Length: 1.1 mm; body dark brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina reaching about 0.6 distance to median ocellus.

Mesosoma: Scutum L:W = 2.0:2.4, surface finely granulate, with scattered small punctures and associated hairs; humeral sulcus crenulate; surface of scutellum finely granulate, posterior margin with single row of foveae ; fore wings L:W = 7.0:2.0; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein.

Metasoma: L:W = 5.0:2.6; surface of metasomal horn granulate-coriaceous except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 0.8:2.3; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *schmidti*-group by the eyes appearing hairless. I have much pleasure in naming it after Mr. Usman Ajmal. *C. usmani* is known only Australian Capital Territory (Fig. 6.428).

6.5.26. The *setosus*-group

Diagnosis

Head in anterior view subtriangular in shape; speculum present; cheek and lower frons striate; eyes normal in size and with rudimentary or long hairs; frontal carina short, reaching 0.3 distance to median ocellus; lateral ocelli continuous with margin of eyes or distance from eyes < 1OD; antennal clava compact, segments appearing fused, with 4 funicle segments; first funicle segment < 2.0 x as long as wide; in dorsal view head moderately broad, slightly wider than mesosoma; notauli present or absent; axillar crenulae present or absent; humeral sulcus smooth; scutum not indented; posterior margin of scutellum rounded, with single row of foveae; propodeal lamellae blunt; wings fully developed; submarginal, marginal and stigmal veins tubular; basal vein faint and spectral or pigmented; fore wings without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; metasomal horn slender, reaching posterior margin of scutellum, not curved forward, apex narrowly rounded, same colour as rest of metasoma; metasoma < 3.0 x as long as wide, same colour as head and mesosoma.

Comments

The major distinguishing characters of this species-group are the cheek and lower frons striate, the propodeal lamellae blunt, and the metasomal horn not curved forward. This group contains two species, *C. moonga* sp. nov. and *C. setosus* Dodd.

6.5.26.1. *Key to females of the* setosus-*group*

1. Eyes with long hairs (Fig. 6.263); basal vein pigmented (as for Fig. 6.280) .... *C. setosus* Dodd
   Eyes appearing hairless (minute hairs present and visible only under SEM) (Fig. 6.260); basal vein spectral .... *C. moonga* sp. nov.

6.5.26.2. ***Ceratobaeus moonga*** sp. nov. (Figs 6.260 - 6.262, 6.429)

Type material:

Holotype: ♀, **Australia, South Australia:** "S. Aust: Mt. Remarkable nr. Mambray Crk (Rangers Stn), 32.48S 138.10E, 6-17.ii.1989, M. T., Austin & Dangerfield" (ANIC).

Female

Length: 1.4 mm; body black, except for legs including coxae which are light brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; eyes appearing hairless (minute hairs present and visible only under SEM).

Mesosoma: Scutum L:W = 2.5:3.2, surface finely granulate, with scattered small punctures and associated hairs; notauli present, reaching one-eighth the distance to anterior margin of scutum; axillar crenulae present; surface of scutellum finely granulate; fore wings L:W = 8.6:2.9; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein faint and spectral.

Metasoma: L:W = 6.1:3.4; surface of metasomal horn granulate-coriaceous except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.8:2.1; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

The name 'moonga' is an aboriginal word meaning 'dark'. *C. moonga* is known only from Mount Remarkable, South Australia (Fig. 6.429).

6.5.26.3. ***Ceratobaeus setosus*** Dodd (Figs 6.263, 6.430)

Ceratobaeus setosus Dodd, 1914b: 65; Kieffer 1926: 157, 162; Austin 1981a: 85; Austin 1984a: 33.

Idris setosus; Johnson 1992: 415.

Type material:

Holotype: ♀, **Australia, Queensland:** "Gordonvale (Nelson), Queensland, 29.x.1913, A. P. Dodd" (SAMA).

Other specimens examined:

Queensland: 7♀, 1♂, Maleny, 14.vi.1973, M.D. (QDPC); 1♀, 15km E Mareeba, 12.ii.1989, H. Howden (CNCI); 1♀, 24.48S 149.46E, 35km SW Moura, 24.x.1992, P. Macnicol (ANIC); 1♀, Sunday Ck., 600-760m, nr. Jimna, 28-29.ix.1974, IDN (QDPC); **New South Wales:** 4♀, 2♂, Caringbah, 22.iii.1976, A.D. Austin (QDPC); **South Australia:** 1♀, 34.19S 139.30E, Brookfield C. P., 12.ix-20.x.1991, J. Stelman & S. Williams (ANIC); **Western Australia:** 1♀, 46km W Ravensthorpe, Hway 1, 4.i.1987, J.S. Noyes (WARI).

Female

Length: 1.2-1.3 mm; body black.

Head: Upper frons, vertex and occiput finely granulate, with scattered punctures and associated hairs; eyes with long hair.

Mesosoma: Scutum L:W = 2.2:2.8, surface finely granulate, with scattered small punctures and associated hairs; notauli absent; axillar crenulae absent; surface of scutellum finely granulate, covered with long hairs; fore wings L:W = 7.5:2.5; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein, basal vein pigmented.

Metasoma: L:W = 6.0:3.3; surface of metasomal horn granulate except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.2:2.2; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with dense long hairs.

Male

Differing from female in the following: antennae 12-segmented; fore wings long, reaching well pass posterior metasoma; anterior T1 expanded dorsally into hump, not reaching above propodeum.

Comments

C. setosus is broadly distributed across mainland Australia (Fig. 6.430).

6.5.27. The *varicornis*-group

Diagnosis

Head in anterior view elongate and broad in buccal region; speculum present; cheek and lower frons striate; eyes normal in size and with rudimentary or long hairs; frontal carina short, never reaching more than 0.3 distance to median ocellus; lateral ocelli continuous with margin of eyes or distance from eyes < 1OD; antennal clava compact, segments appearing fused, with 4 funicle segments; first funicle segment > 2.4 x as long as wide; in dorsal view head moderately broad, slightly wider than mesosoma; notauli absent; axillar crenulae present; humeral sulcus crenulate; scutum not indented; posterior margin of scutellum indented medially, smooth or with single row of foveae; propodeal lamellae blunt; wings fully developed; submarginal, marginal and stigmal veins tubular; basal vein faint and spectral; fore wings without transverse dark bands, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; metasomal horn slender, reaching posterior margin of scutellum, curved forward, apex narrowly rounded, colour darker than rest of metasoma; metasoma < 3.0 x as long as wide, same colour as head and mesosoma.

Comments

The major distinguishing characters of this species-group are the speculum present, the first funicle segment > 2.4 x as long as wide, the metasomal horn curved forward, the apex narrowly rounded, and the metasoma < 3.0 x as long as wide. This group contains three species, *C. grandis* Dodd, *C. proipetye* sp. nov. and *C. varicornis* Dodd.

6.5.27.1. *Key to females of the* varicornis-*group*

1. Head, mesosoma and metasomal horn dark brown to black, metasoma light brown .... *C. varicornis* Dodd
   Body yellow to light brown 2

2. Eyes with long hairs (Fig. 6.264); apical 0.2 of metasomal horn black, basal 0.8 yellow .... *C. grandis* Dodd
   Eyes appearing hairless (minute hairs present and visible only under SEM) (Fig. 6.266); metasomal horn light brown .... *C. proipetye* sp. nov.

6.5.27.2. *Ceratobaeus grandis* Dodd (Figs 6.264, 6.265, 6.431)

Ceratobaeus grandis Dodd, 1914a: 88; Dodd 1914b: 64, 66; Kieffer 1926: 140, 144; Austin 1981a: 84.
Idris grandis; Johnson 1992: 409.

Type material:

Holotype: ♀, **Australia, Queensland:** "Sweeping in forest, Nelson, near Cairns, North Queensland, 2.viii.1913, A.P. Dodd" (SAMA).

Other specimens examined:

Queensland: 1♀, Cloudia R. nr. Mt. Lamond, 20.xii.1971, P.K. McAlpine, G.A. Holloway & D.P. Sands (ANIC); 1♀, 9.3km N Ellis Beach, 50m, 30.iv.1990, J. Heraty (CNCI); 1♀, 9.3km NE Ellis Beach, 10m, 1.v.1990, J. Heraty (CNCI); 1♀, Iron Range, Cape York, 13-20.v.1975, K.J. Houston (QDPC); 1♀, 4km NbyW Kuranda, 16.v.1980, IDN & JCC (ANIC); 2♀, Kowanyama, 26.vii.1982, J.F. Donaldson (QDPC); 1♀, 10km SW Mareeba, 26.iv.1974, I.D. Galloway (QDPC); 1♀, Base Tinaroo Falls, 30.iii.1976, I.D. Galloway (QDPC); 2♀, Wangett Back Riple Range, 23km SE Port Douglas, 31.iii.1991, J.D. Pinto (CNCI); **Western Australia:** 1♀, 14.25S 126.40E, 14km SE Kalumburu Mission, 3-6.vi.1988, T.A. TW (ANIC); 10♀, 14.49S 125.50E, Mining Camp, Mitchell Plateau, 9-19.v.1983, IDN & JCC (ANIC); 1♀, 14.45S 125.47E, 10km NW of Mining Camp, Mitchell Plateau, 17.v.1983, IDN & JCC (ANIC).

Female

Length: 1.6-1.7 mm; body yellow, except apical 0.2 of metasomal horn which is black.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; eyes with long hair; frontal carina reaching about 0.3 distance to median ocellus.

Mesosoma: Scutum L:W = 2.1:3.3, surface finely granulate, with scattered small punctures and associated hairs; surface of scutellum finely granulate, posterior margin smooth; fore wings L:W = 10.0:2.8; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein.

Metasoma: L:W = 7.5:3.4; metasomal surface of metasomal horn smooth except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.3:2.7; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *varicornis*-group by the colour of the body and the eyes with long hairs. *C. grandis* is known from north Queensland and north-western Western Australia (Fig. 6.431).

6.5.27.3. ***Ceratobaeus proipetye*** sp. nov. (Figs 6.266, 6.267, 6.432)

Type material:

Holotype: ♀, **Australia, Queensland:** "11.45S 142.35E, QLD, Heathlands dump, 7 June-25 July 1992, P. Zborowski, E. Nielsen, Malaise #2, open forest" (ANIC).

Paratypes: **Queensland:** 1♀, 11.45S 142.35E, Heathlands, 20.x-21.xi.1992, PZ & A. Calder (ANIC); **Western Australia:** 1♀, 14.49S 125.50E, Mining Camp, Mitchell Plateau, 9-19.v.1983, IDN & JCC (ANIC); 1♀, 14.52S 125.50E, 4km SW Mining Camp, Mitchell Plateau, 2-6.vi.1988, IDN (ANIC).

Female

Length: 1.8-2.1mm; body light brown, except legs including coxae which are yellow.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina rudimentary.

Mesosoma: Scutum L:W = 2.6:4.8, surface granulate, with scattered small punctures and associated hairs; surface of scutellum finely granulate, posterior margin with single row of foveae; fore wings L:W = 12.0:3.9; stigmal vein long, postmarginal vein short, about 0.2 length of stigmal vein.

Metasoma: L:W = 9.5:4.1; metasomal surface of metasomal horn smooth except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 2.0:3.2; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *varicornis*-group by the colour of the body and the eyes appearing hairless. The name 'proipetye' is an aboriginal word meaning 'big face'. *C. proipetye* is known from north Queensland and north-western Western Australia (Fig. 6.432).

6.5.27.4. ***Ceratobaeus varicornis*** Dodd (Figs 6.268, 6.269, 6.433)

Ceratobaeus varicornis Dodd, 1914b: 63, 65; Kieffer 1926: 139, 142; Austin 1981a: 85.
Idris varicornis; Johnson 1992: 417.

Type material:

Holotype: ♀, **Australia, Queensland:** "Sweeping in forest, Nelson, North Queensland, 1.vii.1913, A.P. Dodd" (SAMA).

Other specimens examined:

Queensland: 1♀, Dogwood Ck., 1km W Miles, 7.x.1974, I.D. Galloway (QDPC); 1♀, Emmett Ck. 40km S Townsville, 17.iv.1974, J F. Donaldson (QDPC); 1♀, Peases Lookout, Eungella N. P., 9.v.1980, IDN & JCC (ANIC); 1♀, 4km SE Gordonvale, 15.v.1980, IDN & JCC (ANIC); 1♀, Innisfall, x.1919, A.P. Dodd (ANIC); 1♀, 1.5km N Kennedy, 11.xi.1979, E.C. Dahmn & J. LaSalle (QDPC); 1♀, Mt. Mee, 11.iv.1974, J. Donaldson

(QDPC); 1♀, 18km N Proserpine, 8.xi.1975, I.D. Galloway (QDPC); 1♀, 7km S Rockhampton, 14.iv.1974, J. Donaldson (QDPC); 1♀, no locality, no date, A.A. Girault (ANIC); **Northern Territory:** 1♀, McArthur Riv., vi-vii.1961, A. Fricker (CNCI); **Papua New Guinea:** 1♀, Awar, Village st., 1228, 6.vi.1982, P. Grootaert (CNCI).

Female

Length: 1.7-1.8 mm; head, mesosoma and metasomal horn dark brown to black, metasoma brown, antennae and legs yellow.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated hairs; eyes appearing hairless (minute hairs present and visible only under SEM); frontal carina reaching about 0.3 distance to median ocellus.

Mesosoma: Scutum L:W = 2.2:3.5, surface finely granulate, with scattered punctures and associated hairs; surface of scutellum finely granulate, posterior margin with single row of foveae; fore wings L:W = 10.2:3.3; stigmal vein long, postmarginal vein very short, about 0.2 length of stigmal vein.

Metasoma: L:W = 7.7:3.4; metasomal surface of metasomal horn smooth except for few basal longitudinal striations and scrobiculate antero-basal margins; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.4:2.7; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *varicornis*-group by the colour of the body. *C. varicornis* is known from north Queensland, Northern Territory and Papua New Guinea (Fig. 6.433).

6.5.28. The *zebae*-group

Diagnosis

Head in anterior view subtriangular in shape; speculum absent; cheek and lower frons smooth; eyes normal in size and with long hairs; frontal carina moderately long, reaching 0.6 distance to median ocellus; lateral ocelli continuous with margin of eyes or distance from eyes < 1OD; antennal clava compact, segments appearing fused, with 4 funicle segments; first funicle segment < 2.0 x as long as wide; in dorsal view head moderately broad, slightly wider than mesosoma; notauli absent; axillar crenulae sometimes present; humeral sulcus smooth; scutum not indented; posterior margin of scutellum rounded, smooth; propodeal lamellae blunt; wings fully developed; submarginal, marginal and stigmal veins tubular; basal vein faint and spectral; fore wings with transverse dark bands and marginal fringe present or absent; bristles on submarginal vein of fore wing rudimentary to long; metasomal horn narrow or broad at base, sometimes reaching posterior margin of scutellum, not curved forward, apex narrowly rounded, same colour as rest of metasoma; metasoma < 3.0 x as long as wide, same colour as or lighter than head and mesosoma.

Comments

The major distinguishing characters of this species-group are the posterior margin of the scutellum rounded, smooth, and the metasomal horn not curved forward. This group contains three species, *C. grahami* sp. nov., *C. kiefferi* sp. nov. and *C. zebae* sp. nov. This species-group has restricted distribution to tropical rainforest of north Queensland.

6.5.28.1. *Key to females of the* zebae-*group*

1. Metasomal horn reaching posterior margin of scutellum (Fig. 6.270) 2
   Metasomal horn not reaching posterior margin of scutellum (Fig. 6.275) 3

2. Surface of metasomal horn with transverse striations (Fig. 6.278); head, mesosoma, fore legs and apex of metasomal horn dark brown, antennae, metasoma and basal metasomal horn white, mid and hind legs white with dark brown shading on femora and tibiae .... *C. zebae* sp. nov.
   Surface of metasomal horn with longitudinal striations (Fig. 6.271); head, mesosoma, fore legs and apex of metasomal horn dark brown, antennae, metasoma and basal metasomal horn light brown, mid and hind legs light brown with dark brown shading on femora and tibiae .... *C. anmarae* sp. nov.
3. Head, mesosoma, fore legs and apex of metasomal horn dark brown, antennae, metasoma and basal metasomal horn white, mid and hind legs white with dark brown shading on femora and tibiae .... *C. grahami* sp. nov.
   Body brown, except for posterior margin of scutellum and anterior margins of T3-T5 which are dark brown .... *C. kiefferi* sp. nov.

6.5.28.2. ***Ceratobaeus anmarae*** sp. nov. (Figs 6.270, 6.271, 6.434)

Type material:

Holotype: ♀, **Australia, Queensland:** "17.16S 145.51E, Bellenden Ker Range, Summit TV Stn., 1560m, 17.x-5.xi.1981, no collector, pantrap/ Malaise trap in rainforest" (QDPC).

Paratypes: **Queensland:** 1♀, same data as holotype (QDPC); 1♀, 17.16S 145.51E, Bellenden Ker Range, Summit TV Stn., 1560m, 1-7.xi.1981, no collector (QDPC); 1♀, Bellenden Ker Range, Centre Peak, 1500m, 10.iv.1979, no collector (QDPC); 1♀, Bartle Ferere, 0.5km N Sth. Peak, 1500m, 6-8.xi.1981, no collector (QDPC); 1♀, Bartle Ferere, NW Peak, 1440m, 24.ix.1981, G. Monteith (QDPC).

Female

Length: 1.0-1.2 mm; head, mesosoma, fore legs and apex of metasomal horn dark brown, antennae, metasoma and basal metasomal horn light brown, mid and hind legs light brown with dark brown shading on femora and tibiae.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs.

Mesosoma: Scutum L:W = 1.4:2.2, surface finely granulate, with scattered small punctures and associated hairs; axillar crenulae present; surface of scutellum finely granulate; fore wings L:W = 7.0:2.3, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; stigmal vein long, postmarginal vein about 0.5 the length of stigmal vein.

Metasoma: L:W = 6.1:2.2; metasomal horn slender and narrow apically, reaching posterior margin of scutellum; T1 (including metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.0:2.1; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *zebae*-group by the length and sculpturing of the metasomal horn. I have much pleasure in naming it after Ms. Anne-Marie Dangerfield. *C. anmarae* is known only from north Queensland (Fig. 6.434).

6.5.28.3. ***Ceratobaeus grahami*** sp. nov. (Figs 6.272, 6.273, 6.435)

Type material:

Holotype: ♀, **Australia, Queensland:** "17.27S 145.29E, 1150m, GS3 Hugh Nelson R., QLD, 6.iii-4.iv.1995, P. Zborowski, Malaise trap" (ANIC).

Paratypes: **Queensland:** 1♀, Bartle Frere, NW Peak, 1440m, 24.ix.1981, G. Monteith (ANIC); 1♀, 17.27S 145.29E, Longlands Gap, 4.iv-2.v.1995, PZ (ANIC); 1♀, 17.28S 145.29E, Longlands Gap, 2.v-1.vi.1995, PZ (ANIC); 3♀, 17.27S 145.29E, Longlands Gap, 1.vi-3.vii.1995, PZ (ANIC).

Female

Length: 1.1-1.2 mm; head, mesosoma, fore legs and apex of metasomal horn dark brown, antennae, metasoma and basal metasomal horn white, mid and hind legs white with dark brown shading on femora and tibiae.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs.

Mesosoma: Scutum L:W = 1.6:2.4, surface finely granulate, with scattered small punctures and associated hairs; axillar crenulae absent; surface of scutellum finely granulate; fore wings L:W = 7.0:2.0, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; stigmal vein long, postmarginal vein about 0.5 length of stigmal vein.

Metasoma: L:W = 5.5:2.5; metasomal horn broad at base and narrow apically, not reaching posterior margin of scutellum; T1 (including metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.0:1.9; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *zebae*-group by the colour of the body and length of the metasomal horn. I have much pleasure in naming it after Mr. Graham Lewis, The University of Adelaide, South Australia. *C. grahami* is known only from north Queensland (Fig. 6.435).

6.5.28.4. ***Ceratobaeus kiefferi*** sp. nov. (Figs 6.274, 6.275, 6.436)

Type material:

Holotype: ♀, **Australia, Queensland:** "13.39S 142.40E, 2km N Rokeby, 15.vii-15.viii.1993, Zborowski, Balderson, flight intercept trap" (ANIC).

Paratype: **Queensland:** 1♀, 13.39S 142.40E, 2km N Rokeby, 13.ix-26.x.1993, PZ & D. Reitz (ANIC).

Female

Length: 1.1-1.2 mm; body brown, except for posterior margin of scutellum and anterior margins of T3-T5 which are dark brown.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs.

Mesosoma: Scutum L:W = 1.4:2.5, surface finely granulate, with scattered small punctures and associated hairs; axillar crenulae absent; surface of scutellum finely granulate; fore wings L:W = 5.9:2.0, marginal fringe absent; bristles on submarginal vein of fore wing rudimentary, not reaching beyond anterior margin; stigmal vein long, postmarginal vein as long as stigmal vein.

Metasoma: L:W = 6.1:2.7; metasomal horn broad at base and narrow apically, not reaching posterior margin of scutellum, T1 (including metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.0:2.2; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *zebae*-group by the colour of the body and length of the metasomal horn. I have much pleasure in naming it after Dr. J. Kieffer. *C. kiefferi* is known only from north Queensland (Fig. 6.436).

6.5.28.5. ***Ceratobaeus zebae*** sp. nov. (Figs 6.276 - 6.278, 6.437)

Type material:

Holotype: ♀, **Australia, Queensland:** "26km up Tinaroo Ck. Rd. via Mareeba, Qld., 16.iii-12.iv.1983, Storey, Brown" (QDPC).

Paratypes: **Queensland:** 2♀, same data as holotype (QDPC); 1♀, 17.06S 145.36E, Mt. Haig, 1150m, 4-31.v.1995, PZ (ANIC).

Female

Length: 1.1-1.2 mm; head, mesosoma, fore legs and apex of metasomal horn dark brown, antennae, metasoma and basal metasomal horn white, mid and hind legs white with dark brown shading on femora and tibiae.

Head: Upper frons, vertex and occiput finely granulate, with scattered minute punctures and associated minute hairs.

Mesosoma: Scutum L:W = 1.4:2.3, surface finely granulate, with scattered small punctures and associated hairs; axillar crenulae present; surface of scutellum finely granulate; fore wings L:W = 7.1:2.3, marginal fringe present; bristles on submarginal vein of fore wing long, reaching beyond anterior margin; stigmal vein long, postmarginal vein about 0.5 the length of stigmal vein.

Metasoma: L:W = 6.0:2.3; metasomal horn slender and narrow apically, reaching posterior margin of scutellum, surface with transverse striations except few basal longitudinal striations; rest of T1 (other than metasomal horn) and T2 longitudinally striate, with fine granulate sculpturing; medial length of T2:T3 = 1.2:2.0; T3-T5 finely granulate-coriaceous, with smooth posterior margins; all terga with sparse long hairs.

Male

Unknown.

Comments

This species can be separated from other species in the *zebae*-group by the length and sculpturing of the metasomal horn. I have much pleasure in naming it after Ms. Zeba Iqbal. *C. zebae* is known only from north Queensland (Fig. 6.437).

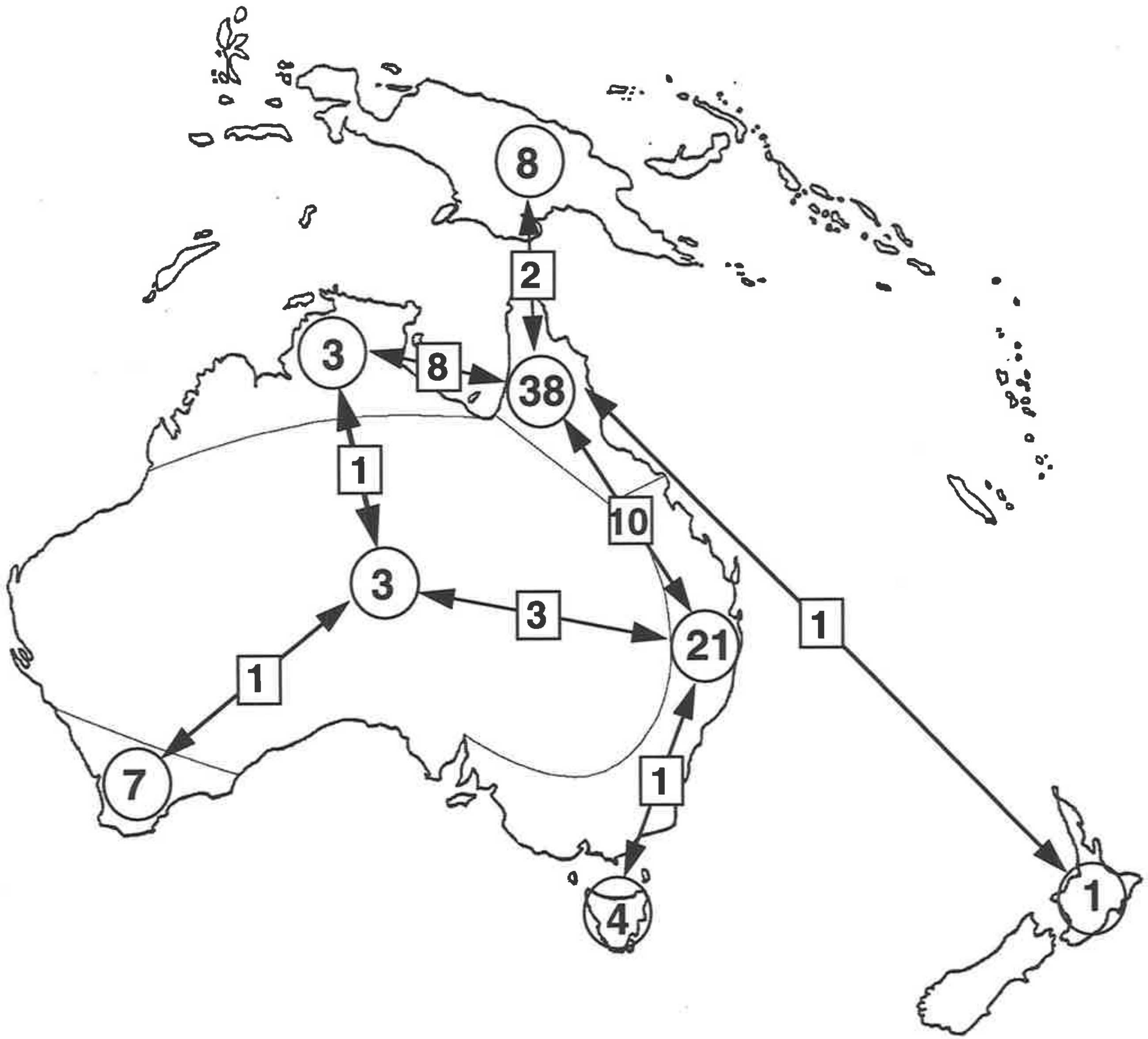
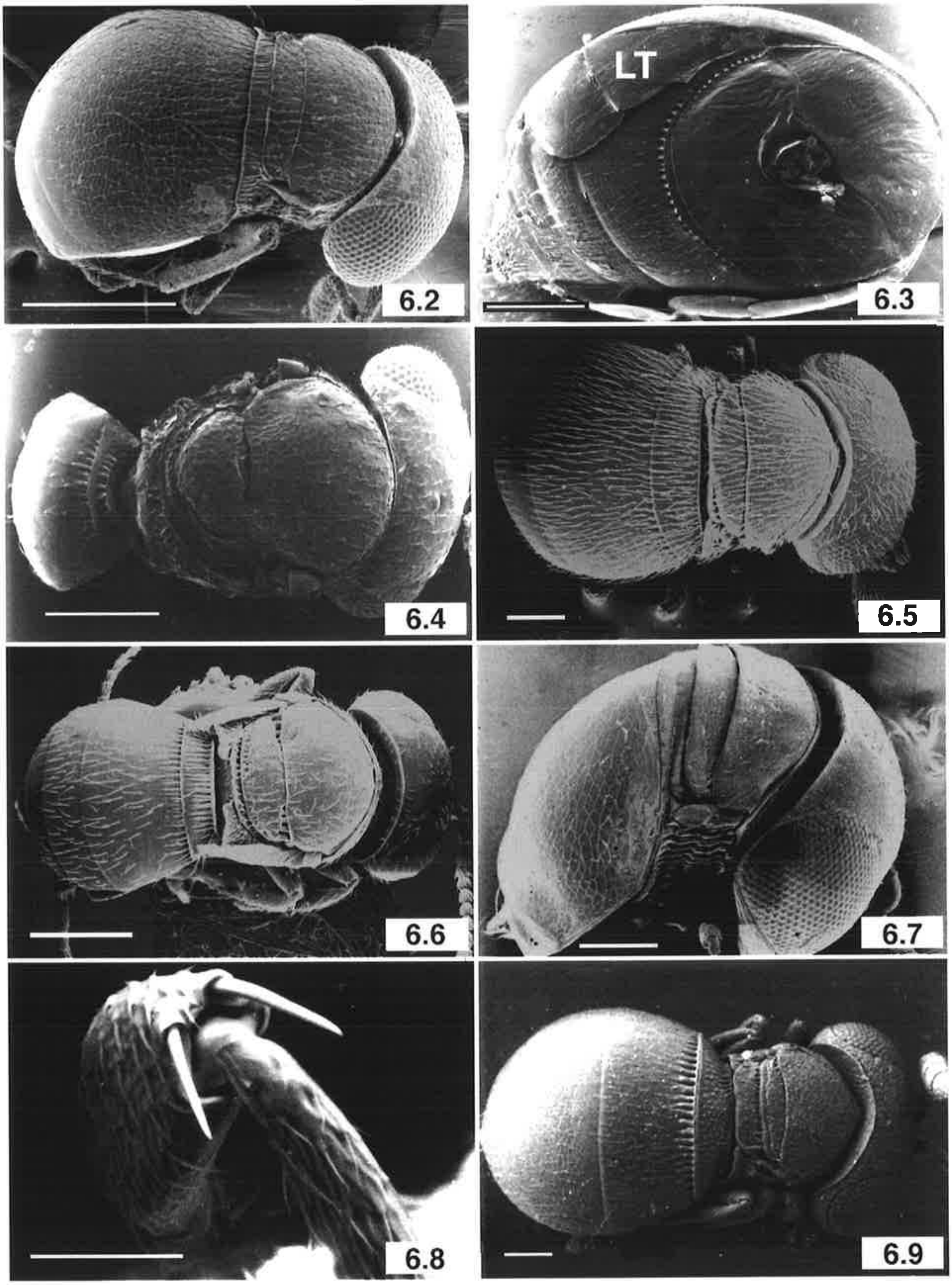
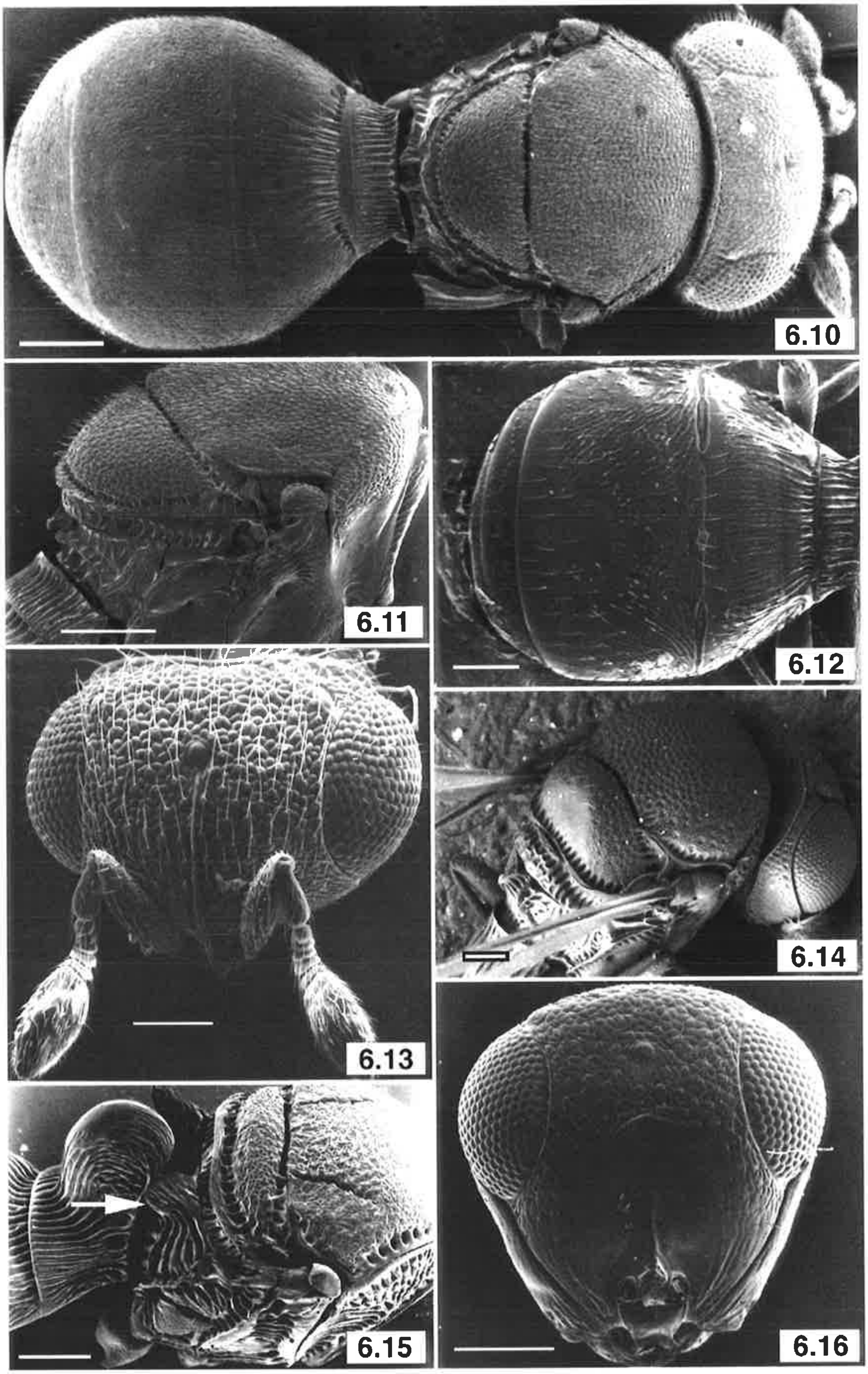


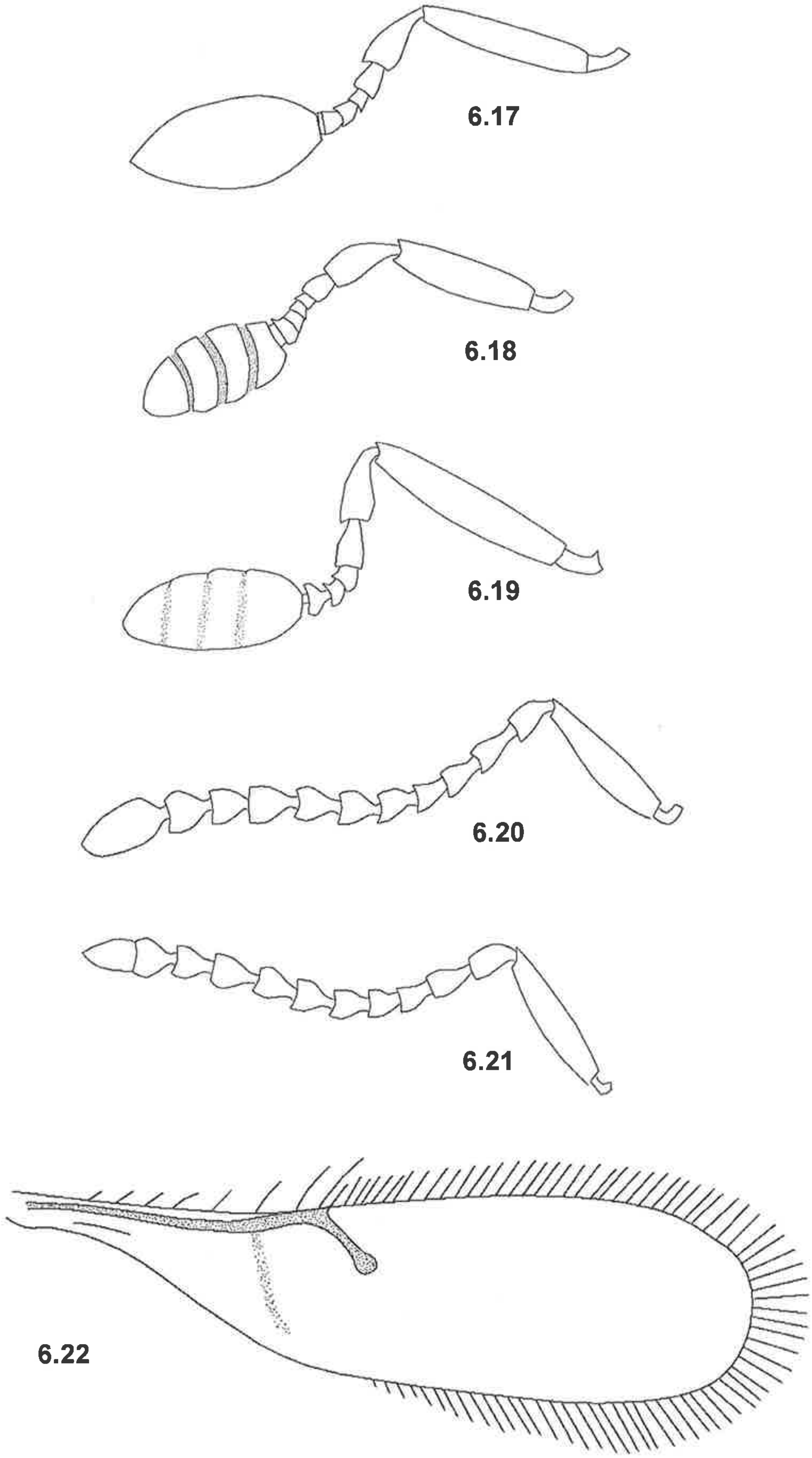
Fig.6.1. Number of *Ceratobaeus* spp. endemic (in circles) to particular biogeographic regions, and shared between them (in squares).



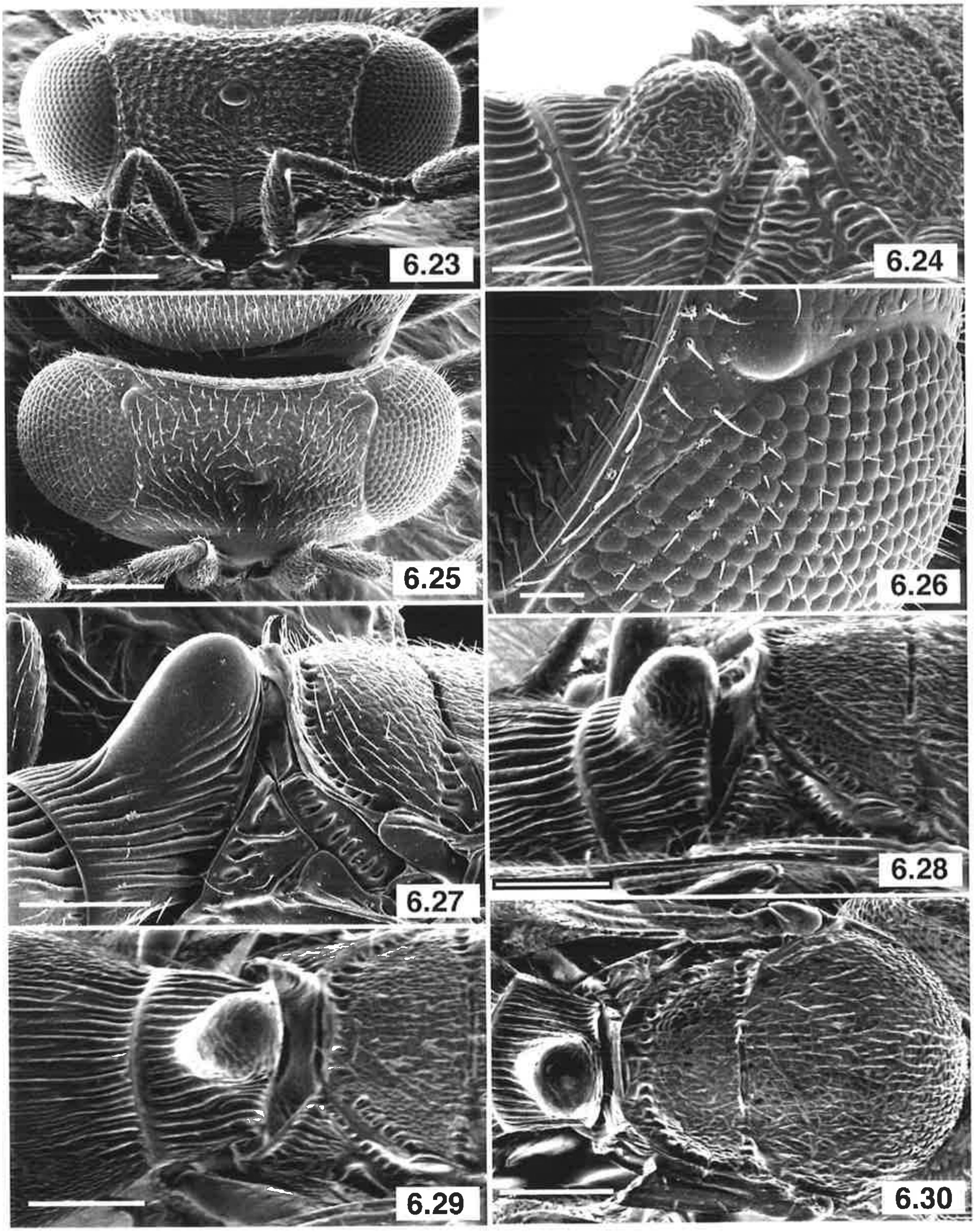
Figs 6.2-6.9. 6.2-6.4, *Baeus* sp.: **6.2**, female; **6.3**, ventral metasoma showing free laterotergites; **6.4**, male with wings removed; 6.5, 6.6, *Neobaeus novazealandensis* Austin: **6.5**, female; **6.6**, male; 6.7-6.8, *Mirobaeoides* sp.: **6.7**, female (lateral view); **6.8**, femoral spines; **6.9**, *Mirobaeus* sp., female. Scale lines: 6.8, 50µm; 6.2-6.7, 6.9, 100µm.



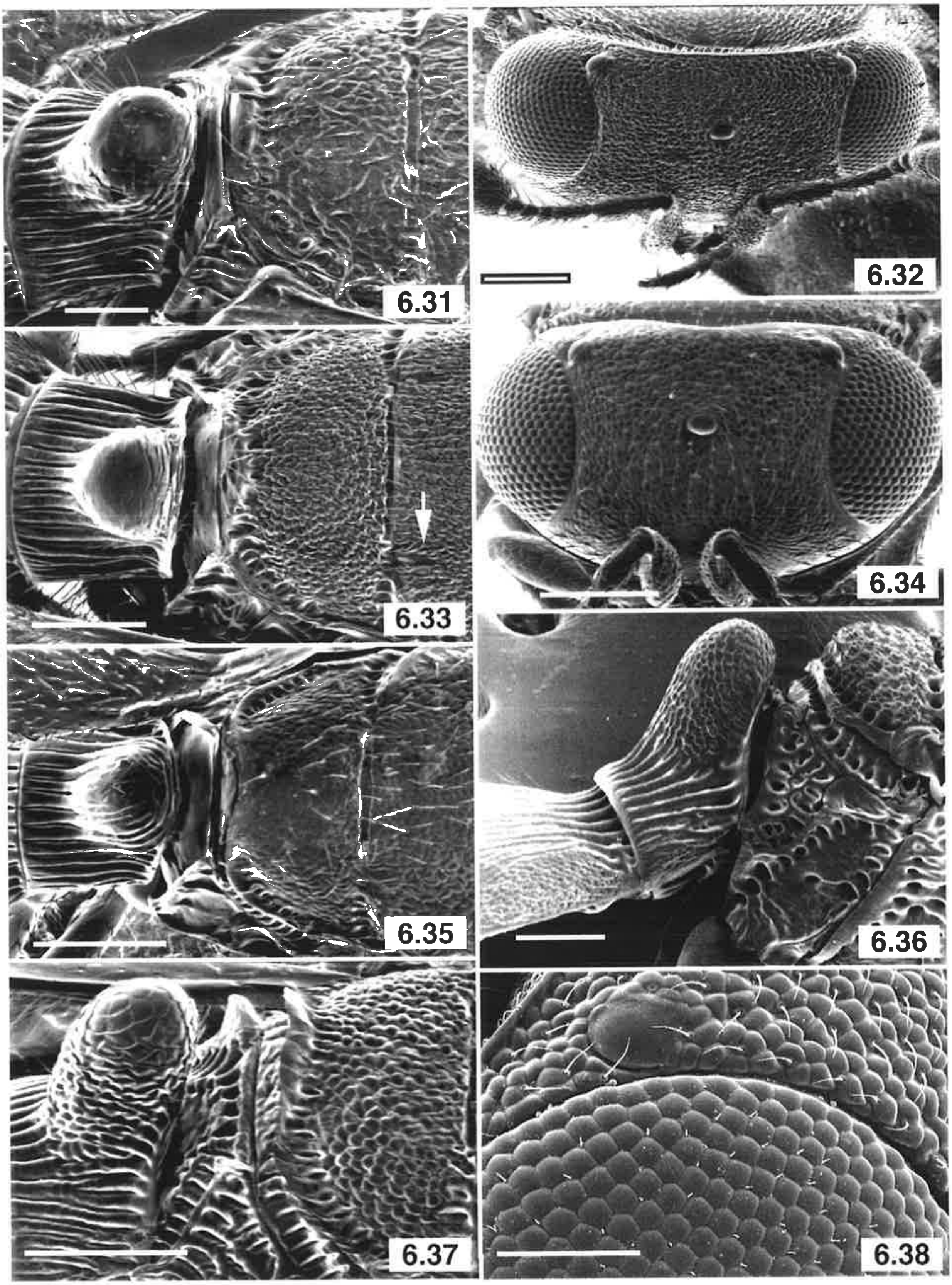
Figs 6.10-6.16. 6.10, 6.11, *Idris* sp.: **6.10**, female with wings removed; **6.11**, male, mesosoma and T1; 6.12, 6.13, *Hickmanella holoplatysa* Austin, female: **6.12**, metasoma; **6.13**, head (anterior view); **6.14**, *Ceratobaeus* sp., male, head and mesosoma; 6.15, 6.16, *Odontacolus* sp.: **6.15**, female, mesosoma and T1 with wings removed (propodeal flanges arrowed); **6.16**, head (anterior view). Scale lines 100μm.



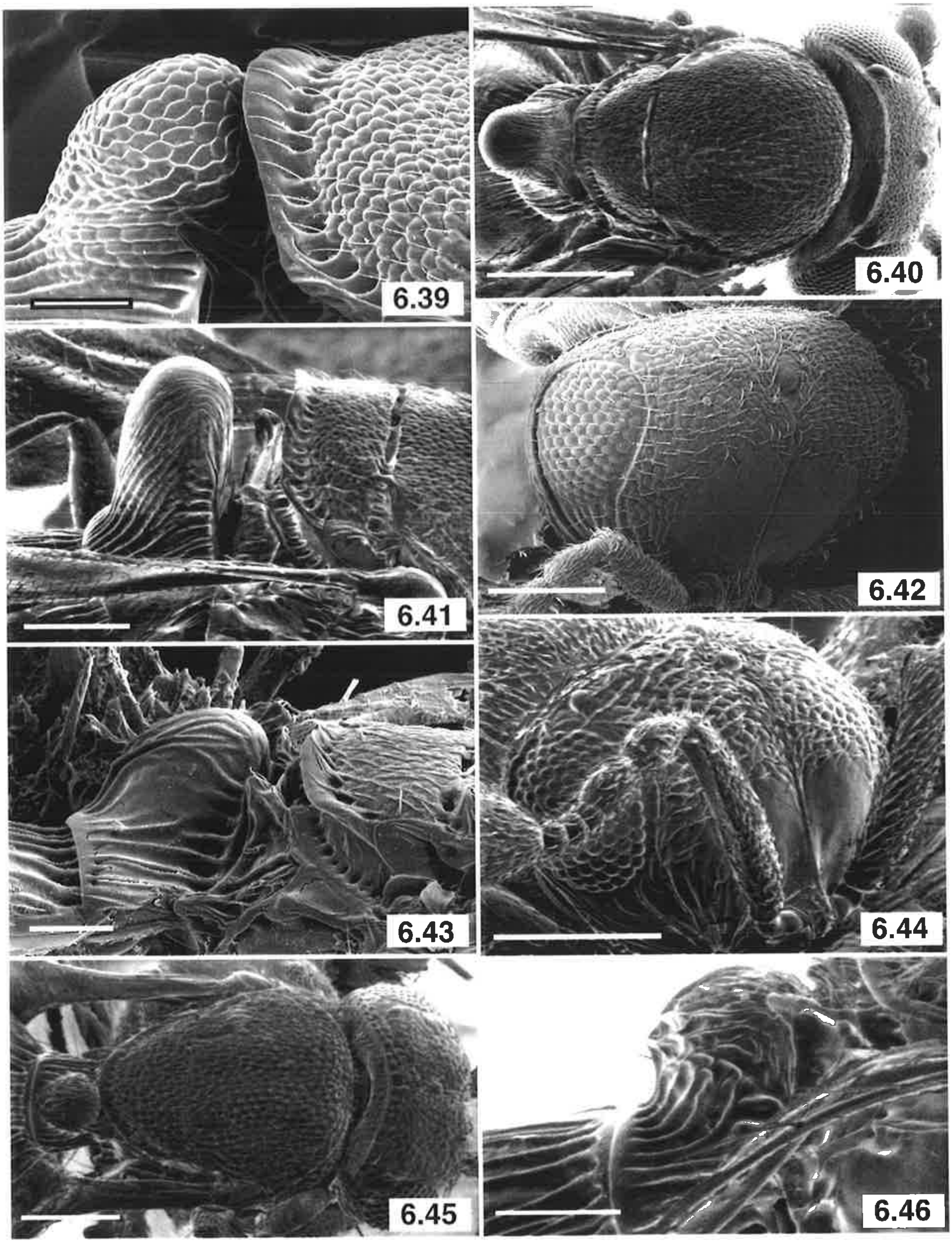
Figs 6.17-6.22. **6.17**, antenna of *Baeus*, *Idris* and most *Ceratobaeus*, female; **6.18**, antenna of *Mirobaeoides*, *Mirobaeus*, *Neobaeus*, *Hickmanella* and *Ceratobaeus* (some species), female; **6.19**, antenna of *Odontacolus*, female; **6.20**, antenna of *Baeus*, *Mirobaeoides*, *Mirobaeus* and *Neobaeus*, male; **6.21**, antenna of *Idris*, *Hickmanella* and *Ceratobaeus*, male; **6.22**, fore wing of *Baeus*, male.



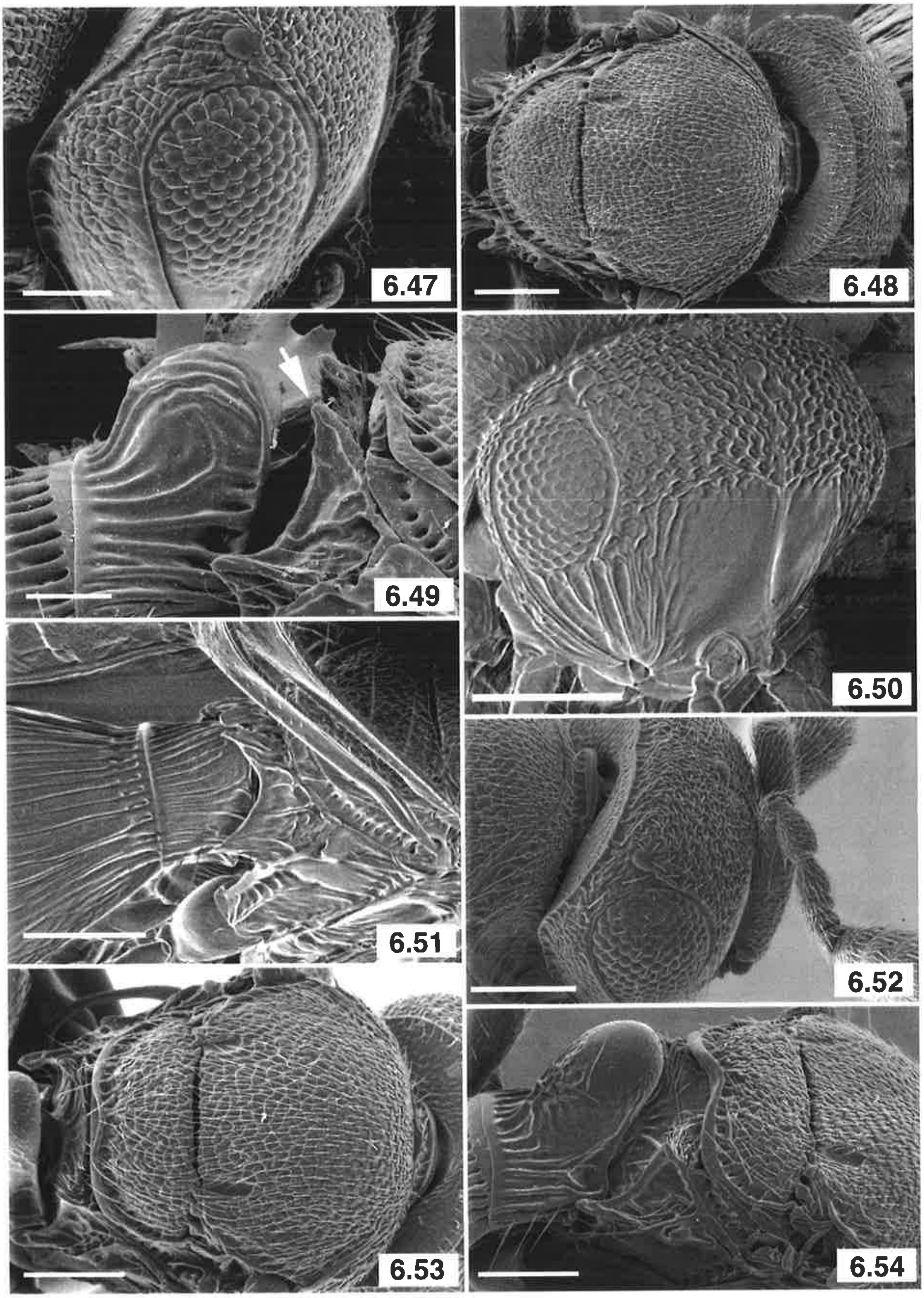
Figs 6.23-6.30. 6.23, 6.24, *Ceratobaeus ashmeadi* sp. nov., female: **6.23**, head (antero-dorsal view); **6.24**, metasomal horn and posterior mesosoma; 6.25-6.27, *C. ater* (Hickman), female: **6.25**, head (dorsal view); **6.26**, eye hairs; **6.27**, metasomal horn and posterior mesosoma (lateral view); 6.28, 6.29, *C. flavicorpus* Dodd, female: **6.28**, metasomal horn and posterior mesosoma (lateral view); **6.29**, scutellum and metasomal horn (dorsal view); **6.30**, *C. greensladeae* sp. nov., female, mesosoma and metasomal horn (dorsal view). Scale lines: 6.26, 20μm; 6.24, 6.25, 6.27-6.30, 100μm; 6.23, 200μm.



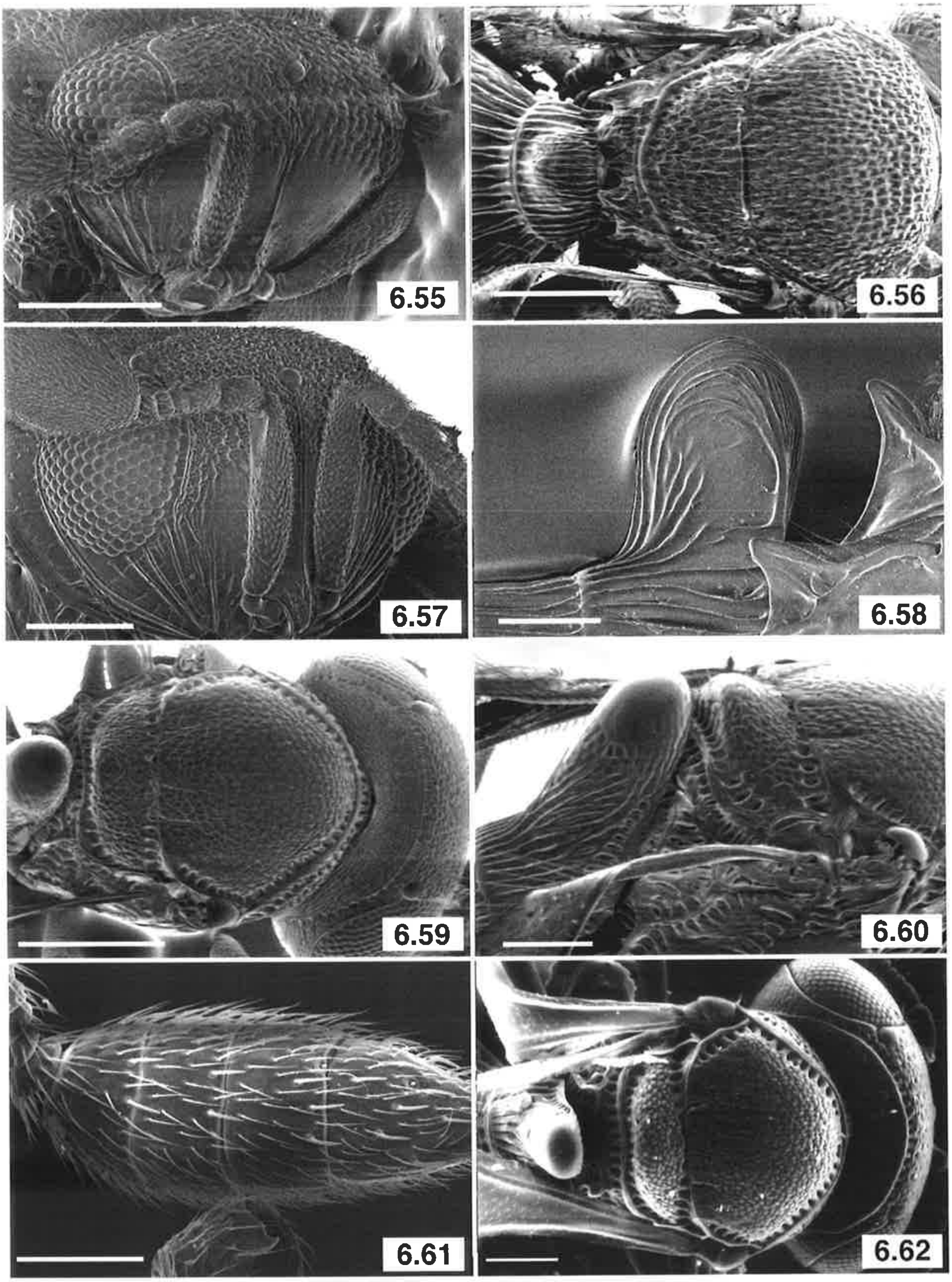
Figs 6.31-6.38. **6.31**, *Ceratobaeus greensladeae* sp. nov., female, scutellum and metasomal horn (dorsal view); 6.32, 6.33, *C. harveyi* sp. nov., female: **6.32**, head (dorsal view); **6.33**, scutellum and metasomal horn (dorsal view) (notauli arrowed); 6.34, 6.35, *C. huggerti* sp. nov., female: **6.34**, head (anterior view); **6.35**, scutellum and metasomal horn (dorsal view); **6.36**, *C. lamponae* (Hickman), female, metasomal horn (lateral view); **6.37**, *C. saeedi* sp. nov., female, scutellum and metasomal horn (lateral view); **6.38**, *C. athysanus* sp. nov., female, eye showing minute hairs. Scale lines: 6.31, 6.38, 50μm; 6.32-6.37, 100μm.



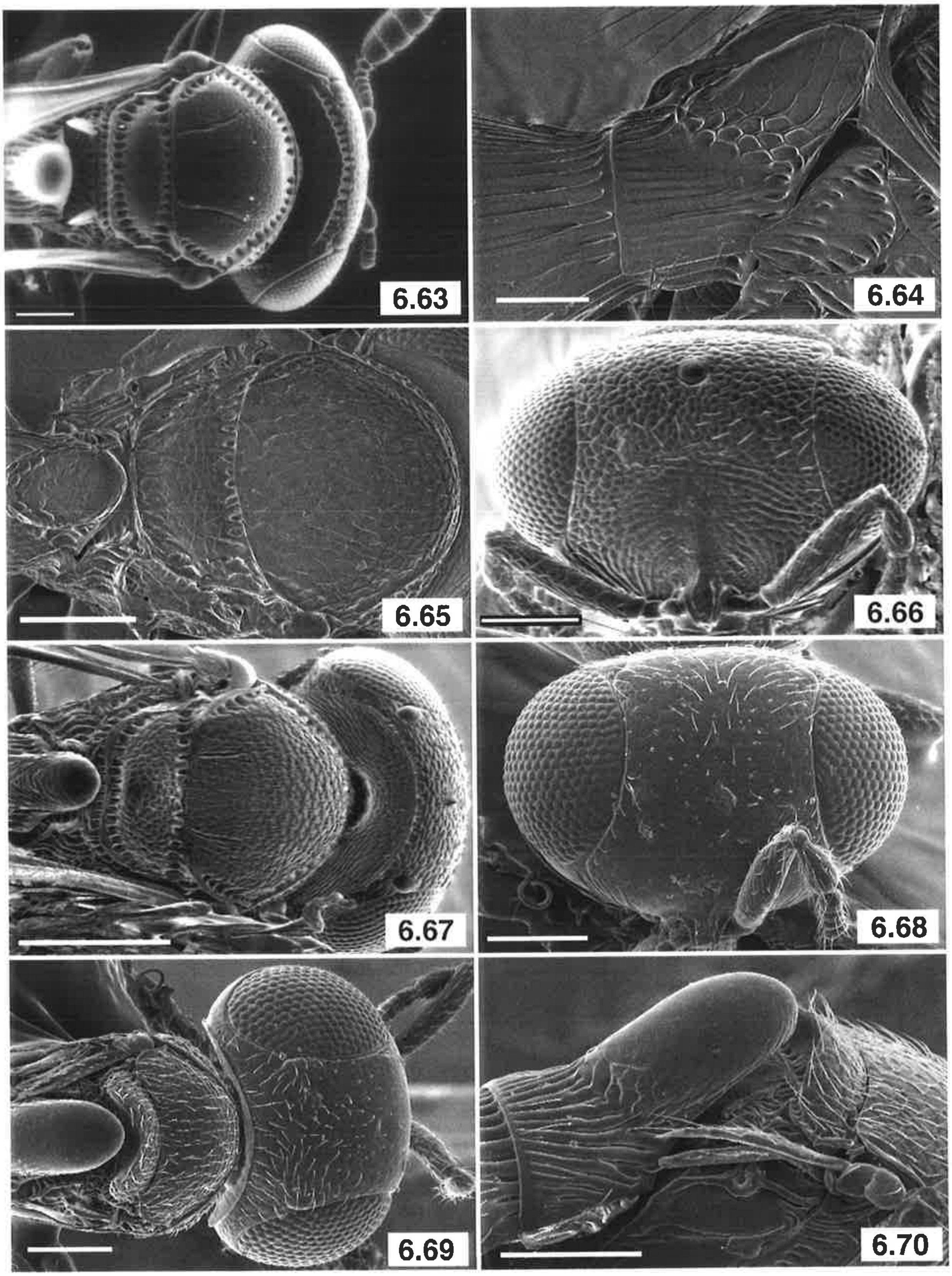
Figs 6.39-46. **6.39**, *Ceratobaeus athysanus* sp. nov., female, scutellum and metasomal horn (lateral view); 6.40, 6.41, *C. raniae* sp. nov, female: **6.40**, head and mesosoma (dorsal view); **6.41**, metasomal horn and posterior mesosoma (lateral view); 6.42, 6.43, *C. ajmali* sp. nov., female: **6.42**, head (anterior view); **6.43**, scutellum and metasomal horn (lateral view); 6.44-6.46, *C. alveus* sp. nov., female: **6.44**, head showing complete frontal carina and smooth speculum (antero-lateral view); **6.45**, head and mesosoma (dorsal view); **6.46**, metasomal horn (lateral view). Scale lines: 6.39, 6.43, 6.46, 50μm; 6.41, 6.42, 6.44, 6.45, 100μm; 6.40, 200μm.



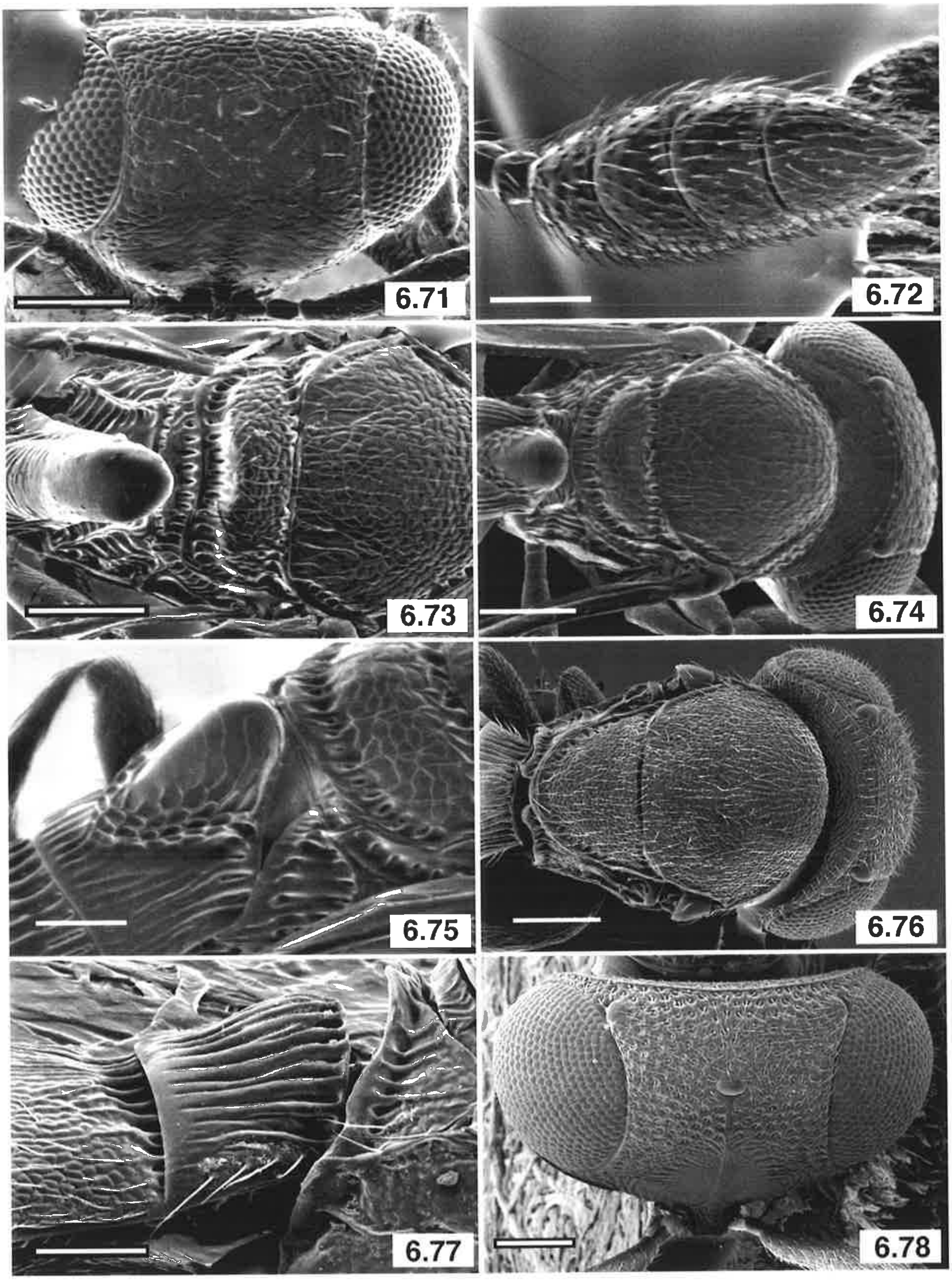
Figs 6.47-6.54. 6.47-6.49, *Ceratobaeus australicus* (Dodd), female: **6.47**, head showing distance of lateral ocellus from eye (dorso-lateral view); **6.48**, head and mesosoma (dorsal view); **6.49**, scutellum and metasomal horn (lateral view) (pointed propodeal lamellae arrowed); 6.50, 6.51, *C. berryae* sp. nov., female: **6.50**, head showing speculum (dorso-lateral view); **6.51**, scutellum and metasomal horn (lateral view); 6.52-6.54, *C. minyamea* sp. nov., female: **6.52**, head (dorso-lateral view); **6.53**, mesosoma (dorsal view); **6.54**, mesosoma and metasomal horn (dorso-lateral view). Scale lines: 6.47, 6.49, 50μm; 6.48, 6.50-6.54, 100μm.



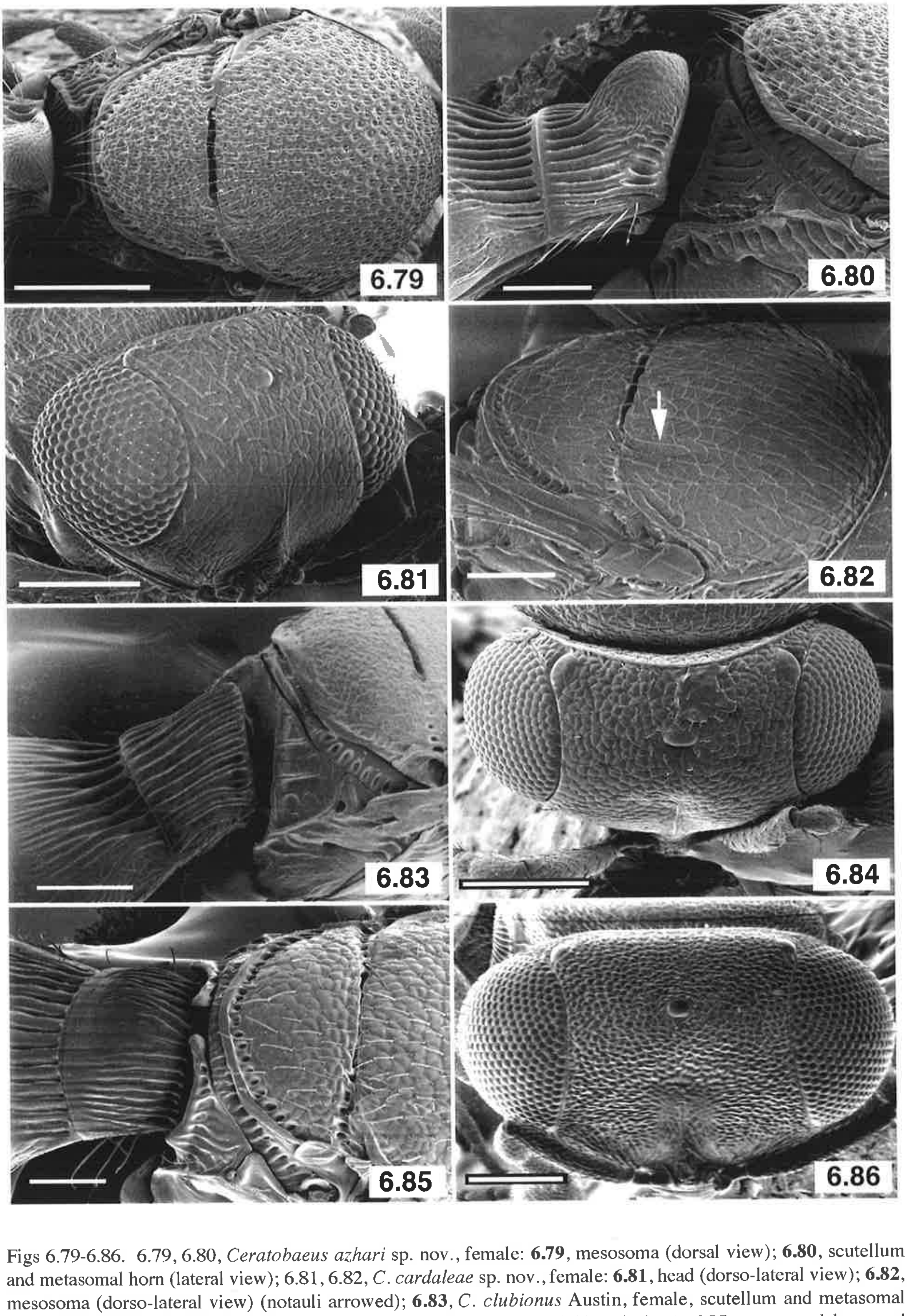
Figs 6.55-6.62. 6.55, 6.56, *Ceratobaeus normani* sp. nov., female: **6.55**, head (antero-lateral view); **6.56**, mesosoma and metasomal horn (dorsal view); 6.57, 6.58, *C. umasensis* sp. nov., female: **6.57**, head (antero-lateral view); **6.58**, metasomal horn (lateral view); 6.59-6.61, *C. boolool* sp. nov., female: **6.59**, head and mesosoma (dorsal view); **6.60**, metasomal horn and posterior mesosoma (lateral view); **6.61**, antennal clava showing sutures; **6.62**, *C. clavisegmentus* Austin, female, head, mesosoma and metasomal horn (dorsal view). Scale lines: 6.58, 6.61, 50μm; 6.55-6.657, 6.59, 6.60, 6.62, 100μm.



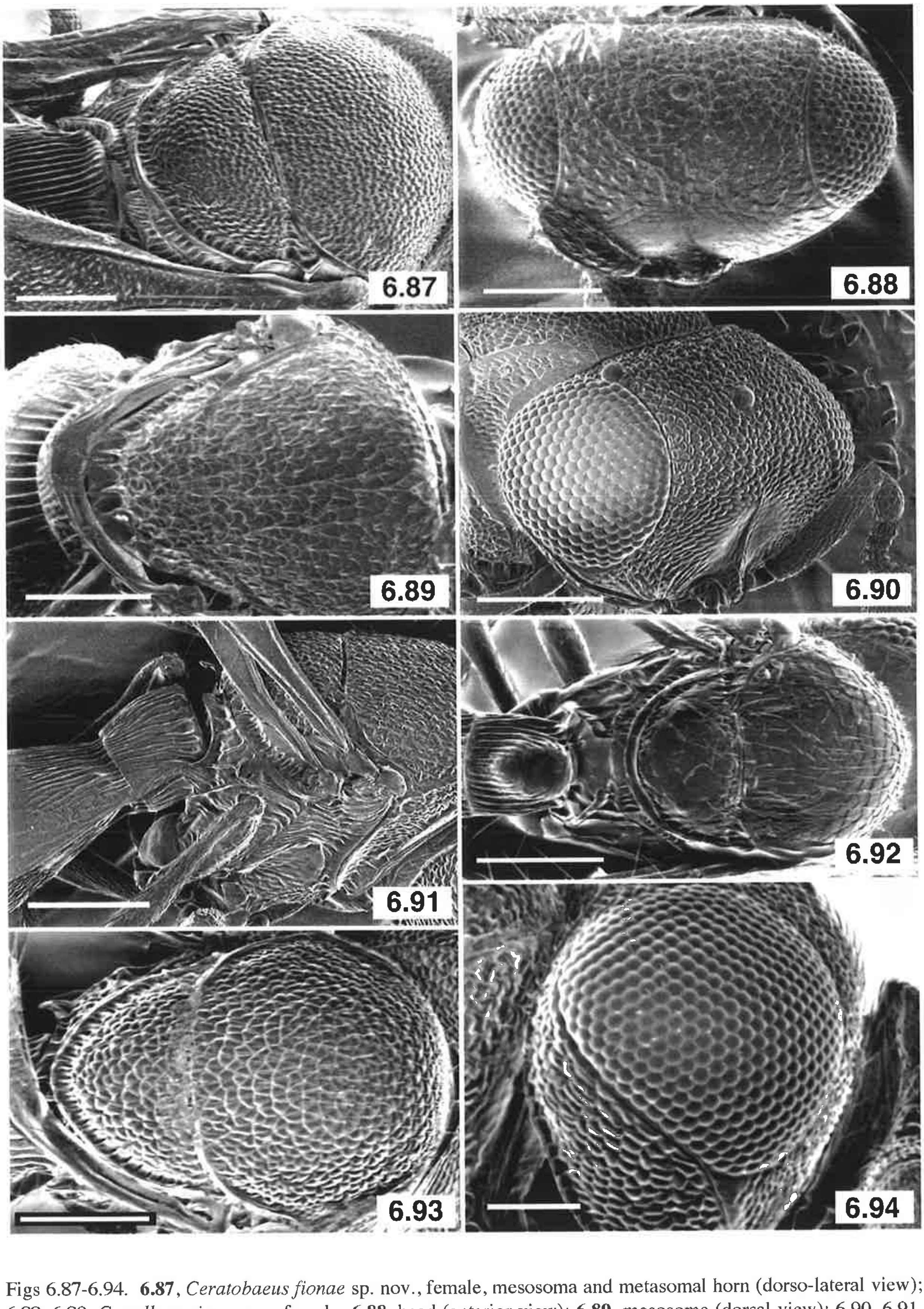
Figs 6.63-6.70. **6.63**, *Ceratobaeus mainae* Austin, female, head, mesosoma and metasomal horn (dorsal view); 6.64, 6.65, *C. moongacutta* sp. nov., female: **6.64**, metasomal horn (lateral view); **6.65**, mesosoma and metasomal horn (dorsal view); 6.66, 6.67, *C. narteol* sp. nov., female: **6.66**, head showing speculum (anterior view); **6.67**, head, mesosoma and metasomal horn (dorsal view); 6.68-6.70, *C. naumanni* sp. nov., female: **6.68**, head (anterior view); **6.69**, head, mesosoma and metasomal horn (dorsal view); **6.70**, metasomal horn and posterior mesosoma (lateral view). Scale lines: 6.64, 50μm; 6.63, 6.65, 6.66, 6.68-6.70, 100μm; 6.67, 200μm.



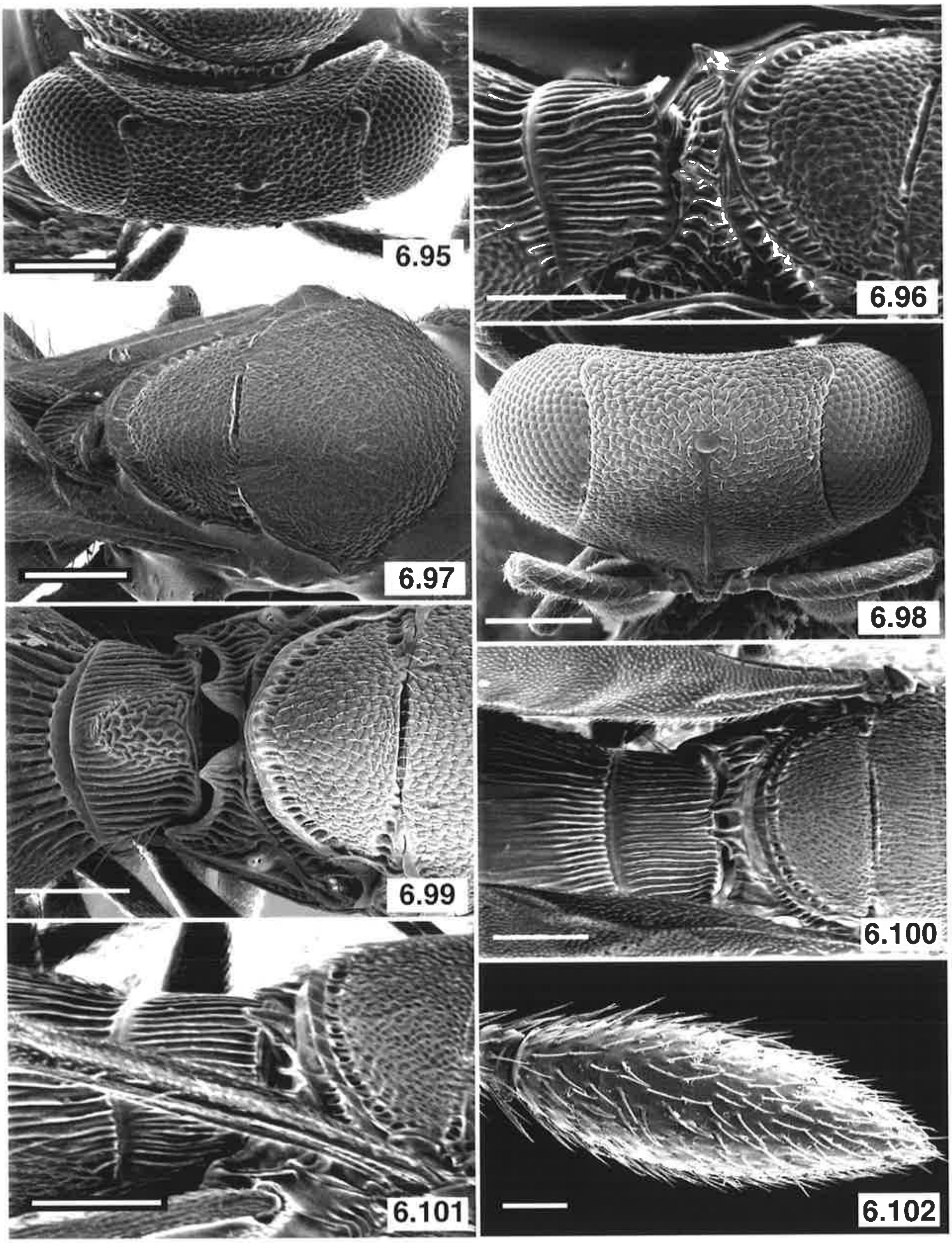
Figs 6.71-6.78. 6.71-6.73, *Ceratobaeus noyesi* sp. nov., female: **6.71**, head (anterior view); **6.72**, antennal clava showing sutures; **6.73**, metasomal horn and posterior mesosoma (dorsal view); 6.74, 6.75, *C. pita* sp. nov., female: **6.74**, head, mesosoma and metasomal horn (dorsal view); **6.75**, scutellum and metasomal horn (lateral view); 6.76, 6.77, *C. aureus* sp. nov., female: **6.76**, head and mesosoma (dorsal view); **6.77**, metasomal horn (lateral view); **6.78**, *C. azhari* sp. nov., female, head (antero-dorsal view). Scale lines: 6.72, 6.75, 6.77, 50μm; 6.71, 6.73, 6.74, 6.76, 6.78, 100μm.



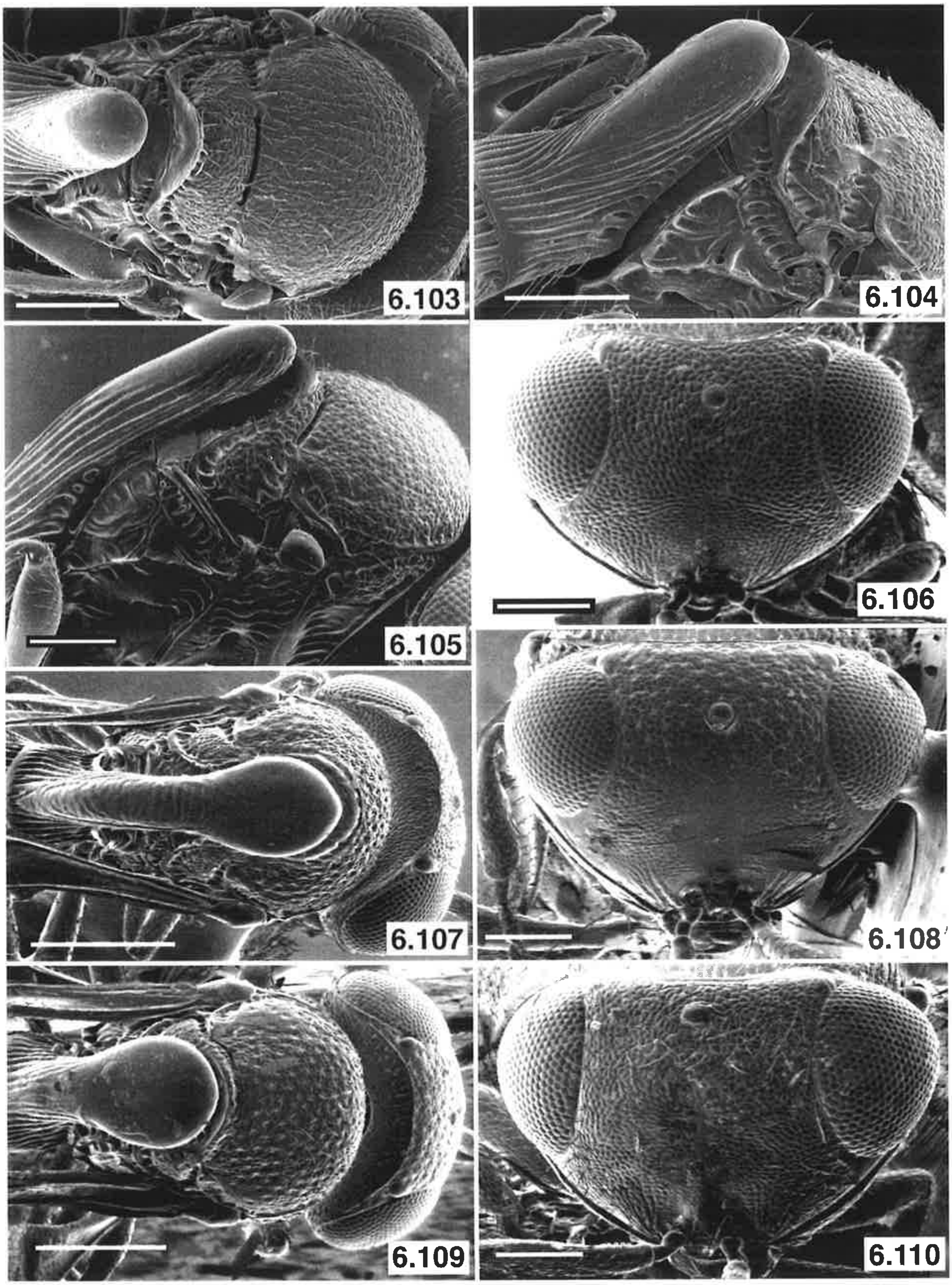
Figs 6.79-6.86. 6.79, 6.80, *Ceratobaeus azhari* sp. nov., female: **6.79**, mesosoma (dorsal view); **6.80**, scutellum and metasomal horn (lateral view); 6.81, 6.82, *C. cardaleae* sp. nov., female: **6.81**, head (dorso-lateral view); **6.82**, mesosoma (dorso-lateral view) (notauli arrowed); **6.83**, *C. clubionus* Austin, female, scutellum and metasomal horn (lateral view); 6.84, 6.85, *C. fieldi* sp. nov., female: **6.84**, head (dorsal view); **6.85**, metasomal horn and posterior mesosoma (dorsal view); **6.86**, *C. fionae* sp. nov., female, head (antero-dorsal view). Scale lines: 6.82, 6.85, 50μm; 6.80, 6.81, 6.83, 6.84, 6.86, 100μm; 6.79, 200μm.



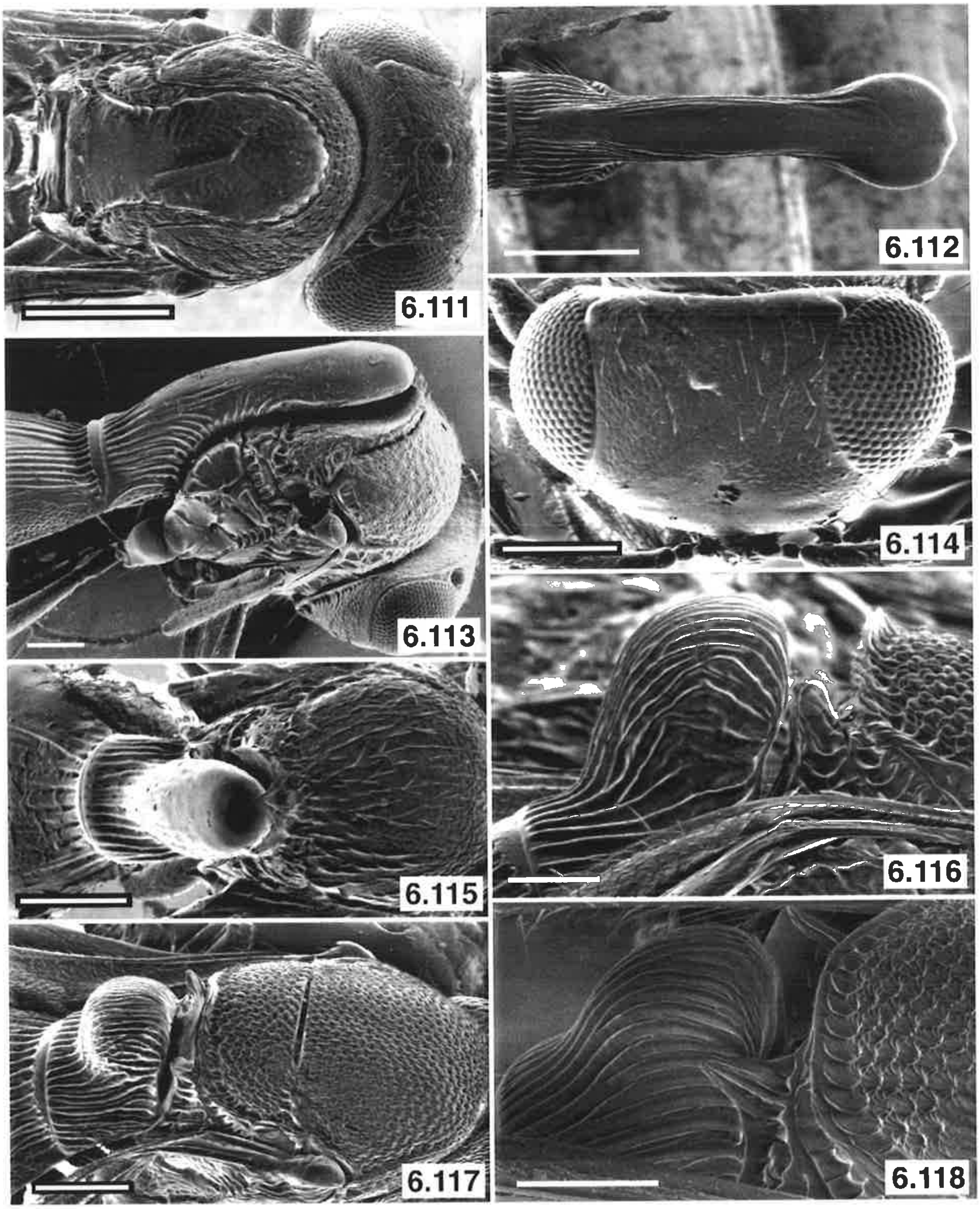
Figs 6.87-6.94. **6.87**, *Ceratobaeus fionae* sp. nov., female, mesosoma and metasomal horn (dorso-lateral view); 6.88, 6.89, *C. gallowayi* sp. nov., female: **6.88**, head (anterior view); **6.89**, mesosoma (dorsal view); 6.90, 6.91, *C. goobita* sp. nov., female: **6.90**, head (antero-lateral view); **6.91**, metasomal horn and posterior mesosoma (lateral view); **6.92**, *C. gorayaran* sp. nov., female, mesosoma and metasomal horn (dorsal view); 6.93, 6.94, *C. kaikai* sp. nov., female: **6.93**, mesosoma (dorsal view); **6.94**, eye showing minute hairs. Scale lines: 6.94, 50μm; 6.87-6.93, 100μm.



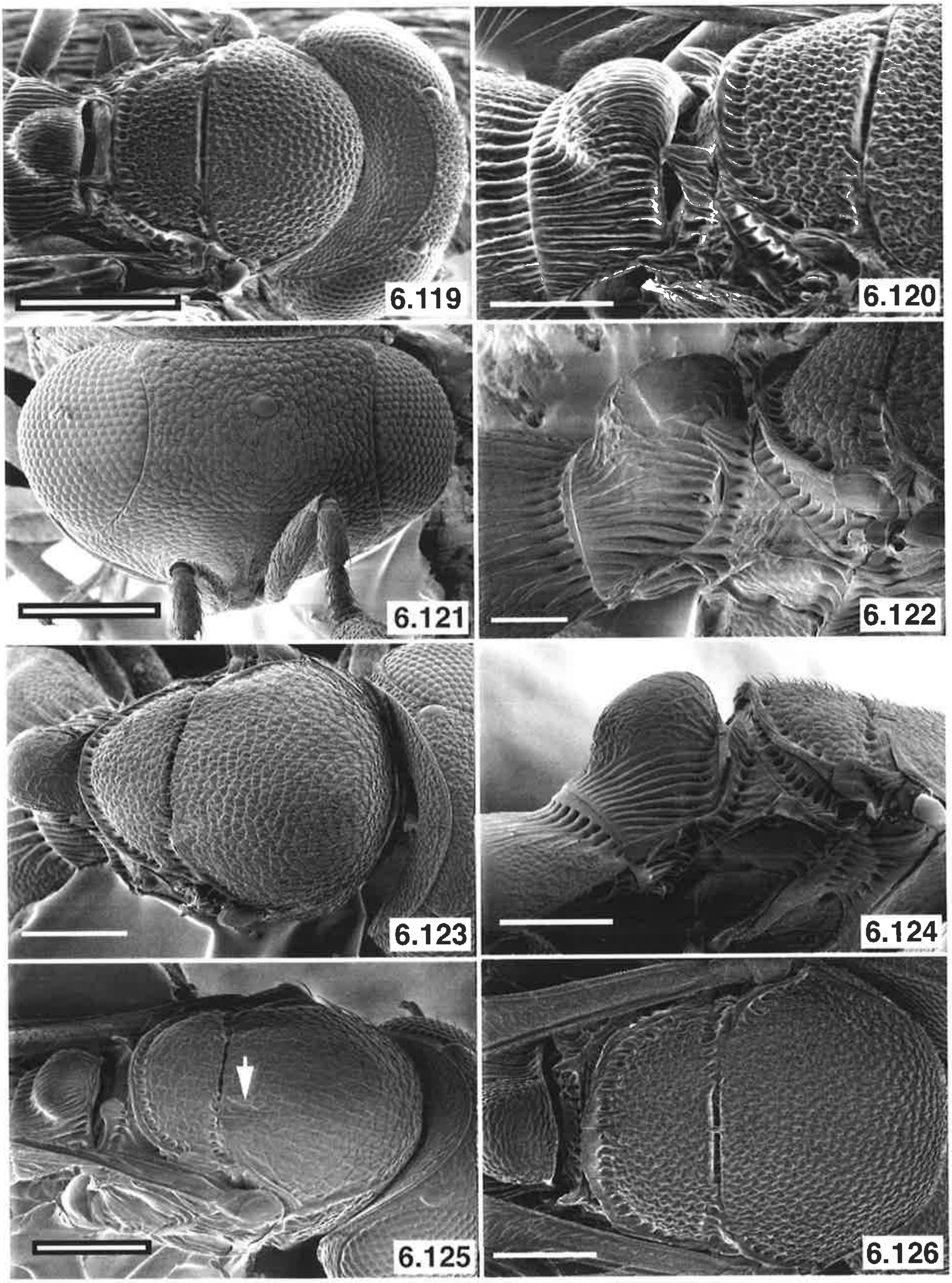
Figs 6.95-6.102. 6.95, 6.96, *Ceratobaeus mansoori* sp. nov., female: **6.95**, head (dorsal view); **6.96**, scutellum and metasomal horn (dorso-lateral view); **6.97**, *C. marroocutta* sp. nov., female, mesosoma and metasomal horn (dorsal view); 6.98, 6.99, *C. parvicornutus* Dodd, female: **6.98**, head (antero-lateral view); **6.99**, metasomal horn and posterior mesosoma (dorsal view); 6.100, 6.101, *C. weemayourula* sp. nov., female: **6.100**, metasomal horn and posterior mesosoma (dorsal view); **6.101**, scutellum and metasomal horn (lateral view); **6.102**, *C. ayeshae* sp. nov., female, antennal clava. Scale lines: 6.102, 20μm; 6.95-6.101, 100μm.



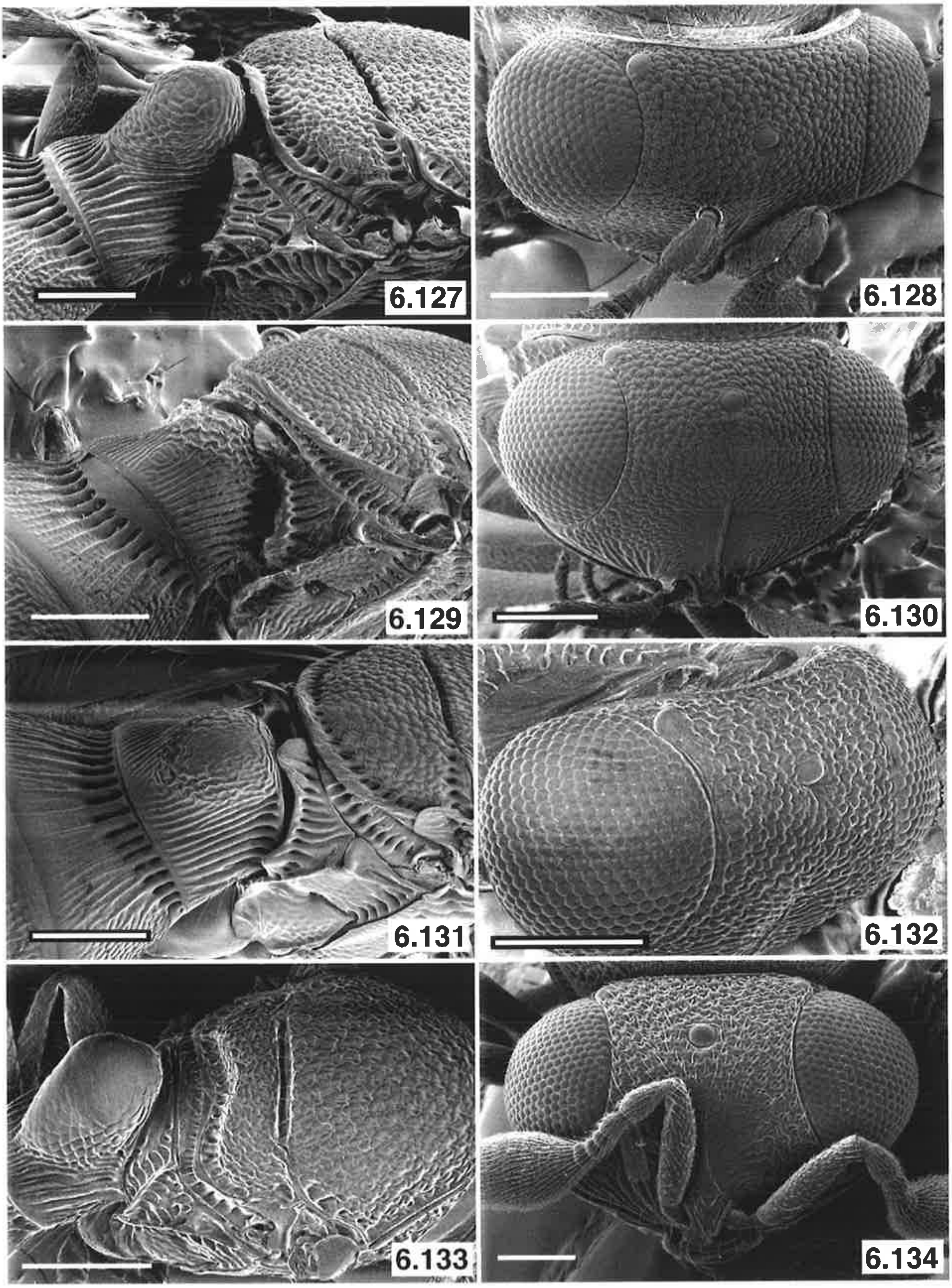
Figs 6.103-6.110. 6.103, 6.104, *Ceratobaeus ayeshae* sp. nov., female: **6.103**, mesosoma and metasomal horn (dorsal view); **6.104**, metasomal horn (lateral view); **6.105**, *C. cuspicornutus* Austin, female, mesosoma and metasomal horn (lateral view); 6.106, 6.107, *C. elongatus* Dodd, female: **6.106**, head (anterior view); **6.107**, head, mesosoma and metasomal horn (dorsal view); 6.108, 6.109, *C. gwenae* sp. nov., female: **6.108**, head (antero-dorsal view); **6.109**, head, mesosoma and metasomal horn (dorsal view); **6.110**, *C. phallocerus* sp. nov., female, head (anterior view). Scale lines: 6.103-6.107, 6.109, 100μm; 6.108, 6.110, 200μm.



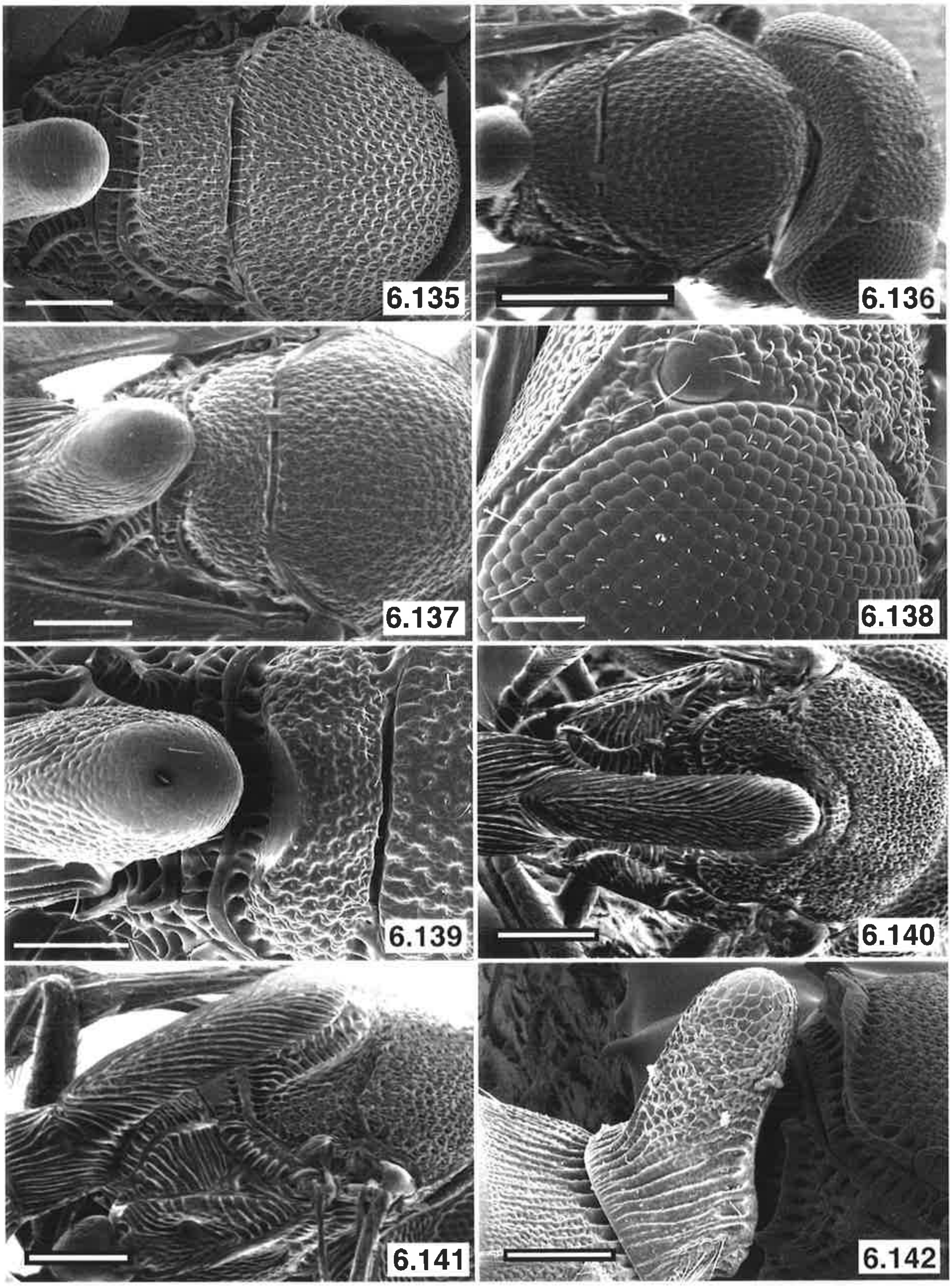
Figs 6.111-6.118. 6.111, 6.112, *Ceratobaeus phallocerus* sp. nov., female: **6.111**, head and mesosoma with metasomal horn removed (dorsal view); **6.112**, metasomal horn showing flat apex; **6.113**, *C. rieki* Austin, female, head, mesosoma and metasomal horn (lateral view); 6.114, 6.115, *C. wattora* sp. nov., female: **6.114**, head (antero-dorsal view); **6.115**, mesosoma and metasomal horn (dorsal view); 6.116, 6.117, *C. balli* sp. nov., female: **6.116**, scutellum and metasomal horn (lateral view); **6.117**, mesosoma and metasomal horn (dorso-lateral view); **6.118**, *C. bouceki* sp. nov., female, scutellum and metasomal horn showing pointed propodeal lamellae. Scale lines: 6.116, 50μm; 6.113, 6.115, 6.117, 6.118, 100μm; 6.111, 6.112, 200μm.



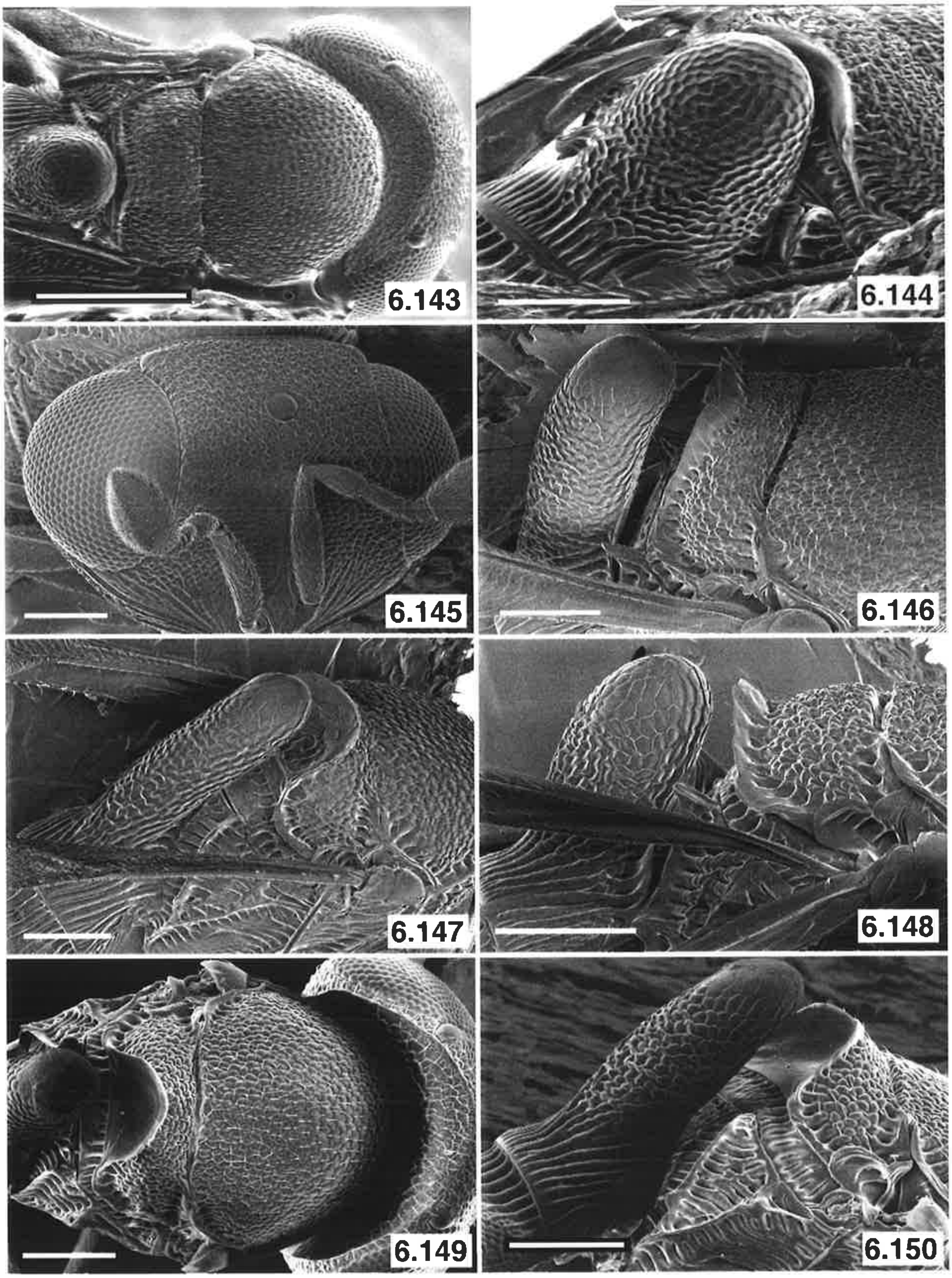
Figs 6.119-6.126. 6.119, 6.120, *Ceratobaeus gullanae* sp. nov., female: **6.119**, head, mesosoma and metasomal horn (dorsal view); **6.120**, metasomal horn and posterior mesosoma (dorso-lateral view); 6.121, 6.122, *C. hardyi* sp. nov., female: **6.121**, head (anterior view); **6.122**, scutellum and metasomal horn (lateral view); 6.123, 6.124, *C. jenningsi* sp. nov., female: **6.123**, mesosoma and metasomal horn (dorsal view); **6.124**, metasomal horn and posterior mesosoma (lateral view); **6.125**, *C. moonae* sp. nov., female, mesosoma and metasomal horn (dorso-lateral view) (notauli arrowed); **6.126**, *C. rabiae* sp. nov., female, mesosoma and metasomal horn (dorsal view). Scale lines: 6.122, 50µm; 6.120, 6.121, 6.123-6.126, 100µm; 6.119, 200µm.



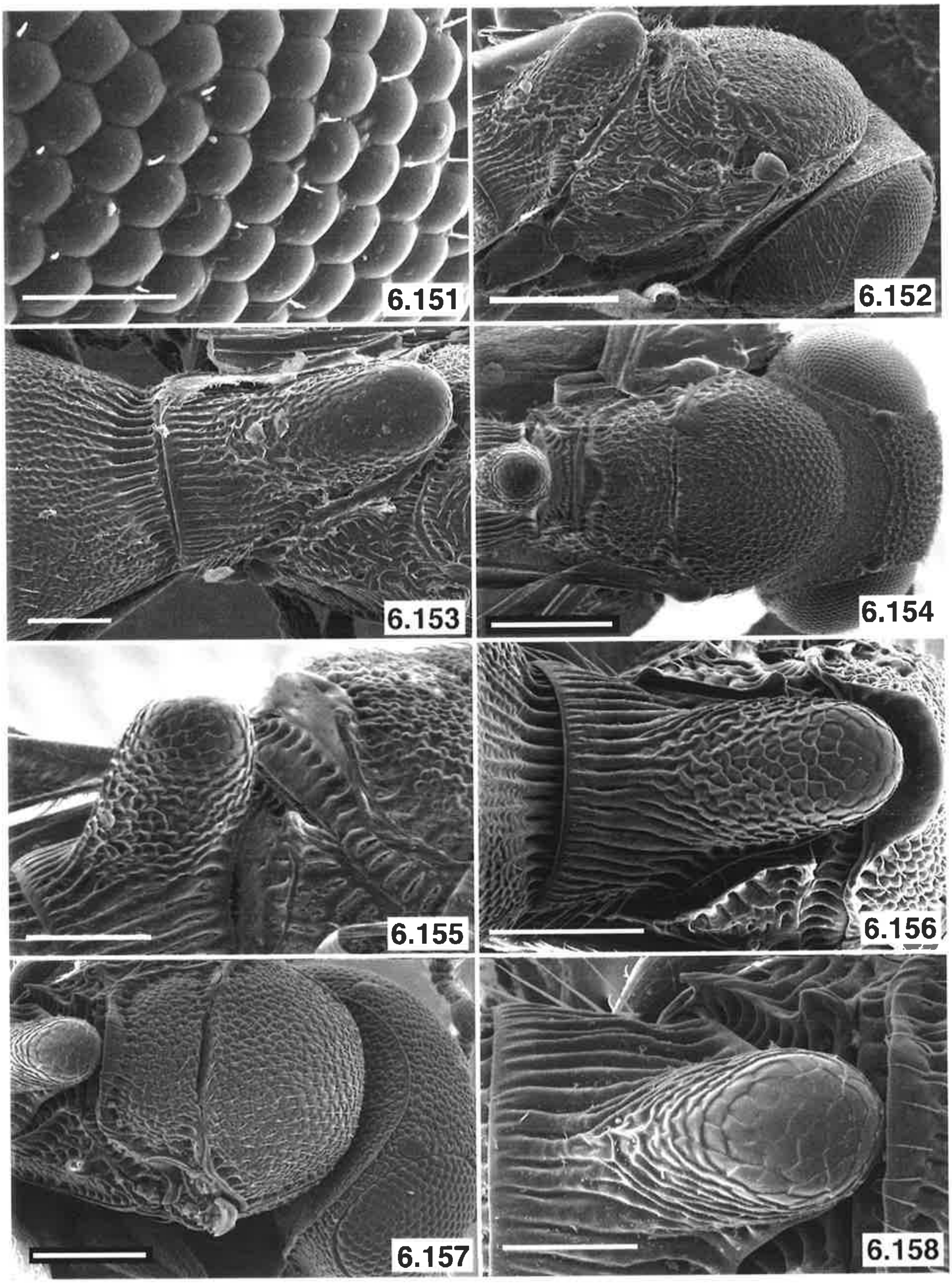
Figs 6.127-6.134. **6.127**, *Ceratobaeus rabiae* sp. nov., female, scutellum and metasomal horn (lateral view); 6.128, 6.129, *C. undeneya* sp. nov., female: **6.128**, head (antero-dorsal view); **6.129**, scutellum and metasomal horn (dorso-lateral view); 6.130, 6.131, *C. yousufi* sp. nov., female: **6.130**, head (anterior view); **6.131**, scutellum and metasomal horn (dorso-lateral view); 6.132, 6.133, *C. doddi* sp. nov., female: **6.132**, head (dorso-lateral view); **6.133**, mesosoma and metasomal horn (dorso-lateral view); **6.134**, *C. fasciatus* Dodd, female, head (anterior view). Scale lines 100μm.



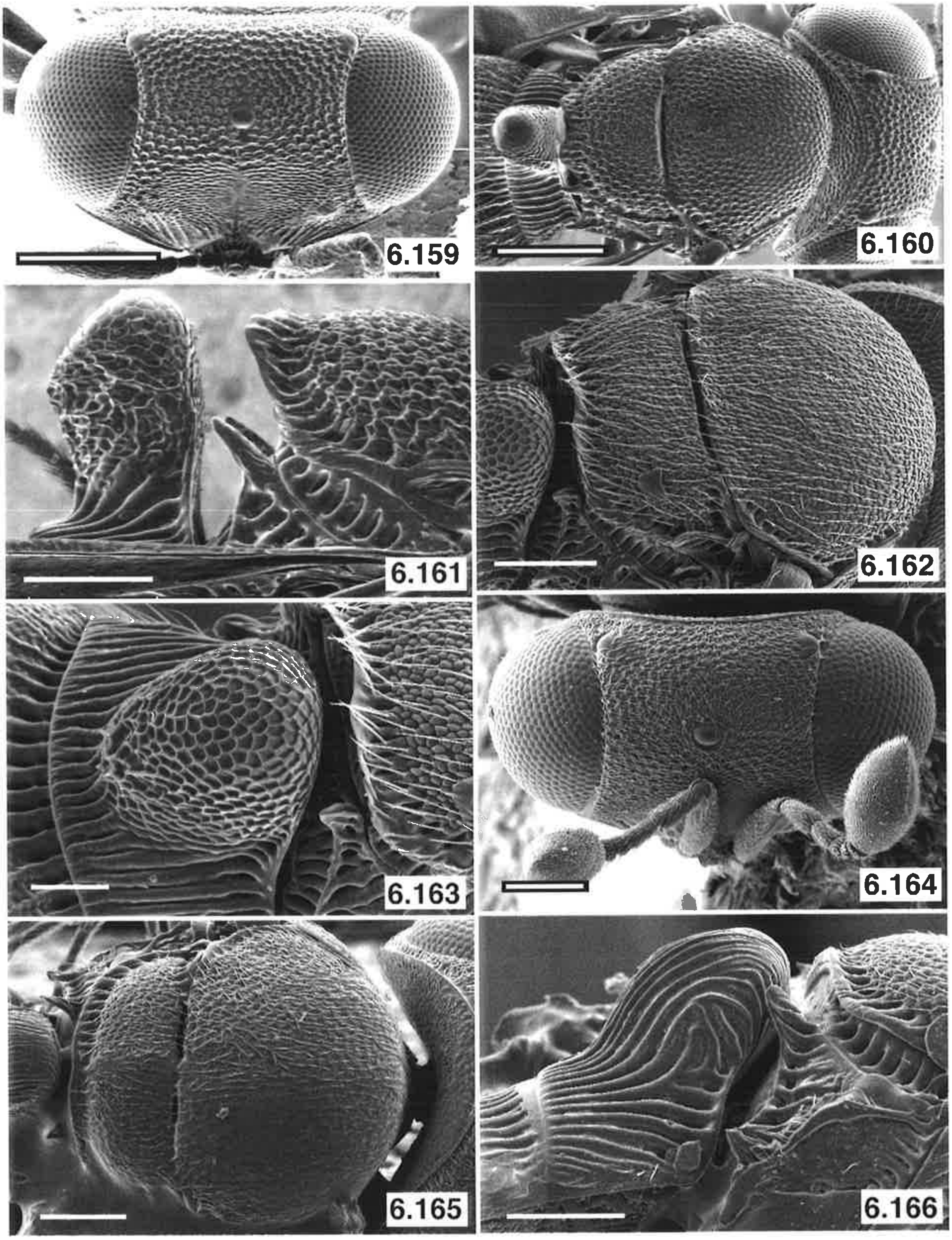
Figs 6.135-6.142. **6.135**, *Ceratobaeus fasciatus* Dodd female, mesosoma and metasomal horn (dorsal view); 6.136, 6.137, *C. faunus* (Girault) female: **6.136**, head and mesosoma (dorsal view); **6.137**, mesosoma and metasomal horn (dorsal view); 6.138, 6.139, *C. moki* sp. nov., female: **6.138**, eye hairs and lateral ocellus; **6.139**, metasomal horn and posterior mesosoma (dorsal view); 6.140, 6.141, *C. zafari* sp. nov., female: **6.140**, mesosoma and metasomal horn (dorsal view); **6.141**, mesosoma and metasomal horn (lateral view); **6.142**, *C. cabon* sp. nov., female, scutellum and metasomal horn (lateral view). Scale lines: 6.138, 50μm; 6.135, 6.137, 6.139-6.142, 100μm; 6.136, 200μm.



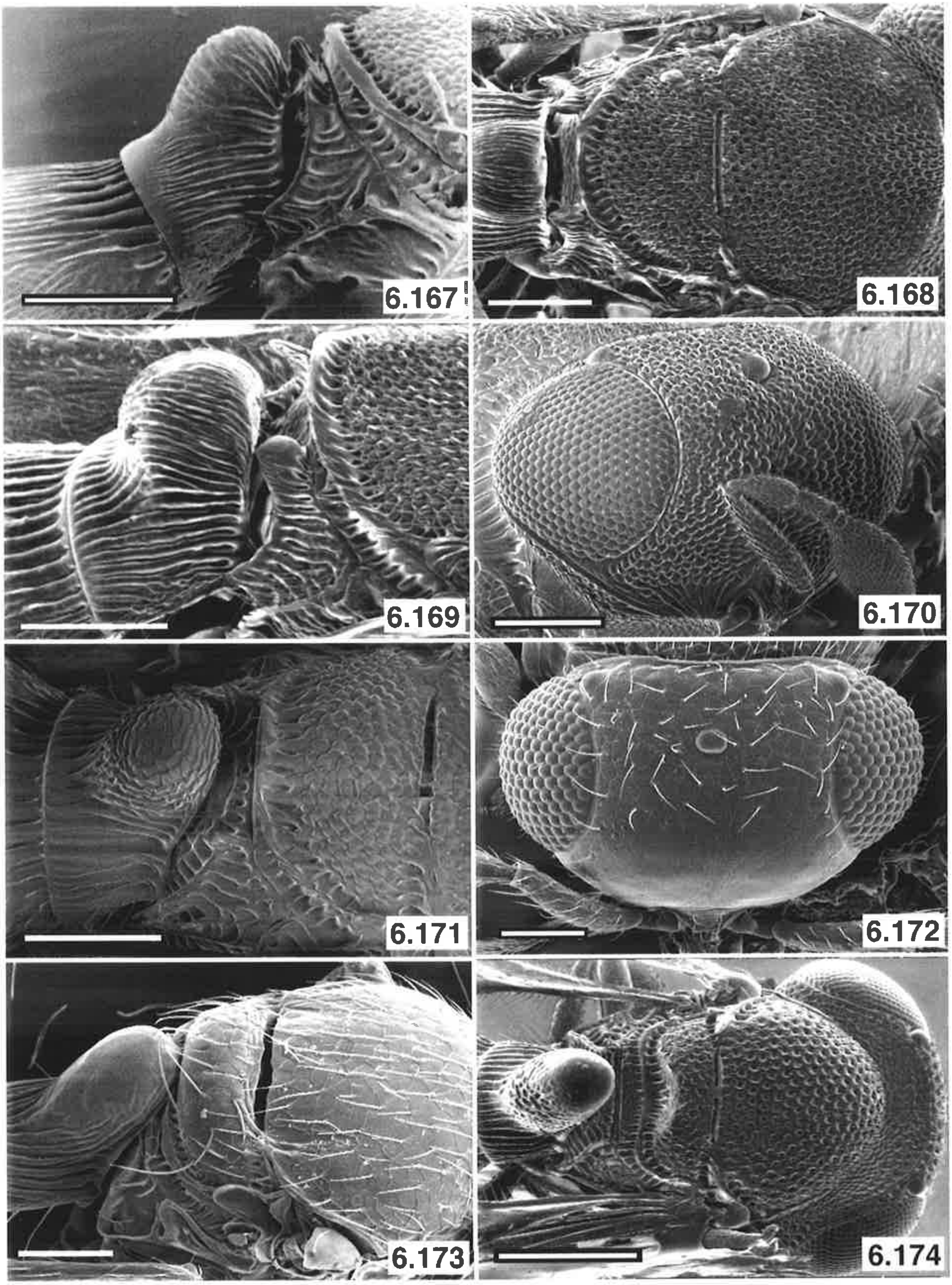
Figs 6.143-6.150. 6.143, 6.144, *Ceratobaeus evelineae* sp. nov., female: **6.143**, head, mesosoma and metasomal horn (dorsal view); **6.144**, scutellum and metasomal horn (dorso-lateral view); 6.145, 6.146, *C. flaviventris* Dodd, female: **6.145**, head (anterior view); **6.146**, scutellum and metasomal horn (dorso-lateral view); **6.147**, *C. mahmoodi* sp. nov., female, scutellum and metasomal horn (lateral view); **6.148**, *C. nephocerus* sp. nov., female, scutellum and metasomal horn (lateral view); 6.149, 6.150, *C. pipayourula* sp. nov., female: **6.149**, head and mesosoma (dorsal view); **6.150**, scutellum and metasomal horn (lateral view). Scale lines: 6.144-6.150, 100μm; 6.143, 200μm.



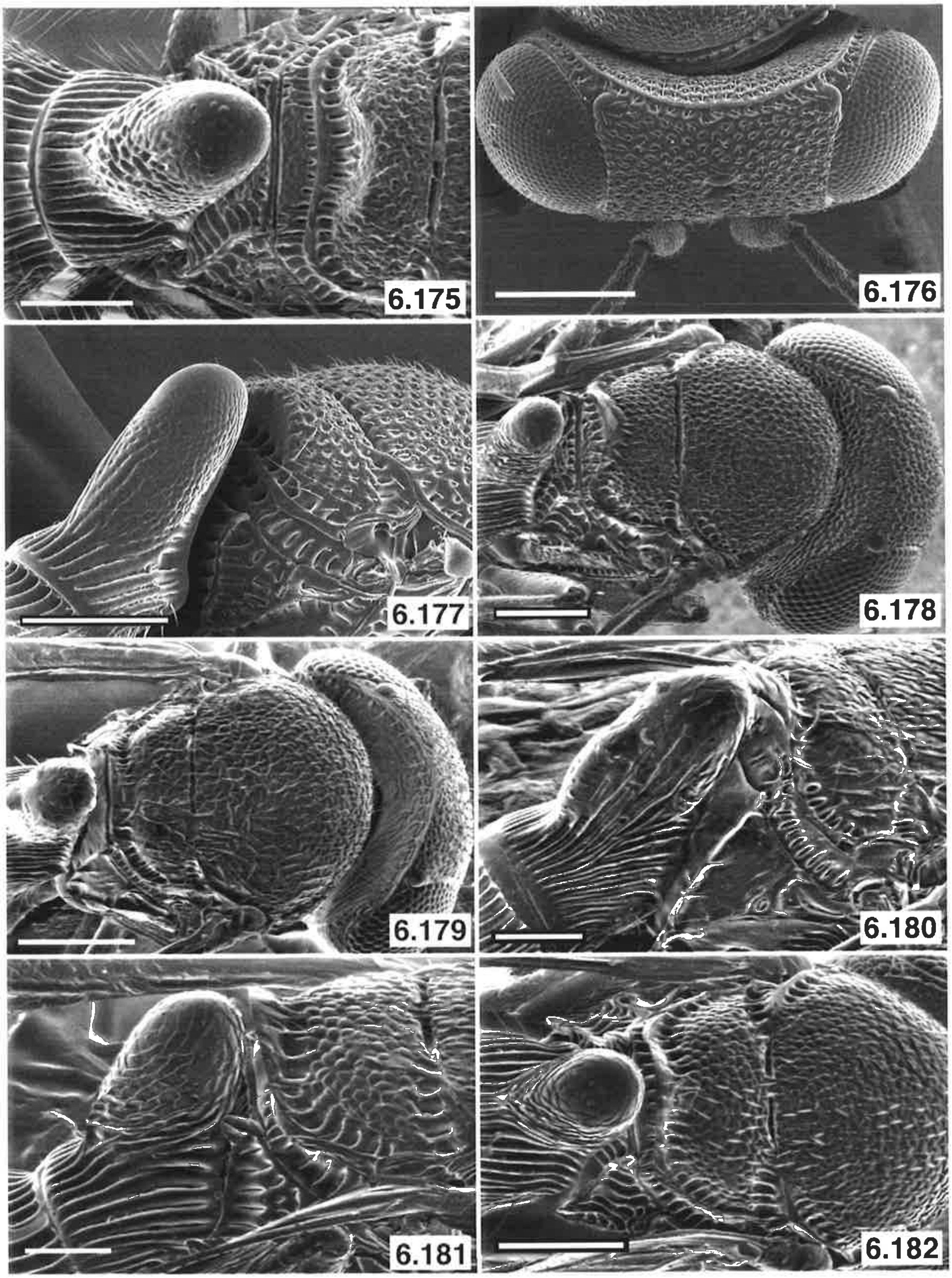
Figs 6.151-6.158. 6.151-6.153, *Ceratobaeus turneri* (Dodd), female: **6.151**, eye showing minute hairs; **6.152**, head, mesosoma and metasomal horn (lateral view); **6.153**, metasomal horn (dorsal view); 6.154, 6.155, *C. buntor* sp. nov., female: **6.154**, head, mesosoma and metasomal horn (dorsal view); **6.155**, scutellum and metasomal horn (lateral view); **6.156**, *C. eumorphus* sp. nov., female, scutellum and metasomal horn (dorsal view); 6.157, 6.158, *C. giraulti* Dodd, female: **6.157**, head, mesosoma and metasomal horn (dorsal view); **6.158**, metasomal horn (dorsal view). Scale lines: 6.151, 20μm; 6.158, 50μm; 6.153, 6.155-6.157, 100μm; 6.152, 6.154, 200μm.



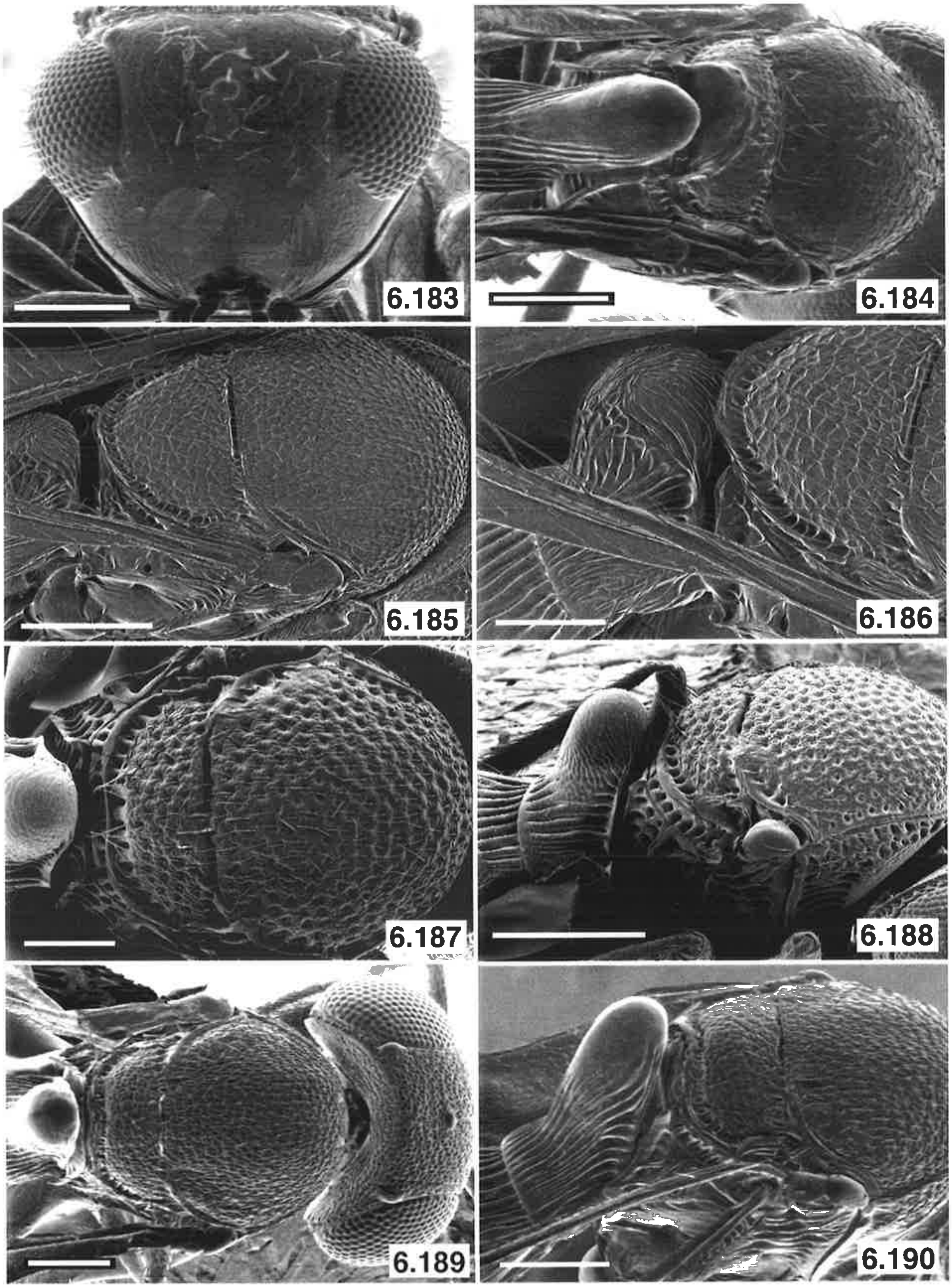
Figs 6.159-6.166. 6.159-6.161, *Ceratobaeus johnsenae* sp. nov., female: **6.159**, head (antero-dorsal view); **6.160**, head, mesosoma and metasomal horn (dorsal view); **6.161**, scutellum and metasomal horn showing pointed propodeal lamellae (lateral view); 6.162, 6.163, *C. litopterus* sp. nov., female: **6.162**, mesosoma (dorso-lateral view); **6.163**, scutellum and metasomal horn (dorsal view); 6.164-6.166, *C. marrooyourula* sp. nov., female: **6.164**, head (anterior view); **6.165**, mesosoma (dorsal view); **6.166**, scutellum and metasomal horn (lateral view). Scale lines: 6.163, 50μm; 6.161, 6.162, 6.164-6.166, 100μm; 6.159, 6.160, 200μm.



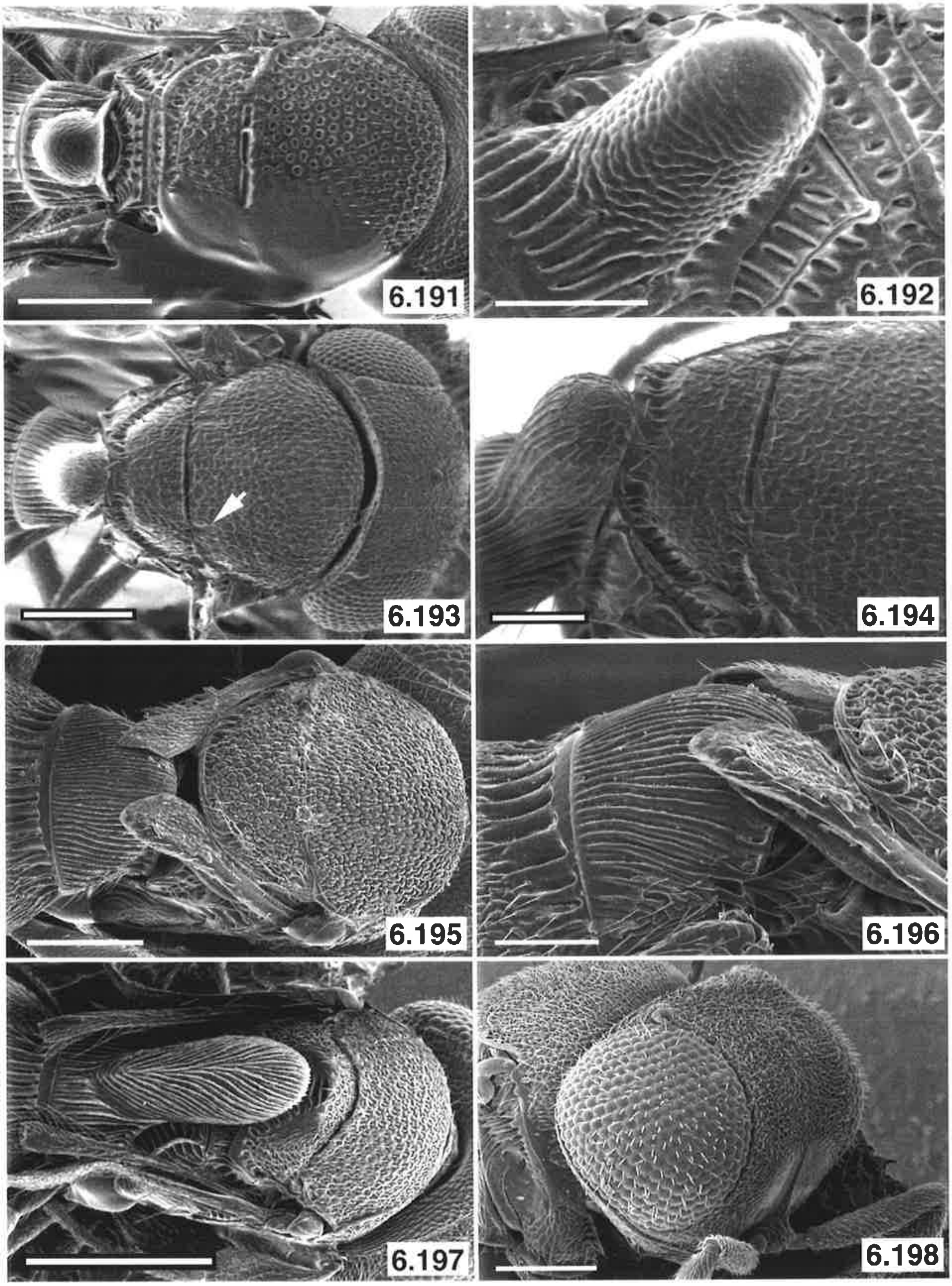
Figs 6.167-6.174. **6.167**, *Ceratobaeus intrudae* Austin, female, scutellum and metasomal horn (lateral view); 6.168, 6.169, *C. nasiri* sp. nov., female: **6.168**, mesosoma and metasomal horn (dorsal view); **6.169**, scutellum and metasomal horn (dorso-lateral view); 6.170, 6.171, *C. saliki* sp. nov., female: **6.170**, head (antero-lateral view); **6.171**, scutellum and metasomal horn (dorso-lateral view); 6.172, 6.173, *C. iota* sp. nov., female: **6.172**, head (anterior view); **6.173**, mesosoma and metasomal horn (dorso-lateral view); **6.174**, *C. markusi* sp. nov., female, head, mesosoma and metasomal horn (dorsal view). Scale lines: 6.172, 6.173, 50μm; 6.167-6.171, 100μm; 6.174, 200μm.



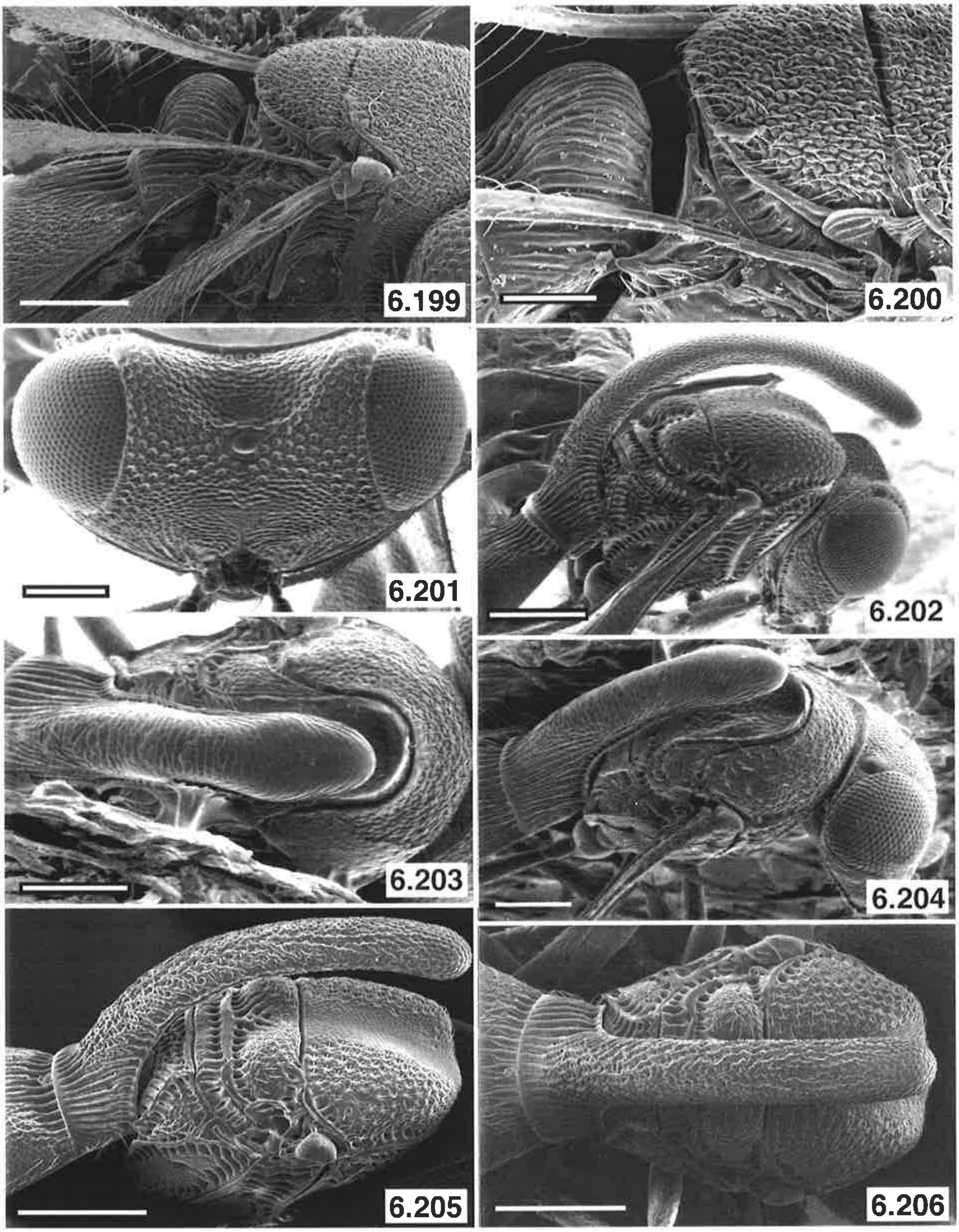
Figs 6.175-6.182. **6.175**, *Ceratobaeus markusi* sp. nov., female, metasomal horn and posterior mesosoma (dorsal view); 6.176, 6.177, *C. matong* sp. nov., female: **6.176**, head (dorsal view); **6.177**, metasomal horn and posterior mesosoma (dorso-lateral view); **6.178**, *C. michaeli* sp. nov., female, head, mesosoma and metasomal horn (dorsal view); 6.179, 6.180, *C. mussiae* sp. nov., female: **6.179**, head, mesosoma and metasomal horn (dorsal view); **6.180**, metasomal horn and posterior mesosoma (lateral view); 6.181, 6.182, *C. ramishi* sp. nov., female: **6.181**, scutellum and metasomal horn; **6.182**, mesosoma and metasomal horn (dorsal view). Scale lines: 6.180, 6.181, 50μm; 6.175, 6.178, 6.179, 6.182, 100μm; 6.176, 6.177, 200μm.



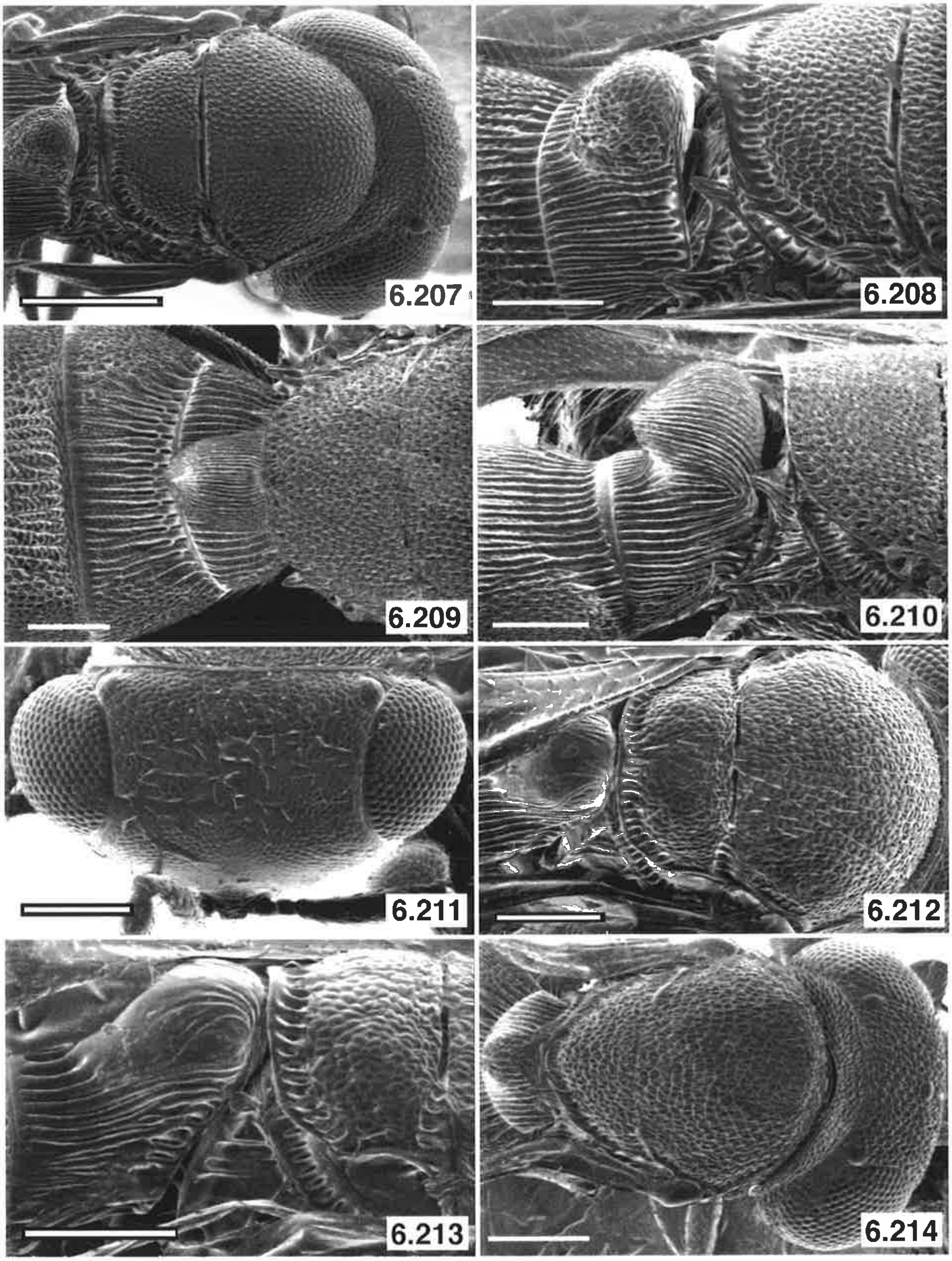
Figs 6.183-6.190. 6.183, 6.184, *Ceratobaeus umari* sp. nov., female: **6.183**, head (anterior view); **6.184**, mesosoma and metasomal horn (dorsal view); 6.185, 6.186, *C. kentae* sp. nov., female: **6.185**, mesosoma and metasomal horn (dorso-lateral view); **6.186**, scutellum and metasomal horn (lateral view); 6.187, 6.188, *C. laeviventris* (Dodd), female: **6.187**, mesosoma and metasomal horn (dorsal view); **6.188**, mesosoma and metasomal horn (lateral view); 6.189, 6.190, *C. nailae* sp. nov., female: **6.189**, head, mesosoma and metasomal horn (dorsal view); **6.190**, mesosoma and metasomal horn (lateral view). Scale lines: 6.183-6.187, 6.189, 6.190, 100μm; 6.188, 200μm.



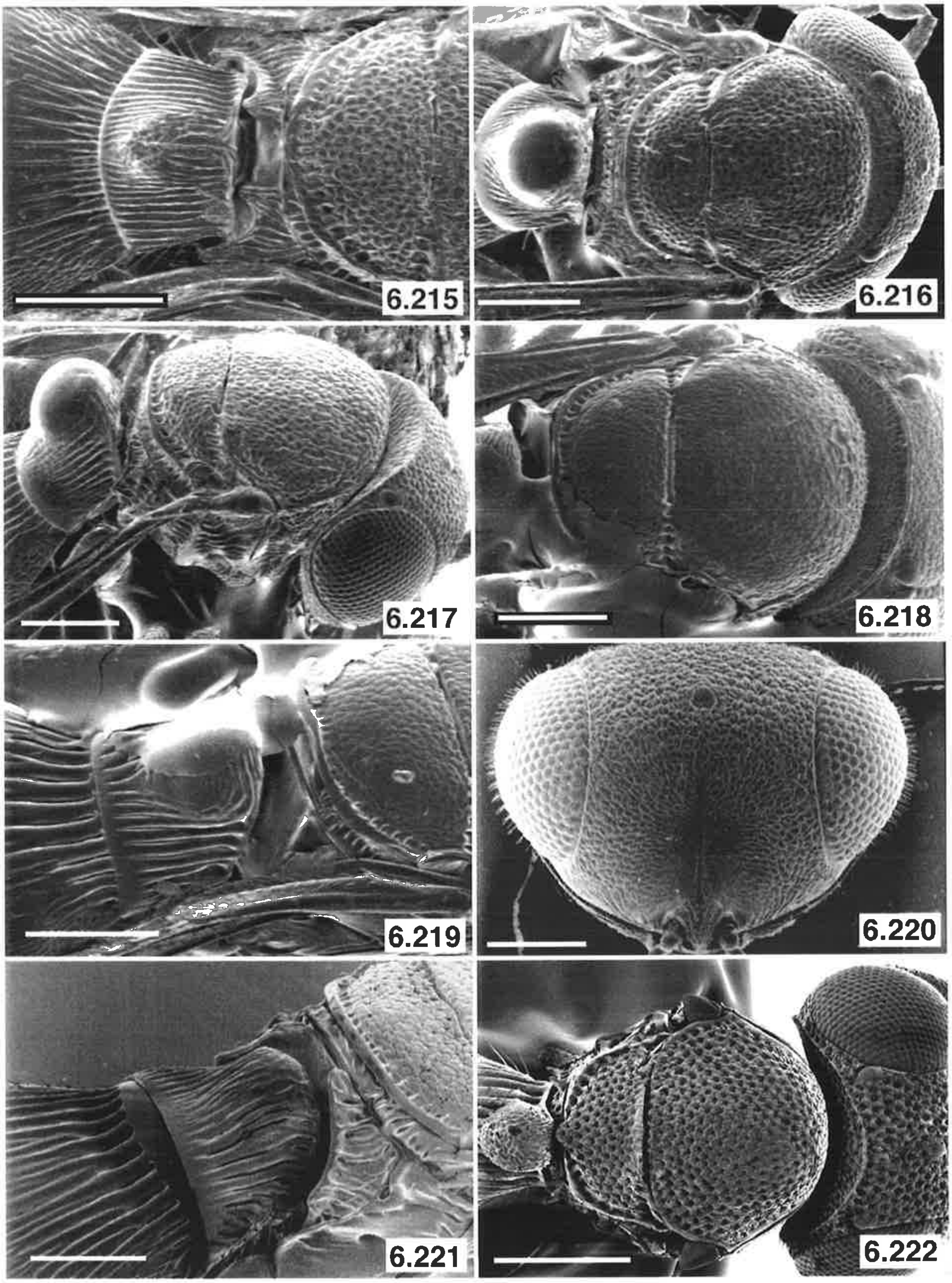
Figs 6.191-6.198. 6.191, 6.192, *Ceratobaeus sabrii* sp. nov., female: **6.191**, mesosoma and metasomal horn (dorsal view); **6.192**, metasomal horn (dorso-lateral view); 6.193, 6.194, *C. taylori* sp. nov., female: **6.193**, head, mesosoma and metasomal horn (dorsal view) (notauli arrowed); **6.194**, mesosoma and metasomal horn (lateral view); 6.195, 6.196, *C. flavipes* (Hickman), female: **6.195**, mesosoma and metasomal horn showing reduced wings (dorsal view); **6.196**, metasomal horn (lateral view); **6.197**, *C. leai* Dodd, female, mesosoma and metasomal horn (dorsal view); **6.198**, *C. minyayunde* sp. nov., female, head showing speculum and frontal carina (antero-lateral view). Scale lines: 6.194, 6.196, 50μm; 6.192, 6.193, 6.195, 6.198, 100μm; 6.191, 6.197, 200μm.



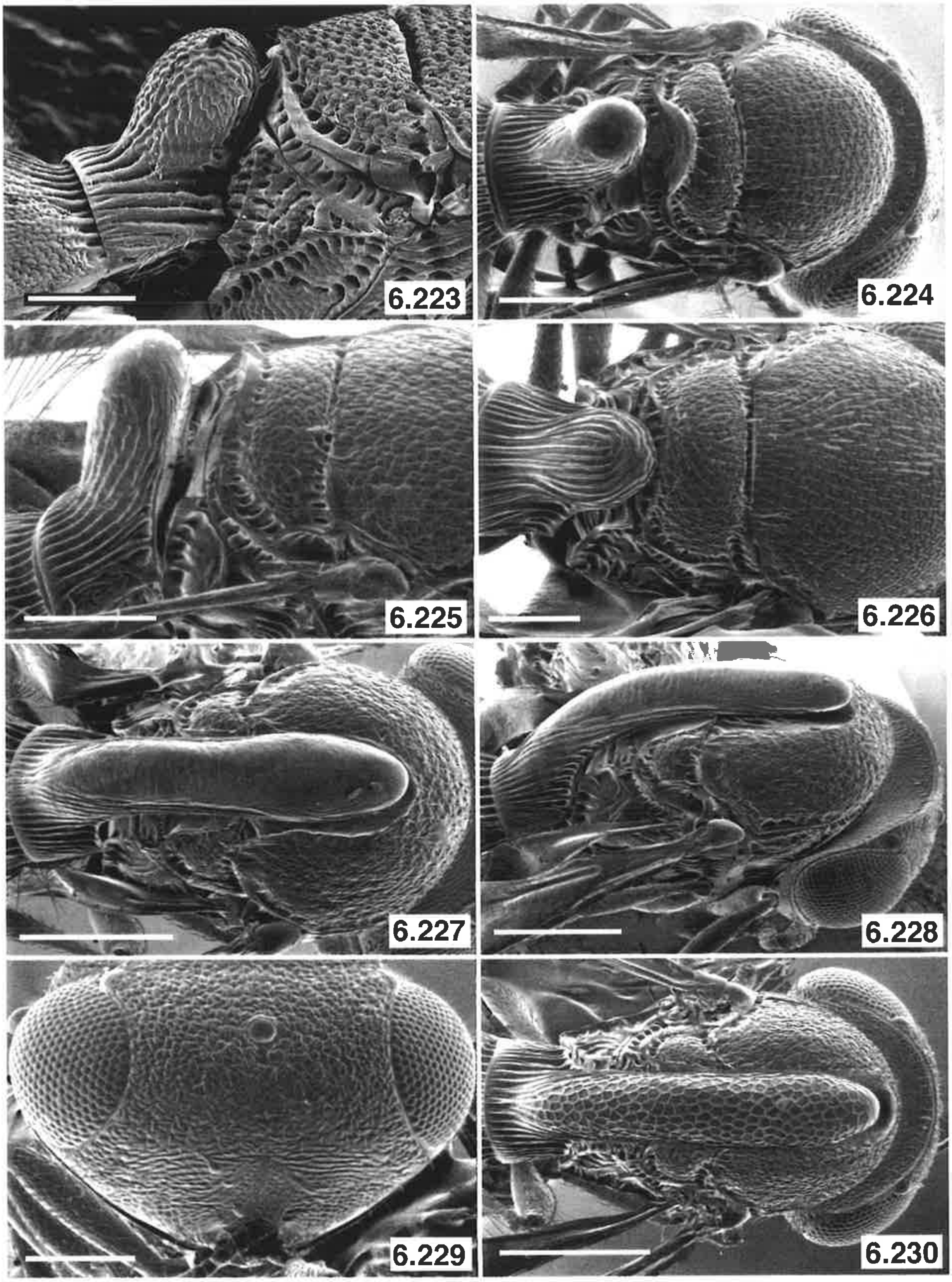
Figs 6.199-6.206. 6.199, 6.200, *Ceratobaeus minyayunde* sp. nov., female: **6.199**, mesosoma and metasomal horn showing reduced wings (lateral view); **6.200**, scutellum and metasomal horn (lateral view); 6.201, 6.202, *C. extraordinarius* sp. nov., female: **6.201**, head showing indentation in vertex to accommodate metasomal horn (antero-dorsal view); **6.202**, head, mesosoma and metasomal horn (lateral view); 6.203, 6.204, *C. longicornutus* Dodd, female: **6.203**, mesosoma and metasomal horn (dorsal view); **6.204**, head, mesosoma and metasomal horn (lateral view); 6.205, 6.206, *C. megacerus* sp. nov., female: **6.205**, mesosoma and metasomal horn (lateral view); **6.206**, mesosoma and metasomal horn (dorsal view). Scale lines: 6.200, 50µm; 6.199, 6.201, 6.203, 6.204, 100µm; 6.202, 6.205, 6.206, 200µm.



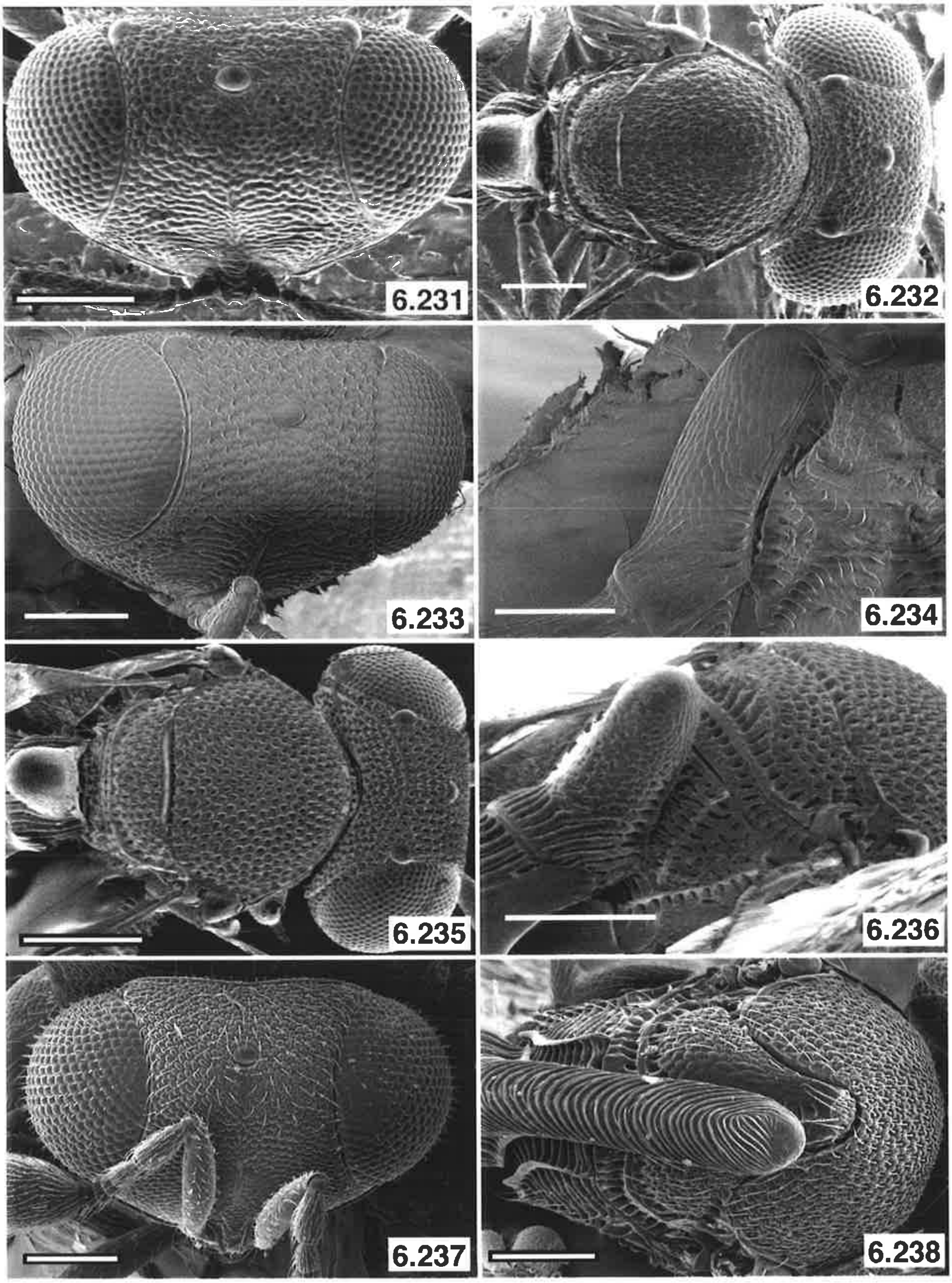
Figs 6.207-6.214. 6.207, 6.208, *Ceratobaeus acrotonus* sp. nov., female: **6.207**, head, mesosoma and metasomal horn (dorsal view); **6.208**, metasomal horn and posterior mesosoma (dorso-lateral view); 6.209, 6.210, *C. oimus* sp. nov., female: **6.209**, metasomal horn and posterior mesosoma (dorsal view); **6.210**, scutellum and metasomal horn (lateral view); 6.211-6.213, *C. ziai* sp. nov., female: **6.211**, head (antero-dorsal view); **6.212**, mesosoma and metasomal horn (dorsal view); **6.213**, scutellum and metasomal horn (lateral view); **6.214**, *C. amiti* sp. nov., female, head, mesosoma and metasomal horn (dorsal view). Scale lines: 6.208-6.214, 100μm; 6.207, 200μm.



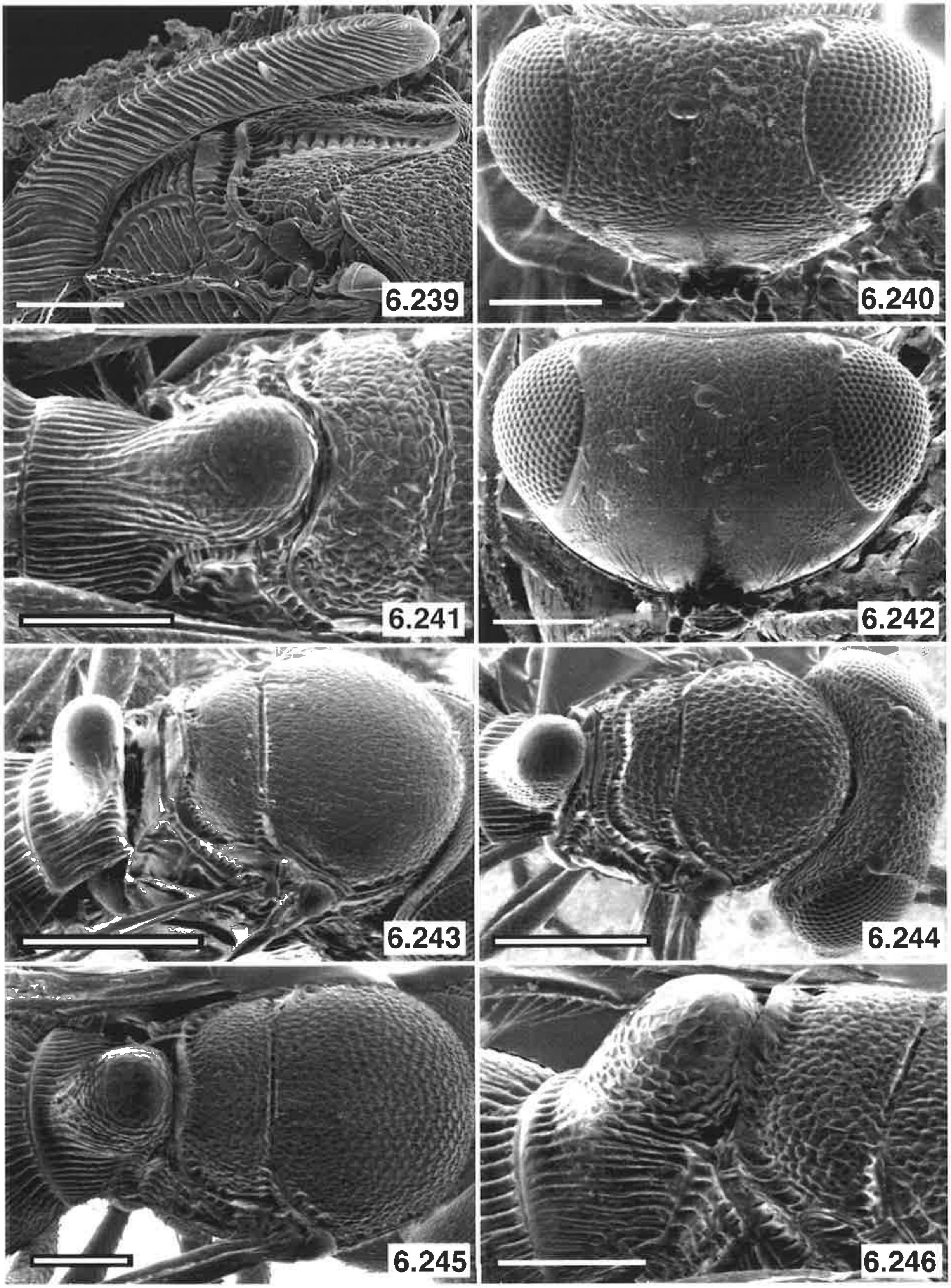
Figs 6.215-6.222. **6.215**, *Ceratobaeus amiti* sp. nov., female, scutellum and metasomal horn (dorsal view); 6.216, 6.217, *C. anjumi* sp. nov., female: **6.216**, head, mesosoma and metasomal horn (dorsal view); **6.217**, head, mesosoma and metasomal horn (dorso-lateral view); 6.218, 6.219, *C. haqi* sp. nov., female: **6.218**, mesosoma (dorsal view); **6.219**, scutellum and metasomal horn (dorso-lateral view); 6.220, 221, *C. masneri* Austin, female: **6.220**, head (anterior view); **6.221**, scutellum and metasomal horn (dorso-lateral view); **6.222**, *C. stegastocerus* sp. nov., female, head, mesosoma and metasomal horn (dorsal view). Scale lines 100μm.



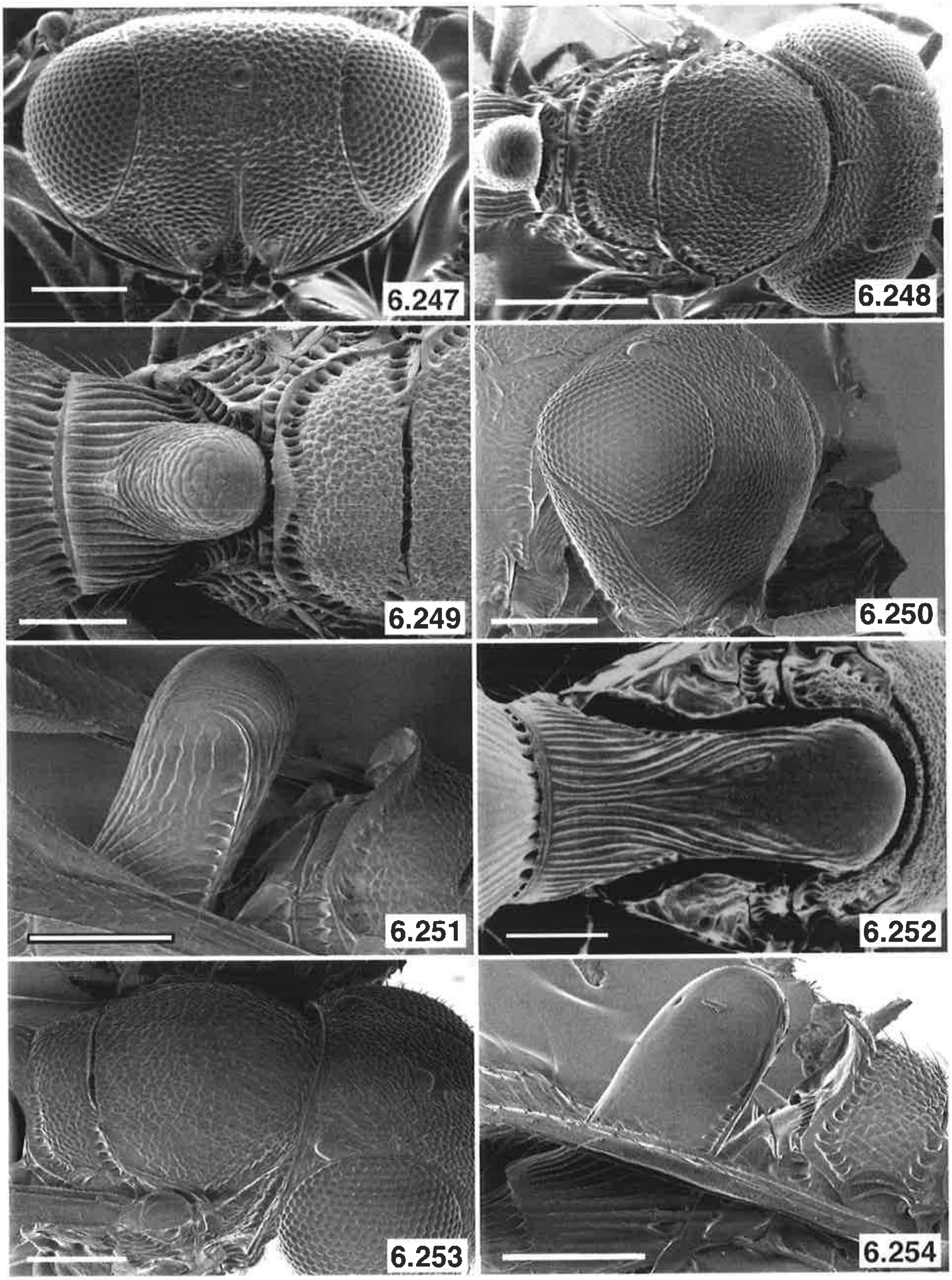
Figs 6.223-6.230. **6.223**, *Ceratobaeus stegastocerus* sp. nov., female, scutellum and metasomal horn (lateral view); 6.224, 6.225, *C. manii* sp. nov., female: **6.224**, head, mesosoma and metasomal horn (dorsal view); **6.225**, metasomal horn and posterior mesosoma (lateral view); **6.226**, *C. melas* sp. nov., female, mesosoma and metasomal horn (dorsal view); 6.227, 6.228, *C. mirabilis* Dodd, female: **6.227**, mesosoma and metasomal horn (dorsal view); **6.228**, head, mesosoma and metasomal horn (lateral view); 6.229, 6.230, *C. toheedi* sp. nov., female: **6.229**, head (anterior view); **6.230**, head, mesosoma and metasomal horn (dorsal view). Scale lines: 6.223-6.226, 6.229, 100μm; 6.227, 6.228, 6.230, 200μm.



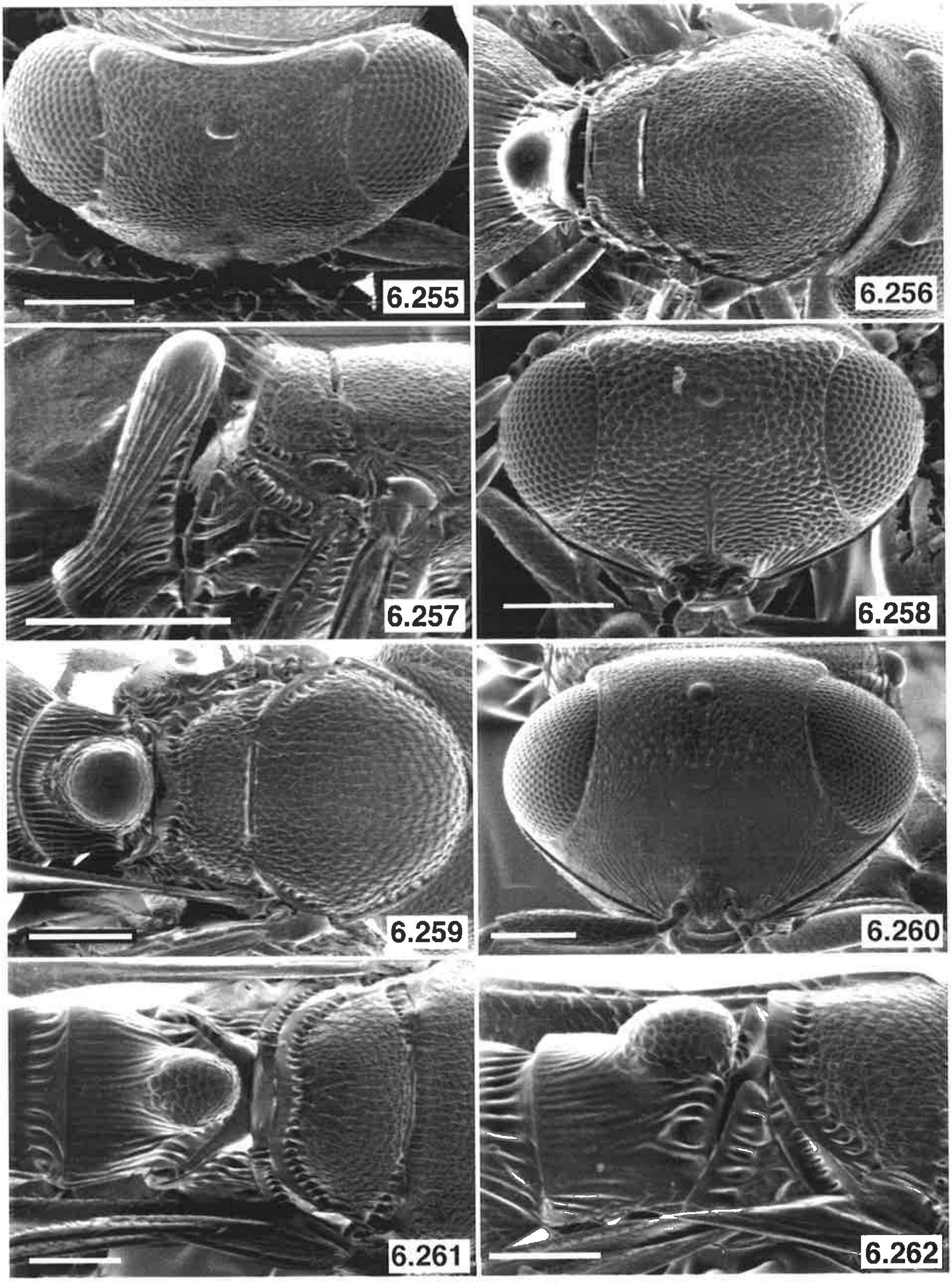
Figs 6.231-6.238. 6.231, 6.232, *Ceratobaeus kabirae* sp. nov., female: **6.231**, head (anterior view); **6.232**, head, mesosoma and metasomal horn (dorsal view); 6.233, 6.234, *C. luboi* sp. nov., female: **6.233**, head (antero-lateral view); **6.234**, metasomal horn (lateral view); 6.235, 6.236, *C. moola* sp. nov., female: **6.235**, head, mesosoma and metasomal horn (dorsal view); **6.236**, metasomal horn and posterior mesosoma (dorso-lateral view); 6.237, 6.238, *C. ogmocerus* sp. nov., female: **6.237**, head (anterior view); **6.238**, mesosoma and metasomal horn (dorsal view). Scale lines: 6.231-6.234, 6.237, 6.238, 100μm; 6.235, 6.236, 200μm.



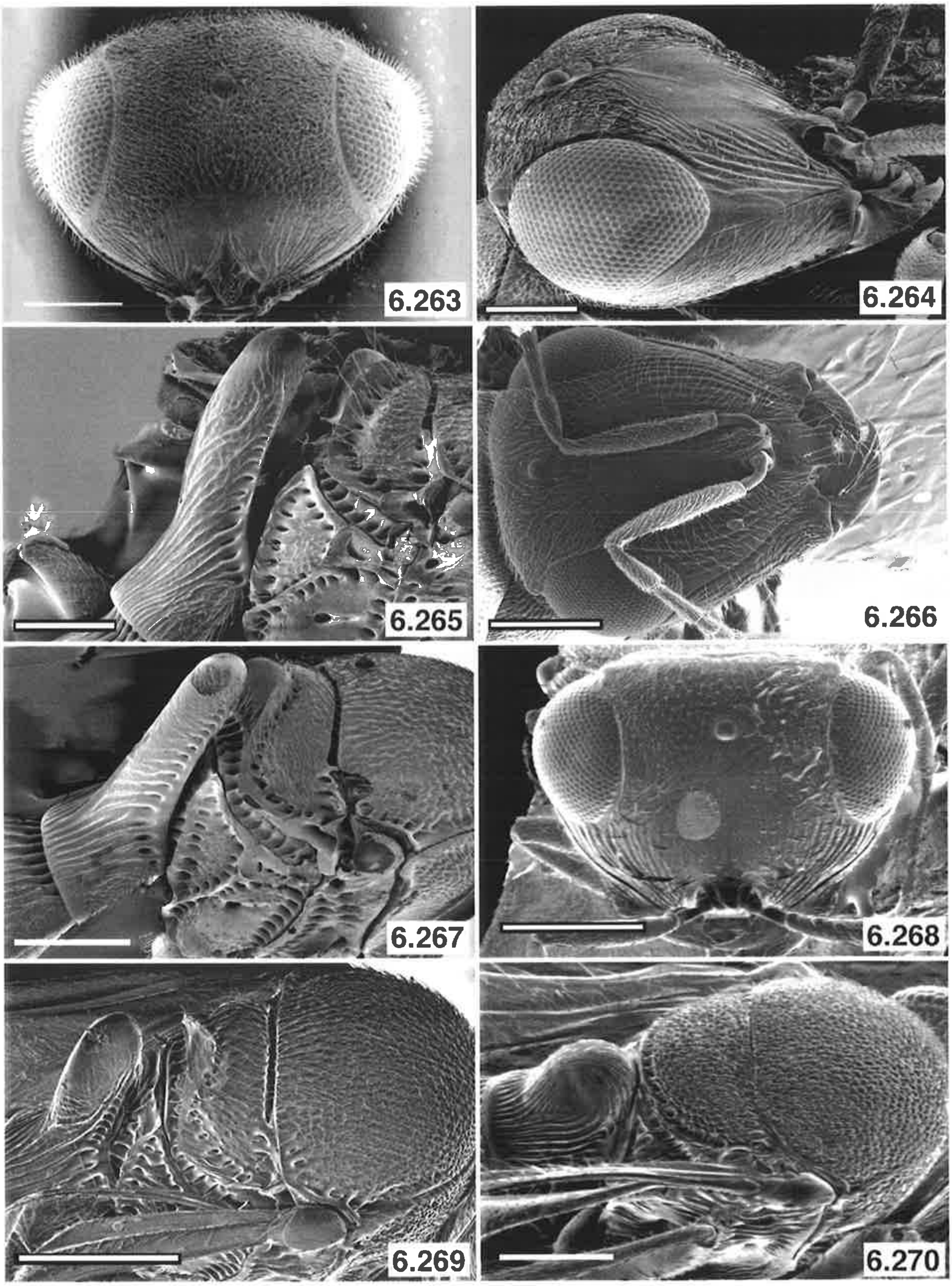
Figs 6.239-6.246. **6.239**, *Ceratobaeus ogmocerus* sp. nov., female, scutellum and metasomal horn (lateral view); 6.240, 6.241, *C. yasini* sp. nov., female: **6.240**, head (anterior view); **6.241**, scutellum and metasomal horn (dorsal view); 6.242, 6.243, *C. bethae* sp. nov., female: **6.242**, head (anterior view); **6.243**, mesosoma and metasomal horn (dorso-lateral view); **6.244**, *C. dillonae* sp. nov., female, head, mesosoma and metasomal horn (dorsal view); 6.245, 6.246, *C. feckneri* sp. nov., female: **6.245**, mesosoma and metasomal horn (dorsal view); **6.246**, metasomal horn and posterior mesosoma (lateral view). Scale lines: 6.239-6.242, 6.245, 6.246, 100μm; 6.243, 6.244, 200μm.



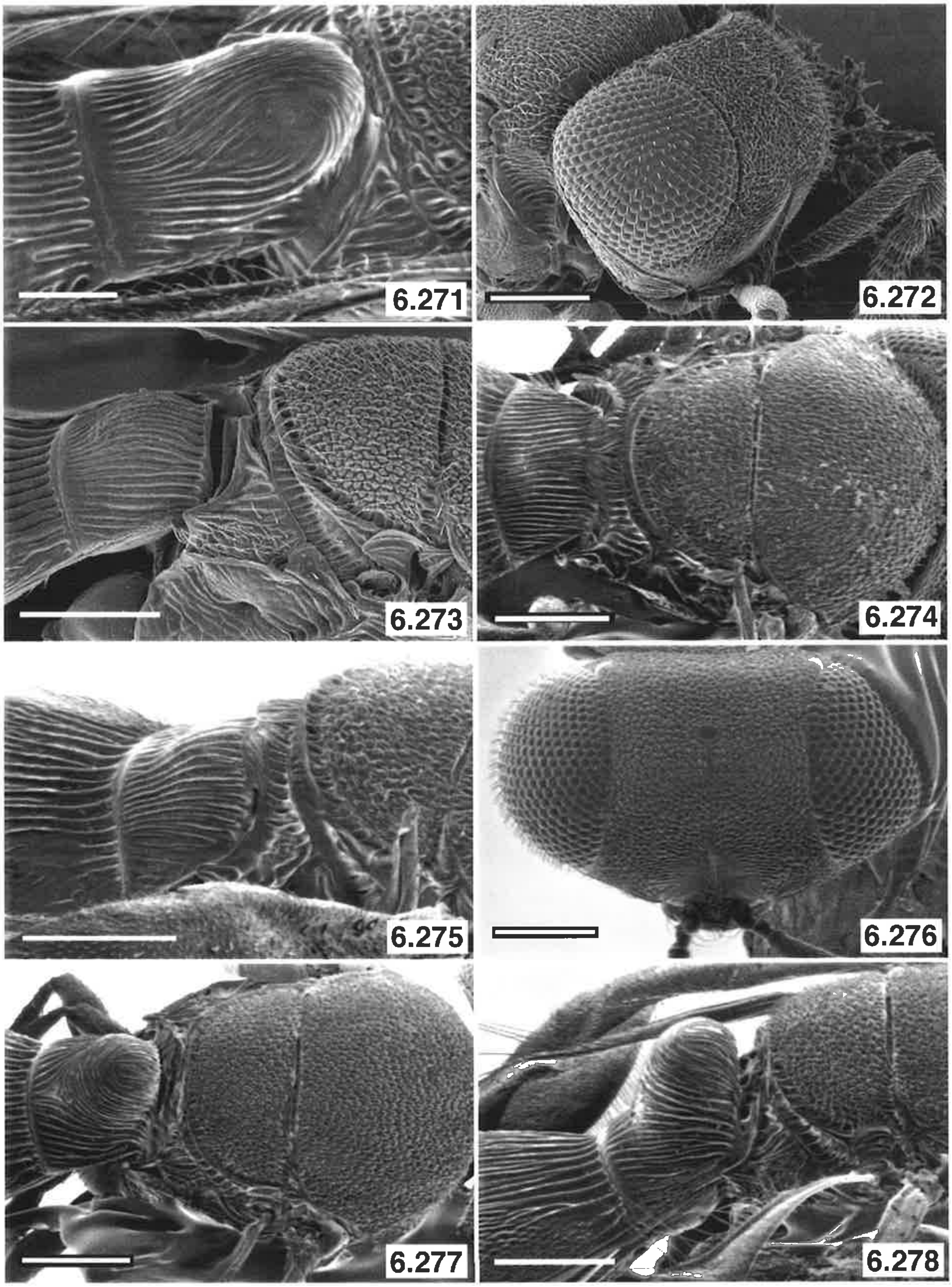
Figs 6.247-6.254. 6.247, 6.248, *Ceratobaeus leysonae* sp. nov., female: **6.247**, head (anterior view); **6.248**, head, mesosoma and metasomal horn (dorsal view); **6.249**, *C. muniri* sp. nov., female, metasomal horn and posterior mesosoma (dorsal view); 6.250, 6.251, *C. pachycerus* sp. nov., female: **6.250**, head (lateral view); **6.251**, scutellum and metasomal horn (lateral view); **6.252**, *C. platycornutus* Austin, female, metasomal horn and posterior mesosoma (dorsal view); 6.253, 6.254, *C. schmidti* sp. nov., female: **6.253**, head and mesosoma (dorso-lateral view); **6.354**, scutellum and metasomal horn (lateral view). Scale lines: 6.247, 6.249-6.254, 100μm; 6.248, 200μm.



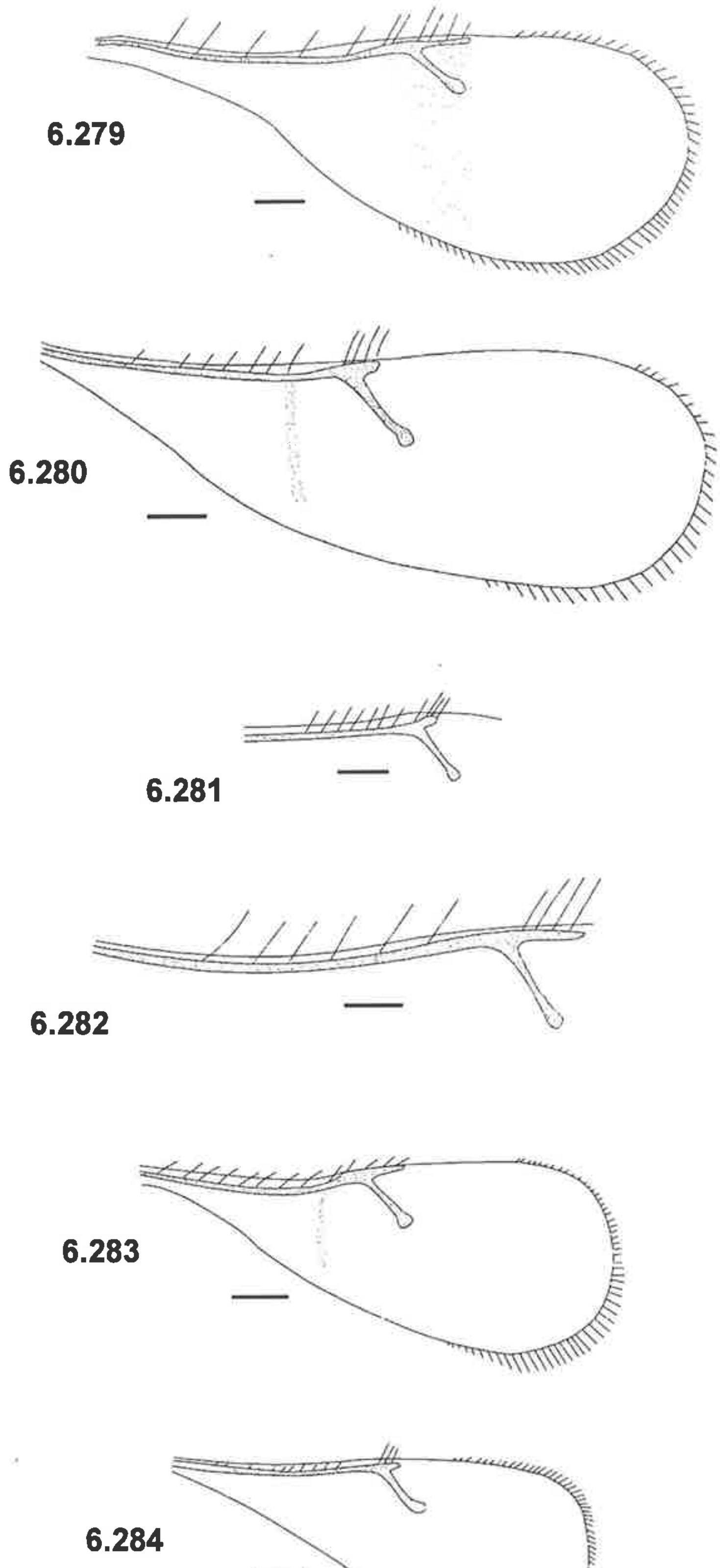
Figs 6.255-6.262. 6.255-6.257, *Ceratobaeus systenus* sp. nov., female: **6.255**, head (antero-dorsal view); **6.256**, mesosoma and metasomal horn (dorsal view); **6.257**, metasomal horn and posterior mesosoma (lateral view); 6.258, 6.259, *C. usmani* sp. nov., female: **6.258**, head (anterior view); **6.259**, mesosoma and metasomal horn (dorsal view); 6.260-6.262, *C. moonga* sp. nov., female: **6.260**, head (anterior view); **6.261**, scutellum and metasomal horn (dorsal view); **6.262**, scutellum and metasomal horn (lateral view). Scale lines: 6.255, 6.256, 6.258-6.262, 100μm; 6.257, 200μm.



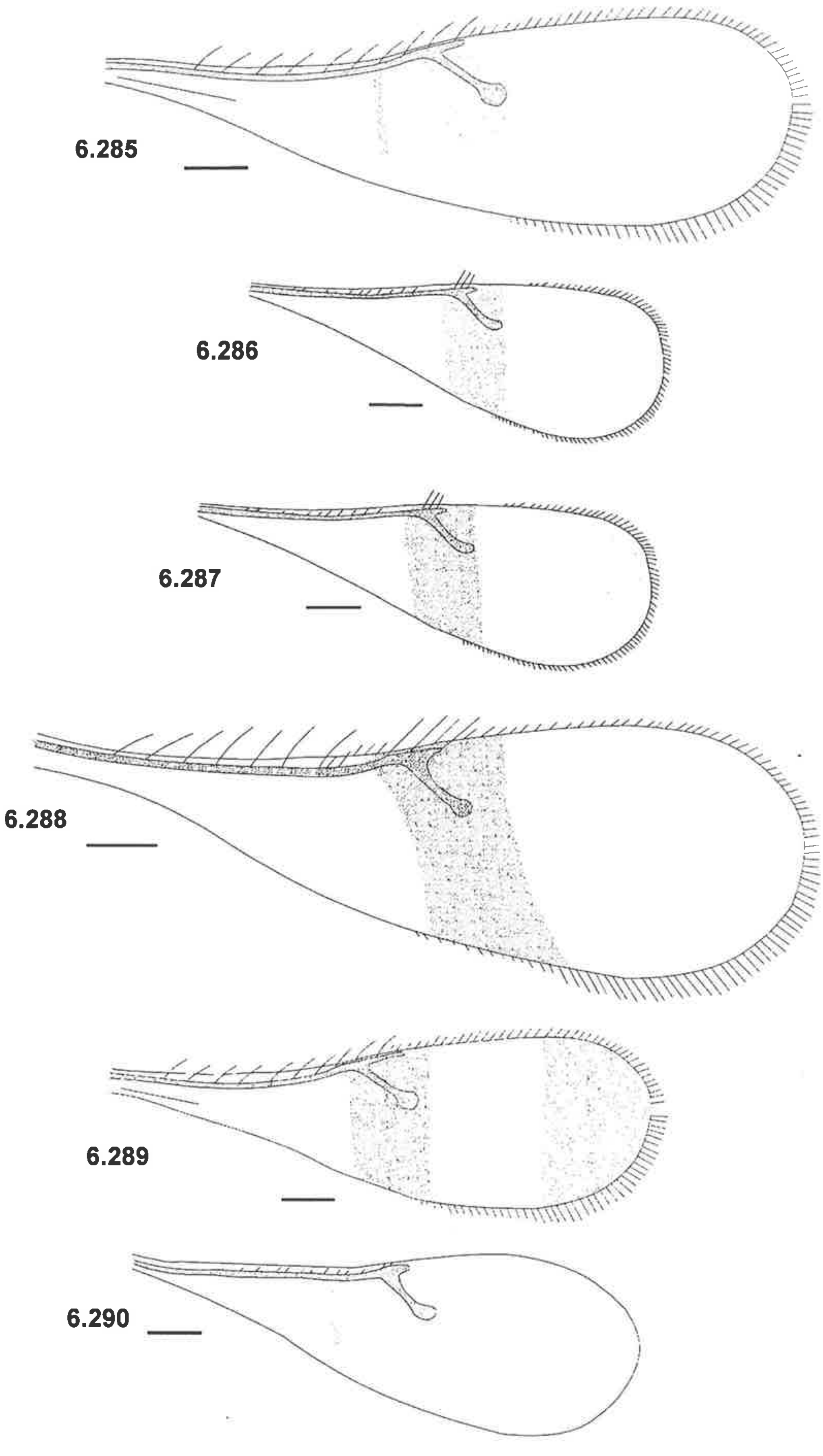
Figs 6.263-6.270. **6.263**, *Ceratobaeus setosus* Dodd, female, head (anterior view); 6.264, 6.265, *C. grandis* Dodd, female: **6.264**, head (lateral view); **6.265**, scutellum and metasomal horn (lateral view); 6.266, 6.267, *C. proipetye* sp. nov., female: **6.266**, head (anterior view); **6.267**, metasomal horn and posterior mesosoma (lateral view); 6.268, 6.269, *C. varicornis* Dodd, female: **6.268**, head (anterior view); **6.269**, mesosoma and metasomal horn (dorso-lateral view); **6.270**, *C. anmarae* sp. nov., female, mesosoma and metasomal horn (dorso-lateral view). Scale lines: 6.263-6.265, 6.270, 100μm; 6.266-6.269, 200μm.



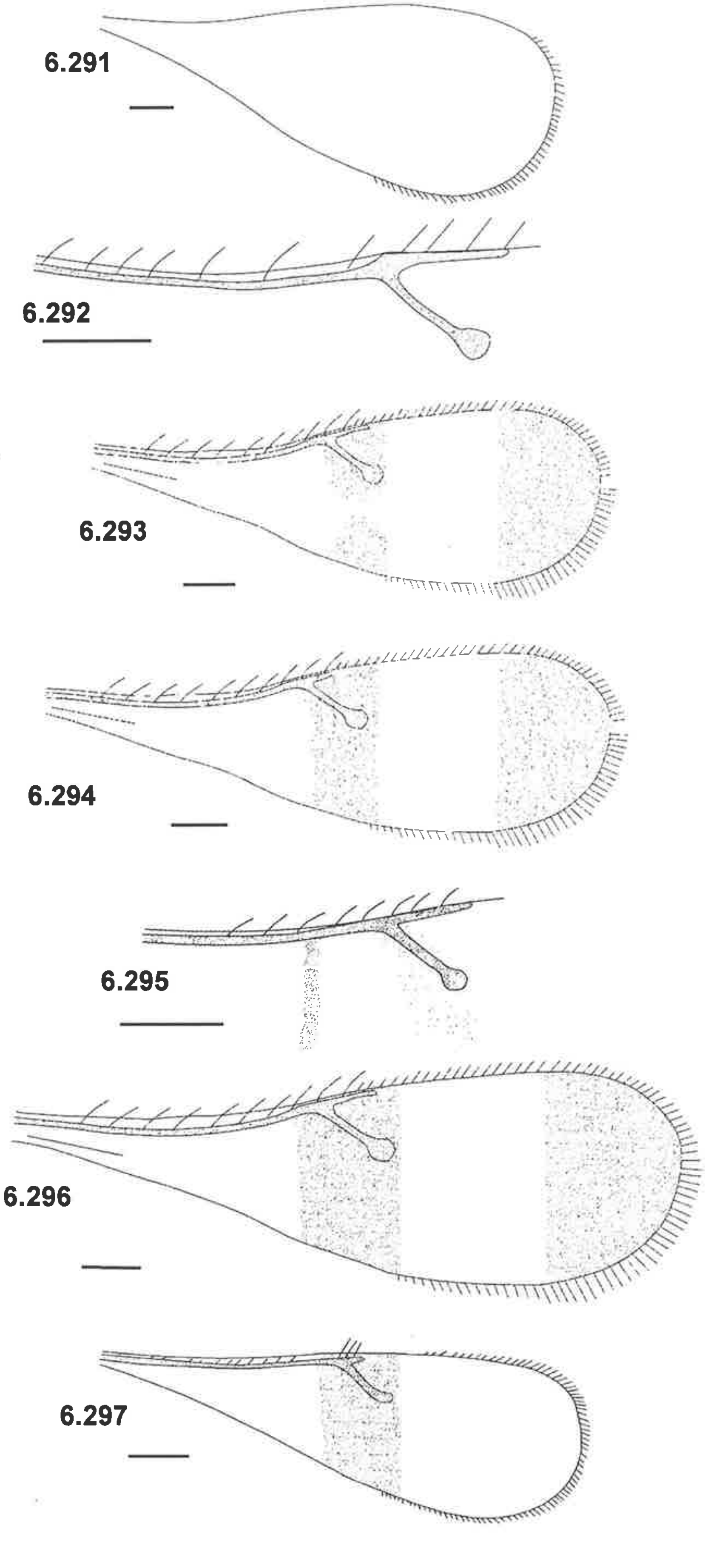
Figs 6.271-6.278. **6.271**, *Ceratobaeus anmarae* sp. nov., female, metasomal horn (dorso-lateral view); 6.272, 6.273, *C. grahami* sp. nov., female: **6.272**, head (dorso-lateral view); **6.273**, scutellum and metasomal horn (dorso-lateral view); 6.274, 6.275, *C. kiefferi* sp. nov., female: **6.274**, mesosoma and metasomal horn (dorsal view); **6.275**, scutellum and metasomal horn (lateral view); 6.276-6.278, *C. zebae* sp. nov., female: **6.276**, head (anterior view); **6.277**, mesosoma and metasomal horn (dorsal view); **6.278**, scutellum and metasomal horn (lateral view). Scale lines: 6.271, 50μm; 6.272-6.278, 100μm.



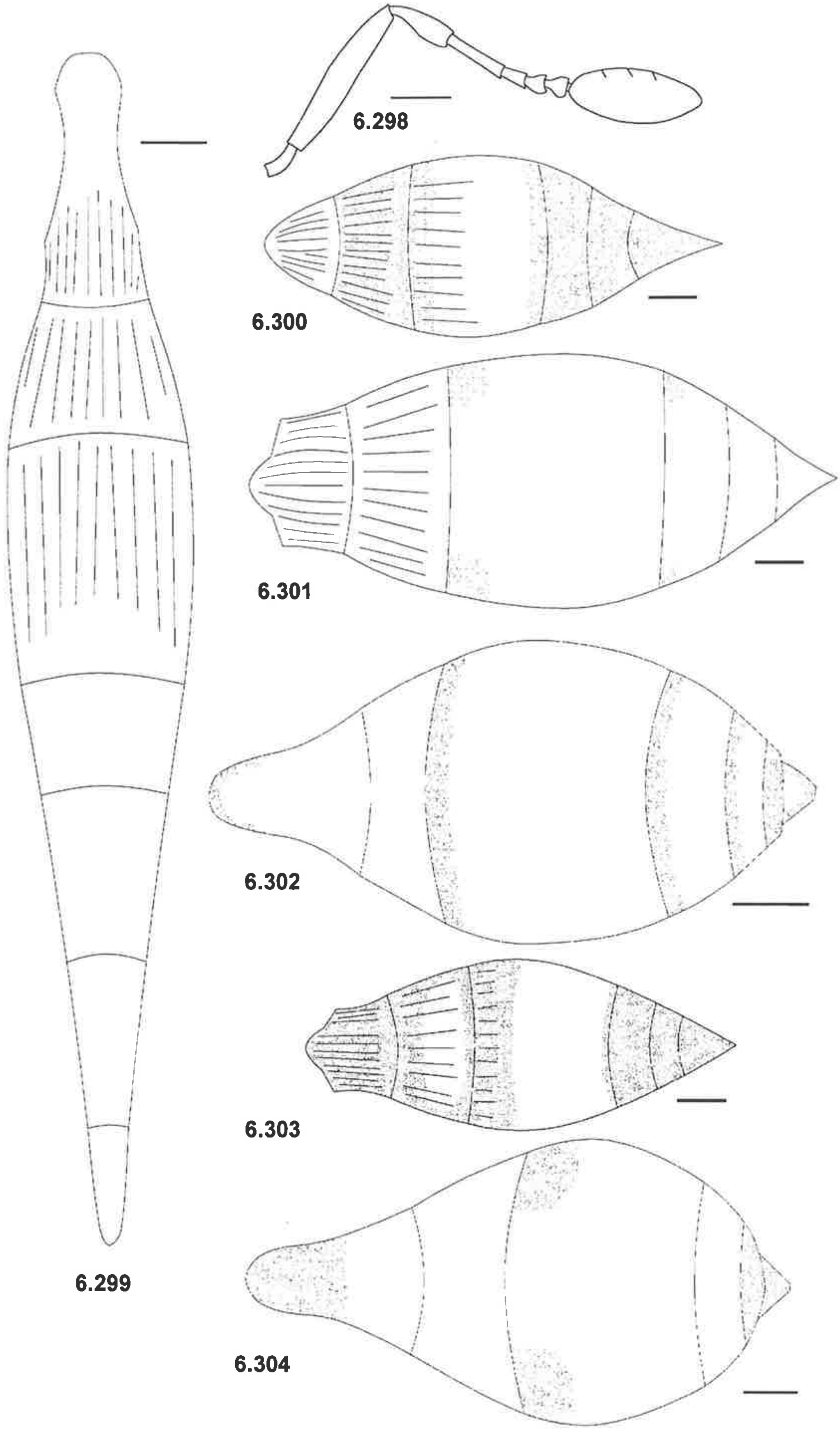
Figs 6.279-6.284. Fore wings: **6.279**, *Ceratobaeus ashmeadi* sp. nov.; **6.280**, *C. ater* (Hickman); **6.281**, *C. flavicorpus* Dodd; **6.282**, *C. azhari* sp. nov; **6.283**, *C. clubionus* Austin; **6.284**, *C. fionae* sp. nov. Scale lines 100μm.



Figs 6.285-6.290. Fore wings: **6.285**, *Ceratobaeus cuspicornutus* Austin; **6.286**, *C. gullanae* sp. nov.; **6.287**, *C. doddi* sp. nov.; **6.288**, *C. fasciatus* Dodd; **6.289**, *C. zafari* sp. nov.; **6.290**, *C. giraulti* Dodd. Scale lines 100μm.



Figs 6.291-6.297. Fore wings, **6.291**, *C. litopterus* sp. nov.; **6.292**, *C. intrudae* Austin; **6.293**, *C. nasiri* sp. nov.; **6.294**, *C. oimus* sp. nov.; **6.295**, *C. masneri* Austin; **6.296**, *C. moola* sp. nov.; **6.297**, *C. yasini* sp. nov. Scale lines 100μm.



Figs 6.298-6.304. **6.298**, *Ceratobaeus grandis* Dodd, female, antennae; 6.299-6.304, Metasoma: **6.299**, *C. rieki* Austin; **6.300**, *C. weemayourula* sp. nov.; **6.301**, *C. bouceki* sp. nov.; **6.302**, *C. fasciatus* Dodd; **6.303**, *C. nasiri* sp. nov.; **6.304**, *C. maculatus* Dodd. Scale lines 100μm.

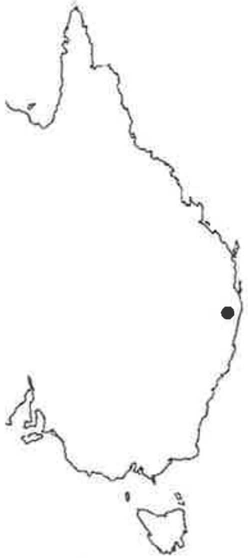


Fig. 6.305 C. ashmeadi

Fig.6.306 C. ater

Fig. 6.307 C. flavicorpus

Fig. 6.308 C. greensladae

Fig. 6.309 C. harveyi

Fig. 6.310 C. huggerti

Fig. 6.311 C. lamponae

Fig. 6.312 C. saeedi

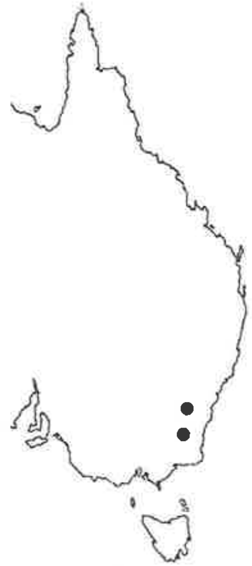


Fig. 6.313 C. athysanus

Fig. 6.314 C. raniae

Fig. 6.315 C. ajmali

Fig. 6.316 C. alveus

Fig. 6.317 C. australicus

Fig. 6.318 C. berryae

Fig. 6.319 C. minyamea

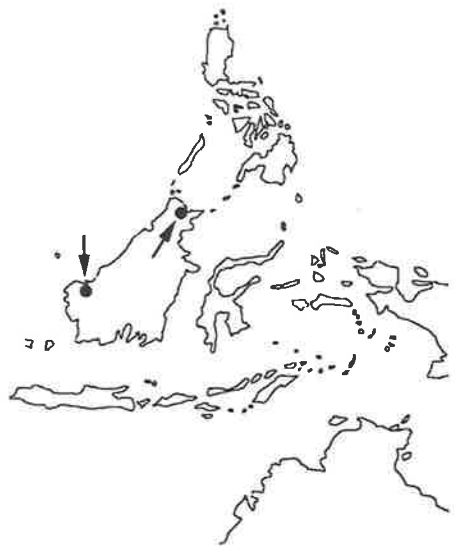


Fig. 6.320 C. normani

Fig. 6.321 C. umasensis

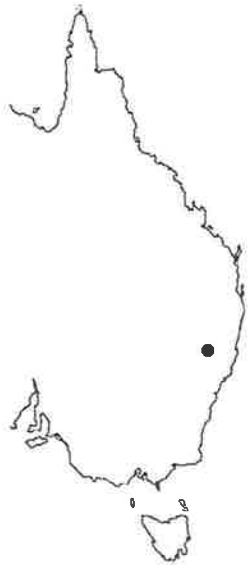


Fig. 6.322 C. boolool

Fig. 6.323 C. clavisegmentus

Fig. 6.324 C. mainae

Fig. 6.325 C. moongacutta

Fig. 6.326 C. narteol

Fig. 6.327 C. naumanni

Fig. 6.328 C. noyesi

Fig. 6.329 C. pita

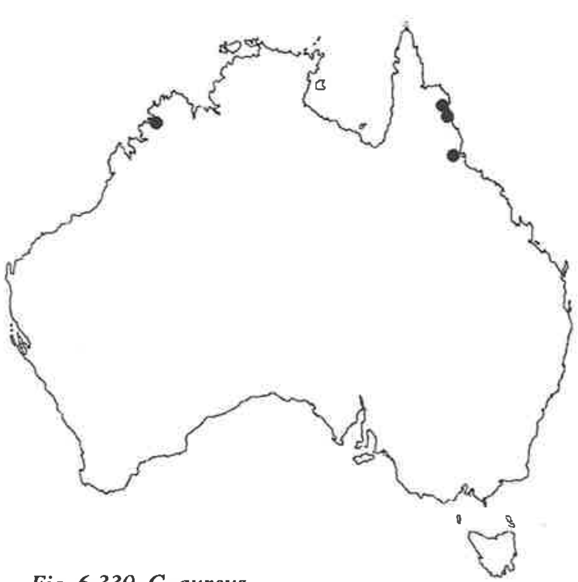


Fig. 6.330 C. aureus

Fig. 6.331 C. azhari

Fig. 6.332 C. cardaleae

Fig. 6.333 C. clubionus

Fig. 6.334 C. fieldi

Fig. 6.335 C. fionae

Fig. 6.336 C. flavios

Fig. 6.337 C. gallowayi

Fig. 6.338 C. goobita

Fig. 6.339 C. gorayaran

Fig. 6.340 C. kaikai

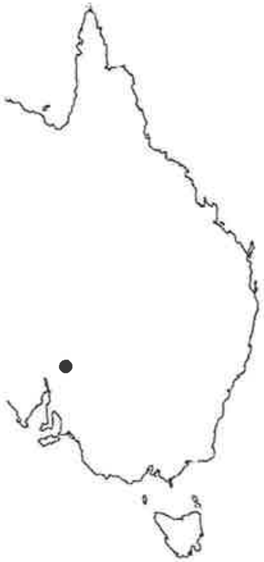


Fig. 6.341 C. mansoori

Fig. 6.342 C. maroocutta

Fig. 6.343 C. parvicornutus

Fig. 6.344 C. weemayourula

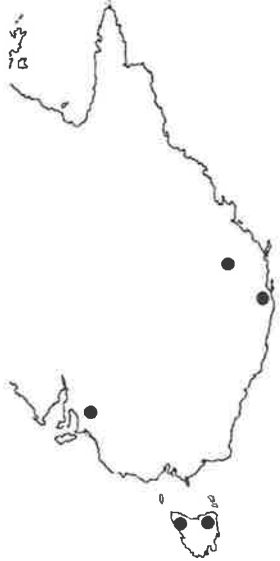


Fig. 6.345 C. ayeshae

Fig. 6.346 C. cuspicornutus

Fig. 6.347 C. elongatus

Fig. 6.348 C. gwenae

Fig. 6.349 C. phallocerus

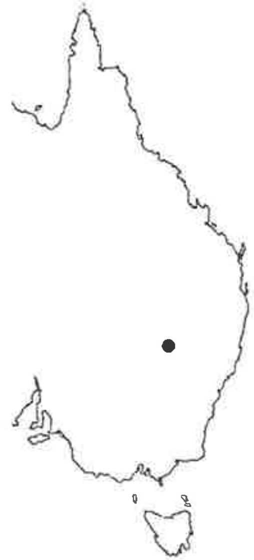


Fig. 6.350 C. rieki

Fig. 6.351 C. wattora

Fig. 6.352 C. balli

Fig. 6.353 C. bouceki

Fig. 6.354 C. fasciativentris

Fig. 6.355 C. gullanae

Fig. 6.356 C. hardyi

Fig. 6.357 C. jenningsi

Fig. 6.358 C. moonae

Fig. 6.359 C. rabiae

Fig. 6.360 C. undeneya

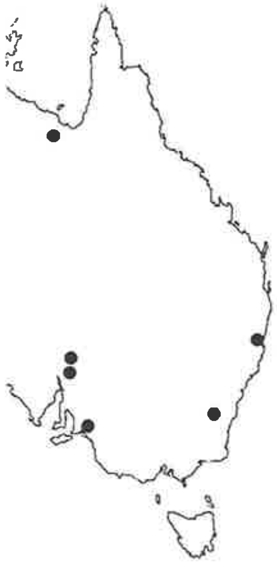


Fig. 6.361 C. yousufi

Fig. 6.362 C. doddi

Fig. 6.363 C. fasciatus

Fig. 6.364 C. faunus

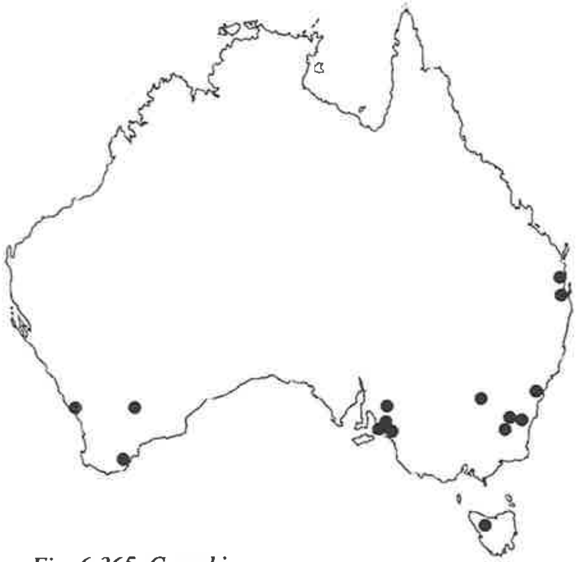


Fig. 6.365 C. moki

Fig. 6.366 C. zafari

Fig. 6.367 C. cabon

Fig. 6.368 C. evelineae

Fig. 6.369 C. flaviventris

Fig. 6.370 C. mahmoodi

Fig. 6.371 C. nephocerus

Fig. 6.372 C. pipayourula

Fig. 6.373 C. turneri

Fig. 6.374 C. buntor

Fig. 6.375 C. eumorphus

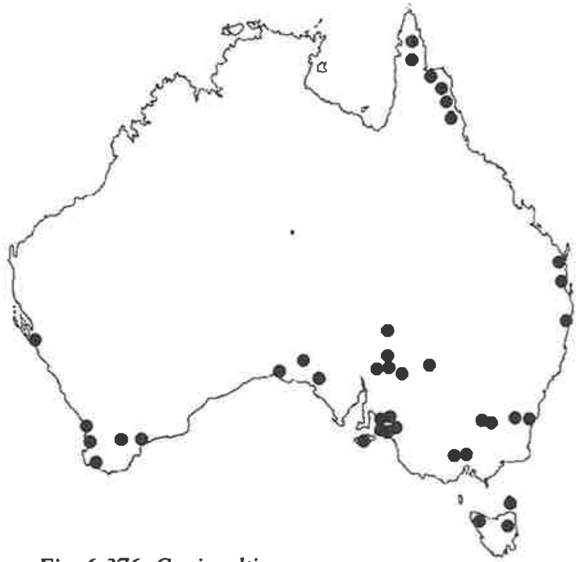


Fig. 6.376 C. giraulti

Fig. 6.377 C. johnsenae

Fig. 6.378 C. litopterus

Fig. 6.379 C. marrooyourula

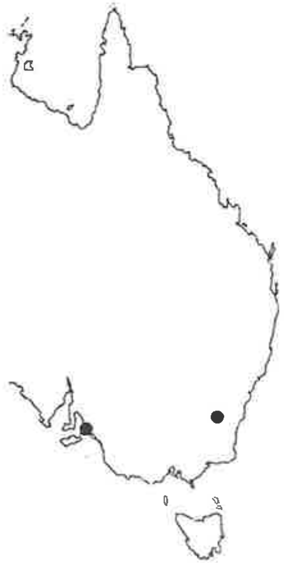


Fig. 6.380 C. intrudae

Fig. 6.381 C. nasiri

Fig. 6.382 C. saliki

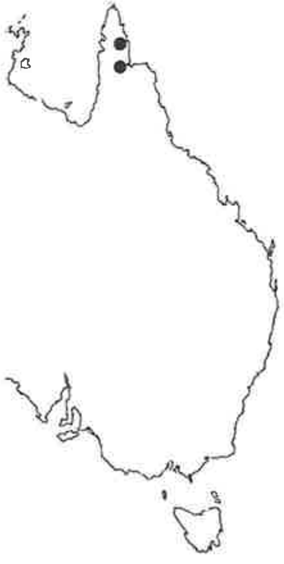


Fig. 6.383 C. iota

Fig. 6.384 C. markusi

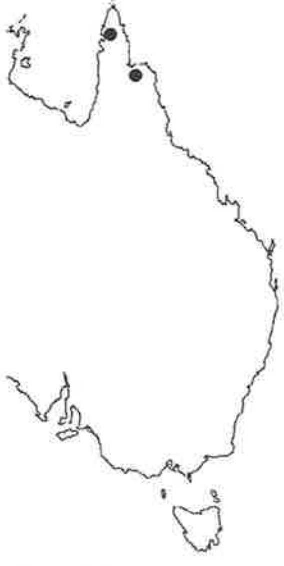


Fig. 6.385 C. matong

Fig. 6.386 C. michaeli

Fig. 6.387 C. mussiae

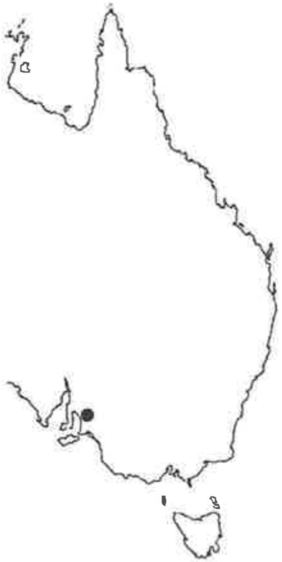


Fig. 6.388 C. ramishi

Fig. 6.389 C. umari

Fig. 6.390 C. kentae

Fig. 6.391 C. laeviventris

Fig. 6.392 C. nailae

Fig. 6.393 C. sabrii

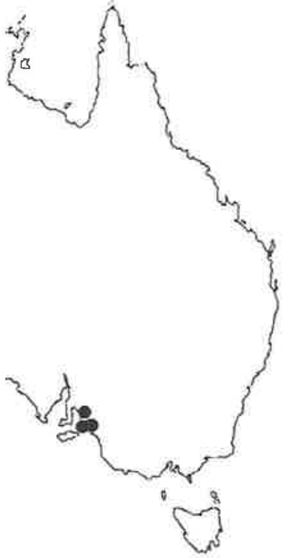


Fig. 6.394 C. taylori

Fig. 6.395 C. flavipes

Fig. 6.396 C. leai

Fig. 6.397 C. minyayunde

Fig. 6.398 C. extraordinarius

Fig. 6.399 C. longicornutus

Fig. 6.400 C. megacerus

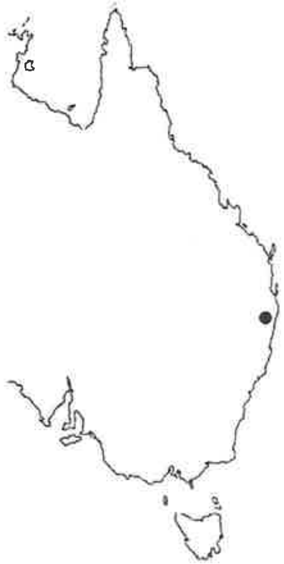


Fig. 6.401 C. acrotonus


Fig. 6.402 C. maculatus


Fig. 6.403 C. oimus


Fig. 6.404 C. ziai


Fig. 6.405 C. amiti


Fig. 6.406 C. anjumi

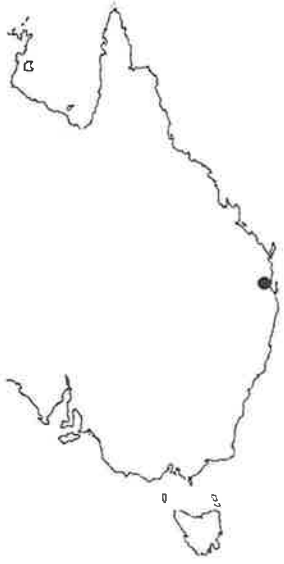


Fig. 6.407 C. haqi


Fig. 6.408 C. masneri


Fig. 6.409 C. stegastocerus


Fig. 6.410 C. manii


Fig. 6.411 C. melas


Fig. 6.412 C. mirabilis

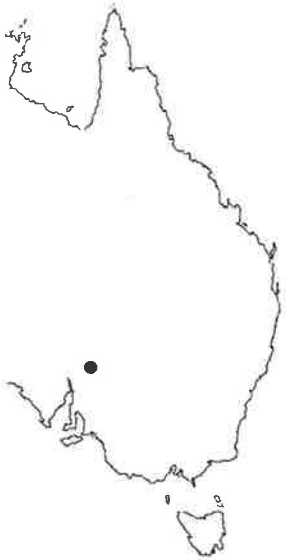


Fig. 6.413 C. toheedi

Fig. 6.414 C. kabirae

Fig. 6.415 C. luboi

Fig. 6.416 C. moola

Fig. 6.417 C. ogmocerus

Fig. 6.418 C. yasini

Fig. 6.419 C. bethae

Fig. 6.420 C. dillonae

Fig. 6.421 C. feckneri

Fig. 6.422 C. leysonae

Fig. 6.423 C. muniri

Fig. 6.424 C. pachycerus

Fig. 6.425 C. platycornutus

Fig. 6.426 C. schmidti

Fig. 6.427 C. systenus

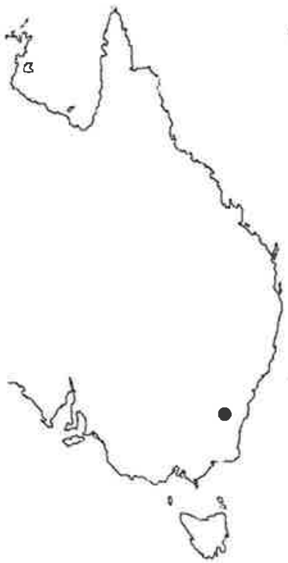


Fig. 6.428 C. usmani

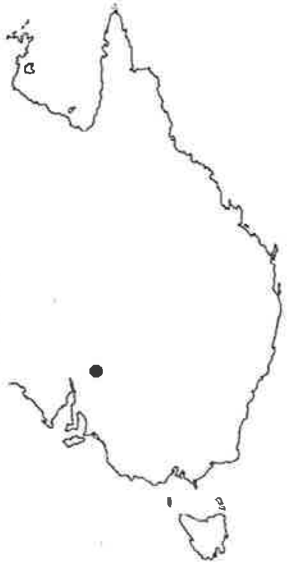


Fig. 6.429 C. moonga

Fig. 6.430 C. setosus

Fig. 6.431 C. grandis

Fig. 6.432 C. proipetye

Fig. 6.433 varicornis

Fig. 6.434 C. anmarae

Fig. 6.435 C. grahami

Fig. 6.436 C. kiefferi

Fig. 6.437 C. zebae

Chapter 7

General Discussion

There were two main aims of this project. Firstly, it attempted to establish a robust phylogenetic hypothesis for a group of parasitic Hymenoptera. Secondly, it attempted to revise a large number of the included species because of their relevance to the study of biodiversity. Their potential role in this respect is heightened by their species richness, their high degree of geographic endemism, and their trophic relationships with another important invertebrate group, spiders.

To determine the phylogenetic relationships among genera of the Baeini, an analysis was conducted using an extensive matrix of morphological characters. These were selected from the literature and, as well, several new ones were included. The results showed that exemplar species of some small genera appeared to be monophyletic. However, the two largest genera *Idris* and *Ceratobaeus*, were polyphyletic. Unfortunately, the results obtained were far from robust because of the high level of homoplasy in the data set. This was further indicated in that the generic level and *Ceratobaeus* species parsimony analyses had only five and three clades, respectively, supported by unequivocal characters.

For these reasons successive weighting of characters was employed in an attempt to identify more informative characters and generate a more stable set of relationships. The resulting trees were indeed better resolved and these were used to interpret the relationships among taxa. However, because of the small size and morphological simplicity of these wasps, the number of truly informative characters was quite low and, in the absence of more convincing support, much of the structure in the resulting trees was derived from reductional characters which, in the case of wing reduction, is known to be highly homoplasious.

The phylogenetic results of this study largely indicate the inadequacy of morphological data to satisfactorily resolve relationships among genera and species of the Baeini, and possibly this situation is indicative of other scelionids and other groups of micro-wasps. Such relationships may be better resolved using molecular data sets that can be analysed separately or together with morphological information. The comparison of DNA sequences, such as those produced from a range of mitochondrial or nuclear genes by the direct sequencing of amplified DNA segments using the polymerase chain reaction, provides the means for examining phylogenetic problems that have not been amenable to analysis using morphological data. For example, Dowton & Austin (1994, 1995; Dowton *et al.* 1997, 1998), using mitochondrial sequence data from the 16S and COI genes, have recently been able to successfully generate robust phylogenies for major groups of parasitic Hymenoptera and the proctotrupoid families, while Cameron (1993) has examined the evolution of eusociality in the Apidae using a similar approach.

Although monophyly of the two largest genera was rejected in this study using cladistic methods, *Ceratobaeus* was recognised as a genus of convenience because it is easy to identify. Although far from satisfactory, this approach at least provides some nomenclatural stability. Like many other phylogenetic studies, the current project has revealed the inadequacies of the current classification, but has not been able to satisfactorily replace in with a more natural and stable framework. However, at least the results here clearly point to the problem areas in baeine systematics so that future research can be better focused towards these.

A second aspect of the current research worth considering in a more general way is the size of the Australasian baeine fauna. Prior to this study only 32 species of *Ceratobaeus* were recognised for Australasia, and this has been increased to 133 species. This represents about a four-fold increase in the number of species, but is substantially less than the 200 estimated by Iqbal & Austin (1997). However, future collecting in the remote areas of mainland Australia and forested regions of New Guinea and adjacent islands is likely to generate a substantial number of additional species, and the estimate of 200 species may end up being a relatively accurate one. In terms of described species, *Ceratobaeus* is now the largest baeine genus world-wide.

In dealing with such diversity it was necessary to employ methods suitable for handling a large number of species. Several options were considered that assist in the generation of taxonomic descriptions and dichotomous keys. The DELTA system (Dallwitz *et al.* 1993) was assessed as one option but eventually rejected because it is not particularly user friendly. It is more suitable for generating interactive keys using the INTKEY option. However, a step towards the future development of an interactive key for the Baeini was taken by employing digital storage of all images. These images are readily manipulated and presented in various forms, so that they can be easily incorporated into different formats in the future, whether they be hard-copy or electronic.

Finally, it is hoped that the present study will serve as a sound basis for future biodiversity and phylogenetic studies on the Baeini, and taxonomic revisionary work on this and other groups of parasitic Hymenoptera for Australasia.

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Appendices

Appendix A1 Means of quantitative characters

A1.1 Means of quantitative characters for the generic level phylogenetic analysis of Baeini

A1.2 Means of quantitative characters for the species level phylogenetic analysis of *Ceratobaeus*

Appendix A2 Graphical representation of quantitative characters

A2.1 Graphical representation of quantitative characters for the analysis to resolve relationships among genera of Baeini

A2.1.1 Graphical representation of Character 44

A2.1.2 Graphical representation of Character 48

A2.1.3 Graphical representation of Character 49

A2.1.4 Graphical representation of Character 50

A2.2 Graphical representation of quantitative characters for the analysis to resolve relationships among species of *Ceratobaeus*

A2.2.1 Graphical representation of Character 41

A2.2.2 Graphical representation of Character 42

A2.2.3 Graphical representation of Character 43

A2.2.4 Graphical representation of Character 44

A2.2.5 Graphical representation of Character 45

A2.2.6 Graphical representation of Character 46

A2.2.7 Graphical representation of Character 47

A2.2.8 Graphical representation of Character 48

A2.2.9 Graphical representation of Character 49

A2.2.10 Graphical representation of Character 50

Appendix A3 Data Matrices

A3.1 Data matrix for the analysis to resolve relationships among genera of Baeini

A3.2 Data matrix for the analysis to resolve relationships among species of *Ceratobaeus*

Appendix A4 Publications

A4.1 Iqbal & Austin (1997)

Appendix A1.1. Means of quantitative characters for the generic level phylogenetic analysis of Baeini.

44. F1 length : width	Mean	48. Pm : St vein	Mean	49. Metasoma L:W	Mean	50. T3 : T2	Mean
	1.36		0.40	Mean	1.98		1.95
	0.63		0.17	SD	0.92		0.88
Coded 0		**Coded 0**		**Coded 0**		**Coded 0**	
Ceratobaeus moongacutta	1.00	*Ceratobaeus cuspicornutus*	0.10	*Mirobaeus bicolor*	0.93	*Mirobaeoides tasmanicus*	0.07
Ceratobaeus naumanni	1.00	*Nixonia sp.*	0.18	*Idris flavicornis*	0.98	*Baeus leai*	0.09
Genus sp. 1	1.00	*Ceratobaeus varicornus*	0.18	*Hickmanella intrudens*	1.08	*Mirobaeoides scutellaris*	0.14
Genus sp. 2	1.00	*Idris sp. 2*	0.20	*Mirobaeoides scutellaris*	1.10	*Baeus seminulum*	0.15
Ceratobaeus leai	1.00	*Ceratobaeus marrooyourula*	0.22	*Mirobaeoides tasmanicus*	1.12	*Mirobaeoides pecki*	0.22
Ceratobaeus litopterus	1.00	*Idris niger*	0.22	*Baeus leai*	1.13	**Coded 1**	
Ceratobaeus setosus	1.00	*Idris pulchar*	0.22	*Genus sp. 3*	1.23	*Nixonia sp.*	1.00
Ceratobaeus iota	1.00	*Ceratobaeus moongacutta*	0.24	*Baeus seminulum*	1.23	*Sparasion sp.*	1.00
Ceratobaeus fieldi	1.00	*Idris theridii*	0.24	*Idris helpidid*	1.31	*Ceratobaeus elongatus*	1.25
Ceratobaeus grahami	1.00	*Ceratobaeus cornutus*	0.25	*Hickmanella holoplatysa*	1.31	*Mirobaeus bicolor*	1.30
Idris flavicornis	1.00	*Ceratobaeus giraulti*	0.25	*Ceratobaeus moongacutta*	1.32	*Mirobaeoides barbarae*	1.33
Idris seminitidus	1.00	*Ceratobaeus reiki*	0.25	*Idris pulchar*	1.32	*Genus sp. 3*	1.36
Idris theridii	1.00	*Ceratobaeus ater*	0.25	*Genus sp. 1*	1.34	*Ceratobaeus cuspicornutus*	1.42
Idris sp. 1	1.00	*Ceratobaeus laeviventris*	0.25	*Idris theridii*	1.36	*Ceratobaeus iota*	1.42
Idris sp. 2	1.00	*Idris helpidid*	0.25	*Ceratobaeus fieldi*	1.48	*Ceratobaeus clubionus*	1.54
Hickmanella holoplatysa	1.00	*Odontacolus sp. 1*	0.25	*Idris sp. 1*	1.48	*Ceratobaeus mirabilis*	1.59
Hickmanella intrudens	1.00	*Ceratobaeus mirabilis*	0.27	*Idris sp. 2*	1.48	*Ceratobaeus fasciatus*	1.59
Odontacolus sp. 1	1.00	*Ceratobaeus yousufi*	0.29	*Odontacolus longiceps*	1.50	*Odontacolus longiceps*	1.60
Mirobaeoides barbarae	1.00	*Ceratobaeus grahami*	0.29	*Odontacolus sp. 1*	1.54	*Ceratobaeus laeviventris*	1.79
Mirobaeoides pecki	1.00	*Ceratobaeus pipayourula*	0.30	*Idris niger*	1.57	*Ceratobaeus varicornus*	1.80
Mirobaeoides scutellaris	1.00	*Idris flavicornis*	0.30	*Idris seminitidus*	1.59	*Ceratobaeus setosus*	1.83
Mirobaeoides tasmanicus	1.00	*Ceratobaeus fasciatus*	0.33	*Mirobaeoides pecki*	1.59	*Odontacolus sp. 1*	1.83
Genus sp. 3	1.00	*Ceratobaeus setosus*	0.38	*Mirobaeoides barbarae*	1.64	**Coded 2**	
Baeus leai	1.00	*Ceratobaeus oimus*	0.38	*Ceratobaeus clubionus*	1.68	*Ceratobaeus ater*	1.88
Baeus seminulum	1.00	*Ceratobaeus elongatus*	0.40	*Ceratobaeus yousufi*	1.72	*Ceratobaeus grahami*	1.90
Ceratobaeus fasciatus	1.17	*Ceratobaeus iota*	0.40	*Ceratobaeus naumanni*	1.79	*Ceratobaeus reiki*	1.93
Ceratobaeus mirabilis	1.20	*Ceratobaeus fieldi*	0.43	*Genus sp. 2*	1.79	*Ceratobaeus cornutus*	2.00
Ceratobaeus reiki	1.20	*Idris seminitidus*	0.43	*Ceratobaeus azhari*	1.80	*Genus sp. 2*	2.00
Ceratobaeus cuspicornutus	1.20	*Ceratobaeus kabirae*	0.44	*Ceratobaeus setosus*	1.82	*Ceratobaeus giraulti*	2.00
Ceratobaeus elongatus	1.33	*Ceratobaeus azhari*	0.46	*Ceratobaeus giraulti*	1.83	*Ceratobaeus fieldi*	2.00
Ceratobaeus pipayourula	1.33	*Ceratobaeus eumorphus*	0.50	*Ceratobaeus litopterus*	1.86	*Idris seminitidus*	2.00
Ceratobaeus eumorphus	1.33	*Ceratobaeus clubionus*	0.72	*Ceratobaeus eumorphus*	1.96	*Ceratobaeus azhari*	2.06
Ceratobaeus clubionus	1.33	**Coded 1**		*Ceratobaeus leai*	2.00	*Hickmanella holoplatysa*	2.08
Idris helpidid	1.33	*Ceratobaeus intrudae*	1.00	*Ceratobaeus laeviventris*	2.00	*Ceratobaeus kabirae*	2.20
Odontacolus longiceps	1.33	*Odontacolus longiceps*	1.00	*Ceratobaeus marrooyourula*	2.00	*Ceratobaeus intrudae*	2.23
Ceratobaeus kabirae	1.50	**Coded 2**		**Coded 1**		*Ceratobaeus yousufi*	2.30
Ceratobaeus marrooyourula	1.50	*Sparasion sp.*	2.14	*Ceratobaeus grahami*	2.40	*Hickmanella intrudens*	2.33
Ceratobaeus oimus	1.50	**Coded missing**		*Ceratobaeus ater*	2.41	*Ceratobaeus pipayourula*	2.40
Idris niger	1.50	*Ceratobaeus naumanni*	-	*Ceratobaeus varicornus*	2.42	*Ceratobaeus marrooyourula*	2.42
Mirobaeus bicolor	1.50	*Genus sp. 1*	-	*Ceratobaeus iota*	2.43	*Ceratobaeus naumanni*	2.45
Ceratobaeus laeviventris	1.60	*Genus sp. 2*	-	*Ceratobaeus kabirae*	2.46	*Idris theridii*	2.57
Ceratobaeus intrudae	1.67	*Ceratobaeus leai*	-	*Ceratobaeus pipayourula*	2.46	*Idris sp. 2*	2.71
Idris pulchar	1.67	*Ceratobaeus litopterus*	-	*Ceratobaeus fasciatus*	2.47	*Idris helpidid*	2.73
Ceratobaeus ater	1.75	*Idris sp. 1*	-	*Ceratobaeus intrudae*	2.51	**Coded 3**	
Ceratobaeus cornutus	2.00	*Hickmanella holoplatysa*	-	*Ceratobaeus mirabilis*	2.62	*Ceratobaeus oimus*	2.82
Ceratobaeus giraulti	2.00	*Hickmanella intrudens*	-	*Ceratobaeus oimus*	2.63	*Idris niger*	2.82
Ceratobaeus yousufi	2.00	*Mirobaeoides barbarae*	-	*Ceratobaeus cuspicornutus*	2.77	*Genus sp. 1*	2.88
Ceratobaeus azhari	2.00	*Mirobaeoides pecki*	-	*Ceratobaeus cornutus*	2.85	*Ceratobaeus leai*	2.90
Coded 1		*Mirobaeoides scutellaris*	-	**Coded 2**		*Ceratobaeus litopterus*	2.90
Nixonia sp.	3.00	*Mirobaeoides tasmanicus*	-	*Sparasion sp.*	3.72	*Ceratobaeus eumorphus*	3.00
Sparasion sp.	3.50	*Mirobaeoides WAMP sp.*	-	*Nixonia sp.*	3.80	*Idris sp. 1*	3.00
Coded 2		*Mirobaeus bicolor*	-	*Ceratobaeus elongatus*	3.81	*Idris flavicornis*	3.13
Ceratobaeus varicornus	4.00	*Baeus leai*	-	**Coded 3**		*Ceratobaeus moongacutta*	3.40
		Baeus seminulum	-	*Ceratobaeus reiki*	6.20	**Coded 4**	
						Idris pulchar	4.29

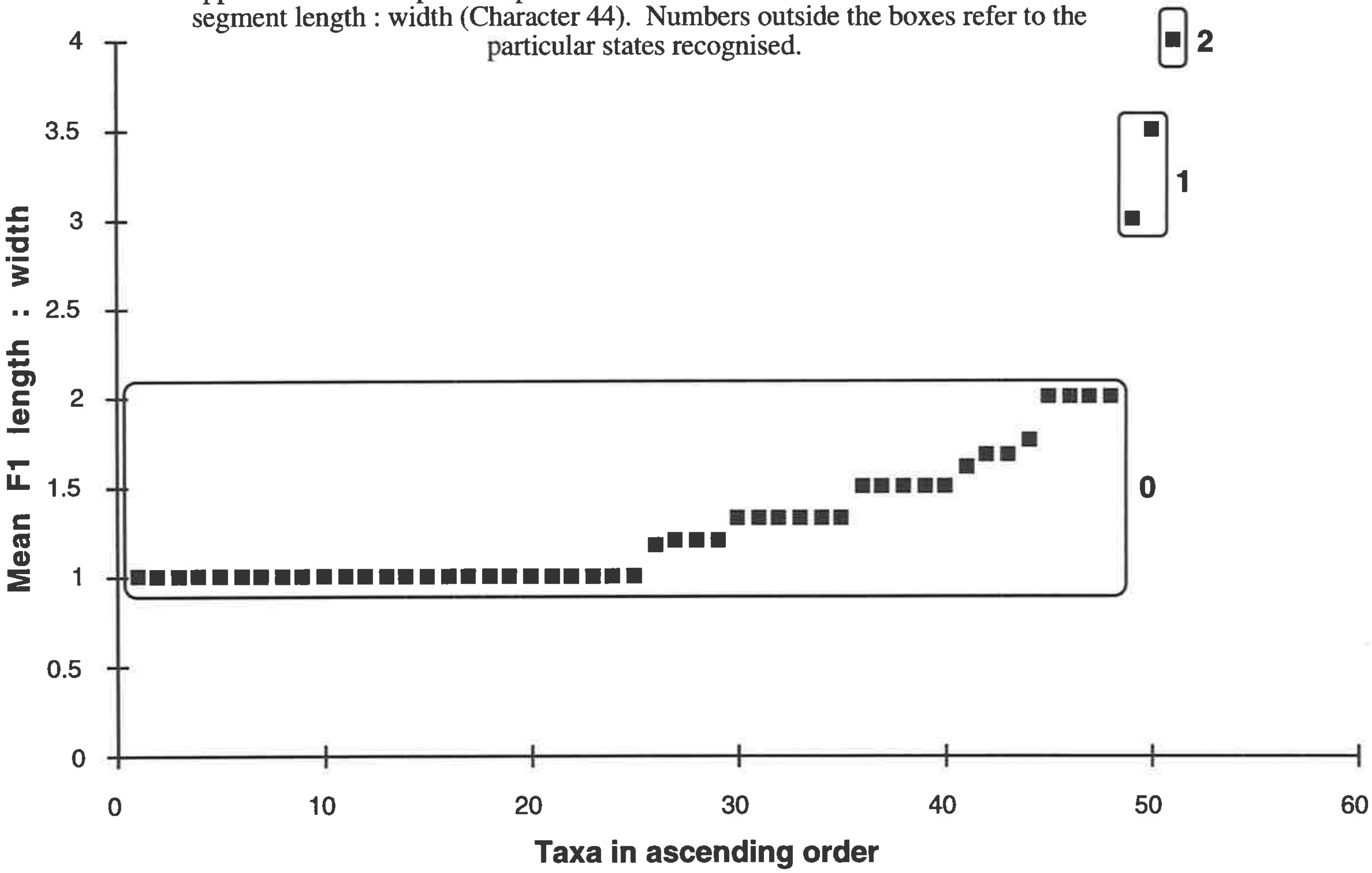
Appendix A1.2. Means of quantitative characters for the species level phylogenetic analysis of *Ceratobaeus*.

41. Body length	Mean	42. Head L:W	Mean	43. Head L:W	Mean	44. F1 L:W	Mean	45. Clava L:W	Mean
Mean	1.62		2.43		0.80		1.61		2.35
SD	1.32		0.37		0.07		0.68		0.38
Coded 0		**Coded 0**		**Coded 0**		**Coded 0**		**Coded 0**	
C. iota	0.67	Sparasion sp.	1.40	C. faunus	0.67	C. australicus	1.00	C. berryae	1.71
C. cardaleae	0.70	C. moongacutta	1.68	C. kabirae	0.69	C. leai	1.00	C. leai	1.80
C. alveus	0.89	Nixonia sp.	1.75	C. mirabilis	0.70	C. setosus	1.00	C. elongatus	1.86
Idris sp.	0.90	**Coded 1**		C. ogmocerus	0.71	C. moongacutta	1.00	C. umasensis	1.88
C. kentae	0.93	C. naumanni	1.95	C. manii	0.71	C. umasensis	1.00	C. gwenae	1.92
C. flavipes	1.01	C. iota	1.96	C. litopterus	0.72	C. gwenae	1.00	C. eumorphus	1.92
C. fieldi	1.03	C. giraulti	2.00	C. cardaleae	0.72	C. iota	1.00	C. marrooyourula	1.93
C. kaikai	1.03	C. cardaleae	2.08	C. reiki	0.73	C. litopterus	1.00	C. flavipes	1.96
C. manii	1.04	C. clavisegmentus	2.11	C. extraordinarius	0.73	C. schmidti	1.00	C. fieldi	2.00
C. moongacutta	1.05	C. raniae	2.12	C. pachycerus	0.74	C. fieldi	1.00	C. ater	2.05
C. berryae	1.06	C. masneri	2.13	C. flaviventris	0.74	C. cardaleae	1.00	C. ogmocerus	2.07
C. eumorphus	1.13	Idris sp.	2.13	**Coded 1**		C. grahami	1.00	C. athysanus	2.08
C. zebae	1.14	C. azhari	2.14	C. schmidti	0.75	Idris sp.	1.00	C. schmidti	2.09
C. umasensis	1.15	C. zebae	2.14	C. raniae	0.75	C. flavipes	1.08	**Coded 1**	
C. yousufi	1.16	C. flavipes	2.15	Idris sp.	0.75	C. naumanni	1.10	C. cuspicornutus	2.14
C. pachycerus	1.17	**Coded 2**		C. platycornutus	0.76	C. mirabilis	1.20	C. mirabilis	2.15
C. australicus	1.19	C. leai	2.18	C. fieldi	0.76	C. alveus	1.20	C. oimus	2.15
C. masneri	1.19	C. turneri	2.18	C. grahami	0.76	C. oimus	1.23	C. reiki	2.17
C. grahami	1.19	C. marrooyourula	2.19	C. kaikai	0.76	C. elongatus	1.25	C. moonga	2.17
C. schmidti	1.21	C. setosus	2.19	C. turneri	0.76	C. clubionus	1.33	C. kabirae	2.17
C. naumanni	1.22	C. platycornutus	2.23	C. clubionus	0.77	C. ogmocerus	1.40	C. turneri	2.17
C. leai	1.23	C. varicornus	2.23	C. intrudae	0.77	C. athysanus	1.40	C. faunus	2.19
C. raniae	1.25	C. alveus	2.24	C. elongatus	0.78	C. intrudae	1.50	C. azhari	2.19
C. setosus	1.26	C. cornutus	2.25	C. masneri	0.78	C. masneri	1.50	C. clubionus	2.20
C. giraulti	1.28	C. oimus	2.26	C. yousufi	0.78	C. platycornutus	1.50	C. kentae	2.20
C. ogmocerus	1.28	C. intrudae	2.29	C. zebae	0.78	C. reiki	1.50	C. kaikai	2.20
C. litopterus	1.34	C. flaviventris	2.35	C. ater	0.78	C. extraordinarius	1.50	C. litopterus	2.22
C. pipayourula	1.34	C. moonga	2.35	C. cuspicornutus	0.79	C. zebae	1.50	C. manii	2.22
C. clubionus	1.38	C. pipayourula	2.35	C. iota	0.79	C. kabirae	1.50	C. giraulti	2.25
C. ater	1.39	C. mahmoodi	2.41	C. fasciatus	0.80	C. minyamea	1.50	C. cardaleae	2.25
C. intrudae	1.43	C. faunus	2.42	C. bouceki	0.80	C. berryae	1.50	C. intrudae	2.33
C. moonga	1.43	C. ater	2.43	C. oimus	0.80	C. kaikai	1.50	C. extraordinarius	2.33
C. clavisegmentus	1.44	C. extraordinarius	2.44	C. moonga	0.80	C. manii	1.50	C. alveus	2.33
C. athysanus	1.45	C. schmidti	2.44	C. eumorphus	0.80	C. pachycerus	1.50	C. raniae	2.40
C. laeviventris	1.46	C. eumorphus	2.45	C. clavisegmentus	0.81	C. mahmoodi	1.50	C. pachycerus	2.40
C. marrooyourula	1.46	C. australicus	2.48	C. setosus	0.81	C. flaviventris	1.50	C. mahmoodi	2.40
C. cornutus	1.50	C. athysanus	2.49	C. alveus	0.81	C. marrooyourula	1.50	C. flaviventris	2.40
C. mahmoodi	1.50	C. litopterus	2.49	C. kentae	0.81	C. pipayourula	1.56	Idris sp.	2.40
C. minyamea	1.53	C. grahami	2.54	C. athysanus	0.81	C. fasciatus	1.62	C. fasciatus	2.41
C. mirabilis	1.59	**Coded 3**		C. azhari	0.81	C. laeviventris	1.65	C. laeviventris	2.43
C. extraordinarius	1.59	C. berryae	2.55	C. laeviventris	0.81	C. giraulti	1.67	C. clavisegmentus	2.44
C. cuspicornutus	1.63	C. bouceki	2.55	**Coded 2**		C. eumorphus	1.67	**Coded 2**	
C. oimus	1.68	C. kentae	2.60	C. giraulti	0.82	**Coded 1**		C. cornutus	2.50
C. elongatus	1.69	C. gwenae	2.62	C. minyamea	0.82	C. clavisegmentus	1.71	C. platycornutus	2.50
C. bouceki	1.69	C. proipetye	2.67	C. berryae	0.82	C. azhari	1.72	C. naumanni	2.51
C. varicornus	1.72	C. umasensis	2.69	C. pipayourula	0.82	C. ater	1.90	C. yousufi	2.51
C. azhari	1.77	C. fieldi	2.70	C. varicornus	0.83	C. cornutus	2.00	C. bouceki	2.56
C. gwenae	1.80	C. manii	2.71	C. mahmoodi	0.84	C. cuspicornutus	2.00	C. pipayourula	2.56
C. platycornutus	1.81	C. fasciatus	2.72	C. flavipes	0.86	C. yousufi	2.00	C. minyamea	2.60
C. flaviventris	1.81	C. laeviventris	2.74	C. umasensis	0.86	C. bouceki	2.00	C. proipetye	2.62
C. kabirae	1.91	C. kaikai	2.75	C. marrooyourula	0.86	C. moonga	2.00	C. masneri	2.75
C. proipetye	1.95	C. clubionus	2.79	C. leai	0.87	C. kentae	2.00	C. iota	2.75
Coded 1		C. yousufi	2.79	C. moongacutta	0.88	C. raniae	2.00	**Coded 3**	
C. turneri	2.00	C. elongatus	2.81	**Coded 3**		C. turneri	2.00	C. australicus	3.00
C. faunus	2.03	C. reiki	2.85	C. naumanni	0.89	**Coded 2**		C. setosus	3.00
C. reiki	2.20	C. mirabilis	2.90	C. gwenae	0.89	C. faunus	2.75	C. zebae	3.00
C. fasciatus	2.28	C. pachycerus	2.92	C. proipetye	0.92	Nixonia sp.	3.00	C. varicornus	3.00
Coded 2		**Coded 4**		C. australicus	0.95	**Coded 3**		**Coded 4**	
Sparasion sp.	5.50	C. kabirae	2.94	**Coded 4**		Sparasion sp.	3.50	C. grahami	3.25
Coded 3		C. minyamea	3.11	Sparasion sp.	0.99	C. varicornus	3.61	**Coded 5**	
Nixonia sp.	10.25	C. cuspicornutus	3.17	Nixonia sp.	1.00	**Coded 4**		C. moongacutta	3.75
		Coded 5		**Coded missing**		C. proipetye	4.50	**Coded missing**	
		C. ogmocerus	3.52	C. cornutus	-			Nixonia sp.	-
								Sparasion sp.	-

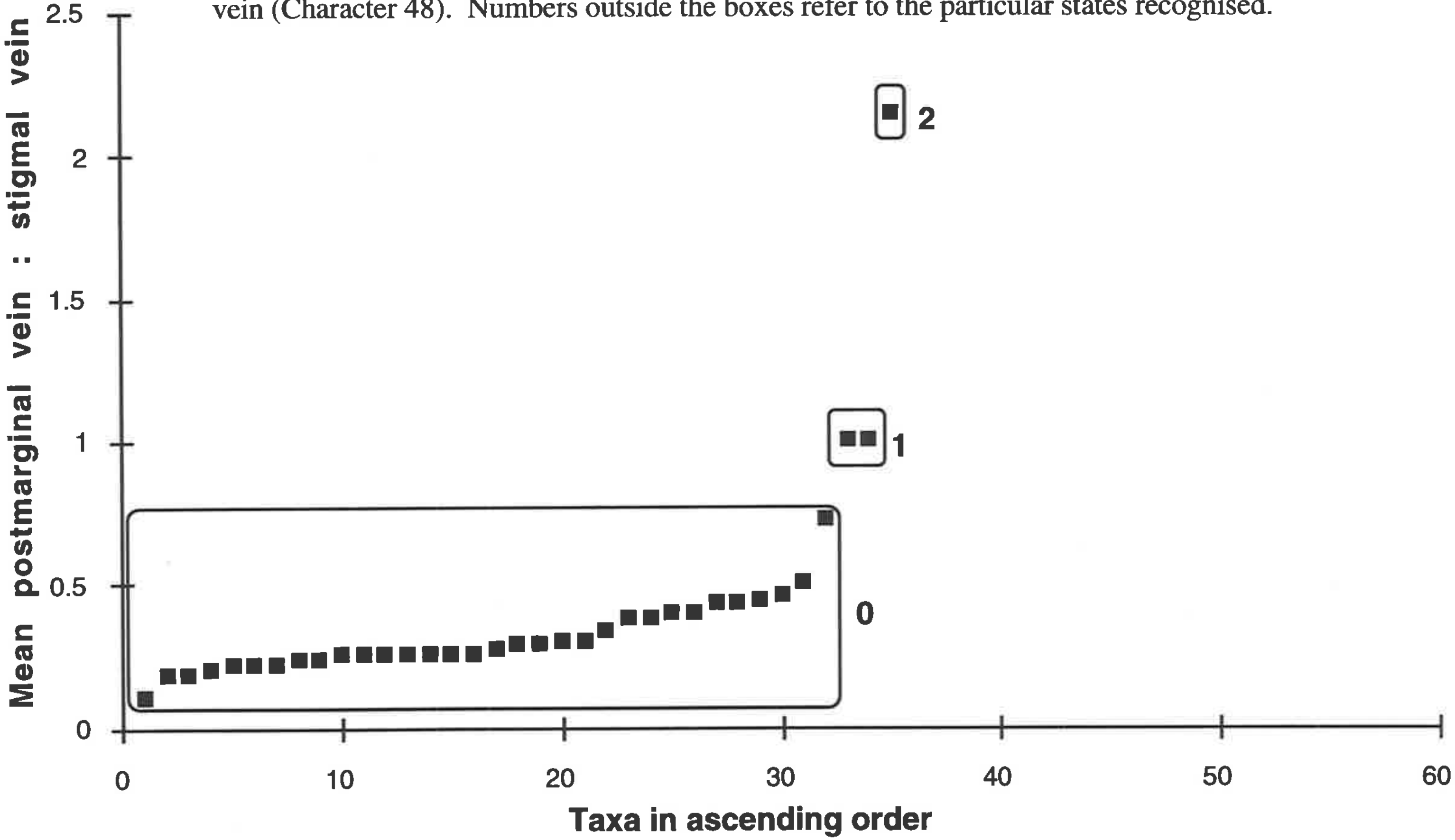
Appendix A1.2. Means of quantitative characters for the species level phylogenetic analysis of *Ceratobaeus* (Cont.).

46. Scutum L:W	**Mean**	**47. Forewing L:W**	**Mean**	**48. Pm:St vein**	**Mean**	**49. Metasoma L:W**	**Mean**	**50. T3 : T2**	**Mean**
Mean	**0.64**		**3.09**		**0.26**		**0.45**		**1.99**
SD	**0.12**		**0.28**		**0.36**		**0.71**		**0.57**
Coded 0		**Coded 0**		**Coded 0**		**Coded 0**		**Coded 0**	
C. leai	0.46	*Sparasion sp.*	2.00	*C. flaviventris*	0.11	*C. moongacutta*	1.32	*C. moongacutta*	0.76
C. gwenae	0.46	**Coded 1**		*C. gwenae*	0.13	*Idris sp.*	1.48	*C. umasensis*	0.80
C. pipayourula	0.47	*C. cornutus*	2.31	*C. proipetye*	0.13	*C. australicus*	1.64	*Nixonia sp.*	1.00
C. reiki	0.50	**Coded 2**		*C. reiki*	0.16	*C. masneri*	1.67	*Sparasion sp.*	1.00
C. naumanni	0.51	*C. clavisegmentus*	2.76	*C. kentae*	0.17	*C. berryae*	1.67	*C. moonga*	1.17
C. giraulti	0.54	*C. laeviventris*	2.78	*C. mahmoodi*	0.17	*C. clubionus*	1.68	*C. minyamea*	1.31
C. alveus	0.54	*C. litopterus*	2.79	*Nixonia sp.*	0.17	*C. alveus*	1.69	*C. platycornutus*	1.33
C. proipetye	0.54	*C. fieldi*	2.80	*C. mirabilis*	0.20	*C. raniae*	1.72	*C. berryae*	1.33
C. fieldi	0.54	*C. clubionus*	2.83	*C. turneri*	0.20	*C. flavipes*	1.73	**Coded 1**	
C. eumorphus	0.56	*C. minyamea*	2.84	*Idris sp.*	0.20	*C. yousufi*	1.73	*C. gwenae*	1.37
C. flaviventris	0.56	**Coded 3**		*C. ater*	0.21	*C. naumanni*	1.75	*C. iota*	1.45
C. australicus	0.57	*C. ater*	2.85	*C. marrooyourula*	0.22	*C. leai*	1.77	*C. kaikai*	1.46
C. berryae	0.57	*C. azhari*	2.89	*C. manii*	0.23	*C. minyamea*	1.77	*C. mirabilis*	1.53
C. marrooyourula	0.57	*C. australicus*	2.90	*C. giraulti*	0.24	*C. moonga*	1.79	*C. clubionus*	1.54
Coded 1		*C. reiki*	2.94	*C. moongacutta*	0.24	*C. setosus*	1.83	*C. proipetye*	1.55
C. clavisegmentus	0.58	*C. bouceki*	2.95	*C. pachycerus*	0.24	*C. azhari*	1.84	*C. zebae*	1.67
C. elongatus	0.58	*C. yousufi*	2.97	*C. varicornus*	0.24	*C. athysanus*	1.86	*C. turneri*	1.71
C. fasciatus	0.58	*C. moonga*	2.97	*C. cornutus*	0.25	*C. umasensis*	1.88	*C. australicus*	1.73
C. mirabilis	0.58	*C. elongatus*	3.00	*C. clavisegmentus*	0.26	*C. eumorphus*	1.88	*C. laeviventris*	1.76
C. pachycerus	0.58	*C. setosus*	3.00	*C. pipayourula*	0.26	*C. litopterus*	1.91	*C. manii*	1.79
C. minyamea	0.59	*Idris sp.*	3.00	*C. clubionus*	0.27	*C. giraulti*	1.95	*C. elongatus*	1.80
C. zebae	0.60	*Nixonia sp.*	3.00	*C. grahami*	0.29	*C. kaikai*	1.96	*C. faunus*	1.81
C. manii	0.60	*C. giraulti*	3.02	*C. cuspicornutus*	0.30	*C. iota*	1.98	*C. setosus*	1.83
C. litopterus	0.61	*C. raniae*	3.04	*C. yousufi*	0.30	*C. cardaleae*	2.00	*C. reiki*	1.89
C. oimus	0.62	*C. proipetye*	3.05	*C. iota*	0.34	**Coded 1**		*C. fieldi*	1.89
C. raniae	0.62	*C. eumorphus*	3.05	*C. platycornutus*	0.35	*C. intrudae*	2.09	*C. grahami*	1.90
C. varicornus	0.62	*C. faunus*	3.07	*C. setosus*	0.38	*C. kabirae*	2.09	**Coded 2**	
C. umasensis	0.63	*C. ogmocerus*	3.07	*C. kabirae*	0.39	*C. pipayourula*	2.14	*C. fasciatus*	1.92
C. ogmocerus	0.63	*C. umasensis*	3.09	*C. fieldi*	0.39	*C. marrooyourula*	2.14	*C. masneri*	1.92
C. cuspicornutus	0.64	*C. moongacutta*	3.10	*C. elongatus*	0.40	*C. grahami*	2.20	*C. ater*	1.94
C. platycornutus	0.65	*C. schmidti*	3.10	*C. cardaleae*	0.40	*C. laeviventris*	2.20	*C. varicornus*	1.96
C. yousufi	0.65	*C. manii*	3.12	*C. eumorphus*	0.42	*C. manii*	2.20	*C. cornutus*	2.00
C. kaikai	0.65	**Coded 4**		*C. schmidti*	0.44	*C. ater*	2.24	*C. cuspicornutus*	2.00
C. mahmoodi	0.65	*C. alveus*	3.13	*C. extraordinarius*	0.46	*C. faunus*	2.27	*C. alveus*	2.00
Idris sp.	0.65	*C. oimus*	3.13	**Coded 1**		*C. ogmocerus*	2.27	*C. azhari*	2.10
C. iota	0.66	*C. marrooyourula*	3.13	*C. oimus*	0.48	*C. varicornus*	2.28	*C. raniae*	2.10
C. athysanus	0.66	*C. kentae*	3.14	*C. athysanus*	0.49	*C. clavisegmentus*	2.29	*C. clavisegmentus*	2.18
C. extraordinarius	0.67	*C. varicornus*	3.14	*C. bouceki*	0.50	*C. mahmoodi*	2.29	*C. ogmocerus*	2.18
C. schmidti	0.67	*C. zebae*	3.16	*C. zebae*	0.50	*C. mirabilis*	2.32	*C. giraulti*	2.19
C. grahami	0.67	*C. extraordinarius*	3.18	*C. laeviventris*	0.55	*C. proipetye*	2.32	*C. flaviventris*	2.19
C. laeviventris	0.67	*C. mirabilis*	3.19	*C. moonga*	0.57	*C. fieldi*	2.33	*C. cardaleae*	2.20
Nixonia sp.	0.67	*C. iota*	3.19	*C. azhari*	0.59	*C. platycornutus*	2.40	*C. pachycerus*	2.21
C. flavipes	0.68	*C. pipayourula*	3.24	*C. alveus*	0.64	*C. kentae*	2.41	*C. yousufi*	2.23
C. masneri	0.68	*C. kaikai*	3.25	*C. ogmocerus*	0.64	*C. extraordinarius*	2.42	*C. marrooyourula*	2.23
C. moongacutta	0.68	*C. berryae*	3.26	*C. kaikai*	0.67	*C. bouceki*	2.43	*C. kabirae*	2.28
C. kabirae	0.69	*C. masneri*	3.27	*C. minyamea*	0.75	*C. oimus*	2.53	*C. intrudae*	2.29
C. cornutus	0.70	*C. kabirae*	3.27	**Coded 2**		*C. zebae*	2.61	*C. mahmoodi*	2.30
C. bouceki	0.70	*C. turneri*	3.28	*C. faunus*	0.84	*C. turneri*	2.65	*C. naumanni*	2.38
Coded 2		*C. pachycerus*	3.29	*C. fasciatus*	0.87	*C. fasciatus*	2.70	*C. bouceki*	2.46
C. faunus	0.71	*C. platycornutus*	3.31	*C. masneri*	0.89	*C. flaviventris*	2.71	*C. schmidti*	2.47
C. kentae	0.71	*C. intrudae*	3.34	*C. raniae*	0.90	*C. pachycerus*	2.72	**Coded 3**	
C. cardaleae	0.71	*C. mahmoodi*	3.37	*C. intrudae*	0.95	**Coded 2**		*C. kentae*	2.60
C. clubionus	0.73	*C. cuspicornutus*	3.38	*C. berryae*	1.00	*C. cornutus*	2.75	*C. extraordinarius*	2.61
C. azhari	0.73	*C. gwenae*	3.38	*C. umasensis*	1.17	*C. schmidti*	2.80	*C. pipayourula*	2.61
C. turneri	0.74	*C. athysanus*	3.40	**Coded 3**		*Sparasion sp.*	2.92	*C. eumorphus*	2.67
C. intrudae	0.76	**Coded 5**		*C. australicus*	1.21	*C. cuspicornutus*	3.24	*Idris sp.*	2.71
C. moonga	0.78	*C. cardaleae*	3.47	**Coded 4**		**Coded 3**		*C. oimus*	2.86
C. setosus	0.79	*C. grahami*	3.50	*Sparasion sp.*	2.14	*C. gwenae*	3.56	*C. litopterus*	2.86
C. ater	0.82	*C. flaviventris*	3.57	**Coded missing**		*C. elongatus*	4.09	*C. athysanus*	2.97
Coded 3		**Coded 6**		*C. flavipes*	-	**Coded 4**		**Coded 4**	
Sparasion sp.	1.33	*C. fasciatus*	3.70	*C. leai*	-	*C. reiki*	6.00	*C. flavipes*	3.25
		Coded missing		*C. naumanni*	-	**Coded missing**		*C. leai*	3.35
		C. flavipes	-	*C. litopterus*	-	*Nixonia sp.*	-		
		C. leai	-						
		C. naumanni	-						

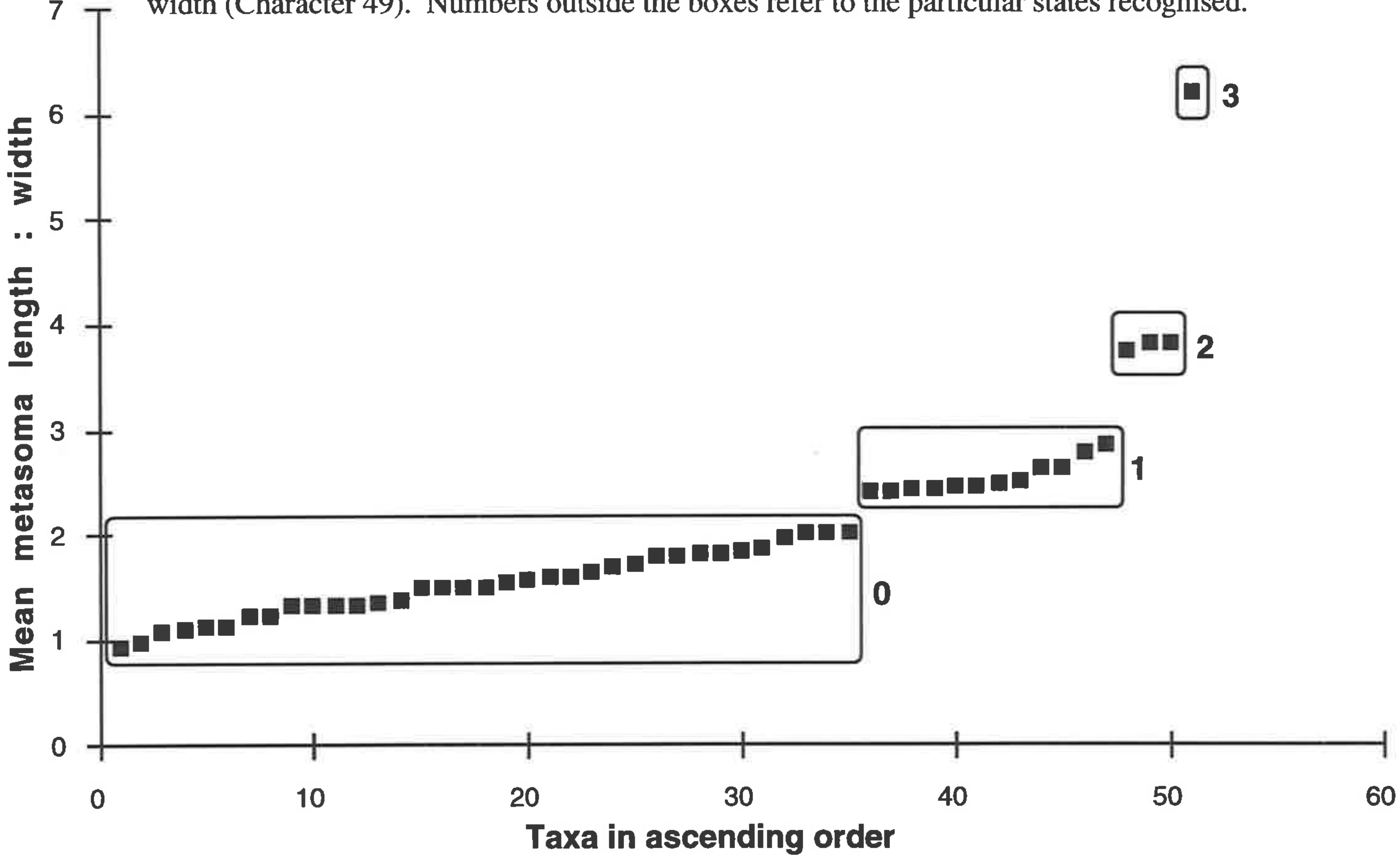
Appendix 2.1.1. Graphical representation of the mean values for the first funicle segment length : width (Character 44). Numbers outside the boxes refer to the particular states recognised.



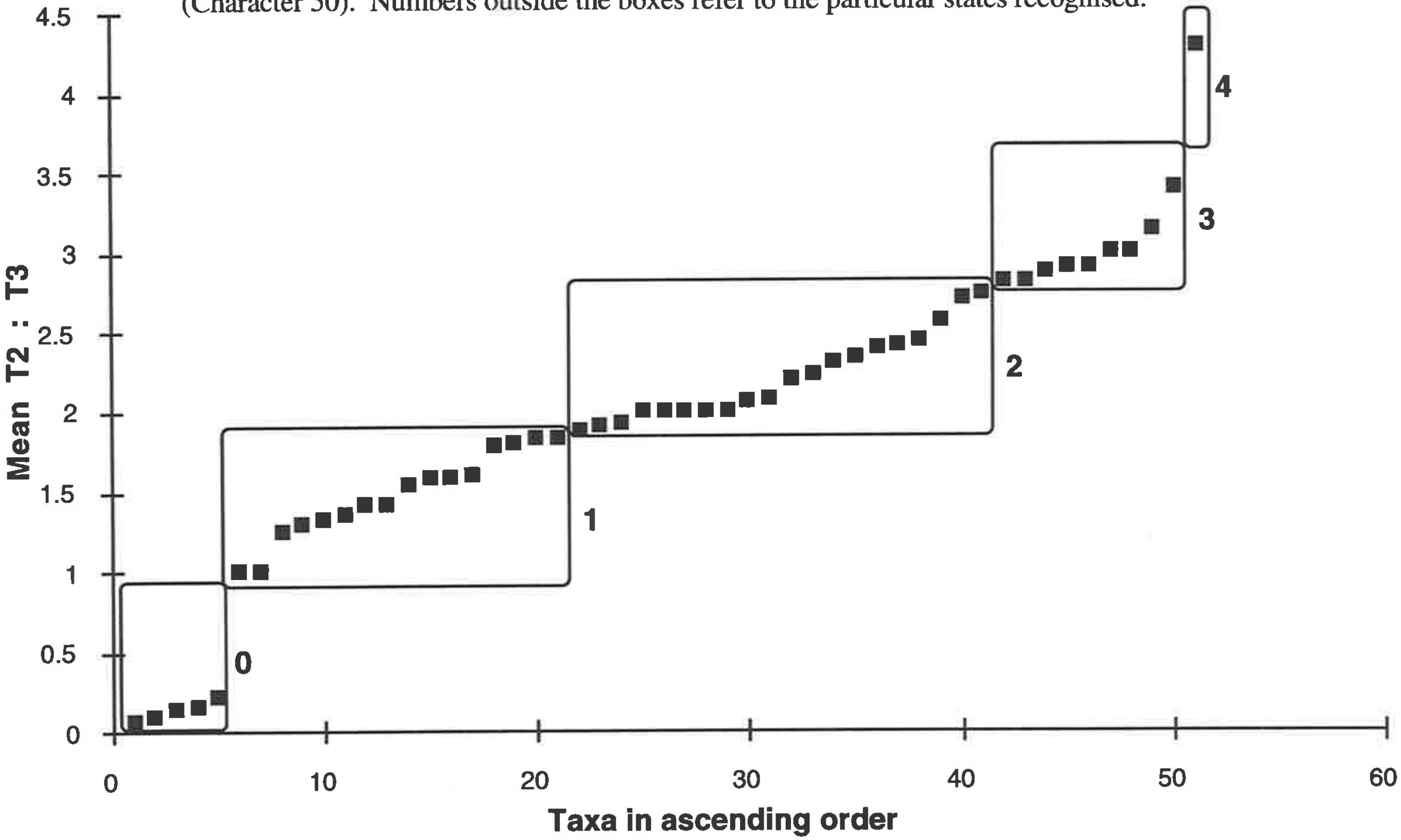
Appendix 2.1.2. Graphical representation of the mean values for the postmarginal vein : stigmal vein (Character 48). Numbers outside the boxes refer to the particular states recognised.



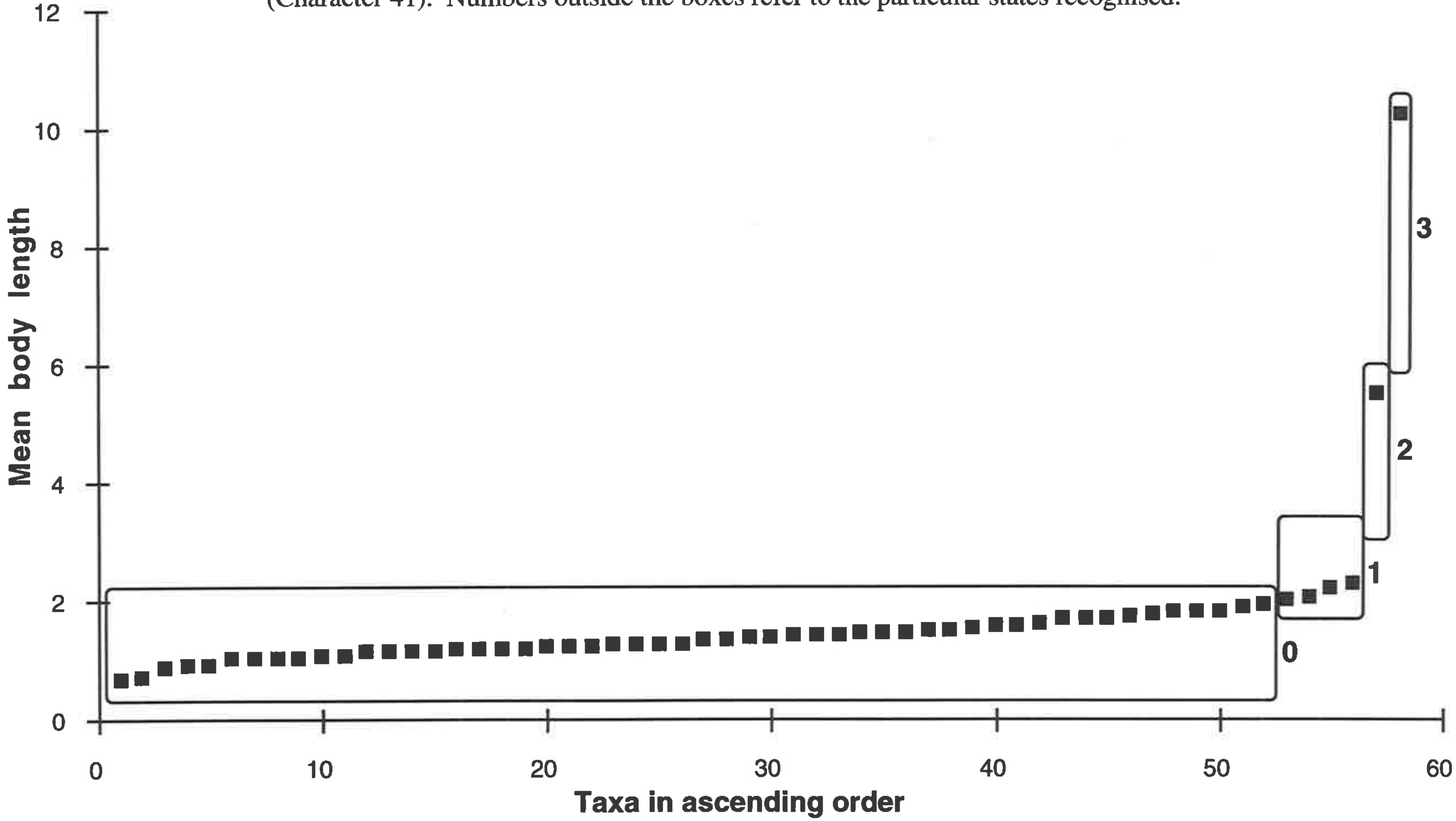
Appendix A2.1.3. Graphical representation of the mean value for the metasoma length : width (Character 49). Numbers outside the boxes refer to the particular states recognised.



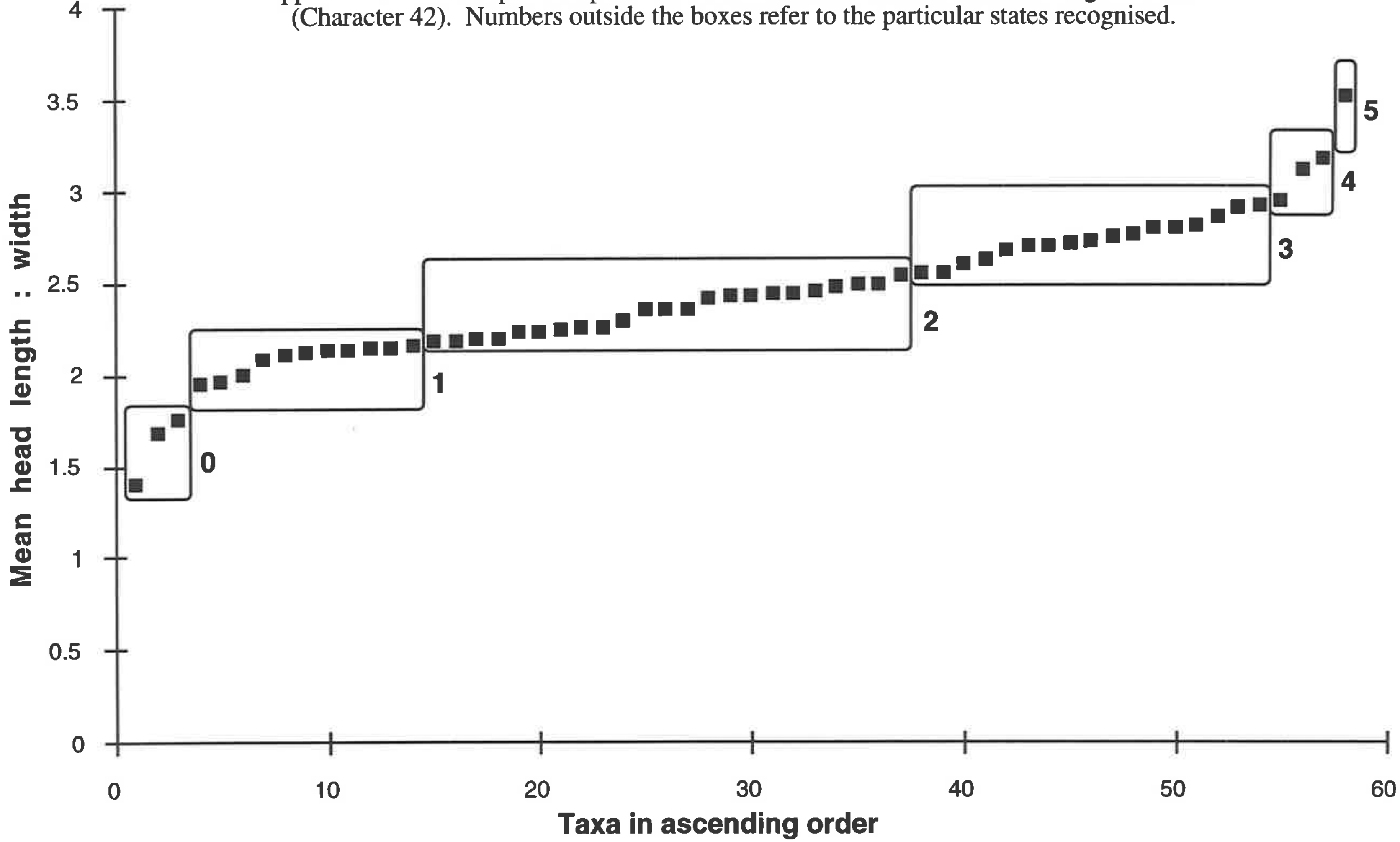
Appendix A2.1.4. Graphical representation of the mean values for the ratios of T3 : T2 (Character 50). Numbers outside the boxes refer to the particular states recognised.



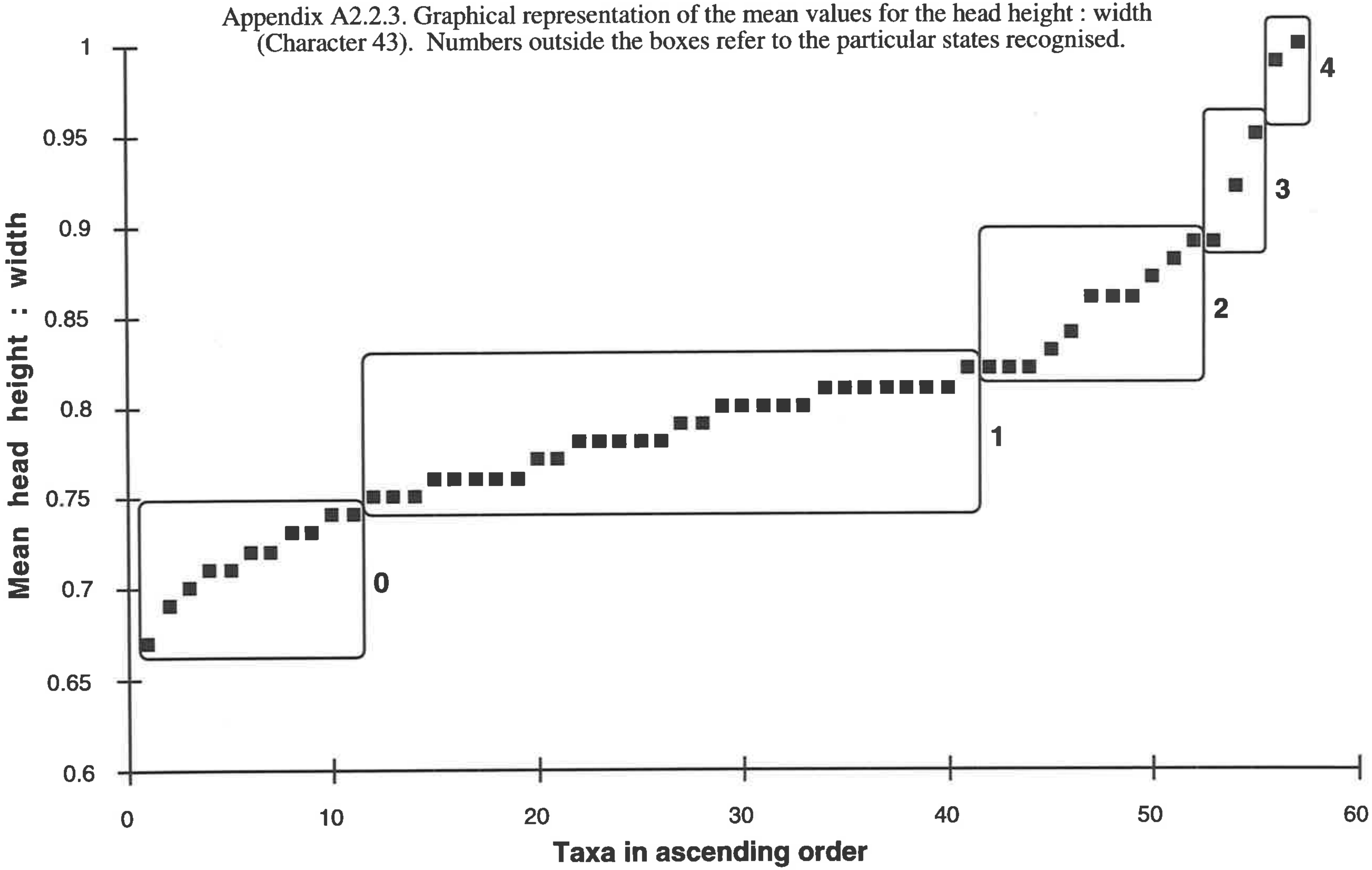
Appendix. A2.2.1. Graphical representation of the mean values for the body length (Character 41). Numbers outside the boxes refer to the particular states recognised.



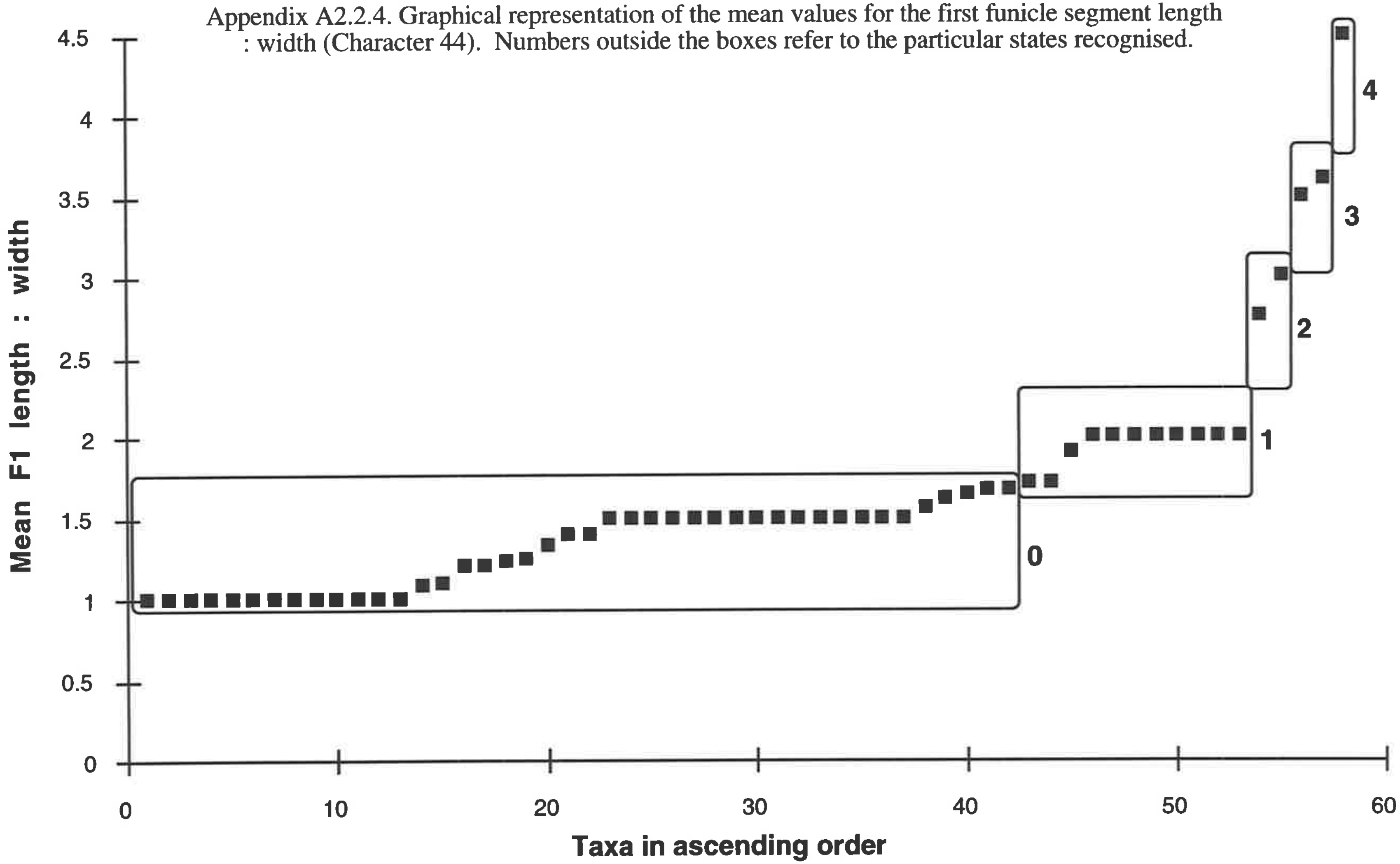
Appendix A2.2.2. Graphical representation of the mean value for the head length : width (Character 42). Numbers outside the boxes refer to the particular states recognised.



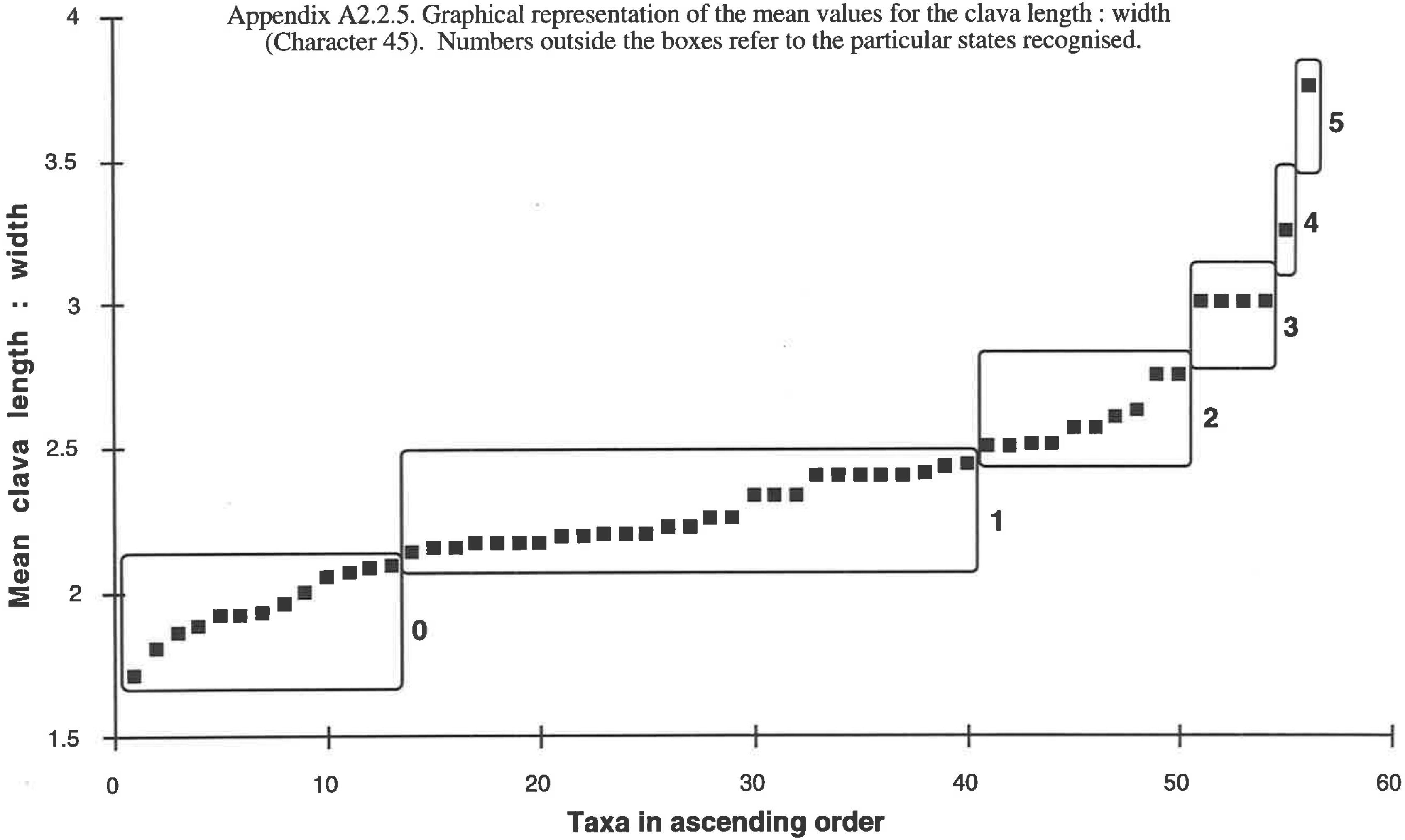
Appendix A2.2.3. Graphical representation of the mean values for the head height : width (Character 43). Numbers outside the boxes refer to the particular states recognised.



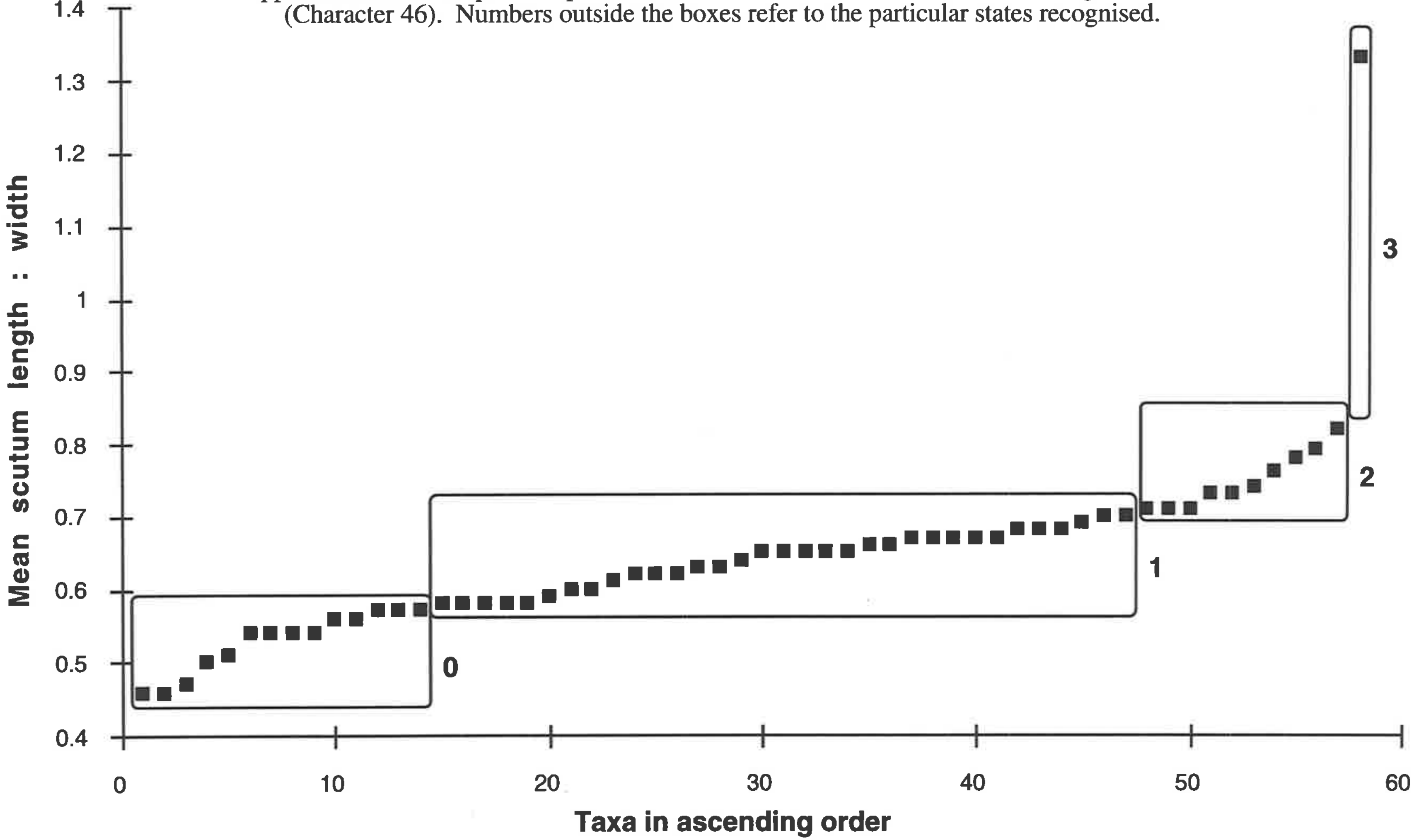
Appendix A2.2.4. Graphical representation of the mean values for the first funicle segment length : width (Character 44). Numbers outside the boxes refer to the particular states recognised.



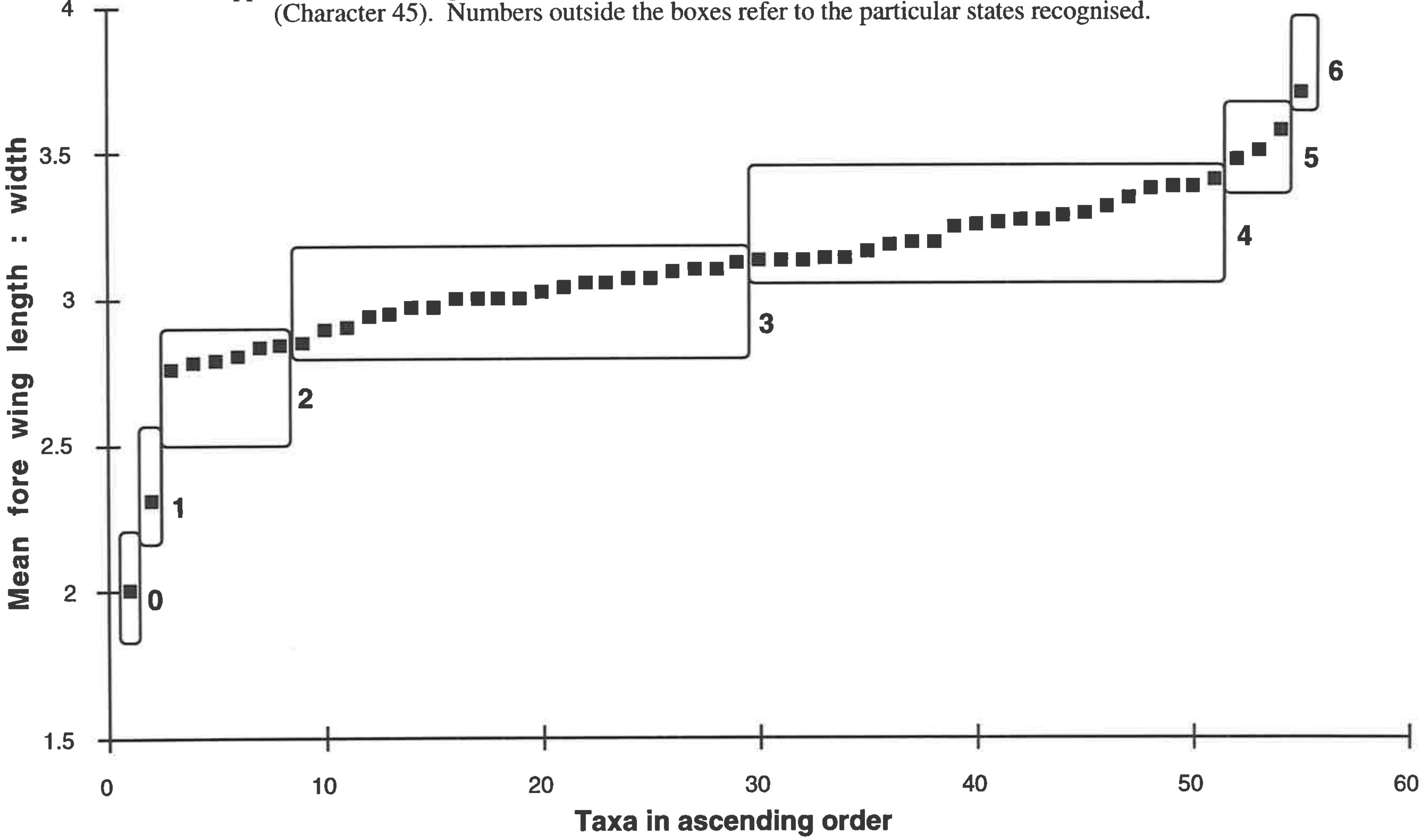
Appendix A2.2.5. Graphical representation of the mean values for the clava length : width (Character 45). Numbers outside the boxes refer to the particular states recognised.



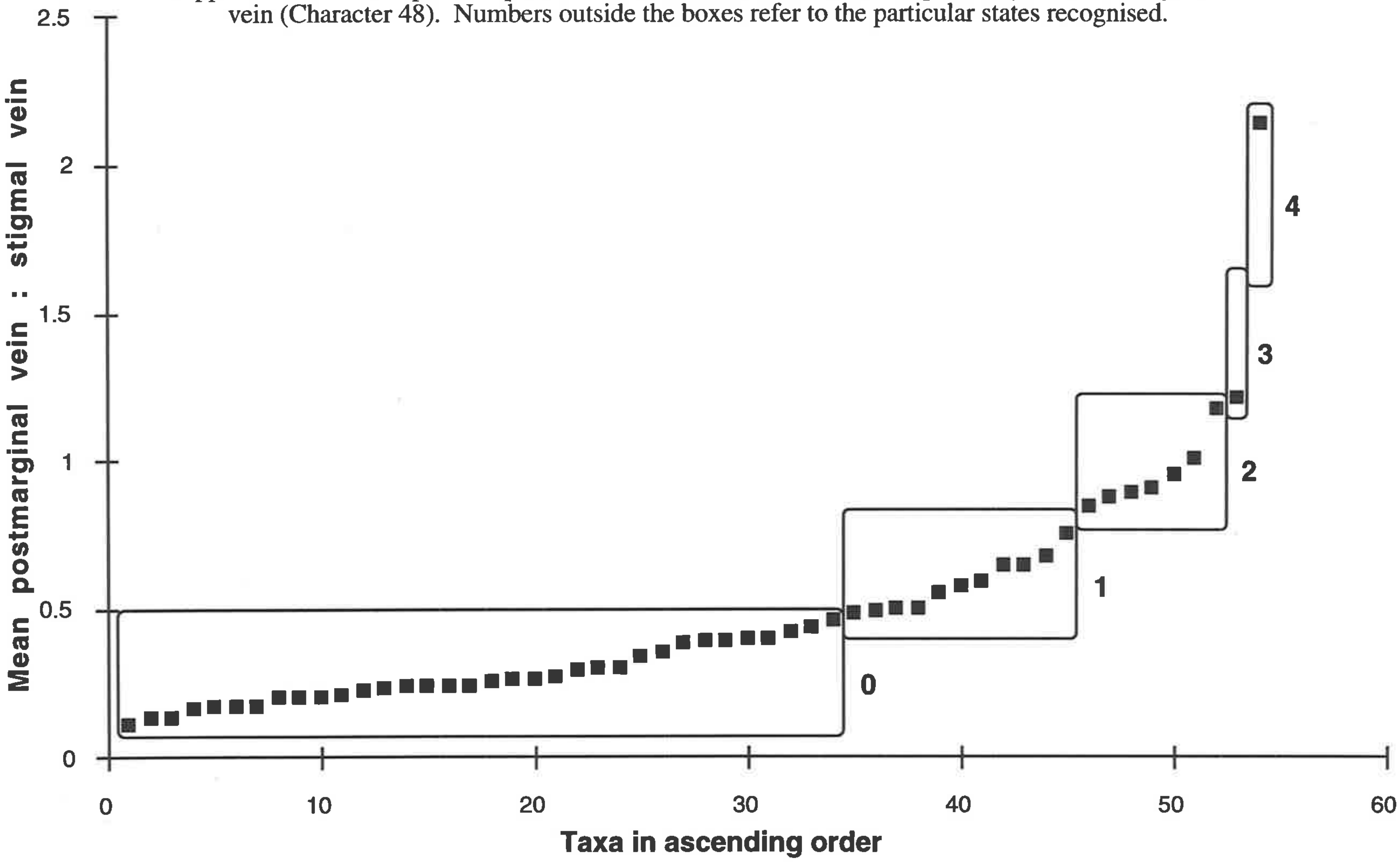
Appendix A2.2.6. Graphical representation of the mean value for the scutum length : width (Character 46). Numbers outside the boxes refer to the particular states recognised.



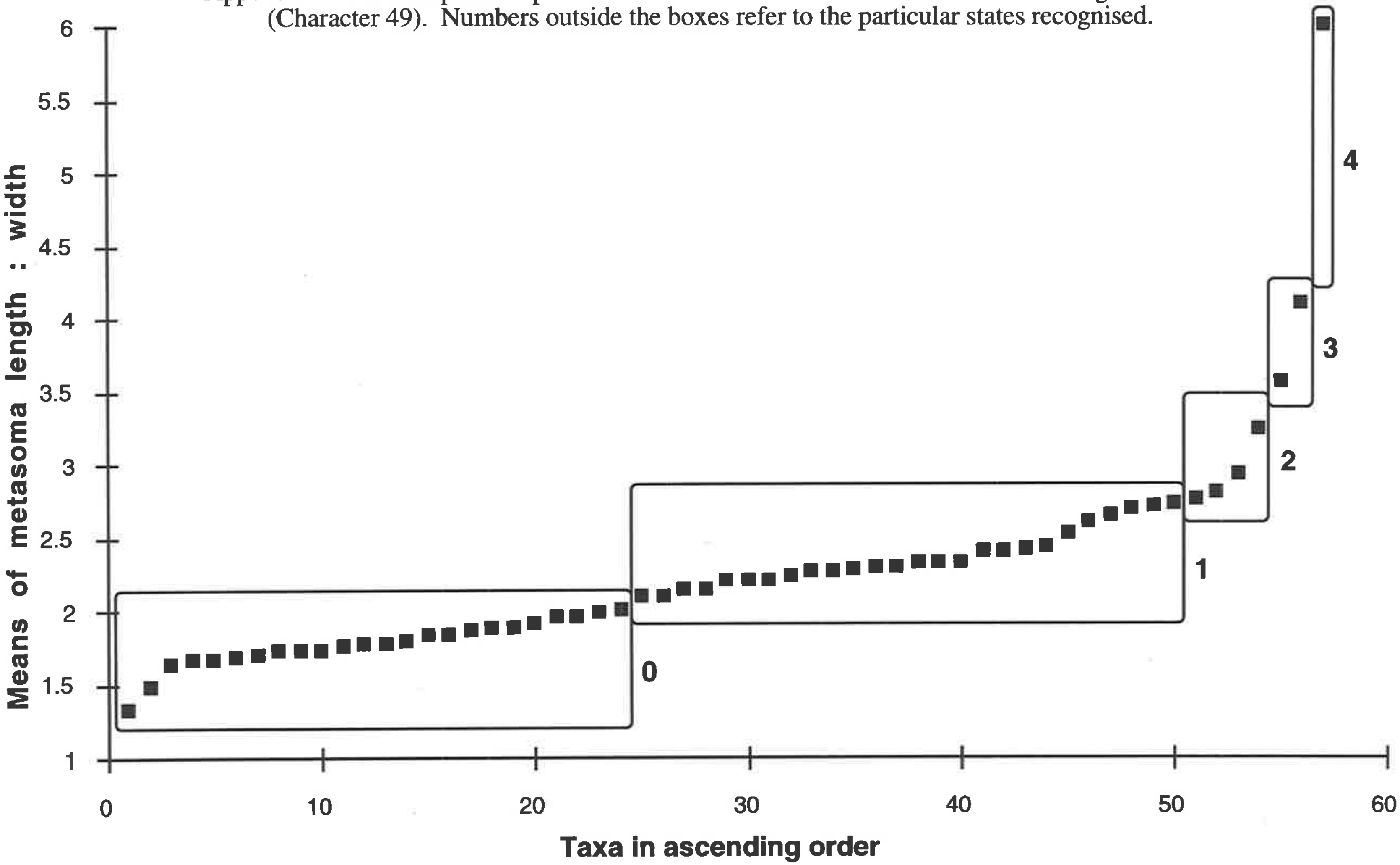
Appendix A2.2.7. Graphical representation of the mean values for the fore wing length : width (Character 45). Numbers outside the boxes refer to the particular states recognised.



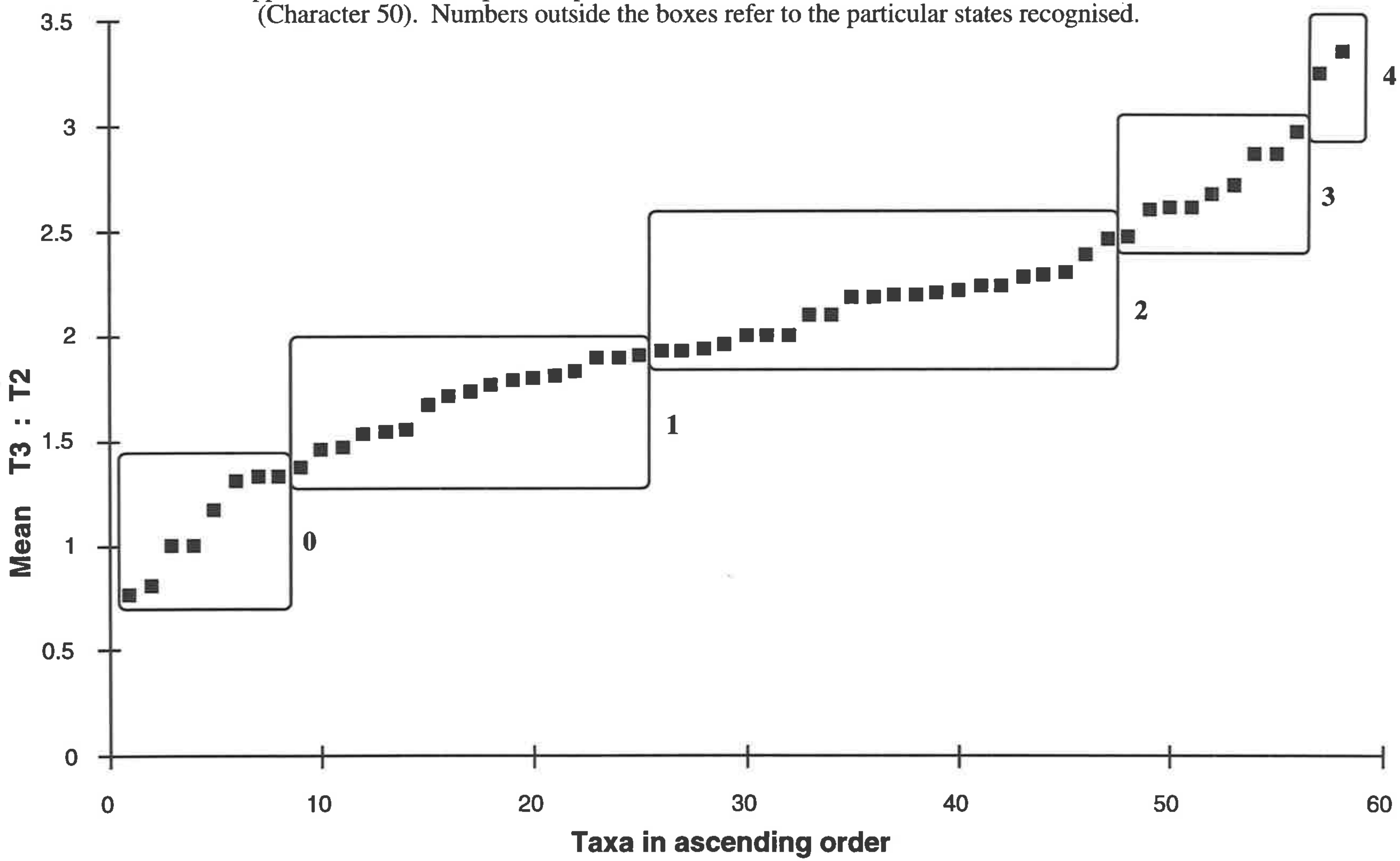
Appendix A2.2.8. Graphical representation of the mean values for the postmarginal vein : stigmal vein (Character 48). Numbers outside the boxes refer to the particular states recognised.



Appendix A2.2.9. Graphical representation of the mean values for the metasoma length : width (Character 49). Numbers outside the boxes refer to the particular states recognised.



Appendix A2.2.10. Graphical representation of the mean values fot the ratios of T3 : T2 (Character 50). Numbers outside the boxes refer to the particular states recognised.



Appendix A3.1. Data matrix for the analysis to resolve relationships among genera of Baeini.

	11	1111112222	2223333333	44445
	1234678902	3456890135	6790134567	04890
Sparasion sp.	000101-101	0100000100	0----00100	11221
Nixonia sp.	000101-101	0100000100	0----00000	11021
Ceratobaeus cornutus	01?1101?0?	?0000?0?00	1000010?00	10012
Ceratobaeus moongacutta	0101000100	0000000100	1000000000	10003
Ceratobaeus naumanni	0110000100	0101-1--10	1000010000	10-02
Ceratobaeus leai	0111101000	0101-1--10	1000010000	10-03
Ceratobaeus litopterus	0111101000	1100100100	1000010100	10-03
Ceratobaeus giraulti	0001101100	1100001100	1000010000	10002
Ceratobaeus elongatus	0101101001	0100010010	1001011000	10021
Ceratobaeus mirabilis	0000101100	1100010010	1000011000	10011
Ceratobaeus rieki	0000101000	0100010010	1000010000	10032
Ceratobaeus cuspicornutus	0001101000	0100010010	1000010000	10011
Ceratobaeus varicornis	0110101100	1100010100	1000010000	12011
Ceratobaeus fasciatus	0110101100	1100010110	1000010000	10011
Ceratobaeus kabirae	0101101100	0100010100	1000010000	10012
Ceratobaeus ater	0010101000	0100010000	1000010000	10012
Ceratobaeus laeviventris	0110101100	1100010100	1000010000	10001
Ceratobaeus pipayourula	0101101100	1100000010	1000010000	10012
Ceratobaeus eumorphus	0101101100	1100000110	1000010000	10003
Ceratobaeus marrooyourula	0110101100	1100000100	1000010100	10002
Ceratobaeus setosus	0110101001	0100010000	1000000000	10001
Ceratobaeus intrudae	0100101000	0100010100	1000000100	10112
Ceratobaeus yousufi	0111101100	1000010100	1000000100	10002
Ceratobaeus oimus	0101101000	0100010100	1000000100	10013
Ceratobaeus kentae	0101101000	0100010010	1000000000	10011
Ceratobaeus azhari	0110101000	1100010100	1100000100	10002
Ceratobaeus fieldi	0000101100	1100010100	1100000000	10002
Ceratobaeus clubionus	0100101000	1100011000	1100000000	10001
Ceratobaeus grahami	0100101000	0100010110	1100000000	10012
Idris flavicornis	0100101001	0001010100	0----00000	10003
Idris helpidid	0101101000	0100010100	0----00000	10002
Idris niger	0101101100	0100000100	0----00000	10003
Idris pulchar	0101101101	0100000100	0----00100	10004
Idris seminitidus	0001101001	0000010100	0----00000	10002
Idris theridii	0001101001	0100010100	0----00000	10002
Idris sp. 1	0100101001	0101----00	0----00000	10-03
Idris sp. 2	0101000101	0100101000	0----00000	10002
Hickmanella holoplatysa	0201000000	0000110100	0----00100	10-02
Hickmanella intrudens	0201000000	0000100100	0----00000	10-02
Odontacolus longiceps	0001101100	0100010100	1000100100	10101
Odontacolus sp. 1	0111101100	0100101100	1000100100	10001
Mirobaeoides barbarae	2101000101	011-----10	1010000010	10-01
Mirobaeoides pecki	2000000001	011-----11	0----00010	10-00
Mirobaeoides scutellaris	2101000101	011-----10	0----00011	10-00
Mirobaeoides tasmanicus	2011000101	011-----10	0----00011	10-00
Mirobaeus bicolor	1001000001	011-----10	0----00000	10-01
Baeus leai	2001101101	011-----11	0----00001	00-00
Baeus seminulum	2101101111	011-----11	0----00001	00-00
Genus sp. 1	1001000101	011-----10	1010010000	10-03
Genus sp. 2	1100000001	0101----10	1010010010	10-02
Genus sp. 3	1001101101	0101----00	0----00010	10-01

Appendix A3.2. Data matrix for the analysis to resolve relationships among species of *Ceratobaeus*.

	1	1111111112	2222222223	3333333344	44444445
	1234567890	1234567890	1234567890	2345678912	34567890
Sparasion sp.	0001-01-10	1101000000	110000----	-001000020	42-30420
Nixonia sp.	0001-01-10	1101000000	110000----	-000001030	41-130-0
Idris sp.	0001-00010	0001000001	110000----	-000000001	00113003
Ceratobaeus cornutus	01-1-101-0	0--00000-0	--01010100	010-00-002	?0211022
Ceratobaeus clavisegmentus	0011-00010	0010000010	0101010100	1100001101	10112012
Ceratobaeus moongacutta	0101-00010	0000000000	1000010100	0000000000	20513000
Ceratobaeus naumanni	0110100010	000101--1-	-101010100	0100001001	3020--02
Ceratobaeus leai	0111-10100	000101--1-	-111010100	0100001002	2000--04
Ceratobaeus flavipes	0101-10110	010101--1-	-000010010	0000001001	2001--04
Ceratobaeus litopterus	0111-10100	0011000100	-000010000	0101001002	00112-03
Ceratobaeus giraulti	0001-10110	0011000001	1000010000	0100001001	20103002
Ceratobaeus athysanus	0011-10110	0011000011	1000010000	1101001002	10014103
Ceratobaeus mirabilis	0000110110	0011000010	0111010100	0110000003	00114011
Ceratobaeus elongatus	0101-10100	0101000010	0111010101	0110001103	10013031
Ceratobaeus extraordinarius	0001-10110	0011000010	1101010100	0110001002	00114013
Ceratobaeus rieki	0000110110	0001000010	0110010100	0100001013	00103041
Ceratobaeus cuspicornutus	0001-10110	0001000010	0110010100	0100001004	10114022
Ceratobaeus platycornutus	0101-10110	0011000010	1111010101	0100001002	10214010
Ceratobaeus gwenae	0000110110	0011000010	1111010101	0110001003	30004031
Ceratobaeus varicornis	0110110110	0011000010	1100010100	1100001002	22314012
Ceratobaeus proipetye	0110110110	0011000010	1100010100	1100001003	33203011
Ceratobaeus fasciatus	0110110110	0011001010	1111010100	0100001013	10116212
Ceratobaeus faunus	0101-10110	0011001010	1101010100	0100001012	01123211
Ceratobaeus ogmocerus	0001-10100	0001001010	1101010100	0110001005	00013112
Ceratobaeus kabirae	0001-10110	0001001010	1101010100	0100001004	00114012
Ceratobaeus ater	0000110100	0001000010	0001010000	0100000002	10023012
Ceratobaeus schmidti	0101-10100	0001000010	1000010100	1100001102	10013022
Ceratobaeus minyamea	0210010101	1010000010	1100010100	0101001004	30212100
Ceratobaeus laeviventris	0110110110	0011000010	1101010100	0100001003	10112111
Ceratobaeus raniae	0001-10110	0011000010	1101010000	1100001001	10113202
Ceratobaeus pipayourula	0101-10110	0011000000	0110010100	1100001002	20204013
Ceratobaeus manii	0110110110	0001000010	0100010100	0100001003	00113011
Ceratobaeus turneri	0001-10110	0011000000	1101010100	0100001012	10124011
Ceratobaeus eumorphus	0101-10110	0011000000	1010010000	0100001002	10003003
Ceratobaeus pachycerus	0001-10110	0011000010	1000010000	0100001003	00114012
Ceratobaeus mahmoodi	0001-10110	0011000000	1110010100	0100001002	20114012
Ceratobaeus flaviventris	0011-10110	0011000000	1100010100	1100001002	00105012
Ceratobaeus marrooyourula	0110110110	0011000000	1000010000	1101001002	20004012
Ceratobaeus setosus	0110110100	0101000010	0000010000	0000001002	10323001
Ceratobaeus masneri	0100010100	0011000010	0100010000	0000001001	10214202
Ceratobaeus intrudae	0100110100	0001000010	1100010000	0001001002	10124212
Ceratobaeus umasensis	0210110100	0001000010	1100010000	0001000003	20013200
Ceratobaeus australicus	0210010101	1000000010	1100010000	0001000002	30303301
Ceratobaeus alveus	0210110101	1000000010	1000010000	0001001002	10104102
Ceratobaeus yousufi	0111-10110	0011000010	1000010000	0001001003	10213002
Ceratobaeus moonga	0110110110	0000000010	1000010000	0000001002	10123100
Ceratobaeus bouceki	0011-10110	0011001010	1000010000	0001000003	10213112
Ceratobaeus oimus	0101-10100	0-01001010	1000010000	1001000002	10114113
Ceratobaeus iota	0101-10110	0-00000010	1011010100	0100001101	10214001
Ceratobaeus zebae	0100110100	0-01001010	1010010000	0000001101	10314111
Ceratobaeus kentae	0100110100	0001000010	0000010000	0000000103	10124013
Ceratobaeus azhari	0110010110	0011001010	1000011000	0001001001	10123102
Ceratobaeus fieldi	0000110110	0011000010	1000011000	0000001003	10002011
Ceratobaeus clubionus	0100110110	0011000010	0000011010	0000001003	10122001
Ceratobaeus berryae	0210010101	1010000010	1100011010	0001000003	20004200
Ceratobaeus cardaleae	0000110110	0010000010	1000011010	0000001101	00125002
Ceratobaeus grahami	0100010100	0-01001010	1010011010	0000000102	10415011
Ceratobaeus kaikai	0001-10110	0011000010	1000011010	0000001003	10114101

ADDENDUM

p.15.	"monophagous" should read "oligophagous".
Table 2.3	should read "31 species are described" as in Table 6. 2, not 32.
p. 26.	Where only one specimen was available, it measures were used in place of a mean value.
p. 46.	under "Pilosity of Eyes" should read "best viewed under SEM".
p. 49.	Remove second reference to Figure 6.179 for Character 29.
Table 3.3	Ratio for *C. moongacutta* should read "1.52".
p. 66.	"188" should read "118".
p. 119.	Length should read "2.0".
p. 131.	"scutum pushed forwards" should read "scutum strongly indented posteriorly".
p. 138.	Couplet 6 should read "best viewed under SEM".
p. 187.	Length should read "1.1".
p. 195.	Length should read "1.35".
Fig. 6.10	Legend should read "laterotergites wide"
p. 240	Ratio for *C. rainae* should read "1.89".
Appendix A.1.2	Legend should read "Means for ratios of quantitative characters ...".
Appendices	"*C. reiki*" should read "*C. rieki*".
	Throughout the thesis "A. Cader" should read "A. Calder".

Iqbal, M. & Austin, A. D. (1997). Species richness and endemism of baeine wasps (Hymenoptera: Scelionidae) in Australia. Memoirs of Museum Victoria, 56(2), 455-459.

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