

Systematics and phylogenetics of glassy-winged Orthotylini (Heteroptera: Miridae) of the west Pacific with a new method for analysing the impact of outgroups in phylogenetic analyses.

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Systematics and phylogenetics of glassy-winged Orthotylini (Heteroptera: Miridae) of the west Pacific with a new method for analysing the impact of outgroups in phylogenetic analyses

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Abstract

The systematics and phylogenetics of glassy-winged orthotylines is examined. Eight new genera and 46 new species are described including 11 new species of *Cyrtorhinus (C. albidus* sp. nov., *C. brunus* sp. nov., *C. defectus sp. nov., C. indi* sp. nov., *C. novabritannia* sp. nov., *C. palauensis* sp. nov., *C. pilosus* sp. nov., *C. quatei* sp. nov., *C. rarus* sp. nov., *C. solomonensis* sp. nov. *and C. yunganensis* sp. nov.*),* seven new species in the *Morobea* group (*Dimifacoris bifurcatus* sp. nov., *Dimifacoris leva* sp. nov., *Dimifacoris trifurcatus* sp. nov., *Dimifacoris splendidus* sp. nov., *Flagellomiris sinuatum* sp. nov., *Flagellomiris tasmaniensis* sp. nov. and *Wumea pilosa* sp. nov.) and 28 new species in the *Candidomiris* group (*Bucculagrandis morobiensis* sp. nov., *Candidomiris clavatasclerita* sp. nov., *Candidomiris cyrtandraphila* sp. nov., *Candidomiris macropiper* sp. nov., *Candidomiris missimensis* sp. nov., *Candidomiris parasponius* sp. nov., *Candidomiris sinuata* sp. nov., *Elongatoductus walli* sp. nov., *Falcum austerum* sp. nov., *Falcum bulldogensis* sp. nov., *Falcum gagnei* sp. nov., *Falcum kaindiensis* sp. nov., *Falcum taiwanensis* sp. nov., *Felisacodes uganda* sp. nov., *Jimia spectabilis* sp. nov., *Nerubia dentomembrana* sp. nov., *Nerubia viridis* sp. nov., *Novacalecoris bisclerita* sp. nov., *Novacalecoris gressiti* sp. nov., *Novacalecoris kraussi* sp. nov., *Novacalecoris macca* sp. nov., *Novacalecoris monteithi* sp. nov., *Novacalecoris rubrafasciae* sp. nov., *Novacalecoris tatarnici* sp. nov., *Novacalecoris turpa* sp. nov., *Prosoponomiris mimetica* sp. nov., *Spinamifera raveni* sp. nov., *Tudoris solomonensis* sp. nov. *Josemiris* is synonymised with *Cyrtorhinus*. Twenty-two species from nine genera are redescribed. Phylogenetic relationships within *Cyrtorhinus* are resolved and two major clades are established. Biogeographic analysis of *Cyrtorhinus* supported the hypothesis that Africa is basal to the rest of the Indo-Pacific and an Asian group as sister to the Pacific. *Orthotylus bilineatus* and *Mecomma* were found to be the closest relatives of *Cyrtorhinus.* Two groups were nested within the *Candidomiris-Morobea* group which is tentatively placed as the sister-group to *Cyrtorhinus, Orthotylus bilineatus* and *Mecomma.* A new TNT script is introduced which tests the robustness of nodes to changing outgroups. The method was successfully applied to *Cyrtorhinus* and *Candidomiris-Morobea* phylogenies and three other previously published phylogenies.

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CHAPTER 1

GENERAL INTRODUCTION

The Miridae (Insecta: Heteroptera) are a hyperdiverse family of heteropteran insects comprising over 11,000 recognised species, with many more yet to be described (Schuh 1995, Cassis et al. 2007, Cassis and Schuh 2012). The family was first erected by Hahn (1833) under the name Mirides. Fieber (1861) was the first to use the pretarsus in the classification of the Miridae, and it is the basis of the higher classification of the family (Schuh 1976). Reuter (1875-1910; see Schuh 1995 for full citations) established much of the suprageneric and generic taxa within the family. Over the past 65+ years the classification of mirids has focused not only on the pretarsus, (Schuh 1976), but also the male genitalia (e.g., Kelton 1959, Kerzhner and Konstantinov 1999, Cassis 2008, Cassis and Schuh 2012) and female genitalia (Slater 1950, Davis 1955, Schwartz 2011). At the species level, much of the classification is based on the shape of the grossly asymmetrical parameres and complexities of the male aedeagus.

There have been recent attempts to incorporate molecular data into the classification of the Miridae (e.g., Jung et al. 2011, Schuh and Menard 2011, Jung and Lee 2012, Menard et al. 2014, Schuh et al. 2014), which investigate mitochondrial (COI–COII, 16S) and nuclear (18S, 28S) genes. The advent of molecular data has not had great impact on mirid classification, aside from the recent reclassification of the subfamily Phylinae (Menard et al. 2014).

The Miridae comprises seven subfamilies (Schuh and Slater 1995, Cassis and Schuh 2012), of which the subfamily Orthotylinae is the third most species rich (Schuh 1995). The tribal classification of the Orthotylinae is still a work in progress and is

comprised of six tribes (Cassis and Schuh 2012): Austromirini, Ceratocapsini, Coridromiini, Halticini, Nichomachini and Orthotylini.

The tribe Orthotylini was first proposed by Reuter (1875), under the divisional name Cyllecoraria and was formally established by Van Duzee (1916) under the name Orthotylini. Early morphological definitions of the group were fraught with exceptions and inconsistencies (see Reuter 1910) and Schuh (1974) provided the first comprehensive assessment of groups within the Orthotylini, recognising the *Orthotylus*-group, *Falconia*-group, *Sericophanes*-group and *Zanchius*-group. Tatarnic and Cassis (2012) in a systematic study of the Halticini, removed *Coridromius* Signoret from it, and erected a new tribe, the Coridromiini to accommodate it. Henry (2015) in a major study of Western Hemisphere orthotylines, resurrected the tribe Ceratocapsini, which is synonymous with Schuh's (1974) *Sericophanes*-group.

Schuh's (1974) *Orthotylus*-group is roughly synonymous with the tribe Orthotylini, and is by far the largest tribal group, comprising over 200 described genera (Cassis and Schuh 2012). Recent works have attempted to group some of these genera together to found more structure within Orthotylini classification (Forero 2008 and 2009, Schaffner and Schwartz 2009, Schwartz 2011, Cheng et al. 2012, Cassis and Symonds 2014). These and other works across the whole subfamily Orthotylinae have focused on establishing homologies of male genitalic structures (Cassis 2008 - *Lattinova* group, Forero 2008 and 2009 - *Hadronema* and *Zanchius*-group taxa, Cheng et al. 2012 - *Myrtlemiris*, Cassis and Symonds 2014 - *Acaciacapsus*, Tatarnic and Cassis 2008, 2012, *Coridromius* and Halticini) to provide insight into suprageneric relationships. The Orthotylini has a significant taxonomic impediment in the Southern Hemisphere (Cassis et al. 2007, Cassis and Schuh 2012) and is hampering efforts to construct a comprehensive suprageneric classification within the tribe.

There have been recent efforts in describing the Orthotylini of Australia (e.g., Cheng et al. 2012, Cassis and Symonds 2014) and South America (Forero 2009), which is revealing a rich and undescribed mirid biota. In contrast, there has been little work on the island nations in the Pacific Basin. There have been a few important works on orthotylines of Pacific islands, including Knight (1935) - *Pseudoloxops* Kirkaldy of Society Islands, Usinger (1946), Carvalho (1956, Micronesia, 1987 New Guinea) and Eyles (1996, 2005, New Zealand), but these are only addressing a small number of taxa compared to what exists in collections.

These fall into two genus-groups that have glassy wings, the first of which is the Indo-Pacific genus *Cyrtorhinus* Fieber has been studied in detail due to their use as biological control agents (Usinger 1939, Carvalho and Southwood 1955); however the species of the South Pacific have not been studied in detail and many new species remained to be described prior to my thesis. I undertook a systematic study of *Cyrtorhinus* in my thesis (Chapter 2).

The second group belongs to a complex of genera and species that are very poorly studied, but miridologists have been aware because of the extensive holdings of them in the Bernice P. Bishop Museum, in Honolulu. Carvalho (1987) first studied this group in any detail, and recognised five new monotypic genera (*Candidomiris* Schuh and Kerzhner [as *Krausella* Carvalho], *Dimifacoris* Carvalho, *Jimia* Carvalho, *Morobea* Carvalho and *Wumea* Carvalho) that I assign to a monophyletic clade within the Orthotylini (Chapter 3; *Candidomiris-Morobea* complex). Wall (2007) is the only author to work on this complex, with the description of a new genus (*Saggitacopula* Wall; and two new species) and one new species of *Morobea* and *Wumea*. Although Wall (2007) speculated on the monophyly of these genera, there has never been a

phylogenetic analysis to test the generic limits of these taxa and their phylogenetic relationships (also Chapter 3), and their position within the Orthotylini.

As part of my thesis, I undertook numerous morphology-based phylogenies. Because of the rarity of specimens and/or lack of fresh material belonging to both *Cyrtorhinus* and *Candidomiris-Morobea* complex I was unable to undertake molecular-based phylogenetic analysis of either group. As a result, my phylogenetic analyses focused on parsimony based analyses. Because of the lack of clarity in the classification of the Orthotylinae, I also investigated the methods for testing the robustness of morphology-based phylogenies. To date, workers have focused on Bremer support (Bremer 1994) and various resampling methods (Felsenstein 1985, Goloboff 2003). No method so far addresses the specific issue of certainty with respect to varying the root of the tree and/or inclusion/exclusion of outgroups. I developed a new script to test for this, and applied it to both the *Cyrtorhinus* and *Candidomiris-Morobea* complex, as well as other heteropteran taxa for which phylogenies have been published (Elias and Cassis 2012 - *Mcateella* Drake, Schuh and Menard 2011 - *Hypseloecus* Reuter, Henry 1997 - Lygaeoidea).

In summary, my thesis has five chapters, as follows:

1) General introduction.
2) Systematics and biogeography of the plant bug genus *Cyrtorhinus* Fieber (Insecta: Heteroptera: Miridae: Orthotylinae).
3) Systematics of the *Candidomiris-Morobea* complex of the tribe Orthotylini (Insecta: Heteroptera: Miridae: Orthotylinae).
4) A new method for determining the effect of outgroups on ingroup topology.
5) General discussion and conclusions.

CHAPTER 2

SYSTEMATICS AND BIOGEOGRAPHY OF THE PLANT BUG GENUS *CYRTORHINUS* FIEBER (INSECTA: HETEROPTERA: MIRIDAE: ORTHOTYLINAE)

ABSTRACT

The plant bug genus *Cyrtorhinus* Fieber is revised. Eleven new species are described (*C. albidus* sp. nov., *C. brunus* sp. nov., *C. defectus* sp. nov., *C. indi* sp. nov., *C. novabritannia* sp. nov., *C. palauensis* sp. nov., *C. pilosus* sp. nov., *C. quatei* sp. nov., *C. rarus* sp. nov., *C. solomonensis* sp. nov. and *C. yunganensis* sp. nov.). The nine previously described species are redescribed. *Josemiris* is synonymised with *Cyrtorhinus. Josemiris carvalhoi* is renamed *Josemiris eylesi* to account for secondary homonymy resulting from the generic synonymy. A diagnostic key is provided together with genitalic illustrations and scanning electron micrographs of diagnostic characters. The phylogeny and biogeography of *Cyrtorhinus* are analysed and discussed. *Cyrtorhinus* is recognised as a monophyletic genus within the subfamily Orthotylinae and the ingroup relationships of the 20 included species are resolved. Paralogy free subtree analysis of the 21 species in 13 areas of endemism yielded 18 paralogy free subtrees, from which 247 compatible trees were generated and an intersection tree was found supporting the hypothesis that African areas are basal to Pacific-Asian areas within an Indo-Pacific distribution.

Keywords: taxonomy, distribution, phylogeny, biogeography, key to species, new species, genitalia

INTRODUCTION

Cyrtorhinus Fieber belongs to the diverse mirid subfamily Orthotylinae (Insecta: Heteroptera: Miridae), whose phylogenetic affinities are uncertain and species level taxonomy has not been studied comprehensively for over 50 years (Carvalho and Southwood 1955; Schuh 1995). The genus is best known for its predatory behaviour, and numerous species are recorded as egg predators of soft-bodied insects, including pest species (Usinger 1939, Reyes and Gabriel 1975, Chua and Milke 1989, Heong et al. 1992).

Carvalho and Southwood (1955) proposed a close relationship of *Cyrtorhinus* with the Northern Hemisphere genus *Mecomma* Fieber on the basis of head, pronotal and genital morphology. Carvalho and Southwood (1955) also described *Fieberocapsus* Carvalho and Southwood, and despite its external similarities concluded that it was distantly related to the *Cyrtorhinus-Mecomma* complex, based on differences of the male genitalia. Kerzhner (1979) described *Mecommopsis* Kerzhner and proposed that it was closely related to the *Cyrtorhinus-Mecomma* complex on the basis of its dorsal vestiture, campanulate pronotum and aspects of the genital morphology. Eyles (1996) described *Josemiris carvalhoi* Eyles, as a new genus and new species, and proposed a close relationship to *Cyrtorhinus*. There has never been a phylogenetic analysis to test *Cyrtorhinus* monophyly or the relationships of it to the other genera mentioned above, or any other orthotyline taxon.

Cyrtorhinus was erected by Fieber (1858) as a monotypic genus for the Palaearctic species *Capsus elegantulus* Meyer-Dür. Thomson (1871) subsequently synonymised this species with *Cyrtorhinus caricis* (Fallén, 1807). Carvalho and Southwood (1955) revised *Cyrtorhinus* and recognised that some of the previously included species needed to be transferred to the phyline genus *Tytthus* Fieber. They

concluded that these two genera exhibit convergence in external morphology but were not closely related and synonymised *C. vitiensis* with *C. lividipennis*, which resulted in a constricted conception of *Cyrtorhinus*, with only six included species. Henry (2012) revised *Tytthus* and confirmed the separation of it from *Cyrtorhinus*. Four species of *Cyrtorhinus* have been described since the revision of Carvalho and Southwood (1955), as follows: *Cyrtorhinus caricisoides* Ghauri, *Cyrtorhinus carvalhoi* Woodward, *Cyrtorhinus dimorphus* Linnavuori and *Cyrtorhinus viridis* Linnavuori. Linnavuori (1994) also synonymised *Cyrtorhinus viridis* with *Cyrtorhinus geniculatus*. As a result and prior to commencement of this study there were nine included species within *Cyrtorhinus*. There were also several undescribed species of *Cyrtorhinus* from islands of the southwest Pacific that are held in museum collections, with a large number of specimens of these new species held in the Bernice P. Bishop Museum.

Carvalho and Southwood (1955) defined *Cyrtorhinus* by the following characters: shape of the pronotum, angle and shape of the head, position of the antennal tubercle, weakly raised calli, opening of the metathoracic gland, labial length, vestiture, colour patterning, and wing shortening. Other authors, such as Yasunaga (1999), and Liu et al. (2001) also addressed the taxonomy of *Cyrtorhinus*, but did not alter the definition of the genus.

Cyrtorhinus has a mostly Indo-Pacific distribution (*sensu* Schuh and Stonedahl 1986). It is represented by a handful of Afrotropical species (*C. caricisoides* Ghauri*, C. dimorphus* Linnavuori, *C. geniculatus* Reuter and *C. melanops* Reuter). There is one Holarctic species (*C. caricis*). *Cyrtorhinus* is represented in islands of the southwest Pacific, but is not natively present in Hawaii. *Cyrtorhinus lividipennis* Reuter 1885 is broadly distributed in the Oriental region (Yasunaga 1999), but its current distribution is

confounded by its broad scale introduction as a biological control agent of delphacid leafhoppers (Usinger 1939).

Indo-Pacific distributions have long been of interest for biogeographers. Central to this distribution pattern is the biogeographic barrier Wallace's Line, or a variation of it, which has been proposed by various authors (Huxley 1868, Mayr 1944, Golson 1971, Camerini 1993) since Wallace (1859). In contrast, Gressitt and Yoshimoto (1963), Van Balgooy (1971) and Schuh and Stonedahl (1986) argued that Wallace's Line, being distributed across it, did not influence other taxa. Recently, biogeographers such as Sanmartín and Ronquist (2004), Parenti and Ebach (2010) and Hawkins et al. (2012) also rejected Wallace's Line as a biogeographic barrier. As with other mirid genera, such as *Hypseloecus* Reuter (Schuh and Menard 2011), *Cyrtorhinus* has an Indo-Pacific distribution based on the known distribution of described and undescribed taxa, and affords a new mirid test case for testing Indo-Pacific and Wallace's Line theory.

The biogeography of terrestrial mirids in the Indo-Pacific region was studied by Schuh and Stonedahl (1986). Regions of endemism varied between these studies and with other studies in the same region. Schuh and Stonedahl (1986) found that the African region was basal to the rest of the Indo-Pacific, the Indian subcontinent was basal to Asia and the Pacific and the Asian mainland was basal to the Pacific islands.

The aims of this chapter are threefold:

1) To undertake a taxonomic revision of the genus, including the description of new species and redescription of previously described species.
2) To test the monophyly of *Cyrtorhinus* and determine ingroup relationships of the included species based on comparative morphology.
3) To construct an hypothesis of area relationships for the species within the genus and test Indo-Pacific biogeographic theory.

MATERIALS AND METHODS

Materials

This study involved an examination of 3922 specimens borrowed from museums around the world. All specimens were digitised with unique specimen identifiers (USI) numbers, recorded in the Plant Bug Inventory database (http://research.amnh.org/pbi/localitydatabase). Material examined was based on material from the following institutions:

AMNH: American Museum of Natural History, New York, USA.

BMNH: Natural History Museum, London, UK.

BPBM: Bernice P. Bishop Museum, Honolulu, Hawaii, USA.

CAS: California Academy of Sciences, San Francisco, USA.

CNC: Canadian National collection of Insects, Arachnids and Nematodes, Ottawa, Canada.

NZAC: New Zealand Arthropod Collection, Auckland, New Zealand.

USNM: Smithsonian National Museum of Natural History, Washington, USA.

Comparative morphology and dissections

Specimens were examined using a Leica M165C stereomicroscope. Examination of male and female genitalia was based on maceration in 5% KOH for about 5 minutes. Abdomens were rinsed in water for 5 minutes and then examined in glycerol.

Imaging

A habitus image of one male and one female of each species was taken using the Visionary Digital system equipped with an Infinity Photo-optical K-2, 3-lens systems and a Canon EOS 40D digital camera (http://www.visionarydigital.com/) was used to generate multiple images of each specimen. Helicon focus software version 2.0 (Kozub et. al 2008) was used to compile an extended focus of the multiple images. All species

were examined and imaged with a Hitachi TM3000 desktop scanning electron microscope, at low vacuum.

Measurements

Morphometric measurements were taken using a stereomicroscope and a digital micrometer, with the data recorded using Winwedge software (http://www.taltech.com/products/winwedge/). All measurements are given in millimetres in and are provided in Table 1. Raw data for the measurements is provided in Appendix A. Five males and five females of each species were measured for all species except those with fewer specimens available. The morphometric characters (including abbreviations) measured were: total body length (TL), length of head (LH), length of pronotum (LP), length of cuneus to clypeus (CC), length of scutellum (LS), width of the scutellum (WS), width of head (WH), width of anterior lobe of pronotum (WA), width of posterior lobe of pronotum (WP), interocular distance (IOD), length of antennal segments 1-4 (AI-AIV).

Homology and terminology

The terminology of external morphological follows Schuh (1976), Cassis and Moulds (2002) and Cassis and Schuh (2012). Female genitalic characters follow Davis (1955) and Yasunaga (2000). The terminology of the male genitalia follows that of Cassis (2008) and Cassis and Symonds (2014), with modifications for *Cyrtorhinus.*

In *Cyrtorhinus* the right paramere is bilobed. Despite the fact that the two lobes vary significantly in size and orientation across species, they are considered as primary homologues between species, and are termed the apophysis and sensory lobe. The apophysis is the lobe that bears a flange and the sensory lobe is the one, which bears the setae.

The left paramere of *Cyrtorhinus* is bilobed and Y-shaped in all species except *C. caricis,* in which it more closely resembles the left paramere of *Mecomma* spp. The apophysis is a long recurved lobe bearing minute teeth. The sensory lobe is the setae-bearing lobe and it is ventral to the apophysis, when the left paramere is at rest in the pygophore. It is worth noting that in *C. caricis* and many species of *Mecomma* the setae are borne on a bulge-like sensory lobe at the base of the apophysis, with the base ventral in position. It is likely that this swelling is homologous with the sensory lobe in the rest of *Cyrtorhinus.*

The stem of either paramere is the section of the paramere between point of attachment to the pygophore and the sensory lobe. In species with only one lobe on the left paramere the stem is the vertical section before the apophysis. In species with only one lobe of the right paramere there is no discernible stem. The stem size is variable, however this variation appears to be continuous. The stem size is used only as a rough comparison to the size of the lobes.

All species of *Cyrtorhinus* also have a flange-like projection on the distal ⅓ to ¼ of the endosomal spicule. Eyles (1996) described this structure in *Cyrtorhinus cumberi* as a flared ‘fish tail’ and implied that it was not homologous with the protrusion found in *Josemiris carvalhoi.* I disagree with this interpretation, and posit them as homologous with *Cyrtorhinus* spp, based on its position, and have termed it the *rudus*, from the Latin meaning lump. The rudus often bears minute teeth and varies in shape between species. It varies in shape across all species but it is always in about the same position, and the shape differences are regarded as species defining. The curvature of the spicule varies between species, which is generally straight in Pacific species, but arcuate in the type species *C. caricis* and almost all the African species. *Cyrtorhinus* has only one

endosomal spicule, which is dorsal in position; I refer to it as the proximal endosomal spicule, in the sense of Cassis and Symonds (2014).

All species of *Cyrtorhinus* have an endosomal membranous bag, which is more prominent in comparison to the Austromirini and other members of the Orthotylini, where the membrane is generally small, and the endosoma is dominated by 2-3 sclerotised spicules (Southwood 1953, Stonedahl and Schwartz 1986, Forero 2008, Cassis 2008, Cheng et al. 2012, Cassis and Symonds 2014). It is a similar size and location to the second spicule in *Mecomma* but is not likely to be homologous; both the spicule in *Mecomma* and the membranous bag in *Cyrtorhinus* are found in *Orthotylus bilineatus.* The membranous nature of the endosomal membrane is also more like that found in the *Zanchius* complex (Schuh 1974).

Phylogenetic methods

A phylogenetic data matrix (Table 2) for *Cyrtorhinus* was compiled in Nexus Data Editor (Page 2001) and comprised 50 unambiguous morphological characters and 48 taxa, including all 21 species of *Cyrtorhinus*, 12 species of *Mecomma*, *Orthotylus bilineatus*, and representatives of 13 other orthotyline genera. An explanatory list of characters and character states in provided in (Table 3). A phyline species of the genus *Tytthus* was used to root the tree.

TNT for Windows, No taxon limit Version 1.1 (Goloboff et al. 2008) was used to conduct a parsimony analysis. An unweighted new technology search was implemented, with the ratchet option applied, set to 1000 iterations, and the tree drift algorithm at default settings. Implied weighting (Goloboff 1993) was then used to further resolve the tree. Symmetric resampling (Goloboff et al. 2003) was employed to generate support values. Tree support statistics are recorded in Table 4.

There has been some debate as to the definition of synapomorphy, homoplasy and apomorphy in the literature is in recent years; discussion of this topic is beyond the scope of this project. In this paper these terms are defined as follows:

Synapomorphy: This term is defined as an uncontradicted character state change which is shared by all taxa below the node which it occurs nowhere else in the analysis.

Apomorphy character state: This term is defined as a character state change which supports a node but either occurs elsewhere in the phylogeny or is reversed below the specified node.

Biogeographic methods

Paralogy-free subtree methodology was used for historical biogeography analyses of *Cyrtorhinus* (Nelson and Ladiges 1996, Parenti and Ebach 2007). Lisbeth software version 1.3 was used to run these analyses (Bagils et al. 2012). Distribution data for the *Cyrtorhinus* species was obtained from specimen labels and from the literature (Usinger 1939, Carvalho and Southwood 1953, Linnavuori 1971, Yasunaga 1999). Known introductions of *Cyrtorhinus* species (Table 5) were excluded. The native distribution of *Cyrtorhinus lividipennis* is uncertain because of human-made introductions for purposes of biological control (Usinger 1939, Asche and Wilson 1989).

Schuh and Stonedahl (1986) used a similar method to examine the area relationships in the Indo-Pacific region using only heteropteran species. Areas of endemism in this study tended to be defined by single or small clusters of islands. The distributions of species of *Cyrtorhinus* tend to be much more widespread than those used by Schuh and Stonedahl (1986), so these areas of endemism were deemed to be inappropriate for the analysis of *Cyrtorhinus*. The fact that *Cyrtorhinus* and many of its species are widely distributed in the Eastern Hemisphere has necessitated the use of broad scale areas of endemism for this analysis. Their distribution is similar to

organisms investigated by Sanmartín and Ronquist (2004), as well as other orthotyline genera such as *Pseudoloxops* Kirkaldy. For this reason and because of the similar distribution I used the area of endemism of Schilder and Schilder (1938-1939), and as adopted by Parenti and Ebach (2007), with the following exceptions:

1) Holarctic region to accommodate *C. caricis.*
2) West African region to accommodate *C. geniculatus.*
3) Instead of a Japanese region I have included an Asian region as the distribution of *Cyrtorhinus* extends into areas of China, which are not included in the original Japanese region.
4) Australian region includes the whole of the Australian continent and southern New Guinea following Crisp et al. (2001).

Table 6 gives the areas of endemism used in this chapter and the taxa associated with them.

RESULTS

Phylogeny

The analysis yielded three shortest trees of equal length. The most parsimonious tree had a length of 15.87 with implied weights with K =3. *Cyrtorhinus* was retained as monophyletic with four synapomorphies (ductus seminis elongate; sclerotised flange bearing teeth on the apophysis of the right paramere; bristle-like setae with a pronounced pit on the medial surface of AI; presence of tibial spinules). There was also a (*Mecomma,*(*Cyrtorhinus*, *Orthotylus bilineatus*)) group found supported by one synapomorphy (presence of a process near the apex of the proximal endosomal spicule) two synapomorphic characters supporting the sister-group relationship between *Cyrtorhinus* and *Orthotylus bilineatus* (presence of a lateral endosomal membranous bag, process on the proximal endosomal spicule forming a dentate rudus). Symmetric

resampling was used to measure the strength of the relationships within the group. Support is strong for the nodes closer to the tips within the tree, whereas only a few of the more basal nodes retain more than 50% symmetric resampling values. The tree is given in Figures 1 and 2, along with the details of the character state changes. Table 4 shows the symmetric resampling values.

Node 1: This node supports the monophyly of the *Mecomma-Cyrtorhinus-Orthotylus bilineatus* group. It received 61% symmetric resampling support. This node is supported by one synapomorphy and six contradicted apomorphic character states.

Node 2: This node supports the monophyly of *Mecomma.* It received 77% symmetric resampling support. This node is supported by five contradicted apomorphic character states.

Node 3: This node establishes a (*Mecomma*,(*Orthotylus bilineatus, Cyrtorhinus*)) relationship. It received 53% symmetric support. This node is supported by two synapomorphies and one apomorphic character state.

Node 4: This node supports the monophyly of *Cyrtorhinus.* It received 86% symmetric resampling support. This node is supported by four synapomorphies and two apomorphic character states.

Node 5: This node establishes *Cyrtorhinus caricis* as the basal species within *Cyrtorhinus.* It received 73% symmetric resampling support. This node is supported by two synapomorphies and one apomorphic character state.

Node 6: This node separates *Cyrtorhinus caricisoides* from the rest of *Cyrtorhinus*. It received less than 50% symmetric resampling support. This node is supported by two synapomorphies.

Node 7: This node separates the (*C. dimorphus, C. novabritannia, C. carvalhoi, C. melanops, C. eylesi*) clade. I refer to it as the ‘large genitalia group’. It received 65%

symmetric resampling support. This node is supported by one synapomorphy and two apomorphic characters.

Node 8: This node divides the large paramere group into (*C. eylesi*, *C. dimorphus, C. carvalhoi,* and *C. novabritannia*). It received less than 50% symmetric resampling support. This node is supported by one synapomorphy and one apomorphic character state.

Node 9: This node supports a (*C. dimorphus, C. eylesi*) relationship. It received less than 50% symmetric resampling support. This node is supported by one synapomorphy and two apomorphic character states.

Node 10: This node supports a (*C. carvalhoi, C. novabritannia*) group. It received less than 50% symmetric resampling support. This node is supported by two synapomorphies and two apomorphic character states.

Node 11: This node supports the monophyly of the main group of *Cyrtorhinus*. I refer to it as the 'small genitalia group'. This group has reduced lobes on the right paramere and a rectangulate or spear-shaped rudus. It received 57% symmetric resampling support. This node is supported by two apomorphic character states.

Node 12: This node establishes *Cyrtorhinus geniculatus* as the basal member of the small genitalia group. It received less than 50% symmetric resampling support. This node is supported by one apomorphic character state.

Node 13: This node separates *Cyrtorhinus pilosus* from (*C. cumberi, 'solomonensis* group', '*lividipennis* group', '*fulvus* group'). It received less than 50% symmetric resampling support. This node is supported by one apomorphic character state.

Node 14: This node establishes the *Cyrtorhinus solomonensis* group, (*C. solomonensis* and *C. palauensis*), as the sister-group to the (*C. cumberi*, '*lividipennis* group', '*fulvus*

group'). It received less than 68% symmetric resampling support. This node is supported by three apomorphic character states.

Node 15: This node established *Cyrtorhinus cumberi* as basal to (*C. lividipennis*-*C. fulvus* group). It received less than 50% symmetric resampling support. This node is supported by one synapomorphy and one apomorphic character state.

Node 16: This node supports a sister-group relationship between the '*fulvus* group' and the '*lividipennis* group'. It received less than 50% symmetric resampling support. This node is supported by one synapomorphy and one apomorphic character state.

Node 17: This node supports the monophyly of the '*fulvus* group' (*C. defectus, C. rarus, C. fulvus* and *C. brunus*). It received 52% symmetric resampling support. This node is supported by one synapomorphy and one apomorphic character state.

Node 18: This node gives *Cyrtorhinus brunus* as the basal member of the '*fulvus* group'. It received less than 50% symmetric resampling support. This node is supported by one apomorphic character state.

Node 19: This node supports a sister-group relationship between *Cyrtorhinus rarus* and *Cyrtorhinus fulvus.* It received 65% symmetric resampling support. This node is supported by one synapomorphy.

Node 20: This node supports the monophyly of the '*lividipennis* group' (*C. lividipennis, C. yunganensis, C. indi, C. albidus* and *C. quatei*). It received 66% symmetric resampling support. This node is supported by one apomorphic character state.

Node 21: This node establishes *Cyrtorhinus yunganensis* as the basal member of the '*lividipennis*' group. It received 62% resampling support. This node is supported by one apomorphic character state.

Node 22: This node supports a (*C. indi, C. quatei*) relationship. It received less than 50% resampling support. This node is supported by one apomorphic character state.

Node 23: This node supports a sister-group relationship between *Cyrtorhinus lividipennis* and *Cyrtorhinus albidus*. It received less than 50% resampling support. This node is supported by one synapomorphy and one apomorphic character state.

Biogeography

The taxon-areagram yielded 38 paralogy free subtrees (Appendix C), from which 45 compatible trees were generated. The minimal tree generated is shown in Fig. 3 and the following area relationships were found.

Node 1: This node separates the Holarctic region from Indo-Pacific region. This is a result of the only Palearctic species, *Cyrtorhinus caricis*, being basal to the remainder.

Node 2: This node separates the Lemuria region from the rest of Africa-SE and Asia-Pacific regions. It is a result of a single species, *Cyrtorhinus caricisoides*.

Node 3: This polytomy established West Africa and East Africa as basal to the Pacific-subcontinent region. It is a result of a conflict of taxa in both the more basal 'large genitalia' group and the 'small genitalia' group of *Cyrtorhinus.*

Node 4: This polytomy support New Zealand and Australia as basal to the Asian-Pacific island group. This is mostly consistent with the Indo-Malayan hypothesis outlined in Parenti and Ebach (2010).

Node 5: This node is composed of the main 'small genitalia' group of *Cyrtorhinus*. It supports a relationship between the Pacific islands and Asian taxa.

Node 6: This node supports the 'SE Asian group' (Subcontinent, Asia, and Micronesia).

Node 7: This node support an Asian-Micronesian sister-group relationship.

Node 8: This node supports a relationship between the (Sulu Sea, Micronesia, Polynesia, and New Caledonia). It is consistent with the Pandoran hypothesis of Parenti and Ebach (2010) with the exclusion of the Australian taxa.

Node 9: This node mostly supports a relationship between New Caledonia and

Polynesia.

Node 10: This node supports a relationship between the Sulu Sea region and Melanesia, a relationship that was also found by Schuh and Stonedahl (1986)

TAXONOMY

Cyrtorhinus Fieber

Images of live specimens of *Cyrtorhinus* are presented in Figure 6.

Type species

Capsus elegantulus Meyer-Dur, 1843, by monotypy (= *Capsus caricis* Fallén, 1807)

Cyrtorhinus Fieber, 1858: 313 (gen. nov.); Carvalho 1956: 55 (Micronesian species); Carvalho 1958: 53 (catalogue); Schuh, 1995: 100-101 (world catalogue)

Chlorosomella Reuter, 1904: 6-7 (gen. nov.; type species: *C. geniculata* Reuter, 1904 by monotypy

Cyrtorhinus (*Reuteriessa*) Usinger 1951: 3 (as new subgenus of *Cyrtorhinus*; type species: *Cyrtorhinus lividipennis* Reuter 1885, by original designation)

Josemiris Eyles (gen. nov.); type species: *Josemiris carvalhoi* Eyles, 1996); **new synonymy, this work** (type species: *Josemiris carvalhoi* Eyles, 1996 = *Cyrtorhinus eylesi* Elias, this work, ***nom. nov*; this work** for *C. carvalhoi* Woodward 1957)

Diagnosis

Cyrtorhinus is diagnosed by the following characters: transverse and short head (e.g. Fig. 10a); pair of pits lateral to midline of anterior lobe of pronotum (e.g. Fig. 12d); translucent hemelytra (Fig. 7); sparse distribution of hair-like vestiture (e.g. Fig. 10); elongate tibial spinules (e.g. Fig. 10f); bilobed right paramere with dentate flange on apophysis (e.g. Fig. 8b); ductus seminis greatly elongate, extending beyond half length of endosoma (Fig. 8a); flange of right paramere on a minute tubercle (Fig. 8b);

apophysis of left paramere bearing minute teeth apically (Fig. 8c); aedeagus with a single sclerotised spicule bearing a dentate rudus distally (Fig. 8a).

Cyrtorhinus can be distinguished from the closely related taxa *Mecomma* and *Orthotylus bilineatus* by: eyes large (e.g. Fig. 10a), about same length as head in macropters; antennae adjacent to anterior margin of eye (e.g. Fig. 12b); campanulate pronotum in macropters (Fig. 29c); Y-shaped left paramere (Fig. 8c); single sclerotised endosomal spicule (Fig. 8a). *Cyrtorhinus* also resembles *Candidomiris* Carvalho and allied Australian and Oceanic taxa, in that they have a glassy external appearance, but the latter taxa generally have a far more complex endosoma and different paramere morphology.

Description

Males, brachyptery unknown; females mostly macropterous, brachyptery absent in most species, rare in some, all females brachypterous in *C. dimorphus*.

COLOURATION: ***Head:*** general colouration variable; clypeus black; vertex variable often with a black marking medially, sometime with light yellow or brown coloured patches around eye. ***Pronotum:*** usually black (e.g. Fig. 7c) or partially black (e.g. Fig. 7b). ***Scutellum:*** often with a black medial line (e.g. Fig. 6). ***Hemelytra:*** pale and translucent, membrane light brown (e.g. Fig. 6). ***Thoracic pleura and sterna:*** pleura black, sterna often red, brown or yellow.

VESTITURE AND TEXTURE: Sparsely covered in simple, decumbent, hair-like setae intermixed with dense distribution of microtrichia (e.g. Fig. 10). ***Antennae:*** densely covered with erect hair-like setae; AI with three thick bristle like, usually on medial surface. ***Legs:*** densely covered with semi-erect hair-like setae (e.g. Fig 10 e,f), two rows of spines usually present on tibiae (e.g. Fig 10e,f). ***Hemelytra:*** usually with

sparse distribution of semi-erect hair-like setae (Fig. 16d), sometimes costal margin fringed with larger setae.

STRUCTURE: ***Head:*** transverse; eyes large, anterior margin usually extending to anterior margin of head, posterior margin always contiguous with anterior margin of pronotum (e.g. Fig. 10a); clypeus strongly hypognathous (e.g. Fig. 12b); gula short (e.g. Fig. 16b). ***Labium:*** variable in length, reaching mesosternum at shortest and s4 at longest; LI usually ca. twice as thick as LII-LIV; LIII and LIV usually similar length to LII. ***Pronotum:*** campanulate (Fig. 12d); pronotal foveae present on anterior lobe (Fig. 12d), sometimes contiguous (Fig. 28b); posterior lobe declivent. ***Metathoracic gland:*** peritreme narrow, ventrally oriented (Fig. 12f). ***Hemelytra:*** ca. 1.5-2x times longer than abdomen, cuneus length 1.5-2x times longer than cuneus width (Fig. 23f). ***Legs:*** cursorial; coxae elongate; pretarsal claws with minute striations uniformly distributed, swollen at the base (Fig. 39d); clump of spiny microtrichia present below swelling (Fig. 19f). ***Male genitalia:*** Pygophore shape simple with a broad opening (Fig. 22g). Left paramere with two distinct lobes (e.g. Fig. 31c), sensory lobe dorsal to apophysis, in *C. caricis* sensory lobe reduced to a small lump at base of apophysis (Fig. 20c); apophysis with file-like texturing apically. Right paramere (e.g. Fig. 13b) bilobed with a heavily sclerotised flange emanating from minute tubercle produced at various angles from the apex dorsal lobe. Aedeagus with proximal endosomal spicule only (e.g. Fig. 8a), distal rudus protruding dorsally, positioned ca. ¾ length of spicule, usually heavily dentate; endosomal membranous bag prominent, ductus seminis large, extending distally to ca. ⅔- ¾ length of spicule. ***Female genitalia:*** Small and highly membranous (e.g. Fig. 14). Left and right gonapophyses 8 symmetrical, usually touching; interramal lobe minutely dentate; vestibulum positioned at midline.

Remarks

According to Carvalho and Southwood (1955) the most distinguishing character of *Cyrtorhinus* is the campanulate pronotum. While the pronotum is distinctly campanulate there is very little difference between the shape of the pronotum in *Cyrtorhinus* as compared with many other orthotyline genera, especially those of the *Zanchius* group. It is this characteristic which led Kerzhner (1979) to include *Mecommopsis* in the *Cyrtorhinus-Mecomma* group. Examination of the genitalia of members of these three genera (Figs 4,5,8) indicates that *Mecommopsis* is much more likely to be in the *Zanchius* group than the *Cyrtorhinus* group.

The genitalia in *Cyrtorhinus* are most similar to *Mecomma* and *Orthotylus bilineatus* and the relationship between these taxa is shown in the phylogeny (Fig. 1). The left paramere bears only a single lobe in *Mecomma,* while in *Cyrtorhinus* and *O. bilineatus* it is bilobed. In *O. bilineatus* and *C. caricis* the sensory lobe is greatly reduced. Of the three genera the right paramere is bilobed only in *Cyrtorhinus*, although in the basal species *C. caricis* the lobe is greatly reduced. The right paramere of both *Mecomma* and *O. bilineatus* possess heavily sclerotised teeth on the apex of the right paramere (Figs 4, 5), which may be homologous with the comb-like flange in *Cyrtorhinus.* The endosoma of *Orthotylus bilineatus* also possesses a rudus-like structure that is weakly sclerotised (Fig. 5), and the apex of the spicule is strongly curved as in basal *Cyrtorhinus* species. Its ductus seminis is greatly elongate nearly reaching the apex of the phallotheca in the same way as *Cyrtorhinus.* All three taxa possess the endosomal membranous bag seen in *Cyrtorhinus;* however it has fields of spinules in only some species of *Cyrtorhinus.* Both *Mecomma* and *O. bilineatus* possess a small sclerotised endosomal sclerotisation, which resembles a short flat endosomal

spicule. In both taxa it is apically dentate. This structure is absent in all species of *Cyrtorhinus*.

Description of the male genitalia of *Orthotylus bilineatus* and *Mecomma* are included for the sake of comparison. Their genitalia are illustrated in Figures 4 (*Mecomma* sp.) and Figure 5 (*Orthotylus bilineatus*).

Orthotylus bilineatus (Fallén): Pygophore shape simple with a broad opening; left paramere sickle shaped, sensory lobe reduced to a small lump at base of apophysis, apophysis apically arrow shaped, with file-like texturing apically, setae sparse but present on both lobes; right paramere reduced, much smaller than left paramere; single bifurcate lobe with sparse dentations apically; aedeagus with proximal endosomal spicule, distal weakly sclerotised rudus protruding dorsally, positioned ca. ½ length of spicule; dorsal endosomal spicule present, greatly reduce, not reaching rudus apically, heavily sclerotised and apically dentate; endosomal membranous bag prominent, ductus seminis large, extending distally to ca to ca. ½ length of spicule.

Mecomma Fieber: Pygophore shape elongate with a narrow opening; left paramere hammer shaped with a two lobes produced in opposite directions from the stem, sensory lobe reduced to a small lump, apophysis apically simple but usually curved, setae sparse but present on both lobes; right single with a single lobe, apically clavate with large heavily sclerotised dentations apically; aedeagus with bifurcate and apically dentate proximal endosomal spicule; dorsal endosomal spicule elongate, usually subequal in length to proximal endosomal spicule; heavily sclerotised endosomal structure present near the base of the proximal endosomal spicule; ductus seminis large, extending distally to ca to ca. ½ length of spicule.

Cyrtorhinus was first thought to be predatory by Muir (1920); however he treated *Tytthus mundulus* as *Cyrtorhinus mundulus.* This resulted in confusion, as

subsequent authors treated all species included within *Cyrtorhinus* to be predatory, including misplaced *Tytthus* species. Usinger (1951) recognised a split within this broader concept of *Cyrtorhinus,* based on the morphology of the pretarsus and parameres, and erected a new subgenus *Cyrtorhinus* (*Reuteriessa*), but no comment on any biological differences within his subdivided notion of the genus. The Carvalho and Southwood (1955) review of the genus resulted in the transfer of *Tytthus* species from *Cyrtorhinus,* and as a result, a reassessment of the feeding preferences of a restricted sense of the latter genus was required, and stated that they were predators, with a preference for insect eggs. Although predation has been recorded in only three species of *Cyrtorhinus* (*C. caricis, C. lividipennis* and *C. fulvus*), records of this behaviour in the basal *Cyrtorhinus* species (see Figure 13; *C. caricis*) and some congeners suggest that it is common throughout the genus (Esaki 1934, Usinger 1939).

Eyles (1996) described *Josemiris* as a new genus encompassing only the new species *Josemiris carvalhoi*. This genus has been synonymised with *Cyrtorhinus* and the species has been named *Cyrtorhinus eylesi* in this paper as the name *Cyrtorhinus carvalhoi* is taken by *Cyrtorhinus carvalhoi* Woodward (1957). This was done despite the fact that Eyles (1996) originally rejected the possibility that they are in the genus. Eyles distinguished the genera by the yellow anterior lobe of the pronotum, weakly declivent trapeziform pronotum and the right paramere has a much longer apophasis than *Cyrtorhinus cumberi*. Eyles based these differences on examination of *Cyrtorhinus cumberi.* These characters were deemed not to be relevant at a generic level in this chapter as pronotal colouration is highly variable within the genus, the pronotal shape and topology varies between macropters and brachypters, and the pronotum of *Cyrtorhinus eylesi* is not unique within the genus. The length of the apophysis of the right paramere in the species is radically different from other *Cyrtorhinus cumberi* but is

similar to that of some other species of *Cyrtorhinus,* such as *C. carvalhoi, C. melanops, C. dimorphus* and *C. novabritannia*.

Checklist of species of *Cyrtorhinus*

Cyrtorhinus albidus sp. nov.	Mariana Islands
Cyrtorhinus brunus sp. nov.	Philippines
Cyrtorhinus caricis Fallén 1807	Palearctic region
Cyrtorhinus caricisoides Ghauri 1970	Madagascar
Cyrtorhinus carvalhoi Woodward 1957	Papua New Guinea
Cyrtorhinus cumberi Woodward 1950	New Zealand
Cyrtorhinus defectus sp. nov.	Papua New Guinea
Cyrtorhinus dimorphus Linnavuori 1994	East Africa
Cyrtorhinus eylesi nom. nov	New Zealand
Cyrtorhinus fulvus Knight 1935	Melanesia
Cyrtorhinus geniculatus Reuter 1904	West Africa
Cyrtorhinus indi sp. nov.	India, Sri Lanka and Myanmar
Cyrtorhinus lividipennis Reuter 1885	Southeast Asia, Melanesia, India
Cyrtorhinus melanops Reuter 1905	West and South Africa
Cyrtorhinus novabritannia sp. nov.	New Britain
Cyrtorhinus palauensis sp. nov.	Australia, New Guinea and Palau
Cyrtorhinus pilosus sp. nov.	Philippines
Cyrtorhinus quatei sp. nov.	Southeast Asia
Cyrtorhinus rarus sp. nov.	New Caledonia
Cyrtorhinus solomonensis sp. nov.	Solomon Islands
Cyrtorhinus yunganensis sp. nov.	Southern China

Key to the species of *Cyrtorhinus*

1. Cuneus short, ca. 1.5x longer than wide (Fig. 16d); right paramere sensory lobe reduced (Fig. 13c); rudus of proximal endosomal spicule curved and weakly dentate (Fig. 13g)..... 2

- Cuneus long, more than 2x longer than wide (Fig. 22h); right paramere with a distinct sensory lobe and apophysis (Fig. 8b); rudus of proximal endosomal spicule variable in shape and strongly dentate (Fig. 8a.)..... 3

2. Body length 3.2-3.4 mm (Table 1); left paramere Y-shaped (Fig. 17c); proximal endosomal spicule of aedeagus weakly curved (Fig. 17a); Madagascar..... ..... *C. caricisoides* Ghauri

- Body length 3.9-4.2 mm (Table 1); left paramere with a single lobe (Fig. 13c); proximal endosomal spicule strongly curved (Figs 13f,g); Holarctic..... ..... *C. caricis* Fallén

3. Pronotum narrowly campanulate, with lateral margins weakly divergent (Fig. 22); right paramere lobes elongate (Fig. 20), ca. 4-5x longer than stem..... 4

- Pronotum broadly campanulate, with lateral margins of posterior lobe flared (Fig. 10a); right paramere lobes short (Fig. 8b), less than or subequal in length to stem.... 8

4. Body black or dark brown (Fig. 7g); file-like texture along entire dorsal surface of apophysis of left paramere (Fig. 20); brachyptery rare in ♀♀..... 5

- Body light green or yellow (Fig. 7); file-like texture along entire dorsal surface of apophysis of left paramere (Fig. 27); ♀♀ usually brachypterous..... 7

5. Labium short, extending to meso- or metasternum; rudus rounded, densely dentate to apex (Fig. 20); Melanesia 6
- Labium elongate, extending to abdominal s3 or s4; rudus strongly triangulate and weakly dentate (Fig. 25); Africa ..... *C. melanops* Reuter
6. Anterior lobe of pronotum steeply produced (Fig. 22); flange of right paramere laterally produced, rudus long and bulbous basally (Fig. 20); New Guinea .... *C. carvalhoi* Woodward
- Anterior lobe of pronotum weakly produced (Fig. 35); flange of right paramere dorsally produced; rudus short and thin, smooth along entire length (Fig. 17); New Britain ..... *C. novabritannia* sp. nov.
7. Elongate setae present on femora and tibiae (Fig. 24); body light green to yellow (Fig. 7), ♀♀ occasionally macropterous; New Zealand..... *C. eylesi* nom. nov.
- Femora without elongate setae (Fig. 26); body deep green (Fig. 7); ♀♀ always brachypterous; Africa.....*C. dimorphus* Linnavuori
8. Body red or brownish red (Fig. 7); rudus rectangulate (Fig. 11) 9
- Body pale grey or yellow or yellowish brown (Fig. 7), or green; rudus ovate (Fig. 7) 13
9. Third labial segment as long as or longer than second; labium short, extending to pro- or mesosternum; body dull red orange or brownish red, rarely green. (Fig. 7)..... 10
- Second labial segment elongate, about as long as third and fourth segment; labium extending to between metacoxae and abdomen; body bright red (Fig. 1); New Caledonia ..... *C. rarus* sp. nov.

10. Setae dark brown, densely distributed; AII and AIII subequal in length (Table 1) 11

- Setae pale grey, sparsely distributed; AII: AIII ratio ca. 1.5:1 (Table 1); Philippines ..... *C. pilosus* sp. nov.

11. Anterior region of pronotum smooth; posterior region rugulose or smooth (Fig. 24.); proximal endosomal spicule strongly sclerotised (Fig. 11)..... 12

- Anterior and posterior regions of pronotum rugulose (Fig. 12); proximal endosomal spicule and rudus weakly sclerotised (Fig. 7a); Philippines ..... *C. brunus* sp. nov.

12. Setae on posterior region of pronotum absent (Fig. 24); bridge between lobes of right paramere evenly curved (Fig. 11); Papua New Guinea ..... *C. defectus* sp. nov.

- Setae on posterior lobe of pronotum present (Fig. 28); bridge between lobes of right paramere sinuate (Fig. 11); Samoa, Fiji ..... *C. fulvus* Knight

13. Body yellow or brown (Fig. 7); hemelytra sometimes spotted green, never entirely green; Asia and Pacific islands..... 14

- Body green (Figure 7); Africa..... *C. geniculatus* Reuter

14. Pronotum and scutellum uniformly black (Fig. 7), midline marking absent 16

- Pronotum and scutellum with multiple colours, with a black or dark brown medial line (Fig. 7)..... 17

15. AIII smooth, without ridges (Fig. 41), prosternal ridge present (Fig. 41); Solomon Islands ..... *C. solomonensis* sp. nov.

- AIII with minute ridges (Fig. 37); thick mat of microtrichia on proxyphus (Fig. 36); Palau ..... *C. palauensis* sp. nov.

16. Body pale, light yellow to grey, with indistinct markings (Fig. 7); posterior region of pronotum steeply declivent, distinctly separating anterior and posterior lobes (Fig. 10) 18

- Body with distinct colours and markings (Fig. 7); posterior region of pronotum weakly declivent (Fig. 23), anterior and posterior lobes indistinct (Fig. 23)..... 19

17. Pronotum white with black markings (Fig. 7); apophysis of left paramere uniformly curved apically (Fig. 8); Indian subcontinent and Myanmar .....*C. indi* sp. nov.

- Pronotum yellow with brown markings (Fig. 1); apophysis of left paramere uniformly curved (Fig. 8); Mariana Islands ..... *C. albidus* sp. nov.

18. Body green (Fig. 7); posterior lobe of pronotum strongly rugulose (Fig. 23) 20

- Body yellow or yellowish brown (Fig. 7); posterior lobe of pronotum smooth (Fig. 32) 21

19. Posterior lobe of pronotum shorter than anterior lobe (Table 1); right paramere apophysis several times thinner than sensory lobe (Fig. 25), ductus seminis extending beyond rudus (Fig. 25); New Zealand.....*C. cumberi* Woodward

- Posterior lobe of pronotum longer than anterior lobe (Table 1); right paramere sensory lobes width subequal to apophysis width (Fig. 38); ductus seminis extending to base of rudus (Fig. 38); Thailand and Vietnam .....*C. quatei* sp. nov.

20. Body brown (Fig. 1); dorsal setae dark; hemelytra ovate in shape (Fig. 7); ductus seminis basal to rudus (Fig. 38); Southern China ..... *C. yunganensis* sp. nov.

- Body variable in colour (Fig. 7); dorsal setae pale; hemelytra with costal margins straight (Fig. 7); ductus seminis extending to base of rudus (Fig. 32.); widespread ..... *C. lividipennis* Reuter

Cyrtorhinus albidus sp. nov.

Habitus, Figure 7a. Male genitalia, Figure 8a-c. Distribution, Figure 9. SEMs, Figure 10.

Etymology

Albidus is the Latin word for white; species named for its whitish appearance.

Materials examined

HOLOTYPE: **MICRONESIA: MARIANA ISLANDS:** Guam: Inarajan, 14.27525°N 144.74794°E, 8 m, 06 Aug 1936, O.H. Swezey, ♂ (UNSW_ENT00046835) (BPBM).

PARATYPES: **MICRONESIA: MARIANA ISLANDS:** Guam: Apra Heights, 02 Jan 1959 - 03 Feb 1959, N.L.H. Krauss, 1♀ (UNSW_ENT00046827), 1♂ (UNSW_ENT00046839) (BPBM). Atantano, 13.42222°N 144.67611°E, 03 Sep 1936, O.H. Swezey, 1♀ (UNSW_ENT00046832), 3♂♂ (UNSW_ENT00046833, UNSW_ENT00046834, UNSW_ENT00046860) (BPBM). Inarajan, 14.27525°N 144.74794°E, 8 m, 06 Aug 1936, O.H. Swezey, 6♀♀ (UNSW_ENT00046828, UNSW_ENT00046829, UNSW_ENT00046854-00046857), 1♂ (UNSW_ENT00046836), 1 juvenile (UNSW_ENT00046853) (BPBM); 15 May 1936, O.H. Swezey, 1♀ (UNSW_ENT00046852) (BPBM); 05 May 1936, O.H. Swezey, 2♂♂ (UNSW_ENT00046858, UNSW_ENT00046859) (BPBM); 30 Sep 1936, O.H. Swezey, 1♂ (UNSW_ENT00046848), 3♀♀ (UNSW_ENT00046849-00046851) (BPBM). Piti, 13.46°N 144.69166°E, 5 m, 01 Sep 1936, O.H. Swezey, 1♀ (UNSW_ENT00046830) (BPBM); 14 Sep 1936, O.H. Swezey, 6♀♀ (UNSW_ENT00046831, UNSW_ENT00046840-00046844), 3♂♂ (UNSW_ENT00046845-00046847) (BPBM). Yona, 13.41°N 144.77°E, 18 November 1936, O.H. Swezey, 1♂ (UNSW_ENT00046837) (BPBM). (no location description), 13.44416°N 144.79361°E,

37 m, 01 Jan 1939-31 Dec 1939, (unknown collector), 1♂ (UNSW_ENT00046838) (BPBM).

Diagnosis

Cyrtorhinus albidus is recognised by the following characters: females usually macropterous, rarely brachypterous; pallid body (Fig. 7a); elongate AII; pronotal foveae present (Fig. 10a); labium extending to metathorax; hemelytral margins convex (Fig. 7a); left paramere Y-shaped, apophysis sinuate (Fig. 8c); right paramere mitt-shaped, apophysis squat, apical comb-like flange (Fig. 8b); endosomal membranous bag without sclerotisation; proximal endosomal spicule straight, rudus rectangulate, margins dentate (Fig. 8a).

Description

Males

COLOURATION: Body pale yellow (Fig. 7a). ***Head:*** generally pale yellow to light brown; vertex most often entirely pale yellow, sometimes indistinct light brown markings present; clypeus mostly pale yellow, sometimes anteriorly brown. ***Antennae:*** AI-AIV brown or pale yellow. ***Labium:*** pale grey. ***Pronotum:*** uniformly pale yellow to grey. ***Scutellum:*** mostly pale yellow, brown midline. ***Hemelytra:*** clavus, corium and cuneus pale yellow, translucent (Fig. 7a); membrane translucent. ***Thoracic pleura and sterna:*** meso- and metapleura and sterna pale yellow. ***Legs:*** pale grey. ***Abdomen:*** venter pale yellow.

VESTITURE AND TEXTURE: Body uniformly covered in pale grey, decumbent, hair-like setae; sparsely covered in minute microtrichia. ***Head:*** vertex with short decumbent hair-like setae, large semi-erect setae present laterally and medially; gula and genae with sparse distribution of long, erect, hair-like setae. ***Antennae:*** dense distribution of decumbent hair-like setae; AI with three thick bristle-like setae on medial

surface (Fig. 10c). ***Pronotum:*** smooth; sparse distribution of hair-like setae, intermixed with minute tufts of microtrichia (Figs 10b,d); proxyphus with dense distribution of microtrichiae. ***Hemelytra:*** sparse and uniform distribution of hair-like setae. ***Legs:*** femora with dense distribution of thick, decumbent, hair-like setae; tibiae with dense distribution of elongate setae, intermixed with two rows of tibial spinules (Fig. 10f).

STRUCTURE: ***Head:*** eyes large, subequal in length to head (Fig. 10a); vertex smooth; bucculae narrow, ovate, not reaching anteniferous tubercles (Fig. 10c). ***Labium:*** extending to metathorax. ***Pronotum:*** calli present (Fig. 10a); foveae narrowly separated (Fig. 10c); posterior lobe declivent; posterior margin concave. ***Hemelytra:*** ca. 1.5x longer than abdomen, lateral margins convex; cuneus ca. 2x longer than wide. ***Male genitalia:*** Left paramere Y-shaped, sensory lobe with two rows of elongate setae; apophysis S-shaped, dorsal margin file-like towards apex, apex with a minute horizontal hook (Fig. 8c). Right paramere (Fig. 8b) small, smaller than left paramere, lobes very short, much shorter than stem; sensory lobe setae elongate; apophysis strongly concave, spoon-like with a lateral lamina, with apical comb-like flange with four teeth. Aedeagus (Fig. 8a) small, with short endosomal membranous lobe, lacking sclerotisation; proximal endosomal spicule straight, more or less parallel to ductus seminis; apically upright, margins dentate, rudus positioned subapically, perpendicular to spicule, rectangulate, distal and proximal margins subparallel; secondary gonopore elongate, surpassing rudus of proximal endosomal spicule, reaching near apex of phallotheca.

Females

Macropterous females externally similar to males. Female genitalia not investigated.

Brachypterous Females

Head strongly declivent, clypeus prominent; eyes small, not reaching anterior margin of head. Pronotum trapezoidal (Fig. 10b). Hemelytra reaching abdominal sternite V.

Uniformly covered with microtrichia.

Measurements

See Table 1.

Distribution

Cyrtorhinus albidus is only known from Guam (Fig. 9).

Biology and hosts

Unknown.

Remarks

Cyrtorhinus albidus belongs to a group of species within *Cyrtorhinus* that possess similar male genitalia, particularly the parameres (cf. Figs 8c,f,i and l). This group includes, *C. brunus*, *C. defectus*, *C. fulvus*, *C. geniculatus*, *C. indi*, *C. lividipennis*, *C. palauensis*, *C. pilosus*, *C. quatei*, *C. solomonensis* and *C. yunganensis*.

The species of this group of species exhibit minor differences in the male genitalia, including degree of sclerotisation of the endosomal membranous bag, position of the comb-like flange of the right paramere, shape and size of the apophysis of the left paramere, and shape and size of the rudus of the proximal endosomal spicule.

Due to its pallid appearance, elongate AII, prominent calli, overall shape of parameres and aedeagus, *Cyrtorhinus albidus* resembles *C. indi*; it can be distinguished from it by the following characters: absence of black markings on scutellum (cf. Figs 7a,m), apex of apophysis of left paramere hooked (cf. Figs 8c,g) and endosomal membranous bag without field of spinules (cf. Figs 8a,g).

Cyrtorhinus brunus sp. nov.

Habitus, Figure 7b. Distribution, Figure 9. Male genitalia, Figures 11a-c. SEMs, Figure 12.

Etymology

Brunus is the Latin word for brown; this species is named for its brownish appearance.

Materials examined

HOLOTYPE: **PHILIPPINES: LUZON ISLAND:** Rizal, Mount Montalban, Wawa Dam, 14.73016°N 121.185°E, 175 m, 29 Mar 1965, L.M. Torrevillas, ♂ (UNSW_ENT00044241) BPBM.

PARATYPES: **PHILIPPINES: LUZON ISLAND:** Rizal, Mount Montalban, Wawa Dam, 14.73016°N 121.185°E, 175 m, 17 Mar 1965, L.M. Torrevillas, 2♂♂ (UNSW_ENT00044257, UNSW_ENT00044258), 1♀ (UNSW_ENT00044259) (BPBM); same locality as holotype, 18 Mar 1965, H.M. Torrevillas, 1♀ (UNSW_ENT00044253), 3♂♂ (UNSW_ENT00044254-00044256) (BPBM); same locality as holotype, 29 Mar 1965, L.M. Torrevillas, 7♂♂ (UNSW_ENT00044242-00044247), 5♀♀ (UNSW_ENT00044248-00044252) (BPBM).

Diagnosis

Cyrtorhinus brunus is recognised by the following characters: macropterous only, costal margins straight (Fig. 7b); colour reddish brown with black markings (Fig. 7b); rugulose pronotum (Fig. 12d); foveae distinctly separated (Fig. 12d); labium extending to mesosternum; hemelytral margins straight (Fig. 7b); left paramere Y-shaped, apophysis sinuate (Fig. 11c); right paramere mitt-shaped, apophysis squat, with apical comb-like flange (Fig. 11b); apophysis of left paramere narrow (Fig. 7c); endosomal membranous bag lacking field of spinules (Fig. 11a); proximal endosomal spicule with small rudus (Fig. 11a).

Description

Males.

COLOURATION: Body reddish brown with black markings (Fig. 7b). ***Head:*** mostly yellow to reddish brown with black markings; vertex mostly yellow, with triangular black marking; clypeus, maxillary and mandibular plates black. ***Antennae:*** AI black, yellow stripe apically; AII yellowish brown to black, sometimes banded; AIII and AIV brown. ***Labium:*** light brown. ***Pronotum:*** anteriorly black, posterior region often uniformly dull black, occasionally with yellow midline. ***Scutellum:*** posteriorly yellowish brown with midline black; mesoscutum dull black. ***Hemelytra:*** translucent, reddish yellow to light brown, membrane with a light brown tinge. ***Thoracic pleura and sterna:*** meso- and metapleura dull black; sterna yellow. ***Legs:*** coxae yellow; yellow, black making at femur-tibia junction. ***Abdomen:*** venter yellow medially, dull black laterally; pygophore fuscous.

VESTITURE AND TEXTURE: Sparsely and uniformly covered with pale grey, semi-erect, hair-like setae and with dense mat of microtrichia. ***Head:*** hair-like setae present on margins and midline of vertex; gula, genae, and clypeus with hair-like setae, gula and genae densely covered in microtrichia (Fig. 11b). ***Antennae:*** densely covered in hair-like setae, AI with three bristle-like setae, on medial surface. ***Pronotum:*** strongly rugulose; with sparse and uniform distribution of hair-like setae (Fig. 12d), microtrichia sparse. ***Hemelytra:*** mostly with sparse distribution of setae, denser on costal margins. ***Legs:*** tibiae and femora with sparse distribution of setae; tibial spinules present.

STRUCTURE: ***Head:*** eyes large, about equal in length to head; vertex topology smooth (Fig. 12a); bucculae narrow, not reaching anteniferous tubercles anteriorly (Fig. 12c). ***Labium:*** terminates between mesocoxae. ***Pronotum:*** lateral margins and posterior margin convex (Fig. 12d); calli weakly developed, foveae narrowly separated (Fig.

12e); posterior lobe greatly declivent. ***Hemelytra:*** ca. 1.5x longer than abdomen; costal margins straight (Fig. 7b); cuneus ca. 3x longer than wide. ***Male genitalia:*** Left paramere (Fig. 11c) Y-shaped, sensory lobe with elongate setae; apophysis S-shaped, dorsal margin with minute and fine setae basally, apical surface swollen. Right paramere (Fig. 11b) reduced, smaller than left paramere, sensory lobe and apophysis short, length subequal to stem; sensory lobe with elongate setae; apophysis concave, spoon like, apical comb-like flange with four teeth. Aedeagus (Fig. 11c) small in size; endosomal membranous lobe present, lacking sclerotisation; proximal endosomal spicule straight, subparallel to ductus seminis, with margins dentate, rudus relatively small, rectangulate, distal margin concave; secondary gonopore greatly elongate, surpassing rudus, reaching near apex of phallotheca.

Females.

Macropterous only.

Externally similar to males. Female genitalia not investigated.

Measurements

See Table 1.

Distribution

Cyrtorhinus brunus is found on the island of Luzon, Philippines (Fig. 9).

Biology and hosts

Unknown.

Remarks

See remarks section of *Cyrtorhinus albidus.*

Due to its reddish colour and straight costal margins of the hemelytra, *Cyrtorhinus brunus* most closely resembles *C. fulvus* Knight, *C. defectus* sp. nov. and *C. rarus* sp. nov. It is differentiated from them by its separate pronotal foveae (Fig. 12d),

its rugulose anterior and posterior lobe of the pronotum convex (Fig. 12d) and its weakly sclerotised rudus (Fig. 11a).

Cyrtorhinus caricis Fallén

Live photograph, Figure 6. Habitus, Figure 7c. Male genitalia, Figure 13. Female genitalia, Figure 14. Distribution, Figure 15. SEMs, Figure 16.

Cyrtorhinus caricis Fallén, 1807: 102 (sp. nov.); Carvalho, 1956: 54 (catalogue; pre-1955 citations); Carvalho and Southwood, 1855: 41 (redescription); Schuh, 1995: 100-101 (world catalogue)

Cyllecoris caricis: Hahn, 1834: 100 (nov. comb.)

Capsus caricis: Sahlberg, 1868: 92 (nov. comb.)

Capsus (*Cyrtorhinus*) *caricis*: Thomson, 1871: 437 (nov. comb.)

Leptomerocoris caricis: Walker, 1873: 130 (nov. comb.)

Chlamydatus caricis: Saunders, 1875: 282 (nov. comb.)

Cyrtorhinus caricis: Sahlberg, 1875: 176 (revised genus-group status)

Capsus elegantulus: Meyer-Dür, 1843: 86 (sp. nov.); Thomson, 1871: 437 (synonymy)

Cyrtorhinus elegantulus: Fieber, 1861: 281 (nov. comb.; description)

Materials examined

UNITED KINGDOM: ENGLAND: DEVON CO.: Torquay, 50.46688°N 3.52715°W, 30 m, 22 Aug 1960, J.R. Vockeroth, 1♂ (UNSW_ENT00124136), 5♀♀ (UNSW_ENT00124142, UNSW_ENT00394975-00394978) (CNC). **CANADA: BRITISH COLOMBIA:** Unknown locality, L.A. Kelton, ex *Beckmannia* sp. (Poaceae), 2♂♂ (UNSW_ENT00124171, UNSW_ENT00394985). **ALBERTA:** Banff National Park, Banff-Jasper Hwy, 51.16666°N 115.56666°W, 1404 m, 26 Aug 1970 - 28 Aug 1970, L.A. Kelton, ex *Carex* sp. (Cyperaceae), 1♂ (UNSW_ENT00124183),

3♀♀ (UNSW_ENT00124190, UNSW_ENT00394987, UNSW_ENT00394988) (CNC). Grande Prairie, 55.16666°N 118.8°W, 26 Jul 1961, A.R. Brooks, 1♂ (UNSW_ENT00394986), 1♂ (UNSW_ENT00124180), 1♀ (UNSW_ENT00124187) (CNC).

Diagnosis

Cyrtorhinus caricis is recognised by the following characters: females usually macropterous, rarely brachypterous; large size 3.82-4.21mm; body mostly black and legs yellow (Fig. 7c); labium extending to SIII ; hemelytral margins straight (Fig. 7c); left paramere with a reduced sensory lobe (Fig. 13c); right paramere with a distal flange and reduced sensory lobe (Fig. 13b); endosomal membranous bag lacking sclerotisation (Fig. 13g); proximal endosomal spicule with a rectangulate rudus, outer margin serrate (Fig. 13g).

Description

Males.

COLOURATION: Body mostly black (Fig. 7c). ***Head:*** generally black; vertex with two pale yellow patches around eyes; clypeus black. ***Antennae:*** uniformly fuscous. ***Labium:*** yellow with a black tip. ***Pronotum:*** black. ***Scutellum:*** black. ***Hemelytra:*** translucent, sometimes green (Fig. 6) or brown; membrane brown. ***Thoracic pleura and sterna:*** meso- and metapleura and sterna black. ***Legs:*** yellow. ***Abdomen:*** venter usually black, sometimes grey.

VESTITURE AND TEXTURE: Body sparsely covered in long, semi-erect, pale grey, hair-like setae intermixed with mat of microtrichia. ***Head:*** vertex with sparsely distributed hair-like setae, forming no distinct pattern (Fig. 16a); scalelike texture present. ***Antennae:*** AI sparsely covered in hair-like setae, three thick bristle-like setae on medial surface (Fig. 16c); AII-IV densely covered in hair-like setae. ***Pronotum:***

smooth; setae uniformly small, sparsely distributed; microtrichia sparsely distributed (Fig. 16f). ***Hemelytra:*** sparse and uniform distribution of hair-like setae; microtrichia sparsely distributed. ***Legs:*** femora with sparse distribution of hair-like setae; tibiae with dense distribution of spinules.

STRUCTURE: ***Head:*** vertex smooth (Figure 16a); bucculae broad, heart-shaped, reaching anteniferous tubercles anteriorly (Fig. 16b); eyes large, subequal in length to head. ***Labium:*** reaching abdominal SIII. ***Pronotum:*** lateral margins and posterior margin convex; calli shallow, foveae separated; posterior lobe declivent. ***Hemelytra:*** costal margins straight (Fig. 7c); cuneus ca. 1.5 x longer than wide (Fig. 16e). ***Male genitalia:*** Left paramere (Fig. 13c) hook-shaped, sensory lobe reduced, resembling a large lump; apophysis strongly sinuate, narrowing apically, dorsal margin with file-like texture apically. Right paramere (Fig. 13b) spoon-shaped, sensory lobe reduced to a small lump; apophysis strongly concave, spoon like, with distal flange, and four teeth. Aedeagus (Figs 13f-g) large, endosomal membranous bag sclerotisation absent; proximal endosomal spicule diverging from ductus seminis, apically sinuate, with margins weakly dentate, apical teeth absent, rudus strongly pronounced and subrectangulate; secondary gonopore moderately elongate, extending to ca. ¾ length of proximal endosomal spicule.

Females.

Usually macropterous, rarely brachypterous.

Macropterous females.

External morphology as in males. ***Female genitalia:*** left and right plates of gonapophyses 8 (Fig. 14) simple, almost symmetrical, moderately sclerotised; vestibulum narrow; inter-ramal sclerite much longer than inter-ramal lobes; inter-ramal lobes simple, glove like, uniformly spiculate, originating near base of inter-ramal

sclerite.

Brachypterous females.

Mostly resemble macropterous specimens with following exception: STRUCTURE: ***Head:*** eyes smaller, about ¾ size of head. ***Pronotum:*** calli weakly developed; foveae narrowly separated; posterior lobe more weakly declivent towards head, less emarginate posteriorly, overall almost trapezoidal. ***Hemelytra:*** extending to abdominal tergite 6; membrane absent.

Measurements

See Table 1.

Distribution

Cyrtorhinus caricis is widely distributed across the Palaearctic region, with records as far west as England and as far east as Japan (Fig. 15). The southernmost records include those within Anatolia and the northernmost are in Scandinavia. It has been introduced into the northeast of the United States (Wheeler and Henry 1992, Kelton 1980b) and has spread across North America. Distribution of the species is also given in Schuh (2002-2013).

Biology and hosts

Leston (1961) recorded *Cyrtorhinus* from *Juncus* sp. (Juncuceae). Kelton (1980a,b) and Yasunaga (1999) recorded this species from *Carex* sp. (Cyperaceae). Specimens examined also show plant associations with *Beckmannia* sp. (Poaceae), *Lupinus parviflorus* (Fabaceae) and *Typha* sp. (Typhaceae).

Remarks

As with many mirids described in the early 19th century, *Cyrtorhinus caricis* was first placed in the genus *Capsus* Fabricius, 1803. Meyer-Dür (1843) described *Capsus elegantulus* without having examined *Capsus caricis.* This species was then renamed

Capsus chloropterus by Herrich-Schaeffer (1853). Walker (1873) proposed the name *Leptomerocoris caricis* and *Leptomerocoris elegantulus* for *Capsus caricis* and *Capsus elegantulus* respectively, placing them in a genus with several other species including *Leptomerocoris ambulans* (now *Mecomma ambulans*). It was redescribed and designated as *Chlamydatus caricis*. *Cyrtorhinus* was first described by Fieber (1858), who designated *C. caricis* as the type species. *Capsus elegantulus* and *Capsus chloropterus* were synonymised with *Cyrtorhinus caricis* by Salhberg (1868).

Cyrtorhinus caricis is the most basal member of *Cyrtorhinus*, based on both its internal and external morphology. It is also recognisable due to its large size, reduced sensory lobe of the left paramere (Fig. 13c) and reduced sensory lobe of the right paramere (Fig. 13b). Due to its black colour, very sparse vestiture, elongate antennae and large parameres, *C. caricis* most closely resembles *C. melanops* and *C. caricisoides*.

This study makes use of a small proportion of museum specimens of *C. caricis* from a wide range of areas; however the full variation within the species has not have been described in this chapter because of a lack of material. Previous descriptions of *C. caricis* (Wagner 1974, Yasunaga 1999) do not discuss in any great deal variation within the species.

***Cyrtorhinus caricisoides* Ghauri 1970**

Habitus, Figure 7d. Male genitalia, Figure 17a-c. Distribution, Figure 18. SEMs, Figure 19.

Cyrtorhinus caricisoides Ghauri, 1970: 104 (sp. nov.); Schuh 1995: 100-101 (world catalogue)

Materials examined

HOLOTYPE: **MADAGASCAR: FIANARANTSOA:** Centre Ice de Tananarive, Station Antoicabe, 18.11667°S 49.01667°E, 382 m, Jun 1962, J. Laurent, *Lotus* sp. (Fabaceae), Holotype, ♂ (BMNH). Type examined.

PARATYPES: **MADAGASCAR: CENTRE ICE DE TANANARIVE:** Station Antoicabe, 18.11667°S 49.01667°E, 382 m, Jun 1962, J. Laurent, *Lotus* sp. (Fabaceae), 1♂ (UNSW_ENT00085413) (BMNH).

Other Specimens Examined

MADAGASCAR: FIANARANTSOA: 7 km W Ranomafana, 110 m, 08 Oct 1988 - 21 Oct 1988, W. E. Steiner, 1♂ (UNSW_ENT00192657), 1♀ (UNSW_ENT00192658) (USNM).

Diagnosis

Cyrtorhinus caricisoides is recognised by the following characters: macropterous only; venter predominately dark red; small size; labium reaching just beyond mesocoxae; hemelytral margins weakly convex (Fig. 7d); left paramere with a greatly reduced sensory lobe (Fig. 17c); right paramere with a apical sensory lobe and reduced sensory lobe (Fig. 17b); endosomal membranous bag without sclerotisation; proximal endosomal spicule divergent from the ductus seminis, rudus rectangulate, margins weakly dentate (Fig. 17a).

Description

Males.

COLOURATION: Body fuscous (Fig. 7d). ***Head:*** Generally fuscous; clypeus and vertex black, small pale yellow patches adjacent to eyes; maxillary and mandibular plates reddish brown. ***Antennae:*** AI black, pale yellow apically; AII pale yellow; AIII

black, pale yellow proximally; AIV black. ***Labium:*** pale yellow. ***Pronotum:*** uniformly black. ***Scutellum:*** black; mesoscutum brown. ***Hemelytra:*** translucent and glassy; membrane with a light brownish tinge. ***Thoracic pleura and sterna:*** meso- and metapleura black with dark red highlighting; thoracic sterna dark red. ***Legs:*** pale yellow. ***Abdomen:*** venter black with dark red highlighting.

VESTITURE AND TEXTURE: Uniformly covered in thick, small, pale grey, hair-like setae; uniformly covered with minute microtrichia. ***Head:*** dense distribution of hair-like setae on vertex, setae absent around eyes (Fig. 19a) and on maxillary and mandibular plates (Fig. 19b); scale-like texture on vertex (Fig. 19a). ***Antennae:*** AI with three bristle-like setae on medial surface; AII-AIV, with dense distribution of hair-like setae. ***Hemelytra:*** sparse distribution of hair-like setae. ***Pronotum:*** smooth (Fig. 19c); uniform distribution of hair-like setae; microtrichia sparsely distributed. ***Legs:*** femora with sparse distribution of hair-like setae (Fig. 19f); tibiae with dense distribution of hair-like setae (Fig. 19f); tibial spinules present.

STRUCTURE: ***Head:*** eyes large, about equal in length to head (Fig. 19a); vertex with weak depression laterally; bucculae narrow, rounded, reaching anteniferous tubercles anteriorly (Fig. 19b). ***Labium:*** extending to metathorax. ***Pronotum:*** lateral margins weakly convex; posterior margin convex; calli weakly developed (Fig. 19c); foveae narrowly separated (Fig. 19c); posterior lobe declivent towards head. ***Hemelytra:*** costal margins weakly convex; cuneus ca. 1.5x longer than wide. ***Male genitalia:*** Left paramere hook-shaped, apophysis not sinuate, dorsal margin without file-like texture, apex hooked, (Fig. 17c). Right paramere small, lobes short, length subequal to stem; sensory lobe reduced; apophysis concave, spoon like, lateral margins weakly sinuate, dentate flange with two teeth (Fig. 17b). Aedeagus large, endosomal membranous bag small, without field of spinules; proximal endosomal spicule divergent from ductus

seminis, apically sinuate, rudus subrectangulate; secondary gonopore moderately elongate (Fig. 17a).

Females.

Macropterous only.

Externally similar to males. Female genitalia not investigated.

Measurements

See Table 1.

Distribution

Cyrtorhinus caricisoides is endemic to eastern Madagascar (Fig. 8).

Biology and hosts

Cyrtorhinus caricisoides has been collected from *Lotus* sp. (Fabaceae).

Remarks

Due to its overall blackish appearance, very sparse vestiture, elongate antennae and large parameres, *Cyrtorhinus caricisoides* resembles *C. caricis* and *C. melanops* but can be distinguished from them by their smaller size, dark red abdominal venter (black in the other species) and reduced left paramere sensory lobe (Fig. 17a).

It also superficially resembles *Mecomma* spp. but can be distinguished from it by the following characters: pronotum campanulate; single endosomal spicule; endosomal membranous bag present; left paramere Y-shaped, right paramere bilobed, flange present on apophysis.

***Cyrtorhinus carvalhoi* Woodward**

Habitus, Figure 7e. Distribution, Figure 9. Male genitalia, Figure 20. Female genitalia, Figure 21. SEMs, Figure 22.

Cyrtorhinus carvalhoi Woodward, 1957: 97 (sp. nov.); Schuh 1995: 100. (world catalogue)

Materials examined

Holotype of the same locality as paratypes, not databased. Examined in Bernice P. Bishop Museum.

PARATYPES: **PAPUA NEW GUINEA: WESTERN HIGHLANDS:** Daulo Pass, 5.87792°S 145.08557°E, 2192 m, 20 Jun 1956 - 22 Jun 1956, T.E. Woodward, 3♂♂ (UNSW_ENT00315516-00315518) (USNM).

OTHER SPECIMENS EXAMINED: **PAPUA NEW GUINEA: CHIMBO PROVINCE:** Gomanigu Valley, 3m. SW Mt. Otto, 5.7955°S 144.60368°E, 1555 m, 16 Sep 1956 - 18 Sep 1956, T.E. Woodward, 2♂♂ (UNSW_ENT00315519, UNSW_ENT00315520) (USNM). Keglsugl, 2700 m, 01 Aug 1969 - 07 Aug 1969, Y. Hirashima, 2♂♂ (UNSW_ENT00046595, UNSW_ENT00046596) (USNM); 08 Aug 1969 - 14 Aug 1969, Y. Hirashima, 1♂ (UNSW_ENT00046597) (USNM). **EASTERN HIGHLANDS:** Aiyura, 1600 m, 09 Jun 1966, J.L. Gressitt, 2♂♂ (UNSW_ENT00046604, UNSW_ENT00046605) (BPBM). Daulo Pass, 13 Jun 1955, J.L. Gressitt, 2♂♂ (UNSW_ENT00046602, UNSW_ENT00046603) (BPBM); 04 Jul 1957, E. Hardy, 4♂♂ (UNSW_ENT00046598-00046601) (BPBM). North East Sinofi 30 km South of Kainantu, 01 Oct 1959 - 06 Oct 1959, T.C. Maa, 11♂ (UNSW_ENT00044188-00044198) (BPBM). **MOROBE PROVINCE:** Arabuka, 07 Jan 1968, J. and M. Sedlacek, 2♂♂ (UNSW_ENT00046443, UNSW_ENT00046444) (BPBM). Mount Kaindi, 7.35°S 146.68333°E, 2350 m, 07 Jun 1971, Tawi, 1♀ (UNSW_ENT00046441) (BPBM); 24 Mar 1966, J.L. Gressitt, 1♂ (UNSW_ENT00046437) (BPBM); 21 May 1967, J.L. Gressitt, 1♂ (UNSW_ENT00046439) (BPBM); 09 Aug 1971, Tawi, 1♂ (UNSW_ENT00046442) (BPBM); 07 Apr 1966, J.L. and M. Gressitt, 6♂♂ (UNSW_ENT00046430-00046435) (BPBM); 06 Sep 1971, W.C. Gagne, (Poaceae), 20♂♂ (UNSW_ENT00046408-00046427), 2♀♀ (UNSW_ENT00046428,

UNSW_ENT00046429) (BPBM); 19 Aug 1965, J. M. Sedlacek, 1♂ (UNSW_ENT00046436) (BPBM); 01 Mar 1968 - 07 Mar 1968, T.C. Maa, 1♂ (UNSW_ENT00046438) (BPBM); 01 May 1968 - 31 May 1968, N.L.H. Krauss, 1♂ (UNSW_ENT00046440) (BPBM); 18 Sep 1972, G.G.E. Scudder, 39♂♂ (UNSW_ENT00043299-00043337), 3♀♀ (UNSW_ENT00043338-00043340) (BPBM); 11 Dec 1976, G.F. Hevel and R. E. Dietz IV, 5♂♂ (UNSW_ENT00185701-00185705), 4♀♀ (UNSW_ENT00185706-00185709) (USNM). SW slope of Mt. Missim nr. Bulolo Gorge, 1100 m, 05 Sep 1971, W.C. Gagne, ex Poaceae, 1♂ (UNSW_ENT00046463) (BPBM). **WESTERN HIGHLANDS:** Daulo Pass, 5.87792°S 145.08557°E, 2192 m, 05 Jul 1957, E. Hardy, 3♂♂ (UNSW_ENT00046460-00046462) (BPBM). Kubor Ra., 2350 m, 23 May 1966, J.L. Gressitt, 3♀♀ (UNSW_ENT00046453-00046455), 4♂♂ (UNSW_ENT00046456-00046459) (BPBM). Kubor Range, 22 May 1966, J.L. Gressitt, ex Poaceae, 8♂♂ (UNSW_ENT00046445-00046452) (BPBM).

Diagnosis

Cyrtorhinus carvalhoi is recognised by the following combination of characters: females usually macropterous, rarely brachypterous; labium not reaching mesocoxae; hemelytral margins straight (Fig. 7e); apex of apophysis of left parameres with a smooth shape; sensory lobe simple cylindrical (Fig. 20c); right paramere flange dorsally oriented, apophysis elongate (Fig. 20b); endosomal membranous bag lacking sclerotisation; proximal endosomal spicule straight, rudus of endosomal spicule bulbous basally (Figs 20d-g).

Description

Males.

COLOURATION: Body black (Fig. 7e). ***Head:*** generally black; vertex black with

faint yellow patches around eyes; clypeus black; maxillary and mandibular plates brown. ***Antennae:*** dark brown to black. ***Labium:*** fuscous. ***Pronotum:*** uniformly dark brown to black. ***Scutellum:*** dark brown to light yellowish brown. ***Hemelytra:*** colourless; membrane with a brownish tinge. ***Thoracic pleura and sterna:*** meso- and metapleura and sterna dull black to dark brown; metathoracic gland with a yellow patch. ***Legs:*** femora yellow; tibiae and pretarsus brown. ***Abdomen:*** venter black.

VESTITURE AND TEXTURE: Body with sparse distribution of small, semi-erect, pale grey, hair-like setae intermixed with microtrichia. ***Head:*** hair-like setae present along vertex fringes, one paired setae present on the midline (Fig. 22a); scale-like texture present; otherwise setae generally sparse (Fig. 22a); genae microtrichia absent. ***Antennae:*** densely covered in small semi-erect hair-like setae (Fig. 22c); AI with one thick bristle-like setae on dorsal and two on lateral surface (Fig. 22c). ***Pronotum:*** smooth; hair-like setae sparse, small; microtrichia very small and sparse. ***Hemelytra:*** hair-like setae fairly dense; evenly distributed. ***Legs:*** hair-like setae sparse, slightly denser on tibia; tibial spinules present, grossly elongate alternating tibial setae present (Fig. 22e).

STRUCTURE: ***Head:*** eyes large, about equal in length to head (Fig. 22a); vertex topology smooth (Fig. 22a); bucculae small, rounded, not reaching anteniferous tubercles anteriorly (Fig. 22b). ***Labium:*** surpassing the forecoxae but not reaching mesocoxae. ***Pronotum:*** calli weakly expressed, in a weakly depressed cavity; foveae separate; posterior margin strongly concave. ***Hemelytra:*** costal margins straight; cuneus ca. 3x longer than wide. ***Male genitalia:*** Left paramere Y-shaped (Fig. 20a); sensory lobe with elongate setae; apophysis sinuate, dorsal margin with file-like subapical, apex simple. Right paramere (Fig. 20b) large, lobes elongate, ca. 2x longer than stem; sensory lobe setae elongate, each with prominent base; apophysis straight, with dorsally

oriented flange, with five teeth. Aedeagus (Figs 20d-g) large, endosoma ca. 0.4mm in length; with short endosomal membranous bag, lacking sclerotisation; proximal endosomal spicule straight, slightly divergent from ductus seminis, apically upright, with margins dentate; rudus positioned apically, elongate ca. 0.1 mm in length, spear tip-shaped; secondary gonopore elongate, reaching rudus of proximal endosomal spicule, reaching near apex of phallotheca.

Females

Usually macropterous, rarely brachypterous.

Macropterous females.

Externally similar to males. ***Female genitalia:*** left and right plates of gonapophyses 8 (Fig. 21; GP8rpl, GP8lpl) simple, almost symmetrical, moderately sclerotised; vestibulum broad, positioned at midline; inter-ramal sclerite much longer than inter-ramal lobe (Fig. 21, IRS, IRL); inter-ramal lobes bifurcate, with a broad base, and free longer lobe, moderately spiculate, originating near base of inter-ramal sclerite.

Brachypterous females.

Head: eyes reduced; clypeus more prominent anteriorly. ***Pronotum:*** posterior margin strongly concave. ***Hemelytra:*** cuneus greatly reduced; membrane reduced to small rim, cells absent (Fig. 22f).

Measurements

See Table 1.

Distribution

Cyrtorhinus carvalhoi is found at high altitudes (>1000m) in New Guinea (Fig. 9).

Biology and hosts

Several specimens of *C. carvalhoi* have been associated with unidentified grasses and forest understory.

Remarks

Cyrtorhinus carvalhoi is closely related to *C. novabritannia,* and is almost indistinguishable externally. The striking difference in their genitalia (Figs 17g-i, 20b-g) has led me to consider them as separate species. These two species fall into a group with *C. eylesi, C. dimorphus* and *C. melanops* based on similarities in the parameres, most notable the size of the lobes on the right paramere (Fig. 20b). The differences between members of this group are more obvious than those of the *C. lividipennis* - *C. fulvus* group. *Cyrtorhinus carvalhoi* and *C. novabritannia* superficially resembles some Southeast Asian species of *Mecomma* more closely than any other species of *Cyrtorhinus*, but the male genitalia of the latter two species place it firmly within the latter genus.

Cyrtorhinus cumberi Woodward

Habitus, Figure 7e. Distribution, Figure 9. Male genitalia, Figure 17d-f. SEMs, Figure 23.

Cyrtorhinus cumberi Woodward, 1950: 923 (sp. nov.); Carvalho 1958: 54; Eyles 2005: 192, pl. 1, figs 23-25

Materials examined

NEW ZEALAND: HAWKE'S BAY: Elsthorpe Scenic Reserve, 39.9125°S 176.82083°E, 300 m, 25 Jan 1998, L. Larivière, 2♂♂ (UNSW_ENT00404622, UNSW_ENT00404623), 2♀♀ (UNSW_ENT00404624, UNSW_ENT00404625) (NZAC).

Diagnosis

Cyrtorhinus cumberi can be recognised by the following combination of characters: females usually macropterous, sometimes brachypterous; reduced bucculae (Fig. 23b);

labium reaching mesocoxae; hemelytral margins weakly convex (Fig. 7e); black tibial spinules; left paramere sensory lobe elongate, apophysis sinuate (Fig. 17f); right paramere lobe subequal to stem (Fig. 17e); endosomal membranous bag lacking sclerotisation; proximal endosomal spicule weakly sinuate, irregularly shaped rudus (Fig. 17d).

Description

Males.

COLOURATION: Body green and yellow (Fig. 7e). ***Head:*** generally yellow to yellowish green; vertex yellow, sometimes black or brown marking anteriorly or posteriorly, not joined, otherwise uniformly black. ***Antennae:*** AI green to yellow; AII-AIV light to dark brown, sometimes with yellow highlighting. ***Labium:*** fuscous. ***Pronotum:*** anterior region black, with yellow highlighting or yellow with black highlighting; posterior region yellow. ***Scutellum:*** yellow with black or green highlighting, sometimes with both. ***Hemelytra:*** green with yellow highlighting; membrane transparent. ***Thoracic pleura and sterna:*** meso- and metapleura and sterna yellow. ***Legs:*** green to pale yellow. ***Abdomen:*** venter yellow.

VESTITURE AND TEXTURE: Sparsely covered in simple, decumbent, hair-like setae intermixed with dense distribution of microtrichia. ***Head:*** setae pale, large, mostly erect; vertex decumbent hair-like setae present on midline and posterior margin; frons with patches of hair-like setae (Fig. 23a). ***Antennae:*** covered in small dark semi-erect hair-like setae; single large thick bristle-like setae interior surface (Fig. 23c). ***Pronotum:*** smooth; setae very small and sparse; microtrichia sparse. ***Hemelytra:*** hair-like setae decumbent, sparse, small, pale. ***Legs:*** hair-like setae dark, thick, erect; tibial spinules present; elongate tibial setae present in an alternating pattern.

STRUCTURE: ***Head:*** eyes large, about equal in length to head (Fig. 23a); vertex

topology smooth (Fig.23a); bucculae small, rounded, not reaching anteniferous tubercles anteriorly (Fig. 23b). ***Labium:*** reaching mesosternum. ***Pronotum:*** calli prominent (Fig. 23c); foveae weakly separated; anterior lobe lateral margin convex; posterior lobe lateral margin concave, strongly declivent; posterior margin concave. ***Hemelytra:*** lateral margins weakly convex; cuneus ca. 2x longer than wide; ca. 1.5x longer than abdomen. ***Male genitalia:*** Left paramere (Fig. 17f) Y-shaped; sensory lobe with dense distribution of setae; apophysis sinuate, apex simple, file-like texture on dorsal surface; right paramere (Fig. 17e) with lobes short, subequal in length to stem, sensory lobe concave, setae elongate; apophysis narrow, bulging on dorsal, flange with five teeth. Aedeagus (Fig. 17d) small in size, endosoma ca. 0.4 mm in length; endosomal membranous bag lacking sclerotisation; spicule weakly sinuate, apically upright, margins dentate; rudus positioned subapically, ca. 0.04mm in length, perpendicular to the spicule strongly pronounced and irregularly shaped, proximal margin concave, apical margin tapering; secondary gonopore twisted, elongate, reaching rudus.

Females.

Macropterous or brachypterous

Macropterous females.

Externally similar to males. Female genitalia not investigated.

Brachypterous females.

Eyes weakly reduced in size; posterior lobe of the pronotum flat. ***Hemelytra:*** reduced, only covering abdominal tergites 5-6, margins strongly convex; membrane present but greatly reduced; without cells.

Measurements

See Table 1.

Distribution

Cyrtorhinus cumberi has been found in many localities on New Zealand's North Island and in Southland on the South Island (Fig. 9).

Biology and Hosts

Eyles (2005) recorded *Carex* sp. and *Scriptus* sp. as hosts. Both these genera belong to the Cyperaceae.

Remarks

Cyrtorhinus cumberi is the basal member of the group that includes *C. lividipennis* and *C. fulvus*. It is one of two New Zealand species of *Cyrtorhinus* which are members of different clades. There is a major difference in genitalia of *C. cumberi* and *C. eylesi* which led Eyles (1996) to erect a new genus for *C. eylesi.* In particular the rudus, which Eyles (1996) called a flared 'fish tail', is significantly different. The lobes of the right paramere are also radically different sizes. Both of these variations occur elsewhere within the genus. Records from the literature indicate that *C. cumberi* is more common on the North Island of New Zealand, whereas *C. eylesi* is more common on the South Island, however both are found on both the major islands of New Zealand.

Due to its green and yellow colouration with black markings and body shape *Cyrtorhinus cumberi* most closely resembles *Cyrtorhinus quatei* and *C. lividipennis*. It can be distinguished from the latter two species by the reduced bucculae (Fig. 23b), black tibial spinules and shape of the rudus (Fig. 17d).

Cyrtorhinus defectus sp. nov.

Habitus, Figure 7h. Distribution, Figure 9. Male genitalia, Figure 11d-f. SEMs, Figure 24.

Etymology

Defectus in Latin can means worn out or tired. Its name comes from the fact that its reddish colouration is duller than that of *C. fulvus* and *C. rarus*.

Materials Examined

HOLOTYPE: **PAPUA NEW GUINEA: CENTRAL PROVINCE:** Mt. Dayman Maneau Range, 700 m, 27 Jul 1953 - 12 Aug 1953, G.M. Tate, ♂ (UNSW_ENT00043348) (BPBM).

PARATYPES: **INDONESIA: PAPUA:** Nabire, 3.36333°N 135.49944°E, 50 m, 25 Jul 1962 - 02 Sep 1962, H. Holtmann, 1♀(AMNH_PBI 00046994) (BPBM); 25 Jul 1962 - 02 Sep 1962, J. Sedlacek, 1♂ (AMNH_PBI 00046992), 1♀(AMNH_PBI 00046993) (BPBM). Tolikara: Swart Valley: Karubaka, 3.68361°N 138.48806°E, 1400 m, 21 NOV 1958, J. L. Gressitt, Light Trap, 1♀(AMNH_PBI 00047003) (BPBM). **PAPUA NEW GUINEA: CENTRAL PROVINCE:** Mt. Dayman Maneau Range, 700 m, 27 Jul 1953 - 12 Aug 1953, G. M. Tate, 2♂♂ (AMNH_PBI 00043348, AMNH_PBI 00043349), 2♀♀ (AMNH_PBI 00043350, AMNH_PBI 00043351) (BPBM). **CHIMBO PROVINCE:** N. Guinea, Chuave, 6.12°S 145.12668°E, 08 Apr 1968 - 14 Apr 1968, J.L. Gressitt and T.C. Maa, 2♀♀(AMNH_PBI 00046995, AMNH_PBI 00046996) (BPBM). **MILNE BAY PROVINCE:** D'Entrecasteaux Island *Co.:* Agamoia, Fergusson Isl., 200 m, 18 Jun 1956 - 24 Jun 1956, L. J. Brass, 2♀♀(AMNH_PBI 00043356, AMNH_PBI 00043357) (BPBM). Rossel Island, Abaleti, 0-50 m, 11.34999°S 154.14999°E, 01 Oct 1956 - 09 Oct 1956, L. J. Brass, 1♀ (AMNH_PBI 00043358) (BPBM). Baiawa, Moi Biri Bay, 9.6°S 149.45°E, 30 m, 08 May 1953 - 11

May 1953, G. M. Tate, 1♀♀(AMNH_PBI 00043359) (BPBM). Biniguni, Gwariu River, 9.6667°S 149.2667°E, 150 m, 27 Jul 1953 - 14 Aug 1973, G. M. Tate, 2♂♂ (AMNH_PBI 00043346, AMNH_PBI 00043347) (BPBM). **MOROBE PROVINCE:** Mt. Missim, 7.1167°S 146.9167°E, 1600 m, 23 Mar 1978, W. C. Gagne, 1♀♀(AMNH_PBI 00047001) (BPBM). Wau, 7.3333°S 146.71667°E, 1200 m, 10 NOV 1964, J. and M. Sedlacek, 1♀♀(AMNH_PBI 00047000) (BPBM). **NEW BRITAIN PROVINCE:** Malmalwan-Vunakanau, Gazelle Pen., 4.6667°S 152°E, 05 Apr 1956 - 12 Apr 1956, J. L. Gressitt, 3♂♂ (AMNH_PBI 00046981-AMNH_PBI 00046983), 8♀♀(AMNH_PBI 00046984-AMNH_PBI 00046991), Light Trap, 4♀♀(AMNH_PBI 00044235-AMNH_PBI 00044238), 1♂ (AMNH_PBI 00044239) (BPBM). Northern Province: Kokoda, 8.6°S 147.2°E, 366 m, 15 Nov 1965 - 20 Nov 1965, J. and M. Sedlacek, 1♂ (AMNH_PBI 00047002) (BPBM). Unknown: Peria Creek, Kwagira River, 50 m, 14 Aug 1953 - 06 Sep 1953, G. M. Tate, 4♀♀ (AMNH_PBI 00043352-AMNH_PBI 00043355) (BPBM). **SOLOMON ISLANDS: GUADALCANAL:** 17.6 km SE. Tetere, Tathimani, 9.54585°S 160.32999°E, 12 May 1960, C. W. O'Brien, 1♂ (AMNH_PBI 00046999) (BPBM). Santa Ysabel: Buala, 8.16624°S 159.61898°E, 20 Aug 1964, R. Straatman, 1♀(AMNH_PBI 00046998) (BPBM). Molao, 8.47°S 159.62°E, 29 Jun 1960, C. W. O'Brien, 1♀(AMNH_PBI 00046997) (BPBM).

Diagnosis

Cyrtorhinus defectus can be recognised by the following combination of characters: females always macropterous; gula and genae densely covered in microtrichia (Fig. 24b); foveae separate (Fig. 24c); black hemelytral membrane (Fig. 7h); labium reaching metacoxae; hemelytral margins convex (Fig. 7h); apophysis of left parameres with a minute folk apically; left paramere Y-shaped, apophysis sinuate (Fig. 11f); right paramere mitt-shaped, apophysis squat, with apical comb-like flange (Fig. 11e);

endosomal membranous bag with a field of minute spinules; proximal endosomal spicule straight, rudus spear-shaped, margins dentate (Fig. 11d).

Description

Males.

COLOURATION: Body red with black markings (Fig. 7h). ***Head:*** generally red with distinct black markings; vertex red with a distinct black shape medially; clypeus black; maxillary and mandibular plates yellow. ***Antennae:*** AI black, yellow band at joints; AII black with yellow bands; AIII and AIV uniformly black. ***Labium:*** labium fuscous. ***Pronotum:*** anterior black, calli sometimes red; pronotum posterior black with a yellow line medially. ***Scutellum:*** orange, black lines medially and laterally; mesoscutum black. ***Hemelytra:*** red, barely translucent; membrane black tinge. ***Thoracic pleura and sterna:*** pleura black, sterna red. ***Legs:*** red to orange. ***Abdomen:*** red.

VESTITURE AND TEXTURE: Generally covered in very sparse, pale grey, erect, hair-like setae (Fig. 24d). ***Head:*** very sparse short hair-like setae (Fig. 24a); vertex posteriorly rugulose (Fig. 24a); gula and genae densely covered in microtrichia. ***Antennae:*** dense, semi decumbent hair-like setae; AI with three laterally oriented large thick bristle-like setae. ***Pronotum:*** anterior lobe rugulose; anterior lobe setae sparse, posterior lobe setae absent medially (Fig. 24c); microtrichia sparse. ***Legs:*** dense hair-like setae; tibial spinules two columns present. ***Hemelytra:*** with a dense semi-erect fringe.

STRUCTURE: ***Head:*** eyes large, about equal in length to head (Fig. 24 a); vertex topology smooth (Fig. 24a); bucculae broad, ovate, not reaching anteniferous tubercles anteriorly (Fig. 24b). ***Labium:*** terminates between metacoxae. ***Pronotum:*** anterior lobe lateral margin convex, calli prominent (Fig. 24c); foveae narrowly separated (Fig. 24c); posterior lobe greatly declivent, lateral margin concave, posterior margin greatly

concave (Fig. 24c). ***Hemelytra:*** about 1.5x size of abdomen; lateral margins convex; cuneus about 2x longer than wide. ***Male genitalia:*** Left paramere (Fig. 11f) Y-shaped; sensory lobe with elongate setae; apophysis sinuate, apex with a minute fork terminally, file-like texture on vertical surface. Right paramere (Fig. 11e) small, lobes very short, much shorter than stem; sensory lobe bulging posteriorly, setae elongate; apophysis concave with a prominent medial ridge, with an apical flange with three teeth. Aedeagus (Fig. 11d) small in size, endosoma surpassing 0.2mm in length; endosomal membranous bag present, lacking teeth; proximal endosomal spicule straight, more or less parallel to ductus seminis; apically upright, with margins dentate, rudus positioned subapically, ca. 0.03 mm in length, perpendicular to spicule, strongly pronounced and spear-shaped, proximal margin sinuate, apical margin tapering; secondary gonopore elongate, surpassing rudus of proximal endosomal spicule, reaching near apex of phallotheca.

Females.

Macropterous only.

Externally similar to males. Female genitalia not investigated.

Measurements

See Table 1.

Distribution

Cyrtorhinus defectus is found in the highlands of New Guinea and surrounding islands (Fig. 9).

Biology and Hosts

Hosts unknown. Several specimens have been collected at light.

Remarks

See remarks section of *Cyrtorhinus albidus.*

Due to its overall reddish colouration and its straight hemelytral margins (Fig. 7h) *Cyrtorhinus defectus* resembles *C. fulvus*, *C. brunus* and *C. rarus* but can be differentiated by the following combination of characters: distinctly separate pronotal foveae (Fig. 24c), labium reaching metacoxae and the dense microtrichia on the gula and genae (Fig. 24b).

Cyrtorhinus dimorphus Linnavuori

Habitus, Figure 7i. Distribution, Figure 18. Male genitalia, Figure 25a-c. SEMs, Figure 26.

Cyrtorhinus dimorphus Linnavuori, 1994: 56, figs 33, 35, Schuh 1995: 101

Materials examined

Holotype not examined. Paratypes from the same series examined.

PARATYPES: **ETHIOPIA: OROMIA:** Suluta, 11 Jun 1963, Linnavuori, 4♀♀ (UNSW_ENT00192641, UNSW_ENT00192642, UNSW_ENT00192685, UNSW_ENT00192686), 16♂♂ (UNSW_ENT00192643-00192656, UNSW_ENT00192687, UNSW_ENT00192688) (USNM).

Diagnosis

Cyrtorhinus dimorphus can be recognised by the following combination of characters: females always brachypterous; antennae uniformly greenish brown (Fig. 7i); labium reaching mesosternum; hemelytral margins straight (Fig. 7i); left paramere Y-shaped, apophysis sinuate (Fig. 25c); right paramere mitt-shaped, apophysis elongate, with apical comb-like flange (Fig. 25b); endosomal membranous bag with a field of minute spinules; proximal endosomal spicule straight, apex clavate; rudus triangulate, margins dentate (Fig. 25a).

Description

Males.

COLOURATION: Body light green (Fig. 7i). ***Head:*** generally green; vertex light green, sometimes brownish, pale yellow around eyes, joined posteriorly; clypeus brown; maxillary and mandibular plates brown or green. ***Antennae:*** AI-AIV greenish brown, yellow at AI-AII joint. ***Labium:*** light brown. ***Pronotum:*** anterior yellow; posterior green; propleura brown. ***Scutellum:*** green; mesoscutum yellow. ***Hemelytra:*** pale translucent green; membrane brown. ***Thoracic pleura and sterna:*** meso and metapleura yellow; sterna pale yellow. ***Legs:*** green. ***Abdomen:*** abdominal venter yellow.

VESTITURE AND TEXTURE: Generally dark, decumbent, hair-like setae. ***Head:*** setae long, hair-like, very sparse dorsally, not present in occipital lobes (Fig. 26a); gula and genae microtrichia absent. ***Antennae:*** setae fine, dense erect; three thick bristle-like setae oriented laterally. ***Pronotum:*** smooth; hair-like setae evenly distributed; microtrichia dense. ***Hemelytra:*** evenly distributed hair-like setae. ***Legs:*** dense larger hair-like setae; tibial spinules absent (Fig. 26c).

STRUCTURE: ***Head:*** eyes large, about equal in length to head (Fig. 26a); vertex topology smooth; bucculae broad, ovate, reaching anteniferous tubercles anteriorly. ***Labium:*** extending to mesosternum. ***Pronotum:*** calli weakly developed; foveae narrowly separated; lateral margins convex; posterior lobe strongly declivent towards head, lateral margins concave; posterior margin concave. ***Hemelytra:*** lateral margins straight; cuneus ca. 1.5x longer than wide. ***Male genitalia:*** Left paramere (Fig. 25c) Y-shaped; sensory lobe with dense large disordered setae; apophysis sinuate, apex simple, file-like texture subapical. Right paramere (Fig. 25b) lobes short, length sub equal to stem; sensory lobe weakly concave, setae elongate with prominent base; apophysis concave, flange with four teeth. Aedeagus (Fig. 25a), endosoma ca. 0.4 mm in length;

endosomal membranous bag absent; spicule uniformly curved, with margins dentate, apex clavate; rudus positioned subapically, ca. 0.04mm in length, perpendicular to spicule, strongly pronounced and triangulate; secondary gonopore elongate, reaching rudus.

Females.

Brachypterous ♀♀ only.

Head: Eyes large, about equal in size to head (Fig. 26b). ***Labium:*** extending to 2nd abdominal sternite. ***Pronotum:*** (Fig. 26b) calli pronounced; foveae contiguous; anterior lobe porrect, lateral margins convex; posterior lobe declivent bulging dorsally in posterior, lateral margins concave posterior margin concave. ***Hemelytra:*** lateral margins straight; cuneus 1.5 longer than wide (Fig. 26e).

Measurements

See Table 1.

Distribution

Cyrtorhinus dimorphus is found in the East African countries of Somalia, the Sudan (South and North Sudan) and most commonly Ethiopia (Fig. 18).

Biology and Hosts

Host records unknown.

Remarks

While brachyptery is typical in the females of many species of *Cyrtorhinus,* especially those in this clade (*C. dimorphus, C. melanops, C. eylesi, C. carvalhoi, C. novabritannia*); *C. dimorphus* is the only species in which all females are brachypterous. Brachyptery in *Cyrtorhinus* females has a similar effect in all species in which it occurs, giving them smaller eyes and trapezoidal pronotum. Due to its green colouration (Fig. 7i), obvious setae and large parameres *C. dimorphus* most closely

resembles *C. geniculatus* and *C. eylesi* but can be distinguished by the females always being brachypterous and the triangulate rudus (Fig. 25a).

***Cyrtorhinus eylesi* nom. nov.**

Habitus, Figure 7j. Distribution, Figure 9. Male genitalia, Figure 25d-f. SEMs, Figure 27.

Etymology

Josemiris carvalhoi Eyles 1996: 211 (sp. nov.)*;* Eyles 2005: 194 (description)

Cyrtorhinus eylesi: ***nom. nov.*, this work.** The original specific epithet *carvalhoi* cannot be used because of secondary homonymy with *Cyrtorhinus carvalhoi* Woodward (1957). The specific epithet *eylesi* is given as a replacement name after Alan Eyles, the original author of the species.

Materials examined

NEW ZEALAND: OTAGO: Old Man Range, 45.35583°S 169.20806°E, 31 Jan 1996, B.I.P. Barratt, 1♀ UNSW_ENT00404628 (NZAC). Rock and Pillar Range, Great Moss Swamp (Loganburn Reservoir), 45.52194°S 169.93972°E, 16 Apr 1983, C.F. Butcher, 1♀ UNSW_ENT00404626 (NZAC). Rocklands Station, 49.66583°S 169.98917°E, 14 Apr 1983, C.F. Butcher, 1♂ UNSW_ENT00404627 (NZAC).

Diagnosis

Cyrtorhinus eylesi can be recognised by the following combination of characters: females usually brachypterous; elongate setae present on femur and tibia; labium reaching mesosternum; hemelytral margins convex (Fig. 7j); left parameres with elongate apophysis, apically spear-shaped (Fig. 25f); right paramere mitt-shaped, sensory lobe large, apophysis greatly reduced with a apical flange (Fig. 25e); endosomal

membranous bag lacking sclerotisation; proximal endosomal spicule curved, weakly divergent from the base; rudus irregularly shaped, margins dentate (Fig. 25d).

Description

Males.

COLOURATION: Body grey or yellow (Fig. 7j). ***Head:*** generally greenish yellow; clypeus brown anteriorly; otherwise entirely yellow or grey. ***Antennae:*** AI-AII light yellow or grey; AIII-AIV brown. ***Labium:*** grey. ***Pronotum:*** yellow or grey variously mottled with black. ***Scutellum:*** variously coloured, mostly yellow or grey. ***Hemelytra:*** yellow or grey; membrane colourless. ***Thoracic pleura and sterna:*** venter uniformly yellow or grey. ***Legs:*** green. ***Abdomen:*** Abdominal venter yellow or grey.

VESTITURE AND TEXTURE: Generally covered in pale grey, erect, hair-like setae (Fig. 24d). ***Head:*** hair-like setae very small and sparse, pale grey colouration (Fig. 27a); vertex with hair-like setae along midline and posterior margin; frons with minute tufts of hair-like setae; gula and genae with longer setae. ***Antennae:*** densely covered in small dark decumbent hair-like setae (Fig. 27c); AI three thick bristle-like setae facing interiorly (Fig. 27c). ***Pronotum:*** smooth; hair-like setae very small and sparse; microtrichia sparse. ***Hemelytra:*** covered in short, dark, semi-erect hair-like setae. ***Legs:*** small erect grey hair-like setae; tibial spinules present on tibia and on femur (Fig. 27e); elongate setae present in a disordered pattern on tibia and femora.

STRUCTURE: ***Head:*** eyes large, about equal in length to head (Fig. 27a); vertex topology smooth (Fig. 27a); bucculae broad, ovate, reaching anteniferous tubercles anteriorly. ***Labium:*** extending to mesothorax. ***Pronotum:*** anterior lobe calli slight (Fig. 27a); lateral margins convex; foveae separate; posterior lobe weakly declivent bulging lateral margins concave posterior margin concave. ***Hemelytra:*** lateral margins straight; cuneus ca. 2x as long as width; short, only just overhanging abdomen. ***Male genitalia:***

Left paramere (Fig. 25f) Y-shaped; sensory lobe with dense small disordered setae; apophysis uniformly curved, grossly elongate, apex spear-shaped, file-like texture present along entire dorsal surface. Right paramere (Fig. 25e) sensory lobe swollen, setae elongate with prominent base; apophysis reduced, narrow, apical flange with five teeth. Aedeagus (Fig. 25d) endosoma ca. 0.4 mm in length; endosomal membranous bag lacking sclerotisation; proximal endosomal spicule apically curved, divergent from ductus seminis with margins weakly dentate; rudus positioned subapically, ca. 0.03mm in length, perpendicular to spicule strongly pronounced and irregularly shaped, proximal margin concave, apical margin tapering; secondary gonopore, elongate, reaching rudus.

Females.

Macropterous or brachypterous.

Macropterous females

Externally similar to males. Female genitalia not investigated.

Brachypterous females.

Head: eyes greatly reduced in size; clypeus pronounced anteriorly (Fig. 27b). ***Pronotum:*** channel between calli very wide, shallow (Fig. 27b); foveae widely separated (Fig. 27b); posterior lobe of pronotum flat, reduced in length (Fig. 27b). ***Hemelytra:*** reduced, only covering to abdominal sternites 7-8, membrane present but greatly reduced, without cells.

Measurements

See Table 1.

Distribution

Cyrtorhinus eylesi is known from several collection events in the South Island of New Zealand and a single female on the North Island (Auckland) (Fig. 9).

Biology and Hosts

Eyles (1996) recorded *Salicornia* sp. as the host (Chenopodiaceae).

Remarks

Also see remarks section on *Cyrtorhinus cumberi.*

Cyrtorhinus eylesi most closely resembles *C. dimorphus* but the females are not always brachypterous; the apophysis of the right paramere is several times narrower than the sensory lobe (Fig. 25e) and the rudus is rounded (Fig. 25d).

Cyrtorhinus eylesi has an unusual right paramere compared with other species of the genus, but the key generic defining characteristics are present. Its genitalia are different in comparison to the other New Zealand species, *C. cumberi*. This led Eyles (1996) to erect a new genus - *Josemiris* - with a single included species - *Josemiris carvalhoi.*

I have synonymised *Josemiris* with *Cyrtorhinus* and thereby renamed *J. carvalhoi* as species *Cyrtorhinus eylesi* because *Cyrtorhinus carvalhoi* is preoccupied by *Cyrtorhinus carvalhoi* Woodward, 1957. Its homology with other species of *Cyrtorhinus* is obvious based on its position and shape. Other reasons provided by Eyles (1996) for the erection of the genus *Josemiris* are dealt with in the remarks section for the genus.

Due to its green colouration, obvious setae and large parameres *C. eylesi* most closely resembles *C. geniculatus* and *C. dimorphus* but can be distinguished by its narrow apophysis of the right paramere (Fig. 25e) and distinctive rudus (Fig. 25d).

Cyrtorhinus fulvus Knight

Habitus, Figure 7k. Distribution, Figure 9. Male genitalia, Figure 11g-i. SEMs, Figure 28.

Cyrtorhinus fulvus Knight, 1935: (sp. nov.); Carvalho 1956: 56, figs 31, 32a-e (description); Carvalho 1958: 55 (world catalogue)

Materials examined

HOLOTYPE: **SAMOA: SAVAII ISLAND:** Lowlands to 1000m, 13.66035°S 172.37067°W, 500 m, 01 May 1924, E.H. Bryant, Jr. Type examined in the Bernice P. Bishop Museum.

PARATYPES: **SAMOA: SAVAII ISLAND:** Lowlands to 1000m, 13.66035°S 172.37067°W, 500 m, 01 May 1924, E.H. Bryant, Jr., 3♂♂ (UNSW_ENT00315521, UNSW_ENT00315522, UNSW_ENT00315524), 1♀ (UNSW_ENT0031552; 3) (USNM). Safune, 04 May 1924, E. H. Bryan, Jr., 7♂♂ (UNSW_ENT00046323-00046329), 3♀♀ (UNSW_ENT00046330-00046332) (BPBM). **UPOLU:** Safune, 13.805°S 171.79519°W, 5 m, 01 May 1924, E.H. Bryant, Jr., 1♂ (UNSW_ENT00315525) (USNM); 04 May 1924, E.H. Bryant, Jr., 1♂ (UNSW_ENT00315526) (USNM).

OTHER SPECIMENS EXAMINED: **AMERICAN SAMOA: MANU'A ISLANDS:** Tau, 14 Jun 1954, C.P. Hoyt, 2♀♀ (UNSW_ENT00046877, UNSW_ENT00046878), 1♂ (UNSW_ENT00046879) (BPBM). **TUTUILA ISLAND:** Fagatogo, 14.2825°S 170.69°W, 08 Nov 1963, N.R. Spencer, 1♀ (UNSW_ENT00046881) (BPBM); 28 Aug 1940, O.H. Swezey, 1♀ (UNSW_ENT00043419) (BPBM). Naval Station, 27 Aug 1940, Swezey and Zimmerman, 1♀ (UNSW_ENT00046880) (BPBM). Naval station, 13 Aug 1940, Swezey and Zimmerman, 1♀ (UNSW_ENT00043418) (BPBM). Pago Pago, 14.2796°S 170.6971°W, 247 m, 07 Oct 1963, N.R. Spencer, 1♂ (UNSW_ENT00046876) (BPBM); 13 Aug 1940, O.H. Swezey, *Sporobolus* sp. (Poaceae), 2♂♂ (UNSW_ENT00046874,

UNSW_ENT00046875) (BPBM). Taputimu Farm, 14.36°S 170.77°W, 20 Apr 1964, N.R. Spencer, 1♂ (UNSW_ENT00046867) (BPBM); 08 Sep 1953, C.P. Hoyt, 1♀ (UNSW_ENT00046873), 1♀ (UNSW_ENT00046886) (BPBM); 26 Mar 1964, N.R. Spencer, 3♀♀ (UNSW_ENT00046861-00046863) (BPBM); 04 Feb 1964, N.R. Spencer, 2♀♀ (UNSW_ENT00046871, UNSW_ENT00046872) (BPBM); 22 Sep 1964, N.R. Spencer, 1♀ (UNSW_ENT00046887) (BPBM); 05 Aug 1963, N.R. Spencer, 1♀ (UNSW_ENT00046869) (BPBM); 06 Jul 1964, N.R. Spencer, 1♀ (UNSW_ENT00046868) (BPBM); 23 Mar 1964, N.R. Spencer, 1♀ (UNSW_ENT00046866) (BPBM); 25 Mar 1964, N.R. Spencer, 1♀ (UNSW_ENT00046864), 1♂ (UNSW_ENT00046865) (BPBM); 29 Oct 1963, N.R. Spencer, 1♀ (UNSW_ENT00046870) (BPBM). Taputimu Farm, 29 Oct 1963 - 13 Oct 1964, N.R. Spencer, 37♀♀ (UNSW_ENT00043360-00043396), 3♂♂ (UNSW_ENT00043397-00043399) (BPBM); 15 Feb 1965 - 19 Feb 1965, G. A. Samuelson, Light Trap, 9♀♀ (UNSW_ENT00043402-00043410) (BPBM). **FIJI: VANUA LEVU:** Tathilevu, 16.76667°S 179.61667°E, 21 Mar 1966, N.L.H. Krauss, 4♂♂ (UNSW_ENT00046882-00046885) (BPBM). **VITI LEVU:** Suva, 18.14132°S 178.44142°E, 55 m, 5 Dec 1958, C.R. Joyce, 1♀ (UNSW_ENT00046590) (BPBM). Suva, Koronivia Research Station, 18.09611°S 178.545°E, 05 Feb 1969, James E. Tobler, 1♂ (UNSW_ENT00399731), 9♀♀ (UNSW_ENT00399732-00399740) (CAS). Lautoka, 21 Oct 1921, R. Veitch, 2♀♀ (UNSW_ENT00046588, UNSW_ENT00046589) (BPBM). **SAMOA: UPOLU:** Afiamalu, 13.91215°S 171.71557°W, 671 m, 10 Jun 1940, Swezey and Zimmerman, 1♂ (UNSW_ENT00046585) (BPBM). Afiamalu, 30 Jun 1940, Swezey and Zimmerman, Light Trap, 24♀♀ (UNSW_ENT00043420-00043443), 2♂♂ (UNSW_ENT00043444, UNSW_ENT00043445) (BPBM); 14 Feb 1969 - 15 Feb 1969, B. Hocking, 1♀

(UNSW_ENT00043401) (BPBM). Alafua, 17 May 1973, R. A. Beaver, 1♀ (UNSW_ENT00046582) (BPBM); 02 Apr 1968 - 04 Apr 1968, B. Hocking, 1♀ (UNSW_ENT00043400) (BPBM). Apia, 01 Feb 1955 - 28 Feb 1955, N.L.H. Krauss Coll., 2♀♀ (UNSW_ENT00043411, UNSW_ENT00043412), 4♂♂ (UNSW_ENT00043413-00043416) (BPBM). Apia, Aleisa rd., 396 m, 06 Apr 1949, O.H. Swezey, 1♀ (UNSW_ENT00043417) (BPBM). Falelaunlu, 13 May 1973, R. A. Beaver, 1♀ (UNSW_ENT00046583), 1♂ (UNSW_ENT00046584) (BPBM). Mulivai, 100 m, Jan 1978, N.L.H. Krauss, 1♀ (UNSW_ENT00046888) (BPBM). Sinaele, 427 m, 27 Jul 1940, O.H. Swezey, 1♂ (UNSW_ENT00043453), 1♀ (UNSW_ENT00043454) (BPBM). Tapatapao, 13.9°S 171.7°W, 305 m, 19 Jul 1940, Swezey and Zimmerman, 1♀ (UNSW_ENT00046587) (BPBM); 20 Jul 1940, Swezey and Zimmerman, Light Trap, 7♀♀ (UNSW_ENT00043446-00043452) (BPBM). Togitogiga, 100 m, 29 Dec 1965, A. Catley, 1♂ (UNSW_ENT00046586) (BPBM). **USA: HAWAII:** *Honolulu Co.:* Honolulu, 21.3069°N 157.8583°W, 35 m, Sep 1943, N.L.H. Krauss, *Colocasia esculenta* (L.) Schott (Araceae), 2♀♀ (UNSW_ENT00315527, UNSW_ENT00315528) (USNM).

Diagnosis

Cyrtorhinus fulvus can be recognised by the following combination of characters: Macropterous specimens only; frons and vertex with scale-like texture (Fig. 28a); anterior lobe of pronotum strongly rugulose (Fig. 28b); foveae contiguous (Fig. 28b); labium reaching metasternum; hemelytral margins straight (Fig. 7k); left parameres sensory lobe strongly elongate (Fig. 11i); right paramere mitt-shaped, apophysis squat, with apical comb-like flange (Fig. 11h); endosomal membranous bag with a sparse field of spinules; proximal endosomal spicule straight; rudus rectangulate, margins dentate (Fig. 11g).

Description

Males.

COLOURATION: Body red with black markings (Fig. 7k). ***Head:*** generally red with distinct black markings; vertex red with a distinct black shape medially; clypeus black; maxillary and mandibular plates yellow. ***Antennae:*** AI black, yellow band at joints; AII black, yellow bands at; AIII and AIV uniformly black. ***Labium:*** clypeus fuscous. ***Pronotum:*** pronotum anterior black, sometime with red markings; pronotum posterior black with a yellow line medially. ***Scutellum:*** scutellum orange, black line medially; mesoscutum black. ***Hemelytra:*** red, barely translucent; membrane black tinge. ***Thoracic pleura and sterna:*** meso- and metapleura black; sterna red. ***Legs:*** red. ***Abdomen:*** venter red; terminal segments sometimes fulvous in females.

VESTITURE AND TEXTURE: Generally covered in pale grey, semi-erect, hair-like setae and densely covered in minute simple microtrichia (Fig. 28d). ***Head:*** vertex setae small, few large thick setae present on fringes, scale-like texture present (Fig. 28a); gula and genae setae long, dense (Fig. 28c). ***Antennae:*** (Fig. 28e) dense, semi decumbent hair-like setae; AI setae sparse, three thick bristle-like laterally oriented. ***Pronotum:*** (Fig. 28b) anterior lobe rugulose; setae relatively dense anterior lobe, sparse on posterior; microtrichia dense. ***Hemelytra:*** hair-like setae fairly evenly spaced. ***Legs:*** dense thick decumbent hair-like setae; tibial spinules present.

STRUCTURE: ***Head:*** eyes large, about equal in length to head (Fig. 28a); vertex weakly depressed laterally (Fig. 28a); bucculae broad, ovate, not reaching anteniferous tubercles anteriorly (Fig. 28c). ***Labium:*** terminates between metacoxae. ***Pronotum:*** (Fig. 28b) anterior lobe lateral margin convex, calli prominent; foveae contiguous; posterior lobe greatly declivent, lateral margin concave; posterior margin greatly concave. ***Hemelytra:*** lateral margins straight (Fig. 7k); cuneus about 2x longer than

wide. ***Male genitalia:*** Left paramere (Fig. 11i) Y-shaped; sensory a few elongate setae distally; apophysis sinuate, apex simple, file-like texture subapical. Right paramere (Fig. 11h) small, lobes very short, much shorter than stem; sensory lobe setae elongate; apophysis concave, with distal flange, with five teeth. Aedeagus (Fig. 11g) small in size, endosoma ca. 0.2 mm in length; with short endosomal membranous bag, apically with few teeth; proximal endosomal spicule straight, more or less parallel to ductus seminis; apically upright, with margins densely dentate, rudus positioned subapically, ca. 0.03 mm in length, perpendicular to spicule, strongly pronounced and rectangulate, distal and proximal margins sub parallel; secondary gonopore elongate, twisted, surpassing rudus of proximal endosomal spicule, reaching near apex of phallotheca.

Females.

Macropterous only.

Externally similar to males. Female genitalia not investigated.

Measurements

See Table 1.

Distribution

Cyrtorhinus fulvus is found broadly in the Pacific, including specimens I examined from Samoa, American Samoa and Hawaii (Fig. 9). Its broad distribution is due to deliberate introductions for biological control and perhaps some accidental introductions. As *C. fulvus* thrives on corn or sugar cane monocultures its native distribution is uncertain. Usinger (1939) speculates that its native distribution is an island of the Pacific, listing records from the Philippine Islands, Samoa, Java and a known introduction to Hawaii. I also have seen specimens from Fiji held in the Bishop Museum, but they were not borrowed for this study, and have not been databased.

Biology and Hosts

A few specimens have been collected from *Sporobolus* sp. (Poaceae) and *Colocasia esculenta* (Araceae). Several specimens have been collected at light, and there are some very large series collected in close proximity to agricultural land. Fullaway (1939) discusses how *C. fulvus* has been successfully used to control taro leafhopper *Megamelus proserpina* Kirkaldy (1902) in Hawaii.

Remarks

See remarks section on *Cyrtorhinus albidus* and *C. defectus.*

Due to its overall reddish colouration and its straight hemelytral margins (Fig. 7k) *Cyrtorhinus fulvus* resembles *C. brunus, C. defectus* and *C. rarus* but can be distinguished by the scale-like texturing on the head (Fig. 28a) and the contiguous pronotal foveae (Fig. 28b).

***Cyrtorhinus geniculatus* (Reuter)**

Habitus, Figure 7l. Male genitalia, Figure 8d-f. Distribution, Figure 18. SEMs, Figure 29.

Chlorosomella geniculata Reuter, 1904: 7-8 (sp. nov.)

Orthotylus geniculatus: Carvalho, 1958:101 (catalogue); Synave, 1970: 14 (type material)

Cyrtorhinus viridis Linnavuori, 1971: 58-59 (sp. nov.). Linnavuori 1994: 54 (synonymy)

Cyrtorhinus geniculatus: Linnavuori, 1994: 54, fig. 33 (nov. comb.)

Materials examined

Holotype not examined. Paratypes from the same series examined.

PARATYPES: **SUDAN: BLUE NILE:** Singa-Damazin, 15 Nov 1962 - 17 Nov 1962,

R. Linnavuori, 1♀ (UNSW_ENT00355402) (AMNH). Unknown: Equatoria, Nimule (Now South Sudan, East Equatoria Province), 11 Mar 1963 - 13 Mar 1963, Linnavuori, 1♀ (UNSW_ENT00355403) (AMNH).

Other Specimens Examined**: BENIN: BORGOU:** Parakou, 05 Sep 1973 - 06 Sep 1973, Linnavuori, 3♂♂ (UNSW_ENT00355410-00355412), 3♀♀ (UNSW_ENT00355413-00355415) (AMNH), 1♀ (UNSW_ENT00192633), 1♂ (UNSW_ENT00192634) (USNM). **BURKINA FASO: CASCADES:** Niangoloko, 25 Oct 1973, Linnavuori, 1♀ (UNSW_ENT00192610) (USNM). **COTE D'IVOIRE (IVORY COAST): DIX-HUIT MONTAGNES:** Le Mont Tonkoui, 7.45436°N 7.6369°W, 1189 m, 15 Oct 1975 - 22 Oct 1975, R. Linnavuori, 1♀ (UNSW_ENT00192606) (USNM). Man, 7.4°N 7.55°W, 14 Oct 1973 - 21 Oct 1973, R. Linnavuori, 11♀ (UNSW_ENT00355404-00355408, UNSW_ENT00355416-00355418, UNSW_ENT00355422-00355424), 7♂♂ (UNSW_ENT00355409, UNSW_ENT00355419-00355421, UNSW_ENT00355425-00355427) (AMNH). **LAGUNES (REGION DES):** Lamto, 08 Oct 1973 - 09 Oct 1973, Linnavuori, 2♀♀ (UNSW_ENT00192609, UNSW_ENT00192618) (USNM). **ZANZAN:** Gouméré, 19 Sep 1973, Linnavuori, 4♀♀ (UNSW_ENT00192613, UNSW_ENT00192638-00192640) (USNM). **DEMOCRATIC REPUBLIC OF THE CONGO: KATANGA:** Lubumbashi, 11.6667°S 27.4667°E, 1208 m, 09 Jul 1971 - 11 Jul 1971, Linnavuori, 2♂♂ (UNSW_ENT00355431, UNSW_ENT00355432) (AMNH). **NIGER:** NIAMEY: 09 Sep 1973, Linnavuori, 4♀♀ (UNSW_ENT00192612, UNSW_ENT00192628-00192630), 3♂♂ (UNSW_ENT00192625-00192627) (USNM). **NIGERIA: BENUE:** B. Pl. St. nr. Makurdi, 7.7333°N 8.5333°E, 30 Aug 1973, R. Linnavuori, 1♀ (UNSW_ENT00192619) (USNM). **EBONYI:** nr. Abakaliki, Norcap, 29 Jun 1973, Linnavuori, 1♂ (UNSW_ENT00192624) (USNM). **KADUNA:** N. C. Zaria

St., 11.06666°N 7.7°E, 02 Aug 1973 - 03 Aug 1973, R. Linnavuori, 1♂ (UNSW_ENT00192623), 2♀♀ (UNSW_ENT00192631, UNSW_ENT00192632) (USNM). Zaria, Samaru, 24 Oct 1974, J.C. Deeming, 1♀ (UNSW_ENT00355428) (AMNH); 15 Sep 1974, J.C. Deeming, 1♀ (UNSW_ENT00355429) (AMNH); 01 Sep 1974 - 30 Sep 1974, J.C. Deeming, 1♀ (UNSW_ENT00355430) (AMNH). **KATSINA:** Malumfashi, 28 Jul 1973 - 30 Jul 1973, Linnavuori, 1♀ (UNSW_ENT00192616), 1♂ (UNSW_ENT00192622) (USNM). **NE STATE:** Near Lankoviri, 24 Aug 1973, Linnavuori, 1♀ (UNSW_ENT00192621) (USNM). Serti, 20 Aug 1975, R. Linnavuori, 1 juvenile (UNSW_ENT00192605) (USNM). **NW STATE:** Badeggi, 08 Aug 1973 - 09 Aug 1973, Linnavuori, 3♀♀ (UNSW_ENT00192608, UNSW_ENT00192607, UNSW_ENT00192614) (USNM). **RIVERS STATE:** Mbiama, 04 Jul 1973 - 05 Jul 1973, Linnavuori, 1♀ (UNSW_ENT00192620) (USNM). **SE STATE:** Obudu Cattle Ranch, 26 Jun 1973 - 18 Aug 1973, Linnavuori, 2♀♀ (UNSW_ENT00192615, UNSW_ENT00192611) (USNM). Badeggi (Lapai), 9.035°N 6.574°E, 08 Aug 1973 - 09 Aug 1973, Linnavuori, 6♂♂ (UNSW_ENT00192679-00192684) (USNM). **TOGO: PLATEAUX:** Anié, 11 Sep 1973 - 12 Sep 1973, Linnavuori, 3♀♀ (UNSW_ENT00192617, UNSW_ENT00192635, UNSW_ENT00192636), 1♂ (UNSW_ENT00192637) (USNM).

Diagnosis

Cyrtorhinus geniculatus can be recognised by the following combination of characters: females always macropterous; smaller size (♀♀ 3.41-3.70mm ♂♂ 2.92-3.37mm.); colouration generally greenish yellow (Fig. 7l); females never brachypterous; labium just reaching metacoxae; hemelytral margins weakly convex (Fig. 7l); left paramere sensory lobe grossly elongate, apex pinched (Fig. 8f); right paramere mitt-shaped, apophysis squat, flange laterally oriented (Fig. 8e); endosomal membranous bag lacking

sclerotisation; proximal endosomal spicule straight; rudus spear-shaped, apex of endosomal spicule simple (Fig. 8d).

Description

Males.

COLOURATION: Body greenish yellow (Fig. 7l). ***Head:*** generally greenish yellow; vertex greenish yellow; clypeus fuscous; maxillary and mandibular plates greenish yellow. ***Antennae:*** AI-AII black and yellow variously banded; AIII-AIV black. ***Labium:*** yellow. ***Pronotum:*** anterior yellow; pronotum posterior yellow in males green in females. ***Scutellum:*** yellow; mesoscutum dark yellow. ***Legs:*** yellow; black markings at femur-tibia joint. ***Hemelytra:*** translucent, greenish; membrane colourless. ***Thoracic pleura and sterna:*** yellow. ***Abdomen:*** abdominal venter yellow.

VESTITURE AND TEXTURE: Body covered in grey, sparse, semi-decumbent, hair-like setae (Fig. 29d). ***Head:*** hair-like setae sparse; hair-like setae dense on genae, gula and genae with minute microtrichia (Fig. 29a). ***Antennae:*** dense erect hair-like setae; three thick bristle-like setae interiorly facing. ***Pronotum:*** smooth; sparse, simple, decumbent hair-like setae (Fig. 29c); microtrichia dense and matted. ***Hemelytra:*** hair-like setae sparse; fringe setae dense, erect. ***Legs:*** dense semi decumbent hair-like setae; tibial spinules pale grey and small.

STRUCTURE: ***Head:*** eyes large, about equal in length to head (Fig. 29a); vertex topology smooth (Fig. 29a); bucculae narrow, ovate, not reaching anteniferous tubercles anteriorly (Fig. 29b). ***Labium:*** extending to meso-meta thoracic boundary. ***Pronotum:*** (Fig. 29c) anterior lobe calli weakly developed; foveae narrowly separated; posterior lobe strongly declivent; lateral margins weakly concave; posterior lobe posterior margin concave. ***Hemelytra:*** lateral margins weakly convex; cuneus about 2x longer than wide, anterior margin sinuate. ***Male genitalia:*** Left paramere (Fig. 8f) Y-shaped; sensory lobe

densely covered in setae of various sizes; apophysis sinuate, pinched apically, file-like texture subapical. Right paramere (Fig. 8e) small, lobes very short, much shorter than stem; sensory lobe setae elongate; apophysis straight, curving apically, with distal flange, with five teeth. Aedeagus (Fig. 8d) small in size, endosoma ca. 0.2 mm in length; with short endosomal membranous bag, lacking sclerotisation; proximal endosomal spicule straight, more or less parallel to ductus seminis; apically upright, with margins dentate, rudus positioned subapically, ca. 0.03 mm in length, perpendicular to spicule, strongly pronounced and spear-shaped, proximal margin concave, apical margin tapering; secondary gonopore elongate, weakly twisted, reaching rudus of proximal endosomal spicule.

Females.

Macropterous only.

Externally similar to males. Female genitalia not investigated.

Measurements

See Table 1.

Distribution

Cyrtorhinus geniculatus is found in West Central Africa and East Africa (Zaire, Ivory Coast, and Sudan) (Fig. 18).

Biology and Hosts

Unknown.

Remarks

This species was originally described as *Chlorosomella geniculata* by Reuter (1904). The species was subsequently moved to the genus *Orthotylus* by Carvalho (1958) without examination of the male genitalia. Linnavuori (1971) collected several specimens and recognised them as belonging to *Cyrtorhinus* and described *Cyrtorhinus*

viridis as a new species. Linnavuori (1994) synonymised *C. viridis* with *Orthotylus geniculatus* and moved the species to *Cyrtorhinus*.

Cyrtorhinus geniculatus is an African species of the genus, which is more closely related to Pacific species *C. fulvus* and *C. lividipennis* than it is to other African species, including *C. melanops* and *C. dimorphus*.

Due to its green colouration (Fig. 7l), prominent setae and large parameres, *C. geniculatus* most closely resembles *C. dimorphus* and *C. eylesi,* but the elongate lobes of the right paramere (Fig. 8e) and straight proximal endosomal spicule (Fig. 8d) indicate that it is closer to the *lividipennis* group.

***Cyrtorhinus indi* sp. nov.**

Habitus, Figure 7m. Male genitalia, Figure 8g-i. Distribution, Figure 9. SEMs, Figure 30.

Etymology

This species is named for its country of origin.

Materials examined

HOLOTYPE: **INDIA: NORTH CENTRAL:** Anuradhapura District Co.: Hunuwilagama, near Wilpattu, 61 m, 28 Oct 1976 - 03 Nov 1976, G.F. Hevel, R. E. Dietz, S. Karunaratne, D. W. Balasooriya, ♂ (UNSW_ENT00192661) (USNM).

PARATYPES: **INDIA: ASSAM:** Sadiya, 27.83°N 95.67°E, 13 Feb 1944 - 14 Feb 1944, D. E. Hardy, 9♀♀ (UNSW_ENT00044838-00044846), 17♂♂ (UNSW_ENT00044847-00044863) (BPBM). **DELHI:** New Delhi, 21 Oct 1959, R.I. Sailer, 1♂ (UNSW_ENT00192666) (USNM). **SRI LANKA: CENTRAL PROV.:** Sri Lankan Agric. Res. Sta. Sita Eliya (3km SE of Nuwara Eliya), 22 Mar 1999, T.J. Henry and A. Wijisekara, 1♂ (UNSW_ENT00192667) (USNM). **NORTH**

CENTRAL: Anuradhapura District: Hunuwilagama, near Wilpattu, 61 m, 28 Oct 1976 - 03 Nov 1976, G.F. Hevel, R.E. Dietz, S. Karunaratne, D.W. Balasooriya, 2♀♀ (UNSW_ENT00192659, UNSW_ENT00192660), 2♂♂ (UNSW_ENT00192662-00192663) (USNM). Wildlife Society Bungalow Hunuwilagama, Wilpattu, 61 m, 10 Mar 1970 - 19 Mar 1970, Davis and Rowe, 1♀ (UNSW_ENT00192665) (USNM). **SABARAGAMUWA:** Kitulgala Resthouse, 03 Feb 1979 - 05 Feb 1979, K.V. Krombein, P.B. Karunaratne, T. Wijesinhe, L. Jayawickrema, V. Gunawardane, 1♂ (UNSW_ENT00192664) (USNM).

Diagnosis

Cyrtorhinus indi can be recognised by the following combination of characters: females always macropterous; colouration pale grey, black markings on scutellum present (Fig. 7m); wings elongate, ca. 2x longer than abdomen; labium reaching mesocoxae; hemelytral margins straight (Fig. 7m); left paramere sensory lobe grossly elongate, apophysis pinched (Fig. 8i); right paramere mitt-shaped, apophysis squat, flange laterally oriented (Fig. 8h); proximal endosomal spicule straight; rudus rounded, weakly dentate (Fig. 8g).

Description

Males.

COLOURATION: Body pale grey (Fig. 7m). ***Head:*** generally pale grey; vertex pale grey, black spot medially on anterior margin; clypeus black; maxillary plates black; mandibular plates pale yellow. ***Antennae:*** AI and AII black, yellow at joints. AIII and AIV black. ***Labium:*** pale yellow, tip of LIV black. ***Pronotum:*** anterior region pale yellow, faint black line anterior to calli; posterior lobe black, thick pale yellow line medially, sometimes pale yellow patches on posterior margin; black midline. ***Scutellum:*** scutellum pale yellow; mesoscutum black. ***Hemelytra:*** translucent,

colourless or rarely with faint green patches. ***Thoracic pleura and sterna:*** sterna pale yellow. ***Legs:*** pale grey to yellow. ***Abdomen:*** venter pale grey.

VESTITURE AND TEXTURE: Sparse distribution of pale grey, erect, hair-like setae. ***Head:*** (Fig. 30a) hair-like setae sparse, absent lateral to midline of vertex (Fig. 30c); microtrichia sparse. ***Antennae:*** dense distribution of decumbent hair-like setae; AI with three thick bristle-like setae on medial surface. ***Pronotum:*** smooth; sparse, hair-like setae; microtrichia sparse. ***Hemelytra:*** with a dense semi-erect exterior fringe. ***Legs:*** dense distribution of elongate hair-like setae; two rows of tibial spinules.

STRUCTURE: ***Head:*** eyes large, about equal in length to head (Fig. 30a); vertex topology smooth (Fig. 30a); bucculae broad, ovate, not reaching anteniferous tubercles anteriorly (Fig. 30b). ***Labium:*** terminates between mesocoxae. ***Pronotum:*** anterior lobe calli slight, lateral margin convex; foveae weakly separated (Fig. 30d); posterior lobe steeply declivent, lateral margin concave; posterior margin straight. ***Hemelytra:*** lateral margins straight; cuneus ca. 2x longer than wide (Fig. 30f). ***Male genitalia:*** Left paramere (Fig. 8i) Y-shaped; sensory lobe with elongate setae; apophysis sinuate, apex pinched, file-like texture subapical. Right paramere (Fig. 8h) small, lobes short, length subequal to stem; apophysis weakly concave with a lateral lamina, apically bent with an apical flange, with four teeth. Aedeagus (Fig. 8g) small in size, endosoma ca. 0.2 mm in length; short endosomal membranous bag, mild teeth apically; proximal endosomal spicule straight, more or less parallel to ductus seminis; apically upright, margins densely dentate, rudus positioned subapically, ca. 0.03 mm in length, perpendicular to spicule, strongly pronounced and rectangulate, distal and proximal margins sub-parallel; secondary gonopore elongate, surpassing rudus of proximal endosomal spicule, reaching near apex of phallotheca.

Females.

Macropterous only.

Externally similar to males. Female genitalia not investigated.

Measurements

See Table 1.

Distribution

Cyrtorhinus indi is known from India, Pakistan, Nepal, and Sri Lanka, as well as a few records from the Malaysian Peninsula (Fig. 9).

Biology and Hosts:

Unknown.

Remarks

See remarks section for *Cyrtorhinus albidus.*

Due to its pallid appearance, elongate AII and prominent calli, *Cyrtorhinus indi* resembles *C. albidus*, but can be distinguished from it by the black midline on the scutellum (Figs 7a,m) and field of spinules of the endosomal membranous bag (Figs 8g).

***Cyrtorhinus lividipennis* Reuter**

Live photograph, Figure 6. Habitus, Figure 7n. Distribution, Figure 9. Male genitalia, Figure 31. Female genitalia, Figure 32. SEMs, Figure 33.

Cyrtorhinus lividipennis Reuter, 1885: 196-200 (sp. nov.); Carvalho 1956: 57, fig. 32f-l (description); Usinger 1939: 270 (key, host); Usinger 1946: 4 (key); Miyamoto 1957: 77 (ovarioles); Carvalho 1958: 55 (catalogue); Linnavuori 1961: 167 (record); Miyamoto 1961: 222 (morphology); Hsiao and Meng 1963: 445 (host); Reyes and Gabriel 1975: 79 (biology); Liquido and Nishida 1985: 95 (life history); Schuh 1995: 100 (world

catalogue); Yasunaga 1999: 166, figs 97, 106, 107 (description); Carvalho and Southwood 1955: 38, figs (description)

Cyrtorhinus vitiensis Usinger 1951: 3 (sp. nov.); Carvalho and Southwood, (1955): 38 (synonymy)

Materials examined

CHINA: FUJIAN (OR FUKIEN): Fuzhou (Foochow), 26.06666°N 119.3°E, 02 Sep 1957, M. S. Yang, 1♂ (UNSW_ENT00309946) (ZISP); 06 Sep 1957, M. S. Yang, 1♂ (UNSW_ENT00309948) (ZISP); 11 Oct 1957, M. S. Yang, 1♀ (UNSW_ENT00310243) (ZISP); 14 Oct 1957, M. S. Yang, 1♂ (UNSW_ENT00309947) (ZISP). Jian'ou (KienOw), 27.0225°N 118.30472°E, 178 m, 09 Aug 1940, T.C. Maa, 27♀♀ (UNSW_ENT00045742-00045768), 8♂♂ (UNSW_ENT00045769-00045776) (BPBM). Kutien, 27.76138°N 118.03555°E, 03 Aug 1940, T.C. Maa, 4♀♀ (UNSW_ENT00045728-00045731), 2♂♂ (UNSW_ENT00045732, UNSW_ENT00045733) (BPBM). **JIANGSU:** Huandun, 34.81666°N 118.81666°E, 01 Dec 1959, Rodendorf, 1♂ (UNSW_ENT00309945) (ZISP). **KIENYANG:** Nwangkeng, 17 Aug 1940, T.C. Maa, 3♀♀ (UNSW_ENT00046374-00046376) (BPBM). Pucheng City, 17 Aug 1940, T.C. Maa, 1♂ (UNSW_ENT00046382), 1♀ (UNSW_ENT00046383) (BPBM). Shaowu, 29 Aug 1940, T.C. Maa, 2♂♂ (UNSW_ENT00046380, UNSW_ENT00046381) (BPBM). **SHAOWU:** Kuhsienkai, 16 Sep 1946, T.C. Maa, 1♂ (UNSW_ENT00046373) (BPBM); Shui Pei Kai, 31 Oct 1941, T.C. Maa, 1♂ (UNSW_ENT00046378) (BPBM); 12 Sep 1941, T.C. Maa, 1♂ (UNSW_ENT00046379) (BPBM); Tachulan, 1000 m, 09 Sep 1942, T.C. Maa, 1♂ (UNSW_ENT00046371) (BPBM); 01 Sep 1942, T.C. Maa, 6♂♂ (UNSW_ENT00046365-00046370), 1♀ (UNSW_ENT00046372) (BPBM); 29 Aug 1942, T.C. Maa, 14♂♂ (UNSW_ENT00046347-00046353, UNSW_ENT00046358-

00046364), 3♀♀ (UNSW_ENT00046355-00046357) (BPBM); 10 Apr 1943, T.C. Maa, 1♀ (UNSW_ENT00046377) (BPBM); 27.34027°N 117.4925°E, 09 Sep 1941, T.C. Maa, 4♀♀ (UNSW_ENT00045702-00045705) (BPBM). Shanghang, 03 Aug 1940, T.C. Maa, 2♂♂ (UNSW_ENT00045668, UNSW_ENT00045669), 2♀♀ (UNSW_ENT00045670, UNSW_ENT00045671) (BPBM); 08 Sep 1940, T.C. Maa, 19♂♂ (UNSW_ENT00045624-00045642), 25♀♀ (UNSW_ENT00045643-00045667) (BPBM); Taohulan, 27.34027°N 117.4925°E, 1000 m, 11 Sep 1941, T.C. Maa, 2♂♂ (UNSW_ENT00045697, UNSW_ENT00045698) (BPBM); 24 Sep 1941, T.C. Maa, 1♂ (UNSW_ENT00045690) (BPBM); 01 Sep 1942, T.C. Maa, 10♀♀ (UNSW_ENT00045777, UNSW_ENT00045778, UNSW_ENT00045788-00045795), 9♂♂ (UNSW_ENT00045779-00045787) (BPBM); 04 Sep 1942, T.C. Maa, 3♂♂ (UNSW_ENT00045699-00045701) (BPBM); 09 Sep 1942, T.C. Maa, 9♂♂ (UNSW_ENT00045796-00045804) (BPBM); 09 Sep 1942, T.C. Maa, 6♂♂ (UNSW_ENT00045691-00045696) (BPBM); 23 Sep 1942, T.C. Maa, 10♂♂ (UNSW_ENT00045672-00045681), 6♀♀ (UNSW_ENT00045682-00045687) (BPBM); 29 Sep 1942, T.C. Maa, 2♂♂ (UNSW_ENT00045688, UNSW_ENT00045689) (BPBM). Taining, 26.9°N 117.17555°E, 290 m, 02 Sep 1940, T.C. Maa, 7♀♀ (UNSW_ENT00045735-00045741) (BPBM). **YUNGAN:** 06 Aug 1940, T.C. Maa, 1♂ (UNSW_ENT00044104) (BPBM); 25 Aug 1940, T.C. Maa, 1♀ (UNSW_ENT00044122) (BPBM); 28 Aug 1940, T.C. Maa, 1♀ (UNSW_ENT00044124) (BPBM); 29 Aug 1940, T.C. Maa, 2♂♂ (UNSW_ENT00044107, UNSW_ENT00044111), 3♀♀ (UNSW_ENT00044108-00044110) (BPBM); 11 Sep 1940, T.C. Maa, 1♂ (UNSW_ENT00044105), 1♀ (UNSW_ENT00044106) (BPBM); 08 Sep 1941, T.C. Maa, 4♀♀ (UNSW_ENT00044112-00044115) (BPBM); 05 Sep 1944, T.C. Maa, 6♀♀

(UNSW_ENT00044116-00044121) (BPBM). Yungding, 24.72388°N 116.73194°E, 260 m, 10 Aug 1940, T.C. Maa, 1♂ (UNSW_ENT00045734) (BPBM). Xishunangbanna Tropical Botanical Garden, near basketball court, 21.93222°N 101.25166°E, 550 m, 21 May 2006, N. Tatarnic, Light Trap, 1♂ (UNSW_ENT00004756), 2♀♀ (UNSW_ENT00004757, UNSW_ENT00004758) (UNSW). Xishunangbanna Tropical Botanical Garden, roof of dormitory, 21.93222°N 101.25166°E, 560 m, 28 May 2006 – 29 May 2006, N. Tatarnic and C. Darling, Light Trap, 23♀♀ (UNSW_ENT00004708-00004730), 25♂♂ (UNSW_ENT00004731-00004755) (UNSW). **GUAM: INARAJAN:** 14.27525°N 144.74794°E, 8 m, 30 Sep 1936, O.H. Swezey, 1♀ (UNSW_ENT00315530) (USNM). Pt. Oca, 13.503°N 144.771°E, 15 May 1945, G.E. Bohart and J.L. Gressitt, 1♀ (UNSW_ENT00315529) (USNM). **HONG KONG: NEW TERRITORIES:** Sai Kung Station, 22.3833°N 114.2667°E, 4 m, 10 Oct 1964, W.J. Voss and Wai Ming Hui, Light Trap, 4♀♀ (UNSW_ENT00044315-00044318), 2♂♂ (UNSW_ENT00044319, UNSW_ENT00044320) (BPBM); 15 Oct 1964 – 30 Nov 1964, W.J. Voss and Wai Ming Hui, Light Trap, 209♀♀ (UNSW_ENT00043455-00043460, UNSW_ENT00043462, UNSW_ENT00043464, UNSW_ENT00043469-00043477, UNSW_ENT00043480-00043483, UNSW_ENT00043485, UNSW_ENT00043487, UNSW_ENT00043489-00043491, UNSW_ENT00043493-00043496, UNSW_ENT00043498-00043500, UNSW_ENT00043502-00043504, UNSW_ENT00043506-00043509, UNSW_ENT00043512-00043528, UNSW_ENT00043530-00043532, UNSW_ENT00043535, UNSW_ENT00043537, UNSW_ENT00043538, UNSW_ENT00043540-00043543, UNSW_ENT00043606-00043619, UNSW_ENT00043743-00043870), 79♂♂ (UNSW_ENT00043461, UNSW_ENT00043463, UNSW_ENT00043465-00043468, UNSW_ENT00043478,

UNSW_ENT00043479, UNSW_ENT00043484, UNSW_ENT00043486, UNSW_ENT00043488, UNSW_ENT00043492, UNSW_ENT00043497, UNSW_ENT00043501, UNSW_ENT00043505, UNSW_ENT00043510, UNSW_ENT00043511, UNSW_ENT00043529, UNSW_ENT00043533, UNSW_ENT00043534, UNSW_ENT00043536, UNSW_ENT00043539, UNSW_ENT00043602-00043605, UNSW_ENT00043690-00043742), 48♀♀ (UNSW_ENT00044019-00044066), 37♂♂ (UNSW_ENT00044067-00044103) (BPBM); 21 Oct 1964, W.J. Voss and Wai Ming Hui, Light Trap, 4♀♀ (UNSW_ENT00044327-00044330) (BPBM); 28 Oct 1964, W.J. Voss and Wai Ming Hui, Light Trap, 5♂♂ (UNSW_ENT00044321-00044325), 1♀ (UNSW_ENT00044326) (BPBM); 02 Nov 1964, W.J. Voss and Wai Ming Hui, Light Trap, 1♀ (UNSW_ENT00044331) (BPBM). Tai Po Kau, 22.4333°N 114.1833°E, 222 m, 07 Jul 1992, T. J. Henry and A. G Wheeler, Jr., 1♂ (UNSW_ENT00315540) (USNM). **INDIA: KERALA:** Cochin, 10.01°N 76.223°E, 03 Feb 1960, Unknown collector, 8♂♂ (UNSW_ENT00309446, UNSW_ENT00309490, UNSW_ENT00309489, UNSW_ENT00309520, UNSW_ENT00309949), 12♀♀ (UNSW_ENT00309446, UNSW_ENT00309490, UNSW_ENT00309489, UNSW_ENT00309520, UNSW_ENT00309949, UNSW_ENT00310244, UNSW_ENT00310245) (ZISP). **INDONESIA: SE BORNEO:** Kalamantan Timur, Sadakan, 1.98068°N 117.57686°E, 62 m, Unknown collector, 1♂ (UNSW_ENT00315538) (USNM). **SUMATRA:** Padang, 05 Mar 1913, O. John., 67♂♂ (UNSW_ENT00310062-00310079, UNSW_ENT00310053-00310061, UNSW_ENT00310080-00310091, UNSW_ENT00310206-00310233), 60♀♀ (UNSW_ENT00310180-00310205, UNSW_ENT00310146-00310179), 1 sex unknown (UNSW_ENT00309461) (ZISP). **JAPAN: HONSHU ISLAND:** Fukui Prefecture,

Tsuruga, 35.641°N 136.077°E, 03 Sep 1917, Roshkovskiy, 1♀ (UNSW_ENT00310236) (ZISP). **KYUSHU (ISLAND):** Okinawa Prefecture, Ishigaki Is. Mount Banna, 24.36666°N 124.16666°E, 20 Oct 1999, Belokobylskij, 1♀ (UNSW_ENT00310235) (ZISP). **KOREA: NORTH KOREA:** Pyongyang, 39.01972°N 125.75027°E, 21 Sep 1966, H. Szelegiewicz and C. Dziadoss, 3♂♂ (UNSW_ENT00310092-00310094), 3♀♀ (UNSW_ENT00310237-00310239) (ZISP). **LAO PEOPLE'S DEMOCRATIC REPUBLIC: LOUANGPHRABANG:** Luang Prabang, 19.885°N 102.134°E, 23 Feb 1983 – 28 Feb 1983, Asyanin, 1♀ (UNSW_ENT00310240) (ZISP). **MALAYSIA: KUALA PAHANG:** Cameron Highlands, Mt. Brichang, 4.51472°N 101.38355°E, 1807 m, 02 Jan 1959 – 07 Jan 1959, L.W. Quate, 1♂ (UNSW_ENT00046540) (BPBM). Kuala Tahan, 4.3833°N 102.4°E, 12 Dec 1958 – 14 Dec 1958, L.W. Quate, 2♀♀ (UNSW_ENT00045596, UNSW_ENT00045597), 5♂♂ (UNSW_ENT00045598-00045600, UNSW_ENT00046536, UNSW_ENT00046537) (BPBM); 15 Dec 1958 – 16 Dec 1958, L.W. Quate, Light Trap, 19♀♀ (UNSW_ENT00043582-00043587, UNSW_ENT00044332-00044344), 21♂ (UNSW_ENT00043588-00043601, UNSW_ENT00044345-00044351), 53♀♀ (UNSW_ENT00043889-00043934, UNSW_ENT00046529-00046535), 54♂♂ (UNSW_ENT00043935-00043982, UNSW_ENT00045601, UNSW_ENT00046524-00046528) (BPBM). **SABAH:** Sandakan Bay (SW), Sapagaya Lumber Camp, 20 m, 11 Jun 1957, J.L. Gressitt, Light Trap, 28♀♀ (UNSW_ENT00043620-00043647), 22♂♂ (UNSW_ENT00043648-00043669) (BPBM). Tawau, Quoin Hill, 03 Jul 1962 – 20 Jul 1962, H. Holtmann, Light Trap, 7♂♂ (UNSW_ENT00043670-00043676), 8♀♀ (UNSW_ENT00043677-00043684) (BPBM). Tawau, Quoin Hill. Cocoa Research Station, 23 Sep 1962 – 26 Sep 1962, Y. Hirashima, Light Trap, 3♂♂

(UNSW_ENT00043685-00043687), 2♀♀ (UNSW_ENT00043688, UNSW_ENT00043689) (BPBM). **MICRONESIA: IFALUK ATOLL:** Ifaluk Island, Ifaluk, 8.61109°N 151.7939°E, 6 m, 06 Sep 1953, Merston Bates, 1♂ (UNSW_ENT00315531) (USNM). **PALAU: NGAREMLENGUI:** Babelthuap Island, 01 Jun 1957, C.W. Sabrosky, Light Trap, 15♀♀ (UNSW_ENT00044209-00044223) (BPBM). **PHILIPPINES: CAMARINES SUR:** Iriga Mt, 13.45416°N 123.45055°E, 550 m, 27 Apr 1962, H.M. Torrevillas, 1♂ (UNSW_ENT00046522) (BPBM). **IFUGAO:** Mt. Province, Mayoyao, 1000-1500 m, 09 Aug 1966, H.M. Torrevillas, 1♂ (UNSW_ENT00046521) (BPBM). **LAGUNA:** Los Banos, 14.16667°N 121.18333°E, 07 Jan 1972, A.D. Pawar, *Oryza* sp. (Poaceae), 1♂ (UNSW_ENT00124211) (CNC); 09 Feb 1972, A.D. Pawar, *Oryza* sp. (Poaceae), 1♂ (UNSW_ENT00124215) (CNC); Apr 1972, A.D. Pawar, Light Trap, 1♂ (UNSW_ENT00124210) (CNC); 14 Apr 1972, A.D. Pawar, *Oryza* sp. (Poaceae), 1♀ (UNSW_ENT00124220) (CNC); 20 May 1972, A.D. Pawar, *Oryza* sp. (Poaceae), 1♀ (UNSW_ENT00124217) (CNC); 11 Oct 1972, A.D. Pawar, *Oryza* sp. (Poaceae), 1♂ (UNSW_ENT00124212) (CNC); Nov 1972, A.D. Pawar, Light Trap, 1♂ (UNSW_ENT00124213), 1♀ (UNSW_ENT00124221) (CNC); 11 Dec 1972, A.D. Pawar, *Oryza* sp. (Poaceae), 1♂ (UNSW_ENT00124214) (CNC). San Pedro, 14.36293°N 121.0518°E, 11 m, 03 Apr 1972, A.D. Pawar, *Oryza* sp. (Poaceae), 1♀ (UNSW_ENT00124219) (CNC); Los Baños: International Rice Research Institute, 14.16722°N 121.23972°E, 27 May 1966, S. H. BAE, 39♂♂ (UNSW_ENT00045460-00045498), 2 juvenile (UNSW_ENT00045499, UNSW_ENT00045500), 35♀♀ (UNSW_ENT00045501-00045535) (BPBM). **LEYTE:** Makapalag, 07 Jul 1964, M.D. Delfinado, 2♂♂ (UNSW_ENT00046517, UNSW_ENT00046518), 1♀ (UNSW_ENT00046519) (BPBM). **LUZON:** Camarinas Sur Province, Iriga, 30 Apr 1962, H.M. Torrevillas, 5♂♂ (UNSW_ENT00046561-

00046565), 1♀ (UNSW_ENT00046566), 1 sex unknown (UNSW_ENT00046567) (BPBM); 09 Apr 1962, H.M. Torrevillas, 1♂ (UNSW_ENT00046570) (BPBM). **MINDANAO:** Zamboanga Peninsula, Dipolog, 08 Aug 1958, H.E. Milliron, 2♀♀ (UNSW_ENT00046568, UNSW_ENT00046569) (BPBM). 24 km NW of Milbuk, nr Lebak, 230 m, 08 Aug 1958, H.E. Milliron, Light Trap, 2♀♀ (UNSW_ENT00043578, UNSW_ENT00043581), 1♂ (UNSW_ENT00043580) (BPBM). Agusan, 10 km SE of S. Francisco, 8.42443°N 124.81034°E, 420 m, 12 Nov 1959, L.W. Quate, 1♀ (UNSW_ENT00046501), 1♂ (UNSW_ENT00046505) (BPBM); 13 Nov 1959, C. M. Yoshimoto, 1♂ (UNSW_ENT00046506) (BPBM). Agusan: 6km SE of San Fransisco, 8.47666°N 125.92527°E, 12 Nov 1959 – 18 Nov 1959, C. M. Yoshimoto, 1♀ (UNSW_ENT00046502), 2♂♂ (UNSW_ENT00046503, UNSW_ENT00046504) (BPBM). Agusan: Esaperana, Bagugan, Matibog creek, 300 m, 10 Nov 1959, C. M. Yoshimoto, 10♀♀ (UNSW_ENT00046541, UNSW_ENT00046542, UNSW_ENT00046545-00046551, UNSW_ENT00046560), 10♂♂ (UNSW_ENT00046543, UNSW_ENT00046544, UNSW_ENT00046552-00046559) (BPBM). Bukidnon, Mt Katanglad, 1480 m, 26 Oct 1959 – 30 Oct 1959, L.W. Quate, 1♂ (UNSW_ENT00046520) (BPBM). Cotabato: General Santos, 6.11666°N 125.16666°E, 14 Aug 1958, H.E. Milliron, 5♀♀ (UNSW_ENT00046333-00046336, UNSW_ENT00046344), 8♂♂ (UNSW_ENT00046337-00046343, UNSW_ENT00046345) (BPBM); General Santos, NDC Cotton Proj., 14 Aug 1958, H.E. Milliron, 3♀♀ (UNSW_ENT00046498-00046500) (BPBM); 15 Aug 1958, H.E. Milliron, 18♀♀ (UNSW_ENT00046464-00046481), 16♂♂ (UNSW_ENT00046482-00046497) (BPBM). **DAVAO:** Genitalan 8 km NW of Mt. Apo, 690 m, 17 Aug 1958, H.E. Milliron, Light Trap, 3♂♂ (UNSW_ENT00043574-00043576) (BPBM). **MISAMIS ORIENTAL:** 3.2 km S Gingoong, 15 May 1961, L. M. Torrevillas, 1♂

(UNSW_ENT00046571) (BPBM). Misamis Oriental 10 km S Gingoong, 12 May 1960, H.M. Torrevillas, 1♂ (UNSW_ENT00046572) (BPBM). Misamis Oriental Pigtibiran, 600 m, 01 May 1961 – 13 May 1961, H.M. Torrevillas, 2♀♀ (UNSW_ENT00046574, UNSW_ENT00046575) (BPBM). Z. Del Sur, Milbuk, 10 Aug 1958, H.E. Milliron, Light Trap, 7♀♀ (UNSW_ENT00043544-00043550), 8♂♂ (UNSW_ENT00043551-00043558), 1♂ (UNSW_ENT00046515), 1♀ (UNSW_ENT00046516) (BPBM). Z. Del Sur 11 km NW of Milbuk, 390 m, 05 Aug 1958, H.E. Milliron, Light Trap, 13♂♂ (UNSW_ENT00043559-00043571) (BPBM). Dinawihan Gingoog 26km E of Gingoog City, 300 m, 21 Aug 1965, H.M. Torrevillas, 1♂ (UNSW_ENT00046508), 2♀♀ (UNSW_ENT00046511, UNSW_ENT00046512) (BPBM); 22 Aug 1965, H.M. Torrevillas, 1♂ (UNSW_ENT00046509) (BPBM); 30 Aug 1965, H.M. Torrevillas, 1♂ (UNSW_ENT00046510), 2♀♀ (UNSW_ENT00046513, UNSW_ENT00046514) (BPBM); 14 Aug 1965, H.M. Torrevillas, 1♂ (UNSW_ENT00046507) (BPBM). Gingoong, 26 Apr 1960 – 27 Apr 1960, H.M. Torrevillas, Light Trap, 3♂♂ (UNSW_ENT00044224-00044226), 8♀♀ (UNSW_ENT00044227-00044234) (BPBM). Hindangon, 20 km S of Gingoog, 7.81361°N 124.96888°E, 600 m, 20 Apr 1960 – 24 Apr 1960, H.M. Torrevillas, 6♂♂ (UNSW_ENT00044199-00044204), 4♀♀ (UNSW_ENT00044205-00044208) (BPBM). **MOUNTAIN PROVINCE:** Bontoc, 17.08191°N 120.97378°E, 853 m, 07 Apr 1972, A.D. Pawar, *Oryza* sp. (Poaceae), 1♀ (UNSW_ENT00124218) (CNC). **NATIONAL CAPITAL REGION:** Manila (Luzon), 14.58333°N 120.96667°E, 20 Nov 1919, R. C. McGregor, 16♀♀ (UNSW_ENT00193438-00193453), 102♂♂ (UNSW_ENT00193454-00193555) (CAS). **NEGROS ORIENTAL:** Dumaguete, 26 Sep 1959 – 29 Sep 1959, L. Quate and C. Yoshimoto, 1♂ (UNSW_ENT00046523) (BPBM). **PALAWAN:** 3 km NE Tinabog, 07 May 1962, H. Holtmann, 1 sex unknown (UNSW_ENT00046346)

(BPBM). **RIZAL:** Muntinlupa, 14.39126°N 121.04778°E, 13 m, 23 May 1972, A.D. Pawar, *Oryza* sp. (Poaceae), 1♀ (UNSW_ENT00124216) (CNC). **SOLOMON ISLANDS: GUADALCANAL:** Honiara, 9.42805°S 160.05472°E, 200 m, Dec 1975, N.L.H. Krauss, 4♂♂ (UNSW_ENT00185715-00185718), 2♀♀ (UNSW_ENT00185724, UNSW_ENT00185725) (USNM). **SAN CRISTOVAL:** Kira Kira, 10.44138°S 161.91666°E, 100 m, Jan 1976, N.L.H. Krauss, 5♂♂ (UNSW_ENT00185710-00185714), 5♀♀ (UNSW_ENT00185719-00185723) (USNM). **SRI LANKA: CENTRAL PROV.:** Kandy, 7.3016°N 80.6476°E, 498 m, 22 Mar 1971 – 29 Mar 1971, P. and P. Spangler, 1♂ (UNSW_ENT00315533) (USNM). Teldeniya, 7.29807°N 80.77028°E, 427 m, 18 Nov 1976 – 20 Nov 1976, D.M. Davies, S. Karunaratne, and D.W. Balasooriya, 1♀ (UNSW_ENT00315535) (USNM). Udawattakele, 7.28333°N 80.63333°E, 586 m, 26 Aug 1975 – 29 Aug 1975, D.M. Davies, S. Karunaratne, and D.W. Balasooriya, 1♂ (UNSW_ENT00315534) (USNM). **EASTERN PROVINCE:** China Bay, 8.53903°N 81.18139°E, 4 m, 09 Nov 1976 – 11 Nov 1976, D.M. Davies, S. Karunaratne, and D.W. Balasooriya, 1♀ (UNSW_ENT00315536) (USNM). Inginiyagala, 7.21666°N 81.53332°E, 104 m, 07 Sep 1975 – 08 Sep 1975, D.M. Davies, S. Karunaratne, and D.W. Balasooriya, 1♂ (UNSW_ENT00315532) (USNM). **TAIWAN: CHANGHUA:** Erlin Township, Tung shih, 23.92082°N 120.4458°E, 17 m, 13 Oct 1951, H.C. Barnett, 1♂ (UNSW_ENT00315537) (USNM). **NANTOU:** Ren-ai Township, Huei-Sun For. Rec. Area, 5km NE of Meiyuan, 24.0667°N 120.9833°E, 733 m, 10 Jul 1992 – 11 Jul 1992, T. J. Henry and A. G Wheeler, Jr., 1♂ (UNSW_ENT00315539) (USNM). **UNKNOWN:** Bantan, 18 Nov 1932, Kay Sakimura, Light Trap, 1♂ (UNSW_ENT00045583) (BPBM). Takao, 11 Jan 1932, Kay Sakimura, Light Trap, 4♀♀ (UNSW_ENT00045586-00045589), 2♂♂ (UNSW_ENT00045584,

UNSW_ENT00045585) (BPBM). **THAILAND: BANGKOK:** Bangkok, 13.728°N 100.525°E, 04 Dec 1957, J.L. Gressitt, Light Trap, 1♀ (UNSW_ENT00045582) (BPBM). Changwat **CHIANG MAI:** Ban-tin-doi, 18.46045°N 98.93862°E, 350 m, 14 Nov 1957, J.L. Gressitt, 2♂♂ (UNSW_ENT00044313, UNSW_ENT00044314) (BPBM). Bon-Tin-Doi, 18.92027°N 98.76083°E, 14 Nov 1957, J.L. Gressitt, Light Trap, 1♀ (UNSW_ENT00045592), 1♂ (UNSW_ENT00045458) (BPBM). Doi Inthanon (Doi Angka) near Chaing Mai Phon, 18.59222°N 98.48666°E, 2436 m, 09 Apr 1958, T.C. Maa, 11♂ (UNSW_ENT00044305-00044310, UNSW_ENT00045453-00045457), 2♀♀ (UNSW_ENT00044311, UNSW_ENT00044312) (BPBM). Pang-Kan Pawng, 18.795°N 99.08055°E, 15 Nov 1957 – 16 Nov 1957, T.C. Maa, Light Trap, 1♂ (UNSW_ENT00045199), 1♀ (UNSW_ENT00045200) (BPBM); 15 Nov 1957, J.L. Gressitt, 44♀♀ (UNSW_ENT00044263-00044278, UNSW_ENT00045437-00045452, UNSW_ENT00045536-00045547), 92♂♂ (UNSW_ENT00044279-00044304, UNSW_ENT00045400-00045436, UNSW_ENT00045548-00045576) (BPBM); Doi Aneka, 04 Dec 1953, T.C. Maa, Light Trap, 2♀♀ (UNSW_ENT00045590, UNSW_ENT00045591) (BPBM). N. Pangmakampon (Pankampwang) Near Fang, 450 m, 15 Nov 1957 – 16 Nov 1957, J.L. Gressitt, 7♀♀ (UNSW_ENT00045067-00045072, UNSW_ENT00045577), 16♂♂ (UNSW_ENT00045073-00045088) (BPBM). **CHONBURI:** Satahip, 12.66305°N 100.90555°E, 24 Nov 1957, T.C. Maa, Light Trap, 4♂♂ (UNSW_ENT00045188-00045191), 8♀♀ (UNSW_ENT00045192-00045198, UNSW_ENT00045594) (BPBM). NE. of Bangkok: Pak Chong (Pakchong), 14.65236°N 101.43461°E, 100 m, 01 Dec 1957, T.C. Maa, Light Trap, 1♂ (UNSW_ENT00045595) (BPBM). **NAKHON RATCHASIMA:** Pak Chong, 01 Dec 1977 – 03 Dec 1977, T.C. Maa, 21♂ (UNSW_ENT00045089-00045101, UNSW_ENT00045172-00045179), 8♀♀ (UNSW_ENT00045180-00045187)

(BPBM). **TRANG:** Khaophappha Khaochang, 200 m, 31 Dec 1963, G.A. Samuelson, Light Trap, 2♂♂ (UNSW_ENT00045620, UNSW_ENT00045621), 2♀♀ (UNSW_ENT00045622, UNSW_ENT00045623) (BPBM); 11 Jan 1964 – 15 Jan 1964, G.A. Samuelson, Light Trap, 64♀♀ (UNSW_ENT00044983-00045041, UNSW_ENT00045615-00045619), 25♂♂ (UNSW_ENT00045042-00045066), 3♂♂ (UNSW_ENT00045604-00045606), 8♀♀ (UNSW_ENT00045607-00045614), 11♂ (UNSW_ENT00043983-00043991, UNSW_ENT00045459, UNSW_ENT00045578), 30♀♀ (UNSW_ENT00043992-00044018, UNSW_ENT00045579-00045581) (BPBM).

Diagnosis

Cyrtorhinus lividipennis can be recognised by the following combination of characters: females always macropterous; anterior lobe of pronotum narrow, with deep depressions laterally (Fig. 33d); distinct black medial line on scutellum; very sparse setae; colourless hemelytra (Fig. 7n); labium reaching mesocoxae; hemelytral margins weakly convex (Fig. 7n); left paramere Y-shaped, apophysis sinuate (Fig. 31c); right paramere mitt-shaped, apophysis squat, with apical comb-like flange and lateral lamina (Fig. 31b); endosomal membranous bag lacking sclerotisation; proximal endosomal spicule straight; rudus spear-shaped, margins dentate (Figs 31d-g).

Description

Males.

COLOURATION: Body yellow and black, colour and patterns highly variable (Figs 6,7n). ***Head:*** generally pale green to bright yellow or light brown; frons black, vertex yellow, black medially, black marking usually forms a distinct diamond shape, indistinct in some populations; clypeus black to brown; maxillary and mandibular plates sometimes mottled with brown or yellow. ***Antennae:*** AI-AIV black, yellow around

joints; AII sometimes with a yellow band. ***Labium:*** pale grey, yellow, brown or fuscous usually with a black tip. ***Pronotum:*** anterior yellow; pronotum black posteriorly with distinct highly variable yellow markings. ***Scutellum:*** yellow to light brown with black medial line; mesoscutum usually black to dark brown, sometimes mottled with yellow or yellow with distinct black lines. ***Hemelytra:*** translucent colourless with a yellow to brown or pale grey or green impression from abdomen; membrane colourless. ***Thoracic pleura and sterna:*** usually yellow, possibly grey to dark brown, sometimes pale green. ***Legs:*** pale grey to yellow or green. ***Abdomen:*** abdominal venter yellow to dark brown, sometime pale green; pygophore usually yellow, sometimes mottled with black.

VESTITURE AND TEXTURE: Sparse distribution of pale grey, erect, hair-like setae. ***Head:*** vertex with setae along midline and fringes of around eyes (Fig. 33a); setae sparse and long on genae (Fig. 33b). ***Antennae:*** densely covered in small, decumbent hair-like setae; AI sparser, slightly longer and more erect setae; three thick bristle-like setae interiorly facing. ***Pronotum:*** rugulose around depressions (Fig. 33d); hair-like setae sparse and short; microtrichia minute, sparse. ***Hemelytra:*** setae decumbent, minute rarely visible with light microscopy; occasionally very sparse fringe of semi-erect hair-like setae on lateral margins. ***Legs:*** femur covered in dense decumbent hair-like setae; tibia sparsely covered in long semi-erect hair-like setae and two columns of tibial spinules.

STRUCTURE: ***Head:*** eyes large, about equal in length to head (Fig. 33a); vertex topology smooth (Fig. 33a); bucculae narrow, ovate, not reaching anteniferous tubercles anteriorly (Fig. 33c). ***Labium:*** extending to mesothorax. ***Pronotum:*** (Fig. 33d) anterior lobe ca. half width of posterior; anterior lobe clear depression posteriorly and medially; calli pronounced; lateral margin convex; posterior lobe lateral margin concave; posterior margin concave. ***Hemelytra:*** about 1.5x longer than abdomen, lateral margins weakly

convex; cuneus about 2x longer than wide. ***Male genitalia:*** Left paramere (Fig. 31c) Y-shaped; sensory lobe with elongate setae; apophysis sinuate, apex recurved, file-like texture subapical. Right paramere (Fig. 31b) small, lobes short, length subequal to stem; apophysis weakly concave, with a lateral lamina, with a dorso-distal flange, with five teeth. Aedeagus (Figs 31d-g) small in size, endosoma ca. 0.2 mm in length; with short endosomal membranous bag, lacking sclerotisation; proximal endosomal spicule straight, more or less parallel to ductus seminis; apically upright, with margins densely dentate, rudus positioned sub apically, ca. 0.03 mm in length, perpendicular to spicule, strongly pronounced and spear-shaped; secondary gonophore elongate, surpassing rudus of proximal endosomal spicule, reaching near apex of phallotheca.

Females.

Macropterous only.

Externally similar to males. ***Female genitalia:*** left and right plates of gonapophyses 8 (Fig. 32; GP8rpl, GP8lpl) simple, symmetrical, weakly sclerotised; vestibulum narrow, positioned at midline; inter-ramal lobes a little longer than inter-ramal sclerite (Fig. 32, IRS, IRL); inter-ramal lobes glove like, spiculate apically, originating at base of inter-ramal sclerite.

Measurements

See Table 1.

Distribution

Cyrtorhinus lividipennis is distributed throughout islands of the Pacific and Southeast Asia (Fig. 9). This distribution is probably due to deliberate introductions for biological control and perhaps some accidental introductions. As *C. lividipennis* thrives in rice monocultures it may be impossible to determine its native distribution. Usinger (1939) suggests that its native distribution is in Southeast Asia, and lists records from Great

Nicobar, Taiwan (as Formosa), Java, Sri Lanka (as Ceylon), Burma, Sumatra, Japan Guam, the Philippines and China.

Biology and Hosts

Carvalho (1956) recorded *Ipomoea* sp. (Convolvulaceae) as its host plant. In the specimens I examined *Cyrtorhinus lividipennis* was commonly collected from rice, as well as at light in close proximity to rice fields. Their association with delphacid leafhoppers, which are pests of rice is discussed above.

Remarks

See remarks section for *Cyrtorhinus albidus.*

The variable colouration of *Cyrtorhinus lividipennis* has resulted in its confusion with other species of *Cyrtorhinus*. It most closely resembles *C. quatei, C. yunganensis* and *C. pilosus* due to their similar size and shape. They also have similar genitalia but they can be distinguished by the following unique combination of characters: anterior lobe of pronotum narrow, with deep depressions laterally (Fig. 33d); distinct black midline on scutellum (Fig. 7n); transparent and colourless hemelytra (Fig. 7n); right paramere of apophysis lacking sclerotisation terminally (Fig. 31b).

Reuter (1885) described *Cyrtorhinus lividipennis*, and early taxonomic treatments are listed by Carvalho (1958). Usinger (1951) described *Cyrtorhinus vitiensis* which was subsequently synonymised by Carvalho (1955). Usinger (1951) in a revision of Pacific *Cyrtorhinus*, erected *Cyrtorhinus* (*Reuteriessa*) as a new subgenus, with *C. lividipennis* as the type species. His subgeneric classification was based on those currently assigned to *Cyrtorhinus* and those belonging to the phyline genus *Tytthus*; the latter being transferred by Carvalho and Southwood (1955) from *Cyrtorhinus*. Usinger (1951) also described *Cyrtorhinus vitiensis* as a new species. It was synonymised by Carvalho and Southwood (1955).

Cyrtorhinus lividipennis is the best known of all the species belonging to this genus, because of its use as a biological control agent. Reyes and Gabriel (1975) discussed the life history and food preferences of this species. Ressif et al. (1982) and Preetha et al. (2010) reported on the effects of insecticides on *C. lividipennis* and its prey. Heong et al. (1992) studied its population dynamics. Senguttuvan and Gopalan (1990) discussed its predatory efficiency. Sivapragasam and Asma (1984) discussed its development and reproduction. Liquido and Nishida (1985) discussed various life history differences with the species *Cyrtorhinus lividipennis*, including fecundity, longevity, prey preference and number of nymphal instars. This study has found that several species which resemble *C. lividipennis* can be found in Asia and it is possible that these biological differences may be a result of a lack of information in species diversity. It may be that several different species may have been confused with *C. lividipennis.*

Cyrtorhinus melanops **Reuter**

Habitus, Figure 7o. Distribution, Figure 18. Male genitalia, Figure 25g-i. SEMs, Figure 34.

Cyrtorhinus melanops Reuter, 1905: 6; Carvalho 1958: 55 (catalogue; pre-1958 literature); Carvalho and Southwood 1955: 40, figs (description); Carvalho, Dutra and Becker 1960: 459, fig. 19 (description); Schuh 1974: 38, figs 9, 102, 103 (description); Linnavuori 1994: 56, figs 34, 40 (description); Schuh 1995: 100 (world catalogue)

Materials examined

Type not examined. Specimens used were previously identified as *Cyrtorhinus melanops.*

ETHIOPIA: Sululta, 9.18333°N 38.75°E, 11 Jun 1963, Linnavuori, 2♂♂

(UNSW_ENT00309952, UNSW_ENT00309953) (ZISP). **SOUTH AFRICA: MPUMALANGA:** Transvaal, Little Sabie River, Sabie, 25.08333°S 30.76666°E, 29 Nov 1967, J.A. and S. Slater, R.T. Schuh, 2♀♀ (UNSW_ENT00355397, UNSW_ENT00355398), 1♂ (UNSW_ENT00355399) (AMNH). **NORTH WEST:** Rustenburg, 04 Jan 1957 - 11 Jan 1957, A.L. Capener, 1♀ (UNSW_ENT00355400), 1♂ (UNSW_ENT00355401) (AMNH).

Diagnosis

Cyrtorhinus melanops can be recognised by the following combination of characters: females always macropterous; body black (Fig. 7o); lateral margins of hemelytra straight (Fig. 7o); labium reaching SIII-SIV; left paramere Y-shaped, apophysis sinuate (Fig. 25i); right paramere mitt-shaped, apophysis elongate, with apical comb-like flange (Fig. 25h); endosomal membranous bag with a field of minute spinules; proximal endosomal spicule curved, divergent from the ductus seminis apically; rudus triangulate, weakly margins dentate (Fig. 25g).

Description

Males

COLOURATION: Body black (Fig. 7o). ***Head:*** generally black, vertex black, pale yellow around eyes; posterior pale yellow; clypeus black; maxillary plates black; mandibular plates yellow. ***Antennae:*** black, pale yellow around joint of AI-AII. ***Labium:*** fuscous. ***Pronotum:*** uniformly black; propleura black. ***Scutellum:*** black. ***Hemelytra:*** translucent colourless; cells of membrane with a brown outline. ***Thoracic pleura and sterna:*** fuscous. ***Legs:*** uniformly yellow. ***Abdomen:*** abdominal venter fuscous.

VESTITURE AND TEXTURE: Generally covered in pale grey, semi-erect, hair-like setae and densely covered in minute simple microtrichia. ***Head:*** vertex setae present

only on fringes and midline; scale-like texture dense in glabrous region (Fig. 34a); gula and genae setae erect, sparse; microtrichia absent (Fig. 34b). ***Antennae:*** dense, semi decumbent hair-like setae; three large thick bristle-like setae interiorly facing. ***Pronotum:*** (Fig. 34c) smooth; setae sparse, long; microtrichia sparse. ***Hemelytra:*** setae sparse, uniformly distributed. ***Legs:*** dense thick decumbent hair-like setae; tibial setae dense, tibial spinules small, brown, erect.

STRUCTURE: ***Head:*** eyes large, about equal in length to head; vertex topology with curved ridges lateral to midline (Fig. 34a); bucculae broad, rounded, not reaching anteniferous tubercles anteriorly (Fig. 34b). ***Labium:*** terminating in at thoracic-abdominal boundary, surpassing mesocoxae. ***Pronotum:*** (Fig. 34c) anterior lobe lateral margin convex; calli weakly developed; foveae narrowly separated; posterior lobe declivent, lateral margin concave, posterior margin convex. ***Hemelytra:*** lateral margins straight; about 1.5x as long as abdomen; cuneus about 2x longer than wide. ***Male genitalia:*** Left paramere (Fig. 25i) Y-shaped; sensory lobe with spare elongate setae; apophysis sinuate strongly, apex simple, file-like texture along dorsal surface. Right paramere (Fig. 25h) lobes long, length longer than stem; sensory lobe straight, setae with prominent base; apophysis concave, flange with four weak teeth. Aedeagus (Fig. 25g) endosoma ca. 0.4 mm in length; endosomal membranous bag with mild sclerotisation distally; proximal endosomal spicule uniformly curved away from ductus seminis, margins smooth; rudus positioned subapically, ca. 0.04mm in length, perpendicular to spicule, strongly pronounced and triangulate; secondary gonopore elongate, reaching rudus.

Females.

Macropterous only.

Externally similar to males. Female genitalia not investigated.

Measurements

See Table 1.

Distribution

Cyrtorhinus melanops is endemic to southern and western Africa (Fig. 18).

Biology and Hosts

Unknown.

Remarks

Cyrtorhinus melanops resembles *C. caricis* in its colouration and size. However, the elongate sensory lobe of the left and right parameres (Figs 25h,i) place it firmly inside the large genitalia clade of *Cyrtorhinus*; i.e., with *C. dimorphus, C. eylesi, C. carvalhoi* and *C. novabritannia.* It can also be distinguished from other species of *Cyrtorhinus* by its elongate labium that extends to abdominal s3-s4. *C. melanops* also superficially resembles *Mecomma* but can be distinguished from it by generic characteristics, particularly of the male genitalia (see generic diagnosis of *Cyrtorhinus*).

***Cyrtorhinus novabritannia* sp. nov.**

Habitus, Figure 7p. Distribution, Figure 9. Male genitalia, Figure 17g-i. SEMs, Figure 35.

Etymology

This species is named for its type locality, New Britain.

Materials examined

HOLOTYPE: **PAPUA NEW GUINEA: NEW BRITAIN PROVINCE:** Malmalwan-Vunakanau, Gazelle Pen., 4.6667°S 152°E, 05 Apr 1956 - 12 Apr 1956, Gressitt, Light Trap, ♀ (UNSW_ENT00044235). (BPBM)

PARATYPES: **PAPUA NEW GUINEA: NEW BRITAIN PROVINCE:** Malmalwan-

Vunakanau, Gazelle Pen., 4.6667°S 152°E, 05 Apr 1956 - 12 Apr 1956, J.L. Gressitt, Light Trap, 3♀♀ (UNSW_ENT00044236-00044238), 1♂ (UNSW_ENT00044239) (BPBM). Unknown: Peria Creek, Kwagira River, 50 m, 14 Aug 1953 - 06 Sep 1953, G.M. Tate, 4♀♀ (UNSW_ENT00043352-00043355) (BPBM).

Diagnosis

Cyrtorhinus novabritannia can be recognised by the following combination of characters: females always macropterous; body black (Fig. 7p); calli slightly raised (Fig. 36b); labium reaching mesosternum; hemelytral margins straight (Fig. 7p); left paramere with elongate sensory lobe, apex of apophysis recurved (Fig. 17i); right paramere apophysis elongate, flange dorso-dorsally oriented; rudus narrow basally (Fig. 17h); endosomal membranous bag lacking sclerotisation; proximal endosomal spicule straight; rudus spear-shaped, margins dentate (Fig. 17g).

Description

Males

COLOURATION: Body black (Fig. 7p). ***Head:*** generally black; maxillary and mandibular plates light brown. ***Antennae:*** fuscous. ***Labium:*** light brown to yellow. ***Pronotum:*** uniformly black; coxae yellow, sometimes partially black. ***Scutellum:*** black to dark brown. ***Hemelytra:*** colourless, translucent; membrane with a brownish tinge. ***Thoracic pleura and sterna:*** black metathoracic gland sometimes with a yellow spot around opening. ***Legs:*** yellow. ***Abdomen:*** abdominal venter fuscous.

VESTITURE AND TEXTURE: Body covered in large erect, pale grey, hair-like setae and densely covered in minute microtrichia. ***Head:*** (Fig. 35a) vertex with hair-like setae present along fringes and one paired setae present on midline; scale-like texture present; genae microtrichia absent. ***Antennae:*** densely covered in small semi-erect setae; AI with one dorsal and two lateral thick bristle-like setae. ***Pronotum:*** (Fig. 35b) smooth;

setae large, erect, sparse; microtrichia sparse. ***Hemelytra:*** hair-like setae dense, evenly distributed; abdomen densely covered in long hair-like setae. ***Legs:*** hair-like setae sparse, slightly denser on tibia; tibial spinules very thick, brown, fairly short.

STRUCTURE: ***Head:*** eyes large, about equal in length to head (Fig. 35a); vertex topology smooth (Fig. 35a); bucculae broad, rounded, not reaching anteniferous tubercles anteriorly. ***Labium:*** extending to mesosternum. ***Pronotum:*** (Fig. 35b) calli weakly developed; foveae narrowly separated; posterior margin mildly concave. ***Hemelytra:*** lateral margins straight (Fig. 7p); cuneus about 3x longer than wide (Fig. 35f). ***Male genitalia:*** Left paramere (Fig. 17i) Y-shaped; sensory lobe with disordered elongate setae; apophysis sinuate, apex recurved, scale-like texture along dorsal surface. Right paramere (Fig. 17h) large, lobes elongate, ca. 2x longer than stem; sensory lobe laterally sinuate, setae elongate, each with prominent base; apophysis straight, with latero-apical flange, with five teeth. Aedeagus (Fig. 17g) large, endosoma ca. 0.4 mm in length; with short endosomal membranous bag, lacking sclerotisation; proximal endosomal spicule straight, slightly divergent from ductus seminis; apically upright, with margins dentate, rudus positioned apically, elongate ca. 0.1 mm in length, prominent, spear-shaped; secondary gonopore sinuate elongate, reaching rudus of proximal endosomal spicule, and near apex of phallotheca.

Females.

Macropterous only.

Externally similar to males. Female genitalia not investigated.

Measurements

See Table 1.

Distribution

Cyrtorhinus novabritannia is endemic to New Britain, Papua New Guinea (Fig. 9).

Biology and Hosts

Specimens of this species have been collected at light. There are no host records.

Remarks

See remarks section of *Cyrtorhinus carvalhoi.*

***Cyrtorhinus palauensis* sp. nov.**

Habitus, Figure 7q. Male genitalia, Figure 8k-m. Distribution, Figure 9. SEMs, Figure 36.

Etymology

This species is named for the locality of the first specimens assigned to this species from Palau.

Materials examined

HOLOTYPE: **PALAU: KOROR:** Koror Island, 7.36055°N 134.47916°E, 31 May 1957, C.W. Sabrosky, 1♂ (UNSW_ENT00046908) (BPBM).

PARATYPES: **PALAU: KOROR:** Koror Island, 7.36055°N 134.47916°E, 31 May 1957, C.W. Sabrosky, 1♀ (UNSW_ENT00046912) (BPBM); 15 Mar 1948, K.L. Maehler, 1♂ (UNSW_ENT00046909), 2♀♀ (UNSW_ENT00046910, UNSW_ENT00046911) (BPBM). Ngaremlengui: Babelthuap Island, 01 Jun 1957, C.W. Sabrosky, 6♀♀ (UNSW_ENT00046913-00046918), Light Trap, 15♀♀ (UNSW_ENT00044209-UNSW_ENT00044223) (BPBM). **PHILIPPINES: MISAMIS ORIENTAL:** Hindangon, 20 km S of Gingoog, 7.81361°N 124.96888°E, 600 m, 20 Apr 1960 - 24 Apr 1960, H.M. Torrevillas, 1♀ (UNSW_ENT00044208) (BPBM).

Diagnosis

Cyrtorhinus palauensis can be recognised by the following combination of characters: females always macropterous; AIII with minute lateral ridges (Fig. 36e); bright yellow

colouration (Fig. 7q); pronotal calli slight (Fig. 36b); uniformly black scutellum (Fig. 7q); labium reaching mesocoxae; uniformly convex hemelytral margins (Fig. 7q); left paramere apophysis elongate, grossly sinuate, apex weakly recurved (Fig. 8m); right paramere mitt-shaped, apophysis squat with a apical flange (Fig. 8l); proximal endosomal spicule straight; rudus rounded; endosomal membrane weakly sclerotised (Fig. 8k).

Description

Males.

COLOURATION: Body yellow with black markings. ***Head:*** generally yellow with distinct black markings; vertex yellow with a black marking medially; clypeus black; maxillary and mandibular plates black. ***Antennae:*** AI- AIV black, pale yellow markings at joints. ***Labium:*** black. ***Pronotum:*** uniformly black. ***Scutellum:*** uniformly black. ***Hemelytra:*** translucent yellow; membrane with a black tinge. ***Thoracic pleura and sterna:*** thoracic pleura black; thoracic sterna yellow. ***Legs:*** yellow. ***Abdomen:*** abdominal venter yellow.

VESTITURE AND TEXTURE: Generally covered in pale grey, semi-erect, hair-like setae and densely covered in minute simple microtrichia. ***Head:*** vertex setae present only on fringes and midline; scale-like texture present on margins (Fig. 36a); gula and genae setae long erect, sparse. ***Antennae:*** dense, semi decumbent hair-like setae; AI three thick bristle-like setae facing interiorly (Fig. 36d); AIII with minute lateral rides (Fig. 36e). ***Pronotum:*** (Fig. 36b) weakly rugulose; setae sparse; microtrichia sparse, very dense on proxyphus. ***Hemelytra:*** (Fig. 36c) setae sparse, fairly evenly spaced. ***Legs:*** (Fig. 36g) dense thick decumbent hair-like setae; relatively dense and long on tibia; tibial spinules small, brown, erect.

STRUCTURE: ***Head:*** eyes large, about equal in length to head (Fig. 36a); vertex

topology smooth (Fig. 36a); bucculae broad, rounded, not reaching anteniferous tubercles anteriorly. ***Labium:*** extending to mesocoxae; resting terminally in a channel. ***Pronotum:*** (Fig. 36b) anterior lobe calli weakly developed; foveae widely separated; posterior lobe lateral margins strongly concave, posterior margin weakly concave. ***Hemelytra:*** 1.5x longer than abdomen (Fig. 7q); lateral margins convex; cuneus 2x longer than wide. ***Male genitalia:*** Left paramere (Fig. 8m) Y-shaped; sensory lobe with two rows of elongate setae; apophysis strongly sinuate, apex incrassate, recurved forming a horizontal sclerotised minute hook, file-like texture subapical. Right paramere (Fig. 8l) small, lobes short, subequal in length to stem; sensory lobe setae elongate, each with prominent base; apophysis strongly concave, spoon like, with distal flange, with six teeth. Aedeagus (Fig. 8k) small in size, endosoma ca. 0.2 mm in length; endosomal membranous bag short, distally weakly sclerotised; proximal endosomal spicule straight, more or less parallel to ductus seminis; apically upright, with margins dentate, rudus positioned subapically, ca. 0.03 mm in length, perpendicular to spicule, strongly pronounced and rounded; secondary gonopore elongate, reaching rudus of proximal endosomal spicule.

Females.

Macropterous only.

Externally similar to males. Female genitalia not investigated.

Measurements

See Table 1.

Distribution

Cyrtorhinus palauensis is found in Palau and Australia (Fig. 9).

Biology and Hosts

Unknown.

Remarks

See remarks section on *Cyrtorhinus albidus.*

Cyrtorhinus palauensis resembles *C. solomonensis,* but can be differentiated from it by the ridges on AIII (Fig. 36e) and differences in the genitalia (Figs 8k-m), particularly the shape of the left paramere (Fig. 8m).

***Cyrtorhinus pilosus* sp. nov.**

Habitus, Figure 7r. Distribution, Figure 9. Male genitalia, Figure 11k-m. SEMs, Figure 37.

Etymology

This species is named from the Latin word for hairs due to its prominent setae.

Materials examined

HOLOTYPE: **PHILIPPINES: IFUGAO:** Jacmal Bunhian, 24 km E. Mayoyao; 800-1000 m, 07 Jul 1961 - 14 Jul 1961, P. I. Natl. Mus. and AMNH Expedition, ♂ (UNSW_ENT00004759) (BPBM).

PARATYPES: **PHILIPPINES: IFUGAO:** Jacmal Bunhian, 24 km E. Mayoyao; 800-1000 m, 13 Apr 1967, H.M. Torrevillas, 1♀ (UNSW_ENT00044260) (BPBM). **LEYTE:** Abuyog, 35 mi S of Tacloban, 10.73527°N 125.02138°E, 07 Jul 1961 - 14 Jul 1961, P. I. Natl. Mus. and AMNH Expedition, 2♂♂ (UNSW_ENT00004760-00004761), 9♀♀ (UNSW_ENT00004762-00004770) (AMNH). Dagami, 14 miles southwest of Tacloban, 11.06138°N 124.90916°E, 23 Jul 1961, P.I. National Museum and AMNH Expedition, 1♀ (UNSW_ENT00004771) (AMNH). **LUZON:** Isabela, San Marino, 16.9825°N 122.01833°E, 20 Apr 1961, P.I. National Museum and AMNH Expedition, 2♂♂ (UNSW_ENT00004777, UNSW_ENT00004778), 2♀♀ (UNSW_ENT00004779, UNSW_ENT00004780) (AMNH); 15 May 1961 - 20 May

1961, P.I. National Museum and AMNH Expedition, 4♂♂ (UNSW_ENT00004772-00004775), 1♀ (UNSW_ENT00004776) (AMNH). **MINDANAO:** Zamboanga Peninsula, Zamboanga del Norte, 25km South of Manucan, 8.22555°N 123.09666°E, 500 m, 18 Oct 1959, L.W. Quate, 1♂ (UNSW_ENT00045284), 3♀♀ (UNSW_ENT00045285-00045287) (BPBM). **AGUSAN:** Esaperana, Bagugan, Matibog creek, 300 m, 07 Nov 1959, C. M. Yoshimoto, 2♂♂ (UNSW_ENT00045297, UNSW_ENT00045303), 1♀ (UNSW_ENT00045304) (BPBM); 10 Nov 1959, C. M. Yoshimoto, 5♂♂ (UNSW_ENT00045288-00045292), 4♀♀ (UNSW_ENT00045293-00045296) (BPBM). **COTABATO:** General Santos, 6.11666°N 125.16666°E, 14 Aug 1958, H.E. Milliron, Light Trap, 17♂♂ (UNSW_ENT00044817-00044833), 4♀♀ (UNSW_ENT00044834-00044837) (BPBM). **DAVAO:** Genitalan 8 km NW of Mt. Apo, 690 m, 17 Aug 1958, H.E. Milliron, Light Trap, 7♀♀ (UNSW_ENT00044802-00044808), 8♂♂ (UNSW_ENT00044809-00044816) (BPBM). **MISAMIS OCCIDENTAL:** Ozamis city, 8.15°N 123.84972°E, 22 Oct 1959, C. M. Yoshimoto, 2♂♂ (UNSW_ENT00045298, UNSW_ENT00045299), 3♀♀ (UNSW_ENT00045300-00045302) (BPBM). Z. Del Sur, Milbuk, 05 Aug 1958, H.E. Milliron, Light Trap, 4♀♀ (UNSW_ENT00044727-00044730), 6♂♂ (UNSW_ENT00044731-00044736) (BPBM); 10 Aug 1958, H.E. Milliron, Light Trap, 183♂♂ (UNSW_ENT00044352-00044400, UNSW_ENT00044470-00044531, UNSW_ENT00044696-00044709, UNSW_ENT00045305-00045362), 122♀♀ (UNSW_ENT00044401-00044469, UNSW_ENT00044710-00044726, UNSW_ENT00045363-00045396, UNSW_ENT00045398, UNSW_ENT00045399) (BPBM). **MISAMIS ORIENTAL:** 3.2 km South of Gingoon, 50 m, 15 May 1961, L. M. Torrevillas, 1♂ (UNSW_ENT00044262) (BPBM). Pigtibiran, 01 May 1961 - 13 May 1961, H.M. Torrevillas, 1♂ (UNSW_ENT00044261) (BPBM). **NATIONAL CAPITAL**

REGION: Manila (Luzon), 14.58333°N 120.96667°E, 20 Nov 1919, R. C. McGregor, 180♂♂ (UNSW_ENT00399500-00399587, UNSW_ENT00399639-00399730), 51♀ (UNSW_ENT00399588-00399638) (CAS). **NEGROS ORIENTAL:** Camp Lookout, Dumaguete, 9.294°N 123.218°E, 396 m, 15 Mar 1961 - 10 Apr 1961, T. Schneirla and A. Reyes, 1♂ (UNSW_ENT00004781) (AMNH); 06 Apr 1961 - 15 May 1961, T. Schneirla and A. Reyes, 2♂♂ (UNSW_ENT00004782, UNSW_ENT00004783), 3♀♀ (UNSW_ENT00004784-00004786) (AMNH).

Diagnosis

Cyrtorhinus pilosus can be recognised by the following combination of characters: females always macropterous; body with elongate and dense setae (Figs 37a-f); labium rests terminally in a mesosternal groove; hemelytral margins weakly convex (Fig. 7r); several thick setae present on AI (Fig. 37c); distinct black marking on scutellum (Fig. 7r); colourless hemelytra; left paramere Y-shaped, apophysis sinuate, apically pinched (Fig. 11m); right paramere mitt-shaped, apophysis squat, with apical comb-like flange (Fig. 11l); endosomal membranous bag lacking sclerotisation; proximal endosomal spicule straight, rudus spear-shaped, margins dentate (Fig. 11k).

Description

Males.

COLOURATION: Body brownish yellow (Fig. 7r). ***Head:*** generally light brown to yellow; vertex yellow, black spot medially on anterior margin; clypeus black; maxillary and mandibular plates yellow. ***Antennae:*** AI - AIV black. ***Labium:*** yellow. ***Pronotum:*** anterior brownish yellow; faint black line between calli; posterior brownish yellow, with a black marking anteriorly. ***Scutellum:*** yellow with medial black line; mesoscutum brownish yellow. ***Hemelytra:*** translucent, colourless. ***Thoracic pleura and sterna:*** brown. ***Legs:*** uniformly brown. ***Abdomen:*** Abdominal venter brown.

VESTITURE AND TEXTURE: Generally long dark grey, erect, hair-like setae. ***Head:*** hair-like setae short, dense across frons vertex and genae erect (Fig. 37a); gula and genae densely covered in dense hair-like setae (Fig. 37b). ***Antennae:*** dense, short semi decumbent hair-like setae; AI with more than four thick bristle-like setae present on various surfaces (Fig. 37c), decumbent. ***Pronotum:*** (Fig. 37d) smooth; hair-like setae short, dense; microtrichia dense. ***Hemelytra:*** with a dense semi-erect fringe. ***Legs:*** dense larger hair-like setae; tibial spinules small, brown.

STRUCTURE: ***Head:*** eyes large, about equal in length to head (Fig. 37a); vertex topology with a mild posterior depression (Fig. 37a); bucculae narrow, ovate, not reaching anteniferous tubercles anteriorly. ***Labium:*** rests terminally in a mesosternal groove. ***Pronotum:*** (Fig. 37d) anterior lobe calli weakly developed; lateral margin convex; posterior lobe lateral margin concave; posterior margin concave. ***Hemelytra:*** lateral margins weakly convex; cuneus ca. 1.5x longer than wide (Fig. 37f). ***Male genitalia:*** Left paramere (Fig. 11m) Y-shaped; sensory lobe covered in setae of various sizes; apophysis strongly sinuate, pinched apically, file-like texture subapical. Right paramere (Fig. 11l) small, lobes very short, much shorter than stem; sensory lobe setae elongate; apophysis thick and short curving slightly apically, with distal flange, with four teeth. Aedeagus (Fig. 11k) small in size, endosoma ca. 0.2 mm in length; with short endosomal membranous bag, lacking sclerotisation; proximal endosomal spicule straight, more or less parallel to ductus seminis; apically upright, with margins dentate, rudus positioned subapically, ca. 0.03 mm in length, perpendicular to spicule, strongly pronounced and spear-shaped, proximal margin concave, apical margin tapering; secondary gonopore elongate, weakly twisted, surpassing rudus of proximal endosomal spicule.

Females.

Macropterous only.

Externally similar to males. Female genitalia not investigated.

Measurements

See Table 1.

Distribution

Cyrtorhinus pilosus is endemic to the Philippines (Fig. 9).

Biology and Hosts

Hosts unknown. Several specimens have been collected at light and given the densely cultivated areas in which it is found it is likely to have an association with rice.

Remarks

See remarks section on *Cyrtorhinus albidus.*

Cyrtorhinus pilosus most closely resembles *C. lividipennis, C. quatei* and *C. yunganensis* due to their similar size and overall shape and distinct black midline on the scutellum. The setae in *C. pilosus* are significantly longer and denser (Figs 37a-f) than in other members of the *lividipennis-solomonensis-fulvus* group of *Cyrtorhinus*.

***Cyrtorhinus quatei* sp. nov.**

Habitus, Figure 7s. Distribution, Figure 9. Male genitalia, Figure 38a-c. SEMs, Figure 39.

Etymology

This species is named after the collector who collected most of the paratypes of this species.

Materials examined

HOLOTYPE: **MALAYSIA: PAHANG:** Kuala Tahan, 4.3833°N 102.4°E, 15 Dec 1958 - 16 Dec 1958, L. W. Quate, ♂ (AMNH_PBI 00044351)(BPBM).

PARATYPES: **MALAYSIA: KUALA LUMPUR:** Klang gates, 3.1667°N 101.7°E, 24 Dec 1958 – 31 Dec 1958, L.W. Quate, 2♀♀ (UNSW_ENT00045603, UNSW_ENT00046538), 1♂ (UNSW_ENT00046539) (BPBM). **PAHANG:** 4.3833°N 102.4°E, 12 Dec 1958 - 14 Dec 1958, L. W. Quate, 2♀♀ (AMNH_PBI 00045596, AMNH_PBI 00045597), 5♂♂ (AMNH_PBI 00045598-AMNH_PBI 00045600, AMNH_PBI 00046536, AMNH_PBI 00046537) (BPBM); 15 Dec 1958 - 16 Dec 1958, L. W. Quate, Light Trap, 19♀♀ (AMNH_PBI 00043582-AMNH_PBI 00043587, AMNH_PBI 00044332-AMNH_PBI 00044344), 21♂♂ (AMNH_PBI 00043588-AMNH_PBI 00043601, AMNH_PBI 00044345-AMNH_PBI 00044350), 53♀♀ (AMNH_PBI 00043889-AMNH_PBI 00043934, AMNH_PBI 00046529-AMNH_PBI 00046535), 54♂♂ (AMNH_PBI 00043935-AMNH_PBI 00043982, AMNH_PBI 00045601, AMNH_PBI 00046524-AMNH_PBI 00046528) (BPBM). **VIETNAM: HO CHI MINH CITY:** PORT OF SAIGON (HO CHI MINH CITY), 10.63806°N 106.75944°E, 10 JAN 1971 - 11 JAN 1971, F.B. STEINER, 27♂ (AMNH_PBI 00047112-AMNH_PBI 00047138), 73♀ (AMNH_PBI 00047139-AMNH_PBI 00047211) (CAS).

Diagnosis

Cyrtorhinus quatei can be recognised by the following combination of characters: females always macropterous; black medial line on scutellum; green hemelytra (Fig. 7s); lateral depression on posterior of head (Fig. 39a); labium short, barely reaching mesosternum; hemelytral margins weakly convex (Fig. 7s); elongate cuneus (Fig. 39e); left paramere Y-shaped, apophysis strongly sinuate (Fig. 38c); right paramere mitt-shaped, apophysis squat with a lamina laterally apical comb-like flange (Fig. 38b); endosomal membranous bag with a field of spinules; proximal endosomal spicule straight, rudus subrectangulate, margins dentate (Fig. 38a).

Description

Males.

COLOURATION: Body green with yellow and black markings (Fig. 7s). ***Head:*** generally pale green; vertex yellow, black marking anteriorly; clypeus black; maxillary plate black; mandibular plate yellow. ***Antennae:*** AI-AIV black, yellow around joints. ***Labium:*** pale green to yellow. ***Pronotum:*** anterior yellow; pronotum posterior black with a yellow line medially, sometimes yellow patches on posterior margin. ***Scutellum:*** anterior black or yellow with a black medial line; posterior yellow with a black medial line. ***Hemelytra:*** pale translucent densely spotted with green; membrane brownish tinge. ***Thoracic pleura and sterna:*** yellow. ***Legs:*** green to yellow, usually green fading to yellow apically. ***Abdomen:*** abdominal venter yellow.

VESTITURE AND TEXTURE: Generally covered in pale grey, decumbent, hair-like setae and densely covered in minute, simple microtrichia. ***Head:*** vertex small, decumbent, hair-like setae present and large, semi-erect setae present only on fringes and midline (Fig. 39a); scale-like texture present (Fig. 39a); gula and genae setae erect, sparse (Fig. 39b). ***Antennae:*** dense, semi decumbent hair-like setae; AI with tree thick bristle-like interiorly facing setae. ***Pronotum:*** (Fig. 39c) smooth; setae sparse; microtrichia spare with minute tufts of thicker, longer microtrichia present; proxyphus microtrichia very dense. ***Hemelytra:*** setae sparse, fairly evenly spaced, minute tufts of thicker, longer microtrichia present. ***Legs:*** dense thick decumbent hair-like setae, relatively dense and thick on tibia; tibial spinules small, brown, erect (Fig. 39f).

STRUCTURE: ***Head:*** eyes large, about equal in length to head (Fig. 39a); vertex topology with a large lateral depression posteriorly (Fig. 39a); bucculae broad, rounded, not reaching anteniferous tubercles anteriorly. ***Labium:*** terminating at pro- and meso sterna boundary. ***Pronotum:*** (Fig. 39c) anterior lobe calli pronounced, lateral margin

convex; foveae widely separated; posterior lobe lateral margin concave; posterior margin concave. ***Hemelytra:*** lateral margins weakly convex (Fig. 7s); cuneus ca. 2x longer than wide (Fig. 38e). ***Male genitalia:*** Left paramere (Fig. 38c) Y-shaped; sensory lobe densely covered in bristle-like setae; apophysis strongly sinuate, pinched apically, file-like texture subapical. Right paramere (Fig. 38b) small, lobes very short, much shorter than stem; sensory lobe setae elongate; apophysis thick and short, weakly spoon-shaped, lightly sclerotised lamina produced laterally, with distal flange, with four teeth. Aedeagus (Fig. 38a) small in size, endosoma ca. 0.2 mm in length; with short endosomal membranous bag, with light sclerotisation apically; proximal endosomal spicule straight, more or less parallel to ductus seminis; apically upright, with margins dentate, rudus positioned subapically, ca. 0.03 mm in length, perpendicular to spicule, strongly pronounced rectangulate, proximal margin concave, apical margin tapering; secondary gonopore elongate, weakly twisted, surpassing rudus of proximal endosomal spicule.

Females.

Macropterous only.

Externally similar to males. Female genitalia not investigated.

Measurements

See Table 1.

Distribution

Cyrtorhinus quatei is known from Vietnam and Malaysia (Fig. 9).

Biology and Hosts

Unknown.

Remarks

See remarks section on *Cyrtorhinus albidus.*

Cyrtorhinus quatei most closely resembles *C. lividipennis, C. pilosus* and *C. yunganensis*, but can be distinguished by its green colouration (Fig. 7s), elongate cuneus (Fig. 39e) and lamina on the apophysis of the right paramere apophysis (Fig. 38b).

***Cyrtorhinus rarus* sp. nov.**

Habitus, Figure 7t. Distribution, Figure 9. SEMs, Figure 40.

Etymology

From the Latin rarus, meaning rare, in reference to the fact that this species is only known from five females; most *Cyrtorhinus* species are known from large series.

Materials examined

HOLOTYPE: **NEW CALEDONIA: PROVINCE NORD:** 5 km S Touho, 100m Ponandou River, 20.81667°S 165.21667°E, 02 Feb 1984, M. Pogue and M. Epstein, ♀ (UNSW_ENT00046892) (BPBM).

PARATYPES: **NEW CALEDONIA: PROVINCE NORD:** 5 km S Touho, 100m Ponandou River, 20.81667°S 165.21667°E, 02 Feb 1984, M. Pogue and M. Epstein, 5♀♀ (UNSW_ENT00046893- 00046896) (BPBM).

Diagnosis

Cyrtorhinus rarus can be recognised by the following combination of characters: females always macropterous; overall colouration red and black (Fig. 7t); hemelytral margins straight (Fig. 7t); labium reaching metacoxae; hemelytral margins straight (Fig. 7t); foveae contiguous (Fig. 40c).

Description

Males.

Unknown

Females.

COLOURATION: Body bright red with black markings (Fig. 40t). ***Head:*** generally bright red with distinct black markings; vertex bright red with a distinct black shape medially; clypeus black; maxillary and mandibular plates red. ***Antennae:*** AI black, yellow band at joints; AII black, distinct yellow bands at joints and medially; AIII and AIV uniformly black. ***Labium:*** light red to brown. ***Pronotum:*** anterior black; pronotum posterior black with a yellow line medially. ***Scutellum:*** yellow, black lines medially and laterally; mesoscutum black. ***Hemelytra:*** bright red, barely translucent; membrane black tinge. ***Thoracic pleura and sterna:*** mesopleura black; metapleura black or red; sterna bright red. ***Legs:*** green, often pale grey basally. ***Abdomen:*** abdominal venter bright red.

VESTITURE AND TEXTURE: Generally covered in pale grey, decumbent, hair-like setae and densely covered in minute simple microtrichia. ***Head:*** vertex small, decumbent setae present only on fringes and midline; scale-like texture present (Fig. 40a); gula and genae setae long erect, sparse (Fig. 40b). ***Antennae:*** dense, semi decumbent hair-like setae; AI three thick bristle-like setae interiorly facing. ***Pronotum:*** smooth; hair-like setae sparse, microtrichia dense on anterior lobe, sparse on posterior; prosternal microtrichia very dense. ***Hemelytra:*** hair-like setae sparse, uniformly distributed. ***Legs:*** dense thick decumbent hair-like setae, relatively dense and long on tibia; tibial spinules small, brown, erect, dense towards pretarsus.

STRUCTURE: ***Head:*** eyes large, about equal in length to head (Fig. 40a); vertex topology with a posterior depression (Fig. 40a); bucculae broad, rounded, not reaching anteniferous tubercles anteriorly. ***Labium:*** terminates between metacoxae, LII elongate. ***Pronotum:*** anterior lobe calli prominent; lateral margin convex; foveae fused; posterior lobe greatly declivent, lateral margin concave; posterior margin slightly concave medially. ***Hemelytra:*** lateral margins straight; cuneus 2x longer than wide (Fig. 40e).

Measurements

See Table 1.

Distribution

Cyrtorhinus rarus is known from a single collection event on the island of New Caledonia (Fig. 9).

Biology and Hosts

Unknown.

Remarks

See remarks section on *Cyrtorhinus albidus.*

Cyrtorhinus rarus resembles *C. brunus C. fulvus* and *C. defectus* but can be distinguished by the following combination of characters: foveae contiguous (Fig. 40c), colouration shiny red (Fig. 7t), absence of scale-like texturing on the head and lack (Fig. 40a) of microtrichia on the gula and genae (Fig. 40b).

External differences are considered sufficient to separate the species however description of the male genitalia might shed more light on the species. The species was separated mostly on the basis of its elongated LII resulting in a longer rostrum than the rest of the *fulvus* group. Their colouration is shiny (Fig. 7t) as in *C. defectus* unlike the duller colouration of *C. fulvus* or *C. brunus* (Figs 7b,k) but their foveae are fused as in *C. fulvus* (Fig. 40c).

Cyrtorhinus solomonensis sp. nov.

Habitus, Figure 7u. Distribution, Figure 9. Male genitalia, Figure 38d-f. SEMs, Figure 41.

Etymology

This species is named for its type locality, the Solomon Islands

Materials examined

HOLOTYPE: **SOLOMON ISLANDS: GUADALCANAL:** *Honiara Co.:* Honiara, 9.43361°S 159.95111°E, 200 m, 01 Dec 1975 - 31 Dec 1975, Krauss, N. I. H., ♂ (UNSW_ENT00043264). (BPBM)

PARATYPES: **PAPUA NEW GUINEA: MADANG PROVINCE:** Baku Forest Stn, 5.1°S 145.48°E, 80 m, 04 Feb 1978 - 12 Feb 1978, W.C. Gagne, 1♂ (UNSW_ENT00046576), 7♀♀ (UNSW_ENT00046577- 00046581, UNSW_ENT00046593, UNSW_ENT00046594), 7♀♀ (UNSW_ENT00046897- 00046903), 4♂♂ (UNSW_ENT00046904- 00046907) (BPBM). **SOLOMON ISLANDS: GUADALCANAL:** Honiara, 9.43361°S 159.95111°E, 200 m, 01 Dec 1975 - 31 Dec 1975, Krauss, N. I. H., 20♂♂ (UNSW_ENT00043265- 00043283), 17♀♀ (UNSW_ENT00043284- 00043298, UNSW_ENT00046591, UNSW_ENT00046592) (BPBM).

Diagnosis

Cyrtorhinus solomonensis can be recognised by the following combination of characters: females always macropterous; bright yellow colouration (Fig. 7u); calli slight (Fig. 42d); uniformly black scutellum (Fig. 7u); AIII smooth; labium reaching mesosternum; hemelytral margins uniformly convex (Fig. 7u); left paramere Y-shaped, apophysis sinuate, apex pinched (Fig. 38c); right paramere mitt-shaped, apophysis squat, with apical comb-like flange (Fig. 38b); endosomal membranous lacking

sclerotisation; proximal endosomal spicule straight, rudus subrectangulate, margins dentate (Fig. 38a).

Description

Males.

COLOURATION: Body yellow (Fig. 7u). ***Head:*** generally yellow with distinct black markings; vertex black, yellow markings on posterior margin and around eyes. ***Antennae:*** AI and AII black, yellow at joints; AIII and AIV black. ***Labium:*** LI and LII yellow; LIII and LIV brown, apex black. ***Pronotum:*** anterior black; pronotum posterior black, yellow markings on posterior medial and posterior lateral and margins. ***Scutellum:*** yellow with a black medial line. ***Hemelytra:*** translucent pale yellow. ***Thoracic pleura and sterna:*** pleura black; sterna yellow. ***Legs:*** uniformly yellow. ***Abdomen:*** abdominal venter yellow.

VESTITURE AND TEXTURE: Generally covered in sparse pale, grey, small, semi-erect, hair-like setae. ***Head:*** vertex small, decumbent hair-like setae sparsely present on midline and fringes, dense microtrichia present; gula and genae with sparse erect hair-like setae, and dense matted microtrichia (Figs 41a,b). ***Antennae:*** sparse decumbent hair-like setae; AI three thick bristle-like setae, interiorly facing. ***Pronotum:*** smooth; hair-like setae sparse, small (Fig. 41d); microtrichia dense. ***Hemelytra:*** hair-like setae sparse; fringe dense. ***Legs:*** dense small semi-erect hair-like setae; tibial spinules small, brown.

STRUCTURE: ***Head:*** eyes large, about equal in length to head (Fig. 41a); vertex topology smooth; bucculae broad, rounded, not reaching anteniferous tubercles anteriorly (Fig. 41b). ***Labium:*** surpassing pro-meso sterna boundary. ***Pronotum:*** (Fig. 41d) anterior lobe calli pronounced narrowly separated; foveae narrowly separated lateral margin lobe weakly concave; posterior lobe lateral margins concave; posterior

margin concave. ***Hemelytra:*** lateral margins weakly convex (Fig. 7u); cuneus ca. 1.5x longer than wide. ***Male genitalia:*** Left paramere (Fig. 38c) Y-shaped; sensory lobe with disordered elongate setae; apophysis strongly sinuate, apex pinched, file-like texture subapical. Right paramere (Fig. 38b) small, lobes very short, much shorter than stem; sensory lobe setae elongate each with prominent base; apophysis strongly concave, spoon like, with distal flange, with four teeth. Aedeagus (Fig. 38a) small in size, endosoma ca. 0.2 mm in length; with short endosomal membranous bag, lacking sclerotisation; proximal endosomal spicule straight, more or less parallel to ductus seminis, apically upright, with margins dentate; rudus positioned subapically, ca. 0.03 mm in length, perpendicular to spicule, strongly pronounced and subrectangulate, proximal margin sinuate, apical margin tapering; secondary gonopore elongate, surpassing rudus of proximal endosomal spicule, reaching near apex of phallotheca.

Females.

Macropterous only.

Externally similar to males. Female genitalia not investigated.

Measurements

See Table 1.

Distribution

Cyrtorhinus solomonensis is restricted to the Solomon Islands (Fig. 9).

Biology and Hosts

Unknown.

Remarks

See remarks section of *Cyrtorhinus albidus* and *C. palauensis.*

Cyrtorhinus yunganensis sp. nov.

Habitus, Figure 7v. Distribution, Figure 9. Male genitalia, Figure 38g-i. SEMs, Figure 42.

Etymology

C. yunganensis is named from the type locality, the Chinese province of Yungan.

Materials examined

HOLOTYPE: **CHINA: YUNGAN:** 27 Feb 1940, T.C. Maa, 1♂ (UNSW_ENT00045273).

PARATYPES: **CHINA: FUKIEN:** Chungan, Bohea Hills, 27°N 117°E, 24 Jul 1939, T.C. Maa, 9♀♀ (UNSW_ENT00045143-00045151) (BPBM); 24 Aug 1940, T.C. Maa, 1♀ (UNSW_ENT00045142) (BPBM). **SHANGHANG:** 08 Sep 1940, T.C. Maa, 8♂♂ (UNSW_ENT00045118-00045125), 16♀♀ (UNSW_ENT00045126-00045141) (BPBM). **YUNGAN:** 06 Jan 1940, T.C. Maa, 1♂ (UNSW_ENT00045228) (BPBM); 05 Feb 1940, T.C. Maa, 1♀ (UNSW_ENT00045270) (BPBM); 5♀♀ (UNSW_ENT00045274-00045278) (BPBM); 25 Jun 1940, T.C. Maa, 1♀ (UNSW_ENT00045242), 1♂ (UNSW_ENT00045243) (BPBM); 10 Jul 1940, T.C. Maa, 1♂ (UNSW_ENT00045169) (BPBM); 21 Jul 1940, T.C. Maa, 5♂♂ (UNSW_ENT00045237-00045241) (BPBM); 28 Jul 1940, T.C. Maa, 5♀♀ (UNSW_ENT00045279-00045283) (BPBM); 01 Aug 1940, T.C. Maa, 1♀ (UNSW_ENT00045266), 3♂♂ (UNSW_ENT00045267-00045269) (BPBM); 22 Aug 1940, T.C. Maa, 1♀ (UNSW_ENT00045271) (BPBM); 28 Aug 1940, T.C. Maa, 6♀♀ (UNSW_ENT00045158-00045163) (BPBM); 31 Aug 1940, T.C. Maa, 2♀♀ (UNSW_ENT00045246, UNSW_ENT00045247), 4♂♂ (UNSW_ENT00045248-00045251) (BPBM); 01 Sep 1940, T.C. Maa, 9♀♀ (UNSW_ENT00045201-00045209), 2♂♂ (UNSW_ENT00045210, UNSW_ENT00045211) (BPBM); 02 Sep 1940, T.C. Maa, 13♀♀ (UNSW_ENT00045212-00045224) (BPBM); 04 Sep 1940, T.C. Maa, 2♀♀

(UNSW_ENT00045225, UNSW_ENT00045226), 1♂ (UNSW_ENT00045227) (BPBM); 05 Sep 1940, T.C. Maa, 1♀ (UNSW_ENT00045168) (BPBM); 06 Sep 1940, T.C. Maa, 1♂ (UNSW_ENT00045171) (BPBM); 10 Sep 1940, T.C. Maa, 5♀♀ (UNSW_ENT00045170, UNSW_ENT00045229, UNSW_ENT00045263-00045265), 3♂♂ (UNSW_ENT00045230, UNSW_ENT00045261, UNSW_ENT00045262) (BPBM); 14 Sep 1940, T.C. Maa, 2♀♀ (UNSW_ENT00045164, UNSW_ENT00045165) (BPBM); 15 Sep 1940, T.C. Maa, 1♀ (UNSW_ENT00045232), 2♂♂ (UNSW_ENT00045233, UNSW_ENT00045234) (BPBM); 21 Sep 1940, T.C. Maa, 1♀ (UNSW_ENT00045152) (BPBM); 23 Sep 1940, T.C. Maa, 1♀ (UNSW_ENT00045272) (BPBM); 30 Sep 1940, T.C. Maa, 2♀♀ (UNSW_ENT00045153, UNSW_ENT00045154) (BPBM); 23 Oct 1940, T.C. Maa, 1♂ (UNSW_ENT00045155), 2♀♀ (UNSW_ENT00045156, UNSW_ENT00045157) (BPBM); 31 Oct 1940, T.C. Maa, 1♀ (UNSW_ENT00045252) (BPBM); 15 Apr 1941, T.C. Maa, 2♂♂ (UNSW_ENT00045235, UNSW_ENT00045236) (BPBM); 12 Jul 1941, T.C. Maa, 1♀ (UNSW_ENT00045231) (BPBM); 05 Sep 1944, T.C. Maa, 7♀♀ (UNSW_ENT00045166, UNSW_ENT00045167, UNSW_ENT00045256-00045260), 3♂♂ (UNSW_ENT00045253-00045255) (BPBM). **HONG KONG: NEW TERRITORIES:** Sai Kung Station, 22.3833°N 114.2667°E, 4 m, 09 Oct 1964, W.J. Voss and Wai Ming Hui, Light Trap, 29♂♂ (UNSW_ENT00044737-00044765), 36♀♀ (UNSW_ENT00044766-00044801) (BPBM); 15 Oct 1964, W.J. Voss and Wai Ming Hui, Light Trap, 2♂♂ (UNSW_ENT00044656, UNSW_ENT00044657), 1♀ (UNSW_ENT00044658) (BPBM); 20 Oct 1964, W.J. Voss and Wai Ming Hui, Light Trap, 1♂ (UNSW_ENT00044659) (BPBM); 21 Oct 1964, W.J. Voss and Wai Ming Hui, Light Trap, 10♀♀ (UNSW_ENT00044637-00044646), 5♂♂ (UNSW_ENT00044647-00044651), 3♂♂ (UNSW_ENT00044543-00044545), 10♀♀ (UNSW_ENT00044546-

00044555) (BPBM); 26 Oct 1964, W.J. Voss and Wai Ming Hui, Light Trap, 2♀♀ (UNSW_ENT00044652, UNSW_ENT00044653), 2♂♂ (UNSW_ENT00044654, UNSW_ENT00044655) (BPBM); 28 Oct 1964, W.J. Voss and Wai Ming Hui, Light Trap, 1♂ (UNSW_ENT00044559), 2♀♀ (UNSW_ENT00044557, UNSW_ENT00044558) (BPBM); 02 Nov 1964, W.J. Voss and Wai Ming Hui, 1♀ (UNSW_ENT00044556) (BPBM).

Diagnosis

Cyrtorhinus yunganensis can be recognised by the following combination of characters: females always macropterous; distinct black medial line on scutellum; brown colouration (Fig. 7v); translucent brown hemelytra; labium reaching mesosternum; hemelytral margins convex (Fig. 7v); left paramere Y-shaped, apophysis strongly sinuate, apex pinched (Fig. 38i); right paramere mitt-shaped, apophysis squat, with disto-lateral comb-like flange (Fig. 38h); endosomal membranous lacking sclerotisation (Fig. 38g); proximal endosomal spicule straight, rudus subrectangulate, margins dentate (Fig. 38g).

Description

Males.

COLOURATION: Body brownish yellow (Fig. 7v). ***Head:*** generally light brown; vertex yellow, black spot medially on anterior margin; clypeus black; maxillary and mandibular plates yellow. ***Antennae:*** AI and AII black, yellow at joints; AIII and AIV black. ***Labium:*** yellow, tip of LIV black. ***Pronotum:*** anterior brownish yellow, faint black line between calli; pronotum posterior yellow, occasionally with a black marking anteriorly. ***Scutellum:*** yellow with medial and sometimes lateral black lines; mesoscutum brownish yellow, sometimes black laterally. ***Hemelytra*** translucent pale yellow. ***Thoracic pleura and sterna:*** yellow. ***Legs:*** pale brown to yellow. ***Abdomen:***

abdominal venter yellow.

VESTITURE AND TEXTURE: Generally covered in pale grey, erect, hair-like setae (Fig. 42e). ***Head:*** setae long, dense on vertex frons and genae (Fig. 42a); dense microtrichia present on gula and genae (Fig. 42b). ***Antennae:*** dense, semi decumbent hair-like setae; AI with three thick bristle-like interior facing setae. ***Pronotum:*** lightly rugulose; setae sparse, small (Fig. 42d); microtrichia dense. ***Hemelytra:*** with a dense semi-erect fringe. ***Legs:*** dense larger hair-like setae; tibial spinules small, brown, two columns.

STRUCTURE: ***Head:*** eyes large, about equal in length to head; vertex topology smooth (Fig. 42a); bucculae narrow, ovate, not reaching anteniferous tubercles anteriorly (Fig. 42c). ***Labium:*** extending to mesocoxae. ***Pronotum:*** (Fig. 42d) anterior lobe with large steep swellings; calli pronounced, lateral margin convex; foveae widely separated; posterior lobe lateral margin concave; posterior margin concave. ***Hemelytra:*** lateral margins convex (Fig. 7v); about 2x longer than wide. ***Male genitalia:*** Left paramere (Fig. 38i) Y-shaped; sensory lobe with disordered setae; apophysis strongly sinuate, apex pinched, file-like texture subapical. Right paramere (Fig. 38h) small, lobes very short, much shorter than stem; sensory lobe setae elongate each with prominent base; apophysis more or less straight with a lateral lamina, disto-lateral flange, with five teeth. Aedeagus (Fig. 38g) small in size, endosoma ca. 0.2 mm in length; with short endosomal membranous bag, lacking sclerotisation; proximal endosomal spicule straight, more or less parallel to ductus seminis; apically upright, margins dentate, rudus positioned subapically, ca. 0.03 mm in length, perpendicular to spicule, strongly pronounced and rounded, distal and proximal margins convex; secondary gonopore elongate, surpassing rudus of proximal endosomal spicule, reaching near apex of phallotheca.

Females.

Macropterous only.

Externally similar to males. Female genitalia not investigated.

Measurements

See Table 1.

Distribution

Cyrtorhinus yunganensis is known from southern China (Fig. 9).

Biology and Hosts

Several specimens have been collected at light.

Remarks

See remarks section on *Cyrtorhinus albidus.*

Cyrtorhinus yunganensis most closely resembles *C. lividipennis, C. pilosus* and *C. quatei* due to their similar size and overall shape (Fig. 7v) and the colouration resembles some rare colour morphs of *C. lividipennis* (Fig. 7n). It can be distinguished by the following combination of characters: mesosternum without groove to receive labium; brown colouration (Fig. 7v); absence of black markings on pronotum; apophysis of right paramere with lateral lamina, flange distolaterally oriented (Fig. 38h); and absence of sclerotisation on endosomal membrane (Fig. 38g).

DISCUSSION

Previous diagnoses of the genus *Cyrtorhinus* (e.g. Carvalho and Southwood 1955, Wagner and Weber 1964, Kerzhner 1979, Eyles 1996) have revolved around external characters, such as the weakly declivent head, antennal tubercle surpassing the midline of the eye, campanulate pronotum, colour of the pronotum, weakly raised calli, the rounded opening of the metathoracic gland, the short labium, the glabrous vestiture and

the short wings. I found that the pronotal foveae, flange of the right paramere, elongate ductus seminis, the presence of a proximal endosomal spicule only, and rudus on the endosomal spicule differentiates *Cyrtorhinus* from other orthotyline genera.

In my phylogenetic analysis, I found *Orthotylus bilineatus* to be the sister-group of *Cyrtorhinus*. *Orthotylus bilineatus* appears to also be a close relative of *Mecomma*, and rather than being a member of the genus *Orthotylus* its original combination with *Pseudorthotylus* may require resurrection. I have refrained from doing this, pending a broader study of *Orthotylus* which is beyond the scope of this project, and retain within the latter genus.

Kerzhner (1979) implied that *Mecommopsis* was related to *Cyrtorhinus* but it is probably in or near the *Zanchius* group of genera as defined by Forero (2009). *Fieberocapsus* has also been allied with *Cyrtorhinus*, but it does not have defining features of the latter genus nor its allies, further work is needed to determine its position within the Orthotylini.

It is possible that some field-based studies have misidentified study species as *Cyrtorhinus lividipennis.* Definitive identification of the latter species requires examination of the male genitalia, particularly as it has highly variable colouration. Having said this, I have not examined any museum material that has been misidentified at a species level, although there were several specimens of *Tytthus* that have been mislabelled as *Cyrtorhinus* sp.

The phylogeny of *Cyrtorhinus* gives *C. caricis* as basal to the remainder of *Cyrtorhinus* and its parameres are so distinct in comparison to its congeners that some authors might it consider worthy of its own genus. However, I did not regard this as an appropriate action, especially as *C. caricis* is also the type species of *Cyrtorhinus*, and if it was separated *C. lividipennis* and *C. fulvus*, would require new generic combinations,

and may confuse their use as biological controls. Aside from any instability in nomenclature, *Cyrtorhinus* was found to be monophyletic and the dramatic difference in the parameres is considered to be synapomorphic.

Cyrtorhinus species that occur beyond node 6 of the phylogeny form two distinct groups, those with large or small genitalia. They are recognisable by the size of the lobes in the right paramere relative to the stem. In the large genitalia group the lobes are much longer than the stem and in the small genitalia group they are subequal or smaller than the stem.

Species of the small genitalia group also have a smaller aedeagus and left paramere. Whereas the large genitalia group comprises far fewer species their range is almost as diverse as the small genitalia group, with members in Africa, Melanesia and New Zealand. The small genitalia group are represented in all areas of endemism and geographic proximity is not an indicator of close phylogenetic relationship. Within the small genitalic group, apart from a few basal members, there are well-supported subgroups, including the '*lividipennis* group' (*C. lividipennis, C. yunganensis, C. indi, C. albidus* and *C. quatei*), '*fulvus* group' (*C. defectus, C. rarus, C. fulvus* and *C. brunus*) and the '*solomonensis* group' (*C. solomonensis* and *C. palauensis)*. Each of these subgroups is easy to recognise based both on their genitalia and on their external colouration and vestiture.

Eyles (1996, 2005) erected the genus *Josemiris*, with one included species, - *J. carvalhoi* (renamed herein as *C. eylesi*) - and excluded it from *Cyrtorhinus* primarily on the basis of the rudus being of a different shape in comparison to *C. cumberi.* This difference reflects the fact that the two New Zealand species belong to different clades within *Cyrtorhinus*, and Eyles (1996) may have not erected the new genus if he had examined a broader sample of species within *Cyrtorhinus*. The right paramere of *C.*

eylesi is also quite unusual for *Cyrtorhinus*, but the two lobes and the flange are in line with my definition of *Cyrtorhinus* as a whole. Eyles (1996) also separated *Josemiris* from *Cyrtorhinus* on the basis of differences of the head, eyes and pronotum. I found that these differences were characteristic of brachypterous females of *Cyrtorhinus*.

Cyrtorhinus are probably exclusively ovivorous bugs, predating mainly on the eggs of insects in the hemipteran suborder Auchenorrhyncha. Feeding behaviour has only been recorded for *Cyrtorhinus fulvus, C. lividipennis* and *C. caricis*; although other members of the genus occur in similar ecosystems and are likely to be ovivorous. *Cyrtorhinus lividipennis* and *C. fulvus* have been used as a biological control of delphacid leafhopper pests on rice. Some authors have suggested that *Cyrtorhinus* also feeds on plant sap if their primary food source is not available (Swezey 1946, Fullaway 1952). Others suggest that this is a misconception due to the habit of *Cyrtorhinus* to puncture unbroken surfaces on the plant in order to find eggs (Usinger 1939, Carvalho and Southwood 1955). Esaki (1934) also proposed facultative blood feeding, but this is likely to be incidental that a common behaviour. Host records for *Cyrtorhinus* collections are sparse and where they are present they are almost all reported from rice or corn, which are common hosts of delphacid leafhoppers.

Many of the species of *Cyrtorhinus* have broad distributions. *Cyrtorhinus lividipennis* and *Cyrtorhinus fulvus* tend to thrive in very large numbers on agricultural lands, particular in rice, sugarcane and corn monocultures. These two species have very large distribution ranges and almost certainly occur outside of their native range. This is partially due to their deliberate introduction as biological controls. Usinger (1939) lists several areas in which *C. fulvus* and *C. lividipennis* have been introduced.

My biogeographic analysis resulted in area relationships similar to those found by Parenti and Ebach (2010). Nodes 6 and 8 of my analysis are of particular interest as

they support in part the Pandora-Indo-Malaysia hypothesis of the previous authors. My results supports the Schuh and Stonedahl (1986) that in terrestrial Indo-Pacific bugs Africa tends to be basal to Asian and the Pacific.

Figures



Figure 1: Phylogeny of *Cyrtorhinus* including all outgroup taxa. Ingroup topology shown in Figure 2.

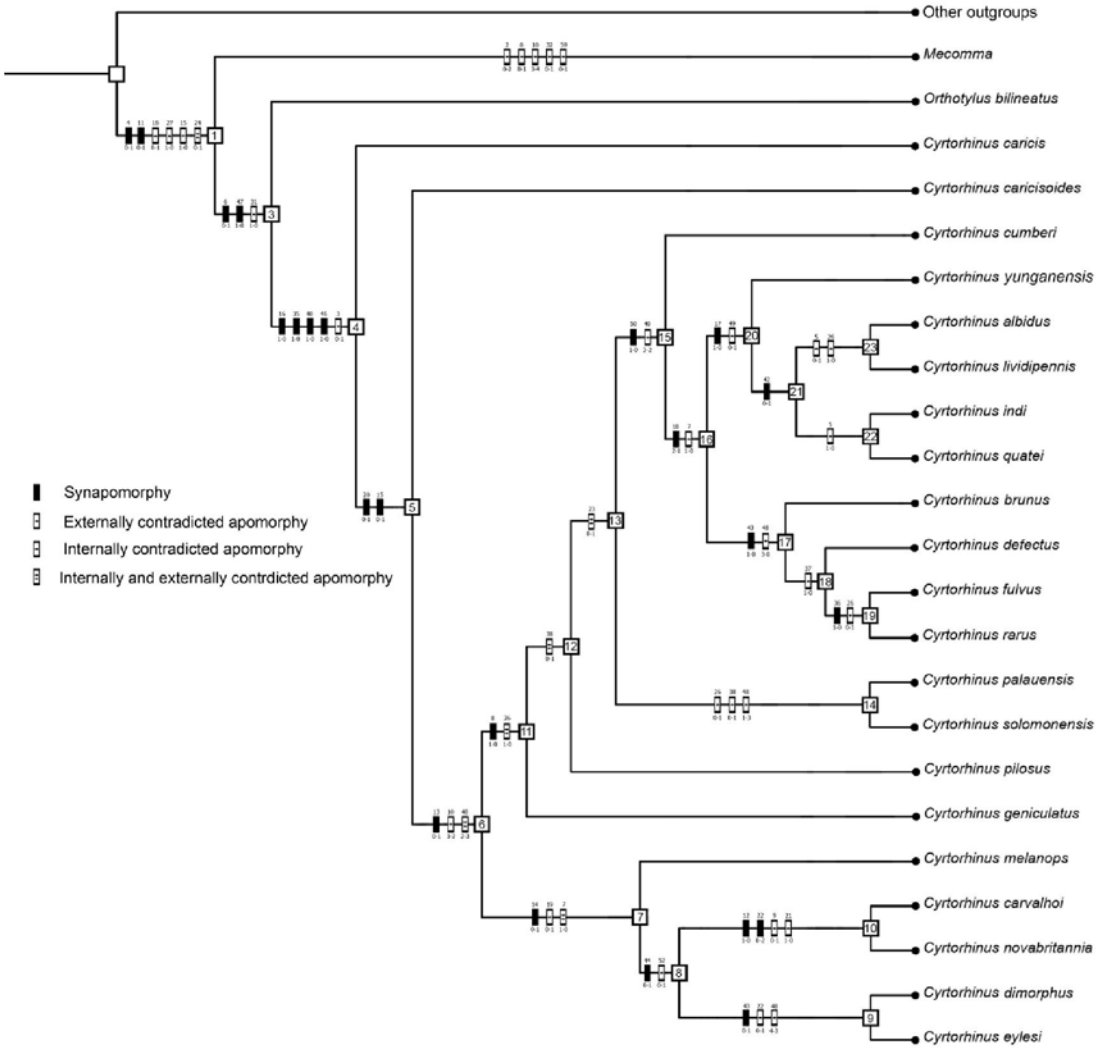


Figure 2: Phylogeny of *Cyrtorhinus* and close relatives with character state changes mapped.

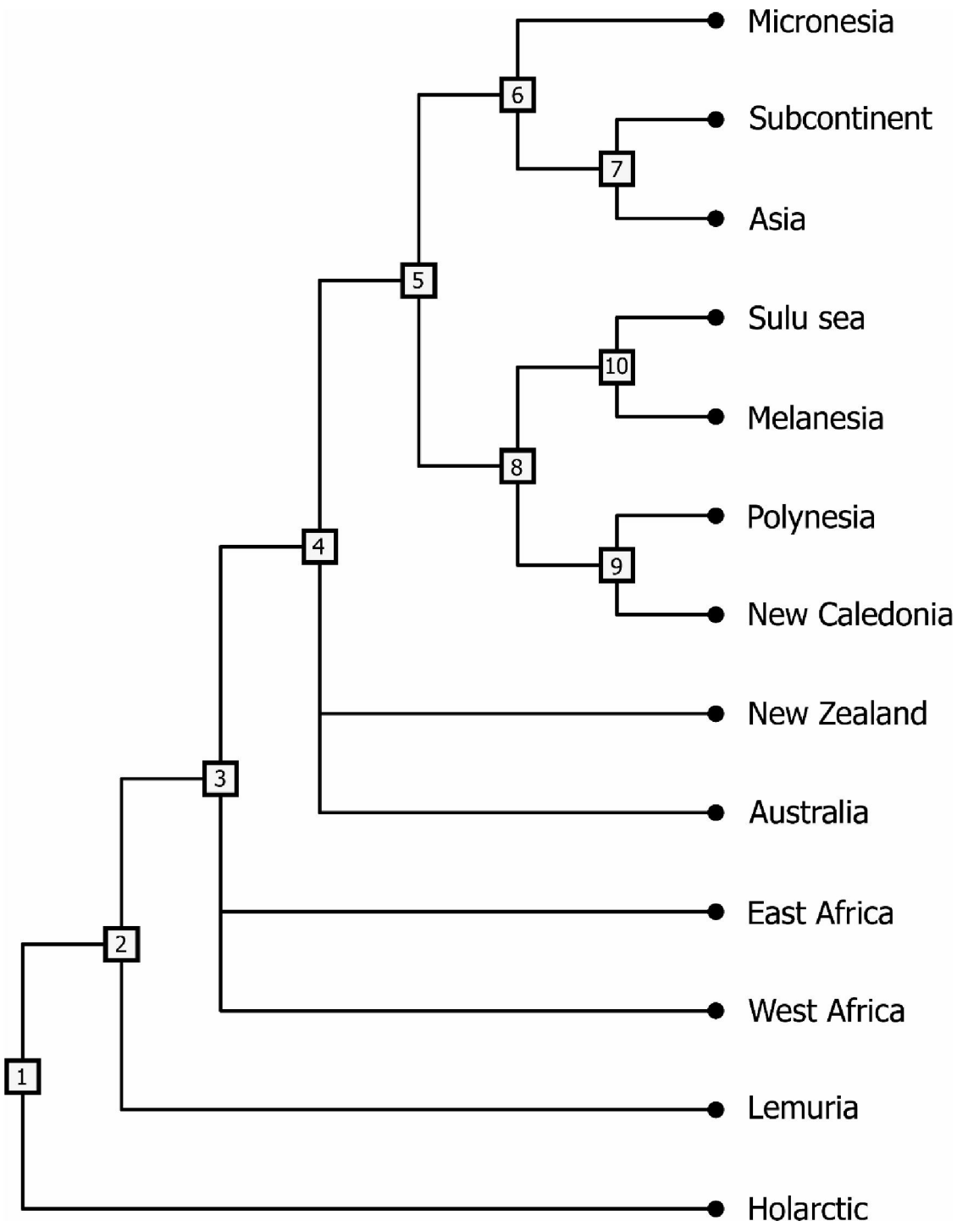


Figure 3: Minimal tree generated from biogeographic analysis. See Table 6 for definition of areas of endemism.

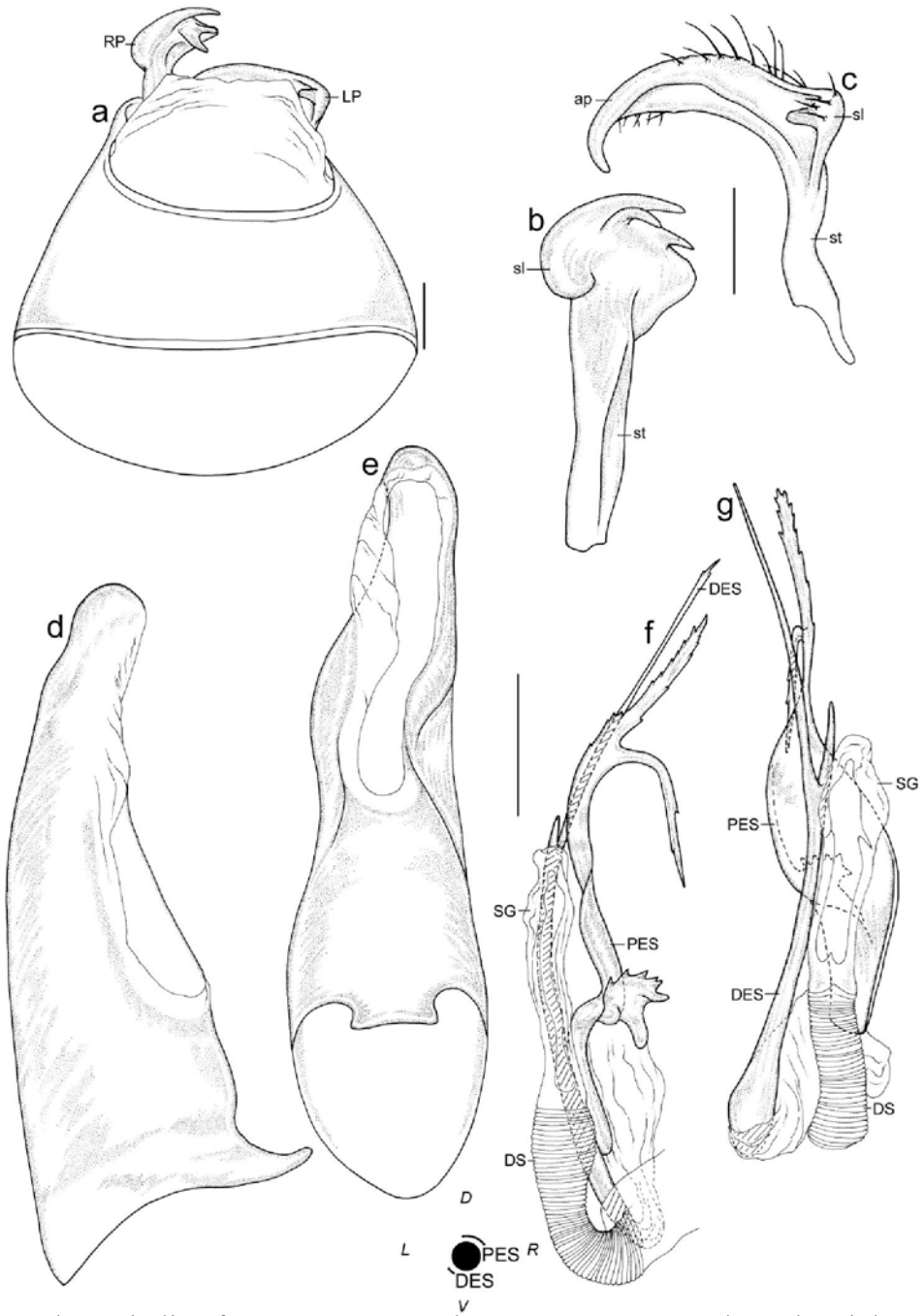


Figure 4: Male genitalia of *Mecomma* sp. scales = 0.1mm a: Pygophore. b: Right paramere. c: Left paramere. d-e: Phallotheca. f-g: Endosoma. Abbreviations: ap: Apophysis, DES: Dorsal endosomal spicule, DS: Ductus seminis, LP: Left paramere, PES: Proximal endosomal RP: Right paramere, SG: Secondary gonopore, st: Stem, sl: Sensory lobe.

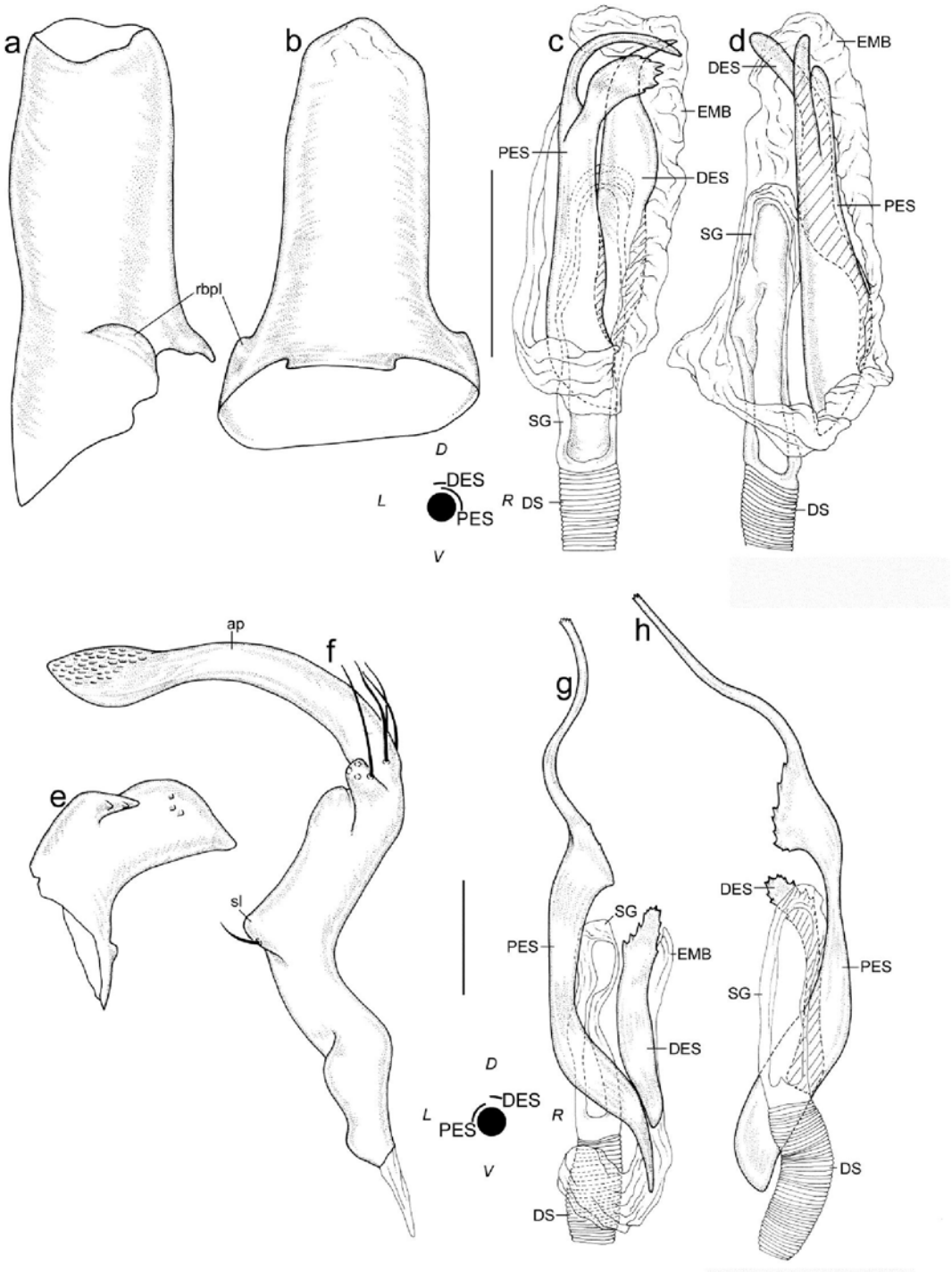


Figure 5: Male genitalia of *Mecommopsis cruciata*, scales = 0.1mm a-b: Phallotheca. c-d: Endosoma. Male genitalia of *Orthotylus bilineatus*: e: Right paramere. f: Left paramere. g-h: Endosoma. Abbreviations: ap: Apophysis, DES: Dorsal endosomal spicule, DS: Ductus seminis, EMB: Endosomal membranous bag, LP: Left paramere, PES: Proximal endosomal spicule, RP: Right paramere, SG: Secondary gonopore, sl: Sensory lobe, st: Stem.



Figure 6: *Cyrtorhinus caricis* (left) and *C. lividipennis* (right) from Japan. Image courtesy of Tomohide Yasunaga

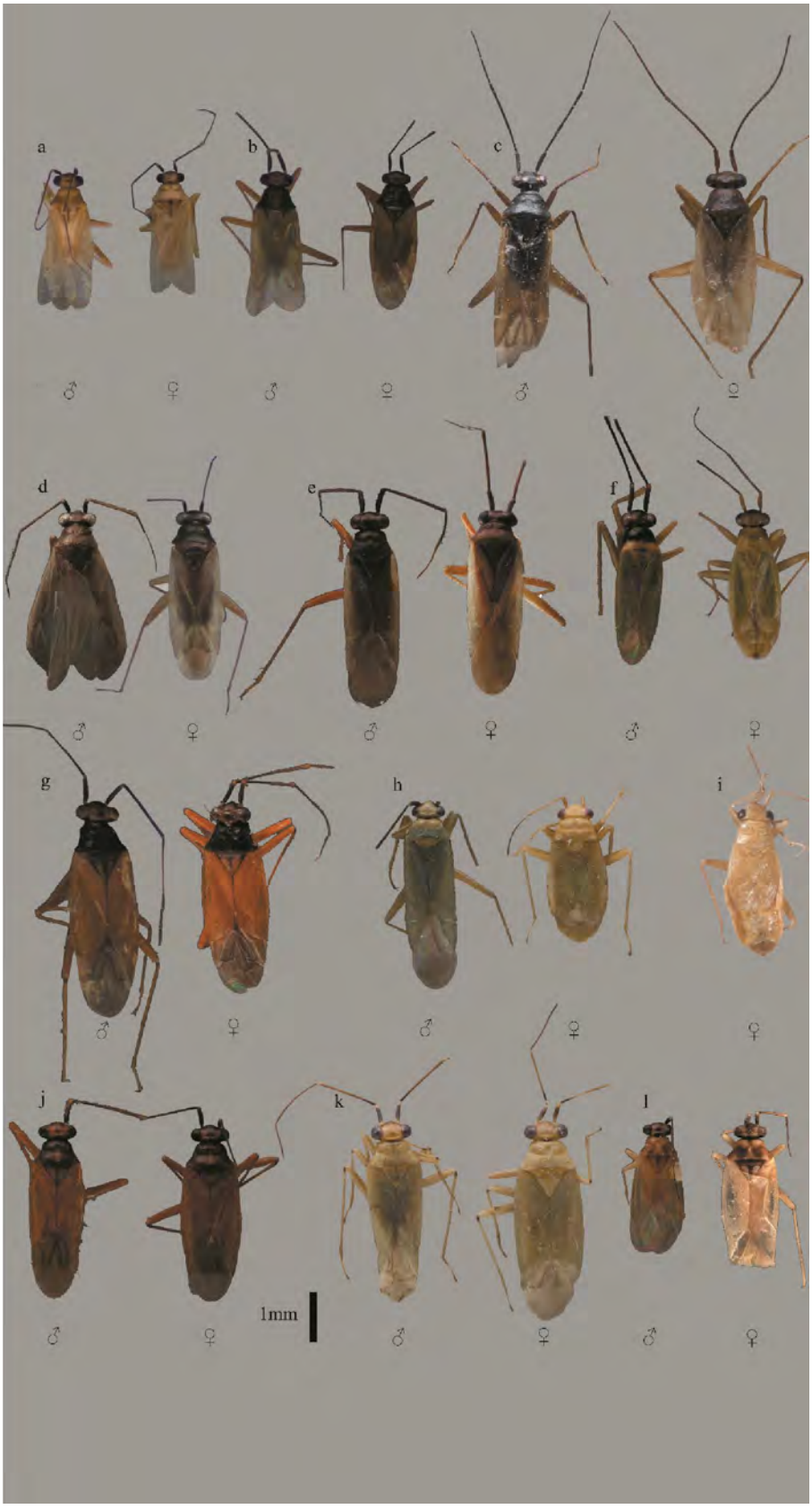


Figure 7: Habitus images of *Cyrtorhinus*. a: *C. albidus*, b: *C. brunus*, c: *C. caricis*, d: *C. caricisoides*, e: *C. carvalhoi*, f: *C. cumberi*, g: *C. defectus*, h: *C. dimorphus*, i: *C. eylesi*, j: *C. fulvus*, k: *C. geniculatus* l: *C. indi*. Continued on next page.



Figure 7 (continued): Habitus images. m: *C. lividipennis*, n: *C. melanops*, o: *C. novabritannia*, p: *C. palauensis*, q: *C. pilosus*, r: *C. quatei*, s: *C. rarus*, t: *C. solomonensis*, u: *C. yunganensis*.

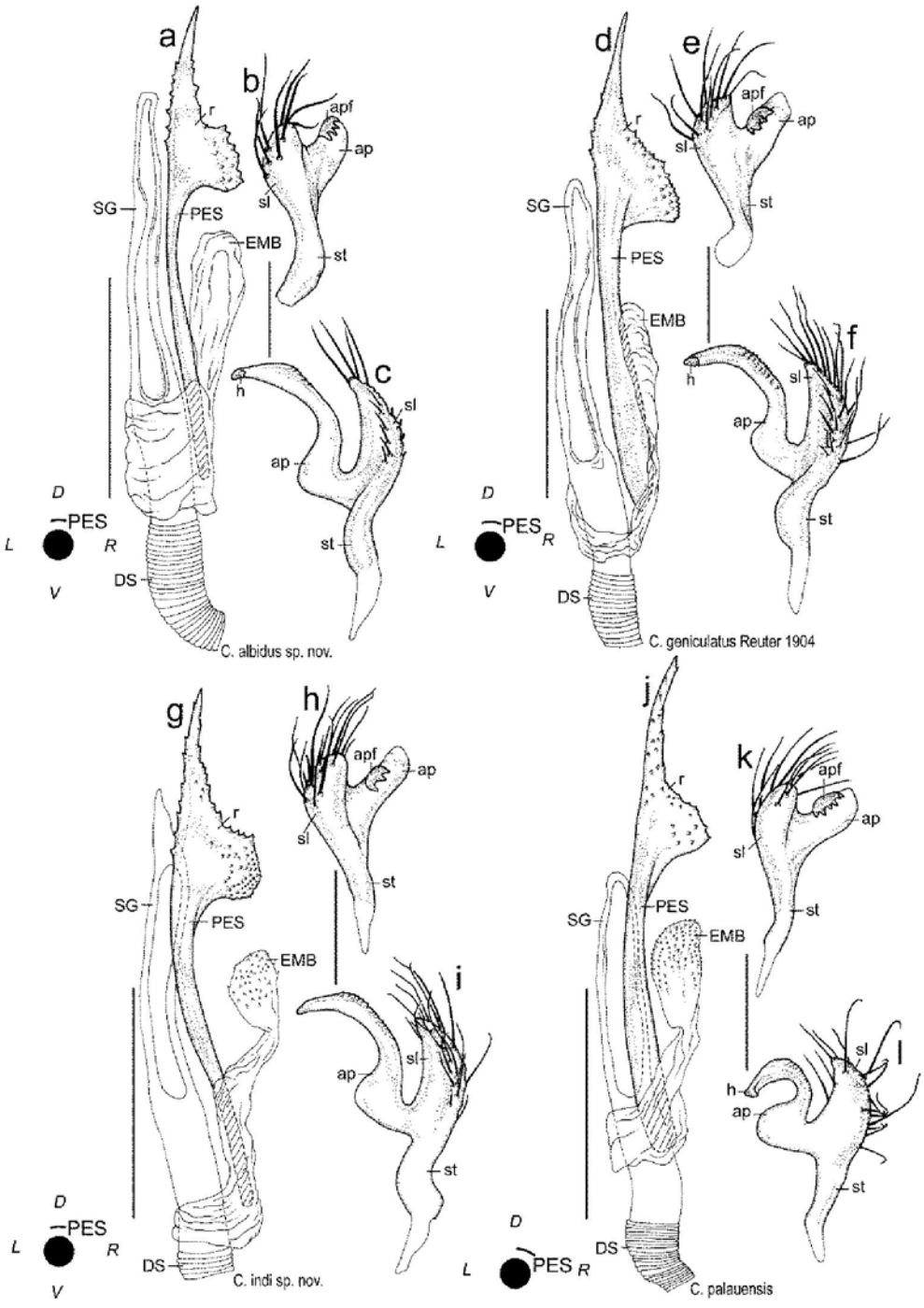


Figure 8: Male genitalia of *Cyrtorhinus albidus*, scales = 0.1mm: a: Endosoma. b: Right paramere. c: Left paramere. Male genitalia of *C. geniculatus*: d: Endosoma. e: Right paramere. f: Left paramere. Male genitalia of *C. indi*: g: Endosoma. h: Right paramere. i: Left paramere. Male genitalia of *C. palauensis*: j: Endosoma. k: Right paramere. l: Left paramere. Abbreviations: ap: Apophysis, apf: Flange of the apophysis, DS: Ductus seminis, EMB: Endosomal membranous bag, PES: Proximal endosomal spicule, r: Rudus, SG: Secondary gonopore, sl: Sensory lobe, st: Stem.

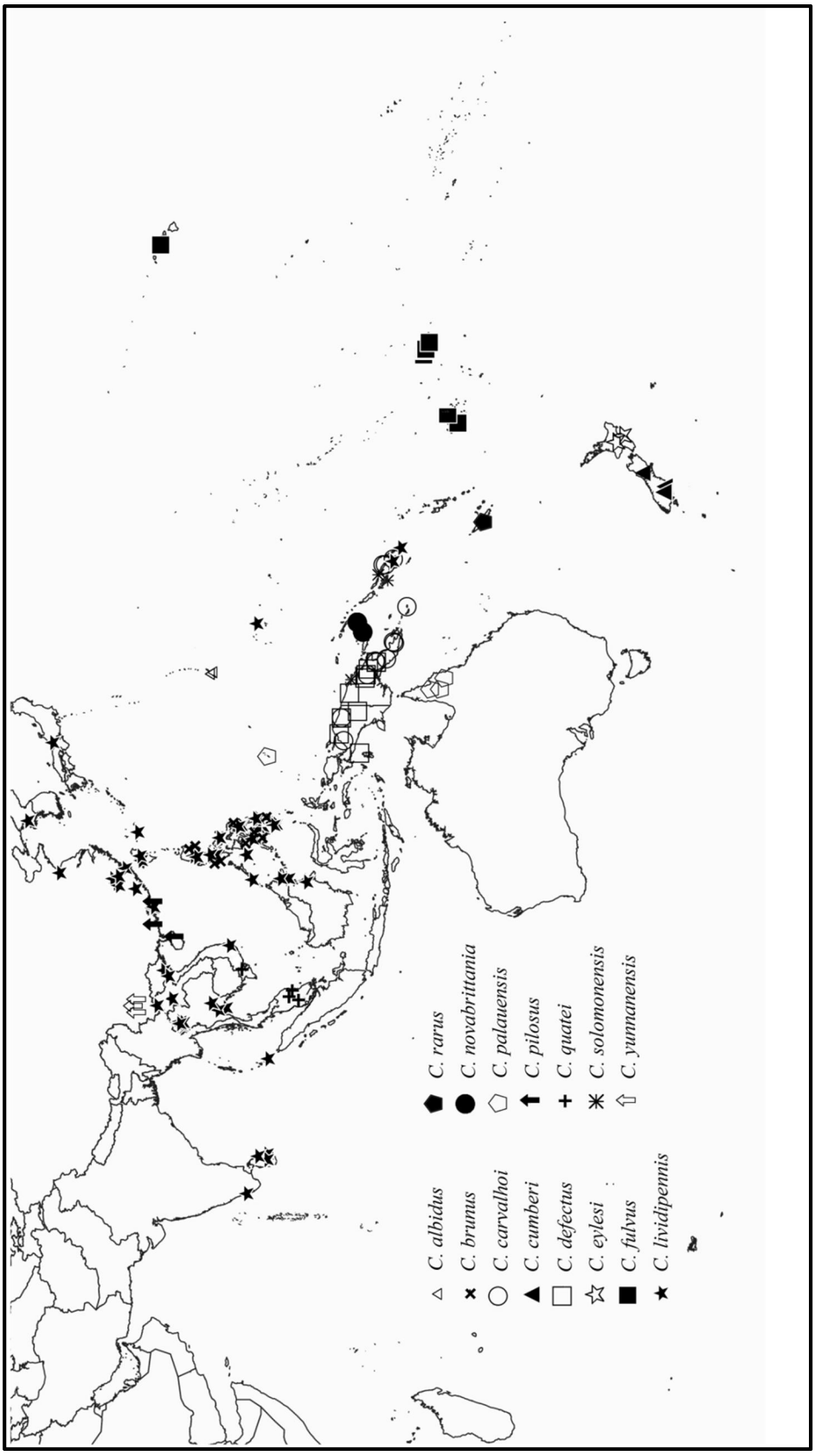


Figure 9: Map of eastern Indo-Pacific *Cyrtorhinus* species.

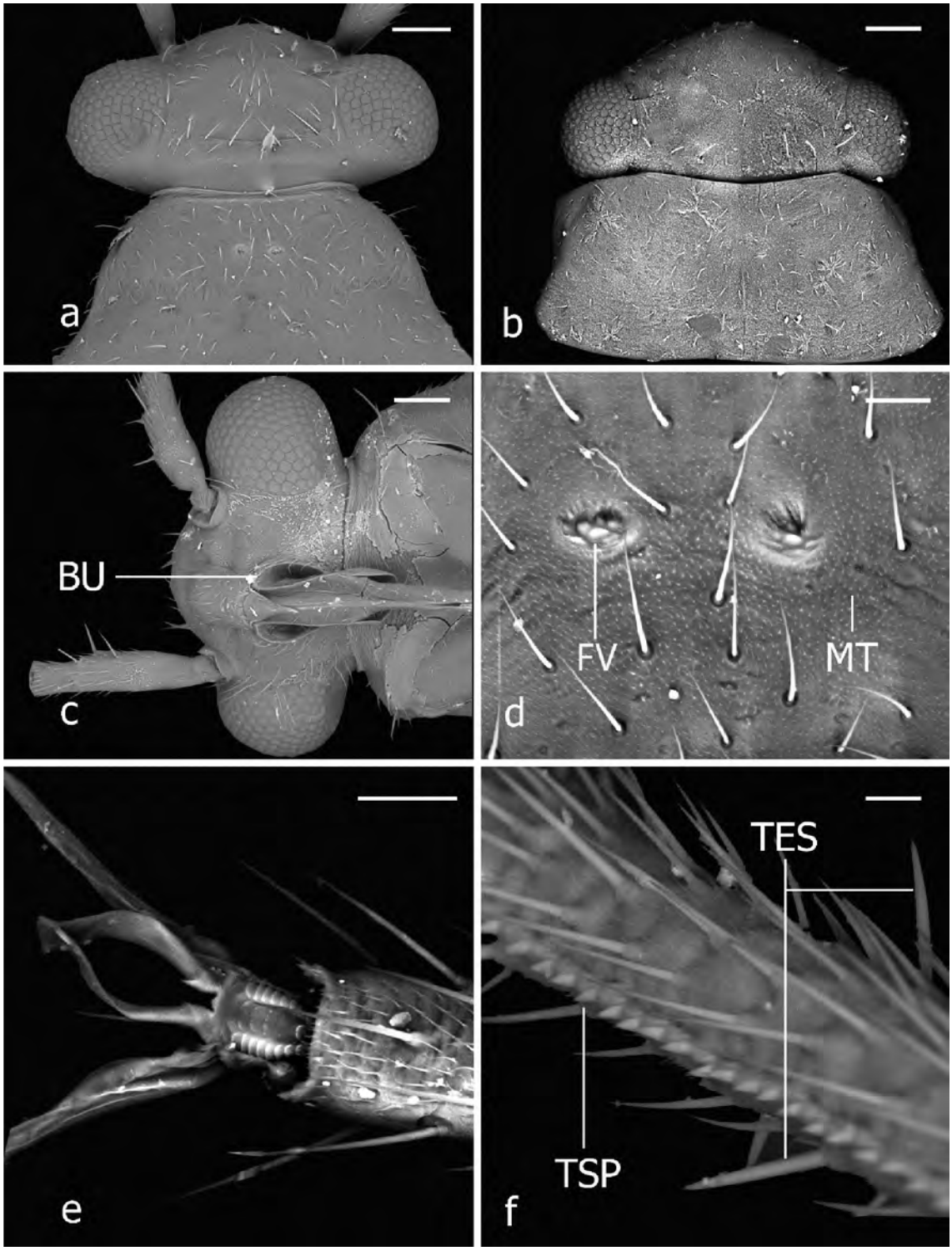


Figure 10: *Cyrtorhinus albidus.* a: Head, dorsal view, scale = 100µm. b: Head brachypterous, scale= 100µm. c: Head, ventral view, scale = 100µm. d: Pronotal vestiture, scale = 40µm. e: Pretarsus, scale = 20µm. f: Tibial vestiture, scale = 100µm. Abbreviations: BU: Bucculae, FV: Foveae, MTA: Microtrichia, TES: Tibial elongate setae, TSP: Tibial spinules.

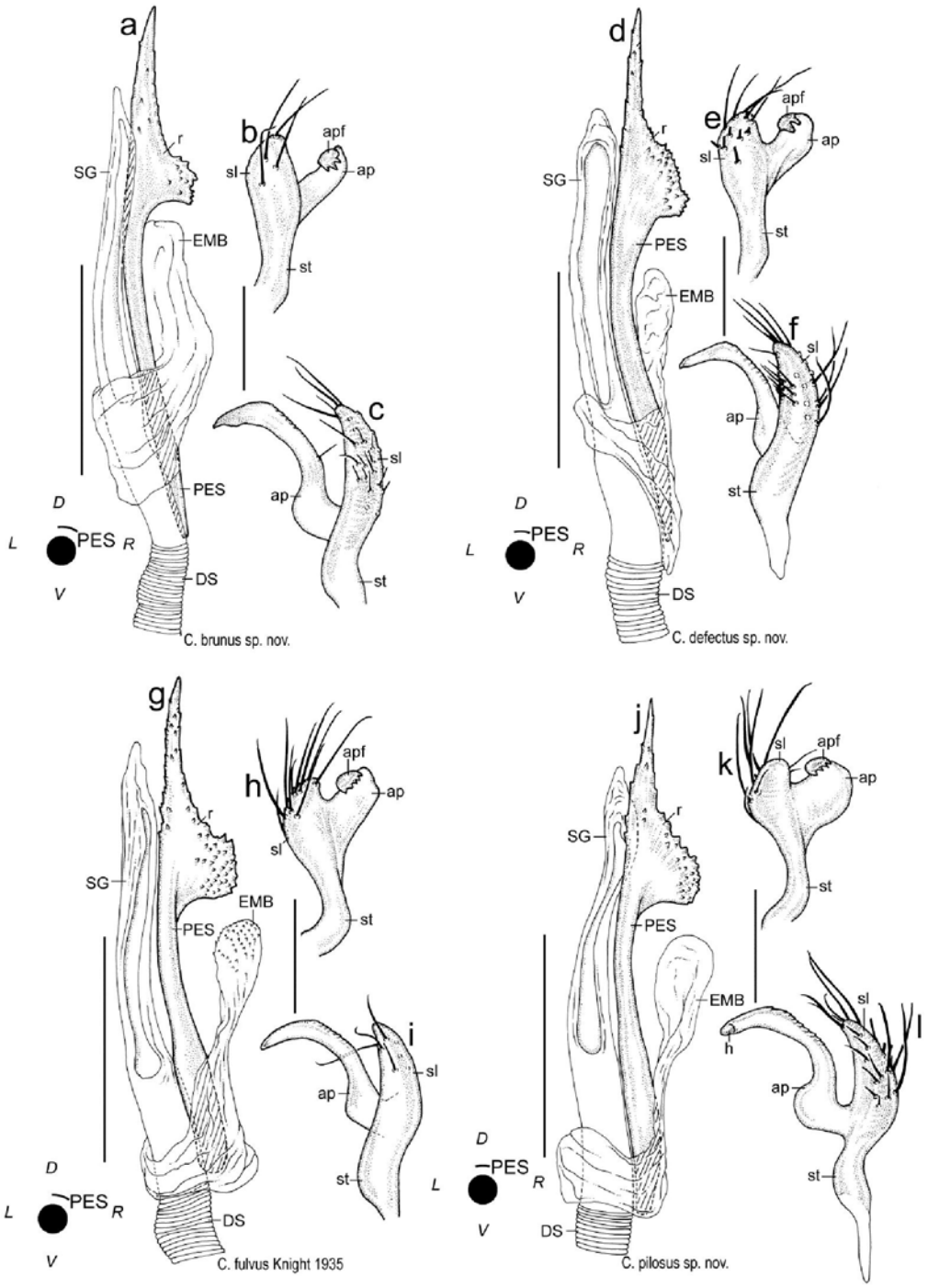


Figure 11: Male genitalia of *Cyrtorhinus brunus*, scales = 0.1mm: a: Endosoma. b: Right paramere. c: Left paramere. Male genitalia of *C. defectus*: d: Endosoma. e: Right paramere. f: Left paramere. *C. fulvus*: g: Endosoma. h: Right paramere. i: Left paramere. Male genitalia of *C. pilosus*: j: Endosoma. k: Right paramere. l: Left paramere. Abbreviations: ap: Apophysis, apf: flange of the apophysis, DS: Ductus seminis, EMB: endosomal membranous bag, PES: proximal endosomal spicule, r: Rudus, st: Stem, sl: Sensory lobe, SG: Secondary gonopore.

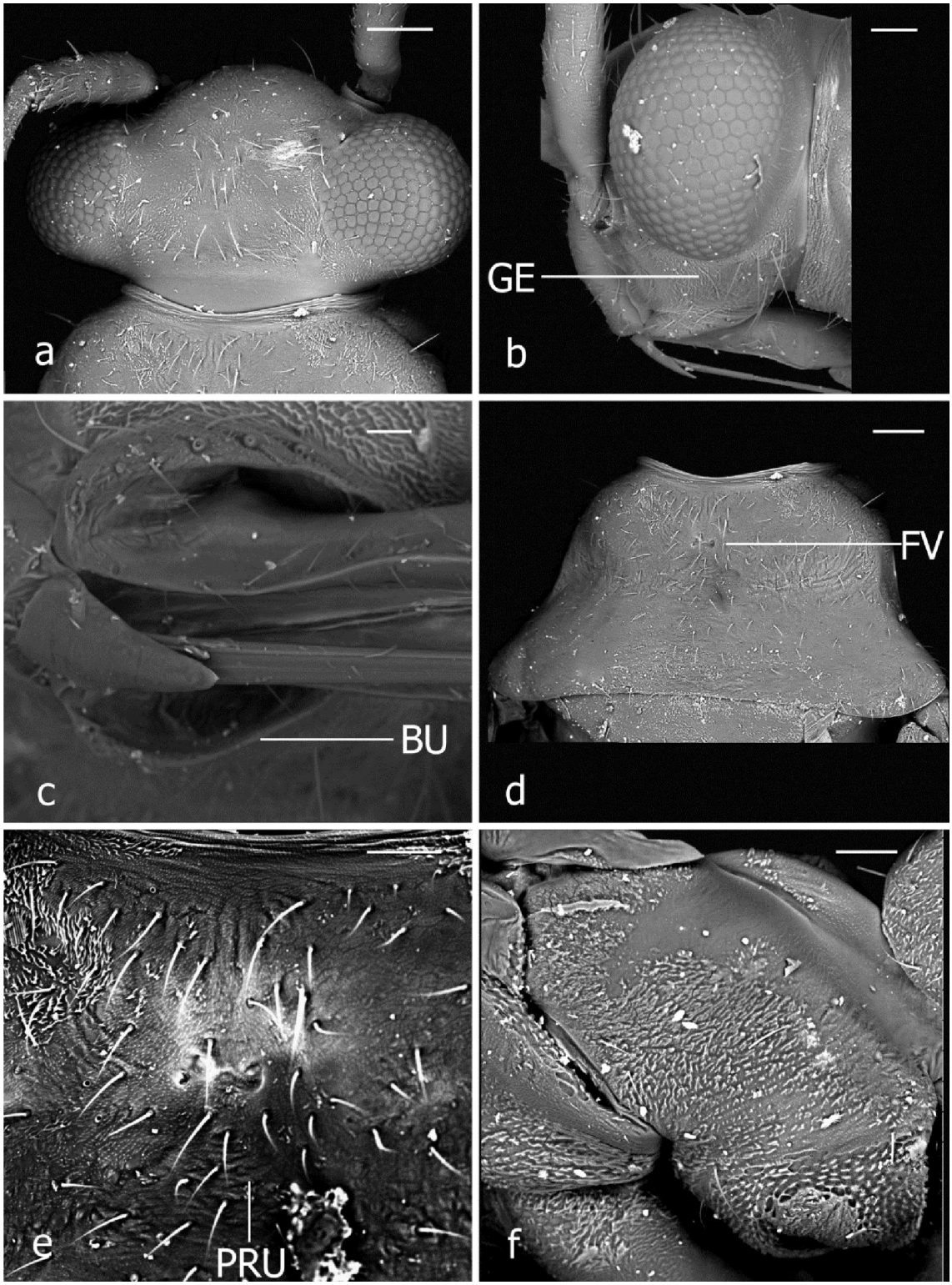


Figure 12: *Cyrtorhinus brunus.* a: Head, dorsal view, scale = 100µm. b: Head, lateral view, scale = 60µm. c: Bucculae, scale = 20µm. d: Pronotum, scale = 100µm. e: Foveae, scale = 40µm. f: Metathoracic gland, scale = 40µm. Abbreviations: BU: Bucculae, GE: Genae, PRU: Pronotal rugae.

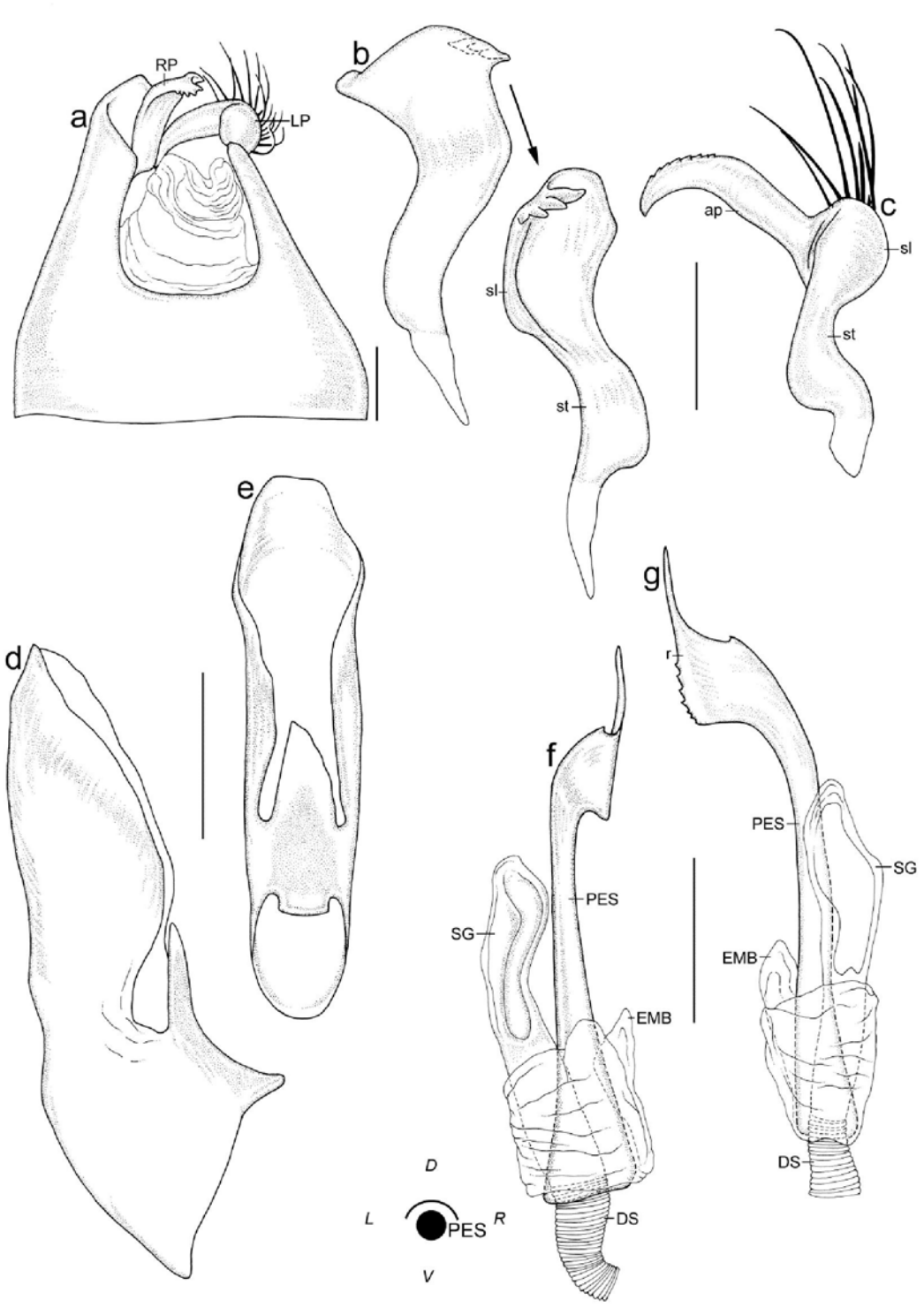


Figure 13: Male genitalia of *Cyrtorhinus caricis*, scales = 0.1mm: a: Pygophore. b: Right paramere. c: Left paramere. d-e: Phallotheca. f-g: Endosoma. Abbreviations: ap: Apophysis, DS: Ductus seminis, EMB: Endosomal membranous bag, LP: Left paramere, PES: Proximal endosomal spicule, r: Rudus, RP: Right paramere, st: Stem, sl: Sensory lobe, SG: Secondary gonopore.

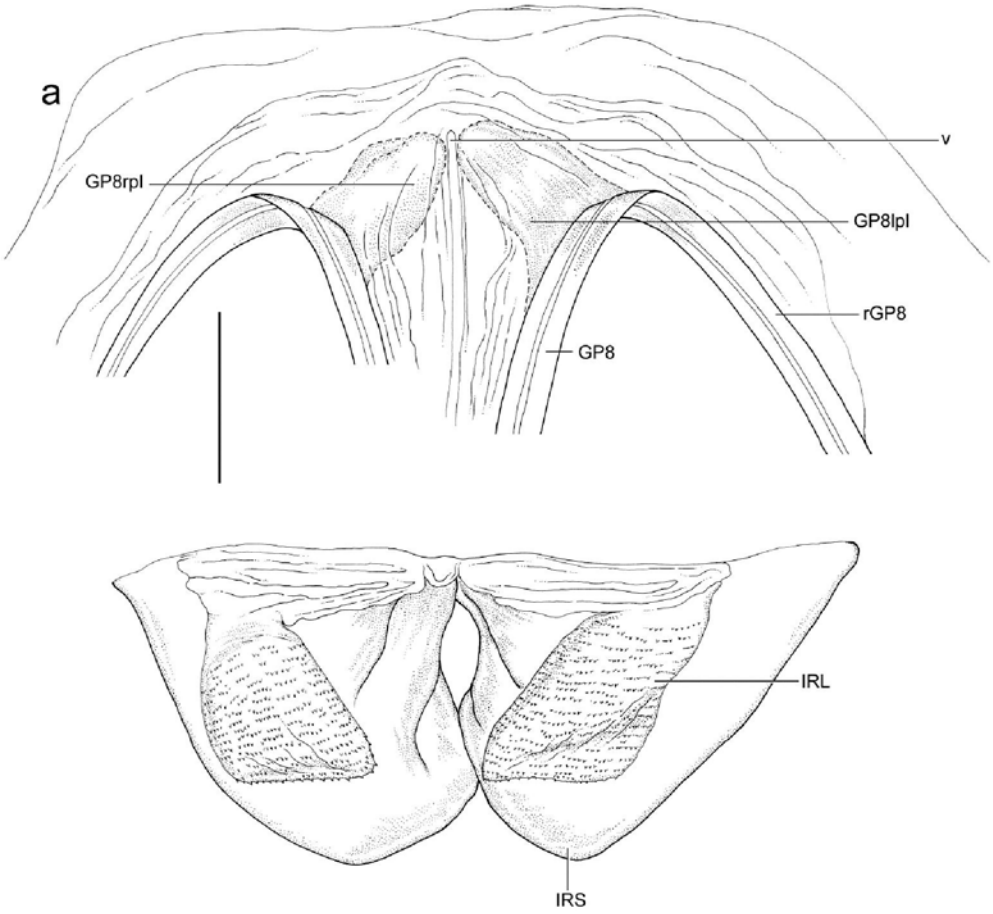


Figure 14: Female genitalia of *Cyrtorhinus caricis*, scale = 0.1mm: Abbreviations: v: Vestibulum, GP8= gonapophysis 8, GP8rpl: gonapophysis 8 right plate, GP8lpl: gonapophysis 8 left plate, IRL: Inter-ramal lobe, IRS: Inter ramal sclerite, Rgp8: Ramus of gonapophysis 8.

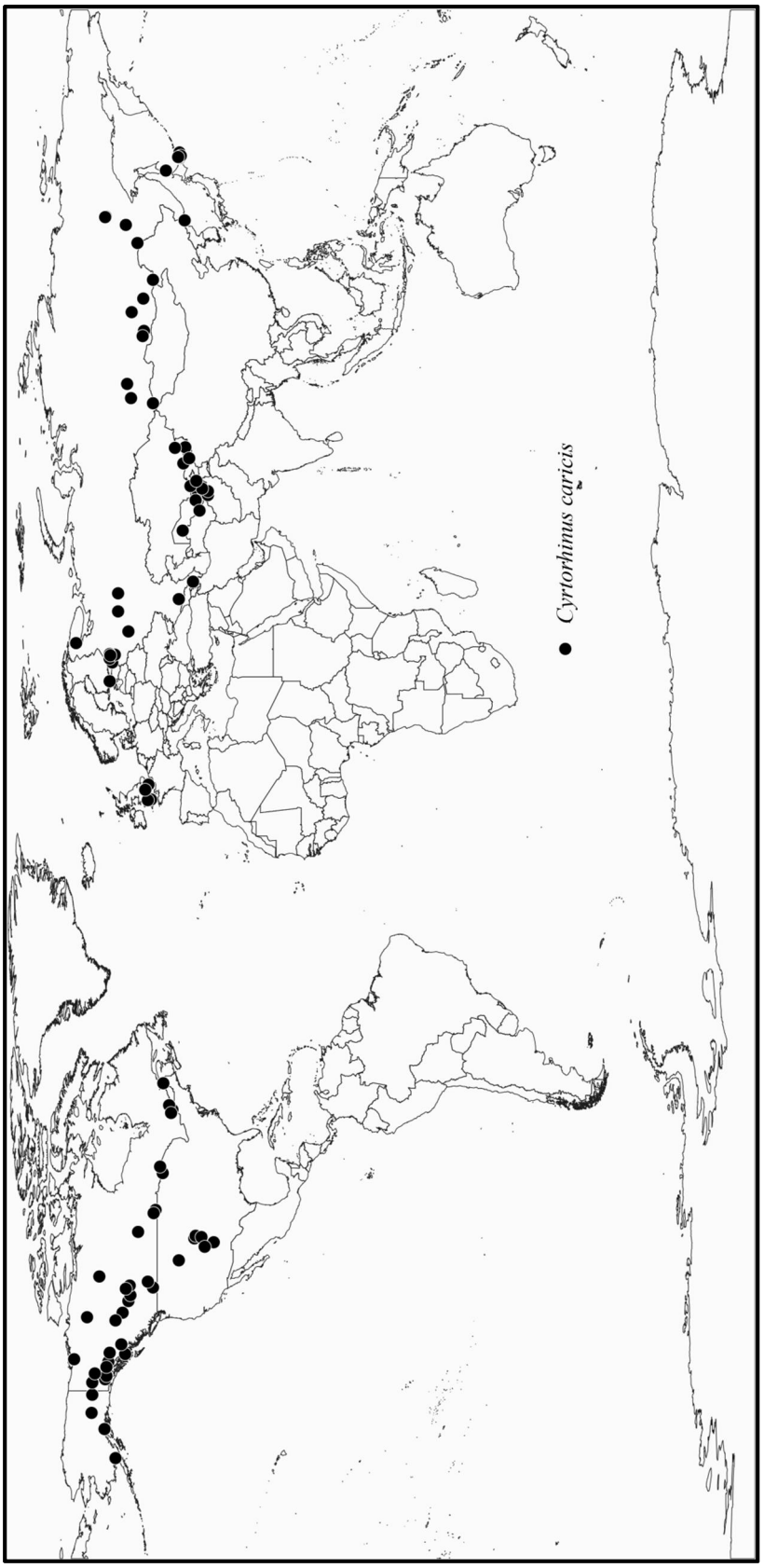


Figure 15: Map of *Cyrtorhinus caricis* in the Holarctic region.

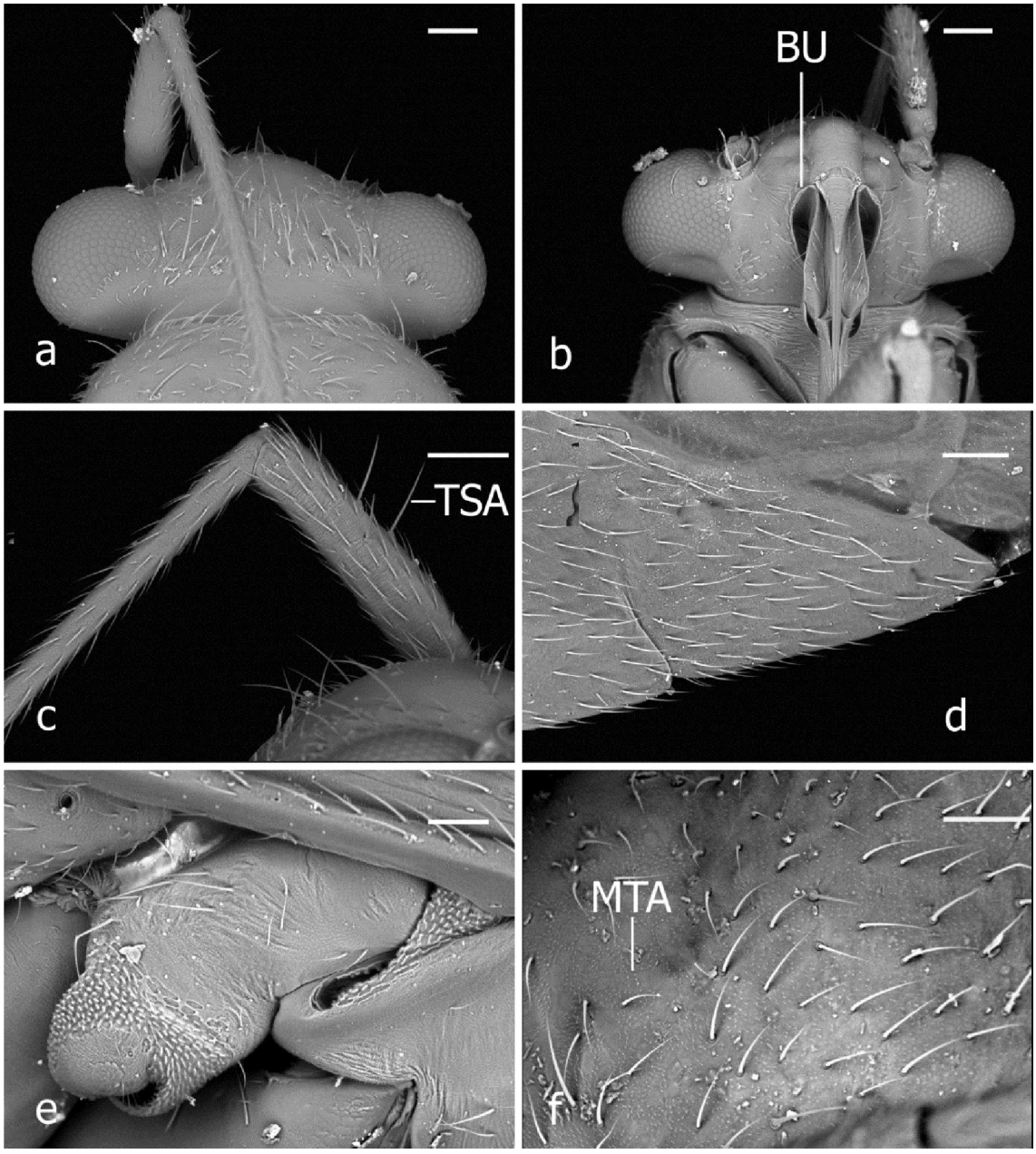


Figure 16: *Cyrtorhinus caricis*. a: Head, dorsal view, scale= 100µm. b: Head, ventral view, scale= 100µm. c: AI, scale= 100µm. d: Cuneus, scale= 100µm. e: Metathoracic gland, scale= 60µm. f: Pronotal vestiture, scale = 30µm. Abbreviations: BU: Bucculae, MTA: Microtrichia, TSA: AI Thickened Setae.

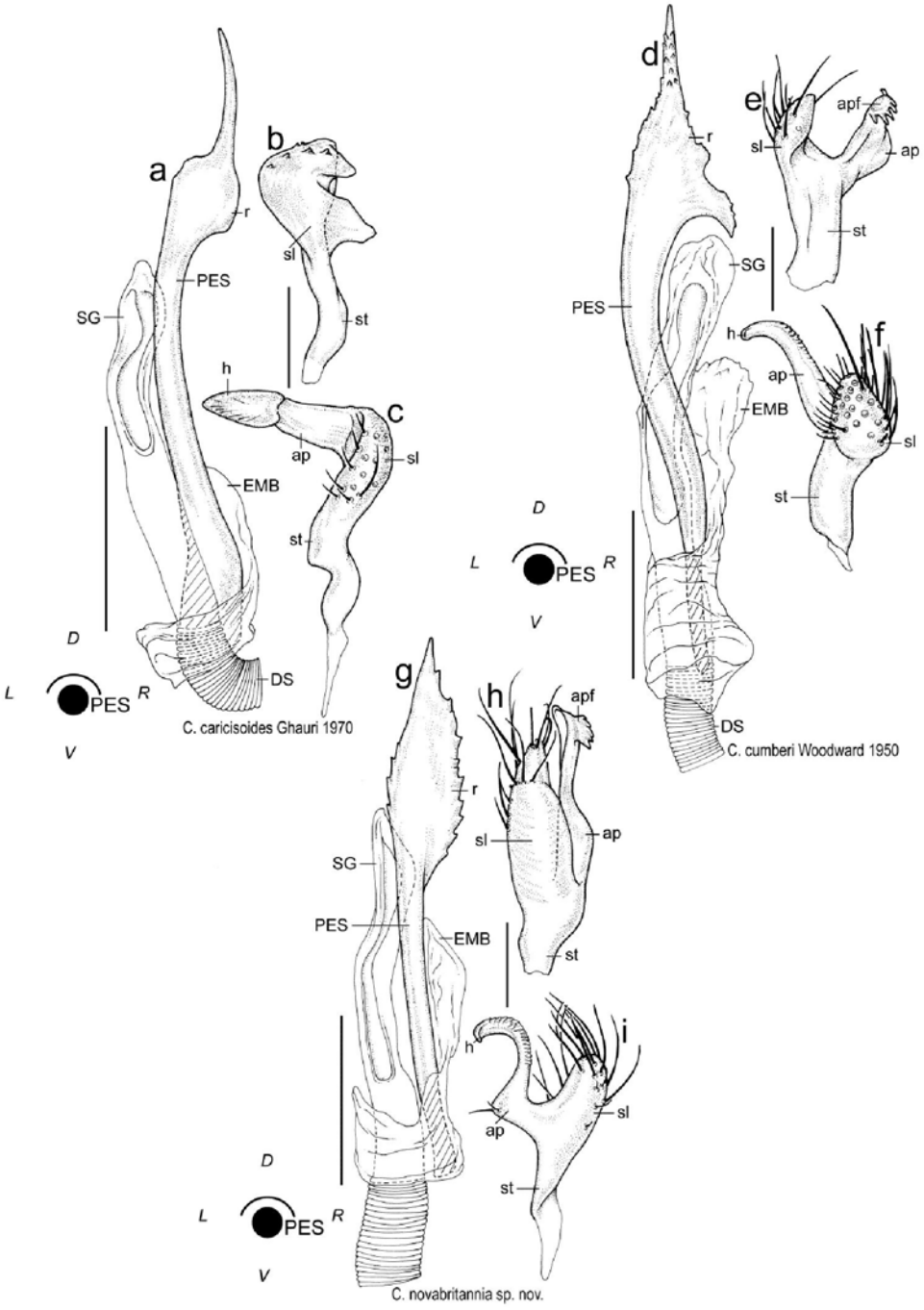


Figure 17: Male genitalia of *C. caricisoides*, scales = 0.1mm: a: Endosoma. b: Right paramere. c: Left paramere. Male genitalia of *C. cumberi*: d: Endosoma. e: Right paramere. f: Left paramere. Male genitalia of *C. novabritannia*: g: Endosoma. h: Right paramere. i: Left paramere. Abbreviations: ap: Apophysis, apf: Flange of the apophysis, DS: Ductus seminis, EMB: Endosomal membrane bag, PES: Proximal endosomal spicule, r: Rudus, SG: Secondary gonopore, sl: Sensory lobe, st: Stem.

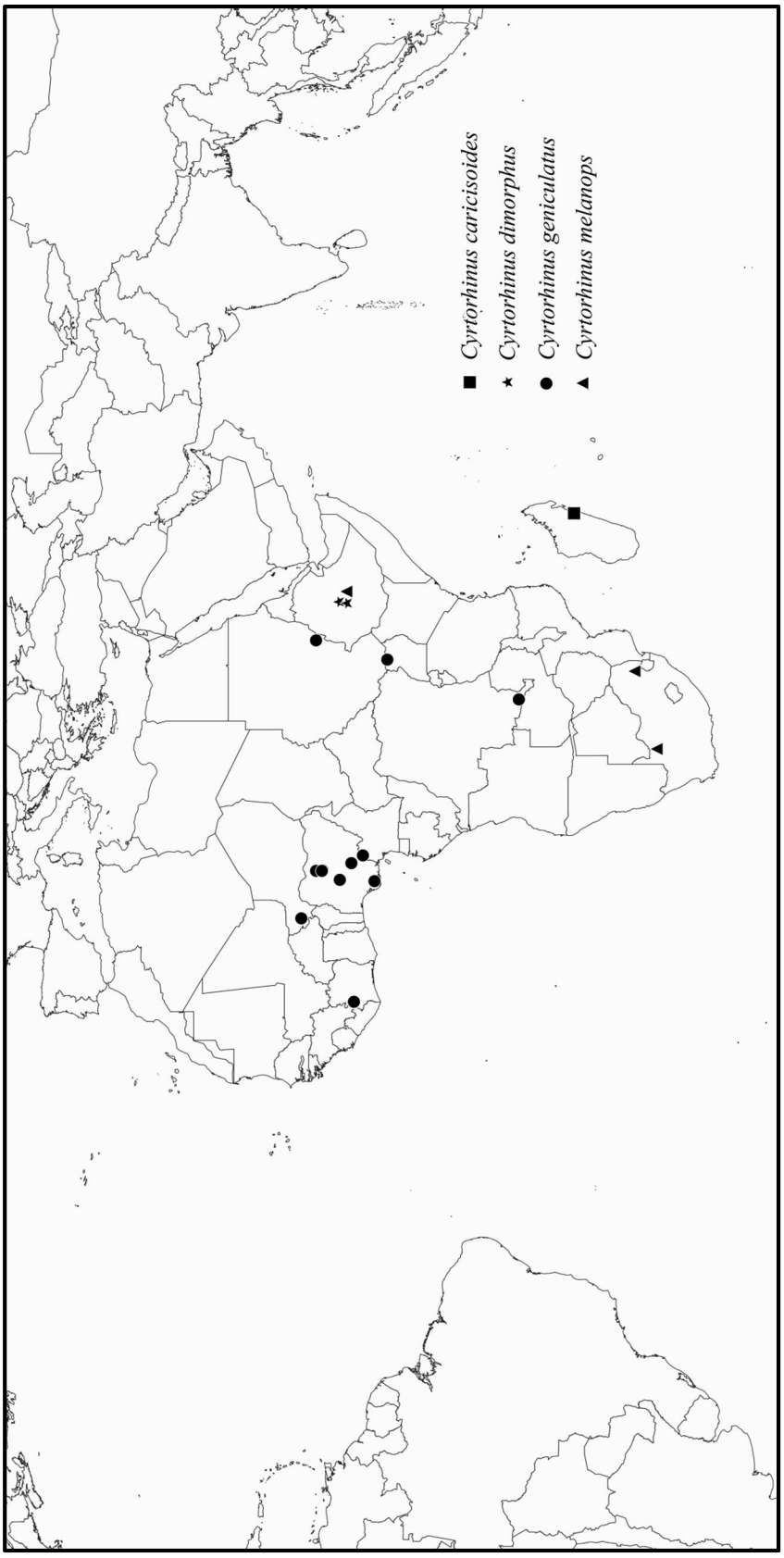


Figure 18: Map of Afrotropical Indo-Pacific *Cyrtorhinus* species.

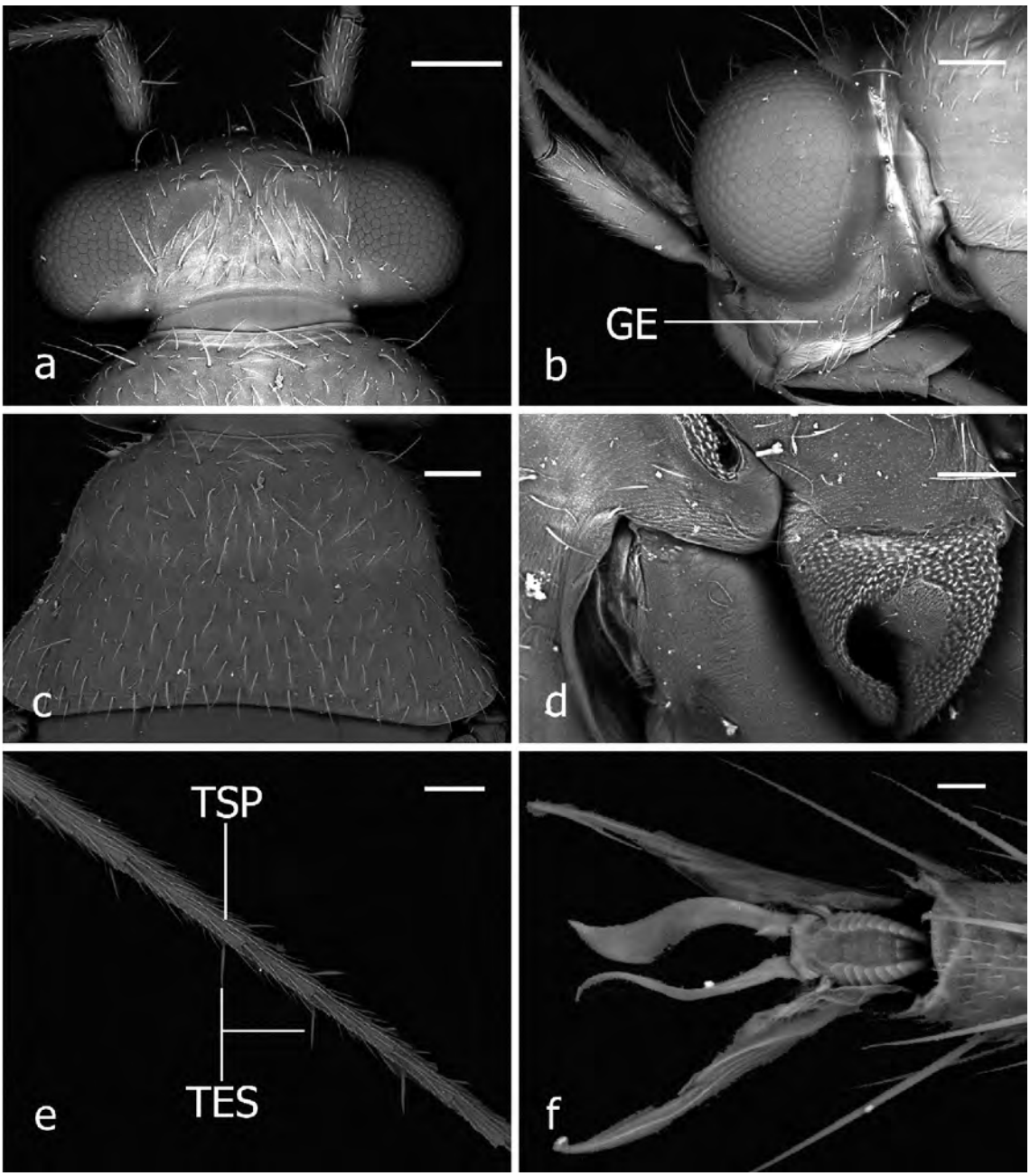


Figure 19: *Cyrtorhinus caricisoides.* a: Head, dorsal view, scale = 100µm. b: Head, lateral view, scale = 100µm. c: Pronotum, scale = 100µm d: Metathoracic gland, scale = 30µm. e: Tibial vestiture, scale = 100µm. f: Pretarsus, scale = 20µm. Abbreviations: GE: genae, TES: Tibial elongate setae, TSP: Tibial spinules.

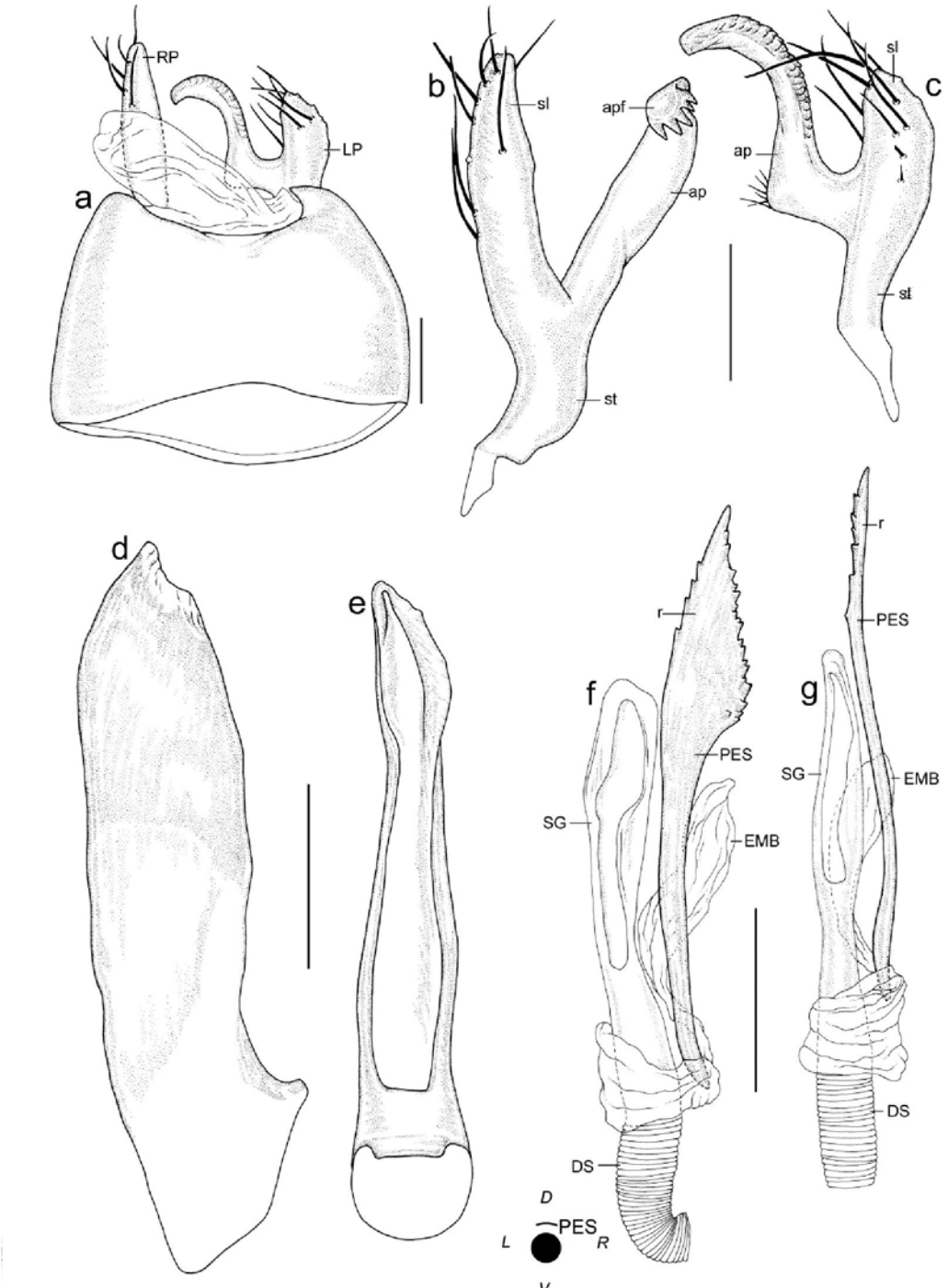


Figure 20: Male genitalia of *C. carvalhoi*, scales = 0.1mm: a: Pygophore. b: Right paramere. c: Left paramere. d-e: Phallotheca. f-g: Endosoma. Abbreviations: ap: Apophysis, apf: Flange of the apophysis, DS: Ductus seminis, EMB: Endosomal membrane bag, LP: Left paramere, PES: proximal endosomal spicule, r: Rudus, RP: Right paramere, SG: secondary gonopore, sl: Sensory lobe, st: Stem.

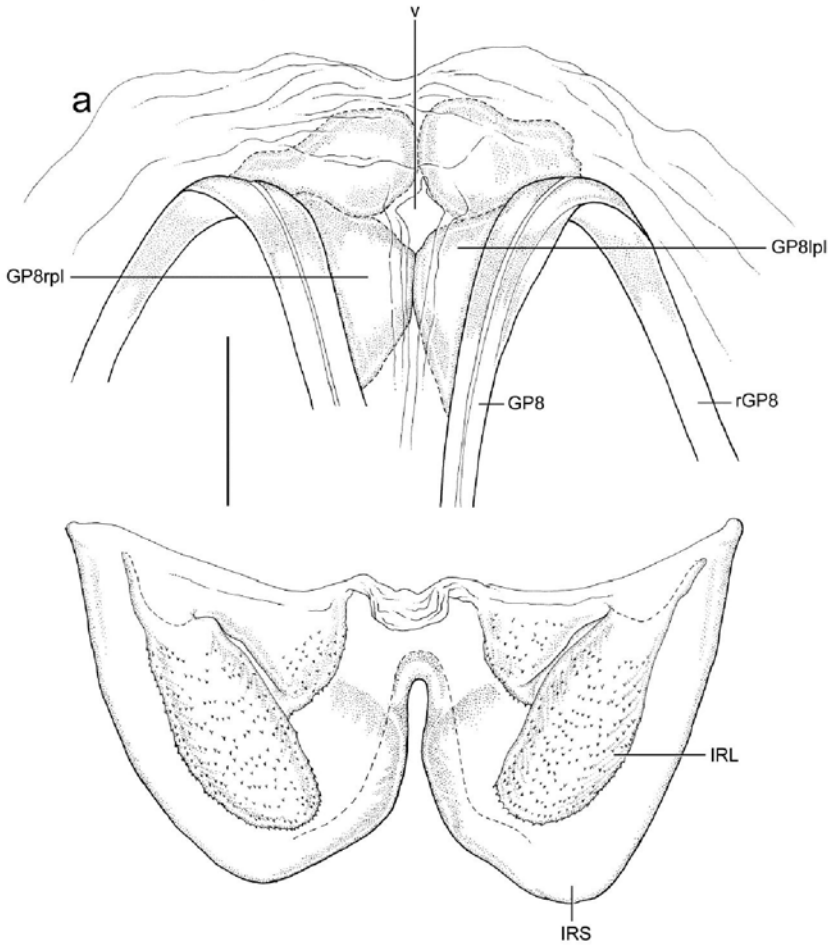


Figure 21: Female genitalia of *C. carvalhoi*, scale = 0.1mm: Abbreviation: v: Vestibulum, GP8= gonapophysis 8, GP8rpl: gonapophysis 8 right plate, GP8lpl: gonapophysis 8 left plate, IRL: Inter-ramal lobe, IRS: Inter ramal sclerite, Rgp8: Ramus of gonapophysis 8.

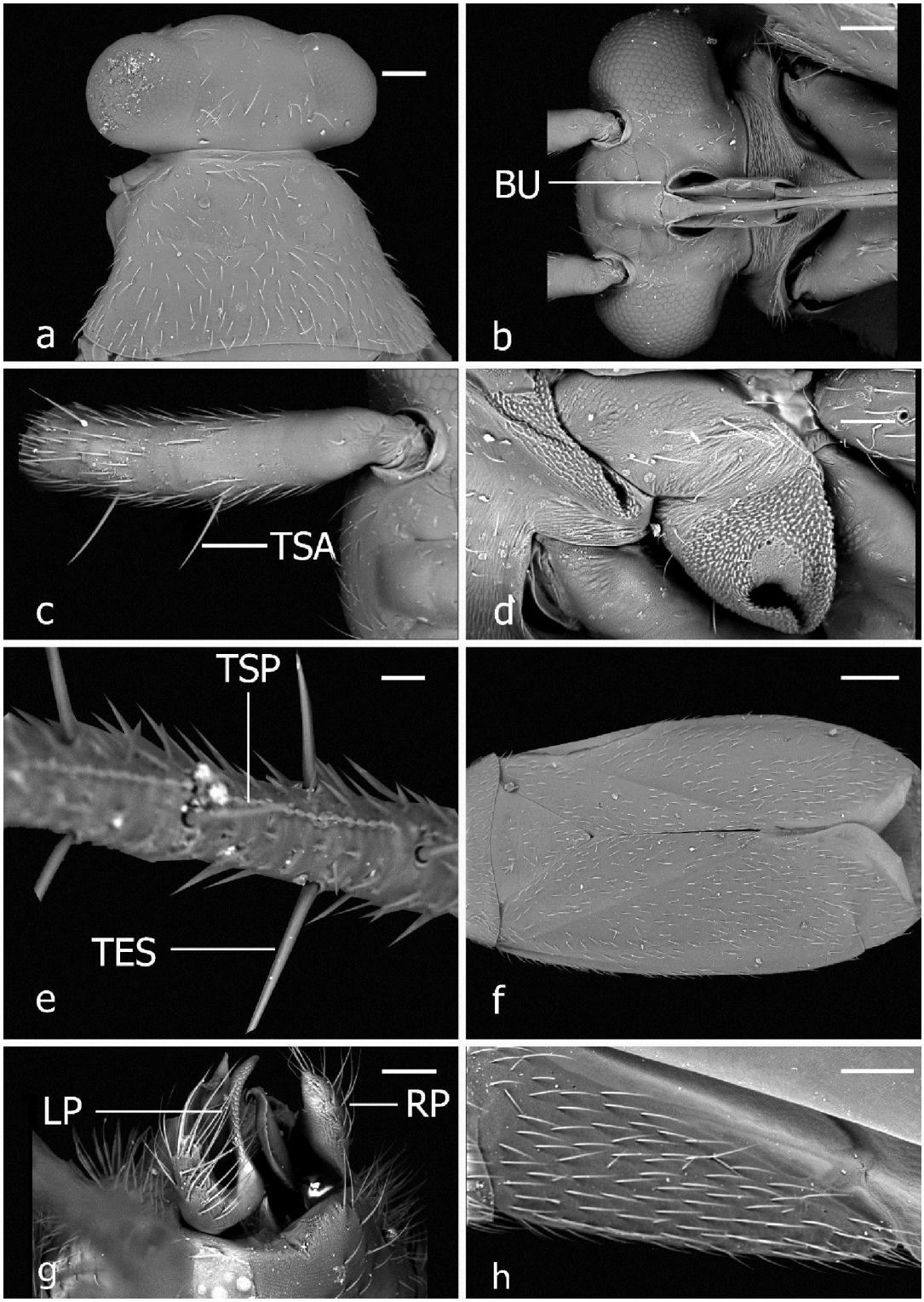


Figure 22: *Cyrtorhinus carvalhoi.* a: Head, dorsal view, scale =100µm. b: Head, ventral view, scale = 60µm. c: AI, scale = 60µm. d: Metathoracic gland, scale = 60µm. e: Tibial vestiture, scale = 20µm. f: Brachypterous hemelytra, scale = 200µm. g: Pygophore, scale = 60µm. h: Cuneus, scale = 100µm. Abbreviations: BU: Bucculae, LP: Left paramere, RP: Right paramere, TES: Tibial elongate setae, TSA: AI Thickened Setae, TSP: Tibial spinules.

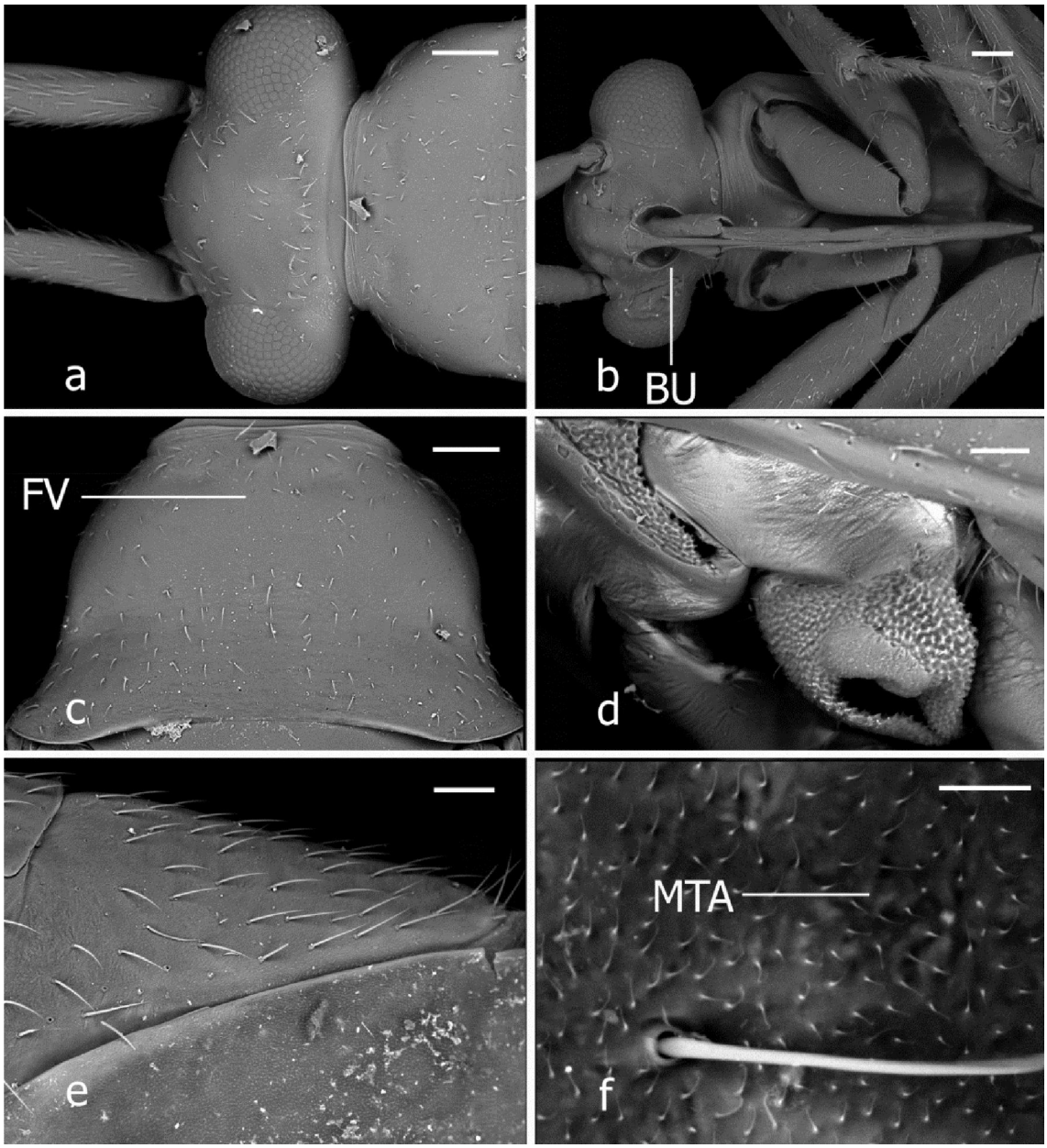


Figure 23: *Cyrtorhinus cumberi.* a: Head, dorsal view, scale =100µm. b: Head, ventral view, scale = 60µm c: Pronotum, scale = 100µm. d: Metathoracic gland, scale = 60µm. e: Cuneus, scale = 60µm. f: Hemelytral vestiture, scale = 200µm. Abbreviations: BU: Bucculae, FV: Foveae, MTA: Microtrichia.

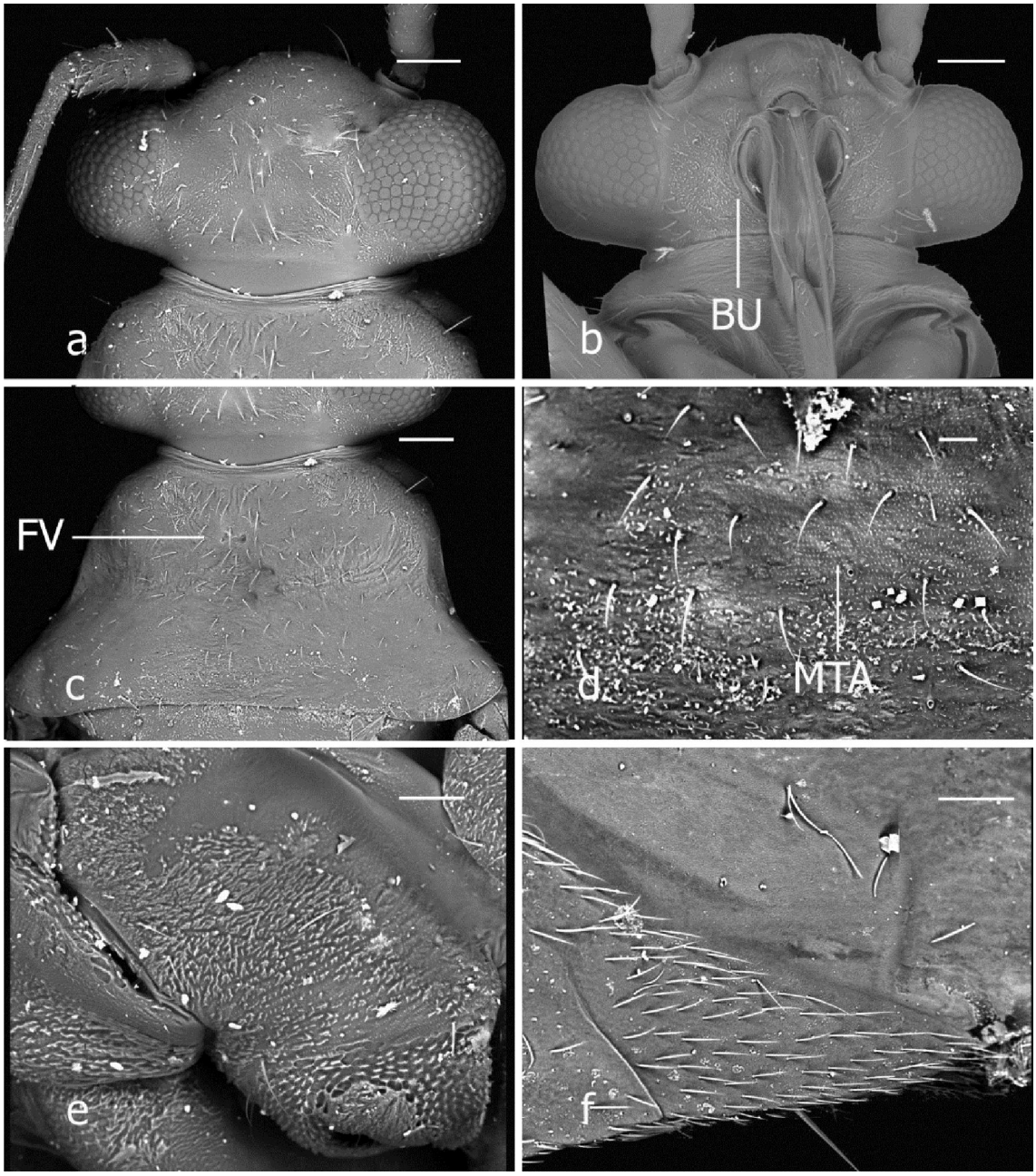


Figure 24: *Cyrtorhinus defectus*. a: Head, dorsal view, scale = 100µm. b: Head, ventral view, scale = 100µm. c: Pronotum scale = 100µm. d: Setae and microtrichia, scale = 20µm. e: Metathoracic gland, scale = 40µm. f: Cuneus, scale = 100µm. Abbreviations: BU: Bucculae, FV: Foveae, MTA: Microtrichia.

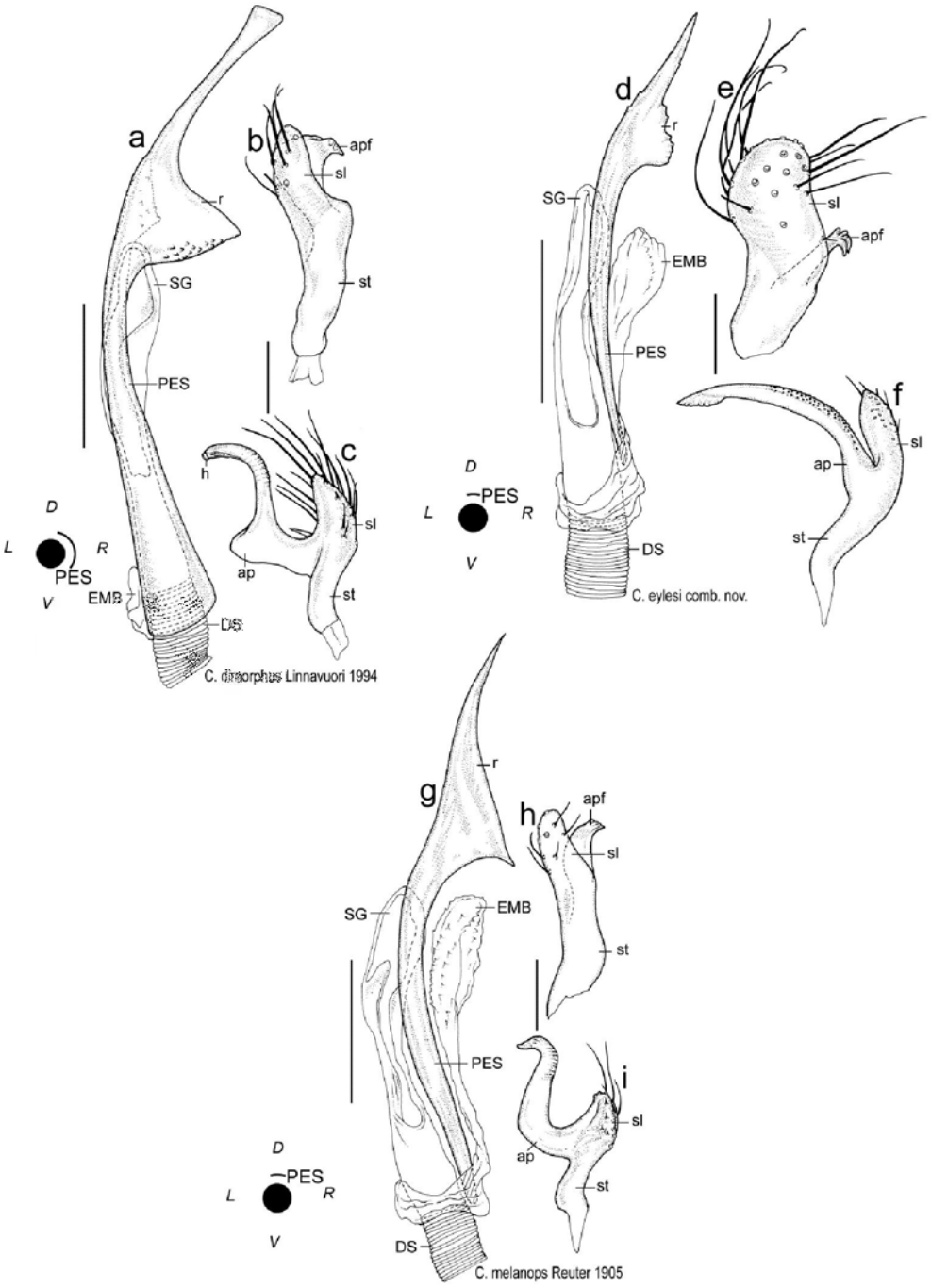


Figure 25: Male genitalia of *C. dimorphus*, scales = 0.1mm: a: Endosoma. b: Right paramere. c: Left paramere. Male genitalia of *C. eylesi*: d: Endosoma. e: Right paramere. f: Left paramere. Male genitalia of *C. melanops*: g: Endosoma. g: Right paramere. i: Left paramere. Abbreviations: ap: Apophysis, apf: Flange of the apophysis, DS: Ductus seminis, EMB: Endosomal membrane bag, PES: Proximal endosomal spicule, r: Rudus, SG: Secondary gonopore, sl: Sensory lobe, st: Stem.

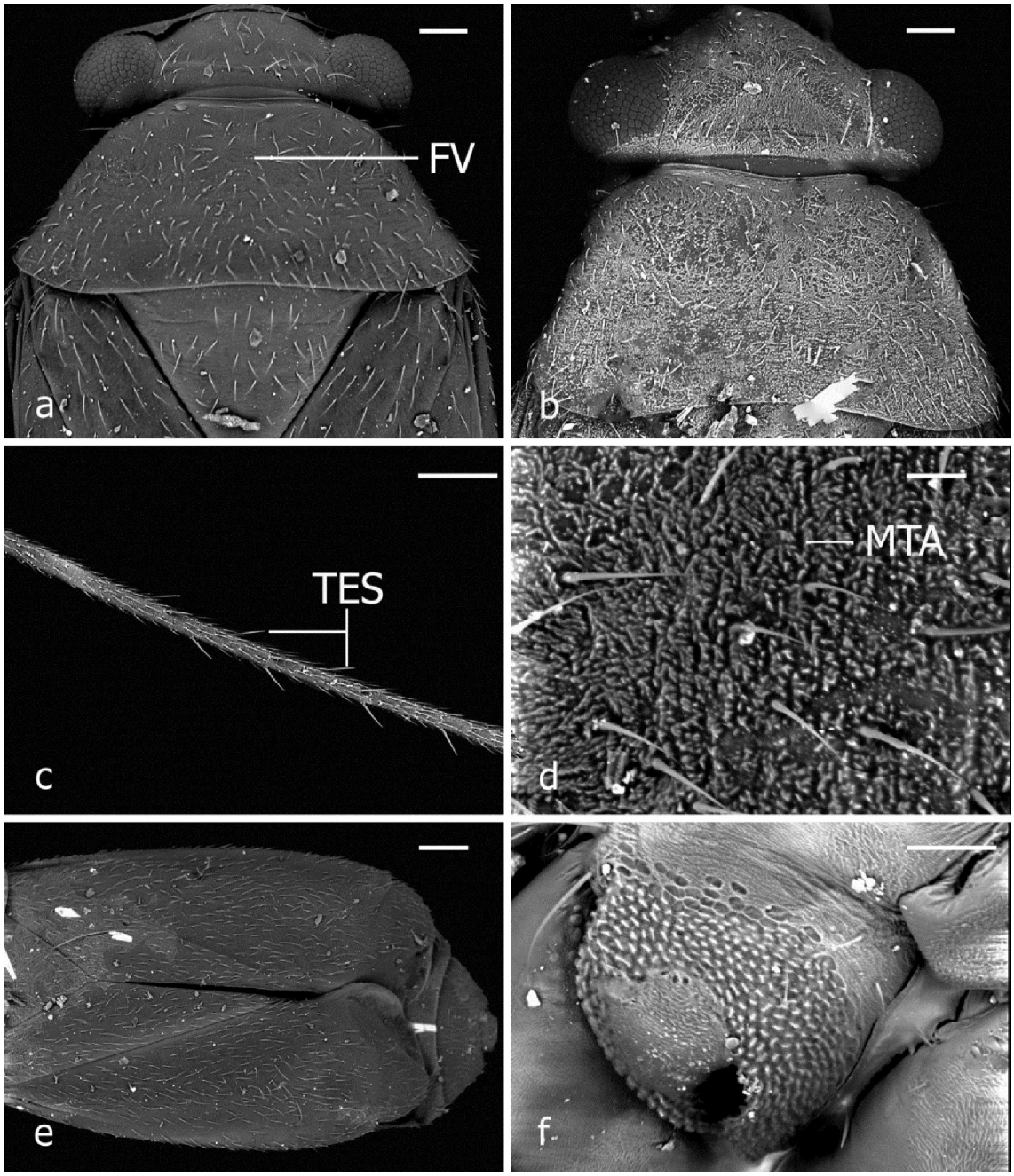


Figure 26: *Cyrtorhinus dimorphus.* a: Head of macropterous morph, dorsal view, scale = 100µm. b: Head and pronotum of brachypterous morph, scale = 100µm. c: Tibial vestiture, scale = 200µm. d: Hemelytral vestiture, scale = 20µm. e: Brachypterous hemelytra, scale = 40µm. f: Metathoracic gland, scale = 40µm. Abbreviations: FV: Foveae, MTA: Microtrichia, TES: Tibial elongate setae.

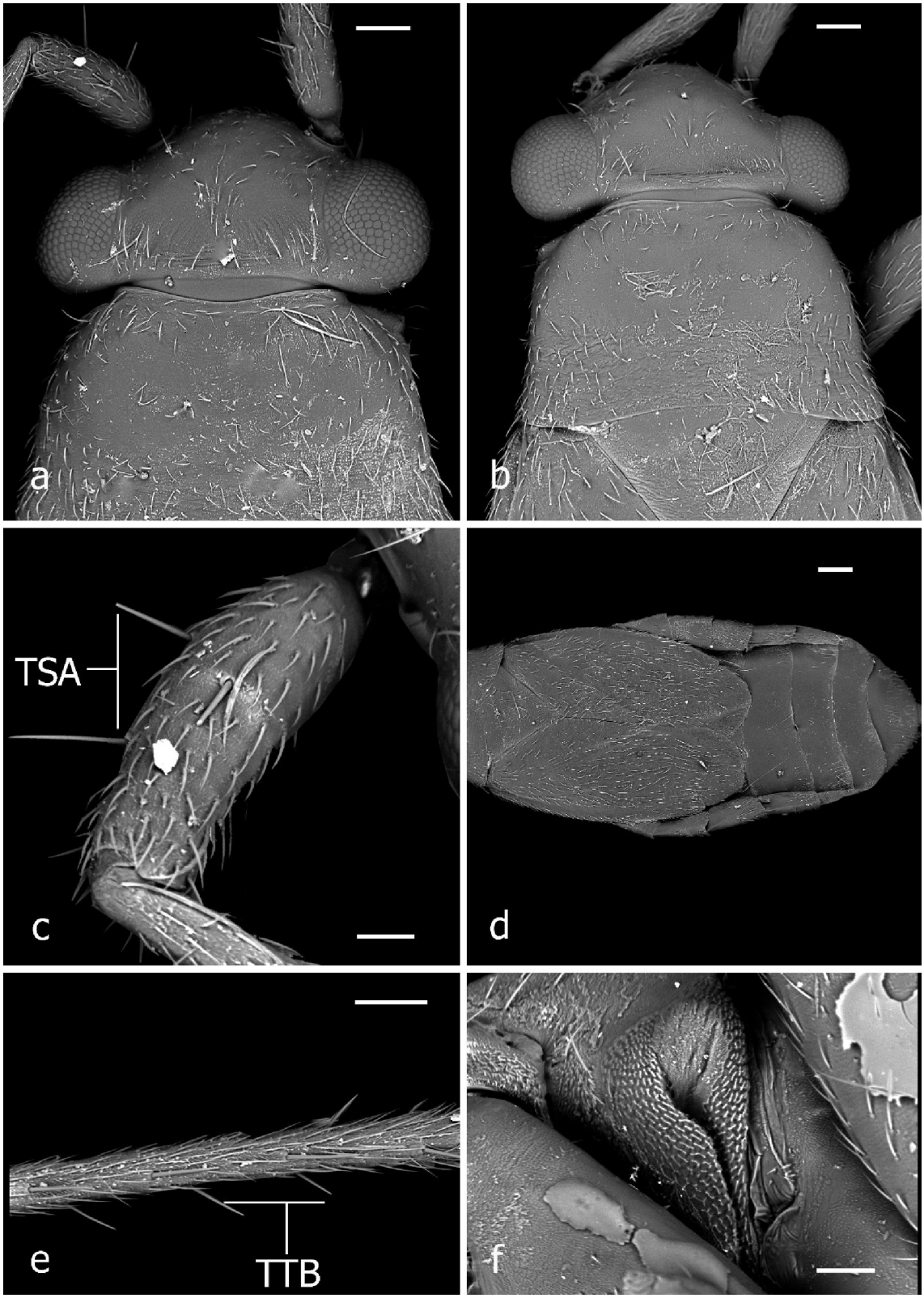


Figure 27: *Cyrtorhinus eylesi.* a: Head and pronotum of macropterous morph, scale = 100µm. b: Head and pronotum of brachypterous morph, scale = 100µm. c: AI, scale = 40µm. d: Brachypterous hemelytra, scale = 200µm. e: Tibial vestiture, scale = 100µm. f: Metathoracic gland, scale = 40µm. Abbreviations: TES: Tibial elongate setae, TSA: AI Thickened Setae.

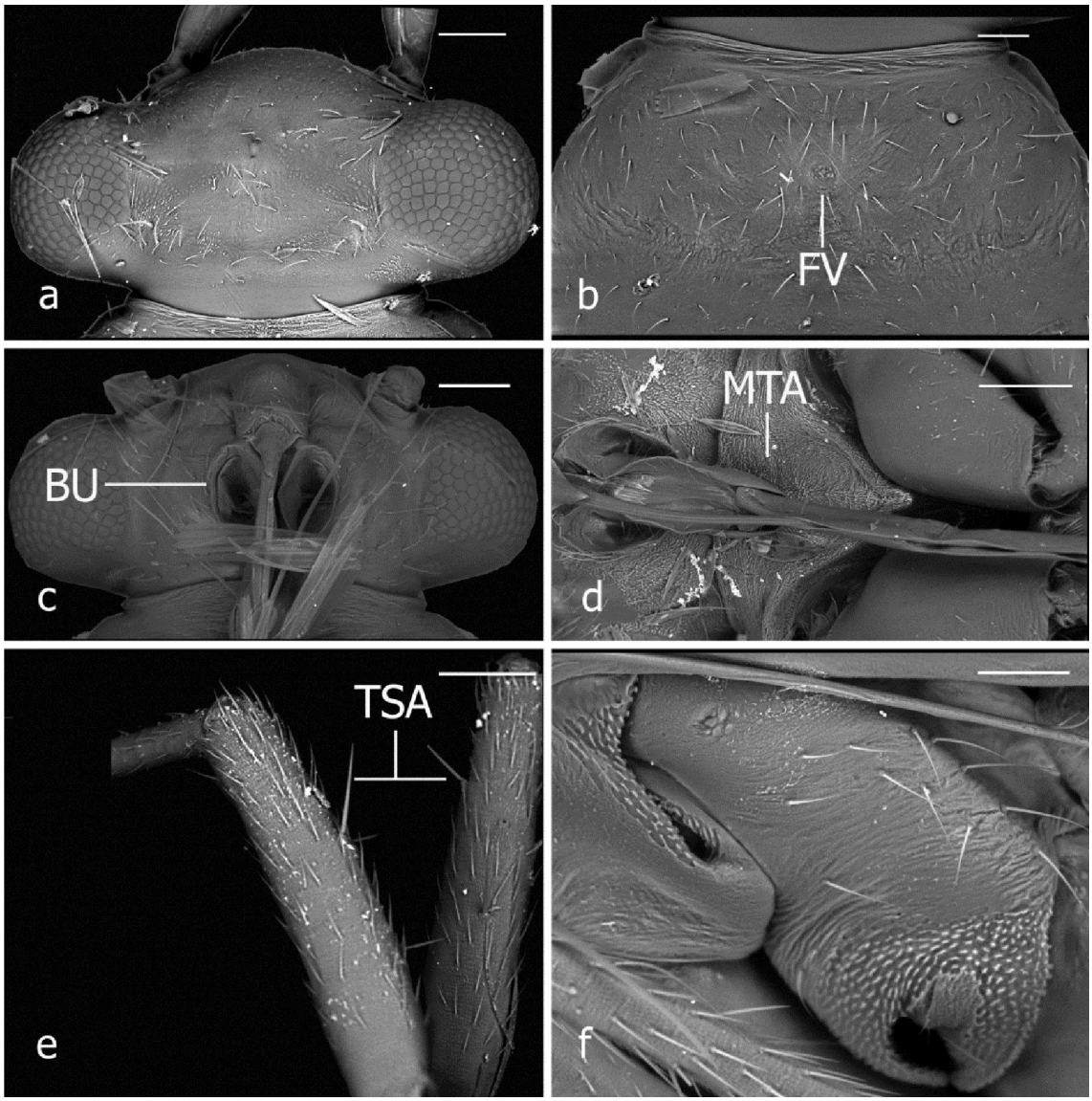


Figure 28: *Cyrtorhinus fulvus.* a: Head, dorsal view, scale = 100µm. b: Pronotum anterior, scale = 60µm. c: Head, ventral view, scale = 100µm. d: Prosternal vestiture, scale = 100µm. e: Antennae, scale = 60µm. f: Metathoracic gland, scale = 60µm. Abbreviations: BU: Bucculae, FV: Foveae, MTA: Microtrichia, TSA: AI Thickened Setae.

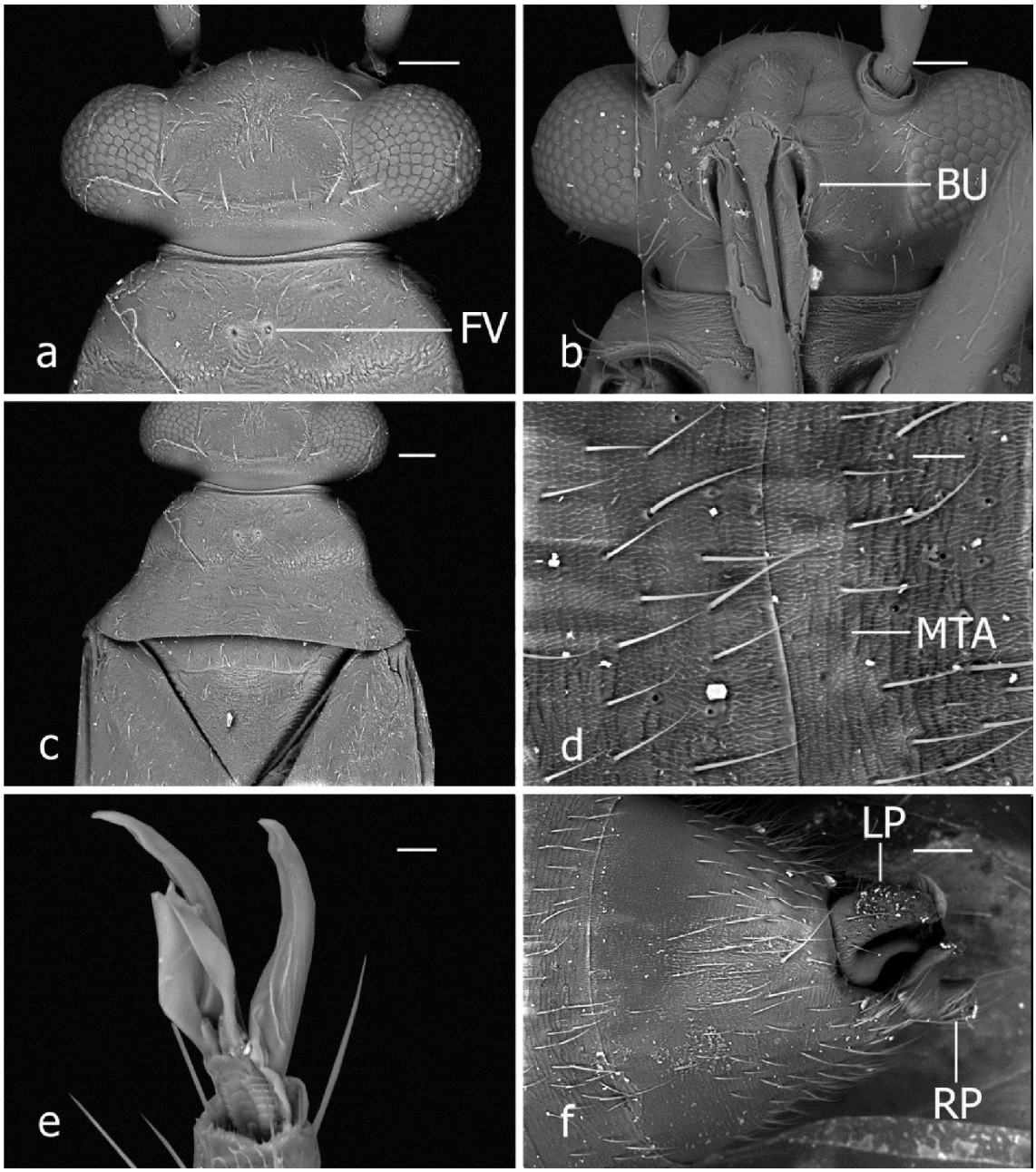


Figure 29: *Cyrtorhinus geniculatus.* a: Head, dorsal view, scale = 100µm. b: Head, ventral view, scale = 100µm. c: Pronotum and scutellum, scale = 100µm. d: Setae and microtrichia, scale = 20µm. e: Pretarsus, scale = 10µm. f: Pygophore, scale = 60µm. Abbreviations: BU: Bucculae, FV: Foveae, LP: Left paramere, MTA: Microtrichia, RP: Right paramere.

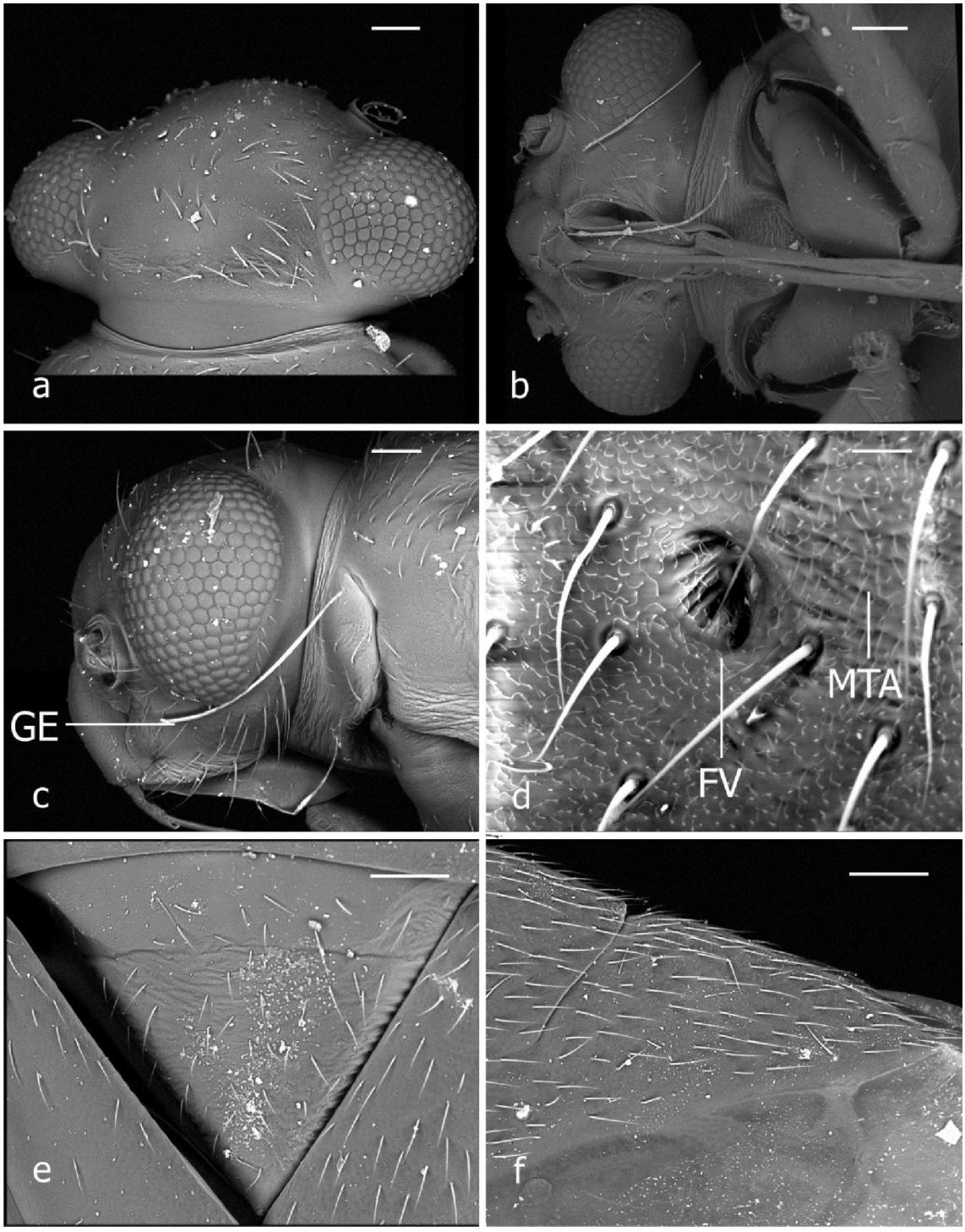


Figure 30: *Cyrtorhinus indi.* a: Head, dorsal view, scale = 60µm. b: Head, ventral view, scale = 100µm. c: Head, lateral view, scale = 60µm. d: Foveae, close up scale = 10µm. e: Scutellum, scale = 100µm. f: Cuneus, scale = 100µm. Abbreviations: GE: Genae, FV: Foveae, MTA: Microtrichia.

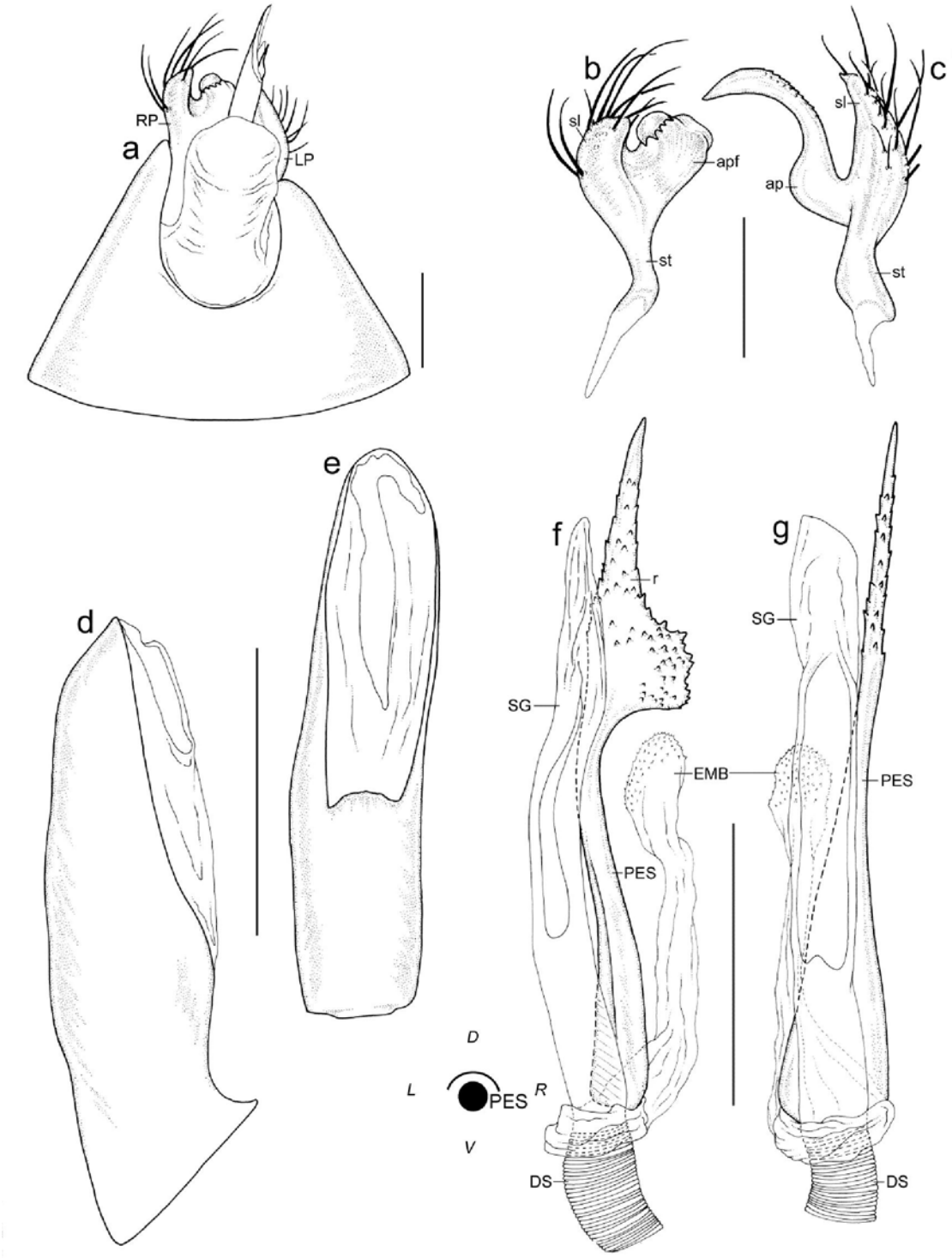


Figure 31: Male genitalia of *C. lividipennis*, scales = 0.1mm: a: Pygophore b: Right paramere. c: Left paramere. d-e: Phallotheca. f-g: Endosoma. Abbreviations: ap: Apophysis, apf: Flange of the apophysis, DS: Ductus seminis, EMB: Endosomal membrane bag, LP: Left paramere, PES: Proximal endosomal spicule, r: Rudus, RP: Right paramere, SG: Secondary gonopore, sl: Sensory lobe, st: Stem.

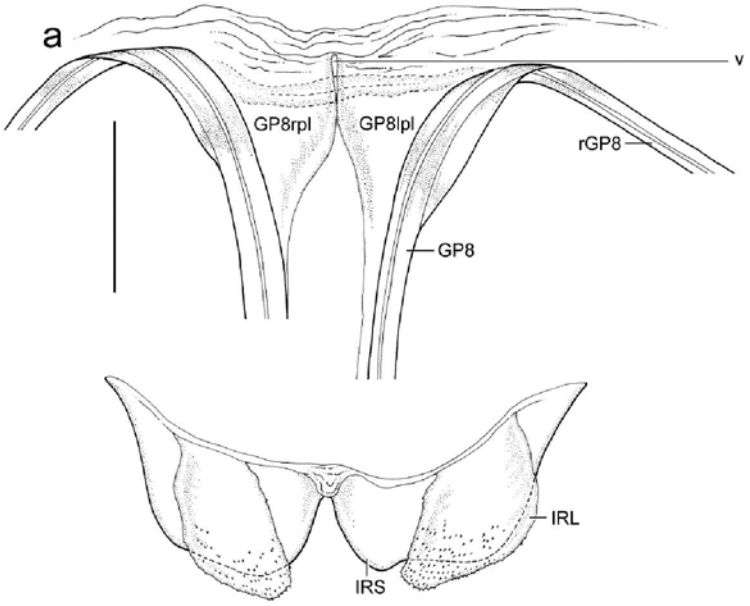


Figure 32: Female genitalia of *C. lividipennis*. Abbreviations: v: Vestibulum, GP8= gonapophysis 8, GP8rpl: gonapophysis 8 right plate, GP8lpl: gonapophysis 8 left plate, IRL: Inter-ramal lobe, IRS: Inter ramal sclerite, Rgp8: Ramus of gonapophysis 8.

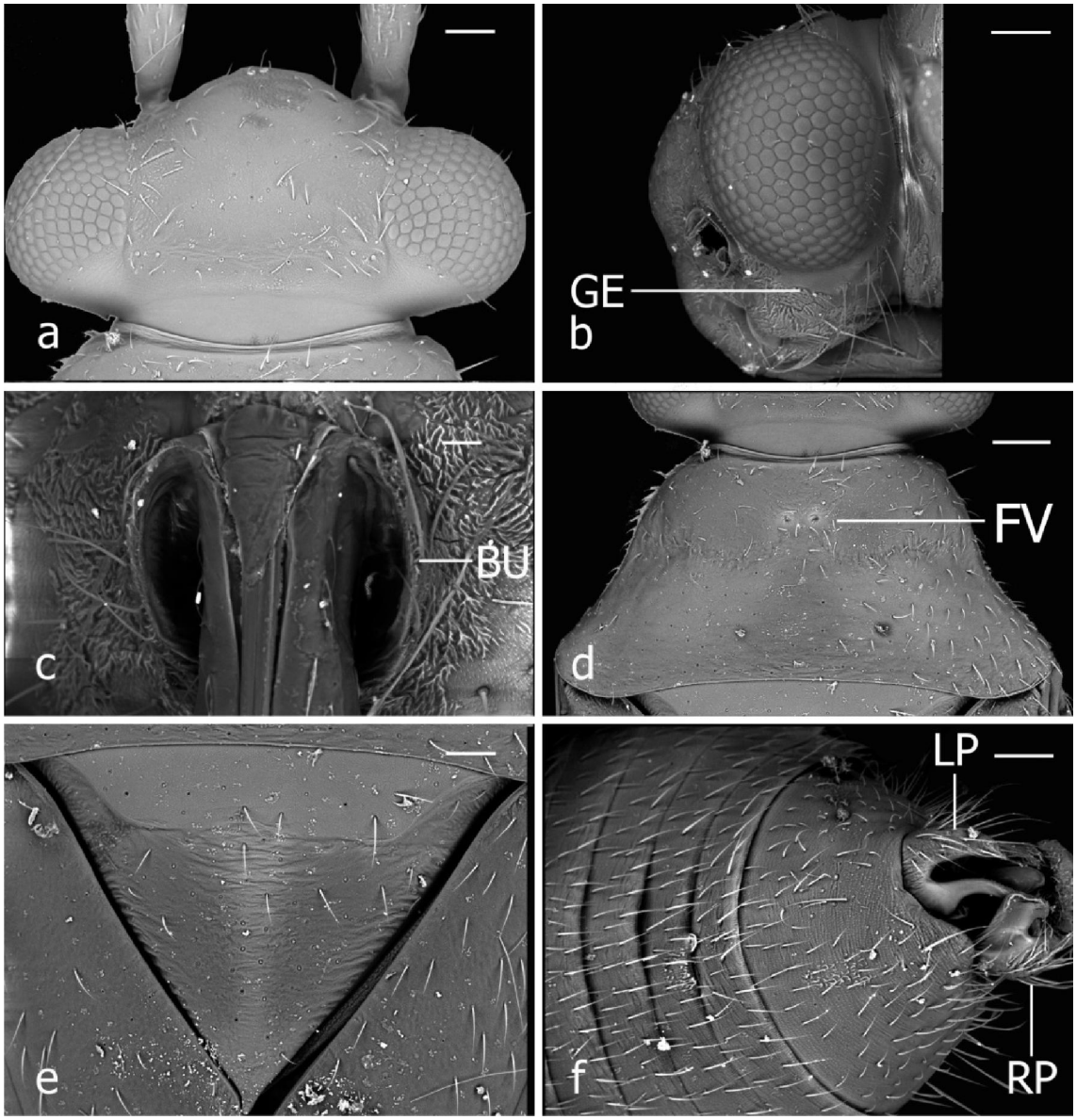


Figure 33: *Cyrtorhinus lividipennis.* a: Head, dorsal view, scale = 60µm. b: Head, lateral view, scale = 60µm. c: Bucculae, scale = 20µm. d: Pronotum, scale = 100µm. e: Scutellum, scale = 60µm. f: Pygophore, scale = 60µm. Abbreviations: BU: Bucculae, FV: Foveae, GE: Genae, LP: Left paramere, RP: Right paramere.

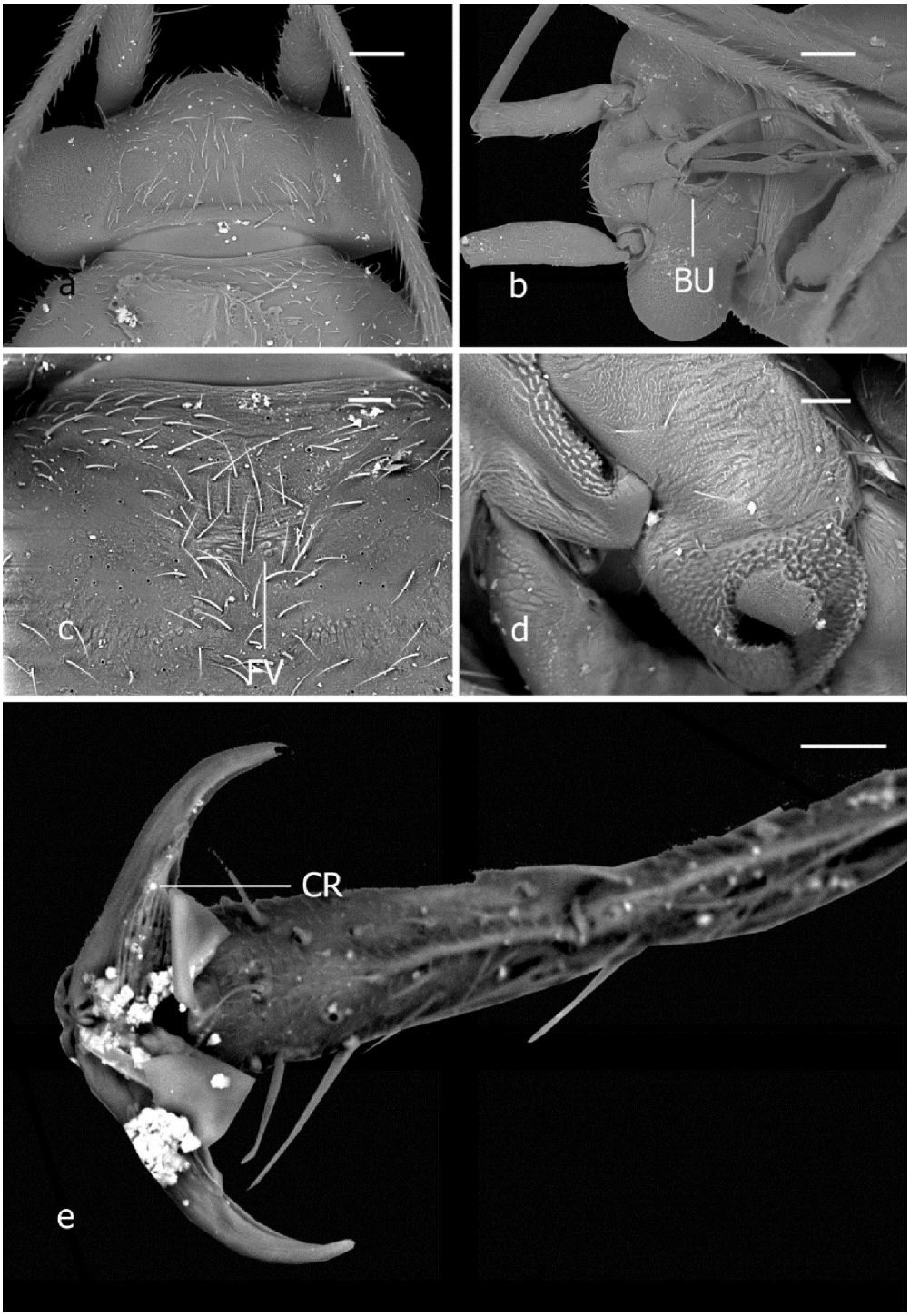


Figure 34: *Cyrtorhinus melanops.* a: Head, dorsal view, scale = 100µm. b: Head, ventral view, scale = 100µm. c: Pronotum, scale = 100µm. d: Metathoracic gland, scale = 40µm. e: Pretarsus, scale = 20µm. Abbreviations: BU: Bucculae, CR: Minute ridges on the claw, FV: Foveae.

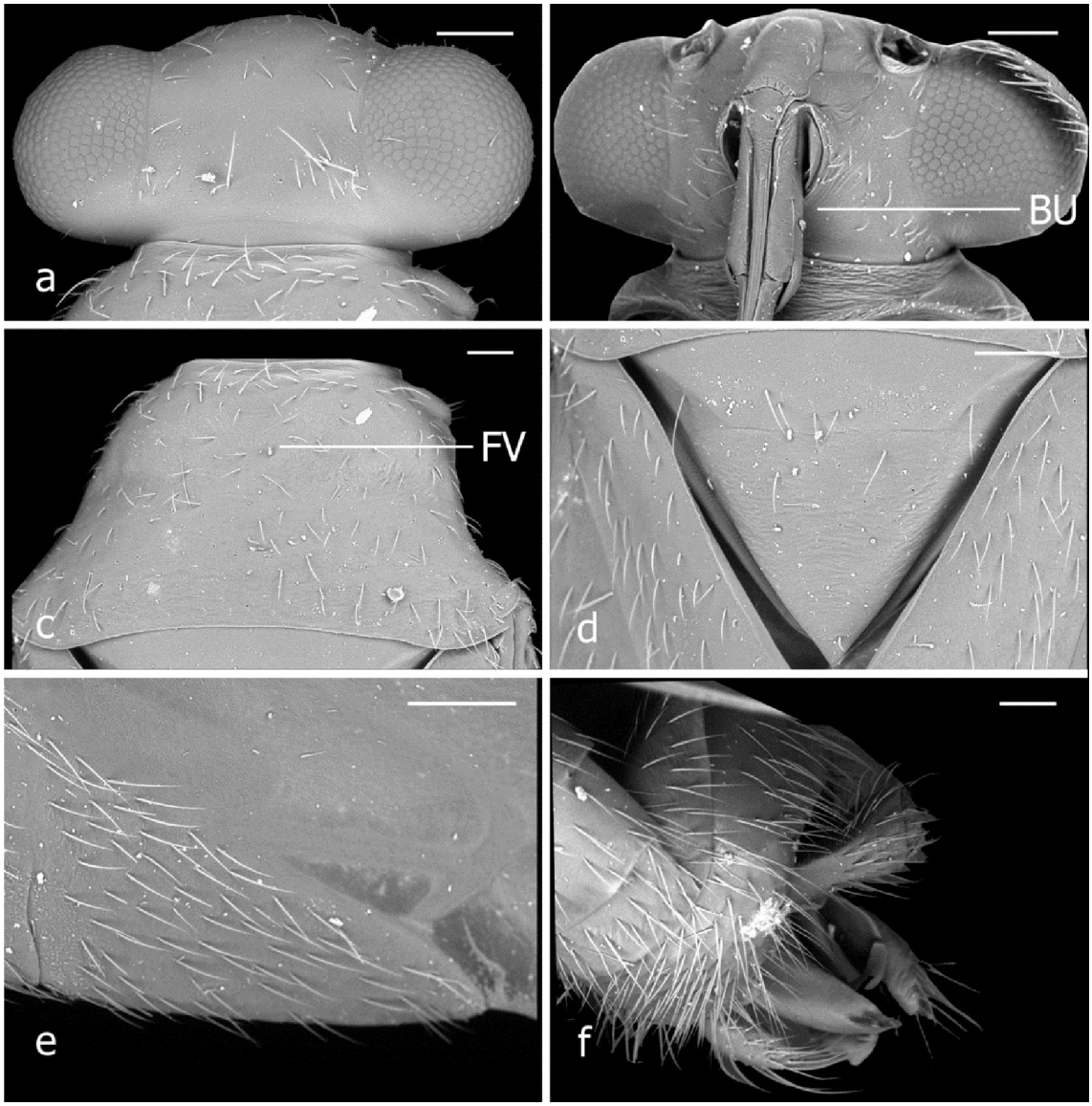


Figure 35: *Cyrtorhinus novabritannia.* a: Head, dorsal view, scale = 100µm. b: Head, ventral view, scale = 100µm. c: Pronotum, scale = 100µm. d: Scutellum, scale = 100µm. e: Cuneus, scale = 100µm. f: Pygophore, lateral view, scale = 60µm. Abbreviations: BU: Bucculae, FV: Foveae.

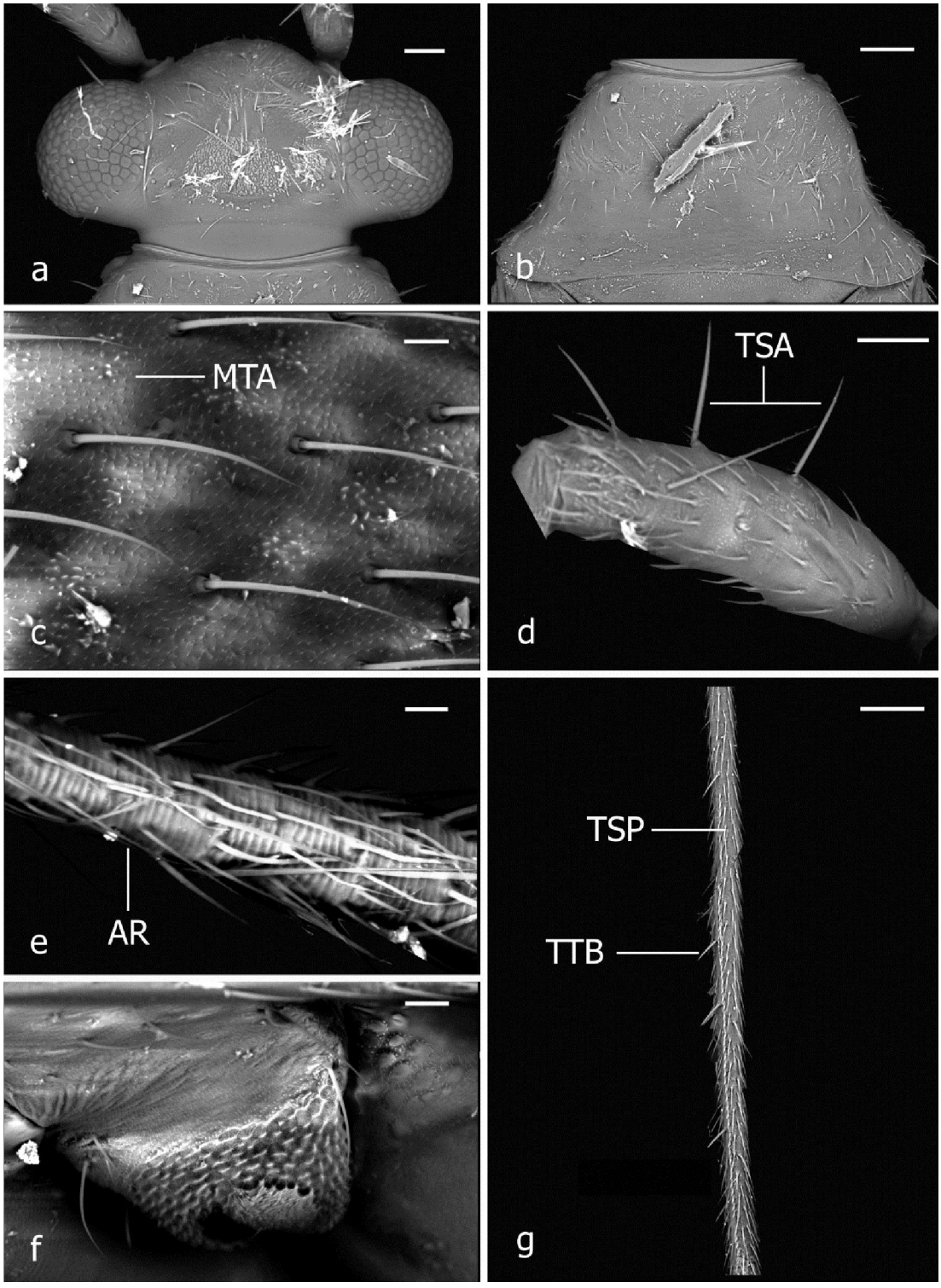


Figure 36: *Cyrtorhinus palauensis.* a: Head, dorsal view, scale = 60µm. b: Pronotum, scale = 100µm. c: Hemelytral vestiture, scale = 40µm. d: AI enlarged setae, scale = 40µm. e: AIII ridges, scale = 10µm. f: Metathoracic gland, scale = 20µm. g: Tibial spinules, scale =100µm. Abbreviations: AR: AIII Ridges, MTA: Microtrichia, TES: Tibial elongate setae, TSA: AI Thickened Setae, TSP: Tibial spinules.

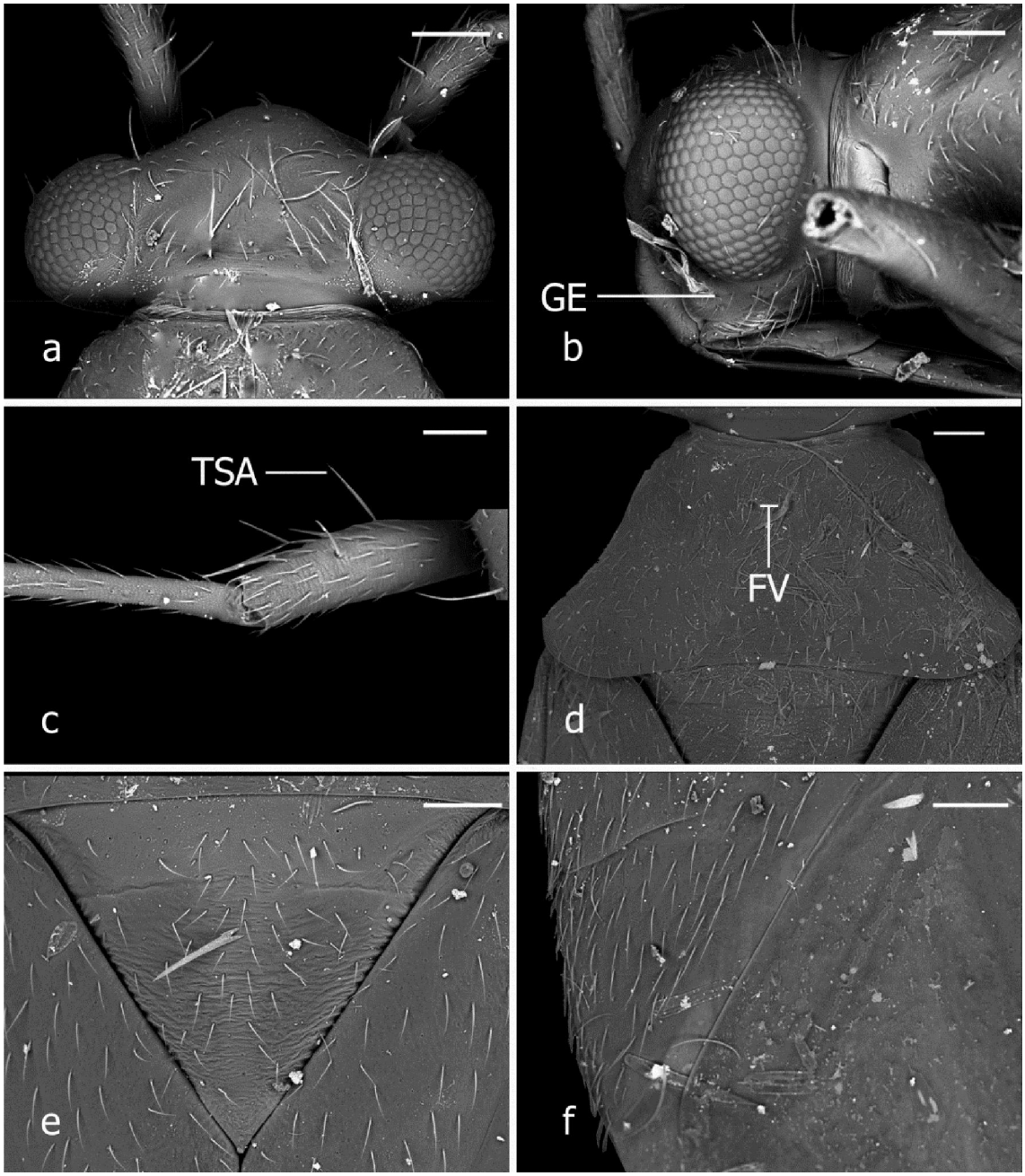


Figure 37: *Cyrtorhinus pilosus.* a: Head, dorsal view, scale = 100um. b: Head, lateral view, scale = 100um. c: AI, scale = 60um. d: Pronotum, scale = 100µm. e: Scutellum, scale = 100µm. f: Cuneus, scale = 100µm. Abbreviations: GE: Genae, FV: Foveae, TSA: AI Thickened Setae.

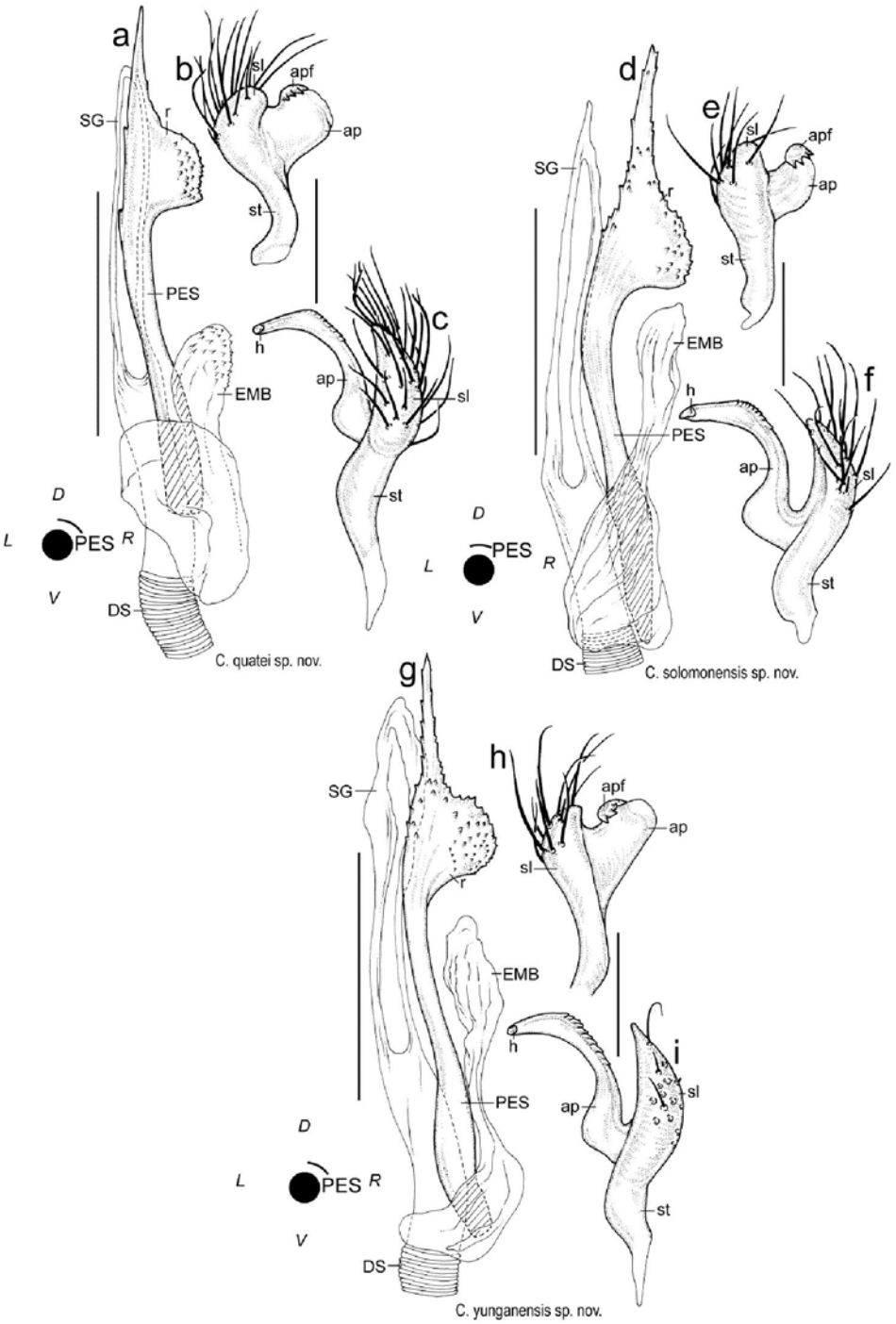


Figure 38: Male genitalia of *C. quatei*, scales = 0.1mm: a: Endosoma. b: Right paramere. c: Left paramere. Male genitalia of *C. solomonensis*: d: Endosoma. e: Right paramere. f: Left paramere. Male genitalia of *C. yunganensis*: g: Endosoma. g: Right paramere. i: Left paramere. Abbreviations: ap: Apophysis, apf: Flange of the apophysis, DS: Ductus seminis, EMB: Endosomal membrane bag, PES: Proximal endosomal spicule, r: Rudus, SG: Secondary gonopore, st: Stem, sl: Sensory lobe.

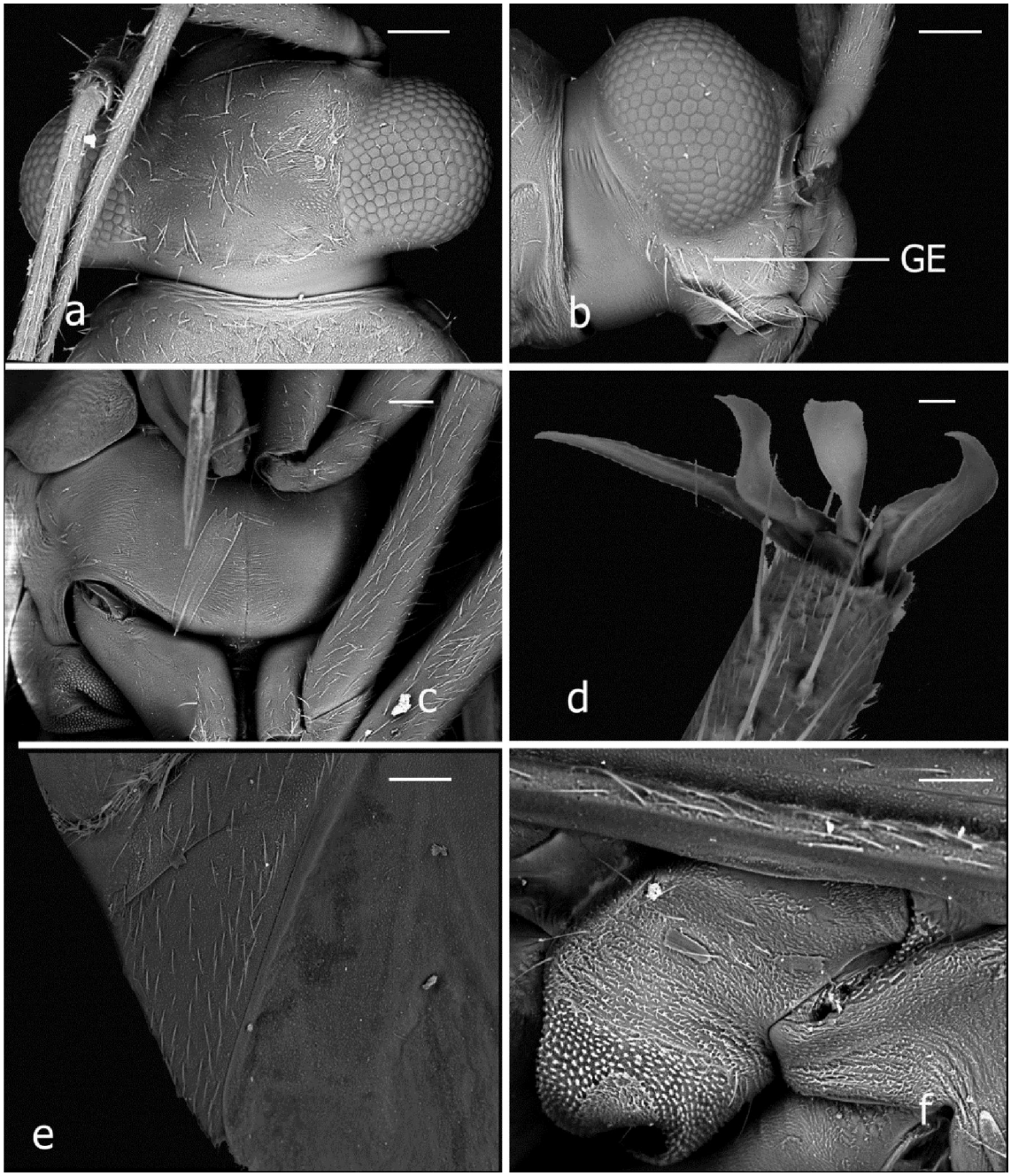


Figure 39: *Cyrtorhinus quatei.* a: Head, dorsal view, scale = 60µm. b: Head, lateral view, scale = 60µm. c: Mesosternum, scale = 100µm. d: Pretarsus, scale = 20µm. e: Cuneus, scale = 60µm. f: Metathoracic gland, scale = 30µm. Abbreviations: GE: Genae.

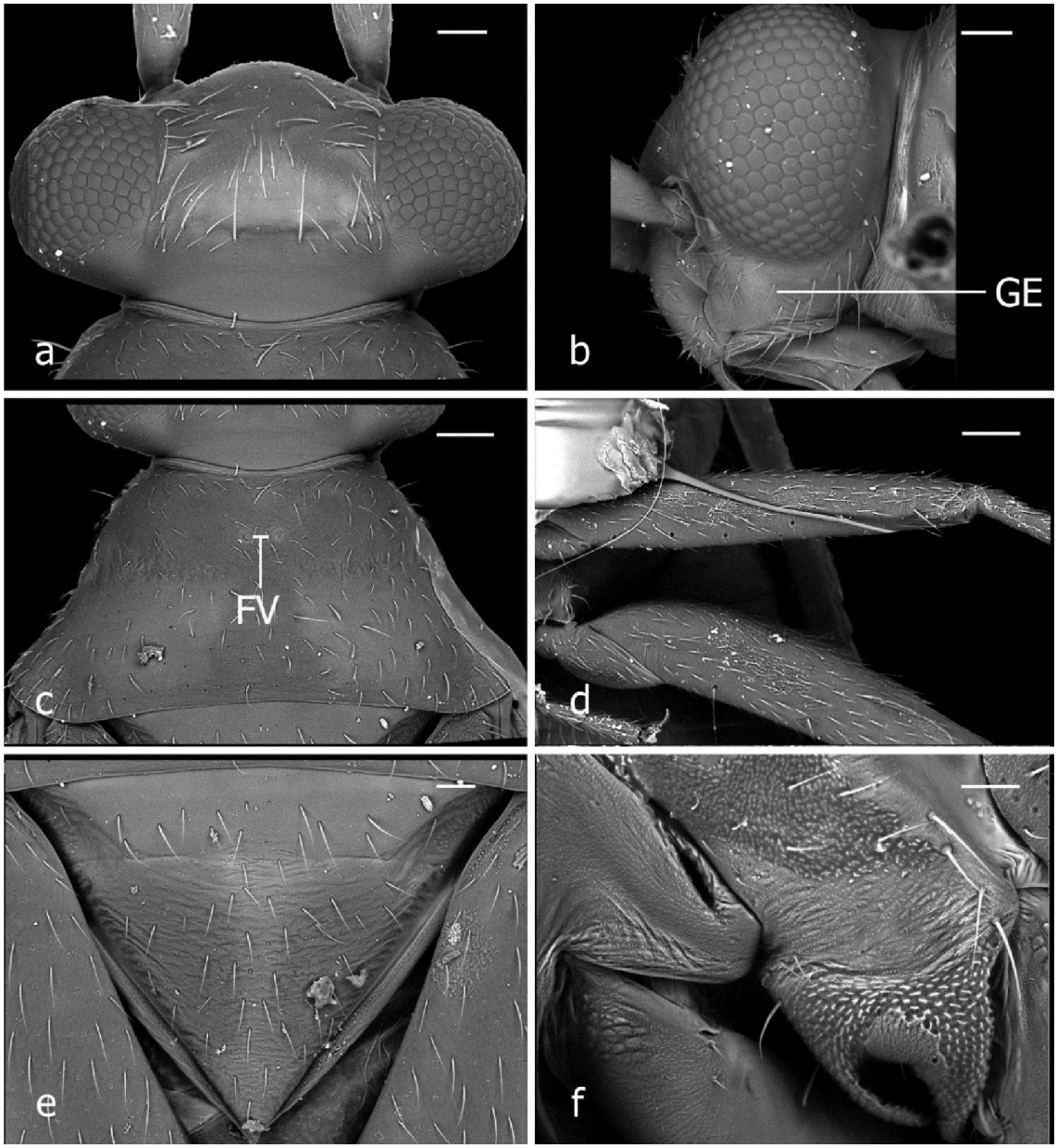


Figure 40: *Cyrtorhinus rarus.* a: Head, dorsal view, scale = 100µm. b: Head, lateral view, scale = 100µm. c: Pronotum, scale = 100µm. d: Femur, scale = 20µm. e: Scutellum, scale =100µm. f: Metathoracic gland, scale = 60µm. Abbreviations: GE: Genae, FV: Foveae.

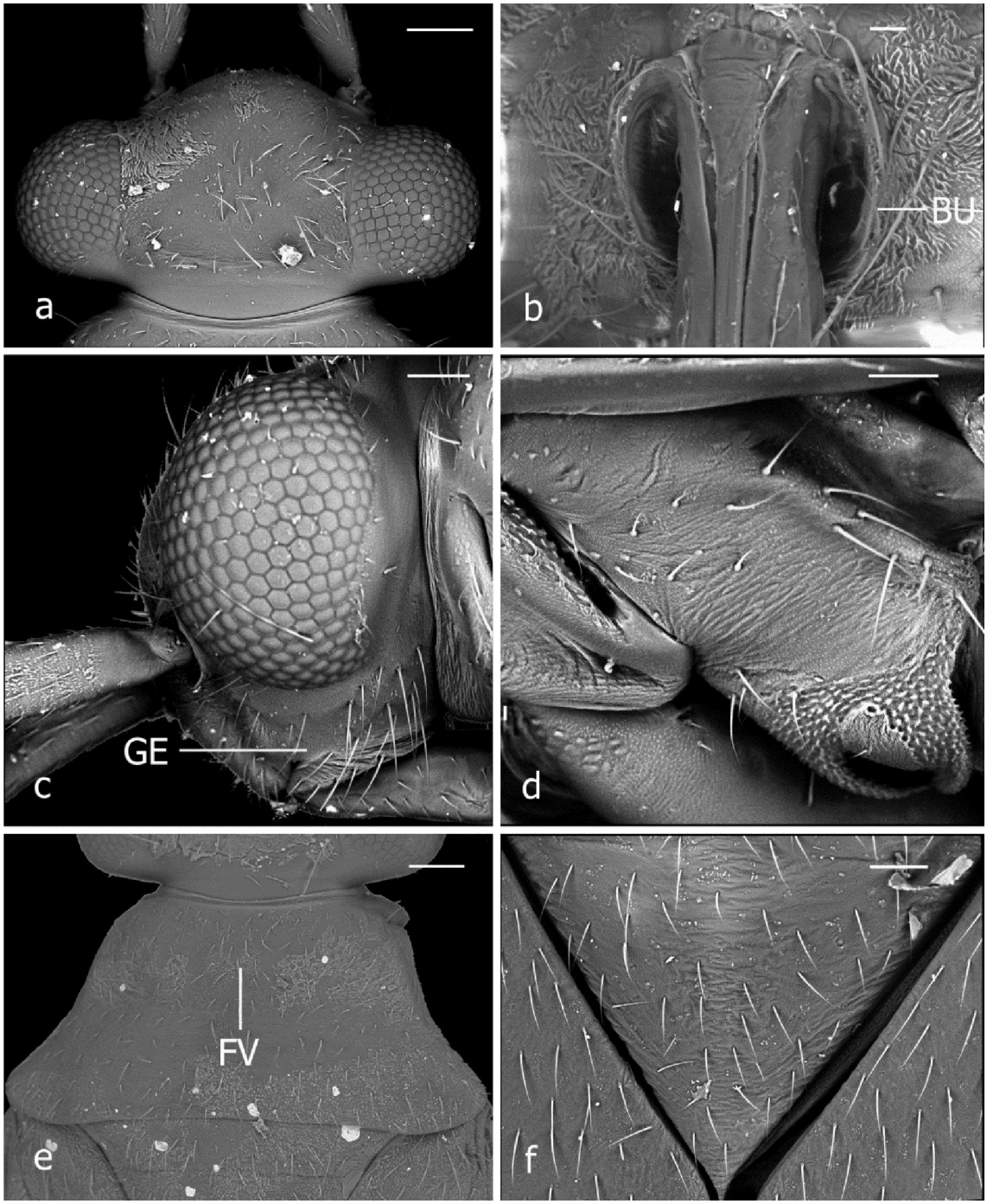


Figure 41: *Cyrtorhinus solomonensis.* a: Head, dorsal view, scale = 100µm. b: Bucculae, scale = 20µm. c: Head, lateral view, scale = 60µm. d: Metathoracic gland, scale = 60µm. Pronotum, scale = 100µm. f: Scutellum, scale = 50µm. Abbreviations: BU: Bucculae, GE: Genae.

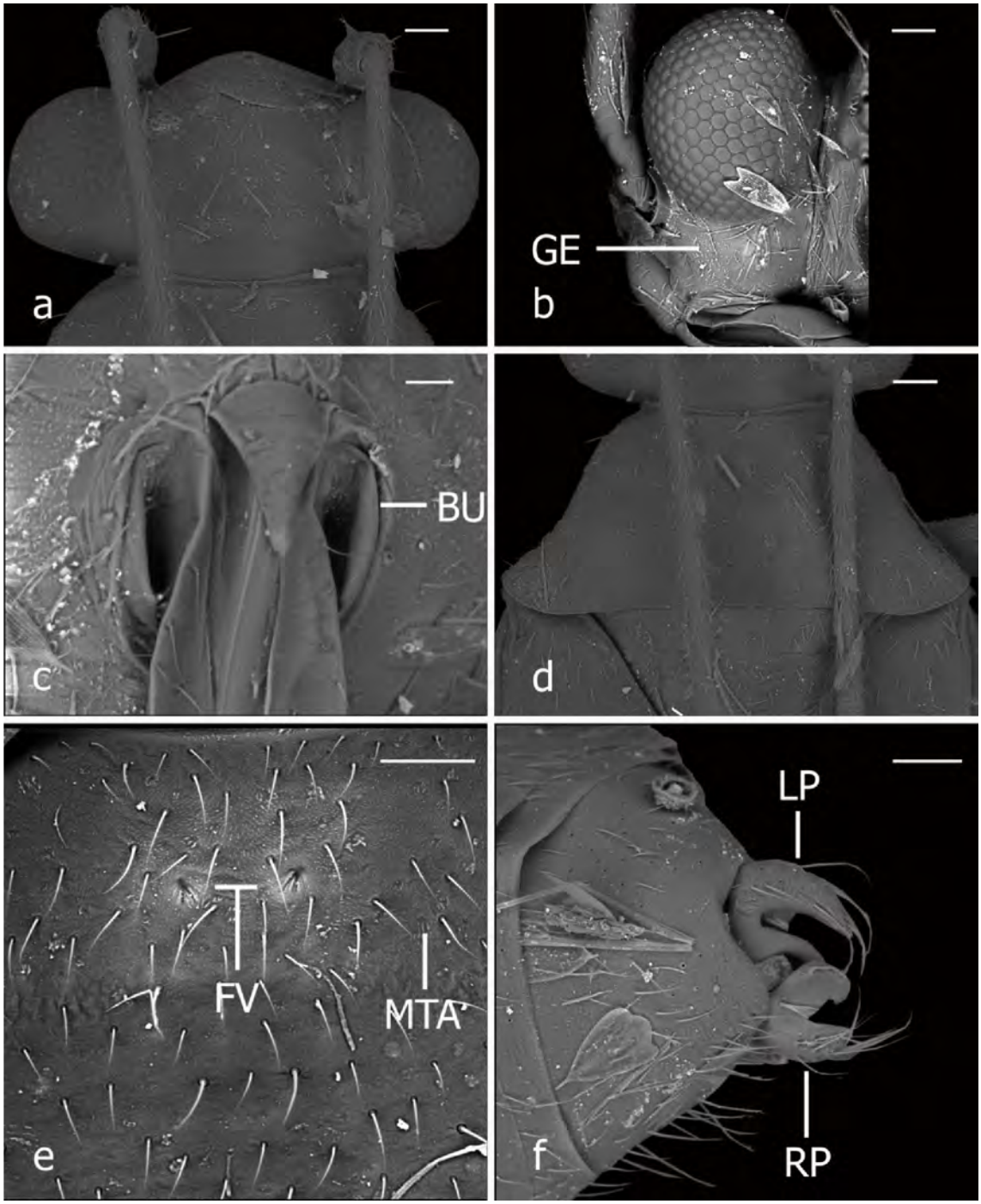


Figure 42: *Cyrtorhinus yunganensis.* a: Head, dorsal view, scale = 60µm. b: Head, lateral view, scale = 60µm. c: Bucculae, scale = 20µm. d: Pronotum, scale = 100µm. e: Pronotal vestiture, scale = 90µm. f: Pygophore, scale = 60µm. Abbreviations: BU: Bucculae, GE: Genae, FV: Foveae, LP: Left paramere, MTA: Microtrichia, RP: Right paramere.

Tables

Table 1: Measurements for *Cyrtorhinus* species. Abbreviations: AI-AIV = Antennal segment one to antennal segment four, CC = Length from cuneus to clypeus, CL = Length of cuneus, HL = Head length, IOD = Inter-ocellic dimension, LP = Length of pronotum, LS = Length of scutellum, PW = Width of pronotum, TL = Total length, WH = Width of head, WS = Width of the scutellum.

		TL	HL	WH	IOD	AI	AII	AIII	AIV	LP	PW	LS	WS	CC	CL
Cyrtorhinus albidus sp. nov.															
Males	Mean	2.84	0.32	0.48	0.26	0.24	0.73	0.75	0.55	0.39	0.48	0.48	0.85	2.04	0.30
	Max.	3.19	0.36	0.53	0.32	0.26	0.83	0.78	0.56	0.46	0.55	0.52	0.96	2.37	0.36
	Min.	2.55	0.27	0.46	0.19	0.21	0.67	0.72	0.55	0.32	0.38	0.43	0.73	1.67	0.22
	St.Dev.	0.23	0.03	0.03	0.06	0.02	0.06	0.03	0.01	0.05	0.07	0.04	0.10	0.29	0.06
	Count	5	5	5	5	5	5	4	2	5	5	5	5	5	5
Females	Mean	2.74	0.29	0.61	0.33	0.23	0.75	0.67	0.45	0.35	0.50	0.39	0.80	1.82	0.32
	Max.	2.92	0.36	0.78	0.37	0.26	0.79	0.75	0.56	0.41	0.56	0.45	0.92	2.09	0.36
	Min.	2.49	0.25	0.42	0.30	0.19	0.69	0.64	0.35	0.25	0.44	0.34	0.67	1.47	0.30
	St.Dev.	0.16	0.04	0.14	0.03	0.03	0.04	0.06	0.15	0.06	0.05	0.05	0.09	0.27	0.02
	Count	5	5	5	5	5	5	3	2	5	5	5	5	5	5
Cyrtorhinus brunus sp. nov.															
Males	Mean	3.43	0.37	0.77	0.30	0.24	0.77	0.67	0.51	0.45	0.51	0.54	0.66	2.00	0.28
	Max.	3.71	0.44	0.92	0.31	0.25	0.85	0.78	0.64	0.51	0.62	0.62	0.77	2.23	0.35
	Min.	3.17	0.34	0.66	0.29	0.23	0.64	0.57	0.42	0.34	0.40	0.48	0.55	1.75	0.21
	St.Dev.	0.24	0.04	0.11	0.01	0.01	0.08	0.08	0.12	0.07	0.08	0.06	0.11	0.20	0.05
	Count	5	5	5	5	5	5	5	3	5	5	5	5	5	5
Females	Mean	3.47	0.38	0.72	0.31	0.23	0.77	0.72	0.44	0.45	0.46	0.58	0.71	2.18	0.29
	Max.	3.70	0.42	0.92	0.33	0.24	0.85	0.79	0.64	0.48	0.54	0.65	0.77	2.40	0.33
	Min.	3.26	0.33	0.54	0.30	0.22	0.67	0.65	0.33	0.39	0.36	0.48	0.64	1.89	0.25
	St.Dev.	0.20	0.04	0.14	0.01	0.01	0.08	0.07	0.18	0.03	0.07	0.07	0.06	0.22	0.03
	Count	5	5	5	5	5	4	3	3	5	5	5	5	5	5

Table 1 continued

		TL	HL	WH	IOD	AI	AII	AIII	AIV	LP	PW	LS	WS	CC
Cyrtorhinus caricis Fallén 1807														
Males	Mean	3.21	0.37	0.78	0.13	0.33	1.19	0.91	0.45	0.42	0.81	0.38	0.60	2.12	0.44
	Max.	3.44	0.46	0.99	0.26	0.35	1.33	1.23	0.69	0.79	1.17	0.64	0.64	2.35	0.52
	Min.	2.98	0.30	0.62	0.14	0.30	1.09	0.75	0.31	0.28	0.66	0.27	0.55	1.88	0.40
	St.Dev.	0.19	0.06	0.15	0.16	0.02	0.10	0.20	0.14	0.21	0.21	0.15	0.04	0.19	0.05
	Count	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Females	Mean	3.29	0.34	0.91	0.18	0.43	1.22	0.93	0.40	0.55	0.96	0.42	0.69	2.10	0.53
	Max.	3.32	0.46	1.13	0.51	0.74	1.42	1.23	0.69	0.79	1.17	0.64	0.95	2.35	0.88
	Min.	3.24	0.17	0.67	0.14	0.23	0.99	0.81	0.19	0.19	0.64	0.09	0.43	1.89	0.37
	St.Dev.	0.03	0.13	0.19	0.29	0.19	0.18	0.17	0.20	0.26	0.20	0.22	0.21	0.17	0.22
	Count	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Cyrtorhinus caricisoides Ghauri 1970														
Males	Mean	3.41	0.24	0.72	0.31	0.29	1.03	0.94	0.34	0.43	0.86	0.35	0.43	2.39	0.53
	Max.	3.41	0.24	0.72	0.31	0.29	1.03	0.94	0.34	0.43	0.86	0.35	0.43	2.39	0.53
	Min.	3.41	0.24	0.72	0.31	0.29	1.03	0.94	0.34	0.43	0.86	0.35	0.43	2.39	0.53
	St.Dev.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Females	Mean	3.42	0.27	0.73	0.32	0.25	0.76	0.74	0.38	0.39	0.91	0.36	0.46	2.41	0.55
	Max.	3.42	0.27	0.73	0.32	0.25	0.76	0.74	0.38	0.39	0.91	0.36	0.46	2.41	0.55
	Min.	3.42	0.27	0.73	0.32	0.25	0.76	0.74	0.38	0.39	0.91	0.36	0.46	2.41	0.55
	St.Dev.	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Table 1 continued

		TL	HL	WH	IOD	AI	AII	AIII	AIV	LP	PW	LS	WS	CC	CL
Cyrtorhinus carvalhoi Woodward 1957															
Males	Mean	4.10	0.33	0.76	0.34	0.53	1.19	1.06	0.46	0.49	0.52	0.69	0.91	2.61	0.39
	Max.	4.25	0.37	0.79	0.35	1.02	1.42	1.21	0.48	0.52	0.64	0.76	1.04	2.82	0.48
	Min.	4.05	0.29	0.74	0.32	0.20	1.02	0.88	0.45	0.43	0.48	0.61	0.71	2.44	0.33
	St.Dev.	0.08	0.03	0.02	0.01	0.30	0.17	0.16	0.02	0.03	0.07	0.07	0.14	0.15	0.06
	Count	5	5	5	5	5	5	4	2	5	5	5	5	5	5
Females	Mean	3.84	0.33	0.78	0.34	0.38	1.14	0.94	0.47	0.59	0.65	0.61	0.90	2.52	0.39
	Max.	4.25	0.37	0.79	0.37	0.48	1.34	1.05	0.51	1.07	0.86	0.78	1.04	2.82	0.48
	Min.	2.86	0.31	0.76	0.30	0.20	0.96	0.88	0.36	0.44	0.52	0.33	0.51	2.27	0.33
	St.Dev.	0.49	0.03	0.01	0.02	0.13	0.17	0.07	0.07	0.24	0.12	0.15	0.20	0.19	0.05
	Count	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Brachypterous Females															
	Mean	2.74	0.30	0.80	0.35	0.42	1.00	0.91	0.70	0.43	0.90	0.34	0.49	2.21	0.36
	Max.	2.86	0.33	0.81	0.37	0.45	1.04	1.06	0.80	0.45	0.95	0.36	0.51	2.30	0.42
	Min.	2.53	0.25	0.78	0.34	0.39	0.98	0.79	0.51	0.40	0.86	0.31	0.48	2.05	0.24
	St.Dev.	0.19	0.04	0.02	0.02	0.03	0.04	0.14	0.16	0.03	0.05	0.03	0.02	0.14	0.10
	Count	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Cyrtorhinus cumberi Woodward 1950															
Males	Mean	3.25	0.23	0.73	0.31	0.22	0.78	0.75	0.57	0.35	0.55	0.47	0.83	1.94	0.31
	Max.	3.31	0.25	0.76	0.39	0.22	0.86	0.81	0.69	0.36	0.56	0.49	0.93	1.97	0.34
	Min.	3.20	0.21	0.69	0.23	0.21	0.69	0.70	0.44	0.33	0.53	0.45	0.73	1.90	0.27
	St.Dev.	0.07	0.03	0.05	0.11	0.01	0.12	0.07	0.18	0.02	0.02	0.03	0.14	0.05	0.06
	Count	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Females	Mean	3.23	0.40	0.59	0.32	0.23	0.58	0.74	0.57	0.36	0.56	0.51	0.78	2.10	0.27
	Max.	3.23	0.40	0.59	0.32	0.23	0.58	0.74	0.57	0.36	0.56	0.51	0.78	2.10	0.27
	Min.	3.23	0.40	0.59	0.32	0.23	0.58	0.74	0.57	0.36	0.56	0.51	0.78	2.10	0.27
	Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Table 1 continued

		TL	HL	WH	IOD	AI	AII	AIII	AIV	LP	PW	LS	WS	CC	CL
Cyrtorhinus dimorphus Linnavuori 1994															
Males	Mean	3.65	1.29	0.74	0.39	0.27	0.98	0.99	0.75	0.44	0.49	0.58	0.98	2.35	0.33
	Max.	3.91	2.91	0.82	0.50	0.31	1.12	1.03	0.75	0.51	0.52	0.68	1.01	2.45	0.34
	Min.	2.97	0.24	0.71	0.36	0.23	0.63	0.96	0.75	0.41	0.45	0.31	0.95	2.20	0.32
	St.Dev.	0.39	1.37	0.05	0.06	0.03	0.20	0.03	-	0.04	0.02	0.16	0.02	0.10	0.01
	Count	5	5	5	5	5	5	5	1	5	5	5	5	5	5
Brachypterous females															
	Mean	2.97	0.34	0.76	0.47	0.25	0.55	1.02	0.66	0.38	0.51	0.29	0.92	2.19	0.30
	Max.	3.06	0.45	0.82	0.50	0.29	0.63	1.05	0.70	0.42	0.52	0.31	1.01	2.33	0.35
	Min.	2.89	0.23	0.65	0.41	0.22	0.46	0.96	0.63	0.35	0.49	0.27	0.85	2.07	0.22
	St.Dev.	0.08	0.09	0.08	0.04	0.03	0.06	0.03	0.04	0.03	0.01	0.02	0.06	0.09	0.05
	Count	5	5	5	5	5	5	3	3	5	5	5	5	5	5
Cyrtorhinus defectus sp. nov.															
Males	Mean	3.25	0.45	0.82	0.30	0.24	0.78	0.74	0.47	0.52	0.53	2.29	0.68	2.13	0.31
	Max.	3.44	0.53	0.99	0.34	0.26	0.83	0.78	0.58	0.56	0.64	2.55	0.75	2.35	0.35
	Min.	3.06	0.37	0.72	0.23	0.21	0.69	0.70	0.39	0.47	0.43	2.08	0.64	1.92	0.27
	St.Dev.	0.15	0.06	0.11	0.05	0.02	0.05	0.03	0.10	0.03	0.09	0.21	0.04	0.20	0.03
	Count	5	5	5	5	5	5	4	3	5	5	4	5	5	5
Females	Mean	3.40	0.45	0.83	0.34	0.21	0.74	0.68	0.50	0.51	0.57	2.60	0.66	2.02	0.29
	Max.	3.58	0.49	0.96	0.38	0.23	0.83	0.78	0.58	0.60	0.64	2.78	0.68	2.19	0.33
	Min.	3.28	0.39	0.74	0.32	0.19	0.68	0.57	0.41	0.44	0.51	2.42	0.63	1.92	0.27
	St.Dev.	0.12	0.04	0.10	0.02	0.01	0.07	0.11	0.12	0.06	0.05	0.14	0.02	0.10	0.02
	Count	5	5	5	5	5	4	4	2	5	5	5	5	5	5

Table 1 continued

		TL	HL	WH	IOD	AI	AII	AIII	AIV	LP	PW	LS	WS	CC	CL
Cyrtorhinus eylesi Elias															
Males	Mean	4.06	0.57	0.50	0.32	0.18	1.65	1.05	0.23	1.04	0.43	0.39	1.27	2.67	0.68
	Max.	4.06	0.57	0.50	0.32	0.18	1.65	1.05	0.23	1.04	0.43	0.39	1.27	2.67	0.68
	Min.	4.06	0.57	0.50	0.32	0.18	1.65	1.05	0.23	1.04	0.43	0.39	1.27	2.67	0.68
	Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Brachypterous Females															
	Mean	3.51	0.93	1.68	0.61	0.75	0.72	1.62	0.08	0.40	0.48	0.29	1.12	2.07	1.14
	Max.	3.51	0.93	1.68	0.61	0.75	0.72	1.62	0.08	0.40	0.48	0.29	1.12	2.07	1.14
	Min.	3.51	0.93	1.68	0.61	0.75	0.72	1.62	0.08	0.40	0.48	0.29	1.12	2.07	1.14
	Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Cyrtorhinus fulvus Knight 1935															
Males	Mean	3.10	0.32	0.69	0.25	0.23	0.68	0.74	0.58	0.46	0.46	0.59	0.71	1.88	0.32
	Max.	3.63	0.37	0.83	0.31	0.25	0.75	0.80	0.65	0.50	0.58	0.70	0.83	2.02	0.37
	Min.	2.90	0.27	0.54	0.17	0.21	0.65	0.60	0.49	0.44	0.40	0.45	0.58	1.74	0.28
	St.Dev.	0.30	0.04	0.11	0.05	0.02	0.04	0.08	0.06	0.03	0.08	0.09	0.11	0.12	0.04
	Count	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Females	Mean	3.74	0.34	0.73	0.22	0.22	0.75	0.72	0.55	0.44	0.45	0.61	0.73	2.00	0.28
	Max.	3.82	0.43	0.84	0.25	0.23	0.86	0.84	0.77	0.52	0.55	0.75	0.81	2.38	0.37
	Min.	3.63	0.27	0.62	0.19	0.21	0.65	0.64	0.39	0.34	0.40	0.52	0.67	1.73	0.20
	St.Dev.	0.07	0.07	0.10	0.02	0.01	0.08	0.09	0.16	0.07	0.06	0.08	0.06	0.25	0.06
	Count	5	5	5	5	5	5	5	5	5	5	5	5	5	5

Table 1 continued

		TL	HL	WH	IOD	AI	AII	AIII	AIV	LP	PW	LS	WS	CC	CL
Cyrtorhinus geniculatus Reuter 1904															
Males	Mean	3.26	0.31	0.63	0.33	0.35	1.06	0.94	0.56	0.43	0.64	0.48	0.87	2.14	0.31
	Max.	3.41	0.35	0.72	0.35	0.42	1.21	1.02	0.63	0.48	0.69	0.55	0.93	2.32	0.38
	Min.	2.92	0.26	0.33	0.30	0.29	0.95	0.87	0.48	0.41	0.55	0.40	0.80	1.95	0.25
	St.Dev.	0.20	0.04	0.17	0.02	0.05	0.09	0.08	0.10	0.03	0.06	0.06	0.05	0.17	0.05
	Count	5	5	5	5	5	5	4	2	5	5	5	5	5	5
Females	Mean	3.43	0.33	0.61	0.35	0.35	1.00	0.75	0.60	0.44	0.64	0.51	0.91	2.27	0.36
	Max.	3.70	0.36	0.74	0.37	0.36	1.04	0.94	0.63	0.53	0.70	0.57	0.96	2.53	0.44
	Min.	2.93	0.30	0.23	0.31	0.33	0.93	0.54	0.58	0.37	0.50	0.45	0.80	2.00	0.27
	St.Dev.	0.30	0.02	0.22	0.02	0.01	0.04	0.19	0.04	0.06	0.08	0.04	0.07	0.24	0.07
	Count	5	5	5	5	5	5	5	2	5	5	5	5	5	5
Cyrtorhinus indi sp. nov.															
Males	Mean	2.68	0.30	0.61	0.28	0.24	0.71	0.66	0.49	0.34	0.46	0.45	0.78	1.83	0.28
	Max.	2.93	0.33	0.65	0.31	0.26	0.91	0.81	0.49	0.37	0.55	0.52	0.87	2.02	0.30
	Min.	2.43	0.28	0.57	0.27	0.22	0.33	0.40	0.49	0.31	0.40	0.40	0.72	1.72	0.24
	St.Dev.	0.20	0.02	0.03	0.02	0.02	0.24	0.23	-	0.02	0.06	0.05	0.06	0.13	0.03
	Count	5	5	5	5	5	5	3	1	5	5	5	5	5	5
Females	Mean	2.91	0.30	0.63	0.31	0.21	0.68	0.74	0.55	0.37	0.54	0.47	0.87	2.08	0.30
	Max.	3.21	0.33	0.65	0.31	0.24	0.78	0.77	0.56	0.38	0.64	0.52	0.92	2.19	0.33
	Min.	2.65	0.27	0.61	0.30	0.18	0.33	0.67	0.52	0.34	0.47	0.39	0.84	2.00	0.29
	St.Dev.	0.20	0.02	0.01	0.00	0.02	0.19	0.04	0.02	0.02	0.06	0.05	0.03	0.08	0.02
	Count	5	5	5	5	5	5	4	3	5	5	5	5	5	5

Table 1 continued

		TL	HL	WH	IOD	AI	AII	AIII	AIV	LP	PW	LS	WS	CC	CL
Cyrtorhinus lividipennis Reuter 1885															
Males	Mean	2.80	0.29	0.65	0.30	0.28	0.89	0.65	0.55	0.35	0.83	0.28	0.37	1.74	0.46
	Max.	2.93	0.34	0.67	0.33	0.30	1.07	0.91	0.84	0.38	0.93	0.29	0.43	2.08	0.53
	Min.	2.65	0.23	0.61	0.28	0.26	0.72	0.37	0.28	0.30	0.78	0.24	0.33	1.03	0.41
	St.Dev.	0.11	0.04	0.03	0.02	0.02	0.13	0.21	0.23	0.03	0.06	0.02	0.04	0.41	0.05
	Count	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Females	Mean	3.17	0.31	0.68	0.32	0.28	0.85	0.74	0.41	0.39	0.93	0.31	0.44	2.03	0.50
	Max.	3.35	0.41	0.72	0.34	0.33	0.90	0.95	0.53	0.42	0.98	0.37	0.46	2.34	0.52
	Min.	2.87	0.24	0.65	0.30	0.24	0.80	0.64	0.28	0.36	0.88	0.27	0.42	1.03	0.48
	St.Dev.	0.20	0.07	0.02	0.01	0.04	0.04	0.13	0.09	0.02	0.04	0.04	0.02	0.56	0.02
	Count	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Cyrtorhinus melanops Reuter 1905															
Males	Mean	3.51	0.31	0.71	0.30	0.48	1.31	0.00	0.00	0.50	0.48	0.58	0.86	2.32	0.33
	Max.	3.51	0.31	0.71	0.30	0.48	1.31	0.00	0.00	0.50	0.48	0.58	0.86	2.32	0.33
	Min.	3.51	0.31	0.71	0.30	0.48	1.31	0.00	0.00	0.50	0.48	0.58	0.86	2.32	0.33
	Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Females	Mean	3.89	0.34	0.78	0.33	0.41	0.00	0.00	0.00	0.44	0.52	0.53	0.78	2.65	0.37
	Max.	3.89	0.34	0.78	0.33	0.41	0.00	0.00	0.00	0.44	0.52	0.53	0.78	2.65	0.37
	Min.	3.89	0.34	0.78	0.33	0.41	0.00	0.00	0.00	0.44	0.52	0.53	0.78	2.65	0.37
	Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Table 1 continued

		TL	HL	WH	IOD	AI	AII	AIII	AIV	LP	PW	LS	WS	CC	CL
Cyrtorhinus novabritannia sp. nov.															
Males	Mean	3.90	0.33	0.76	0.33	0.43	1.21	1.13	0.48	0.46	0.51	0.61	0.91	2.51	0.36
	Max.	4.00	0.38	0.78	0.35	0.50	1.26	1.14	0.48	0.51	0.55	0.66	1.00	2.65	0.38
	Min.	3.84	0.30	0.74	0.32	0.41	1.11	1.13	0.48	0.40	0.47	0.53	0.78	2.42	0.34
	St.Dev.	0.07	0.03	0.02	0.01	0.04	0.07	0.01	-	0.04	0.03	0.05	0.08	0.09	0.01
	Count	5	5	5	5	5	4	2	1	5	5	5	5	5	5
Females	Mean	3.86	0.34	0.77	0.34	0.41	1.15	1.07	0.47	0.47	0.58	1.68	0.99	2.57	0.36
	Max.	4.22	0.36	0.81	0.38	0.49	1.21	1.13	0.47	0.52	0.65	6.18	1.08	2.76	0.40
	Min.	3.72	0.32	0.74	0.31	0.33	1.06	1.02	0.47	0.40	0.53	0.40	0.90	2.42	0.32
	St.Dev.	0.21	0.02	0.04	0.03	0.06	0.07	0.06	-	0.05	0.05	2.51	0.07	0.16	0.04
	Count	5	5	5	5	5	4	3	1	5	5	5	5	5	5
Cyrtorhinus palauensis sp. nov.															
Males	Mean	2.97	0.32	0.63	0.31	0.22	0.74	0.72	0.50	0.36	0.55	0.51	0.91	1.89	0.30
	Max.	3.27	0.38	0.79	0.38	0.26	0.92	0.84	0.58	0.42	0.64	0.56	0.99	2.18	0.37
	Min.	2.62	0.24	0.53	0.20	0.19	0.62	0.62	0.41	0.29	0.46	0.47	0.81	1.58	0.23
	St.Dev.	0.23	0.07	0.10	0.07	0.02	0.12	0.08	0.08	0.06	0.07	0.03	0.07	0.26	0.06
	Count	5	5	5	5	5	5	5	4	5	5	5	5	5	5
Females	Mean	3.01	0.30	0.64	0.27	0.26	0.76	0.80	0.56	0.39	0.50	0.46	0.82	2.22	0.32
	Max.	3.20	0.36	0.73	0.37	0.28	0.91	0.86	0.58	0.46	0.55	0.54	0.92	2.48	0.37
	Min.	2.62	0.24	0.59	0.20	0.22	0.62	0.70	0.53	0.30	0.45	0.31	0.69	2.10	0.29
	St.Dev.	0.23	0.05	0.05	0.07	0.02	0.12	0.08	0.03	0.07	0.05	0.10	0.09	0.15	0.03
	Count	5	5	5	5	5	5	4	3	5	5	5	5	5	5

Table 1 continued

		TL	HL	WH	IOD	AI	AII	AIII	AIV	LP	PW	LS	WS	CC	CL
Cyrtorhinus pilosus sp. nov.															
Males	Mean	3.03	0.27	0.62	0.27	0.24	1.02	0.89	0.28	0.39	0.76	0.33	0.39	2.13	0.41
	Max.	3.11	0.32	0.67	0.30	0.27	1.13	1.02	0.30	0.44	0.81	0.46	0.42	2.21	0.54
	Min.	2.89	0.24	0.58	0.25	0.22	0.92	0.67	0.26	0.34	0.69	0.28	0.35	2.07	0.34
	St.Dev.	0.08	0.03	0.04	0.03	0.02	0.08	0.14	0.01	0.03	0.05	0.08	0.02	0.06	0.08
	Count	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Females	Mean	3.02	0.28	0.64	0.28	0.24	0.92	0.91	0.29	0.33	0.78	0.28	0.39	2.07	0.47
	Max.	3.05	0.30	0.67	0.30	0.27	1.02	0.95	0.31	0.38	0.85	0.30	0.42	2.19	0.54
	Min.	2.97	0.24	0.60	0.27	0.20	0.81	0.85	0.27	0.30	0.73	0.26	0.37	1.92	0.41
	St.Dev.	0.03	0.02	0.03	0.01	0.03	0.08	0.04	0.02	0.03	0.05	0.02	0.02	0.11	0.05
	Count	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Cyrtorhinus quatei sp. nov.															
Males	Mean	2.76	0.28	0.62	0.38	0.29	0.87	0.77	0.38	0.34	0.76	0.28	0.39	1.89	0.39
	Max.	2.96	0.33	0.63	0.72	0.33	0.92	0.89	0.48	0.42	0.80	0.31	0.49	2.06	0.44
	Min.	2.43	0.22	0.60	0.28	0.23	0.79	0.54	0.26	0.30	0.72	0.26	0.34	1.60	0.32
	St.Dev.	0.20	0.05	0.01	0.20	0.04	0.07	0.15	0.09	0.05	0.03	0.02	0.06	0.18	0.05
	Count	5	5	5	5	5	5	5	4	5	5	5	5	5	5
Females	Mean	2.88	0.54	0.62	0.30	0.24	0.77	0.72	0.42	0.36	0.81	0.31	0.39	1.98	0.40
	Max.	2.96	1.39	0.65	0.32	0.29	0.90	0.80	0.49	0.41	0.87	0.33	0.40	2.06	0.44
	Min.	2.72	0.29	0.58	0.28	0.16	0.64	0.54	0.29	0.32	0.74	0.30	0.38	1.82	0.36
	St.Dev.	0.10	0.48	0.03	0.02	0.05	0.11	0.11	0.11	0.03	0.05	0.01	0.01	0.10	0.04
	Count	5	5	5	5	5	5	5	3	5	5	5	5	5	5

Table 1 continued

		TL	HL	WH	IOD	AI	AII	AIII	AIV	LP	PW	LS	WS	CC	CL
Cyrtorhinus rarus sp. nov.															
Females	Mean	3.30	0.33	0.62	0.24	0.22	0.94	0.74	0.49	0.32	0.46	0.43	0.82	2.06	0.29
	Max.	3.57	0.39	0.74	0.28	0.25	1.07	0.82	0.63	0.41	0.54	0.50	0.90	2.11	0.34
	Min.	3.04	0.26	0.39	0.19	0.20	0.83	0.69	0.42	0.28	0.40	0.29	0.69	1.95	0.24
	St.Dev.	0.20	0.06	0.13	0.04	0.02	0.12	0.05	0.08	0.05	0.06	0.09	0.08	0.07	0.04
	Count	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Cyrtorhinus solomonensis sp. nov.															
Males	Mean	3.14	0.33	0.78	0.28	0.22	0.82	0.76	0.59	0.38	0.53	0.44	0.81	2.08	0.27
	Max.	3.22	0.36	0.84	0.32	0.25	0.96	0.79	0.59	0.46	0.65	0.54	0.94	2.46	0.29
	Min.	3.08	0.31	0.68	0.22	0.20	0.68	0.75	0.59	0.32	0.44	0.36	0.67	1.85	0.26
	St.Dev.	0.06	0.02	0.06	0.04	0.02	0.12	0.02	-	0.05	0.07	0.08	0.12	0.23	0.02
	Count	5	5	5	5	5	4	4	1	5	5	5	5	5	5
Females	Mean	3.01	0.30	0.64	0.27	0.26	0.76	0.80	0.56	0.39	0.50	0.46	0.82	2.22	0.32
	Max.	3.20	0.36	0.73	0.37	0.28	0.91	0.86	0.58	0.46	0.55	0.54	0.92	2.48	0.37
	Min.	2.62	0.24	0.59	0.20	0.22	0.62	0.70	0.53	0.30	0.45	0.31	0.69	2.10	0.29
	St.Dev.	0.23	0.05	0.05	0.07	0.02	0.12	0.08	0.03	0.07	0.05	0.10	0.09	0.15	0.03
	Count	5	5	5	5	5	5	4	3	5	5	5	5	5	5

Table 1 completed

		TL	HL	WH	IOD	AI	AII	AIII	AIV	LP	PW	LS	WS	CC	CL
Cyrtorhinus yunganensis sp. nov.															
Males	Mean	2.86	0.26	0.63	0.30	0.22	0.91	0.64	0.30	0.34	0.87	0.33	0.43	2.04	0.48
	Max.	2.99	0.29	0.64	0.34	0.24	0.98	0.66	0.37	0.36	0.88	0.34	0.45	2.13	0.53
	Min.	2.74	0.22	0.61	0.26	0.20	0.82	0.61	0.25	0.30	0.84	0.30	0.40	1.96	0.44
	St.Dev.	0.09	0.03	0.01	0.03	0.02	0.06	0.03	0.06	0.02	0.01	0.02	0.02	0.08	0.04
	Count	5	5	5	5	5	5	3	3	5	5	5	5	5	5
Females	Mean	3.06	0.28	0.64	0.33	0.22	0.95	0.72	0.27	0.36	0.84	0.34	0.47	2.19	0.48
	Max.	3.33	0.33	0.68	0.37	0.28	0.98	0.79	0.28	0.43	0.95	0.35	0.53	2.38	0.56
	Min.	2.81	0.22	0.60	0.29	0.16	0.91	0.63	0.25	0.30	0.63	0.32	0.44	2.01	0.34
	St.Dev.	0.25	0.05	0.04	0.03	0.05	0.03	0.07	0.02	0.06	0.12	0.01	0.04	0.17	0.09
	Count	5	5	5	5	5	5	4	2	5	5	5	5	5	5

Table 2: Data matrix for *Cyrtorhinus* phylogeny

Taxa	Characters																																																		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**	**52**
Cyrtorhinus																																																				
C. albidus	0	0	1	1	1	1	0	1	1	1	0	1	1	1	1	0	0	0	0	1	0	0	2	1	1	1	1	0	1	1	0	0	0	0	1	2	0	0	0	2	0	1	0	0	0	0	0	5	1	0	0	0
C. brunus	0	0	1	1	1	1	0	1	1	1	0	1	1	1	1	0	1	0	0	1	0	1	4	1	1	0	1	0	1	1	0	0	0	0	1	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
C. caricis	0	0	1	1	1	1	1	0	0	3	0	1	0	1	0	0	1	0	0	0	0	-	3	1	1	1	1	0	1	1	0	0	0	0	1	1	1	0	0	2	1	0	0	0	0	0	0	2	0	1	0	0
C. caricisoides	0	0	1	1	1	1	1	0	0	3	0	1	0	-	1	0	1	0	0	1	0	-	0	1	1	1	1	0	1	1	0	0	0	0	1	1	1	0	0	2	1	0	0	0	0	0	0	2	0	1	0	0
C. carvalhoi	0	0	1	1	1	1	0	0	1	2	0	0	1	0	1	0	1	0	0	1	0	2	3	1	1	0	1	0	1	1	0	0	0	0	1	1	0	0	0	1	1	0	1	0	0	0	0	4	0	1	0	1
C. cumberi	0	0	1	1	0	1	1	1	0	2	0	1	1	1	1	0	1	0	0	1	0	0	3	1	1	0	1	0	1	1	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	3	1	0	0	2
C. dimorphus	0	0	1	1	1	1	0	0	0	0	0	1	1	0	1	0	1	0	1	1	0	0	2	1	1	1	1	0	1	1	0	0	0	0	1	1	1	0	0	1	0	0	1	0	0	0	1	3	1	1	0	2
C. defectus	0	0	1	1	1	1	0	1	1	1	0	1	1	1	1	0	1	0	0	1	0	1	2	1	1	0	1	0	1	1	0	0	0	0	1	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
C. eylesi	0	0	1	1	0	1	1	0	0	2	0	1	1	0	1	0	1	0	1	1	0	1	0	1	1	1	1	0	1	1	0	0	0	0	1	1	0	0	0	2	0	0	1	0	0	0	1	3	0	1	0	1
C. fulvus	0	0	1	1	0	1	0	1	1	1	0	1	1	1	1	0	1	0	0	1	0	1	3	1	1	0	1	0	1	1	0	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
C. geniculatus	0	0	1	1	0	1	1	1	1	2	0	1	1	1	1	0	1	0	0	1	0	0	1	1	1	0	1	0	1	1	0	0	0	0	1	2	0	0	0	2	0	0	0	0	0	0	0	3	0	1	0	0
C. indi	0	0	1	1	0	1	0	1	1	1	0	1	1	1	1	0	0	0	0	1	0	0	1	1	1	1	1	0	1	1	0	0	0	0	1	2	0	0	0	2	0	0	0	0	0	0	0	5	1	0	0	0
C. lividipennis	0	0	1	1	1	1	0	1	1	1	0	1	1	1	1	0	0	0	0	1	0	0	3	1	1	1	1	0	1	1	0	0	0	0	1	2	0	0	0	2	0	1	0	0	0	0	0	1	1	0	0	0

Table 2 continued

Taxa	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
C. melanops	0	0	1	1	0	1	0	0	0	0	0	1	1	0	1	0	1	0	1	1	0	1	3	1	1	1	1	0	1	1	0	0	0	0	1	1	0	0	0	2	1	0	1	0	0	0	0	2	0	1	0	0
C. novabritannia	0	0	1	1	1	1	0	0	1	2	0	0	1	0	1	0	1	0	1	1	0	2	2	1	1	0	1	0	1	1	0	0	0	0	1	1	0	0	0	1	1	0	1	0	0	0	0	4	0	1	0	1
C. palauensis	0	0	1	1	0	1	0	1	1	2	0	1	1	1	1	0	1	0	0	1	0	0	2	1	1	1	1	0	1	1	0	0	0	0	1	2	1	0	0	2	0	0	0	0	0	0	0	1	0	1	0	0
C. pilosus	0	0	1	1	1	1	1	1	1	2	0	1	1	1	1	0	1	0	0	1	0	0	1	1	1	0	1	0	1	1	0	0	0	0	1	2	0	0	0	3	0	0	0	0	0	0	0	4	0	1	0	0
C. quatei	0	0	1	1	0	1	0	1	1	1	0	1	1	1	1	0	0	0	0	1	0	0	1	1	1	0	1	0	1	1	0	0	0	0	1	2	0	0	0	2	0	1	0	0	0	0	0	1	1	0	0	0
C. rarus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	1	1	1	1	0	1	1	0	0	0	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
C. solomonensis	0	0	1	1	1	1	0	1	1	2	0	1	1	1	1	0	1	0	0	1	0	0	1	1	1	1	1	0	1	1	0	0	0	0	1	2	1	0	0	2	0	0	0	0	0	0	0	1	0	1	0	0
C. yunganensis	0	0	1	1	1	1	0	1	1	1	0	1	1	1	1	0	0	0	0	1	0	0	1	1	1	0	1	0	1	1	0	0	0	0	1	2	0	0	0	2	1	0	0	0	0	0	0	1	1	0	0	0
Mecomma																																																						
M. ambulans	0	2	0	0	-	0	1	1	0	4	0	1	0	-	0	1	1	0	-	0	1	-	3	1	1	1	1	0	1	0	0	1	0	0	1	1	1	0	1	-	?	0	0	0	1	0	0	2	0	1	0	1
M. giviples	0	2	0	0	-	0	1	1	0	4	0	1	0	-	0	1	1	0	-	0	1	-	3	1	1	1	1	0	1	0	0	1	0	0	1	1	1	0	1	-	?	0	0	0	1	0	0	2	0	1	0	1
M. krysothemis	0	2	0	0	-	0	1	1	0	4	0	1	0	-	0	1	1	0	-	0	1	-	3	1	1	1	1	0	1	0	0	1	0	0	1	1	1	0	1	-	?	0	0	0	1	0	0	2	0	1	0	1
M. madagascarensis	0	2	0	0	-	0	1	1	0	4	0	1	0	-	0	1	1	0	-	0	1	-	3	1	1	1	1	0	1	0	0	1	0	0	1	1	1	0	1	-	?	0	0	0	1	0	0	2	0	1	0	1
M. rectangulus	0	2	0	0	-	0	1	1	0	4	0	1	0	-	0	1	1	0	-	0	1	-	3	1	1	1	1	0	1	0	0	1	0	0	1	1	1	0	1	-	?	0	0	0	1	0	0	2	0	1	0	1
Mecomma sp. #1	0	2	0	0	-	0	1	1	0	4	0	1	0	-	0	1	1	0	-	0	1	-	3	1	1	1	1	0	1	0	0	1	0	0	1	1	1	0	1	-	?	0	0	0	1	0	0	2	0	1	0	1
Mecomma sp. #2	0	2	0	0	-	0	1	1	0	4	0	1	0	-	0	1	1	0	-	0	1	-	3	1	1	1	1	0	1	0	0	1	0	0	1	1	1	0	1	-	?	0	0	0	1	0	0	2	0	1	0	1

Table 2 continued

Taxa	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
M. amicus	0	2	0	0	-	0	1	1	0	4	0	1	0	-	0	1	1	0	-	0	1	-	3	1	1	0	1	0	1	0	0	1	0	0	1	1	1	0	1	-	?	0	?	0	1	0	0	2	0	1	0	1
M. bradora	0	2	0	0	-	0	1	1	0	4	0	1	0	-	0	1	1	0	-	0	1	-	3	1	1	0	1	0	1	0	0	1	0	0	1	1	1	0	1	-	?	0	?	0	1	0	0	2	0	1	0	1
M. angustata	0	2	0	0	-	0	1	1	0	4	0	1	0	-	0	1	1	0	-	0	1	-	3	1	1	1	1	0	1	0	0	1	0	0	1	1	1	0	1	-	?	0	?	0	1	0	0	2	0	1	0	1
M. dispar	0	2	0	0	-	0	1	1	0	4	0	1	0	-	0	1	1	0	-	0	1	-	3	1	1	1	1	0	1	0	0	1	0	0	1	1	1	0	1	-	?	0	?	0	1	0	0	2	0	1	0	1
M. fumida	0	2	0	0	-	0	1	1	0	4	0	1	0	-	0	1	1	0	-	0	1	-	3	1	1	?	1	0	1	0	0	1	0	0	1	1	1	0	1	-	?	0	?	0	1	0	0	2	0	1	0	1
Other outgroups																																																					
Orthotylus bilineatus	0	0	0	1	1	1	1	0	0	3	0	1	0	-	0	1	1	0	-	0	0	-	0	1	1	1	1	0	1	0	0	0	0	0	1	1	0	0	1	-	?	0	0	0	1	0	0	2	0	1	0	0
Mecommopsis cruciata	1	2	1	0	-	0	1	1	-	-	1	1	0	-	0	1	1	0	-	0	0	-	3	0	0	1	0	1	0	0	1	1	1	0	1	1	0	0	1	-	?	0	0	0	1	1	-	2	1	1	0	1
Cyllecoris historianicus	1	1	1	0	-	0	1	0	-	-	1	1	1	-	1	1	1	1	-	2	1	-	3	0	1	0	0	1	0	0	0	1	0	1	1	2	0	0	1	-	?	0	?	0	1	1	-	2	1	1	1	0
Fieberocapsus flavelous	1	2	1	0	-	0	1	0	0	-	1	1	0	-	1	1	1	1	-	0	1	-	3	1	1	1	0	0	1	1	0	1	0	1	1	2	1	0	1	-	?	0	0	0	1	1	-	1	0	1	1	1
Nycticapsus melanocephalus	1	2	1	0	-	0	1	1	0	-	1	1	0	-	1	1	1	1	-	0	0	-	3	0	1	1	0	0	1	0	0	1	0	1	1	2	0	0	1	-	?	0	?	0	1	1	-	3	0	1	0	0
Globiceps cruciata	1	1	1	0	-	0	1	0	-	-	1	1	1	-	1	1	1	1	-	2	1	-	3	1	1	1	0	1	1	0	0	1	0	1	1	2	0	0	1	-	?	0	?	0	1	1	-	2	0	1	1	0
Zanchius alba	1	1	1	0	-	0	1	0	0	-	1	1	0	-	1	1	1	1	-	0	1	-	3	2	1	1	0	1	0	1	1	1	1	0	1	1	0	2	1	-	?	0	?	0	1	1	-	1	0	1	0	0
Dimifacoris fasciatus	0	1	1	0	-	0	1	0	1	-	1	1	0	-	1	1	1	1	-	0	1	-	3	2	0	1	1	1	1	1	1	1	1	0	1	1	0	2	1	-	?	0	?	0	1	1	0	3	1	1	0	0
Candidomiris albomaculata	0	0	1	0	-	0	1	0	1	-	1	1	0	-	1	1	1	1	-	0	1	-	3	0	0	1	1	0	1	0	0	0	1	0	1	1	1	2	1	-	?	0	?	0	1	1	0	2	1	1	0	0

Table 2 completed

Taxa	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Onconotellus buxtoni	0	0	1	0	-	0	1	0	1	-	1	1	0	-	1	1	1	1	-	0	1	-	3	0	0	1	1	0	1	1	1	0	1	0	1	1	0	2	1	-	?	0	?	0	1	1	0	2	0	1	0	0
Hadronema militare	1	1	1	0	-	0	1	0	1	-	1	1	0	-	1	1	1	1	-	0	1	-	3	1	1	1	1	1	1	1	0	1	0	1	1	2	0	1	1	-	?	0	?	1	1	1	0	0	1	1	1	0
Bomberia foliacea	0	0	1	0	-	0	1	1	-	-	1	1	0	-	1	1	1	1	-	2	1	-	3	1	1	1	0	0	1	0	0	1	0	1	1	2	1	1	1	-	?	0	?	0	1	1	0	2	0	1	1	0
Neoloxops rubrosignatus	0	1	1	0	-	0	1	0	1	-	1	1	0	-	1	1	1	1	-	0	1	-	3	2	1	0	0	1	0	1	1	0	1	0	1	2	0	2	1	-	?	0	?	0	1	1	0	1	0	1	0	0
Falconia sp.	1	1	1	0	-	0	1	0	1	-	1	1	0	-	1	1	1	1	-	2	1	-	3	2	0	1	0	1	0	1	1	1	1	0	1	1	0	2	1	-	?	0	?	0	1	1	0	1	0	1	0	0
Tytthus sp.	1	-	-	-	-	-	-	-	-	-	-	-	-	0	-	1	1	1	1	-	-	1	-	3	2	0	0	0	0	1	1	0	-	1	0	-	1	1	1	1	-	?	0	?	0	1	1	-	2	1	1	0	0

Table 3: Characters and character states codified in data matrix

	Character	States			
		0	1	2	3
1	Pygophore shape	Trapezoidal	Conical		
2	Endosomal spicules	1 simple endosomal spicule	3-6 spicules, structure complex	2 simple endosomal spicules	
3	Reduced dorsal endosomal spicule	Present	Absent		
4	Endosomal membranous bag	Absent	Present		
5	Endosomal membranous bag texture	Terminally with field of spinules	Terminally smooth or wrinkled		
6	Extension of ductus seminis	Well short of rudus	Up to or surpassing rudus		
7	Secondary gonopore	Elongate, at least 1/2 size of endosoma	Short ovate		
8	Aedeagus size	Large	Small		
9	Angle of apex of the spicule	Divergent from ductus seminis	Parallel to ductus seminis		
10	Rudus of proximal endosomal spicule shape	Spear-shaped	Twisted and weakly dentate	Tubular	
11	Proximal endosomal spicule	Lacking bifurcation	With an apical process		
12	Rudus of proximal endosomal spicule	Present	Absent		
13	Position of rudus proximal endosomal spicule	Apical	Subapical		
14	Right paramere structure	Undifferentiated	Two lobes with sensory lobe and apophysis		
15	Right paramere sensory lobe and apophysis	Elongate	Short		
16	Right paramere sensory lobe shape	Oval	Finger-like		

Table 3 continued

	Character	States			
		0	1	2	3
17	Right paramere flange	Present	Absent		
18	Dentation on apex of apophysis of right paramere	Present	Absent		
19	Orientation of flange	Lateral or apical	Dorsal		
20	Sensory lobe on left paramere	Reduced to a small lump	Elongate, horizontal	Elongate, upright	
21	Dentation on apophysis of left paramere	Present	Absent		
22	Base of apophysis of left paramere	Incrassate	Narrow, sinuate	Narrow, uniformly curved	
23	Apex of apophysis of left paramere	Spear shaped	Pinched	Recurved	Rounded
24	AI origin in lateral view	At midline of eye	Below midline of eye	Above the midline of eye	
25	AI length	Elongate, 2x length head or longer	Subequal to head length		
26	Ratio of AII:AIII ratio	AIII slightly larger or more or less equal to AII	AII larger than AIII		
27	Clypeus	Pronounced anteriorly to head	Tucked under frons		
28	Eye size	Large, about as long as head	Small, much smaller than head		

Table 3 continued

	Character	States			
		0	1	2	3
29	Eye position	Removed from anterior margin of pronotum	Contiguous of sub-contiguous with pronotum		
30	Eye shape in lateral view	Reniform	Rounded		
31	Gula length	Reduced, less than 1/4 length of head	Long, usually 1/2 length of head or more		
32	Collar	Reduced and concave anteriorly	Distinct		
33	Ratio or width of anterior of pronotum to posterior of pronotum.	1:1-1.5	1:2-3		
34	Pronotum shape	Campanulate	Trapezoidal		
35	Foveae	Fused	Separated		
36	Costal margins of hemelytra	Sinuate, bulging at the cuneus	Straight	Convex	
37	Ration of cuneus length: width	2:1 or greater	1.5:1		
38	Frons seta pattern	Present only on margins and midline	Setae uniformly present	Setae absent or very few setae present on margins	
39	AI thickened seta	Present	Absent		
40	Number of thickened setae	1	2	3	
41	Scale-like texture on vertex	Present	Absent		
42	Small patches of thickened microtrichia	Absent	Present		

Table 3 completed

	Character	States			
		0	1	2	3
43	Microtrichia on genae	Present	Absent		
44	Dorsal vestiture	Sparse, small, hairlike setae	Seriaceous, elongate hairlike setae		
45	Tibial rows of spinules	Present	Absent		
46	Tibial elongate setae	Present	Absent		
47	Tibial elongate setae arrangement	In rows	Alternating		
48	Ground colour	Red	Yellow or brown	Black	Green
49	Pronotal colour	Anterior and posterior lobes concolourous	Anterior and posterior lobe contrasting colour		
50	Black medial line on scutellum	Present	Absent		
51	Hemelytra colouration	Pale, translucent	Opaque, usually bright colour		
52	Wing polymorphism	Always macropterous	Females sometimes brachypterous	Females always brachypterous	

Table 4: Symmetric resampling statistics for phylogeny of *Cyrtorhinus*

Node	Symmetric resampling	Synapomorphies	Contradicted apomorphies
1	61	2	4
2	77	0	5
3	53	2	1
4	86	4	1
5	73	2	0
6	<50	1	2
7	65	1	2
8	<50	1	1
9	<50	1	2
10	<50	2	2
11	57	1	1
12	<50	0	1
13	<50	0	1
14	68	0	3
15	<50	1	1
16	<50	1	1
17	52	1	1
18	<50	0	1
19	65	1	1
20	66	1	0
21	62	0	1
22	<50	0	1
23	<50	1	1

Table 5: Known introductions of *Cyrtorhinus* species from the literature.

According to Usinger (1939)

Species	**Area**
C. fulvus	Philippine Islands
	Java
	Hawaii
C. lividipennis	Guam
	China

According to Asche and Wilson (1989)

Species	**Area**
C. fulvus	Tahiti
	Solomon Islands
	Tuvalu

Table 6: Areas of endemism for *Cyrtorhinus*

Areas of endemism	Taxa
Micronesia	*Cyrtorhinus albidus*
Sulu sea	*Cyrtorhinus brunus, Cyrtorhinus lividipennis, Cyrtorhinus pilosus*
Holarctic	*Cyrtorhinus caricisoides*
Lemuria	*Cyrtorhinus caricisoides*
Melanesia	*Cyrtorhinus carvalhoi, Cyrtorhinus defectus, Cyrtorhinus novabritannia, Cyrtorhinus palauensis, Cyrtorhinus solomonensis*
Polynesia	*Cyrtorhinus fulvus*
New Zealand	*Cyrtorhinus cumberi, Cyrtorhinus eylesi*
East Africa	*Cyrtorhinus geniculatus*
West Africa	*Cyrtorhinus dimorphus, Cyrtorhinus melanops*
Indian	*Cyrtorhinus indi*
Asian	*Cyrtorhinus lividipennis, Cyrtorhinus quatei Cyrtorhinus yunganensis*
Queensland	*Cyrtorhinus palauensis*
New Caledonia	*Cyrtorhinus rarus*

CHAPTER 3

SYSTEMATICS OF THE *CANDIDOMIRIS-MOROBEA* COMPLEX OF THE TRIBE ORTHOTYLINI (INSECTA: HETEROPTERA: MIRIDAE: ORTHOTYLINAE)

ABSTRACT

A study of the systematics of the *Candidomiris-Morobea* complex of the mirid tribe Orthotylini is given. This complex of genera and species is defined as a monophyletic group using morphological data. Although the *Candidomiris-Morobea* complex was found to be monophyletic it is premature to establish it as a new tribe pending a broader study of the Orthotylini. Two major clades were detected within this complex: the *Candidomiris* group and the *Morobea* group. The complex is comprised of 17 genera and 48 species, with 12 genera and 36 species belonging to the *Candidomiris* group, and four genera and 12 species belonging to the *Morobea* group. All genera and species are diagnosed and described or redescribed. A key to all taxa is given. The male and female genitalia were investigated and new terminology is established for endosomal lobal sclerites and complex vestiture types. Illustrations and scanning electron micrographs of key characters are given. The locality records for all examined specimens were databased and their distributions are mapped. The following nine new genera are described: *Bucculagrandis* gen. nov., *Elongatoductus* gen. nov., *Falcum* gen. nov., *Flagellomiris* gen. nov., *Nerubia* gen. nov., *Novacalecoris* gen. nov., *Prosoponomiris* gen. nov., *Spinamifera* gen. nov. and *Tudoris* gen. nov. The following 35 new species are described: *Bucculagrandis morobiensis* sp. nov., *Candidomiris clavatasclerita* sp. nov., *Candidomiris cyrtandraphila* sp. nov., *Candidomiris macropiper* sp. nov., *Candidomiris missimensis* sp. nov., *Candidomiris parasponius* sp. nov., *Candidomiris sinuata* sp. nov., *Dimifacoris bifurcatus* sp. nov., *Dimifacoris leva* sp. nov., *Dimifacoris trifurcatus* sp. nov., *Dimifacoris splendidus* sp. nov., *Elongatoductus walli* sp. nov.,

Falcum austerum sp. nov., *Falcum bulldogensis* sp. nov., *Falcum gagnei* sp. nov., *Falcum kaindiensis* sp. nov., *Falcum taiwanensis* sp. nov., *Felisacodes uganda* sp. nov., *Flagellomiris sinuatum* sp. nov., *Flagellomiris tasmaniensis* sp. nov., *Jimia spectabilis* sp. nov., *Nerubia dentomembrana* sp. nov., *Nerubia viridis* sp. nov., *Novacalecoris bisclerita* sp. nov., *Novacalecoris gressiti* sp. nov., *Novacalecoris kraussi* sp. nov., *Novacalecoris macca* sp. nov., *Novacalecoris monteithi* sp. nov., *Novacalecoris rubrafasciae* sp. nov., *Novacalecoris tatarnici* sp. nov., *Novacalecoris turpa* sp. nov., *Prosoponomiris mimetica* sp. nov., *Spinamifera raveni* sp. nov., *Tudoris solomonensis* sp. nov. and *Wumea pilosa* sp. nov. The Afrotropical genera *Felisacodes* Bergroth and *Zanchiella* Schuh are included within the largely southwest *Candidomiris-Morobea* complex.

Keywords: taxonomy, phylogeny, distribution, new taxa, Miridae

INTRODUCTION

The true bug family Miridae is comprised of eight subfamilies, with the subfamily Orthotylinae being the third most species rich (Schuh 1995, Cassis and Schuh 2012). The Orthotylinae is comprised of six tribes; Austromirini, Ceratocapsini, Coridromiini, Halticini, Nichomachini and Orthotylini (Cassis and Schuh 2012), as well as two informal suprageneric groups- *Falconia* Distant group and *Zanchius* Distant group (Schuh 1974). The Orthotylini is by far the most speciose tribe in the subfamily. Over the past decade various authors (Forero 2008 and 2009, Schwartz 2011, Cheng et al. 2012, Cassis and Symonds 2014) have defined genera and groups of genera phylogenetically. There are many species of Orthotylini in the southwest Pacific that have not been described and many of those do not fit in with the above suprageneric frameworks. Many of these Pacific taxa have a glassy appearance and have morphological similarities that need a modern investigation.

Carvalho (1987) described six monotypic genera of Pacific orthotylines. He gave male genitalic and external descriptions but did not indicate if they formed a monophyletic group. Wall (2007) subsequently revised two of these genera, as well as describing *Saggitacopula* Wall as a new genus and four new species. He found no evidence of the monophyly of these taxa but his investigation did not include several of the large undescribed genera, many of which are housed in the B.P. Bishop Museum (Honolulu).

This chapter aims to describe and taxonomically revise this backlog of unknown species as well as the described species, which I refer hereafter as the *Candidomiris-Morobea* complex. It also aims to investigate if these taxa are monophyletic on the basis of morphological data. Much of the material is rare and old, which prevented me from undertaking a molecular study of their relationships.

For the morphological work I attempted to investigate the male genitalia in reference to recent studies of Cassis (2008), Schwartz (2011), Tatarnic and Cassis (2012), Cheng et al. (2012) and Cassis and Symonds (2014). In addition, I examined the female genitalia, as well as characters of the head and vestiture to find alternative character systems for determining higher-level relationships within the tribe Orthotylini.

These classifications are conceived on the basis of the male genitalia with corroborating external characters and female genitalia. Male genitalia are so variable within the Orthotylini that finding homologies and searching for synapomorphies is a work in progress.

MATERIALS AND METHODS

Materials

This study was based on an examination of specimens housed in the following collections:

AM: The Australian Museum.

AMNH: American Museum of Natural History, New York, USA.

BPBM: Bernice P. Bishop Museum, Honolulu, Hawaii, USA.

UNSW: University of New South Wales.

USNM: Smithsonian National Museum of Natural History, Washington, USA.

All specimens were databased, with unique specimen identifiers (USIs), in the Plant Bug Inventory database (http://research.amnh.org/pbi/localitydatabase).

Genital dissections

Specimens were examined using a Leica M165C stereomicroscope. Examination of male and female genitalia followed their maceration in 5% KOH for about five minutes. Abdomens were rinsed in water for five minutes and then examined in glycerol.

Imaging

A habitus image of one male and one female of each species was taken using the Visionary Digital system equipped with an Infinity Photo-optical K-2, 3-lens systems and a Canon EOS 40D digital camera (http://www.visionarydigital.com/). This system generated multiple images of each specimen. Helicon focus software version 2.0 (Kozub et. al 2008) was used to compile an extended focus of the multiple images. Key characters of species were examined and imaged with a Hitachi TM3000 desktop scanning electron microscope, at low vacuum.

Measurements

Morphometric measurements were taken using a stereomicroscope interfaced with a digital micrometer, and the data were recorded using Winwedge software (http://www.taltech.com/products/winwedge/). All measurements are given in millimetres in Table 1. Five males and five females of each species were measured for all species except for those taxa which are known from fewer specimens. These measurements are reported for each genus separately in tables 6-22. The raw data for the measurements is given in appendix C. The morphometric characters (including abbreviations) measured were: Antennal segment one to antennal segment four (AI-AIV), Length from cuneus to clypeus (CC), Length of cuneus (CL), Inter-ocellic dimension (IOD), Head length (LH), Length of mesoscutum (LM), Length of pronotum (LP), Length of scutellum (LS), Width of pronotum (PW), Total length (TL), Width of anterior lobe of the pronotum (WA), Width of cuneus (WC), Width of head (WH), Width of posterior lobe of pronotum (WP) and Width of the scutellum (WS).

Homology and terminology

The terminology employed to describe external morphological characters follows Schuh (1974), Cassis (2008) and Schwartz (2011). Female genitalic characters follow Davis (1955), Yasunaga (2000) and Schwartz (2011).

Male genitalia

I conducted extensive comparative studies of the male genitalia of the *Candidomiris-Morobea* complex. My phylogenetic analysis given below places the Afrotropical genera *Felisacodes* Bergroth and *Zanchiella* Schuh in the *Candidomiris-Morobea* complex. However, I had very limited material of either group, and was only able to investigate the genitalia of *Felisacodes uganda* sp. nov.

Cassis (2008) proposed a means for interpreting homology of the spicules of the endosoma in the *Lattinova* Cassis complex of the orthotyline tribe Austromirini. In his paper homology was determined by the basal position of the spicule to the secondary gonopore. The terms dorsal and ventral endosomal spicules were coined for the pair of elongate sclerotised processes. Cheng et. al (2012) found that the ventral endosomal spicule was positioned dorsal to the secondary gonopore in the genus *Myrtlemiris* Cheng, Mututantri and Cassis. In this case the ventral endosomal spicule was closest to the secondary gonopore. In some species of the *Candidomiris* Kerzhner and Schuh group of genera the endosoma either lacks sclerotisation or possesses lobal sclerites as in the subfamily Mirinae, in the sense of Stonedahl (1987; short sclerotised processes attached apically to membrane of the aedeagus). In many genera such as *Candidomiris* and *Falcum* gen. nov. these endosomal lobal sclerites are well developed, whereas in others such as *Novacalecoris* gen. nov. they are minute. In all cases they are attached to membrane, distal to the secondary gonopore, and in this way they are different to the endosomal spicules proposed by Cassis (2008) for the Austromirini, which are either attached by membrane to the base of the secondary gonopore or apex of the ductus seminis.

In the *Morobea* Carvalho clade, the endosomal spicules are homologous with those described for the Orthotylini by Schwartz (2011) and Cassis and Symonds (2014). They are sometimes present in *Saggitacopula* and lobal sclerites are absent. This suggests that lobal sclerites may be precursors to endosomal spicules, at least within the *Saggitacopula* clade and the Orthotylini and Austromirini.

However, homology of the endosomal lobal sclerites in the *Candidomiris* group of genera with those of the *Morobea* clade and rest of the Orthotylini is not made in this work because of their position relative to endosomal membrane and the ductus seminis.

The lobal sclerites are not attached basal to the ductus seminis as in the Austromirini (Cassis 2008) and Orthotylini (Cheng et al. 2012, Cassis and Symonds 2014); as stated above they are attached apically, distal to the secondary gonopore. These lobal sclerites lack dentate substructure or branching and are short and often flat.

All species in the *Candidomiris* group have an enlarged endosomal membranous bag, which is more prominent in comparison to other members of the Orthotylini and Austromirini, where the membrane is generally small, and the endosoma is dominated by two or three sclerotised spicules (Southwood 1953, Stonedahl and Schwartz 1986, Forero 2008, Cassis 2008, Cheng et al. 2012, Cassis and Symonds 2014). It is usually bilobed and they usually bear lobal sclerites. The membranous nature of the endosomal membrane is also more like that found in the *Zanchius* complex (Schuh 1976) and in *Cyrtorhinus* Fieber (also see Chapter 1).

The endosomal membrane in the *Candidomiris-Morobea* complex is generally bilobed and the endosomal lobal sclerites are variable in shape and position. I have categorised the endosomal lobal sclerites in this complex of taxa as follows:

Apical endosomal lobal sclerite: this sclerite is present on the apex of membrane which attaches very tightly around the secondary gonopore (e.g. Fig. 61d).

Dorsal endosomal lobal sclerites: dorsal endosomal lobal sclerite are distal sclerotised processes of the endosomal membrane which are positioned distal to the ductus seminis (e.g. Fig. 84d). In some species (e.g., *Candidomiris macropiper*) there are two dorsal endosomal spicules, with DELS1 more medial and DELS2 more laterally positioned.

Ventral endosomal lobal sclerites: The ventral endosomal lobal sclerites only occur in *Candidomiris macropiper* and are discussed further in the remarks for this species. They are two small sclerotised process of the endosomal membrane towards the

base of the phallotheca ventrad to the secondary gonopore, and distal to the ductus seminis.

Parameres

In the *Candidomiris-Morobea* complex, the sensory lobe of both the left and right paramere is the lobe of the paramere which bears setae. The majority of species in the complex do not have an elongate sensory lobe as in *Cyrtorhinus.* The sensory lobe is reduced to a swelling to which the apophysis is attached, and is sometimes not noticeable. In some taxa the right paramere is reduced so that there is no differentiation into a sensory lobe and apophysis.

The apophysis is an elongate apical lobe. Most species of *Novacalecoris* gen. nov. have two apophyses, and are referred to as apophysis 1 and 2. Apophysis 1 is on the opposite side of the stem of the paramere to the sensory lobe and apophysis 2 extends apically from the base of the sensory lobe (Fig. 128b).

Vestiture

I introduce the following new terminology for novel vestiture belonging to the *Candidomiris-Morobea* complex.

Star-shaped setae: a synapomorphy for *Jimia* Carvalho. These are tiny, thick setae with 3-4 or rarely 5 terminal branches covering most of the body.

Conical setae: These are thick, conical-shaped setae about the size of star-shaped setae, which cover the body of *Nerubia* gen. nov. These setae appear to be similar in size and thickness and their homology with star-shaped setae is unknown.

Species descriptions

The species descriptions for males and females are combined (in comparison to Chapter 2), as there is no significant sexual dimorphism.

Phylogenetic methods

A phylogenetic data matrix (Table 23) for the *Candidomiris* group was compiled in Nexus Data Editor (Page 2001) and comprised 107 morphological characters and 82 taxa, including 48 species belonging to the *Candidomiris* group, and 30 members of other orthotyline genera that were putatively assessed as outgroup taxa. The tree was rooted with an unidentified phyline species of the genus *Tytthus* Fieber. Characters and character states are given in Table 25.

TNT for Windows, no taxon limit Version 1.1 (Goloboff et al. 2008) was used to conduct a parsimony analysis. An unweighted new technology search was implemented, with the ratchet option applied, set to 1000 iterations, and the tree drift algorithm at default settings. Implied weighting (Goloboff 1993) was then used to further resolve the tree. Symmetric resampling (Goloboff et al. 2003) was employed to generate support values for the relationships found.

Terminology for synapomorphy and apomorphic character states used in this chapter are the same as those used in Chapter 2.

RESULTS

Phylogeny

Phylogenetic analysis resulted in two maximum parsimony trees with a shortest length of 533 in an unweighted analysis. All nodes supported by at least 50% resampling value were retained in weighted and unweighted analyses. Of the chosen outgroups, *Cyrtorhinus*, as outlined in Chapter 2 of this thesis, was weakly found as the sistergroup to the *Candidomiris*-*Morobea* complex. All 48 putative ingroup species were recovered as a monophyletic group. Within the *Morobea*-*Candidomiris* complex, two clades were found. One of these clades, which I refer to as the *Candidomiris* group, comprises the

genera *Bucculagrandis* gen. nov., *Candidomiris*, *Felisacodes* Bergroth, *Falcum* gen. nov., *Jimia*, *Nerubia*, *Novacalecoris, Saggitacopula, Spinamifera* gen. nov. and *Zanchiella* Schuh. The other clade, the *Morobea* clade, encompasses the genera *Dimifacoris* gen. nov., *Flagellomiris* gen. nov., *Morobea* and *Wumea* Carvalho. Within the *Morobea* clade, intergeneric relationships are strongly supported, whereas in the *Candidomiris* clade, sistergroup relationships have weak support and are partially unresolved. All genera were found to be monophyletic and received more than 50% symmetric resampling support.

The topology of the phylogeny is given in Figure 43 shows the results of the phylogenetic analysis. Table 24 gives the resampling values and Figure 44-45 gives the character state changes which support each node. Following is a summary of the data and support values for each node within the phylogeny.

Node 1: This clade establishes the monophyly of the *Morobea-Candidomiris* complex. This node received 80% symmetric resampling support. It is supported by seven apomorphic character states.

Node 2: This node establishes the *Morobea* Carvalho group as a monophylum. It had a symmetric resampling score of 70%. It is supported by one synapomorphy and eight apomorphic character states.

Node 3: This node establishes *Dimifacoris* Carvalho as a monophyletic genus. It is supported by 53% symmetric resampling, two synapomorphies and five apomorphic character states.

Node 4: The analysis resulted in *Dimifacoris leva* sp. nov. as the sister-group to the remaining species of *Dimifacoris*. This node received <50% resampling support. It is supported by one apomorphic character states.

Node 5: *Dimifacoris splendidus* sp. nov. is basal to the clade comprising *Dimifacoris fasciatus* Carvalho, *Dimifacoris trifurcatus* sp. nov. and *Dimifacoris bifurcatus* sp. nov. This node received <50% resampling support. It is supported by one apomorphic character states.

Node 6: This node establishes a sister-group relationship between the Northern Australian species *Dimifacoris trifurcatus* sp. nov. and *Dimifacoris bifurcatus* sp. nov. This relationship is supported by a symmetric resampling value of 65% and two apomorphic character states.

Node 7: This node establishes a relationship between *Flagellomiris* gen. nov., *Morobea* gen. nov. and *Wumea* gen. nov. It received 53% symmetric resampling support. It is also supported by six apomorphic character states.

Node 8: This node establishes the monophyly of the genus *Flagellomiris* gen. nov. It is supported by 99% symmetric resampling and by seven apomorphic character states.

Node 9: This node establishes a *Morobea-Wumea* sister-group relationship. It is supported by 100% symmetric resampling. It is also supported by one synapomorphy, and ten apomorphic character states.

Node 10: This node establishes the monophyly of the genus *Morobea* Carvalho. It is supported by 100% symmetric resampling and seven apomorphic character states.

Node 11: This node establishes the monophyly of the genus *Wumea* gen. nov., inclusive of the new species *Wumea pilosa*. This node had 61% symmetric resampling support, two synapomorphies and four apomorphic character states.

Node 12: This node establishes a sister-group relationship between *Wumea cassisi* Wall and *Wumea pilosa* sp. nov. to the exclusion of *Wumea clypealis* Carvalho. It is supported by <50% symmetric resampling. It is also supported by one apomorphic character states.

Node 13: This node establishes the *Candidomiris* group of genera as a clade, with a symmetric resampling value of 76%. It is also supported by one synapomorphy, and five apomorphic character states.

Node 14: This node establishes *Novacalecoris* gen. nov. and *Prosoponomiris* gen. nov. as basal to the rest of *Candidomiris* group. It is supported by a symmetric resampling value of 52%. It is supported by five apomorphic character states.

Node 15: This establishes the monophyly of *Novacalecoris* gen. nov. It is supported by 56% symmetric resampling and apomorphic character states.

Node 16: This node suggests that *Novacalecoris gressiti* sp. nov. is the basal member of the genus *Novacalecoris.* It received a symmetric resampling value of 56%. It is supported by one synapomorphy.

Node 17: This node separates *Novacalecoris monteithi* from (*N. kraussi* sp. nov.*, N. macca* sp. nov.*, N. bisclerita* sp. nov.*, N. rubrafasciae* sp. nov.*, N. tatarnici* sp. nov. and *N. turpa* sp. nov.) It received <50% symmetric resampling support. It is supported by one apomorphic character state.

Node 18: This node further separates *Novacalecoris kraussi* sp. nov. from the rest of the *Novacalecoris* species. It has <50% symmetric resampling support. It is supported by one apomorphic character state.

Node 19: This node further separates *Novacalecoris macca* sp. nov. from the rest of *Novacalecoris*. It is supported by <50% symmetric resampling and one apomorphic character state.

Node 20: This node supports a *Novacalecoris rubrafasciae* sp. nov.*, Novacalecoris tatarnici* sp. nov.*, Novacalecoris turpa* sp. nov. relationship. It is supported by a symmetric resampling value of <50% and two apomorphic character states.

Node 21: This node posits the sistergroup relationship between *Novacalecoris tatarnici* sp. nov. and *Novacalecoris turpa* sp. nov. It receives <50% symmetric resampling and is supported by one apomorphic character states.

Node 22: This component of the *Candidomiris* group had <50% symmetric resampling support. It established *Novacalecoris* gen. nov. and *Prosoponomiris* gen. nov. as basal to the rest of the *Candidomiris* group and was supported by five apomorphic character states but receives <50% symmetric resampling support.

Node 23: This node established a clade comprising *Tudoris* gen. nov., *Saggitacopula* Wall, *Nerubia* gen. nov., *Spinamifera* gen. nov. and *Jimia* gen. nov. It is supported by a <50% symmetric resampling value. It is supported by two apomorphic character states.

Node 24: This node establishes the monophyly of *Saggitacopula* Wall. It is supported by a symmetric resampling value of 100%. This node is supported by one synapomorphy and four apomorphic character states.

Node 25: This node suggests a relationship between the genera *Tudoris* gen. nov., *Nerubia* gen. nov., *Spinamifera* gen. nov. and *Jimia* Carvalho. It is supported by a symmetric resampling value of 51%. This is reinforced by two synapomorphies and one apomorphic character states.

Node 26: This node establishes the monophyly of *Nerubia* gen. nov. It is supported by a 74% symmetric resampling value and eight apomorphic character states.

Node 27: This node suggests a relationship between the genera *Tudoris* gen. nov., *Spinamifera* gen. nov. and *Jimia* Carvalho. It is supported by one synapomorphy but receives <50% symmetric resampling.

Node 28: This node proposes a sistergroup relationship between *Spinamifera* gen. nov. and *Jimia* Carvalho. It is supported by <50% symmetric resampling, one synapomorphy and three apomorphic character states.

Node 29: This node establishes the monophyly of *Jimia* gen. nov. and is supported by a 99% symmetric resampling value. It is supported by one synapomorphies and five apomorphic character states which occur outside of this node.

Node 30: This node separates the genera (*Falcum* gen. nov., *Elongatoductus* gen. nov., *Candidomiris* gen. nov., *Bucculagrandis* gen. nov., *Zanchiella* Schuh, and *Felisacodes* Bergroth) from the rest of the *Candidomiris* group. It is supported by <50% symmetric resampling and five apomorphic character states.

Node 31: This node supports the monophyly of *Falcum* gen. nov., with a symmetric resampling score of 73%. It is also supported by one synapomorphy and two apomorphic character states which occur elsewhere in the *Morobea-Candidomiris* complex.

Node 32: This node proposes *Falcum austerum* sp. nov. as the basal within *Falcum*. It received <50% symmetric resampling support. It is also supported by one apomorphic character state.

Node 33: This node places *Falcum gagnei* sp. nov. as sister to a clade comprising *Falcum taiwanensis* sp. nov., *Falcum kaindiensis* sp. nov. and *Falcum bulldogensis* sp. nov. It received less than 50% symmetric resampling support and one apomorphic character state.

Node 34: This node establishes a *Falcum kaindiensis* sp. nov., *Falcum bulldogensis* sp. nov. sister-group relationship supported by a symmetric resampling value of >50% It is also supported two apomorphic character states.

Node 35: This node suggests that *Elongatoductus* gen. nov., *Felisacodes* Bergroth., *Zanchiella* gen. nov., *Bucculagrandis* gen. nov. and *Candidomiris* gen. nov. form a monophyletic clade. It received <50% resampling support. It is also supported by four apomorphic character states.

Node 36: This node places *Felisacodes* gen. nov. as basal to a clade consisting of *Elongatoductus* gen. nov., *Zanchiella* gen. nov., *Bucculagrandis* gen. nov. and *Candidomiris* gen. nov. It receives <50% symmetric resampling and is supported by four apomorphic character states.

Node 37: This node supports the monophyly of *Felisacodes* gen. nov. species which were investigated in this study. It received 95% symmetric resampling support and four apomorphic character states.

Node 38: This node establishes a sister-group relationship between *Felisacodes diaboura* Odhiambo and *Felisacodes bryocorina* (Poppius) to the exclusion of *Felisacodes uganda* sp. nov. It received <50% resampling support. It is supported by one apomorphic character state.

Node 39: This node establishes *Zanchiella* gen. nov., *Bucculagrandis* gen. nov. and *Candidomiris* gen. nov. as a clade. It received <50% symmetric resampling support. It is also supported by two apomorphic character states.

Node 40: This node establishes the monophyly of the two *Zanchiella* gen. nov. species investigated in this study. It is supported by a symmetric resampling value of 97%. It is also supported by seven apomorphic character states.

Node 41: This node establishes a sister-group relationship between *Bucculagrandis* gen. nov. and *Candidomiris* gen. nov. It is supported by a symmetric resampling value of 61%. It is also supported by two synapomorphies and four apomorphic character states.

Node 42: This node establishes the monophyly of *Candidomiris* gen. nov. It is supported by a symmetric resampling value of 58%. It is supported by two apomorphic character states.

Node 43: This node places *Candidomiris missimensis* sp. nov. as the basal species in the genus *Candidomiris.* It received <50% symmetric resampling support. It is also supported by one apomorphic character state.

Node 44: This node places *Candidomiris parasponius* sp. nov. as the next most basal species of *Candidomiris.* It received <50% symmetric resampling support. It is also supported by one synapomorphy.

Node 45: This node further separates *Candidomiris clavatasclerita* sp. nov. from the remaining *Candidomiris* species. It received <50% symmetric resampling support. It is supported by one apomorphic character state.

Node 44: This suggests a (*Candidomiris cyrtandraphila* sp. nov., *Candidomiris cyrtandraphila* sp. nov.*, Candidomiris clavatasclerita* sp. nov.) relationship. It received <50% symmetric resampling support. It is supported by one apomorphic character state.

Node 45: This node establishes a sister-group relationship between *Candidomiris macropiper* sp. nov. and *Candidomiris sinuata* sp. nov. It received <50% symmetric resampling support and three apomorphic character states.

TAXONOMY

Candidomiris-Morobea complex

Diversity and Distribution

The *Candidomiris-Morobea* group has an Indo-Pacific distribution, with the vast majority of the species diversity occurring in Papua New Guinea and New Caledonia, and several species from Australia. Two genera are found in Africa (*Felisacodes* and *Zanchiella*) and a single species is found in Asia (Taiwan). One species (*Nerubia dentomembrana*) is found in Fiji. Geographic distributions of these species tend to be more limited than those of *Cyrtorhinus* (Chapter 2) of this thesis with generic

endemicity in the *Candidomiris-Morobea* group being more or less equivalent to species endemicity in *Cyrtorhinus.*

Remarks

The *Candidomiris* group can be recognised from other Orthotylini by its shiny colouration, near glabrous body, strongly hypognathous head, lack of endosomal spicules and presence of sclerotised endosomal lobal sclerites. The *Morobea* group can be distinguished by its prognathous head, gracile body shape and appendages, dense distribution of rugae and/or scale-like texturing on the head and/or pronotum, and presence of a proximal endosomal spicule.

Checklist of species and genera in the *Candidomiris-Morobea* group

Bucculagrandis gen. nov.

Bucculagrandis morobiensis sp. nov.	New Guinea

Candidomiris Kerzhner and Schuh 1995

Candidomiris albomaculata Carvalho 1987	New Guinea
Candidomiris clavatasclerita sp. nov.	New Guinea
Candidomiris cyrtandraphila sp. nov.	New Guinea
Candidomiris macropiper sp. nov.	New Guinea
Candidomiris missimensis sp. nov.	New Guinea
Candidomiris parasponius sp. nov.	New Guinea
Candidomiris sinuata sp. nov.	New Guinea

Dimifacoris Carvalho 1987

Dimifacoris bifurcatus sp. nov.	Australia (Queensland)
Dimifacoris fasciatus Carvalho 1987	New Guinea
Dimifacoris leva sp. nov.	Australia (Queensland)
Dimifacoris splendidus sp. nov.	Australia (Queensland)

Dimifacoris trifurcatus sp. nov.	Australia (Queensland)
Elongatoductus gen. nov.	
Elongatoductus walli sp. nov.	New Caledonia
Falcum gen. nov.	
Falcum austerum sp. nov.	New Guinea
Falcum bulldogensis sp. nov.	New Guinea
Falcum gagnei sp. nov.	New Guinea
Falcum kaindiensis sp. nov.	New Guinea
Falcum taiwanensis sp. nov.	Taiwan
Felisacodes Bergroth, 1926	
Felisacodes bryocorina (Poppius 1914)	South Africa, East Africa
Felisacodes diaboura Odhiambo 1967	East Africa
Felisacodes uganda sp. nov.	East Africa
Flagellomiris gen. nov.	
Flagellomiris sinuatum sp. nov.	Australia (New South Wales)
Flagellomiris tasmaniensis sp. nov.	Australia (Tasmania)
Jimia Carvalho 1987	
Jimia bimaculata Carvalho 1987	New Guinea
Jimia spectabilis sp. nov.	New Guinea
Morobea Carvalho 1987	
Morobea longipes Carvalho 1987	New Guinea
Morobea spectabilis Wall 2007	New Guinea
Nerubia gen nov.	
Nerubia dentomembrana sp. nov.	Fiji
Nerubia viridis sp. nov.	New Guinea

Novacalecoris gen. nov.	
Novacalecoris bisclerita sp. nov.	New Caledonia
Novacalecoris gressiti sp. nov.	New Caledonia
Novacalecoris kraussi sp. nov.	New Caledonia
Novacalecoris macca sp. nov.	New Caledonia
Novacalecoris monteithi sp. nov.	New Caledonia
Novacalecoris rubrafasciae sp. nov.	New Caledonia
Novacalecoris tatarnici sp. nov.	New Caledonia
Novacalecoris turpa sp. nov.	New Caledonia
Prosoponomiris gen. nov.	
Prosoponomiris mimetica sp. nov.	New Caledonia
Saggitacopula Wall 2007	
Saggitacopula carvalhoi Wall 2007	New Guinea
Saggitacopula rufescens Wall 2007	Australia (Queensland)
Spinamifera gen. nov.	
Spinamifera raveni sp. nov.	Australia (Queensland)
Tudoris	
Tudoris solomonensis sp. nov.	Solomon Islands
Wumea Carvalho 1987	
Wumea cassisi Wall 2007	New Guinea
Wumea clypealis Carvalho 1987	New Guinea
Wumea pilosa sp. nov.	New Guinea
Zanchiella Schuh 1974	
Zanchiella bowkeriae Schuh 1974	South Africa
Zanchiella sweeti Schuh 1974	South Africa

Key to the genera and species of the *Candidomiris-Morobea* complex

1. Pronotum smooth; dorsum shiny; legs moderately long..... 2
- Pronotum rugulose or with scale-like texturing; legs greatly elongate..... 10
2. Body with simple hair-like setae intermixed with shorter apically divided or conical setae (Figs 97d,135d)..... 3
- Body sparsely distributed with simple, hair-like setae, not intermixed with either shorter apically divided or conical setae (Fig. 74e) 4
3. Smaller setae apically trifurcate (Fig. 97d) (*Jimia)* 14
- Smaller setae conical, apically simple; Australia (Fig. 135d)..... .....*Spinamifera raveni* sp. nov.
4. Anterior lobe of pronotum cylindrical, about half width of posterior lobe (Fig. 92c)..... 5
- Anterior lobe of pronotum trapezoidal, broad (Fig. 126d)..... 15
5. Bucculae enlarged, occupying much of length of head in ventral view, extending to proxyphus (Fig. 108c); gula reduced (Fig. 108b) 6
- Bucculae occupying at most about half head length (Fig. 144c); costal margins of hemelytra straight or weakly convex (Fig. 51)..... 8
6. Bucculae with a pair of posterior projection overlapping proxyphus (Fig. 47a); hemelytral markings white (Fig. 46a).....*Bucculagrandis morobiensis* sp. nov.
- Bucculae with convex posterior margin (Fig. 108c); hemelytral markings dark or not contrasting with remainder of hemelytra (Fig. 46e) 7
7. Costal margins of hemelytra sinuate (Fig. 23e); endosoma with lobal sclerites (Fig. 56d); endosomal membrane without spinules (Fig. 56d)..... 23
- Costal margins of hemelytra convex (Fig. 46e); endosoma lacking lobal sclerites (Fig. 109d); endosomal membrane with spinules (Fig. 109d) (*Nerubia*) 30

8. Row of punctures on clavus (Fig. 90f); endosoma with sclerotised process (Fig. 91d) 9

- Clavus without punctures (Fig. 133d); endosoma simple with no spicules or enlarged sclerotised processes (Fig. 134d); New Guinea and New Britain (*Saggitacopula*) 31

9. AI short, subequal to head length; legs moderately elongate; body dark (Fig. 87d) (*Zanchiella*) 32

- AI elongate, ca. 2x longer than head; legs gracile; body pale (Fig. 87a) (*Felisacodes*) 33

10. AII and AIII greatly elongate, combined length longer than body 11

- AII and AIII not longer than the body 12

11. Cuneus red (Fig. 102c), contrasting with remainder of hemelytra; parameres with multiple lobes (Fig. 142) (*Wumea*) 36

- Cuneus concolourous with remainder of hemelytra (Fig. 102a); parameres undivided (Fig. 104b) (*Morobea*) 38

12. Eyes large round in lateral view (Fig. 83c) 13

- Eyes small, reinform or oval in lateral view (Fig. 65b) (*Dimifacoris*) 39

13. AIV subequal to AI; body small, ~2mm in length (*Falcum*) 43

- AIV greatly elongate, longest antennal segment; body >3.5mm (*Flagellomiris*) 47

14. Labium reaching abdominal s2-s3; pygophore with a minute spoon like ventral process (Fig. 98a); endosomal membrane lacking sclerotisation (Fig. 98d); New Guinea .....*Jimia bimaculata* Carvalho

- Labium reaching metathorax; pygophore lacking minute posterior process (Fig. 101a), endosomal membrane with complex dentation (Fig. 101d); New Guinea .....*Jimia spectabilis* sp. nov.

15. Pygophore with a left tergal process (Fig. 123a) 16

- Pygophore without left tergal process (Fig. 130)..... 21

16. Dorsum with red markings (Fig. 112f) 17

- Dorsum without red markings (Fig. 112a)..... 20

17. Body ovoid (Fig. 112b)..... 18

- Body elongate-ovoid (Fig. 112g) 19

18. Eye dorsoventrally elongate, ovoid (Fig. 118b); calli flat .....
.....*Novacalecoris kraussi* sp. nov.

- Eye kidney shape (Fig. 124b); calli elevated .....
.....*Novacalecoris rubrafasciae* sp. nov.

19. Clypeus light brown; left paramere undivided, with single apophysis (Fig. 116b); New Caledonia .....*Novacalecoris gressiti* sp. nov.

- Clypeus red; left paramere with two apophyses (Fig. 121b); New Caledonia.....
.....*Novacalecoris macca* sp. nov.

20. Scutellum smooth (Fig. 113f); left paramere lacking medial process (Fig. 114b); New Caledonia..... *Novacalecoris bisclerita* sp. nov.

- Scutellum rugulose (Fig. 127e); left paramere with a medial process (Fig. 128b) New Caledonia.....*Novacalecoris turpa* sp. nov.

21. Myrmecomorphic (Fig. 112i), with hemelytra pinched medially; New Caledonia ..... *Prosoponomiris mimetica* sp. nov.

- Costal margins of hemelytra weakly convex (Fig. 112g) 22

22. Labium extending at most to abdominal s4 or s5; New Caledonia..... ..... *Novacalecoris tatarnici* sp. nov.

- Labium extending to pygophore in males; New Caledonia .... *Novacalecoris monteithi* sp. nov.

23. Proxyphus densely covered in microtrichia 24

- Proxyphus lacking microtrichia 28

24. Cuneus elongate, length ca. 3x width (Table 7)..... 25

- Cuneus 2-2.5x longer than wide (Table 7)..... 26

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Taxon Descriptions

***Bucculagrandis* gen. nov.**

Etymology

Named for its greatly enlarged bucculae; noun in apposition. Feminine.

Type species

Bucculagrandis morobiensis sp. nov. by original designation.

Diagnosis

Bucculagrandis is recognised by the following combination of characters: dorsum mostly black (Fig. 46a), almost glabrous; myrmecomorphic (Fig. 46a); labium reaching thoracico-abdominal boundary; bucculae greatly enlarged, keyhole-shaped in ventral

view (Fig. 47b), with a pair of posterior projections (Fig. 47a); anterior lobe of pronotum anteriorly explanate and strongly rugulose (Fig. 47c); pygophore mildly enlarged (Fig. 48a); left paramere bilobed (Fig. 48b); right paramere reduced, weakly clavate apically (Fig. 48c); endosomal; membrane with a single lobe (Fig. 48d); single apical lobal sclerite present, projecting from phallotheca at rest (Fig. 48d); phallotheca with apical opening (Fig. 48d).

Description

COLOURATION: Body black with white markings (Fig. 46a). ***Head:*** uniformly black. ***Pronotum:*** anterior and posterior lobes black. ***Hemelytra:*** opaque, black.

VESTITURE AND TEXTURE: Body sparsely covered in simple, decumbent, hair-like setae, intermixed with sparse distribution of microtrichia, no complex setae present (Fig. 47). ***Antennae:*** densely covered in erect, hair-like setae. ***Pronotum:*** anterior lobe smooth; posterior lobe with strong, transverse rugae (Fig. 47c). ***Prosternum:*** weakly rugulose, microtrichia densely distributed (Fig. 47d). ***Legs:*** densely covered with semi-erect, hair-like setae, two rows of spinules present on tibiae. ***Hemelytra:*** sparse distribution of semi-erect, hair-like setae.

STRUCTURE: Body shape elongate-ovoid (Fig. 46a). ***Head:*** declivent (Fig. 47a); about twice as wide as long (Fig. 47b); clypeus posteroventrally oriented, anteriorly weakly convex (Fig. 47a); medial sulcus shallow, broad; bucculae greatly enlarged (Fig. 47b), two large protrusions oriented posteriorly (Fig. 47a); gula short, restricted to posterior ¼ of head (Fig. 47a); eyes greatly dorsoventrally elongate, reinform, contiguous with anterior margin of pronotum (Fig. 47a); postocular region absent (Fig. 47a). ***Antennae:*** AI elongate, usually subequal in length to head (Table 6); mandibular plate dorsoventrally elongate (Fig. 47a), raised. ***Labium:*** extending to thoracico-abdominal boundary. ***Pronotum:*** (Fig. 47c) hourglass-shaped, foveae absent; collar

thin; calli absent; anterior lobe oval, without calli, lateral margins strongly convergent posteriorly, explanate; posterior lobe trapezoidal, lateral margins strongly divergent posteriorly, posterior margin excavate; anterolateral margins explanate. ***Mesepimeron:*** (Fig. 47e) with evaporative bodies, spiracle weakly exposed. ***Metathoracic Gland:*** (Fig. 47e) peritreme short, tongue-like, strongly raised, dorsally oriented; evaporative area occupying ca. ⅓rd of metepisternum, peritreme reaching dorsal margin of evaporative area. ***Thoracic sterna:*** (Fig. 47d) proxyphus weakly depressed. ***Scutellum:*** (Fig. 47c) weakly convex; anterolateral angles declivent posteriorly, with foveae; lateral margins straight, most often serrate, rarely smooth; anterolateral margins declivent posteriorly. ***Hemelytra:*** costal margins weakly sinuate; ca. 1.5-2x longer than abdomen, cuneus length 1.5-2x longer than cuneus width (Fig. 47f). ***Legs:*** cursorial; coxae elongate; metatibiae and metafemora moderately; pretarsal claws with uniformly spaced minute striations, narrow basally. ***Male Genitalia:*** pygophore short (Fig. 48a), weakly asymmetrical; ventral process weakly developed, lacking grooves (Fig. 48a); posteriorly oriented genital opening (Fig. 48a); with erect setae. Left paramere (Fig. 48b) with broad and quadrate sensory lobe, apophysis sinuate, apex blunt. Right paramere (Fig. 48c) club-shaped, much smaller than left paramere. Aedeagus (Fig. 48d) with apical lobal sclerite, extending beyond phallotheca at rest, endosomal membrane undivided, attached to secondary gonopore, without spicules; phallotheca narrow, small, without lobes, opening dorsally; ductus seminis elongate, moderately broad; secondary gonopore moderately long, simple, projecting beyond apex of phallotheca. ***Female genitalia:*** (Fig. 49) subgenital plate triangular, not greatly elongate; interramal lobes digitiform, with scale-like texture.

Remarks

Bucculagrandis is most closely related to *Candidomiris.* The strongly explanate, keyhole-shaped bucculae resemble the bucculae in *Candidomiris*. However, no species of *Candidomiris* has bucculae with a pair of posterior projections that extend to the proxyphus, as in *Bucculagrandis*. They also lack the anteriorly explanate lateral margins of the anterior lobe of the pronotum and the strongly rugulose posterior lobe of the pronotum.

Bucculagrandis is a monotypic genus. I have examined specimens with similar bucculae and dorsal appearance from Cape York, Queensland. However, the specimens were too badly damaged to warrant any definitive placement to genus or if it is conspecific with *B. morobiensis*.

***Bucculagrandis morobiensis* sp. nov.**

Habitus, Figure 46. SEMs, Figure 47. Male genitalia, Figure 48. Female genitalia, Figure 49. Distribution, Figure 50.

Etymology

Named after the type locality.

Materials examined

HOLOTYPE: **PAPUA NEW GUINEA: MOROBE PROVINCE:** Bulolo, 7.20472°S 146.63167°E, 750 m, 07 May 1979, W.C. Gagne, ex *Plumeria* sp. (Apocynaceae),♂(AMNH_PBI 00046229) (BPBM).

PARATYPES: **INDONESIA: WEST PAPUA:** Cyclops Mountains, Ifar, 2.6°S 140.61°E, 300 m, 22 Jun 1959, T.C. Maa, 1♀ (AMNH_PBI 00046239), 1♂ (AMNH_PBI 00046240) (BPBM). **PAPUA NEW GUINEA: MOROBE PROVINCE:** Bulolo, 7.20472°S 146.63167°E, 750 m, 07 May 1979, W.C. Gagne, ex

Plumeria sp. (Apocynaceae), 1♀ (AMNH_PBI 00046228), 2♂♂ (AMNH_PBI 00046230-AMNH_PBI 00046231) (BPBM). Lae Botanical Gardens, 6.72056°S 146.99694°E, 50 m, 02 May 1976, W.C. Gagne, ex *Datura* sp. (Solanaceae), 2♀♀ (AMNH_PBI 00046237, AMNH_PBI 00046238) (BPBM). Wau, 7.3333°S 146.71667°E, 1200 m, 16 Dec 1977, W.C. Gagne, 1♀ (AMNH_PBI 00046236) (BPBM); 14 Oct 1976, W.C. Gagne, 2♀♀ (AMNH_PBI 00053269, AMNH_PBI 00046232) (BPBM); 28 Apr 1976, W.C. Gagne, ex *Piper* sp. (Piperaceae), 2♀♀ (AMNH_PBI 00046233, AMNH_PBI 00046235), 1 specimen, sex unknown (AMNH_PBI 00046234) (BPBM).

Diagnosis

See generic diagnosis.

Description

COLOURATION: Mostly black (Fig. 46a). ***Head:*** clypeus, maxillary and mandibular plates, gula and genae light brown to stramineous; frons and vertex fuscous; bucculae light brown, fuscous posteriorly. ***Antennae:*** AI white with two lateral brown bands; AII yellow; AIII-AIV brown. ***Pronotum:*** black, posterior margin white. ***Thoracic venter:*** thoracic pleura and sterna dark reddish brown to fuscous. ***Scutellum:*** black. ***Hemelytra:*** fuscous with white markings as lateral band posterior to the scutellum, at apex of clavus, and lateral band between clavus and membrane; cuneus red or brownish red; membrane translucent, brown. ***Legs:*** brown to brownish red, white band on apex of femora, apex of tibiae white. ***Abdomen:*** black, sometimes reddish brown.

VESTITURE AND TEXTURE: ***Head:*** setae sparse, erect; frons and vertex smooth, otherwise weakly rugulose (Fig. 47). ***Antennae:*** setae small, decumbent, densely distributed, more sparse on AI. ***Pronotum:*** (Fig. 47c) collar rugulose; anterior lobe with sparse, semi-erect, hair-like setae, mostly along midline and anterior margin; smooth

texture; posterior lobe surface coarse, densely rugulose sparse distribution of semi-erect, hair-like setae. ***Thoracic venter:*** (Fig. 4d) proxyphus coarsely rugulose, densely covered in minute, matted microtrichia; mesosternum rugulose, microtrichiae present medially. ***Scutellum:*** finely rugulose, weblike texture posteriorly; semi-erect, hair-like setae; mesoscutum anteriorly covered in microtrichiae. ***Hemelytra:*** minute weblike texture present; sparsely distributed decumbent setae. ***Legs:*** densely covered with small, erect, hair-like setae, longer on tibiae.

Male and female genitalia given in generic description.

Measurements

See Table 6.

Distribution

Known from the Morobe province of Papua New Guinea and the Cyclops Mountains in the northeastern region of Papua province of Irian Jaya, Indonesia (Fig. 50).

Biology and plant associations

Four specimens were collected from *Plumeria* (Apocynaceae), two specimens from *Datura kainda* (Solanaceae) and three specimens from a *Piper* sp. (Piperaceae).

Remarks

See generic remarks.

Candidomiris Kerzhner and Schuh

Krausella Carvalho, 1987: 180 (gen. n.)

Candidomiris Kerzhner and Schuh, 1995: 1 (nom. nov.; *Krausella* Carvalho preoccupied by *Krausella* Bolivar, 1909 [Orthoptera]); Schuh 1995: 89 (world catalogue)

Type species

Krausella albomaculata Carvalho by original designation.

Diagnosis

Candidomiris is recognised by the following combination of characters: mostly glabrous; overall colouration black or stramineous (Figs 51a-g); costal margins of hemelytra sinuate (Figs 51a-g); head vertically projected (e.g. Fig 52c); elongate in lateral view (e.g. Fig 52c); clypeus flattened, elongate anteriorly (e.g. Fig 52c); arcuate bucculae, not reaching posterior margin of head (e.g. Fig 54b); distinct anterior and posterior lobes of pronotum (e.g. Fig 54d); simple hair-like vestiture only; pygophore short, without tergal processes (e.g. Fig 55a); left paramere (e.g. Fig 55b) sickle-shaped (r- or v-shaped); right paramere (e.g. Fig 55c) reduced, simple; phallotheca (e.g. Fig 55d) with apical opening; endosoma (e.g. Fig 55d) with dorsal and apical endosomal lobal sclerites; apical lobal sclerite, projecting from phallotheca at rest.

Description

COLOURATION: Shiny, general colouration varies between species (Figs 51a-g). ***Head:*** colour variable, sometimes with light yellow or brown markings around eye; maxillary and mandibular plates often red, sometimes brown. ***Pronotum:*** anterior and posterior lobe usually differently coloured. ***Hemelytra:*** hyaline, transparent with markings.

VESTITURE AND TEXTURE: Body sparsely covered in simple, decumbent, hair-like setae intermixed with sparse distribution of microtrichia; no complex setae present (e.g. Fig. 54). ***Antennae:*** often covered with erect, hair-like setae, AI with setae less densely distributed setae. ***Pronotum:*** (e.g. Fig. 57c) anterior and posterior lobes smooth. ***Prosternum:*** weakly rugulose, microtrichia densely distributed. ***Legs:*** densely covered with semi-erect, hair-like setae; two rows of spinules usually present on tibiae. ***Hemelytra:*** usually with sparse distribution of semi-erect, hair-like setae.

STRUCTURE: Body shape elongate-ovoid (Figs 51a-g). ***Head:*** strongly hypognathous (e.g. Fig. 54c); frons and clypeus ventrally to posteroventrally oriented (e.g. Fig. 54c); frons almost flat (e.g. Fig. 54a); about twice as wide as long, in dorsal view (e.g. Fig. 54a); medial sulcus shallow, wide (e.g. Fig. 54a); bucculae strongly arcuate to weakly keyhole-shaped, strongly produced ventrally beyond ventral margin of eyes (e.g. Fig. 54b); gula straight, short, restricted to posterior ¼ of head (e.g. Fig. 54c); eyes reinform to ovoid in lateral view, contiguous or almost contiguous with anterior margin of pronotum (e.g. Fig. 54d); postocular region absent (e.g. Fig. 59b). ***Antennae:*** AI weakly elongate, usually ~1.5-2x longer than head, always longer than interocular distance. ***Pronotum:*** (e.g. Fig. 59c) bilobed, with anterior lobe much shorter than posterior lobe; collar small, barely visible medially; anterior lobe subrectangulate, lateral margins weakly rounded, calli weakly developed, often contiguous medially; posterior lobe trapezoidal, lateral margins strongly divergent posteriorly, posterior margin rectilinear. ***Mesepimeron:*** (e.g. Fig. 60e) with evaporative areas; opening of metathoracic spiracle elongate. ***Metathoracic Gland:*** (e.g. Fig. 60e) evaporative area occupying about ⅓ of metepisternum; dorsal margin excavate, not reaching mesepimeron; peritreme short, tongue-like, posterodorsally oriented. ***Scutellum:*** (e.g. Fig. 54e) smooth, weakly convex; pair of foveae present at anterolateral angles; lateral

margins weakly serrate. ***Hemelytra:*** (Figs 51a-g) costal margins sinuate; ca. 1.5-2x longer than abdomen; cuneus length ca. 1.5-2x longer than cuneus width. ***Legs:*** cursorial; coxae elongate; pretarsal claws with minute striations on interior margin; narrow basally. ***Male Genitalia:*** pygophore short (e.g. Fig 55a), weakly asymmetrical, lacking grooves, dorsal opening, prominent ventral process with erect setae, supragenital bridge present. Left paramere r-shaped (e.g. Fig 61b) or v-shaped (e.g. Fig 54b), sensory lobe most often incrassate, with prominent setae (e.g. Fig 54b), usually lacking additional teeth or processes; apophysis, either straight (e.g. Fig 61b) or sinuate (e.g. Fig 54b), with apex blunt (e.g. Fig 63b) or splayed (e.g. Fig 61b). Right paramere small (e.g. Fig 61c), columnar with medial kink, sometimes laterally flattened and sinuate (e.g. Fig 55c), rarely with short apophysis. Aedeagus (e.g. Fig 55d) with phallotheca narrow, lacking lobes, with apical genital opening; ductus seminis long; secondary gonopore elongate, ribbon like, extending to apex of phallotheca at rest; endosoma with dorsal and apical endosomal lobal sclerites; endosomal membrane bilobed.

Distribution

All species of *Candidomiris* are known from New Guinea, including Papua New Guinea and Irian Jaya (Indonesia). Most specimens were collected by researchers of the Bishop Museum.

Biology and plant associations

Plant records for the genus are sporadic and are likely to be sitting records. There is no phylogenetic pattern to the documented plant associations. These are indicated in the biology and plant association sections for each species.

Remarks

Carvalho (1987) first described *Krausella*, for a single species, *K. albomaculata*, from Wau, Morobe Province, Papua New Guinea. This genus name is preoccupied by *Krausella* Bolivar 1909 (Orthoptera), and was replaced by Kerzhner and Schuh (1995) with *Candidomiris*. Aside from Schuh's (1995) world catalogue, the genus has not received further treatment.

Candidomiris can be separated from other genera of the *Morobea-Candidomiris* complex by its weakly keyhole-shaped bucculae, anteriorly convergent lateral margins of the pronotum, very strongly hypognathous head, strongly elongate eyes and flattened clypeus.

There are no large series of any of the species of *Candidomiris,* and most species are known from singletons or a few specimens.

***Candidomiris albomaculata* (Carvalho 1987)**

Habitus, Figure 51a. SEMs, Figure 52. Distribution, Figure 53.

Krausella albomaculata Carvalho, 1987: 180, Figs 15-18 (gen. nov.); Schuh 1995: 89 (world catalogue)

Candidomiris albomaculata: Kerzhner and Schuh, 1995: 1 (nov. comb.)

Materials examined

HOLOTYPE: **PAPUA NEW GUINEA: MOROBE PROVINCE:** Wau, 1.200-1.500 m, VII.1968, W.L.H. Krauss ♂. Type examined in the collection of the Bernice P. Bishop Museum, Honolulu, Hawaii.

PARATYPES: **INDONESIA: WEST PAPUA:** Swart Valley: Karubaka, 3.6°S 138.4667°E, 1450 m, 17 Nov 1958, J.L. Gressitt, 1♂ (AMNH_PBI 00315504) (USNM). **PAPUA NEW GUINEA: EAST NEW BRITAIN PROVINCE:** Vunabakan, 10km E of Keravat, 4.34835°S 152.0956°E, 180 m, 16 Nov 1959-20 Nov 1959, T.C.

Maa, 1♂ (AMNH_PBI 00315502) (USNM). **Morobe Province:** Wau, Kunai creek, 7.33333°S 146.71667°E, 1200 m, 15 May 1965, J. Sedlacek, ex *Saurauia* (Actinidiaceae), ex Urticaceae, 1♀ (AMNH_PBI 00047102) (BPBM). Wau: Namie Road, 7.33845°S 146.73412°E, 1240 m, 02 Oct 1965, W.C. Gagne, ex *Poikilogyne* sp. (Melastomataceae), 2♂♂ (AMNH_PBI 00047079, AMNH_PBI 00047080) (BPBM).

OTHER SPECIMENS EXAMINED: **PAPUA NEW GUINEA: MOROBE PROVINCE:** Bulldog road, S of Wau, 2550 m, 28 May 1976, W.C. Gagne, 1♂ (AMNH_PBI 00047082) (BPBM). Mount Kaindi, 7.35°S 146.68333°E, 2300 m, 19 May 1977, W.C. Gagne, 1♀ (AMNH_PBI 00047081) (BPBM). Mt. Missim, 7.1167°S 146.9167°E, 1600 m, 29 Jun 1976, W.C. Gagne, 1♀ (AMNH_PBI 00047101) (BPBM). Saruwaged Mts, Bandong, 6.23663°S 147.08451°E, 1250 m, 01 Jun 1979, W.C. Gagne, 1♂ (AMNH_PBI 00047083) (BPBM).

Diagnosis

Candidomiris albomaculata is recognised by the following combination of characters: dorsum black with white marking posterior to the apex of the clavus (Fig. 51a); labium extending to abdominal s2-s3; proxyphus rugulose, flat; clypeus posteroventrally oriented (Fig. 52c); sparse distribution of setae on dorsal surface of head (Fig. 52); proxyphus densely covered in microtrichia; cuneus ca 2x longer than wide (Fig. 52f); ventral projection of pygophore broad and dome-shaped; right paramere simple, weakly curved; two endosomal lobal sclerites present, extending beyond phallotheca at rest; dorsal endosomal lobal sclerite elongate, apically incrassate with several small teeth.

Description

COLOURATION: Shiny, mostly yellow with brown markings (Fig. 51a). ***Head:*** clypeus yellow; frons light brown; vertex yellow with light brown line medially; mandibular and maxillary plates and genae pale yellow; bucculae pale yellow anteriorly,

light brown posteriorly; gula light brown. ***Antennae:*** AI yellow; AII-AIV brown. ***Labium:*** pale yellow. ***Pronotum:*** anterior lobe dark brown to black, calli sometimes yellow; posterior lobe yellow to light brown sometimes with fuscous midline. ***Thoracic venter:*** mostly light brown to black, medial sulcus white; evaporative area of metathoracic gland white. ***Scutellum:*** yellow, black or yellow with black markings. ***Metathoracic glands:*** evaporative area pale grey. ***Hemelytra:*** translucent with a distinct white mark anterior to the membrane; sometimes brown markings on the clavus; embolium, cuneal margins and membrane veins brown. ***Legs:*** pale yellow, sometimes brown markings on metafemora. ***Abdomen:*** patterned yellow and fuscous.

VESTITURE AND TEXTURE: Sparsely distributed microtrichia and hair-like setae (Fig. 52). ***Head:*** very sparse distribution of semi-erect, hair-like setae (Fig. 52a). ***Antennae:*** AI with sparse, erect, hair-like setae; AII-AIV with dense distribution of short, erect, hair-like setae. ***Pronotum:*** (Fig. 52c) collar rugulose, otherwise smooth; sparsely covered in small, decumbent, hair-like setae and microtrichia. ***Thoracic venter:*** proxyphus with dense distribution of microtrichia; mesosternum smooth with line of minute setae adjacent to labium. ***Scutellum:*** (Fig. 52e) smooth; sparsely covered in small, decumbent, hair-like setae and microtrichia. ***Hemelytra:*** covered in large, decumbent, hair-like setae. ***Legs:*** femora sparsely covered in small, decumbent, hair-like setae; tibiae densely covered in small, decumbent, hair-like setae.

STRUCTURE: Body elongate-ovoid. ***Head:*** vertex with sulcate midline (Fig. 52a); bucculae broad, strongly rounded with weak medial sinuation, not covering gula medially (Fig. 52b); eyes strongly rounded dorsally, elongate in lateral view, weakly reniform, extending ventrad to anterior margin of clypeus (Fig. 52c); clypeus vertical (Fig. 52c). ***Labium:*** reaching abdominal s2-s3. ***Pronotum:*** (Fig. 52d) collar pronounced; foveae absent; anterior lobe transversely weakly convex, with weakly

developed calli, lateral margins weakly convex, rectilinear posteriorly; posterior lobe strongly declivent towards head, lateral margins strongly divergent posteriorly, posterior margin weakly concave medially. ***Thoracic venter:*** proxyphus depressed, triangular. ***Scutellum:*** (Fig. 52e) weakly convex; pair of foveae present at anterolateral angles; lateral margins serrate; mesoscutum raised. ***Hemelytra:*** costal margins concave; cuneus ca. 2x longer than wide, medial margin straight. ***Legs:*** femora metafemora and metatibiae greatly elongate. ***Male Genitalia:*** (based on Carvalho 1987); genital opening of pygophore simple, ovate, ventral projection broad, simple and dome-shaped. Left paramere sickle-shaped; sensory lobe incrassate with several small setae, blunt broad medial process, apophysis sinuate, apically chisel-shaped. Right paramere weakly curved, laterally flattened. Aedeagus with elongate ductus seminis; secondary gonopore elongate, reaching apex of phallotheca; dorsal endosomal lobal sclerite elongate, apically incrassate with several small teeth, projecting from phallotheca at rest; endosomal membrane bilobed.

Measurements

See Table 7.

Distribution

Known from a few localities in Morobe Province, Papua New Guinea, and a single specimen from the Eastern Highlands (Fig.53).

Biology and plant associations

Two specimens were collected on *Poikilogyne* sp. (Melastomataceae), one specimen was collected on an unidentified Urticaceae, and one specimen was collected on *Saurauia* sp. (Actinidiaceae).

Remarks

Candidomiris albomaculata most closely resembles *C. clavatasclerita, C. cyrtandraphila, C. missimensis* and *C. parasponius*. It is one of three species of *Candidomiris* (also *C. clavatasclerita* and *C. parasponius*) with a strongly clavate dorsal endosomal lobal sclerite. It is most readily recognised from the latter species by the dorsum black with white markings posterior to the apex of the clavus, cuneus ca. 2x longer than wide, and the ventral projection of the pygophore broad and dome-shaped.

The description of the male genitalia is based on the illustration of Carvalho (1987). I have applied my own terminology to his illustrations (see materials and methods for terminology).

***Candidomiris clavatasclerita* sp. nov.**

Habitus, Figure 51b. Distribution, Figure 53. SEMs Figure 54. Male genitalia Figure 55. Female genitalia, Figure 56 a,b.

Etymology

Named for it clavate-shaped dorsal endosomal lobal sclerite; noun in apposition.

Materials examined

HOLOTYPE: **PAPUA NEW GUINEA: WEST SEPIK PROVINCE:** Sandaun, Feramin, 1500 m, 13 Jul 1976, W.C. Gagne, *Macropiper* sp. (Piperaceae), 1♂ (AMNH_PBI 00047094) (BPBM).

PARATYPES: **INDONESIA: WEST PAPUA:** Waris, S of Hollandia, 3.21028°S 140.88556°E, 450 m, 16 Aug 1959-23 Aug 1959, T.C. Maa, ex Urticaceae, 1♂ (AMNH_PBI 00047100) (BPBM). **PAPUA NEW GUINEA: MOROBE PROVINCE:** Mt. Missim, 7.1167°S 146.9167°E, 1600 m, 29 Jun 1976, W.C. Gagne, 1♂ (AMNH_PBI 00047097) (BPBM). SW slope of Mt. Missim nr. Bulolo Gorge, 1100 m,

05 Sep 1971, W.C. Gagne, (Urticaceae), 1♂ (AMNH_PBI 00047098) (BPBM). Wau, 7.3333°S 146.71667°E, 1300 m, 15 Jun 1961, J.L. Gressitt, ex Urticaceae, 1♀ (AMNH_PBI 00047099) (BPBM). **WEST SEPIK PROVINCE [Sandaun]:** Feramin, 1500 m, 14 Jul 1976, W.C. Gagne, 1♀ (AMNH_PBI 00047096) (BPBM); 13 Jul 1976, W.C. Gagne, ex *Micropiper* sp. (Piperaceae), 1♂ (AMNH_PBI 00047095) (BPBM).

Diagnosis

Candidomiris clavatasclerita is recognised by the following combination of characters: dorsum black with white markings posterior to claval commissure (Fig. 51b); head with sparse distribution of setae (Fig. 54a); labium extending to abdominal s2; proxyphus flat, rugulose, densely covered in microtrichia; cuneus ca. 3x longer than wide (Fig. 54f); ventral projection of pygophore broad, simple and dome-shaped (Fig. 55a); left paramere sickle-shaped (Fig. 55b), with an acute medial process, apophysis sinuate; right paramere (Fig. 55c) small and flattened, weakly curved; phallotheca (Fig. 55d) with dorso-apical opening; dorsal endosomal (Fig. 55d) lobal sclerite apically strongly clavate, extending beyond opening of phallotheca at rest; blade-like apical endosomal lobal sclerites.

Description

COLOURATION: Body mostly stramineous (Fig. 51b). ***Head:*** mostly stramineous, sometimes mottled in stramineous and black. ***Antennae:*** mostly stramineous; AII fuscous apically. ***Pronotum:*** stramineous. ***Scutellum:*** stramineous. ***Thoracic venter:*** pleura fuscous, thoracic sterna stramineous. ***Metathoracic glands:*** evaporative area pale grey. ***Hemelytra:*** translucent with faint brown markings; clavus stramineous; membrane veins brown. ***Legs:*** pale grey. ***Abdomen:*** stramineous or fuscous.

VESTITURE AND TEXTURE: Sparsely distributed microtrichia and hair-like setae (Fig. 54). ***Head:*** (Fig. 54a) sparsely distributed semi-erect, hair-like setae; finely

rugulose, smooth around eyes dorsally. ***Antennae:*** AI sparsely distributed semi-erect, hair-like setae; AII-AIV with dense distribution of erect, hair-like setae. ***Pronotum:*** (Fig. 54d) with very few small, hair-like setae; posterior lobe finely rugulose. ***Scutellum:*** (Fig. 54e) smooth, glabrous. ***Thoracic venter:*** proxyphus finely rugulose, densely covered in densely matted microtrichia. ***Hemelytra:*** elongate, erect, hair-like setae and dense distribution of microtrichia. ***Legs:*** mostly with dense distribution of short hair-like setae; tibiae with thick, dark setae.

STRUCTURE: Body elongate-ovoid (Fig. 51b). ***Head:*** vertex with sulcate midline (Fig. 54a); bucculae broad, strongly ovate with weak medial sinuation, not covering gula medially (Fig. 54b); eyes strongly ovate dorsally, elongate in lateral view, extending ventrad to anterior margin of clypeus (Fig. 54c); clypeus vertical (Fig. 54c). ***Labium:*** extending to abdominal s2. ***Pronotum:*** (Fig. 54d) collar pronounced; foveae absent; anterior lobe rectangulate, lateral margins weakly convex; posterior lobe declivent towards head, anterior margin straight, lateral margins weakly rounded, posterior margin weakly convex. ***Thoracic venter:*** proxyphus weakly depressed. ***Scutellum:*** (Fig. 54e) weakly convex; pair of foveae present at anterolateral angles; lateral margins serrate; mesoscutum raised. ***Hemelytra:*** costal margins straight; cuneus ca. 3x longer than wide, medial margin curved. ***Legs:*** metafemora and metatibiae greatly elongate. ***Male Genitalia:*** genital opening of pygophore simple, oval, ventral projection broad and dome-shaped (Fig. 55a). Left paramere (Fig. 55b) sickle-shaped; sensory lobe reduced, weakly swollen, with several small setae and a short thick medial process; apophysis weakly sinuate, with a recurved apex. Right paramere (Fig. 55b) flattened, weakly curved. Aedeagus (Fig. 55d) with phallotheca opening dorso-apically; secondary gonopore elongate, reaching apex of phallotheca at rest; dorsal endosomal lobal sclerite present, strongly clavate apically, extending beyond opening of

phallotheca; apical endosomal lobal sclerite broad and flattened; endosomal membrane bilobed. ***Female genitalia:*** (Figs 56a,b) subgenital plate rectangulate, tapering apically; interramal lobes divergent from midline with broad apex; with spine-like texture.

Measurements

See Table 7.

Distribution

Known only from Morobe Province, Papua New Guinea Fig. 53.

Biology and plant associations

Several specimens are associated with plant species belonging to the family Urticaceae.

Remarks

See remarks section of *Candidomiris albomaculata.*

Candidomiris clavatasclerita is most readily recognised from other members of the genus by its stramineous colouration, cuneus ca. 3x longer than wide, and the ventral projection of the pygophore broad and dome-shaped.

Candidomiris cyrtandraphila **sp. nov.**

Habitus, Figure 51c. Distribution, Figure 53.

Etymology

Named for its association with the plant genus *Cyrtandra*; noun in apposition.

Materials examined

HOLOTYPE: **PAPUA NEW GUINEA: WEST SEPIK PROVINCE:** Sandaun, Bolfaim, 8 km E of Feramin, 2300 m, 03 Jul 1976-10 Jul 1976, W.C. Gagne, ex *Cyrtandra* sp. (Gesneriaceae), 1♂ (AMNH_PBI 00046217) (BPBM).

PARATYPES: **PAPUA NEW GUINEA: NEW BRITAIN PROVINCE:** Vunabakan, 10 Km East of Keravat., 4.35861°S 152.13861°E, 180 m, 16 Nov 1959-20 Nov 1959, T.C.

Maa, 1♂ (AMNH_PBI 00046216) (BPBM). **WEST SEPIK PROVINCE:** Sandaun, Bolfaim, 8 km E of Feramin, 5.11667°S 141.7°E, 2300 m, 03 Jul 1976-10 Jul 1976, W.C. Gagne, ex *Cyrtandra* sp. (Gesneriaceae), 1♀ (AMNH_PBI 00046218) (BPBM).

Diagnosis

Candidomiris cyrtandraphila is recognised by the following combination of characters: dorsum stramineous, lacking markings (Fig. 51c); labium extending to abdominal s2; proxyphus lacking microtrichia; cuneus ca. 2x wide (Fig. 57e); proxyphus rugulose; clypeus posteroventrally oriented; dorsal surface of head without setae (Fig. 57a).

Description

COLOURATION: Generally black with yellow markings (Fig. 51c). ***Head:*** clypeus black and yellow; frons black; vertex black; antennal tubercle pale grey with red stripe; mandibular plate yellow; maxillary plate black; bucculae black; eyes black. ***Antennae:*** AI yellow; AII-AIV black. ***Labium:*** pale yellow. ***Pronotum:*** collar yellow, anterior lobe black or yellow, posterior lobe yellow. ***Thoracic venter:*** yellow, mottled with black on lateral margins. ***Scutellum:*** black or yellow. ***Metathoracic glands:*** evaporative area white. ***Hemelytra:*** translucent, veins brown. ***Legs:*** pale grey. ***Abdomen:*** yellow to pale yellow mottled with black.

VESTITURE AND TEXTURE: Sparse distribution of microtrichia and hair-like setae (Fig. 57). ***Head:*** (Fig. 57a) smooth, glabrous dorsally, sparse distribution of small, hair-like setae along margins of eyes. ***Antennae:*** setae very sparse. ***Pronotum:*** (Fig. 57c) smooth, very sparse distribution of hair-like setae; sparse distribution of minute microtrichia. ***Thoracic venter:*** proxyphus coarsely rugulose, dense distribution of matted microtrichia. ***Scutellum:*** (Fig. 57d) rugulose; with minute, erect, hair-like setae;

very sparse distribution of microtrichia. ***Hemelytra:*** semi-erect, hair-like setae present; dense distribution of microtrichia. ***Legs:*** dense distribution of short, hair-like setae; tibiae with dense distribution of thick, dark setae.

STRUCTURE: Body shape elongate-ovoid (Fig. 51c). ***Head:*** vertex with sulcate midline (Fig. 57a); bucculae broad, strongly ovate with weak medial sinuation, not covering gula medially (Fig. 57b); eyes strongly ovate dorsally, reniform, extending ventrad to anterior margin of clypeus; clypeus posteroventrally oriented (Fig. 57b). ***Labium:*** extending to s2. ***Pronotum:*** (Fig. 57c) collar pronounced; foveae absent; anterior lobe transversely strongly convex, with weakly developed calli, lateral margins weakly convex, rectilinear posteriorly; posterior lobe strongly declivent towards head, lateral margins strongly divergent posteriorly, posterior margin straight. ***Thoracic venter:*** proxyphus; scent gland. ***Scutellum:*** (Fig. 57d) weakly convex; pair of foveae present at anterolateral angles; lateral margins weakly serrate; mesoscutum raised. ***Hemelytra:*** costal margins weakly convex; cuneus ca. 2x longer than wide, medial margin weakly curved. ***Legs:*** metafemora and metatibiae greatly elongate.

Male and female genitalia not investigated.

Measurements

See Table 7.

Distribution

Known from New Britain and West Sepik Province, Papua New Guinea (Fig. 53).

Biology and plant associations

Two specimens were collected from a *Cyrtandra* sp. (Gesneriaceae). A singleton was collected from a *Ficus* sp. (Moraceae)

Remarks

See remarks section of *Candidomiris albomaculata.*

The characters that are unique to *Candidomiris cyrtandraphila* and distinguishes it from all its cogeners are the dorsum being stramineous and lacking markings, the cuneus ca. 2x longer than wide, and the clypeus posteroventrally oriented.

***Candidomiris macropiper* sp. nov.**

Habitus, Figure 51d. Distribution, Figure 53. Female genitalia Figure 54c,d. SEMs Figure 57. Male genitalia, Figure 58.

Etymology

Named after the plant genus *Macropiper,* from which the holotype and one paratype were collected.

Materials examined

HOLOTYPE: **PAPUA NEW GUINEA: WEST SEPIK PROVINCE:** Sandaun, Feramin, 1500 m, 13 Jul 1976, W.C. Gagne, ex *Macropiper* sp. (Piperaceae), 1♂ (AMNH_PBI 00046201) (BPBM).

PARATYPES: **PAPUA NEW GUINEA: MOROBE PROVINCE:** Kaisenik Rd, Wau Subdistrict, 7.38012°S 146.77817°E, 1100 m, 26 Mar 1978, W.C. Gagne, ex *Parasponia* sp. (Ulmaceae), 1♂ (AMNH_PBI 00053268) (BPBM). Saruwaged Mts: 'Umbang', 1700 m, 03 Jul 1979, W.C. Gagne, ex *Saurauia* sp. (Actinidiaceae), 1♀ (AMNH_PBI 00046203), 1♂ (AMNH_PBI 00046204) (BPBM). **WEST SEPIK PROVINCE:** Sandaun, Feramin, 1500 m, 13 Jul 1976, W.C. Gagne, ex *Macropiper* sp. (Piperaceae), 1♂ (AMNH_PBI 00046200), 1 sex unknown (AMNH_PBI 00046202) (BPBM).

Diagnosis

Candidomiris macropiper is recognised by the following combination of characters: dorsum stramineous with yellow to dark brown markings on the hemelytral veins (Fig. 51d); cuneus <2.5x longer than wide; clypeus posteroventrally oriented (Fig. 57b);

labium extending to abdominal s2; dorsal surface of head with sparsely distributed setae (Fig. 57a); proxyphus smooth, lacking microtrichia; ventral projection of pygophore broad, dorsoventrally flattened and dome-shaped (Fig. 58a); left paramere r-shaped (Fig. 58b); four endosomal lobal sclerites present (2 dorsal and 2 ventral) (Fig. 58d); endosomal membranous bag bilobed (Fig. 58d).

Description

COLOURATION: Body mostly stramineous (Fig. 51d). ***Head:*** entirely stramineous. ***Antennae:*** AI stramineous; AII-AIV fuscous. ***Labium:*** pale grey. ***Pronotum:*** stramineous, sometimes with red or black markings on lateral margins of anterior lobe; small brown spots on posterior lobe. ***Thoracic venter:*** mostly stramineous. ***Scutellum:*** yellow to dark brown, sometimes mottled with red. ***Metathoracic glands:*** evaporative area white with minute black markings. ***Hemelytra:*** transparent, embolium and cuneal boundaries with brown markings. ***Legs:*** pale white to light brown, brown markings proximally on metafemora. ***Abdomen:*** pale grey; lateral margins of sternites sometimes fuscous or red basally; genital segments in females fuscous.

VESTITURE AND TEXTURE: Body with sparsely distributed microtrichia and hair-like setae (Fig. 57). ***Head:*** (Fig. 57a) dorsal surface with few, hair-like setae; genae with sparse distribution of semi-erect, hair-like setae. ***Antennae:*** dense distribution of semi-erect, hair-like setae. ***Pronotum:*** (Fig. 57c) smooth, almost glabrous, with only a few short, hair-like setae present. ***Thoracic venter:*** proxyphus smooth, with sparse distribution of microtrichia; mesosternum finely rugulose. ***Scutellum:*** (Fig. 57d) weakly rugulose, setae mostly absent. ***Hemelytra:*** setae decumbent, hair-like; uniformly covered in microtrichia. ***Legs:*** femora with sparse distribution of erect, hair-like setae and microtrichia; tibiae with dense distribution of microtrichia.

STRUCTURE: Body elongate-ovoid (Fig. 51d). ***Head:*** vertex with sulcate midline (Fig. 57a); bucculae broad, strongly ovate with weak medial sinuation, not covering gula medially (Fig. 57b); eyes ovoid dorsally, reniform laterally, extending ventrad to anterior margin of clypeus (Fig. 57b); clypeus strongly posteroventrally oriented (Fig. 57b). ***Labium:*** extending to abdominal s2. ***Pronotum:*** (Fig. 57c) collar weakly developed; foveae absent; anterior lobe strongly convex transversely, with weakly developed calli, lateral margins weakly convex, rectilinear posteriorly; posterior lobe strongly declivent towards head, lateral margins strongly divergent posteriorly, posterior margin weakly convex. ***Thoracic venter:*** proxyphus depressed. ***Scutellum:*** (Fig. 57d) pair of foveae present at anterolateral angles; lateral margins serrate; mesoscutum raised. ***Hemelytra:*** costal margins almost straight, broadened at cuneus; cuneus ca. 2-2.5x longer than wide, medial margin curved (Fig. 57e). ***Legs:*** gracile, elongate; femora weakly incrassate. ***Male Genitalia:*** genital opening of pygophore oval, ventral projection broad, dorsoventrally flattened and dome-shaped (Fig. 58a). Left paramere (Fig. 58b) r-shaped; sensory lobe swollen; apophysis straight, apex blunt. Right paramere (Fig. 58c) sickle-shaped (not illustrated). Aedeagus (Fig. 58d) with phallotheca opening dorsally; genital opening with supragenital plate; ductus seminis short; secondary gonopore elongate and strongly sclerotised apically; two dorsal endosomal lobal sclerites present, DELS1 long and flattened; DELS2 small, and more laterally positioned; two ventral endosomal sclerites present; endosomal membrane unilobed. ***Female genitalia:*** (Figs 56b,c) subgenital plate triangular with strongly explanate lateral margins; interramal lobes straight, medially constricted with minute scale-like texturing.

Measurements

See Table 7.

Distribution

Known from Morobe and West Sepik provinces, Papua New Guinea (Fig. 53).

Biology and plant associations

Three specimens were collected from an unidentified species of *Macropiper.* Also, singletons were collected from unidentified species of *Saurauia* and *Parasponia*.

Remarks

Candidomiris macropiper most closely resembles *C. parasponius* due to them both having an overall stramineous appearance. The lack of microtrichia on the proxyphus of *C. macropiper* is the most readily recognised difference between the two species. In addition, the male genitalia of *C. macropiper* has four endosomal lobal sclerites, including two ventral sclerites, which are not present in any other species of *Candidomiris*.

***Candidomiris missimensis* sp. nov.**

Habitus, Figure 51e. Distribution, Figure 53. SEMs, Figure 59.

Etymology

Named after the type location.

Materials examined

HOLOTYPE: **PAPUA NEW GUINEA: MOROBE PROVINCE:** Mt. Missim, 7.1167°S 146.9167°E, 1600 m, 26 Jun 1976, W.C. Gagne, 1♀ (AMNH_PBI 00046199) (BPBM).

PARATYPES: **PAPUA NEW GUINEA: WEST SEPIK PROVINCE [SANDAUN]:** Bolfaim, 8 km E of Feramin, 5.11667°S 141.7°E, 2300 m, 03 Jul 1976 - 10 Jul 1976, W. C. Gagne, *Cyrtandra* sp. (Gesneriaceae), 1 ♀ (AMNH_PBI 00053272) (BPBM). **WESTERN HIGHLANDS:** Waghi to Jimi Divide, 2200 m, 13 Feb 1978, J. L. Gressitt, *Ficus* sp. (Moraceae), 1 sex unknown (AMNH_PBI 00046198) (BPBM).

Diagnosis

Candidomiris missimensis is recognised by the following combination of characters: dorsal surface black, intermixed with brown markings (Fig. 51e); cuneus <2.5x longer than wide; clypeus posteroventrally oriented (Fig. 59b); bucculae keyhole-shaped (Fig. 59b); labium extending to abdominal s2-s3; dorsal surface of head with sparse distribution of setae; proxyphus lacking microtrichia, smooth.

Description

COLOURATION: Body mostly black with grey and yellow markings (Fig. 51e). ***Head:*** vertex and frons fuscous with variable yellow markings. ***Antennae:*** AI pale grey, AII-AIII black, AIV lost in all specimens. ***Pronotum:*** collar yellow; anterior lobe black, sometimes yellow anteriorly; posterior lobe pale grey, sometimes black mottled with yellow. ***Thoracic pleura and sterna:*** black. ***Scutellum:*** brown. ***Metathoracic glands:*** evaporative area fuscous. ***Hemelytra:*** pale grey, with indistinct light to dark brown markings. ***Legs:*** pale grey. ***Abdomen:*** pale grey, sometimes with brown markings.

VESTITURE AND TEXTURE: Body sparsely distributed with microtrichia and hair-like setae (Fig. 59). ***Head:*** mostly with sparse distribution of erect, hair-like setae; gula weakly rugulose (Fig. 59a). ***Antennae:*** setae semi-erect; AI setae sparsely distributed, with a few bristle-like setae; AII-AIV with dense distribution of short, hair-like setae. ***Pronotum:*** (Fig. 59c) uniformly smooth; sparse distribution of short, decumbent, hair-like setae and microtrichia. ***Thoracic venter:*** coarsely rugulose; hair-like setae and microtrichia absent. ***Scutellum:*** (Figs 59d) sparse distribution of small, decumbent, hair-like setae and microtrichia. ***Hemelytra:*** uniform distribution of large, decumbent, hair-like setae. ***Legs:*** femora with sparse distribution of short, decumbent, hair-like setae; tibiae with dense distribution of short, decumbent setae.

STRUCTURE: Body elongate-ovoid (Fig. 51e). ***Head:*** (Fig. 59a) vertex with sulcate midline; bucculae comparatively narrow, keyhole-shaped, covering gula medially (Fig. 59b); eyes oval dorsally, elliptical laterally, extending ventrad to anterior margin of clypeus (Fig. 59b); clypeus posteroventrally oriented (Fig. 59b). ***Labium:*** extending to abdominal s2-s3. ***Pronotum:*** (Fig. 59c) collar pronounced; foveae absent; anterior lobe strongly convex transversely, with weakly developed calli, lateral margins weakly convex, linear posteriorly; posterior lobe strongly declivent towards head, lateral margins strongly divergent posteriorly, posterior margin weakly convex. ***Thoracic venter:*** proxyphus depressed. ***Scutellum:*** (Fig. 59d) weakly convex; pair of foveae present at anterolateral angles; lateral margins weakly serrate; mesoscutum weakly raised. ***Hemelytra:*** costal margins weakly sinuate, weakly emarginate posteriorly; cuneus ca. 2.5x longer than wide, medial margin curved. ***Legs:*** metafemora and metatibiae greatly elongate.

Male and female genitalia not investigated.

Measurements

See Table 7.

Distribution

Known from Morobe and West Sepik provinces of Papua New Guinea (Fig. 53).

Biology and plant associations

Only three specimens are known, one with no host records, one collected from *Cyrtandra* and one collected from *Ficus.*

Remarks

See remarks section of *Candidomiris albomaculata.*

Candidomiris missimensis is most easily distinguished form its congeners by the dorsum being black with brown markings, the cuneus is <2.5x longer than wide, and the bucculae are keyhole-shaped.

Candidomiris parasponius sp. nov.

Habitus, Figure 52f. Distribution, Figure 53. Female genitalia, Figure 54 e,f. SEMs, Figure 60. Male genitalia, Figure 61.

Etymology

Named for the plant genus *Parasponia*, from which the holotype and one paratype were collected.

Materials examined

HOLOTYPE: **PAPUA NEW GUINEA: MOROBE PROVINCE:** Kaisenik Rd, Wau Subdistrict, 7.38012°S 146.77817°E, 1100 m, 02 Mar 1978, W.C. Gagne, ex *Parasponia* sp. (Ulmaceae), 1♂ (AMNH_PBI 00046162) (BPBM).

PARATYPES: **PAPUA NEW GUINEA: EASTERN HIGHLANDS PROVINCE:** Daulo Pass, 20 Aug 1956-22 Aug 1956, T. E. Woodward, 1 sex unknown (AMNH_PBI 00192991) (UQIC). **MOROBE PROVINCE:** Kaisenik Rd, Wau subdistrict, 7.38012°S 146.77817°E, 1100 m, 02 Mar 1978, W.C. Gagne, ex *Parasponia* sp. (Ulmaceae), 5♂♂ (AMNH_PBI 00046163, AMNH_PBI 00046185-AMNH_PBI 00046188) ex *Parasponia* sp. (Ulmaceae), 1♂ (AMNH_PBI 00046161) (BPBM).

Diagnosis

Candidomiris parasponius is recognised by the following combination of characters: dorsum stramineous with brown markings (Fig. 51f); dorsal surface of head with sparse distribution of hair-like setae (Fig. 60); clypeus ventrally oriented (Fig. 60b); proxyphus densely covered in microtrichia; labium extending to abdominal s2-s3; cuneus ca. 3x

longer than wide; ventral projection of pygophore broad (Fig. 61a); left paramere r-shaped, with chisel-like apex (Fig. 61b); right paramere c-shaped (Fig. 61c); apical endosomal lobal sclerite elongate and recurved (Fig. 61d); dorsal endosomal lobal sclerite strongly spoon-like apically (Fig. 61d).

Description

COLOURATION: Mostly stramineous with black markings (Fig. 51f). ***Head:*** frons black; vertex stramineous; mandibular and maxillary plates stramineous; clypeus black; bucculae stramineous; eyes black. ***Antennae:*** AI stramineous; AII-AIV stramineous or fuscous. ***Pronotum:*** anterior lobe stramineous, black markings posterolaterally; posterior lobe stramineous; thoracic pleura stramineous. ***Thoracic venter:*** proxyphus stramineous; mesosternum pale grey; metasternum stramineous. ***Scutellum:*** black to fuscous. ***Metathoracic glands:*** evaporative area pale grey. ***Hemelytra:*** transparent, with brown markings bounding membrane veins. ***Legs:*** coxae pale grey; femora pale grey proximally, stramineous apically; tibiae stramineous. ***Abdomen:*** pale stramineous; lateral margins of abdominal s2 black; abdominal terga dark brown or stramineous; pygophore dark brown.

VESTITURE AND TEXTURE: Sparsely distributed microtrichia and small, hair-like setae (Fig. 60). ***Head:*** sparse distribution of small, semi-erect, hair-like setae (Fig. 60a); vertex rugulose posteriorly (Fig. 60a); gula, genae and bucculae rugulose (Fig. 61b). ***Antennae:*** AI weakly rugulose; sparse distribution of hair-like setae; AII-AIV with dense distribution of hair-like setae. ***Pronotum:*** smooth; very sparse distribution of small, hair-like setae. ***Thoracic venter:*** proxyphus coarsely rugulose; dense distribution of microtrichia. ***Scutellum:*** (Fig. 61d) very sparse distribution of small, hair-like setae. ***Hemelytra:*** very sparse distribution of small, hair-like setae. ***Legs:*** femora with sparse

distribution of small, hair-like setae; tibiae with small, semi-erect, hair-like setae intermixed with large, erect, bristle-like setae.

STRUCTURE: Body elongate-ovoid (Fig. 51f). ***Head:*** vertex with sulcate midline (Fig. 60a); bucculae broad, with weak medial sinuation, not covering gula medially (Fig. 60c); clypeus ventrally oriented (Fig. 60b); eyes strongly ovate dorsally, reniform, extending ventrad to anterior margin of clypeus (Fig. 60b). ***Labium:*** extending to abdominal s2-s3. ***Pronotum:*** collar weakly pronounced; foveae absent; anterior lobe transversely convex, with weakly developed calli, lateral margins weakly convex, rectilinear posteriorly; posterior lobe declivent towards head, lateral margins strongly divergent posteriorly, posterior margin strongly convex. ***Thoracic venter:*** proxyphus depressed. ***Scutellum:*** (Fig. 60d) pair of foveae present at anterolateral angles; lateral margins weakly serrate; mesoscutum raised. ***Hemelytra:*** costal margins straight; cuneus ca. 3x longer than wide, medial margin straight. ***Legs:*** coxae large; hind legs elongate, subequal to body length; metafemora incrassate. ***Male Genitalia:*** genital opening of pygophore oval, ventral projection broad (Fig. 61a). Left paramere (Fig. 61b) r-shaped; sensory lobe weakly incrassate with several setae; apophysis strongly almost straight, chisel-like apex. Right paramere (Fig. 61c) c-shaped. Aedeagus (Fig. 61d) with phallotheca opening apically; ductus seminis and secondary gonopore elongate, latter reaching beyond apex of phallotheca; dorsal endosomal lobal sclerite strongly clavate apically, margins weakly serrate, projecting from phallotheca at rest; apical endosomal sclerite elongate, laterally flattened, with weakly serrate margins, strongly projecting beyond phallotheca at rest; endosomal membrane bilobed. ***Female genitalia:*** (Figs 56e,f) subgenital plates small, triangular; interramal lobes broad and bifurcate apically, with scale-like texture.

Measurements

See Table 7.

Distribution

Morobe and Central Highlands provinces, Papua New Guinea (Fig. 53).

Biology and plant associations

Seven species were collected from an unidentified species of *Parasponia* (Cannabaceae). It is assumed to be its host plant based on the relatively high number of specimens collected on this plant.

Remarks

See remarks section in *Candidomiris albomaculata.*

Candidomiris parasponius lacks the distinctive white marking medially on the hemelytra, which is typical of the genus, and has a more elongate cuneus. The male genitalia is distinctive, with a spoon-like dorsal endosomal spicule and a strongly projecting apical endosomal lobal sclerite.

***Candidomiris sinuata* sp. nov.**

Habitus, Figure 51g. Distribution, Figure 53. SEMs, Figure 62. Male genitalia, Figure 63.

Etymology

Named for its sinuate parameres.

Materials examined

HOLOTYPE: **PAPUA NEW GUINEA: MOROBE PROVINCE:** Mount Kaindi, 7.35°S 146.68333°E, 2300 m, 17 Apr 1977, W.C. Gagne, ex *Rubus archboldianus* Merr. and L.M. Perry (Rosaceae), 1♂ (AMNH_PBI 00046254) (BPBM).

PARATYPES: **PAPUA NEW GUINEA: MOROBE PROVINCE:** Mount Kaindi, 7.35°S 146.68333°E, 2350 m, 01 Mar 1971, J.L. Gressitt, ex *Nothofagus carri* Steen (Nothofagaceae), 1♀ (AMNH_PBI 00046256) (BPBM). Mount Kaindi, 7.35°S 146.68333°E, 2300 m, 17 Apr 1977, W.C. Gagne, ex *Rubus archboldianus* Merr. and L.M. Perry ex Rosaceae, 1♂ (AMNH_PBI 00046254) (BPBM); 26 Mar 1977, J.L. Gressitt, ex *Macaranga* sp. (Euphorbiaceae), 1♂ (AMNH_PBI 00046257) (BPBM). Mt. Por, 2300 m, 02 Dec 1979-03 Dec 1979, J.L. Gressitt, 1♂ (AMNH_PBI 00046258) (BPBM). Wau, 7.3333°S 146.71667°E, 1200 m, 01 Jan 1979-31 Dec 1979, W.C. Gagne, 1♀ (AMNH_PBI 00046255) (BPBM).

Diagnosis

Candidomiris sinuata is recognised by the following combination of characters: dorsum black (Fig. 51g); cuneus ca. <2.5x longer than wide; proxyphus rugulose, flat; clypeus posteroventrally oriented (Fig. 62b); proxyphus densely covered in microtrichia (Fig. 63a); dorsum with a few setae only; ventral projection of pygophore broad, short and dorsoventrally flattened (Fig. 63a); left paramere (Fig. 63b) r-shaped, with large apical hook; right paramere (Fig. 63c) spoon-shaped; phallotheca opening apically (Fig. 63d); endosomal without sclerotisation (Fig. 63d); secondary gonopore (Fig. 63d) greatly enlarged, projecting well beyond phallotheca.

Description

COLOURATION: Body mostly black (Fig. 51g). ***Head:*** frons, vertex, clypeus, maxillary and mandibular plates black; bucculae yellow; genae and gula yellow. ***Antennae:*** AI pale yellow proximally, black apically; AII-AIV black. ***Labium:*** yellow. ***Pronotum:*** anterior lobe yellow anteriorly, black posteriorly; posterior lobe black, sometimes with pair of pale yellow markings, posterior margin white. ***Thoracic venter:*** black. ***Scutellum:*** black. ***Metathoracic glands:*** evaporative area pale grey. ***Hemelytra:***

black with translucent area medially and anterior to cuneus; membrane translucent. ***Legs:*** pale yellow to grey. ***Abdomen:*** venter black laterally, white medially.

VESTITURE AND TEXTURE: Body with sparsely distributed microtrichia and hair-like setae (Fig. 62). ***Head:*** (Fig. 62a) with a few semi-erect, hair-like setae only; sparse distribution of microtrichia. ***Antennae:*** sparse distribution of short, hair-like setae and microtrichia. ***Pronotum:*** (Fig. 62d) uniformly smooth; with a few very short, hair-like setae only. ***Thoracic venter:*** proxyphus with dense distribution of microtrichia; distinctly rugulose; meso- and metasternum with distinct striations. ***Scutellum:*** sparse distribution of short, hair-like setae; microtrichia absent. ***Hemelytra:*** sparse distribution of small, hair-like setae; microtrichia absent. ***Legs:*** femora with erect, elongate, hair-like setae; tibiae with thick, erect, hair-like setae intermixed with thin, semi-erect setae.

STRUCTURE: Body elongate-ovoid. ***Head:*** vertex with sulcate midline (Fig. 62a); bucculae broad, with weak medial sinuation, covering gula medially (Fig. 62c); eyes oval dorsally, extending ventrad to anterior margin of clypeus (Fig. 62b); clypeus straight (Fig. 62b). ***Labium:*** extending to abdominal s3. ***Pronotum:*** (Fig. 62d) collar well developed; foveae absent; anterior lobe transversely convex, with weakly developed calli, lateral margins convex, rectilinear posteriorly; posterior lobe strongly declivent towards head, lateral margins strongly divergent posteriorly, posterior margin sinuate. ***Thoracic venter:*** proxyphus pinched medially, broad posteriorly. ***Scutellum:*** weakly convex; pair of foveae present at anterolateral angles; lateral margins serrate; mesoscutum raised. ***Hemelytra:*** broad, costal margins weakly concave medially; cuneus ca. 2x longer than wide. ***Legs:*** coxae large; hind legs elongate, subequal to body length; metafemora incrassate. ***Male Genitalia:*** genital opening of pygophore oval, ventral projection broad, short and dorsoventrally flattened and dome-shaped (Fig. 63a). Left paramere (Fig. 63b) r-shaped, with sensory lobe moderately swollen; apophysis straight,

dorsally dentate, with apex strongly hooked. Right paramere (Fig. 62c) simple, weakly sinuate, setae absent. Aedeagus (Fig. 62d) with phallotheca opening apically; ductus seminis elongate; secondary gonopore greatly elongate, projecting well beyond apex of phallotheca, bounded with membrane.

Measurements

See Table 7.

Distribution

Known from Morobe and West Sepik provinces, Papua New Guinea (Fig. 53).

Biology and plant associations

Singletons were collected from *Nothofagus carri* (Nothofagaceae), and a *Macaranga* sp. (Euphorbiaceae). Two specimens were collected from *Rubus archboldianus* (Rosaceae).

Remarks

See remarks section in *Candidomiris macropiper.*

Candidomiris sinuata has a remarkable secondary gonopore, which is greatly elongate, and extending well beyond the phallotheca, and it is the most exaggerated of all those that I have investigated in the *Candidomiris-Morobea* complex.

Dimifacoris Carvalho

Dimifacoris Carvalho, 1987: 178 (original description); Schuh 1995: 104 (world catalogue).

Type species

Dimifacoris fasciatus Carvalho by original designation

Diagnosis

Dimifacoris can be distinguished by the following combination of characters: mostly glabrous (Figs 64a-e); colouration stramineous and/or green with contrasting markings (Figs 64a-e); costal margins of hemelytra straight (Figs 64a-e); head smooth (e.g. Fig. 65a); elongate, small eyes, not contiguous with the anterior margin of the pronotum in lateral view (e.g. Fig. 65b); AII and AIII not greatly elongate; narrow postocular region (e.g. Fig. 65b); pronotum campanulate with distinct lobes (e.g. Fig. 65d); posterior lobe of the pronotum finely rugulose (e.g. Fig. 72d); pygophore short (e.g. Fig. 66a); left paramere (e.g. Fig. 66b) r-shaped usually with scales or teeth apically; right paramere (e.g. Fig66c) elongate, straight with a clavate or textured apex; endosomal membrane complex (e.g. Fig. 66d); proximal endosomal spicule usually complex (e.g. Fig. 66d); apical endosomal sclerite usually absent (e.g. Fig. 66b); dentate interramal sclerite present (e.g. Fig. 67b).

Description

COLOURATION: Body mostly stramineous with green or fuscous markings, or green with brown or red markings (e.g. Fig. 64a). ***Head:*** colour stramineous with contrasting markings. ***Pronotum:*** bicoloured. ***Hemelytra:*** green to brown, usually with translucent areas.

VESTITURE AND TEXTURE: Body with sparse distribution of simple, decumbent hair-like setae, intermixed with microtrichia (e.g. Fig. 65). ***Antennae:*** dense distribution

of erect, hair-like setae. ***Pronotum:*** (e.g. Fig. 65d) anterior lobe smooth; posterior lobe very weakly rugulose. ***Prosternum:*** weakly rugulose or with scale-like texturing; sparse distribution of microtrichia. ***Hemelytra:*** sparse distribution of semi-erect, hair-like setae. ***Legs:*** dense distribution of semi-erect, hair-like setae; two rows of spinules usually present on tibiae.

STRUCTURE: Body elongate, gracile. ***Head:*** prognathous (e.g. Fig. 65b); frons and clypeus anterio-ventrally oriented, frons almost flat (e.g. Fig. 65b); about twice as wide as long in dorsal view (e.g. Fig. 65a); without medial sulcus (e.g. Fig. 65a); bucculae rounded, weakly produced ventrally (e.g. Fig. 65c); gula convex, long, reaching ½ length of head (e.g. Fig. 64b); eyes spherical in lateral view, contiguous or almost contiguous with anterior margin of pronotum (e.g. Fig. 65b); postocular region present, narrow (e.g. Fig. 65b). ***Antennae:*** AI greatly elongate, ca. 2x longer than head. ***Pronotum:*** (e.g. Fig. 65d) bilobed, with anterior lobe much shorter than posterior lobe; collar pronounced; calli present, widely separated; posterior lobe trapezoidal, lateral margins strongly divergent posteriorly, posterior margin rectilinear. ***Mesepimeron:*** (e.g. Fig. 65f) with evaporative bodies, spiracle weakly exposed. ***Metathoracic Gland:*** (e.g. Fig. 65f) peritreme short, tongue-like, weakly raised, laterally oriented; evaporative area occupying ca. ⅓ of metepisternum, peritreme not reaching dorsal margin of evaporative area. ***Hemelytra:*** margins straight (e.g. Fig.64a); ca. 2x longer than abdomen, cuneus ca. 1.5x longer than wide; cuneus medial margin straight. ***Legs:*** cursorial; coxae elongate; pretarsal claws with uniformly spaced minute striations; narrow at base. ***Male Genitalia:*** pygophore (e.g. Fig. 66a) small, almost symmetrical, lacking grooves, genital opening of pygophore terminal, with decumbent setae. Left paramere (e.g. Fig. 66b) sickle-shaped; with scale-like texturing, usually present dorsally. Right paramere (e.g. Fig. 66c) straight, narrow often incrassate apically or with scale-like texturing.

Aedeagus (e.g. Fig. 66d) complex, broad basally, narrow apically; phallotheca apically narrow, lacking lobes, phallotheca with dorsal opening; ductus seminis short and twisted, curved at 90º towards base; secondary gonopore elongate, twisted, ribbon-like; proximal endosomal spicule present; dorsal endosomal lobal sclerite present; apical endosomal sclerite absent; endosomal membrane bilobed.

Distribution

Dimifacoris is known from Cape York and the Atherton Tablelands in Australia and southern Papua New Guinea (Fig. 68).

Biology and plant associations

Dimifacoris species have been collected in heavily forested areas, particularly in rainforests, with most species occurring in north Queensland. Little is known of the host relationships of *Dimifacoris*.

Remarks

Dimifacoris shares a similar body form to *Flagellomiris* and both genera have complex dentate apical endosomal lobal sclerites. Phylogenetic analysis, however, indicates that these characters are symplesiomorphic.

Dimifacoris is best distinguished by the more gracile body, weakly developed postocular region and more elongate endosomal lobal sclerites.

Dimifacoris bifurcatus sp. nov.

Habitus, Figure 64a. SEMs, Figure 65. Male genitalia, Figure 66. Female genitalia, Figure 67a,b. Distribution, Figure 68.

Etymology

Named for the bifurcate apex of the proximal endosomal spicule.

Materials examined

HOLOTYPE: **AUSTRALIA: QUEENSLAND:** Wongabel State Forest, 17.332°S 145.47°E, 10 MAY 1967, D.H. Colless, 1♂ (UNSW_ENT 00026459) (UQIC).

PARATYPES: **AUSTRALIA: QUEENSLAND:** Bellenden Ker Range, 1 km S of Cable Tower 6, 17.16°S 145.53°E, 500 m, 03 Nov 1981, Earthwatch/QLD. Museum, 1♀ (UNSW_ENT 00026463) (QM). Dunbulla State Forest, 3km NW of Mobo Creek Crateron Dunbulla Forest Drive, 17.17055°S 145.62694°E, 27 Apr 1998, G. Cassis, 1♂ (AMNH_PBI 00021724), 1♀ (AMNH_PBI 00021725) (QM). Koombooloomba Dam, Upper Tully, 17.8353°S 145.605°E, 08 Dec 1989, Monteith, Thompson and Janetzki, 2♀♀ (UNSW_ENT 00026453, UNSW_ENT 00026454) (QM). Kuranda, 16.81722°S 145.635°E, 200 m, 12 Mar 1956, J.L. Gressitt, 1♂ (UNSW_ENT 00026457), 1♀ (UNSW_ENT 00026458) (UQIC). Kuranda Range State Forest, Black Mtn. Road, N. Qld, 16.7982°S 145.63964°E, 20 Apr 1967, D.H. Colless, 1 sex unknown (UNSW_ENT 00026464) (QM). Lake Barrine, 17.25472°N 145.63667°E, 530 m, 19 Apr 1964, J. Sedlacek, 1♂ (UNSW_ENT 00047038) (BPBM). Mt. Hypipamee National Park, "The Crater", 17.42389°S 145.48389°E, 25 Apr 1998, G. Cassis, ex *Dendrocnide excelsa* (Urticaceae), 2♀♀ (AMNH_PBI 00021722, AMNH_PBI 00021723) (QM). South of Ravenshoe. Evelyn Tableland, 17.63°N 145.49028°E, 350 m, 10 Mar 1956, J.L. Gressitt, 1♀ (UNSW_ENT 00047039) (BPBM). The Boulders, Babinda, 17.35°S 145.867°E, 10 May 1967, D.H. Colless, 1♂ (UNSW_ENT 00026465) (QM). Upper

Mulgrave River, 17.2167°S 145.9667°E, 30 Apr 1970, G. B. Monteith, 2♂♂ (UNSW_ENT 00026455, UNSW_ENT 00026456) (UQIC). Whitfield Ra. Forest Reserve, Cairns, 16.9333°S 145.7°E, 19 Apr 1967, D.H. Colless, 2♂♂ (UNSW_ENT 00026461, UNSW_ENT 00026462) (QM). Wongabel State Forest, 17.332°S 145.47°E, 10 May 1967, D.H. Colless, 1♂ (UNSW_ENT 00026460) (UQIC).

Diagnosis

Dimifacoris bifurcatus is recognised by the following combination of characters: body dull brown with green markings; scutellum rugulose, microtrichia absent; labium extending to metasternum; ventral projection of pygophore broad, short and dorsoventrally flattened; left paramere c-shaped, with bifurcate apex; right paramere narrow and straight, distally denticulate; proximal endosomal spicule narrow basally, with basal branch, bifurcate distally, branches denticulate.

Description

COLOURATION: Body mostly brown with green markings. ***Head:*** clypeus brown mottled with yellow; vertex yellow with brown line medially and posteriorly; mandibular plate yellow; maxillary plate brown; bucculae pale grey to light brown; gula and genae pale grey. ***Antennae:*** AI yellow proximally, fuscous posteriorly; AII-AIV fuscous. ***Pronotum:*** collar yellow, anterior lobe light brown, posterior lobe yellow, usually light brown to olive green posteriorly. ***Thoracic venter:*** yellow. ***Scutellum:*** yellow with indistinct brown marking medially. ***Metathoracic glands:*** evaporative area pale white. ***Hemelytra:*** translucent, corium often pale green, indistinct, with light brown lateral band anterior to cuneus, membrane translucent brown. ***Legs:*** coxae pale grey; femora pale grey proximally, gradually becoming dark brown apically; tibiae and pretarsus dark brown. ***Abdomen:*** s2-s5 and genital segments fuscous, remainder of abdomen pale grey.

VESTITURE AND TEXTURE: Body with sparsely distributed microtrichia and hair-like setae. ***Head:*** sparse distribution of decumbent, hair-like setae; microtrichia present on posterior margin and midline of vertex; gula rugulose, with microtrichia; genae with microtrichia. ***Antennae:*** decumbent, hair-like setae and microtrichia; present AI interspersed with thick, erect setae. ***Pronotum:*** one row of small, erect, hair-like setae posterior to collar; sparse distribution of decumbent, hair-like setae; microtrichia present; collar rugulose, hair-like setae absent; calli without setae; posterior lobe finely rugulose. ***Thoracic venter:*** proxyphus coarsely rugulose with scale-like texture; mesosternum finely rugulose, microtrichia present along midline and anterior margin; very few erect, short, hair-like setae. ***Scutellum:*** coarsely rugulose; with dense distribution of microtrichia and decumbent, hair-like setae. ***Hemelytra:*** large, decumbent, hair-like setae present; fine weblike texture visible. ***Legs:*** dense distribution of decumbent, hair-like setae and microtrichia.

STRUCTURE: Body gracile. ***Head:*** bucculae narrow, rounded, not covering gula medially; eyes weakly reniform dorsally, not extending ventrad to anterior margin of clypeus; clypeus straight with uniformly convex anterior margin; gula sinuate in lateral view. ***Labium:*** extending to metasternum. ***Pronotum:*** collar well developed; foveae absent; anterior lobe transversely convex, with weakly developed calli, lateral margins convex, rectilinear posteriorly; posterior lobe strongly declivent head, lateral margins weakly concave, divergent posteriorly, posterior margin weakly concave. ***Thoracic venter:*** posterior margin weakly and broadly concave. ***Scutellum:*** without foveae on anterolateral angles; lateral margins straight, smooth. ***Hemelytra:*** costal margins straight; cuneus ca. 2.5-3x longer than wide. ***Legs:*** metafemora elongate. ***Male Genitalia:*** genital opening of pygophore oval; ventral projection broad, short and dorsoventrally flattened and dome-shaped. Left paramere c-shaped, bifurcate distally;

single row of minute setae on dorsolateral margin. Right paramere finger-like, elongate, straight; apically dentate. Aedeagus with ductus seminis short and broad; secondary gonopore moderately elongate, margins of opening sinuate; proximal endosomal spicule with large spine-like basal process, apically bifurcate with convergent branches, surface strongly denticulate, minor variations between populations (cf. Figs 27d, e,f,g); dorsal endosomal lobal sclerite absent; endosomal membrane bilobed, without field of spinules. ***Female genitalia:*** subgenital plate lanceolate; interramal lobe finger-like, uniformly denticulate.

Measurements

See Table 8.

Distribution

Known from North East Queensland and the Atherton Tablelands (Fig. 68).

Biology and plant associations

Most specimens are known from rainforest of northeast Queensland. Several specimens have been collected from *Dendrocnide excelsea* (Urticaceae).

Remarks

Dimifacoris bifurcatus strongly resembles *Dimifacoris trifurcatus.* There are three colour morphs within *Dimifacoris bifurcatus* and they are readily differentiated from the colour pattern of *D. trifurcatus* (see below); the two species also differ in the shape of the proximal endosomal spicule. Individual from three populations of *Dimifacoris bifurcatus* were dissected, with minor variations in the proximal endosomal spicule, none of them have a triple pronged apex as seen in *Dimifacoris trifurcatus.* In contrast, the parameres are very similar in shape and texture.

Dimifacoris fasciatus Carvalho

Habitus, Figure 64b. Distribution, Figure 68.

Dimifacoris fasciatus Carvalho, 1987: 178 (original description).

Materials examined

HOLOTYPE: **PAPUA NEW GUINEA: MOROBE PROVINCE:** NE, Moife, 2.100 m, 15 km NW Okapa, Oct. 7-14, 1959♂. Type examined in the collection of the Bernice P. Bishop Museum, Honolulu, Hawaii.

PARATYPES: **PAPUA NEW GUINEA: EASTERN HIGHLANDS PROVINCE:** Moife, 15km NW of Okapa, 6.43206°S 145.49581°E, 2100 m, 07 Oct 1959-14 Oct 1959, T.C. Maa, 1♀ (AMNH_PBI 00047077), 1♂ (AMNH_PBI 00047078) (BPBM).

Diagnosis

Dimifacoris fasciatus is recognised by the following combination of characters: bicoloured brown and green (e.g. Fig. 64b); midline of head to scutellum red; labium extending to metasternum; scutellum smooth, microtrichia densely distributed; ventral projection of pygophore broad, short and dorsoventrally flattened; right paramere narrow, elongate, straight with small hooked apical process.

Description

COLOURATION: Body mostly stramineous (e.g. Fig. 64b). ***Head:*** clypeus stramineous; frons and vertex stramineous, midline red; mandibular and maxillary plates red; bucculae stramineous; gula and genae stramineous. ***Antennae:*** AI-AII stramineous, fuscous at joints. ***Labium:*** stramineous. ***Pronotum:*** stramineous with light brown marking laterally; midline red. ***Thoracic venter:*** stramineous. ***Scutellum:*** red, stramineous laterally. ***Metathoracic glands:*** evaporative area pale white. ***Hemelytra:*** translucent, costal margin light brown medially. ***Legs:*** stramineous. ***Abdomen:*** pale stramineous.

VESTITURE AND TEXTURE: Body sparsely distributed with microtrichia and hair-like setae. ***Head:*** elongate, semi-erect, hair-like setae; dorsal setae present on posterior margin and midline; microtrichia present posteriorly; gula rugulose. ***Antennae:*** AI with dense distribution of thick, erect, hair-like setae; AII-AIV dense distribution of decumbent, hair-like setae. ***Pronotum:*** sparse distribution of semi-erect, hair-like setae; dense distribution of microtrichia; proxyphus weakly rugulose. ***Scutellum:*** smooth; dense distribution of microtrichia; with short, decumbent, hair-like setae. ***Hemelytra:*** sparse distribution of short, decumbent, hair-like setae; microtrichia present. ***Legs:*** femora with small, decumbent, hair-like setae and large, erect setae; tibiae with small, decumbent, setae and small spinules.

STRUCTURE: Body gracile. ***Head:*** clypeus straight with uniformly convex anterior margin; bucculae narrow, circular not covering gula medially; eyes spherical, not extending ventrad to anterior margin of clypeus; gula uniformly concave in lateral view. ***Labium:*** extending to metasternum. ***Pronotum:*** collar well developed; foveae absent; anterior lobe transversely convex, with weakly developed calli, lateral margins convex, rectilinear posteriorly; posterior lobe strongly declivent towards head, lateral margins weakly concave, divergent posteriorly, posterior margin weakly concave. ***Thoracic venter:*** proxyphus weakly depressed. ***Scutellum:*** without foveae on anterio-lateral margins; lateral margins straight, smooth; mesoscutum flat. ***Hemelytra:*** costal margins straight; cuneus length ca. 2.5x longer than wide; medial margin straight (e.g. Fig. 64b). ***Legs:*** cursorial, metafemora elongate. ***Male Genitalia:*** (based on Carvalho 1987); pygophore not examined. Left paramere elongate, r-shaped. Right paramere narrow, elongate, straight; with small hooked apex. Aedeagus ductus seminis short; secondary gonopore elongate; apical endosomal lobal sclerite elongate, weakly projecting beyond phallotheca at rest; proximal endosomal spicule elongate, weakly

projecting from the phallotheca at rest. ***Female genitalia:*** subgenital plates with weakly explanate lateral margins, apex rounded; interramal lobes narrow, concave interiorly covered in minute teeth.

Measurements

See Table 8.

Distribution

Only known from Morobe Province, Papua New Guinea (Fig. 68).

Biology and plant associations

Unknown.

Remarks

Dimifacoris fasciatus was described from a handful of specimens. I have described the male genitalia based on the illustrations of Carvalho (1987), as there were no specimens available for dissection. These illustrations did not give details of the endosomal membrane.

The species is best distinguished from its cogeners by the smooth scutellum, labium extending to the metasternum. Also, the endosomal lobes sclerites are elongate, but are simple, unlike other members of the genus.

***Dimifacoris leva* sp. nov.**

Habitus, Figure 64c. Female genitalia, Figure 67d,e. Distribution, Figure 68. SEMs, Figure 69. Male genitalia, Figure 70.

Materials examined

HOLOTYPE: **AUSTRALIA: QUEENSLAND:** Birthday Creek, 7 mi. W Paluma, 18.967°S 146.15°E, 15 Jan 1970, G.A. Holloway, 1♂ (AMNH_PBI 00021720) (QM).

PARATYPES: **AUSTRALIA: QUEENSLAND:** Birthday Creek, 7 mi. W Paluma, 18.967°S 146.15°E, 30 Jan 1972, G.K. McAlpine and G.A. Holloway, 1♀ (AMNH_PBI 00021721) (QM). Lake Barrine, 17.25°S 145.6333°E, 750 m, 18 Apr 1932, Darlington, 1♂ (AMNH_PBI 00046219), 2♀♀ (AMNH_PBI 00046220, AMNH_PBI 00046221) (BPBM); 19 Apr 1932, Darlington, 2♂♂ (AMNH_PBI 00046222, AMNH_PBI 00046223), 3♀♀ (AMNH_PBI 00046224-AMNH_PBI 00046226) (BPBM). Lake Eacham, 17.28796°S 145.62616°E, 750 m, 06 May 1967, G. Monteith, 2♂♂ (AMNH_PBI 00021717, AMNH_PBI 00021718), 1♀ (AMNH_PBI 00021719) (QM). Mt Fisher, 7 km SW. of Millaa Millaa, 17.55°S 145.55°E, 1100 m, 27 Apr 1982-29 Apr 1982, Monteith, Yeates, and Cook, 1♀ (AMNH_PBI 00021716), 1♂ (AMNH_PBI 00021715) (QM). Mt Spurgeon, 16.43361°S 145.19917°E, 1219m, 28 Jul 1928, Darlington, 1♂ (AMNH_PBI 00046227) (BPBM).

Etymology

From the Latin, leva in reference to the smooth right paramere which does not have teeth that is typical of other members of the genus.

Diagnosis

Dimifacoris leva is recognised by the following combination of characters: body dull green with light brown markings (e.g. Fig. 64c); labium extending to abdominal s4; scutellum smooth, microtrichia densely distributed (e.g. Fig. 69e); ventral projection of pygophore broad and triangular (Fig. 70a); left paramere (Fig. 70b) c-shaped, apophysis with scale-like texture; right paramere (Fig. 70c) narrow, distally expanded; secondary gonopore (Fig. 70d) greatly expanded; proximal endosomal spicule (Fig. 70d) with lateral flange, and tapering distally; no lobal sclerites present.

Description

COLOURATION: Body mostly green and brown (Fig. 64c). ***Head:*** clypeus light brown, remainder pale yellow. ***Antennae:*** AI light brown to greenish yellow. ***Pronotum:*** anterior lobe and posterior lobe brown. ***Thoracic venter:*** light to dark brown. ***Scutellum:*** scutellum light brown; mesoscutum yellow. ***Metathoracic glands:*** evaporative area grey. ***Hemelytra:*** pale green to light brown, translucent, midline of wings at rest and membrane veins without markings, brown markings sometimes on cuneus. ***Legs:*** light brown to greenish yellow. ***Abdomen:*** light yellow to brown.

VESTITURE AND TEXTURE: Body sparsely distributed microtrichia and hair-like setae (Fig. 69). ***Head:*** elongate and semi-erect, hair-like setae (Fig. 69a) present; dorsal surface with setae on posterior margin and midline (Fig. 69a); microtrichia present posteriorly (Fig. 69a); gula rugulose. ***Antennae:*** AI with dense distribution of thick, decumbent, hair-like setae; AII-AIV with dense distribution of decumbent, hair-like setae. ***Pronotum:*** sparse distribution of semi-erect, hair-like setae; microtrichia present; proxyphus coarsely rugulose. ***Scutellum:*** (Fig. 69e) sparse distribution of small, decumbent, hair-like setae. ***Hemelytra:*** sparse distribution of small, decumbent, hair-like setae; microtrichia present. ***Legs:*** femora small decumbent, hair-like setae intermixed with large, erect setae; tibiae with small, decumbent, hair-like setae and small tibial spinules.

STRUCTURE: Body gracile (Fig. 64c). ***Head:*** clypeus straight with uniformly convex anterior margin; bucculae narrow, elliptical not covering gula medially (Fig. 69b); eyes weakly reniform dorsally, not extending ventrad to anterior margin of clypeus; gula uniformly convex in lateral view. ***Labium:*** extending to abdominal s4. ***Pronotum:*** collar well developed; foveae absent; anterior lobe transversely convex, with weakly developed calli, lateral margins weakly convex, rectilinear posteriorly;

posterior lobe strongly declivent towards head, lateral margins weakly concave, divergent posteriorly, posterior margin straight. ***Thoracic venter:*** proxyphus depressed, triangular. ***Scutellum:*** (Fig. 69e) without foveae on anterolateral angles; lateral margins straight, smooth; mesoscutum flat. ***Hemelytra:*** costal margins straight; cuneus ca. 3x longer than wide. ***Legs:*** metafemora and metatibiae elongate, femora only weakly incrassate. ***Male Genitalia:*** genital opening of pygophore oval, ventral projection broad, triangular, dorsoventrally flattened. Left paramere c-shaped; sensory lobe weakly developed; apophysis with scale-like texture. Right paramere narrow, elongate; distally incrassate with minute apical process. Aedeagus with ductus seminis short; secondary gonopore greatly elongate and expanded apically, reaching apex of phallotheca at rest; proximal endosomal spicule, elongate, tapered distally, with lateral flange; no lobal sclerites present; endosomal membrane simple, without field of spinules. ***Female genitalia:*** (Figs 67c,d) subgenital plates with weakly explanate lateral margins, apex rounded; interramal lobes narrow, crescent-shaped covered in minute teeth.

Measurements

See Table 8.

Distribution

Restricted to Cape York Peninsula, north Queensland (Fig. 68).

Biology and plant associations

Unknown.

Remarks

Dimifacoris leva most closely resembles *D. bifurcatus* and *D. trifurcatus*. *Dimifacoris leva* can be distinguished from *D. bifurcatus* and *D. trifurcatus* in size, colouration and vestiture however its simple parameres and endosoma most closely resemble those found in *D. fasciatus.*

Dimifacoris splendidus sp. nov.

Habitus, Figure 64d. Distribution, Figure 68. SEMs, Figure 71.

Etymology

Named for the intricate and colourful pattern on the dorsum.

Materials examined

HOLOTYPE: **AUSTRALIA: QUEENSLAND:** Cloudlands Nature Refuge, 17.43769°S 145.53311°E, 918 m, 20 May 2010, M. Elias and A. Namyatova, 1♂ (UNSW_ENT 00002926) (QM).

PARATYPES: **AUSTRALIA: QUEENSLAND:** Cloudlands Nature Refuge, 17.43769°S 145.53311°E, 918 m, 20 May 2010, M. Elias and A. Namyatova, 1♀ (UNSW_ENT 00002927) (QM). Wongabel State Forest, Atherton Tableland, 17.33258°S 145.49941°E, 782 m, 29 May 2006, Cassis, Barrow, Finlay, and Symonds, 1♂ (UNSW_ENT 00002928) (QM). Cape Tribulation: Pilgrim Sounds, 16.08333°S 145.48333°E, 10 Sep 1990-11 Sep 1990, T. J. Henry, 2♂♂ (AMNH_PBI 00192427, AMNH_PBI 00192428), 3♀♀ (AMNH_PBI 00192429-AMNH_PBI 00192431) (USNM). Cairns, 16.91666°S 145.76666°E, Aug 1904, Koebele, 1♀ (AMNH_PBI 00021693) (QM). Wongabel State Forest, Atherton Tableland, 17.33258°S 145.49941°E, 782 m, 29 May 2006, Cassis, Barrow, Finlay, and Symonds, ex Lauraceae, det. RBG staff, 1♂ (AMNH_PBI 00021692) (AM), ex Lauraceae, det. RBG staff, 2♀♀ (AMNH_PBI 00021690, AMNH_PBI 00021691). (AM).

Diagnosis

Dimifacoris splendidus is recognised by the following combination of characters: body weakly gracile; body green with red or brown markings; pronotum bicoloured; labium extending to metasternum; scutellum smooth, with dense distribution of microtrichia.

Description

COLOURATION: Body pale green with red or brown markings (Fig. 64d). ***Head:*** clypeus light brown; otherwise pale yellow. ***Antennae:*** AI-AII yellow with indistinct red bands; AIII-AIV light brown. ***Pronotum:*** anterior lobe yellow, posterior lobe green. ***Thoracic venter:*** pleura and sterna light to dark brown. ***Scutellum:*** dark brown, apex yellow; mesoscutum pale yellow. ***Metathoracic Gland:*** evaporative area white. ***Hemelytra:*** pale green, translucent, red or brown markings sometimes present along midline of wings at rest and cuneus; membrane veins sometimes red or brown. ***Legs:*** yellow to pale green. ***Abdomen:*** pale yellow.

VESTITURE AND TEXTURE: Body with sparsely distributed microtrichia and hair-like setae. ***Head:*** sparse distribution of elongate, semi-erect, hair-like setae (Fig. 71). ***Antennae:*** AI-AIV with dense distribution of decumbent, hair-like setae. ***Pronotum:*** sparse distribution of decumbent, hair-like setae; anterior lobe with patchy distribution of microtrichia (Fig. 71d); posterior lobe with dense distribution of microtrichia. ***Thoracic venter:*** proxyphus weakly rugulose, dense distribution of microtrichia; mesosternum finely rugulose; microtrichia present along midline and anterior margin. ***Scutellum:*** (Fig. 71e) coarsely rugulose; dense distribution of microtrichia and decumbent, hair-like setae. ***Hemelytra:*** setae large, decumbent, hair-like; fine weblike texture visible. ***Legs:*** densely covered in decumbent, hair-like setae and microtrichia.

STRUCTURE: Body weakly gracile (Fig. 64d). ***Head:*** bucculae narrow, elliptical, not covering gula medially (Fig. 71b); eyes spherical, not extending ventrad to anterior margin of clypeus (Fig. 71c); clypeus straight with sinuate anterior margin (Fig. 71c); gula sinuate in lateral view (Fig. 71c). ***Labium:*** extending to metasternum. ***Pronotum:*** collar weakly developed; foveae absent; anterior lobe transversely convex, with strongly developed calli, lateral margins convex, rectilinear posteriorly; posterior lobe weakly

declivent towards head, lateral margin concave, weakly divergent posteriorly, posterior margin concave. ***Thoracic venter:*** posterior margin weakly and broadly concave; proxyphus depressed, triangular. ***Scutellum:*** (Fig. 71e) without foveae on anterolateral angles; lateral margins straight, smooth; mesoscutum flat. ***Hemelytra:*** (Fig. 64b) costal margins weakly convex; cuneus ca. 2x longer than wide; medial margin straight. ***Legs:*** metafemora elongate, narrow.

Male and female genitalia not investigated.

Measurements

See Table 8.

Distribution

Dimifacoris splendidus is known from Cairns and Cape Tribulation, north Queensland (Fig. 68).

Biology and plant associations

A few specimens were collected from an unidentified plant species belonging to the Lauraceae.

Remarks

Dimifacoris splendidus resembles *D. fasciatus* but can easily be distinguished from it by its colour patterning, with the body of the former species being green with red or brown markings.

Dimifacoris trifurcatus sp. nov.

Habitus, Figure 64d. Distribution, Figure 68. SEMs, Figure 72. Male genitalia, Figure 73.

Etymology

Named for the trifurcate apex of the proximal endosomal spicule.

Materials examined

HOLOTYPE: **AUSTRALIA: QUEENSLAND:** Lake Barrine, Atherton Tableland, 17.2667°S 145.6333°E, 701 m, 18 Apr 1932-19 Apr 1932, Darlington, 1♂ (AMNH_PBI 00021711) (QM).

PARATYPES: **AUSTRALIA: QUEENSLAND:** Kuranda State Forest, 28.1 km N of Kuranda, 16.67361°S 145.50222°E, 28 Apr 1998, G. Cassis, 5♀♀ (AMNH_PBI 00021698-AMNH_PBI 00021702) (AM). Lake Barrine, Atherton Tableland, 17.2667°S 145.6333°E, 701 m, 18 Apr 1932-19 Apr 1932, Darlington, 2♂♂ (AMNH_PBI 00021713, AMNH_PBI 00021714), 3♀♀ (AMNH_PBI 00021709, AMNH_PBI 00021710, AMNH_PBI 00021712) (QM). Mossman Gorge, 15.55°S 144.4333°E, 23 Apr 1967, D.H. Colless, 3♂♂ (AMNH_PBI 00021703-AMNH_PBI 00021705), 3♀♀ (AMNH_PBI 00021706-AMNH_PBI 00021708) (QM).

Diagnosis

Dimifacoris trifurcatus is recognised by the following combination of characters: body stramineous with green markings (Fig. 64e); scutellum rugulose, microtrichia absent (Fig. 72e); labium extending to metasternum; ventral projection of pygophore broad, short and dorsoventrally flattened (Fig. 73a); left paramere large (Fig. 73b), c-shaped, with bifid apex; right paramere (Fig. 73c) narrow, elongate, straight, apically dentate; proximal endosomal spicule elongate (Fig. 73d), broad, distally trifurcate; endosomal membrane with field of spinules distally (Fig. 73d).

Description

COLOURATION: Body mostly stramineous (Fig. 64e). ***Head:*** stramineous with indistinct brown marking medially; mandibular plate stramineous; mandibular plate brown; bucculae pale grey to light brown; gula and genae stramineous. ***Antennae:*** AI stramineous, fuscous at extremities; AII-AIV fuscous. ***Scutellum:*** stramineous, mesoscutum fuscous. ***Hemelytra:*** translucent, multiple coloured markings; discoidal area light brown pale green; clavus faint, faded green; indistinct light brown lateral band anterior to the cuneus; membrane translucent, light brown. ***Legs:*** stramineous; tibiae and pretarsus dark brown. ***Abdominal venter*****:** stramineous, pygophore fuscous.

VESTITURE AND TEXTURE: Body with sparsely distributed microtrichia and hair-like setae (Fig. 72). ***Head:*** sparse distribution of decumbent, hair-like setae (Fig. 72a); vertex with dense distribution of microtrichia, with a paired round glabrous area lateral to the midline (Fig. 72a); gula weakly rugulose, microtrichia present (Fig. 72b); genae microtrichia present. ***Antennae:*** decumbent setae and microtrichia present; AI with thick, erect, hair-like setae. ***Pronotum:*** (Fig. 72c) collar finely rugulose; with sparse distribution of decumbent, hair-like setae; dense distribution of microtrichia, forming weblike patterns on calli; posterior lobe finely rugulose. ***Thoracic venter:*** proxyphus coarsely rugulose, setae absent; mesosternum finely rugulose. ***Scutellum:*** (Fig. 72c) rugulose; setae decumbent. ***Hemelytra:*** setae decumbent. ***Legs:*** femora with small, decumbent, hair-like setae and large, erect setae; tibiae with small decumbent setae and small spinules.

STRUCTURE: Body gracile (Fig. 64e). ***Head:*** clypeus straight with uniformly convex anterior margin (Fig. 72b); bucculae narrow, elliptical not covering gula medially (Fig. 72b); eyes weakly reniform, not extending ventrad to anterior margin of clypeus; gula uniformly weakly convex in lateral view (Fig. 72b). ***Labium:*** extending to

abdominal s4. ***Pronotum:*** (Fig. 72c) collar pronounced, rounded, anterior margin weakly concave; calli weakly raised; anterior lobe trapezoidal, lateral margins weakly convex; posterior lobe strongly declivent, anterior margin straight; lateral margins weakly concave, emarginate posteriorly; posterior margin weakly and broadly concave. ***Thoracic venter:*** proxyphus depressed, lateral margins steep. ***Scutellum:*** (Fig. 72c) without foveae on anterolateral angles; lateral margins straight, smooth; mesoscutum flat. ***Hemelytra:*** costal margins straight (Fig. 64e); cuneus ca. 2-2.5x longer than wide, medial margin weakly convex (Fig. 72f). ***Legs:*** metafemora elongate. ***Male Genitalia:*** genital opening of pygophore narrow, asymmetrical (Fig. 73a); ventral projection broad, short and triangular, dorsoventrally flattened (Fig. 73a). Left paramere (Fig. 73b) c-shaped, apophysis with scale-like texturing on dorsal surface, apically bifid; sensory lobe weakly incrassate. Right paramere (Fig. 73c) narrow, elongate, straight; apically denticulate, weakly bent. Aedeagus (Fig. 73d) with ductus seminis short and broad; phallotheca opening apically; secondary gonopore elongate, with denticulate texture apically; proximal endosomal spicule elongate, with basal and medial flanges, distally trifurcate; endosomal membrane bilobed with field of spinules distally.

Measurements

See Table 8.

Distribution

Cape York region, Australia (Fig. 68).

Biology and plant associations

No host records known.

Remarks

See Remarks section of *Dimifacoris bifurcatus*.

Elongatoductus gen. nov.

Etymology

Named for its narrow, elongate ductus seminis; noun in apposition. Masculine.

Type species

Elongatoductus walli sp. nov. by original designation.

Diagnosis

Elongatoductus is recognised by the following combination of characters: dorsum stramineous, lacking contrasting markings (Fig. 51h); sparse distribution of simple hair-like setae (Fig. 74); weakly convex hemelytral lateral margins (Fig. 51h); bucculae oval not contiguous with posterior margin of pronotum (Fig. 74b); eyes reniform; distinct anterior and posterior lobes of pronotum (Fig. 74c); pronotal foveae present (Fig. 74c); head bearing rugae dorsally (Fig. 74a); pygophore short, weakly asymmetrical (Fig. 75a); left paramere (Fig. 75b) with an exaggerated sensory lobe and densely setose; right paramere (Fig. 75c) with moderately swollen sensory lobe and densely setose; ductus seminis (Fig. 75d) with weakly developed ribbing; endosoma (Fig. 75d) with sclerotisation and bilobed membranous bag.

Description

COLOURATION: Body mostly stramineous (Fig. 51h). ***Head:*** lacking distinctive markings. ***Pronotum:*** anterior and posterior lobes contrastingly coloured. ***Hemelytra:*** hyaline, lacking markings.

VESTITURE AND TEXTURE: Body with sparsely distributed microtrichia and hair-like setae. ***Antennae:*** dense distribution of erect hair-like setae (Fig. 74). ***Pronotum:*** anterior and posterior lobes smooth (Fig. 74c). ***Prosternum:*** weakly rugulose; microtrichia densely distributed. ***Legs:*** dense distribution of semi-erect hair-like setae, two rows of spinules usually present on tibiae. ***Hemelytra:*** sparse distribution of semi-erect hair-like setae.

STRUCTURE: Body elongate-ovoid (Fig. 51h). ***Head:*** strongly hypognathous, about twice as wide as long, in dorsal view (Fig. 74b); frons and clypeus posteroventrally oriented, frons almost flat (Fig. 74b); medial sulcus shallow, wide (Fig. 74a); bucculae strongly arcuate, strongly produced ventrally beyond ventral margin of eyes (Fig. 74b); gula straight, short, restricted to posterior ¼ of head; eyes strongly reinform in lateral view, contiguous or almost contiguous with anterior margin of pronotum (Fig. 74b); postocular region absent. ***Antennae:*** AI weakly elongate, usually ~2x length of head. ***Pronotum:*** (Fig. 74c) bilobed, with anterior lobe much shorter than posterior lobe; collar small, barely visible medially; anterior lobe subrectangulate, lateral margins weakly rounded, calli contiguous medially; posterior lobe trapezoidal, lateral margins strongly divergent posteriorly, posterior margin strongly sinuate. ***Metathoracic Gland:*** peritreme short, tongue-like, weakly raised, laterally oriented; evaporative area occupying ca. ⅓ of metepisternum, peritreme not reaching dorsal margin of evaporative area. ***Scutellum:*** (Fig. 74d) smooth; without foveae; lateral margins straight. ***Hemelytra:*** margins weakly convex (Fig. 51h); ca. 1.5-2x longer than abdomen, cuneus length 1.5-2x longer than wide (Fig. 74f). ***Legs:*** legs cursorial; coxae elongate; pretarsal claws with minute striations on interior margin; narrow at base. ***Male Genitalia:*** pygophore short, weakly asymmetrical, lacking grooves, genital opening of pygophore dorsal (Fig. 75a); with small ventral process; with erect setae. Left paramere (Fig. 75b) sickle-shaped, sensory lobe greatly exaggerated, densely setose; apophysis short, with apical hook. Right paramere (Fig. 75c) sickle-shaped, sensory lobe moderately enlarged, densely setose, with short apophysis, apex acute. Aedeagus (Fig. 75d) with phallotheca narrow, lacking lobes, opening apically; ductus seminis long and straight with weakly developed ribbing; secondary gonopore moderately long, narrow; endosoma lacking sclerotisation; endosomal membrane bilobed. ***Female genitalia:*** (Fig.

76) subgenital plate subtriangular; interramal lobes mitt-shaped; densely covered in scale-like texture.

Distribution

Only known from Province Nord, New Caledonia (Fig. 77).

Biology and plant associations

See species treatment for *Elongatoductus walli*.

Remarks

Elongatoductus most closely resembles *Candidomiris* externally. Its parameres resemble *Falcum* or *Prosoponomiris* but its endosoma is atypical in comparison to allied taxa in the *Candidomiris* group. It is easily recognised within the *Candidomiris* group by its strongly sinuate posterior margin of the pronotum, the sickle shaped parameres with densely setose and enlarged sensory lobes, and the elongate and weakly ribbed ductus seminis.

***Elongatoductus walli* sp. nov.**

Habitus, Figure 51h. SEMs, Figure 74. Male genitalia, Figure 75. Female genitalia, Figure 76. Distribution, Figure 77.

Etymology

Named for one of the collectors of this species, Dr Michael Wall of the San Diego Natural History Museum, who has contributed significantly to knowledge of this group of orthotylines.

Materials examined

HOLOTYPE: **NEW CALEDONIA: PROVINCE NORD:** Aoupinié Sawmill, 21.15619°S 165.32019°E, 531 m, 01 May 2005, Cassis, Wall, Tatarnic, Monteith, ex *Pagiantha*

cerifera (Pancher and Seb.) Markgr. (Apocynaceae), det. NOU Staff NYBG VOUCHER, 1♂ (AMNH_PBI 00021777) (MNHP).

PARATYPES: **NEW CALEDONIA: PROVINCE NORD:** Aoupinié Sawmill, 21.15619°S 165.32019°E, 531 m, 01 May 2005, Cassis, Wall, Tatarnic, Monteith, ex *Pagiantha cerifera* (Pancher and Seb.) Markgr. (Apocynaceae), det. NOU Staff NYBG VOUCHER, 2♂ (AMNH_PBI 00021778, AMNH_PBI 00021779), 3♀♀ (AMNH_PBI 00021780-AMNH_PBI 00021782) (AM).

Diagnosis

See generic diagnosis.

Description

COLOURATION: Mostly stramineous, mostly glabrous (Fig. 51h). ***Head:*** clypeus stramineous, fuscous anterior; otherwise stramineous. ***Antennae:*** AI stramineous; AII stramineous proximally, fuscous apically, AIII-AIV fuscous. ***Pronotum:*** anterior lobe stramineous; posterior lobe pale green. ***Thoracic venter:*** propleura black, meso- and metapleura stramineous, black posteriorly; thoracic sterna stramineous. ***Scutellum:*** stramineous with black or uniformly black. ***Hemelytra:*** transparent, corium pale green; cuneus sometimes with pale green tinge; membrane veins brown. ***Legs:*** coxae pale grey; femora pale yellow; tibiae pale green; pretarsus black. ***Abdomen:*** venter pale stramineous; lateral margins black posteriorly; pygophore dark brown.

VESTITURE AND TEXTURE: Body with sparsely distributed microtrichia and hair-like setae (Fig. 74). ***Head:*** very sparse distribution of decumbent, hair-like setae (Fig. 74a); frons and vertex bounding foveae finely rugulose (Fig. 74a); gula coarsely rugulose (Fig. 74b). ***Antennae:*** AI with sparse distribution of erect, hair-like setae; AII-AIV with dense distribution of smaller, erect, hair-like setae. ***Pronotum:*** (Fig. 74c) very sparse distribution of decumbent, hair-like setae; anterior lobe rugulose on posterior

margin of calli; posterior lobe smooth. ***Thoracic venter:*** proxyphus rugulose; dense distribution of microtrichia. ***Scutellum:*** (Fig. 74d) coarsely rugulose, sparse distribution of large, decumbent, hair-like setae. ***Hemelytra:*** sparse distribution of large, decumbent, hair-like setae. ***Legs:*** femora with sparsely distributed short, hair-like setae; tibiae with small, semi-erect, hair-like setae and large, bristle-like, erect setae.

STRUCTURE: Body elongate-ovoid. ***Head:*** vertex with strongly sulcate midline (Fig. 74a); bucculae broad, strongly ovate, not covering gula medially (Fig. 74b); clypeus straight oriented with weakly convex anterior margin; eyes strongly reniform dorsally, extending ventrad to anterior margin of clypeus. ***Labium:*** extending to abdominal s2. ***Pronotum:*** (Fig. 74c) collar well developed; foveae present; anterior lobe transversely convex, with weakly developed calli, lateral margins convex, rectilinear posteriorly; posterior lobe weakly declivent towards head, lateral margins weakly concave, divergent posteriorly, posterior margin weakly concave. ***Thoracic venter:*** proxyphus depressed, triangular. ***Scutellum:*** (Fig. 74d) without foveae on anterolateral angles; lateral margins straight, smooth; mesoscutum raised. ***Hemelytra:*** costal margins weakly convex; cuneus (Fig. 74f) ca. 2x longer than wide, medial margin straight. ***Legs:*** metafemora only weakly incrassate, weakly elongate.

Male and female genitalia as in generic description.

Measurements

See Table 9.

Distribution

Only known from Province Nord, New Caledonia (Fig. 77).

Biology and plant associations

Seven specimens were collected from *Pagiantha cerifera* (Apocyanaceae); this is assumed to be a host for the species based on number of specimens found.

Remarks

See generic remarks.

Falcum gen. nov.

Type Species

Falcum bulldogensis sp. nov. by original designation.

Etymology

Named from the Latin for the sickle-shaped left and right parameres found in species of this genus. Neuter.

Diagnosis

Falcum is recognised by the following combination of characters: costal margins of hemelytral convex (e.g. Figs 78a-d); eyes large ventrally elongate egg-shaped (Fig. 83c); bucculae ventrally and laterally explanate, rounded contiguous with the anterior margin of the pronotum in lateral view (e.g. Fig. 83b); distinct anterior and posterior lobes of the pronotum (e.g. Fig 83d); simple vestiture (e.g. Fig. 83); pygophore conical, weakly asymmetrical (e.g. Fig. 80a); left and right parameres both c-shaped with weakly developed sensory lobes (e.g. Figs 80b,c); phallotheca with apical opening (e.g. Fig. 80d); proximal endosomal spicule elongate, narrow, tapering distally, usually extending beyond phallotheca at rest (e.g. Fig. 80d); dorsal endosomal lobal sclerite blade-like, restricted to anterior ½ of phallotheca (e.g. Fig. 80d); interramal sclerites bilobed (e.g. Fig. 80d).

Description

COLOURATION: Body mostly stramineous (e.g. Figs 78a-d). ***Head:*** most often uniformly coloured, clypeus often fuscous. ***Pronotum:*** uniformly coloured with midline red. ***Hemelytra:*** translucent, without distinct markings or patterning.

VESTITURE AND TEXTURE: Body sparsely distributed with microtrichia and hair-like setae. ***Antennae:*** dense distribution of erect, hair-like setae (e.g. Fig. 80). ***Pronotum:*** (e.g. Fig. 80d) anterior and posterior lobes finely rugulose. ***Prosternum:*** rugulose; dense distribution of microtrichia. ***Scutellum:*** (e.g. Fig. 80e) rugulose. ***Hemelytra:*** sparse distribution of semi-erect hair-like setae. ***Legs:*** dense distribution of semi-erect, hair-like setae; two rows of spinules usually present on tibiae

STRUCTURE: Body gracile, appendages elongate (e.g. Figs 78a-d). ***Head:*** strongly hypognathous, frons and medial sulcus deep, narrow (e.g. Fig. 83c); bucculae strongly arcuate, strongly produced ventrally beyond ventral margin of eyes (e.g. Fig. 83b); gula straight, exceeding ½ length of head (e.g. Fig. 83c); eyes egg-shaped in lateral view, contiguous or almost contiguous with anterior margin of pronotum (e.g. Fig. 83c); postocular region absent (e.g. Fig. 83c). ***Antennae:*** AI greatly elongate, several times longer than head. ***Pronotum:*** (e.g. Fig. 83d) bilobed, with anterior lobe much shorter than posterior lobe; collar small, barely visible medially; anterior lobe subrectangulate, lateral margins weakly rounded, calli weakly developed, often contiguous medially; posterior lobe trapezoidal, lateral margins strongly divergent posteriorly, posterior margin rectilinear. ***Mesepimeron:*** (e.g. Fig. 83f) with evaporative bodies, spiracle weakly exposed. ***Metathoracic Gland:*** (e.g. Fig. 83f) peritreme short, ovate, weakly raised, posterodorsally oriented; evaporative area occupying ca. ⅓ of metepisternum, peritreme not reaching dorsal margin of evaporative area. ***Hemelytra:*** costal margins weakly convex; ca. 2-3x longer than abdomen, cuneus ca. 2.5-3x longer than wide. ***Legs:*** cursorial; coxae elongate; pretarsal claws with uniformly spaced minute striations; narrow at base. ***Male Genitalia:*** pygophore (e.g. Fig. 80a) conical, weakly asymmetrical, ventral process triangular, lacking grooves; genital opening of pygophore dorsal, with erect hair-like setae. Left paramere (e.g. Fig. 80b) c-shaped with

weakly incrassate sensory lobe and short apophysis. Right paramere (e.g. Fig. 80c) simple, c-shaped. Aedeagus (e.g. Fig. 80d) with phallotheca tube-like, opening apically; ductus seminis short and with weak sinuation towards base; secondary gonopore elongate; proximal endosomal spicule elongate, most often projecting beyond phallotheca at rest; dorsal endosomal lobal sclerite blade-like; endosomal membrane simple, with two lobes.

Distribution

Three species are known from Morobe Province, Papua New Guinea. A single species is known from Taiwan. The widely disjunct distribution is possibly due to insufficient collection data, with most species of *Falcum* known only from a single collection event (Fig. 79).

Host Plants

Most species of *Falcum* have been found on grasses. *Falcum gagnei* and *F. kaindiensis* are both recorded from the grass genus *Nastus*. The record for *F. bulldogensis* does not specify a taxon of grass. Species of *Falcum* have an elongate and gracile body, with light brown to brownish green colouration, which is a shape consistent with other true bugs species that specialise on grasses.

Remarks

Falcum most closely resembles *Candidomiris* but lacks many of the distinctive derived characters present in many of genera of the *Candidomiris* group. The two former genera can be differentiated by the weakly keyhole-shaped bucculae in *Candidomiris* and the rugulose posterior region of the pronotum in *Falcum. Falcum* can also be distinguished from its genital character with the left paramere and right parameres both c-shaped and the proximal endosomal spicule elongate.

Falcum austerum sp. nov.

Habitus, Figure 78a, Distribution, Figure 79.

Etymology

Named for its plain colouration; from the Latin word austera meaning plain from its plain colouration.

Materials examined

HOLOTYPE: **PAPUA NEW GUINEA: MOROBE PROVINCE:** Mount Kaindi, 7.35°S 146.68333°E, 2300 m, 19 May 1977, W.C. Gagne, (Poaceae), 1♂ (BPBM).

PARATYPES: **PAPUA NEW GUINEA: EASTERN HIGHLANDS PROVINCE:** Moife, 15km NW of Okapa, 6.43206°S 145.49581°E, 2100 m, 11 Oct 1959-13 Oct 1959, T.C. Maa, 1♀ (BPBM). **MOROBE PROVINCE:** Mount Kaindi, 7.35°S 146.68333°E, 2350 m, 01 Nov 1966-14 Nov 1966, G.A. Samuelson, 1♀ (BPBM).

Diagnosis

Falcum austerum is recognised by the following combination of characters: body stramineous (Fig. 78a); pronotum stramineous with midline red or brown; vertex sulcate; eyes elliptical in lateral view; bucculae narrow, about twice as long as wide; calli of pronotum not elevated; pronotum and scutellum without foveae.

Description

COLOURATION: Body mostly stramineous (Fig. 78a). ***Head:*** clypeus, mandibular and maxillary plates, bucculae stramineous; frons fuscous; eyes red; vertex stramineous, rarely mottled with green; gula and genae brown. ***Antennae:*** AI-AIV stramineous to light green. ***Labium:*** stramineous. ***Pronotum:*** stramineous with red or light brown midline. ***Thoracic pleura and sterna:*** stramineous. ***Scutellum:*** uniformly stramineous. ***Metathoracic Gland:*** evaporative area grey. ***Hemelytra:*** translucent. ***Legs:*** stramineous. ***Abdomen:*** stramineous, sometimes lateral margins of abdomen fuscous.

VESTITURE AND TEXTURE: Body with sparsely distributed microtrichia and decumbent, hair-like setae. ***Head:*** very sparse distribution of long, erect, hair-like setae. ***Antennae:*** dense distribution of decumbent, hair-like setae. ***Pronotum:*** very sparse distribution of hair-like setae; collar coarsely rugulose; anterior lobe smooth; posterior lobe finely rugulose posteriorly. ***Thoracic venter:*** proxyphus with dense distribution of microtrichia. ***Scutellum:*** finely rugulose, more densely on mesoscutum; sparse distribution of semi-erect, hair-like setae. ***Hemelytra:*** semi-erect, hair-like setae present; dense distribution of microtrichia. ***Legs:*** elongate erect, hair-like setae; tibiae with thick, dark setae.

STRUCTURE: Body elongate-ovoid (Fig. 78a). ***Head:*** vertex with strongly sulcate midline; bucculae narrow, not covering gula medially; clypeus straight with strongly convex anterior margin; gula extending ca. ⅔ length of eye; eyes egg-shaped dorsally, extending ventrad to anterior margin of clypeus. ***Labium:*** extending to metathorax. ***Pronotum:*** collar well developed; foveae absent; anterior lobe transversely convex, with weakly developed calli, lateral margins convex, rectilinear posteriorly; posterior lobe weakly declivent towards head, lateral margins concave, strongly divergent posteriorly, posterior margin weakly convex. ***Thoracic venter:*** proxyphus depressed, triangular. ***Scutellum:*** without foveae on anterolateral angles; lateral margins straight, smooth; mesoscutum raised. ***Hemelytra:*** costal margins straight; cuneus ca. 3x longer than wide, medial margin curved. ***Legs:*** metafemora and metatibiae elongate.

Male genitalia not investigated.

Measurements

See Table 10.

Distribution

Known from Morobe and Eastern Highlands Province, Papua New Guinea (Fig. 79).

Biology and plant associations

Plant associations recorded as Poaceae. All specimens are known from high altitudes.

Remarks

Falcum austerum resembles *F. gagnei*, but it lacks the colour markings of the latter species and the calli are not elevated. Although, the male genitalia could not be investigated, because only the holotype is a male, the external morphology and colour of these two species are considered distinct enough to warrant species separation.

Falcum bulldogensis sp. nov.

Habitus, Figure 78b. Distribution, Figure 79. Male genitalia, Figure 81. Female genitalia, Figure 82a,b.

Etymology

Named after the type locality.

Materials examined

HOLOTYPE: **PAPUA NEW GUINEA: MOROBE PROVINCE:** NE Wau, Bulldog Road, 2600 m, 21 05 1967, J.L. Gressitt, 1♂ ex Poaceae, (AMNH_PBI 00046194) (BPBM).

PARATYPES: **PAPUA NEW GUINEA: MOROBE PROVINCE:** NE Wau, Bulldog Road, 2600 m, 21 05 1967, J.L. Gressitt, 1♂ (AMNH_PBI 00046195) ex Poaceae, 1♀ (AMNH_PBI 00046196), 1 sex unknown (AMNH_PBI 00046197) (BPBM).

Diagnosis

Falcum bulldogensis is recognised by the following combination of characters: body pale grey (e.g. Fig. 78b); eyes elliptical in lateral view; bucculae narrow, about twice as long as wide; calli of anterior lobe of pronotum elevated; parameres c-shaped (Figs 81b,c); right paramere with more developed sensory lobe; proximal endosomal spicule

elongate and sinuate, projecting from phallotheca at rest (Fig. 81d); dorsal endosomal lobal sclerite sinuate, restricted to anterior ½ of endosoma (Fig. 81d).

Description

COLOURATION: Body mostly pale grey (Fig. 78b). ***Head:*** frons pale grey; vertex pale grey with red midline; clypeus pale grey; eyes black; antennal tubercle pale grey with red stripe; mandibular and maxillary plates, bucculae, gula and genae pale grey. ***Antennae:*** AI pale grey or dark brown; AII-AIV fuscous. ***Labium:*** pale grey. ***Pronotum:*** pale grey with red medially. ***Thoracic pleura and sterna:*** propleura brown; meso- and meta pleura, proxyphus and metasternum pale grey. ***Scutellum:*** pale grey, midline, sometimes with indistinct brown markings medially. ***Metathoracic Gland:*** evaporative area black. ***Hemelytra:*** translucent, pale grey, a pair of small brown markings lateral to membrane towards apex; membrane veins brown. ***Legs:*** pale grey. ***Abdomen:*** dark brown mottled with pale yellow.

VESTITURE AND TEXTURE: Body with sparsely distributed microtrichia and decumbent, hair-like setae. ***Head:*** dorsal surface with sparse distribution of small, erect, hair-like setae; gula coarsely rugulose, with few semi-erect setae posterior to each eye; otherwise setae absent. ***Antennae:*** AI-AIV with dense distribution of small, semi-erect, hair-like setae. ***Pronotum:*** sparse distribution of small, decumbent, hair-like setae; collar coarsely rugulose; anterior lobe smooth; posterior lobe finely rugulose along midline and posterior margin. ***Thoracic venter:*** proxyphus coarsely rugulose; dense distribution of microtrichia. ***Scutellum:*** coarsely rugulose; sparse distribution of decumbent, hair-like setae. ***Hemelytra:*** setae decumbent, hair-like. ***Legs:*** femora hair-like setae sparse, erect; tibiae with short, thick, semi-decumbent, hair-like setae.

STRUCTURE: Body elongate-ovoid (Fig. 78b). ***Head:*** vertex with strongly sulcate midline; bucculae narrow, not covering gula medially; clypeus straight with strongly

weakly anterior margin; gula extending ca. ⅔ length of eye; eyes egg-shaped dorsally, extending ventrad to anterior margin of clypeus. ***Labium:*** extending to metasternum. ***Pronotum:*** collar weakly developed; foveae absent; anterior lobe transversely convex, with weakly developed calli, lateral margins convex, rectilinear posteriorly; posterior lobe weakly declivent towards head, lateral margins concave, strongly divergent posteriorly, posterior margin convex. ***Thoracic pleura and sterna:*** proxyphus depressed, triangular. ***Scutellum:*** without foveae on anterolateral angles; lateral margins straight, smooth; mesoscutum raised. ***Hemelytra:*** costal margins straight; cuneus ca. 1.5x longer than wide, medial margin curved. ***Legs:*** metafemora and metatibiae elongate, metafemora incrassate. ***Male Genitalia:*** genital opening of pygophore circular (Fig. 81a); ventral projection broad, elongate, triangular, and dorsoventrally flattened (Fig. 81a). Left paramere (Fig. 81b) c-shaped, sensory lobe vestigial, setae almost absent, apex weakly deflexed. Right paramere (Fig. 81c) c-shaped, with moderately swollen sensory lobe, setose, apex of apophysis blunt. Aedeagus (Fig. 81d) with tube-like phallotheca, apical opening; ductus seminis short; secondary gonopore, elongate, with spinules apically; proximal endosomal spicule thin, sinuate, tapering distally, projecting beyond phallotheca at rest; dorsal endosomal spicule sinuate, shorter than apical endosomal lobal sclerite, restricted to anterior ½ of endosoma; endosomal membrane bilobed. ***Female genitalia:*** (Figs 82 a-b) subgenital plate subtriangular, apex rounded; lateral margins straight and smooth; interramal lobes mitt-shaped with scale-like texture.

Measurements

See Table 10.

Distribution

Only known from Wau, Morobe Province, Papua New Guinea (Fig. 79).

Biology and plant associations

Two specimens of *Falcum bulldogensis* were reported as from the bamboo, using the common name on the label, as there was no more detail I recorded the host as Poaceae.

Remarks

Falcum bulldogensis is known from very few specimens and was originally considered to be a smaller colour morph of *F. gagnei*, but was separated based on differences in the male genitalia. The right paramere of *F. bulldogensis* has a simple apex, whereas in *F. gagnei* it is hooked. The dorsal endosomal lobal sclerite is sinuate in this species whereas it is elongate and longer in *F. gagnei*, projecting beyond the phallotheca at rest in the latter species.

***Falcum gagnei* sp. nov.**

Habitus, Figure 78c. Distribution, Figure 79. Female genitalia, Figure 83c,d. Male genitalia, Figure 84.

Etymology

Named for the type collector W.C. Gagne in honour of his collection efforts in the Pacific.

Materials examined

HOLOTYPE: **PAPUA NEW GUINEA: MOROBE PROVINCE:** Mount Kaindi, 7.35°S 146.68333°E, 2300 m, 19 May 1977, W.C. Gagne, ex *Nastus* sp. (Poaceae), 1♂ (AMNH_PBI 00046173) (BPBM).

PARATYPES: **PAPUA NEW GUINEA: MOROBE PROVINCE:** Mount Kaindi, 7.35°S 146.68333°E, 2300 m, 15 Jun 1971, Tawi, 1♂ (AMNH_PBI 00046174) (BPBM); 31 Oct 1976, W.C. Gagne, ex *Nastus* sp. (Poaceae), 1♀ (AMNH_PBI 00046172) (BPBM); 19 May 1977, W.C. Gagne, ex *Nastus* sp. (Poaceae), 5♂♂

(AMNH_PBI 00046165-AMNH_PBI 00046168, AMNH_PBI 00046171), 2♀♀ (AMNH_PBI 00046169, AMNH_PBI 00046170) (BPBM); 01 Nov 1982, W.C. Gagne, ex *Rhodomyrtus tomentosa* (Aiton) Hassk. (Myrtaceae), 1♂ (AMNH_PBI 00046164) (BPBM). **SOUTHERN HIGHLANDS PROVINCE:** Mt. Giluwe, 2500 m, 27 Dec 1977-29 Dec 1977, W.C. Gagne, 1♂ (AMNH_PBI 00046175) (BPBM).

Diagnosis

Falcum gagnei is recognised by the following combination of characters: overall colouration stramineous (Fig. 78c); midline red or brown from head to scutellum (Fig. 78c); eyes reniform in lateral view; bucculae narrow, about twice as long as wide; calli of anterior lobe of pronotum elevated; left paramere v-shaped (Fig. 83b); right paramere c-shaped (Fig. 83c); proximal endosomal spicule elongate, sinuate; dorsal endosomal lobal sclerite moderately long, extending beyond phallotheca at rest (Fig. 83d); subgenital plate, subtriangular (Fig. 83d).

Description

COLOURATION: Body mostly stramineous (Fig. 78c). ***Head:*** clypeus, mandibular and maxillary plates, bucculae stramineous; frons fuscous; vertex stramineous with red or light brown line medially; gula and genae stramineous; eyes red. ***Antennae:*** AI-AIV stramineous to light brown. ***Labium:*** stramineous. ***Pronotum:*** stramineous with red or light brown midline. ***Thoracic venter:*** stramineous. ***Scutellum:*** stramineous with midline red. ***Metathoracic Gland:*** evaporative area pale grey. ***Hemelytra:*** translucent, sometimes with faint brown markings posteriorly. ***Legs:*** pale grey, with wings at rest. ***Abdomen:*** stramineous, sometimes lateral margins of abdominal venter fuscous.

VESTITURE AND TEXTURE: Body with sparsely distributed microtrichia and decumbent, hair-like setae. ***Head:*** setae decumbent, only present on frons and anterior of vertex; gula rugulose; otherwise smooth and glabrous. ***Antennae:*** dense distribution

of decumbent, hair-like setae. ***Pronotum:*** very sparse distribution of erect to decumbent hair-like setae; collar coarsely rugulose; anterior lobe smooth; posterior lobe finely rugulose posteriorly. ***Thoracic venter:*** proxyphus with dense distribution of matted microtrichia. ***Scutellum:*** finely rugulose, dense on mesoscutum; sparse distribution of semi-erect, hair-like setae. ***Hemelytra:*** semi-erect, hair-like setae present; dense distribution of microtrichia. ***Legs:*** elongate, erect, hair-like setae, intermixed on tibiae with bristle-like setae.

STRUCTURE: Body elongate-ovoid (Fig. 78c). ***Head:*** vertex with strongly sulcate midline; bucculae narrow, not covering gula medially; clypeus straight with strongly convex anterior margin; gula extending ca. ⅔ length of eye; eyes strongly reniform dorsally, extending ventrad to anterior margin of clypeus. ***Labium:*** extending to abdominal s2. ***Pronotum:*** collar strongly developed; foveae absent; anterior lobe transversely convex, with weakly developed calli, lateral margins convex, rectilinear posteriorly; posterior lobe declivent towards head, lateral margins concave, strongly divergent posteriorly, posterior margin convex. ***Scutellum:*** without foveae on anterolateral angles; lateral margins straight, smooth; mesoscutum raised. ***Thoracic venter:*** proxyphus depressed, triangular. ***Hemelytra:*** costal margins straight; cuneus ca. 2.5-3x longer than wide, medial margin curved. ***Legs:*** metafemora and metatibiae elongate, femora incrassate. ***Male Genitalia:*** genital opening of pygophore circular (Fig. 83a); ventral projection broad, elongate, triangular and dorsoventrally flattened (Fig. 83a). Left paramere (Fig. 83b) v-shaped, sensory lobe moderately incrassate; apophysis weakly sinuate, elongate, apically blunt. Right paramere (Fig. 83c) c-shaped, apophysis acruate, apex rounded. Aedeagus (Fig. 83d) with phallotheca with apical opening; ductus seminis short; secondary gonopore elongate, sinuate; proximal endosomal sinuate, narrow, tapered distally, projecting beyond phallotheca at rest;

dorsal endosomal spicule narrow, apex rounded, extending beyond phallotheca at rest; endosomal membrane bilobed, without field of spinules. ***Female genitalia:*** (Figs 82c,d) subgenital plate short, subtriangular, margins smooth and straight; interramal lobes mitt-shaped, covered with scale-like texture.

Measurements

See Table 10.

Distribution

Known from the Southern Highlands and Morobe provinces, Papua New Guinea (Fig. 79).

Biology and plant associations

Singletons found on both a *Nastus* sp. (Poaceae) and *Rhodomyrtus tomentosa* (Poaceae).

Remarks

See remarks of *Falcum bulldogensis.*

Falcum kaindiensis **sp. nov.**

Habitus, Figure 78d. Distribution, Figure 79. Female genitalia, Figure 82e,f. SEMs, Figure 84. Male genitalia, Figure 85.

Etymology

Named after the type locality.

Materials examined

HOLOTYPE: **PAPUA NEW GUINEA: MOROBE PROVINCE:** Mount Kaindi, 7.35°S 146.68333°E, 2300 m, 31 Oct 1976, W.C. Gagne, ex *Nastus* sp. (Poaceae), 1♂(AMNH_PBI 00046321) (BPBM).

PARATYPES: **PAPUA NEW GUINEA: MOROBE PROVINCE:** Mount Kaindi, 7.35°S 146.68333°E, 2300 m, 31 Oct 1976, W.C. Gagne, ex *Nastus* sp. (Poaceae), 2♀

(AMNH_PBI 00046319, AMNH_PBI 00046320), 1♂ (AMNH_PBI 00046322) (BPBM).

Diagnosis

Falcum kaindiensis is recognised by the following combination of characters: body stramineous (Fig. 78d); bucculae broad, ca. as wide as long (Fig. 84b); eyes reniform in lateral view (Fig. 84b); calli of anterior lobe of pronotum elevated; left and right parameres c-shaped (Figs 84b,c); left paramere with a medial process; proximal endosomal spicule elongate, apically recurved towards secondary gonopore (Fig. 84d); dorsal endosomal sclerite restricted to anterior ½ of endosoma, flat and apically bifurcate (Fig. 84d); subgenital plate subtriangular, short (Fig. 82d).

Description

COLOURATION: Body mostly stramineous (Fig. 78d). ***Head:*** frons dark brown; eyes black; vertex stramineous with faint red midline; mandibular and maxillary plates stramineous; clypeus pale yellow; bucculae pale grey; gula and genae stramineous. ***Antennae:*** dark brown to stramineous. ***Labium:*** pale grey. ***Pronotum:*** stramineous, sometimes mottled with pale green. ***Thoracic venter:*** stramineous. ***Scutellum:*** stramineous. ***Metathoracic Gland:*** evaporative area pale stramineous. ***Hemelytra:*** transparent, without markings. ***Legs:*** stramineous. ***Abdomen:*** stramineous mottled with pale green.

VESTITURE AND TEXTURE: Body sparsely distributed microtrichia and decumbent, hair-like setae (Fig. 84). ***Head:*** erect, hair-like setae present; vertex setae present anteriorly and posteriorly (Fig. 84a); otherwise hair-like setae uniformly present; maxillary and mandibular plates, genae and gula rugulose (Fig. 84c). ***Antennae:*** setae decumbent, hair-like; AI rugulose, setae thick; AII-AIV dense distribution of microtrichia. ***Pronotum:*** (Fig. 84d) finely rugulose; very sparse

distribution of small hair-like setae. ***Thoracic venter:*** proxyphus rugulose; dense distribution of matted microtrichia; mesosternal microtrichia present medially. ***Scutellum:*** (Fig. 84e) rugulose; sparse distribution of semi-erect, hair-like setae. ***Hemelytra:*** setae semi-erect, hair-like; dense distribution of microtrichia. ***Legs:*** setae long, erect, hair-like; tibiae with thick dark setae.

STRUCTURE: Body elongate-ovoid (Fig. 78d). ***Head:*** (Fig. 84a) vertex with sulcate midline; bucculae broad, not covering gula medially (Fig. 84b); clypeus straight with convex anterior margin (Fig. 84c); gula extending ca. ½ length of eye (Fig. 84c); eyes strongly reniform, extending ventrad to posterior margin of clypeus (Fig. 84c). ***Labium:*** extending to abdominal s2. ***Pronotum:*** (Fig. 84d) collar strongly developed; foveae absent; anterior lobe transversely convex, with weakly developed calli, lateral margins convex, rectilinear posteriorly; posterior lobe declivent towards head, lateral margins concave, strongly divergent posteriorly, posterior margin convex. ***Thoracic venter:*** proxyphus depressed, rounded. ***Scutellum:*** (Fig. 84e) without foveae on anterolateral angles; lateral margins straight, smooth; mesoscutum raised. ***Hemelytra:*** costal margins straight; cuneus ca. 2.5x longer than wide, curved medial margin. ***Legs:*** metafemora and metatibiae elongate; femora only weakly incrassate. ***Male Genitalia:*** genital opening of pygophore subrectangulate (Fig. 85b); ventral projection broad, elongate, triangular and dorsoventrally flattened. Left paramere (Fig. 85b) c-shaped; sensory lobe incrassate with several small setae and a large medial process; apophysis weakly arcuate, with apex acute. Right paramere (Fig. 85c) c-shaped, with acute apical process. Aedeagus (Fig. 85d) with phallotheca with dorsal opening; ductus seminis short; secondary gonopore moderately long, sinuate; proximal endosomal spicule elongate, apically recurved towards secondary gonopore, laterally flattened, not extending beyond phallotheca at rest; dorsal endosomal lobal sclerite restricted to

anterior ½ of endosoma, flat, apically bifurcate. ***Female genitalia:*** (Figs 85e,f) subgenital plate triangular, short, rounded apically, margins weakly crenulate; interramal lobes mitt-shaped, uniformly covered with scale-like texture.

Measurements

See Table 10.

Distribution

Known only from Mt. Kaindi, Morobe Province, Papua New Guinea (Fig. 79).

Biology and plant associations

All specimens were collected from an unidentified grass species belonging to the genus *Nastus* (Poaceae).

Remarks

Falcum kaindiensis is known from four specimens from a single locality. In colouration and vestiture it most closely resembles *Falcum gagnei* and *F. kaindiensis* but can be distinguished externally by the following characters: bucculae broad, about the same width as length instead of elongate; and, calli of the anterior lobe of the pronotum elevated, instead of flat. These differences are supported by the male genitalia; the proximal endosomal spicule is recurved in the latter species, and straight in the former.

Falcum taiwanensis **sp. nov.**

Habitus, Figure 78e. Distribution, Figure 79. Male genitalia, Figure 86.

Etymology

Named after Taiwan, from which all known specimens were collected.

Materials examined

HOLOTYPE: **TAIWAN: CHIAYI:** Arisan, 23.57333°N 120.81306°E, 2130 m, 17 08 1947, J.L. Gressitt, 1♂ (AMNH_PBI 00047054).

PARATYPES: **TAIWAN: CHIAYI:** Arisan, 23.57333°N 120.81306°E, 2130 m, 17 08 1947, J.L. Gressitt, 2♂♂ (AMNH_PBI 00047055, AMNH_PBI 00047056), 3♀♀ (AMNH_PBI 00047057-AMNH_PBI 00047059) (BPBM); 08 Apr 1965-09 Apr 1965, J.L. Gressitt, 1♀ (AMNH_PBI 00047060) (BPBM); 03 Jul 1972-09 Jul 1972, J.L. Gressitt, 1♂ (AMNH_PBI 00047061) (BPBM).

Diagnosis

Falcum taiwanensis is recognised by the following combination of characters: body black (Fig. 78e); bucculae narrow, about twice as long as it is wide (Fig. 85b); eyes elliptical-shaped in lateral view (Fig. 85c); calli of the anterior lobe of the pronotum mildly elevated (Fig. 85b); apical endosomal sclerite absent (Fig. 86d); dorsal endosomal sclerite reduced (Fig. 86d).

Description

COLOURATION: Body mostly black (Fig. 78e). ***Head:*** mostly black; bucculae and posterior margin of head yellow. ***Antennae:*** AI yellow proximally, remainder black; AII-AIV black. ***Pronotum:*** collar yellow, otherwise uniformly black. ***Thoracic pleura and sterna:*** black. ***Scutellum:*** uniformly black. ***Metathoracic Gland:*** evaporative area black. ***Hemelytra:*** clavus dark brown to black brown lateral markings on apex of corium. ***Legs:*** uniformly pale yellow. ***Abdomen:*** venter black, sometimes mottled with pale yellow.

VESTITURE AND TEXTURE: Body with sparsely distributed microtrichia and long erect hair-like setae (Fig. 85). ***Head:*** (Fig. 85a) vertex and frons with hair-like setae, setae shorter on gula, genae and clypeus. ***Antennae:*** AI smooth, with bristle-like setae; AII-AIV with dense distribution of decumbent setae and microtrichia. ***Pronotum:*** (Fig. 85d) with sparse distribution of elongate, hair-like setae. ***Thoracic venter:*** rugulose; with dense distribution of matted microtrichia. ***Scutellum:*** weakly rugulose. ***Hemelytra:***

very sparse distribution of hair-like setae. ***Legs:*** elongate, erect, hair-like setae, intermixed with bristle-like setae on tibiae.

STRUCTURE: Body elongate-ovoid (Fig. 78e). ***Head:*** vertex with sulcate midline (Fig. 85a); bucculae broad, not covering gula medially (Fig. 85b); gula extending ca. ½ length of eye (Fig. 85c); eyes egg-shaped, extending ventrad to anterior margin of clypeus (Fig. 85c); clypeus straight with convex anterior margin (Fig. 85c). ***Pronotum:*** (Fig. 85d) collar strongly developed; foveae absent; anterior lobe transversely convex, with weakly developed calli, lateral margins convex, rectilinear posteriorly; posterior lobe declivent towards head, lateral margins concave, strongly divergent posteriorly, posterior margin convex. ***Thoracic venter:*** proxyphus depressed, rounded. ***Scutellum:*** without foveae on anterolateral angles; lateral margins straight, smooth; mesoscutum raised. ***Hemelytra:*** costal margins straight; cuneus approximately 3x longer than wide, curved medial margin. ***Legs:*** metafemora and metatibiae elongate, femora only weakly incrassate. ***Male Genitalia:*** genital opening of pygophore subrectangular; ventral projection broad, elongate and triangular, dorsoventrally flattened (Fig. 86a). Left paramere (Fig. 86b) r-shaped, mildly sinuate; sensory lobe incrassate with several small setae; apophysis apically hooked. Right paramere (Fig. 86c) r-shaped, strongly incrassate apically. Aedeagus (Fig. 86d) with ductus seminis short; secondary gonopore elongate attached near base of lobal sclerites; apical endosomal sclerite absent; dorsal endosomal sclerite elongate with several small dentations towards apex; endosomal membrane bilobed.

Measurements

See Table 10.

Distribution

Endemic to Taiwan (Fig. 79).

Biology and plant associations

No host plants recorded.

Remarks

Falcum taiwanensis is the only species in this treatment to have been collected in the Oriental biogeographic region. It is the only member of *Falcum* that does not have the stramineous colour of the other species, being mostly black. It was placed in *Falcum* because of similarities of the enlarged triangulate ventral process of the pygophore, the r-shaped left and right paramere and the short but broad ductus seminis.

Felisacodes **Bergroth**

Rhodesiella Poppius, 1914: 64 (gen. nov.); *Rhodesiella* Carvalho 1958: 62 (world catalogue

Madagascariella Carvalho 1953: 44 (gen. nov.; type species: *Madagascariella longipedes* Carvalho 1953 by original designation); Schuh 1974: 40 (synonymy)

Felisacodes Odhiambo, 1967: 1681 (nom. nov. for *Rhodesiella* Poppius; preoccupied by *Rhodesiella* Adams, 1905 [Diptera]); Schuh 1974: 40 (discussion; species list); Schuh 1995: 109 (world catalogue).

Type species

Rhodesiella bryocorina Poppius 1914 by monotypy.

Diagnosis

Felisacodes can be distinguished by the following combination of characters: body black (e.g. Fig. 87a); hair-like setae only; row of punctures on clavus (e.g. Fig. 88e); costal margins of hemelytra straight (e.g. Fig. 87a); bucculae rounded, contiguous with anterior margin of pronotum (e.g. Fig. 88b); eyes large, egg-shaped in lateral view;

distinct anterior and posterior lobes of pronotum (e.g. Fig. 88b), posterior lobe strongly declivent towards head; pygophore mildly elongate (e.g. Fig. 91a); left paramere apophysis simple, sensory lobe reduced, weakly incrassate (e.g. Fig. 91b); right paramere small, most often with heavily sclerotised lateral process (e.g. Fig. 91c); phallotheca with apical opening (e.g. Fig. 91d); endosomal membrane simple (e.g. Fig. 91d); proximal endosomal spicule present (e.g. Fig. 91d); apical endosomal sclerite sometimes present (e.g. Fig. 91d).

Description

COLOURATION: Body mostly black, with stramineous markings (e.g. Fig. 87a). ***Head:*** mostly brown to black. ***Pronotum:*** anterior and posterior lobes contrastingly coloured. ***Hemelytra:*** hyaline, sometimes with dark indistinct markings; clavus variable, usually with fuscous to brown markings.

VESTITURE AND TEXTURE: Body with sparsely distributed microtrichia and hair-like setae. ***Antennae:*** mostly with dense distribution of erect, hair-like setae (e.g. Fig. 87a). ***Pronotum:*** (e.g. Fig. 88c) collar strongly rugulose; anterior lobe smooth, posterior lobes weakly or strongly rugulose. ***Thoracic venter:*** proxyphus rugulose; setae absent; dense distribution of microtrichia. ***Hemelytra:*** (e.g. Fig. 88c) sparse distribution of elongate, erect, hair-like setae; sparse distribution of microtrichia. ***Legs:*** dense distribution of semi-erect, hair-like setae; several rows of spinules usually present on tibiae.

STRUCTURE: Body gracile (e.g. Fig. 87a). ***Head:*** (e.g. Fig. 88a) hypognathous, frons and clypeus posteroventrally oriented, frons almost flat; about twice as wide as long, in dorsal view; vertex without midline sulcus; bucculae narrow, strongly produced ventrally, beyond ventral margin of eyes (e.g. Fig. 88b); gula sinuate, approximately ½ length of head (Fig. 88b); eyes egg-shaped in lateral view, contiguous or almost

contiguous with anterior margin of pronotum; postocular region absent. ***Antennae:*** greatly elongate, ca. 3x longer than head. ***Pronotum:*** bilobed, with anterior lobe much shorter than posterior lobe (e.g. Fig. 88c); collar small; anterior lobe subrectangulate, lateral margins weakly rounded, calli strongly developed, separated; posterior lobe trapezoidal, lateral margins strongly divergent posteriorly, posterior margin rectilinear. ***Mesepimeron:*** with evaporative bodies, spiracle weakly exposed. ***Metathoracic Gland:*** peritreme short, tongue-like, raised, dorsally oriented; evaporative area occupying ca. ⅓ of metepisternum, peritreme reaching dorsal margin of evaporative area. ***Hemelytra:*** (e.g. Fig. 88e) margins straight; ca. 2x longer than abdomen; cuneus 2x longer than wide. ***Legs:*** cursorial; coxae elongate; pretarsal claws with uniformly spaced minute striations; narrow at base. ***Male Genitalia:*** pygophore mildly elongate (e.g. Fig. 91a), weakly asymmetrical, sometimes with lateral groove; genital opening of pygophore dorsal, with prominent ventral process, and erect, hair-like setae. Left paramere (e.g. Fig. 91b) sensory lobe weakly incrassate; apophysis simple, twisted, tapered apically. Right paramere (e.g. Fig. 91c) small, often with prominent medial process. Aedeagus (e.g. Fig. 91d) with phallotheca narrow constricted medially, lacking basal lobes, with apical opening; ductus seminis short and straight with weak sinuation towards base; secondary gonopore moderately long; proximal endosomal spicule moderately long, sometimes apex crenulated; apical endosomal sclerite sometimes present; endosomal membrane bilobed, without field of spinules.

Distribution

Southwest and Central-west Africa (Fig. 89).

Biology and plant associations

Unknown

Remarks

Because I lacked specimens of *Felisacodes longipes* my description of the genus and included species is limited. *Felisacodes* can be easily distinguished from other genera by the punctures on the clavus of the hemelytra, combined with its dark body.

Schuh (1974) described the males of the genus as having typical genitalia for an Orthotylini with a membranous "vesica" lacking spiculii and well developed "k-structures" of the female genitalia.

***Felisacodes bryocorina* (Poppius)**

Habitus, Figure 87a. SEMs, Figure 88. Distribution, Figure 89.

Rhodesiella bryocorina Poppius, 1914: 65 (sp. nov.)

Felisacodes bryocorina: Carvalho, 1958: 62 (nov. comb.). Schuh 1974: 40 (list); Schuh 1995: 109 (world catalogue); Linnavuori 1975:57; Linnavuori 1994: 67

Materials examined

PARATYPES: **SOUTH AFRICA: WESTERN CAPE PROVINCE:** Grootvatersbosch For. Res., 14mi N of Heidelburg, 05 Feb 1968, R.T. Schuh, J.A. and S. Slater, M. Sweet, *Plectranthus fruticosus* Wight (Lamiaceae), 1♂ (AMNH_PBI 00315808), 1♀(AMNH_PBI 00315809) (USNM).

Diagnosis

Felisacodes bryocorina can be distinguished by the following combination of characters: body black with yellow markings (Fig. 87a); antennae bicoloured black and yellow; collar and anterior lobe of pronotum yellow, posterior lobe black (Fig. 87a); scutellum black (Fig. 87a); scutellum weakly punctate (Fig. 88d); hemelytra mostly translucent yellow, with clavus black or with black markings; proxyphus smooth; left

paramere apically simple; apical endosomal sclerite absent; dorsal endosomal sclerite elongate, projecting from phallotheca at rest, with terminal striations.

Description

COLOURATION: Body mostly black with yellow markings (Fig. 87a). ***Head:*** clypeus yellow with brown midline; frons, vertex and genae yellow; mandibular and maxillary plates, and bucculae black; gula brown. ***Antennae:*** AI white to pale yellow distally, black proximally; AII black with large pale yellow band medially; AIII yellow; AIV black. ***Pronotum:*** collar and anterior lobe yellow; posterior lobe black. ***Thoracic venter:*** pleura black; proxyphus yellow; mesosternum black with an indistinct yellow midline; metasternum pale yellow with faint red midline. ***Scutellum:*** black. ***Metathoracic Gland:*** evaporative area grey. ***Hemelytra:*** translucent, clavus region black, indistinct black spot anterior to membrane. ***Legs:*** pale yellow. ***Abdomen:*** s2 black, s3-s8 pale yellow; terminal segments fuscous.

VESTITURE AND TEXTURE: Body with sparsely distributed microtrichia and elongate, hair-like setae. ***Head:*** setae elongate, hair-like, mostly sparsely distributed, more so on frons; single column of setae present on anterior margin of clypeus; gula and genae very sparsely setose. ***Antennae:*** AI with sparse distribution of hair-like setae; AII-AIV with dense distribution of setae. ***Pronotum:*** sparse distribution of erect, hair-like setae; anterior lobe smooth; posterior, weakly punctate. ***Thoracic venter:*** smooth; proxyphus with sparse distribution of microtrichia; setae absent. ***Scutellum:*** weakly punctate; dense distribution of elongate, hair-like setae. ***Hemelytra:*** short, hair-like setae, more dense on corium. ***Legs:*** metafemora and metatibiae elongate, metafemora incrassate.

STRUCTURE: Body elongate-ovoid (Fig. 87a). ***Head:*** vertex with weakly sulcate midline; clypeus straight with convex anterior margin; bucculae small, rounded not

covering gula medially; gula extending ca. ½ length of the eye; eyes spherical, extending ventrad to anterior margin of clypeus. ***Labium:*** extending to metasternum. ***Pronotum:*** collar strongly developed; foveae absent; anterior lobe transversely convex, with weakly developed calli, lateral margins convex, rectilinear posteriorly; posterior lobe strongly declivent towards head, lateral margins convex, weakly divergent posteriorly, posterior margin convex. ***Thoracic venter:*** proxyphus triangular, weakly depressed. ***Scutellum:*** foveae present on anterolateral angles; lateral margins straight, serrate; mesoscutum raised. ***Hemelytra:*** costal margins straight, bulging at cuneus; cuneus ca. 2x longer than wide. ***Legs:*** elongate, gracile. ***Male Genitalia:*** genital opening of pygophore circular; ventral projection broad and elongate and dome-shaped. Left paramere strongly sinuate, twisted; sensory lobe weakly incrassate with sparse row of elongate setae. Right paramere elongate, sinuate with thorn-like apical process. Aedeagus ductus seminis short; secondary gonopore elongate; apical endosomal sclerite absent; dorsal endosomal sclerite elongate, projecting from phallotheca at rest, with striations terminally; endosomal membrane bilobed.

Measurements

See Table 11.

Distribution

Known from several locations in South and East Africa (Fig. 89).

Biology and plant associations

The species was collected on *Plectranthus fruticosus* (Lamiaceae). Schuh (1974) observed that both adults and nymphs were collected in the same series, which is a strong indication that this is a host plant for the species.

Remarks

Male genitalia described from drawings Linnavuori (1994). The homology of the structures in Linnavuori (1994) is not discussed, however a dorsal endosomal lobal sclerite clearly resembles that of *Felisacodes uganda* in its broad, dentate apex.

Species of *Felisacodes* can be distinguished by the body texture. *Felisacodes bryocorina* has a smooth anterior lobe of its pronotum, a smooth thoracic venter and a weakly punctate posterior lobe of the pronotum and scutellum.

Felisacodes diaboura **Odhiambio**

Habitus, Figure 87b. Distribution, Figure 89. SEMs, Figure 90.

Felisacodes diaboura Odhiambio, 1967: 1681 (sp. nov.); Schuh 1995: 40 (world catalogue)

Materials examined

CAMEROON: SOUTHWEST REGION: Mt. Cameroon, Buea slope, 4.15839°N 9.21139°E, 1372 m, 12 May 1949, Borys Malkin, 2♂♂ (AMNH_PBI 00192694, AMNH_PBI 00192695) (CAS).

Diagnosis

Felisacodes diaboura can be distinguished by the following combination of characters: pronotum black (Fig. 87b); scutellum stramineous (Fig. 87e); posterior lobe of pronotum; proxyphus and scutellum rugulose (Fig. 90d).

Description

COLOURATION: Body mostly black with yellow markings (Fig. 87b). ***Head:*** black. ***Antennae:*** AI pale yellow anteriorly, remainder black; AII-AIV uniformly black. ***Pronotum:*** uniformly black. ***Thoracic venter:*** black. ***Scutellum:*** stramineous, mesoscutum black. ***Metathoracic Gland:*** evaporative area pale yellow. ***Hemelytra:***

translucent, with lateral brown band anterior to membrane. ***Legs:*** pale yellow, sometimes mottled with dark brown. ***Abdomen:*** black.

VESTITURE AND TEXTURE: Body with sparsely distributed microtrichia and hair-like setae (Fig. 90). ***Head:*** sparse distribution of erect, hair-like setae (Fig. 90a); gula rugulose (Fig. 90b). ***Antennae:*** AI with a few bristle-like setae; AII-AIV dense distribution of small, hair-like setae. ***Pronotum:*** (Fig. 90d) anterior lobe smooth; posterior lobe rugulose; very sparse distribution of setae. ***Thoracic venter:*** proxyphus coarsely rugulose; setae absent. ***Scutellum:*** (Fig. 90e) weakly rugulose; very sparse distribution of setae. ***Hemelytra:*** smooth; sparse distribution of elongate, decumbent, hair-like setae. ***Legs:*** dense, decumbent setae; tibiae with thick, semi-erect setae.

STRUCTURE: Body elongate-ovoid (Fig. 87b). ***Head:*** (Fig. 90a) vertex with weakly sulcate midline; bucculae narrow, short not covering gula medially (Fig. 90c); clypeus straight with sinuate anterior margin; gula extending ca. ½ length of eye (Fig. 90b); eyes spherical, extending ventrad to anterior margin of clypeus (Fig. 90b). ***Labium:*** extending to metasternum. ***Pronotum:*** (Fig. 90d) collar strongly developed; foveae absent; anterior lobe transversely convex, with weakly developed calli, lateral margins convex, rectilinear posteriorly; posterior lobe strongly declivent towards head, lateral margins convex, weakly divergent posteriorly, posterior margin weakly convex. ***Thoracic venter:*** proxyphus weakly developed, lateral margins straight. ***Scutellum:*** (Fig. 90e) foveae present on anterolateral angles; lateral margins straight, serrate; mesoscutum raised. ***Hemelytra:*** costal margins straight; cuneus ca. 2x longer than wide, medial margin weakly curved. ***Legs:*** metafemora and metatibiae elongate, metafemora incrassate.

Measurements

See Table 11.

Distribution

Known from a single locality in the Cameroon (Fig. 89).

Biology and plant associations

Unknown.

Remarks

Type materials of this species have not been examined however these specimens strongly resemble *Felisacodes diaboura* as described by Odhiambo (1967).

See Remarks section of *Felisacodes bryocorina*. *Felisacodes diaboura* is most readily recognised from *Felisacodes bryocorina* and *Felisacodes uganda* by its strongly rugulose posterior lobe of the pronotum weakly rugulose posterior lobe, coarsely rugulose thoracic venter, weakly rugulose scutellum.

***Felisacodes uganda* sp. nov.**

Habitus, Figure 87c. Distribution, Figure 89. Male genitalia, Figure 91.

Etymology

Named after the type locality.

Materials examined

HOLOTYPE: **UGANDA: CENTRAL REGION:** Mulange, 0.5025°N 33.04389°E, no collector or date, 1♂ (AMNH_PBI 00192697) (USNM).

PARATYPES: **UGANDA: CENTRAL REGION:** same data as Holotype, 1♂, 6♀♀ (AMNH_PBI 00192698-AMNH_PBI 00192703) (USNM) (USNM).

Diagnosis

Felisacodes uganda can be recognised by the following combination of characters: pronotum and scutellum black (Fig. 87c); posterior lobe of pronotum rugulose; proxyphus coarsely rugulose; scutellum weakly rugulose; left paramere r-shaped, with

apophysis rounded (Fig. 91b); right paramere club-shaped; phallotheca opening apically (Fig. 91c); proximal endosomal spicule blade-like, with serrated apex (Fig. 91f,g); small dorsal endosomal spicule present (Fig. 91f).

Description

COLOURATION: Body mostly black (Fig. 87c). ***Head:*** maxillary plate lighter, otherwise black. ***Antennae:*** AI pale yellow, usually fuscous apically; AII-AIV black, often mottled with yellow. ***Pronotum:*** collar pale white, anterior lobe black, often with an indistinct white midline; posterior lobe black. ***Thoracic venter:*** pleura and sterna black. ***Scutellum:*** black fading to very pale yellow apically. ***Metathoracic Gland:*** evaporative area pale yellow, mottled with black. ***Hemelytra:*** transparent, with indistinct lateral fuscous band between membrane and clavus region. ***Legs:*** pale yellow to grey; metafemora with fuscous markings. ***Abdomen:*** venter uniformly black.

VESTITURE AND TEXTURE: Body with sparsely distributed microtrichia and hair-like setae. ***Head:*** sparse distribution of erect, hair-like setae; gula weakly rugulose. ***Antennae:*** AI with sparse distribution of large setae; AII-AIV with dense distribution of small, semi-erect, hair-like setae. ***Pronotum:*** anterior lobe smooth, posterior lobe rugulose; very sparse distribution of hair-like setae. ***Thoracic venter:*** proxyphus smooth; sparse distribution of microtrichia; setae absent. ***Scutellum:*** weakly rugulose. ***Hemelytra:*** smooth, sparse distribution of decumbent, hair-like setae. ***Legs:*** dense distribution of decumbent, hair-like setae; intermixed on tibiae with bristle-like, semi-erect setae.

STRUCTURE: Body elongate-ovoid. ***Head:*** vertex with weakly sulcate midline; bucculae narrow, short not covering gula medially; clypeus straight with sinuate anterior margin; gula extending ca. ½ length of eye; eyes spherical, extending to anterior margin of clypeus. ***Labium:*** extending to mesosternum. ***Pronotum:*** collar

strongly developed; foveae absent; anterior lobe transversely convex, with weakly developed calli, lateral margins convex, rectilinear posteriorly; posterior lobe strongly declivent towards head, lateral margins convex, weakly divergent posteriorly, posterior margin weakly convex. ***Thoracic venter:*** proxyphus short, lateral margins weakly curved. ***Scutellum:*** foveae present on anterolateral angles; lateral margins straight, serrate; mesoscutum raised. ***Hemelytra:*** costal margins straight; cuneus ca. 2-2.5x longer than wide, medial margin weakly curved. ***Legs:*** metafemora and metatibiae elongate, metafemora incrassate. ***Male Genitalia:*** genital opening of pygophore circular (Fig. 91a); ventral projection broad, elongate and subtriangular. Left paramere (Fig. 91b) r-shaped, with apophysis rounded, and apex tapered. Right paramere (Fig. 91c) club-shaped, with medical and apical process, apophysis weakly rounded, with apex acute. Aedeagus with phallotheca opening apically (Figs 91d-e); secondary gonopore moderately long (Figs 91f-g); proximal endosomal spicule blade-like, with apex weakly serrated (Figs 91f-g); with a short subtriangular dorsal endosomal lobal sclerite (Figs 91f-g); endosomal membrane large and bilobed (Figs 91f-g).

Measurements

See Table 11.

Distribution

Known from a single locality in Uganda (Fig. 89).

Biology and plant associations

Unknown.

Remarks

The male genitalia and the distinct punctures on the clavus of this species place it firmly within *Felisacodes.* It is differentiated from *F. diaboura* and *F. bryocorina* on the basis of the descriptions and the genitalic illustrations in Schuh (1974). I am confident that it

is not *F. longipedes*. Its most distinctive feature is the unusual dorsal endosomal lobal sclerite (Fig. 91d).

See Remarks section of *F. bryocorina*. *Felisacodes bryocorina* also has a smooth anterior lobe of the pronotum, weakly rugulose posterior lobe of the pronotum and scutellum.

Flagellomiris **gen. nov.**

Etymology

From the Latin *flagellum*, meaning whip, due to its whip-like endosomal spicules; the –*miris* suffix is in reference to its membership of the family Miridae; noun in apposition. Neuter.

Type species

Flagellomiris tasmaniensis sp. nov. by original designation

Diagnosis

Flagellomiris can be distinguished by the following combination of characters: body green and stramineous (Figs 64f,g); hemelytral costal margins straight (Figs 64f,g); elongate, large eyes, contiguous with the anterior margin of pronotum (e.g. Fig. 92b); AII and AIII not greatly elongate; narrow postocular region (e.g. Fig. 92b); pronotum campanulate with distinct lobes (e.g. Fig. 92c); head and posterior lobe of pronotum with scale-like texturing (e.g. Fig. 92b); pygophore conical, elongate (e.g. Fig. 93a); left paramere (e.g. Fig. 93b) r-shaped, sensory lobe moderately developed, apophysis rounded; right paramere (e.g. Fig. 96c) c-shaped, sensory lobe moderately developed, apophysis weakly sinuate and apex recurved; phallotheca opening dorsal (Figs 93c-d); three endosomal spicules present (e.g. Figs 92e-f); endosomal membrane reduced (e.g. Figs 92e-f).

Description

COLOURATION: Body green and stramineous (Figs 64f,g). ***Head:*** region around eyes pale, colour contrasting with rest of head. ***Pronotum:*** anterior and posterior lobe colouration distinct from each other. ***Hemelytra:*** hyaline with indistinct brown markings on corium; cuneus red.

VESTITURE AND TEXTURE: Body with sparse distribution of large, semi-erect, hair-like setae and dense distribution of microtrichia (e.g. Fig. 92). ***Antennae:*** AI rugulose; dense distribution of decumbent, hair-like setae and microtrichia. ***Pronotum:*** (e.g. Fig. 92c) anterior lobe with sparse distribution of elongate, hair-like setae; dense distribution of microtrichia; posterior lobe weakly textured with short, hair-like setae. ***Prosternum:*** dense distribution of small transverse rugae; dense distribution of microtrichia. ***Legs:*** dense distribution of microtrichia; hair-like setae of variable lengths. ***Hemelytra:*** large, decumbent, hair-like setae.

STRUCTURE: Body elongate, gracile (Figs 64f,g). ***Head:*** weakly hypognathous (e.g. Fig. 92b); frons and clypeus ventrally oriented (e.g. Fig. 92b); frons almost flat (e.g. Fig. 92a); about twice as wide as long, in dorsal view (e.g. Fig. 92a); medial sulcus absent (e.g. Fig. 92a); bucculae rounded, weakly produced ventrally beyond (e.g. Fig. 95b); gula concave, restricted to posterior ¼ of the length of the head (e.g. Fig. 92b); eyes reniform in lateral view, contiguous or almost contiguous with anterior margin of pronotum (e.g. Fig. 92b); postocular region present, narrow (e.g. Fig. 92b). ***Antennae:*** AI greatly elongate, ca. 3x longer than head. ***Pronotum:*** (e.g. Fig. 92c) bilobed, with anterior lobe much shorter than posterior lobe; collar relatively flat; anterior lobe subrectangulate, lateral margins weakly rounded, calli strongly developed, contiguous medially; posterior lobe trapezoidal, lateral margins strongly divergent posteriorly,

posterior margin rectilinear. ***Mesepimeron:*** (e.g. Fig. 92e) with evaporative bodies, spiracle weakly exposed. ***Metathoracic Gland:*** (e.g. Fig. 92e) peritreme long, tongue-like, strongly raised, posterodorsally oriented; evaporative area occupying ca. ⅓ of metepisternum, peritreme reaching dorsal margin of evaporative area. ***Hemelytra:*** costal margins straight; ca. 2x longer than abdomen, cuneus ca. 3x longer than wide (e.g. Fig. 92f). ***Legs:*** cursorial; coxae and metafemora greatly elongate; pretarsal claws smooth; broad at the base. ***Male Genitalia:*** pygophore conical, elongate, sometimes with groove for right paramere, dorsocaudal genital opening of pygophore with short ventral process (e.g. Fig. 93a). Left paramere (e.g. Fig 93b) r-shaped; sensory lobe moderately developed; apophysis arcuate, tapered distally. Right paramere (e.g. Fig. 93c) c-shaped, sensory lobe moderately developed; apophysis weakly sinuate, apex recurved. Aedeagus with phallotheca distally tapered, with dorsal opening (e.g. Figs 92c-d); ductus seminis short (e.g. Figs 92e,f); secondary gonopore moderately long; three unbranched endosomal spicules (e.g. Figs 92e,f); two dorsal endosomal spicules, DES1 narrow, elongate, rounded, distally serrate, DES2 sinuate, elongate, narrow, distally serrate; proximal endosomal spicule narrow, elongate, strongly reflexed (e.g. Figs 92e,f); endosomal membrane very short lobe, lacking field of spinules (e.gs Figs 92e,f).

Distribution

Flagellomiris is known from Eastern Australia and Tasmania (Fig. 94).

Biology and plant associations

Flagellomiris tasmaniensis is found on numerous *Eucalyptus* species. *Flagellomiris sinuatum* is possibly a *Eucalyptus*-feeder as well, although there are few specimens.

Remarks

Flagellomiris is the only genus in the group which is endemic to Australia and is the only one which is not found in the tropics, being restricted to Southeast Australia.

Externally they resemble austromirines, and they share with them endosomal spicules. They are placed in this *Candidomiris-Morobea* complex because of their similarities with *Dimifacoris* including its unusual scale-like texturing, strongly prognathous head, and greatly elongate gracile appendages. Unlike the austromirines, they do not have a swollen peritreme of the metathoracic glands.

***Flagellomiris sinuatum* sp. nov.**

Habitus, Figure 64f. SEMs Figure 92. Male genitalia, Figure 93. Distribution, Figure 94.

Etymology

Named after its sinuate parameres.

Materials examined

HOLOTYPE: **AUSTRALIA: NEW SOUTH WALES:** Dainers Gap, 36.2°S 148.71666°E, 1585 m, 21 Feb 1974, P. Morrow, *Eucalyptus perriniana* (Myrtaceae), 1♂ (AM).

PARATYPES: **AUSTRALIA: NEW SOUTH WALES:** 77.2 km E of Broken Hill on Barrier Hi-way, 31.76668°S 142.2592°E, 150 m, 10 Nov 2001, Cassis, Schuh, and Schwartz, *Amyema quandang* (Lindley) Tieghem *var. quandang* (Loranthaceae), det. NSW staff NSW666386, 1♀ (AM).

Diagnosis

Flagellomiris sinuatum is recognised by the following combination of characters: labium extending to mesosternum; left paramere c-shaped (Fig. 92b); right paramere club-shaped; DES1 longer than DES2 (Figs 92e,f).

Description

COLOURATION: Body mostly stramineous with green markings (Fig. 64f). ***Head:*** clypeus brown; vertex yellow with distinct brown line medially; frons brown; mandibular and maxillary plates and bucculae yellow mottled with brown; bucculae

yellow; genae yellow; gula brown. ***Antennae:*** AI-AIV brown to yellow. ***Pronotum:*** anterior lobe yellow with brown markings medially and laterally or uniformly brown; posterior lobe light brown mottled with pale yellow. ***Thoracic venter:*** proxyphus yellow; thoracic pleura and sterna otherwise black to light brown. ***Scutellum:*** yellow with brown markings. ***Hemelytra:*** transparent. ***Legs:*** fuscous.

VESTITURE AND TEXTURE: Body with sparsely distributed pale and elongate, hair-like setae; microtrichia densely distributed (Fig. 64f). ***Head:*** dorsal surface with sparse distribution of hair-like setae (Fig. 92a); genae without setae (Fig. 92b); gula setae elongate (Fig. 92b). ***Antennae:*** AI-AIV with dense distribution of short, decumbent, hair-like setae. ***Pronotum:*** (Fig. 92c) with sparse distribution of decumbent, hair-like setae; very finely punctate; posterior lobe with sparse distribution of small, decumbent, hair-like setae; very finely rugulose. ***Thoracic venter:*** proxyphus with dense distribution of matted microtrichia; very finely rugulose. ***Scutellum:*** (Fig. 92d) sparse distribution of long, decumbent, hair-like setae. ***Hemelytra:*** sparse distribution of semi-erect, hair-like setae. ***Legs:*** femora and tibiae with dense distribution of decumbent, hair-like setae; tibiae also with spinules.

STRUCTURE: Body gracile (Fig. 64f). ***Head:*** bucculae broad, oval not covering gula medially; clypeus straight with uniformly convex anterior margin (Fig. 92b); gula strongly weakly convex in lateral view (Fig. 92b); eyes reniform dorsally, not extending ventrad to anterior margin of clypeus (Fig. 92b). ***Labium:*** extending to metasternum. ***Pronotum:*** (Fig. 92c) collar strongly developed; foveae absent; anterior lobe transversely convex, with strongly developed calli, lateral margins convex, rectilinear posteriorly; posterior lobe strongly declivent towards head, lateral margins convex, divergent posteriorly, posterior margin weakly convex. ***Thoracic venter:*** proxyphus weakly raised. ***Scutellum:*** (Fig. 92d) without foveae on anterior anterolateral angles;

lateral margins straight, smooth; mesoscutum straight. ***Hemelytra:*** costal margins straight; cuneus ca. 2x longer than wide (Fig. 92f), medial margin concave. ***Legs:*** metafemora and metatibiae greatly elongate. ***Male Genitalia:*** genital opening of pygophore oval (Fig. 93a); ventral projection broad, short, dome-shaped (Fig. 93a). Left paramere (Fig. 93b) c-shaped; sensory lobe weakly incrassate; apophysis elongate, rounded, apex recurved. Right paramere club-shaped, weakly sinuate. Aedeagus (Fig. 93c-f) with DES1 and DES2 swollen basally, distally narrow, weakly sinuate; DES1 longer than DES2.

Measurements

See Table 12.

Distribution

Known from eastern New South Wales (Fig. 94).

Biology and plant associations

Flagellomiris sinuatum is known from a few specimens from *Eucalyptus perriniana* (Myrtaceae), and a single specimen from *Amyema quandang* (Loranthaceae).

Remarks

This species is smaller than *Flagellomiris tasmaniensis.* Otherwise they are externally very similar with the exception of labial length, and DES1 is longer than DES2 in *F. sinuatum*, and the converse is true for *F. tasmaniensis*.

Flagellomiris tasmaniensis sp. nov.

Habitus, Figure 64g. Distribution, Figure 94. SEMs, Figure 95. Male genitalia, Figure 96.

Materials examined

HOLOTYPE: **AUSTRALIA: TASMANIA:** Mt. Wellington, under Organ Pipes formation, 42.89488°S 147.2446°E, 892 m, 15 Jan 2004, M.D. Schwartz and P.P. Tinerella, 1♂ (AMNH_ENT 00013435) (AM).

PARATYPES: **AUSTRALIA: TASMANIA:** 12.3 km N of A6 on Jeffery's Track, (C618), 42.09995°S 147.04734°E, 727 m, 21 Jan 2004, M.D. Schwartz and P.P. Tinerella, *Eucalyptus delegatensis* R.T. Baker (Myrtaceae), det. NSW staff NSW658243, 8♀ (AMNH_PBI 00021399-AMNH_PBI 00021406), 2♂ (AMNH_PBI 00021412, AMNH_PBI 00021413) (AM). 26.3 km WSW of Geeveston Hartz Mountains National Park: carpark at Hartz Mountain Trail head, 43.21738°S 146.7705°E, 864 m, 21 Jan 2004, M.D. Schwartz and P.P. Tinerella, *Eucalyptus delegatensis* R.T. Baker (Myrtaceae), det. NSW staff NSW658243, 1♀ (AMNH_PBI 00021407) *Eucalyptus subcrenulata* Maiden and Blakely (Myrtaceae), det. NSW staff NSW658241, 1♀ (AMNH_PBI 00021408) (AM). Arve River Picnic Ground on C632, 43.15874°S 146.8068°E, 172 m, 21 Jan 2004, M.D. Schwartz and P.P. Tinerella, 1♀ (AMNH_PBI 00021409) (AM). Devonport, Stoney Rise, 41.17801°S 146.35871°E, 70 m, 23 Dec 1993, L. Hill, *Acacia baileyana* F. Muell. (Fabaceae), det. NSW staff NSW658237, 1♂ (AMNH_PBI 00021414) (AM). Kingston, Welcome Inn grounds just E of A6, 42.96942°S 147.287°E, 120 m, 20 Jan 2004, M.D. Schwartz and P.P. Tinerella, *Acacia baileyana* F. Muell. (Fabaceae), det. NSW staff NSW658237, 1♂ (AMNH_PBI 00021415) (AM). Mt. Wellington, under Organ Pipes formation, 42.89488°S 147.2446°E, 892 m, 15 Jan 2004, M.D. Schwartz and P.P.

Tinerella, *Eucalyptus* sp. (Myrtaceae), det. NSW staff NSW658213, 34♀ (AMNH_ENT 00013470-AMNH_ENT 00013503), 35♂ (AMNH_ENT 00013435-AMNH_ENT 00013469) (AM). New Norfolk, carpark of Bush Inn Hotel, 42.77859°S 147.0615°E, 30 m, 22 Jan 2004, M.D. Schwartz and P.P. Tinerella, *Leptospermum lanigerum* Maiden and Betche (Myrtaceae), det. NSW staff NSW658245, 2♀ (AMNH_PBI 00021410, AMNH_PBI 00021411) (AM).

Etymology

Named for the type locality.

Diagnosis

Flagellomiris tasmaniensis is recognised by the following combination of characters: labium extending to metasternum; left paramere (Fig. 96b) incrassate medially bearing long dorsal setae; proximal endosomal spicule (Fig. 96f,g) apex <180˚ divergent from base.

Description

COLOURATION: Mostly stramineous with green markings (Fig. 64g). ***Head:*** clypeus stramineous, fuscous anterior; otherwise stramineous. ***Antennae:*** AI stramineous; AII stramineous proximally, fuscous apically, AIII-AIV fuscous. ***Pronotum:*** anterior lobe stramineous; posterior lobe pale green. ***Thoracic venter:*** propleura black, meso- and metapleura stramineous, black posteriorly; thoracic sterna stramineous; scutellum stramineous, margin black or uniformly black. ***Hemelytra:*** transparent, brachial vein pale green; cuneus with pale green tinge; membrane veins brown. ***Legs:*** coxae pale grey; femora pale yellow; tibiae pale green; pretarsus black. ***Abdomen:*** venter pale stramineous; lateral margin black posteriorly; pygophore dark brown.

VESTITURE AND TEXTURE: Setae pale, long hair-like, sparsely distributed; with dense distribution of microtrichia (Fig. 95). ***Head:*** (Fig. 95a) frons few large, erect,

hair-like setae present; sparse distribution of large, semi-erect, hair-like setae (Fig. 95a); setae absent on lateral surface; gula with sparse distribution of elongate, hair-like setae (Fig. 95c); bucculae (Fig. 95b) with sparse fringe of small, laterally erect setae; labium dense distribution of small, erect setae. ***Antennae:*** AI-AIV dense distribution of short, decumbent, hair-like setae. ***Pronotum:*** (Fig. 95d) anterior lobe with fringe of erect setae on anterior margin, otherwise with sparse distribution of decumbent setae, very finely punctate; posterior lobe sparse distribution of small, decumbent, hair-like setae, very finely rugulose. ***Thoracic venter:*** proxyphus with dense distribution of thin matted microtrichia; very finely rugulose. ***Scutellum:*** (Fig. 95f) sparse distribution of long, decumbent, hair-like setae. ***Hemelytra:*** sparse distribution of semi-erect, hair-like setae. ***Legs:*** femora and tibiae with dense distribution of decumbent, hair-like setae; tibiae with spinules.

STRUCTURE: Body shape robust with slender appendages (Fig. 64g). ***Head:*** bucculae broad, ovate not covering gula medially (Fig. 95b); clypeus straight with uniformly convex anterior margin; gula uniformly strongly convex in lateral view (Fig. 95c); eyes reniform dorsally, not extending ventrad to anterior margin of clypeus (Fig. 95c). ***Labium:*** extending to metasternum. ***Pronotum:*** (Fig. 95d) collar strongly developed; foveae absent; anterior lobe transversely convex, with strongly developed calli, lateral margins convex, rectilinear posteriorly; posterior lobe strongly declivent towards head, lateral margins convex, divergent posteriorly, posterior margin weakly convex. ***Thoracic venter:*** proxyphus raised, heart-shaped. ***Scutellum:*** (Fig. 95f) without foveae on anterolateral angles; lateral margins straight, smooth; mesoscutum straight. ***Hemelytra:*** costal margins straight; cuneus ca. 2-2.5x longer than wide, medial margin concave. ***Legs:*** metafemora and metatibiae greatly elongate. ***Male Genitalia:*** genital opening of pygophore elliptical (Fig. 96a); ventral projection broad, short and dome-

shaped (Fig. 96a). Left paramere (Fig. 96b) c-shaped; sensory lobe weakly incrassate; apophysis sinuate, apex recurved. Right paramere (Fig. 96c) r-shaped, incrassate medially with blunt apex. Aedeagus (Figs 96d-g) with ductus seminis short; secondary gonopore moderately long; three endosomal spicules present; DES2 longer than DES1.

Measurements

See Table 12.

Distribution

Known from Tasmania only (Fig. 94).

Biology and plant associations

Large series were collected from *Eucalyptus cordata* and *Eucalyptus delegatensis.* Five other specimens were collected from *Eucalyptus nitens* and two from *Eucalyptus globulis*, from several localities.

Remarks

See remarks for *Flagellomiris sinuatum.*

Jimia Carvalho

Jimia Carvalho, 1987: 179 (original description); Schuh 1995: 126 (world catalogue).

Type species

Jimia bimaculata Carvalho by original designation.

Diagnosis

Jimia is recognised by the following combination of characters: body uniformly covered in small star-shaped setae (e.g. Fig. 97); body yellow with red markings (Figs 46b,c); body ovoid (Figs 46b,c); head hypognathous (e.g. Fig. 100b); eyes dorsoventrally elongate, reniform, contiguous with anterior lobe of pronotum (e.g. Fig. 100b); pronotum with row of punctures present on posterior margin of anterior lobe (e.g. Fig. 100d); pygophore (e.g. Fig. 101a) with finger-like ventral process (e.g. Fig. 98a); left

paramere (e.g. Fig. 98b) r-shaped sensory, elongate apophysis, apically swollen; right paramere (e.g. Fig. 98c) v-shaped; phallotheca tube-like, with apical opening (e.g. Fig. 98d); endosomal membrane unilobed, without lobal sclerites or spicules (e.g. Fig. 98d).

Description

COLOURATION: Body mostly yellow with red markings (Figs 46b,c). ***Head:*** colour variable, sometimes with light yellow or brown coloured markings around eyes; maxillary and mandibular plates often red. ***Pronotum:*** anterior and posterior lobes usually contrastingly coloured. ***Hemelytra:*** mostly hyaline, with coloured markings.

VESTITURE AND TEXTURE: Body with a dense distribution of simple, decumbent, hair-like setae intermixed with star-shaped setae and a sparse distribution of microtrichia (e.g. Fig. 97). ***Head:*** (e.g. Fig. 97a) densely covered in star-shaped and hair-like setae, a pair of distinct right angle-shaped patch of absent microtrichia and setae. ***Antennae:*** densely covered with erect, hair-like setae only. ***Pronotum:*** (e.g. Fig. 97c) anterior and posterior lobes smooth, hair-like and star-shaped setae present. ***Prosternum:*** weakly rugulose; microtrichia dense and matted. ***Hemelytra:*** sparse distribution of semi-erect, hair-like and star-shaped setae. ***Legs:*** femora with sparsely distributed elongate, hair-like setae; two rows of spinules present on tibiae.

STRUCTURE: Body ovoid, dorsoventrally flattened (e.g. Figs 46b,c). ***Head:*** hypognathous (e.g. Fig. 100d); frons and clypeus posteroventrally oriented, frons almost flat (e.g. Fig. 100d); about twice as wide as long, in dorsal view (e.g. Fig. 97b); bucculae rounded, produced ventrally beyond ventral margin of eyes (e.g. Fig. 97b); gula straight, restricted to anterior ¼ of head (e.g. Fig. 100b); eyes reniform in lateral view, contiguous with anterior margin of pronotum (e.g. Fig. 100b); postocular region absent. ***Antennae:*** AI subequal in length to head, always longer than interocular distance. ***Pronotum:*** (e.g. Fig. 97c); bilobed, with anterior lobe much shorter than

posterior lobe; collar weakly developed; anterior lobe subrectangulate, lateral margins straight, calli weakly developed, contiguous medially with a posterior row of punctures; posterior lobe trapezoidal, lateral margins strongly divergent posteriorly, weakly declivent, posterior margin rectilinear. ***Mesepimeron:*** with evaporative bodies; spiracle weakly exposed. ***Metathoracic Gland:*** (e.g. Fig. 97f) peritreme short, tongue-like, weakly raised, dorsally oriented; evaporative area occupying <¼ of metepisternum, peritreme not reaching dorsal margin of evaporative area. ***Hemelytra:*** margins weakly convex; ca. 1.5-2x longer than abdomen; cuneus ca. 2x longer than wide. ***Legs:*** cursorial; coxae elongate; pretarsal claws with uniformly spaced minute striations, narrow at base. ***Male Genitalia:*** pygophore (e.g. Fig. 101a) weakly asymmetrical, dorsal genital opening. Left paramere (e.g. Fig. 101b) r-shaped, sensory lobe moderate size, weakly incrassate; long apophysis, apex swollen. Right paramere (e.g. Fig. 101c) v-shaped. Aedeagus (e.g. Figs 101d-g) with phallotheca tube-like, narrow, opening apically, no lobes present; ductus seminis long and broad, with weak sinuation towards base; secondary gonopore large and rounded; endosomal sclerites or spicules absent; endosomal membrane with a single lobe, with or without field of spinules.

Distribution

Jimia is endemic to New Guinea (Fig. 77).

Biology and plant associations

The host of *Jimia bimaculata* is *Castanopsis accuminatissima* (Fagaceae), however no host information is known for the new species *Jimia spectabilis*.

Remarks

Jimia superficially strongly resembles *Neoloxops* Carvalho; specimens of *Jimia* were labelled as *Neoloxops* sp. in collections of the Bishop Museum. I examined the type of *Jimia bimaculata* at the Bishop Museum and conclude that the above specimens were

conspecific, and the identification of the non-type material was a misidentification, and they are not related to *Neoloxops.*

The aedeagus of *Neoloxops* was lost during dissection by Carvalho (1987) and images and detailed descriptions are absent. I support Forrero's (2009) suggestion that *Neoloxops* is probably related to *Zanchius,* based on the position of the eyes. The endosoma of *Jimia bimaculata* in Carvalho (1987) appears damaged and there is no discussion of this in the original description. The specimens I examined are conspecific based on the colouration and parameres being identical and they have the same transverse row of punctures posterior to the pronotal calli. It is surprising that Carvalho (1987) did not mention the distinctive star-shaped setae, even they are present on the holotype.

Jimia is easily recognised from other taxon in the *Candidomiris-Morobea* complex by the star-shaped setae. It can also be recognised by its distinctly punctate pronotum and ovoid body shape.

***Jimia bimaculata* Carvalho**

Habitus, Figure 46b. Distribution, Figure 77. SEMs, Figure 97. Male genitalia, Figure 98. Female genitalia, Figure 99.

Materials examined

HOLOTYPE: **PAPUA NEW GUINEA: JIWAKA PROVINCE:** NE, Tsenga, 1.200 m, Upper Jimmi Valley, Jul 13, 1955, J.L. Gressitt (BPBM; not databased). Type examined in the collection of the Bernice P. Bishop Museum, Honolulu, Hawaii.

NON-TYPE MATERIAL: **PAPUA NEW GUINEA: MOROBE PROVINCE:** Wau: Namie Road, 6♀♀ (AMNH_PBI 00046113-AMNH_PBI 00046118) (BPBM); 23 Jun

1984, W.C. Gagne and UREP III, 11♂ (AMNH_PBI 00046101-AMNH_PBI 00046111), 11♀ (AMNH_PBI 00046119-AMNH_PBI 00046129) (BPBM).

Diagnosis

Jimia bimaculata is recognised by the following combination of characters: labium extending to abdominal s2-3; yellow marking on clavus present (Fig. 46b); pygophore with finger-like ventral process, with scale-like apex (Fig. 98a); left paramere (Fig. 98b) r-shaped; right paramere (Fig. 98c) v-shaped; endosomal membrane (Fig. 98d) simple, lacking sclerotisation.

Description

COLOURATION: Body mostly yellow with red markings (Fig. 46b). ***Head:*** clypeus red to brown; otherwise yellow to light brown. ***Antennae:*** AI red mottled with yellow; AII yellow anteriorly, black posteriorly; AIII-AIV black. ***Labium:*** yellow. ***Pronotum:*** mostly yellow mottled with dark brown or black; posterior margin of collar black; humeral angles black; midline white to grey; posterior margin of calli black. ***Thoracic venter:*** proxyphus yellow; meso- and metasternum and pleura dark brown, sometimes red marking along thoracic sternal sulcus. ***Scutellum:*** mesoscutum light brown; scutellum light brown with white midline and lateral margins. ***Metathoracic Gland:*** evaporative area white. ***Hemelytra:*** translucent; clavus region yellow; claval region transparent, red marking on anterior apex, red lateral band anterior to membrane; embolium brown. ***Legs:*** pale grey to yellow, pretarsus brown. ***Abdomen:*** yellow to light brown.

VESTITURE AND TEXTURE: Body with dense distribution of long, simple, hair-like setae, microtrichia and star-shaped setae (Fig. 97). ***Head:*** hair-like setae semi-erect; star-shaped setae densely distributed (Fig. 97a); clypeus with only hair-like setae present (Fig. 97b); maxillary and mandibular plates and gula glabrous; gula coarsely

rugulose. ***Antennae:*** dense distribution of erect, hair-like setae; AI setae longer. ***Pronotum:*** (Fig. 97c) smooth; collar with microtrichia, star-shaped setae and simple, hair-like setae; calli with setae absent in patches forming weblike pattern. ***Thoracic venter:*** proxyphus with dense distribution of thickly matted microtrichia. ***Scutellum:*** finely rugulose; sparse distribution of star-shaped setae. ***Hemelytra:*** microtrichia absent; sparse distribution of star-shaped setae. ***Legs:*** sparse distribution of hair-like setae; star-shaped setae absent.

STRUCTURE: Body ovoid and dorsoventrally flattened (Fig. 46b). ***Head:*** vertex with weakly sulcate midline (Fig. 97a); bucculae broad, rounded, covering gula medially (Fig. 97b); clypeus posteroventrally oriented with uniformly convex anterior margin (Fig. 97b); eyes reniform, extending ventrad to anterior margin of clypeus. ***Labium:*** extending to abdominal s2-3. ***Pronotum:*** (Fig. 97c) collar weakly developed; foveae absent; anterior lobe trapezoidal, with weakly developed calli, curved row of seven large punctures on posterior margin of each callus, lateral margins straight, rectilinear posteriorly; posterior lobe weakly declivent towards head, lateral margins straight, strongly divergent posteriorly, posterior margin weakly sinuate convex. ***Thoracic venter:*** proxyphus lateral margins raised, interior heart-shaped. ***Scutellum:*** foveae present on anterolateral angles; lateral margins serrate; mesoscutum raised. ***Hemelytra:*** costal margins convex; cuneus ca. 1.5x longer than wide, medial margin strongly concave. ***Male Genitalia:*** genital opening (Fig. 98a) of pygophore broad; ventral projection broad, short, with minute posterior spoon-like process, scale-like texturing apically. Left paramere (Fig. 98b) r-shaped; sensory lobe strongly swollen, bearing minute setae; apophysis apex hooked. Right paramere (Fig. 98c) v-shaped, weakly flattened laterally, spoon-shaped with minute process apically. Aedeagus (Fig. 98d) with ductus seminis large, secondary gonopore reaching apex of phallotheca;

endosomal sclerites and spicules absent; endosomal membrane without any sclerotisation. ***Female genitalia:*** (Figs 99a,b) subgenital plate hemispherical and weakly explanate lateral margins; interramal sclerite finger-like, with broad base; covered in minute scale-like texture.

Measurements

See Table 13.

Distribution

Mostly known from a single location in Morobe Province, Papua New Guinea (Fig. 77).

Biology and plant associations

Thirty specimens of this species were collected by pyrethrum fogging from the canopy of *Castanopsis accuminatissima* (Fagaceae); it is assumed to be the host of this species. One specimen is known from the canopy of a *Lithocarpus* sp., and is possibly a sitting record.

Remarks

Jimia bimaculata appears to be restricted to rainforest canopy in Papua New Guinea, a microhabitat.

Jimia bimaculata is differentiated from *J. spectabilis* by the very long labium, non-sclerotised endosoma and finger-like process of the ventral surface of the pygophore.

Jimia spectabilis sp. nov.

Habitus, Figure 46c. Distribution, Figure 77. SEMs, Figure 100. Male genitalia, Figure 101.

Etymology

Named for its spectacular colouration.

Materials examined

HOLOTYPE: **PAPUA NEW GUINEA: MILNE BAY PROVINCE:** Baiawa, Moi Biri Bay, 9.6°S 149.45°E, 30 m, 08 May 1953-11 May 1953, G.M. Tate, 1 (AMNH_PBI 00047108)♂ (BPBM).

PARATYPE: **PAPUA NEW GUINEA: MOROBE PROVINCE:** No. 2, Oomsis, 22 mi W of Lae on Lae-Bulolo Rd., 6.71845°S 146.73865°E, 100 m, 26 Apr 1959, L.J. Brass, 1♀ (AMNH_PBI 0033596) (AMNH).

Diagnosis

Jimia spectabilis is recognised by the following combination of characters: labium reaching metathorax; clavus unicolourous (Fig. 46c), contrasting markings absent; pygophore (Fig. 101a) without a finger-like ventral process; left paramere (Fig. 101b) r-shaped; right paramere (Fig. 101c) v-shaped; phallotheca (Fig. 101d) opening apically; endosomal membrane complex with field of spinules.

Description

COLOURATION: Body mostly red and yellow (Fig. 46c). ***Head:*** yellow with intricate red pattern. ***Antennae:*** yellow, sometimes mottled with red. ***Pronotum:*** anterior lobe red; posterior lobe red mottled with black. ***Thoracic venter:*** sterna yellow, pleura red. ***Scutellum:*** reddish light brown. ***Metathoracic Gland:*** evaporative area white. ***Hemelytra:*** transparent, red lateral band medially. ***Legs:*** yellowish brown. ***Abdomen:*** venter brown.

VESTITURE AND TEXTURE: Body with dense distribution of hair-like setae, star-shaped setae and microtrichia (Fig. 100). ***Head:*** (Fig. 100a) with long, semi-erect, hair-like setae; maxillary plates, mandibular plates, and gula glabrous; gula coarsely rugulose. ***Antennae:*** short, decumbent, hair-like, thicker on AI. ***Pronotum:*** (Fig. 100a) smooth; with hair-like, semi-erect setae; collar with microtrichia and star-shaped setae; anterior lobe with glabrous patches. ***Thoracic venter:*** smooth; microtrichia sparsely distributed. ***Scutellum:*** (Fig. 100e) finely rugulose; sparse distribution of star-shaped setae; with elongate hair-like setae. ***Hemelytra:*** sparse distribution of star-shaped setae. ***Legs:*** sparse distribution of hair-like setae; star-shaped setae absent.

STRUCTURE: Body subovoid and dorsoventrally flattened (Fig. 46c). ***Head:*** (Fig. 100a) vertex with weakly sulcate midline; bucculae broad, rounded, covering gula medially clypeus posteroventrally oriented with uniformly convex anterior margin (Fig. 100b); eyes reniform, extending ventrad to anterior margin of clypeus (Fig. 100b). ***Labium:*** extending to metasternum. ***Pronotum:*** (Fig. 100a) collar weakly developed; foveae absent; anterior lobe trapezoidal, with weakly developed calli, curved row of seven large punctures on posterior margin of either calli, lateral margins straight, rectilinear posteriorly; posterior lobe weakly declivent towards head, lateral margins straight, strongly divergent posteriorly, posterior margin weakly sinuate. ***Thoracic venter:*** metafemora incrassate. ***Scutellum:*** (Fig. 100e) foveae present on anterolateral angles; lateral margins sinuate, serrate; mesoscutum raised. ***Hemelytra:*** costal margins convex; cuneus width subequal to length. ***Legs:*** setae sparse, long, erect. ***Male Genitalia:*** genital opening of pygophore dorsal, broad (Fig. 101a); ventral projection broad, short, dome-shaped (Fig. 101a). Left paramere (Fig. 101b) r-shaped; sensory lobe bearing large setae; apex of apophysis blunt. Right paramere (Fig. 101c) v-shaped. Aedeagus (Figs 101d-g) with ductus seminis broad; secondary gonopore not reaching

apex of phallotheca; endosomal lobal sclerites and spicules absent; endosomal membrane with a field of spinules.

Measurements

See Table 13.

Distribution

Singletons known from Normandy Island, Northern Province and Morobe Province, Papua New Guinea (Fig. 77).

Biology and plant associations

Unknown.

Remarks

See *Jimia bimaculata* remarks.

This species is made up of two singletons from separate localities, which vary in colouration. As there is one male and one female it is difficult to tell whether the variation is due to sexual dimorphism or whether they are separate species. Their structure and vestiture is the same and so they were both placed in the same species.

***Morobea* Carvalho**

Morobea Carvalho, 1987: 181 (original description); Schuh 1995: 145 (world catalogue); Wall 2007: 2 (redescription)

Type species

Morobea longipes Carvalho by original designation.

Diagnosis

Morobea is recognised by the following combination of characters: body mostly stramineous (Figs 102a,b); body gracile, elongate (Figs 102 a,b); AII and AIII greatly elongate, combined length longer than body; anterior lobe rugulose or with scale-like

texture (e.g. Fig. 103a); posterior lobe with deep transverse rugae (e.g. Fig. 103a); hemelytral margins straight (e.g. Fig. 102); cuneus concolourous with rest of hemelytra (e.g. Fig. 102); legs greatly elongate; pygophore elongate with complex ventral process (e.g. Fig. 104a); parameres simple, sensory lobe weakly incrassate (e.g. Figs 104b,c); endosomal membrane with exaggerated endosomal sclerites (e.g. Fig. 104d); phallotheca with dorsal opening (e.g. Fig. 104d).

Redescription

COLOURATION: Body mostly stramineous (Figs 102a,b). ***Head:*** stramineous with red midline. ***Pronotum:*** anterior and posterior lobe stramineous, concolourous, with red midline. ***Hemelytra:*** hyaline, stramineous, indistinct markings sometimes present.

VESTITURE AND TEXTURE: Body with sparse distribution of simple, decumbent, hair-like setae and microtrichia (e.g. Fig. 103); complex setae absent. ***Antennae:*** sparse distribution of erect, hair-like setae. ***Pronotum:*** (e.g. Fig. 103c) anterior lobe rugulose or with scale-like texture; posterior lobe with deep, transverse rugae; sparse distribution of minute setae. ***Prosternum:*** coarsely rugulose; sparse distribution of microtrichia. ***Hemelytra:*** sparse distribution of semi-erect, hair-like setae; weakly textured. ***Legs:*** sparse distribution of small, decumbent, hair-like setae.

STRUCTURE: Body gracile, elongate (Figs 102 a,b). ***Head:*** weakly prognathous (e.g. Fig. 103b), frons and clypeus anteriorly oriented; head about twice as wide as long in dorsal view (e.g. Fig. 103a); midline sulcus deep, narrow (e.g. Fig. 103a); bucculae elongate, weakly produced (e.g. Fig. 106c); gula concave, ca. ⅔ length of head (e.g. Fig. 103b); eyes rounded in lateral view, contiguous with anterior margin of pronotum (e.g. Fig. 103b); postocular region absent. ***Antennae:*** AI greatly elongate, more than twice length of head; AII and AIII greatly elongate, subequal in length to entire body. ***Pronotum:*** (e.g. Fig. 103c) bilobed, with anterior lobe elongate; collar strongly

developed; anterior lobe subrectangulate, lateral margins straight, calli weakly developed, separated medially; posterior lobe trapezoidal, lateral margins weakly divergent posteriorly, posterior margin rectilinear. ***Mesepimeron:*** with evaporative bodies; metathoracic spiracle weakly exposed. ***Metathoracic Gland:*** peritreme short, tongue-like, strongly raised, posterolaterally oriented; evaporative area occupying ca. ⅓ of metepisternum, peritreme reaching dorsal margin of evaporative area. ***Hemelytra:*** margins straight; ca. 2x longer than abdomen, cuneus ca. 3x longer than wide. ***Legs:*** cursorial; coxae and metafemora greatly elongate; pretarsal claws covered in striations; thick at base. ***Male Genitalia:*** pygophore elongate, lacking grooves or processes, greatly asymmetrical (e.g. Fig. 104a); genital opening dorsal in orientation, with prominent ventral process (e.g. Fig. 104a); ventral margin with one or two ventral processes (e.g. Fig. 104a); semi-decumbent setae present. Left paramere (e.g. Fig. 104b) simple, sinuate, sensory lobe close to base. Right paramere (e.g. Fig. 104c) reduced. Aedeagus (e.g. Fig. 104d) straight; phallotheca apically broad, opening dorsal, lacking lobes; ductus seminis short and twisted, curved at 90º towards base; secondary gonopore elongate ribbon like; lacking endosomal sclerotisation; endosomal membrane dense towards apex with several small complex lobal sclerites.

Distribution

Morobea is known only from Morobe Province, Papua New Guinea (Fig. 105).

Biology and plant associations

Unknown.

Remarks

Morobea species have an elongate and gracile body. It most closely resembles *Wumea*, its sister-genus, with both genera having a weakly prognathous head, and stramineous colouration. *Morobea* can be distinguished by its anterior lobe of the pronotum being

rugulose and with scale-like texture, which is smooth in *Wumea*; the posterior lobe of the pronotum has deep transverse rugae, whereas in *Wumea* it has fine, shallow longitudinal rugae; the cuneus is concolourous with the rest of the hemelytra, whereas in *Wumea* the cuneus is marked red with red; and, and the presence of a ventral processes on the pygophore contrasts with its absence in *Wumea*.

Morobea longipes Carvalho

Habitus, Figure 102b. SEMs, Figure 103. Male genitalia Figure 104. Distribution, Figure 105.

Morobea longipes Carvalho, 1987: 181 (original description); Schuh 1995: 145 (world catalogue); Wall 2007: 3, Figs 1-4 (redescription)

Materials examined

HOLOTYPE: **PAPUA NEW GUINEA: MOROBE DISTRICT:** nr, Kaindi, 2.350 m, 9.XI.1979, W.C. Gagne 1♂. Type examined in the collection of the Bernice P. Bishop Museum, Honolulu, Hawaii.

NON-TYPE MATERIAL: **PAPUA NEW GUINEA: MOROBE PROVINCE:** Wau, 7.3333°S 146.71667°E, 1100 m, 16 Aug 1972, G.G.E. Scudder, 1♀ (AMNH_PBI 00053260) (BPBM); 20 Jul 1974, A.D. Hart, *Pipturus* sp. (Urticaceae), 1♂ (AMNH_PBI 00053258) (BPBM); 12 Aug 1977, W.C. Gagne, 1♀ (AMNH_PBI 00053259) (BPBM); 21 Apr 1979, W.C. Gagne, 1♂ (AMNH_PBI 00053261) (BPBM).

Diagnosis

Morobea longipes is most readily recognised by the following combination of characters: dorsal margin of propleuron without red demarcation (Fig. 102a); labium extending to abdominal s4-s5; narrow ventral process of genital opening of the pygophore asymmetrical, skewed left (Fig. 104a); without dorsal process of ventral

margin of pygophore absent (Fig. 104a); aedeagus with relatively small, hatchet-like endosomal lobal sclerites (Fig. 104c).

Description

COLOURATION: Body mostly stramineous (Fig. 102a). ***Head:*** clypeus red; frons, vertex, maxillary plate, bucculae, gula and genae, stramineous; eyes black, mandibular plate red. ***Antennae:*** AI-AII stramineous; AIII-AIV dark brown. ***Labium:*** black. ***Pronotum:*** stramineous with red markings. ***Thoracic venter:*** proxyphus and pleura red mottled with yellow; meso- and metapleura stramineous; mesosternum dark yellow, metasternum red. ***Scutellum:*** stramineous. ***Hemelytra:*** translucent, stramineous, clavus dull brownish red, cuneus with red margins, membrane transparent, veins marked with red. ***Legs:*** mostly stramineous; pretarsus black. ***Abdomen:*** venter pale stramineous.

VESTITURE AND TEXTURE: Body with sparse distribution of simple, decumbent, hair-like setae and microtrichia (Fig. 103). ***Head:*** (Fig. 103a) sparse distribution of semi-erect, hair-like setae; vertex rugulose with scale-like texture posteriorly; frons with scale-like texture; maxillary and mandibular plates, gula and bucculae rugulose; genae smooth, setae small; gula glabrous. ***Antennae:*** AI with sparse distribution of small, erect, hair-like setae; AII-AIV with dense distribution of small, decumbent, hair-like setae. ***Pronotum:*** (Fig. 103c) collar coarsely rugulose; sparse distribution of hair-like setae; anterior lobe scale-like texture, rugulose medially; posterior lobe densely covered in small, deep ruga; hair-like setae small. ***Thoracic venter:*** proxyphus with dense distribution of long decumbent microtrichia; mesosternum densely rugulose. ***Scutellum:*** (Fig. 103e) with small, semi-erect, hair-like setae; dense distribution of fine wave-like rugae. ***Hemelytra:*** small, semi-erect, hair-like setae; dense distribution of microtrichia. ***Legs:*** femora with sparse distribution of hair-like setae and microtrichia; tibial with dense distribution setae.

STRUCTURE: Body shape greatly elongate (Fig. 102a). ***Head:*** vertex with strongly sulcate midline (Fig. 103a); bucculae narrow, elongate, not covering gula medially; clypeus anterio-ventrally oriented with uniformly convex anterior margin (Fig. 103b); eyes round, not extending ventrad to anterior margin of clypeus (Fig. 103b). ***Labium:*** extending to abdominal s4-s5. ***Pronotum:*** (Fig. 103c) collar strongly developed; foveae absent; anterior lobe trapezoidal, with weakly developed calli, lateral margins convex, rectilinear posteriorly; posterior lobe strongly declivent towards head, lateral margins convex, strongly divergent posteriorly, posterior margin weakly concave. ***Thoracic venter:*** proxyphus depressed, triangular. ***Scutellum:*** (Fig. 103e) without foveae on anterolateral angles; lateral margins straight, serrate; mesoscutum flat. ***Hemelytra:*** costal margins straight; cuneus ca. 3x longer than wide, medial margin curved. ***Legs:*** femoral setae and microtrichia sparsely distributed; dense and thick microtrichia on femora. ***Male Genitalia:*** genital opening of pygophore broad (Fig. 104a); ventral projection broad, short, weakly asymmetrical and dome-shaped, oriented to left (Fig. 104a). Left paramere (Fig. 104b) elongate, r-shaped, sinuate with thin row of setae along entire dorsal surface. Right paramere (Fig. 104c) curved with a small apical process. Aedeagus (Fig. 104d) with ductus seminis elongate; secondary gonopore attached extending to apex of phallotheca; saw-like anterior endosomal lobal sclerite and hatchet-like dorsal endosomal lobal sclerite, projecting from phallotheca at rest (Fig. 104e); endosomal membrane multilobed.

Measurements

See Table 14.

Distribution

Known only from Morobe Province, Papua New Guinea (Fig. 105).

Biology and plant associations

One specimen was recorded from a *Pipturus* sp. (Urticaceae); assumed to be a sitting record.

Remarks

This redescription enhances that of Wall's (2007) and gives a broader comparison to other taxa of the *Candidomiris-Morobea* complex. The species is most readily recognised by the narrow ventral pygophore process, which is asymmetrical and skewed to the left, and absence of a dorsal pygophore process.

***Morobea spectabilis* Wall**

Habitus, Figure 102. Distribution, Figure 105. SEMs, Figure 106. Male genitalia, Figure 107.

Morobea spectabilis Wall, 2007: 3, Figs 1-4 (original description).

Materials examined

HOLOTYPE: **PAPUA NEW GUINEA: MOROBE PROVINCE:** Wau, 7.3333°S 146.71667°E, 1100 m, 14 Aug 1972, G.G.E. Scudder, Light Trap, 1♂ (AMNH_PBI 00053250) (BPBM).

PARATYPES: **PAPUA NEW GUINEA: MOROBE PROVINCE:** Wau, 7.3333°S 146.71667°E, 1100 m, 09 Aug 1972, G.G.E. Scudder, Light Trap, 1♀ (AMNH_PBI 00053252) (BPBM); 11 Sep 1972, G.G.E. Scudder, Light Trap, 1♂ (AMNH_PBI 00053251) (BPBM).

Diagnosis

Morobea spectabilis is most readily recognised by the following combination of characters: red line along dorsal margin of propleuron present (Fig. 102b); labium extending to posterior margin of metasternum; pygophore with lateral tubercle (Fig.

107a); ventral process of the genital opening of pygophore asymmetrical, skewed right (Fig. 107a); dorsal process of ventral margin of pygophore skewed right (Fig. 107a); aedeagus large, serrated, with hatchet-like endosomal lobal sclerite (Fig. 107c).

Description

COLOURATION: Covered in variously coloured markings as described below (Fig. 102b). ***Head:*** clypeus red; frons stramineous; eyes black, sometimes faded; vertex pale olive-green; mandibular plate red; maxillary plate pale grey; bucculae pale grey; red line along dorsal margin of propleuron; gula and genae brown. ***Antennae:*** antennae pale brown. ***Labium:*** pale grey. ***Pronotum:*** pale olive green, usually with medial red line, sometimes patchy; thoracic pleura pale grey mottled with pale green. ***Thoracic venter:*** proxyphus pale green; meso- and metasternum stramineous. ***Scutellum:*** mesoscutum red or stramineous, scutellum usually olive-green, rarely stramineous. ***Hemelytra:*** transparent, pale grey, veins usually marked in red; red markings also present anterior to cuneus; membrane veins red. ***Legs:*** pale yellow mottled with green; red bands and sometimes brown markings on metafemora. ***Abdomen:*** pale grey; abdominal terga dark brown or stramineous.

VESTITURE AND TEXTURE: Body covered in long, hair-like setae and sparsely covered in minute microtrichia (Fig. 106). ***Head:*** (Fig. 106a) sparse distribution of semi-erect, hair-like setae; frons with scale-like texture; vertex rugulose with scale-like texture posteriorly and medially (Fig. 106a); genae smooth, rugulose near eyes (Fig. 106b); otherwise rugulose. ***Antennae:*** AI setae thick, erect with prominent pit; AII-AIV with dense distribution of small, decumbent, hair-like setae. ***Pronotum:*** collar coarsely rugulose; sparse distribution of hair-like setae; anterior lobe with scale-like texture (Fig. 106d), rugulose medially; posterior lobe densely covered in small deep ruga; setae small. ***Thoracic venter:*** proxyphus with dense distribution of long, decumbent

microtrichia; mesosternum densely rugulose. ***Scutellum:*** (Fig. 106e) setae small, semi-erect, hair-like; densely covered in fine wave-like rugae. ***Hemelytra:*** short, semi-erect, hair-like setae; dense distribution of microtrichia. ***Legs:*** femora with sparse distribution of erect, hair-like setae and microtrichiae; tibiae with dense distribution of decumbent, thick, hair-like setae.

STRUCTURE: Body greatly elongate (Fig. 102b). ***Head:*** vertex with strongly sulcate midline (Fig. 106b); bucculae narrow, elongate, not covering gula medially (Fig. 106c); clypeus anterio-ventrally oriented with uniformly convex anterior margin (Fig. 106b); eyes rounded, not extending ventrad to anterior margin of clypeus (Fig. 106b). ***Labium:*** extending to posterior margin of metasternum. ***Pronotum:*** collar weakly developed; foveae absent; anterior lobe trapezoidal, with weakly developed calli, lateral margins convex, rectilinear posteriorly; posterior lobe strongly declivent towards head, lateral margins convex, strongly divergent posteriorly, posterior margin weakly concave. ***Thoracic venter****:* proxyphus depressed flat, triangular. ***Scutellum:*** (Fig. 106e) without foveae on anterolateral angles; lateral margins straight, serrate; mesoscutum flat. ***Hemelytra:*** costal margins straight; cuneus ca. 3x longer than wide, medial margin straight. ***Legs:*** metafemora and metatibiae greatly elongate, femora only weakly incrassate. ***Male Genitalia:*** genital opening of pygophore weakly elongate (Fig. 107a); ventral projection broad, short, weakly asymmetrical, subrectangular; narrow ventral process asymmetrical, skewed right (Fig. 107a). Left paramere (Fig. 107b) elongate, fingerlike sinuate with thin row of setae along entire dorsal surface. Right paramere (Fig. 107c) r-shaped, apex at 90 degrees to base. Aedeagus (Fig. 107d) with ductus seminis large, secondary gonopore attached towards apex; c-shaped dorsal endosomal lobal sclerite and saw-like anterior endosomal lobal sclerite projecting from phallotheca

at rest; sclerotisation complex throughout rest of endosoma; endosomal membrane multilobed.

Measurements

See Table 14.

Distribution

Known only from Morobe Province, Papua New Guinea (Fig. 105).

Biology and plant associations

Unknown.

Remarks

See remarks of *Morobea longipes.*

Nerubia gen. nov.

Etymology

Nerubia is race of arthropod-like creatures from Warcraft III; a companion of mine during my thesis. I name this genus after them. Feminine.

Type species

Nerubia dentomembrana sp. nov. by original description

Diagnosis

Nerubia is recognised by the following combination of characters: simple hair-like vestiture only (e.g. Fig. 108); body usually unicolourous, pale green or brown and yellow, lacking contrasting markings (Figs 46d,e); hemelytra costal margins convex (Figs 46d,e); bucculae (e.g. Fig. 108c) ventrally expanded, greatly enlarged, extending underneath gula; gula straight, short; eyes large, dorsoventrally elongate, egg-shaped (e.g. Fig. 108b); anterior and posterior lobes of the pronotum poorly differentiated, posterior lobe weakly declivent (e.g. Fig. 108c); legs short, metafemora incrassate;

pygophore short, without ventral process (e.g. Fig. 109a); left paramere (e.g. Fig. 109b) c-shaped, sensory lobe weakly incrassate; right paramere (e.g. Fig. 109c) club-like; phallotheca opening dorso-apically (e.g. Fig. 109d); endosomal lobal spicules and sclerites absent (e.g. Fig. 109d); endosomal membranous bag with four lobes and field of spinules (e.g. Fig. 109d).

Description

COLOURATION: Body mostly pale green or brown and yellow (Figs 46d,e). ***Head:*** uniformly coloured, lacking in contrasting markings. ***Pronotum:*** anterior and posterior lobes not differentiated by colour marking; lateral markings often present. ***Hemelytra:*** hyaline, transparent with indistinct brown markings on corium and red markings on cuneus.

VESTITURE AND TEXTURE: (e.g. Fig. 108) Body with sparse distribution of microtrichia and hair-like setae; complex setae absent. ***Antennae:*** AI with sparse distribution of erect, hair-like setae varying in lengths; AII-AIV with dense distribution of decumbent, hair-like setae. ***Pronotum:*** (e.g. Fig. 108d) anterior and posterior lobes smooth. ***Thoracic venter:*** rugulose; dense distribution of matted microtrichia on proxyphus. ***Hemelytra:*** semi-erect, hair-like setae. ***Legs:*** microtrichia present; tibiae with sparse distribution of hair-like setae.

STRUCTURE: Body sub-ovoid; dorsoventrally flat (e.g. Figs 46d,e). ***Head:*** strongly hypognathous, frons and clypeus straight (e.g. Fig. 108b); frons almost flat (e.g. Fig. 108b); about twice as long as wide, in dorsal view (e.g. Fig. 108b); bucculae elongate, produced ventrally beyond ventral margin of eyes (e.g. Fig. 108c); gula straight, restricted to anterior ¼ of head (e.g. Fig. 108b); eyes weakly reniform in lateral view, contiguous with anterior margin of pronotum (e.g. Fig. 108b); postocular region absent (e.g. Fig. 108b). ***Antennae:*** AI weakly elongate, subequal in length to head;

always longer than interocular distance. ***Pronotum:*** (e.g. Fig. 108d) with anterior lobe and posterior lobe subequal in length; collar weakly developed; anterior lobe subrectangulate, lateral margins straight, calli depressed, contiguous medially; posterior lobe trapezoidal, lateral margins strongly divergent posteriorly, weakly declivent, posterior margin rectilinear. ***Mesepimeron:*** with evaporative bodies, spiracle weakly exposed. ***Metathoracic Gland:*** peritreme short, disc-shaped, strongly raised, dorso-laterally oriented; evaporative area occupying ca. ⅓ of metepisternum, peritreme reaching dorsal margin of evaporative area. ***Hemelytra:*** costal margins uniformly convex; ca. 1.5x longer than abdomen, cuneus 1.5-2x longer than cuneus width. ***Legs:*** short; metafemora incrassate. ***Male Genitalia:*** pygophore (e.g. Fig. 109a) short; very weakly asymmetrical; lacking processes or grooves on ventral surface. Left paramere (e.g. Fig 109b) c-shaped, sensory lobe reduced, weakly incrassate; apophysis rounded, tapered distally, apically rounded. Right paramere (e.g. Fig. 109c) club-like, with apex strongly tapered, thorn-like. Aedeagus (e.g. Fig. 109d) with phallotheca broad, with left lateral opening; secondary gonopore squat, asymmetrical; ductus seminis short and broad; lacking endosomal lobal sclerites or spicules; endosomal membranous bag with four lobes, with field of spinules. ***Female genitalia:*** (e.g. Fig. 110) subgenital plates with strongly explanate lateral margins; a pair of setae present; interramal lobes apically crassate, weakly curved, apically covered in minute setae.

Distribution

Know from the Melanesian biogeographic subregion (Fig. 77).

Biology and plant associations

Plant records are scarce and no phylogenetic patterns are evident.

Remarks

There are no explicit defining characters within the group, however in body and head shape *Nerubia* most closely resembles *Jimia* and *Spinamifera.* It is defined by absence dorsal ruga or complex setae and the absence of endosomal spicules.

***Nerubia dentomembrana* sp. nov.**

Habitus, Figure 46d. Distribution, Figure 77. SEMs, Figure 108. Male genitalia, Figure 109. Female genitalia, Figure 110.

Etymology

Named for the extensive field of spinules on the endosomal membrane; noun in apposition.

Materials examined

HOLOTYPE: **FIJI: VITI LEVU:** 2-10 km South of Nandarivatu, 17.56417°S 177.93083°E, 600 m, 04 Aug 1979, G.M. Nishida, 1♂(AMNH_PBI 00046149) (BPBM).

PARATYPES: **FIJI: VANUA LEVU:** Trans-Insular Road, above summit, 16.62865°S 179.19914°E, 525 m, 06 Oct 1979-09 Oct 1979, S.N. Lal, G.A. and S.L. Samuelson, 1♀ (AMNH_PBI 00046145), 1♂ (AMNH_PBI 00046146) (BPBM). **VITI LEVU:** Lami, 18.11111°S 178.4125°E, 200 m, 01 Jul 1978-31 Jul 1978, N. Krauss, 1♂ (AMNH_PBI 00046147) (BPBM). Namosi Rd: 6 km N of Queens Hwy, 18.12639°S 178.19889°E, 250 m, 03 Jun 1981-07 Jun 1981, W.C. Gagne, ex *Elatostema* sp. (Urticaceae), 1♂ (AMNH_PBI 00046132), 1♀ (AMNH_PBI 00046134) ex *Acalypha* sp. (Euphorbiaceae), 1♂ (AMNH_PBI 00046133), 1♀ (AMNH_PBI 00046135) ex *Elatostema* sp. (Urticaceae), 1♂ (AMNH_PBI 00046131) (BPBM). Nandarivatu, 17.566°S 177.966°E, 11 Sep 1938, E.C. Zimmerman, 1♀ (AMNH_PBI 00046144)

(BPBM); 10 Sep 1938, E.C. Zimmerman, 2♂♂ (AMNH_PBI 00046136, AMNH_PBI 00046137) (BPBM); 06 Sep 1938, E.C. Zimmerman, 1♂ (AMNH_PBI 00046140) (BPBM); 16 Sep 1938, E.C. Zimmerman, 1♂ (AMNH_PBI 00046139) (BPBM); 05 Sep 1938, E.C. Zimmerman, 1♂ (AMNH_PBI 00046142) (BPBM); 07 Sep 1938, E.C. Zimmerman, 1♂ (AMNH_PBI 00046138), 1♀ (AMNH_PBI 00046143) (BPBM). Nausori Highlands, 600 m, 01 Jul 1976-31 Jul 1976, N. Krauss, 1♀ (AMNH_PBI 00046148) (BPBM).

Diagnosis

Nerubia dentomembrana is recognised by the following combination of characters: dorsum dark brown with yellow marking (Fig. 46d); scutellum with foveae on anterior margin (Fig. 46e); labium extending to abdominal s4; pygophore without ventral process (Fig. 109a); left paramere (Fig. 109b) c-shaped; right paramere (Fig. 109c) c-shaped; phallotheca (Fig. 109d) with right lateral opening; endosomal membrane with extensive field of spinules.

Description

COLOURATION: Body mostly pale yellow and dark brown (Fig. 46d). ***Head:*** clypeus dark brown, or pale yellow with red marking; frons dark brown; vertex dark brown anteriorly, pale yellow posteriorly; mandibular and maxillary plates and bucculae pale yellow; genae and gula pale yellow rarely dark brown; eyes fulvous. ***Antennae:*** AI pale yellow proximally, red or dark brown distally; AII-AIV dark brown or rarely yellow. ***Labium:*** pale yellow. ***Pronotum:*** pale yellow with brown markings laterally. ***Thoracic venter:*** pale yellow or bright orange. ***Scutellum:*** pale yellow. ***Metathoracic Gland:*** evaporative areas pale grey. ***Hemelytra:*** transparent; clavus fuscous in ♂, membrane pale brown. ***Legs:*** pale grey to dark brown, usually pale red brown distally on metafemora. ***Abdomen:*** venter fuscous in ♂, pale yellow in ♀.

VESTITURE AND TEXTURE: Body with a sparse distribution of large, erect, hair-like setae; microtrichiae absent (Fig. 108). ***Head:*** frons and vertex with sparse distribution of erect, hair-like setae of variable lengths (Fig. 108a); gula and genae with very sparse distribution of hair-like setae (Fig. 108b). ***Antennae:*** AI with sparse distribution of erect, hair-like setae; AII-AIV with dense distribution of smaller decumbent, hair-like setae. ***Pronotum:*** (Fig. 108d) with sparse distribution of decumbent, hair-like setae. ***Thoracic venter:*** proxyphus coarsely rugulose; dense distribution of minute matted microtrichia. ***Scutellum:*** (Fig. 108e) sparse distribution of long, decumbent, hair-like setae; microtrichia absent. ***Hemelytra:*** dense distribution of short, decumbent, hair-like setae. ***Legs:*** sparse distribution of small, erect, hair-like setae.

STRUCTURE: Body elongate-ovoid (Fig. 46d). ***Head:*** vertex midline not sulcate (Fig. 108a); bucculae narrow, elongate, covering gula medially (Fig. 108c); clypeus posteroventrally oriented with straight anterior margin (Fig. 108b); eyes reniform, extending ventrad to anterior margin of clypeus (Fig. 108b). ***Labium:*** extending to abdominal s4. ***Pronotum:*** (Fig. 108d) collar strongly developed; foveae absent; anterior lobe trapezoidal, with weakly developed calli, lateral margins concave, rectilinear posteriorly; posterior lobe declivent towards head, lateral margins concave, strongly divergent posteriorly, posterior margin weakly concave. ***Thoracic venter:*** proxyphus raised, circular with central crater. ***Scutellum:*** (Fig. 108e) foveae present on anterolateral angles; lateral margins sinuate, serrate; mesoscutum raised. ***Hemelytra:*** costal margins convex; cuneus ca. 1.5x longer than wide, medial margin straight. ***Legs:*** metafemora incrassate. ***Male Genitalia:*** as in generic description. ***Female genitalia:*** (Fig. 109) as in generic description.

Measurements

See Table 15.

Distribution

Known from the Fiji Islands of Viti Levu, Vanua Levu and Ovalau (Fig. 77).

Biology and plant associations

Most specimens without records. Recorded from *Elatostema* sp. (Urticaceae) and *Acalypha* (Euphorbiaceae) recorded, which are possibly sitting records.

Remarks

Nerubia dentomembrana is most readily recognised within the genus by its dark brown colouration and the presence of foveae on the scutellum.

Nerubia viridis sp. nov.

Habitus, Figure 46e. Distribution, Figure 77. SEMs, Figure 111.

Etymology

Named from the overall greenish colouration.

Materials examined

HOLOTYPE: **INDONESIA: WEST PAPUA:** Vogelkop (Bird's Head Peninsula): Bomberi, 3°N 132.01667°E, 800 m, 03 Jun 1959, J.L. Gressitt, 1♂ (AMNH_PBI 00047085) (BPBM).

PARATYPES: **INDONESIA: WEST PAPUA:** Vogelkop (Bird's Head Peninsula), Bomberi, 3°N 132.01667°E, 800 m, 03 Jun 1959, J.L. Gressitt, 1♂ (AMNH_PBI 00047084) (BPBM).

Diagnosis

Nerubia viridis is recognised by the following combination of characters: dorsum almost entirely glabrous, mostly pale green (Fig. 46e); collar strongly developed (Fig.

111b); scutellum lacking foveae on anterior margin (Fig. 111c); labium extending to abdominal s3.

Description

COLOURATION: Body mostly pale green (Fig. 46e). ***Head:*** mostly stramineous, sometimes mottled with green. ***Antennae:*** stramineous to dark brown, darker apically. ***Labium:*** labium pale brown. ***Pronotum:*** light green. ***Thoracic venter:*** fuscous. ***Scutellum:*** pale grey. ***Hemelytra:*** transparent; cuneus red; membrane light brown. ***Legs:*** pale grey. ***Abdomen:*** venter fuscous, pale grey apically.

VESTITURE AND TEXTURE: Body with a sparse distribution of large, erect, hair-like setae; microtrichiae almost absent (Fig. 111). ***Head:*** very sparse distribution of hair-like setae and microtrichia (Fig. 111a). ***Antennae:*** AI very sparse distribution of erect, hair-like setae; AII-AIV dense distribution of decumbent, hair-like setae. ***Pronotum:*** (Fig. 111b) setae and microtrichia absent. ***Thoracic venter:*** smooth; microtrichia sparsely distributed. ***Scutellum:*** (Fig. 111c) smooth; microtrichia and setae absent. ***Hemelytra:*** smooth, glabrous. ***Legs:*** sparse distribution of semi-erect, hair-like setae.

STRUCTURE: Body elongate-ovoid (Fig. 46e). ***Head:*** vertex with midline sulcus (Fig. 111a); bucculae narrow, elongate, covering gula medially; clypeus posteroventrally oriented with anterior surface straight; eyes reniform, extending ventrad to anterior margin of clypeus. ***Labium:*** extending to abdominal s3. ***Pronotum:*** (Fig. 111b) collar strongly developed; foveae absent; anterior lobe trapezoidal, with weakly developed calli, lateral margins concave, rectilinear posteriorly; posterior lobe declivent towards head, lateral margins concave, strongly divergent posteriorly, posterior margin strongly concave. ***Thoracic venter:*** proxyphus depressed, triangular. ***Scutellum:*** (Fig. 111c) without foveae on anterolateral angles; lateral margins sinuate,

serrate; mesoscutum raised. ***Hemelytra:*** costal margins convex; cuneus length and width subequal (Fig. 111d), medial margin curved. ***Legs:*** metafemora incrassate.

Male genitalia not examined.

Measurements

See Table 15.

Distribution

Known From West Papua, Indonesia (Fig. 77).

Biology and plant associations

Unknown.

Remarks

Nerubia viridis is similar to *Nerubia dentomembrana* in its body and head shape but can be recognised by its pale green colouration and the absence of foveae on the scutellum. The specimens were insufficient quality to examine the male genitalia.

Novacalecoris gen. nov.

Type species

Novacalecoris rubrafasciae sp. nov. by original designation.

Etymology

Named for the New Caledonia endemicity of all species of the genus. Feminine.

Diagnosis

Novacalecoris can be distinguished by the following combination of characters: simple, hair-like setae only (e.g. Fig. 113); eyes large, dorsoventrally elongate (e.g. Fig. 113c); bucculae rounded, explanate, ventrally produced, not covering gula (e.g. Fig. 113b); anterior and posterior lobes of pronotum poorly differentiated, posterior lobe weakly declivent towards head (e.g. Fig. 113d); legs short; pygophore short (e.g. Fig. 114a),

usually with left tergal process of varying size (e.g. Figs 114a,116a, 125a); left paramere sensory lobe small, with one (e.g. Fig. 119b) or two (e.g. Fig. 114b) apophyses; right paramere greatly elongate and strongly curved (e.g. Fig. 119a); anterior endosomal lobal sclerite simple, sometimes projecting beyond phallotheca at rest (e.g. Figs 123d,e); dorsal endosomal lobal sclerite laterally flattened (e.g. Fig. 123d); phallotheca with apical opening (e.g. Fig. 123d).

Description

COLOURATION: Usually shiny, pale colouration, sometimes with colour patterns comprised of red, yellow, brown and/or black (e.g. Figs 112a-h). ***Head:*** clypeus usually fuscous; maxillary and mandibular plates often red. ***Pronotum:*** anterior lobe uniformly coloured, rare exceptions only in females; posterior lobe usually with posterior and lateral fuscous markings. ***Hemelytra:*** hyaline, with markings which vary between species, including a brown or red lateral band between corium and membrane.

VESTITURE AND TEXTURE: Body with sparse distribution of decumbent, hair-like setae and microtrichia (e.g. Fig. 113). ***Antennae:*** dense distribution of erect hair-like setae. ***Pronotum:*** anterior and posterior lobes smooth (e.g. Fig. 113d). ***Prosternum:*** mostly smooth; microtrichia sparsely distributed. ***Scutellum:*** smooth (e.g. Fig. 113e). ***Hemelytra:*** usually with sparse distribution of semi-erect, hair-like setae. ***Legs:*** densely covered with semi-erect, hair-like setae; two rows of spinules usually present on tibiae.

STRUCTURE: Body elongate-ovoid to strongly ovoid (e.g. Figs 112a-h). ***Head:*** strongly hypognathous (e.g. Fig. 113c), frons and clypeus straight (e.g. Fig. 113c); frons almost flat (e.g. Fig. 113a); about twice as wide as long, in dorsal view (e.g. Fig. 113a); bucculae rounded, produced ventrally beyond ventral margin of eyes (e.g. Fig. 113b); gula straight, restricted to anterior ¼ of head (e.g. Fig. 113c); eyes weakly reniform in lateral view, contiguous with anterior margin of pronotum; postocular region absent

(e.g. Fig. 113c). ***Antennae:*** AI subequal in length to head; always longer than interocular distance. ***Pronotum:*** (e.g. Fig. 113d) bilobed, with anterior lobe subequal in length to posterior lobe; collar weakly developed; anterior lobe rectangulate, lateral margins straight, calli mildly elevated, often contiguous medially; posterior lobe trapezoidal, lateral margins strongly divergent posteriorly, weakly declivent, posterior margin rectilinear. ***Mesepimeron:*** (e.g. Fig. 113e) with evaporative bodies; metathoracic spiracle weakly exposed. ***Metathoracic Gland:*** (e.g. Fig. 113e) peritreme short, tongue-like, weakly raised, posterodorsally oriented; evaporative area occupying ca. ⅓ of metepisternum, peritreme not reaching dorsal margin of evaporative area. ***Hemelytra:*** margins uniformly convex; ca. 1-2x longer than abdomen (e.g. Fig. 113f). ***Legs:*** cursorial; coxae elongate; pretarsal claws with uniformly spaced minute striations; narrow at base. ***Male Genitalia:*** pygophore short, with narrow finger-like lateral process of varying length (e.g. Fig. 121a), and a weak ventral process (e.g. Fig. 121a), sometimes with a long groove to receive right paramere (e.g. Fig. 120f); genital opening broad; with erect setae (e.g. Fig. 121a). Left paramere highly variable, one (e.g. Fig. 119b) or two (e.g. Fig. 114b) complex (e.g. Fig 125b) or simple (e.g. Fig 123b) apophyses; sensory lobe small. Right paramere greatly elongate and strongly curved (e.g. Fig 123e). Aedeagus (e.g. Fig 123d,e) with phallotheca broad at base gradually narrowing apically, opening apical with a pair of minute folds (e.g. Fig 123d,e); ductus seminis long; (e.g. Fig 125d,e) anterior endosomal lobal sclerite often projecting from phallotheca at rest; dorsal endosomal lobal sclerite laterally flattened (e.g. Fig 125d).

Distribution

Restricted to New Caledonia, including the Loyalty Islands (Fig. 115).

Biology and plant associations

Host records for *Novacalecoris* are patchy, with only a few species having identified plant associations; there is no apparent phylogenetic pattern to the associations.

Remarks

Novacalecoris is the basal member of the *Candidomiris* group, and are also the only member that lack the distinctive bilobed pronotum. The apical endosomal lobal sclerite is the character which places this genus within the *Candidomiris* group.

Novacalecoris bisclerita sp. nov.

Habitus, Figure 112a. SEMs, Figure 113. Male genitalia, Figure 114. Distribution, Figure 115.

Etymology

Named for its two endosomal lobal sclerites; noun in apposition.

Materials examined

HOLOTYPE: **NEW CALEDONIA: PROVINCE SUD:** 9.2km NE Col d' Amieu on toute 5, slopes of Mount Rembai, 21.59472°N 165.83639°E, 500 m, 23 Nov 1979, W.C. Gagne, 1♂ (AMNH_PBI 00047063) (MNPH).

PARATYPES: **NEW CALEDONIA: PROVINCE SUD:** 9.2 km NE Col d' Amieu on toute 5, slopes of Mount Rembai, 21.59472°S 165.83639°E, 500 m, 23 Nov 1979, W.C. Gagne, 11♂♂ (AMNH_PBI 00047063-AMNH_PBI 00047073) (MNPH).

Diagnosis

Novacalecoris bisclerita is recognised by the following combination of characters: dorsum pale yellow, lacking distinct markings (Fig. 112a); body elongate-ovoid (Fig. 112a); labium reaching the pygophore; calli flat (Fig. 113d); scutellum smooth; hemelytra costal margins weakly convex (Fig. 112a); pygophore with serrate left tergal

process projecting terminally (Fig. 114a); left paramere hatchet-shaped, with two apophyses (Fig. 114b); right paramere elongate, c-shaped (Fig. 114c); phallotheca with a right basal lobe (Fig. 114d); endosoma with two dorsal endosomal lobal sclerites (Fig. 114d).

Description

COLOURATION: Body pale yellow (Fig. 112a). ***Head:*** uniformly pale yellow. ***Antennae:*** AI pale yellow; AII-AIV fuscous. ***Labium:*** yellow. ***Pronotum:*** uniformly pale yellow. ***Thoracic venter:*** uniformly pale yellow. ***Scutellum:*** pale yellow. ***Metathoracic glands:*** evaporative area pale grey. ***Hemelytra:*** transparent. ***Legs:*** uniformly pale yellow. ***Abdomen:*** pale stramineous, sometimes dark markings on terminalia.

VESTITURE AND TEXTURE: Body with elongate, hair-like setae and dense distribution of microtrichia (Fig. 113a). ***Head:*** setae absent dorsally except along midline and posterior margin (Fig. 113a). ***Antennae:*** AI sparse distribution of erect, hair-like setae; AII-AIV dense distribution of decumbent, hair-like setae. ***Pronotum:*** (Fig. 113d) uniformly smooth; with sparse and uniform distribution of hair-like setae. ***Thoracic venter:*** smooth; sparse distribution of minute microtrichia. ***Scutellum:*** smooth; sparse distribution of hair-like setae. ***Hemelytra:*** sparse distribution of hair-like setae; dense distribution of microtrichia. ***Legs:*** dense distribution of microtrichia.

STRUCTURE: Body elongate-ovoid (Fig. 112a). ***Head:*** vertex with weakly sulcate midline (Fig. 113a); bucculae broad, not covering gula medially (Fig. 113b); clypeus ventrally oriented with convex anterior margin (Fig. 113c); eyes reniform, extending ventrad to anterior margin of clypeus (Fig. 113c). ***Labium:*** reaching the pygophore. ***Pronotum:*** (Fig. 113d) collar strongly developed; foveae absent; anterior lobe trapezoidal, with weakly developed calli, lateral margins straight, rectilinear posteriorly;

posterior lobe strongly declivent towards head, lateral margins concave, strongly divergent posteriorly, posterior margin strongly concave. ***Thoracic venter:*** proxyphus depressed, triangular. ***Scutellum:*** without foveae on anterolateral angles; lateral margins straight, smooth; mesoscutum raised. ***Hemelytra:*** costal margins convex; cuneus ca. 2x longer than wide (Fig. 113f); medial margin straight. ***Legs:*** metafemora and metatibiae not long; femora greatly incrassate. ***Male Genitalia:*** genital opening of pygophore elliptical (Fig. 114a); ventral projection narrow, short and quadrate (Fig. 114a); with large serrate left tergal process projecting terminally (Fig. 114b). Left paramere (Fig. 114b) hatchet-shaped; apophysis 1 apically bifurcate, one prong minutely dentate; apophysis 2 apically flat, curved, apically minutely divided. Aedeagus (Fig. 114c) with phallotheca opening dorsally, with a right basal lobe; ductus seminis short and broad; secondary gonopore elongate reaching near base of phallotheca at rest; two narrow and tapered dorsal endosomal lobal sclerites present, not projecting beyond phallotheca at rest; endosomal membrane bilobed.

Measurements

See Table 16.

Distribution

Known from a single location in Province Sud of New Caledonia (Fig. 115).

Biology and plant associations

Nine of the 11 specimens are recorded from '*Melastoma* shrub' (Melastomataceae), which is assumed to be a host for this species due to the number of specimens.

Remarks

Novacalecoris bisclerita is the most isolated member of the genus. This is due to its more prognathous head, larger eyes, and the costal margins of hemelytra are less

convex. However, it does share similarities in the genitalia, particularly with *Novacalecoris turpa* and *Novacalecoris rubrafasciae*.

Novacalecoris gressiti sp. nov.

Habitus, Figure 112b. Distribution, Figure 115. Male genitalia, Figure 116. Female genitalia, Figure 117a,b.

Etymology

Named after the late Dr J.L. Gressitt, the collector of this species.

Materials examined

HOLOTYPE: **NEW CALEDONIA: PROVINCE SUD:** 10 km NW of Plum, 22.21667°N 166.53333°E, 24 Mar 1968, J.L. Gressitt and T.C. Maa, 1♂ (AMNH_PBI 00047105) (MNPH).

PARATYPES: **NEW CALEDONIA: PROVINCE SUD:** 20 km NNE of Col de Kuenthio (Col de Nassirah) Route 4 at Kous Road., 21.76667°S 166.76667°E, 200 m, 22 Nov 1979, W.C. Gagne, 1♂ (AMNH_PBI 00047107) (BPBM). Dumbea valley, 22.2°S 166.48333°E, June 1950, N.L.H. Krauss, 1♀ (AMNH_PBI 00047106) (BPBM). Mt. Koghi, 22.16666°S 166.53333°E, 525 m, 27 Jan 1963, C. Yoshimoto and N.L.H. Krauss, ex Urticaceae, 1♂ (AMNH_PBI 00047104) (BPBM). Yate, 2-50 m, 22.15°S 166.9°E, 25 Mar 1968, J.L. Gressitt and T.C. Maa, ex Urticaceae, 1♀ (AMNH_PBI 00047103) (MNPH).

Diagnosis

Novacalecoris gressiti is recognised by the following combination of characters: body yellow (Fig. 112b) with distinct red markings; clypeus light brown; body ovoid (Fig. 112b); labium reaching abdominal s5-s6; pronotal calli flat; scutellum smooth; costal margins of hemelytra greatly convex (Fig. 112b); pygophore with finger-like left tergal

process (Fig. 116a); left and right parameres c-shaped (Fig. 116b,c), with left larger than right; phallotheca deeply dissected apically (Fig. 116d), with a right basal lobe; dorsal endosomal lobal sclerite large, blade-like (Fig. 116d).

Description

COLOURATION: Body yellow with contrasting red markings (Fig. 112b). ***Head:*** clypeus light brown; frons yellow to light brown; vertex pale yellow; mandibular and maxillary plates, gula and genae yellow; bucculae pale orange to red. ***Labium:*** yellow. ***Antennae:*** AI pale yellow; AII pale yellow proximally, light brown distally; AIII-AIV light brown. ***Pronotum:*** pale yellow to reddish brown. ***Thoracic venter:*** light brown to dark reddish brown. ***Scutellum:*** light red. ***Metathoracic glands:*** evaporative area pale grey. ***Hemelytra:*** hyaline, red with contrasting markings; cuneus bright red; membrane transparent; veins demarcated in red or light brown. ***Legs:*** pale grey, coxae sometimes red. ***Abdomen:*** s2-s5 or s6 light to dark brown, otherwise pale yellow.

VESTITURE AND TEXTURE: Body with hair-like setae; microtrichia sparsely distributed. ***Head:*** elongate, erect, hair-like setae. ***Antennae:*** AI with sparse distribution of decumbent, hair-like setae; AII-AIV dense distribution of small, decumbent, hair-like setae. ***Pronotum:*** uniform distribution of decumbent, hair-like setae. ***Thoracic venter:*** proxyphus finely rugulose; setae absent; mesosternum finely rugulose along medial sulcus; microtrichia absent, with sparse distribution of small, erect, hair-like setae. ***Scutellum:*** finely rugulose laterally; uniform distribution of hair-like setae. ***Hemelytra:*** dense distribution of large, semi-erect, hair-like setae. ***Legs:*** femora with sparse distribution of semi-erect setae; tibiae with dense distribution of pale decumbent, hair-like setae and sparsely distributed dark, bristle-like setae.

STRUCTURE: Body ovoid (Fig. 112a). ***Head:*** vertex with weakly sulcate midline; bucculae broad, not covering gula medially; clypeus ventrally oriented with uniformly

convex anterior margin; eyes weakly reniform, extending ventrad to anterior margin of clypeus. ***Labium:*** elongate, extending to abdominal s5-6. ***Pronotum:*** collar weakly developed; foveae absent; anterior lobe trapezoidal, with weakly developed calli, lateral margins straight, rectilinear posteriorly; posterior lobe weakly declivent towards head, lateral margins concave, strongly divergent posteriorly, posterior margin weakly convex. ***Thoracic venter:*** proxyphus depressed, triangular. ***Scutellum:*** without foveae on anterolateral angles; lateral margins straight, smooth; mesoscutum raised. ***Hemelytra:*** costal margins convex; cuneus length and width subequal, medial margin curved. ***Legs:*** metafemora incrassate, metatibiae elongate. ***Male Genitalia:*** genital opening of pygophore elliptical (Fig. 116a); ventral projection narrow, short; finger-like left tergal process (Fig. 116a). Left paramere (Fig. 116b) c-shaped, sensory lobe small, with short thorn-like medial process, apophysis curved. Right paramere (Fig. 116c) c-shaped, shorter than left paramere simple, apophysis curved. Aedeagus (Fig. 116d) small; phallotheca deeply dissected, with right basal lobe, opening apically; ductus seminis short, very broad; secondary gonopore elongate; dorsal endosomal lobal sclerite blade-like, restricted to apex of endosoma, subequal to phallotheca at rest. ***Female genitalia:*** (Figs 117a,b) subgenital plates with strongly explanate lateral margins and a smooth apex; interramal plate spear-shaped; covered in scale-like texture.

Measurements

See Table 16.

Distribution

Known from various locations in Province Sud, New Caledonia (Fig. 115).

Biology and plant associations

No host records available.

Remarks

Novacalecoris gressiti most closely resembles *N. macca*, with both species ovoid, mostly red species, with a shortened cuneus. It is most readily recognised externally by the brown clypeus. The species is also differentiated based by the right paramere, which has a single apophysis in *N. gressiti* and two in *N. macca.*

Novacalecoris kraussi sp. nov.

Habitus, Figure 112c. Distribution, Figure 115. SEMs, Figure 118. Male genitalia, Figure 119.

Etymology

Named for the collector of the species, N.L.H. Krauss.

Materials examined

HOLOTYPE: **NEW CALEDONIA: PROVINCE SUD:** Mt. Koghi, 22.16666°S 166.53333°E, 525 m, Dec 1983, N.L.H. Krauss, 1♂ (AMNH_PBI 00047091) (MNPH).

PARATYPES: **NEW CALEDONIA: PROVINCE NORD:** Mt. Aoupinié, 21.21667°S 165.25°E, 700 m, 18 Jun 1996, M.S. Moulds, 3♂♂ (AMNH_PBI 00021783-AMNH_PBI 00021785), 1♀ (AMNH_PBI 00021786) (AM). Mt. Panie, 20.6°S 164.78333°E, 500 m, 5 Jun 1996, M.S. Moulds, 1♂ (AMNH_PBI 00021787) (AM). **PROVINCE SUD:** Yahoué, 22.19583°S 166.49861°E, 100 m, 01 Feb 1980-28 Feb 1980, N.L.H. Krauss, 1♀ (AMNH_PBI 00047089), 1♂ (AMNH_PBI 00047090) (BPBM).

Diagnosis

Novacalecoris kraussi is recognised by the following combination of characters: dorsum pale yellow with distinct red markings (Fig. 112c); body elongate-ovoid (Fig. 112c); labium reaching metasternum; calli flat; scutellum smooth; costal margins of

hemelytra convex (Fig. 112c); pygophore with a finger-like left tergal process (Fig. 119a); left paramere (Fig. 119b) hatchet-shaped, with two apophyses; right paramere (Fig. 119c) c-shaped, much longer than left, with medial process, and apex blade-like; phallotheca (Fig. 119d) with dorsal opening; endosoma with dorsal endosomal lobal sclerite.

Description

COLOURATION: Mostly pale yellow (Fig. 112c). ***Head:*** Clypeus yellow mottled with red; frons vertex pale yellow to pale grey; maxillary plates red or red and pale yellow; mandibular plates yellow; bucculae yellow; gula and genae pale yellow. ***Antennae:*** AI-AIV yellow with light brown markings around joints. ***Labium:*** pale yellow. ***Pronotum:*** anterior lobe variable, deep to pale red or pale yellow sometimes with dusty colouration; posterior lobe yellow to pale yellow, sometimes with red marking medially. ***Thoracic venter:*** yellow to pale grey sometimes mottled with dusty colouration. ***Scutellum:*** dark to light red, mesoscutum concolourous with scutellum or yellow. ***Metathoracic glands:*** evaporative area dark grey. ***Hemelytra:*** transparent, usually with red line medially. ***Legs:*** uniformly pale yellow. ***Abdomen:*** yellow to pale grey.

VESTITURE AND TEXTURE: Body with simple, hair-like setae and sparse distribution of microtrichia (Fig. 118). ***Head:*** frons, vertex and clypeus with dense distribution of long, decumbent, hair-like setae; otherwise sparse distribution of smaller, hair-like setae (Fig. 118a). ***Antennae:*** AI sparse distribution of erect, hair-like setae; AII-AIV dense distribution of erect, hair-like setae. ***Pronotum:*** uniformly smooth; sparse distribution of hair-like setae; dense distribution of microtrichia. ***Thoracic venter:*** (Fig. 118c) proxyphus smooth; uniformly covered in microtrichia; mesosternum smooth, sparse distribution of microtrichia. ***Scutellum:*** (Fig. 118d) mildly rugulose;

with simple, hair-like setae. ***Hemelytra:*** sparse distribution of hair-like setae with dense fringe on costal margins. ***Legs:*** femora with sparse distribution of semi-erect, hair-like setae; tibiae with dense distribution pale, decumbent, hair-like setae and sparse distribution of dark, semi-erect setae.

STRUCTURE: Body elongate-ovoid (Fig. 112c). ***Head:*** vertex with weakly sulcate midline (Fig. 118a); bucculae broad, not covering gula medially (Fig. 118c); clypeus ventrally oriented with uniformly convex anterior margin (Fig. 118b); eyes egg-shaped, extending ventrad to anterior margin of clypeus. ***Labium:*** extending to metasternum. ***Pronotum:*** (Fig. 118c) collar weakly developed; foveae absent; anterior lobe trapezoidal, with weakly developed calli, lateral margins concave, rectilinear posteriorly; posterior lobe weakly declivent towards head, lateral margins concave, strongly divergent posteriorly, posterior margin straight. ***Thoracic venter:*** proxyphus depressed, triangular. ***Scutellum:*** (Fig. 118d) without foveae on anterolateral angles; lateral margins straight, smooth; mesoscutum raised. ***Hemelytra:*** costal margins concave medially; cuneus ca. 1.5x longer than wide, medial margin curved. ***Legs:*** metafemora weakly incrassate. ***Male Genitalia:*** genital opening of pygophore round (Fig. 119a); ventral projection; with finger-like left tergal process. Left paramere (Fig. 119b) hatchet-shaped, with two tapered apophyses, and two medial processes. Right paramere (Fig. 119c) c-shaped, much larger than left, with a basal process, apophysis greatly elongate, apically blade-like. Aedeagus (Fig. 119d) with phallotheca opening dorsally; ductus seminis short and broad; secondary gonopore moderately long, about ½ length of phallotheca at rest; apical endosomal lobal sclerite absent; dorsal endosomal sclerite large, blade-like; endosomal membrane bilobed.

Measurements

See Table 16.

Distribution

Known from a single locality in the Southern Province of New Caledonia (Fig. 115).

Remarks

Novacalecoris kraussi resembles *N. monteithi, N. rubrafasciae, N. tatarnici* and *N. turpa*. These species are differentiated by their colouration, labial length, and shape of left paramere apophysis and endosomal lobal sclerites. These species don't form a monophyletic group according to my phylogenetic analysis, but most of the relationships within this genus are not well supported.

Novacalecoris macca sp. nov.

Habitus, Figure 112d. Distribution, Figure 115. SEMs, Figure 120. Male genitalia, Figure 121.

Etymology

Named from the Latin *macca*, meaning fool or clown; named after the red clypeus.

Materials examined

HOLOTYPE: **NEW CALEDONIA: PROVINCE SUD:** Haute Yaté, 22.16805°S 166.90133°E, 411 m, 24 Apr 2005, Cassis, Wall, Tatarnic, Monteith, *Beccariella seberti* (Sapotaceae) 1♂ (AMNH_PBI 00012019) (MNHP).

PARATYPES: **NEW CALEDONIA: PROVINCE SUD:** Haute Yaté, 22.16805°S 166.90133°E, 411 m, 24 Apr 2005, Cassis, Wall, Tatarnic, Monteith, ex. *Beccariella seberti* (Sapotaceae) 6♂♂ (AMNH_PBI 00012013, AMNH_PBI 00012016-AMNH_PBI 00012018, AMNH_PBI 00021219, AMNH_PBI 00021222), 3♀♀ (AMNH_PBI 00012014, AMNH_PBI 00012015, AMNH_PBI 00021232) (AM). ca. 3 km N Port Boisé, 22.31729°S 166.9658°E, 87 m, 20 Apr 2005, Cassis, Wall, Tatarnic, Monteith, ex *Alphitonia* sp. (Rhamnaceae), det. NOU Staff NYBG VOUCHER, 9♂♂

(AMNH_PBI 00021220, AMNH_PBI 00021221, AMNH_PBI 00021223-AMNH_PBI 00021229), 6♀♀ (AMNH_PBI 00021230, AMNH_PBI 00021231, AMNH_PBI 00021233-AMNH_PBI 00021236), 2 nymphs (AMNH_PBI 00021237, AMNH_PBI 00021238), 2 sex unknown (AMNH_PBI 00021239, AMNH_PBI 00021240) (AM).

Diagnosis

Novacalecoris gressiti is recognised by the following combination of characters: body mostly glabrous (Fig. 112d), yellow with distinct red markings (Fig. 112d); clypeus red; body ovoid (Fig. 112d); labium reaching abdominal s5-s6; calli flat; scutellum smooth; costal margins of hemelytra greatly convex (Fig. 112d); pygophore (Fig. 121a) with a small left tergal process; left paramere (Fig. 121b) bilobed with two apophyses; right paramere (Fig. 121c) strongly c-shaped; phallotheca (Fig. 121d) with right basal lobe, opening apically; endosoma with apical and dorsal endosomal sclerites.

Description

COLOURATION: Body shiny, mostly reddish (Fig. 112d). ***Head:*** clypeus red; frons stramineous; eyes black, sometimes red markings on occipital lobe; vertex stramineous; mandibular and maxillary plates pale grey; bucculae red; gula and genae stramineous. ***Antennae:*** AI, AII stramineous proximally fuscous apically, AIII-IV stramineous. ***Labium:*** stramineous. ***Pronotum:*** anterior lobe stramineous; posterior lobe brown bearing pale grey spots. ***Thoracic venter:*** propleura stramineous, meso- and metapleura black; proxyphus stramineous; meso- and metasternum black. ***Scutellum:*** stramineous. ***Metathoracic glands:*** evaporative area dark grey. ***Hemelytra:*** transparent, with stramineous tinge, cuneus red posteriorly, brownish red lateral marking anterior to membrane, membrane veins red. ***Legs:*** coxae pale grey; femora pale grey proximally, red marks on metafemora; stramineous apically; tibiae and pretarsus stramineous. ***Abdomen:*** dark brown; female genital plates stramineous.

VESTITURE AND TEXTURE: Body with a sparse and uniform distribution of short setae and microtrichia (Fig. 120). ***Head:*** frons and vertex with sparse distribution of long semi-erect setae; genae and ventral surface with sparse distribution of short, erect hair-like setae (Fig. 120a). ***Antennae:*** AI-AIV with dense distribution of short, decumbent, hair-like setae. ***Pronotum:*** smooth; sparsely covered in decumbent, hair-like setae. ***Thoracic venter:*** proxyphus finely rugulose; setae absent; mesosternum finely rugulose along midline, microtrichia absent and with sparse distribution of small erect, hair-like setae. ***Scutellum:*** dense distribution of decumbent, hair-like setae; microtrichia present. ***Hemelytra:*** dense distribution of decumbent, hair-like setae; microtrichia present. ***Legs:*** femora with sparse distribution of semi-erect, hair-like setae; tibiae with dense distribution of pale, decumbent, hair-like setae and sparse distribution of dark, semi-erect, hair-like setae.

STRUCTURE: Body ovoid (Fig. 112d). ***Head:*** vertex with weakly sulcate midline (Fig. 120a); bucculae broad, not covering gula medially (Fig. 120b); clypeus ventrally oriented with uniformly convex anterior margin (Fig. 120b); eyes weakly reniform, extending ventrad to anterior margin of clypeus (Fig. 120b). ***Labium:*** extending to abdominal s5-6. ***Pronotum:*** collar weakly developed; foveae absent; anterior lobe trapezoidal, with weakly developed calli, lateral margins straight, rectilinear posteriorly; posterior lobe weakly declivent towards head, lateral margins concave, strongly divergent posteriorly, posterior margin weakly concave. ***Thoracic venter:*** proxyphus deeply depressed. ***Scutellum:*** without foveae on anterolateral angles; lateral margins straight, smooth; mesoscutum raised. ***Hemelytra:*** costal margins strongly convex; cuneus width subequal to length. ***Legs:*** metafemora incrassate. ***Male Genitalia:*** genital opening of pygophore elliptical (Fig. 121a); ventral projection short, rounded; short thumb-like left tergal process. Left paramere (Fig. 121b) hatchet-shaped, with a pair of

apophyses, subequal in length; sensory lobe weakly developed, with a few small setae; apophysis 1 large, medially serrate; apophysis 2 with large irregularly-shaped lump. Right paramere (Fig. 121c) c-shaped, strongly arched, with elongate and strongly tapered apophysis, apex acute. Aedeagus (Fig. 121c) with right basal lobe, apical opening; ductus seminis short, secondary gonopore moderately long; apical endosomal lobal sclerite broad, blade-like; dorsal endosomal lobal sclerite narrow and straight not projecting from phallotheca at rest; endosomal membrane bilobed.

Measurements

See Table 16.

Distribution

Known from two locations in Province Sud, New Caledonia (Fig. 115).

Biology and plant associations

Ten specimens were collected from *Beccariella seberti* (Sapotaceae) and nineteen specimens were collected from *Alphitonia* sp. (Rhamnaceae), which are assumed to be hosts of this species.

Remarks

See Remarks section of *Novacalecoris gressiti.*

Novacalecoris monteithi sp. nov.

Habitus, Figure 112e. Distribution, Figure 115. SEMs, Figure 122. Male genitalia, Figure 123.

Etymology

Named after Geoff Monteith of the Queensland Museum, one of the collectors of the type specimens.

Materials examined

HOLOTYPE: **NEW CALEDONIA: PROVINCE SUD:** 2 km E Nakety, 21.55735°S 166.0702°E, 45 m, 26 Apr 2005, Cassis, Wall, Tatarnic, Monteith, 1♂ (AMNH_PBI 00021241) (MNHP).

PARATYPES**: NEW CALEDONIA: Province Sud:** 2 km E Nakety, 21.55735°S 166.0702°E, 45 m, 26 Apr 2005, Cassis, Wall, Tatarnic, Monteith, 3♀♀ (AMNH_PBI 00046316-AMNH_PBI 00046318), 1♂ (AMNH_PBI 00021242) (AM). Col d'Amieu sawmill, east side picnic area, 21.59275°S 165.8322°E, 325 m, 26 Apr 2005, Cassis, Wall, Tatarnic, Monteith, ex *Solanum manritianum* Scop. (Solanaceae), det. NOU Staff NYBG VOUCHER, 4♀♀ (AMNH_PBI 00046307-AMNH_PBI 00046310), 1 sex unknown (AMNH_PBI 00046311), 4♂♂ (AMNH_PBI 00046312-AMNH_PBI 00046315) (AM).

Diagnosis

Novacalecoris monteithi is recognised by the following combination of characters: dorsum yellow with black markings (Fig. 112e); body elongate-ovoid (Fig. 112e); labium reaching pygophore; calli flat; scutellum rugulose; costal margins of hemelytra convex; pygophore lacking left tergal process; left paramere y-shaped, sensory lobe with two apophyses; right paramere greatly elongate, c-shaped; aedeagus with arcuate dorsal endosomal lobal sclerite.

Description

COLOURATION: (e.g. Fig. 112e) Body shiny, mostly yellow with black markings. ***Head:*** clypeus and frons yellow; vertex fuscous; maxillary and mandibular plates, bucculae, gula and genae pale yellow. ***Antennae:*** AI-AII yellow; AIII-AIV brown. ***Labium:*** pale yellow. ***Pronotum:*** uniformly black in males, in females anterior lobe pale yellow to light orange; posterior lobe black, sometimes with yellow markings anteriorly. ***Thoracic pleura and sterna:*** sometimes with indistinct pale brown markings. ***Scutellum:*** fuscous, pale yellow apically. ***Metathoracic glands:*** evaporative area pale grey. ***Hemelytra:*** translucent, colourless. ***Legs:*** pale yellow. ***Abdomen:*** pale yellow with tinge of green.

VESTITURE AND TEXTURE: Body with sparse distribution of hair-like setae and microtrichia (Fig. 122). ***Head:*** uniform distribution of erect, hair-like setae (Fig. 122a). ***Antennae:*** AI sparse distribution of decumbent, hair-like setae; AII-AIV dense distribution of small, decumbent, hair-like setae. ***Pronotum:*** (Fig. 122d) smooth; uniform distribution of semi-erect, hair-like setae. ***Thoracic venter:*** proxyphus rugulose; setae absent. ***Scutellum:*** (Fig. 122e) rugulose laterally; uniform distribution of semi-erect, hair-like setae. ***Hemelytra:*** uniform distribution of semi-erect, hair-like setae. ***Legs:*** femora sparse distribution of semi-erect, hair-like setae; tibiae dense distribution of pale, decumbent, hair-like setae and sparse distribution of dark, semi-erect bristle-like setae.

STRUCTURE: Body elongate-ovoid (Fig. 112e). ***Head:*** vertex with weakly sulcate midline (Fig. 122a); bucculae broad, not covering gula medially (Fig. 122b); clypeus ventrally oriented with uniformly convex anterior margin (Fig. 122c); eyes strongly reniform, extending ventrad to anterior margin of clypeus (Fig. 122c). ***Labium:*** greatly elongate, extending to pygophore. ***Pronotum:*** (Fig. 122d) collar weakly developed;

foveae absent; anterior lobe trapezoidal, with weakly developed calli, lateral margins concave, rectilinear posteriorly; posterior lobe weakly declivent towards head, lateral margins concave, posterior margin weakly concave. ***Thoracic venter:*** proxyphus depressed, triangular. ***Scutellum:*** (Fig. 122e) without foveae on anterolateral angles; lateral margins straight, smooth; mesoscutum raised. ***Hemelytra:*** costal margins convex, mildly sinuate medially; cuneus 1.5-2x longer than wide, medial margin straight. ***Legs:*** metafemora incrassate. ***Male Genitalia:*** genital opening of pygophore elliptical (Fig. 123a); ventral projection short and broad. Left paramere (Fig. 123b) y-shaped, strongly arched; sensory lobe incrassate, with robust bristle-like setae; two apophysis, apophysis 1 rounded, with medial margin serrate, apophysis 2 smooth, rounded. Right paramere (Fig. 123c) c-shaped, greatly enlarged. Aedeagus (Figs 123d,e) with phallotheca dorsal opening; ductus seminis short and broad; secondary gonopore moderately long; apical endosomal lobal sclerite basally thick, partially projecting from phallotheca at rest, rounded; endosomal membrane bilobed.

Measurements

See Table 16.

Distribution

Known from a single location in Province Sud, New Caledonia (Fig. 115).

Biology and plant associations

All 15 specimens of *N. monteithi* were collected from *Solanum manritianum* (Solanaceae), and is assumed to be the host plant.

Remarks

See Remarks section of *Novacalecoris kraussi.*

Novacalecoris rubrafasciae sp. nov.

Habitus, Figure 112f. Distribution, Figure 115. Female genitalia, Figure 117c-d. SEMs, Figure 124. Male genitalia, Figure 125.

Etymology

Named for the Latin for red bands on the dorsum; noun in apposition.

Materials examined

HOLOTYPE: **NEW CALEDONIA: PROVINCE NORD:** 18 km N Houialou, 21.18232°S 165.5372°E, 25 m, 03 May 2005, Cassis, Wall, Tatarnic, Monteith, *Geissois hirsuta* (Cunoniaceae), 1♂ (AMNH_PBI 00012020) (MNPH).

PARATYPES: **NEW CALEDONIA: PROVINCE NORD:** ca. 18 km N Houialou, 21.18232°S 165.5372°E, 25 m, 03 May 2005, Cassis, Wall, Tatarnic, Monteith, *Geissois hirsuta* (Cunoniaceae), 6♂♂ (AMNH_PBI 00012021-AMNH_PBI 00012026), 9♀♀ (AMNH_PBI 00012028-AMNH_PBI 00012036) (AM).

Diagnosis

Novacalecoris rubrafasciae is recognised by the following combination of characters: dorsum stramineous with red markings (Fig. 112f); body elongate-ovoid (Fig. 112f); labium reaching abdominal s2; calli elevated (Fig. 124a); scutellum rugulose (Fig. 124e); costal margins of hemelytra convex; pygophore with large left tergal process (Fig. 112e); left paramere (Fig. 125b) hatchet-shaped, with two apically bifid apophyses; right paramere (Fig. 124d) c-shaped; with an apical and dorsal endosomal lobal sclerites (Fig. 125d).

Description

COLOURATION: Body shiny, mostly stramineous with red markings (Fig. 112e). ***Head:*** frons usually stramineous with faint red markings, otherwise entirely stramineous. ***Antennae:*** uniformly stramineous. ***Pronotum:*** red with stramineous

markings laterally and sometimes anteriorly. ***Thoracic pleura and sterna:*** entirely stramineous. ***Scutellum:*** red. ***Metathoracic glands:*** evaporative area pale grey. ***Hemelytra:*** transparent, faintly stramineous usually with bright red markings on cuneus; membrane transparent, veins usually bright red. ***Legs:*** uniformly stramineous. ***Abdomen:*** venter stramineous, genital segments usually pale grey in ♂ and ♀.

VESTITURE AND TEXTURE: Body with simple, decumbent, hair-like setae and minute microtrichia (Fig. 124a). ***Head:*** very sparse distribution of hair-like setae; frons setae only present along midline and posterior margin (Fig. 124a). ***Antennae:*** AI sparse distribution of thick, hair-like setae; AII-AIV with dense distribution of smaller, hair-like setae. ***Pronotum:*** sparse, uniform distribution of semi-erect, hair-like setae. ***Thoracic venter:*** proxyphus rugulose; setae absent. ***Scutellum:*** (Fig. 124e) rugulose laterally; uniform distribution of semi-erect, hair-like setae. ***Hemelytra:*** sparse distribution of decumbent, hair-like setae; uniform distribution of minute, decumbent microtrichia. ***Legs:*** dense distribution of thick, hair-like setae; tibiae with rows of spinules.

STRUCTURE: Body elongate-ovoid (Fig. 112f). ***Head:*** (Fig. 124a) vertex with weakly sulcate midline; bucculae broad, not covering gula medially (Fig. 124c); clypeus ventrally oriented with uniformly convex anterior margin (Fig. 124b); eyes strongly reniform, extending ventrad to anterior margin of clypeus (Fig. 124b). ***Labium:*** extending to abdominal s2. ***Pronotum:*** collar weakly developed; foveae absent; anterior lobe trapezoidal, with weakly developed calli, lateral margins straight, rectilinear posteriorly; posterior lobe weakly declivent towards head, lateral margins concave, strongly divergent posteriorly, posterior margin weakly concave. ***Thoracic venter:*** proxyphus depressed, triangular. ***Scutellum:*** (Fig. 124e) without foveae on anterolateral angles; lateral margins straight, smooth; mesoscutum raised. ***Hemelytra:*** costal margins

convex; cuneus ca. 1.5x longer than wide, medial margin straight. ***Legs:*** metafemora incrassate; tibiae and femora moderately long. ***Male Genitalia:*** genital opening of pygophore simple, subrectangulate (Fig. 125a); ventral projection short, broad, subrectangulate; left tergal process, large, recurved. Left paramere (Fig. 125b) hatchet-shaped, with two apophyses, apophysis 1 bifid, with acute apices, apophysis 2 bifid, with short rounded apices. Right paramere (Fig. 125c) c-shaped, elongate, with thorn-like apex. Aedeagus (Fig. 125d) small and ovoid; phallotheca opening apically; ductus seminis short and broad; secondary gonopore moderately long; apical endosomal lobal sclerite short, rounded, projecting from phallotheca at rest; dorsal endosomal lobal sclerite narrow, partially projecting from phallotheca at rest; endosomal membrane bilobed. ***Female genitalia:*** (Figs 117c-d) subgenital plates with weakly explanate lateral margins and a pointed apex; interramal plate spear-shaped, covered in scale-like sclerites.

Measurements

See Table 16.

Distribution

Known from a single location in Province Nord, New Caledonia (Fig. 115).

Biology and plant associations

All 16 specimens were collected from *Geissois hirsuta* (Cunoniaceae), which is the likely host plant of *N. rubrafasciae*.

Remarks

See Remarks section of *Novacalecoris kraussi.*

Novacalecoris tatarnici sp. nov.

Habitus, Figure 112g. Distribution, Figure 115. SEMs, Figure 126.

Etymology

Named after Dr Nik Tatarnic, of the Western Australian Museum, one of the type collectors.

Materials examined

HOLOTYPE: **NEW CALEDONIA: PROVINCE NORD:** ca. 18 km N Houialou, 21.18232°S 165.5372°E, 25 m, 03 May 2005, Cassis, Wall, Tatarnic, Monteith, ex *Geissois* sp. (Cunoniaceae), det. NOU Staff NYBG VOUCHER, 1♂(AMNH_PBI 00046305) (MNPH).

PARATYPES: **NEW CALEDONIA: PROVINCE NORD:** ca. 18 km N Houialou, 21.18232°S 165.5372°E, 25 m, 03 May 2005, Cassis, Wall, Tatarnic, Monteith, ex *Geissois* sp. (Cunoniaceae), det. NOU Staff NYBG VOUCHER, 6♀♀ (AMNH_PBI 00046299-AMNH_PBI 00046304), 1♂ (AMNH_PBI 00046306) (AM).

Diagnosis

Novacalecoris tatarnici is recognised by the following combination of characters: dorsum stramineous with black markings (Fig. 112g); body elongate-ovoid (Fig. 112g); labium reaching s4-s5; calli flat (Fig. 126d); scutellum rugulose; costal margins of hemelytra uniformly convex (Fig. 112g).

Description

COLOURATION: Body shiny, mostly stramineous with black markings (Fig. 112g). ***Head:*** vertex fuscous and/or stramineous; remainder stramineous. ***Antennae:*** most often stramineous, AIII-AIV sometimes fuscous. ***Pronotum:*** anterior lobe fuscous or stramineous; posterior lobe fuscous; in females anterior lobe sometimes pale yellow. ***Thoracic pleura and sterna:*** pale yellow. ***Thoracic venter:*** proxyphus sometimes

fuscous. ***Scutellum:*** fuscous, pale yellow apically. ***Metathoracic glands:*** evaporative area dark grey. ***Hemelytra:*** translucent, colourless. ***Legs:*** pale yellow. ***Abdomen:*** pale yellow.

VESTITURE AND TEXTURE: Body with simple, hair-like setae and sparse distribution of microtrichia (Fig. 126). ***Head:*** uniform distribution of erect, hair-like setae (Fig. 126a). ***Antennae:*** AI sparse distribution of decumbent, hair-like setae; AII-AIV dense distribution of smaller, decumbent, hair-like setae. ***Pronotum:*** (Fig. 126d) smooth; uniform distribution of semi-erect, hair-like setae. ***Thoracic venter:*** proxyphus rugulose; setae and microtrichia absent. ***Scutellum:*** rugulose laterally, uniform distribution of semi-erect, hair-like setae. ***Hemelytra:*** uniform distribution of semi-erect, hair-like setae. ***Legs:*** femora with sparse distribution of semi-erect, hair-like setae; tibiae with dense distribution of pale, decumbent, hair-like setae and sparse distribution of dark, semi-erect, hairlike setae.

STRUCTURE: Body elongate-ovoid (Fig. 112g). ***Head:*** (Fig. 126a) vertex with weakly sulcate midline; bucculae broad, not covering gula medially; clypeus ventrally oriented with uniformly convex anterior margin; eyes strongly reniform, extending ventrad to anterior margin of clypeus. ***Labium:*** extending to abdominal s4-s5. ***Pronotum:*** (Fig. 126d) collar weakly developed; foveae absent; anterior lobe trapezoidal, with weakly developed calli, lateral margins straight, rectilinear posteriorly; posterior lobe weakly declivent towards head, lateral margins concave, strongly divergent posteriorly, posterior margin weakly concave. ***Thoracic venter:*** proxyphus depressed, triangular. ***Scutellum:*** without foveae on anterolateral angles; lateral margins straight, smooth; mesoscutum raised. ***Hemelytra:*** costal margins; cuneus ca. 1.5x longer than wide, medial margin straight (Fig. 126f). ***Legs:*** metafemora incrassate.

Male and female genitalia are not investigated.

Measurements

See Table 16.

Distribution

Known from a single location in Province Nord, New Caledonia (Fig. 115).

Biology and plant associations

All 7 specimens were collected from *Geissois* sp. (Cunoniaceae).

Remarks

See Remarks section of *Novacalecoris kraussi.*

Novacalecoris turpa sp. nov.

Habitus, Figure 112h. Distribution, Figure 115. SEMs, Figure 127. Male genitalia, Figure 128.

Etymology

Named from the Latin, turpa meaning ugly, in reference to its bland colouration.

Materials examined

HOLOTYPE: **NEW CALEDONIA: PROVINCE NORD:** 18 km N Houialou, 21.18232°S 165.5372°E, 25 m, 03 May 2005, Cassis, Wall, Tatarnic, Monteith, ex *Geissois* sp. (Cunoniaceae), det. NOU Staff NYBG VOUCHER 1♂ (AMNH_PBI 00012027) (MNHP).

PARATYPES: **NEW CALEDONIA: PROVINCE NORD:** ca. 18 km N Houialou, 21.18232°S 165.5372°E, 25 m, 03 May 2005, Cassis, Wall, Tatarnic, Monteith, ex *Geissois* sp. (Cunoniaceae), det. NOU Staff NYBG VOUCHER, 2♀♀ (AMNH_ENT 00021686, AMNH_ENT 00021687), 1♂ (AMNH_ENT 00021685) (AM).

Diagnosis

Novacalecoris turpa is recognised by the following combination of characters: dorsum stramineous with red markings (Fig. 112h); body elongate-ovoid (Fig. 112h); labium reaching abdominal s2; calli flat (Fig. 127d); scutellum rugulose; costal margins of hemelytra convex (Fig. 112h); pygophore with finger-like left tergal process (Fig. 128a); left paramere (Fig. 128b) hatchet-shaped-shaped, with two apophyses; right paramere (Fig. 128c) longer than left, serrate distally; phallotheca (Fig. 128d) with right basal lobe; aedeagus (Fig. 128d) with dorsal and ventral endosomal lobal sclerites.

Description

COLOURATION: Body shiny, mostly stramineous with red markings (Fig. 112h). ***Head:*** mostly stramineous; maxillary and mandibular plates red. ***Antennae:*** uniformly stramineous. ***Pronotum:*** red with stramineous markings laterally, sometimes anteriorly. ***Thoracic venter:*** uniformly stramineous. ***Scutellum:*** red. ***Metathoracic glands:*** evaporative area pale grey. ***Hemelytra:*** transparent, faintly stramineous usually with bright red markings on corium; membrane transparent, veins usually bright red. ***Legs:*** uniformly stramineous. ***Abdomen:*** stramineous, genital segments usually pale grey in ♂ and ♀.

VESTITURE AND TEXTURE: Body with hair-like setae and sparse distribution of microtrichia (Fig. 127). ***Head:*** uniform distribution of erect, hair-like setae (Fig. 127a). ***Antennae:*** AI with sparse distribution of decumbent, hair-like setae; AII-AIV with dense distribution of smaller, decumbent, hair-like setae. ***Pronotum:*** (Fig. 127c) smooth; covered in semi-erect, hair-like setae. ***Thoracic venter:*** proxyphus rugulose; setae and microtrichia absent. ***Scutellum:*** (Fig. 127d) rugulose laterally; uniform distribution of semi-erect, hair-like setae. ***Hemelytra:*** uniform distribution of semi-

erect, hair-like setae. ***Legs:*** femora with long, erect, hair-like setae; tibiae with thick decumbent hair-like setae.

STRUCTURE: Body elongate-ovoid (Fig. 112h). ***Head:*** vertex with weakly sulcate midline (Fig. 127a); bucculae broad, not covering gula medially (Fig. 127b); clypeus ventrally oriented with uniformly convex anterior margin; eyes strongly reniform, extending ventrad to anterior margin of clypeus. ***Labium:*** extending to abdominal s2. ***Pronotum:*** (Fig. 127c) collar weakly developed; foveae absent; anterior lobe trapezoidal, with weakly developed calli, lateral margins straight, rectilinear posteriorly; posterior lobe weakly declivent towards head, lateral margins concave, strongly divergent posteriorly, posterior margin weakly convex. ***Thoracic venter:*** proxyphus depressed, triangular. ***Scutellum:*** (Fig. 127d) without foveae on anterolateral angles; lateral margins straight, smooth; mesoscutum raised. ***Hemelytra:*** costal margins convex, mildly sinuate medially; cuneus ca. 1.5x longer than wide, medial margin straight. ***Legs:*** metafemora incrassate, tibiae and femora only weakly elongate. ***Male Genitalia:*** genital opening of pygophore elliptical (Fig. 128a); ventral projection short; large finger-like left tergal process. Left paramere (Fig. 127a) hatchet-shaped, with two undivided apophyses, subequal in length, distally tapered. Right paramere (Fig. 127c) large, c-shaped, strongly curved, with apex serrate. Aedeagus (Fig. 127d) with phallotheca with dorsal opening; ductus seminis short and broad; secondary gonopore moderately long; dorsal endosomal lobal sclerite large, basally incrassate, partially projecting from phallotheca at rest; ventral endosomal lobal sclerite small, entirely projecting from phallotheca at rest; endosomal membranous bag bilobed.

Measurements

See Table 16.

Distribution

Known from a single location in Province Nord, New Caledonia (Fig. 115).

Biology and plant associations

All four specimens of *N. turpa* were collected from *Geissois* sp. (Cunoniaceae).

Remarks

See Remarks section of *Novacalecoris kraussi.*

***Prosoponomiris* gen. nov.**

Etymology

Prosoponomiris is from the Greek *Prosopon* meaning mask as they disguise themselves as ants. Noun in apposition. Feminine.

Type species

Prosoponomiris mimetica sp. nov. by original designation.

Diagnosis

Prosoponomiris mimetica is recognised by the following combination of characters: myrmecomorphic (Fig. 112i); dorsum black with white markings (Fig. 112i); body elongate-ovoid (Fig. 112i); labium reaching mesosternum; calli weakly elevated (Fig. 129b); scutellum weakly rugulose (Fig. 129d); costal margins of hemelytra sinuate (Fig. 112i); pygophore (Fig. 130a) lacking left tergal and ventral process, genital opening elliptical; left paramere (Figs 130b,c) r-shaped, with apex of sensory lobe granulate; right paramere (Fig. 130d) thumb-like; two dorsal endosomal lobal sclerites, weakly dentate (Fig. 130e).

Description

COLOURATION: Generally black with pale yellow markings (Fig. 112i).

VESTITURE AND TEXTURE: Body with sparse distribution of decumbent, hair-like setae and microtrichia; branched setae absent (Fig. 129). ***Antennae:*** dense distribution of erect, hair-like setae. ***Pronotum:*** (Fig. 129b) anterior and posterior lobes smooth, with a denser distribution of hair-like setae. ***Prosternum:*** mostly smooth; microtrichia sparsely distributed. ***Scutellum:*** (Fig. 129d) smooth. ***Hemelytra:*** sparse distribution of semi-erect, hair-like setae. ***Legs:*** densely covered with semi-erect, hair-like setae, two rows of spinules usually present on tibiae.

STRUCTURE: Body elongate-ovoid, myrmecomorphic shape (Fig. 112i). ***Head:*** strongly hypognathous, frons and clypeus straight; frons almost flat (Fig. 129a); about twice as wide as long, in dorsal view; bucculae keyhole shaped, produced ventrally beyond ventral margin of eyes (Fig. 129c); gula straight, restricted to anterior ¼ of head (Fig. 129a); eyes strongly elliptical in lateral view, contiguous with anterior margin of pronotum (Fig. 129a); postocular region absent (Fig. 129). ***Antennae:*** AI subequal in length to head; always longer than interocular distance. ***Pronotum:*** (Fig. 129b) bilobed, with anterior lobe subequal in length to posterior lobe; collar weakly developed; anterior lobe rectangulate, lateral margins straight, calli midly elevated, often contiguous medially; posterior lobe trapezoidal, lateral margins strongly divergent posteriorly, weakly declivent, posterior margin rectilinear. ***Mesepimeron:*** with evaporative bodies; metathoracic spiracle weakly exposed. ***Metathoracic Gland:*** peritreme short, tongue-like, weakly raised, posterodorsally oriented; evaporative area occupying ca. ⅓ of metepisternum, peritreme not reaching dorsal margin of evaporative area. ***Hemelytra:*** (Fig. 112i) margins sinuate, constricting medially; subequal in length to abdomen. ***Legs:*** cursorial; coxae mildly elongate; pretarsal claws with uniformly spaced minute striations; narrow at base. ***Male Genitalia:*** pygophore mildly elongate, lacking ventral or lateral process; genital opening elongate; with erect setae (Fig. 130a).

Left paramere (Figs 130b-c) r-shaped; sensory lobe prominent, with several small setae and five apical tooth-like processes; apophysis narrow, apically hooked. Right paramere (Fig. 130d) greatly elongate and strongly curved. Aedeagus (Fig. 130e) with phallotheca broad at base gradually narrowing apically, opening apical; ductus seminis short; secondary gonopore long; two dorsal endosomal lobal sclerites with minutely dentate margins towards the apex. ***Female genitalia:*** (Fig. 131) subgenital plates with strongly explanate lateral margins and a pointed apex; interramal plate reduced, narrow, spear-shaped, covered in minute bristles.

Distribution

Prosoponomiris is restricted to New Caledonia, including the Loyalty Islands.

Biology and plant associations

The genus is a likely *Acacia* specialist (See species biology for details).

Remarks

Prosoponomiris somewhat resembles *Bucculagrandis* due to its Myrmecomorphic body shape and declivent head. It is also worth noting that both genera have keyhole shaped bucculae, although this character is strongly exaggerated in *Bucculagrandis*, while it is only weakly expressed in *Prosoponomiris.* The two genera can be separated by the anterior explanate and strongly rugulose pronotum in *Bucculagrandis* which is smooth and anteriorly constricted in the former genus.

Its uniformly smooth dorsum and generally glabrous body give it an affinity with *Novacalecoris* and *Zanchiella,* however it can be distinguished from these two by it medially constricted hemelytra and overall black colouration. The genitalia seem to resemble those of *Falcum* more than any other genus in the group due to a similar r-shaped left paramere and serrate dorsal endosomal lobal sclerite as in *Falcum taiwanensis. Prosoponomiris* does not have the prominent ventral process of the

pygophore present in *Falcum*, nor does it possess the r-shaped right paramere.

Prosoponomiris mimetica sp. nov.

Habitus, Figure 112i. Distribution, Figure 115. SEMs, Figure 129. Male genitalia, Figure 130. Female genitalia, Figure 131.

Etymology

Named for its myrmecomorphic appearance.

Materials examined

HOLOTYPE: **NEW CALEDONIA: PROVINCE SUD:** Yahoué, 22.19583°S 166.49861°E, 100 m, 01 Feb 1980-28 Feb 1980, N.L.H. Krauss, 1♂ (AMNH_PBI 00046259) (MNPH).

PARATYPES: **NEW CALEDONIA: PROVINCE NORD:** 3 km NE, Ouegoa, 23 Jan 1969, N.L.H. Krauss, 1♂ (AMNH_PBI 00046291) (BPBM). 15 km N of Koumac, 20.4775°S 164.31639°E, 150 m, 01 Feb 1971, N.L.H. Krauss, 1♂ (AMNH_PBI 00046294) (BPBM). Gomen, 20.66667°S 164.38333°E, 50 m, 30 Jan 1971, N.L.H. Krauss, 1♀ (AMNH_PBI 00046298) (BPBM). Hienghene, 20.68333°S 164.93333°E, 05 Oct 1940, F.X. Williams, 2♂♂ (AMNH_PBI 00046292, AMNH_PBI 00046293) (BPBM). Mokoue to Dothio, 21.55°S 166.06667°E, 500 m, 20 Mar 1968-22 Mar 1968, J.L. Gressitt and T.C. Maa, ex *Acacia* sp. (Fabaceae), 1♀ (AMNH_PBI 00046295) (BPBM). Paagoumene, 20.48278°S 167.18361°E, 20 m, 31 Jan 1971, N.L.H. Krauss, 1♀ (AMNH_PBI 00046290) (BPBM). Poindimié, 20.93333°S 165.33333°E, 50 m, Jan 1969, N.L.H. Krauss, 1♂ (AMNH_PBI 00046296), 1 sex unknown (AMNH_PBI 00046297) (BPBM). 0.5 km N Chagrin, 20.48651°S 164.2602°E, 94 m, 30 Apr 2005, G. Monteith, 1♀ (AMNH_PBI 00046177) (AM). Koumac Caves, 20.53525°S 164.3395°E, 19 m, 1 Feb 2004, G. Monteith, 1♂ (AMNH_PBI 00046176) (AM).

Néhoué Campground, 20.419°S 164.22013°E, 29 Apr 2005, G. Monteith, 1♀ (AMNH_PBI 00046178) (AM). Pindaii Peninsula, 21.32759°S 164.9668°E, 65 m, 27 Apr 2005, Cassis, Wall, Tatarnic, Monteith, ex *Acacia spirorbis* Labill. (Fabaceae), 5 juvenile (AMNH_PBI 00046179-AMNH_PBI 00046183), 1 sex unknown (AMNH_PBI 00046184) ex *Acacia spirorbis* Labill. (Fabaceae), det. NOU Staff NYBG VOUCHER, 14♀♀ (AMNH_PBI 00021198-AMNH_PBI 00021211), 7♂♂ (AMNH_PBI 00021212-AMNH_PBI 00021218) (AM). **PROVINCE SUD:** Isle of Pines, Vao, 22.66888°S 167.489°E, 100 m, Jan 1985, N.L.H. Krauss, 2♂♂ (AMNH_PBI 00046276, AMNH_PBI 00046277) (BPBM). Noumea: Anse Vata, 22.30028°S 166.445°E, 30 m, 06 Aug 1979, G.A. Samuelson, 1♀ (AMNH_PBI 00046275) (BPBM); 08 Aug 1979, G.M. Nishida, 3♂♂ (AMNH_PBI 00046269-AMNH_PBI 00046271), 1♀ (AMNH_PBI 00046272), 1 sex unknown (AMNH_PBI 00046273) (BPBM). Nouméa, 0-100 m, 22.3067°S 166.45233°E, 50 m, 01 Jan 1986-31 Jan 1986, N.L.H. Krauss, 1♂ (AMNH_PBI 00046274) (BPBM). Riviere Bleue, 22.08333°S 166.68333°E, 200 m, 25 Mar 1981-27 Mar 1981, J.L. Gressitt, ex *Alphitonia* sp. (Rhamnaceae), 1♂ (AMNH_PBI 00046278) (BPBM). Road to Mt des Koghis, 400 m, 01 Feb 1980-28 Feb 1980, N.L.H. Krauss, 1♂ (AMNH_PBI 00046251) (BPBM). Sarramea, 21.64111°S 165.84667°E, 12 Dec 1963, C. Yoshimoto and N.L.H. Krauss, 1♀ (AMNH_PBI 00046279) (BPBM). Sarramea, 21.64111°S 165.84667°E, 150 m, 01 Jan 1971, N.L.H. Krauss, 1♂ (AMNH_PBI 00046280) (BPBM). Yahoué, 22.19583°S 166.49861°E, 100 m, 01 Feb 1980-28 Feb 1980, N.L.H. Krauss, 4♂♂ (AMNH_PBI 00046260-AMNH_PBI 00046262, AMNH_PBI 00046267), 5♀♀ (AMNH_PBI 00046263-AMNH_PBI 00046266, AMNH_PBI 00046268) (BPBM). **PROVINCE DES ILES LOYAUTÉ:** Lifou Island. 1 km West of Doueoulou, 20.93083°S 167.07806°E, 35 m, 19 Aug 1979-20 Aug 1979, W.C. Gagne, ex *Myoporum* sp. (Scrophulariaceae), 2♀♀

(AMNH_PBI 00046288, AMNH_PBI 00046289) ex *Acacia* sp. (Fabaceae), 2♂♂ (AMNH_PBI 00046281, AMNH_PBI 00046282), 3♀♀ (AMNH_PBI 00046283-AMNH_PBI 00046285), 2 sex unknown (AMNH_PBI 00046286, AMNH_PBI 00046287) (BPBM).

Diagnosis

See generic diagnosis.

Description

COLOURATION: Body dull, mostly fuscous (Fig. 112i). ***Head:*** clypeus, frons and vertex fuscous; maxillary and mandibular plates pale grey; gula and genae fuscous. ***Antennae:*** AI pale grey; otherwise fuscous. ***Labium:*** yellow. ***Pronotum:*** uniformly black. ***Thoracic venter:*** uniformly black. ***Scutellum:*** uniformly black. ***Metathoracic glands:*** evaporative area pale grey. ***Hemelytra:*** clavus black; corium mostly yellow, with distal transverse dark brown fasciae and apical lighter brown band; cuneus with dark brown fasciae, and apical yellow band; membrane bicoloured, mostly dark brown, with apical whitish marking. ***Legs:*** coxae pale yellow; femora and tibiae fuscous mottled with pale yellow.

VESTITURE AND TEXTURE: Body with sparse distribution of simple, hair-like setae and microtrichia (Fig. 129). ***Head:*** (Fig. 129a) frons, vertex and clypeus with dense distribution of long, decumbent, hair-like setae; otherwise with sparse distribution of smaller, hair-like setae. ***Antennae:*** AI with sparse distribution of erect, hair-like setae; AII-AIV with dense distribution of small, erect, hair-like setae. ***Pronotum:*** (Fig. 129b) uniformly smooth; sparse distribution of hair-like setae; dense distribution of microtrichia. ***Thoracic venter:*** proxyphus smooth; uniformly covered in microtrichia; mesosternum smooth, sparse distribution of microtrichia. ***Scutellum:*** (Fig. 129f) sparse distribution of hair-like setae. ***Hemelytra:*** costal margin setae present. ***Legs:*** femora

sparse distribution of semi-erect, hair-like setae; tibiae dense distribution of pale, decumbent, hair-like setae and sparse distribution of dark, semi-erect, hair-like setae.

STRUCTURE: Body myrmecomorphic (Fig. 112i). ***Head:*** midline of vertex without groove (Fig. 129a); bucculae broad, laterally weakly sinuate, not covering gula medially (Fig. 129c); clypeus ventrally oriented with uniformly convex anterior margin (Fig. 129a); eyes elongate, egg-shaped, extending ventrad to anterior margin of clypeus (Fig. 129a). ***Labium:*** extending to mesosternum. ***Pronotum:*** (Fig. 129b) collar weakly developed; foveae absent; anterior lobe trapezoidal, with weakly developed calli, lateral margins concave, rectilinear posteriorly; posterior lobe weakly declivent towards head, lateral margins concave, strongly divergent posteriorly, posterior margin weakly concave. ***Thoracic venter:*** proxyphus depressed, triangular; scent gland laterally oriented. ***Scutellum:*** (Fig. 129d) without foveae on anterolateral angles; lateral margins straight, smooth; mesoscutum raised. ***Hemelytra:*** costal margins concave medially; cuneus ca. 1.75-2x longer than wide, medial margin curved. ***Legs:*** metafemora weakly incrassate.

See generic description for male and female genitalia.

Measurements

See Table 17.

Distribution

Known from several locations on Lifou Island, New Caledonia (Fig. 115).

Biology and plant associations

A large series of *Prosoponomiris mimetica* was collected from *Acacia spiorbis* (Fabaceae), and is the likely host plant of this mirid species. One specimen was collected from an unspecified *Acacia*, a singleton from *Alphitonia* (Rhamnaceae), and two from *Myroporum* (Scrophulariaceae).

Remarks

See generic remarks.

Saggitacopula Wall

Saggitacopula Wall, 2007: 13 (sp. nov.)

Type species

Saggitacopula rufescens Wall 2007 by original designation.

Diagnosis

Saggitacopula can be distinguished by the following combination of characters: body orange or brown (Figs 78f,g); convex hemelytra costal margins (Figs 78f,g); eyes large, spherical (e.g. Fig. 133a); bucculae narrow, weakly produced ventrally, not extending to gula; distinct anterior and posterior lobes of pronotum, posterior lobe strongly declivent (e.g. Fig. 133b); punctures absent from hemelytra; simple vestiture (e.g. Fig. 133); pygophore short, with large conical ventral process (e.g. Fig. 134a); supragenital bridge present (e.g. Fig. 134a); left paramere small, r-shaped (e.g. Fig. 134b); right paramere c-shaped, greatly elongate, much larger than left paramere (e.g. Fig. 133c); phallotheca with dorsal opening (e.g. Fig. 133d); secondary gonopore is greatly enlarged (e.g. Fig. 133d); endosoma without sclerites or spicules (e.g. Fig. 133d); endosomal bag bilobed (e.g. Fig. 133d).

Description

COLOURATION: Body shiny, mostly orange to stramineous (Figs 78f,g). ***Head:*** usually stramineous with red to orange markings. ***Pronotum:*** anterior and posterior lobe concolourous. ***Hemelytra:*** transparent, mottled with red and brown.

VESTITURE AND TEXTURE: Body generally with very sparse distribution of fine, semi-erect, hair-like setae (e.g. Fig. 133). ***Antennae:*** dense distribution of erect, hair-like setae. ***Pronotum:*** (e.g. Fig. 133b) anterior and posterior lobes smooth. ***Prosternum:***

smooth; densely covered in matted microtrichia. ***Hemelytra:*** semi-erect, hair-like setae. ***Legs:*** sparse distribution of small, semi-erect, hair-like setae, becoming denser distally.

STRUCTURE: Body gracile (Figs 78f,g). ***Head:*** strongly hypognathous; frons and clypeus flat; bucculae narrow, strongly produced ventrally beyond ventral margin of eyes; gula sinuate, extending ca. ½ length of head; eyes egg-shaped in lateral view, contiguous with anterior margin of pronotum (e.g. Fig. 133a); postocular region absent. ***Antennae:*** AI weakly elongate, ca. 1.5x longer than head, always longer than interocular distance; AII and AIII greatly elongate, subequal in length to entire body. ***Pronotum:*** (e.g. Fig. 133b) strongly bilobed; anterior lobe much shorter than posterior lobe; collar weakly developed; anterior lobe subrectangulate, lateral margins convex, calli strongly developed, widely separated medially; posterior lobe trapezoidal, lateral margins weakly divergent posteriorly, posterior margin rectilinear. ***Mesepimeron:*** with evaporative bodies, spiracle weakly exposed. ***Metathoracic Gland:*** peritreme short, tongue-like, strongly raised, dorsally oriented; evaporative area occupying ca. ⅓ of metepisternum, peritreme reaching dorsal margin of evaporative area. ***Hemelytra:*** margins straight; ca. 2x longer than abdomen, cuneus 3x longer than width. ***Legs:*** coxae and metafemora greatly elongate; pretarsal claws with striations; thick at base. ***Male Genitalia:*** pygophore short, weakly asymmetrical (e.g. Fig. 134a); prominent ventral process with erect setae; broad terminal genital opening, with supragenital bridge (e.g. Fig. 134a). Left paramere (e.g. Fig. 134b) r-shaped, sensory lobe moderately developed; apophysis sinuate, apex weakly hooked. Right paramere (e.g. Fig. 134c) c-shaped, greatly elongate, much larger than left paramere, strongly curved, with medial process, apex acute. Aedeagus (e.g. Fig. 134c) simple, straight with curved base; phallotheca narrow, dorsal opening, and apical projections; ductus seminis short and broad;

secondary gonopore greatly enlarged, oval; endosoma without sclerites or spicules; endosomal membranous bag bilobed.

Distribution

Saggitacopula is known from Northern Australia (Arnhem Land and Cape York) and Papua New Guinea (Fig. 105).

Biology and plant associations

Unknown.

Remarks

Saggitacopula most strongly resembles *Zanchiella* and *Candidomiris* but a few unusual characters place it within the *Nerubia-Spinamifera-Jimia* clade, including its narrow, weakly ventrally produced bucculae, supragenital bridge of the pygophore, small left paramere, and greatly elongate right paramere.

Wall (2007) referred to the phallotheca as having a membranous plate. I regard this to be an incorrect interpretation of the endosomal bag.

***Saggitacopula carvalhoi* Wall**

Habitus, Figure 78f. Distribution, Figure 105. Male genitalia, Figure 132.

Saggitacopula rufescens Wall, 2007: 14 (sp. nov.)

Materials examined

HOLOTYPE: **PAPUA NEW GUINEA: MOROBE PROVINCE:** Oomsis, 6.67166°S 146.8°E, 02 Aug 2000, R.L. Kitching, *Piper* sp. (Piperaceae) 1♂ (AMNH_PBI 00053255) (AM).

PARATYPES: **PAPUA NEW GUINEA: MOROBE PROVINCE:** Oomsis, 6.67166°S 146.8°E, 05 Jul 2000, R.L. Kitching, *Piper* sp. (Piperaceae) 1♀ (AMNH_PBI 00053254) (AM).

Diagnosis

Saggitacopula carvalhoi is recognised by the following combination of characters: collar reduced (Fig. 133b); body dull generally brown (Fig. 78g); pygophore with small ventral projection (e.g. Fig. 132a); right paramere with an apical flange (e.g. Fig. 132c).

Description

COLOURATION: Body mostly brown (e.g. Fig. 78f). ***Head:*** clypeus red; frons and vertex brown; mandibular and maxillary plates red; gula and genae pale grey; bucculae pale grey; gula and genae brown. ***Antennae:*** AI pale grey proximally, orange apically; AII-AIV brown. ***Labium:*** LI red; LII-LIV brown. ***Pronotum:*** brown with faint black markings. ***Thoracic venter:*** brown. ***Scutellum:*** brown. ***Hemelytra:*** transparent. ***Legs:*** fuscous. ***Abdomen:*** brown.

VESTITURE AND TEXTURE: Body with sparse distribution of simple, hair-like, setae and microtrichia. ***Head:*** dorsal surface with sparse distribution of large, semi-erect hair-like setae; gula and genae setae small, erect, hair-like. ***Antennae:*** AI dense distribution of small, hair-like setae and sparse distribution of thick, elongate, hair-like setae. ***Pronotum:*** anterior lobe strongly rugulose, posterior lobe rugulose; sparse distribution of small, erect, hair-like setae; densely distribution of microtrichia. ***Thoracic venter:*** smooth; proxyphus with dense distribution of microtrichia. ***Scutellum:*** sparse distribution of small, hair-like setae and microtrichia. ***Hemelytra:*** very sparse distribution of small, hair-like setae. ***Legs:*** femora sparse distribution of small, hair-like setae; tibiae dense distribution of small, hair-like setae.

STRUCTURE: Body gracile (Fig. 78f). ***Head:*** vertex with strongly sulcate midline; bucculae broad, not covering gula medially; clypeus ventrally oriented with uniformly convex anterior margin; eyes spherical, extending ventrad to anterior margin of clypeus. ***Labium:*** extending to metasternum. ***Pronotum:*** collar weakly developed; foveae

absent; anterior lobe trapezoidal, with strongly developed calli, lateral margins concave, rectilinear posteriorly; posterior lobe strongly declivent towards head, lateral margins concave, strongly divergent posteriorly, posterior margin sinuate. ***Thoracic venter:*** proxyphus weakly depressed. ***Scutellum:*** without foveae on anterolateral angles; lateral margins straight, serrate; mesoscutum raised. ***Hemelytra:*** costal margins straight; cuneus 2.5-3x longer than wide, medial margin straight. ***Legs:*** metafemora elongate. ***Male Genitalia:*** pygophore with left tergal process (Fig. 132a); genital opening of pygophore elliptical (Fig. 132a); ventral projection short and broad (Fig. 132a). Left paramere (Fig. 132b) r-shaped, small; sensory lobe moderately developed with few elongate setae; apophysis weakly sinuate, apex weakly hooked. Right paramere (Fig. 132c) greatly enlarged, c-shaped, with medial and apical process. Aedeagus not investigated.

Measurements

See Table 18.

Distribution

Known from Morobe Province, Papua New Guinea (Fig. 105).

Biology and plant associations

One specimen was recorded from a *Piper* sp. (Piperaceae).

Remarks

Saggitacopula carvalhoi is easily recognisable from *S. rufescens* by its dull brown colouration, cf. to the bright orange colouration of the latter species. Few specimens are available and they are in poor condition. The species are also differentiated by the shape of the right parameres (see Wall 2007).

Saggitacopula rufescens Wall

Habitus, Figure 78g. Distribution, Figure 105. SEMs Figure 133. Male genitalia, Figure 134.

Saggitacopula rufescens Wall, 2007: 15 (sp. nov.)

Materials examined

HOLOTYPE: **AUSTRALIA: QUEENSLAND:** West Claudie River, 12.8333°S 143.35°E, 25 Jun 1982, M.A. Schneider and G. Daniels, 1♀ (AMNH_PBI 00053236) (UQIC).

PARATYPES: **AUSTRALIA: QUEENSLAND:** Kuranda-Cairns, 16.81666°S 145.65°E, 01 Apr 1919-30 Apr 1919, F.P. Dodd and sons, 1♂ (AMNH_PBI 00053253) (SAMA).

Diagnosis

Saggitacopula rufescens is most readily recognised by the following combination of characters: collar weakly enlarged (Fig. 133b); body bright orange (Fig. 78g); pygophore dorsoposterior projection large (Fig. 134a); right paramere (Fig. 134d) with two small apical processes; left tergal process papillate (Fig. 134b); ventral process of pygophore elongate (Fig. 134a).

Description

COLOURATION: Body mostly orange (Fig. 78g). ***Head:*** clypeus red; frons and vertex brown; mandibular and maxillary plates, gula and genae pale grey; bucculae red. ***Antennae:*** AI pale grey proximally, orange apically; AII-AIV brown. ***Labium:*** LI red; LII-LIV brown. ***Pronotum:*** uniformly orange. ***Thoracic venter:*** stramineous mottled with orange patterns. ***Scutellum:*** orange. ***Hemelytra:*** translucent, with orange of abdomen visible. ***Legs:*** stramineous. ***Abdomen:*** orange.

VESTITURE AND TEXTURE: Body with sparse distribution of simple hair-like setae and microtrichia (Fig. 133). ***Head:*** sparse distribution of small, erect, hair-like setae

(Fig. 133a). ***Antennae:*** AI dense distribution of small, hair-like setae and sparse distribution of thick, elongate, hair-like setae. ***Pronotum:*** (Fig. 133b) anterior lobe weakly rugulose (Fig. 133c), posterior lobe strongly rugulose; sparse distribution of small, semi-erect, hair-like setae; dense distribution of microtrichia. ***Thoracic venter:*** weakly rugulose; proxyphus with dense distribution of microtrichia. ***Scutellum:*** (Fig. 133d) sparse distribution of small, hair-like setae and microtrichia. ***Hemelytra:*** very sparse distribution of small, hair-like setae. ***Legs:*** femora sparse distribution of elongate, hair-like setae; tibiae with dense distribution of hair-like setae.

STRUCTURE: Body gracile (Fig. 78g). ***Head:*** vertex with strongly sulcate midline (Fig. 133a); bucculae broad, not covering gula medially; clypeus ventrally oriented with uniformly convex anterior margin; eyes reniform, extending ventrad to anterior margin of clypeus. ***Labium:*** extending to mesosternum. ***Pronotum:*** (Fig. 133b) collar weakly developed; foveae absent; anterior lobe trapezoidal, with weakly developed calli, lateral margins concave, rectilinear posteriorly; posterior lobe strongly declivent towards head, lateral margins concave, strongly divergent posteriorly, posterior margin sinuate. ***Thoracic venter:*** proxyphus weakly depressed. ***Scutellum:*** (Fig. 133d) without foveae on anterolateral angles; lateral margins straight, serrate; mesoscutum raised. ***Hemelytra:*** costal margins straight; cuneus ca. 1.5x longer than wide, medial margin straight. ***Legs:*** metafemora elongate. ***Male Genitalia:*** genital opening of pygophore elliptical (Fig. 134a); ventral projection long and broad, with papillate left tergal process (Fig. 134b). Left paramere (Fig. 134c) r-shaped, small; sensory lobe moderately incrassate with few elongate setae; apophysis weakly sinuate, apex weakly hooked. Right paramere (Fig. 134d) c-shaped, greatly elongate, two medial processes. Aedeagus (Fig. 134e) with phallotheca bearing apical projections, opening dorsally; ductus seminis short and broad; secondary gonopore robust and elongate; endosoma without sclerites or spicules;

endosomal membranous bag bilobed.

Measurements

See Table 18.

Distribution

Arnhem Land and Cape York, Australia (Fig. 105).

Biology and plant associations

Unknown.

Remarks

Whereas *Saggitacopula rufescens* is very similar in colour to *Tudoris solomonensis,* it more closely resembles *S. carvalhoi* in the shape of the pronotal collar and features of the male genitalia. It can be distinguished from *Tudoris* by the absence of pronotal punctures and from *S. carvalhoi* by its bright orange colouration and differences in the right paramere.

Spinamifera **gen. nov.**

Etymology

From the Latin, *spina* meaning spine, and *fera* meaning bearing; in reference to the thorn-like setae on the body; noun in apposition. Feminine.

Type species

Spinamifera raveni sp. nov. by original designation.

Diagnosis

Spinamifera is recognised by the following combination of characters: yellow with bright red markings (Fig. 46f); body elongate-ovoid (Fig. 46f); eyes dorsoventrally elongate, reniform, contiguous with anterior lobe of pronotum (Fig. 135b); pronotum with row of punctures present on posterior margin of calli (Fig. 135a); anterior and

posterior lobes of pronotum poorly differentiated, posterior margin explanate (Fig. 135a); densely covered in small apically pointed setae (Fig. 135d); pygophore lacking ventral process (Fig. 136a); left paramere r-shaped, sensory lobe weakly developed (Fig. 136b), with curved apophysis; right paramere y-shaped (Fig. 136c), distally bifurcate; phallotheca opening apical (Figs 136d,e); secondary gonopore greatly enlarged; dorsal endosomal sclerite finger-like, broad (Fig. 136g).

Description

COLOURATION: Body shiny, mostly yellow with red markings (Fig. 46f).

VESTITURE AND TEXTURE: Body sparsely covered with decumbent, hair-like setae intermixed with conical setae; sparse distribution of microtrichia (Fig. 135). ***Head:*** evenly distributed microtrichia and setae (Fig. 135a). ***Antennae:*** dense distribution of erect, hair-like setae. ***Pronotum:*** (Fig. 135a) anterior and posterior lobes smooth; conical and hair-like setae present. ***Prosternum:*** weakly rugulose; dense distribution of conical and hair-like setae; dense distribution of matted microtrichia. ***Hemelytra:*** sparse distribution of semi-erect, hair-like and conical setae. ***Legs:*** femora distribution of elongate, hair-like setae; tibiae with two rows of spinules.

STRUCTURE: Body elongate-ovoid (Fig. 46f). ***Head:*** strongly hypognathous, frons and clypeus straight (Fig. 135b); frons almost flat (Fig. 135a), about twice as wide as long, in dorsal view; foveae absent; bucculae narrow, strongly produced ventrally beyond ventral margin of eyes (Fig. 135c), restricted to posterior ¼ of head; eyes egg-shaped in lateral view, contiguous with anterior margin of pronotum (Fig. 135b); postocular region absent (Fig. 135b). ***Antennae:*** AI subequal in length to head, always longer than interocelic distance. ***Pronotum:*** (Fig. 135a) with anterior lobe subequal in length to posterior lobe; collar well developed; anterior lobe subrectangulate, lateral margins convex, calli weakly developed, widely separated medially, with a posterior

row of punctures (Fig. 135d); posterior lobe trapezoidal, lateral margins weakly divergent posteriorly, weakly elevated posteriorly, posterior margin rectilinear. ***Mesepimeron:*** with evaporative bodies, spiracle weakly exposed. ***Metathoracic Gland:*** peritreme short, tongue-like, strongly raised, posterodorsally oriented; evaporative area occupying ca. ⅓ of metepisternum, peritreme reaching dorsal margin of evaporative area. ***Hemelytra:*** margins weakly convex; ca. 1x longer than abdomen, cuneus length 1.5-2x longer than cuneus width. ***Legs:*** legs cursorial; coxae elongate; pretarsal claws with uniformly spaced minute striations; narrow at base. ***Male Genitalia:*** pygophore weakly asymmetrical, short and broad ventral process (Fig. 136a); broad dorsal genital opening. Left paramere (Fig. 136b) r-shaped, sensory lobe reduced; apophysis weakly rounded, with apex spoon-like. Right paramere (Fig. 136c) y-shaped, larger than left paramere, distally diburate, with dorsal-most branch serrate. Aedeagus (Figs 136d-g) with phallotheca opening apical; secondary gonopore greatly enlarged; dorsal endosomal lobal sclerite finger-like; endosomal membranous bag bilobed.

Distribution

Endemic to Cape York North Queensland (Fig. 77)

Biology and plant associations

Five specimens collected from *Dendrocnide excelsa* which is assumed to be a host.

Remarks

The closest relative to *Spinamifera* is *Jimia* both in superficial appearance and phylogenetically. Both these genera bear unusual secondary setae with a thick base, however in *Spinamifera* these setae are apically pointed, while in *Jimia* they are apically branched into 3 or 4 terminal arms, which is the best diagnostic character. In the character matrix these setae were treated as unambiguous and coded as separate

character states, so there was no *a priori* assumption of homology, however it is highly likely that these characters are homologous on some level.

***Spinamifera raveni* sp. nov.**

Habitus, Figure 46f. Distribution, Figure 77. SEMs, Figure 135. Male genitalia, Figure 136.

Materials examined

HOLOTYPE: **AUSTRALIA: QUEENSLAND:** Mt. Lewis, 11.3 km along Mt. Lewis Road, 16.59194°S 145.27083°E, 30 Apr 1998, G. Cassis, ex *Dendrocnide excelsa* (Urticaceae), ♂ (AMNH_PBI 00046190) (QM).

PARATYPES: **AUSTRALIA: QUEENSLAND:** Mt. Hypipamee, National Park "The Crater", 17.42388°S 145.48388°E, 25 Apr 1998, G. Cassis, ex *Dendrocnide excelsa* (Urticaceae), 1♀ (AMNH_PBI 00046193) (QM). Mt. Lewis, 11.3 km along Mt. Lewis Road, 16.59194°S 145.27083°E, 30 Apr 1998, G. Cassis, ex *Endiandra sankeyana* Bailey (Lauraceae), 1♀ (AMNH_PBI 00046189), 2♂♂ (AMNH_PBI 00046191, AMNH_PBI 00046192) (AM).

Etymology

Named after Robert Raven of the Queensland Museum, who supported me during a Bush Blitz survey in north Queensland.

Diagnosis

See generic diagnosis.

Description

COLOURATION: Body shiny, mostly stramineous with red patterns (Fig. 46f). ***Head:*** clypeus black; frons stramineous; eyes black, sometimes red around margins; vertex stramineous; mandibular and maxillary plates stramineous; bucculae pale grey.

Antennae: AI stramineous; AII-AIV fuscous. ***Labium:*** stramineous. ***Pronotum:*** stramineous mottled with black. ***Thoracic venter:*** thoracic pleura stramineous; proxyphus stramineous; mesosternum black; metasternum stramineous. ***Scutellum:*** foveae present on anterolateral angles; lateral margins sinuate, serrate; mesoscutum raised. ***Metathoracic glands:*** evaporative area black. ***Hemelytra:*** transparent, clavicle region brownish red, cuneus red posteriorly, brownish red lateral marking anterior to membrane, membrane veins red. ***Abdomen:*** venter pale stramineous; lateral margins black posteriorly; abdominal terga dark brown or stramineous; pygophore dark brown. ***Legs:*** coxae pale grey; femora pale grey proximally, stramineous apically; tibiae and pretarsus stramineous.

VESTITURE AND TEXTURE: Body with sparse distribution of microtrichiae and tiny, thick, erect, conical setae and long, semi-erect, hair-like setae (Fig. 135). ***Head:*** uniformly sparse distribution of long, hair-like setae and conical setae (Fig. 135a). ***Antennae:*** AI sparse distribution of long, decumbent, hair-like setae; AII-AIV dense distribution of decumbent, hair-like setae. ***Pronotum:*** (Fig. 135a) anterior lobe sparse distribution of conical and hair-like setae, microtrichia dense with circular bald patches; posterior lobe sparse distribution of long, hair-like setae, lacking conical setae, with dense distribution of microtrichia. ***Thoracic venter:*** proxyphus with dense distribution of minute, matted microtrichia; distinctly rugulose. ***Scutellum:*** (Fig. 135e) setae large, decumbent, hair-like; sparse distribution of conical setae. ***Hemelytra:*** setae large, decumbent, dense distribution of conical setae. ***Legs:*** femora with sparse distribution of erect, hair-like setae; tibiae with thick, erect, hair-like setae and decumbent setae.

STRUCTURE: Body elongate-ovoid (Fig. 46f). ***Head:*** vertex with strongly sulcate midline (Fig. 135a); bucculae narrow, not covering gula medially (Fig. 135c); clypeus posteroventrally oriented with uniformly convex anterior margin (Fig. 135b); eyes

reniform, extending ventrad to anterior margin of clypeus (Fig. 135b). ***Labium:*** extending to metasternum. ***Pronotum:*** (Fig. 135a) collar strongly developed; foveae absent; anterior lobe trapezoidal, with weakly developed calli, with five punctures on posterior margin, lateral margins straight, rectilinear posteriorly; posterior lobe declivent towards head, lateral margins concave, strongly emarginate posteriorly; posterior margin weakly convex. ***Thoracic venter:*** proxyphus weakly raised, heart-shaped. ***Scutellum:*** (Fig. 135e) with curved margins. ***Hemelytra:*** costal margins convex; cuneus ca. 2x longer than wide, medial margin convex. ***Legs:*** metafemora only weakly incrassate, metafemora and tibiae elongate.

See generic description for male genitalia.

Measurements

See Table 19.

Distribution

Known from two nearby localities in Cape York, Queensland (Fig. 77).

Biology and plant associations

Five specimens were collected from *Dendrocnide excels*ea (Urticaceae) which is assumed to be a host.

Remarks

See generic Remarks.

Tudoris gen. nov.

Etymology

Tudoris is named for its enlarged pronotal collar; inspired by the giant ruffled collars of the Tudor era. Feminine.

Type species

Tudoris solomonensis sp. nov. by monotypy.

Diagnosis

Tudoris can be distinguished by the following combination of characters: body bright orange (Fig. 78h); weakly sinuate hemelytral margins (Fig. 78h); eyes large spherical (Fig. 137b); bucculae narrow, weakly produced ventrally (Fig. 137c); distinct anterior and posterior lobes of pronotum, posterior lobe strongly declivent (Fig. 137d); punctures present on posterior margin of calli (Fig. 137e); punctures absent from hemelytra simple vestiture; pygophore short with a narrow ventral process (Fig. 138a); left paramere (Fig. 138b) reduced, sensory lobe strongly incrassate; left paramere (Fig. 138b) elongate, weakly curved; right paramere (Fig. 138c) small, club-like, with basal process; phallotheca (Fig. 138d) apical opening; secondary gonopore (Fig. 138d) greatly elongate, extending beyond phallotheca at rest; no endosomal sclerites and spicules (Fig. 138d); small membranous bag present (Fig. 138d).

Description

COLOURATION: Body, mostly orange (Fig. 78h). ***Head:*** stramineous with red to orange markings. ***Pronotum:*** anterior and posterior lobe concolourous. ***Hemelytra:*** hyaline, intricately patterned with red and brown, with colourless areas.

VESTITURE AND TEXTURE: Body with very sparse distribution of fine, semi-erect, hair-like setae and microtrichia (Fig. 137). ***Antennae:*** dense distribution of erect, hair-like setae. ***Pronotum:*** (Fig. 137d) anterior and posterior lobes smooth. ***Prosternum:*** smooth; dense distribution of matted microtrichia. ***Legs:*** sparse distribution of small,

semi-erect, hair-like setae, becoming denser apically. ***Hemelytra:*** dense distribution of semi-erect, hair-like setae.

STRUCTURE: Body gracile (Fig. 78h). ***Head:*** strongly hypognathous, frons and clypeus straight (Fig. 137b); frons almost flat (Fig. 137b); about twice as wide as long in dorsal view (Fig. 137a); bucculae narrow, strongly produced ventrally beyond ventral margin of eyes (Fig. 137c); gula sinuate, extending ½ length of head (Fig. 137b); eyes rounded in lateral view, contiguous with anterior margin of pronotum (Fig. 137b); postocular region absent. ***Antennae:*** AI strongly elongate, ca. 2x longer than head; AII and AIII greatly elongate, subequal to body length. ***Pronotum:*** (Fig. 137d) bilobed, with anterior lobe much shorter than posterior lobe; collar greatly enlarged; anterior lobe subrectangulate, lateral margins convex, calli strongly developed, widely separated medially, with a posterior row of punctures; posterior lobe trapezoidal, lateral margins weakly divergent posteriorly, posterior margin rectilinear. ***Mesepimeron:*** with evaporative bodies, spiracle weakly exposed. ***Metathoracic Gland:*** peritreme short, elliptical, weakly raised, dorsally oriented; evaporative area occupying ca. ⅓ of metepisternum, peritreme not reaching dorsal margin of evaporative area. ***Hemelytra:*** costal margins straight; ca. 2x longer than abdomen, cuneus length 3x longer than wide. ***Legs:*** cursorial; coxae and metafemora greatly elongate; pretarsal claws covered in striations of varying sizes; thick at base. ***Male Genitalia:*** pygophore weakly asymmetrical, with narrow ventral process (Fig. 137a); broad dorsal genital opening. Left paramere (Fig. 137b) elongate, weakly curved, without sensory lobe; right paramere (Fig. 137c) small, club-shaped, with a thin basal process. Aedeagus (Fig. 137d) with tubelike phallotheca, with apical opening; secondary gonopore greatly enlarged, extending beyond phallotheca at rest; small endosomal membranous bag present.

Distribution

Tudoris is endemic to the Solomon Islands (Fig. 105).

Biology and plant associations

Unknown.

Remarks

Tudoris most closely resembles *Saggitacopula*, particularly *S. rufescens* in its bright orange colouration. It can easily be distinguished from it by its enlarged collar and differences of the male genitalia, including the simplified parameres, the greatly exaggerated and sclerotised secondary gonopore.

See also Remarks section of *Saggitacopula.*

***Tudoris solomonensis* sp. nov.**

Habitus, Figure 78h. Distribution, Figure 105. SEMs, Figure 137. Male genitalia, Figure 138.

Etymology

Named after the Solomon Islands, from where it was collected.

Materials examined

HOLOTYPE: **SOLOMON ISLANDS: GUADALCANAL:** Honiara, 9.43028°S 159.94944°E, 100 m, 01 Mar 1986-31 Mar 1986, N.L.H. Krauss, 1♂ (AMNH_PBI 00046241) (BPBM).

PARATYPES: **SOLOMON ISLANDS: GUADALCANAL:** Honiara Co.: 35 km E of Haniara, 200 m, 17 May 1964, R. Straatman, 1♀ (AMNH_PBI 00046151) (BPBM). Honiara, 9.43028°S 159.94944°E, 100 m, 01 Mar 1986-31 Mar 1986, N.L.H. Krauss, 2♂♂ (AMNH_PBI 00046242, AMNH_PBI 00046243), 4♀♀ (AMNH_PBI 00046244-AMNH_PBI 00046247), 1 sex unknown (AMNH_PBI 00046248) (BPBM). Honiara,

9.43361°S 159.95111°E, 200 m, 12 May 1964, R. Straatman, 1 sex unknown (AMNH_PBI 00046160) (BPBM); 01 Oct 1970-31 Oct 1970, Krauss, N.L.H., 1 sex unknown (AMNH_PBI 00046159) (BPBM); 01 Oct 1972-31 Oct 1972, Krauss, N.L.H., 1♂ (AMNH_PBI 00046153) (BPBM); 01 Jan 1973-31 Jan 1973, Krauss, N.L.H., 1♂ (AMNH_PBI 00046152) (BPBM); 01 Dec 1980-31 Dec 1980, Krauss, N.L.H., 1♂ (AMNH_PBI 00046154) (BPBM); 01 Jan 1981-31 Jan 1981, Krauss, N.L.H., 1♀ (AMNH_PBI 00046150) (BPBM); 01 Feb 1986-28 Feb 1986, Krauss, N.L.H., 3♀♀ (AMNH_PBI 00192601-AMNH_PBI 00192603), 1♂ (AMNH_PBI 00192604) (USNM); 01 Mar 1987-31 Mar 1987, N.L.H. Krauss, 1♀ (AMNH_PBI 00046249) (BPBM). Kukum, 9.43361°S 159.95111°E, 05 Oct 1957, J.L. Gressitt, 1♂ (AMNH_PBI 00046157) (BPBM). Paripao, 9.53333°S 160.36667°E, 22 May 1960, C.W. O'Brien, 1♂ (AMNH_PBI 00046155) (BPBM); 21 May 1960, C.W. O'Brien, Light Trap, 1♀ (AMNH_PBI 00046156) (BPBM). Suta, 9.68333°S 160.13333°E, 27 Jun 1956, J.L. Gressitt, 1 sex unknown (AMNH_PBI 00046158) (BPBM). **NEW GEORGIA ISLANDS:** Vangunu, Tigge, 100 m, 01 Feb 1987-28 Feb 2987, N.L.H. Krauss, 2♂♂ (AMNH_PBI 00046252, AMNH_PBI 00046253) (BPBM).

Diagnosis

See generic diagnosis.

Description

COLOURATION: Body mostly orange (Fig. 78h). ***Head:*** clypeus reddish yellow mottled with red; frons, vertex, mandibular plates and genae orange; maxillary plates and gula pale yellow and bucculae. ***Antennae:*** AI orange; AII-AIII black. ***Labium:*** LI reddish orange; LII-LIV pale grey mottled with red. ***Pronotum:*** collar and anterior lobe orange; posterior lobe mostly pale yellow, orange laterally. ***Thoracic venter:*** orange. ***Scutellum:*** yellow. ***Metathoracic glands:*** evaporative area black. ***Hemelytra:*** mostly

transparent; clavus orange; brown lateral band between clavus and membrane, membrane veins red. ***Legs:*** mostly pale grey; markings apically on femora and proximally on tibiae, markings orange on pro- and mesofemora and tibia, red on metafemora. ***Abdomen:*** sterna pale yellow; pleura pale yellow, red medially; pygophore red.

VESTITURE AND TEXTURE: Body with very sparse distribution of fine, semi-erect, hair-like setae and microtrichia (Fig. 137). ***Head:*** uniformly sparse distribution of semi-erect, hair-like setae (Fig. 137a); maxillary plate and gula rugulose (Fig. 137b). ***Antennae:*** uniformly sparse distribution of small, semi-erect, hair-like setae. ***Pronotum:*** (Fig. 137d) smooth; dense distribution of semi-erect, hair-like setae. ***Thoracic venter:*** proxyphus rugulose; microtrichia present anteriorly and medially. ***Scutellum:*** (Fig. 137f) rugulose anteriorly; uniform distribution of small, erect, hair-like setae and microtrichia. ***Hemelytra:*** dense distribution of semi-erect, hair-like setae; microtrichia present. ***Legs:*** dense distribution of elongate, hair-like setae.

STRUCTURE: Body gracile (Fig. 78h). ***Head:*** vertex with weakly sulcate midline (Fig. 137a); bucculae narrow, not covering gula medially (Fig. 137c); clypeus ventrally oriented with uniformly convex anterior margin (Fig. 137b); eyes spherical, extending ventrad to anterior margin of clypeus (Fig. 137b). ***Labium:*** extending to metasternum. ***Pronotum:*** (Fig. 137d) collar very strongly developed, rounded; foveae absent; anterior lobe trapezoidal, with weakly developed calli, row of punctures on posterior margin, lateral margins convex, rectilinear posteriorly; posterior lobe strongly declivent towards head, lateral margins convex, strongly divergent posteriorly, posterior weakly concave. ***Scutellum:*** (Fig. 137d) without foveae on anterolateral angles; lateral margins serrate; mesoscutum raised. ***Hemelytra:*** costal margins weakly pinched medially; cuneus ca. 2.5x longer than wide, medial margin concave. ***Legs:*** metafemora elongate.

Male genitalia given in generic description.

Measurements

See Table 20.

Distribution

Known from Guadalcanal, Solomon Islands (Fig. 105).

Biology and plant associations

Unknown.

Remarks

See generic remarks.

Wumea Carvalho

Wumea Carvalho, 1987: 186 (sp. nov.); Schuh 1995: 203 (world catalogue); Wall 2007: 2 (redescription)

Type species

Wumea clypealis Carvalho, 1987 by original designation.

Diagnosis

Wumea is recognised by the following combination of characters: body stramineous (Figs 102c-e); body gracile (Figs 102c-e); AII and AIII greatly elongate, combined length longer than body; anterior lobe of pronotum rugulose or with scale-like texture (e.g. Fig. 139d); posterior lobe with deep transverse rugae (e.g. Fig. 139d); hemelytral margins straight (e.g. Figs 139c-e); cuneus red; legs greatly elongate; parameres bilobed (e.g. Fig. 139d); pygophore elongate, weakly asymmetrical (e.g. Fig. 139a); phallotheca with dorsal opening (e.g. Fig. 139d); dorsal endosomal lobal sclerite elongate, flattened (e.g. Fig. 139d); apical endosomal lobal sclerite elongate, flattened (e.g. Fig. 139d).

Description

COLOURATION: Shiny, mostly stramineous (Figs 102c-e). ***Head:*** stramineous with red line medially. ***Pronotum:*** anterior and posterior lobes concolourous, with red midline. ***Hemelytra:*** hyaline, stramineous; indistinct markings sometimes present.

VESTITURE AND TEXTURE: Body with sparse distribution of simple, hair-like setae and microtrichia (e.g. Fig. 139). ***Antennae:*** sparse distribution of erect, hair-like setae. ***Pronotum:*** (e.g. Fig. 139d) anterior lobe rugulose or with scale-like texture; posterior lobe with deep, transverse rugae. ***Prosternum:*** coarsely rugulose; sparse distribution of microtrichia. ***Legs:*** sparse distribution of small, decumbent, hair-like setae. ***Hemelytra:*** sparse distribution of semi-erect, hair-like setae.

STRUCTURE: Body strongly gracile (Figs 102c-e). ***Head:*** prognathous, frons and clypeus straight; frons almost flat (e.g. Fig. 139b); about twice as wide as long, in dorsal view (e.g. Fig. 139a); bucculae curved, weakly produced ventrally (e.g. Fig. 139c); gula sinuate, ca. ½ length of head (e.g. Fig. 139b); eyes rounded in lateral view, contiguous with anterior margin of pronotum (e.g. Fig. 139b). ***Antennae:*** AI greatly elongate, more than 2x longer than head; AII and AIII greatly elongate, subequal in length to entire body. ***Pronotum:*** (e.g. Fig. 139d) bilobed; collar weakly developed; anterior lobe elongate, subrectangulate, lateral margins convex; calli strongly developed, widely separated medially; posterior lobe trapezoidal, lateral margins weakly divergent posteriorly, posterior margin rectilinear. ***Mesepimeron:*** (e.g. Fig. 139f) with evaporative bodies, spiracle weakly exposed. ***Metathoracic Gland:*** (e.g. Fig. 139f) peritreme short, tongue-like, strongly raised, anterio-dorsally oriented; evaporative area occupying ca. ⅓ of metepisternum, peritreme not reaching dorsal margin of evaporative area. ***Hemelytra:*** margins straight; ca. 2x longer than abdomen; cuneus ca. 3x longer than wide (e.g. Fig. 141d). ***Legs:*** coxae and metafemora greatly elongate; pretarsal

claws with uniformly spaced striations; thick basally. ***Male Genitalia:*** pygophore elongate, weakly asymmetrical, with prominent ventral process, lacking grooves dorsally (e.g. Fig. 140a). Left and right parameres highly variable; usually bilobed (e.g. Figs 140b,c). Aedeagus (e.g. Fig. 140d) complex, broad towards base; phallotheca narrow, with dorsal opening; ductus seminis short; secondary gonopore elongate ribbon-like, sinuate; dorsal endosomal lobal sclerite elongate, flattened; apical endosomal lobal sclerite elongate, flattened; endosomal membrane bilobed, lacking fields of spinules.

Distribution

Wumea is restricted to Papua New Guinea (Fig. 105).

Biology and plant associations

Host records are limited.

Remarks

See Remarks section of *Morobea.*

Like its sister genus *Morobea, Wumea* is similar to several grass feeding heteropteran, in having a gracile body.

Wumea cassisi

Habitus, Figure 102c. Distribution, Figure 105. SEMs, Figure 139. Male genitalia, Figure 140.

Wumea cassisi Wall, 2007:11 (sp. nov.)

Materials examined

HOLOTYPE: **PAPUA NEW GUINEA: MOROBE PROVINCE:** Huon Peninsula, Moigisung, 6.4167°S 147.5°E, 500 m, 13 Sep 1976, W.C. Gagne, Light Trap, 1♂ (AMNH_PBI 00053257) (BPBM).

PARATYPES: **PAPUA NEW GUINEA: MOROBE PROVINCE:** Trail between Moigisung and Manga, 6.4167°S 147.5°E, 500 m, 16 Sep 1976, W.C. Gagne, ex *Saurauia* sp. (Actinidiaceae), 1♂ (AMNH_PBI 00053256) (BPBM).

Diagnosis

Wumea cassisi is recognised by the following combination of characters: body stramineous (Fig. 102c); body with sparse distribution of decumbent setae (Fig. 139); gula and genae rugulose (Fig. 139b); pygophore with acute ventral projection (Fig. 140d); left paramere r-shaped, with huge sensory lobe, apically bifurcate apophysis (Fig. 140b); right paramere with an angulate sensory lobe and irregular apophysis (Fig. 140c); with two elongate and flattened dorsal endosomal lobal sclerites (Fig. 140d).

Description

COLOURATION: Body mostly stramineous (Fig. 102c). ***Head:*** mostly stramineous; clypeus red; mandibular and maxillary plates stramineous highlighted with red. ***Antennae:*** uniformly stramineous. ***Labium:*** stramineous. ***Pronotum:*** mostly stramineous; posterior lobe with indistinct fuscous markings. ***Thoracic venter:*** propleura stramineous; meso- and metapleura fuscous; pro- and mesosternum stramineous; metasternum black. ***Scutellum:*** stramineous. ***Metathoracic glands:*** evaporative area red, mottled with grey. ***Hemelytra:*** clavus fuscous, otherwise stramineous mottled with black; cuneus pale red; membrane veins red. ***Legs:*** pale grey. ***Abdomen:*** uniformly black.

VESTITURE AND TEXTURE: Body with sparse distribution of simple, decumbent, hair-like setae and microtrichia (Fig. 139). ***Head:*** uniformly weakly rugulose (Fig. 139a); dorsal surface with sparse distribution of hair-like setae (Fig. 139a). ***Antennae:*** AI with very sparse distribution of small, decumbent, hair-like setae. ***Pronotum:*** (Fig. 139d) very sparse distribution of very small, erect, hair-like setae; collar coarsely

rugulose; anterior lobe with scale-like texture, rugulose medially; posterior lobe deeply and densely rugulose. ***Thoracic venter:*** proxyphus rugulose; dense distribution of microtrichia. ***Scutellum:*** (Fig. 139e) heavily rugulose; uniform distribution of setae. ***Hemelytra:*** sparse distribution of setae and microtrichia. ***Legs:*** erect and elongate setae on femora.

STRUCTURE: Body gracile (Fig. 102c). ***Head:*** vertex with strongly sulcate midline (Fig. 139a); bucculae narrow, not covering gula medially (Fig. 139c); clypeus dorsoventrally oriented, with sinuate convex anterior margin (Fig. 139b); with convex posterior projection (Fig. 139a); eyes elliptical, extending ventrad to anterior margin of clypeus (Fig. 139b). ***Labium:*** extending to metasternum. ***Pronotum:*** (Fig. 139d) collar strongly developed; foveae absent; anterior lobe narrow, elongate, with weakly developed calli, lateral margins convex, rectilinear posteriorly; posterior lobe weakly declivent towards head, lateral margins convex, weakly divergent posteriorly, posterior weakly concave. ***Thoracic venter:*** proxyphus weakly depressed. ***Scutellum:*** (Fig. 139e) without foveae on anterolateral angles; lateral margins straight, serrate; mesoscutum raised. ***Hemelytra:*** costal margins straight; cuneus ca. 2x longer than wide, medial margin straight. ***Legs:*** metafemora elongate. ***Male Genitalia:*** pygophore with enlarged and acute ventral projection (Fig. 140a). Left paramere (Fig. 140b) r-shaped, with greatly enlarged sensory lobe, with distal margin serrate; apophysis curved, with apex strongly bifurcate. Right paramere (Fig. 140c) irregularly shaped; with an angulate sensory lobe with minute setae, apophysis is rounded, with a dorsal triangular projection, apically dentate. Aedeagus (Fig. 140d) with phallotheca opening dorsally; secondary gonopore moderately long; two elongate and flattened dorsal endosomal lobal sclerites present.

Measurements

See Table 21.

Distribution

Only known from Morobe Province, New Guinea (Fig. 105).

Biology and plant associations

One specimen collected from *Saurauia* sp. (Actinidiaceae); possible sitting record.

Remarks

All species of *Wumea* have a similar colouration, size and shape. *Wumea cassisi* can be differentiated within the genus by its distinctly acute ventral projection of the pygophore and the autapomorphic parameres, and the presence of two flattened and elongate dorsal endosomal lobal sclerites. In comparison, *Wumea clypealis* has a much broader and rounded ventral process of the pygophore, and the apophysis of the left paramere is undivided, and the right paramere is club-shaped. *Wumea cassisi* is differentiated from *W. pilosa* by its decumbent, sparse, hair-like setae as opposed to densely distributed long, erect setae of the latter species, as well as differences in the genitalia (i.e., greatly elongate right paramere and absence of endosomal lobal sclerites of the latter species).

Wumea clypealis Carvalho

Habitus, Figure 102d. Distribution, Figure 105. SEMs, Figure 141. Male genitalia, Figure 142.

Wumea clypealis Carvalho, 1987: 187 (sp. nov.)*;* Wall 2007: 9, Fig. 1, 6 (redescription)

Materials examined

HOLOTYPE: **PAPUA NEW GUINEA: MOROBE PROVINCE:** NE, Wum, Upper Jimmi Valley, 840 m, VI.16.'55, J.L. Gressitt (BPBM; not databased). Type examined in the collection of the Bernice P. Bishop Museum.

PARATYPES: **INDONESIA: WEST PAPUA:** Swart Valley, 3.6°S 138.46667°E, 1400 m, 07 Nov 1958-18 Nov 1958, J.L. Gressitt, 6♂♂ (AMNH_PBI 00053245, AMNH_PBI 00053239, AMNH_PBI 00053240, AMNH_PBI 00053242-AMNH_PBI 00053244), 3♀♀ (AMNH_PBI 00053237, AMNH_PBI 00053241, AMNH_PBI 00053238) (BPBM). **PAPUA:** Swart Valley: Karubaka, 3.74417°S 138.32166°E, 1400 m, 07 Nov 1958, J.L. Gressitt, 1♂ (AMNH_PBI 00047092) (BPBM); 06 Nov 1958, J.L. Gressitt, 2♂♂ (AMNH_PBI 00160835, AMNH_PBI 00160836) (USNM).

Diagnosis

Wumea clypealis is recognised by the following combination of characters: body stramineous (Fig. 102d), with sparse distribution of decumbent of hair-like setae (Fig. 141); gula and genae rugulose (Fig. 141 b); left paramere r-shaped, greatly enlarged sensory lobe, apophysis with apex hooked (Fig. 142b); right paramere club-shaped (Fig. 142c); ventral projection of pygophore broadly rounded and enlarged (Fig. 142d); loosely ribbed and narrow secondary gonopore (Fig. 142d); large subtriangular apical endosomal lobal sclerite present (Fig. 142d); two flattened dorsal endosomal lobal sclerites present (Fig. 142d).

Description

COLOURATION: Body, mostly stramineous (Fig. 102d). ***Head:*** mostly stramineous; clypeus, maxillary and mandibular plates red. ***Antennae:*** AI pale grey anteriorly, stramineous posteriorly; AII stramineous mottled with pale red; AIII-AIV stramineous. ***Pronotum:*** anterior lobe stramineous; posterior lobe uniformly stramineous or stramineous mottled with fuscous, posterolateral margins pale red or fuscous. ***Thoracic venter:*** proxyphus pale red mottled with yellow; pleura and meso- and metasternum dark brown. ***Scutellum:*** pale grey. ***Metathoracic glands:*** evaporative area grey. ***Hemelytra:*** stramineous, posteriorly pale grey; cuneus red; membrane veins red. ***Legs:*** mostly stramineous; pretarsus black. ***Abdomen:*** s2-5 red, sometimes mottled with yellow; s5-7 yellow; genital segments dark brown.

VESTITURE AND TEXTURE: Body with sparse distribution of simple, decumbent, hair-like setae and microtrichia (Fig. 141). ***Head:*** sparse distribution of small, decumbent, hair-like setae (Fig. 141a); frons with scale-like texture (Fig. 141a); vertex with scale-like texture and rugae (Fig. 141a); posterior projection rugulose (Fig. 141a); clypeus, bucculae, maxillary and mandibular plates rugulose (Fig. 141b); gula and genae finely rugulose (Fig. 141b). ***Antennae:*** very sparse distribution of hair-like setae. ***Pronotum:*** very sparse distribution of very small, erect, hair-like setae; collar coarsely rugulose; anterior lobe with scale-like texture, rugulose medially; posterior lobe deeply, densely rugulose. ***Thoracic venter:*** proxyphus coarsely rugulose; dense distribution of matted microtrichia. ***Scutellum:*** (Fig. 141c) rugulose; sparse distribution of small, erect, hair-like setae; mesoscutum bearing microtrichia***.*** ***Hemelytra:*** roughly textured; sparse distribution of small, erect, hair-like setae; dense distribution of microtrichia. ***Legs:*** femora with sparse distribution of decumbent, hair-like setae; tibial setae small, thick, decumbent.

STRUCTURE: Body gracile (Fig. 102d). ***Head:*** vertex with strongly sulcate midline (Fig. 141a); bucculae narrow, not covering gula medially (Fig. 141b); clypeus strongly ventrally oriented with sinuate convex anterior margin; with convex posterior projection (Fig. 141a); eyes reniform, extending ventrad to anterior margin of clypeus. ***Labium:*** extending to metasternum. ***Pronotum:*** collar weakly developed; foveae absent; anterior lobe narrow, elongate, with weakly developed calli, lateral margins convex, rectilinear posteriorly; posterior lobe weakly declivent towards head, lateral margins convex, weakly divergent posteriorly, posterior margin strongly concave. ***Thoracic venter:*** proxyphus depressed, triangular. ***Scutellum:*** (Fig. 141c) without foveae on anterolateral angles; lateral margins serrate; mesoscutum raised. ***Hemelytra:*** costal margins straight; cuneus ca. 3x longer than wide (Fig. 141d); medial margin straight. ***Legs:*** metafemora elongate, cursorial. ***Male Genitalia:*** (Fig. 142a) pygophore moderately asymmetrical, with a broad and prominent ventral process, genital opening dorsal. Left paramere (Fig. 142b) r-shaped, with an exaggerated and tuberculate sensory lobe; apophysis sinuate, with a broad apical hook. Right paramere (Fig. 142c) club-shaped, with a tuberculate apex. Aedeagus (Fig. 142d) with phallotheca opening dorsally; ductus seminis narrow and loosely ribbed; endosoma with two dorsal endosomal lobal sclerites, flattened and ribbon-like; apical endosomal lobal sclerite subtriangule, enlarged, with lateral flanges.

Measurements

See Table 21.

Distribution

Wumea clypealis is known from West Papua, Indonesia (Fig. 105).

Biology and plant associations

Unknown.

Remarks

See Remarks section of *Wumea cassisi.*

The description of the male genitalia involved my own observations of the dissection of Wall (2007). I have introduced my definition endosomal lobal sclerites consistent with the remaining taxa of the *Candidomiris-Morobea* complex.

Wumea pilosa sp. nov.

Habitus, Figure 102e. Distribution, Figure 105. Male genitalia, Figure 143.

Etymology

Named for its dense vestiture.

Materials examined

HOLOTYPE: **PAPUA NEW GUINEA: MOROBE PROVINCE:** Saruwaged Mts, Bandong, 6.23663°S 147.08451°E, 1250 m, 01 Jun 1979, W.C. Gagne, ex Poaceae, 1♀ (AMNH_PBI 00047074) (BPBM).

PARATYPES: **PAPUA NEW GUINEA: EASTERN HIGHLANDS PROVINCE:** No. 9, Kimi Creek Camp, NE slopes Mount Michael, 6.41666°S 145.33333°E, 1980 m, 29 Aug 1959, L. J. Brass, 1♀ (AMNH_PBI 00047076) (BPBM). **MOROBE PROVINCE:** Mt. Missim, 7.1167°S 146.9167°E, 1600 m, 23 Jun 1977, Thane Pratt, 1♀ (AMNH_PBI 00047075) (BPBM).

Diagnosis

Wumea pilosa is recognised by the following combination of characters: body with densely distributed semi-erect setae; gula and genae lacking rugae; left paramere (Fig. 143b) r-shaped, with a strong apical hook; right paramere (Fig. 143c) weakly c-shaped, much longer than left paramere; ventral projection of pygophore broad and rounded

(Fig. 143a); phallotheca with a basal lobe (Figs 143d-e); endosoma bilobed with a basal sclerite (Figs 143f-g).

Description

COLOURATION: Almost entirely stramineous (Fig. 102e). ***Head:*** mostly stramineous; clypeus, mandibular and maxillary plates orange; gula and genae pale grey. ***Antennae:*** AI orange; AII-AIV stramineous, black towards joints. ***Pronotum:*** entirely stramineous. ***Abdominal venter*****:** stramineous or green. ***Scutellum:*** stramineous. ***Hemelytra:*** translucent stramineous. ***Metathoracic glands:*** evaporative area grey. ***Legs:*** stramineous.

VESTITURE AND TEXTURE: Body with dense distribution of simple, semi-erect, hair-like setae and microtrichia. ***Head:*** dorsal surface, clypeus and bucculae dense distribution of semi-erect, hair-like setae; otherwise sparse distribution of small, erect, hair-like setae; vertex with scale-like texture, depressions rugulose; genae smooth; otherwise sparsely rugulose. ***Antennae:*** AI-AIV dense distribution of small, semi-erect, hair-like setae, larger on AI. ***Pronotum:*** uniform distribution of semi-erect, hair-like setae; texture rugulose; calli with scale-like texture. ***Thoracic venter:*** proxyphus with dense patterns of microtrichia present; rugulose. ***Scutellum:*** dense distribution of semi-erect, hair-like setae and microtrichia; finely rugulose. ***Hemelytra:*** uniform distribution of semi-erect, hair-like setae and microtrichia. ***Legs:*** sparse distribution of decumbent, hair-like setae.

STRUCTURE: Body shape gracile (Fig. 102e). ***Head:*** vertex with strongly sulcate midline; bucculae broad, curved, not covering gula medially; clypeus strongly dorsoventrally oriented with sinuate convex anterior margin; with convex posterior projection; eyes spherical, extending ventrad to anterior margin of clypeus. ***Labium:*** extending to metasternum. ***Pronotum:*** collar strongly developed; foveae absent;

anterior lobe narrow, elongate, with weakly developed calli, lateral margins convex, rectilinear posteriorly; posterior lobe weakly declivent towards head, lateral margins convex, weakly divergent posteriorly, posterior margin concave. ***Thoracic venter:*** proxyphus raised, rounded. ***Scutellum:*** without foveae on anterolateral angles; lateral margins serrate; mesoscutum raised. ***Hemelytra:*** costal margins straight; cuneus ca. 2x longer than wide; medial margin curved. ***Legs:*** metafemora and tibiae elongate. ***Male genitalia:*** pygophore (Fig. 143a) weakly asymmetrical, ventral projection broad; genital opening elliptical. Left paramere (Fig. 143b) r-shaped; sensory lobe weakly developed with moderately dense distribution of thick setae; apophysis sinuate with dentate dorsal margin, apex strongly hooked. Right paramere (Fig. 143c) large, much longer than left paramere, weakly c-shaped, setose distally, with apex pinched. Aedeagus (Fig. 143d) with ductus seminis short; secondary gonopore not long, not reaching apex of phallotheca; apical endosomal lobal sclerite present, broad and flattened; tube-like phallotheca, left dorsal lobe, opening dorsally; endosoma mostly membranous, bilobed, with a small basal sclerite.

Measurements

See Table 21.

Distribution

Wumea pilosa is known from northern New Guinea (Fig. 105).

Biology and plant associations

A single plant record, given as Poaceae only.

Remarks

See Remarks section of *Wumea cassisi.*

The male endosoma has a small basal sclerite which is unlike other sclerotisation in the *Candidomiris-Morobea* complex, and does not fit definitions of a spicule or an endosomal lobal sclerite; I refer to it descriptively as a basal sclerite.

Zanchiella **Schuh**

Zanchiella Schuh, 1974: 49 (sp. nov.); Schuh 1995: 203 (world catalogue);

Type species

Zanchiella bowkeriae Schuh by original designation.

Diagnosis

Zanchiella can be distinguished by the following combination of characters: pale yellowish colouration (Figs 87d,e); simple vestiture (e.g. Fig. 144); convex hemelytra costal margins (Figs 87d,e); eye large, egg-shaped, contiguous with anterior margin of pronotum (e.g. Fig. 144b); bucculae narrow, not extending to gula (Fig. 144c); gula sinuate, long, extending ½ the length of head (Fig. 144b); distinct anterior and posterior lobes of the pronotum, posterior lobe strongly declivent (Fig. 144d); punctures present on hemelytra (Fig. 144f).

Description

COLOURATION: (Figs 87d,e) Shiny, mostly pale yellow colouration, sometimes with dark markings. ***Head:*** generally yellow or light brown. ***Pronotum:*** anterior and posterior lobe differently coloured. ***Hemelytra:*** hyaline, transparent some dark indistinct marking; clavus coloured.

VESTITURE AND TEXTURE: Body with sparse distribution of simple, decumbent, hair-like setae and microtrichia (e.g. Fig. 144). ***Antennae:*** dense distribution of erect, hair-like setae. ***Pronotum:*** (e.g. Fig. 144d) collar strongly rugulose; anterior lobe and

posterior lobes smooth. ***Thoracic venter:*** rugulose, setae absent; dense distribution of microtrichia. ***Hemelytra:*** (e.g. Fig. 144f) sparse distribution of erect, hair-like setae; sparse distribution of microtrichia. ***Legs:*** dense distribution of semi-erect, hair-like setae; several rows of spinules usually present on tibiae.

STRUCTURE: Body shape gracile (e.g. Figs 87d,e). ***Head:*** strongly hypognathous, frons and clypeus straight (e.g. Fig. 144b); frons almost flat (e.g. Fig. 144a); about twice as wide as long, in dorsal view (e.g. Fig. 144a); bucculae narrow, not produced ventrally beyond ventral margin of eyes (e.g. Fig. 144c); gula sinuate, extending ½ length of head (e.g. Fig. 144b); eyes egg-shaped in lateral view, contiguous with anterior margin of pronotum (e.g. Fig. 144b); postocular region absent (e.g. Fig. 144b). ***Antennae:*** greatly elongate, ca. 2x longer than head. ***Pronotum:*** (e.g. Fig. 144d) bilobed; collar weakly developed; anterior lobe subrectangulate, lateral margins straight, calli weakly developed, widely separated medially; posterior lobe trapezoidal, lateral margins strongly divergent posteriorly, posterior margin rectilinear. ***Mesepimeron:*** with evaporative bodies, spiracle weakly exposed. ***Metathoracic Gland:*** peritreme short, tongue-like, weakly raised, posterodorsally oriented; evaporative area occupying ca. ⅓ of metepisternum, peritreme reaching dorsal margin of evaporative area. ***Hemelytra:*** margins straight; ca. 2x longer than abdomen; cuneus 2x longer than wide, medial margin convex. ***Legs:*** cursorial; weakly elongate; pretarsal claws with uniformly spaced minute striations; narrow basally.

Distribution

Zanchiella is endemic to South and East Africa (Fig. 89).

Biology and plant associations

Unknown.

Remarks

This genus has not been studied in great detail as the focus of my study was on southwest Pacific species within this group of orthotylines. Descriptions of these species was included for comparison to other members of the *Candidomiris-Morobea* complex. Its external characteristics place the genus within the complex.

Zanchiella resembles *Felisacodes* and *Candidomiris* but can be distinguished by its pale yellowish colouration, long sinuate gula and narrow bucculae.

Schuh 1974 described the genus as having a membranous "vesical" lacking spiculii and well developed "k-structures" and for each of the species wrote not illustrated, see generic discussion. It is possible that while the genus lacks spiculii they still possess lobal sclerites as in *Felisacodes* as the same generic description was given in both genera.

***Zanchiella bowkeriae* Schuh**

Habitus, Figure 87d. Distribution, Figure 89. SEMs, Figure 144.

Zanchiella bowkeriae Schuh, 1974: 51 (sp. nov.); Schuh 1995: 203 (world catalogue)

Materials examined

PARATYPES: **SOUTH AFRICA: MPUMALANGA:** Transvaal, 22 mi South of Barberton, 26.10472°N 30.98889°E, 1494 m, 24 Mar 1968, R.T. Schuh, J.A and S. Slater, M. Sweet, ex *Bowkeria cymosa* (Stilbaceae), 1♂ (UNSW_ENT 00026496), 1♀ (UNSW_ENT 00026495) (SANC).

Diagnosis

Zanchiella bowkeriae is recognised by the following combination of character: body mostly pale yellow, with abdomen green, hemelytra with red markings; punctures on posterior lobe of pronotum weakly developed; labium extending to mesothorax.

Description

COLOURATION: Mostly pale yellow (Fig. 87d). ***Head:*** Clypeus, frons and vertex pale yellow; mandibular and maxillary plates grey; bucculae pale yellow. ***Antennae:*** AI-AII pale yellow, dark markings at joints; AIII-AIV light brown. ***Pronotum:*** anterior lobe pale yellow; posterior lobe pale yellow with brown markings laterally and posteriorly. ***Thoracic venter:*** pale yellow to grey. ***Scutellum:*** pale yellow, light brown laterally, mesoscutum light brown. ***Hemelytra:*** pale translucent yellow with dark brown lateral band; membrane translucent brown. ***Legs:*** pale yellow to grey, darkening distally ***Abdomen:*** pale green.

VESTITURE AND TEXTURE: Body with sparse distribution of short, hair-like setae and sparse distribution of microtrichia (Fig. 144). ***Head:*** very few setae dorsally (Fig. 144a); sparse distribution of hair-like setae laterally and ventrally (Figs 144b,c); with sparse, uniform distribution of microtrichia (Fig. 144c). ***Antennae:*** AI setae small, erect; AII-AIV setae longer, semi-erect. ***Pronotum:*** (Fig. 144d) uniformly smooth, sparse distribution of setae and microtrichia. ***Thoracic venter:*** proxyphus weakly rugulose; dense distribution of microtrichia. ***Scutellum:*** (Fig. 144f) smooth, sparse distribution of setae and microtrichia. ***Hemelytra:*** sparse distribution of setae and microtrichia. ***Legs:*** erect, hair-like setae, tibiae with thickened erect setae.

STRUCTURE: Body shape elongate-ovoid (Fig. 87d). ***Head:*** vertex with weakly sulcate midline (Fig. 144a); bucculae rounded, ovate, not covering gula medially (Fig. 144c); clypeus ventrally oriented with sinuate anterior margin (Fig. 144b); eyes

spherical, extending ventrad to anterior margin of clypeus (Fig. 144b). ***Labium:*** extending to mesothorax. ***Pronotum:*** (Fig. 144d) collar strongly developed; foveae absent; anterior lobe narrow, with weakly developed calli, lateral margins convex, rectilinear posteriorly; posterior lobe weakly declivent towards head, lateral margins convex, weakly divergent posteriorly, posterior margin concave. ***Scutellum:*** (Fig. 144f) foveae present on anterolateral angles; lateral margins straight, serrate; mesoscutum raised. ***Thoracic venter:*** proxyphus weakly depressed. ***Hemelytra:*** small punctures along clavus (Fig. 144f); costal margins straight; cuneus ca. 2x longer than wide; medial margin convex. ***Legs:*** cursorial; metafemora elongate, narrow.

Male genitalia only known from description in Schuh (1974).

Measurements

See Table 22.

Distribution

Both in specimens examined in this study and in the literature, *Zanchiella bowkeriae* is only known from Transvaal, South Africa (Fig. 89).

Biology and plant associations

All known specimens of *Zanchiella bowkeriae,* were collected off *Bowkeria cymosum* McOwan (Scrophulariaceae), a plant which is endemic to South Africa.

Remarks

This species was described from a limited number of specimens and no genitalic dissections. It can be distinguished from *Zanchiella sweeti* from the red markings on the hemelytra, its shorter labium and its shallow punctures on the posterior lobe of the pronotum.

Zanchiella sweeti Schuh

Habitus, Figure 87d. Distribution, Figure 89.

Zanchiella bowkeriae Schuh, 1974: 57 (sp. nov.); Schuh 1995: 203 (world catalogue).

Materials examined

PARATYPES: **SOUTH AFRICA: GAUTENG:** Fountains, Pretoria, 25.783°S 28.183°E, 15 Dec 1967, M. Sweet, 2♂♂ (UNSW_ENT 00026497, UNSW_ENT 00026498) (SANC).

Diagnosis

Zanchiella sweeti is most readily recognised by the following combination of characters: labium extending to thoracic-abdominal boundary; hemelytra with brown markings (Fig. 87d); abdomen yellow; punctures on posterior lobe of pronotum deep.

Description

COLOURATION: Body mostly pale greenish yellow (Fig. 87d). ***Head:*** clypeus, frons and vertex pale yellow; mandibular and maxillary plates grey; bucculae pale yellow. ***Antennae:*** AI-AII pale yellow, dark markings at joints; AIII-AIV light brown. ***Labium:*** pale green. ***Pronotum:*** anterior lobe pale yellow; posterior lobe pale yellow with brown markings laterally and posteriorly. ***Thoracic venter:*** pale greenish yellow. ***Scutellum:*** pale yellow, light brown laterally, mesoscutum light brown. ***Hemelytra:*** pale translucent yellow with pale red lateral band; membrane translucent brown. ***Legs:*** pale green. ***Abdomen:*** pale green.

VESTITURE AND TEXTURE: Body with sparse distribution short, hair-like setae and sparse distribution of microtrichia. ***Head:*** very few setae dorsally; sparse distribution of lateral and ventral setae; uniformly sparse distribution of microtrichia. ***Antennae:*** AI setae small, erect, hair-like; AII-AIV longer, semi-erect. ***Pronotum:***

anterior lobe smooth; posterior lobe weakly rugulose; sparse distribution of hair-like setae and microtrichia. ***Thoracic venter:*** proxyphus weakly rugulose; dense distribution of microtrichia. ***Scutellum:*** weakly rugulose, setae absent, sparse distribution of microtrichia. ***Hemelytra:*** sparse distribution of microtrichia. ***Legs:*** mostly erect, hair-like setae, intermixed with bristle-like setae on tibiae.

STRUCTURE: Body elongate-ovoid (Fig. 87d). ***Head:*** vertex with weakly sulcate midline; bucculae rounded, not covering gula medially; clypeus ventrally oriented, with sinuate anterior margin; eyes round, extending ventrad to anterior margin of clypeus. ***Labium:*** extending to thoracic-abdominal boundary. ***Pronotum:*** collar strongly developed; anterior lobe narrow, with weakly developed calli, lateral margins convex, rectilinear posteriorly; posterior lobe weakly declivent towards head, lateral margins convex, weakly divergent posteriorly, posterior margin concave. ***Thoracic venter:*** proxyphus weakly depressed. ***Scutellum:*** foveae present on anterolateral angles; lateral margins straight, serrate; mesoscutum raised. ***Hemelytra:*** punctures along clavus; costal margins straight; cuneus ca. 2x longer than wide. ***Legs:*** metafemora elongate, narrow.

Male genitalia not investigated.

Measurements

See Table 22.

Distribution

Zanchiella sweeti is known from South Africa (Fig. 89).

Biology and plant associations

Unknown.

Remarks

See remarks for *Zanchiella bowkeriae.*

Male genitalia only known from description in Schuh (1974).

DISCUSSION

Aside from the works of Poppius (1914), Bergroth (1926), Odhiambo (1967) Schuh (1974), Carvalho (1976) and Wall (2007), there are no other works on the glassy-winged Orthotylini, which I have placed in the *Candidomiris-Morobea* complex. The systematic position of this complex within the Orthotylini is yet to be determined with confidence.

The *Candidomiris* group has some resemblance with the Ceratocapsini. I was not able to examine this in detail as no specimens were available for study, but was able to assess this based on a major ceratocapsine monograph by Henry (2015). The ceratocapsine and the *Candidomiris* group both lack a postocular region, have broad bucculae, and the pygophore has a lateral process, which Henry (2006, 2015) refers to as the spatulate process. The male genitalia of some ceratopasines also resemble those of the *Morobea* group. Endosomal spicules are usually absent and the endosomal membrane can be large, although there is no evidence of the distinctive lobal sclerites in the *Candidomiris* group in ceratocapsines.

There are also many similarities between the *Candidomiris-Morobea* group and *Irianocoris* (Carvalho 1971). Work on the genus by Cassis et. al (2012) shows an elongate secondary gonopore, thick ductus seminis, enlarged eyes and a large right paramere, all characters which are shared with some or all of the *Candidomiris-Morobea* group or *Cyrtorhinus.* The head and microstructures as well as the endosomal spicules appear to be closer to other orthotylines. The genus is not believed to be in the group but detailed study of the relationship between *Irianocoris* and the *Candidomiris-Morobea* group is beyond the scope of this project.

The *Candidomiris* group is the most unique within the *Candidomiris-Morobea* complex, with its taxa having a hypognathous head and caudally produced bucculae.

They also lack endosomal spicules, which are so characteristic of many taxa of the Orthotylini, and have instead endosomal lobal sclerites, which are possibly homologous to those found in the *Zanchius* group (Schuh 1974; Forero 2009). The presence of endosomal lobal sclerites and complex endosomal membrane provide useful characters for generic diagnoses within the *Candidomiris* group. In the taxonomy of the *Candidomiris* group, the male genitalic characters are supported by external characters, such as body texture, shape of the anterior lobe of the pronotum, width of the head, length of the antennal segments, and vestiture type.

The taxonomy of the *Candidomiris-Morobea* complex relies heavily on microstructures observed using scanning electron microscopy. I made a deliberate attempt to find new characters for resolving their relationships within this complex, which may be relevant more broadly in the Orthotylini in future studies.

The *Candidomiris* group can be broadly divided into two well-supported groups. The *Morobea* group comprised species belonging to the genera *Morobea, Wumea, Falcum* and *Dimifacoris.* The *Candidomiris* group comprised species belonging to the genera *Nerubia, Felisacodes, Novacalecoris, Candidomiris, Jimia, Zanchiella, Spinamifera, Nerubia* and *Saggitacopula*. *Flagellomiris* is the basal member of the group and does not fit into either the *Candidomiris* or *Morobea* group.

Wall (2007) rejected the possibility of all these genera forming a monophyletic group. This assessment was based to some extent on the significant morphological difference between *Saggitacopula* and *Wumea-Morobea*, which in my phylogenetic analysis are separate clades within the *Candidomiris* group. Some of the other genera included in this study account for some of this difference. The *Candidomiris* and *Morobea* groups form strongly supported clades and may form the basis of a subtribe.

Their sister-group relationship requires more analysis, and I did not have enough critical material to test their monophyly more broadly in the Orthotylini.

Species of the *Candidomiris* group are less heavily textured, have simpler setae and more distinctive endosomal membrane and sclerites. The presence of a large ductus seminis is similar to that found in *Cyrtorhinus* (see Chapter 2). My phylogenetic analysis supports Schuh's (1974) proposed relationship between *Felisacodes* and *Zanchiella,* although I found that they are not sister taxa, even though they both have punctures on the clavus and similar male genitalia. It is a shortcoming of this Chapter that I did not have several species of *Zanchiella* and *Felisacodes longipedes* to examine, particularly as Schuh (1974) describes *Felisacodes longipedes* with a rugulose pronotal texture and *Felisacodes bryocorina* and *Felisacodes diaboura* with a smooth pronotal texture. This difference is minor and not sufficient to divide the genus especially as Electron microscopy reveals that the posterior lobe of the pronotum in *Felisacodes diaboura* and *Felisacodes bryocorina* is not perfectly smooth but very finely rugulose, which is not obvious under light microscopy. I support Schuh's (1974) species composition of *Felisacodes.*

The *Morobea* group has a more elongate and gracile body, with elongate appendages and stramineous colouration. These characters are shared with several unrelated heteropterans that are associated with grasses. Several specimens of the *Morobea* group have been found off various grasses, although plant records are scarce in this group.

Carvalho (1987) also erected and described other genera which I examined in this study (*Bomberia* Carvalho*, Neoloxops* Carvalho*, Urapura* Carvalho), but were excluded from my analysis as they were deemed to be not members of the *Candidomiris-Morobea* complex. I examined *Onconotellus* Knight in this study as it has

a similar overall appearance to the species in the *Candidomiris* clade, particularly with the genus *Saggitacopula. Onconotellus* has previously been included in the Orthotylini; however I agree with Carvalho (1986) that the genus does not belong in the Orthotylini.

Figures

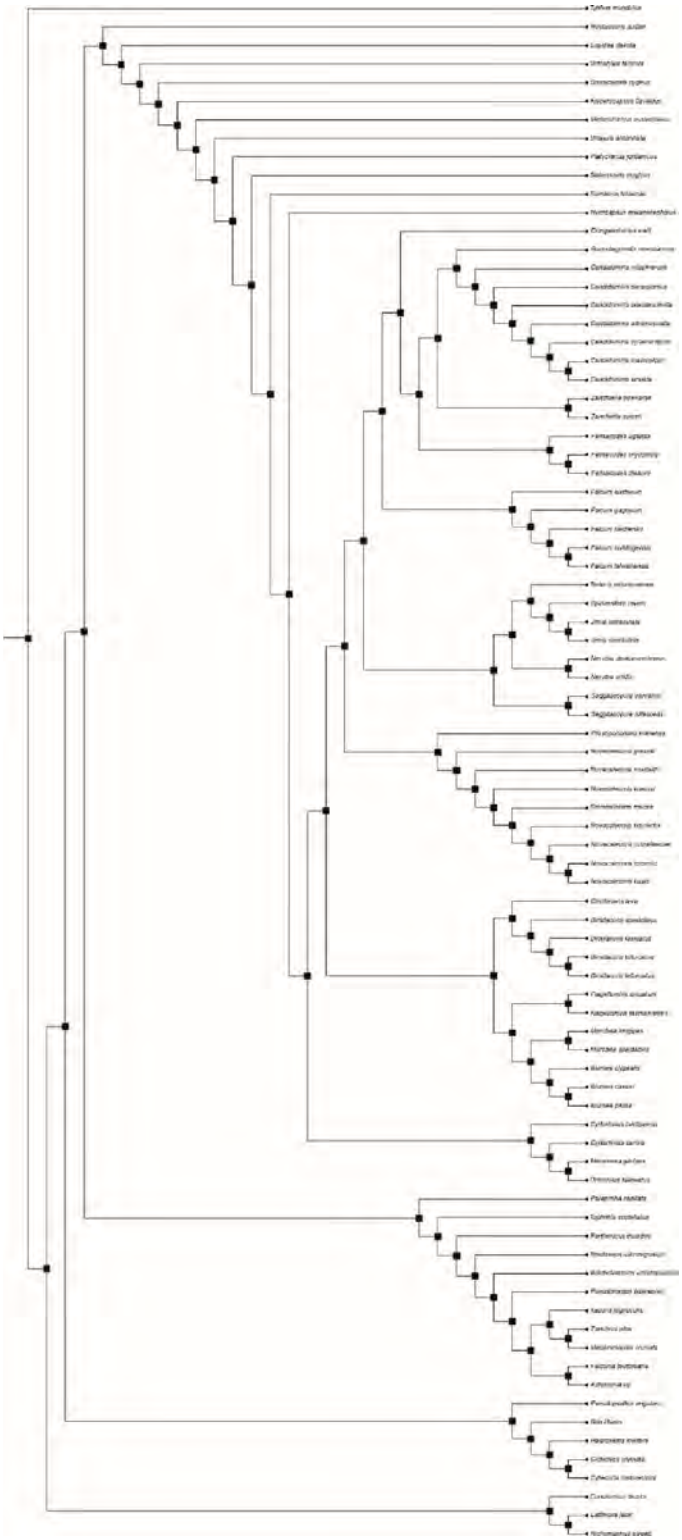


Figure 43: Phylogeny of the *Candidomiris-Morobea* complex. For taxon names in larger font see Figures 44-45

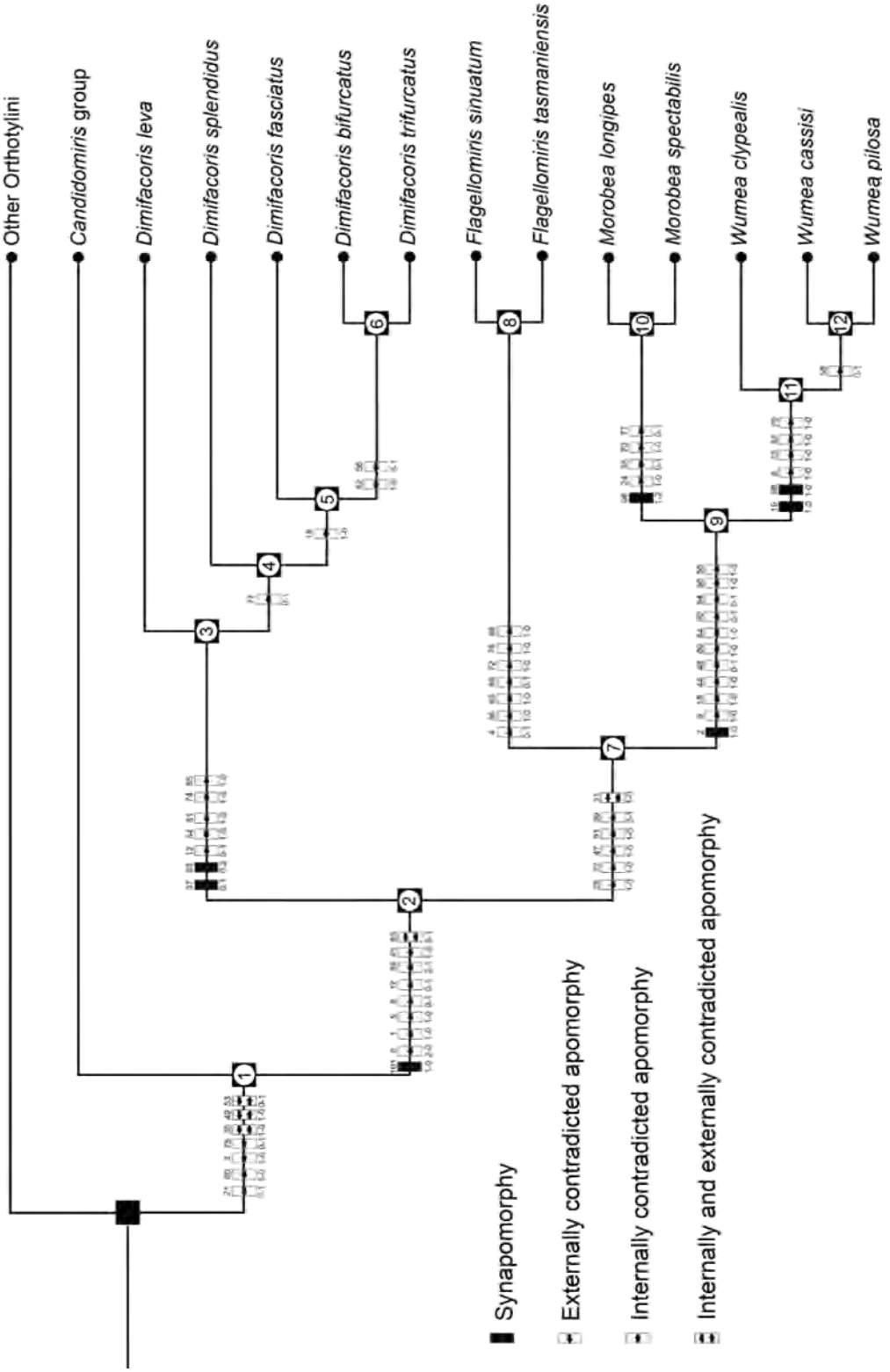


Figure 44: Phylogeny of the *Morobea* group with synapomorphies and apomorphies mapped.

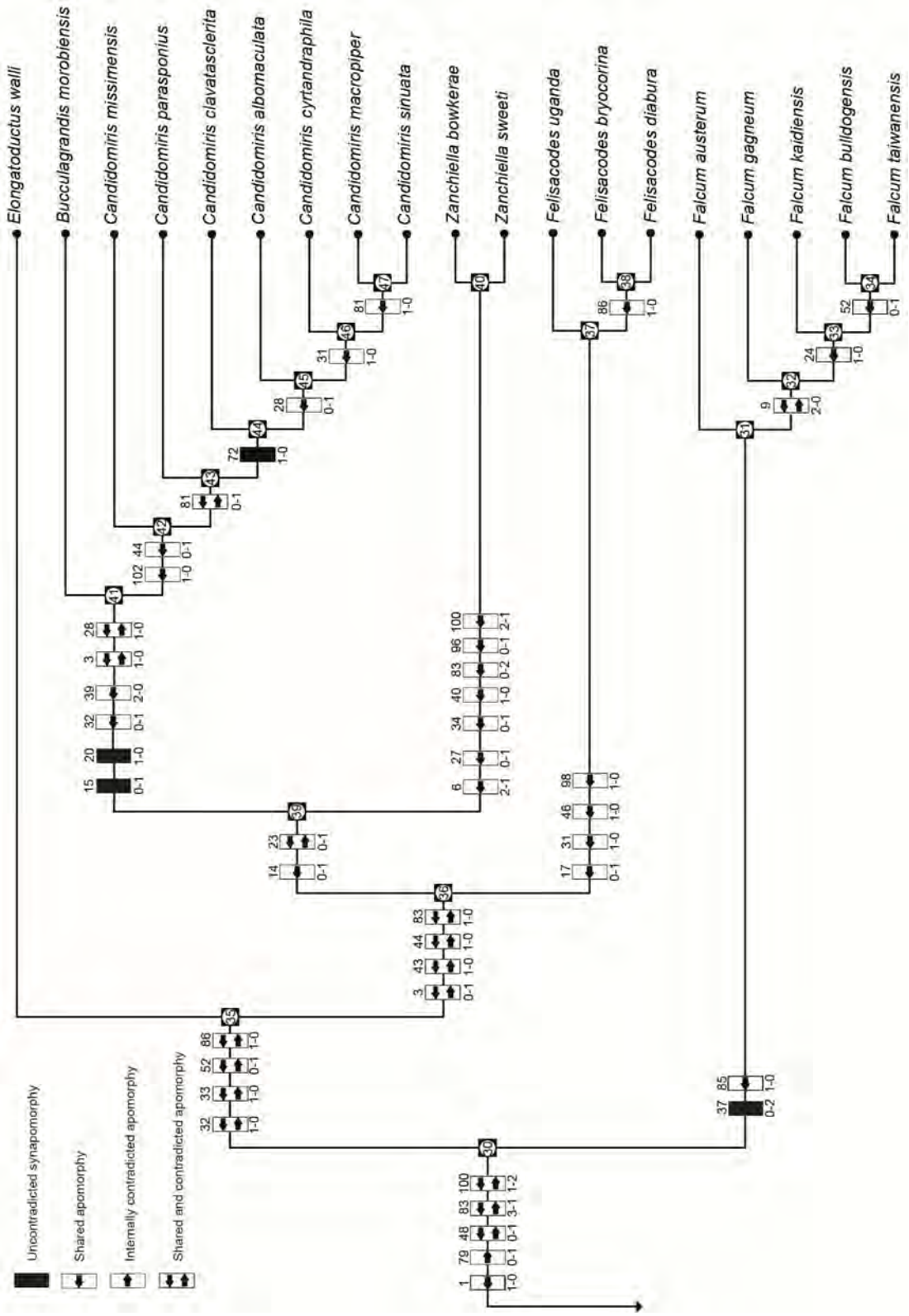


Figure 45: Phylogeny of the *Candidomiris* group with synapomorphies mapped.

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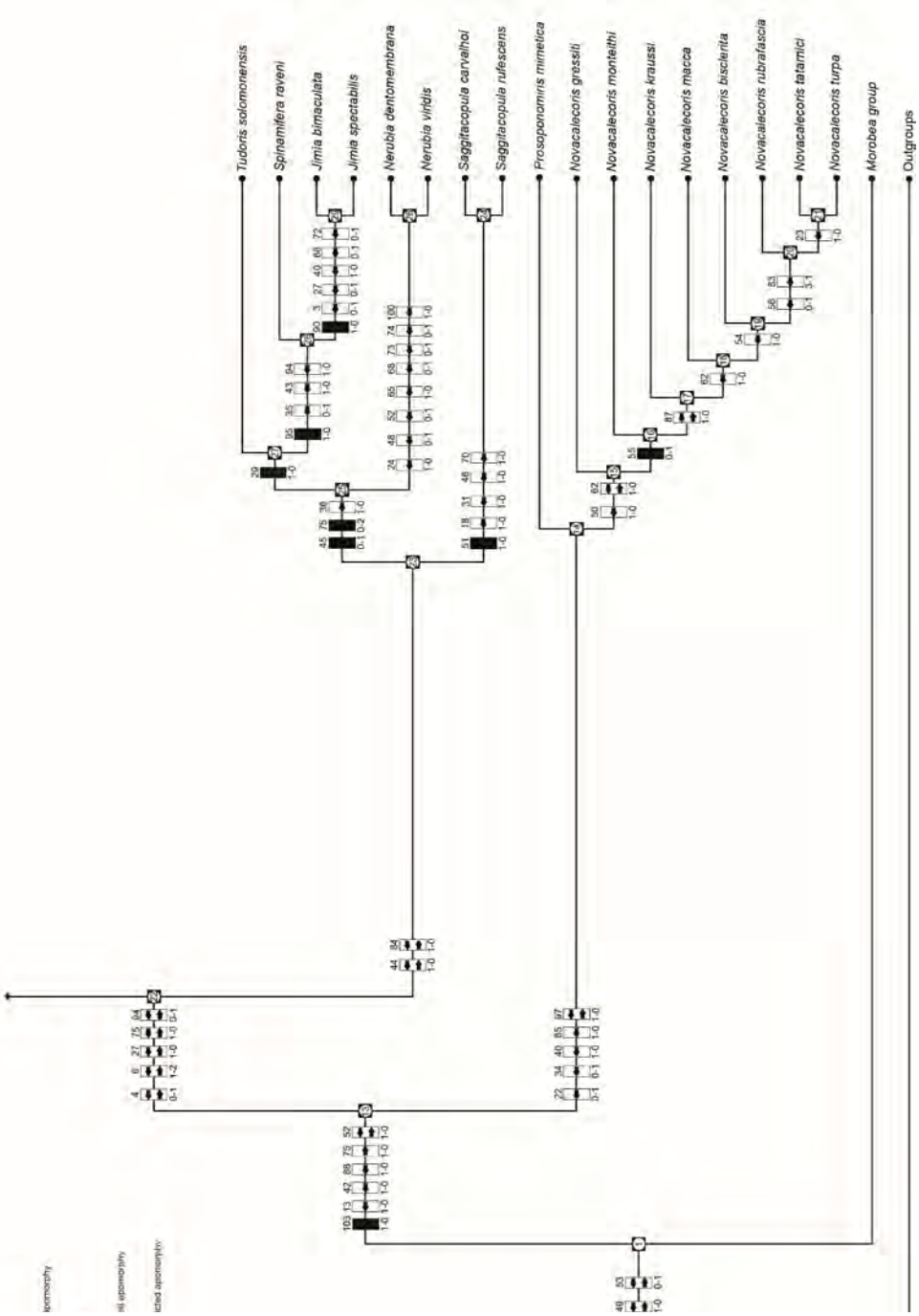


Figure 45 continued.

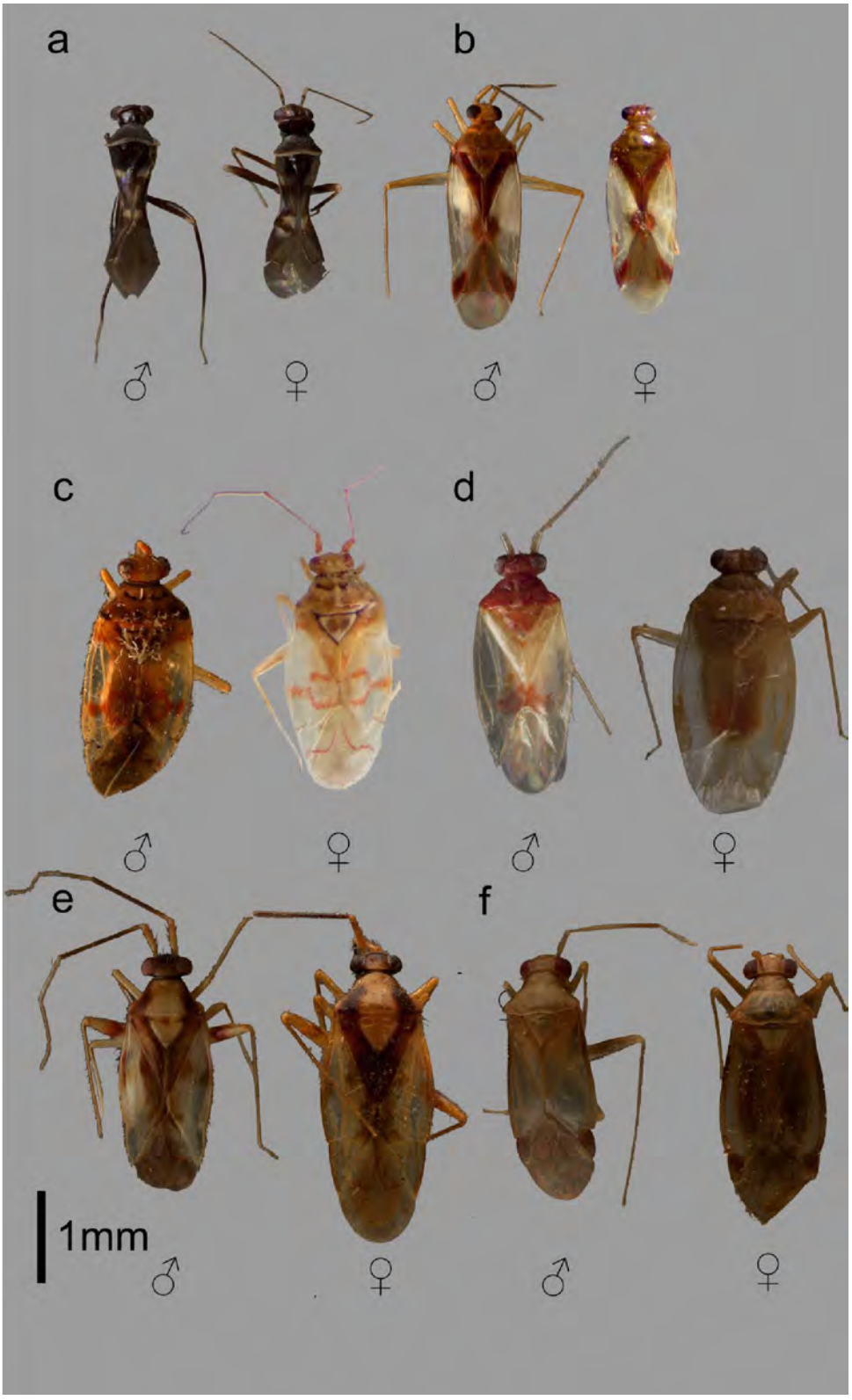

a
b
c
d
e
f
1mm
♂
♀

Figure 46: Habitus photos of species in the genera *Bucculagrandis, Spinamifera, Jimia* and *Nerubia.* a: *Bucculagrandis morobiensis.* b: *Spinamifera raveni.* c: *Jimia bimaculata.* d: *Jimia spectabilis.* e: *Nerubia dentomembrana.* f: *Nerubia viridis.*

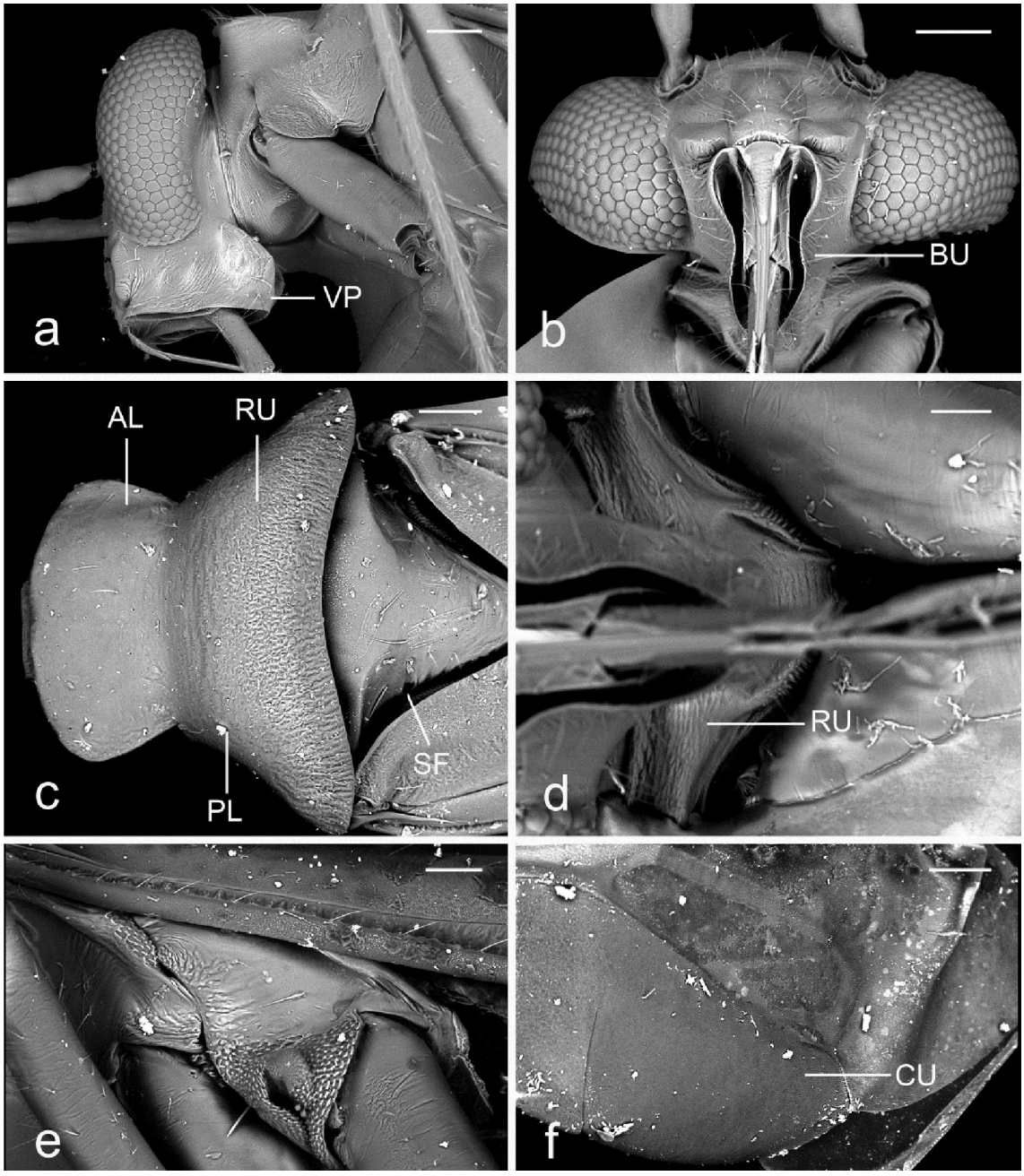


Figure 47: *Bucculagrandis morobiensis.* a: Head, lateral view, scale = 100µm. b: Head, ventral view, scale = 100 µm. c: Pronotum, scale = 100 µm. d: Prosternum, scale = 100µm. e: Metathoracic gland, scale = 100 µm. f: Cuneus, scale = 100µm.

Abbreviation: AL: Anterior lobe, BU: Bucculae, CU: Cuneus, PL: Posterior lobe, RU: Ruga, SF: Scutellum fovae, VP: Ventral projection.

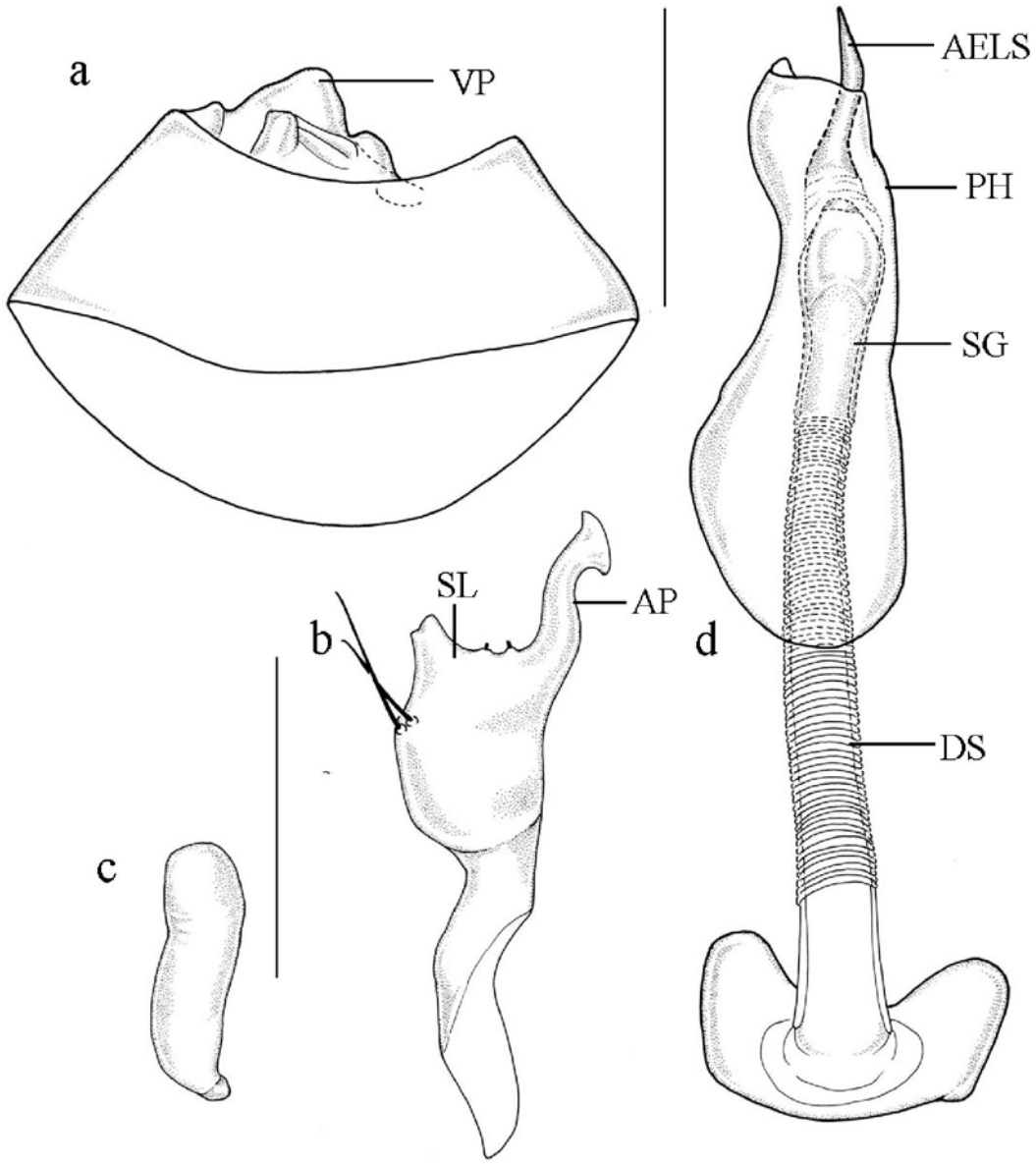


Figure 48: Male genitalia of *Bucculagrandis morobiensis*. a: Pygophore, dorsal view, scale = 0.1 mm. b: Right paramere, ventral view, scale = 0.05mm. c: Left paramere, ventral view, scale = 0.05 mm. d: Aedeagus, ventral view, scale = 0.05 mm. Abbreviation: AP: apophysis, DELS: Dorsal endosomal lobal sclerite, DS: Ductus seminis, SG: Secondary gonopore, SL: Sensory lobe, VP: Ventral projection.

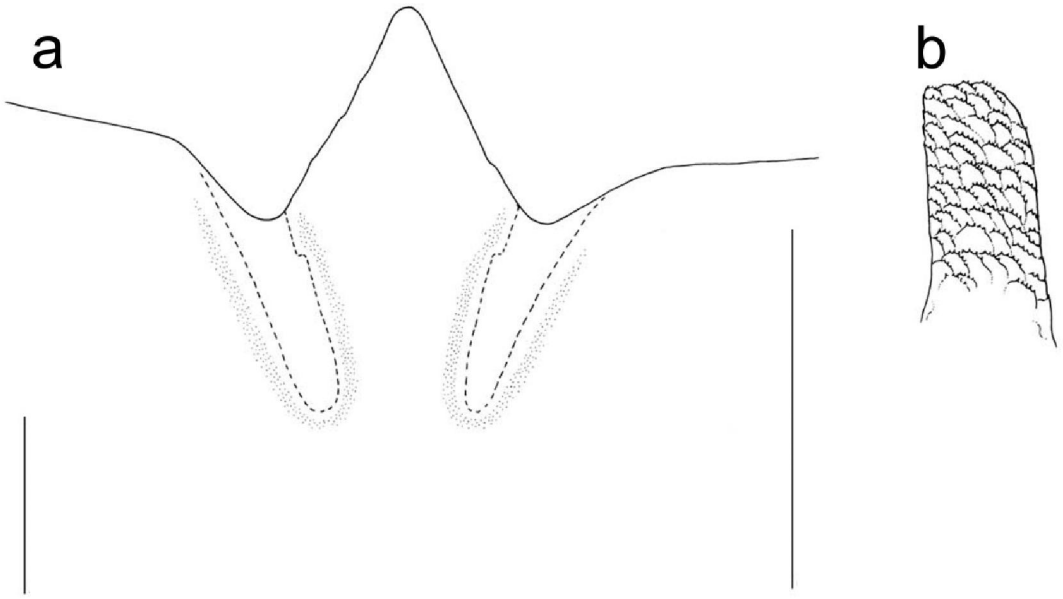


Figure 49: Female genitalia of *Bucculagrandis*. a: *Bucculagrandis morobiensis* subgenital plate, scale = 0.1 mm. b: *Bucculagrandis morobiensis* inter-ramal lobe, scale = 0.1 mm.

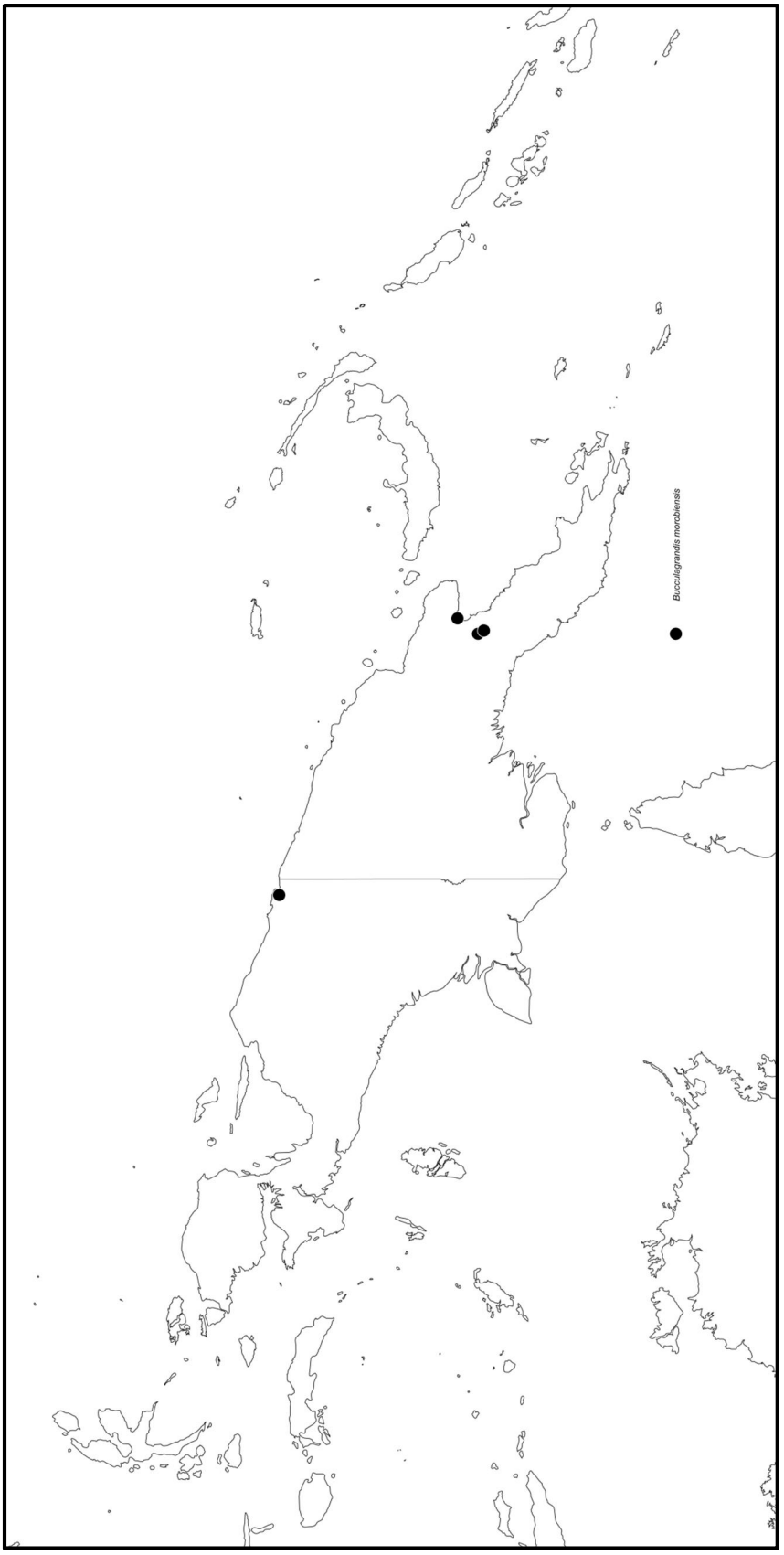


Figure 50: Distribution map of *Bucculagrandis*.

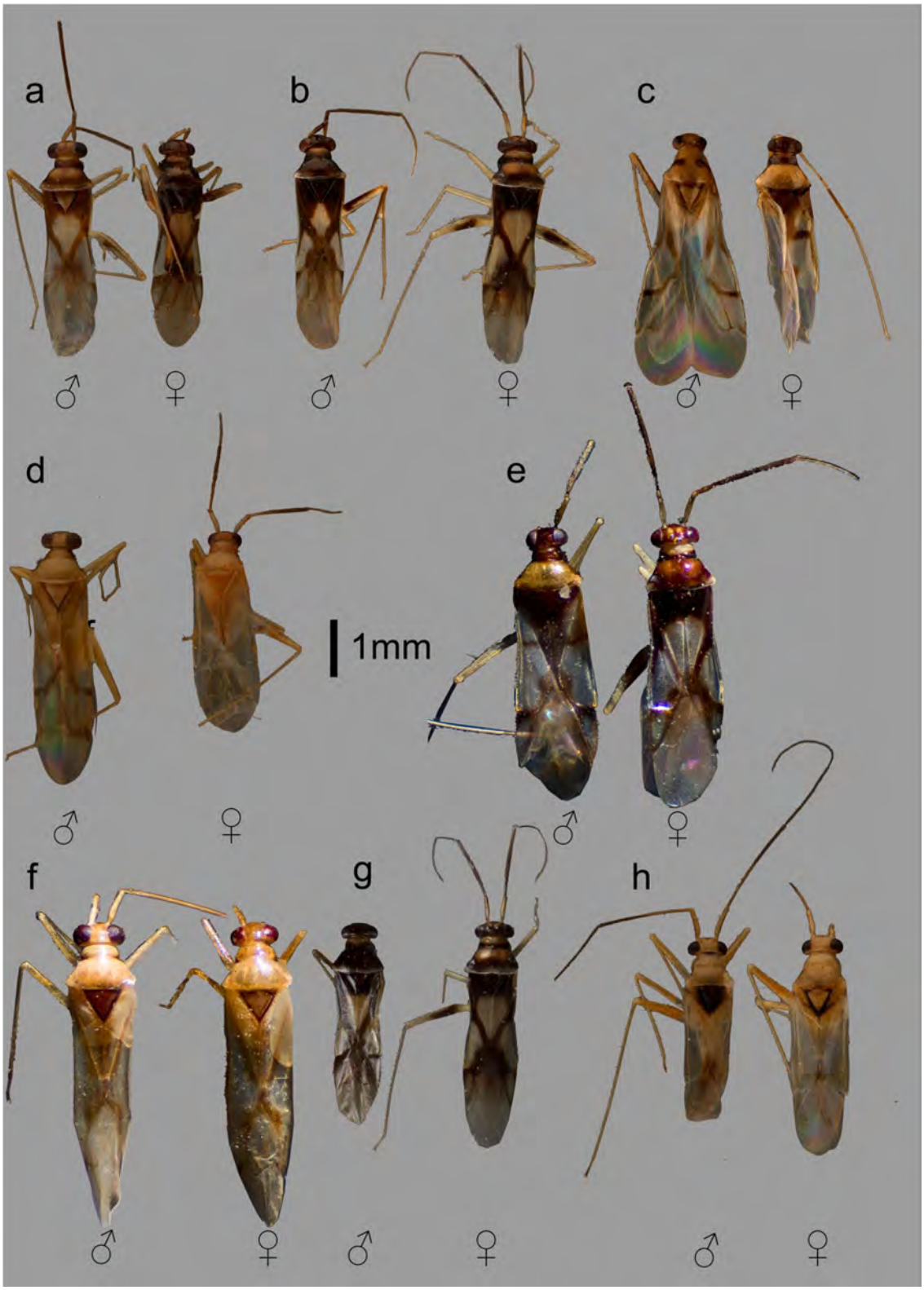


Figure 51: Habitus pictures of species in the genera *Candidomiris* and *Elongatoductus*. a: *Candidomiris albomaculata.* b: *Candidomiris clavatasclerita*. c: *Candidomiris cyrtandraphila*. d: *Candidomiris macropiper*. e: *Candidomiris missimensis.* f: *Candidomiris parasponius.* g: *Candidomiris sinuata*. h: *Elongatoductus walli.*

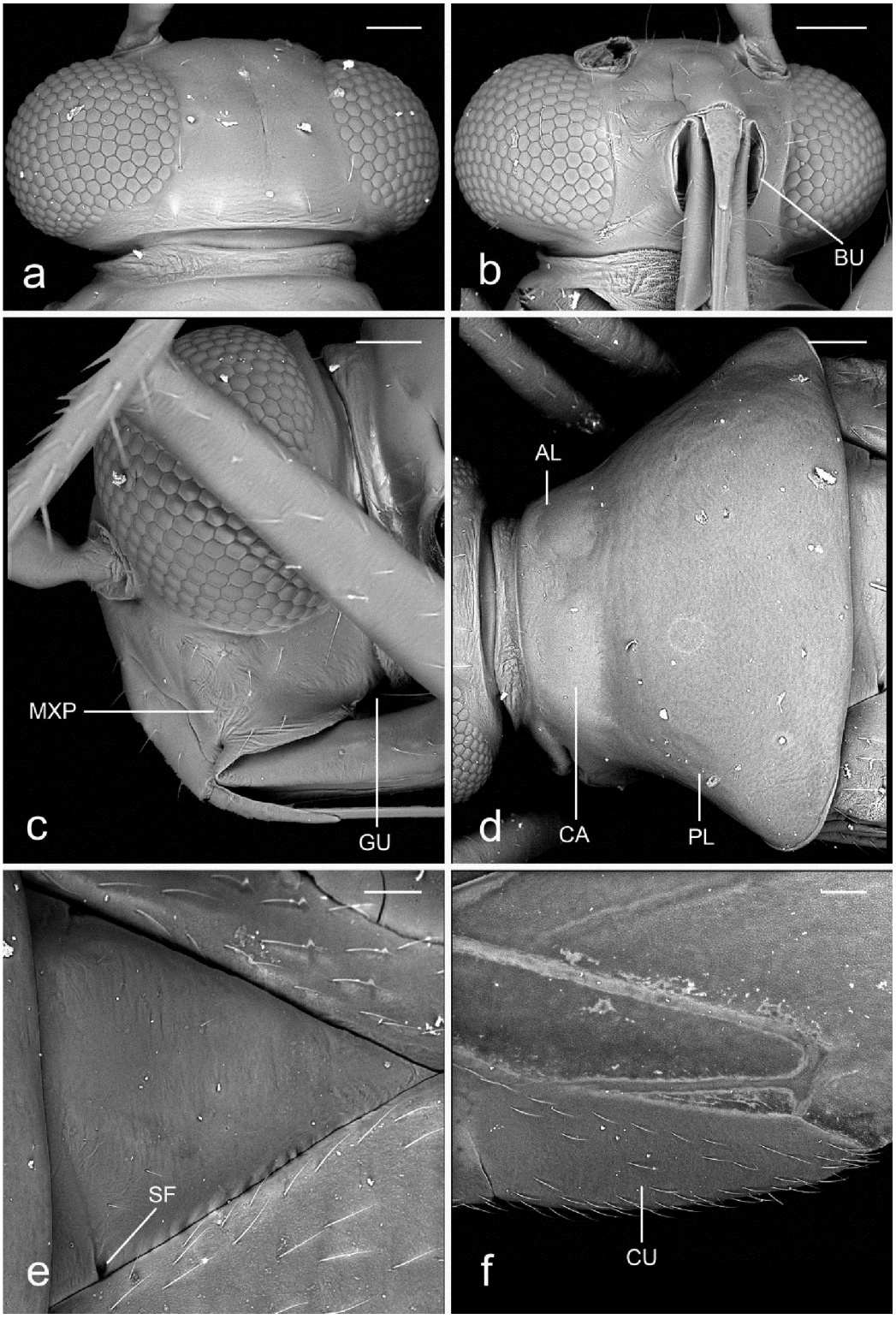


Figure 52: *Candidomiris albomaculata*. a: Head, dorsal view, scale = 60µm. b: Head, ventral view, scale = 100µm. c: Head, lateral view, scale = 100µm. d: Pronotum, scale = 100µm. e: Scutellum, scale = 60µm. f: Cuneus, scale = 100µm. Abbreviation: AL: Anterior lobe, Bu: Bucculae, CA: Calli, CU: Cuneus, GU: Gula, MXP: Maxillary plate, PL: Posterior lobe, SF: Scutellum fovea.

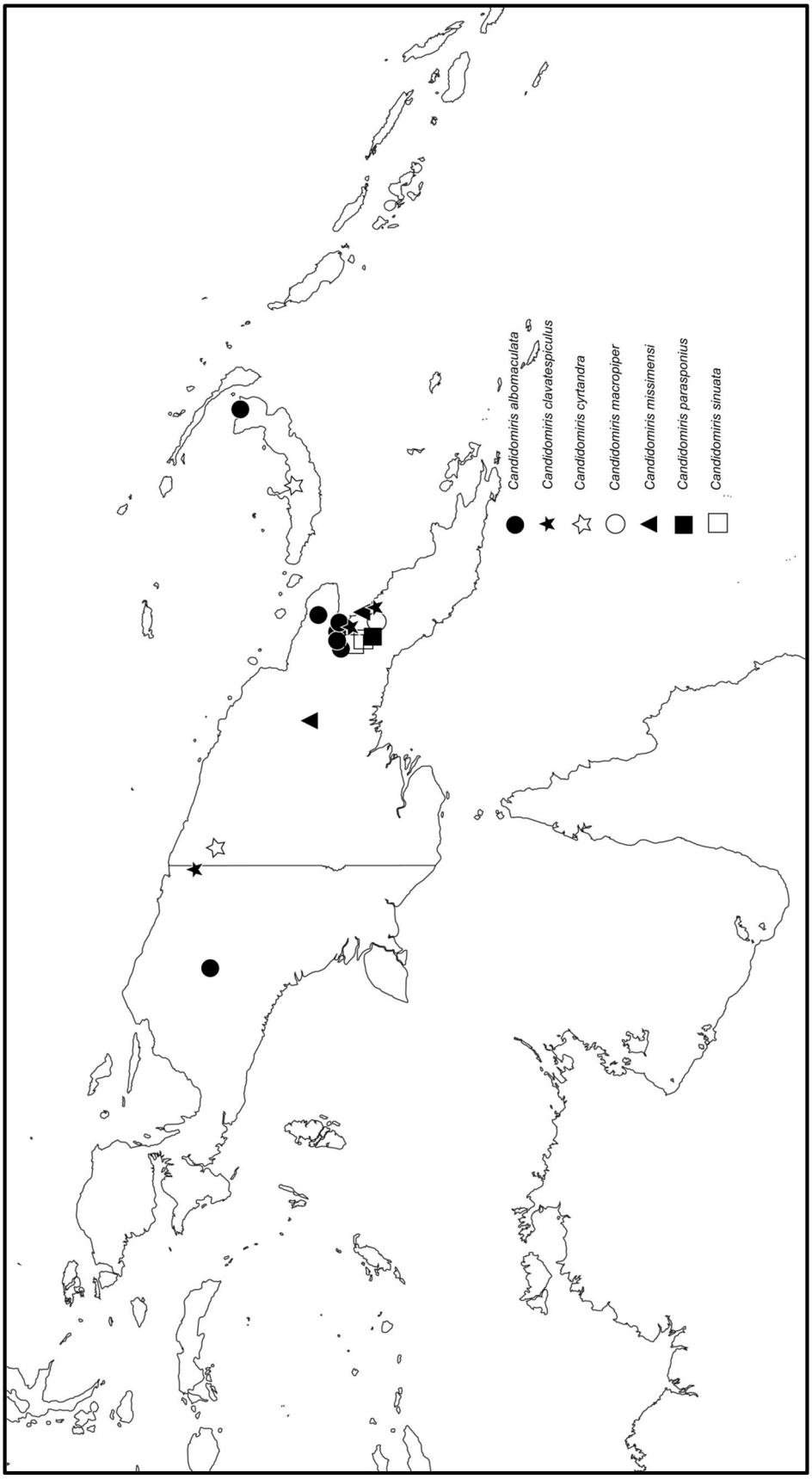


Figure 53: Distribution map of *Candidomiris*.

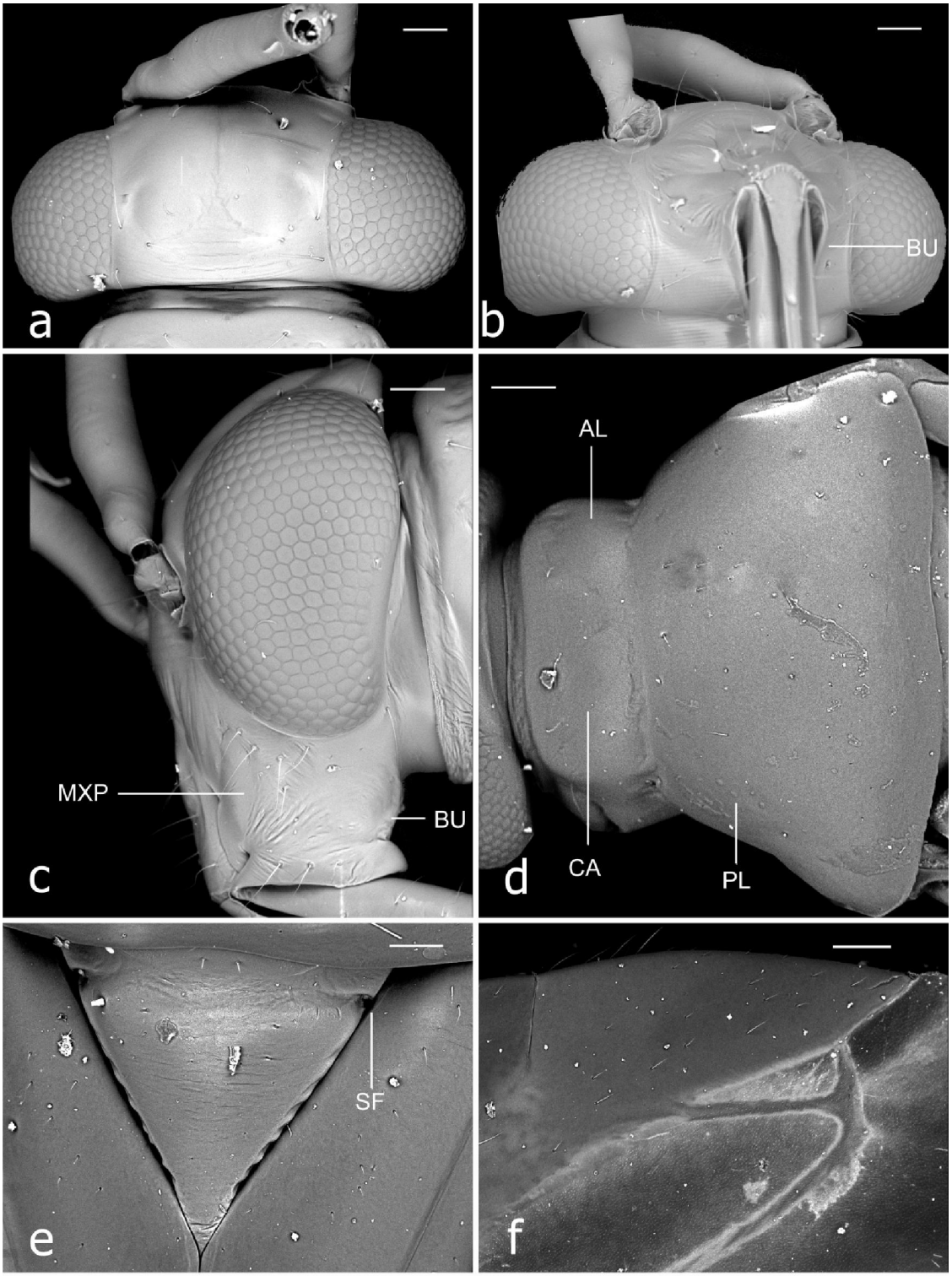


Figure 54: *Candidomiris clavatasclerita* a: Head, dorsal view, scale = 60µm. b: Head, ventral view, scale = 60µm. c: Head, lateral view, scale = 60µm. d: Pronotum, scale = 100µm. e: Scutellum, scale = 60µm. f: Cuneus, scale = 100µm. Abbreviation: AL: Anterior lobe, BU: Bucculae, CA: Calli, GU: Gula, MXP: Maxillary plate, PL: Posterior lobe, SF: Scutellum fovea.

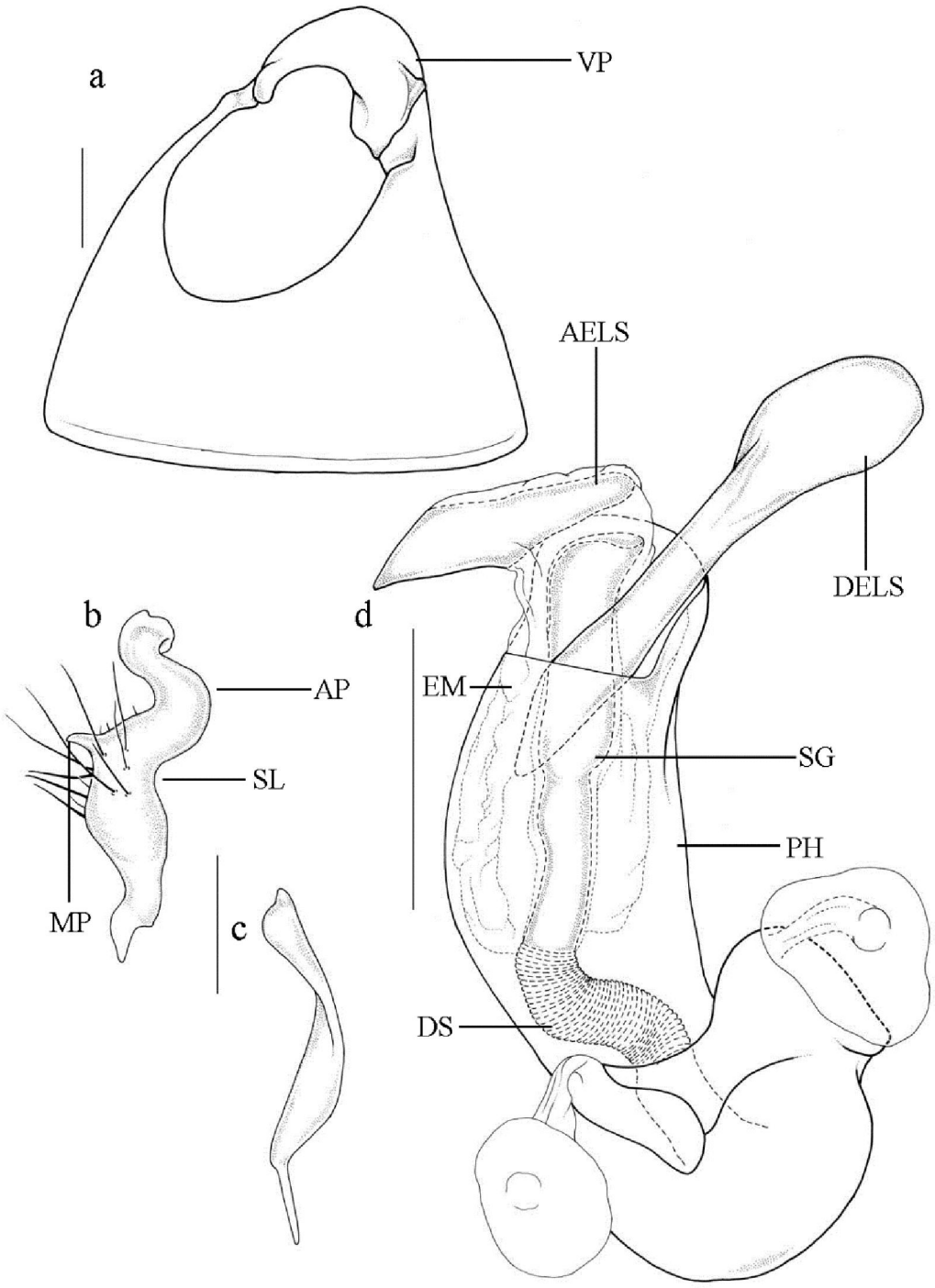


Figure 55: Male genitalia of *Candidomiris clavatasclerita*. a: Pygophore, dorsal view, scale = 0.1 mm. b: Left paramere, ventral view, scale = 0.1 mm. c: Right paramere, ventral view, d: Endosoma, ventral view, scale = 0.05 mm. Abbreviation: AELS: Apical endosomal sclerite, AP: Apophysis, DELS: Dorsal endosomal lobal sclerite, DS: Ductus seminis, MP: Medial process, PH: Phallotheca, SG: Secondary gonopore, SL: Sensory lobe, VP: Ventral process.

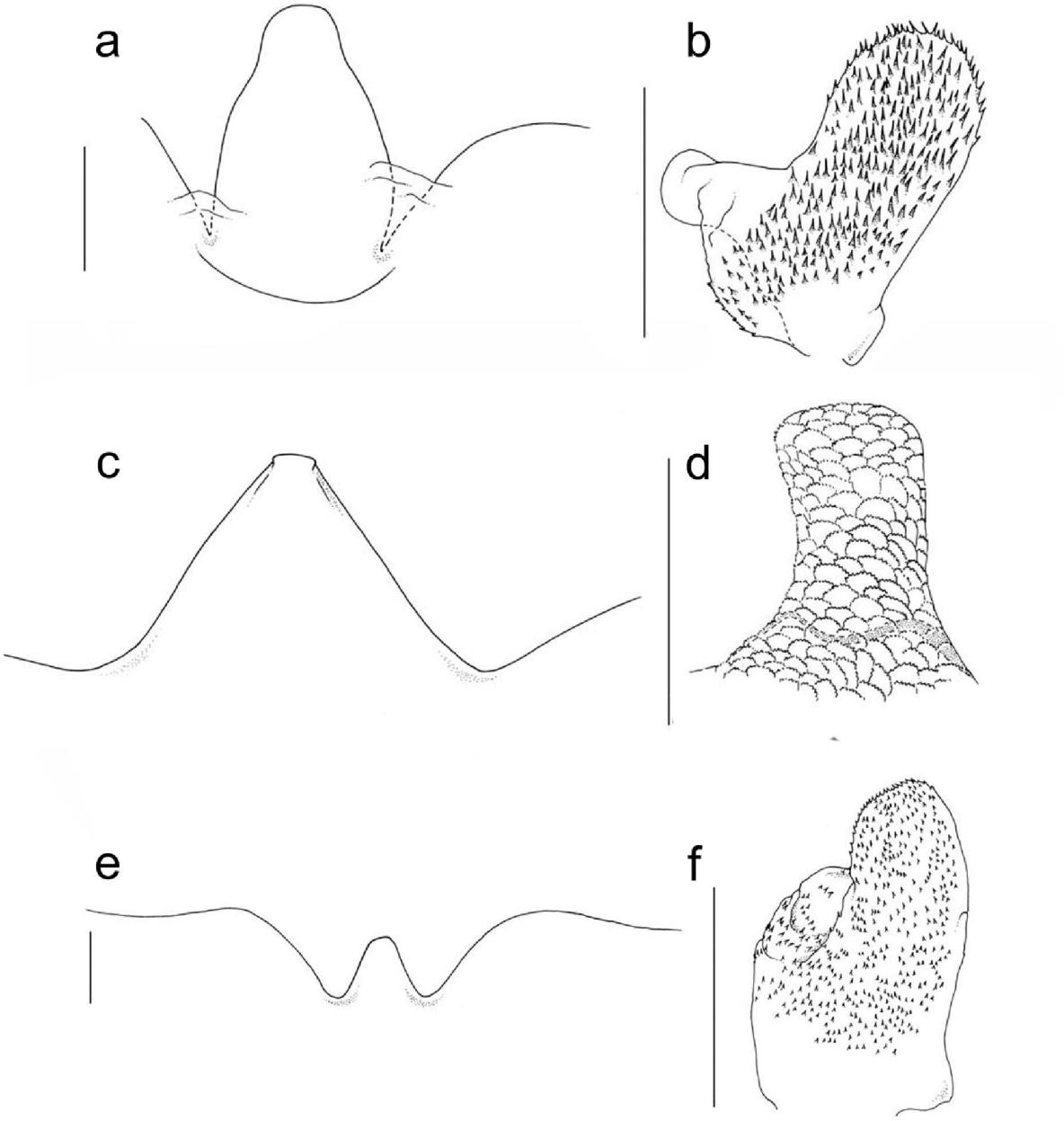


Figure 56: Female genitalia of *Candidomiris*. a: *Candidomiris clavatasclerita* subgenital plate, scale = 0.1mm. b: *Candidomiris clavatasclerita* inter-ramal lobe, scale = 0.1mm. c. *Candidomiris macropiper* subgenital plate, scale = 0.1mm. d. *Candidomiris macropiper* inter-ramal lobe, scale = 0.1mm. e. *Candidomiris parasponius* subgenital plate, scale = 0.1mm. f. *Candidomiris parasponius* inter-ramal lobe, scale = 0.1mm.

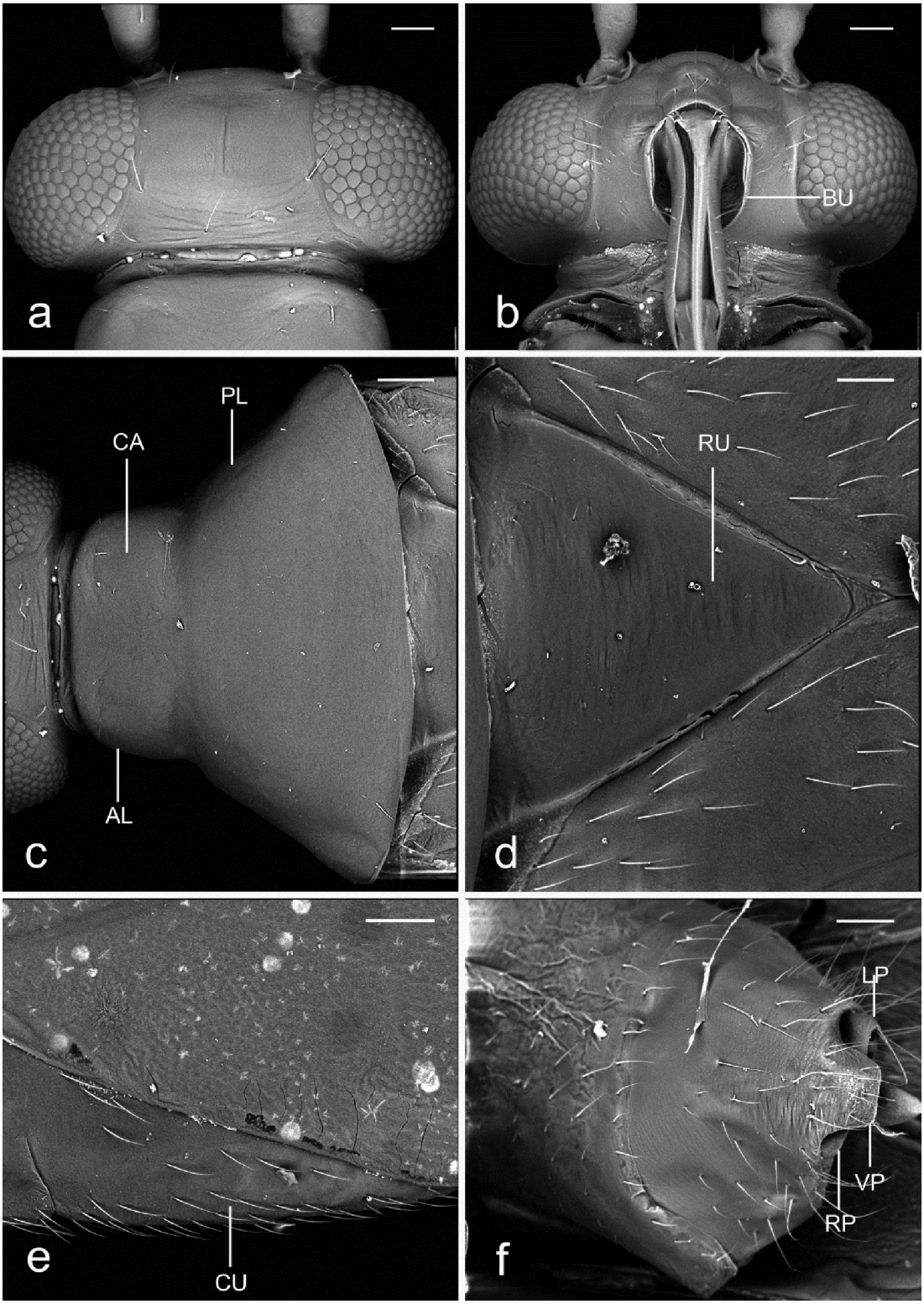


Figure 57: *Candidomiris macropiper* a: Head, dorsal view, scale = 60 b: Head, ventral view, scale = 60µm. c: Pronotum, scale = 100µm. d: Scutellum, scale = 60µm. e: Cuneus, scale = 100µm. f: Pygophore, scale = 100µm. Abbreviation: AL: Anterior lobe, Bu: Bucculae, CA: Calli, LP: Left Paramere, PL: Posterior lobe, RP: Right paramere, RU: Ruga, VH: Ventral Projection.

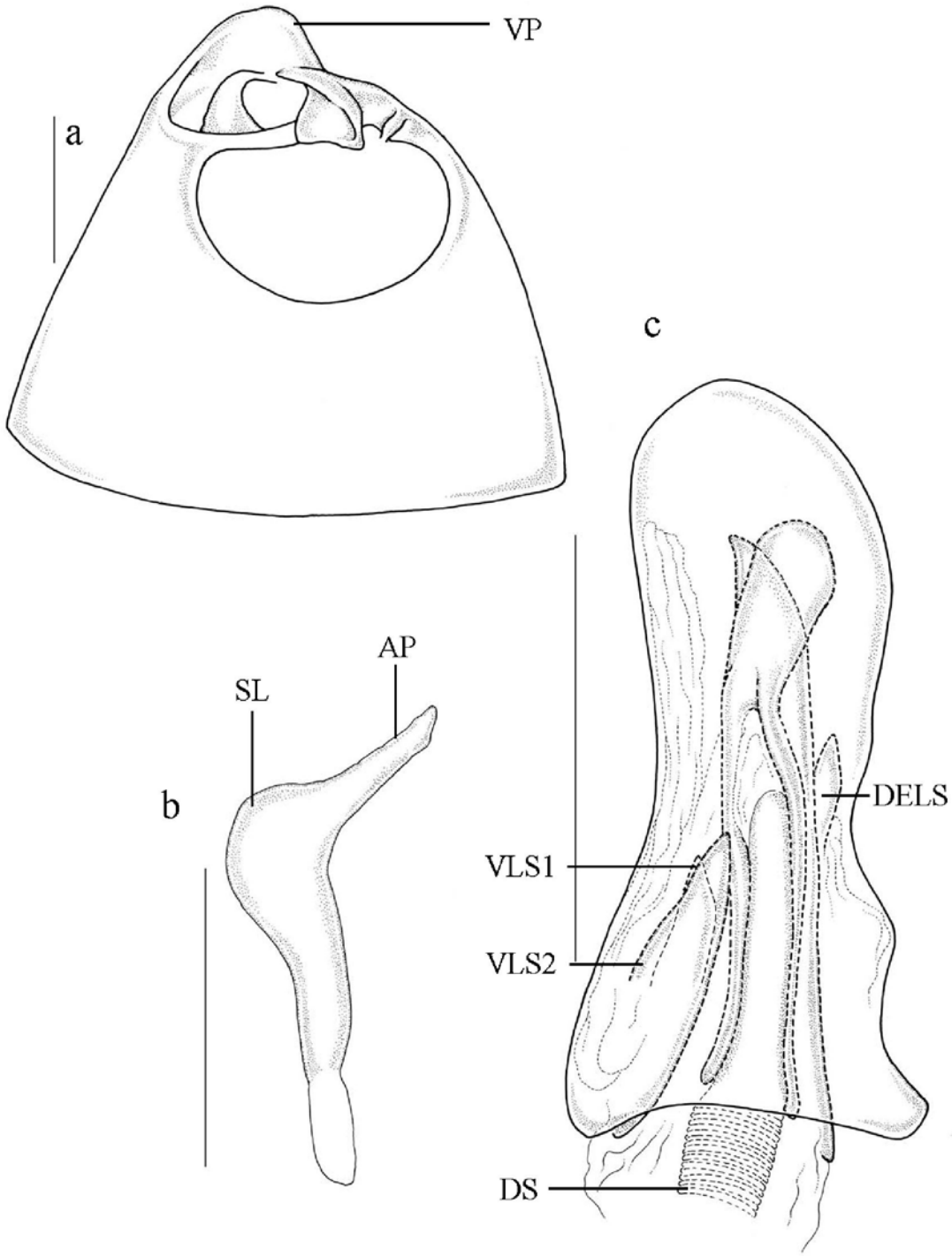


Figure 58: Male genitalia of *Candidomiris macropiper* a: Pygophore, dorsal view, scale = 0.1 mm. b: Left paramere, dorsal view, scale = 0.1 mm. c: Aedeagus, left lateral view, scale = 0.05 mm. Abbreviation: AP: Apophysis, DELS: Dorsal endosomal lobal sclerite, DS: Ductus seminis, LTP: Left tergal process, RPL: Right phallothecal lobe, SL: Sensory lobe, VLS1: Ventral lobal sclerite 1, VLS2: Ventral lobal sclerite 2, VP: Ventral process.

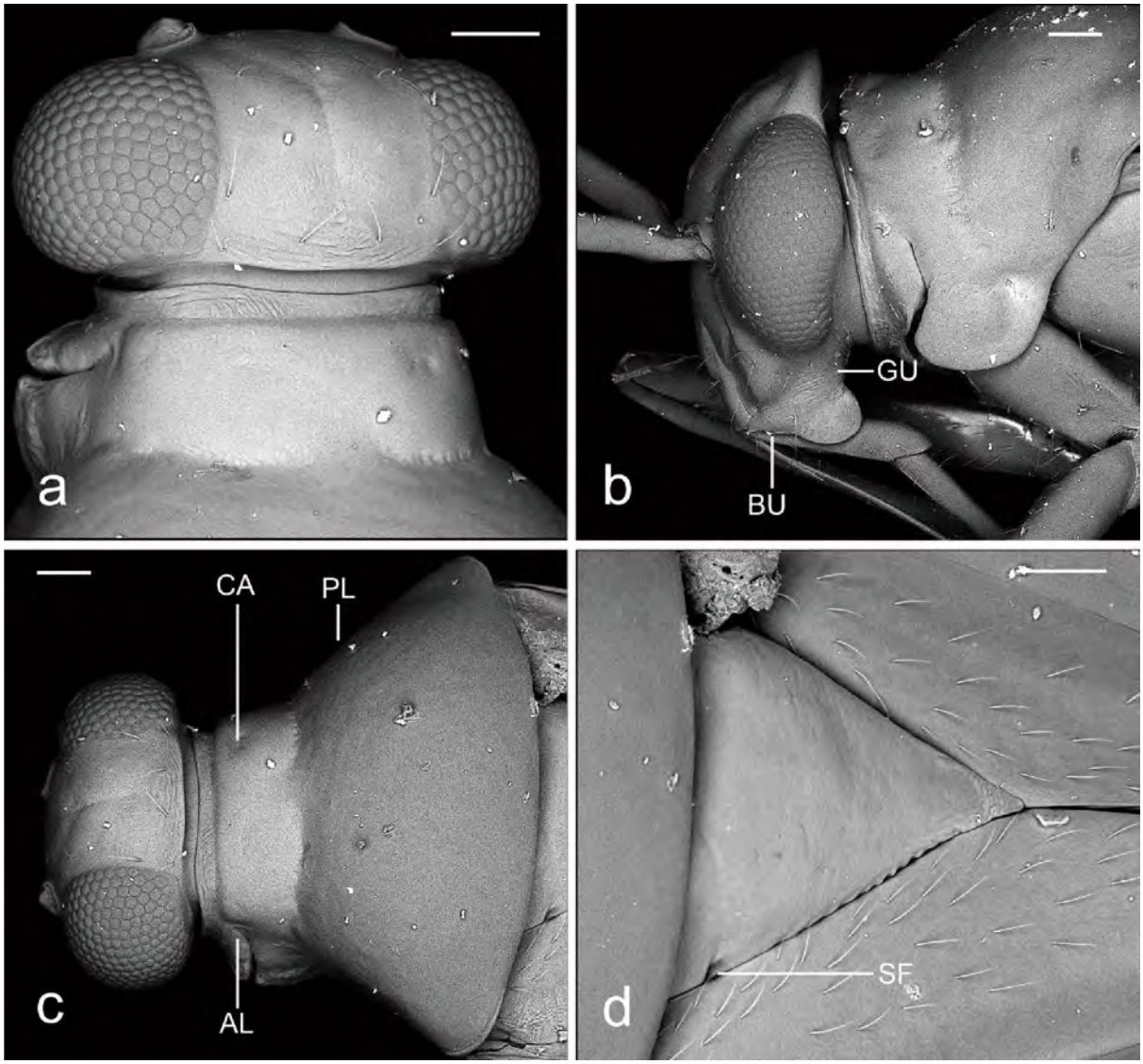


Figure 59: *Candidomiris missimensis* a: Head, dorsal view, scale = 100µm. b: Head, lateral view, scale = 100µm. c: Pronotum, scale = 100µm. d: Scutellum, scale = 100µm. Abbreviation: AL: Anterior lobe, BU: Bucculae, CA: Calli, GU: Gula, PL: Posterior lobe, SF: Scutellum foveae.

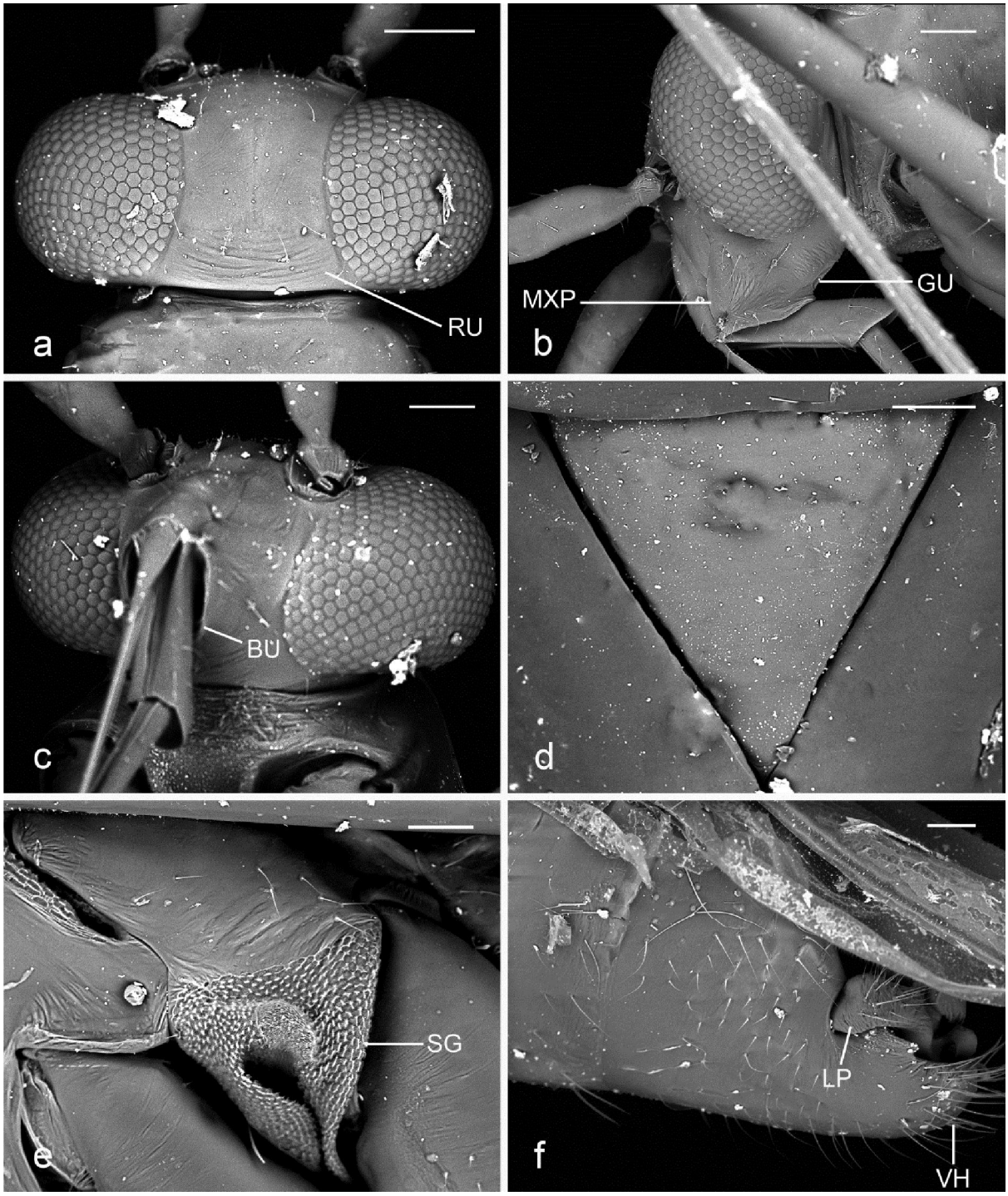


Figure 60: *Candidomiris parasponius* a: Head, dorsal view, scale = 100µm. b: Head, lateral view, scale = 100µm. c: Head, ventral view, scale = 100µm. d: Scutellum, scale = 100µm. e: Scent gland, scale = 60µm. f: Pygophore, lateral view, scale = 60µm. Abbreviation: BU: Bucculae, CA: Calli, GU: Gula, SG: scent gland, LP: Left paramere, MXP: Maxillary plate, RU: Ruga, VP: Ventral process.

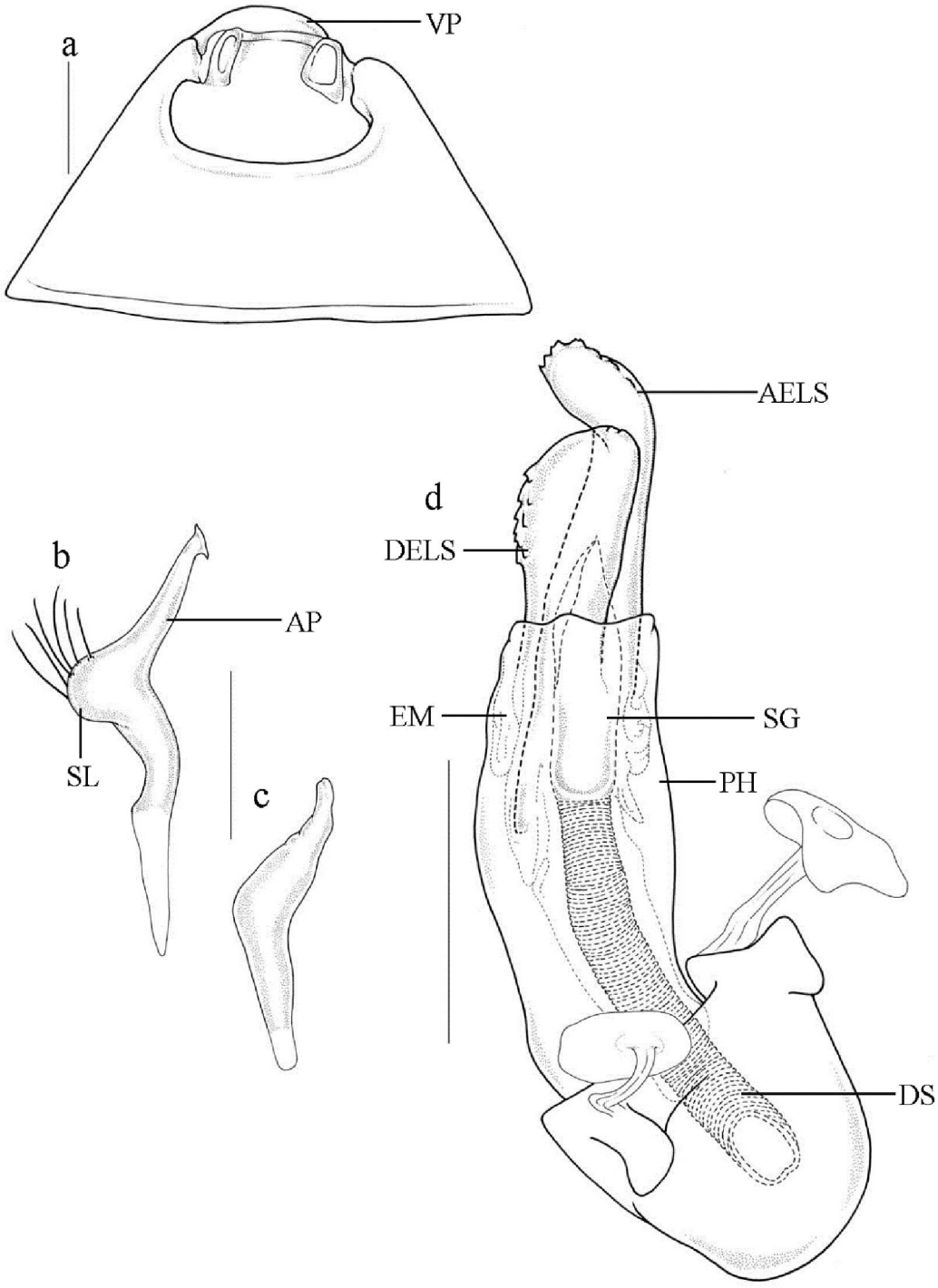


Figure 61: Male genitalia of *Candidomiris parasponius* a: Pygophore, dorsal view, scale = 0.1 mm. b: Left paramere ventral view, scale = 0.1 mm. c: Right paramere, ventral view, d: Aedeagus, dorsal view, scale = 0.05 mm. Abbreviation: AELS: Apical endosomal sclerite, AP: Apophysis, DELS: Dorsal endosomal lobal sclerite, DS: Ductus seminis, PH: Phallotheca, SG: Secondary gonopore, SL: Sensory lobe, VP: Ventral process.

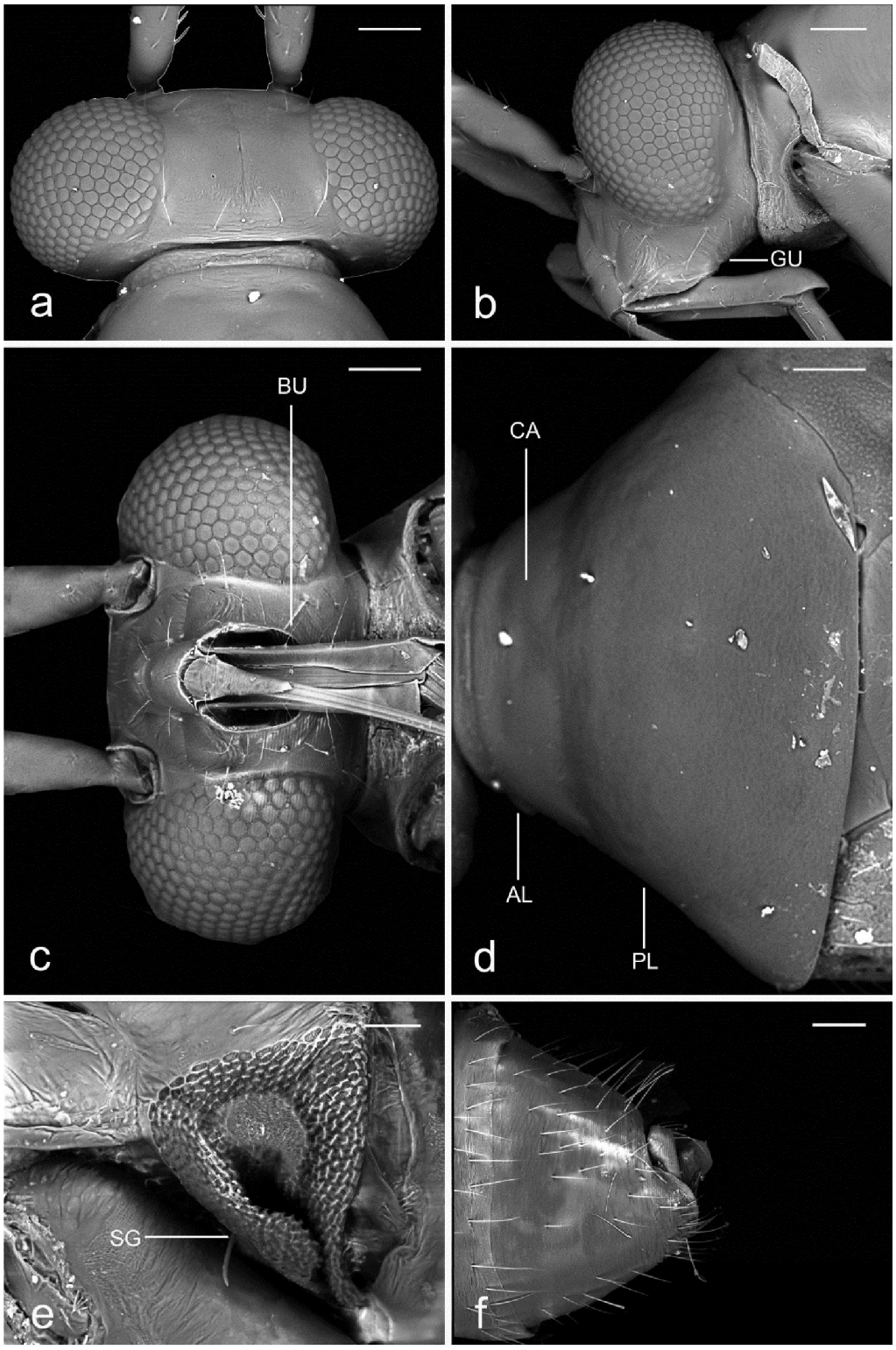


Figure 62: *Candidomiris sinuata* a: Head, dorsal view, scale = 100µm. b: Head, lateral view, scale = 100µm. c: Head, ventral view, scale = 100µm. d: Pronotum, scale = 100µm. e: Scent gland, scale = 40µm. f: Pygophore, scale = 100µm. Abbreviation: AL: Anterior lobe, Bu: Bucculae, CA: Calli, GU: Gula, PL: Posterior lobe, SG: Scent Gland.

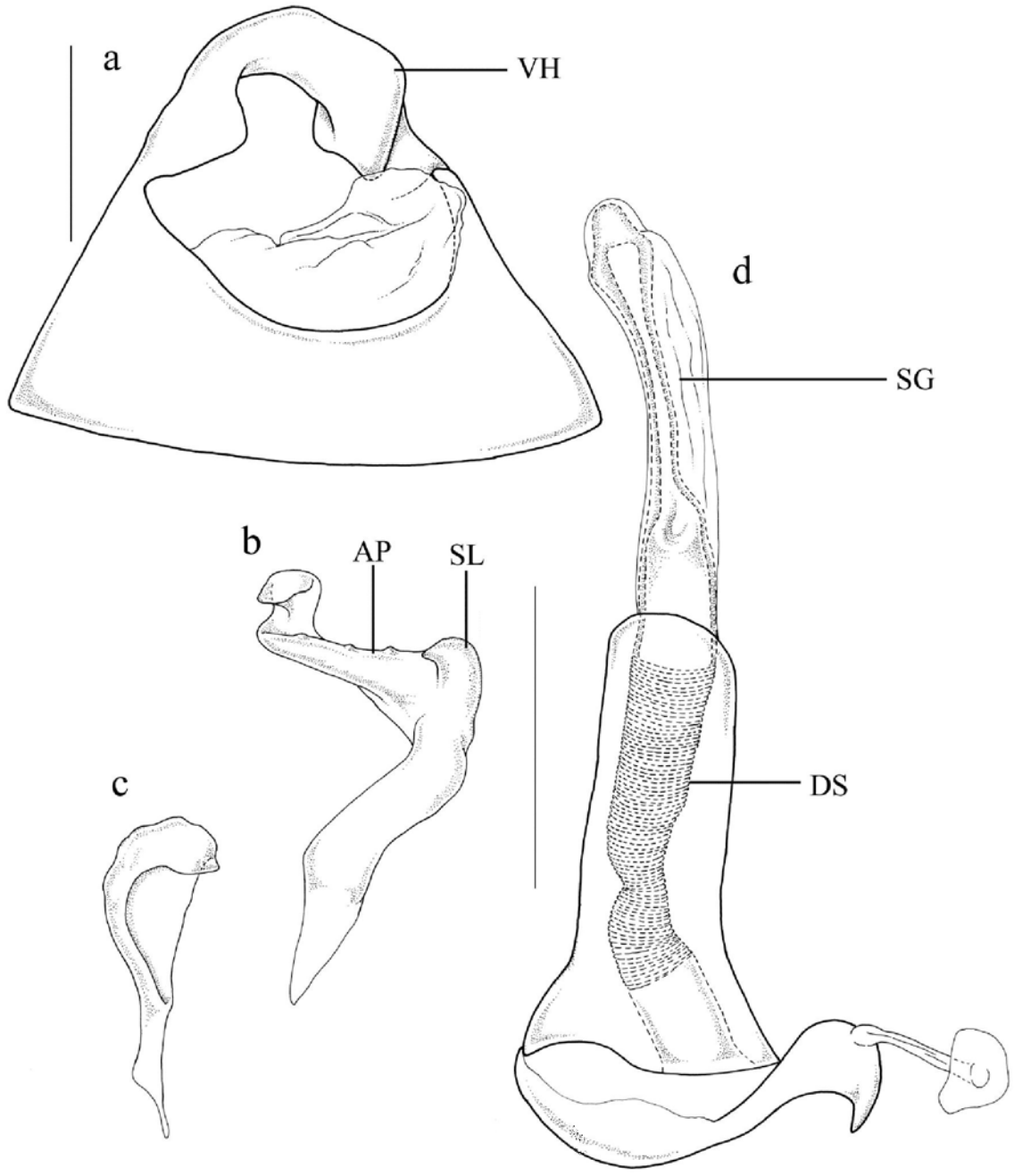


Figure 63: Male genitalia of *Candidomiris sinuata.* a: Pygophore, ventral view, scale = 0.5mm. b: Left paramere, ventral view, scale = 0.5mm. c: Right paramere, ventral view. d: Phallotheca, scale = 0.5 mm. Abbreviation: AP: Apophysis, DS: Ductus seminis, SG: Secondary gonopore, SL: Sensory lobe, VP: Ventral process.

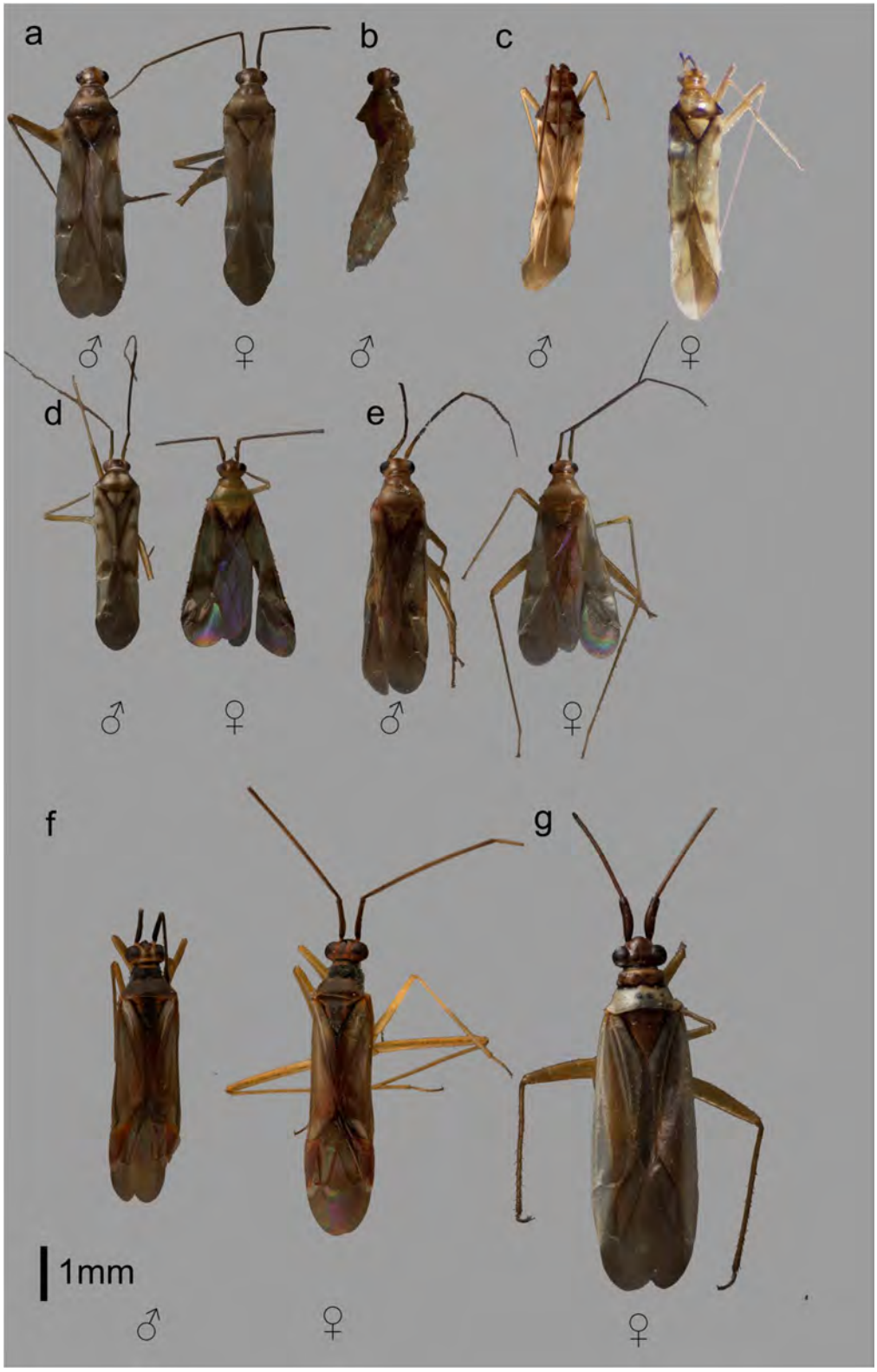


Figure 64: Habitus, *Dimifacoris, Flagellomiris*. a: *Dimifacoris bifurcatus*, b: *Dimifacoris fasciatus,* c: *Dimifacoris leva*, d: *Dimifacoris splendidus,* e: *Dimifacoris trifurcatus,* f: *Flagellomiris sinuatum,* g: *Flagellomiris tasmaniensis*.

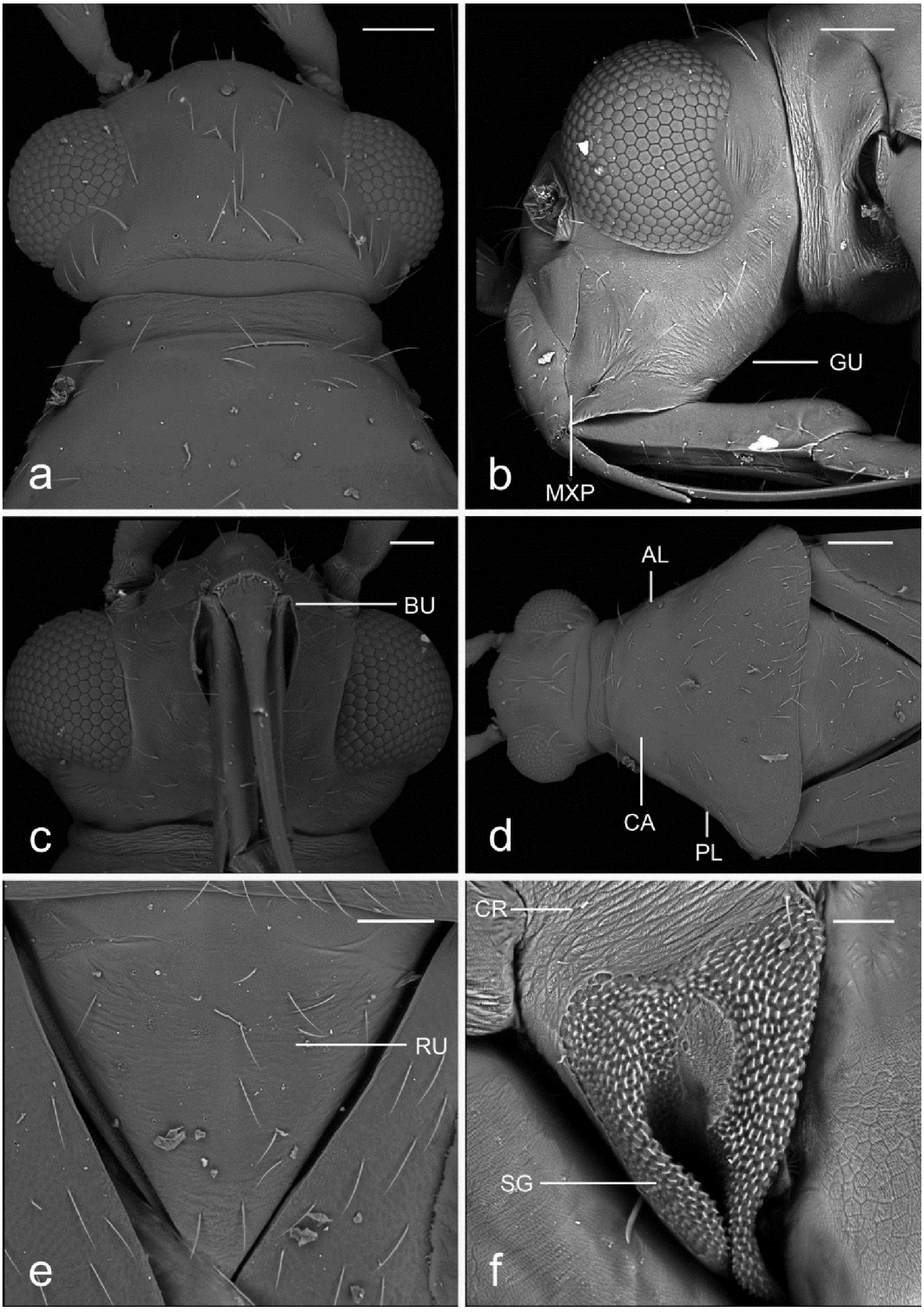


Figure 65: *Dimifacoris bifurcatus* a: Head, dorsal view, scale = 100µm. b: Head, lateral view, scale = 100µm. c: Head, ventral view, scale = 60µm. d: Pronotum, scale = 200µm. e: Scutellum, scale = 100µm. f: Scent gland, scale = 40µm. Abbreviation: AL: Anterior lobe, Bu: Bucculae, CA: Calli, CR: Cross vein ruga, GU: Gula, MXP: Maxillary plate, PL: Posterior lobe, RU: Ruga, SG: Scent gland.

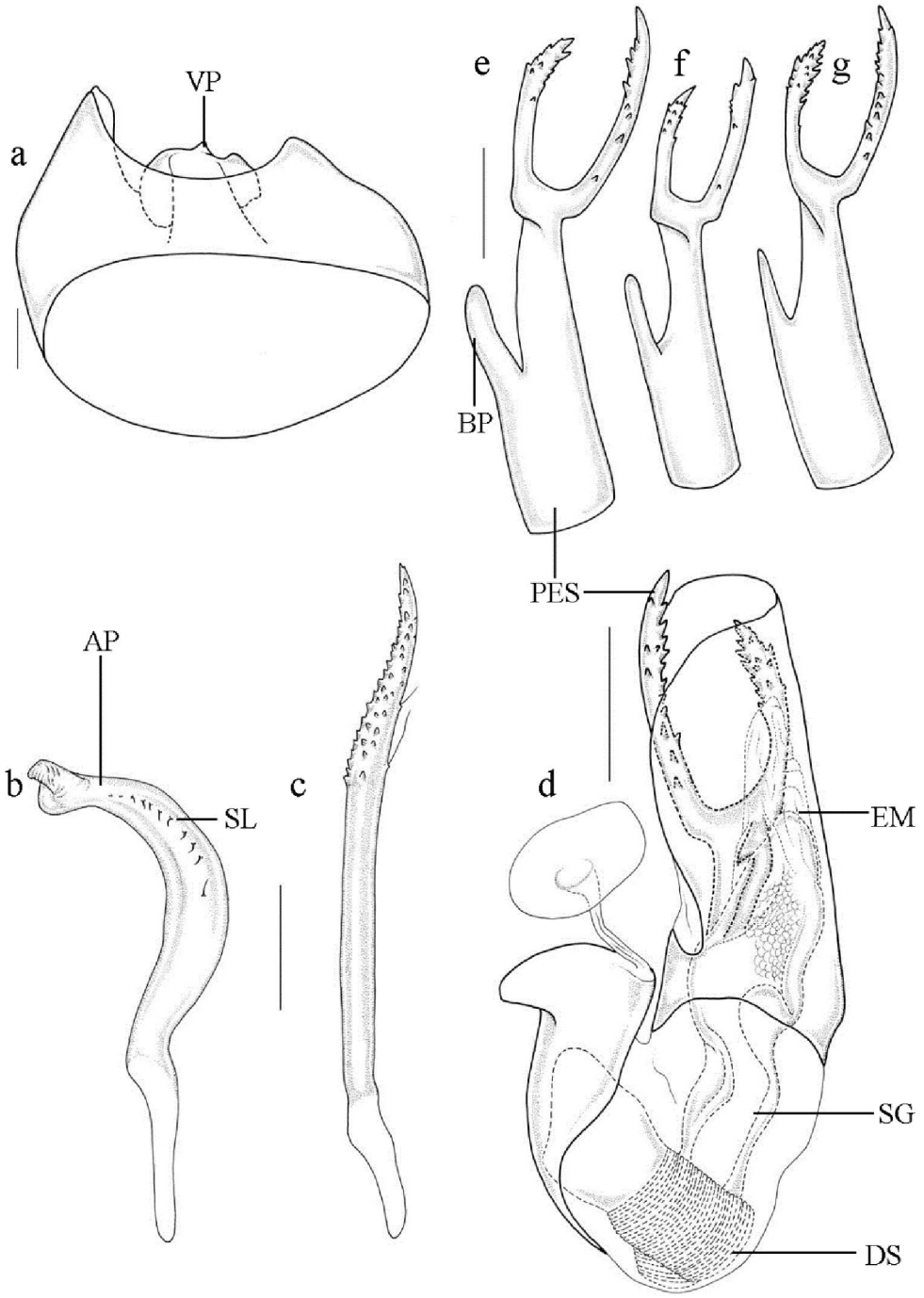


Figure 66: Male genitalia of *Dimifacoris bifurcatus* a: Pygophore, dorsal view, scale = 0.1 mm. b: Left paramere, ventral view, scale = 0.1 mm. c: Right paramere, ventral view. d: Endosoma, lateral view, scale = 0.05 mm. e-g: Dorsal endosomal lobal sclerites from various populations, right lateral view. Abbreviation: AP: Apophysis, BP: Basal process, DELS: Dorsal endosomal lobal sclerite, DS: Ductus seminis, EM: Endosomal membrane, PES: Proximal endosomal spicule, SG: Secondary gonopore, VP: Ventral process.

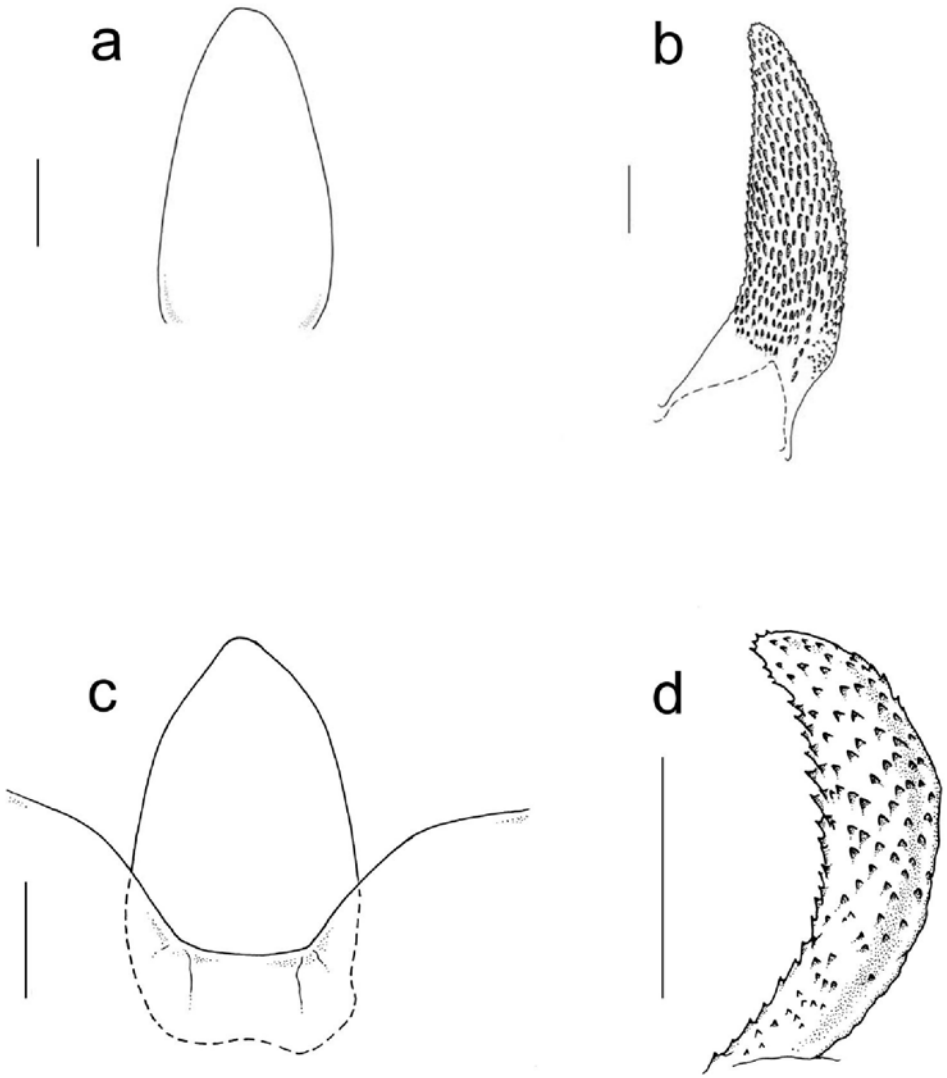


Figure 67: Female genitalia of *Dimifacoris*. a: *Dimifacoris bifurcatus* subgenital plate, scale = 0.1 mm. b: *Dimifacoris bifurcatus* inter-ramal lobe, scale = 0.1 mm. c: *Dimifacoris leva* subgenital plate, scale = 0.1 mm. d: *Dimifacoris leva* inter-ramal lobe, scale = 0.1 mm.

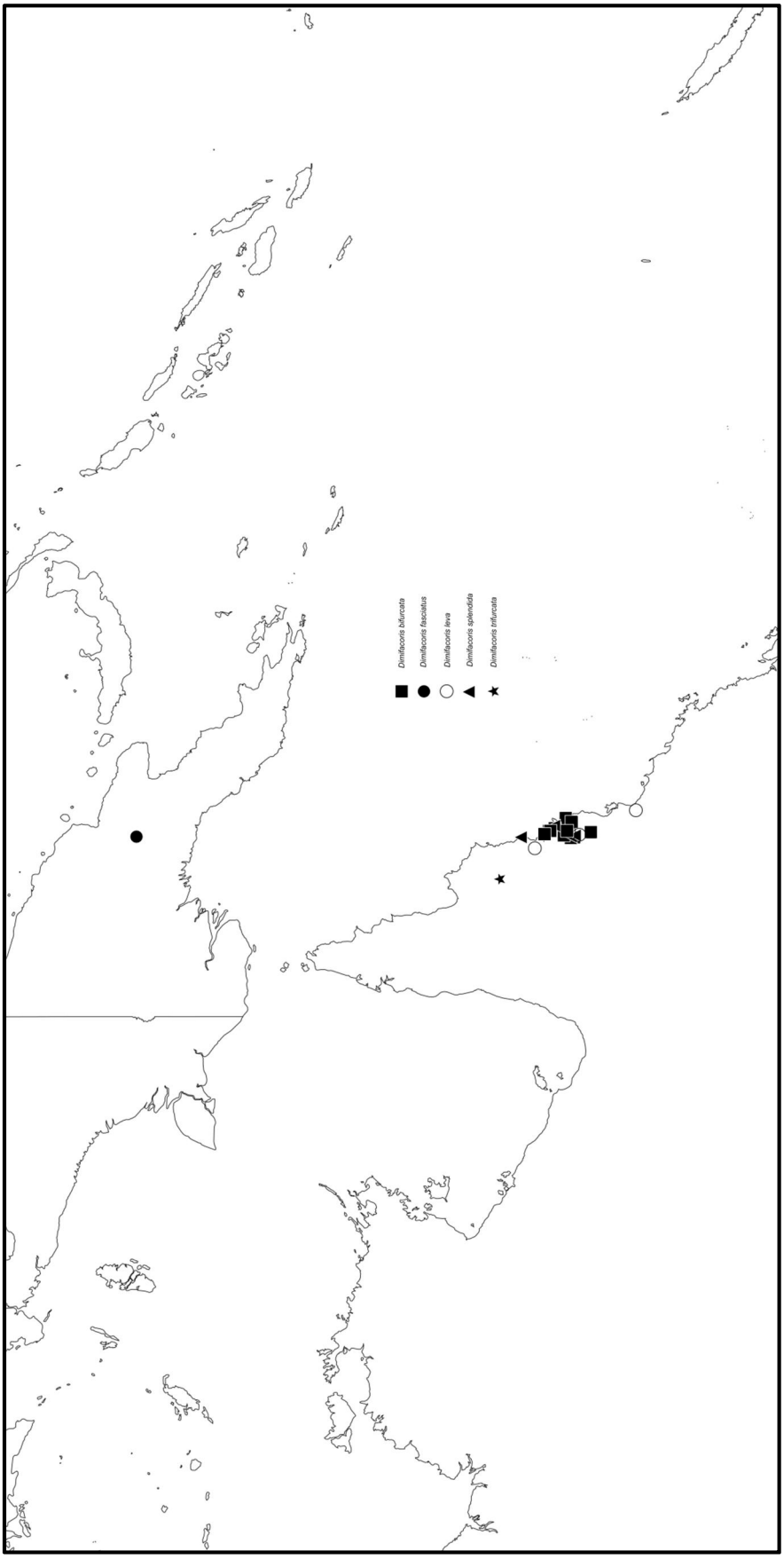


Figure 68: Distribution map of *Dimifacoris*

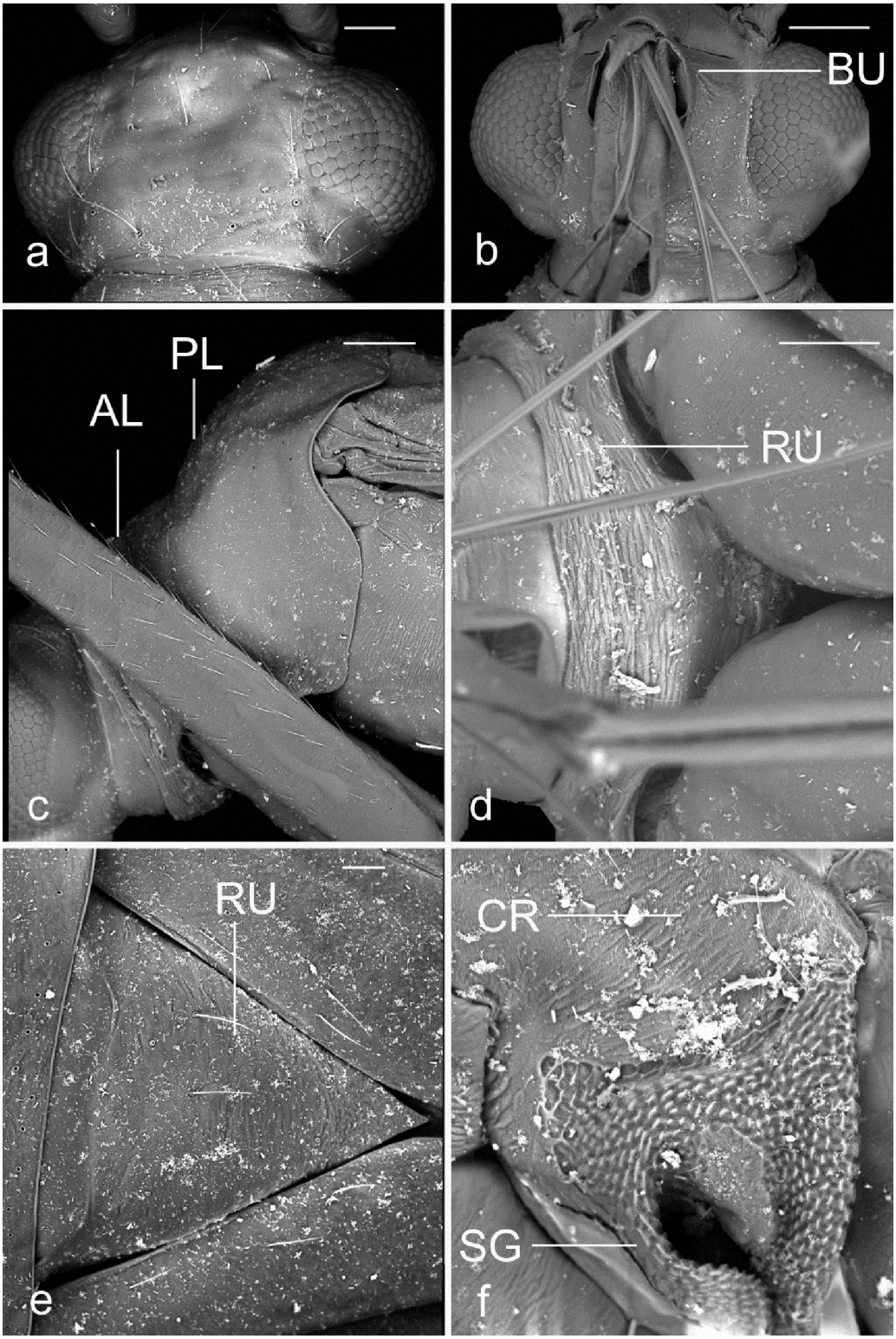


Figure 69: *Dimifacoris leva.* a: Head, dorsal view, scale = 60µm. b: Head, ventral view, scale = 60µm. c: Pronotal topology, lateral view, scale = 100µm. d: Proxyphus, scale = 60µm. e: Scutellum, scale = 60µm. f: Scent gland, scale = 20µm. Abbreviation: AL: Anterior lobe, Bu: Bucculae, CR: Cross Vein Ruga, PL: Posterior lobe, RU: Ruga, SG: Scent Gland.

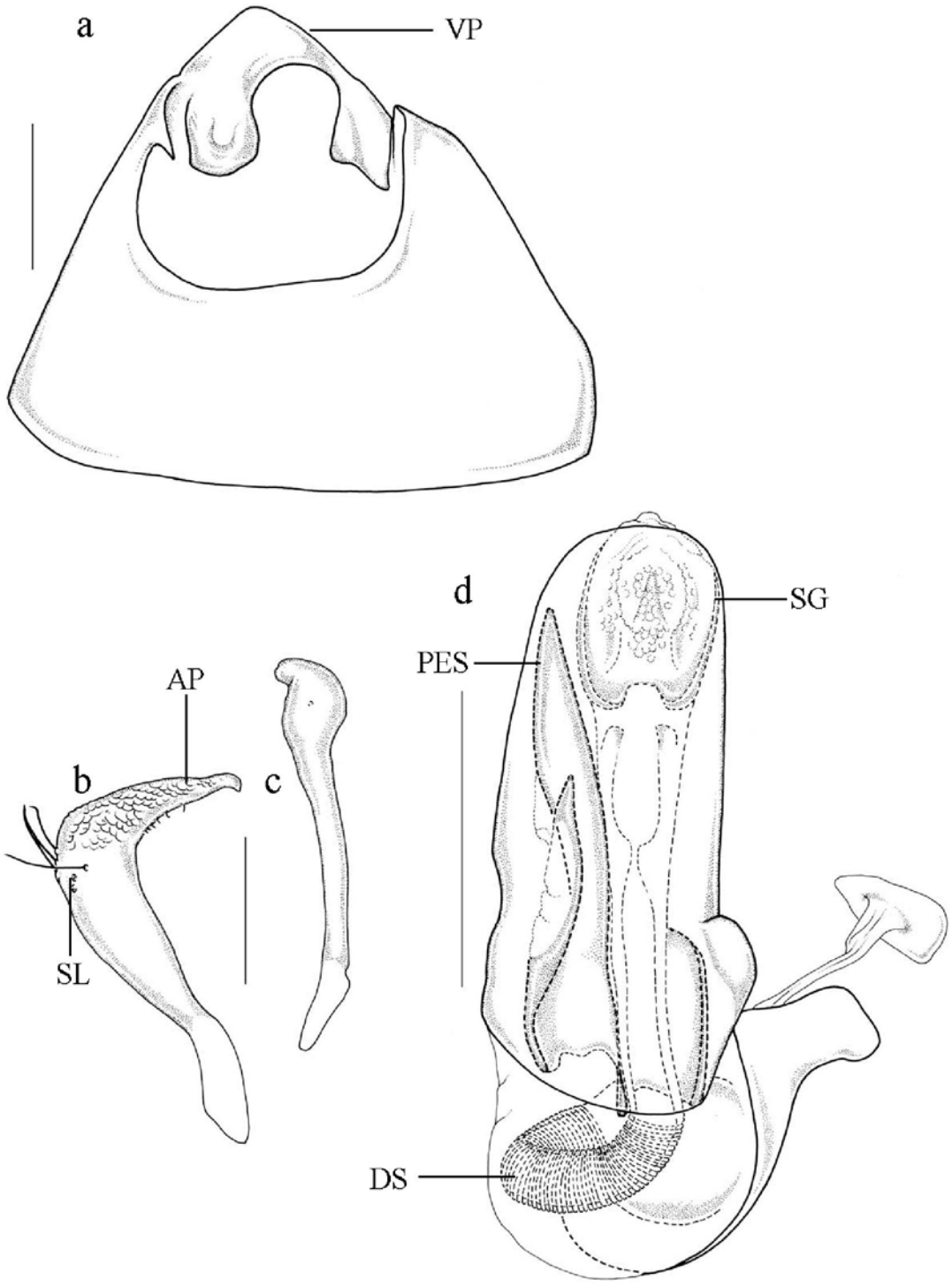


Figure 70: Male genitalia of *Dimifacoris leva* a: Pygophore, dorsal view, scale = 0.1 mm. b: Left paramere, ventral view, scale = 0.1 mm. c: Right paramere, ventral view. d: Aedeagus, Right lateral view scale = 0.05 mm. Abbreviation: AP: Apophysis, DS: Ductus seminis, SG: Secondary gonopore, PES: Proximal endosomal spicule SL: Sensory lobe, VP: Ventral process.

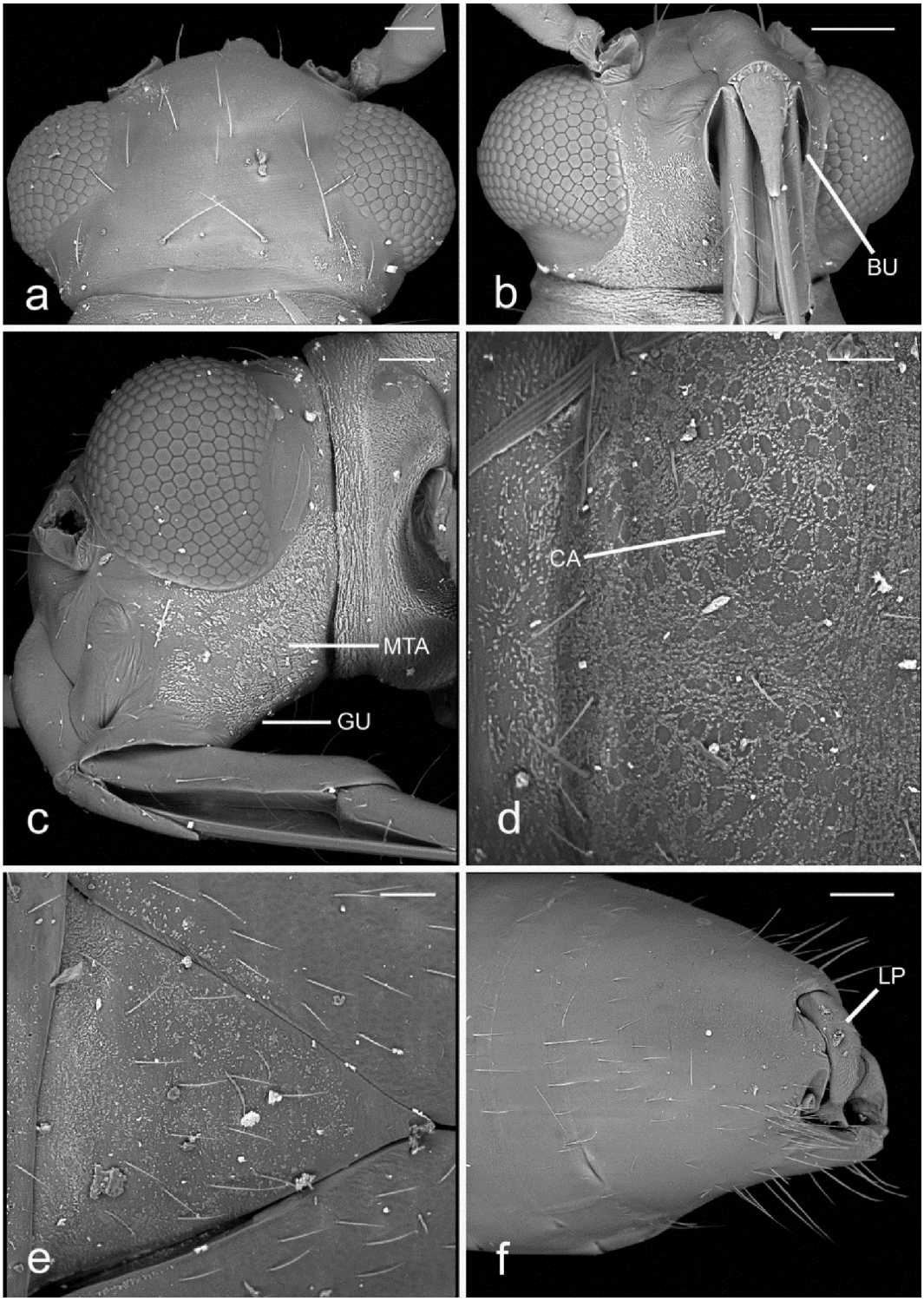


Figure 71: *Dimifacoris splendidus*. a: Head, dorsal view, scale = 100µm. b: Head, lateral view, scale = 100µm. c: Head, lateral view, scale = 100µm. d: Calli, scale = 60µm. e: Scutellum, scale = 60µm. f: Cuneus, scale = 100µm. Abbreviation: AL: Anterior lobe, CA: Calli, CR: Cross Vein Ruga, CU: Cuneus, GU: Gula, MTA: Microtrichia, PL: Posterior lobe, SG: Scent Gland.

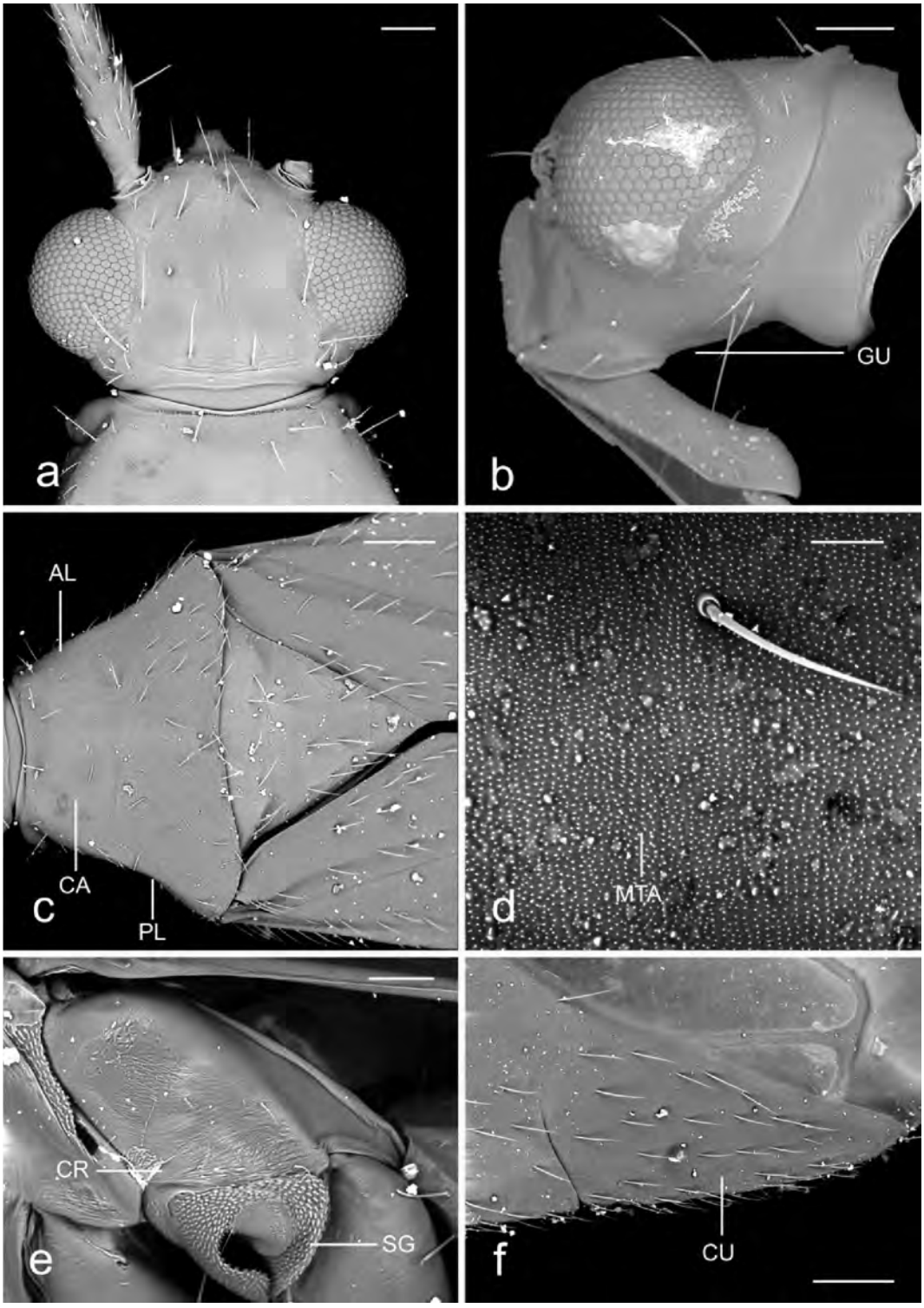


Figure 72: *Dimifacoris trifurcatus* a: Head, dorsal view, scale = 60µm. b: Head, lateral view, scale = 60µm. c: Pronotum, scale = 100µm. d: Microtrichia, scale = 20µm. e: Scent gland, scale = 60µm. g: Cuneus, scale = 20µm. Abbreviation: AL: Anterior lobe, Bu: Bucculae, CA: Calli, CR: Cross Vein Ruga, PL: Posterior lobe, RU: Ruga, SG: Scent gland.

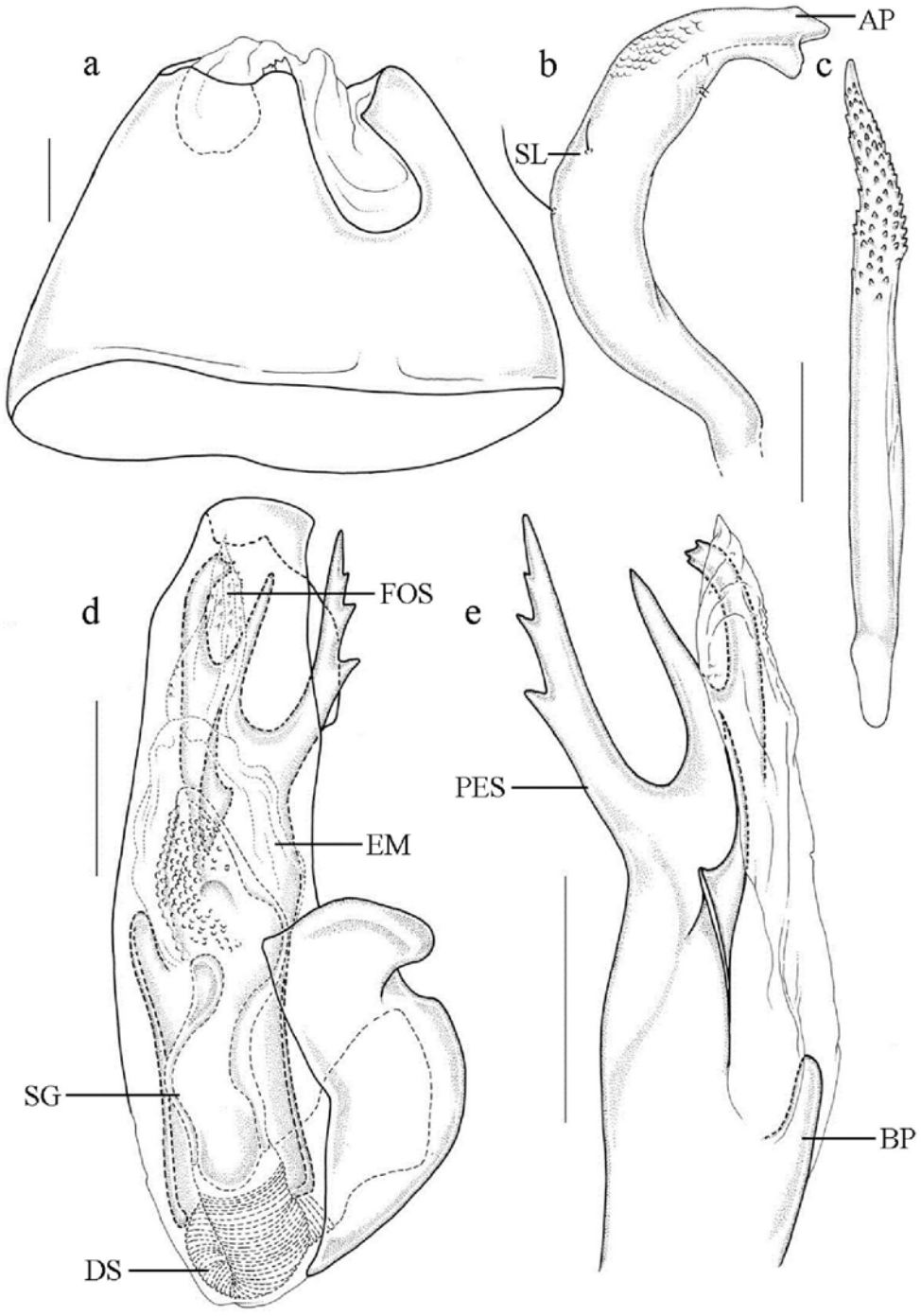


Figure 73: Male genitalia of *Dimifacoris trifurcatus* a: Pygophore, lateral view, scale = 0.1 mm. b: Left paramere, ventral view, scale = 0.1 mm. c: Right paramere, ventral view. d: Aedeagus, right lateral view, scale = 0.05 mm. e: Proximal endosomal spicule, left lateral view, scale = 0.025. Abbreviation: AP: Apophysis, BP: Basal process, DS: Ductus seminis, EM: Endosomal membrane, FOS: Field of spinules, PES: Proximal endosomal spicule, DS: Ductus seminis, SG: Secondary gonopore, SL: Sensory lobe.

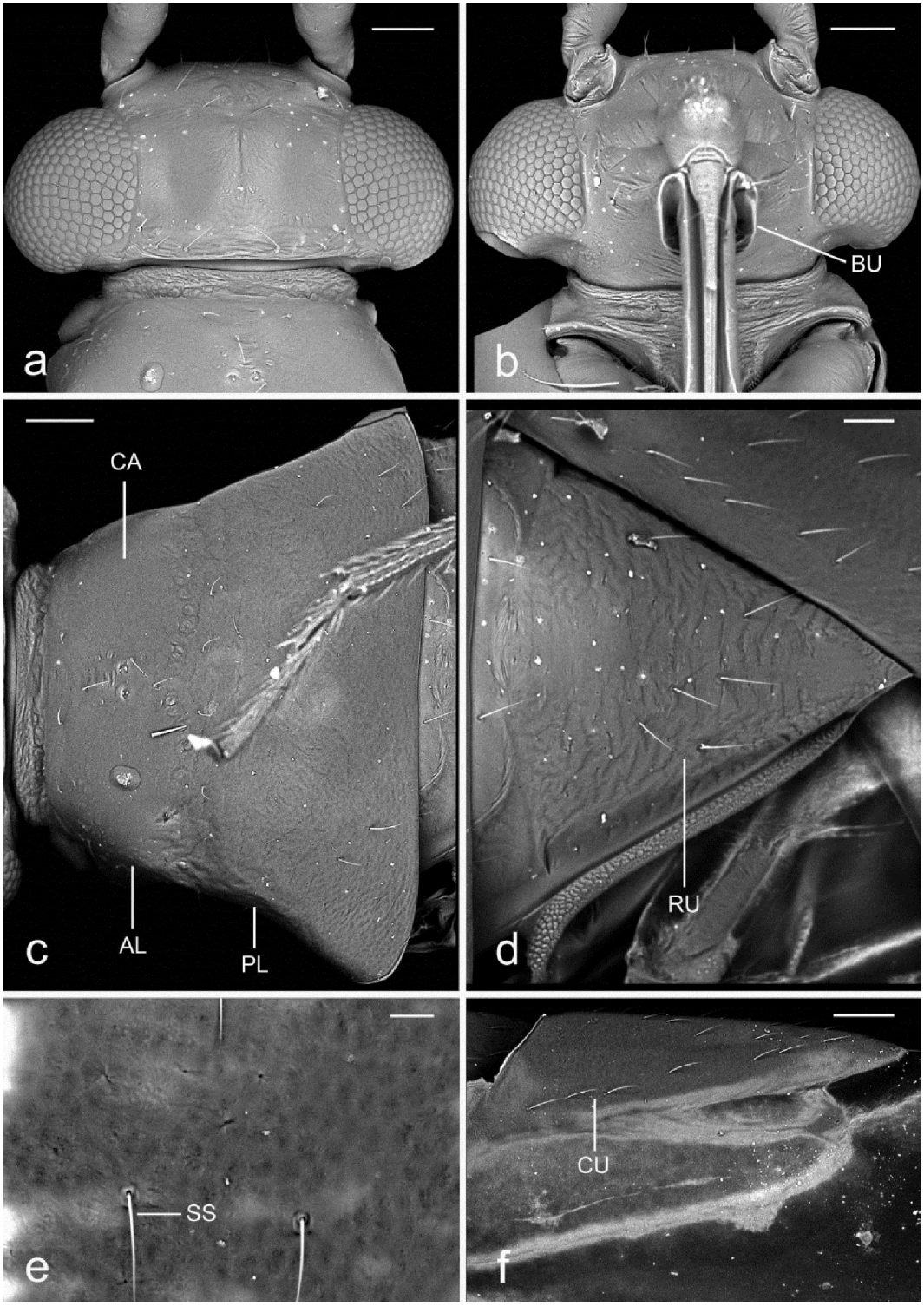


Figure 74: *Elongatoductus walli* a: Head, dorsal view, scale = 100µm. b: Head, ventral view, scale = 100µm. c: Pronotum, scale = 100µm. d: Scutellum, scale = 100µm. e: Smooth hemelytron, scale = 20µm. f: Cuneus, scale = 100µm. Abbreviation: AL: Anterior lobe, BU: Bucculae, CA: Calli, CU: Cuneus, PL: Posterior lobe, RU: Ruga, SE: Setae.

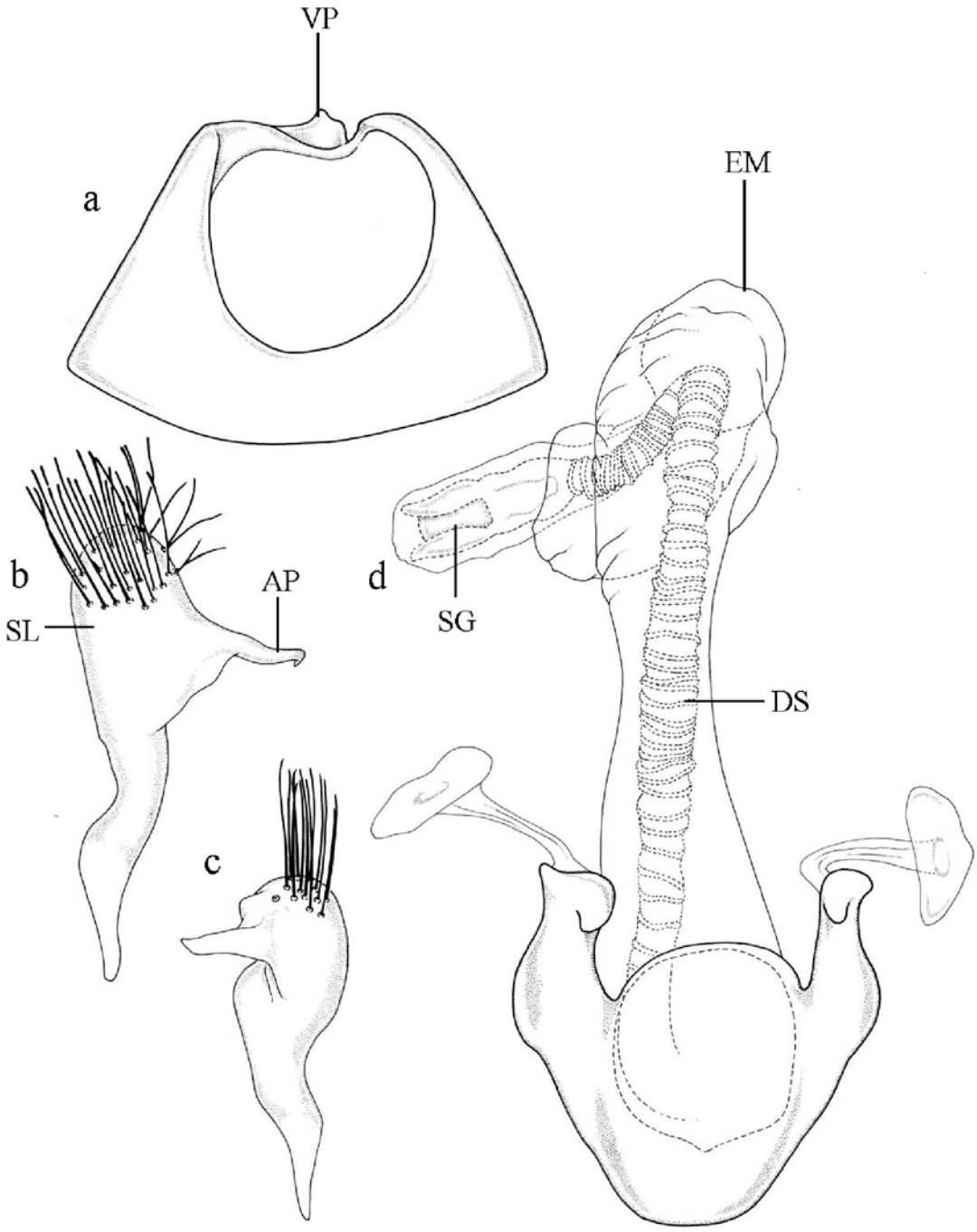


Figure 75: Male genitalia of *Elongatoductus walli* a: Pygophore, dorsal view, scale = 0.1 mm. b: Left paramere, ventral view, scale = 0.1 mm. c: Right paramere, ventral view. d: Aedeagus, dorsal view, scale = 0.05 mm. Abbreviation: AELS: Apical endosomal sclerite, AP: Apophysis, DS: Ductus seminis, EM: Endosomal membrane, SG: Secondary gonopore, SL: Sensory lobe, VP: Ventral process.

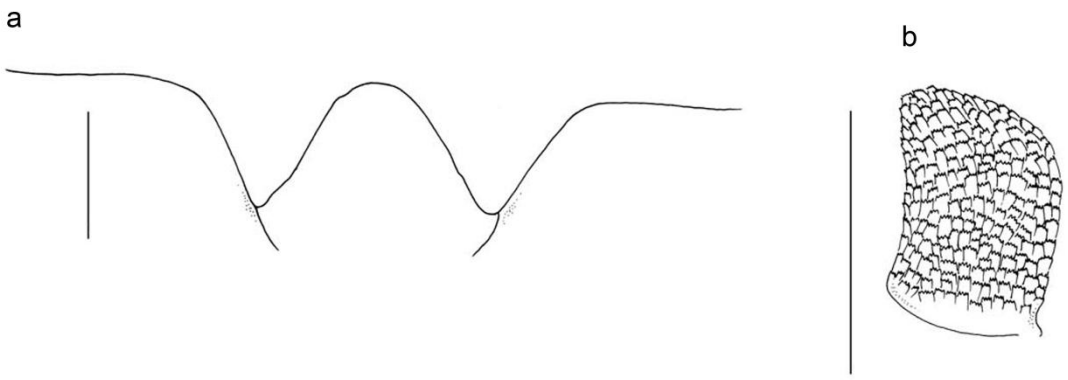


Figure 76: Female genitalia of *Elongatoductus* a. *Elongatoductus walli* subgenital plate, scale = 0.1 mm. b. *Elongatoductus walli* inter-ramal lobe, scale = 0.1 mm.

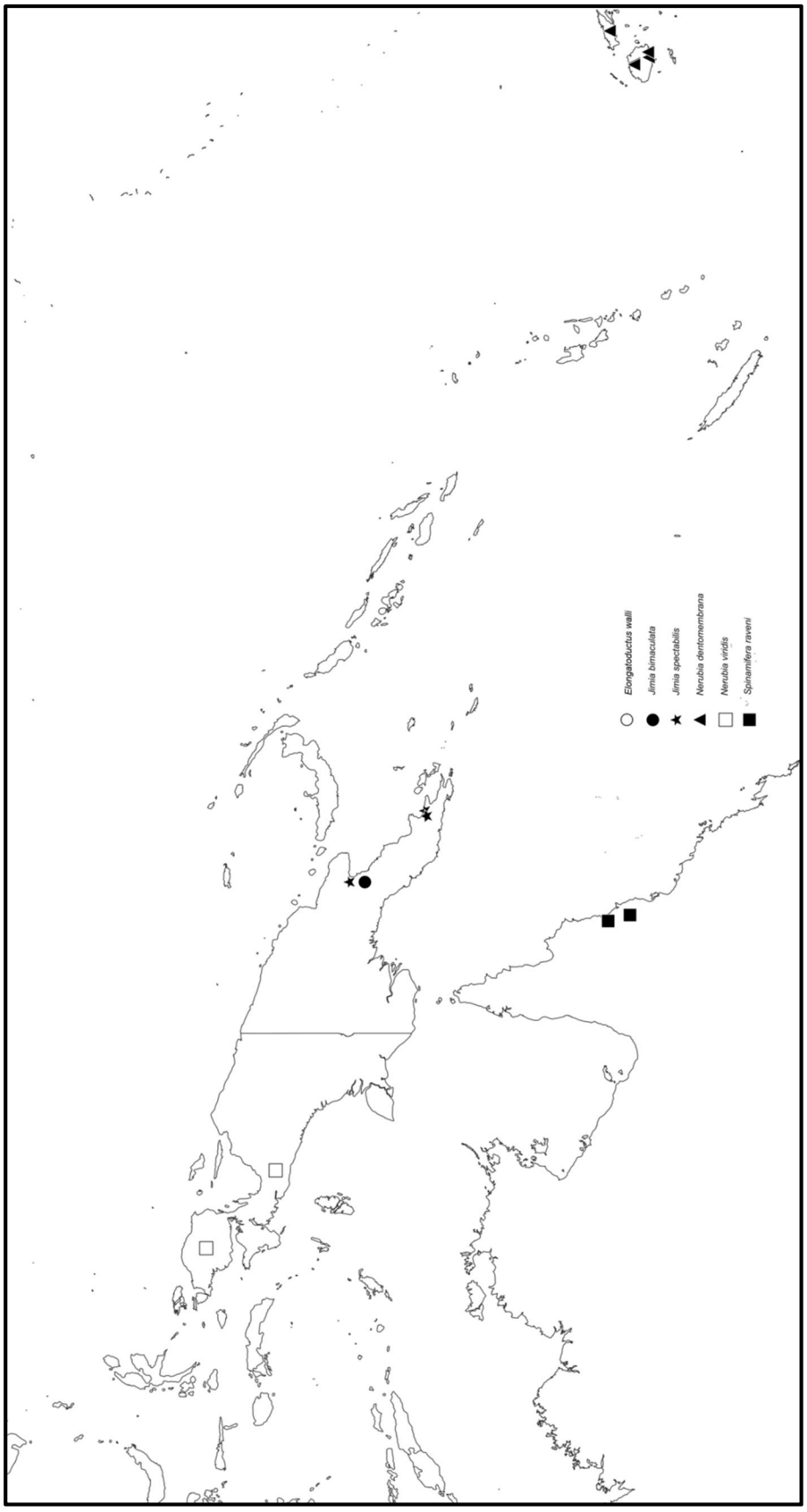


Figure 77: Distribution of *Elongatoductus, Jimia, Nerubia* and *Spinamifera.*

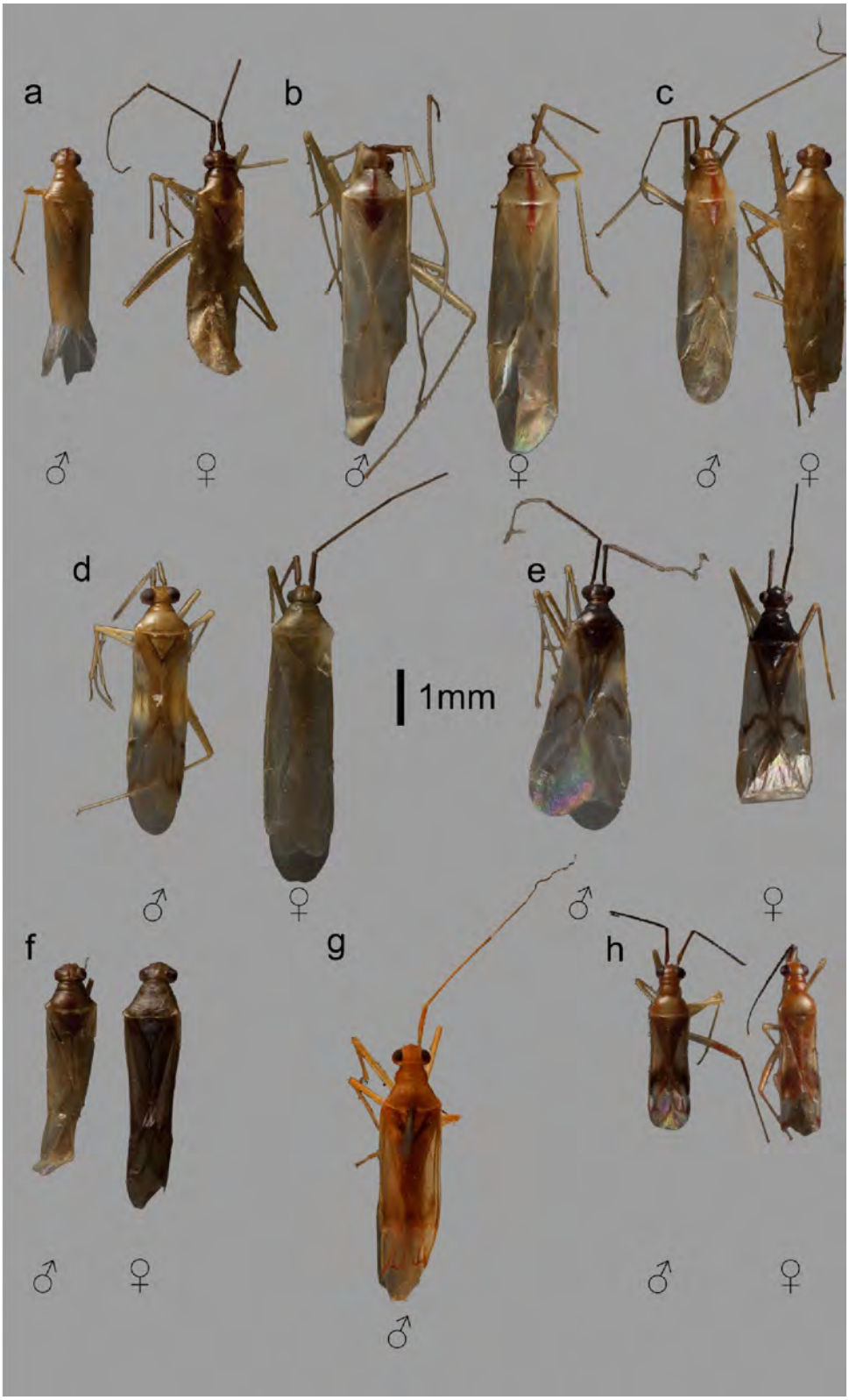


Figure 78: Habitus, *Falcum, Saggitacopula* and *Tudoris*. a: *Falcum austerum*, b: *Falcum bulldogensis*, c: *Falcum gagnei*, d: *Falcum kaindiensis*, e: *Falcum taiwanensis*, f: *Saggitacopula carvalhoi*, g: *Saggitacopula rufescens*, h: *Tudoris solomonensis.*

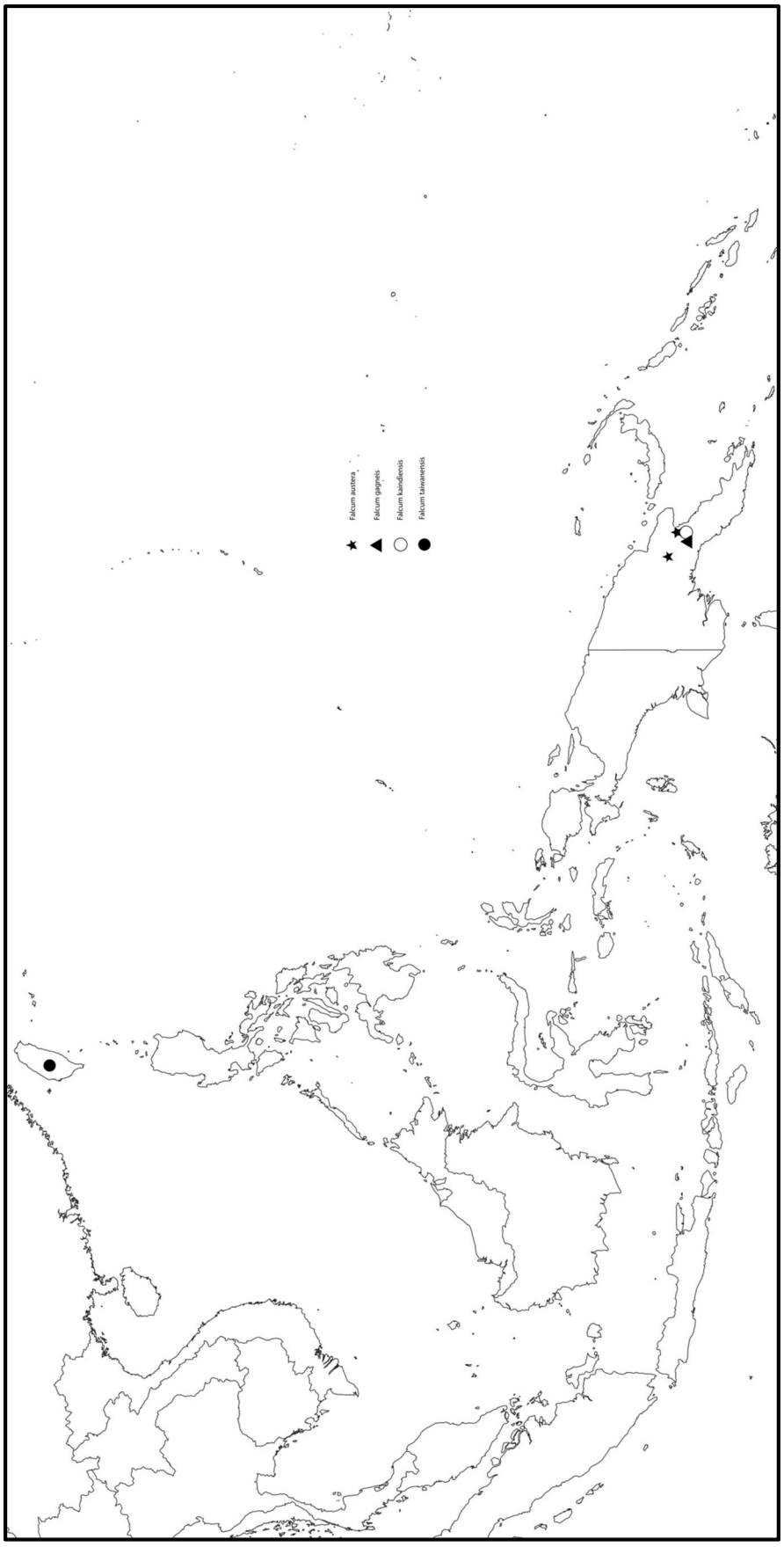


Figure 79: Distribution map of *Falcum*

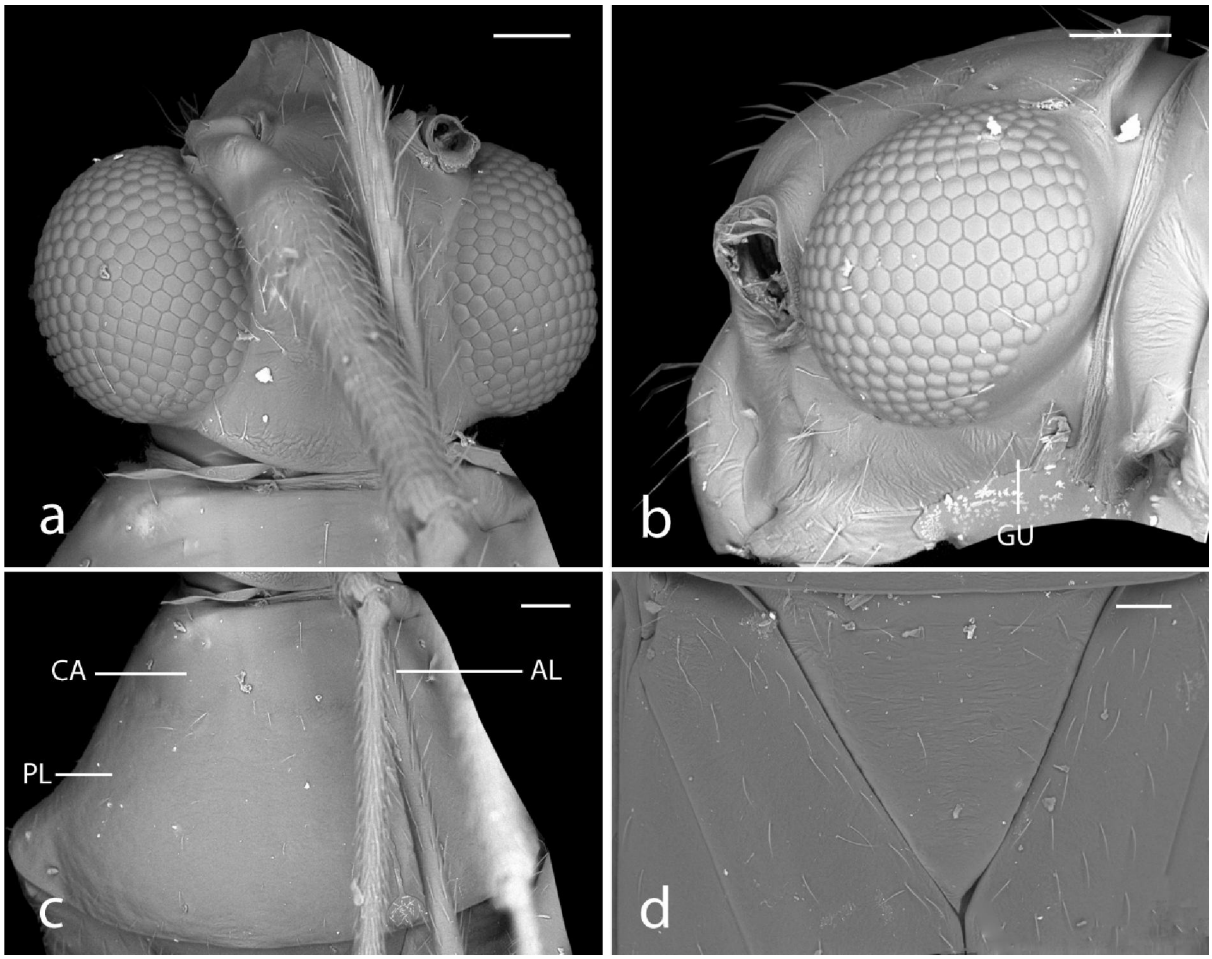


Figure 80: *Falcum bulldogensis* a: Head, dorsal view, scale = 100µm. b: Head, lateral view, scale = 100µm. c: Pronotum, scale = 100µm. d: Scutellum, scale = 100µm. Abbreviation: AL: Anterior lobe, CA: Calli, GU: Gula, PL: Posterior lobe.

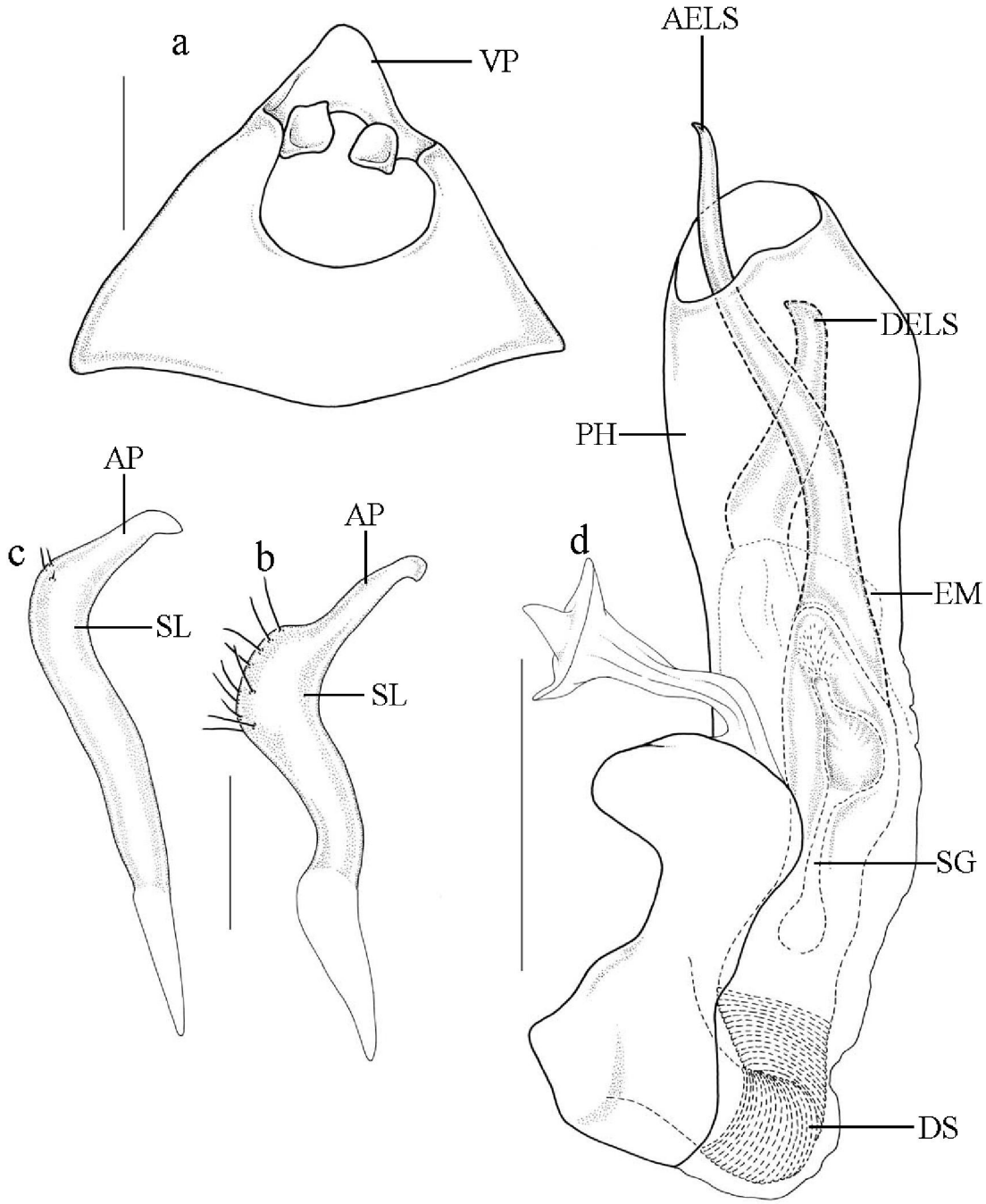


Figure 81: Male genitalia of *Falcum bulldogensis* a: Pygophore, dorsal view, scale = 0.1 mm. b: Left paramere, ventral view, scale = 0.1 mm. c: Right paramere, ventral view. d: Aedeagus, dorsal view, scale = 0.05 mm. Abbreviation: AELS: Apical endosomal lobal sclerite, AP: Apophysis, DELS: Dorsal endosomal lobal sclerite, DS: Ductus seminis, EM: Endosomal membrane, PH: Phallotheca, SG: Secondary gonopore, SL: Sensory lobe, VP: Ventral process.

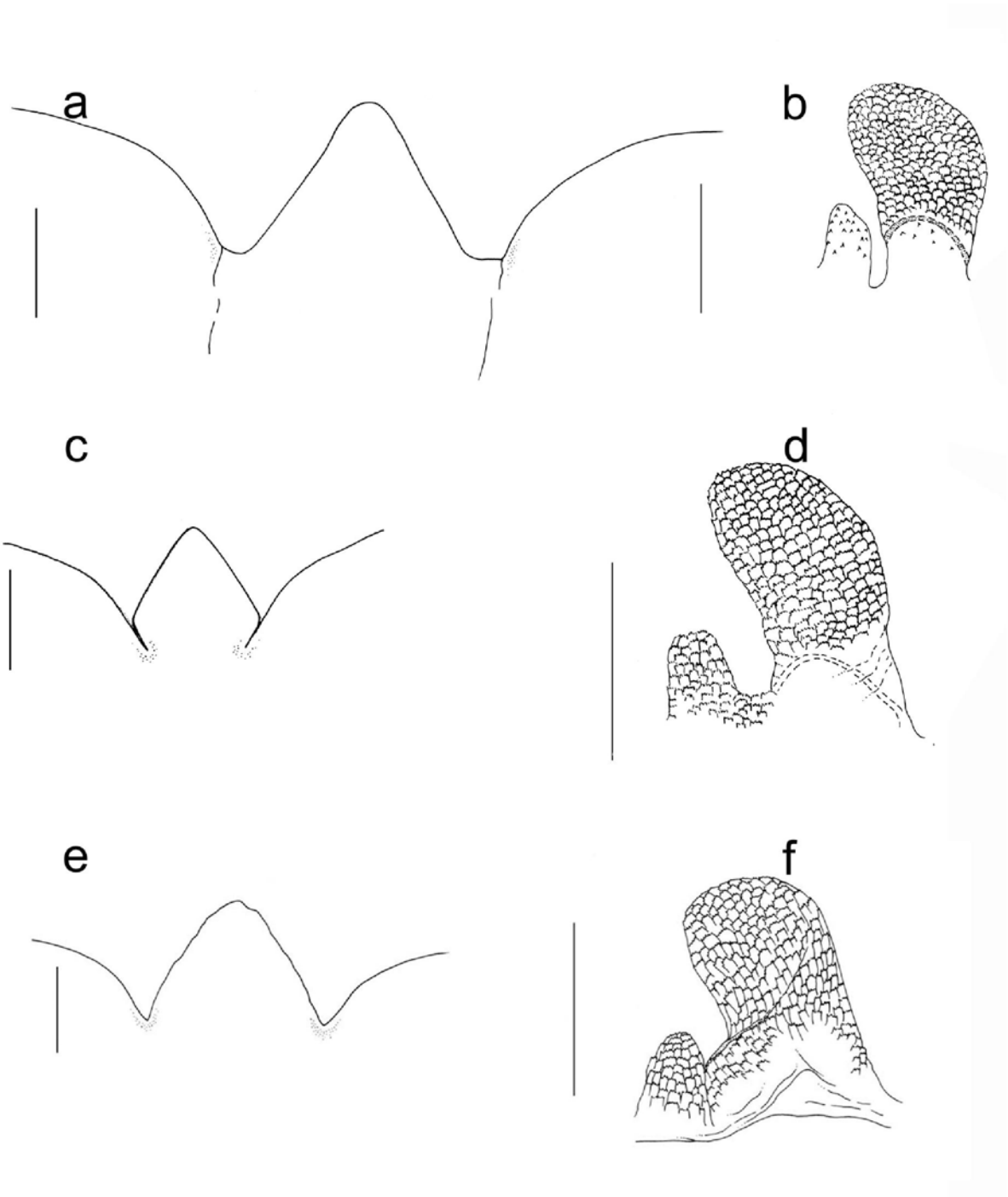


Figure 82: Female genitalia of *Falcum*. a: *Falcum bulldogensis* subgenital plate, scale = 0.1 mm. b: *Falcum bulldogensis* inter-ramal lobe, scale = 0.1 mm. c: *Falcum gagnei* subgenital plate, scale = 0.1 mm. d: *Falcum gagnei* inter-ramal lobe, scale = 0.1 mm. e: *Falcum kaindiensis* subgenital plate, scale = 0.1 mm. f: *Falcum kaindiensis* inter-ramal lobe, scale = 0.1 mm.

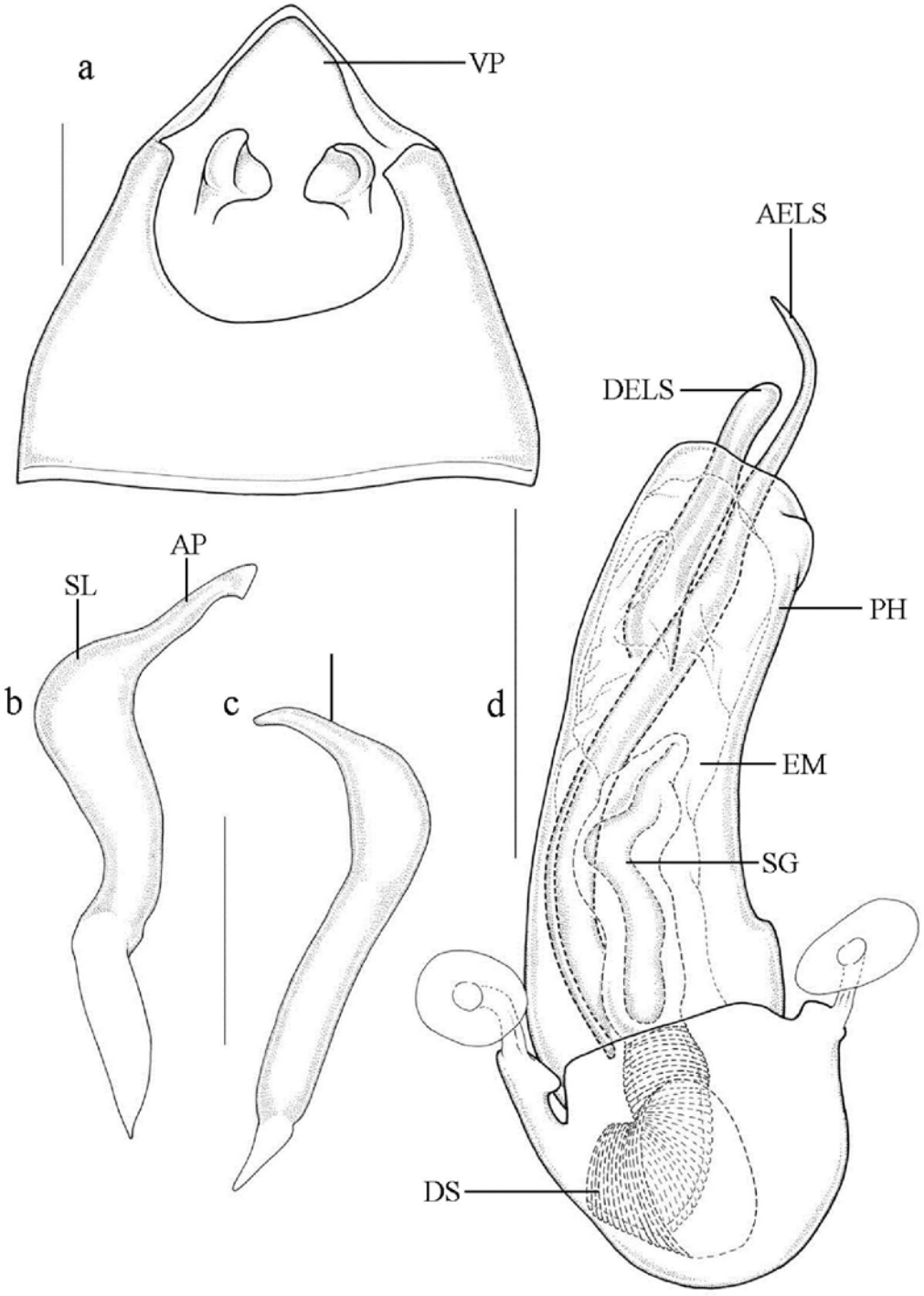


Figure 83: Male genitalia of *Falcum gagnei* a: Pygophore, dorsal view, scale = 0.1 mm. b: Left paramere, ventral view, scale = 0.1 mm. c: Right paramere, ventral view. d: Aedeagus, dorsal view, scale = 0.05 mm. Abbreviation: AELS: Apical endosomal sclerite, AP: Apophysis, DELS: Dorsal endosomal lobal sclerite, DS: Ductus seminis, EM: Endosomal membrane, PH: phallotheca, SG: Secondary gonopore, SL: Sensory lobe, VP: Ventral process.

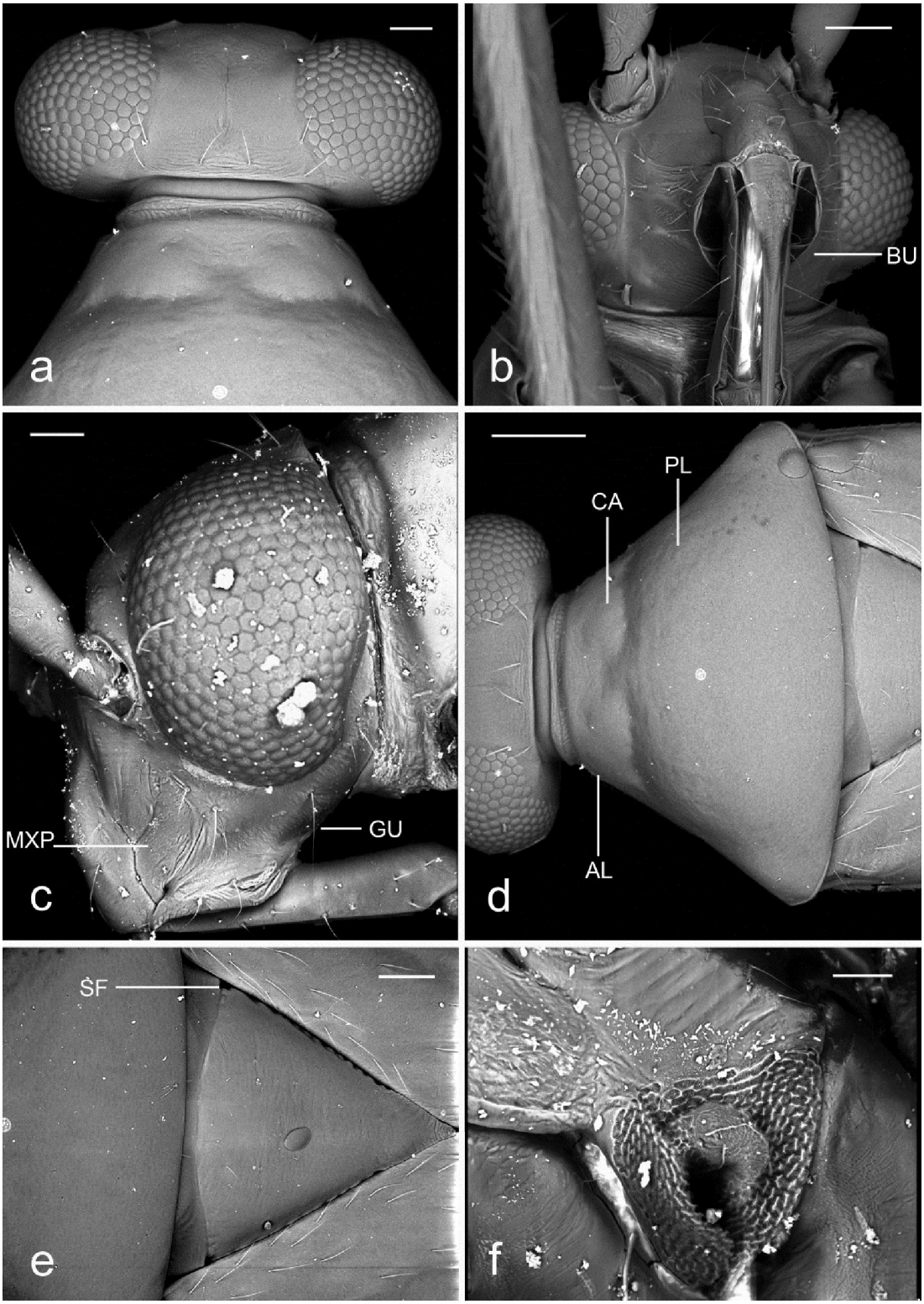


Figure 84: *Falcum kaindiensis* a: Head, dorsal view, scale = 100µm. b: Head, ventral view, scale = 100µm. c: Head, lateral view, scale = 60µm. d: Pronotum, scale = 200µm. e: Scutellum, scale = 100µm. f: Scent gland, scale = 40µm. Abbreviation: AL: Anterior lobe, BU: Bucculae, CA: Calli, GU: Gula, MXP: Maxillary plate, PL: Posterior lobe, SF: Scutellum foveae.

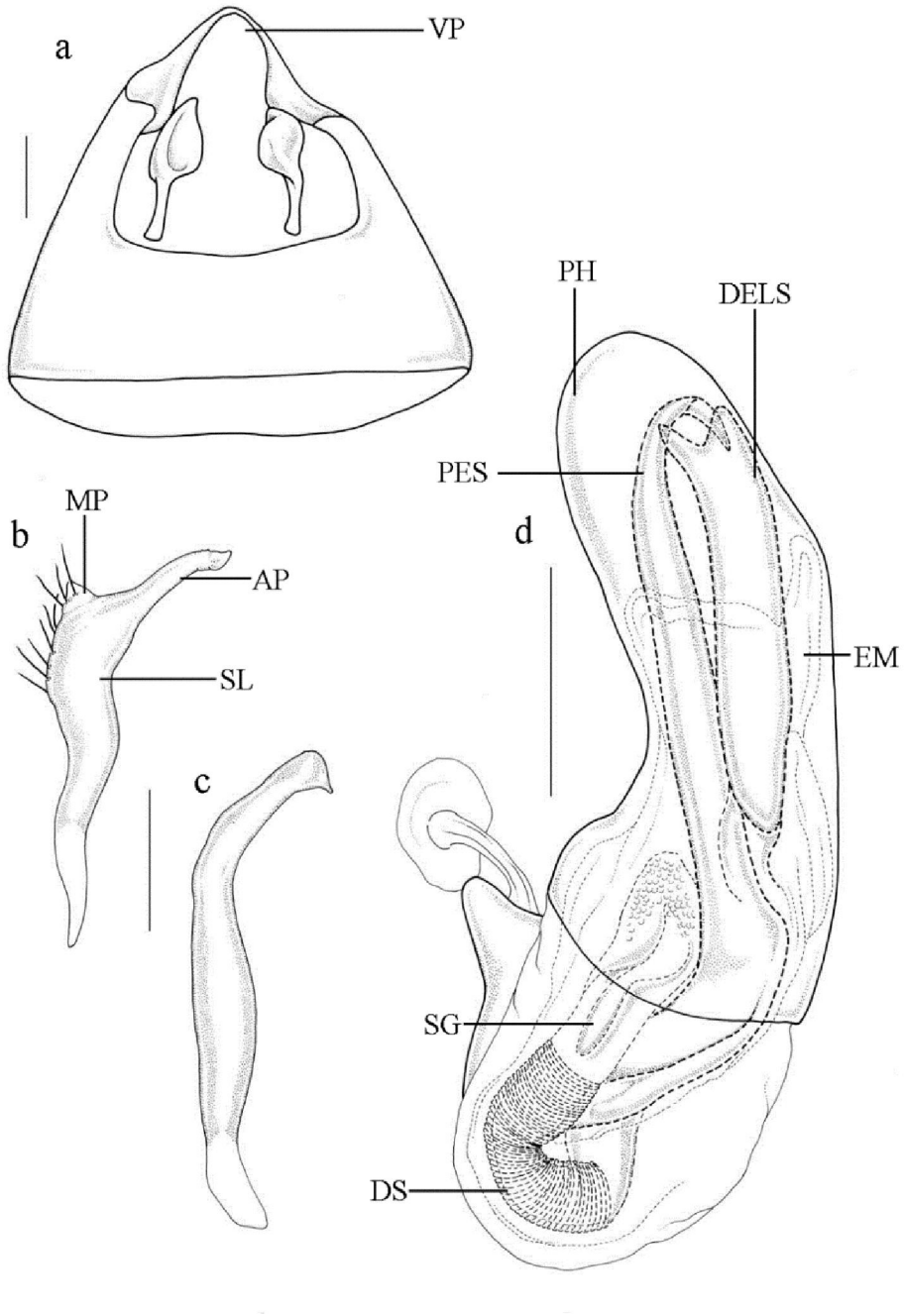


Figure 85: Male genitalia of *Falcum kaindiensis* a: Pygophore, dorsal view, scale = 0.1 mm. b: Left paramere, dorsal view, scale = 0.1 mm. c: Right paramere, ventral view. d: Aedeagus, left lateral view, scale = 0.05 mm. Abbreviation: AELS: Apical endosomal sclerite, AP: Apophysis, DELS: Dorsal endosomal lobal sclerite, DS: Ductus seminis, EM: Endosomal membrane, MP: Medial process, PH: Phallotheca, SG: Secondary gonopore, SL: Sensory lobe, VP: Ventral process.

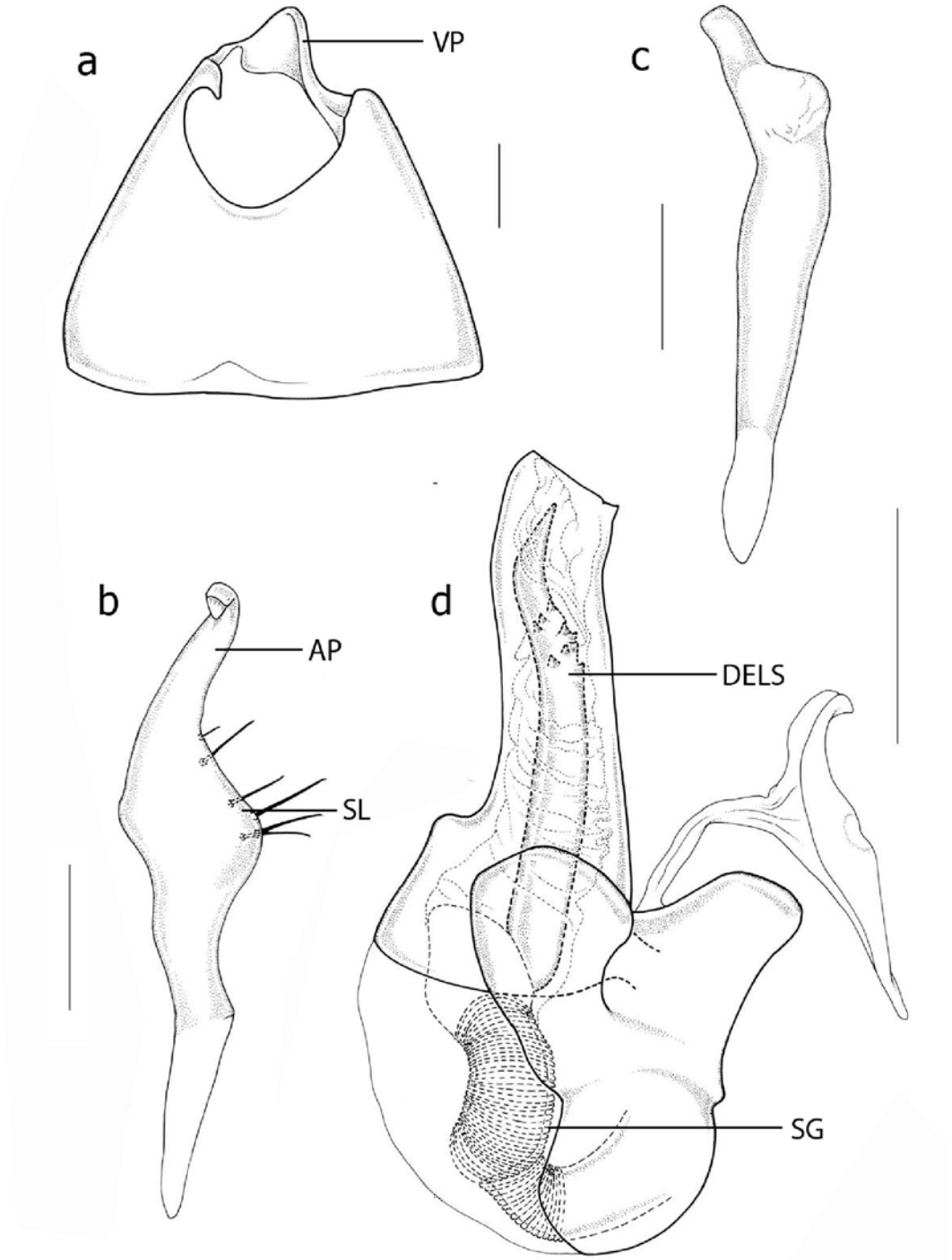


Figure 86: Male genitalia of *Falcum taiwanensis*. a: Pygophore, dorsal view, scale = 0.1mm. b: Left paramere, ventral view, scale = 0.1mm. c: Right paramere, dorsal view, scale = 0.1mm. d: Aedeagus, left lateral view, scale = 0.1mm. Abbreviation: AP: Apophysis, DELS: Dorsal endosomal lobal sclerite, EM: Endosomal membrane, PH: Phallotheca, SG: Secondary gonopore, SL: Sensory lobe, VP: Ventral process.

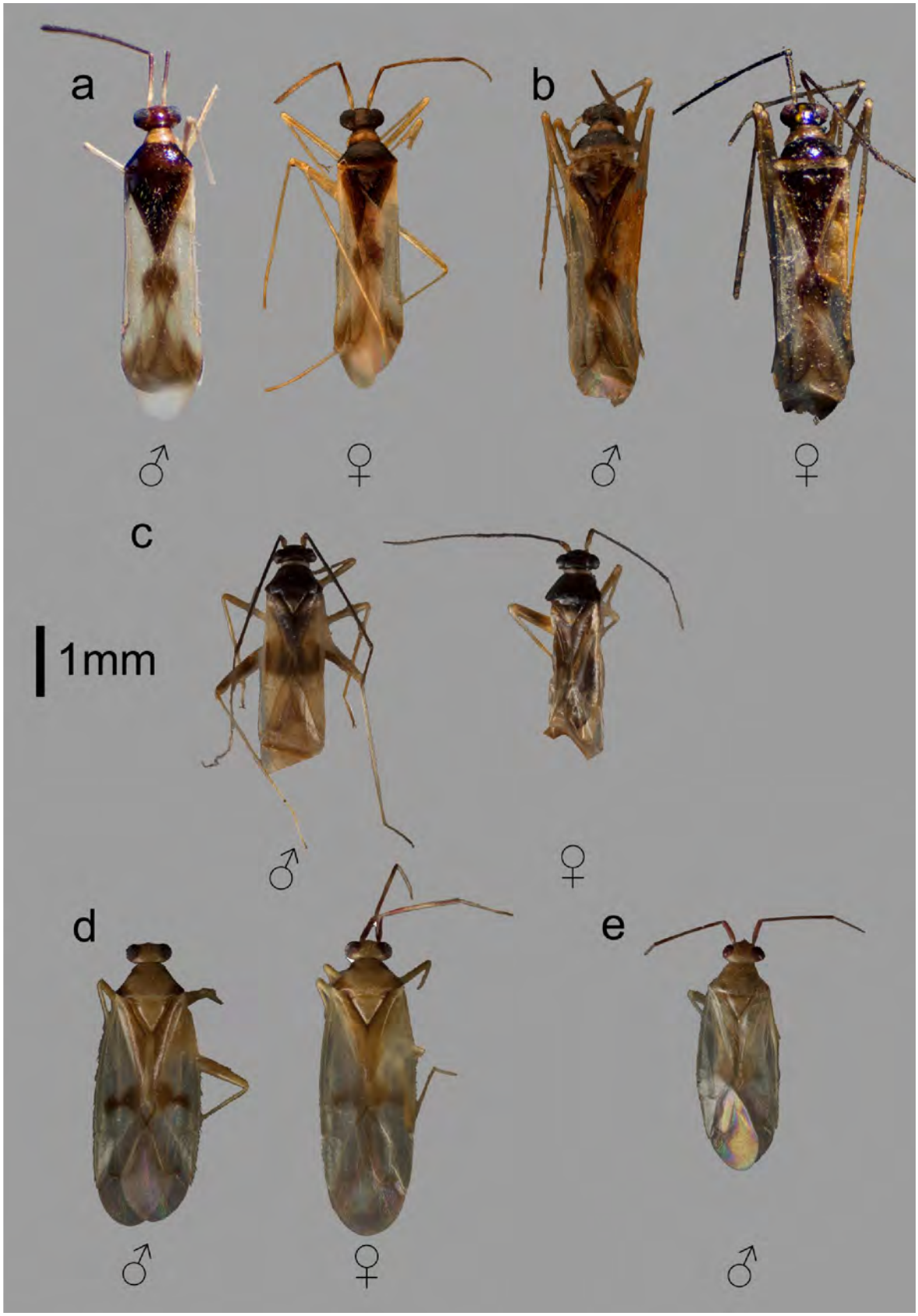


Figure 87: Habitus, *Felisacodes* and *Zanchiella*. a: *Felisacodes bryocorina,* b: *Felisacodes diaboura*, c: *Felisacodes uganda,* d: *Zanchiella bowkeriae,* e: *Zanchiella sweeti*.

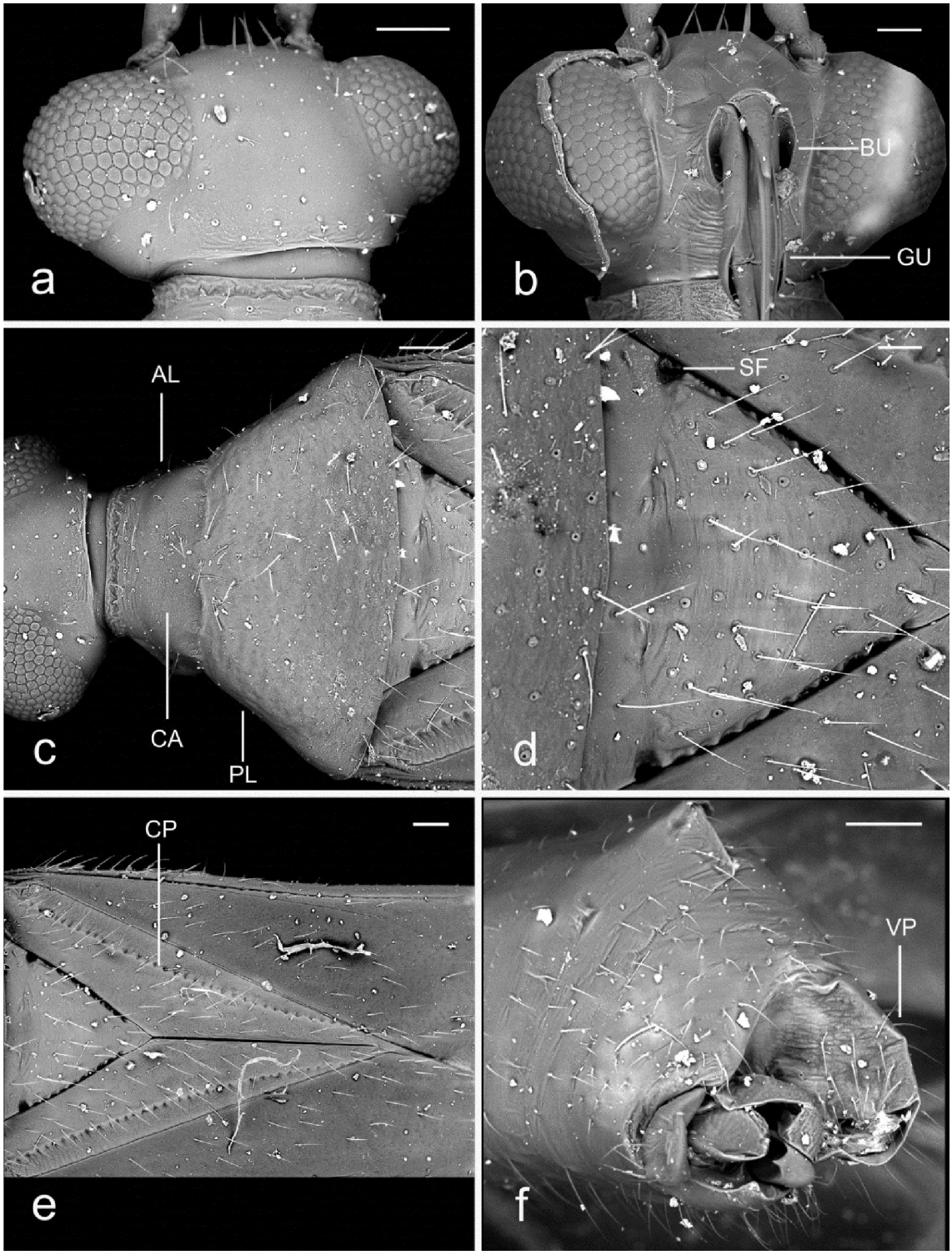


Figure 88: *Felisacodes bryocorina* a: Head, dorsal view, scale = 100µm. b: Head, ventral view, scale = 100µm. c: Pronotum, scale = 100µm. d: Scutellum, scale = 100µm. e: Hemelytra, scale = 60µm. f: Pygophore ventral view, scale = 60µm. Abbreviation: AL: Anterior lobe, BU: Bucculae, CA: Calli, CP: Claval punctures, GU: Gula, PL: Posterior lobe, SF: Scutellum fovea, VP: Ventral process.

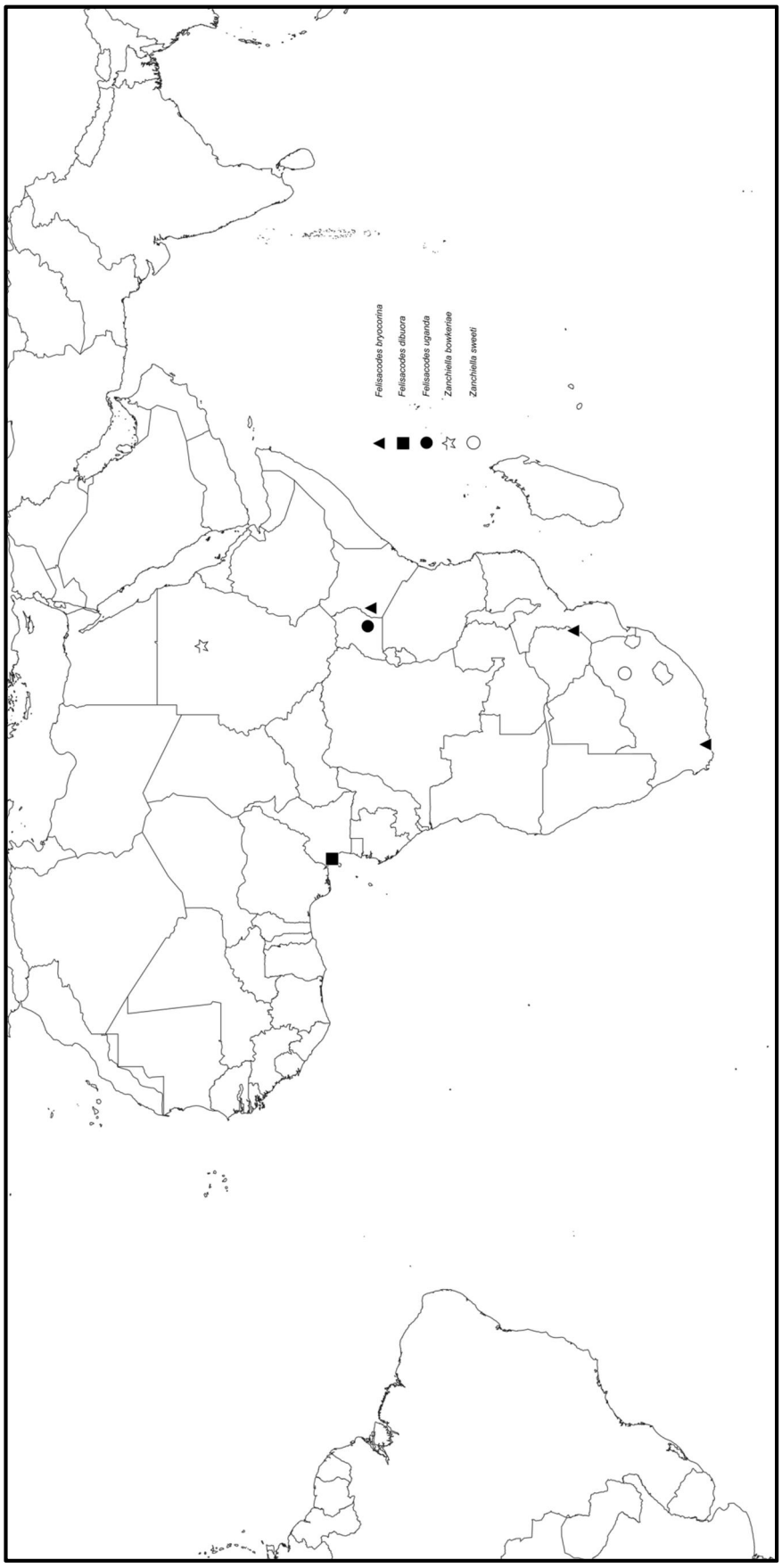


Figure 89: Distribution map of *Felisacodes* and *Zanchiella*.

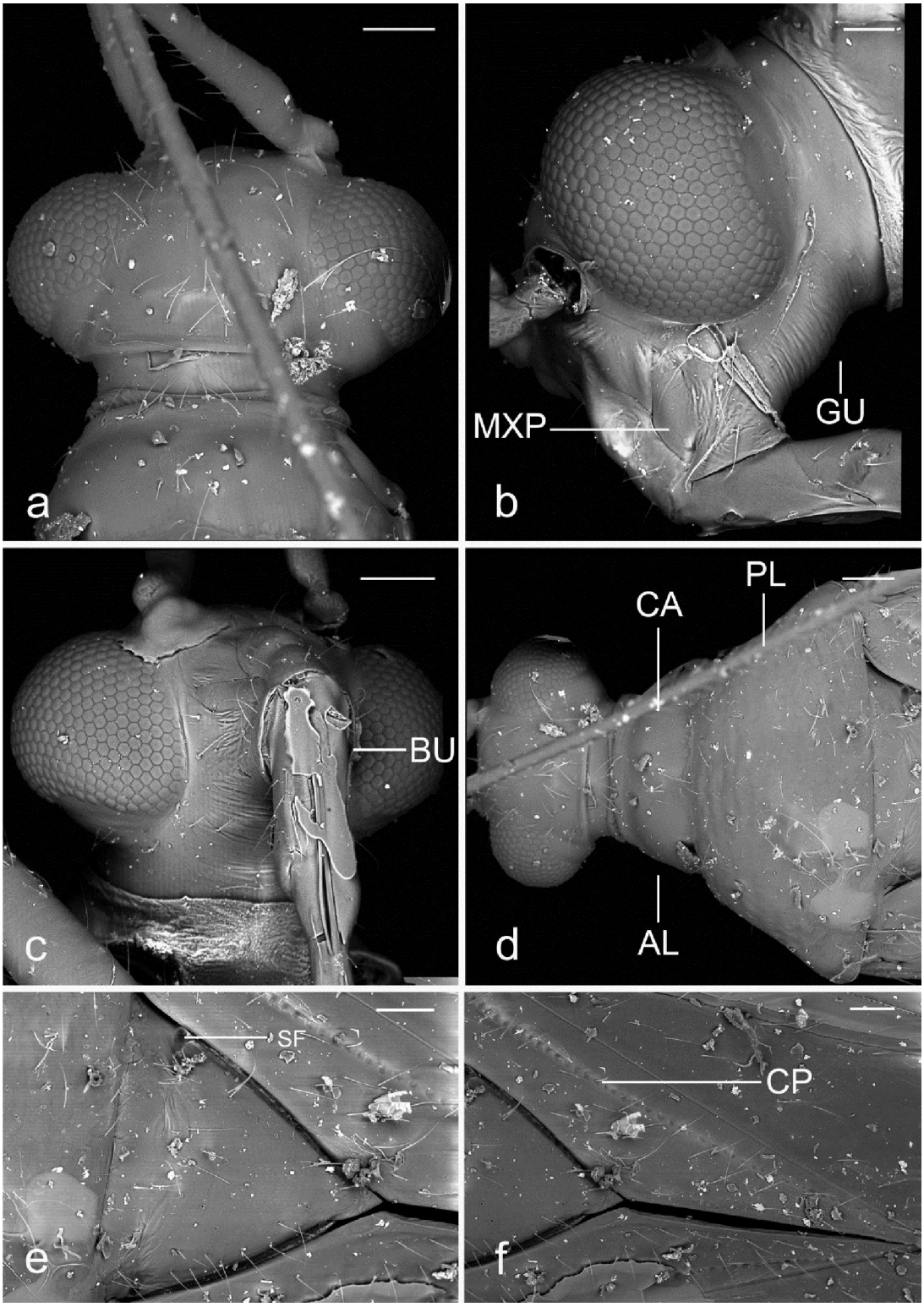


Figure 90: *Felisacodes diaboura* a: Head, dorsal view, scale = 100µm. b: Head, lateral view, scale = 60µm. c: Head, ventral view, scale = 100µm. d: Pronotum, scale = 100µm. e: Scutellum, scale = 100µm. f. Hemelytral punctures, scale = 100µm. Abbreviation: AL: Anterior lobe, BU: Bucculae, CA: Calli, CP: Claval Punctures, GU: Gula, MXP: Maxillary plate, PL: Posterior lobe, SF: Scutellum foveae.

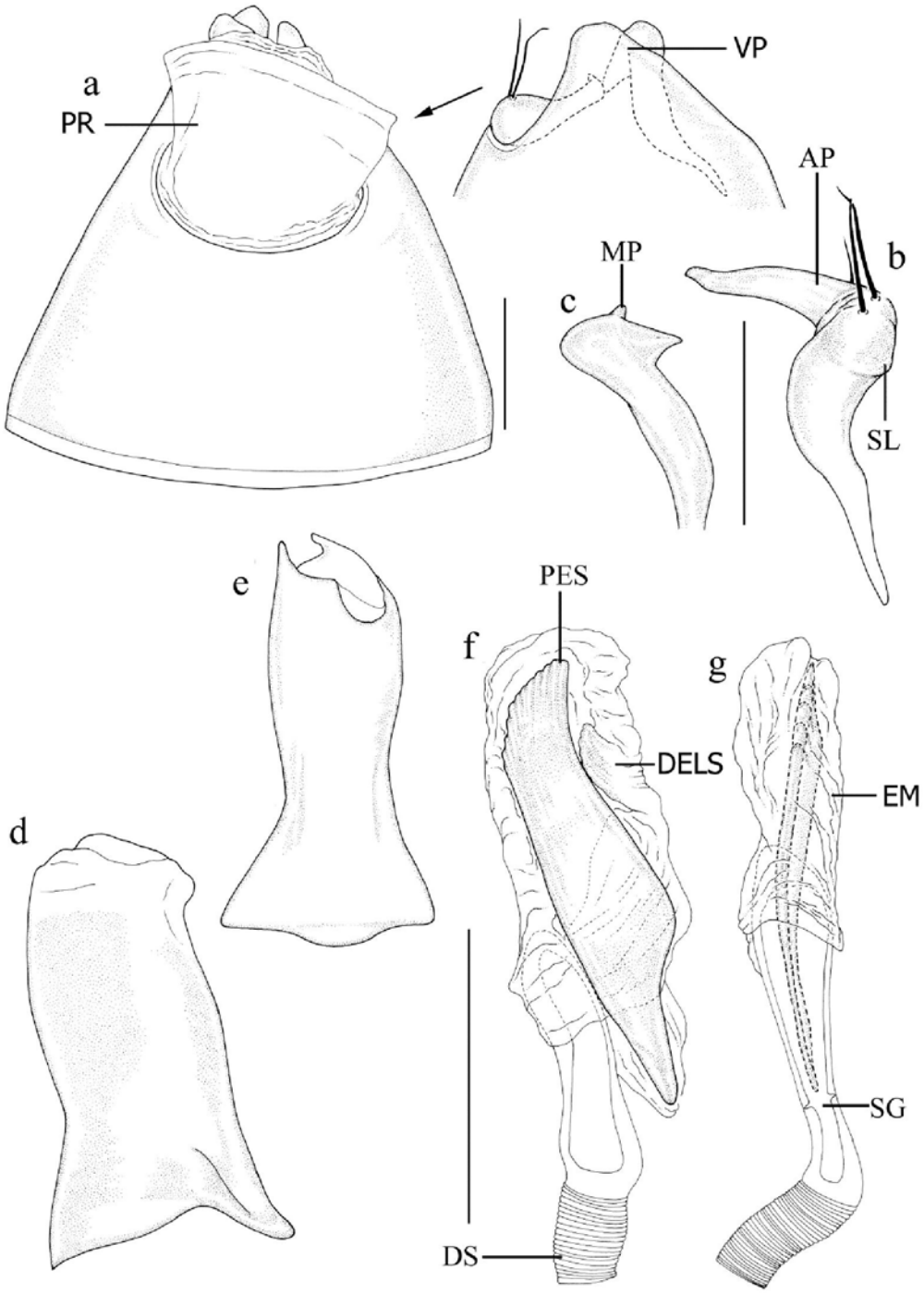


Figure 91: Male genitalia of *Felisacodes uganda* a: Pygophore, dorsal view, scale = 0.1 mm. b: Left paramere, dorsal view, scale = 0.1 mm. c: Right paramere, dorsal view. d: Phallotheca, lateral view. e: Phallotheca, dorsal view, scale = 0.05 mm. f: Endosoma, lateral view. g: Endosoma, dorsal view scale = 0.05 mm. Abbreviation: AP: Apophysis, DELS: Dorsal endosomal lobal sclerite, DS: Ductus seminis, EM: Endosomal membrane, MP: Medial process, SG: Secondary gonopore, SL: Sensory lobe, PR: Proctyger, VP: Ventral process.

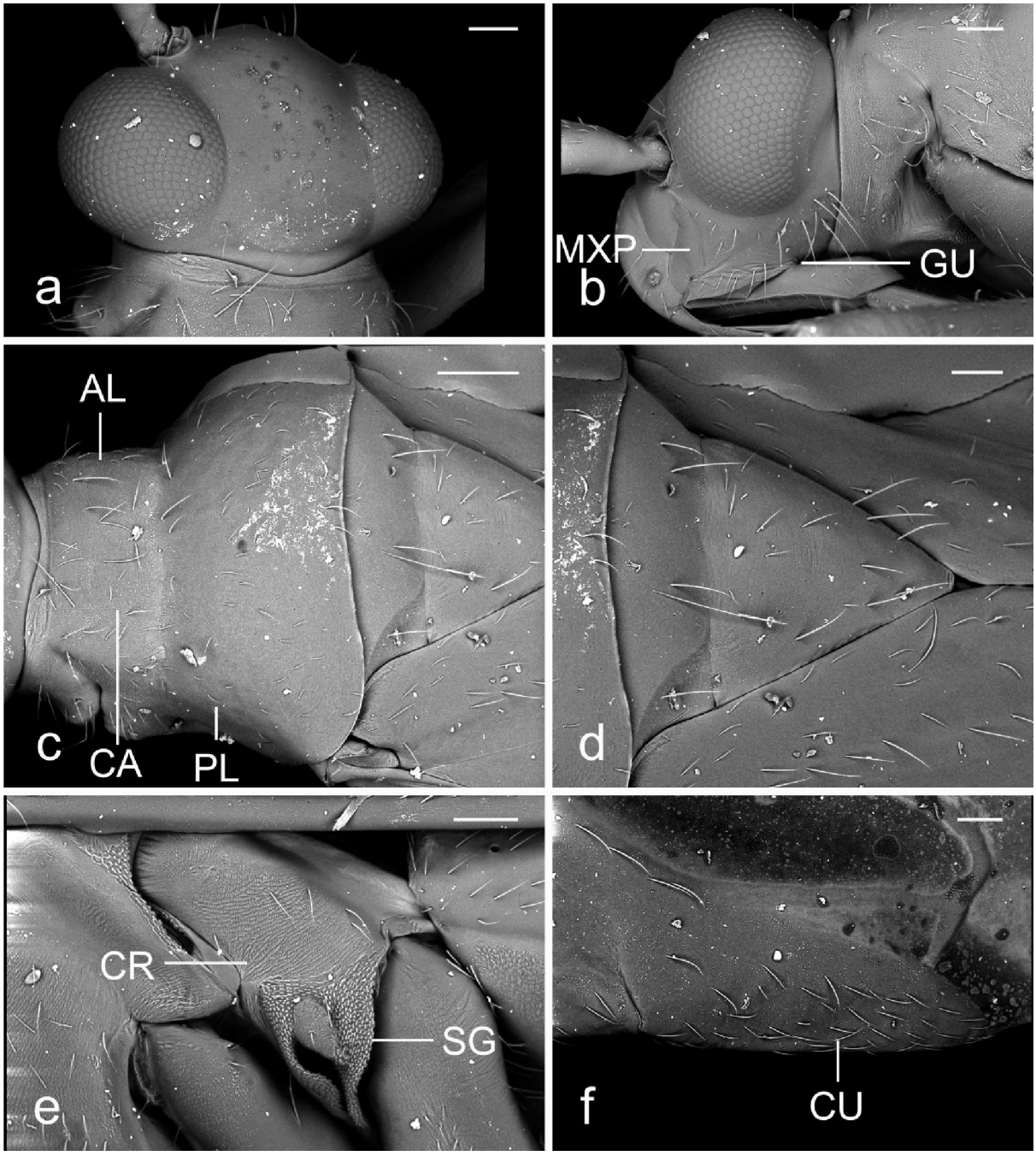


Figure 92: *Flagellomiris sinuatum* a: Head, dorsal view, scale = 100µm. b: Head, lateral view, scale = 100µm. c: Pronotum, scale = 200µm. d: Scutellum, scale = 100µm. e: Scent gland, scale = 100µm. f: Cuneus, scale = 100µm. Abbreviation: AL: Anterior lobe, CA: Calli, CR: Cross vein Ruga, CU: Cuneus, GU: Gula, MXP: Maxillary plate, PL: Posterior lobe, SG: Scent gland.

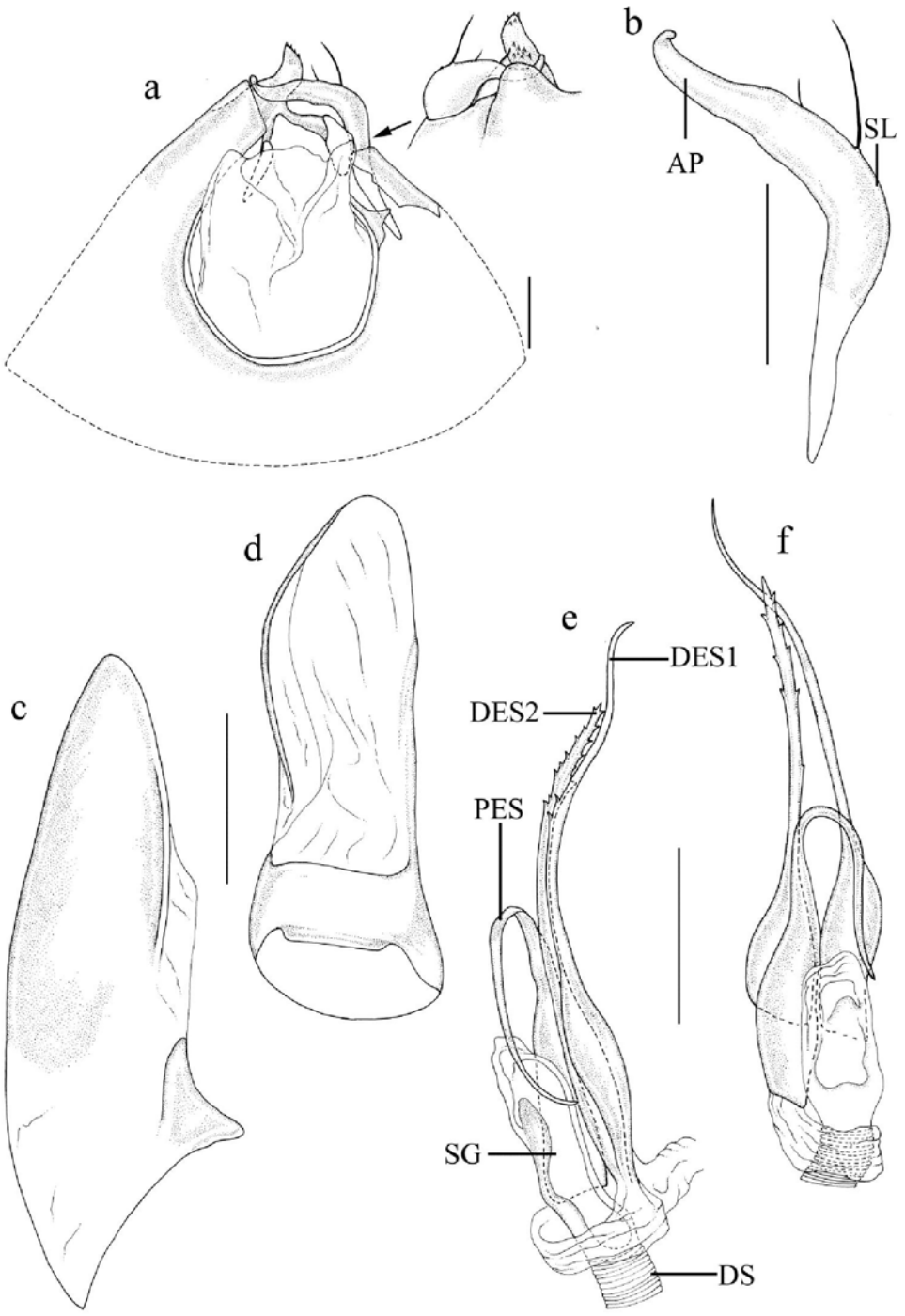


Figure 93: Male genitalia of *Flagellomiris sinuatum* a: Pygophore, dorsal view, scale = 0.1 mm. b: Left paramere, ventral view, scale = 0.1 mm. c: Phallotheca, lateral view. d: Phallotheca, dorsal view, scale = 0.05 mm. e: Endosoma, lateral view. f: Endosoma, dorsal view, scale = 0.05 mm. Abbreviation: AP: Apophysis, DS: Ductus seminis, DES1: Dorsal endosomal spicule 1, DES2: Dorsal endosomal spicule 2, SG: Secondary gonopore, SL: Sensory lobe.

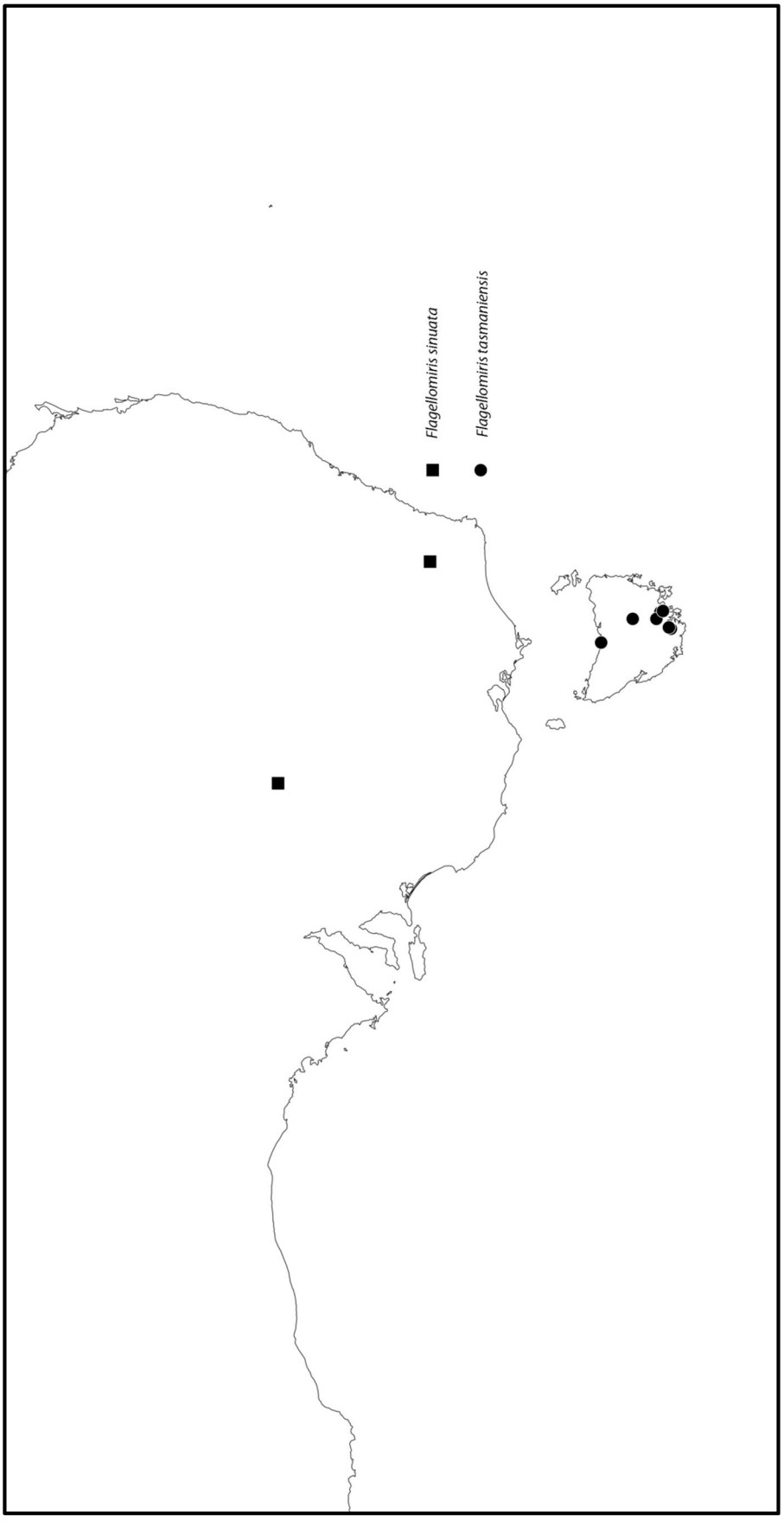


Figure 94: Distribution map of *Flagellomiris*

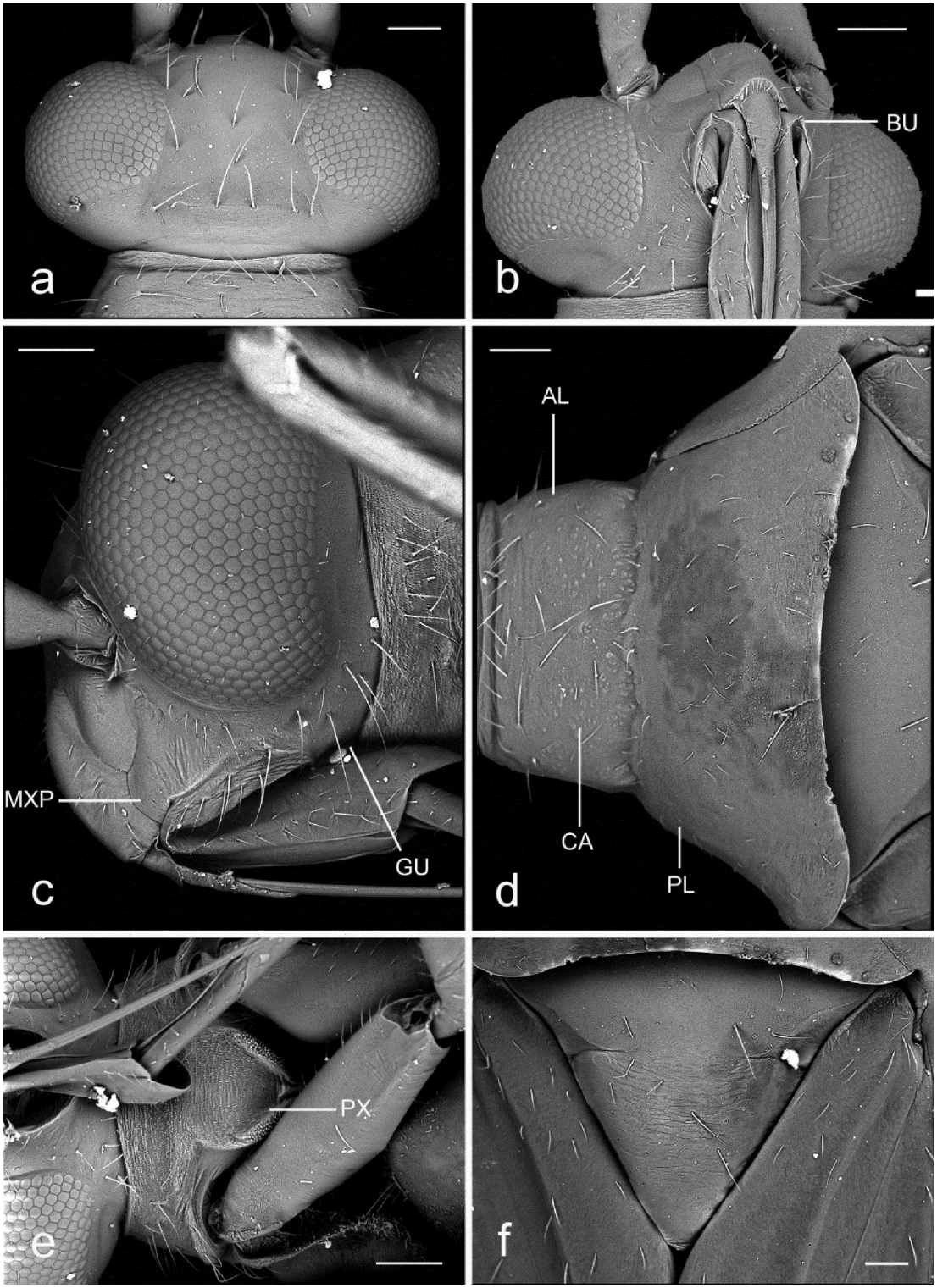


Figure 95: *Flagellomiris tasmaniensis*. a: Head, dorsal view, scale = 100µm. b: Head, ventral view, scale = 100µm. c: Head, lateral view, scale = 100µm. d: Pronotum, scale = 100µm. e: Prosternum, scale = 100µm. f: Scutellum, scale = 100µm. Abbreviation: AL: Anterior lobe, BU: Bucculae, CA: Calli, GU: Gula, MXP: Maxillary plate, PL: Posterior lobe, PX: Proxyphus.

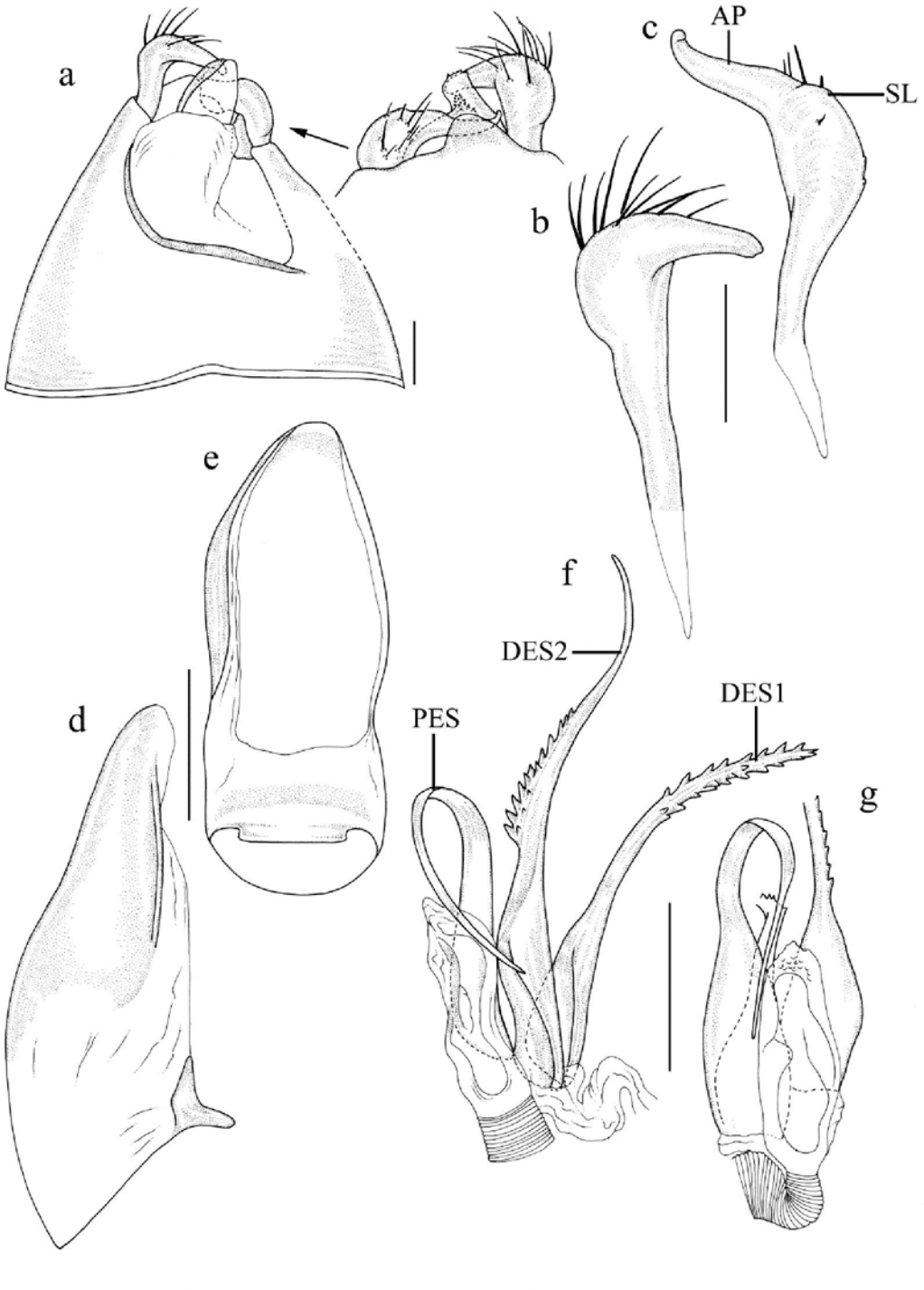


Figure 96: Male genitalia of *Flagellomiris tasmaniensis* a: Pygophore, dorsal view, scale = 0.1 mm. b: Left paramere, dorsal view, scale = 0.1 mm. c: Right paramere, dorsal view. d: Phallotheca, lateral view. e: Phallotheca, dorsal view, scale = 0.05 mm. f: Endosoma, lateral view. g: Endosoma, dorsal view scale = 0.05 mm. Abbreviation: AP: Apophysis, DES1: Dorsal endosomal spicule 1, DES2: Dorsal endosomal spicule 2, PES: Proximal endosomal spicule, SL: Sensory lobe.

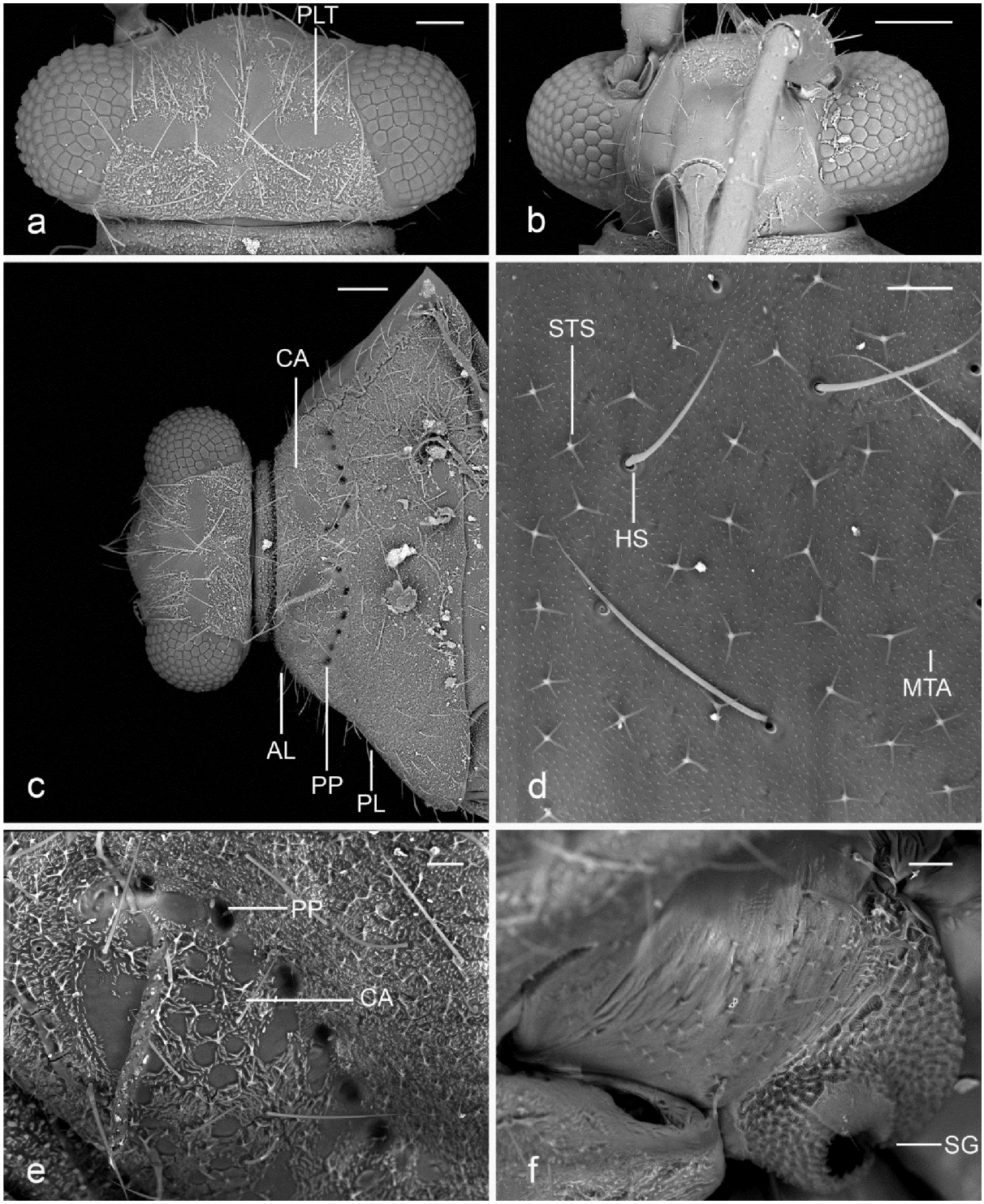


Figure 97: *Jimia bimaculata*. a: Head, dorsal view, scale = 60µm. b: Head, ventral view, scale = 100µm. c: Pronotum, scale = 100µm. d: Hemelytral vestiture, scale = 20µm. e: Posterior margin of the calli, scale = 20µm. f: Scent gland, scale = 20µm. Abbreviation: AL: Anterior lobe, CA: Calli, HS: Hairlike setae, MTA: Microtrichia, PL: Posterior lobe, PLT: Dorsal patch lacking microtrichia, PP: Pronotal punctures, SG: Scent Gland, STS: Starlike setae.

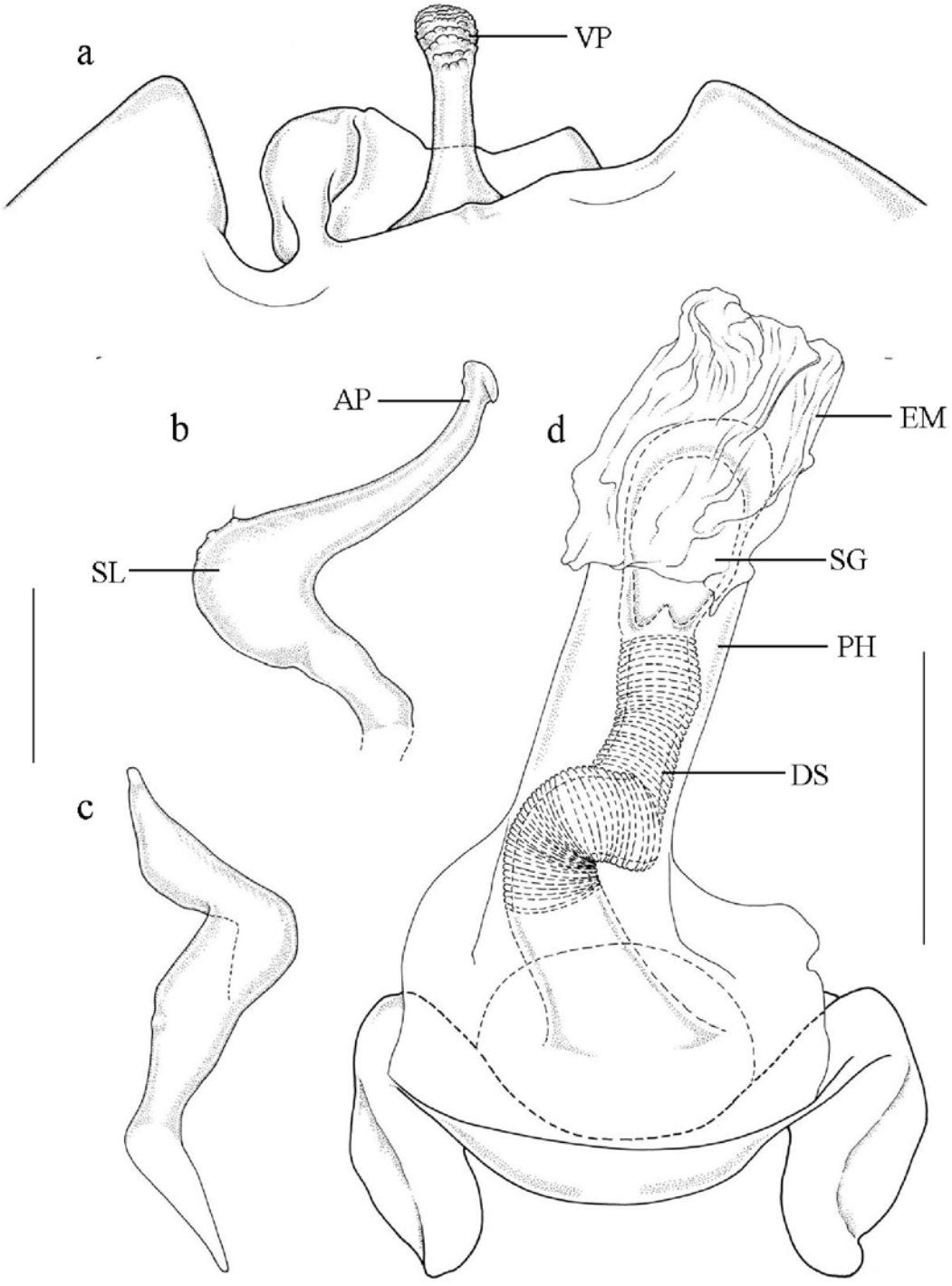


Figure 98: Male genitalia of *Jimia bimaculata.* a: Pygophore, dorsal view, scale = 0.1 mm. b: Left paramere, ventral view, scale = 0.1 mm. c: Right paramere, ventral view. d: Aedeagus, dorsal view, scale = 0.05 mm. Abbreviation: AP: Apophysis, DS: Ductus seminis, EM: Endosomal membrane, PH: Phallotheca, SG: Secondary gonopore, SL: Sensory lobe, VP: Ventral process.

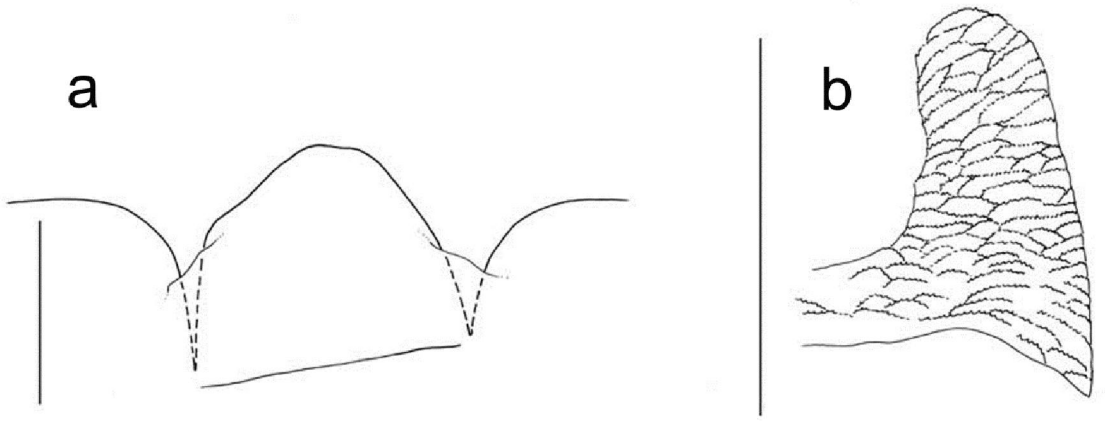


Figure 99: Female genitalia of *Jimia*. *Jimia bimaculata* a: subgenital plate, scale = 0.1 mm. b: Jimia bimaculata inter-ramal lobe, scale = 0.1 mm.

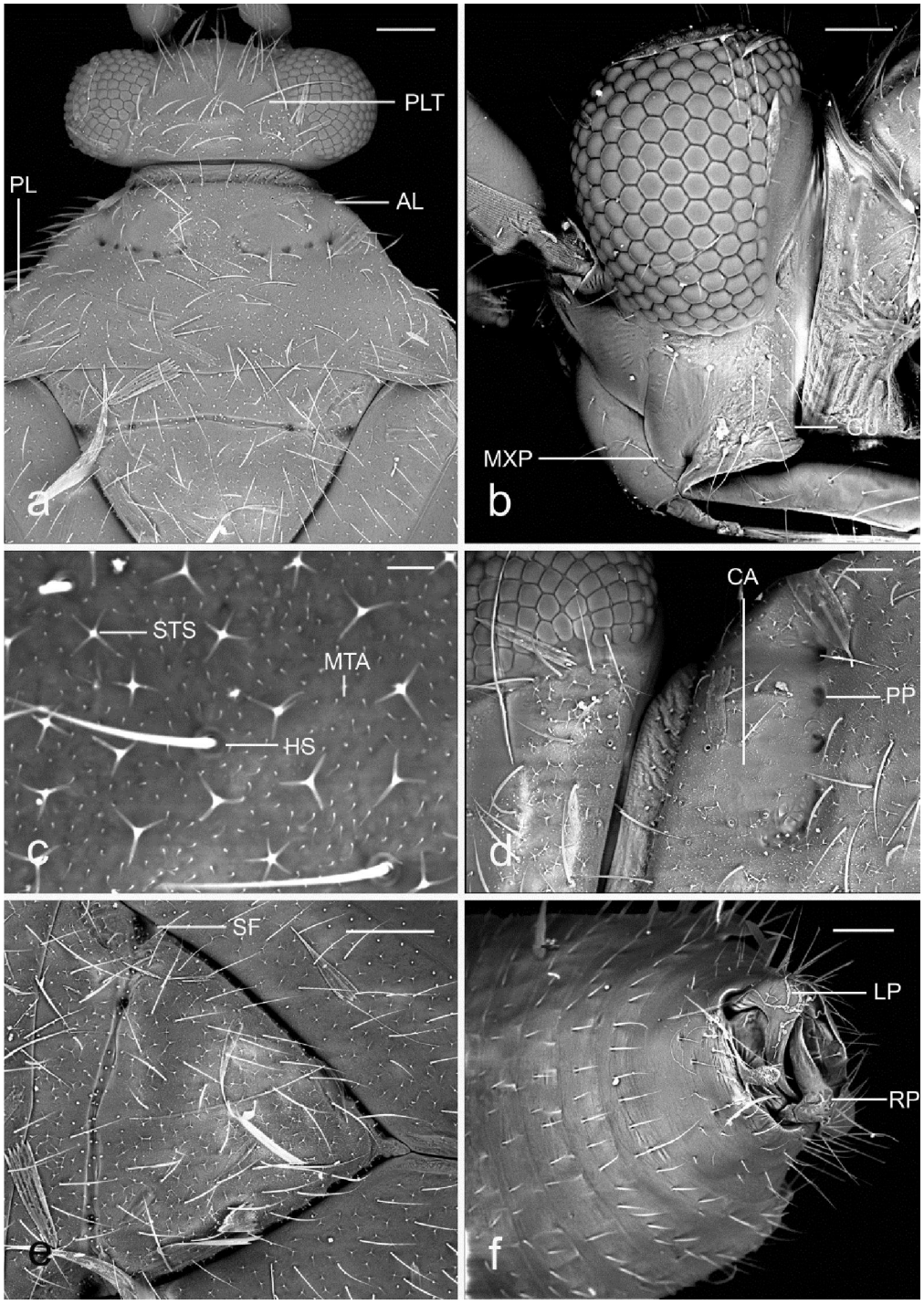


Figure 100: *Jimia spectabilis* a: Head, dorsal view, scale = 100µm. b: Head, lateral view, scale = 60µm. c: Pronotal setae, scale = 10µm. d: Calli punctures scale = 40µm. e: Scutellum, scale = 100µm. f: Pygophore scale = 60µm. Abbreviation: AL: Anterior lobe, BU: Bucculae, CA: Calli, GU: Gula, LP: Left Paramere, HS: Hairlike setae, MXP: Maxillary Plate, MTA: Microtrichia, PL: Posterior lobe, PLT: Dorsal patch lacking microtrichia, PP: Pronotal punctures, RP: Right paramere, SF: Scutellum foveae, STS: Star-shaped setae.

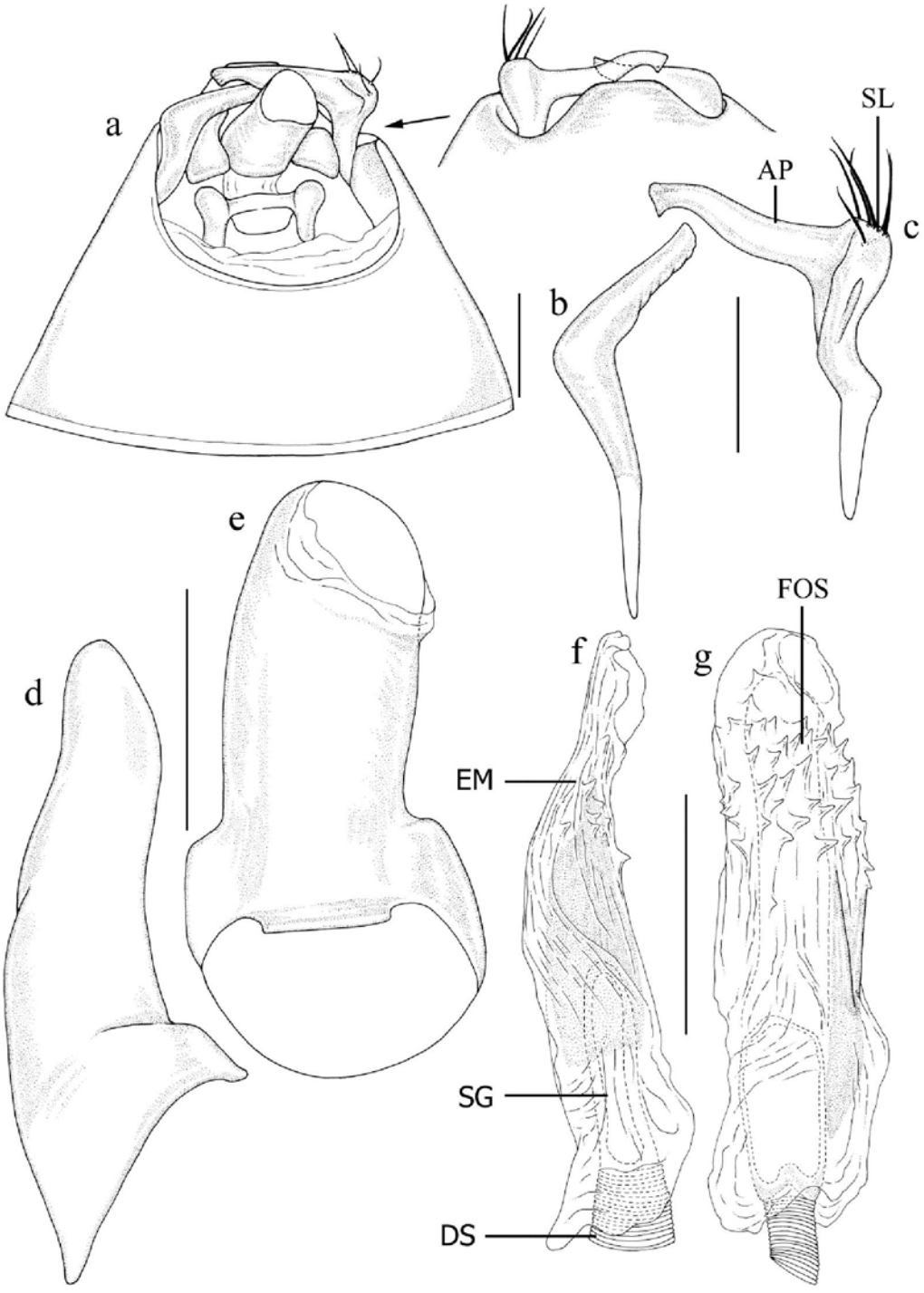


Figure 101: Male genitalia of *Jimia spectabilis* a: Pygophore, dorsal view, scale = 0.1 mm. b: Left paramere, dorsal view, scale = 0.1 mm. c: Right paramere, dorsal view. d: Phallotheca, left lateral view. e: Phallotheca, dorsal view scale = 0.05mm. f: Endosoma, left lateral view. g: Endosoma, dorsal view scale = 0.05 mm. Abbreviation: AELS: Apical endosomal sclerite, AP: Apophysis, APR: Apical process, DELS: Dorsal endosomal lobal sclerite, DS: Ductus seminis, EM: Endosomal membrane, FOS: Field of spinules, SG: Secondary gonopore, SL: Sensory lobe.

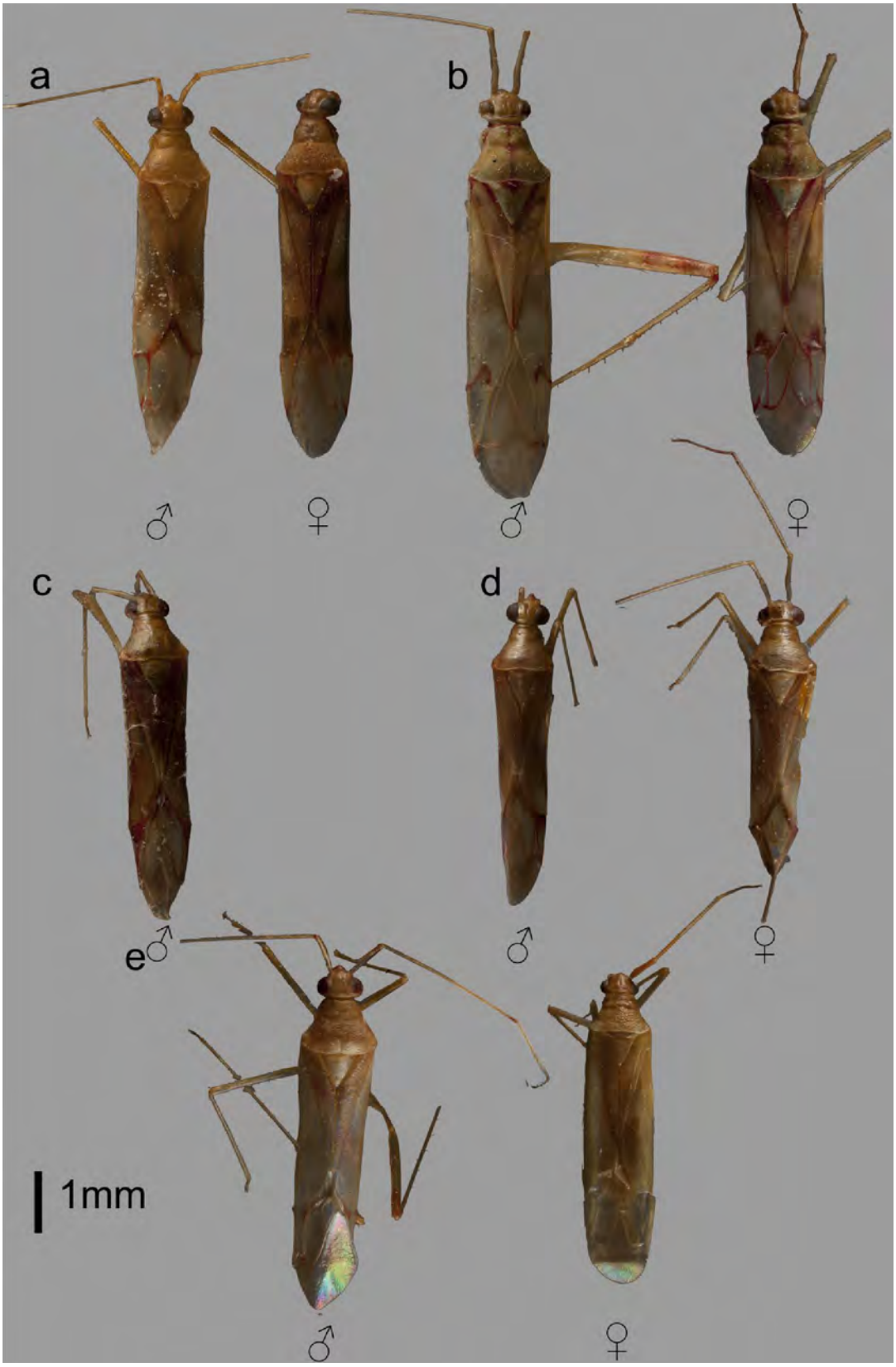


Figure 102: Habitus, *Morobea* and *Wumea.* a: *Morobea longipedes*, b: *Morobea spectabilis*, c: *Wumea cassisi,* d: *Wumea clypealis*, e: *Wumea pilosa*.

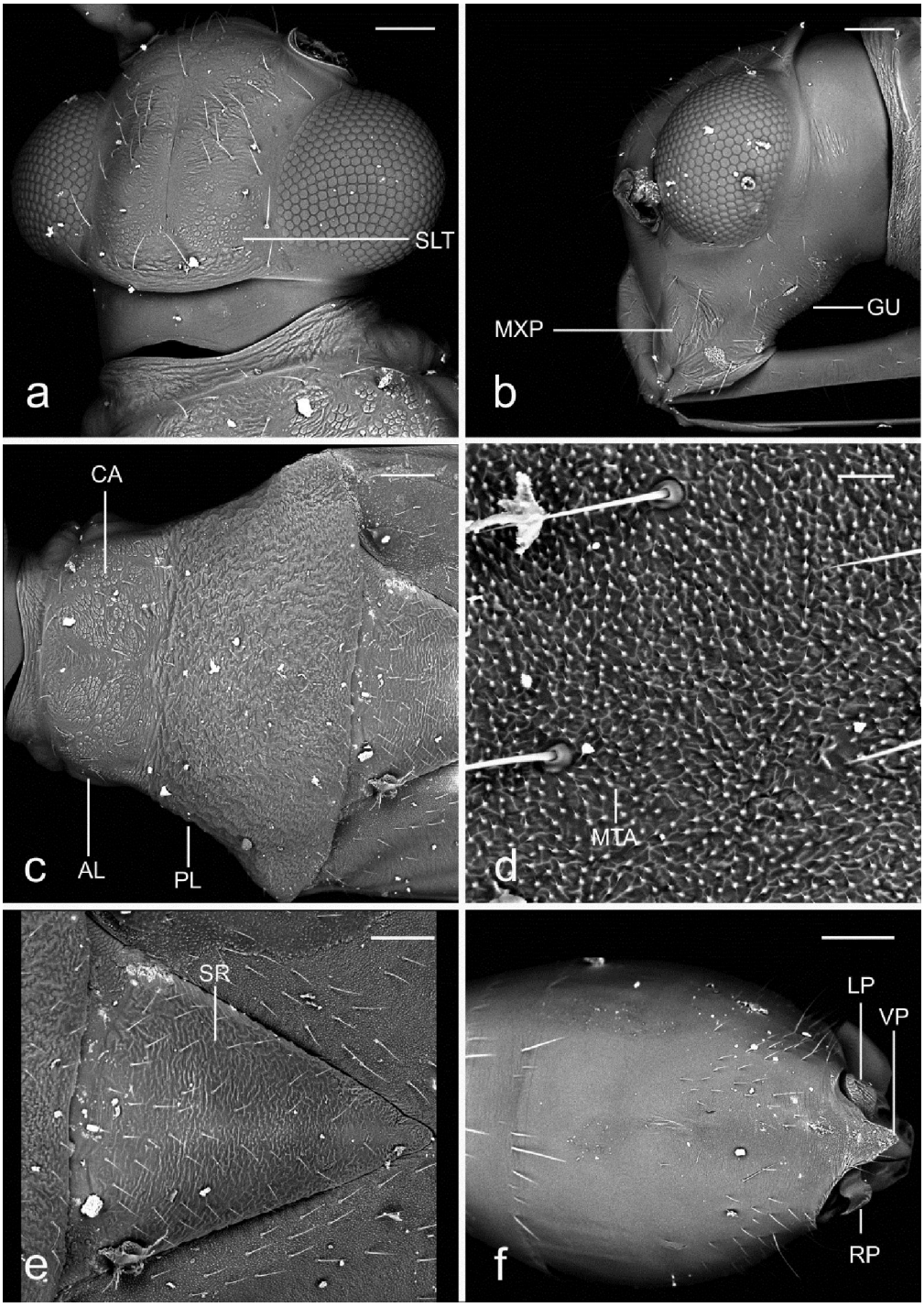


Figure 103: *Morobea longipes.* a: Head, dorsal view, scale = 100µm. b: Head, lateral view, scale = 100µm. c: Pronotum, scale = 100µm d: Pronotal vestiture, scale = 20µm. e: Scutellum, scale = 100µm. f: Pygophore, scale = 200µm. Abbreviation: AL: Anterior lobe, CA: Calli, GU: Gula, LP: Left paramere, MXP: Maxillary plate, PL: Posterior lobe, PLR: Posterior lobe ruga, RP: Right paramere, SLT: Scale like texturing, SR: Scutellum ruga, VP: Ventral projection.

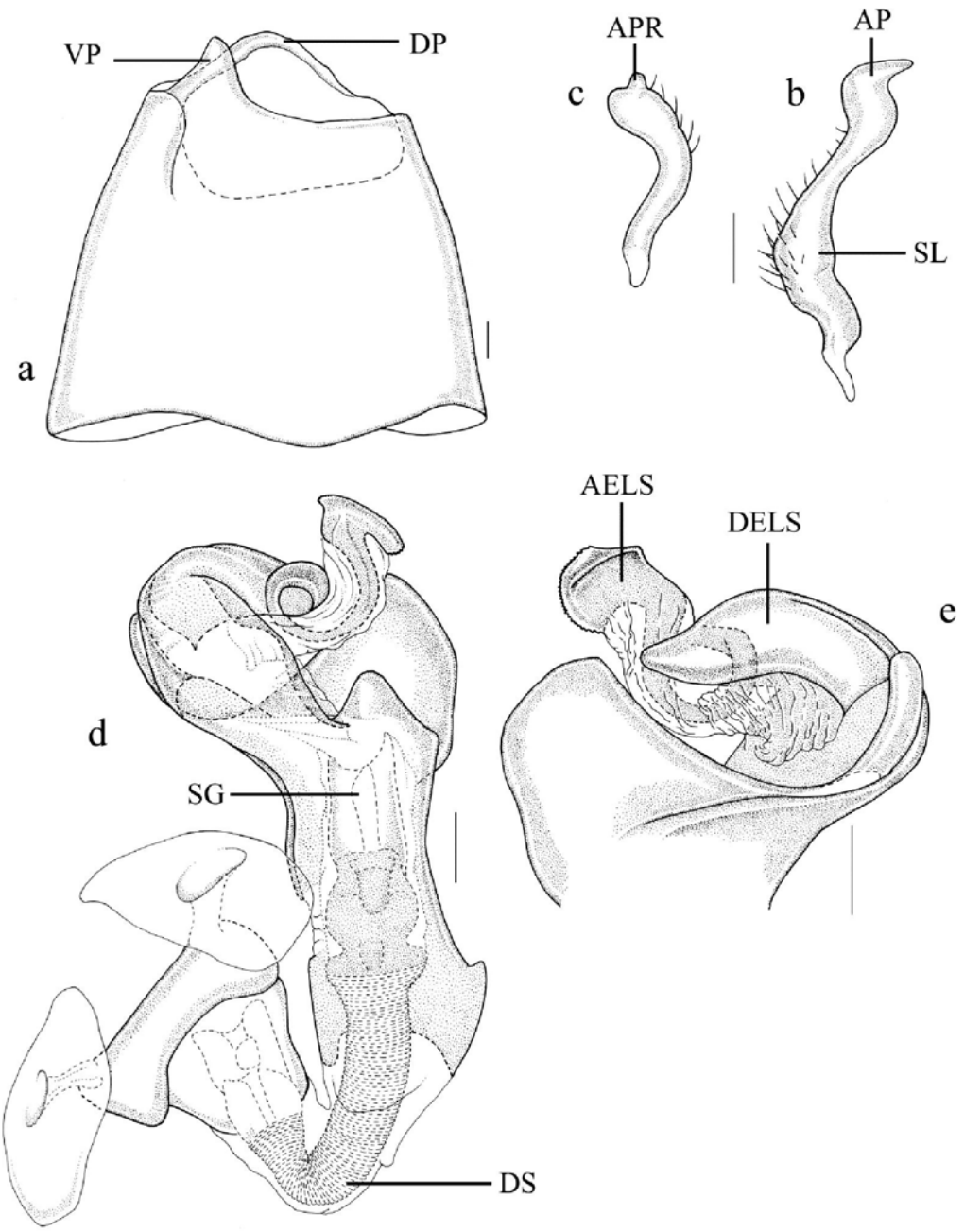


Figure 104: Male genitalia of *Morobea longipes.* Images reproduced from Wall 2007 with permission of the author. a: Pygophore, lateral view, scale = 0.1mm. b: Left paramere, dorsal view, scale = 0.1 mm. c: Right paramere, dorsal view, scale = 0.1mm. d: Aedeagus, lateral view, scale = 0.1mm. e: Lobal sclerites, scale = 0.05mm. Abbreviation: AELS: Anterior endosomal lobal sclerite, AP: Apophysis, APR: Apical process, DELS: Dorsal endosomal lobal sclerite, DS: Ductus seminis, SG: Secondary gonopore, SL: Sensory lobe, VP: Ventral process.

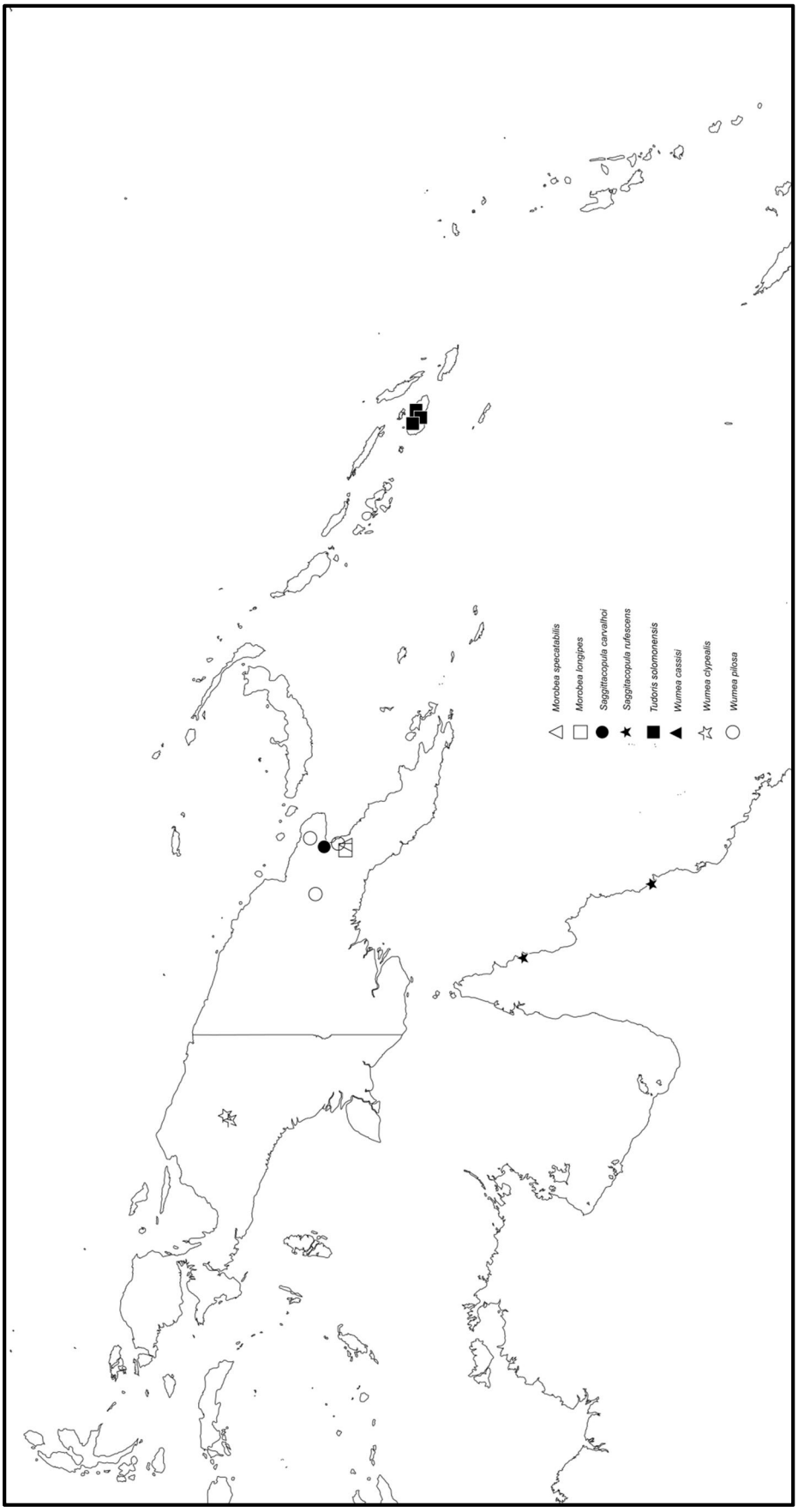


Figure 105: Distribution map of *Morobea, Wumea, Saggitacopula* and *Tudoris*

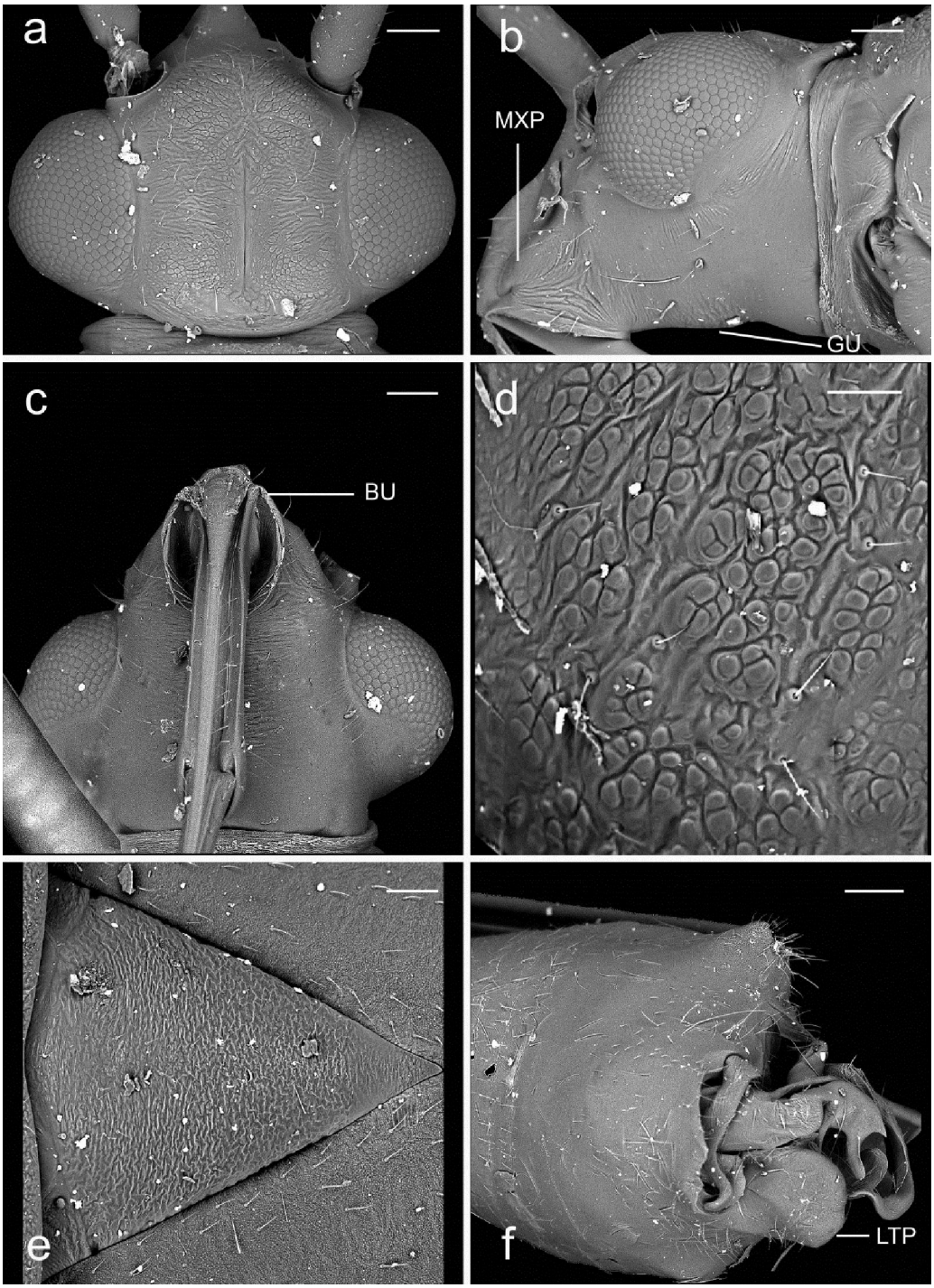


Figure 106: *Morobea spectabilis*. a: Head, dorsal view, scale = 100µm. b: Head, lateral view, scale = 100µm. c: Head, ventral view, scale = 100µm. d: Anterior pronotal lobe, texture detail, showing ruga, scale = 20µm. e: Scutellum, scale = 100µm. f: Pygophore, scale = 100µm. Abbreviation: BU: Bucculae, GU: Gula, MXP: Maxillary plate, LTP: Left tergal process.

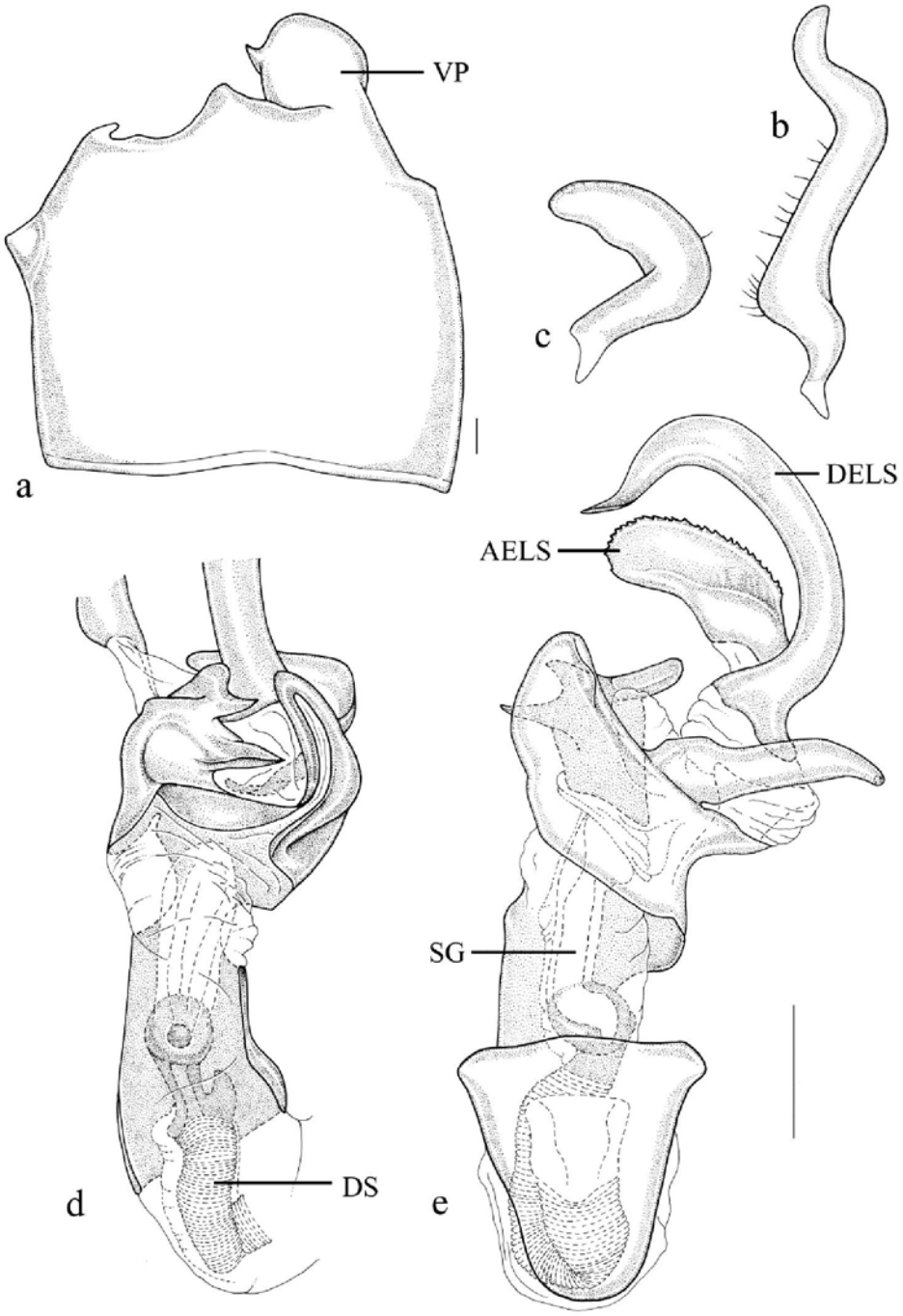


Figure 107: Male genitalia of *Morobea spectabilis*. Images reproduced from Wall 2007 with permission of the author. a: Pygophore, ventral view, scale = 0.1mm. b: Left paramere, dorsal view. c: Right paramere, dorsal view. d: Aedeagus, dorsal view, scale = 0.1mm. e: Aedeagus, lateral view, scale = 0.1mm. Abbreviation: AELS: Anterior endosomal lobal sclerite, DELS: Dorsal endosomal lobal sclerite, DS: Ductus seminis, SG: Secondary gonopore, VP: Ventral process.

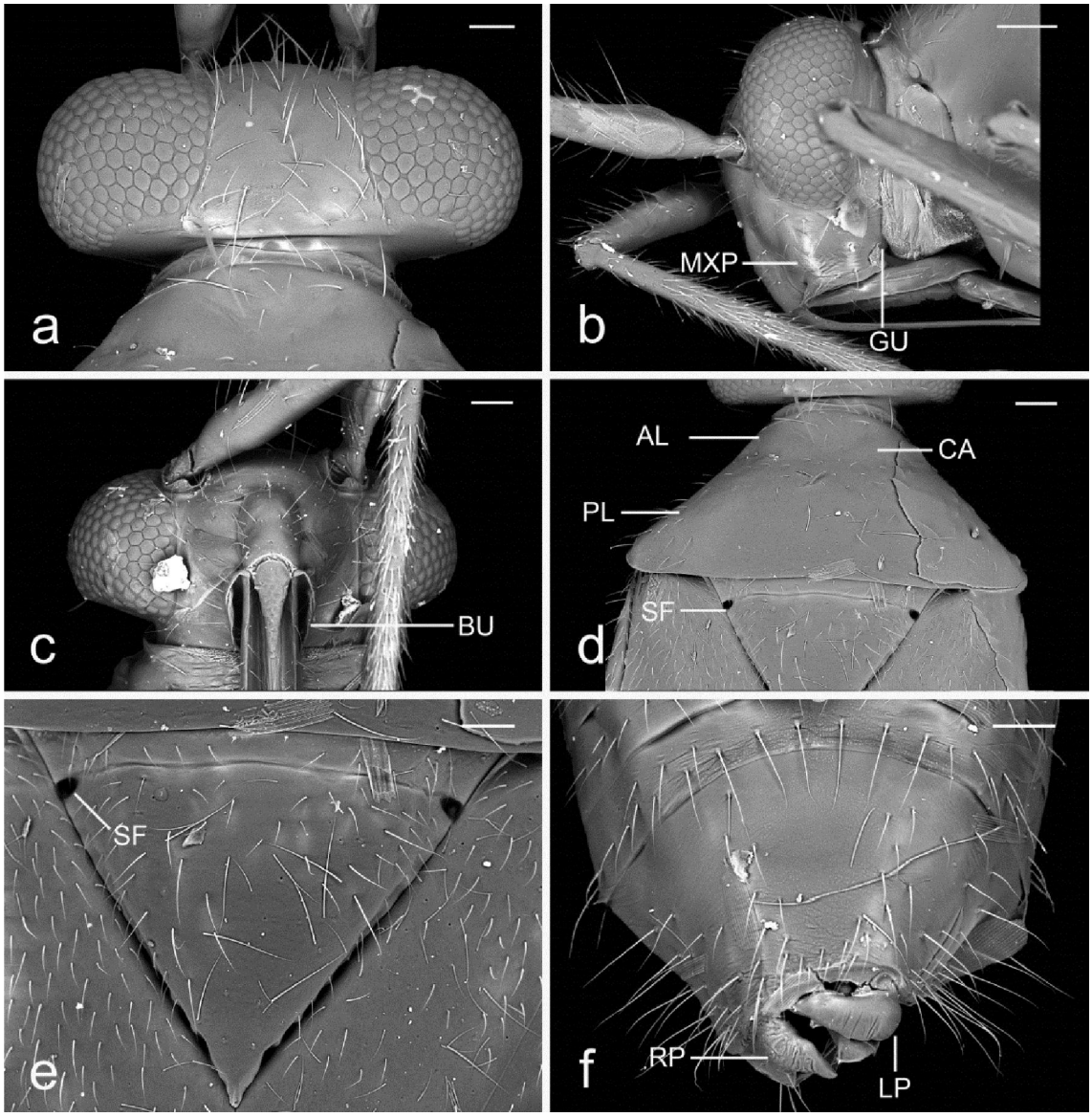


Figure 108: *Nerubia dentomembrana*. a: Head, dorsal view, scale = 60µm. b: Head, lateral view, scale = 100µm. c: Head, ventral view, scale = 60µm. d: Pronotum, scale = 100µm. e: Scutellum, scale = 60µm. f: Pygophore, scale = 100µm. Abbreviation: AL: Anterior lobe, CA: Calli, GU: Gula, LP: Left paramere, MXP: Maxillary plate, PL: Posterior lobe, RP: Right paramere, SF: Scutellum foveae.

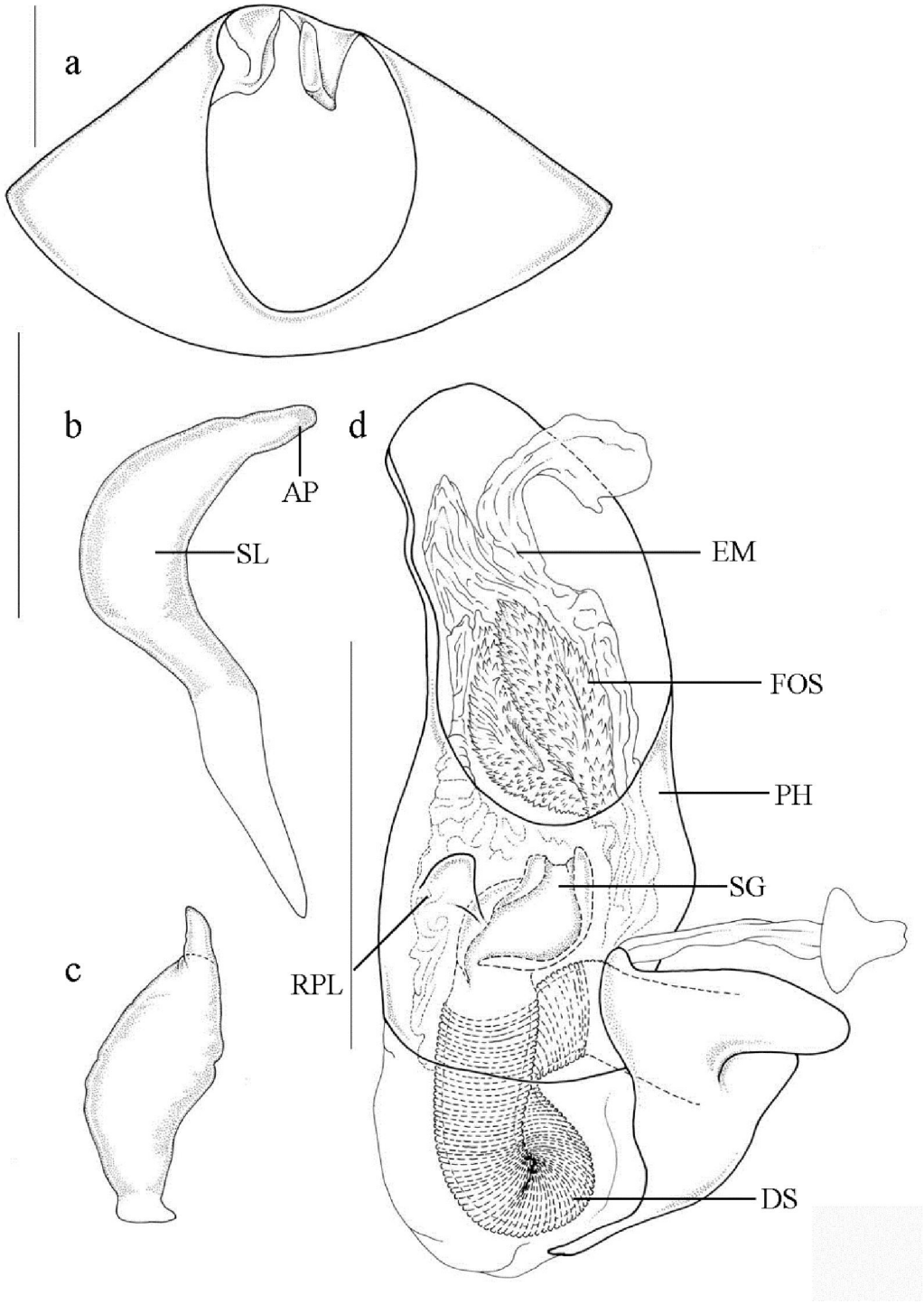


Figure 109: Male genitalia of *Nerubia dentomembrana*. a: Pygophore, dorsal view, scale = 0.1 mm. b: Left paramere, ventral view, scale = 0.1 mm. c: Right paramere, ventral view. d: Aedeagus, right lateral view, scale = 0.05 mm. Abbreviation: AP: Apophysis, APR: Apical process, DS: Ductus seminis, EM: Endosomal membrane, FOS: Field of spinules, PH: Phallotheca, RPL: Right phallothecal lobe, SG: Secondary gonopore, SL: Sensory lobe.

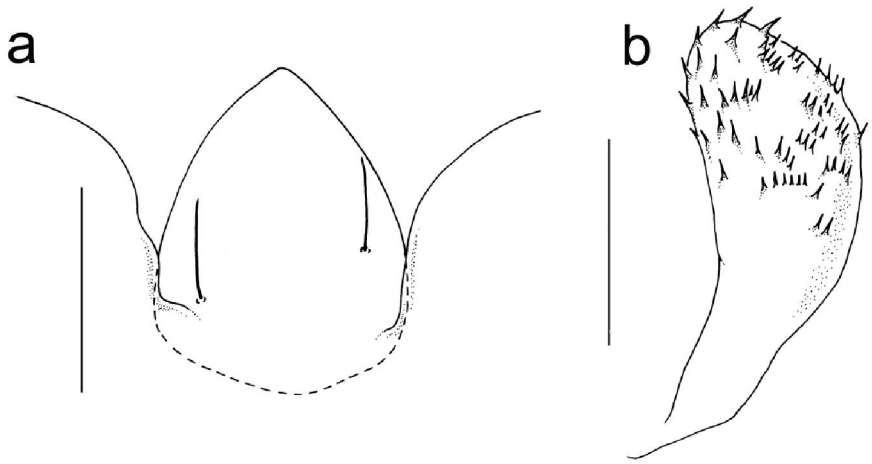


Figure 110: Female genitalia of *Nerubia*. a: *Nerubia dentomembrana* subgenital plate, scale = 0.1 mm. b: *Nerubia dentomembrana* inter-ramal lobe, scale = 0.05 mm.

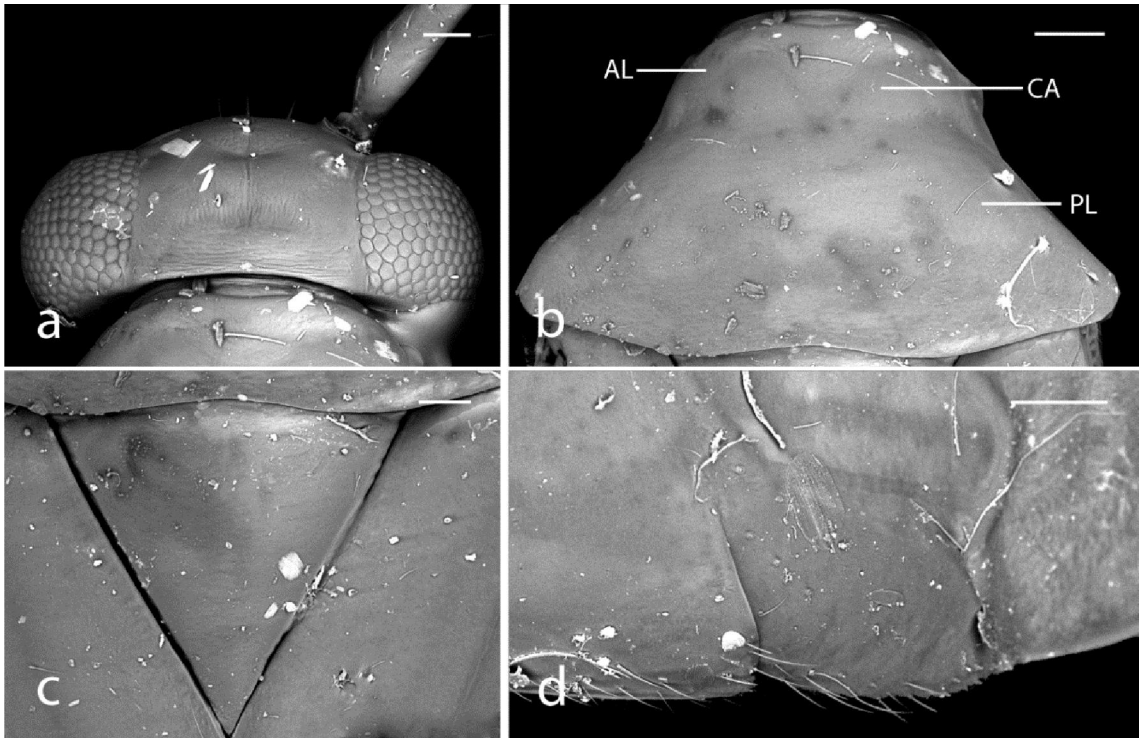


Figure 111: *Nerubia viridis* a: Head, dorsal view, scale = 60µm. b: Pronotum, scale = 100µm. c: Scutellum, scale = 60µm. d: Cuneus, scale = 60µm. Abbreviation: AL: Anterior lobe, CA: Calli, PL: Posterior lobe.

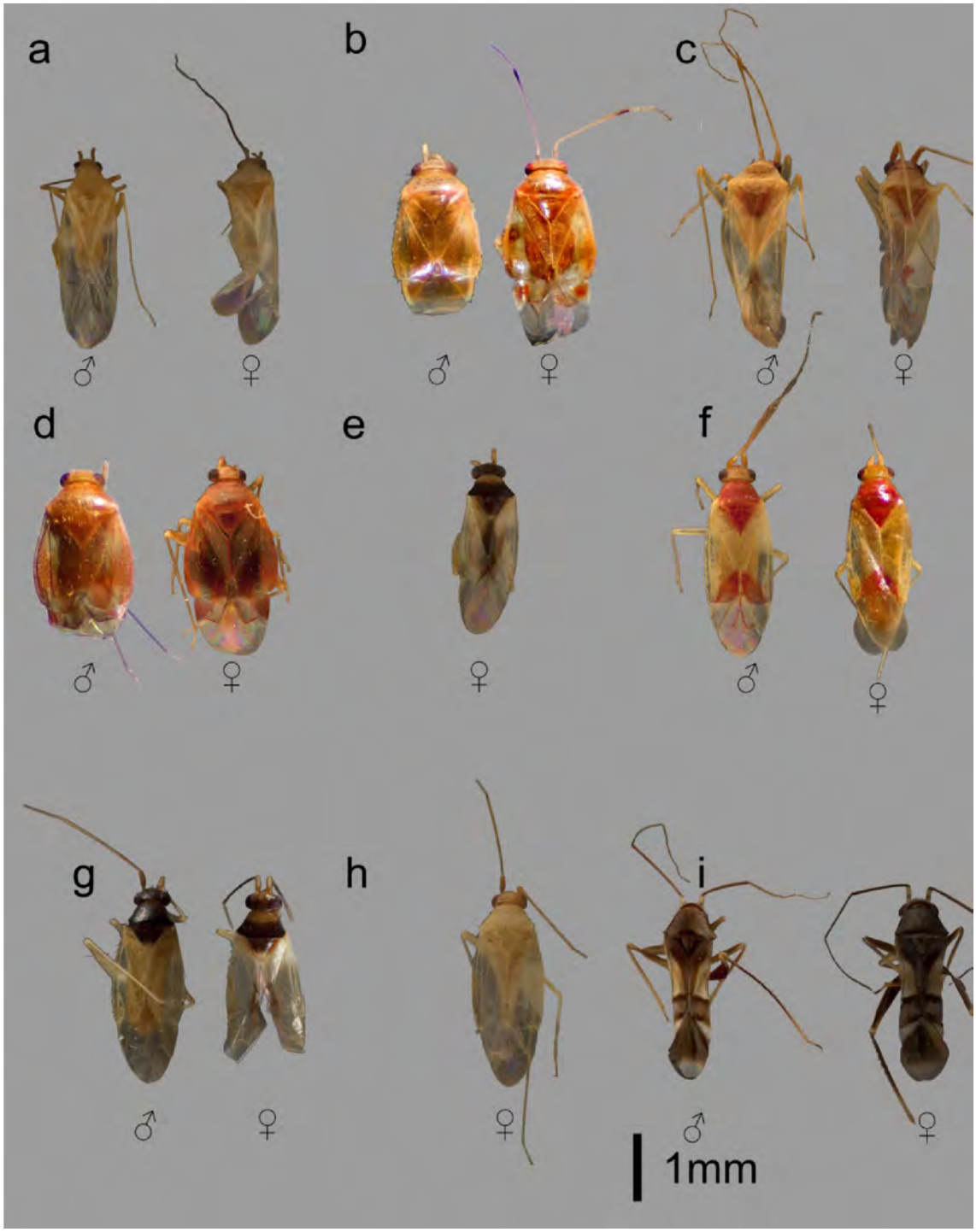


Figure 112: Habitus, *Novacalecoris* and *Prosoponomiris*. a: *Novacalecoris bisclerita*, b: *Novacalecoris gressiti*, c: *Novacalecoris kraussi*, d: *Novacalecoris macca,* e: *Novacalecoris monteithi,* f: *Novacalecoris rubrafasciae,* g: *Novacalecoris tatarnici*, g: *Novacalecoris turpa,* i: *Prosoponomiris mimetica.*

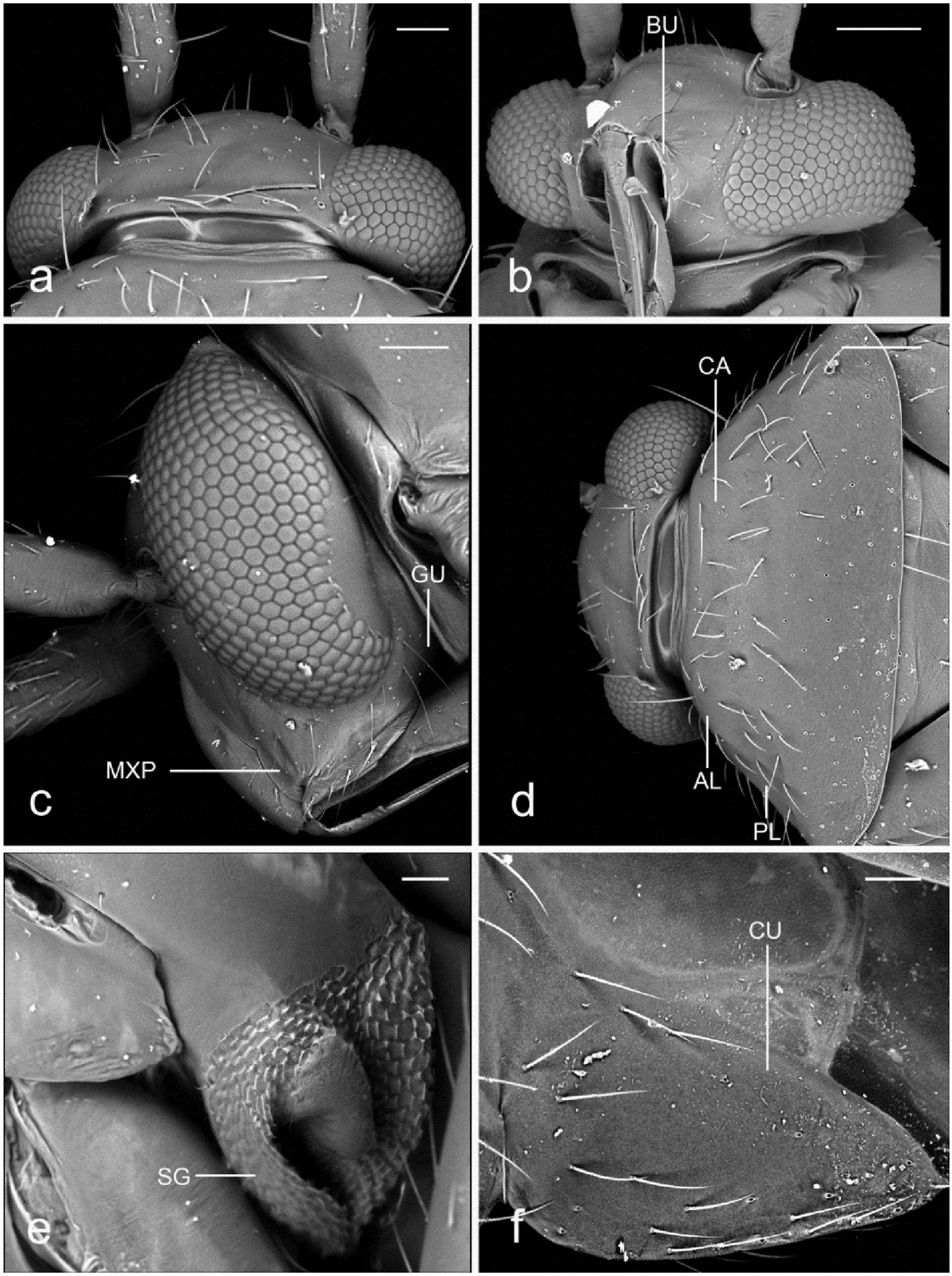


Figure 113: *Novacalecoris bisclerita.* a: Head, dorsal view, scale = 100µm. b: Head, ventral view, scale = 100µm. c: Head, lateral view, scale = 100µm. d: Pronotum, scale = 100µm. e: Scent gland, scale = 60µm. f: Cuneus, scale = 100µm. Abbreviation: AL: Anterior lobe, BU: Bucculae, CA: Calli, GU: Gula, MXP: Maxillary plate, PL: Posterior lobe, SG: Scent gland.

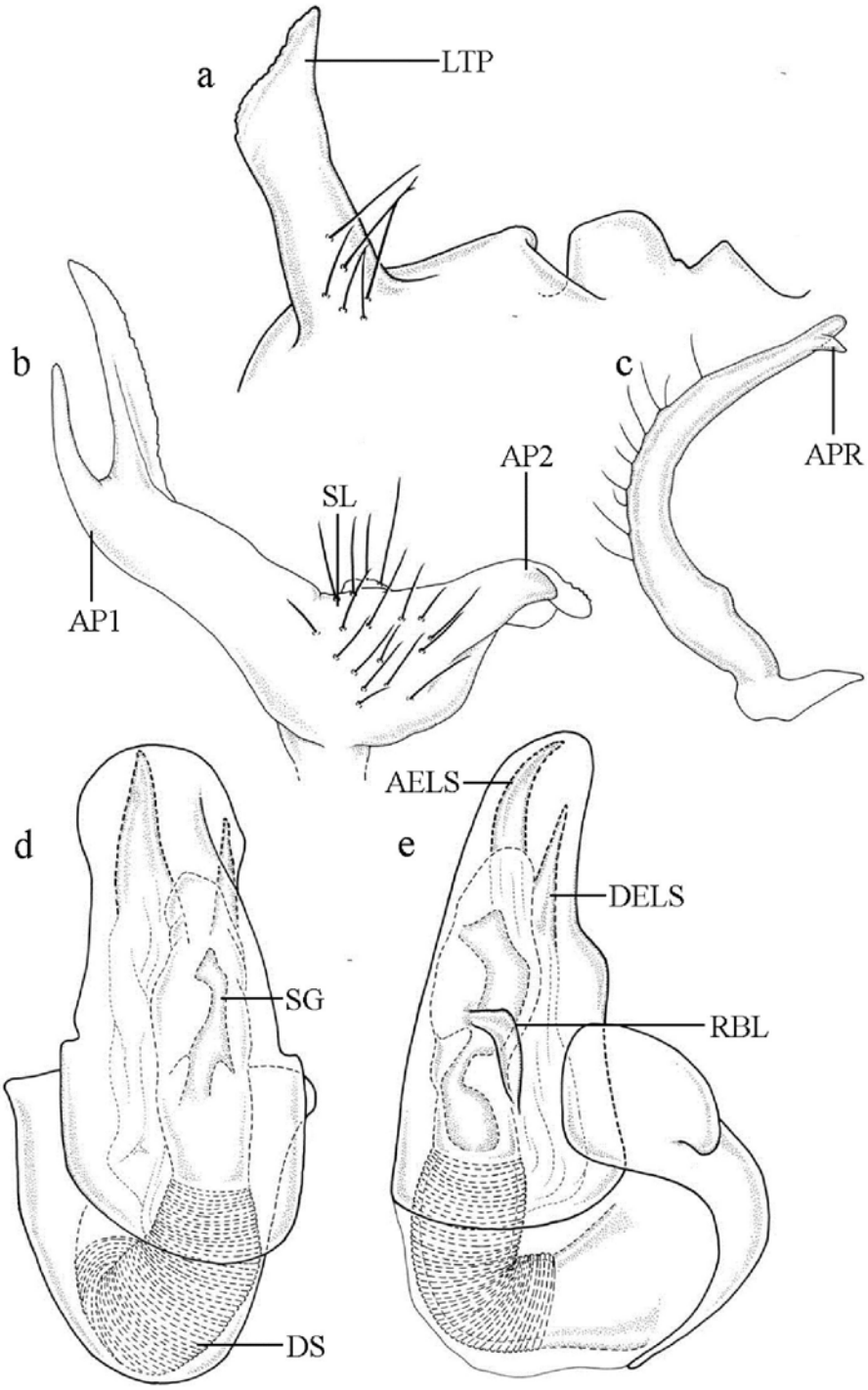


Figure 114: Male genitalia of *Novacalecoris bisclerita* a: Pygophore, ventral view, scale = 0.1 mm. b: Left paramere, dorsal view, scale = 0.1 mm. c: Right paramere, dorsal view. d: Aedeagus, ventral view, scale = 0.05 mm. e: Aedeagus, right lateral view, scale = 0.05 mm. Abbreviation: AELS: Apical endosomal sclerite, AP1: Apophysis 1, AP2: Apophysis 2, APR: Apical process, DELS: Dorsal endosomal lobal sclerite, DS: Ductus seminis, LTP: Left tergal process, RPL: Right phallothecal lobe, SG: Secondary gonopore, SL: Sensory lobe.

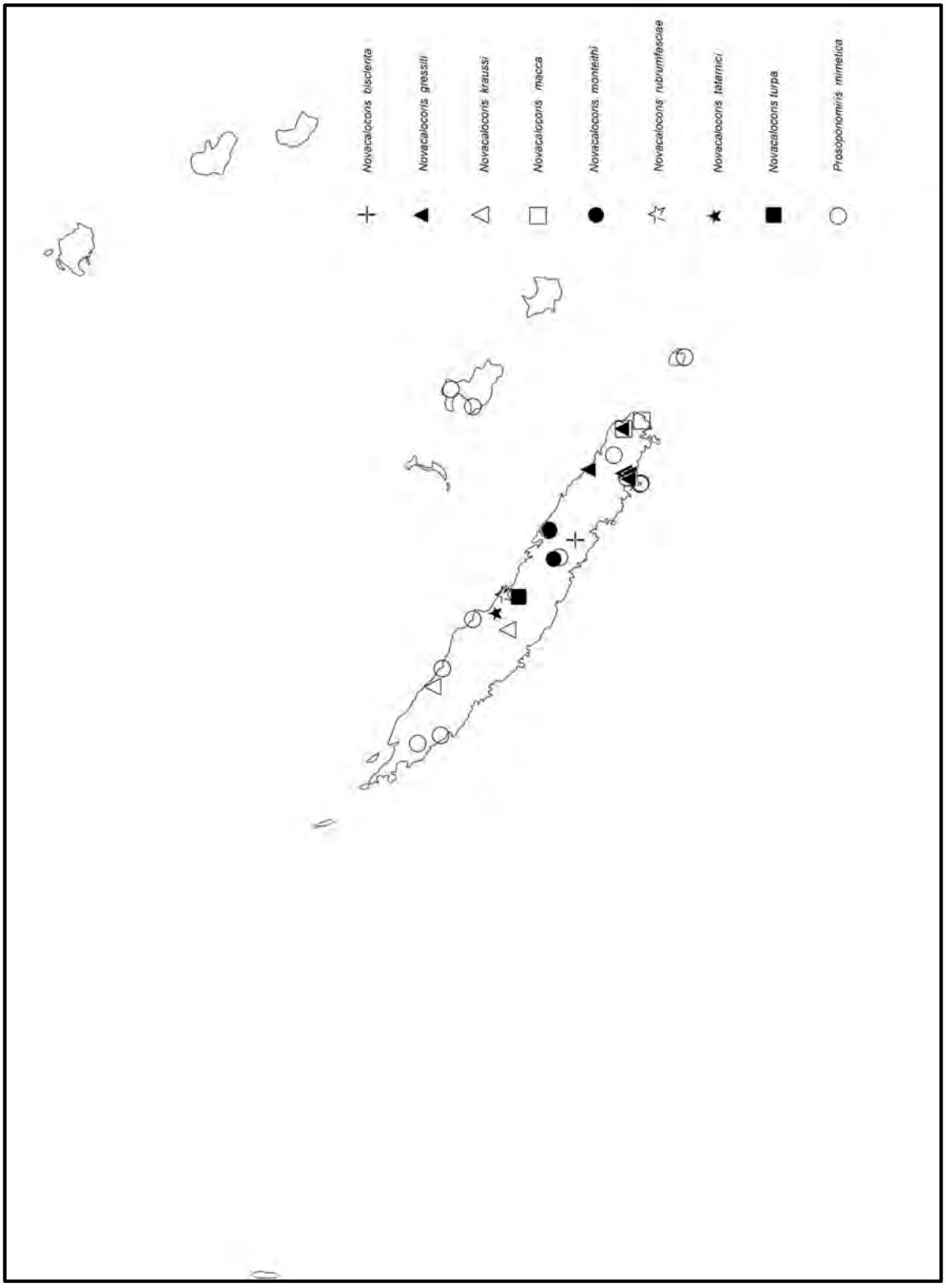


Figure 115: Distribution map of *Novacalecoris* species.

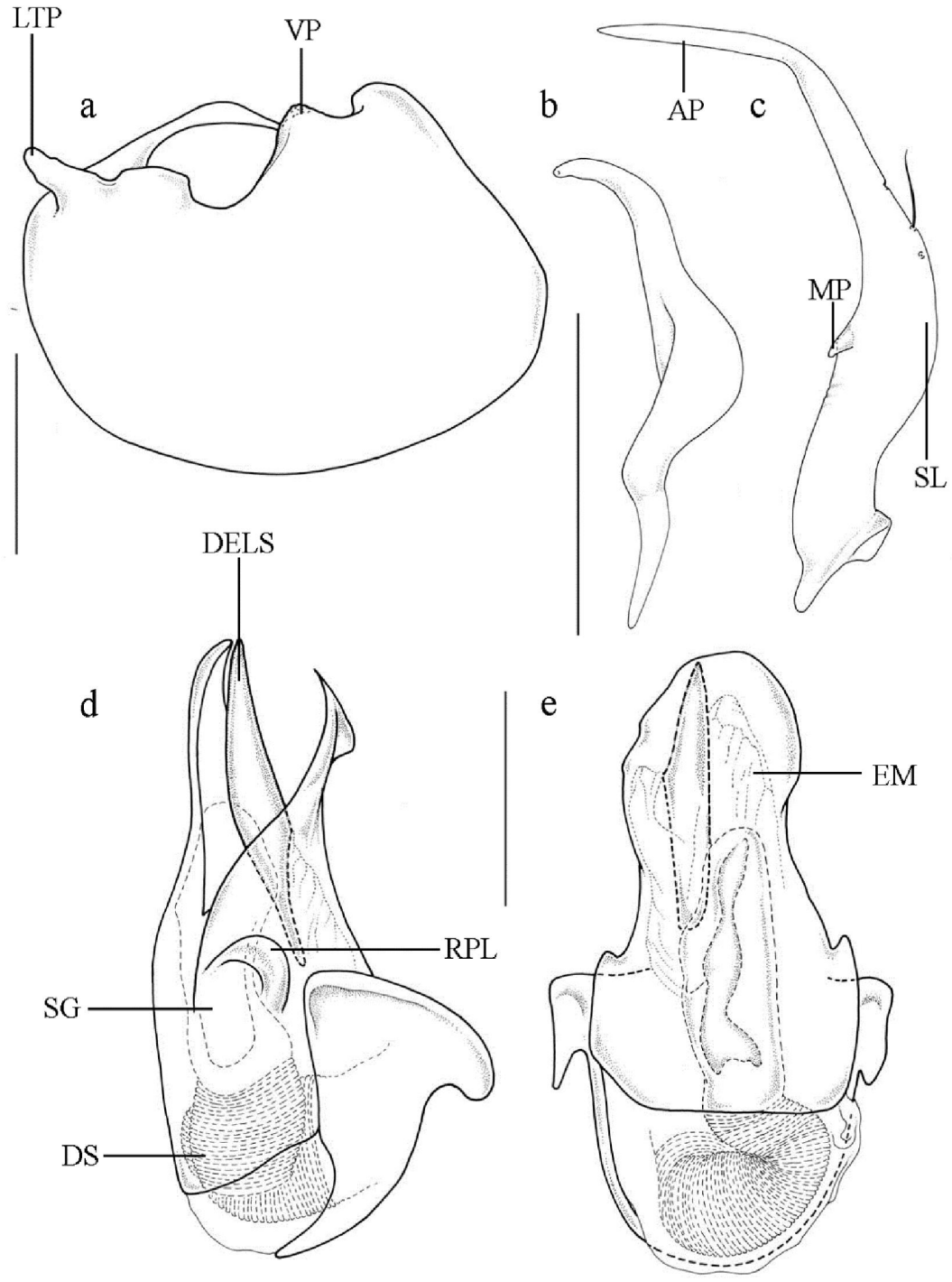


Figure 116: Male genitalia of *Novacalecoris gressiti* a: Pygophore, ventral view, scale = 0.1 mm. b: Left paramere, dorsal view, scale = 0.1 mm. c: Right paramere, ventral view. d: Endosoma, right lateral view scale = 0.05 mm. e. Endosoma, ventral view. Abbreviation: AP: Apophysis, DS: Ductus seminis, EM: Endosomal membrane, LTP: Left tergal process, MP: Medial process, RPL: Right phallothecal lobe, SG: Secondary gonopore, VP: Ventral process.

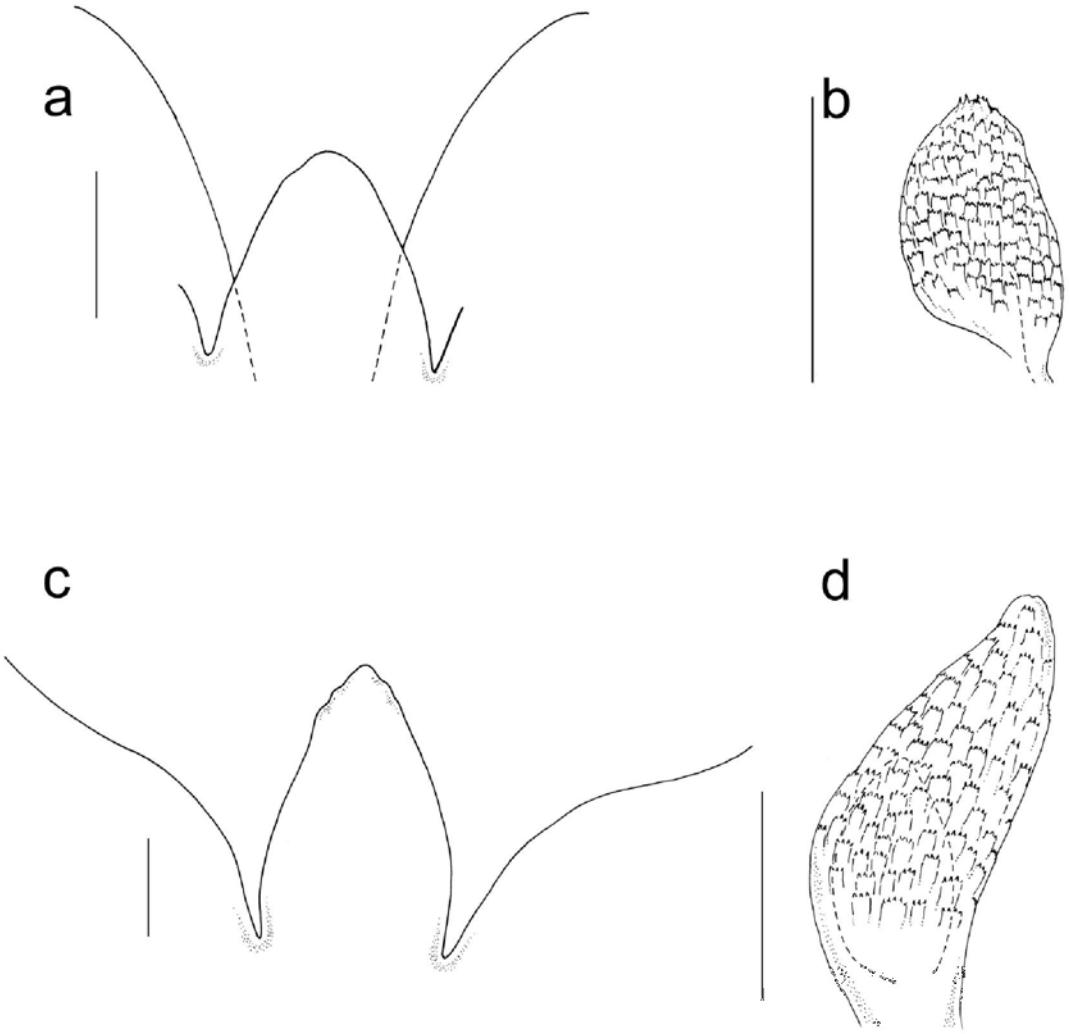


Figure 117: Female genitalia of *Novacalecoris*. a: *Novacalecoris gressiti* subgenital plate, scale = 0.1 mm. b: *Novacalecoris gressiti* inter-ramal lobe, scale = 0.1 mm. c: *Novacalecoris rubrafasciae* subgenital plate, scale = 0.1 mm. d: *Novacalecoris rubrafasciae* inter-ramal lobe, scale = 0.05 mm.

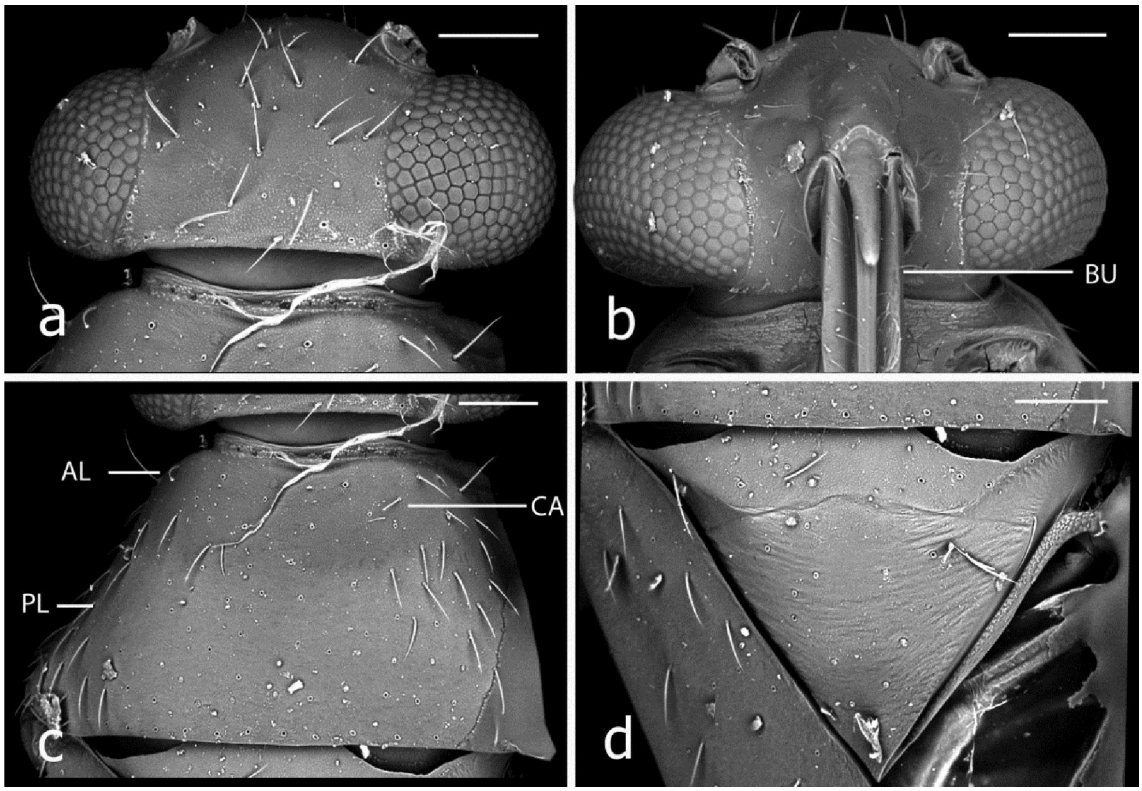


Figure 118: *Novacalecoris kraussi* Head, dorsal view, scale = 100µm. b: Head, ventral view, scale = 60µm. c: Pronotum, scale = 100µm. d: Scutellum, scale = 40µm. Abbreviation: AL: Anterior lobe, BU: Bucculae, CA: Calli, PL: Posterior lobe, RU: Ruga,

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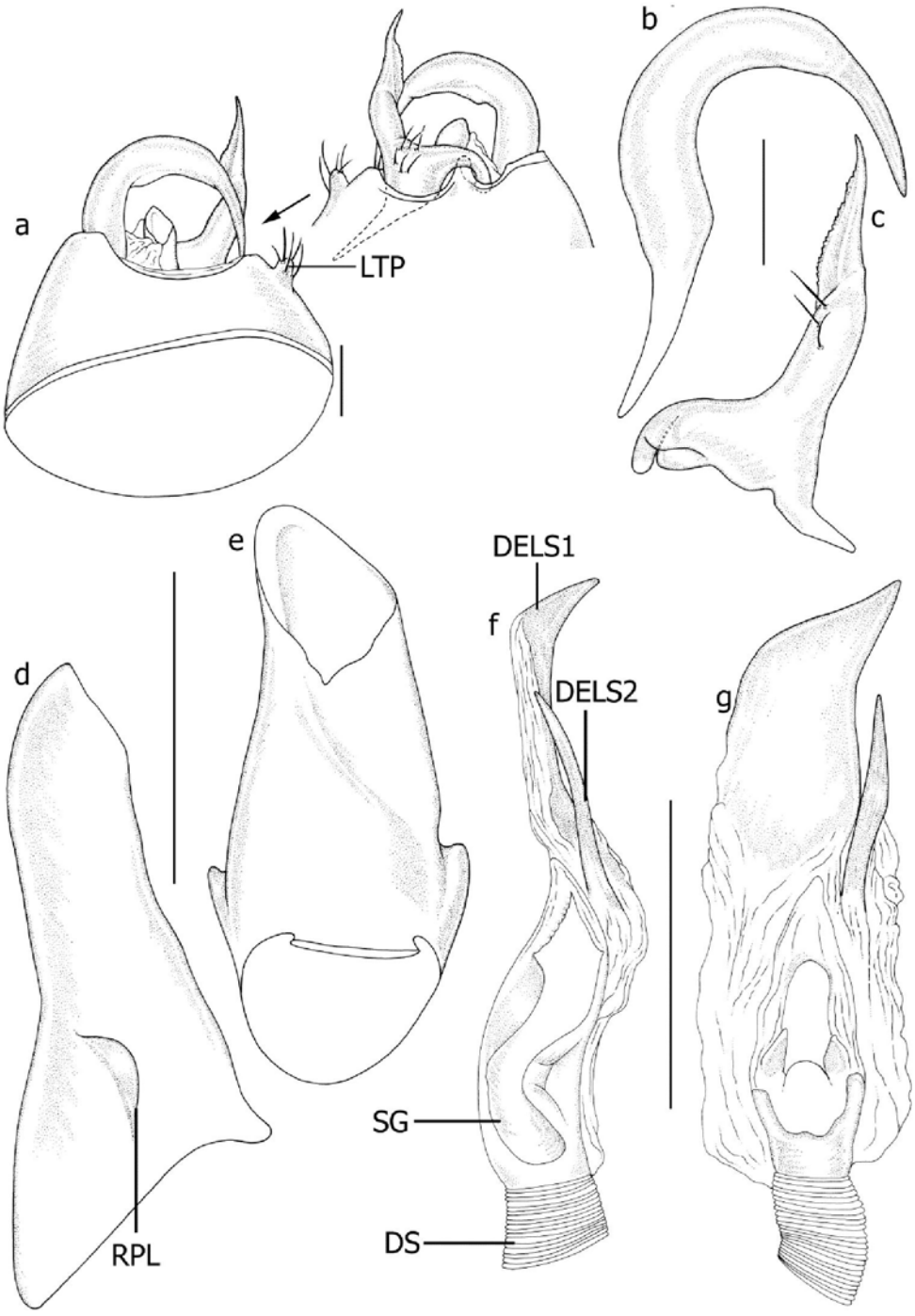


Figure 119: Male genitalia of *Novacalecoris kraussi* a: Pygophore, dorsal view, scale = 0.1 mm. b: Left paramere, dorsal view, scale = 0.1 mm. c: Right paramere, dorsal view. d: Phallotheca, right lateral view, scale = 0.1mm. e: Phallotheca, dorsal view. f: Endosoma, lateral view. g: Endosoma, ventral view, scale = 0.05 mm. Abbreviation: DELS1: Dorsal endosomal lobal sclerite 1, DELS2: Dorsal endosomal lobal sclerite 2, DS: Ductus seminis, LTP: Left tergal process, RPL: Right phallothecal lobe, SG: Secondary gonopore.

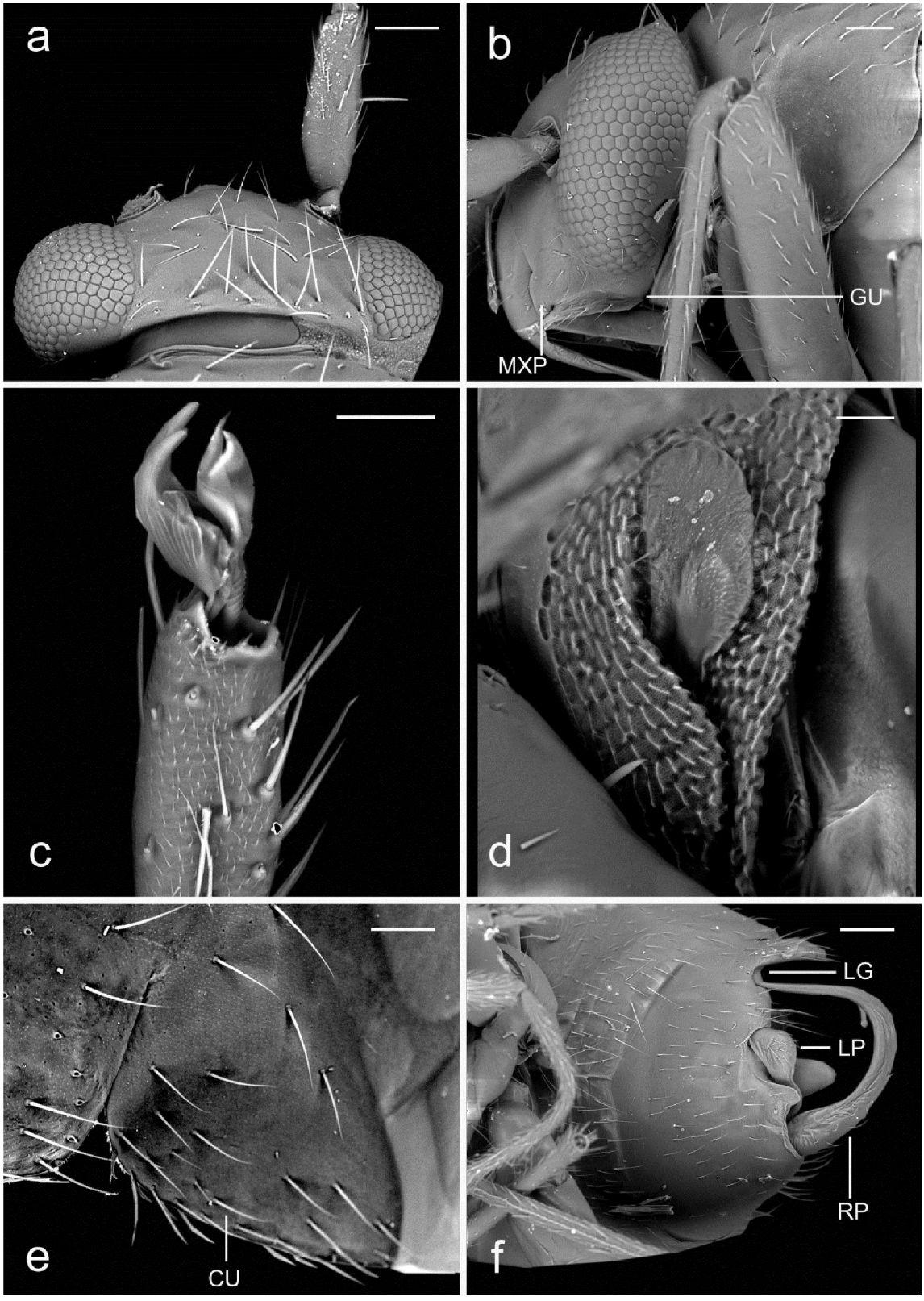


Figure 120: *Novacalecoris macca*. a: Head, dorsal view, scale = 100µm. b: Head, lateral view, scale = 60µm. c: Pretarsus, scale = 20µm. e: Cuneus, scale = 60µm. f: Pygophore ventral view, scale = 60µm. Abbreviation: CU: Cuneus, GU: Gula, LG: Lateral groove, LP: Left paramere, MXP: Maxillary plate, SG: Scent gland, RP: Right paramere.

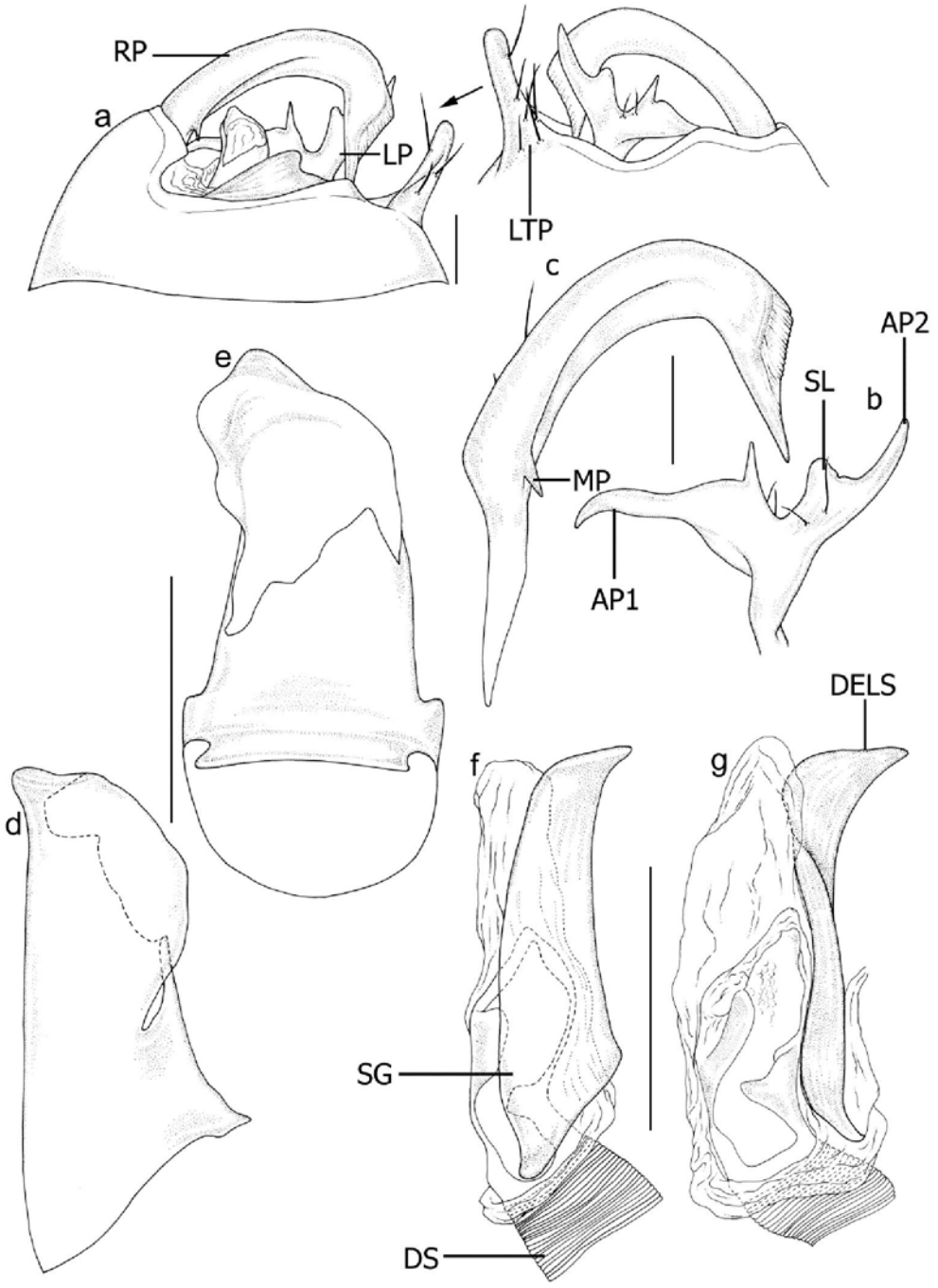


Figure 121: Male genitalia of *Novacalecoris macca* a: Pygophore, dorsal view, scale = 0.1 mm. b: Left paramere, dorsal view, scale = 0.1mm. c: Right paramere, dorsal view. d: Phallotheca, right lateral view. e: Phallotheca, dorsal view, scale = 0.1mm. f: Endosoma, ventral view, scale = 0.05mm. g: Endosoma, lateral view, scale = 0.05mm. Abbreviation: AP1: Apophysis 1, AP2: Apophysis 2, APR: Apical process, BP: Basal process, DELS: Dorsal endosomal lobal sclerite, DS: Ductus seminis, LP: Left paramere LTP: Left tergal process, MP: Medial process, RP: Right paramere, RPL: Right phallothecal lobe, SG: Secondary gonopore, VP: Ventral process.

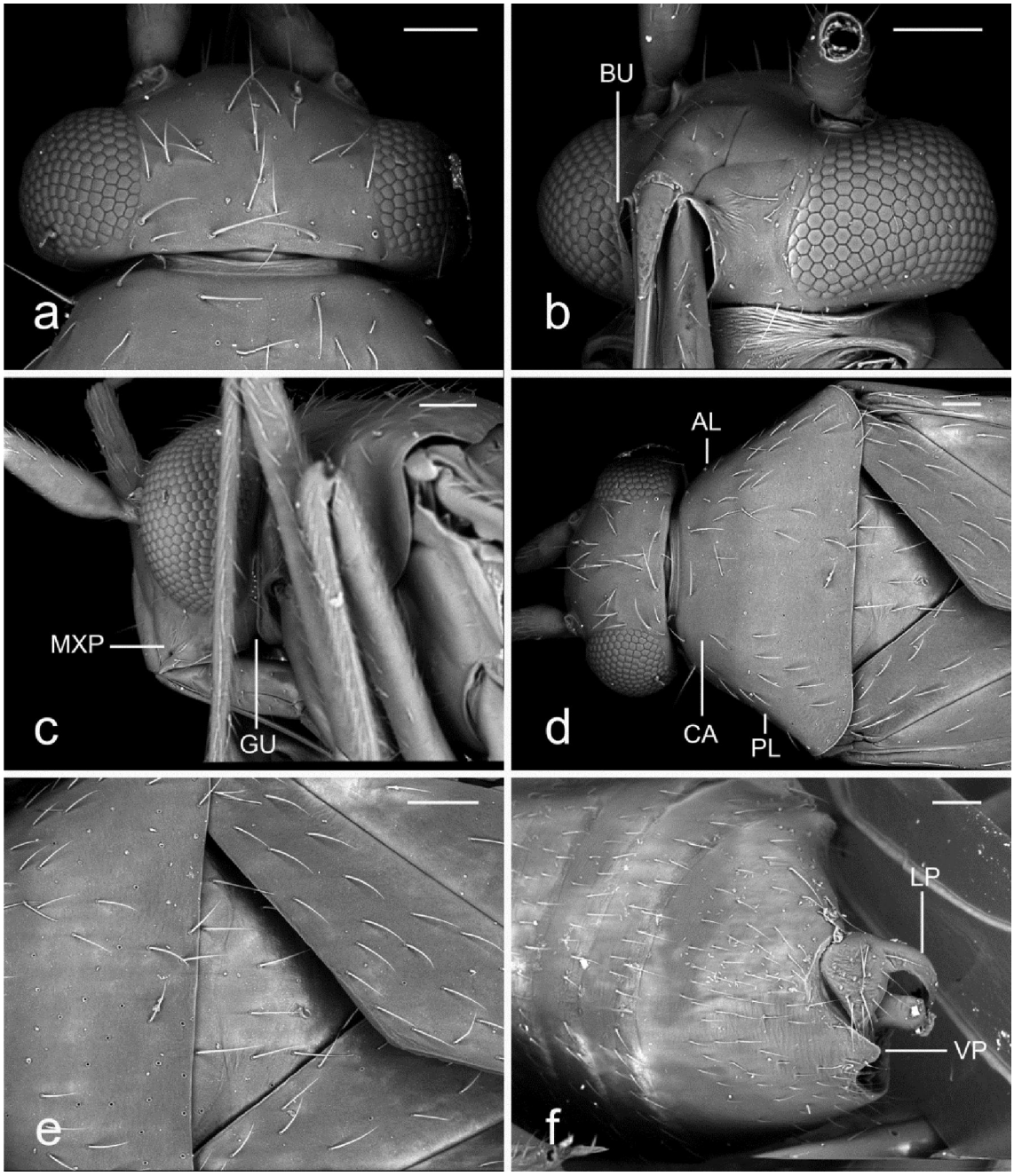


Figure 122: *Novacalecoris monteithi*. a: Head, dorsal view, scale = 100µm. b: Head, ventral view, scale = 100µm. c: Head, lateral view, scale = 100µm. d: Pronotum, scale = 100µm. e: Scutellum, scale = 100µm. f: Pygophore, scale = 60µm. Abbreviation: AL: Anterior lobe, BU: Bucculae, CA: Calli, GU: Gula, LP: Left paramere, MXP: Maxillary plate, PL: Posterior lobe, VP: Ventral projection of the pygophore.

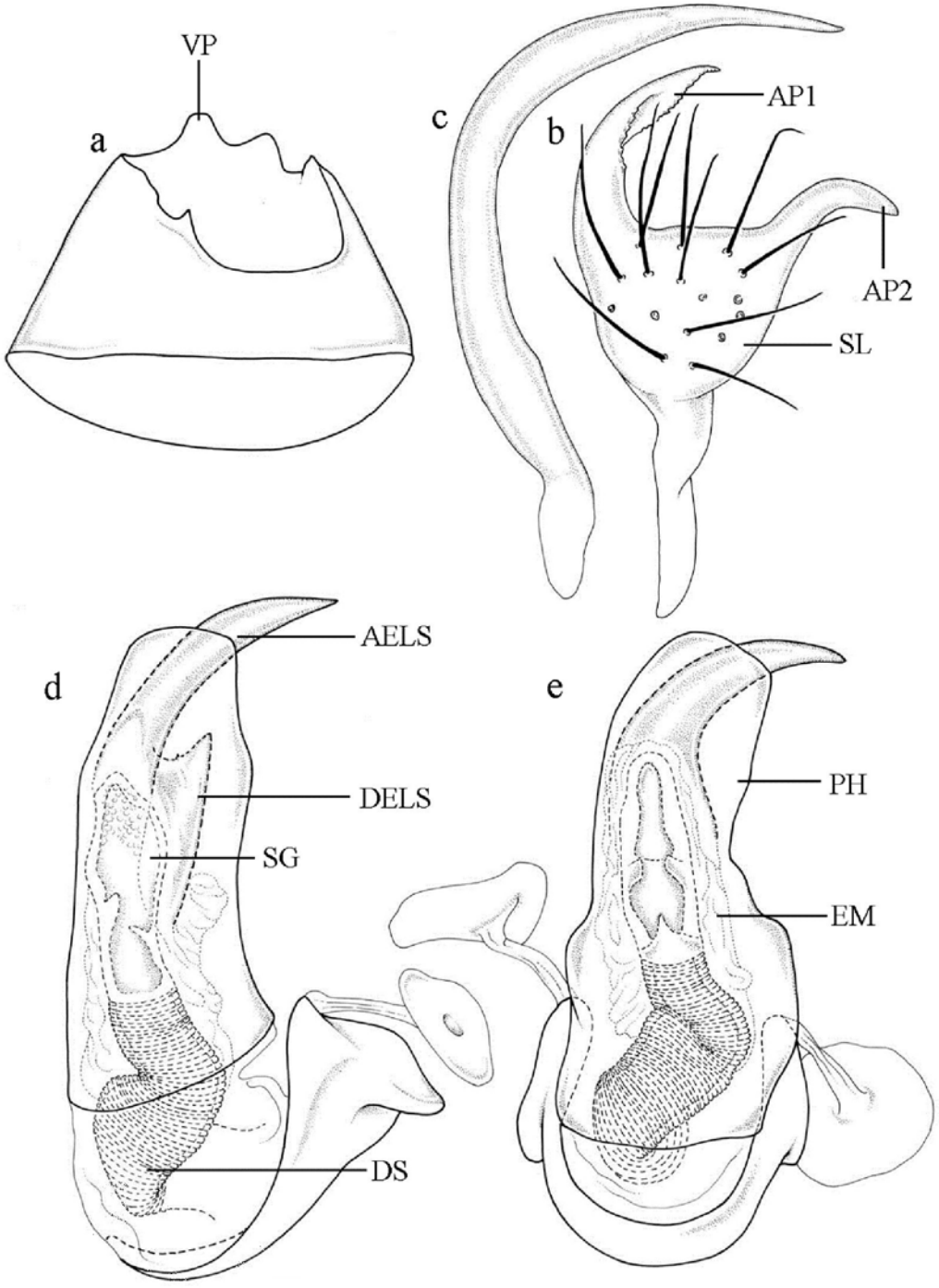


Figure 123: Male genitalia of *Novacalecoris monteithi*. a: Pygophore, dorsal view, scale = 0.1 mm. b: Left paramere, lateral view, scale = 0.1 mm. c: Right paramere, dorsal view. d: Endosoma, lateral view. e: Endosoma, dorsal view, scale = 0.05 mm. Abbreviation: AELS: Apical endosomal sclerite, AP: Apophysis, APR: Apical process, DELS: Dorsal endosomal lobal sclerite, DS: Ductus seminis, LTP: Left tergal process, SG: Secondary gonopore, SL: Sensory lobe, VP: Ventral process.

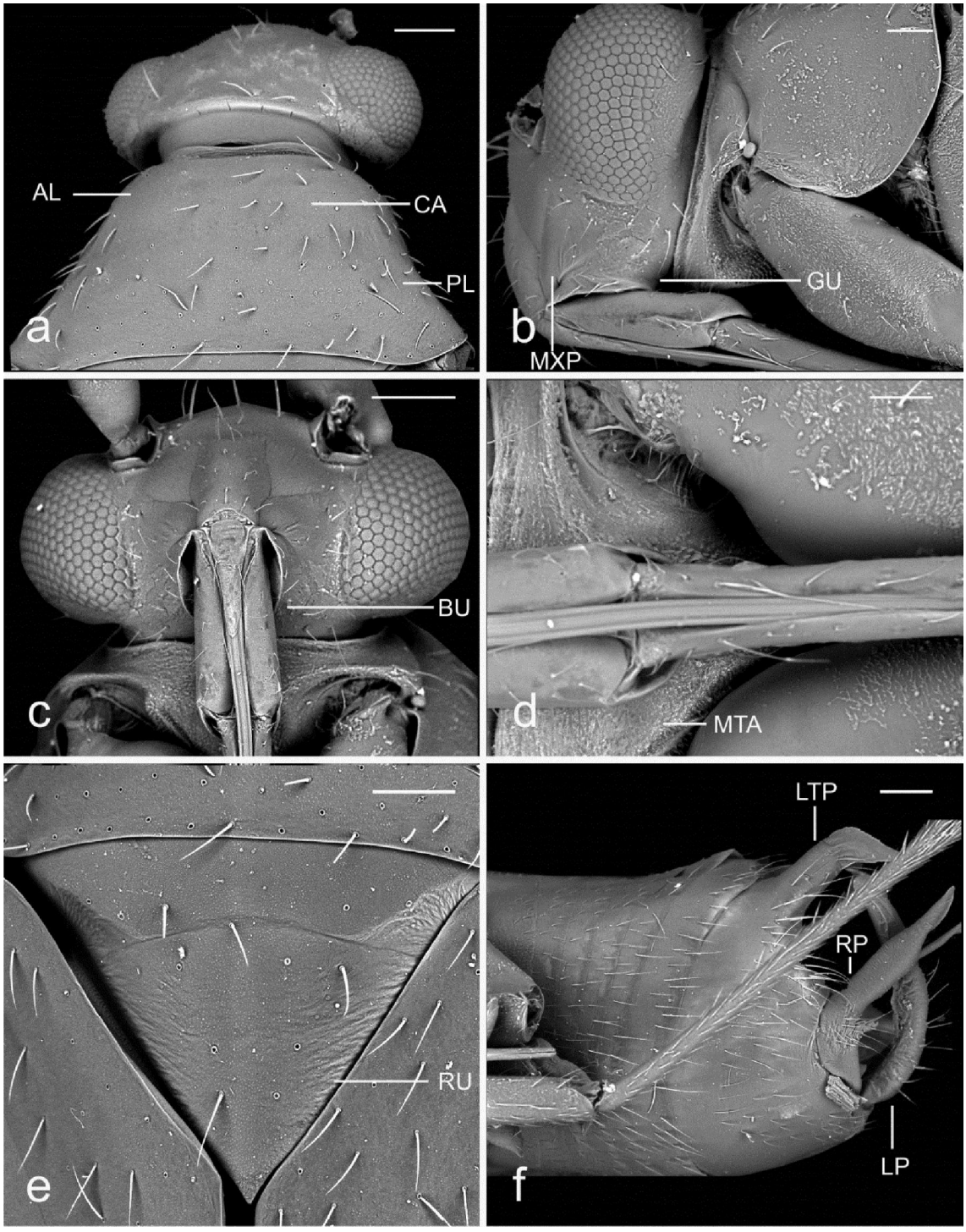


Figure 124: *Novacalecoris rubrafasciae*. a: Head, dorsal view, scale = 100µm. b: Head, lateral view, scale = 60µm. c: Head, ventral view, scale = 100µm. d: Prosternal vestiture, scale = 40µm. e: Scutellum, scale = 100µm. f: Pygophore, scale = 100µm. Abbreviation: AL: Anterior lobe, BU: Bucculae, CA: Calli, GU: Gula, MTA: Microtrichia, RU: Ruga, LP: Left paramere, LTP: Lateral process, MXP: Maxillary plate, PL: Posterior lobe, RP: Right paramere.

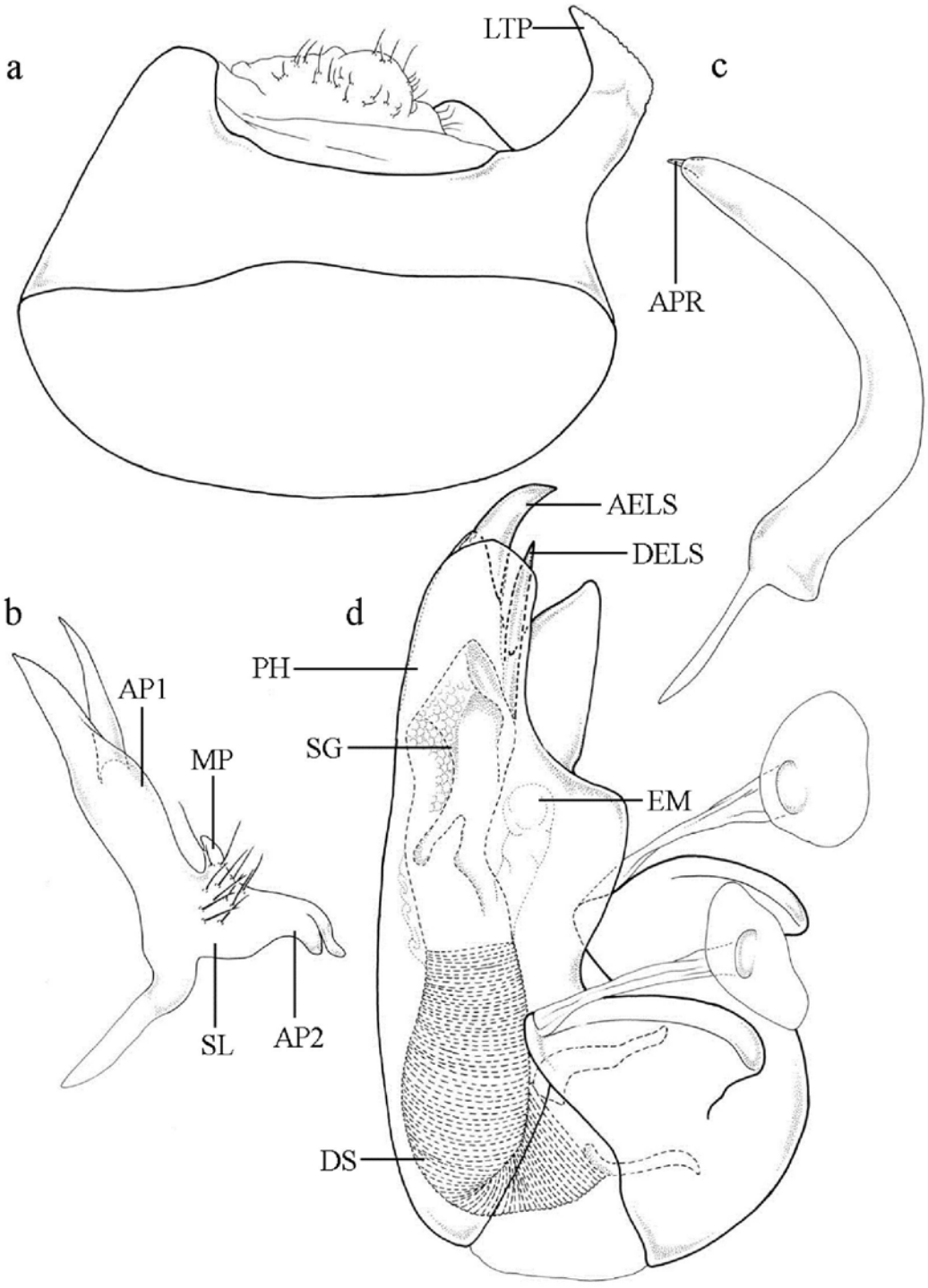


Figure 125: Male genitalia of *Novacalecoris rubrafasciae*. a: Pygophore, dorsal view, scale = 0.1 mm. b: Left paramere, lateral view, scale = 0.1 mm. c: Right paramere, ventral view. d: Endosoma, right lateral view, scale = 0.05 mm. Abbreviation: AELS: Apical endosomal sclerite, AP1: Apophysis 1, AP2: Apophysis 2, APR = Apical process, DELS: Dorsal endosomal lobal sclerite, DS: Ductus seminis, EM: Endosomal membrane, LTP: Left tergal process, MP: Medial process, SG: Secondary gonopore, SL: Sensory lobe.

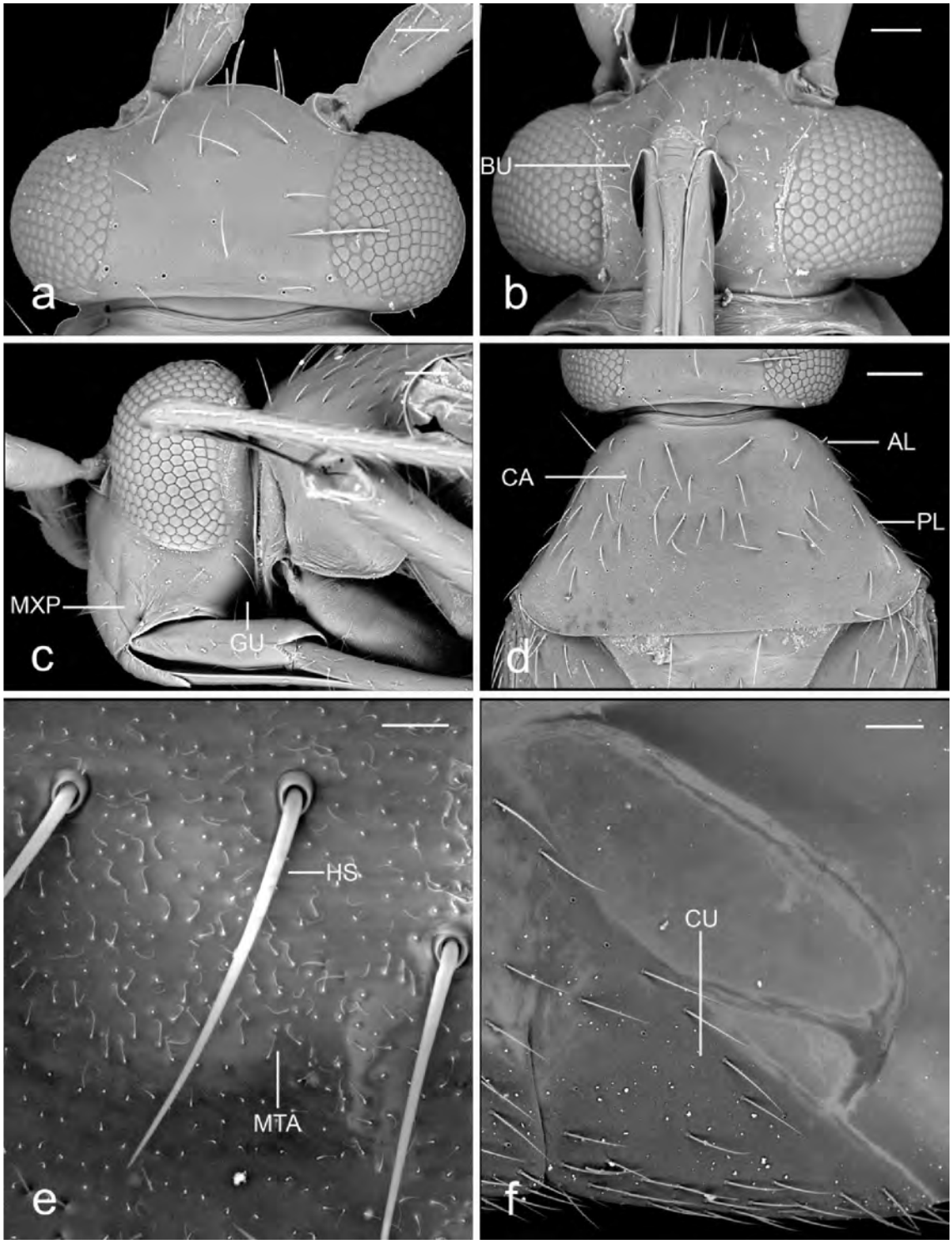


Figure 126: *Novacalecoris tatarnici.* a: Head, dorsal view, scale = 60µm. b: Head, ventral view, scale = 60µm. c: Head, lateral view, scale = 60µm. d: Pronotum, scale = 100µm. e: Hemelytral vestiture, scale = 10µm. f: Cuneus, scale = 60µm. Abbreviation: AL: Anterior lobe, BU: Bucculae, CA: Calli, CU: Cuneus, GU: Gula, HS: Hairlike setae, MTA: Microtrichia, MXP: Maxillary Plate, PL: Posterior lobe.

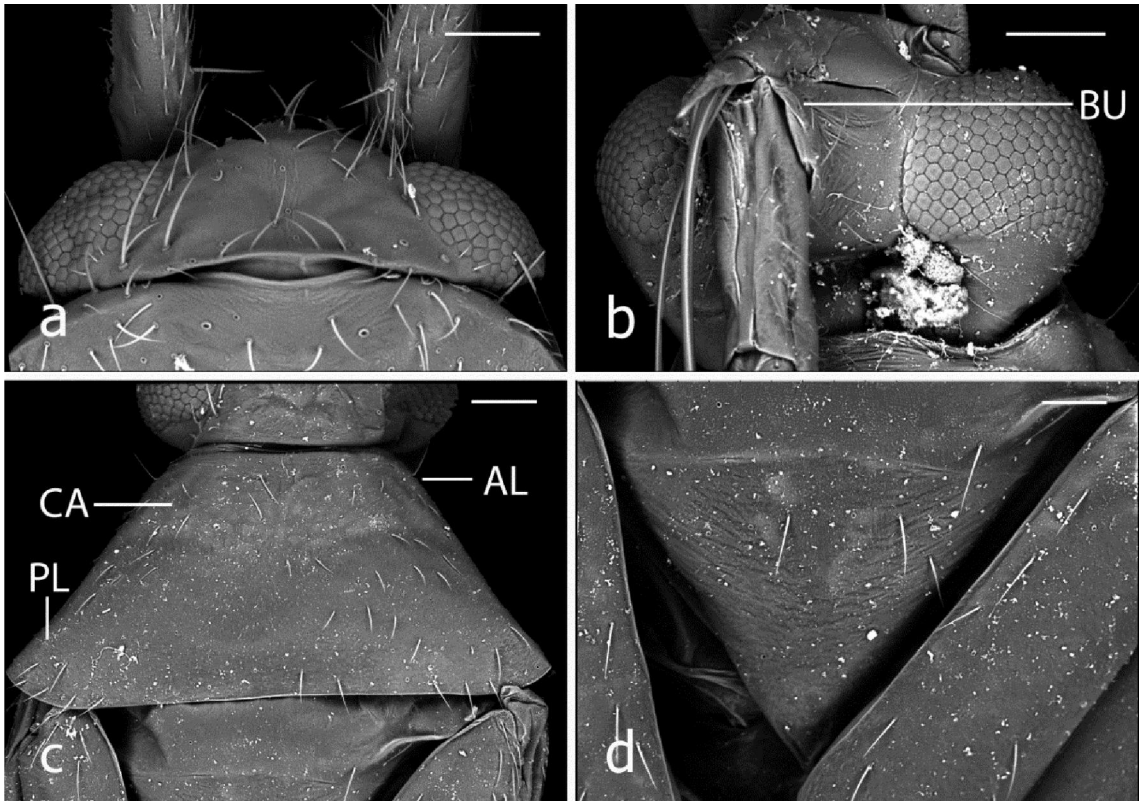


Figure 127: SEMs *Novacalecoris turpa* Head, dorsal view, scale = 100µm. b: Head, ventral view, scale = 100µm. c: Pronotum, scale = 100µm. d: Scutellum, scale = 100µm. Abbreviation: AL: Anterior lobe, BU: Bucculae, CA: Calli, PL: Posterior lobe.

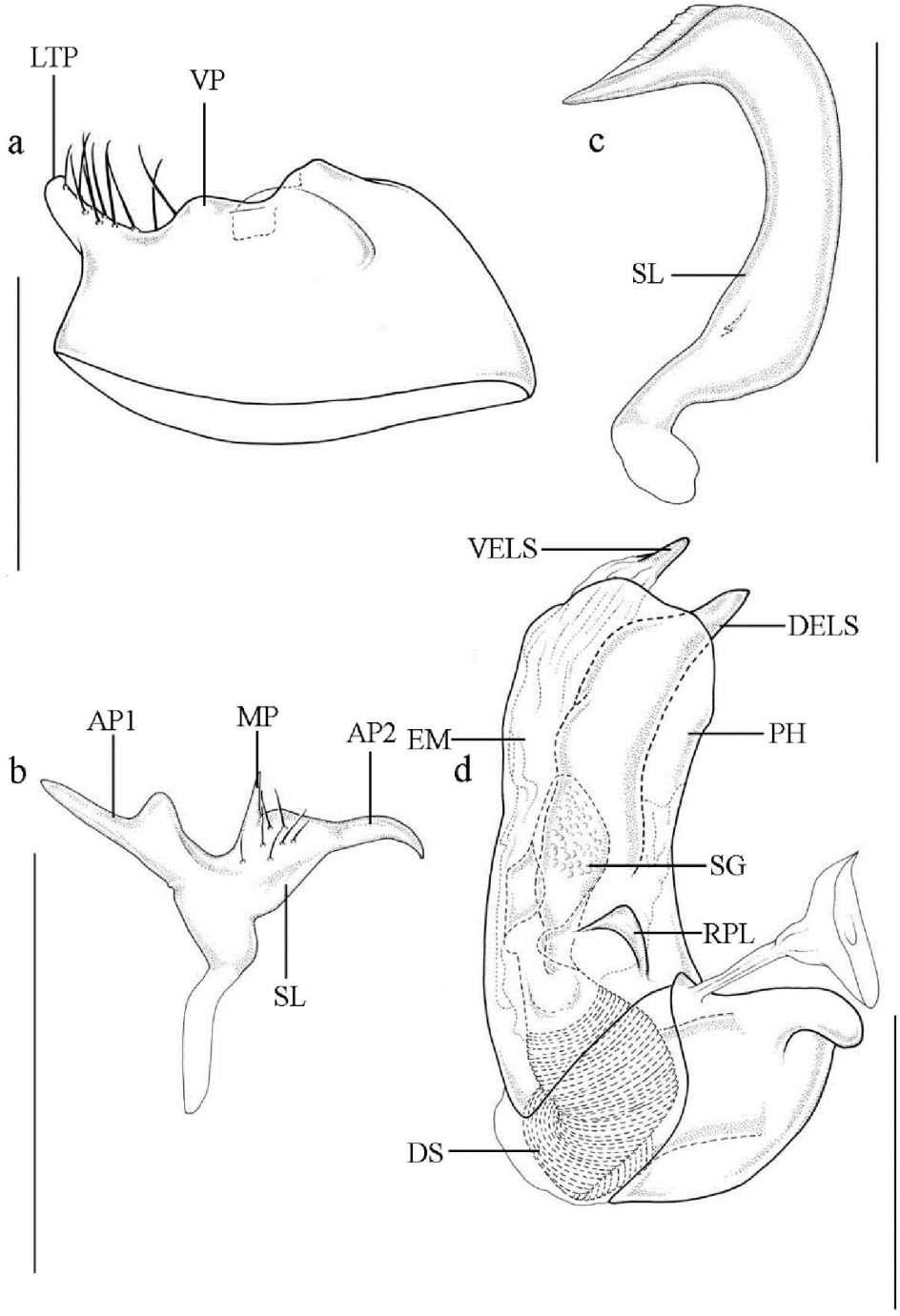


Figure 128: Male genitalia of *Novacalecoris turpa*. a: Pygophore, ventral view, scale = 0.1 mm. b: Left paramere, ventral view, scale = 0.1 mm. c: Right paramere, ventral view. d: Aedeagus, right lateral view, scale = 0.05 mm. Abbreviation: AELS: Apical endosomal lobal sclerite. AP1: Apophysis1, AP2: Apophysis 2, DELS: Dorsal endosomal lobal sclerite, DS: Ductus seminis, LTP: Left tergal process, MP: Medial process, PH: Phallotheca, RPL: Right phallothecal lobe, SG: Secondary gonopore, SL: Sensory lobe, VELS: Ventral endosomal lobal sclerite, VP: Ventral process.

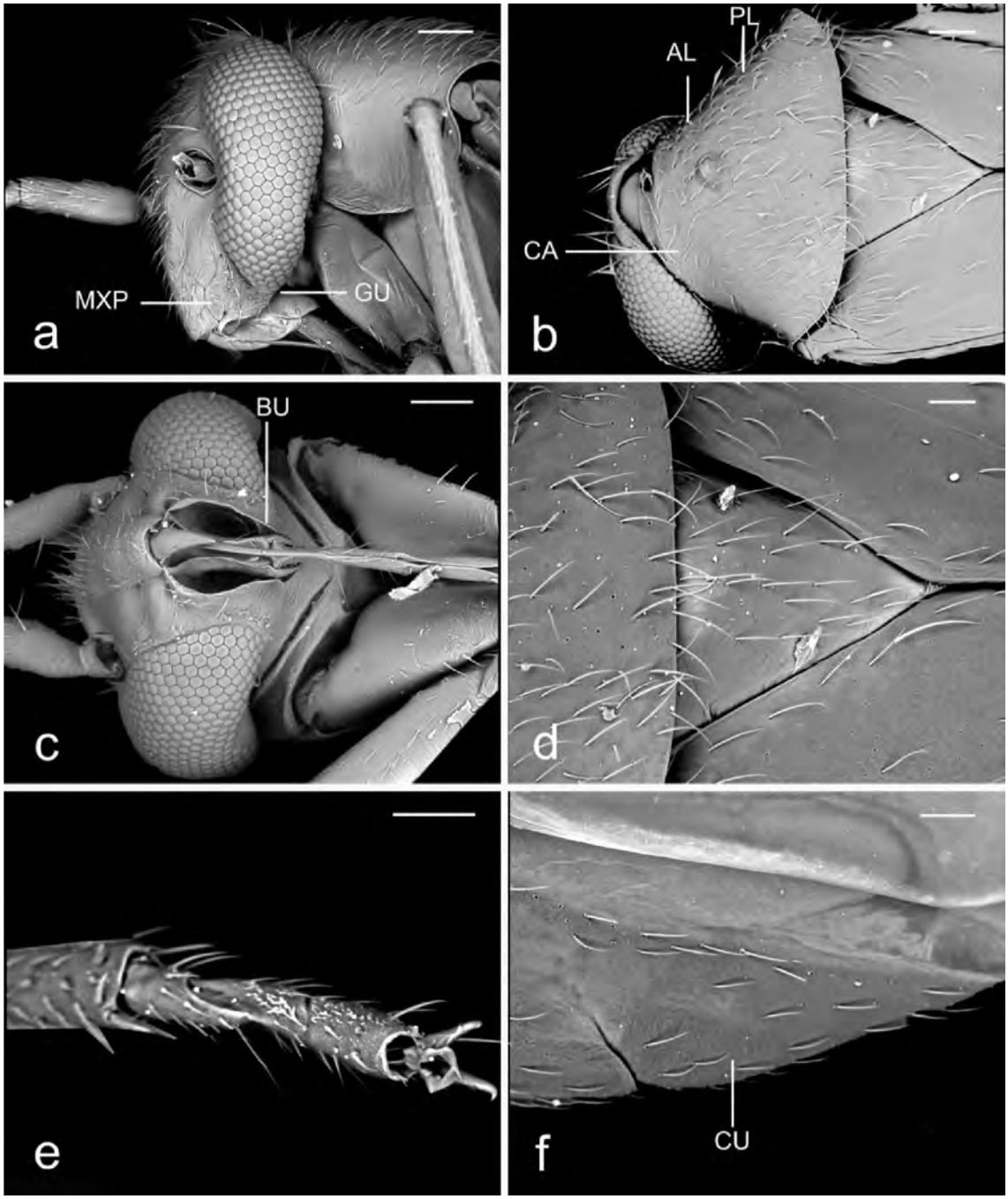


Figure 129: *Prosoponomiris mimetica* a: Head, lateral view, scale = 100µm. b: Pronotum, scale = 100µm. c: Head, ventral view, scale = 100µm. d: Scutellum, scale = 60µm. e: Pretarsus, scale = 40µm. f: Cuneus, scale = 60µm. Abbreviation: AL: Anterior lobe, BU: Bucculae, CA: Calli, CU: Cuneus, GU: Gula, MXP: Maxillary plate, PL: Posterior lobe.

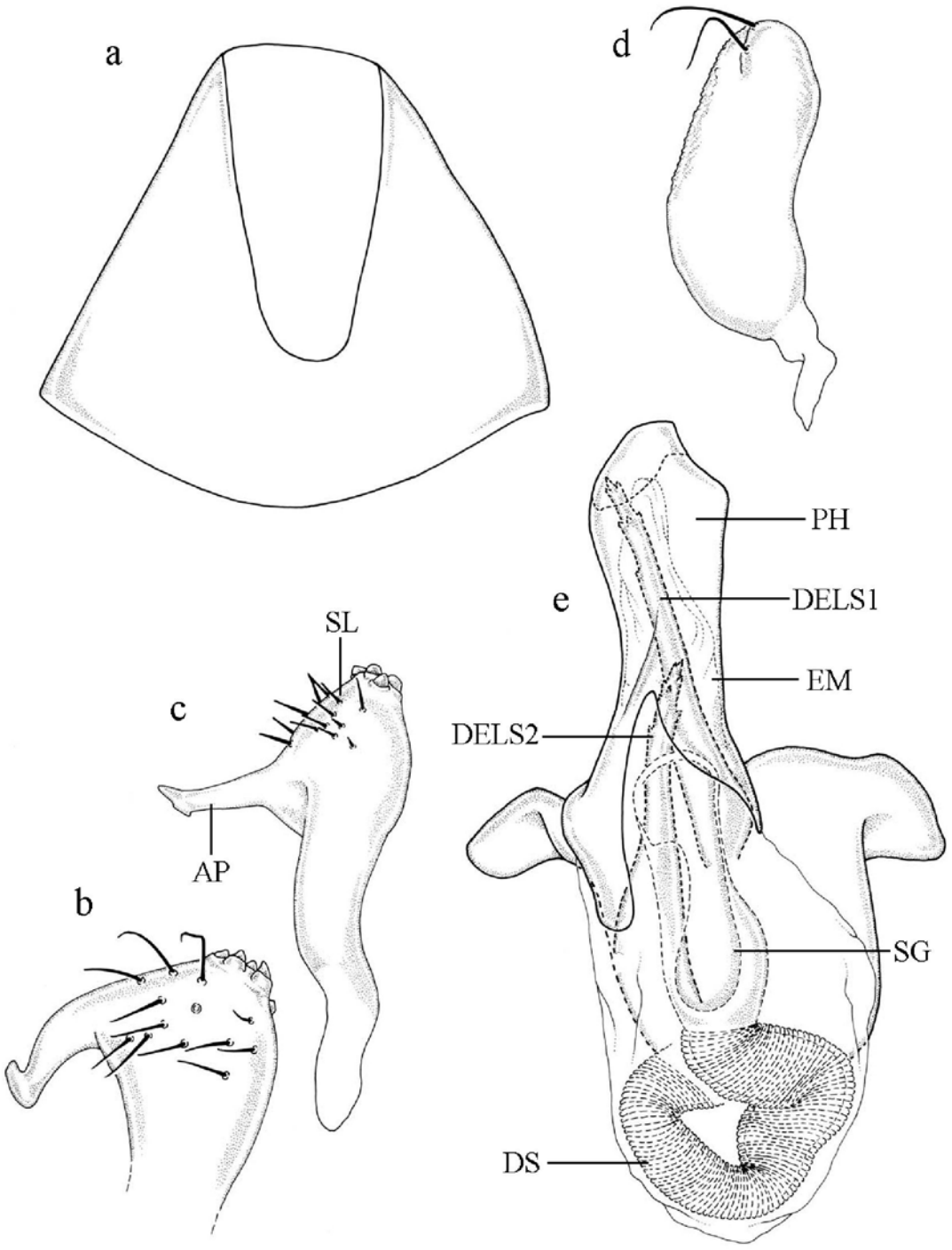


Figure 130: Male genitalia of *Prosoponomiris mimetica* a: Pygophore, dorsal view, scale = 0.1 mm. B-C: Left paramere, ventral view, scale = 0.1 mm. d: Right paramere, ventral view. e: Endosoma, dorsal view, scale = 0.05 mm. Abbreviation: AELS: Apical endosomal sclerite, AP: Apophysis, APR: Apical process, DELS1: Dorsal endosomal lobal sclerite, DELS2: Dorsal endosomal lobal sclerite 2, DS: Ductus seminis, PH = Phallotheca, RPL: Right phallothecal lobe, SG: Secondary gonopore, SL: Sensory lobe

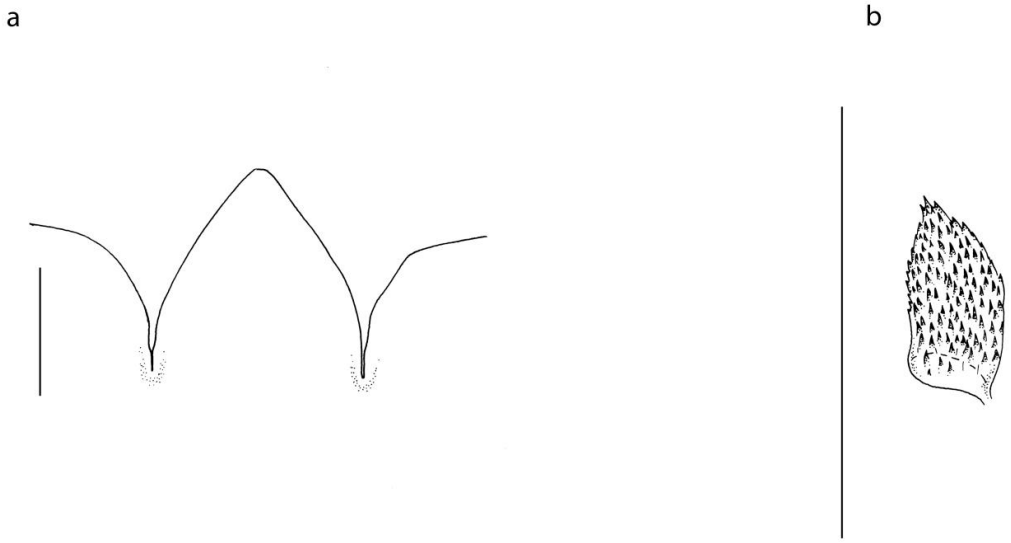


Figure 131: Female genitalia of *Prosoponomiris.* a: *Prosoponomiris mimetica* subgenital plate, scale = 0.1 mm. b: *Prosoponomiris mimetica* inter-ramal lobe, scale = 0.1 mm.

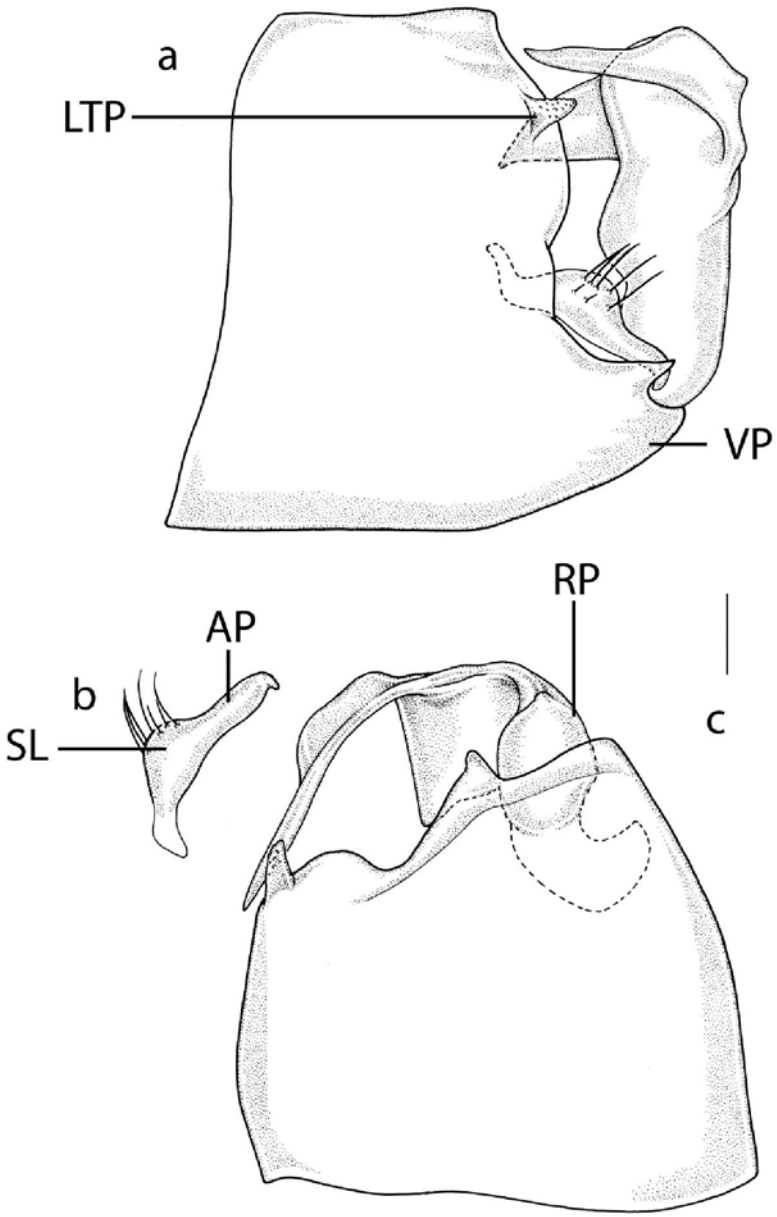


Figure 132: Male genitalia of *Saggitacopula carvalhoi.* Images reproduced from Wall 2007 with permission of the author. a: Pygophore, left lateral view, scale = 0.1mm. b: Left paramere, dorsal view. c: Pygophore, right lateral view, scale = 0.1mm. Abbreviation: AP: Apophysis, LTP: Left tergal process, RP: Right paramere, SL: Sensory lobe, VP: Ventral process.

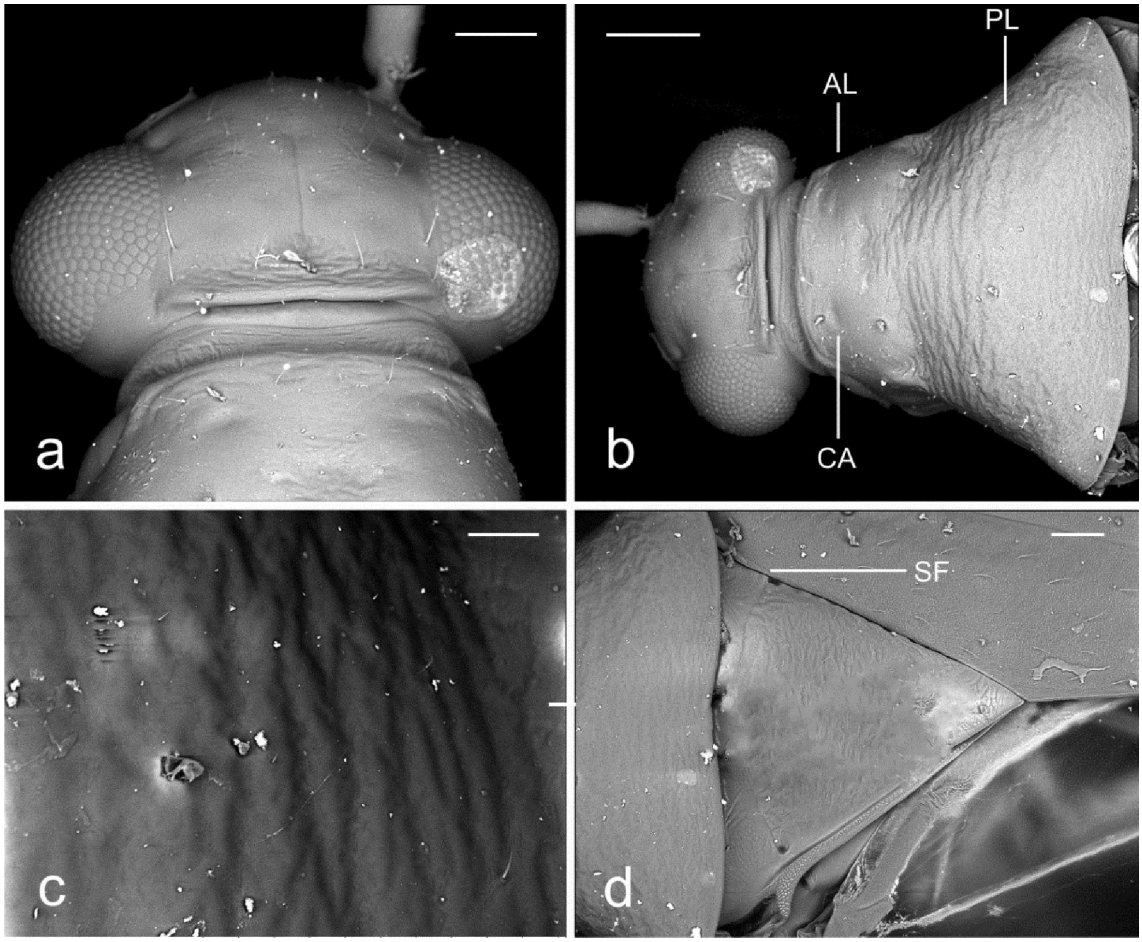


Figure 133: *Saggitacopula rufescens*. a: Head, dorsal view, scale = 100µm. b: Pronotum, scale = 200µm. c: Pronotum posterior lobe ruga, scale = 40µm. d: Scutellum, scale = 100µm. Abbreviation: AL: Anterior lobe, CA: Calli, PL: Posterior lobe, SF: Scutellum foveae.

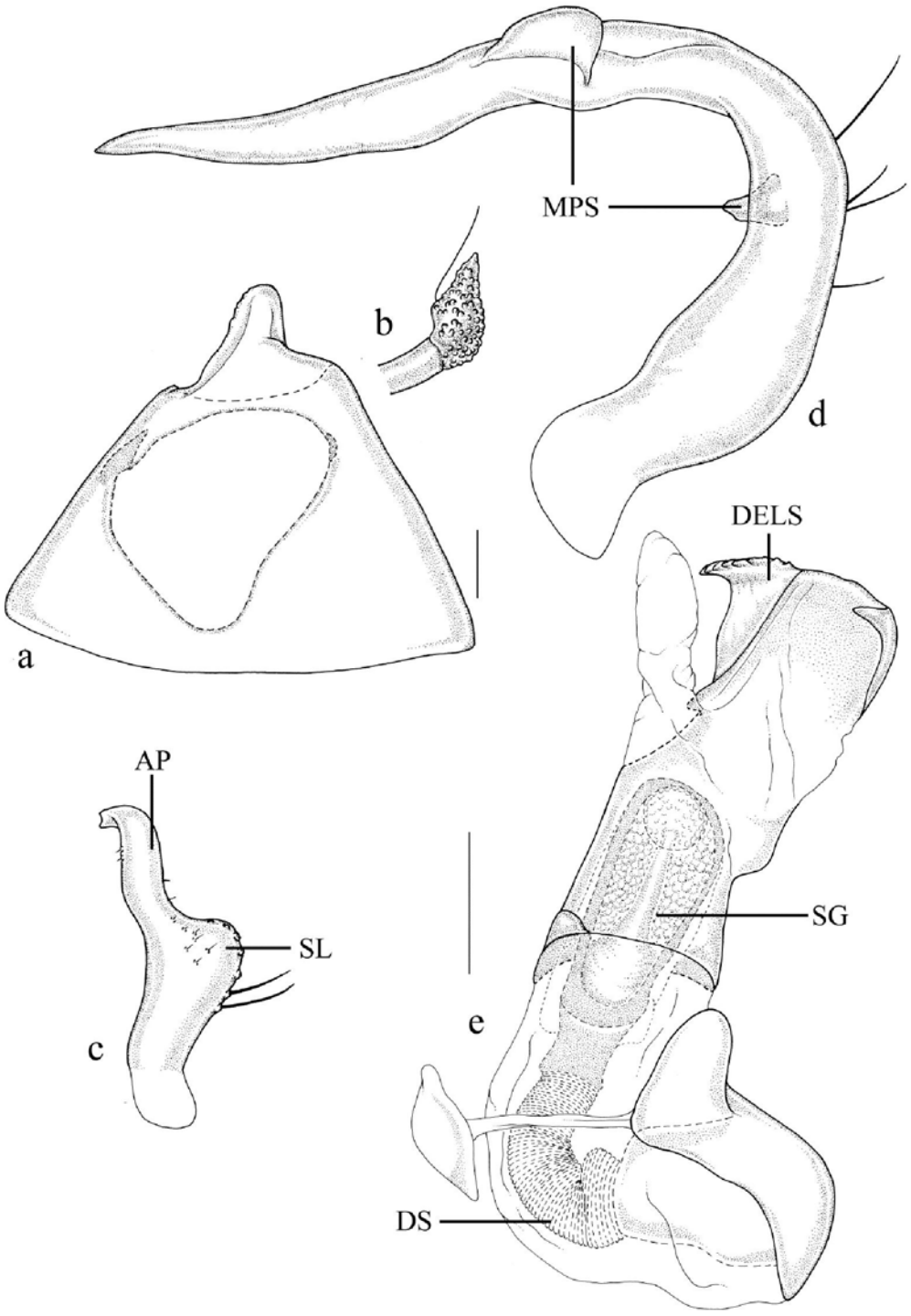


Figure 134: Male genitalia of *Saggitacopula rufescens*. Images reproduced from Wall 2007 with permission of the author. a: Pygophore, dorsal view, scale = 0.1mm. b: Ventral process. c: Left paramere, ventral view. d: Right paramere, dorsal view. d: Aedeagus, left lateral view, scale = 0.05mm. Abbreviation: AP: Apophysis, DELS: Dorsal endosomal lobal sclerite, DS: Ductus seminis, MPS: Marginal process, SG: Secondary gonophore.

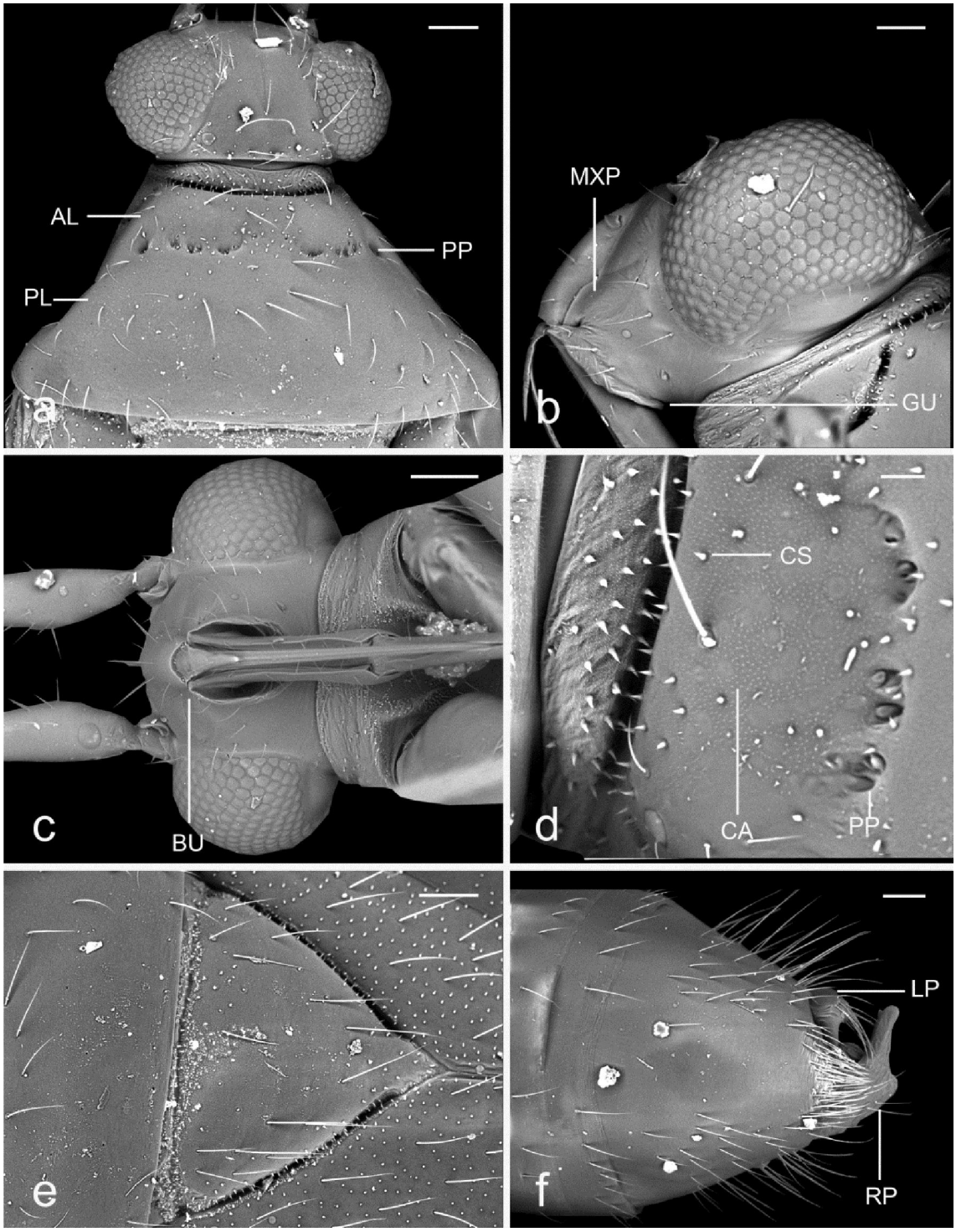


Figure 135: *Spinamifera raveni*. a: Head and Pronotum, scale = 100µm. b: Head, lateral view, scale = 60µm. c: Head, ventral view, scale = 100µm. d: Calli, scale = 20µm. e: Scutellum, scale = 100µm. f: Pygophore, scale = 60µm. Abbreviation: AL: Anterior lobe, BU: Bucculae, CA: Calli, CS: Conical setae, GU: Gula, LP: Left paramere, MXP: Maxillary plate, PL: Posterior lobe, PP: Pronotal punctures, RP: Right paramere, SG: Scent gland.

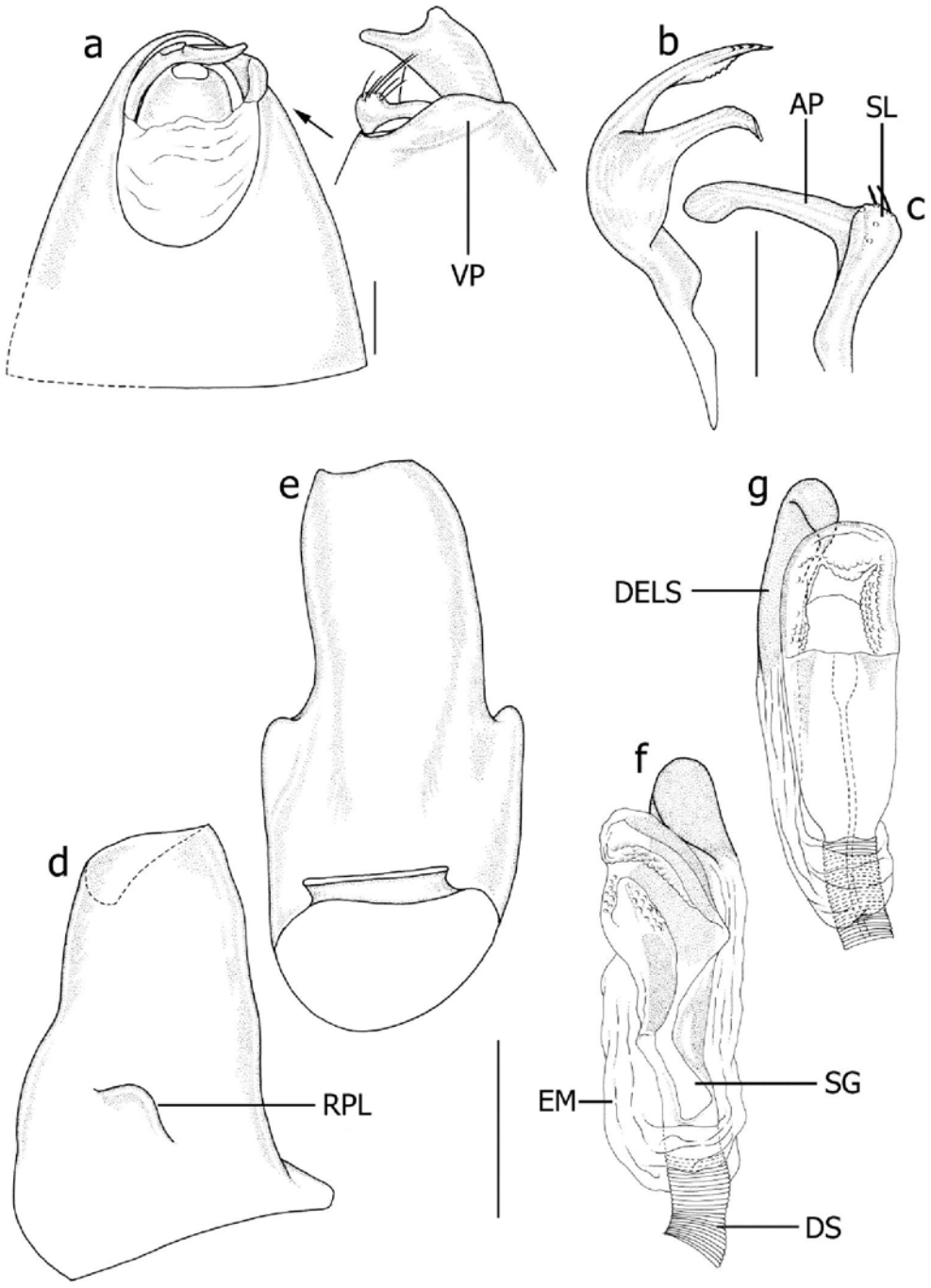


Figure 136: Male genitalia of *Spinamifera raveni*. a: Pygophore, ventral view, scale = 0.1 mm. b: Left paramere, dorsal view, scale = 0.1 mm. c: Right paramere, dorsal view. d: Phallotheca, lateral view, scale = 0.05. e: Phallotheca, dorsal view, scale = 0.05, scale = 0.05. f: Endosoma, right lateral view, scale = 0.05 mm. g: Endosoma, dorsal view, scale = 0.05 mm. Abbreviation: AP: Apophysis, DELS: Dorsal endosomal lobal sclerite, DS: Ductus seminis, EM = Endosomal membrane, RPL: Right phallothecal lobe, SG: Secondary gonopore, SL: Sensory lobe, VP: Ventral process.

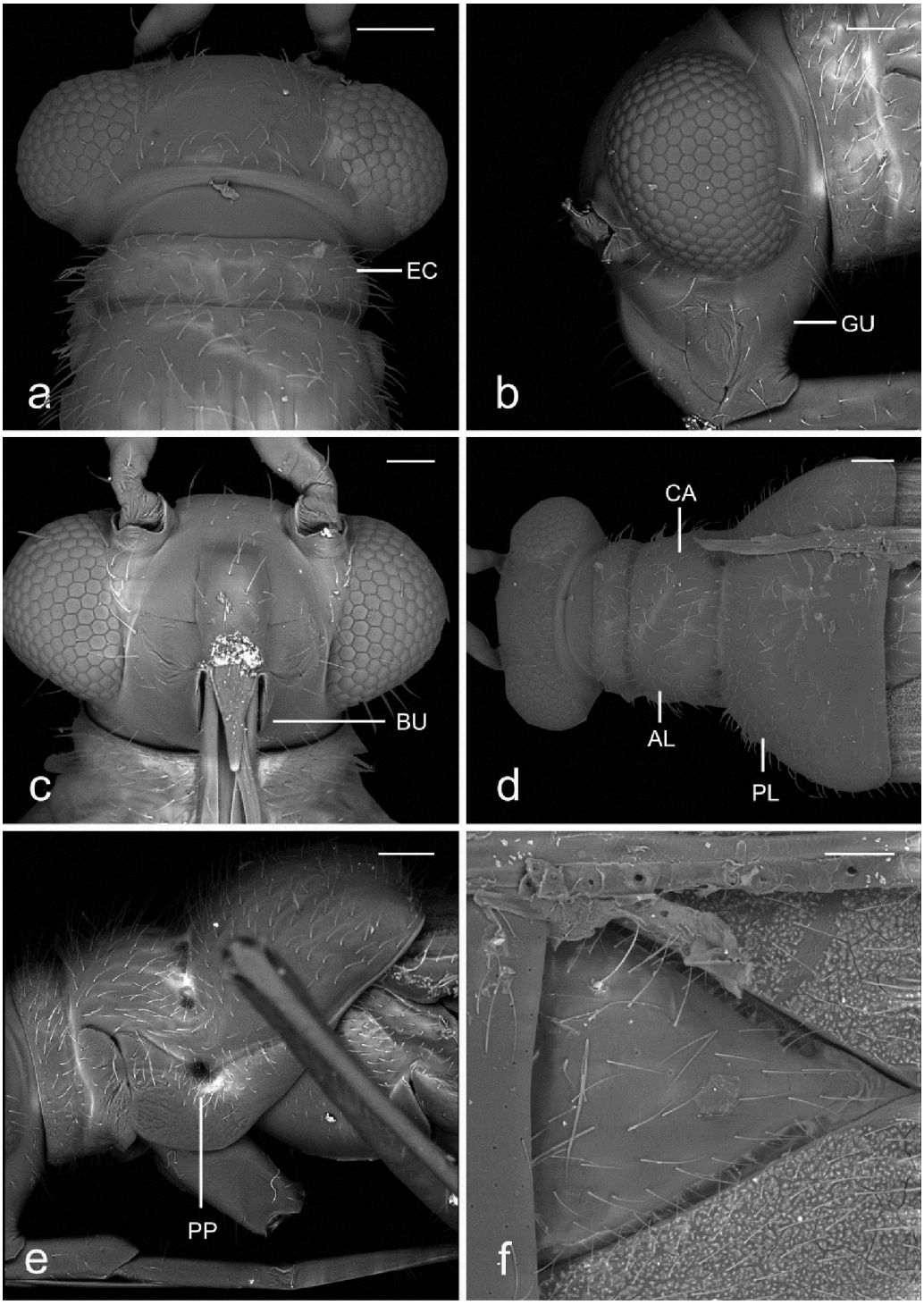


Figure 137: *Tudoris solomonensis* a: Head, dorsal view, scale = 100µm. b: Head, lateral view, scale = 60µm. c: Head, ventral view, scale = 60µm. d: Pronotum, scale = 100µm. e: Pronotal punctures, scale = 100µm. f: Scutellum, scale = 60µm. Abbreviation: AL: anterior lobe, BU: Bucculae, CA: Calli, EC: Enlarged collar, GU: Gula, PL: Posterior lobe, PP: Pronotal punctures.

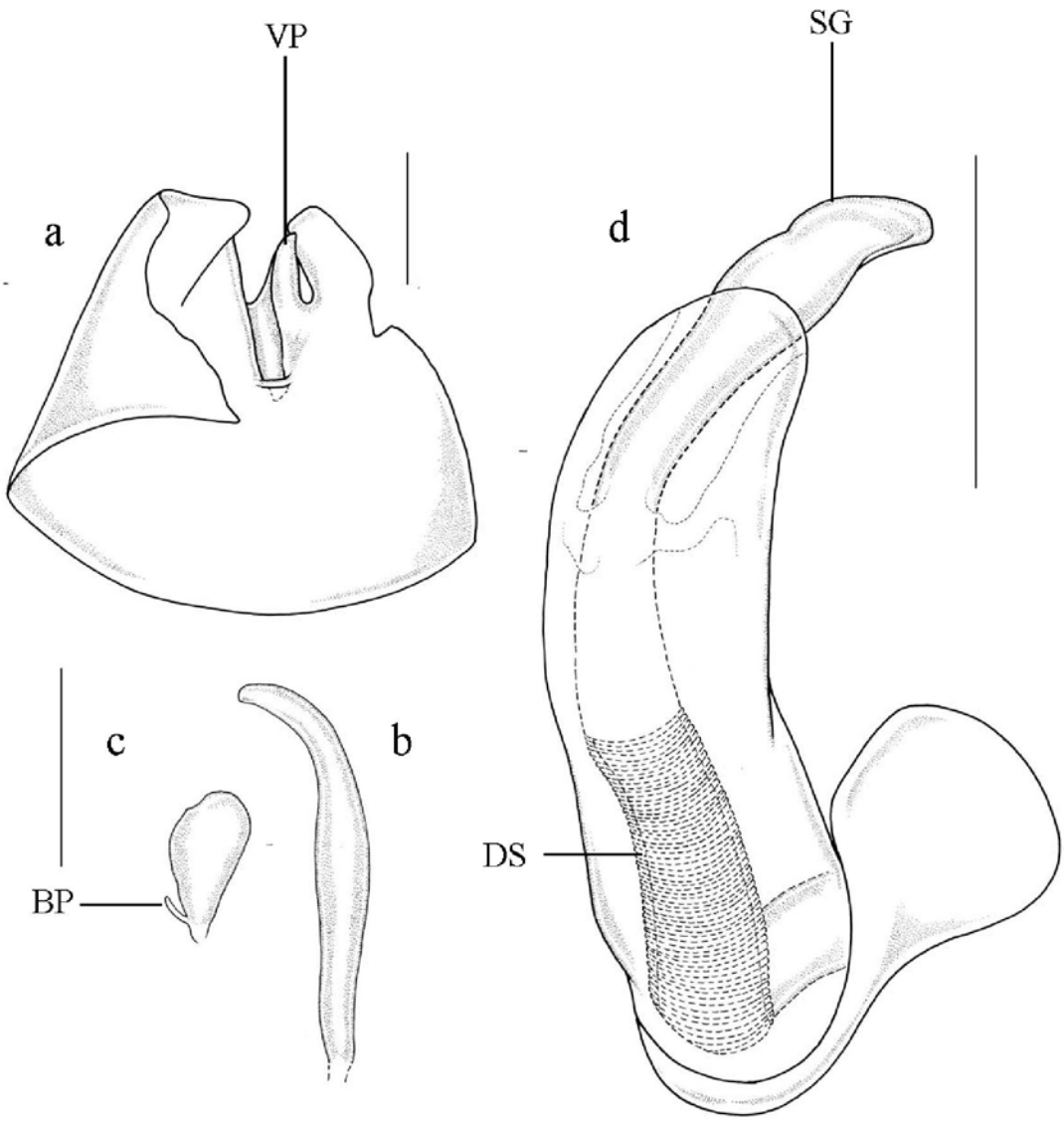


Figure 138: Male genitalia of *Tudoris solomonensis*. a: Pygophore, dorsal view, scale = 0.05 mm. b: Left paramere, dorsal view, scale = 1mm. c: Right paramere, dorsal view. d: Aedeagus, right lateral view, scale = 0.05mm. Abbreviation: BP: Basal process, DS: Ductus seminis, SG: Scent gland, VP: Ventral process.

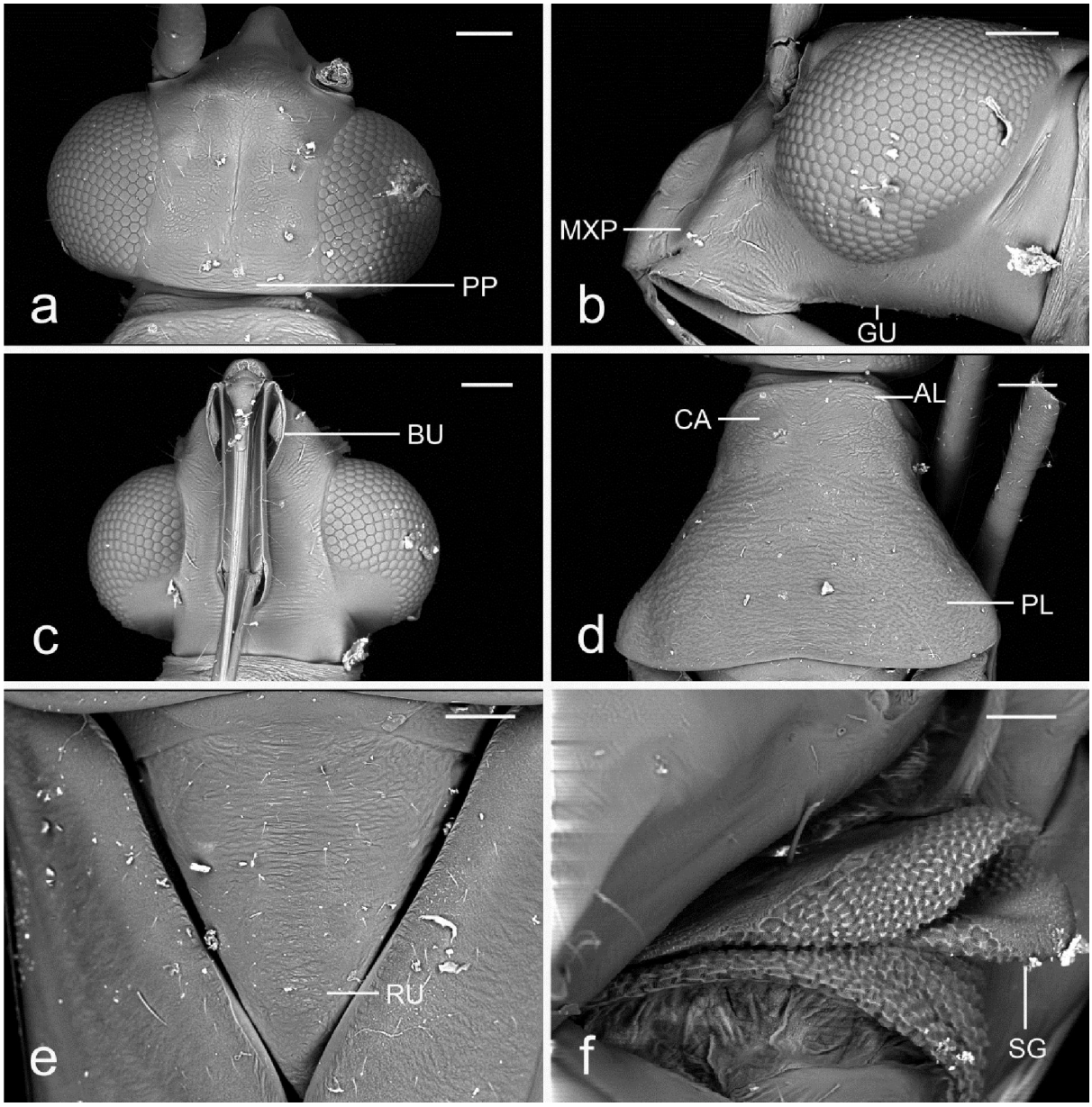


Figure 139: *Wumea cassisi* a: Head, dorsal view, scale = 60µm. b: Head, lateral view, scale = 60µm. c: Head, ventral view, scale = 60µm. d: Pronotum, scale = 100µm. e: Scutellum, scale = 100µm. f: Scent gland, scale = 60µm. Abbreviation: AL: Anterior lobe, BU: Bucculae, CA: Calli, GU = Gula, MXP: Maxillary Plate, PL: Posterior lobe, SG: Scent gland, RU: Ruga.

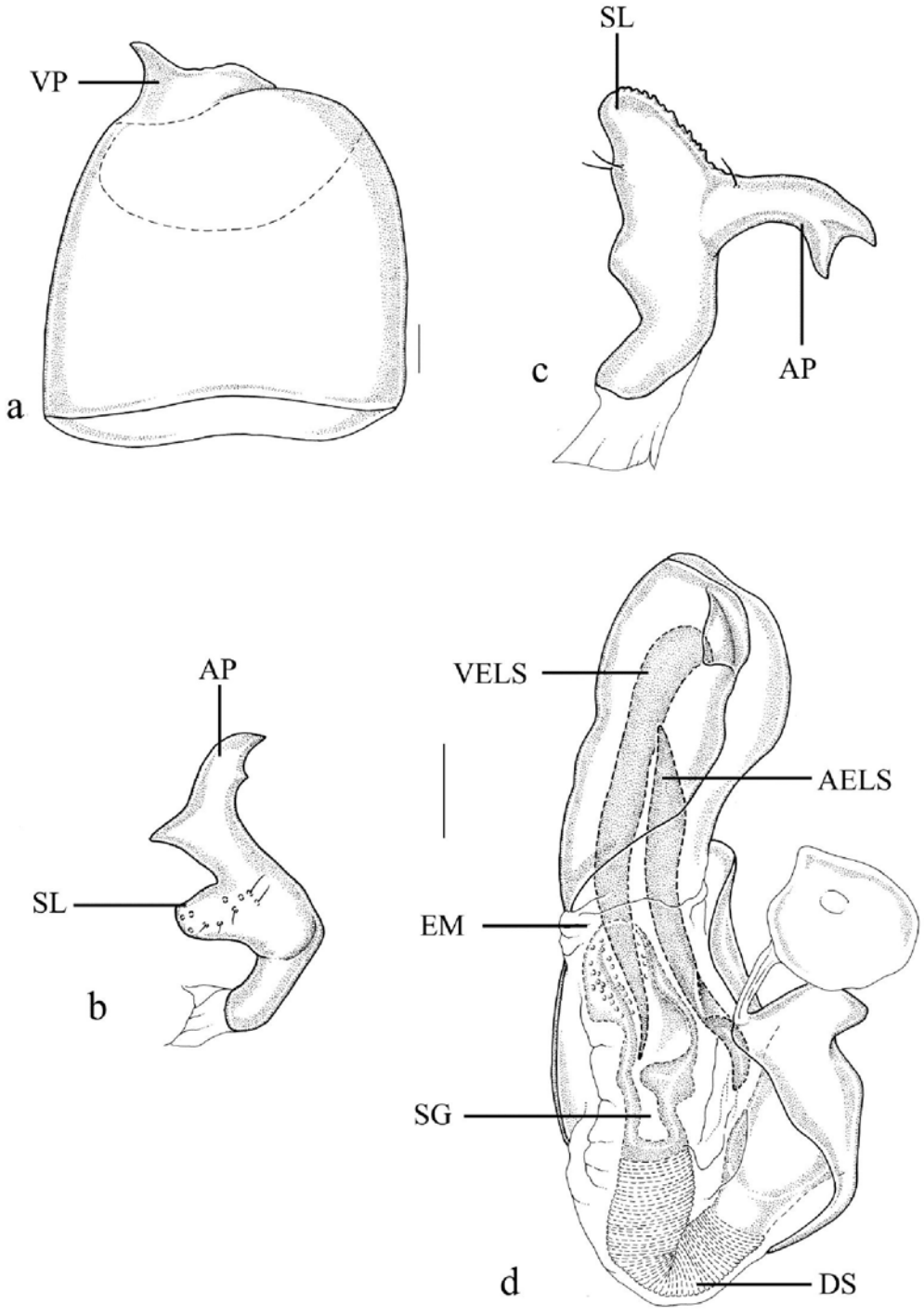


Figure 140: Male genitalia of *Wumea cassisi*. Images reproduced from Wall 2007 with permission of the author. a: Pygophore, ventral view, scale = 0.1mm. b: Left paramere, ventral view. c: Right paramere, dorsal view. d: Aedeagus, right lateral view, scale = 0.05mm. Abbreviation: AELS: Anterior endosomal lobal sclerite, AP: Apophysis, DS: Ductus seminis, EM: Endosomal membrane, SG: Scent gland, SL: Sensory lobe, VELS: Ventral endosomal lobal sclerite, VP: Ventral process.

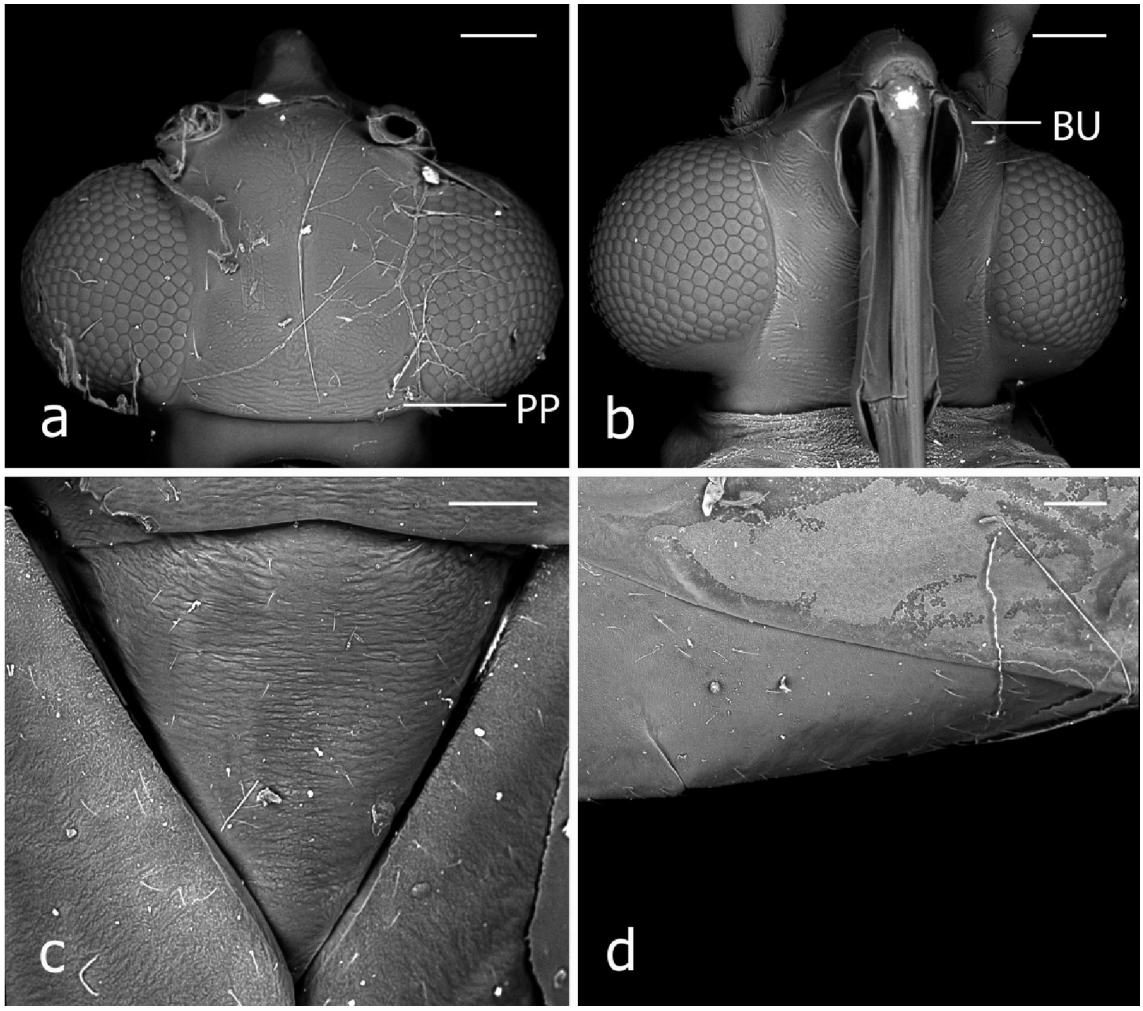


Figure 141: *Wumea clypealis*. a: Head, dorsal view, scale = 100µm. b: Head, ventral view, scale = 100µm. c: Scutellum, scale = 60µm. d: Cuneus, scale = 100µm. Abbreviation: BU: Bucculae, PP: Posterior process.

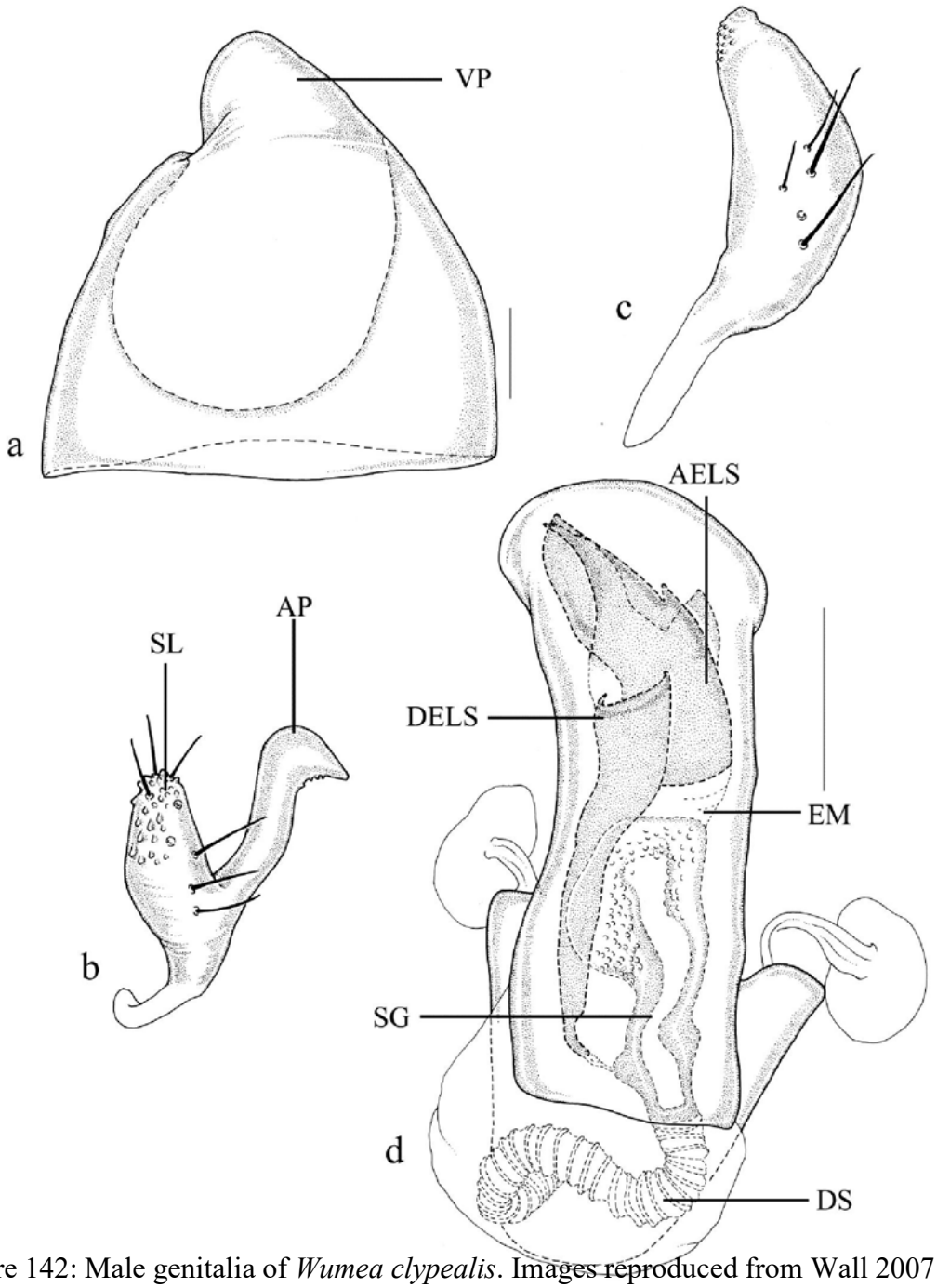


Figure 142: Male genitalia of *Wumea clypealis*. Images reproduced from Wall 2007 with permission of the author. a: Pygophore, ventral view, scale = 0.1mm. b: Left paramere, dorsal view. c: Right paramere, dorsal view. d: Aedeagus, ventral view, scale = 0.05mm. Abbreviation: DELS: Dorsal endosomal lobal sclerite, DS: Ductus seminis, EM: Endosomal membrane, SG: Scent gland, SL: Sensory lobe, VP: Ventral process.

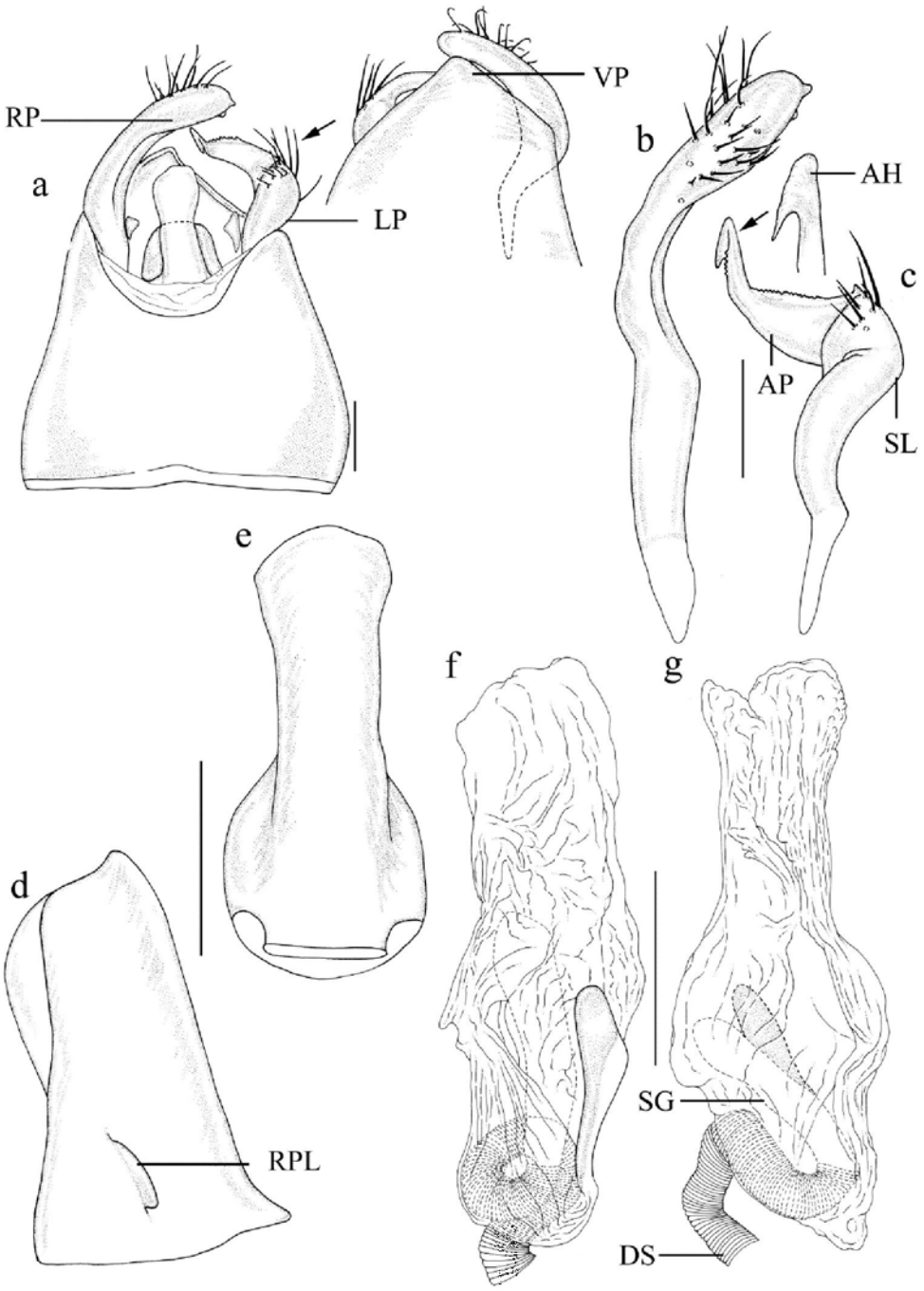


Figure 143: Male genitalia of *Wumea pilosa*. a: Pygophore, dorsal view. b: Left paramere, ventral view. c: Right paramere, ventral view. d: Phallotheca, lateral view. e: Phallotheca, dorsal view. f: Endosoma, lateral view. g: Endosoma, dorsal view, scale = 0.1 mm. Abbreviation: AH: Apical hook of the left paramere, AP: Apophysis, DS: Ductus seminis, LP: Left paramere, RP: Right paramere, RPL: Right phallotheca lobe, SG: Scent gland, SL: Sensory lobe, VP: Ventral process of the pygophore.

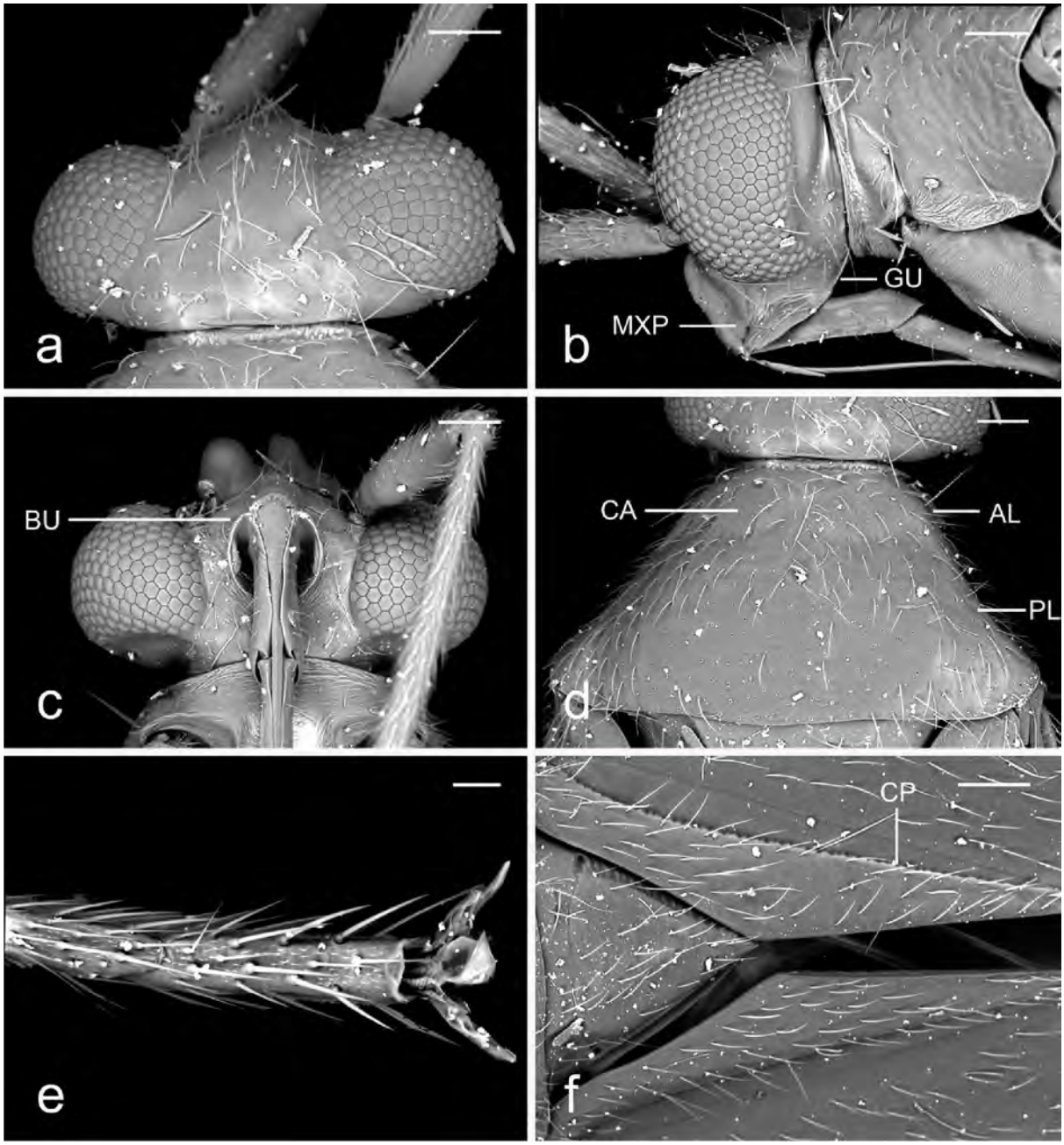


Figure 144: *Zanchiella bowkeriae* a: Head, dorsal view, scale = 100µm. b: Head, lateral view, scale = 100µm. c: Head, ventral view, scale = 100µm. d: Pronotum, scale = 100µm. e: Pretarsus, scale = 20µm. f: Hemelytra with claval punctures, scale = 200µm. Abbreviation: AL: Anterior lobe, BU: Bucculae, CA: Calli, CP: Claval punctures, GU: Gula, MXP: Maxillary plate, PL: Posterior lobe.

Tables

Table 7: Measurements for the genus *Bucculagrandis*. Abbreviations: AI-AIV = Antennal segment one to antennal segment four, CC = Length from cuneus to clypeus, CL = Length of cuneus, IOD = Inter-ocellic dimension, LH = Head length, LM = Length of mesoscutum, LP = Length of pronotum, LS = Length of scutellum, PW = Width of pronotum, TL = Total length, WA = Width of anterior lobe of the pronotum, WC = Width of cuneus, WH = Width of head, WP = Width of posterior lobe of pronotum, WS = Width of the scutellum.

	TL	**CC**	**LH**	**LP**	**LPP**	**LM**	**LS**	**LC**	**WC**	**WH**	**WP**	**WA**	**WS**	**IOD**	**A1**	**A2**	**A3**	**A4**
Bucculagrandis morobiensis																		
Females																		
Mean	3.24	2.11	0.23	0.30	0.32	0.09	0.29	0.57	0.23	0.63	0.79	0.58	0.33	0.32	0.29	0.98	0.81	0.96
Standard Deviation	0.19	0.12	0.03	0.02	0.02	0.02	0.03	0.04	0.04	0.04	0.08	0.05	0.03	0.02	0.03	0.19	0.11	0.11
Range	0.44	0.26	0.09	0.05	0.06	0.06	0.08	0.11	0.08	0.10	0.19	0.14	0.06	0.05	0.07	0.48	0.27	0.29
Minimum	3.00	1.98	0.18	0.27	0.29	0.06	0.25	0.51	0.17	0.57	0.67	0.49	0.29	0.28	0.25	0.72	0.68	0.85
Maximum	3.43	2.24	0.28	0.32	0.35	0.12	0.33	0.62	0.26	0.67	0.86	0.63	0.36	0.33	0.33	1.19	0.94	1.14
Count	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Males																		
Mean	1.88	1.28	0.16	0.15	0.20	0.05	0.17	0.29	0.14	0.37	0.45	0.28	0.21	0.15	0.16	0.51	0.32	0.44
Standard Deviation	1.72	1.18	0.16	0.13	0.18	0.05	0.16	0.27	0.13	0.34	0.42	0.26	0.19	0.14	0.18	0.59	0.39	0.51
Range	3.29	2.28	0.34	0.26	0.34	0.10	0.32	0.54	0.25	0.67	0.80	0.53	0.37	0.26	0.32	1.10	0.80	0.92
Minimum	2.84	1.91	0.20	0.22	0.31	0.07	0.24	0.43	0.22	0.58	0.66	0.41	0.32	0.22	0.30	0.94	0.59	0.84
Maximum	3.29	2.28	0.34	0.26	0.34	0.10	0.32	0.54	0.25	0.67	0.80	0.53	0.37	0.26	0.32	1.10	0.80	0.92
Count	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	4	4	3

Table 8: Measurements for the genus *Candidomiris*. Abbreviations: AI-AIV = Antennal segment one to antennal segment four, CC = Length from cuneus to clypeus, CL

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Candidomiris clavatasclerita																		
Females																		
Mean	3.83	2.55	0.28	0.24	0.41	0.07	0.37	0.61	0.30	0.68	0.95	0.51	0.43	0.33	0.48	1.40	0.88	0.99

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Candidomiris albomaculata																		
Females																		
Mean	3.81	2.56	0.26	0.23	0.40	0.06	0.37	0.68	0.30	0.58	0.97	0.48	0.42	0.25	0.46	1.31	0.64	0.99
Standard Deviation	0.13	0.08	0.01	0.02	0.04	0.04	0.00	0.08	0.00	0.02	0.10	0.08	0.03	0.04	0.07	0.07	-	-
Range	0.18	0.12	0.01	0.02	0.06	0.06	0.00	0.11	0.01	0.03	0.15	0.11	0.04	0.06	0.09	0.10	0.00	0.00
Minimum	3.71	2.50	0.25	0.22	0.37	0.03	0.37	0.63	0.30	0.56	0.89	0.42	0.40	0.22	0.41	1.26	0.64	0.99
Maximum	3.90	2.62	0.26	0.24	0.43	0.09	0.37	0.74	0.30	0.60	1.04	0.54	0.44	0.28	0.50	1.36	0.64	0.99
Count	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1
Males																		
Mean	3.20	2.38	0.84	0.82	0.93	0.70	0.91	1.12	0.87	1.05	1.31	0.99	0.95	0.83	0.97	1.54	0.76	0.99
Standard Deviation	1.05	0.33	1.01	1.02	0.92	1.12	0.94	0.76	0.98	0.82	0.60	0.88	0.91	1.01	0.89	0.40	0.21	0.01
Range	1.90	0.62	1.75	1.78	1.63	1.97	1.63	1.37	1.70	1.44	1.11	1.58	1.60	1.78	1.59	0.74	0.36	0.01
Minimum	2.00	2.00	0.25	0.22	0.37	0.03	0.37	0.63	0.30	0.56	0.89	0.42	0.40	0.22	0.41	1.26	0.64	0.99
Maximum	3.90	2.62	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	1.00	1.00
Count	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Males																		
Mean	4.05	2.85	0.27	0.23	0.48	0.09	0.37	0.68	0.37	0.61	0.98	0.43	0.43	0.29	0.52	1.63	1.09	1.16
Standard Deviation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Range	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	4.05	2.85	0.27	0.23	0.48	0.09	0.37	0.68	0.37	0.61	0.98	0.43	0.43	0.29	0.52	1.63	1.09	1.16
Maximum	4.05	2.85	0.27	0.23	0.48	0.09	0.37	0.68	0.37	0.61	0.98	0.43	0.43	0.29	0.52	1.63	1.09	1.16
Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Table 8 continued

Table 8 continued

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Candidomiris macropiper																		
Females																		
Mean	3.85	2.76	0.30	0.26	0.42	0.13	0.41	0.64	0.37	0.60	0.90	0.50	0.48	0.27	0.50	1.25	0.63	-
Standard Deviation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Range	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	3.85	2.76	0.30	0.26	0.42	0.13	0.41	0.64	0.37	0.60	0.90	0.50	0.48	0.27	0.50	1.25	0.63	-
Maximum	3.85	2.76	0.30	0.26	0.42	0.13	0.41	0.64	0.37	0.60	0.90	0.50	0.48	0.27	0.50	1.25	0.63	-
Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-
Males																		
Mean	3.90	2.67	1.52	0.24	0.42	0.05	0.39	0.67	0.26	0.66	0.96	0.49	0.45	0.23	0.54	1.41	0.75	2.88
Standard Deviation	0.32	0.20	2.40	0.02	0.02	0.03	0.04	0.07	0.04	0.05	0.08	0.05	0.03	0.01	0.06	0.23	0.15	2.98
Range	0.68	0.44	4.84	0.03	0.05	0.06	0.10	0.13	0.09	0.12	0.17	0.12	0.07	0.03	0.13	0.54	0.30	5.41
Minimum	3.60	2.49	0.29	0.23	0.41	0.03	0.35	0.61	0.22	0.63	0.90	0.44	0.42	0.21	0.46	1.20	0.60	0.90
Maximum	4.28	2.93	5.12	0.26	0.46	0.09	0.45	0.74	0.30	0.74	1.07	0.56	0.49	0.24	0.59	1.74	0.89	6.31
Count	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3
Candidomiris missimensis																		
Females																		
Mean	4.60	3.34	0.37	0.32	0.49	0.07	0.44	0.58	0.23	0.64	1.01	0.47	0.52	0.26	0.69	1.75	0.78	0.71
Standard Deviation	0.01	0.02	0.01	0.00	0.01	0.01	0.01	0.05	0.02	0.00	0.03	0.02	0.02	0.04	0.09	0.06	-	-
Range	0.01	0.03	0.01	0.00	0.01	0.02	0.02	0.08	0.02	0.01	0.04	0.02	0.03	0.06	0.13	0.08		
Minimum	4.59	3.33	0.37	0.32	0.48	0.06	0.43	0.55	0.22	0.63	0.99	0.46	0.50	0.23	0.63	1.71	0.78	0.71
Maximum	4.60	3.36	0.38	0.32	0.49	0.08	0.44	0.62	0.24	0.64	1.03	0.48	0.53	0.28	0.76	1.80	0.78	0.71
Count	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1
Males																		
Mean	4.60	3.34	0.37	0.32	0.49	0.07	0.44	0.58	0.23	0.64	1.01	0.47	0.52	0.26	0.69	1.75	0.78	0.71
Standard Deviation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Range	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	4.60	3.34	0.37	0.32	0.49	0.07	0.44	0.58	0.23	0.64	1.01	0.47	0.52	0.26	0.69	1.75	0.78	0.71
Maximum	4.60	3.34	0.37	0.32	0.49	0.07	0.44	0.58	0.23	0.64	1.01	0.47	0.52	0.26	0.69	1.75	0.78	0.71
Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Table 8 completed

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Candidomiris parasponius																		
Females																		
Mean	4.69	3.23	0.32	0.33	0.45	0.09	0.49	0.72	0.34	0.65	1.02	0.59	0.51	0.30	0.40	1.80	1.17	1.08
Standard Deviation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Range	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	4.69	3.23	0.32	0.33	0.45	0.09	0.49	0.72	0.34	0.65	1.02	0.59	0.51	0.30	0.40	1.80	1.17	1.08
Maximum	4.69	3.23	0.32	0.33	0.45	0.09	0.49	0.72	0.34	0.65	1.02	0.59	0.51	0.30	0.40	1.80	1.17	1.08
Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Males																		
Mean	4.53	3.02	0.35	0.25	0.49	0.05	0.46	0.70	0.27	0.74	1.13	0.54	0.51	0.22	0.52	1.99	1.13	1.10
Standard Deviation	0.21	0.10	0.03	0.00	0.04	0.01	0.05	0.14	0.05	0.06	0.08	0.08	0.02	0.04	0.05	0.10	0.18	0.26
Range	0.57	0.24	0.08	0.01	0.09	0.03	0.12	0.33	0.13	0.14	0.23	0.19	0.04	0.11	0.14	0.22	0.35	0.59
Minimum	4.21	2.93	0.31	0.24	0.44	0.04	0.41	0.51	0.21	0.64	1.01	0.41	0.49	0.14	0.44	1.87	0.93	0.87
Maximum	4.78	3.16	0.39	0.25	0.53	0.07	0.53	0.84	0.34	0.78	1.24	0.60	0.53	0.25	0.57	2.09	1.28	1.46
Count	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	4
Candidomiris sinuata																		
Males																		
Mean	4.36	2.81	0.35	0.20	0.43	0.05	0.40	0.89	0.29	0.71	0.99	0.53	0.48	0.23	0.50	1.50	0.69	1.00
Standard Deviation	0.14	0.09	0.04	0.02	0.02	0.02	0.04	0.02	0.02	0.02	0.03	0.03	0.00	0.00	0.09	0.27	0.04	0.41
Range	0.25	0.17	0.07	0.05	0.04	0.03	0.09	0.05	0.04	0.03	0.06	0.06	0.00	0.00	0.18	0.53	0.05	0.58
Minimum	4.20	2.74	0.31	0.18	0.41	0.03	0.36	0.86	0.27	0.70	0.96	0.49	0.48	0.22	0.40	1.21	0.67	0.71
Maximum	4.45	2.91	0.37	0.22	0.45	0.07	0.45	0.91	0.32	0.73	1.01	0.55	0.48	0.23	0.59	1.74	0.72	1.29
Count	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2

Table 9 continued *icoris*. Abbreviations: AI-AIV = Antennal segment one to antennal segment four, CC = Length from cuneus to clypeus, CL = Length of cuneus, IOD = Inter ocular dimension, LH = Head length, LM = Length of mesoscutum, LP = Length of pronotum, LS = Length of scutellum, PW = Width of pronotum, TL = Total length, WA = Width of anterior lobe of the pronotum, WC = Width of cuneus, WH = Width of head, WP = Width of posterior lobe of pronotum, WS = Width of the scutellum.

Mean	4.64	2.78	0.33	0.64	0.38	0.06	0.45	0.76	0.28	0.59	0.94	0.44	0.49	0.23	0.64	2.92	-	-
Standard Deviation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Range	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	4.64	2.78	0.33	0.64	0.38	0.06	0.45	0.76	0.28	0.59	0.94	0.44	0.49	23	0.64	2.92	-	-
Maximum	4.64	2.78	0.33	0.64	0.38	0.06	0.45	0.76	0.28	0.59	0.94	0.44	0.49	23	0.64	2.92	-	-
Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Males																		
Mean	4.78	2.83	0.3	0.68	0.41	0.08	0.47	0.81	0.3	0.57	0.96	0.47	0.53	0.2	0.59	-	-	-
Standard Deviation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Range	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	4.78	2.83	0.3	0.68	0.41	0.08	0.47	0.81	0.3	0.57	0.96	0.47	0.53	0.2	0.59	-	-	-
Maximum	4.78	2.83	0.3	0.68	0.41	0.08	0.47	0.81	0.3	0.57	0.96	0.47	0.53	0.2	0.59	-	-	-
Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Dimifacoris leva																		
Females																		
Mean	3.55	2.46	0.31	0.22	0.33	0.03	0.32	0.61	0.21	0.49	0.74	0.47	0.37	0.22	0.51	1.36	0.88	0.62
Standard Deviation	0.14	0.16	0.05	0.02	0.03	0.00	0.01	0.05	0.02	0.03	0.05	0.04	0.03	0.02	0.02	0.14	0.20	0.40
Range	0.33	0.34	0.09	0.05	0.07	0.01	0.02	0.12	0.04	0.06	0.10	0.08	0.07	0.05	0.04	0.33	0.38	0.56
Minimum	3.40	2.25	0.26	0.20	0.30	0.02	0.32	0.55	0.19	0.47	0.67	0.43	0.33	0.20	0.50	1.17	0.66	0.34
Maximum	3.73	2.60	0.35	0.25	0.36	0.03	0.33	0.68	0.23	0.53	0.77	0.51	0.40	0.24	0.54	1.51	1.04	0.90
Count	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	2
Males																		
Mean	3.52	2.43	0.28	0.22	0.32	0.04	0.33	0.63	0.20	0.50	0.77	0.46	0.36	0.22	0.51	1.43	0.97	0.81
Standard Deviation	0.19	0.11	0.02	0.02	0.01	0.01	0.02	0.07	0.04	0.01	0.05	0.03	0.04	0.01	0.04	0.06	0.07	0.03
Range	0.47	0.26	0.06	0.06	0.01	0.04	0.05	0.16	0.08	0.02	0.12	0.08	0.09	0.02	0.10	0.15	0.18	0.07
Minimum	3.38	2.34	0.25	0.19	0.31	0.02	0.31	0.53	0.16	0.48	0.71	0.41	0.29	0.22	0.44	1.33	0.86	0.79
Maximum	3.85	2.60	0.31	0.26	0.32	0.06	0.37	0.70	0.24	0.51	0.84	0.48	0.39	0.23	0.53	1.48	1.04	0.86
Count	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4

Table 9 completed

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Dimifacoris splendidus																		
Females																		
Mean	4.59	3.11	0.50	0.33	0.28	0.08	0.60	0.89	0.54	0.68	0.93	0.83	0.60	0.29	0.60	1.81	1.38	0.95
Standard Deviation	0.13	0.12	0.06	0.05	0.03	0.01	0.05	0.07	0.03	0.08	0.06	0.04	0.06	0.02	0.06	0.04	0.04	0.07
Range	0.29	0.29	0.15	0.11	0.07	0.01	0.10	0.18	0.07	0.18	0.15	0.10	0.14	0.03	0.13	0.10	0.08	0.15
Minimum	4.42	2.98	0.44	0.27	0.25	0.08	0.56	0.79	0.51	0.60	0.85	0.78	0.53	0.27	0.54	1.76	1.35	0.86
Maximum	4.70	3.27	0.58	0.38	0.31	0.09	0.66	0.97	0.58	0.78	0.99	0.88	0.67	0.30	0.67	1.86	1.43	1.01
Count	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Males																		
Mean	4.68	3.25	0.56	0.38	0.30	0.09	0.50	0.87	0.44	0.66	0.96	0.74	0.60	0.33	0.64	1.68	1.12	0.96
Standard Deviation	0.10	0.04	0.07	0.02	0.02	0.01	0.03	0.04	0.03	0.05	0.04	0.05	0.04	0.01	0.05	0.08	0.10	0.04
Range	0.28	0.10	0.18	0.04	0.04	0.03	0.08	0.10	0.08	0.14	0.10	0.12	0.10	0.02	0.15	0.20	0.25	0.09
Minimum	4.53	3.21	0.47	0.35	0.29	0.07	0.48	0.82	0.41	0.58	0.90	0.67	0.54	0.32	0.56	1.56	1.00	0.93
Maximum	4.81	3.31	0.65	0.39	0.32	0.10	0.56	0.92	0.49	0.72	1.00	0.78	0.64	0.34	0.71	1.76	1.25	1.01
Count	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Dimifacoris trifurcatus																		
Females																		
Mean	3.65	2.51	0.29	0.23	0.33	0.05	0.31	0.67	0.22	0.52	0.83	0.51	0.39	0.24	0.51	1.56	0.99	0.82
Standard Deviation	0.15	0.18	0.04	0.05	0.02	0.02	0.05	0.09	0.05	0.04	0.05	0.04	0.05	0.03	0.10	0.14	0.25	0.14
Range	0.06	0.10	0.05	0.07	0.04	0.03	0.03	0.13	0.10	0.07	0.08	0.05	0.03	0.03	0.06	0.39	0.19	0.00
Minimum	3.50	2.38	0.25	0.16	0.32	0.03	0.24	0.58	0.14	0.50	0.77	0.44	0.33	0.21	0.42	1.41	0.70	0.66
Maximum	3.88	2.83	0.34	0.30	0.37	0.07	0.38	0.82	0.27	0.59	0.88	0.54	0.45	0.28	0.68	1.78	1.41	1.04
Count	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Males																		
Mean	3.66	2.57	0.29	0.26	0.34	0.06	0.32	0.59	0.21	0.53	0.81	0.50	0.38	0.25	0.53	1.53	1.04	0.79
Standard Deviation	0.13	0.16	0.02	0.03	0.02	0.01	0.06	0.06	0.04	0.03	0.03	0.03	0.04	0.03	0.07	0.15	0.23	0.07
Range	0.06	0.10	0.05	0.07	0.04	0.03	0.03	0.13	0.10	0.07	0.08	0.05	0.03	0.03	0.06	0.39	0.19	0.00
Minimum	3.50	2.38	0.27	0.22	0.32	0.04	0.24	0.49	0.14	0.50	0.77	0.44	0.33	0.21	0.42	1.37	0.70	0.68
Maximum	3.85	2.75	0.32	0.30	0.36	0.07	0.38	0.67	0.24	0.56	0.86	0.53	0.43	0.28	0.59	1.70	1.28	0.86
Count	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5

Table 10: Measurements for the genus *Elongatoductus.* Abbreviations: AI-AIV = Antennal segment one to antennal segment four, CC = Length from cuneus to clypeus, CL = Length of cuneus, IOD = Inter-ocellic dimension, LH = Head length, LM = Length of mesoscutum, LP = Length of pronotum, LS = Length of scutellum, PW = Width of pronotum, TL = Total length, WA = Width of anterior lobe of the pronotum, WC = Width of cuneus, WH = Width of head, WP = Width of posterior lobe of pronotum, WS = Width of the scutellum.

	TL	**CC**	**LH**	**LP**	**LPP**	**LM**	**LS**	**LC**	**WC**	**WH**	**WP**	**WA**	**WS**	**IOD**	**A1**	**A2**	**A3**	**A4**
Elongatoductus walli																		
Females																		
Mean	3.92	2.86	0.36	0.28	0.36	0.08	0.39	0.62	0.30	0.74	0.97	0.59	0.47	0.35	0.57	1.79	1.36	1.38
Standard Deviation	0.14	0.02	0.01	0.03	0.02	0.01	0.01	0.03	0.04	0.01	0.01	0.02	0.01	0.01	0.03	0.18	0.06	0.19
Range	0.28	0.04	0.02	0.05	0.04	0.02	0.02	0.06	0.07	0.01	0.02	0.04	0.02	0.03	0.07	0.32	0.11	0.38
Minimum	3.78	2.84	0.35	0.25	0.35	0.07	0.38	0.59	0.25	0.73	0.96	0.57	0.46	0.34	0.54	1.59	1.30	1.20
Maximum	4.06	2.87	0.37	0.31	0.38	0.09	0.40	0.65	0.32	0.75	0.98	0.60	0.49	0.36	0.60	1.91	1.41	1.58
Count	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Males																		
Mean	3.54	2.56	0.33	0.26	0.34	0.06	0.39	0.59	0.25	0.69	0.86	0.55	0.45	0.31	0.54	1.81	1.24	1.53
Standard Deviation	0.17	0.05	0.02	0.03	0.02	0.00	0.03	0.07	0.03	0.03	0.07	0.02	0.03	0.02	0.08	0.12	0.14	0.14
Range	0.35	0.09	0.03	0.05	0.04	0.01	0.07	0.13	0.06	0.05	0.13	0.04	0.05	0.04	0.15	0.21	0.26	0.25
Minimum	3.36	2.53	0.31	0.23	0.32	0.06	0.36	0.52	0.22	0.67	0.79	0.52	0.43	0.29	0.45	1.66	1.14	1.38
Maximum	3.71	2.62	0.34	0.29	0.36	0.07	0.43	0.65	0.27	0.72	0.92	0.56	0.48	0.33	0.61	1.88	1.40	1.62
Count	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Table 11: Measurements for the genus *Falcum*. Abbreviations: AI-AIV = Antennal segment one to antennal segment four, CC = Length from cuneus to clypeus, CL = Length of cuneus, IOD = Inter-ocellic dimension, LH = Head length, LM = Length of mesoscutum, LP = Length of pronotum, LS = Length of scutellum, PW = Width of pronotum, TL = Total length, WA = Width of anterior lobe of the pronotum, WC = Width of cuneus, WH = Width of head, WP = Width of posterior lobe of pronotum,

	TL	**CC**	**LH**	**LP**	**LPP**	**LM**	**LS**	**LC**	**WC**	**WH**	**WP**	**WA**	**WS**	**IOD**	**A1**	**A2**	**A3**	**A4**
Falcum austerum																		
Females																		
Mean	5.32	3.32	0.37	0.25	0.43	0.05	0.46	0.98	0.32	0.66	1.09	0.65	0.54	0.28	0.70	1.78	1.15	1.61
Standard Deviation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Range	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	5.32	3.32	0.37	0.25	0.43	0.05	0.46	0.98	0.32	0.66	1.09	0.65	0.54	0.28	0.70	1.78	1.15	1.61
Maximum	5.32	3.32	0.37	0.25	0.43	0.05	0.46	0.98	0.32	0.66	1.09	0.65	0.54	0.28	0.70	1.78	1.15	1.61
Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Males																		
Mean	5.26	3.28	0.36	0.25	0.42	0.06	0.46	0.95	0.33	0.66	1.08	0.63	0.53	0.28	0.69	1.74	1.15	1.58
Standard Deviation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Range	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	5.26	3.28	0.36	0.25	0.42	0.06	0.46	0.95	0.33	0.66	1.08	0.63	0.53	0.28	0.69	1.74	1.15	1.58
Maximum	5.26	3.28	0.36	0.25	0.42	0.06	0.46	0.95	0.33	0.66	1.08	0.63	0.53	0.28	0.69	1.74	1.15	1.58
Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Table 11 continued

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Falcum bulldogensis																		
Females																		
Mean	5.24	3.71	0.42	0.28	0.40	0.05	0.49	0.86	0.38	0.65	1.06	0.67	0.50	0.30	-	-	-	-
Standard Deviation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Range	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	5.24	3.71	0.42	0.28	0.40	0.05	0.49	0.86	0.38	0.65	1.06	0.67	0.50	0.30	-	-	-	-
Maximum	5.24	3.71	0.42	0.28	0.40	0.05	0.49	0.86	0.38	0.65	1.06	0.67	0.50	0.30	-	-	-	-
Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-	-	-	-
Males																		
Mean	5.48	3.81	0.40	0.31	0.46	0.05	0.48	0.97	0.34	0.74	1.20	0.65	0.57	0.29	0.80	2.03	1.28	1.81
Standard Deviation	0.12	0.03	0.10	0.08	0.02	0.01	0.05	0.13	0.01	0.03	0.03	0.04	0.03	0.01	0.08	0.08	-	-
Range	0.18	0.04	0.15	0.12	0.03	0.02	0.07	0.19	0.02	0.04	0.05	0.06	0.04	0.01	0.12	0.12	-	-
Minimum	5.39	3.79	0.33	0.25	0.44	0.04	0.44	0.87	0.33	0.72	1.17	0.63	0.55	0.28	0.74	1.97	1.28	1.81
Maximum	5.56	3.83	0.48	0.36	0.48	0.06	0.51	1.06	0.35	0.76	1.22	0.68	0.59	0.29	0.86	2.09	1.28	1.81
Count	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1
Falcum gagnei																		
Females																		
Mean	4.93	3.13	0.35	0.24	0.41	0.05	0.45	0.95	0.33	0.61	1.02	0.60	0.51	0.26	0.65	1.63	1.08	1.80
Standard Deviation	0.20	0.20	0.04	0.01	0.02	0.01	0.01	0.16	0.03	0.02	0.02	0.05	0.01	0.01	0.05	0.12	0.14	0.07
Range	0.41	0.37	0.07	0.02	0.04	0.02	0.02	0.30	0.05	0.04	0.04	0.09	0.01	0.03	0.10	0.24	0.28	0.09
Minimum	4.71	2.90	0.32	0.23	0.39	0.04	0.43	0.77	0.31	0.59	1.00	0.56	0.50	0.25	0.61	1.51	0.93	1.76
Maximum	5.12	3.26	0.39	0.25	0.43	0.06	0.45	1.08	0.36	0.62	1.04	0.65	0.51	0.28	0.71	1.74	1.20	1.85
Count	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2
Males																		
Mean	4.27	2.75	0.31	0.23	0.38	0.04	0.41	0.78	0.32	0.59	0.91	0.53	0.45	0.26	0.57	1.56	1.01	1.63
Standard Deviation	0.19	0.03	0.03	0.03	0.03	0.01	0.02	0.05	0.02	0.01	0.04	0.05	0.01	0.01	0.05	0.07	0.08	0.03
Range	0.47	0.08	0.08	0.08	0.09	0.01	0.04	0.12	0.05	0.02	0.12	0.13	0.02	0.04	0.13	0.18	0.19	0.07
Minimum	4.12	2.72	0.26	0.19	0.33	0.03	0.39	0.73	0.29	0.58	0.84	0.46	0.44	0.24	0.49	1.48	0.96	1.59
Maximum	4.59	2.80	0.34	0.27	0.41	0.05	0.43	0.85	0.34	0.60	0.96	0.59	0.46	0.28	0.63	1.66	1.15	1.66
Count	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4

Table 11 completed

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Falcum kaindiensis																		
Females																		
Mean	5.33	3.29	0.34	0.25	0.44	0.05	0.45	1.10	0.23	0.63	1.05	0.69	0.55	0.30	0.71	1.63	1.20	1.28
Standard Deviation	0.29	0.13	0.04	0.01	0.02	0.00	0.02	0.09	0.16	0.00	0.02	0.04	0.03	0.00	-	-	-	-
Range	0.41	0.18	0.05	0.02	0.03	0.01	0.03	0.13	0.22	0.00	0.03	0.06	0.04	0.00	-	-	-	-
Minimum	5.12	3.20	0.31	0.24	0.42	0.04	0.43	1.03	0.12	0.63	1.04	0.66	0.53	0.30	0.71	1.63	1.20	1.28
Maximum	5.53	3.38	0.36	0.26	0.45	0.05	0.46	1.16	0.34	0.63	1.07	0.72	0.57	0.30	0.71	1.63	1.20	1.28
Count	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1
Males																		
Mean	5.38	3.45	0.35	0.17	0.45	0.10	0.49	0.94	0.47	0.72	1.19	0.70	0.58	0.28	0.67	1.85	1.21	1.37
Standard Deviation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Range	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	5.38	3.45	0.35	0.17	0.45	0.10	0.49	0.94	0.47	0.72	1.19	0.70	0.58	0.28	0.67	1.85	1.21	1.37
Maximum	5.38	3.45	0.35	0.17	0.45	0.10	0.49	0.94	0.47	0.72	1.19	0.70	0.58	0.28	0.67	1.85	1.21	1.37
Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Falcum taiwanensis																		
Females																		
Mean	5.64	3.53	0.39	0.27	0.46	0.06	0.49	1.03	0.35	0.71	1.15	0.71	0.57	0.31	0.76	1.87	1.23	1.70
Standard Deviation	1.39	0.83	0.47	0.48	0.48	0.50	0.46	0.47	0.50	0.49	0.52	0.55	0.60	0.63	0.50	0.32	0.27	
Range	0.10	0.09	0.00	0.01	0.01	0.00	0.01	0.01	0.01	0.01	0.00	0.02	0.02	0.01	0.02	0.00	0.02	
Minimum	5.69	3.57	0.39	0.28	0.46	0.06	0.50	1.03	0.35	0.71	1.15	0.72	0.58	0.31	0.76	1.87	1.24	1.70
Maximum	5.59	3.48	0.39	0.27	0.45	0.06	0.49	1.03	0.34	0.70	1.15	0.70	0.57	0.30	0.75	1.87	1.22	1.70
Count	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	1
Males																		
Mean	5.66	3.52	0.39	0.27	0.46	0.06	0.50	1.03	0.35	0.70	1.16	0.70	0.58	0.31	0.76	1.91	1.24	1.72
Standard Deviation	1.40	0.83	0.45	0.46	0.46	0.47	0.44	0.45	0.47	0.47	0.50	0.53	0.58	0.62	0.51	0.34	0.28	-
Range	0.02	0.03	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.02	0.03	0.03	0.01	0.01	0.01	0.01	0.02	-
Minimum	5.67	3.54	0.39	0.28	0.46	0.06	0.50	1.03	0.35	0.71	1.18	0.72	0.58	0.31	0.77	1.91	1.25	1.72
Maximum	5.65	3.51	0.38	0.27	0.45	0.06	0.50	1.03	0.35	0.69	1.15	0.69	0.58	0.30	0.75	1.90	1.23	1.72
Count	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	1

Table 12: Measurements for the genus *Felisacodes*. Abbreviations: AI-AIV = Antennal segment one to antennal segment four, CC = Length from cuneus to clypeus, CL = Length of cuneus, IOD = Inter-ocellic dimension, LH = Head length, LM = Length of mesoscutum, LP = Length of pronotum, LS = Length of scutellum, PW = Width of pronotum, TL = Total length, WA = Width of anterior lobe of the pronotum, WC = Width of cuneus, WH = Width of head, WP = Width of posterior lobe of pronotum, WS = Width of the scutellum.

	TL	**CC**	**LH**	**LP**	**LPP**	**LM**	**LS**	**LC**	**WC**	**WH**	**WP**	**WA**	**WS**	**IOD**	**A1**	**A2**	**A3**	**A4**
Felisacodes bryocorina																		
Females																		
Mean	4.06	2.77	0.31	0.20	0.46	0.04	0.08	0.82	0.35	0.70	1.02	0.47	0.45	0.28	0.52	1.46	0.72	0.78
Standard Deviation	0.18	0.02	0.01	0.08	0.12	0.01	0.52	0.11	0.02	0.09	0.17	0.04	0.10	0.05	0.14	0.30	0.04	-
Range	0.34	0.04	0.03	0.17	0.27	0.02	1.19	0.22	0.04	0.21	0.39	0.08	0.19	0.13	0.27	0.57	0.08	-
Minimum	3.90	2.75	0.29	0.13	0.28	0.03	0.61	0.72	0.33	0.57	0.82	0.42	0.35	0.22	0.41	1.23	0.68	0.78
Maximum	4.24	2.78	0.32	0.30	0.55	0.05	0.58	0.94	0.37	0.78	1.21	0.50	0.54	0.35	0.68	1.80	0.76	0.78
Count	4	4	4	4	4	4	4	4	4	4	4	4	4	4	3	3	3	1
Males																		
Mean	4.05	2.65	0.30	0.21	0.53	0.05	0.45	0.73	0.31	0.59	1.20	0.44	0.38	0.33	0.52	1.03	0.68	0.76
Standard Deviation	0.23	0.04	0.01	0.01	0.12	0.01	0.82	0.36	0.04	0.03	0.03	0.04	0.05	0.05	0.05	-	-	-
Range	0.33	0.05	0.01	0.02	0.16	0.01	1.16	0.51	0.06	0.04	0.05	0.06	0.07	0.07	0.07	-	-	-
Minimum	3.89	2.62	0.30	0.20	0.45	0.04	0.13	0.47	0.28	0.57	1.18	0.41	0.35	0.29	0.48	1.03	0.68	0.76
Maximum	4.22	2.67	0.30	0.22	0.61	0.06	1.03	0.98	0.34	0.60	1.22	0.47	0.42	0.37	0.55	1.03	0.68	0.76
Count	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1

Table 12 continued

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Felisacodes diaboura																		
Females																		
Mean	4.10	2.73	0.29	0.23	0.46	0.03	0.37	0.63	0.32	0.70	1.02	0.53	0.44	0.36	0.44	1.57	1.00	0.83
Standard Deviation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Range	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	4.10	2.73	0.29	0.23	0.46	0.03	0.37	0.63	0.32	0.70	1.02	0.53	0.44	0.36	0.44	1.57	1.00	0.83
Maximum	4.10	2.73	0.29	0.23	0.46	0.03	0.37	0.63	0.32	0.70	1.02	0.53	0.44	0.36	0.44	1.57	1.00	0.83
Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Males																		
Mean	4.07	2.69	0.32	0.20	0.43	0.05	0.41	0.82	0.32	0.59	0.99	0.42	0.48	0.24	0.48	1.38	0.44	1.01
Standard Deviation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Range	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	4.07	2.69	0.32	0.20	0.43	0.05	0.41	0.82	0.32	0.59	0.99	0.42	0.48	0.24	0.48	1.38	0.44	1.01
Maximum	4.07	2.69	0.32	0.20	0.43	0.05	0.41	0.82	0.32	0.59	0.99	0.42	0.48	0.24	0.48	1.38	0.44	1.01
Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Felisacodes uganda																		
Females																		
Mean	4.10	2.73	0.29	0.23	0.46	0.03	0.37	0.63	0.32	0.70	1.02	0.53	0.44	0.36	0.44	1.57	1.00	0.83
Standard Deviation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Range	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	4.10	2.73	0.29	0.23	0.46	0.03	0.37	0.63	0.32	0.70	1.02	0.53	0.44	0.36	0.44	1.57	1.00	0.83
Maximum	4.10	2.73	0.29	0.23	0.46	0.03	0.37	0.63	0.32	0.70	1.02	0.53	0.44	0.36	0.44	1.57	1.00	0.83
Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Males																		
Mean	4.07	2.69	0.32	0.20	0.43	0.05	0.41	0.82	0.32	0.59	0.99	0.42	0.48	0.24	0.48	1.38	0.44	1.01
Standard Deviation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Range	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	4.07	2.69	0.32	0.20	0.43	0.05	0.41	0.82	0.32	0.59	0.99	0.42	0.48	0.24	0.48	1.38	0.44	1.01
Maximum	4.07	2.69	0.32	0.20	0.43	0.05	0.41	0.82	0.32	0.59	0.99	0.42	0.48	0.24	0.48	1.38	0.44	1.01
Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Table 13: Measurements for the genus *Flagellomiris*. Abbreviations: AI-AIV = Antennal segment one to antennal segment four, CC = Length from cuneus to clypeus, CL = Length of cuneus, IOD = Inter-ocellic dimension, LH = Head length, LM = Length of mesoscutum, LP = Length of pronotum, LS = Length of scutellum, PW = Width of pronotum, TL = Total length, WA = Width of anterior lobe of the pronotum, WC = Width of cuneus, WH = Width of head, WP = Width of posterior lobe of pronotum, WS = Width of the scutellum.

Table 13 continued

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Flagellomiris sinuatum																		
Females																		
Mean	6.47	4.49	0.46	0.76	0.44	0.19	0.5	0.85	0.41	0.79	1.02	0.63	0.62	0.3	0.81	1.83	-	-
Standard Deviation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Range	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	6.47	4.49	0.46	0.76	0.44	0.19	0.5	0.85	0.41	0.79	1.02	0.63	0.62	0.3	0.81	1.83	-	-
Maximum	6.47	4.49	0.46	0.76	0.44	0.19	0.5	0.85	0.41	0.79	1.02	0.63	0.62	0.3	0.81	1.83	-	-
Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0
Males																		
Mean	6.23	4.38	0.43	0.78	0.41	0.16	0.47	0.83	0.38	0.75	1	0.59	0.65	0.28	0.8	-	-	-
Standard Deviation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Range	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	6.23	4.38	0.43	0.78	0.41	0.16	0.47	0.83	0.38	0.75	1	0.59	0.65	0.28	0.8	-	-	-
Maximum	6.23	4.38	0.43	0.78	0.41	0.16	0.47	0.83	0.38	0.75	1	0.59	0.65	0.28	0.8	-	-	-
Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0

Table 14: Measurements for the genus *Jimia.* Abbreviations: AI-AIV = Antennal segment one to antennal segment four, CC = Length from cuneus to clypeus, CL = Length of cuneus, IOD = Inter-ocellic dimension, LH = Head length, LM = Length of mesoscutum, LP = Length of pronotum, LS = Length of scutellum, PW = Width of pronotum, TL = Total length, WA = Width of anterior lobe of the pronotum, WC = Width of cuneus, WH = Width of head, WP = Width of the scutellum.

Table 14 continued

	TL	**CC**	**LH**	**LP**	**LPP**	**LM**	**LS**	**LC**	**WC**	**WH**	**WP**	**WA**	**WS**	**IOD**	**A1**	**A2**	**A3**	**A4**
Jimia bimaculata																		
Females																		
Mean	3.12	2.21	0.27	0.22	0.21	0.11	0.42	0.49	0.38	0.58	1.05	0.64	0.53	0.62	0.27	0.89	0.63	0.93
Standard Deviation	0.11	0.08	0.02	0.03	0.02	0.02	0.03	0.05	0.03	0.02	0.05	0.05	0.01	0.76	0.01	0.04	0.04	0.08
Range	0.26	0.19	0.05	0.06	0.05	0.04	0.07	0.11	0.07	0.05	0.15	0.12	0.03	1.72	0.03	0.10	0.11	0.22
Minimum	2.97	2.16	0.25	0.17	0.19	0.08	0.39	0.43	0.34	0.55	0.97	0.57	0.51	0.26	0.26	0.84	0.57	0.86
Maximum	3.23	2.34	0.30	0.23	0.24	0.12	0.46	0.54	0.42	0.60	1.11	0.69	0.54	1.97	0.29	0.94	0.69	1.08
Count	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Males																		
Mean	3.07	2.19	0.26	0.23	0.21	0.13	0.41	0.49	0.34	0.57	0.99	0.58	0.52	0.26	0.44	0.94	0.65	0.81
Standard Deviation	0.14	0.11	0.04	0.03	0.01	0.01	0.01	0.05	0.06	0.02	0.04	0.01	0.01	0.01	0.43	0.01	0.01	0.18
Range	0.34	0.27	0.08	0.06	0.02	0.03	0.02	0.12	0.15	0.04	0.09	0.03	0.03	0.02	0.97	0.03	0.04	0.40
Minimum	2.96	2.05	0.22	0.20	0.20	0.12	0.40	0.43	0.26	0.56	0.94	0.56	0.50	0.25	0.23	0.93	0.64	0.63
Maximum	3.30	2.32	0.30	0.26	0.22	0.15	0.42	0.55	0.41	0.60	1.03	0.59	0.53	0.27	1.20	0.95	0.67	1.03
Count	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5

Table 15: Measurements for the genus *Morobea.* Abbreviations: AI-AIV = Antennal segment one to antennal segment four, CC = Length from cuneus to clypeus, CL = Length of cuneus, IOD = Inter-ocellic dimension, LH = Head length, LM = Length of mesoscutum, LP = Length of pronotum, LS = Length of scutellum, PW = Width of pronotum, TL = Total length, WA = Width of anterior lobe of the pronotum, WC = Width of cuneus, WH = Width of head, WP = Width of posterior lobe of pronotum, WS = Width of the scutellum.

	TL	**CC**	**LH**	**LP**	**LPP**	**LM**	**LS**	**LC**	**WC**	**WH**	**WP**	**WA**	**WS**	**IOD**	**A1**	**A2**	**A3**	**A4**
Morobea longipes																		
Females																		
Mean	6.21	4.68	0.49	0.50	0.50	0.11	0.87	1.09	0.39	0.76	1.44	0.65	0.67	0.30	1.01	3.16	1.71	1.53
Standard Deviation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Range	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	6.21	4.68	0.49	0.50	0.50	0.11	0.87	1.09	0.39	0.76	1.44	0.65	0.67	0.30	1.01	3.16	1.71	1.53
Maximum	6.21	4.68	0.49	0.50	0.50	0.11	0.87	1.09	0.39	0.76	1.44	0.65	0.67	0.30	1.01	3.16	1.71	1.53
Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Males																		
Mean	5.88	4.20	0.38	0.51	0.74	0.13	0.56	1.10	0.29	0.80	1.19	0.67	0.59	0.35	1.06	3.09	1.45	1.84
Standard Deviation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Range	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	5.88	4.20	0.38	0.51	0.74	0.13	0.56	1.10	0.29	0.80	1.19	0.67	0.59	0.35	1.06	3.09	1.45	1.84
Maximum	5.88	4.20	0.38	0.51	0.74	0.13	0.56	1.10	0.29	0.80	1.19	0.67	0.59	0.35	1.06	3.09	1.45	1.84
Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Morobea spectabilis																		
Males																		
Mean	6.33	5.22	0.50	0.43	0.50	0.33	2.22	1.07	0.35	0.86	1.38	0.73	0.68	0.39	0.95	3.14	1.77	2.27
Standard Deviation	0.37	0.29	0.08	0.02	0.00	0.01	0.00	0.14	0.04	0.04	0.04	0.01	0.02	0.03	0.08	0.21	0.06	-
Range	0.53	0.41	0.11	0.03	0	0.03	0.1	0.2	0.06	0.05	0.06	0.01	0.03	0.04	0.12	0.3	0.08	-
Minimum	6.06	5.01	0.44	0.41	0.50	0.29	2.12	0.97	0.32	0.83	1.35	0.72	0.66	0.37	0.89	2.99	1.73	-
Maximum	6.59	5.42	0.55	0.44	0.50	0.32	2.22	1.17	0.38	0.88	1.41	0.73	0.69	0.41	1.01	3.29	1.81	2.27
Count	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1

Table 16: Measurements for the genus *Nerubia*. Abbreviations: AI-AIV = Antennal segment one to antennal segment four, CC = Length from cuneus to clypeus, CL = Length of cuneus, IOD = Inter-ocellic dimension, LH = Head length, LM = Length of mesoscutum, LP = Length of pronotum, LS = Length of scutellum, PW = Width of pronotum, TL = Total length, WA = Width of anterior lobe of the pronotum, WC = Width of cuneus, WH = Width of head, WP = Width of posterior lobe of pronotum, WS = Width of the scutellum.

Table 16 continued

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Nerubia viridis																		
Females																		
Mean	3.07	2.26	0.25	0.20	0.37	0.04	0.37	0.35	0.32	0.60	0.96	0.50	0.44	0.29	0.40	-	-	-
Standard Deviation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Range	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	3.07	2.26	0.25	0.20	0.37	0.04	0.37	0.35	0.32	0.60	0.96	0.50	0.44	0.29	0.40	-	-	-
Maximum	3.07	2.26	0.25	0.20	0.37	0.04	0.37	0.35	0.32	0.60	0.96	0.50	0.44	0.29	0.40	-	-	-
Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-	-	-
Males																		
Mean	2.53	1.99	0.27	0.15	0.34	0.05	0.35	0.24	0.26	0.57	0.87	0.51	0.40	0.24	0.34	1.20	0.54	-
Standard Deviation	0.06	0.05	0.01	0.05	0.01	0.02	0.02	0.05	0.01	0.04	0.03	0.08	0.01	0.04	0.02	0.04	-	-
Range	0.09	0.07	0.01	0.07	0.02	0.03	0.03	0.06	0.01	0.06	0.04	0.11	0.02	0.06	0.03	0.05	-	-
Minimum	2.49	1.95	0.26	0.11	0.33	0.03	0.34	0.21	0.25	0.54	0.85	0.46	0.39	0.21	0.33	1.17	0.54	-
Maximum	2.58	2.02	0.27	0.18	0.35	0.06	0.36	0.28	0.27	0.60	0.89	0.56	0.41	0.27	0.36	1.23	0.54	-
Count	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	-

Table 17 continued *Novacalecoris*. Abbreviations: AI-AIV = Antennal segment one to antennal segment four, CC = Length from cuneus to clypeus, CL = Length of cuneus, IOD = Inter-ocellic dimension, LH = Head length, LM = Length of mesoscutum, LP = Length of pronotum, LS = Length

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Novacalecoris gressiti																		
Females																		
Mean	2.47	1.80	0.20	0.17	0.25	0.08	0.31	0.33	0.33	0.54	1.99	0.58	0.43	0.70	0.22	0.98	0.61	0.44
Standard Deviation	0.06	0.06	0.03	0.02	0.03	0.03	0.02	0.05	0.04	0.02	2.26	0.04	0.02	0.84	0.01	0.09	0.05	0.04
Range	0.13	0.12	0.05	0.04	0.05	0.07	0.05	0.10	0.09	0.04	4.57	0.08	0.05	1.68	0.02	0.21	0.10	0.06
Minimum	2.42	1.73	0.17	0.14	0.22	0.04	0.29	0.27	0.29	0.52	0.82	0.54	0.41	0.28	0.20	0.88	0.57	0.40
Maximum	2.55	1.85	0.22	0.19	0.27	0.12	0.34	0.37	0.38	0.56	5.39	0.62	0.46	1.95	0.22	1.09	0.67	0.47
Count	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	2
Males																		
Mean	2.56	1.82	0.19	0.18	0.25	0.08	0.32	0.35	0.28	0.57	0.91	0.60	0.50	0.28	0.25	-	-	-
Standard Deviation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Range	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	2.56	1.82	0.19	0.18	0.25	0.08	0.32	0.35	0.28	0.57	0.91	0.60	0.50	0.28	0.25	-	-	-
Maximum	2.56	1.82	0.19	0.18	0.25	0.08	0.32	0.35	0.28	0.57	0.91	0.60	0.50	0.28	0.25	-	-	-
Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	-	-	-
Novacalecoris kraussi																		
Females																		
Mean	3.03	2.11	0.25	0.19	0.25	0.08	0.30	0.48	0.29	0.51	0.77	0.51	0.38	0.26	0.25	1.25	0.86	0.67
Standard Deviation	0.06	0.03	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.03	0.01	0.01
Range	0.09	0.04	0.00	0.01	0.01	0.00	0.00	0.01	0.01	0.02	0.02	0.02	0.01	0.01	0.01	0.05	0.86	-
Minimum	3.08	2.13	0.25	0.20	0.25	0.08	0.31	0.48	0.29	0.52	0.78	0.52	0.38	0.27	0.26	1.27	0.86	-
Maximum	2.98	2.10	0.25	0.19	0.25	0.08	0.30	0.47	0.28	0.50	0.76	0.50	0.37	0.26	0.25	1.23	-	-
Count	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	0
Males																		
Mean	3.01	2.06	0.25	0.19	0.24	0.08	0.30	0.47	0.30	0.51	0.77	0.49	0.38	0.27	0.24	1.23	0.85	0.67
Standard Deviation	0.04	0.05	0.01	0.00	0.01	0.00	0.01	0.02	0.01	0.01	0.03	0.01	0.02	0.01	0.01	0.04	0.03	0.03
Range	0.11	0.11	0.01	0.01	0.02	0.00	0.02	0.04	0.01	0.01	0.07	0.03	0.04	0.02	0.01	0.07	0.05	-
Minimum	3.07	2.12	0.26	0.19	0.25	0.08	0.31	0.50	0.30	0.51	0.82	0.51	0.40	0.28	0.25	1.28	-	-
Maximum	2.96	2.02	0.25	0.18	0.23	0.08	0.29	0.46	0.29	0.50	0.75	0.48	0.37	0.26	0.24	-	-	-
Count	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	2	3	1

Table 17 continued

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Novacalecoris macca																		
Females																		
Mean	2.34	1.74	0.18	0.17	0.25	0.04	0.32	0.36	0.31	0.55	0.90	0.59	0.46	0.28	0.22	0.82	0.50	0.42
Standard Deviation	0.29	0.18	0.02	0.02	0.03	0.02	0.04	0.07	0.05	0.01	0.03	0.02	0.04	0.01	0.04	0.07	0.06	0.07
Range	0.74	0.43	0.06	0.04	0.08	0.04	0.11	0.15	0.12	0.03	0.08	0.05	0.09	0.03	0.09	0.17	0.13	0.10
Minimum	2.10	1.60	0.16	0.15	0.22	0.02	0.27	0.30	0.26	0.53	0.87	0.56	0.42	0.26	0.18	0.74	0.42	0.37
Maximum	2.84	2.03	0.22	0.19	0.30	0.06	0.38	0.45	0.39	0.57	0.95	0.61	0.52	0.30	0.27	0.91	0.55	0.47
Count	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	2
Males																		
Mean	2.32	1.76	0.22	0.17	0.25	0.67	0.87	0.37	0.30	0.53	0.85	0.55	0.43	0.27	0.21	0.91	0.58	0.37
Standard Deviation	0.37	0.19	0.03	0.02	0.02	1.39	1.25	0.05	0.05	0.04	0.07	0.07	0.04	0.02	0.03	0.11	0.06	0.08
Range	0.74	0.47	0.07	0.04	0.06	3.13	2.84	0.13	0.13	0.10	0.18	0.17	0.10	0.07	0.07	0.26	0.16	0.17
Minimum	1.98	1.58	0.19	0.15	0.21	0.02	0.26	0.31	0.24	0.45	0.73	0.45	0.37	0.23	0.18	0.80	0.51	0.27
Maximum	2.72	2.05	0.26	0.20	0.27	3.15	3.10	0.44	0.38	0.56	0.91	0.62	0.47	0.30	0.25	1.06	0.67	0.44
Count	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4
Novacalecoris monteithi																		
Females																		
Mean	2.90	2.01	0.25	0.17	0.24	0.07	0.31	0.47	0.32	0.54	0.77	0.52	0.38	0.26	0.25	1.20	0.98	0.97
Standard Deviation	0.12	0.09	0.03	0.01	0.02	0.03	0.02	0.07	0.04	0.01	0.01	0.03	0.02	0.01	0.02	0.20	0.23	0.67
Range	0.25	0.21	0.08	0.03	0.05	0.05	0.03	0.19	0.12	0.02	0.03	0.07	0.04	0.02	0.05	0.51	0.56	1.53
Minimum	2.78	1.89	0.21	0.15	0.21	0.04	0.30	0.37	0.27	0.53	0.75	0.48	0.36	0.25	0.22	0.99	0.82	0.64
Maximum	3.03	2.10	0.30	0.18	0.25	0.10	0.33	0.55	0.39	0.55	0.78	0.54	0.40	0.27	0.27	1.51	1.38	2.17
Count	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Males																		
Mean	2.85	1.95	0.25	0.18	0.23	0.06	0.30	0.51	0.31	0.54	0.79	0.51	0.39	0.25	0.26	1.29	0.96	0.73
Standard Deviation	0.16	0.08	0.03	0.01	0.02	0.02	0.02	0.02	0.02	0.03	0.05	0.05	0.01	0.04	0.03	0.05	0.02	0.08
Range	0.42	0.20	0.07	0.02	0.05	0.04	0.06	0.04	0.05	0.08	0.13	0.12	0.03	0.09	0.09	0.12	0.04	0.18
Minimum	2.57	1.81	0.21	0.17	0.21	0.04	0.26	0.48	0.28	0.50	0.70	0.43	0.38	0.19	0.23	1.23	0.94	0.63
Maximum	2.99	2.01	0.28	0.19	0.26	0.08	0.31	0.52	0.32	0.58	0.83	0.55	0.41	0.28	0.32	1.35	0.98	0.81
Count	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	4	4

Table 17 continued

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Novacalecoris rubrafasciae																		
Females																		
Mean	3.07	2.23	0.29	0.22	0.25	0.09	0.32	0.46	0.31	0.57	0.80	0.51	0.41	0.30	0.25	1.25	0.95	0.67
Standard Deviation	0.17	0.09	0.02	0.03	0.01	0.02	0.03	0.06	0.01	0.01	0.03	0.03	0.01	0.01	0.03	0.10	0.18	0.07
Range	0.41	0.25	0.06	0.07	0.04	0.04	0.07	0.16	0.03	0.02	0.06	0.07	0.03	0.03	0.08	0.27	0.47	0.17
Minimum	2.83	2.10	0.27	0.19	0.23	0.07	0.28	0.37	0.30	0.56	0.77	0.47	0.40	0.29	0.20	1.09	0.64	0.56
Maximum	3.24	2.35	0.33	0.25	0.27	0.11	0.35	0.53	0.33	0.58	0.83	0.54	0.43	0.32	0.28	1.35	1.11	0.74
Count	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Males																		
Mean	2.92	2.15	0.28	0.20	0.24	0.10	0.32	0.41	0.31	0.57	0.82	0.51	0.41	0.30	0.28	1.38	1.02	0.68
Standard Deviation	0.16	0.09	0.03	0.02	0.01	0.05	0.02	0.05	0.01	0.01	0.04	0.02	0.01	0.02	0.06	0.04	0.04	0.13
Range	0.39	0.24	0.06	0.04	0.03	0.13	0.04	0.14	0.03	0.01	0.09	0.06	0.02	0.04	0.14	0.10	0.11	0.28
Minimum	2.66	1.98	0.24	0.18	0.23	0.07	0.29	0.34	0.29	0.56	0.78	0.48	0.41	0.29	0.24	1.33	0.97	0.55
Maximum	3.05	2.23	0.30	0.22	0.26	0.19	0.33	0.48	0.32	0.57	0.87	0.53	0.42	0.33	0.38	1.44	1.09	0.83
Count	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Novacalecoris tatarnici																		
Females																		
Mean	2.74	1.91	0.25	0.20	0.23	0.05	0.29	0.45	0.31	0.53	0.73	0.48	0.38	0.23	0.27	1.27	1.11	0.67
Standard Deviation	0.12	0.09	0.03	0.01	0.01	0.01	0.02	0.05	0.03	0.04	0.05	0.04	0.03	0.03	0.02	0.09	0.05	0.11
Range	0.33	0.20	0.08	0.02	0.03	0.03	0.04	0.11	0.08	0.08	0.10	0.12	0.08	0.06	0.05	0.21	0.15	0.25
Minimum	2.57	1.83	0.20	0.18	0.22	0.03	0.27	0.39	0.27	0.49	0.68	0.43	0.34	0.19	0.25	1.16	1.03	0.54
Maximum	2.89	2.03	0.28	0.21	0.25	0.06	0.31	0.50	0.35	0.57	0.78	0.55	0.42	0.26	0.30	1.37	1.18	0.79
Count	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4
Males																		
Mean	2.62	1.74	0.25	0.16	0.23	0.04	0.29	0.52	0.35	0.54	0.73	0.47	0.41	0.23	0.23	1.32	1.21	0.57
Standard Deviation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Range	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	2.62	1.74	0.25	0.16	0.23	0.04	0.29	0.52	0.35	0.54	0.73	0.47	0.41	0.23	0.23	1.32	1.21	0.57
Maximum	2.62	1.74	0.25	0.16	0.23	0.04	0.29	0.52	0.35	0.54	0.73	0.47	0.41	0.23	0.23	1.32	1.21	0.57
Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Table 17 continued

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Novacalecoris turpa																		
Females																		
Mean	2.89	2.03	0.25	0.19	0.24	0.08	0.29	0.49	0.32	0.52	0.79	0.49	0.39	0.27	0.25	1.26	0.91	0.75
Standard Deviation	0.10	0.10	0.01	0.00	0.01	0.00	0.01	0.02	0.03	0.00	0.02	0.00	0.01	0.01	0.01	0.05	0.08	-
Range	0.13	0.14	0.01	0.00	0.01	0.00	0.02	0.02	0.04	0.00	0.03	0.00	0.01	0.01	0.02	0.08	0.11	-
Minimum	2.83	1.95	0.25	0.19	0.24	0.08	0.28	0.47	0.29	0.52	0.78	0.49	0.38	0.26	0.25	1.23	0.85	0.75
Maximum	2.96	2.10	0.25	0.19	0.25	0.08	0.30	0.50	0.34	0.52	0.81	0.50	0.39	0.27	0.26	1.30	0.96	0.75
Count	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1
Males																		
Mean	2.59	1.50	0.23	0.21	0.25	0.08	0.16	0.72	0.60	0.51	1.03	0.59	0.40	0.26	0.27	1.29	0.80	-
Standard Deviation	0.11	0.69	0.07	0.01	0.02	0.01	0.18	0.40	0.42	0.08	0.28	0.10	0.00	0.05	0.00	0.06	0.27	-
Range	0.16	0.98	0.10	0.02	0.03	0.01	0.26	0.57	0.60	0.12	0.40	0.14	0.00	0.07	0.00	0.09	0.39	-
Minimum	2.51	1.01	0.18	0.20	0.23	0.07	0.03	0.44	0.30	0.45	0.82	0.52	0.40	0.23	0.27	1.25	0.61	-
Maximum	2.66	1.98	0.28	0.22	0.26	0.08	0.29	1.01	0.90	0.57	1.23	0.66	0.41	0.30	0.27	1.33	1.00	-
Count	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0

Table 18: Measurements for the genus *Prosoponomiris.* Abbreviations: AI-AIV = Antennal segment one to antennal segment four, CC = Length from cuneus to clypeus, CL = Length of cuneus, IOD = Inter-ocellic dimension, LH = Head length, LM = Length of mesoscutum, LP = Length of pronotum, LS = Length of scutellum, PW = Width of pronotum, TL = Total length, WA = Width of anterior lobe of the pronotum, WC = Width of cuneus, WH = Width of head, WP = Width of posterior lobe of pronotum, WS = Width of the scutellum.

	TL	**CC**	**LH**	**LP**	**LPP**	**LM**	**LS**	**LC**	**WC**	**WH**	**WP**	**WA**	**WS**	**IOD**	**A1**	**A2**	**A3**	**A4**
Prosoponomiris mimetica																		
Females																		
Mean	2.81	2.19	0.24	0.25	0.29	0.04	0.31	0.46	0.26	0.60	0.80	0.60	0.31	0.31	0.24	1.06	0.77	0.94
Standard Deviation	0.50	0.18	0.03	0.06	0.03	0.03	0.06	0.09	0.05	0.02	0.02	0.02	0.07	0.01	0.01	0.08	0.04	0.08
Range	1.30	0.37	0.06	0.16	0.07	0.07	0.15	0.21	0.13	0.04	0.06	0.05	0.17	0.04	0.04	0.17	0.09	0.21
Minimum	1.97	2.01	0.19	0.16	0.24	0.02	0.25	0.34	0.20	0.58	0.77	0.57	0.24	0.29	0.22	1.00	0.71	0.85
Maximum	3.27	2.38	0.26	0.31	0.31	0.08	0.40	0.55	0.33	0.62	0.83	0.63	0.41	0.33	0.26	1.17	0.81	1.06
Count	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
Males																		
Mean	2.97	2.12	0.23	0.26	0.28	0.05	0.30	0.46	0.24	0.65	0.80	0.57	0.38	0.24	0.25	1.06	0.69	0.97
Standard Deviation	0.06	0.12	0.06	0.04	0.02	0.04	0.04	0.06	0.02	0.06	0.03	0.03	0.06	0.01	0.01	0.07	0.08	0.05
Range	0.16	0.26	0.14	0.09	0.06	0.11	0.10	0.13	0.06	0.15	0.08	0.07	0.13	0.03	0.02	0.20	0.18	0.11
Minimum	2.90	2.00	0.15	0.22	0.26	0.01	0.23	0.37	0.21	0.56	0.75	0.54	0.30	0.23	0.24	0.96	0.60	0.92
Maximum	3.06	2.26	0.29	0.31	0.32	0.12	0.33	0.51	0.27	0.71	0.83	0.61	0.43	0.26	0.25	1.16	0.78	1.03
Count	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5

Table 20: Measurements for the genus *Spinamifera.* Abbreviations: AI-AIV = Antennal segment one to antennal segment four, CC = Length from cuneus to clypeus, CL = Length of cuneus, IOD = Inter-ocellic dimension, LH = Head length, LM = Length of mesoscutum, LP = Length of pronotum, LS = Length of scutellum, PW = Width of pronotum, TL = Total length, WA = Width of anterior lobe of the pronotum, WC = Width of cuneus, WH = Width of head, WP = Width of posterior lobe of pronotum, WS = Width of the scutellum.

	TL	**CC**	**LH**	**LP**	**LPP**	**LM**	**LS**	**LC**	**WC**	**WH**	**WP**	**WA**	**WS**	**IOD**	**A1**	**A2**	**A3**	**A4**
Saggitacopula carvalhoi																		
Females																		
Mean	4.65	3.17	0.41	0.33	0.51	0.06	0.51	0.71	0.45	0.70	4.24	0.54	0.52	0.32	0.73	2.03	1.46	1.60
Standard Deviation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Range	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	4.65	3.17	0.41	0.33	0.51	0.06	0.51	0.71	0.45	0.70	4.24	0.54	0.52	0.32	0.73	2.03	1.46	1.60
Maximum	4.65	3.17	0.41	0.33	0.51	0.06	0.51	0.71	0.45	0.70	4.24	0.54	0.52	0.32	0.73	2.03	1.46	1.60
Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Saggitacopula rufescens																		
Females																		
Mean	4.63	3.35	0.40	2.73	2.79	0.04	0.51	0.83	0.39	0.73	1.12	0.60	0.54	0.32	0.89	2.51	1.34	1.61
Standard Deviation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Range	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	4.63	3.35	0.40	2.73	2.79	0.04	0.51	0.83	0.39	0.73	1.12	0.60	0.54	0.32	0.89	2.51	1.34	1.61
Maximum	4.63	3.35	0.40	2.73	2.79	0.04	0.51	0.83	0.39	0.73	1.12	0.60	0.54	0.32	0.89	2.51	1.34	1.61
Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Males																		
Mean	4.66	3.33	0.39	0.28	0.46	0.05	0.50	0.83	0.30	0.67	1.04	0.59	0.53	0.29	0.66	2.28	-	-
Standard Deviation	0.86	0.56	0.06	0.07	0.06	0.02	0.09	0.18	0.12	0.08	0.13	0.01	0.05	0.02	0.16	-	-	-
Range	1.69	1.12	0.12	0.13	0.12	0.03	0.18	0.33	0.24	0.16	0.26	0.01	0.09	0.04	0.31	0.00	0.00	0.00
Minimum	3.91	2.81	0.32	0.21	0.40	0.03	0.41	0.71	0.19	0.57	0.91	0.59	0.49	0.26	0.49	2.28	0.00	0.00
Maximum	5.59	3.93	0.44	0.34	0.52	0.06	0.59	1.04	0.43	0.74	1.17	0.60	0.58	0.30	0.80	2.28	0.00	0.00
Count	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	1	0	0

Table 21: Measurements for the genus *Tudoris*. Abbreviations: AI-AIV = Antennal segment one to antennal segment four, CC = Length from cuneus to clypeus, CL = Length of cuneus, IOD = Inter-ocellic dimension, LH = Head length, LM = Length of mesoscutum, LP = Length of pronotum, LS = Length of scutellum, PW = Width of pronotum, TL = Total length, WA = Width of anterior lobe of the pronotum, WC = Width of cuneus, WH = Width of head, WP = Width of posterior lobe of pronotum, WS = Width of the scutellum.

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Tudoris solomonensis																		
Females																		
Mean	3.21	2.46	0.28	0.34	0.34	0.03	0.77	0.50	0.18	0.42	0.74	0.34	0.31	0.18	0.80	1.01	0.43	0.52
Standard Deviation	0.14	0.07	0.01	0.10	0.08	0.01	0.43	0.15	0.02	0.24	0.14	0.03	0.09	0.06	0.32	0.14	0.04	0.08
Range	0.36	0.21	0.02	0.27	0.21	0.02	1.08	0.41	0.05	0.58	0.38	0.07	0.21	0.16	0.83	0.36	0.10	0.11
Minimum	3.07	2.36	0.27	0.20	0.25	0.02	0.29	0.27	0.16	0.20	0.55	0.31	0.19	0.10	0.36	0.87	0.37	0.46
Maximum	3.43	2.56	0.29	0.47	0.46	0.05	1.37	0.68	0.20	0.78	0.93	0.38	0.40	0.26	1.19	1.23	0.47	0.58
Count	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	2
Males																		
Mean	3.19	2.34	0.27	0.31	0.30	0.06	0.09	0.48	0.24	0.53	0.68	0.42	0.35	0.21	0.52	1.12	0.58	0.46
Standard Deviation	0.20	0.21	0.01	0.17	0.11	0.02	0.82	0.11	0.06	0.21	0.08	0.10	0.04	0.06	0.35	0.13	0.25	0.12
Range	0.47	0.46	0.03	0.34	0.26	0.05	1.81	0.30	0.14	0.60	0.18	0.21	0.09	0.15	0.83	0.31	0.46	0.18
Minimum	2.98	2.10	0.25	0.18	0.23	0.04	0.96	0.35	0.15	0.23	0.60	0.31	0.29	0.12	0.25	0.96	0.40	0.38
Maximum	3.45	2.56	0.28	0.51	0.49	0.08	0.84	0.64	0.29	0.83	0.78	0.52	0.38	0.27	1.07	1.27	0.86	0.55
Count	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	3	2

Table 22: Measurements for the genus *Wumea*. Abbreviations: AI-AIV = Antennal segment one to antennal segment four, CC = Length from cuneus to clypeus, CL = Length of cuneus, IOD = Inter-ocellic dimension, LH = Head length, LM = Length of mesoscutum, LP = Length of pronotum, LS = Length of scutellum, PW = Width of pronotum, TL = Total length, WA = Width of anterior lobe of the pronotum, WC = Width of cuneus, WH = Width of head, WP = Width of posterior lobe of pronotum, WS = Width of the scutellum.

	TL	**CC**	**LH**	**LP**	**LPP**	**LM**	**LS**	**LC**	**WC**	**WH**	**WP**	**WA**	**WS**	**IOD**	**A1**	**A2**	**A3**	**A4**
Wumea cassisi																		
Males																		
Mean	4.98	3.63	0.42	0.29	0.47	0.06	0.56	0.91	0.24	0.70	1.06	0.58	0.56	0.32	0.70	2.08	1.36	1.75
Standard Deviation	0.12	0.26	0.10	0.03	0.03	0.01	0.08	0.12	0.02	0.05	0.05	0.07	0.15	0.02	0.05	0.06	0.07	
Range	0.24	0.52	0.19	0.05	0.05	0.02	0.15	0.23	0.05	0.08	0.10	0.13	0.29	0.03	0.10	0.11	0.10	
Minimum	4.85	3.35	0.31	0.27	0.45	0.05	0.49	0.80	0.21	0.65	1.01	0.52	0.43	0.30	0.65	2.04	1.31	1.75
Maximum	5.09	3.87	0.50	0.32	0.50	0.07	0.64	1.03	0.26	0.73	1.11	0.65	0.72	0.33	0.75	2.15	1.41	1.75
Count	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	1

Table 22 continued

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Wumea clypealis																		
Females																		
Mean	4.98	3.63	0.42	0.29	0.47	0.06	0.56	0.91	0.24	0.70	1.06	0.58	0.56	0.32	0.70	2.08	1.36	1.75
Standard Deviation	0.12	0.26	0.10	0.03	0.03	0.01	0.08	0.12	0.02	0.05	0.05	0.07	0.15	0.02	0.05	0.06	0.07	
Range	0.24	0.52	0.19	0.05	0.05	0.02	0.15	0.23	0.05	0.08	0.10	0.13	0.29	0.03	0.10	0.11	0.10	
Minimum	4.85	3.35	0.31	0.27	0.45	0.05	0.49	0.80	0.21	0.65	1.01	0.52	0.43	0.30	0.65	2.04	1.31	1.75
Maximum	5.09	3.87	0.50	0.32	0.50	0.07	0.64	1.03	0.26	0.73	1.11	0.65	0.72	0.33	0.75	2.15	1.41	1.75
Count	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	1
Mean	4.89	3.55	0.42	0.28	0.50	0.07	0.55	0.90	0.25	0.70	1.08	0.54	0.57	0.31	0.70	2.12	1.39	1.28
Standard Deviation	0.15	0.17	0.06	0.03	0.02	0.02	0.04	0.08	0.02	0.05	0.08	0.04	0.04	0.03	0.03	0.13	0.08	0.58
Range	0.40	0.34	0.16	0.07	0.06	0.06	0.09	0.18	0.05	0.12	0.16	0.08	0.10	0.09	0.08	0.31	0.14	0.82
Minimum	4.64	3.35	0.36	0.24	0.47	0.03	0.50	0.82	0.23	0.63	0.99	0.50	0.52	0.25	0.66	1.97	1.30	0.87
Maximum	5.04	3.69	0.52	0.31	0.53	0.09	0.59	1.00	0.28	0.75	1.15	0.57	0.62	0.34	0.74	2.28	1.44	1.69
Count	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	4	3	2
Wumea pilosa																		
Females																		
Mean	5.01	3.43	0.34	0.28	0.42	0.05	0.48	0.94	0.23	0.61	1.02	0.61	0.50	0.31	0.65	1.85	1.11	1.24
Standard Deviation	0.64	0.45	0.05	0.03	0.12	0.02	0.09	0.13	0.04	0.10	0.19	0.08	0.10	0.06	0.11	0.54	0.28	0.09
Range	1.13	0.82	0.09	0.06	0.21	0.03	0.17	0.25	0.08	0.19	0.33	0.17	0.18	0.11	0.20	1.07	0.54	0.17
Minimum	4.62	3.13	0.30	0.25	0.35	0.03	0.42	0.84	0.20	0.54	0.91	0.54	0.44	0.25	0.57	1.37	0.88	1.13
Maximum	5.75	3.95	0.39	0.31	0.55	0.06	0.58	1.09	0.28	0.73	1.24	0.71	0.62	0.36	0.77	2.44	1.42	1.30
Count	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Table

Table 23: Measurements for the genus *Zanchiella.* Abbreviations: AI-AIV = Antennal segment one to antennal segment four, CC = Length from cuneus to clypeus, CL = Length of cuneus, IOD = Inter-ocellic dimension, LH = Head length, LM = Length of mesoscutum, LP = Length of pronotum, LS = Length of scutellum, PW = Width of pronotum, TL = Total length, WA = Width of anterior lobe of the pronotum, WC = Width of cuneus, WH = Width of head, WP = Width of posterior lobe of pronotum, WS = Width of the scutellum.

Cl

SPECIMEN	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Zanchiella bowkeriae																		
Females																		
Mean	4.13	2.81	0.29	0.17	0.35	0.06	0.48	0.75	0.41	0.68	0.96	0.5	0.67	0.25	0.32	1.23	0.79	-
Standard Deviation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Range	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	4.13	2.81	0.29	0.17	0.35	0.06	0.48	0.75	0.41	0.68	0.96	0.5	0.67	0.25	0.32	1.23	0.79	-
Maximum	4.13	2.81	0.29	0.17	0.35	0.06	0.48	0.75	0.41	0.68	0.96	0.5	0.67	0.25	0.32	1.23	0.79	-
Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Males																		
Mean	3.99	2.69	0.28	0.13	0.3	0.02	0.56	0.81	0.24	0.66	0.92	0.51	0.64	0.28	0.35	1.17	0.83	0.42
Standard Deviation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Range	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	3.99	2.69	0.28	0.13	0.3	0.02	0.56	0.81	0.24	0.66	0.92	0.51	0.64	0.28	0.35	1.17	0.83	0.42
Maximum	3.99	2.69	0.28	0.13	0.3	0.02	0.56	0.81	0.24	0.66	0.92	0.51	0.64	0.28	0.35	1.17	0.83	0.42
Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Zanchiella sweeti																		
Males																		
Mean	3.2	2.22	0.33	0.12	0.33	0.03	0.35	0.58	0.26	0.6	0.88	0.5	0.46	0.27	0.36	1.07	1.21	-
Standard Deviation	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Range	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Minimum	3.2	2.22	0.33	0.46	0.12	0.33	0.35	0.58	0.26	0.6	0.88	0.5	0.46	0.27	0.36	1.07	1.21	-
Maximum	3.2	2.22	0.33	0.46	0.12	0.33	0.35	0.58	0.26	0.6	0.88	0.5	0.46	0.27	0.36	1.07	1.21	-
Count	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0

Taxon	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
***Candidomiris* group**																											
Bucculagrandis morobiensis	2	1	1	0	0	1	2	1	0	2	0	0	0	0	1	1	-	0	1	1	0	1	0	1	-	1	1
Candidomiris albomaculata	2	0	1	0	1	1	2	1	0	2	0	0	0	0	1	1	-	0	1	1	0	1	0	1	-	1	1
Candidomiris clavatasclerita	2	1	1	0	1	1	2	1	0	1	0	0	0	0	1	1	-	0	1	1	0	1	0	0	1	0	1
Candidomiris cyrtandraphila	2	1	1	0	1	1	2	1	0	1	0	0	0	0	1	1	-	0	1	1	0	1	0	0	1	0	1
Candidomiris macropiper	2	0	1	0	1	1	2	1	0	0	0	0	0	0	1	1	-	0	1	1	0	1	0	0	1	0	1
Candidomiris missimensis	2	0	1	0	1	1	2	1	0	2	0	0	0	0	1	1	-	0	1	1	0	1	0	1	-	1	1
Candidomiris parasponius	2	1	1	1	1	1	2	1	0	1	0	0	0	0	1	1	-	0	1	1	0	1	0	1	-	1	1
Candidomiris sinuata	2	0	1	0	1	1	2	1	0	0	0	0	0	0	1	1	-	0	1	1	0	1	0	0	0	1	1
Dimifacoris bifurcatus	0	0	1	0	0	0	1	1	1	1	0	1	1	1	0	0	1	1	0	1	1	1	0	0	1	1	0
Dimifacoris fasciatus	0	0	1	0	0	0	1	1	1	1	0	1	1	1	0	0	1	1	0	1	1	1	0	0	1	1	0
Dimifacoris leva	0	0	1	0	0	0	1	1	1	1	0	1	1	1	0	0	1	1	1	1	1	1	0	0	1	1	0
Dimifacoris trifurcatus	0	0	1	0	0	0	1	1	1	1	0	1	1	1	0	0	1	1	0	1	1	1	0	0	1	1	0
Dimifacoris splendidus	0	0	1	0	0	0	1	1	1	1	0	1	1	1	0	0	1	1	1	1	1	1	0	0	1	1	0
Elongatoductus walli	2	1	0	0	1	0	2	1	0	1	0	0	0	0	0	0	-	0	0	1	1	1	0	0	1	1	1
Falcum bulldogensis	2	0	1	0	0	1	2	1	0	1	0	0	0	0	0	0	-	0	1	1	1	1	0	0	0	1	1
Falcum gagnei	2	0	1	0	1	1	2	1	0	0	0	0	0	0	0	0	-	0	1	1	1	1	0	0	1	1	1
Falcum kaindiensis	2	0	1	0	0	1	2	1	0	0	0	0	0	0	0	0	-	0	1	1	1	1	0	0	0	1	1
Falcum taiwanensis	2	0	1	0	1	1	2	1	0	0	0	0	0	0	0	0	-	0	1	1	1	1	0	0	0	0	1
Felisacodes bryocorina	2	0	1	1	1	1	2	1	0	0	0	0	0	0	0	0	-	1	0	1	1	1	0	0	1	1	1
Felisacodes diaboura	2	0	1	1	1	1	2	1	0	2	0	0	0	0	0	0	-	1	0	1	1	1	0	1	-	0	1
Felisacodes uganda	2	0	1	1	1	1	2	1	0	0	0	0	0	0	0	0	-	1	0	1	1	1	0	0	1	1	1
Falcum austerum	2	0	1	0	1	1	2	1	0	2	0	0	0	0	0	0	-	0	1	1	1	1	0	0	1	1	1
Flagellomiris sinuatum	0	0	1	0	1	0	1	1	1	1	0	1	1	1	0	0	1	1	1	1	1	1	0	0	1	1	0
Flagellomiris tasmaniensis	0	0	1	1	1	0	1	1	1	1	0	1	1	1	0	0	1	1	1	1	1	1	0	0	1	1	0
Jimia bimaculata	2	1	1	1	1	1	2	1	0	2	0	0	0	0	0	0	-	0	1	1	1	1	0	0	1	1	1
Jimia spectabilis	2	1	1	1	1	1	2	1	0	2	0	0	0	0	0	0	-	0	1	1	1	1	0	0	1	1	1
Nerubia dentomembrana	2	1	1	1	1	1	2	1	0	2	0	0	0	0	0	0	-	0	1	1	1	1	0	0	0	1	1
Nerubia viridis	2	1	1	?	1	1	2	1	0	1	0	0	0	0	0	0	-	1	1	1	1	1	0	0	0	0	1
Novacalecoris bisclerita	2	1	1	0	0	1	1	1	0	1	0	0	0	0	0	0	-	0	1	1	1	1	1	1	-	1	1
Novacalecoris gressiti	1	1	1	0	0	1	1	1	0	0	0	0	0	0	0	0	-	0	1	1	1	1	1	1	-	1	1
Novacalecoris kraussi	2	1	1	0	0	1	1	1	0	?	0	0	0	0	0	0	-	0	1	1	1	1	1	1	-	1	1
Novacalecoris macca	1	1	1	1	0	1	1	1	0	2	0	0	0	0	0	0	-	0	1	1	1	1	1	1	-	1	1
Prosoponomiris mimetica	2	1	1	0	0	1	1	1	0	2	0	0	0	0	0	0	-	0	1	1	1	1	1	1	-	1	1
Novacalecoris monteithi	2	1	1	0	0	1	1	1	0	1	0	0	0	0	0	0	-	0	1	1	1	1	1	1	-	1	1
Novacalecoris rubrafasciae	2	1	1	0	0	1	1	1	0	1	0	0	0	0	0	0	-	0	1	1	1	1	1	1	-	1	1
Novacalecoris tatarnici	2	1	1	0	0	1	1	1	0	1	0	0	0	0	0	0	-	0	1	1	1	1	1	1	-	1	1
Novacalecoris turpa	2	1	1	0	0	1	1	1	0	1	0	0	0	0	0	0	-	0	1	1	1	1	1	0	1	1	1
Morobea longipes	0	0	0	0	0	0	1	1	1	0	0	1	0	1	0	0	-	1	0	1	1	1	0	0	0	1	1
Morobea spectabilis	0	0	0	0	0	0	1	1	1	0	0	1	0	1	0	0	-	1	0	1	1	1	0	0	0	1	1
Saggitacopula carvalhoi	2	1	1	0	1	1	2	1	0	1	0	0	0	0	0	0	-	1	0	1	1	1	0	0	1	1	1
Saggitacopula rufescens	2	1	1	0	1	1	2	1	0	1	0	0	0	0	0	0	-	1	0	1	1	1	0	0	1	1	1
Spinamifera raveni	2	1	1	0	1	1	1	1	0	2	0	0	0	0	0	1	-	0	1	1	1	1	0	0	0	0	1

Table 24 continued

Taxon	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Tudoris solomonensis	0	0	0	0	1	1	2	1	0	2	0	0	0	0	0	0	-	1	0	1	1	1	0	0	1	1	0
Wumea cassisi	0	0	0	0	0	0	0	1	1	0	0	1	0	1	0	0	-	1	0	0	1	1	0	0	1	1	1
Wumea clypealis	0	0	0	0	0	0	0	1	1	0	0	1	0	1	0	0	-	1	0	0	1	1	0	0	1	1	1
Wumea pilosa	0	0	0	0	0	0	0	1	1	0	0	1	0	1	0	0	-	1	0	0	1	1	0	0	1	1	1
Zanchiella bowkeriae	2	0	1	1	1	1	1	1	0	0	0	0	0	0	1	0	-	0	1	1	1	1	0	1	-	1	1
Zanchiella sweeti	2	0	1	1	1	1	1	1	0	0	0	0	0	0	1	0	-	0	1	1	1	1	0	1	-	1	1
Orthotylini outgroups																											
Adfalconia sp.	2	1	1	1	1	0	0	0	1	0	0	0	1	1	0	0	0	1	0	1	1	0	1	1	-	1	0
Bomberia foliaceae	1	1	1	1	0	1	1	1	0	1	0	0	0	1	0	0	-	0	1	1	1	0	1	1	-	1	1
Cyrtorhinus caricis	2	1	1	1	1	1	1	1	0	0	0	0	0	1	0	0	-	0	1	1	1	1	0	1	-	1	1
Cyrtorhinus lividipennis	2	1	1	1	1	1	1	1	0	0	0	0	0	1	0	0	-	0	1	1	1	0	0	1	-	1	1
Cyllecoris historanicus	2	1	1	1	1	1	1	1	1	2	0	1	0	1	0	0	1	1	1	1	1	0	0	1	-	1	1
Falconia teutoniana	2	1	1	1	1	0	0	0	1	0	0	0	1	1	0	0	0	1	0	1	1	0	1	1	-	1	0
Fieberocapsus flavelous	2	1	1	1	0	1	1	1	1	2	0	1	1	1	0	0	1	1	1	1	1	0	1	1	-	1	1
Gilo tibialis	1	1	1	1	1	1	1	1	1	1	0	1	0	1	0	0	-	1	1	1	1	0	0	1	-	1	1
Globiceps cruciata	2	1	1	1	1	1	1	1	1	2	0	1	0	1	0	0	1	1	1	1	1	0	0	1	-	1	1
Hadronema militare	2	1	1	1	1	1	1	1	1	1	0	1	0	1	0	0	1	1	1	1	1	0	0	1	-	1	1
Itocoris nigrioculis	0	1	1	1	1	0	0	0	1	1	0	1	1	1	0	0	0	1	0	1	1	0	1	1	-	1	0
Mecomma gilvipes	2	1	1	1	1	1	1	1	0	0	0	0	0	1	0	0	-	0	1	1	?	0	0	1	-	1	1
Mecommopsis cruciata	0	1	1	1	1	0	0	0	1	0	0	0	1	1	0	0	0	1	0	1	1	0	0	1	-	1	0
Melanotrichus australianus	2	1	1	1	1	1	1	1	1	0	0	1	0	1	0	0	-	1	1	1	1	0	1	1	-	1	1
Nycticapsus melanocephalus	1	1	1	1	0	1	1	1	0	1	0	1	0	1	0	0	-	1	1	1	1	0	1	1	-	1	1
Neoloxops rubrosignatus	1	1	1	1	1	1	1	0	0	0	0	1	1	1	0	0	0	1	1	1	1	0	0	1	-	1	0
Noctuocoris autlan	2	1	1	1	0	1	1	1	1	1	0	1	0	1	0	0	-	1	1	1	1	0	1	1	-	1	1
Oaxacacoris cygnus	2	1	1	1	1	1	1	1	1	0	0	1	0	1	0	0	-	1	1	1	1	0	1	1	-	1	1
Orthotylus bilineatus	2	1	1	1	1	1	1	1	1	0	0	1	0	1	0	0	-	0	1	1	1	0	0	1	-	1	1
Orthotylus farcha	2	1	1	1	1	1	1	1	1	0	0	1	0	0	0	0	-	1	1	1	1	0	1	1	-	1	1
Paraproba capitata	0	1	1	1	1	0	0	1	1	2	0	1	1	1	0	0	1	1	0	1	1	0	1	1	-	1	1
Parthenicus mundus	2	1	1	1	1	1	1	0	1	0	0	1	1	1	0	0	1	1	1	1	1	0	1	1	-	1	1
Pseudoloxops baiawaensi	2	1	1	1	1	0	0	0	1	1	0	0	1	1	0	0	1	1	0	1	?	0	0	1	-	1	0
Pseudopsallus angularis	2	1	1	1	1	1	1	1	1	0	0	1	0	1	0	0	1	1	1	1	1	0	0	1	-	1	1
Slaterocoris stygicus	1	1	1	1	0	1	1	1	0	1	0	1	0	1	0	0	-	0	1	1	1	0	1	1	-	1	1
Tupimiris scutellatus	2	1	1	1	1	1	1	1	1	1	0	1	1	1	0	0	1	1	1	1	1	0	1	1	-	1	1
Urapura antennata	2	1	1	1	1	1	1	1	0	1	0	1	0	1	0	0	-	1	1	1	1	0	1	1	-	1	1
Platycranus jordanicus	1	1	1	1	0	1	1	1	0	1	0	1	0	1	0	0	-	1	1	1	1	0	1	1	-	1	1
Witchelinamiris viridmaculatus	0	1	1	1	0	0	0	0	1	1	0	1	1	1	0	0	1	1	0	1	1	0	0	1	-	1	0
Lopidea dakota	2	1	1	1	1	1	1	1	1	1	0	1	0	1	0	0	-	1	1	1	1	0	1	1	-	1	1
Zanchius alba	0	1	1	1	1	0	1	0	1	0	0	0	1	1	0	0	0	1	1	1	1	0	1	1	-	1	0
Other outgroups																											
Coridromius bicolor	1	1	1	1	0	1	1	1	0	1	0	1	0	1	0	0	-	0	1	1	1	0	1	1	-	1	0
Lattinova jacki	2	1	1	1	1	0	1	1	1	1	1	1	1	1	0	0	1	1	1	1	1	0	0	1	-	1	0
Nichomachus sweeti	2	1	1	1	1	1	1	1	1	0	1	1	1	1	0	0	1	1	1	1	1	0	0	1	-	1	0
Tytthus mundulus	2	1	1	1	1	1	1	1	1	0	0	0	0	1	0	0	-	1	1	1	1	0	0	1	-	1	1

Table 24 continued

Taxon	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
***Candidomiris* group**																											
Bucculagrandis morobiensis	-	0	1	1	1	1	1	0	0	0	1	0	0	1	1	0	0	0	0	1	1	0	1	1	1	1	0
Candidomiris albomaculata	0	1	1	1	1	1	0	0	0	1	2	0	0	1	1	0	0	1	0	1	1	1	0	1	1	1	1
Candidomiris clavatasclerita	0	0	1	1	1	1	0	0	0	1	2	0	0	1	1	0	0	1	0	1	1	1	0	1	1	1	1
Candidomiris cyrtandraphila	0	1	1	1	0	1	0	0	0	1	2	0	0	1	1	0	0	1	0	1	?	?	?	?	?	?	?
Candidomiris macropiper	0	1	1	1	0	1	0	0	0	1	2	0	0	1	1	0	0	1	0	1	1	1	0	1	1	1	1
Candidomiris missimensis	0	0	1	1	1	1	0	0	0	1	2	0	0	1	1	0	0	1	0	1	?	?	?	?	?	?	?
Candidomiris parasponius	0	0	1	1	1	1	0	0	0	1	2	0	0	1	1	0	0	1	0	1	1	1	0	1	1	0	1
Candidomiris sinuata	0	1	1	1	0	1	0	0	0	1	2	0	0	1	1	0	0	1	0	1	1	1	0	1	1	1	1
Dimifacoris bifurcatus	1	1	1	1	1	1	1	0	0	1	1	0	1	1	0	1	1	1	0	1	1	0	0	1	1	0	1
Dimifacoris fasciatus	1	1	1	1	1	1	1	0	0	1	1	0	1	1	0	1	1	1	0	1	1	0	0	1	?	1	2
Dimifacoris leva	1	1	1	1	0	1	1	0	0	1	1	0	1	1	0	1	1	1	0	1	1	0	0	1	1	1	1
Dimifacoris trifurcatus	1	1	1	1	0	1	1	0	0	1	1	0	1	1	0	1	1	1	0	1	1	0	0	1	1	0	1
Dimifacoris splendidus	1	1	1	1	1	1	1	0	0	1	2	0	1	1	0	1	1	1	0	1	?	?	?	?	?	?	?
Elongatoductus walli	0	1	1	0	1	0	0	0	0	1	1	0	2	1	1	0	1	1	0	1	1	1	0	1	1	1	1
Falcum bulldogensis	0	1	1	1	0	1	1	0	0	1	0	0	2	1	1	0	1	1	0	1	1	1	0	1	1	1	1
Falcum gagnei	0	1	1	1	1	1	1	0	0	1	0	0	2	1	1	0	1	1	0	1	1	1	0	1	1	0	1
Falcum kaindiensis	0	1	1	1	0	1	1	0	0	1	0	0	2	1	1	0	1	1	0	1	1	1	0	1	1	0	1
Falcum taiwanensis	0	1	1	1	1	1	1	0	0	1	0	0	2	1	1	0	1	1	0	1	1	1	0	1	1	1	1
Felisacodes bryocorina	0	1	1	1	0	0	0	0	1	1	2	0	2	1	1	0	0	0	0	0	1	1	0	1	1	1	1
Felisacodes diaboura	0	1	1	1	0	0	0	0	1	1	2	0	2	1	1	0	0	0	0	0	1	1	0	1	1	1	1
Felisacodes uganda	0	1	1	1	0	0	0	0	1	1	2	0	2	1	1	0	0	0	0	0	1	1	0	1	1	1	1
Falcum austerum	0	1	1	1	1	1	1	0	0	1	0	0	2	1	1	0	1	1	0	1	?	?	?	?	?	?	?
Flagellomiris sinuatum	1	0	1	1	0	0	0	0	0	0	0	0	1	1	0	1	1	1	0	1	0	0	0	1	1	1	1
Flagellomiris tasmaniensis	1	0	1	1	0	0	0	0	0	0	0	0	1	1	0	1	1	1	0	1	0	0	0	1	1	0	1
Jimia bimaculata	1	1	0	1	1	1	1	0	1	0	0	0	2	0	1	0	0	0	1	1	1	0	0	1	1	0	1
Jimia spectabilis	1	1	0	1	1	1	1	0	1	0	1	0	2	0	1	0	0	0	1	1	1	0	0	1	1	0	1
Nerubia dentomembrana	0	1	1	1	1	0	1	0	0	0	1	0	2	1	1	0	0	0	1	1	1	1	0	1	1	1	1
Nerubia viridis	0	1	1	1	0	0	1	0	0	0	1	0	2	1	1	0	1	0	1	1	1	1	0	1	1	1	1
Novacalecoris bisclerita	1	1	1	1	1	1	1	1	0	1	0	0	2	0	1	0	1	1	0	1	1	0	0	0	1	0	0
Novacalecoris gressiti	1	1	1	1	1	1	1	1	0	1	0	0	2	0	1	0	1	1	0	1	1	0	0	0	1	0	1
Novacalecoris kraussi	1	1	1	1	1	1	1	1	0	1	0	0	2	0	1	0	1	1	0	1	1	0	0	1	1	0	1
Novacalecoris macca	1	1	1	1	1	1	1	1	0	1	0	0	2	0	1	0	1	1	0	1	1	0	0	1	1	0	1
Prosoponomiris mimetica	1	1	1	1	1	1	1	1	0	1	0	0	0	0	1	0	1	1	0	1	1	0	0	1	1	0	1
Novacalecoris monteithi	1	1	1	1	1	1	1	1	0	1	0	0	2	0	1	0	1	1	0	1	1	0	0	1	1	0	1
Novacalecoris rubrafasciae	1	1	1	1	1	1	1	1	0	1	0	0	2	0	1	0	1	1	0	1	1	0	0	0	1	0	0
Novacalecoris tatarnici	1	1	1	1	1	1	1	1	0	1	0	0	2	0	1	0	1	1	0	1	1	0	0	1	1	0	0
Novacalecoris turpa	1	1	1	1	1	1	1	1	0	1	0	0	2	0	1	0	1	1	0	1	1	0	0	0	1	0	0
Morobea longipes	1	0	1	1	0	0	1	0	1	1	2	0	1	1	0	1	1	0	0	1	0	1	0	0	1	1	1
Morobea spectabilis	1	0	1	1	0	0	1	0	1	1	2	0	1	1	0	1	1	0	0	1	0	1	0	0	1	1	1
Saggitacopula carvalhoi	0	1	1	1	0	1	1	0	0	1	0	0	2	1	1	0	1	0	0	0	1	0	0	1	0	0	1
Saggitacopula rufescens	0	1	1	1	0	1	1	0	0	1	0	0	2	1	1	0	1	0	0	0	1	0	0	1	0	0	1
Spinamifera raveni	0	1	0	1	1	1	0	0	1	0	2	0	2	1	1	0	0	0	1	1	1	0	0	1	1	1	1

Table 24 continued

Taxon	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
Tudoris solomonensis	0	1	0	1	1	0	0	0	0	0	0	0	1	1	0	0	1	1	1	0	1	0	0	1	1	0	1
Wumea cassisi	1	0	1	1	0	0	0	0	0	1	2	0	1	1	0	1	1	0	0	1	0	1	0	1	1	1	0
Wumea clypealis	1	0	1	1	0	0	0	0	0	1	2	0	1	1	0	1	1	0	0	1	0	1	0	0	1	1	0
Wumea pilosa	1	0	1	1	1	0	0	0	0	1	2	0	1	1	0	1	1	0	0	1	0	1	0	0	1	1	0
Zanchiella bowkeriae	1	1	1	1	1	0	0	1	1	1	2	0	2	0	1	0	0	0	0	1	1	0	0	1	1	1	-
Zanchiella sweeti	1	1	1	1	1	0	0	1	1	1	2	0	2	0	1	0	0	0	0	1	1	0	0	1	1	1	-
Orthotylini outgroups																											
Adfalconia sp.	0	1	1	1	1	0	1	1	1	1	0	0	1	1	0	1	1	1	0	1	1	0	1	1	1	1	0
Bomberia foliaceae	1	1	1	1	1	1	1	0	1	1	1	0	2	0	1	0	1	1	0	1	1	0	1	1	1	1	0
Cyrtorhinus caricis	1	1	1	0	1	0	1	0	1	1	1	0	2	1	1	1	1	1	0	1	1	0	1	1	1	1	0
Cyrtorhinus lividipennis	1	1	1	0	1	0	1	0	1	1	1	0	2	1	1	1	1	1	0	1	1	0	1	1	1	1	0
Cyllecoris historanicus	1	1	1	1	1	1	1	1	1	1	0	0	2	1	1	1	1	1	0	1	1	0	1	1	1	1	0
Falconia teutoniana	0	1	1	1	1	0	1	1	1	1	1	0	1	1	0	1	1	1	0	1	1	0	1	1	1	1	0
Fieberocapsus flavelous	1	1	1	1	1	1	1	1	1	1	0	0	2	0	1	1	1	1	0	1	1	0	0	1	1	1	0
Gilo tibialis	1	1	1	1	1	1	1	1	1	1	0	0	2	1	1	1	1	1	0	1	1	0	1	1	1	1	0
Globiceps cruciata	1	1	1	1	1	1	1	1	1	1	0	0	2	1	1	1	1	1	0	1	1	0	1	1	1	1	0
Hadronema militare	1	1	1	1	1	1	1	1	1	1	0	0	2	1	1	0	1	1	0	1	1	0	0	1	1	1	0
Itocoris nigrioculis	0	1	1	1	1	0	0	0	1	1	0	0	1	1	1	0	1	1	0	1	1	0	1	1	1	1	0
Mecomma gilvipes	1	1	1	0	1	0	1	0	1	1	1	0	2	1	1	1	1	1	0	1	1	0	1	1	1	1	1
Mecommopsis cruciata	0	1	1	1	1	0	0	0	1	1	0	0	1	1	0	1	1	1	0	1	0	0	1	1	1	1	1
Melanotrichus australianus	1	1	1	1	1	1	1	1	1	1	0	0	2	0	1	1	1	1	0	1	1	0	1	1	1	1	0
Nycticapsus melanocephalus	1	1	1	1	1	1	1	1	1	1	1	0	2	0	1	1	1	1	0	1	1	0	1	1	1	1	0
Neoloxops rubrosignatus	1	1	1	1	1	1	1	0	1	1	0	0	2	0	1	1	1	1	0	1	1	0	1	1	1	1	0
Noctuocoris autlan	1	1	1	1	1	1	0	1	1	1	0	0	2	1	1	1	1	1	0	1	1	0	1	1	1	1	0
Oaxacacoris cygnus	1	1	1	1	1	1	1	1	1	1	0	0	2	0	1	1	1	1	0	1	1	0	1	1	1	1	0
Orthotylus bilineatus	1	1	1	0	1	0	1	0	1	1	1	0	2	0	1	1	1	1	0	1	1	0	1	1	1	1	1
Orthotylus farcha	1	1	1	1	1	1	1	1	1	1	1	0	2	0	1	1	1	1	0	1	1	0	0	1	1	1	0
Paraproba capitata	1	1	1	1	1	0	1	1	1	1	1	0	2	1	1	1	1	1	0	1	1	0	1	1	1	1	0
Parthenicus mundus	1	1	1	1	1	1	1	1	1	1	0	0	2	0	1	1	1	1	0	1	1	0	1	1	1	1	0
Pseudoloxops baiawaensi	0	1	1	1	1	0	1	0	1	1	1	0	1	1	0	1	1	1	0	1	1	0	0	1	1	1	0
Pseudopsallus angularis	1	1	1	1	1	1	1	1	1	1	0	0	2	1	1	1	1	1	0	1	1	0	1	1	1	1	0
Slaterocoris stygicus	1	1	1	1	1	1	0	1	1	1	0	0	2	0	1	0	1	1	0	1	1	0	1	1	1	1	0
Tupimiris scutellatus	1	1	1	1	1	1	1	1	1	1	0	0	2	1	1	1	1	1	0	1	1	0	1	1	1	1	0
Urapura antennata	1	1	1	1	1	1	1	1	1	1	0	0	2	0	1	1	1	1	0	1	?	?	?	?	?	?	?
Platycranus jordanicus	1	1	1	1	1	1	1	1	1	1	0	0	2	0	1	1	1	1	0	1	1	0	1	1	1	1	0
Witchelinamiris viridmaculatus	1	1	1	1	1	0	0	0	1	1	2	0	1	1	1	0	1	1	0	1	1	1	0	1	1	1	0
Lopidea dakota	1	1	1	1	1	1	1	1	1	1	0	0	2	1	1	1	1	1	0	1	1	0	1	1	1	1	0
Zanchius alba	1	1	1	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	0	1	1	0	1	1	1	1	0
Other outgroups																											
Coridromius bicolor	1	1	1	1	1	1	0	1	1	1	1	1	2	0	1	1	1	1	0	1	1	0	1	1	1	1	0
Lattinova jacki	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	0	1	1	0	1	1	1	1	0
Nichomachus sweeti	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	0	1	1	0	1	1	1	1	0
Tytthus mundulus	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	0	1	1	0	0	1	1	1	0

Table 24 continued

Taxon	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81
***Candidomiris* group**																											
Bucculagrandis morobiensis	0	1	1	1	0	1	1	1	0	0	1	1	1	0	1	1	-	1	0	0	0	0	0	1	0	-	0
Candidomiris albomaculata	1	0	1	1	1	1	1	1	0	0	1	1	1	0	1	0	0	1	0	0	0	0	0	1	1	0	1
Candidomiris clavatasclerita	1	0	1	1	1	1	1	1	0	0	1	1	1	0	0	0	0	1	0	0	0	0	0	1	1	0	1
Candidomiris cyrtandraphila	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	0	?	?	?	1	0	1
Candidomiris macropiper	1	0	1	1	1	1	1	1	0	0	1	1	1	0	0	1	-	1	0	0	0	0	0	1	1	0	0
Candidomiris missimensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	0	?	?	?	1	0	0
Candidomiris parasponius	0	0	1	0	1	1	1	1	0	0	1	1	1	0	0	0	1	0	0	0	0	0	0	1	1	0	1
Candidomiris sinuata	1	0	1	0	0	1	1	1	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0
Dimifacoris bifurcatus	0	1	1	?	1	1	0	1	0	0	1	1	1	0	1	1	-	1	0	0	1	0	1	1	0	-	2
Dimifacoris fasciatus	0	0	1	?	1	1	0	1	0	0	1	1	1	0	0	1	-	?	0	0	1	0	1	1	0	-	2
Dimifacoris leva	0	0	1	?	0	1	0	1	0	0	1	1	0	0	0	1	-	1	0	0	1	0	0	1	0	-	2
Dimifacoris trifurcatus	0	1	1	?	1	1	0	1	0	0	1	1	1	0	1	1	-	1	0	0	1	0	1	1	0	-	2
Dimifacoris splendidus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	1	?	?	?	0	-	2
Elongatoductus walli	0	1	1	1	1	1	1	1	0	1	1	1	1	1	1	-	-	0	0	0	0	0	0	1	1	0	0
Falcum bulldogensis	1	0	1	?	1	1	1	1	0	0	1	1	1	0	0	1	-	1	0	0	0	0	0	1	1	0	0
Falcum gagnei	1	0	1	?	1	1	1	1	0	0	1	1	1	0	0	1	-	1	0	0	0	0	0	1	1	0	0
Falcum kaindiensis	0	0	1	?	1	1	1	1	0	0	1	1	1	0	0	1	-	1	0	0	0	0	0	1	1	0	0
Falcum taiwanensis	1	0	1	?	1	1	1	1	0	0	1	1	1	0	1	1	-	1	0	0	0	0	0	1	1	0	0
Felisacodes bryocorina	1	0	1	?	1	1	1	1	0	0	1	1	1	0	1	0	1	1	0	0	0	0	0	1	?	?	?
Felisacodes diaboura	1	0	1	?	1	1	1	1	0	0	1	1	1	0	1	0	1	1	0	0	0	0	0	1	?	?	?
Felisacodes uganda	1	0	1	?	1	1	1	1	0	0	1	1	1	0	1	0	1	1	0	0	0	0	0	1	?	?	?
Falcum austerum	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	0	?	?	?	1	0	0
Flagellomiris sinuatum	0	0	1	?	1	1	1	1	0	0	1	0	0	1	1	1	-	0	0	1	1	0	0	0	?	?	?
Flagellomiris tasmaniensis	1	0	1	?	0	1	1	1	0	0	1	0	0	1	1	1	-	0	0	1	1	0	0	0	?	?	?
Jimia bimaculata	0	0	1	?	0	1	1	1	0	0	1	1	1	1	1	-	-	1	1	0	2	0	1	1	0	-	0
Jimia spectabilis	0	0	1	?	0	1	1	1	0	0	1	1	1	1	1	-	-	1	1	0	2	0	1	1	0	-	?
Nerubia dentomembrana	1	0	1	?	0	1	1	1	0	0	0	1	1	1	1	-	-	1	1	1	2	0	1	1	0	-	1
Nerubia viridis	1	0	1	?	1	1	1	1	0	0	0	1	1	1	1	-	-	1	1	1	2	0	1	1	0	-	?
Novacalecoris bisclerita	0	0	1	?	1	1	1	0	0	0	0	1	1	0	0	1	-	1	0	1	0	0	0	1	0	-	0
Novacalecoris gressiti	1	0	1	?	1	1	1	0	0	0	0	1	1	0	0	1	-	1	0	1	0	0	0	1	0	-	0
Novacalecoris kraussi	1	0	1	?	1	1	1	1	0	0	0	1	1	0	0	1	-	1	0	1	0	0	0	1	0	-	0
Novacalecoris macca	1	0	1	?	1	1	1	0	0	0	0	1	1	0	0	1	-	1	0	1	0	0	0	1	0	-	0
Prosoponomiris mimetica	0	0	1	?	0	1	1	1	0	0	0	1	1	0	0	1	-	1	0	1	0	0	0	1	0	-	1
Novacalecoris monteithi	1	0	1	?	1	1	1	1	0	0	0	1	1	0	0	1	-	1	0	1	0	0	0	1	0	-	0
Novacalecoris rubrafasciae	0	1	1	?	1	1	1	0	0	0	0	1	1	0	0	1	-	1	0	1	0	0	0	1	0	-	0
Novacalecoris tatarnici	1	0	1	?	1	1	1	0	0	0	0	1	1	0	0	1	-	1	0	1	0	0	0	1	0	-	0
Novacalecoris turpa	0	1	1	?	0	1	1	0	0	0	0	1	1	0	0	1	-	1	0	1	0	0	0	1	0	-	0
Morobea longipes	1	0	1	?	1	1	1	1	0	0	1	1	1	0	0	0	2	1	0	1	1	0	1	1	0	-	?
Morobea spectabilis	1	0	1	?	1	1	1	1	0	0	1	1	1	0	0	0	2	1	0	1	1	0	1	1	0	-	?
Saggitacopula carvalhoi	0	0	1	?	1	1	1	1	0	0	1	1	1	0	0	0	2	1	0	0	0	0	0	1	0	-	?
Saggitacopula rufescens	0	0	1	?	1	1	1	1	0	0	1	1	1	0	0	0	2	1	0	0	0	0	0	1	0	-	?
Spinamifera raveni	1	0	1	?	1	0	1	1	0	0	0	1	1	0	1	1	-	1	0	0	2	0	1	1	0	-	?

Table 24 continued

Taxon	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81
Tudoris solomonensis	0	0	1	?	0	1	1	0	0	0	1	1	1	0	0	-	-	1	0	0	2	0	0	1	0	-	?
Wumea cassisi	1	1	1	?	1	1	1	1	0	0	1	1	1	0	0	1	-	1	0	0	1	0	0	1	0	-	?
Wumea clypealis	1	0	1	?	0	1	1	1	0	1	1	1	1	0	0	1	-	1	0	0	1	0	0	1	0	-	?
Wumea pilosa	1	1	1	?	1	1	1	1	0	0	1	1	1	0	0	1	-	1	0	0	1	0	0	1	0	-	?
Zanchiella bowkeriae	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	?	-	-	-	-	-	-
Zanchiella sweeti	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	?	-	-	-	-	-	-
Orthotylini outgroups																											
Adfalconia sp.	1	0	0	?	0	1	1	?	1	1	1	0	0	1	1	1	-	0	1	1	1	1	0	0	?	?	?
Bomberia foliaceae	1	0	0	?	0	0	1	?	1	1	1	1	1	1	1	1	-	0	1	1	1	0	0	0	?	?	?
Cyrtorhinus caricis	0	0	1	?	1	0	0	1	0	0	1	1	0	1	1	1	-	1	0	1	1	1	1	0	0	-	?
Cyrtorhinus lividipennis	0	0	0	?	1	0	0	1	0	0	1	1	0	1	1	1	-	1	0	1	1	0	1	0	0	-	?
Cyllecoris historanicus	1	0	0	?	1	0	1	?	1	1	1	0	0	1	1	1	-	0	1	1	1	1	0	0	?	?	?
Falconia teutoniana	1	0	0	?	0	1	1	?	1	1	1	0	0	1	1	1	-	0	1	1	1	1	0	0	?	?	?
Fieberocapsus flavelous	1	0	0	?	1	1	1	?	1	1	1	0	0	1	1	1	-	0	1	1	1	0	0	0	?	?	?
Gilo tibialis	1	0	0	?	0	1	1	?	1	1	1	0	0	1	1	1	-	0	1	1	1	1	0	0	?	?	?
Globiceps cruciata	1	0	0	?	1	0	1	?	1	1	1	0	0	1	1	1	-	0	1	1	1	1	0	0	?	?	?
Hadronema militare	1	0	0	?	0	0	1	?	1	1	1	0	0	1	1	1	-	0	1	1	1	1	0	0	?	?	?
Itocoris nigrioculis	1	0	0	?	1	0	1	?	1	1	0	0	0	1	1	1	-	0	1	1	1	1	0	0	?	?	?
Mecomma gilvipes	1	0	1	?	1	0	0	1	0	0	1	1	0	0	1	1	-	1	0	1	1	1	0	0	0	-	?
Mecommopsis cruciata	1	0	0	?	1	0	1	?	1	1	0	0	0	1	1	1	-	0	1	1	1	1	0	0	0	-	?
Melanotrichus australianus	1	0	0	?	0	1	1	?	1	1	1	0	0	1	1	1	-	0	1	1	1	0	0	0	?	?	?
Nycticapsus melanocephalus	1	0	0	?	0	0	1	?	1	1	1	1	1	1	1	1	-	0	1	1	1	0	0	0	?	?	?
Neoloxops rubrosignatus	1	0	0	?	0	1	1	?	?	?	?	?	?	?	?	?	-	?	?	?	?	?	?	?	?	?	?
Noctuocoris autlan	1	0	0	?	0	1	1	?	1	1	1	0	0	1	1	1	-	0	1	1	1	1	0	0	?	?	?
Oaxacacoris cygnus	1	0	0	?	1	1	1	?	1	1	1	0	0	1	1	1	-	0	1	1	1	1	0	0	?	?	?
Orthotylus bilineatus	1	0	1	?	1	0	0	1	0	0	1	1	0	0	1	1	-	1	0	1	1	1	0	0	0	-	?
Orthotylus farcha	1	0	0	?	0	1	1	?	1	1	1	0	0	1	1	1	-	0	1	1	1	1	0	0	?	?	?
Paraproba capitata	1	0	0	?	0	1	1	?	1	1	1	0	0	1	1	1	-	0	1	1	1	1	0	0	?	?	?
Parthenicus mundus	1	0	0	?	1	1	1	?	1	1	1	0	0	1	1	1	-	0	1	1	1	1	0	0	?	?	?
Pseudoloxops baiawaensi	1	0	0	?	0	0	1	1	1	1	1	0	0	1	1	1	-	0	1	1	1	1	0	0	?	?	?
Pseudopsallus angularis	1	0	0	?	0	1	1	?	1	1	1	0	0	1	1	1	-	0	1	1	1	1	0	0	?	?	?
Slaterocoris stygicus	1	0	0	?	0	1	1	?	1	1	1	0	0	1	1	1	-	0	1	1	1	0	0	0	?	?	?
Tupimiris scutellatus	1	0	0	?	1	1	1	?	1	1	1	0	0	1	1	1	-	0	1	1	1	1	0	0	?	?	?
Urapura antennata	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Platycranus jordanicus	1	0	0	?	0	0	1	?	1	1	1	0	0	1	1	-	-	0	1	1	1	?	0	0	?	?	?
Witchelinamiris viridmaculatus	1	0	0	?	1	0	1	?	1	1	1	0	0	1	1	1	-	0	1	1	1	1	0	0	?	?	?
Lopidea dakota	1	0	0	?	0	1	1	?	1	1	1	0	0	1	1	1	-	0	1	1	1	1	0	0	?	?	?
Zanchius alba	1	0	0	?	0	0	1	1	1	1	0	0	0	1	1	1	-	0	1	1	1	1	0	0	?	?	?
Other outgroups																											
Coridromius bicolor	1	0	0	?	1	1	1	?	1	1	1	0	0	1	1	1	-	0	1	1	1	1	0	0	?	?	?
Lattinova jacki	1	0	0	?	1	1	1	?	1	1	0	0	0	1	1	1	-	0	1	1	1	1	0	0	?	?	?
Nichomachus sweeti	1	0	0	?	1	1	1	?	1	1	1	0	0	1	1	1	-	0	1	1	1	1	0	0	?	?	?
Tytthus mundulus	1	0	0	?	1	1	1	1	1	1	1	1	1	1	1	-	-	0	1	1	?	1	0	0	?	?	?

Table 24 continued

Taxon	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103

***Candidomiris* group**																						
Bucculagrandis morobiensis	0	0	1	1	1	1	0	1	1	1	-	0	1	1	0	0	2	2	0	1	1	0
Candidomiris albomaculata	0	0	1	0	1	1	0	0	1	1	-	0	1	1	0	1	1	1	2	1	0	0
Candidomiris clavatasclerita	0	0	1	1	1	1	0	0	1	1	-	0	1	1	0	1	1	1	2	1	0	0
Candidomiris cyrtandraphila	0	0	1	1	1	1	0	0	1	1	-	0	1	1	0	1	1	1	2	1	0	0
Candidomiris macropiper	0	1	1	1	1	1	0	0	1	1	-	0	1	1	0	1	1	1	2	1	0	0
Candidomiris missimensis	0	0	1	1	1	1	0	0	1	1	-	0	1	1	0	1	1	1	2	1	0	0
Candidomiris parasponius	0	1	1	1	1	1	0	0	1	1	-	0	1	1	0	1	1	1	2	1	0	0
Candidomiris sinuata	0	0	1	1	1	1	0	0	1	1	-	0	1	1	0	0	1	1	2	1	0	0
Dimifacoris bifurcatus	0	4	1	0	0	1	1	0	1	1	-	0	0	1	1	1	1	2	1	0	1	1
Dimifacoris fasciatus	0	1	1	0	0	1	1	0	1	0	0	0	0	1	1	1	1	2	1	0	1	1
Dimifacoris leva	0	2	1	0	0	1	1	0	1	1	-	0	0	1	1	1	1	2	1	0	1	1
Dimifacoris trifurcatus	0	2	1	0	0	1	1	0	1	1	-	0	0	1	1	1	1	2	1	0	1	1
Dimifacoris splendidus	0	1	1	0	0	0	1	0	1	1	-	0	0	1	1	1	1	2	1	0	1	1
Elongatoductus walli	0	1	1	1	1	1	0	0	1	1	-	0	1	1	0	1	1	2	2	1	1	0
Falcum bulldogensis	0	5	1	0	0	1	0	0	1	1	-	0	1	1	1	1	1	1	2	1	1	0
Falcum gagnei	0	1	1	0	0	1	0	0	1	1	-	0	1	1	1	1	1	1	2	1	1	0
Falcum kaindiensis	0	1	1	0	0	1	0	0	1	1	-	0	1	1	1	1	1	1	2	1	1	0
Falcum taiwanensis	0	0	1	0	0	1	0	0	1	1	-	0	1	1	1	1	1	1	2	1	1	0
Felisacodes bryocorina	0	0	1	1	0	1	0	0	1	1	-	0	1	1	0	1	0	1	2	1	1	0
Felisacodes diaboura	0	0	1	1	0	1	0	0	1	1	-	0	1	1	0	1	0	1	2	1	1	0
Felisacodes uganda	0	0	1	1	1	1	0	0	1	1	-	0	1	1	0	1	0	1	2	1	1	0
Falcum austerum	?	1	1	0	0	1	0	0	1	1	-	0	1	1	1	1	1	1	2	1	1	0
Flagellomiris sinuatum	0	1	1	1	0	0	0	0	1	0	0	0	0	1	1	1	1	1	1	0	1	1
Flagellomiris tasmaniensis	0	1	1	1	0	0	0	0	1	0	0	0	0	1	1	1	1	1	1	0	1	1
Jimia bimaculata	0	3	0	1	0	1	0	0	0	1	-	0	0	0	1	0	1	0	1	1	1	0
Jimia spectabilis	0	3	0	1	0	1	0	0	0	1	-	0	0	0	1	0	1	0	1	1	1	0
Nerubia dentomembrana	0	3	0	1	0	1	0	0	1	1	-	0	1	-	1	0	1	0	0	1	1	0
Nerubia viridis	0	2	1	1	0	1	0	0	1	1	-	0	1	-	1	1	1	0	0	1	1	0
Novacalecoris bisclerita	0	3	1	1	1	1	0	0	1	1	-	0	0	1	1	0	1	2	1	1	1	0
Novacalecoris gressiti	0	3	0	1	1	0	0	0	1	1	-	0	0	1	1	0	1	2	1	1	1	0
Novacalecoris kraussi	0	3	1	0	1	0	0	0	?	1	-	0	0	1	1	0	1	2	1	1	1	0
Novacalecoris macca	0	6	0	1	1	0	0	0	1	1	-	0	0	1	1	0	1	2	1	1	1	0
Prosoponomiris mimetica	0	0	1	1	1	1	0	0	1	1	-	0	0	1	1	0	1	2	1	1	1	0
Novacalecoris monteithi	0	3	1	1	1	1	0	0	1	1	-	0	0	1	1	0	1	2	1	1	1	0
Novacalecoris rubrafasciae	0	1	1	0	1	1	0	0	1	1	-	0	0	1	1	0	1	2	1	1	1	0
Novacalecoris tatarnici	0	1	1	1	1	1	0	0	1	1	-	0	0	1	1	0	1	2	1	1	1	0
Novacalecoris turpa	0	1	1	1	1	1	0	0	1	1	-	0	0	1	1	1	1	2	1	1	1	0
Morobea longipes	0	1	0	1	0	1	1	0	1	0	1	0	1	-	0	1	2	1	2	0	1	1
Morobea spectabilis	0	1	0	0	0	1	1	0	1	0	1	0	1	-	0	1	2	1	2	0	1	1
Saggitacopula carvalhoi	0	4	0	1	0	1	0	0	1	1	-	0	1	-	1	1	1	2	1	1	1	0
Saggitacopula rufescens	0	6	0	1	0	1	0	0	1	1	-	0	1	-	1	1	1	2	1	1	1	0
Spinamifera raveni	0	1	0	1	0	0	0	0	2	1	-	0	0	1	1	1	1	1	1	1	1	0

Table 24 continued

Taxon	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103
Tudoris solomonensis	0	6	0	1	1	0	1	0	1	1	-	0	1	-	1	0	1	2	1	1	1	0
Wumea cassisi	0	1	0	1	0	0	1	0	1	1	1	0	1	-	0	1	0	1	2	0	1	1
Wumea clypealis	0	1	0	1	0	0	1	0	1	0	1	0	1	-	0	1	0	1	2	0	1	1
Wumea pilosa	0	1	1	1	0	0	1	0	1	0	1	0	1	-	0	0	0	1	2	0	1	1
Zanchiella bowkeriae	-	3	1	1	1	1	0	0	1	1	-	0	1	-	1	1	1	1	1	1	1	0
Zanchiella sweeti	-	3	1	1	1	1	0	0	1	1	-	0	1	-	1	1	1	1	1	1	1	0
Orthotylini outgroups																						
Adfalconia sp.	0	2	1	1	1	1	1	1	1	1	-	1	0	1	1	0	1	?	?	?	1	?
Bomberia foliaceae	0	0	1	1	1	1	1	1	1	1	-	0	0	?	1	1	1	?	?	?	1	1
Cyrtorhinus caricis	0	0	1	1	1	1	1	0	1	1	-	0	0	1	1	1	1	1	1	1	1	1
Cyrtorhinus lividipennis	0	3	1	1	1	1	1	0	1	1	-	0	0	1	1	1	1	1	1	1	1	1
Cyllecoris historanicus	0	0	1	1	1	1	1	1	1	1	-	1	0	?	1	1	1	?	?	?	1	1
Falconia teutoniana	0	0	1	1	1	1	1	1	1	1	-	1	0	?	1	0	1	?	?	?	1	?
Fieberocapsus flavelous	0	5	1	1	1	1	1	1	1	1	-	1	0	?	1	0	1	?	?	?	1	1
Gilo tibialis	0	2	1	1	1	1	1	1	1	1	-	1	0	1	1	0	1	?	?	?	1	?
Globiceps cruciata	0	2	1	1	1	1	1	1	1	1	-	1	0	?	1	1	1	?	?	?	1	1
Hadronema militare	0	6	1	0	1	0	1	1	1	1	-	1	0	1	1	0	1	?	?	?	1	1
Itocoris nigrioculis	0	0	1	1	1	1	1	1	1	1	-	1	0	?	1	1	1	?	?	?	1	1
Mecomma gilvipes	0	0	1	1	1	1	1	0	1	1	-	0	0	1	1	1	1	1	1	1	1	1
Mecommopsis cruciata	0	0	1	1	1	1	1	0	1	1	-	0	0	1	1	1	1	2	1	1	1	1
Melanotrichus australianus	0	4	1	1	1	1	1	1	1	1	-	1	0	?	1	0	1	?	?	?	1	1
Nycticapsus melanocephalus	0	3	1	1	1	1	1	0	1	1	-	1	0	?	1	1	1	?	?	?	1	1
Neoloxops rubrosignatus	0	6	1	1	0	0	1	1	1	1	-	0	0	1	1	0	1	?	?	?	1	1
Noctuocoris autlan	0	4	1	1	1	1	1	1	1	1	-	1	0	1	1	0	1	?	?	?	1	1
Oaxacacoris cygnus	0	3	1	1	1	1	1	1	1	1	-	1	0	?	1	0	1	?	?	?	1	1
Orthotylus bilineatus	0	5	1	1	1	1	1	0	1	1	-	0	0	1	1	1	1	1	1	1	1	1
Orthotylus farcha	0	2	1	1	1	1	1	1	1	1	-	1	0	?	1	0	1	?	?	?	1	1
Paraproba capitata	0	4	1	1	1	1	1	1	1	1	-	1	0	?	1	0	1	?	?	?	1	1
Parthenicus mundus	0	4	1	1	1	1	1	1	1	1	-	1	0	1	1	0	1	?	?	?	1	1
Pseudoloxops baiawaensi	0	6	1	0	0	0	1	1	1	1	-	1	0	1	1	0	1	?	?	?	1	1
Pseudopsallus angularis	0	4	1	1	1	1	1	1	1	1	-	1	0	?	1	0	1	?	?	?	1	?
Slaterocoris stygicus	0	0	1	1	1	1	1	1	1	1	-	0	0	?	1	1	1	?	?	?	1	1
Tupimiris scutellatus	0	4	1	1	1	1	1	1	1	1	-	1	0	?	1	0	1	?	?	?	1	?
Urapura antennata	0	3	1	1	1	1	1	1	1	1	-	1	0	?	1	0	1	?	?	?	1	?
Platycranus jordanicus	0	3	1	1	1	1	1	1	1	1	-	1	0	?	1	0	1	?	?	?	1	?
Witchelinamiris viridmaculatus	0	2	1	1	1	1	1	1	1	1	-	1	0	1	1	0	1	?	?	1	1	1
Lopidea dakota	0	2	1	1	1	1	1	1	1	1	-	1	0	1	1	0	1	?	?	?	1	?
Zanchius alba	0	3	1	1	1	1	1	0	1	1	-	0	0	1	1	1	1	?	?	?	1	1
Other outgroups																						
Coridromius bicolor	?	4	1	1	1	1	1	1	1	1	-	1	0	1	1	1	1	?	?	?	1	?
Lattinova jacki	0	2	1	1	1	1	1	1	1	1	-	1	0	1	1	0	1	?	?	?	1	?
Nichomachus sweeti	1	3	1	1	1	1	1	1	1	1	-	1	0	1	1	0	1	?	?	?	1	?
Tytthus mundulus	1	4	1	1	1	1	1	1	1	1	-	1	0	1	1	0	1	?	?	1	1	1

Table 25: Characters and character states used in the *Candidomiris-Morobea* phylogeny.

	Character	state						
		0	1	2	3	4	5	6
1	Overall body shape	Gracile	Ovoid	Elongate-ovoid				
2	A1	Grossly elongate, several times longer than head	Subequal in size or shorter than head					
3	A2 and A3	Longer than body together	Not longer than body					
4	A4	Grossly elongate, subequal in length to A2 or A3	much shorter than A3 and A2					
5	Head angle	Declivent	Porrect					
6	Head width	Head much narrower than pronotum	Head subequal in width to pronotum					
7	Clypeus	Prognathous	Hypognathous	Hypognathous/ posterior				
8	Frons projection	Projecting beyond clypeus	Not projecting beyond clypeus					
9	Eye size, dorso-laterally	Subequal to or larger than head	Within margins of head					
10	Eye shape (lateral view)	More or less spherical	Reniform	Elliptical				
11	Antennal tubercle placement	Anterior to midline of eye	Posterior to midline of eye					
12	Preocular region	Absent	Present					
13	Posterior margin of the eye	Contiguous with the posterior margin of the head	Anteriorly produced					
14	Bucculae ventral extension	Ventrally expanded	Much shorter than the rest of the head					
15	Bucculae shape	Round or elliptical	Keyhole-shaped					
16	Bucculae extension	Not extending underneath gula	Extending underneath gula					
17	Postocular region	Swollen	Narrow					
18	Gula length	Short	Long					
19	Gula shape	Sinuate (partially convex)	Entirely convex					
20	Posterior margin of the head	With a rugulose convex projection posteriorly	More or less straight or mildly convex					
21	Mandibular plate	Dorso-ventrally oriented	Anterio-posteriorly oriented					
22	Labial segments	L1 slightly incrassate	L1 short and Strongly incrassate					
23	Pronotum	Bilobed	Anterior and posterior lobe indistinct					
24	Pronotal midline sulcus	Present	Absent					
25	Pronotal midline sulcus extension	Along entire pronotum	Restricted to anterior lobe					
26	Sub lateral carina	Present	Absent					
27	Collar of pronotum	Well developed	Restricted to absent					
28	Anterior lobe of pronotum	Rectangulate	Broad and more or less trapezoidal					
29	Posterior margin of pronotum	Strongly concave medially	Straight or weakly convex					

Table 25 continued

		0	1	2	3	4	5	6
30	Row of punctures on the posterior margin of the calli	Present	Absent					
31	Pronotal foveae	Present	Absent					
32	Anterior margin of the posterior lobe of the pronotum	With an anterior projection medially	Flat					
33	Pronotal calli topology	Elevated	Depressed or flat					
34	Posterior lobe of the pronotum	Strongly declivent	Weakly declivent or					
35	Lateral margin of the posterior lobe	Broadly flared	Weakly to moderately divergent					
36	Prosternal shape	Posteriorly constricted	Posteriorly broad					
37	Proxyphus lateral margins	Shallow lateral margins	Raised lateral margins					
38	Scent gland	Ventrally oriented and raised	More or less laterally oriented	Laterally oriented and raised				
39	Parempodia	Fleshy and apically convergent	Hairlike					
40	Hemelytral margins	Concave medially	Straight	Convex				
41	Cuneus length vs width	Subequal	2-3x					
42	Metathoracic legs	Grossly elongate metacoxae	About the length of the body or shorter					
43	Mesoscutum	Raised	Straight or depressed					
44	Scutellum foveae	Present	Absent					
45	Scutellum margins	Serrate	Straight					
46	Scutellum shape	Triangulate, apex not modified	Triangulate, apex broadened					
47	Row of punctures on hemelytra	Present	Absent					
48	Pygophore size	Subequal in size or larger than rest of abdomen	Not exaggerated, subequal to SVII and SVIII					
49	Pygophore opening	Pygophore opens apically	Pygophore opens dorsally					
50	Ventral process of the genital opening	Present	Absent					
51	Pygophore left tergal process	Present	Absent					
52	Conical papillate tubercle on of pygophore	Present	Absent					
53	Sheath for right paramere on the pygophore	Present	Absent					
54	Left paramere	With 2 apophyses	r-shaped	Club shaped				
55	Left paramere apex	Hooked	Simple					
56	Left paramere apophyses	Smooth	Dissected/dentate					
57	Left paramere sensory lobe	Elongate	Reduced to small swelling					

Table 25 continued

		0	1	2	3	4	5	6
	Left paramere apophysis shape							
58	Candidomiris only	Grossly sinuate	Simple					
59	Right paramere	Small, club like	Elongate, r-shaped					
60	Right paramere apophyses	Broad with distil flange	Narrow, lacking distil flange					
61	Right paramere texture	Scale like texture apically	Smooth					
62	Right paramere apophysis	Branching	Undivided					
63	Ductus seminis	Elongate	Short					
64	Ductus seminis thickness	Broad	Narrow					
65	Phallotheca processes	Present	Absent					
66	Dorsal endosomal spicule	Present	Absent					
67	Proximal endosomal spicule	Present	Absent					
68	Dorsal endosomal lobal sclerite	Present	Absent					
69	Anterior endosomal lobal sclerites	Present	Absent					
70	Endosomal lobal sclerite	Projecting beyond apex of phallotheca at res	Contained within phallotheca at rest					
71	Dorsal endosomal lobal sclerite	Dentate and swollen	Smooth	Divided/ exaggerated				
72	Endosomal membrane size	Large, extending around secondary gonopore	Short, as basal skirt					
73	Secondary gonopore	Elongate, ribbon-like	Short, sounded					
74	Phallotheca shape	Apically narrow, basally broad	Uniformly broad					
75	Phallotheca opening	Apical	Dorsal	Right lateral				
76	Phallotheca position	Retracted - not visible externally	At least partly visible					
77	Endosomal membrane	Without spinules	Field of spinules present					
78	Endosomal membrane lobes	One	Two or more					
79	Inter-ramal lobes	An undivided process	Bifurcate					
80	Inter-ramal lobes	Not joined medially	Joined medially					
81	Inter ramal sclerite texture	Scale-like	Spiniferous	Dentate				
82	Inter-ramal lobes	Present, broad	Spiniferous-absent					
83	Overall colouration	Black	Stramineous	Green	Yellow	Brown	Grey	Red
84	Clypeal colouration	Red	Concolorous with rest of head					
85	Red or brown line over midline of head	Present	Absent					
86	Membrane veins	Contrasting with membrane, usually red	Concolourous with rest of membrane					

Table 25 continued

		0	1	2	3	4	5	6
87	Cuneus	Red, contrasting with rest of hemelytra	Concolourous with rest of hemelytra					
88	Clavus colouration	Dark, contrasting with rest of hemelytra	Concolourous with rest of hemelytra					
89	Hemelytra medium	Translucent	Opaque (except membrane)					
90	Star shaped setae	Present	Absent	Absent, but conical setae present				
91	Scale like vestiture	Present	Absent					
92	Scalelike vestiture pattern	Present on head only	Present on head and anterior lobe of pronotum					
93	Dorsal texture	Shiny	Dull					
94	Head dorsal microtrichia	Present	Absent					
95	Frons and vertex head microtrichia pattern	Paired L- shaped bald patch	Uniformly distributed					
96	Head ruga	Present	Absent					
97	Pronotal setae	Densely distributed	Sparsely distributed (<12 setae)					
98	Texture of posterior lobe of pronotum	With long shallow wavelike rugae	Smooth	With short, deep rugae				
99	Prosternal microtrichia	Dense and matted	Microtrichia dense, not matted	Microtrichia virtually absent or absent				
100	Mesosternal microtrichia pattern	Microtrichia absent	Microtrichia covering most of mesosternum	Microtrichia present along midline				
101	Metapleura texture	Rugulose with cross veins forming a scale like pattern	With linear distil rugae					
102	Hemelytral setae	Glabrous to obsolete	Present					
103	Pygophore setae	Erect and laterally obsolete	Erect and latero-ventrally oriented					

Table 26: Symmetric resampling statistics for the Phylogeny of for *Candidomiris-Morobea*

Node	Symmetric resampling	Synapomorphies	Contradicted apomorphies
1	80	0	7
2	70	1	8
3	53	2	5
4	>50	0	1
5	>50	0	1
6	65	0	2
7	53	0	6
8	99	0	7
9	100	1	10
10	100	1	4
11	61	2	4
12	>50	0	1
13	76	1	5
14	52	0	5
15	56	0	2
16	>50	1	0
17	>50	0	1
18	>50	0	1
19	>50	0	1
20	>50	0	1
21	>50	0	2
22	>50	0	5
23	>50	0	2
24	100	1	4
25	51	2	1

Table 26 continued

Node	Symmetric resampling	Synapomorphies	Contradicted apomorphies
26	75	0	8
27	>50	1	0
28	>50	1	3
29	99	1	5
30	>50	0	5
31	73	1	1
32	>50	0	1
33	>50	0	1
34	>50	0	1
35	>50	0	1
36	>50	0	4
37	97	0	4
38	>50	0	1
39	>50	0	1
40	97	0	7
41	61	2	4
42	58	0	2
43	>50	0	0
44	>50	0	0
45	>50	1	1
46	>50	0	1
47	>50	0	1

CHAPTER 4

A METHOD FOR EVALUATING THE IMPACT OF OUTGROUP SELECTION ON INGROUP TOPOLOGY

ABSTRACT

This Chapter explores the impact of outgroup selection on ingroup topology. I have written a TNT script that tests the robustness of nodes in the ingroup in response to altering the composition and number of outgroups. The various options available in the script address a variety of scenarios. The use of these options and their output are outlined. Examples of the script's output are demonstrated using three published morphological phylogenies from within the suborder Heteroptera (Insecta: Hemiptera: *Hypseloecus* Reuter [Schuh and Menard 2011], Lygaeoidea [Henry 1997], *Mcateella* Drake [Elias and Cassis 2012] and the phylogenies derived in this thesis for *Cyrtorhinus* (Chapter 2) and the *Candidomiris-Morobea* complex (Chapter 3). The metrics generated by this script can be used as branch supports to test the robustness of particular nodes against varying outgroup selection or to show the impact of the addition of outgroups to the topology of the ingroup.

INTRODUCTION

Since Hennig (1966) various systematists have sought to determine whether character states are derived or ancestral. Those who employ parsimony analysis most often use outgroups to solve this problem (Lundberg 1973, Watrous and Wheeler 1981, Maddison et al. 1984, Nixon and Carpenter 1993, Barriel and Tassy 1998). Outgroup selection can be of crucial importance to parsimony analysis as in some cases different outgroup selection can dramatically change the ingroup topology (Milinkovitch and Lyons-Weiler 1998, Graham et al. 2002, Puslednik, L. and Serb, J. M. 2008, Flynn et al 2009).

In modern parsimony analysis outgroups are not only used to polarise characters but also to test the monophyly of the ingroup (Nixon and Carpenter 1993, Barriel and Tassy 1998). It is now typical to use multiple outgroup taxa in parsimony analyses. As discussed in Barriel and Tassy (1998) using multiple outgroups reduces the number of assumptions needed to polarise the ingroup taxon as the sister-group to the ingroup is not determined *a priori* by the author. Instead they are selected by the maximum parsimony criterion, the same method by which ingroup topology is determined.

In recent years there has been a general trend to increase the number of outgroups in modern phylogenetic analyses (Bariel and Tassy 1998, Nixon and Carpenter 1993). In many large taxa such as mirids most groups have not been described or properly defined (May 1988, Schuh 1995, Cassis et al. 2007, Cassis and Schuh 2012). In these cases it is impossible to include all potentially relevant outgroups in the analysis, as there may be hundreds possible candidates. This raises a question mark over the usefulness of phylogenetic analyses in these large groups, as the relationships of the ingroup taxa may be entirely different if a different suite of outgroups were chosen, or if undescribed groups were included. This Chapter attempts to introduce a method which tests the robustness of ingroup topology when different outgroups are used.

There has been one attempt to evaluate the impact of changing outgroups on ingroup topology before, namely that of Milinkovich and Lyons-Weiler (1998). This study used Relative apparent synapomorphy analysis (RASA) (Lyons-Weiler et al. 1996) to evaluate which outgroups are redundant as they are included in the analysis. However this method does not measure the sensitivity of individual ingroup nodes to changing outgroups. Besides this Kluge and Farris (1999) raised an objection to the

RASA method as it is effectively a measure of phenetic similarity and not synapomorphy.

Other *post hoc* sensitivity analyses are regularly used for various purposes in phylogenetic analysis such as: Bremer supports (Bremer 1994) which measures how many suboptimal steps are required to collapse each individual nodes. Bootstraps (Felsenstein 1985) which measures the effect of resampling characters in a given analysis on individual nodes. Jack-knife (Lanyon 1985) which is similar but mainly different in that it randomly resamples taxa rather than characters. Symmetric resampling (Goloboff et al. 2003) which is a resampling method similar to the bootstrapped modified specifically for analyses which employ Implied weights (Goloboff 1993).

These methods address robustness of different nodes in an analysis to a variety of possible confounding factors. Bremer support address how robust each node is within the given dataset. Bootstrap and symmetric resampling test how robust nodes are is certain characters were absent or present in double. The Jack-knife tests how robust nodes are if certain taxa are taken away. None of them deal with the specific issue of the robustness of ingroup nodes when altering outgroups. I have developed this method as a means to test the impact of changing the root of a tree or the number of outgroups on ingroup topologies. This is supposed to be used as a sensitivity analysis after a phylogenetic hypothesis has already been generated as with other sensitivity analyses. I have also included a means for testing which outgroups have the greatest impact on ingroup topology for the users to employ at their discretion. This can potentially be used to identify problematic outgroups which may be a result of a misinterpretation of character homology or a misplaced taxon. This does not attempt to propose a method for optimal outgroup analysis such as in Lyons-Weiler et al. (1998), it merely tests the

robustness of ingroup topologies if outgroups are included or excluded, which is useful in instances in which not all possible outgroup taxa can be coded. This is particularly oriented towards analyses of large groups such as the Mirid tribes or groups with a lot of phylogenetic uncertainty such as the Lygaeoidea. This chapter does not attempt to address the problems associated with outgroup selection in general but rather to give phylogenetic practitioners a tool with which to conduct investigations into the impact of outgroup selection and outgroup number on ingroup topology.

METHODS

How the script works

I wrote a script for TNT software (Goloboff et. al. 2008) to examine the impact of outgroups at a cladistic node. It is available in Appendix A and will be uploaded to the TNT wiki http://tnt.insectmuseum.org/index.php/Scripts. Its purpose is to test which nodes are robust to the use of poorly selected outgroups and which nodes are vulnerable to changing basal character polarities.

The script analyses the same dataset multiple times and comparing the results from each run. The script first uses a single outgroup, preferably the nearest relative of the ingroup, if this is known by the user. It then cumulatively adds one outgroup at a time, rooting the tree by the newest outgroup, preferably finishing with the most distant outgroup. The number of iterations executed in the analysis is equal to the number of outgroups. The consensus tree generated at each iteration is compared to a single consensus tree, which can be consensus tree generated by any one of the iterations. By default it will be the first iteration. This analysis is useful for determining the impact of adding more outgroups to the analysis.

The script executes two types of analyses, an ingroup sensitivity analysis and an outgroup impact analysis. The ingroup sensitivity analysis tests the sensitivity of ingroup nodes to changing basal character polarity. The results of the ingroup sensitivity analysis is reported visually for each node and in the text buffer of the TNT window, as is discussed below. In an ingroup sensitivity analysis the script can report the results either as the number of iterations in which each node is not retained or as a list of outgroups which do not retain the given node.

Outgroup impact analysis tests whether each node is not retained when each individual outgroup is used as the root of the tree. In an outgroup impact analysis, the results are reported beside each outgroup representing the results as each outgroups is used to root the tree. These results can be reported either as the number of nodes not retained by each outgroup or as a list of nodes which each outgroup does not retain. These options are defined by the user at the beginning of an analysis. The number of iterations in which the node is not retained should be considered as a proportion of the number of iterations the script runs.

There is also a user defined option which causes the analysis to dispose of the previously used outgroups after each analysis so that only one outgroup is being used at each iteration. This option can be employed in both the ingroup sensitivity analysis and the outgroup impact analysis and the results can be reported as either a number or a list of nodes/outgroups. This option is particularly useful for determining the impact on ingroup topology if the ancestral polarity of the ingroup is changed. This method used real tree roots as opposed to a hypothetical ancestor as I am not interested in what impact fictional organisms would have on ingroup topologies if they were made the root of the tree.

Instructions for running the analysis

Once TNT is open the script can be run immediately without opening a file. Enter the name of the file into the command bar. Once the script has started an open file window appears for the input file for the analysis. The script then asks the user to order the outgroups correctly. Another window appears and the user can then select the type of analysis (ingroup sensitivity analysis or outgroup impact analysis). Within the same window (Figure 146) the user will be queried as to whether outgroups will be cumulatively added or dropped after each analysis so there is only one outgroup at a time. At this point the user defines whether they want the script to report their results in the form of a number or a list.

The user is then asked to input the first and last outgroup taxon (Figure 147). It is important to note that the first outgroup taxon in TNT is taxon number 0; so assuming the outgroups are at the top of your taxon list, the last outgroup taxon will be n-1 (where n is the number of outgroup taxa). The number of outgroups must be known before running the script. This window also contains an option to change the tree to which the nodes on all other trees will be compared. By default it will be the first iteration which will mean the analysis will be compared to the tree generated when Taxon 0 is the only outgroup. If the user adjusts this number it will compare each iteration to the tree generated using outgroup at the user defined number as the root. The user is then asked to define the algorithm setting number of ratchet iteration, the tree fusing rounds and the drift cycles. This is shown in Figure148.

The script uses the *xmult* command in TNT with the ratchet, tree fusing and drift algorithms, activated with the number of iterations, rounds and cycles as user

defined variables. If one changes any of the settings for the New Technology search they will be applied to the analysis except for those defined by the script. If the user wants to change the search algorithms used in the search (e.g., get rid of the ratchet or perform a sectorial search) they will need to modify this line of the script:

xmult= fuse 'fuseno' ratchet 'ratno' drift 'driftno';

If the user chooses to use implied weights they need to activate them before the analysis and they will then be used for all iterations.

Specifics on how to use commands to activate different search algorithms in TNT are available on the TNT wiki (http://tnt.insectmuseum.org/index.php/Commands). The script does not activate or deactivate implied weights or any other settings not mentioned above.

Once the settings have been selected the analysis will run and a progress bar will appear. When the analysis is complete a tree with tagged nodes will appear. This will be the consensus tree generated by the analysis, which the user sets as the comparative standard. A screenshot of its appearance is given in Figure 149.

In all analyses the script is based on the number of nodes which are not retained, so the lower the number the stronger the support. If the user wants to view the consensus trees generated by each individual analysis they are still in memory and can be viewed with the tree view icon. If the user wants to recall the tree with tags this can be done by typing *ttags;* into the command line and pressing enter. The results are also reported in the tree buffer and can be accessed from them if the user prefers. The results will be in the format illustrated in Figure 150. Only the last set of numbers is to be used in the results as previous sets of numbers are the result of earlier iterations and the results will not be complete. The results will be saved in the TNT log file automatically

generated by the script called *out.out*. It can be opened using notepad or similar text reading programs. If a user decides to extract the result from this file it is again important to make sure that they only use the last set of results. The log file will be replaced after each analysis, so it will only contain the results of the last analysis that were run.

Examples

I used the following examples to test the script and demonstrate the output. The first outgroup taxon was set as the closest outgroup and the last was set as the furthest in the input file. Each analysis was undertaken with the nearest outgroup as the reference tree. An example of an input file is shown in Appendix F.

The script was tested using morphological phylogenies in the windows version of TNT only. In theory the script will work with molecular or combined analyses, although such data have not been tested in this chapter. As examples I chose heteropteran phylogenies with a varying numbers of outgroups. The taxa used were: *Hypseloecus* Reuter (Schuh and Menard 2011), Lygaeoidea (Henry 1997), *Mcateella* Drake (Elias and Cassis 2012). All analyses used exclusively discreet morphological datasets.

The results are shown on a tree at the end of the analysis as explained below for the various scripts.

RESULTS

The following analyses are divided into ingroup sensitivity and outgroup impact analyses, for each of the case studies. In all cases outgroup are listed in the order in which they were added to the analysis.

1. *Candidomiris-Morobea* group

Data from Chapter 3 of this thesis was used. The tree with node numbers is reported in Figure 151, with the data matrix in Chapter 3 - Table 24. Table 27 gives the metrics for the ingroup sensitivity analysis and Table 28 gives the metrics for the outgroup impact analysis.

Ingroup sensitivity analysis

Most nodes in this analysis are robust to changing outgroups, however a few nodes are not retained with almost any change in the tree root. It is noteworthy that the basal nodes for the *Morobea* and *Candidomiris* groups (nodes 6 and 18 in this analysis) are contradicted by several outgroups suggesting that this relationship is vulnerable to changing character polarities. Doubts as to the monophyly of this group are raised in Chapter 3 despite the fact that it receives more than 50% symmetric resampling. It is interesting that nodes that perform well in a cumulative analysis are strongly contradicted in a non-cumulative analysis and vice versa, indicating that changing the number of outgroups has a different effect on topology than changing ancestral polarity.

Outgroup impact analysis

Nearly all outgroups contradict a similar number of nodes ranging from between 9-12 with no outgroup retaining exactly the same ingroup topology. Ingroup topology is more stable if the tree is rooted in the ‘nearer’ outgroups *Cyrtorhinus* or *Mecomma*. The only other tree root which gives a similar result is *Nichomachus sweeti* Schuh, a member of the orthotyline tribe Nichomachini. One possible explanation for this is that

there is a *Cyrtorhinus-Mecomma-Candidomiris-Morobea* grouping which is basal or near-basal within the Orthotylini.

2. *Cyrtorhinus* Fieber

Data from Chapter 2 of this thesis was used. The tree with node numbers reported in Figure 152 is given, and the data matrix in Chapter 2 - Table 2. Table 29 gives the metrics for the ingroup sensitivity analysis and Table 30 gives the metrics for the outgroup impact analysis.

Ingroup sensitivity analysis

This analysis yielded somewhat consistent internal topology at the more basal nodes, but there is significant contradiction at the lower nodes. The results are almost universally less stable if you use a single outgroup than if you use a cumulative outgroup analysis, which leads me to confidently conclude that *Orthotylus bilineatus* and *Mecomma* are accurately defining character polarity for *Cyrtorhinus*. Nodes 18-23 with the exception of node 22 are the least stable. These nodes represent the *Cyrtorhinus lividipennis* and *Cyrtorhinus fulvus* groups, which have similar genitalia and few clearly defined synapomorphies.

Outgroup impact analysis

Most outgroups contradict Tree 0 at between four to six nodes whether a cumulative analysis or an analysis with a single outgroup is executed. Some outgroups such as *Bomberia foliacea* Carvalho, *Dimifacoris fasciatus* Carvalho, *Cyllecoris historianicus* Linnaeus and *Neoloxops rubrosignatus* Carvalho yield significantly less contradiction than most other outgroups in the cumulative analysis, but if they are the only outgroup used they contradict as many nodes as the other outgroups.

3. *Hypseloecus* Reuter (Heteroptera: Cimicomorpha: Miridae: Phylinae)

Data was taken from Schuh and Menard (2011), with only the morphology partition used. The tree with node numbers is given in Figure 153. Table 31 gives the metrics for the ingroup sensitivity analysis and Table 32 gives the metrics for the outgroup impact analysis.

Ingroup sensitivity analysis

In this analysis there is a dramatic difference between the cumulative and non-cumulative analyses. As a proportion of outgroups used, only three nodes scored poorly in the ingroup sensitivity analysis, whereas many scored poorly in the non-cumulative analysis, which is not surprising considering the size of the analysis. There is significant instability in some of the nodes, mostly 5, 7 and 8. In the non-additive analysis nodes 2,3,4,5 and 9 are also unstable.

Outgroup impact analysis

Every root contradicts at least one of the nodes in both the cumulative analysis and the analysis which uses only one outgroup with the exception of *Druthmarus philippinensis* in the cumulative analysis. This suggests that polarity does make a big difference to the ingroup topology and that adding multiple outgroups does not necessarily improve the result, but including close relatives in the analysis makes a significant difference.

4. Lygaeoidea (Heteroptera: Pentatomomorpha)

Data from Henry (1997) was used. The tree with node numbers is reported in Figure 154. Table 33 gives the metrics for the ingroup sensitivity analysis and Table 34 gives the metrics for the outgroup impact analysis.

Ingroup sensitivity analysis

In this analysis it is the basal nodes (9-16) which are regularly contradicted by changing the ancestral polarity in both the cumulative and non-cumulative analyses. The lower nodes seem to be very robust to changing character polarity suggesting that certain relationships between small groups of families in the Lygaeoidea are fairly certain, whereas the higher relationships remain uncertain.

Outgroup impact analysis

The nodes which are not retained are evenly spread across all outgroups except Rhopalidae and Stenocephalidae, which retain all the nodes. Lower level topology is somewhat consistent. In this case the choice of outgroups does make a very significant difference on the internal topology. Results are similar when one outgroup at a time is used. This example illustrates how tree topology can change quite dramatically if basal character polarity is changed.

5. *Mcateella* Drake (Heteroptera: Pentatomomorpha: Piesmatidae)

Data from Elias and Cassis (2012) was used and is given in Appendix F. The tree with node numbers is reported in Figure 153. Table 35 gives the metrics for the ingroup sensitivity analysis and Table 36 gives the metrics for the outgroup impact analysis.

Ingroup sensitivity analysis

Nodes 12 and 15 were shown to collapse with several of the outgroups, whereas node 10 only collapses in a single case when *Geocoris* is used as the root. This phylogeny proved to be very resilient to changing outgroups, perhaps because several very similar outgroups were used. Unlike the Miridae, the groups within the Lygaeoidea are fairly easily diagnosed due to significant external variation.

Outgroup impact analysis

In this example the further outgroups are the ones which cause most of the contradiction, especially in a non-cumulative analysis. *Geocoris* performs the poorest out of all the outgroups scoring a 3 and a 6 out of 10 nodes, which are not retained, when it is the root and the only outgroup respectively. Unsurprisingly the other non-piesmatid outgroups score poorly when they are the only outgroups with *Geocoris* scoring 5 and *Nysius vinitor* scoring 4. Each of these only scores 1 when the piesmatid ingroups are included, that one being the unresolved node, node 2. This example is quite different from the mirids or the family level lygaeoids phlogeny as *Mcateella* are a genus in a small, fairly well defined family and the list of close outgroups is close to exhaustive. This means that there is not much inconsistency in the data and homology of characters is relatively well understood.

DISCUSSION

In general, nodes which receive low support using Bremer support or resampling methods also receive weak support using this method, although this is not universally so. In some analyses basal nodes are vulnerable to changing outgroups despite the fact that they receive strong support using other methods. This tends to occur more in the mirids examined in this chapter compared to the lygaeoids. This is possibly because

mirid genitalia, which are the basis of most phylogenies, may evolve rapidly and exhibit high levels of homoplasy.

Each of these analyses have certain nodes which can be considered weak nodes. A node is weakly supported if by changing the outgroup it is not often retained. Examples of this include nodes 23 and 37 in the *Candidomiris-Morobea* group; nodes 18-21 and node 23 of the *Cyrtorhinus* phylogeny; nodes 5,7 and 8 of the *Hypseloecus* group; nodes 11-13 of the Lygaeoidea phylogeny and nodes 2 and 5 of the *Mcateella* phylogeny. In the *Hypseloecus* and *Lygaeoidea* examples these are higher nodes, which indicates that the basal ingroup taxa are liable to be rooted incorrectly. In the case of *Candidomiris-Morobea* and *Cyrtorhinus* the weaker nodes tend to be lower, which is probably a result of well chosen close outgroups, but poorly defined nodes in certain parts of the tree.

In the same way, in some of these examples certain outgroups can be considered as 'bad' outgroups. An outgroup can be considered bad if it contradicts several of the ingroup nodes which are retained by most other taxa. Examples of this include *Cyrtorhinus caricis, Cyrtorhinus lividipennis, Orthotylus bilineatus* and *Neoloxops rubrosignatus* in the *Candidomiris-Morobea* phylogeny and *Sthenaridea piceoniger* and *Sthenaridea suturalis* of the *Hypseloecus* phylogeny. It is interesting that in the *Candidomiris-Morobea* group these taxa are fairly close to the ingroups, indicating that polarity at the basal node of the ingroups is very important in defining the ingroup topology casting doubts to the monophyly of certain ingroups. This is one of the main reasons the *Candidomiris-Morobea* group has not been erected as a taxon. In the *Hypseloecus* example the bad outgroups occur when the tree is rooted with certain *Sthenaridea* species and is probably a result of convergence leading to characters states being interpreted as homologous *a priori*. In most examples, using distant outgroups does change the internal topology of the ingroups in a non-

cumulative analysis, but has very little effect on ingroup topology in the cumulative analysis. It appears that as long as the close relatives are included, the addition of distant relatives has little impact highlighting the importance of selecting the closest relatives of the ingroups to determine basal character polarity.

I envisage this script as being particularly useful when analysing taxa from a highly diverse clade, such as within the tribe Orthotylini. It adds an element of assessing the robustness of relationships when an author is unsure of the root of the tree, as they can tell whether the basal node will be retained regardless of how the tree is rooted. When applied to the phylogenetic analysis of *Cyrtorhinus* (Chapter 2) of this thesis, one is more confident that *Cyrtorhinus* is monophyletic, and *Orthotylus bilineatus* and *Mecomma* are very likely to be its sister taxa or nearest relatives. When applied to *Candidomiris-Morobea* (Chapter 3) of this thesis it indicates that this complex is not as strongly held together, and warrants further investigation before a formal supergeneric taxon is erected.

Known problems in the script

When you run the script a second time using a different data files TNT will sometimes close unexpectedly. I am not sure why this happens but to overcome the problem it is recommend that users close and reopen TNT every time you want to analyse a different dataset.

For reasons yet to be determined the script sometimes crashes when a taxon name has >25 characters and is performing an outgroup impact analysis when reporting on the number of the nodes.

There is a limit of 300 outgroup taxa. This issue has to do with the way the array variables are handled in TNT. It is unlikely however that users will want to analyse more than 300 outgroups.

The node numbering is automatically generated during the analysis, and they don't follow a logical order. The first few node numbers will refer to the nodes supporting the outgroups, which are not the subject of study. This is not a major issue, but the results may look odd. A user can always use their own node numbers when reporting results, but bear in mind that if you are generating a list of nodes not retained you need to change the node numbers in the list.

In a list analysis, if the analysis contains many labels at each node it is virtually unreadable as the branches are too long for the page. In this situation it is recommended that the user makes use of the tags in the display buffer or the log file.

There will be a part in the display buffer which looks like this:

ttag !;

ttag +61

/2/3/4/5/6/7/8/9/10/11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26/27/28/29/30/31/32/33/34/35/36/37/38/39/40_Node0;

ttag +62 /32/33/34/35/36/37/38/39/40_Node1;

etc...

If you want to copy and paste the list they should be in the log file out.out in the same folder as your TNT program. Here is an example of what the output will look like:

'Tree with tags'

(1 2 3 4 5 6 7 8 9 (0 ((10 11)((((16 (26 ((17 (18 (19 ((12 13)(31 32)))))(28 3 3))))(15 20))(21 (24 (23 25))))(14 ((22 27)(29 30)))))));

ttag !;

ttag +35 1/2/3/4/5/6/7/8/_Node0;

ttag +36 _Node1;

ttag +37 _Node2;

ttag +38 _Node3;

ttag +39 _Node4;

ttag +40 _Node5;

ttag +41 _Node6;

ttag +42 _Node7;

ttag +43 4/8/_Node8;

ttag +44 3/5/6/_Node9;

ttag +45 3/5/6/_Node10;

ttag +46 0/3/4/5/6/7/8/_Node11;

ttag +47 0/3/4/5/6/7/8/_Node12;

ttag +48 0/3/4/6/7/8/_Node13;

ttag +49 3/5/6/_Node14;

ttag +50 0/4/7/8/_Node15;

ttag +51 0/4/7/8/_Node16;

ttag +52 _Node17;

ttag +53 _Node18;

ttag +54 3/_Node19;

ttag +55 3/6/_Node20;

ttag +56 _Node21;

ttag +57 _Node22;

ttag +58 _Node23;

In this case the outgroups 0, 4, 7 and 8 do not retain node 15 or 16 and outgroups 3, 5 and 6 do not retain node 14 etc. Choose the last set of data in the log file as it will be the only one to include all the iterations of the script

The script will be uploaded to the TNT wiki (http://tnt.insectmuseum.org/index.php/Scripts). Any other bugs can be discussed there.

Figures

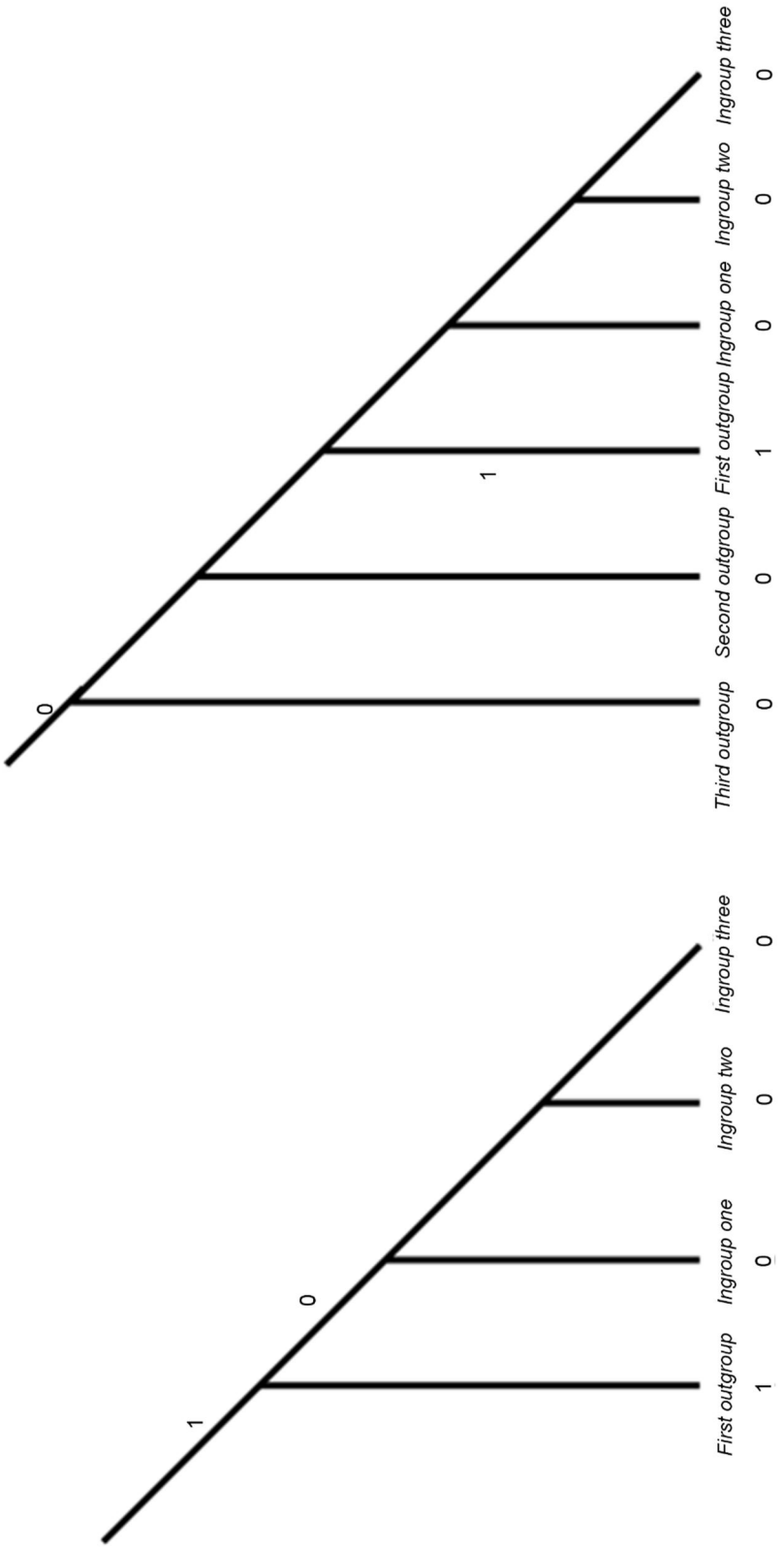


Figure 145: How multiple outgroups can improve character polarity using hypothetical taxa.

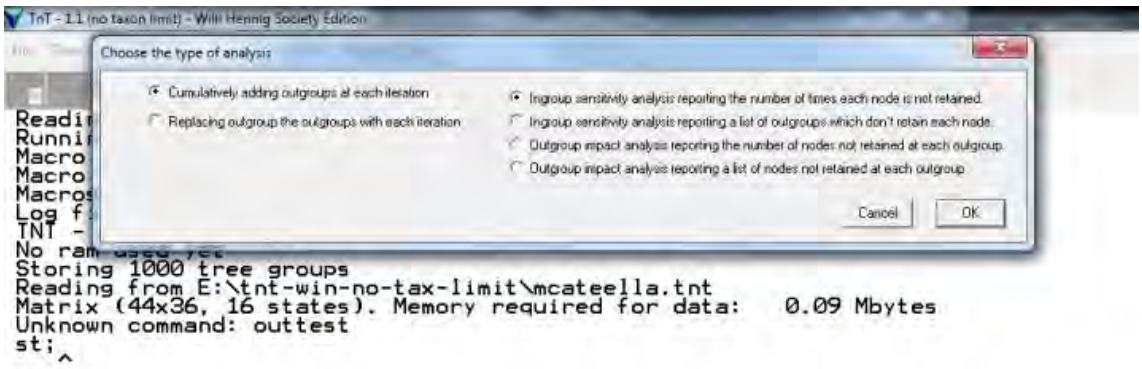


Figure 146: Search settings option box

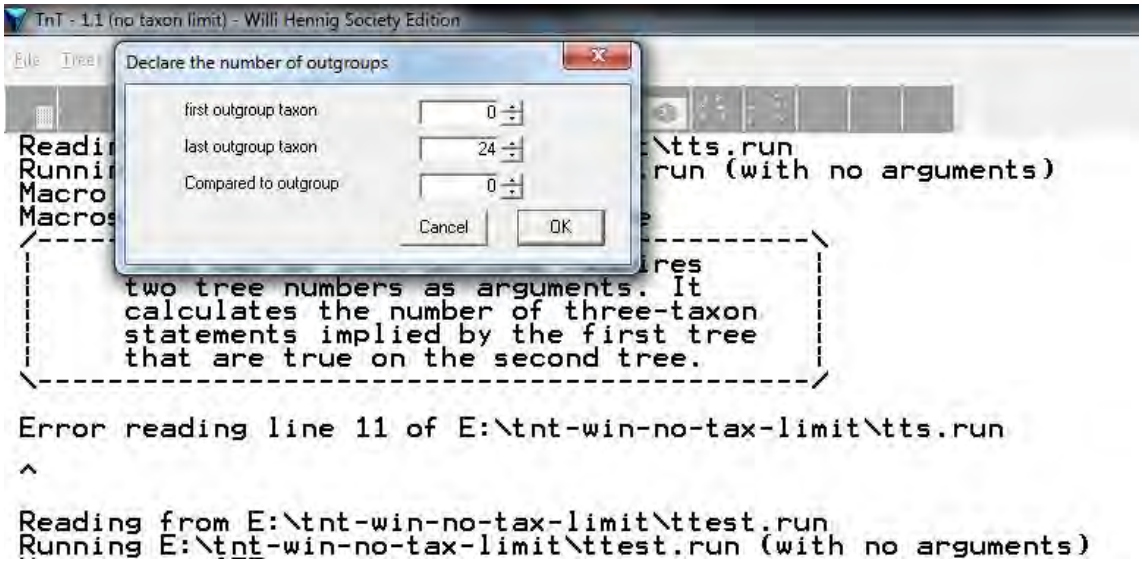


Figure 147: Outgroup options box.

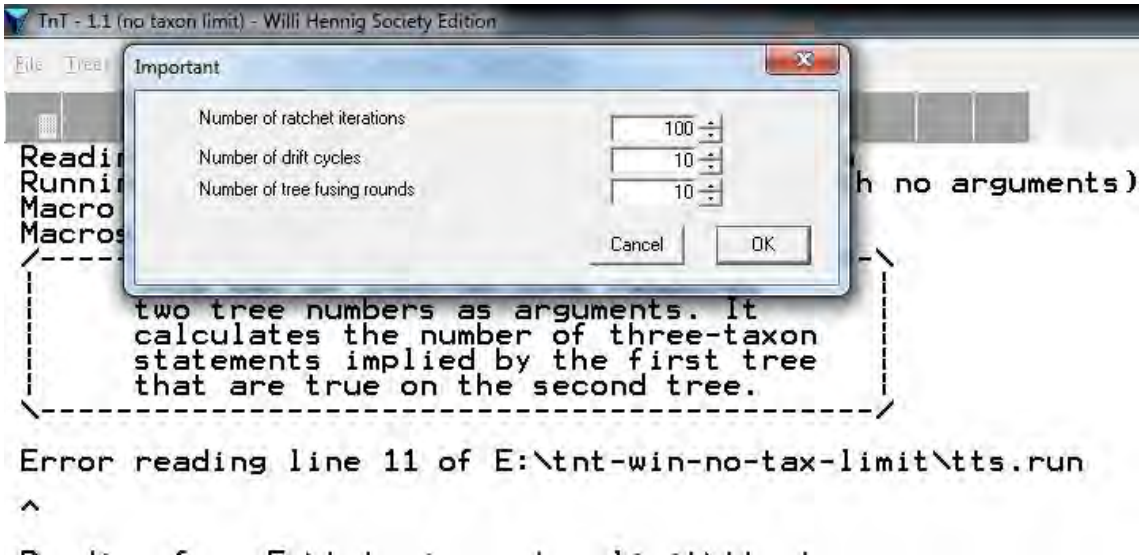


Figure 148: Search options box.

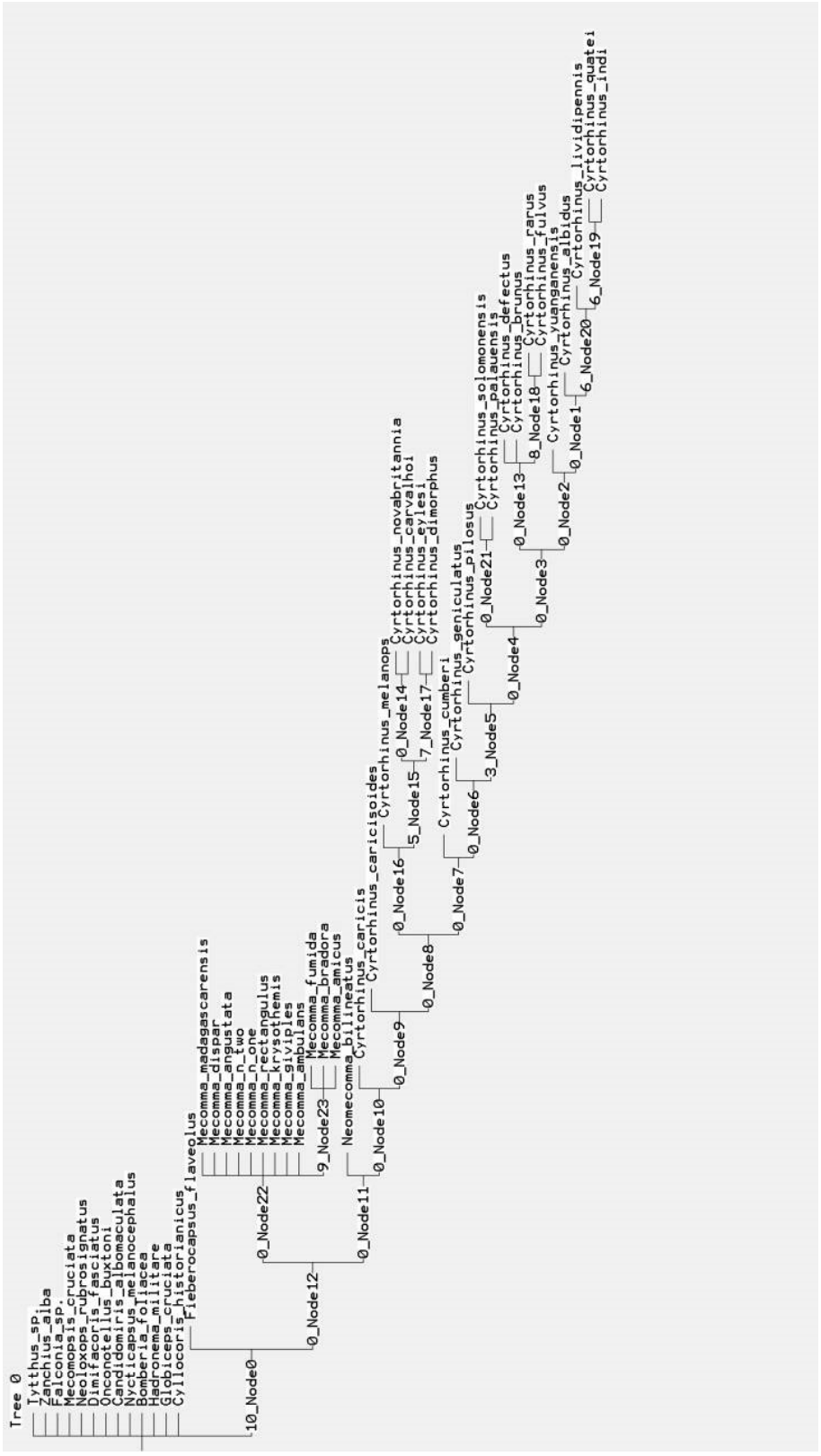


Figure 149: Example of TNT tree output

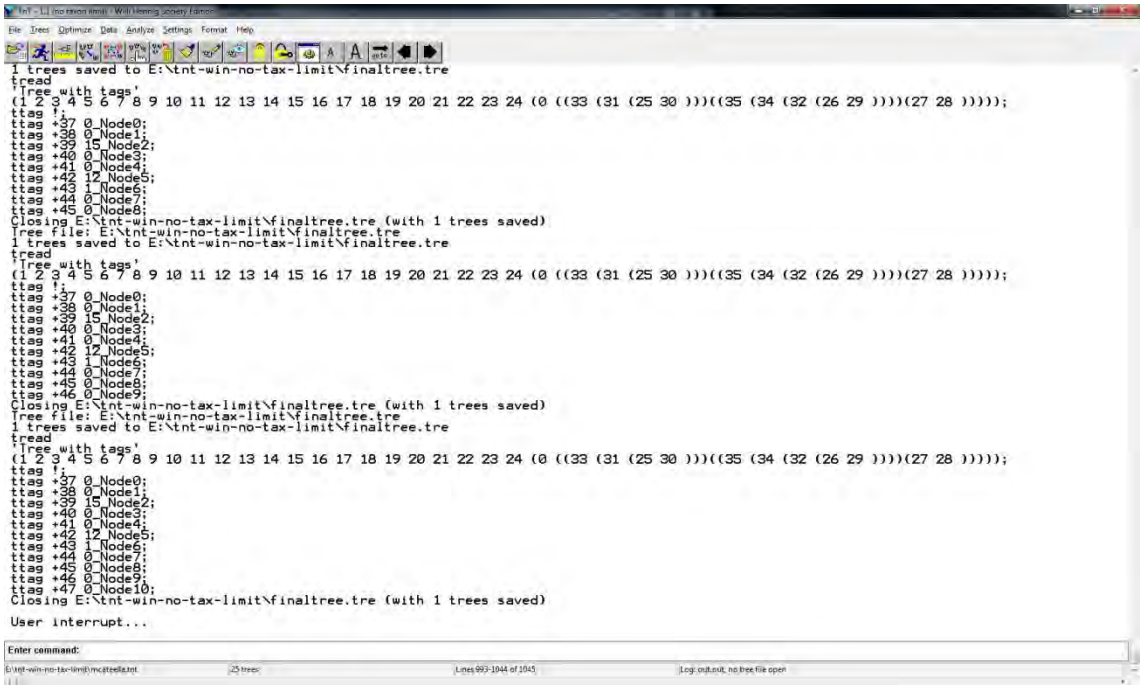


Figure 150: Example of TNT text buffer output.

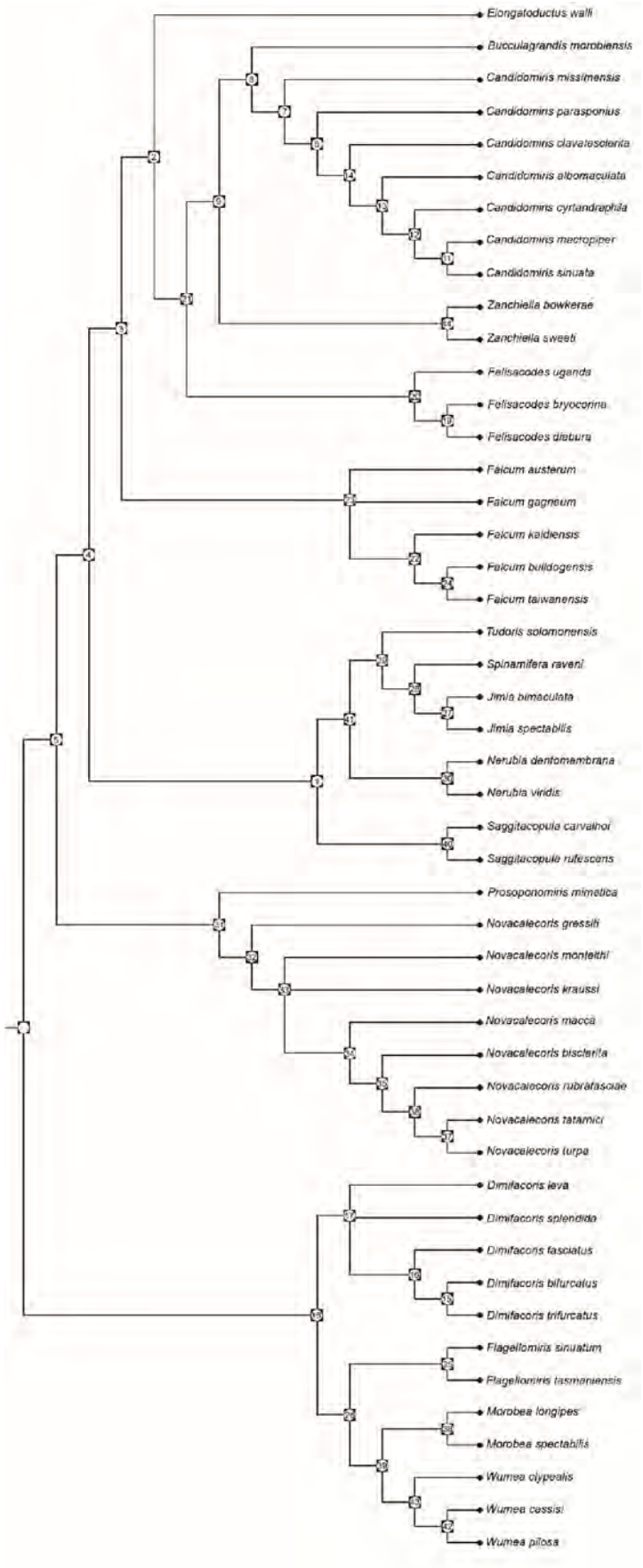


Figure 151: *Candidomiris-Morobea* group with node numbers

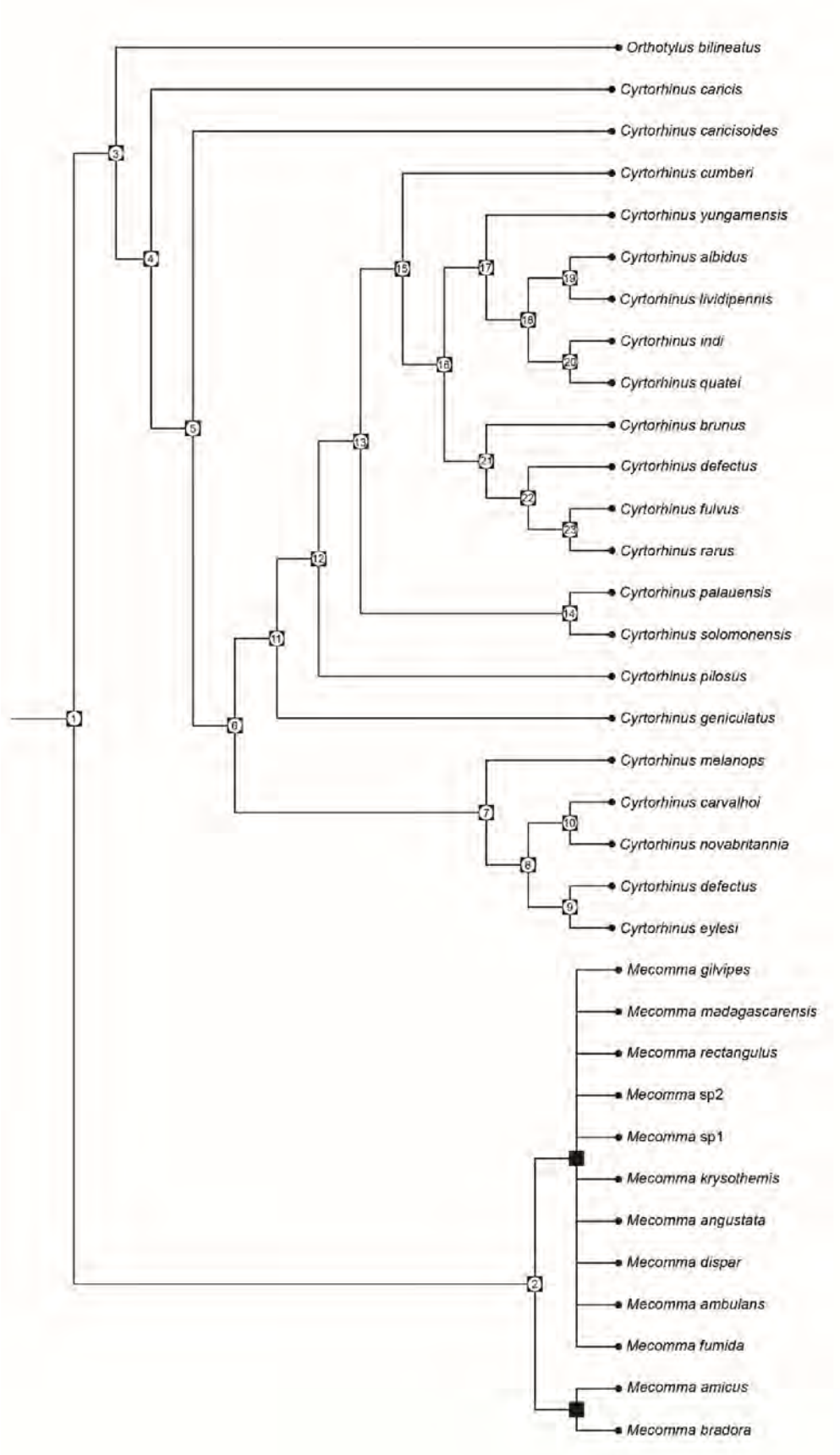


Figure 152: *Cyrtorhinus* tree with node numbers

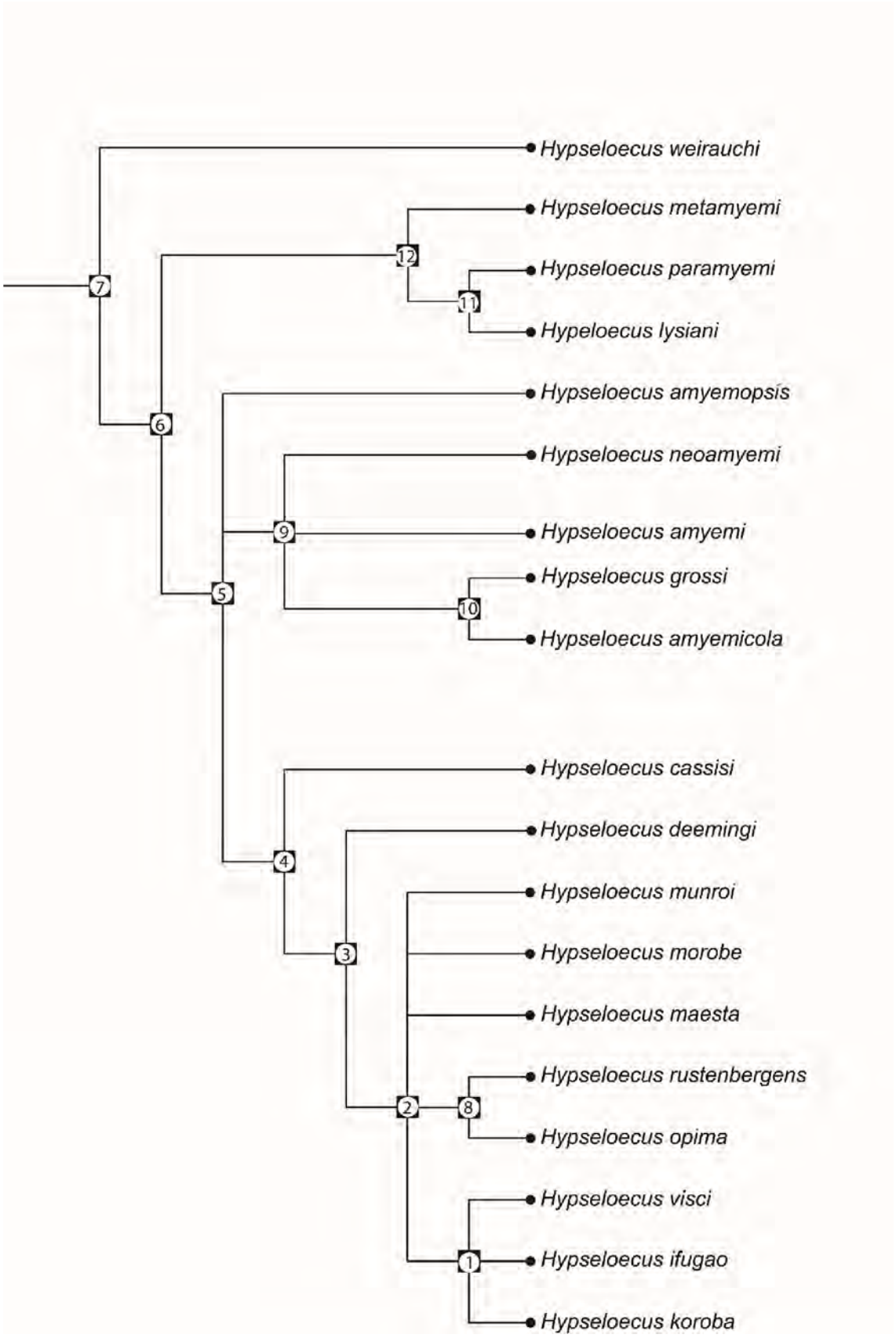


Figure 153: *Hypseloecus* tree with node numbers

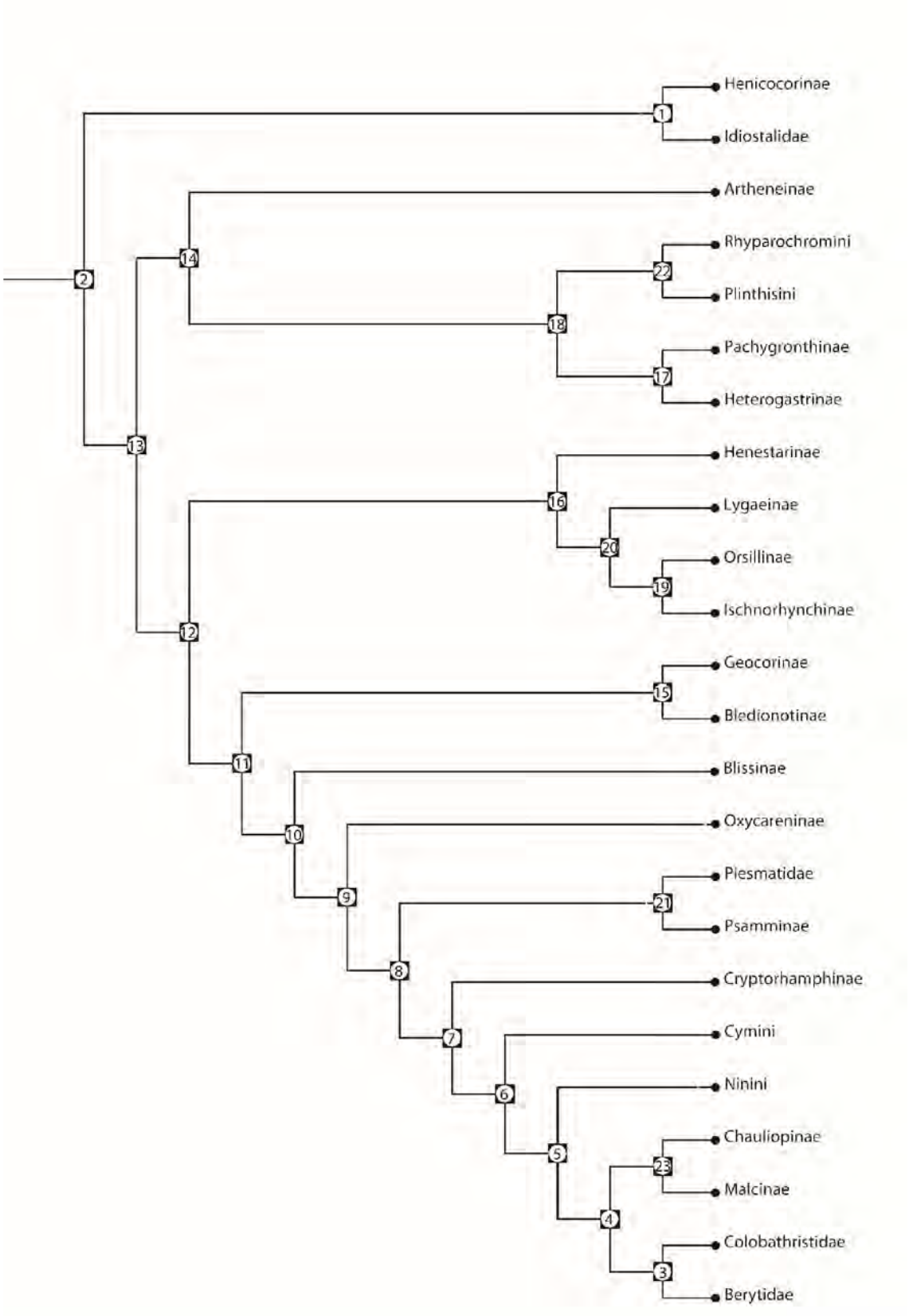


Figure 154: Lygaeoidea tree with node numbers

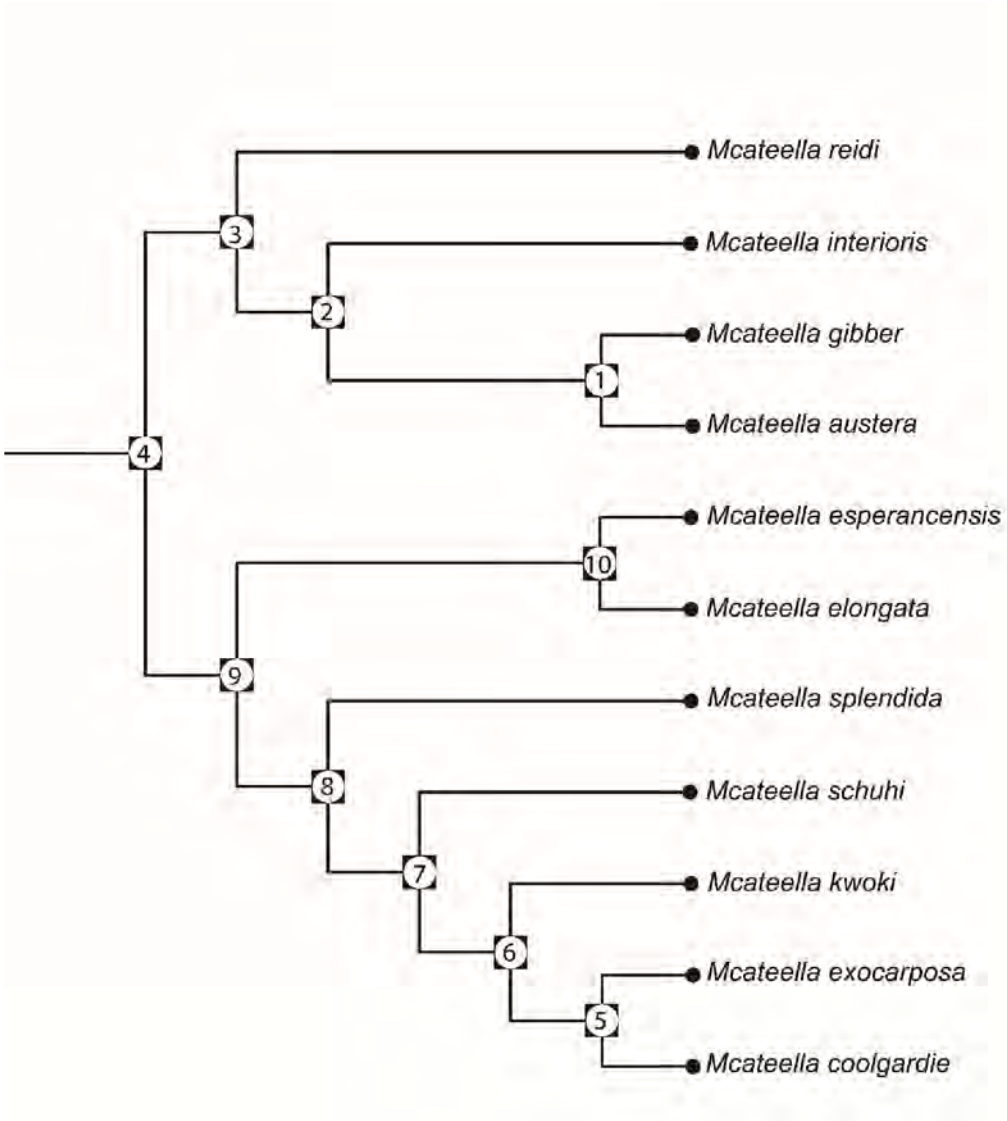


Figure 155: *Mcateella* tree with node numbers

Tables

Table 27: Ingroup sensitivity analyses for the *Candidomiris-Morobea* group

Outgroups: 35

Node	Cumulatively adding outgroups		Only using one outgroup at a time	
	Number of outgroups which do not retain the node	List of outgroups which do not retain the node	Number of nodes not retained with this outgroup	List of nodes not retained with this outgroup
1	2	0/4	n/a	0
3	3	0/3/4	1	28
4	3	0/3/4	1	28
5	2	0/4	9	8/22/23/24/25/26/27/28/29
6	1	3	1	8
7	0	n/a	n/a	0
8	0	n/a	n/a	0
9	3	0/3/4	n/a	0
10	3	0/3/4	n/a	0
11	3	0/3/4	n/a	0
12	2	0/4	n/a	0
13	2	0/4	n/a	0
14	2	0/4	1	28
15	1	0	n/a	0
16	0	n/a	n/a	0
17	0	n/a	n/a	0
18	5	10/14/15/18/28	13	13/14/20/22/23/24/25/26/27/28/29/30/31
19	0	n/a	1	28
20	1	4	n/a	0
21	0	n/a	n/a	0
22	3	0/3/4	n/a	0
23	23	0/4/6/7/8/9/11/12/13/15/16/17/19/20/21/22/24/26/27/28/31/32/33	n/a	0
24	0	n/a	n/a	0
25	0	n/a	13	13/14/20/22/23/24/25/26/27/28/29/30/31
26	0	n/a	n/a	0
27	0	n/a	14	4/6/7/9/10/11/12/16/17/18/19/21/24/33
28	0	n/a	n/a	0

Table 27 continued

Node	Cumulatively adding outgroups		Only using one outgroup at a time	
	Number of outgroups which do not retain the node	List of outgroups which do not retain the node	Number of nodes not retained with this outgroup	List of nodes not retained with this outgroup
29	1	0	9	8/22/23/24/25/26/27/28/29
30	0	n/a	9	8/22/23/24/25/26/27/28/29
31	0	n/a	n/a	0
32	1	2	n/a	0
33	0	n/a	n/a	0
34	0	n/a	n/a	0
35	0	n/a	n/a	0
36	1	1	9	5/6/7/8/9/10/11/12/32
37	33	0/1/3/4/5/6/7/8/9/10/11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26/27/28/29/30/31/32/33	n/a	0
38	0	n/a	n/a	0
39	0	n/a	n/a	0
40	0	n/a	n/a	0
41	0	n/a	n/a	0
42	2	0/4	n/a	0
43	0	n/a	n/a	0
44	0	n/a	n/a	0

Table 28: Outgroup impact analyses for the *Candidomiris-Morobea* group

Nodes: 23

Outgroup	Cumulatively adding outgroups		Only using one outgroup at a time	
	Number of nodes not retained with this outgroup	List of nodes not retained with this outgroup	Number of nodes not retained with this outgroup	List of nodes not retained with this outgroup
Cyrtorhinus caricis	16	1/2/3/4/8/9/10/11/12/13/14/21/22/28/36/41	n/a	0
Cyrtorhinus lividipennis	2	35/36	n/a	0
Mecomma gilvipes	1	31	n/a	0
Orthotylus bilineatus	8	2/3/5/8/9/10/21/36	n/a	0
Neoloxops rubrosignatus	15	1/2/3/4/8/9/10/11/12/13/19/21/22/36/41	n/a	0
Bomberia foliaceae	1	36	1	26
Slaterocoris stygicus	2	22/36	1	35
Nycticapsus melanocephalus	2	22/36	2	26/35
Wauella squamata	2	22/36	2	26/35
Urapura antennata	2	22/36	5	4/5/28/29/35
Fieberocapsus flavelous	2	17/36	2	26/35
Melanotrichus australianus	2	22/36	2	26/35
Orthotylus farcha	2	22/36	2	26/35
Oaxacacoris cygnus	2	22/36	2	26/35
Parthenicus mundus	2	17/36	2	17/24
Tupimiris scutellatus	3	17/22/36	2	17/24
Noctuocoris autlan	2	22/36	1	26
Lopidea dakota	2	22/36	1	26

Table 28 continued

Outgroup	Cumulatively adding outgroups		Only using one outgroup at a time	
	Number of nodes not retained with this outgroup	List of nodes not retained with this outgroup	Number of nodes not retained with this outgroup	List of nodes not retained with this outgroup
Globiceps cruciata	2	17/36	1	26
Cyllecoris historanicus	2	22/36	1	26
Hadronema militare	2	22/36	2	17/24
Gilo tibialis	2	22/36	1	26
Pseudopsallus angularis	2	22/36	5	4/17/24/28/29
Zanchius alba	1	36	5	4/17/24/28/29
Pseudoloxops baiawaensi	2	22/36	6	4/17/24/26/28/29
Mecomopsis cruciata	1	36	5	4/17/24/28/29
Falconia teutoniana	2	22/36	5	4/17/24/28/29
Paraproba capitate	2	22/36	5	4/17/24/28/29
Adfalconia sp.	3	17/22/36	9	2/3/4/13/17/18/24/28/29
Witchelinamiris viridmaculatus	1	36	5	4/17/24/28/29
Itocoris nigrioculis	1	36	2	17/24
Lattinova jacki	2	22/36	2	17/24/
Nichomachus sweeti	2	22/36	1	35
Tytthus mundulus	2	22/36	1	26

Table 29: Ingroup sensitivity analyses for the *Cyrtorhinus* group

Outgroups: 14

Node	Cumulatively adding outgroups		Only using one outgroup at a time	
	Number of outgroups which do not retain the node	List of outgroups which do not retain the node	Number of nodes not retained with this outgroup	List of nodes not retained with this outgroup
1	0	n/a	0	n/a
2	0	n/a	0	n/a
3	0	n/a	0	n/a
4	0	n/a	0	n/a
5	3	1/5/7	5	3/4/6/8/11
6	0	n/a	0	n/a
7	0	n/a	0	n/a
8	0	n/a	0	n/a
9	0	n/a	1	6
10	0	n/a	0	n/a
11	0	n/a	1	6
12	0	n/a	0	n/a
13	0	n/a	0	n/a
14	0	n/a	0	n/a
15	0	n/a	5	0/1/6/7/9
16	5	1/4/9/10/11	0	n/a
17	0	n/a	5	0/1/6/7/9
18	7	1/4/6/9/10/11/12	3	0/9/12
19	8	1/2/4/5/6/7/11/12	8	0/2/3/5/6/8/9/10
20	6	1/4/5/6/9/11	8	0/2/3/5/6/8/9/10
21	6	1/4/5/6/9/11	0	n/a
22	0	n/a	2	9/12
23	9	0/2/35/6/8/10/11/12	12	0/1/2/3/4/5/6/8/9/10/11/12

Table 30: Outgroup impact analyses for the *Cyrtorhinus* group

Nodes: 23

Outgroup	Cumulatively adding outgroups		Only using one outgroup at a time	
	Number of nodes not retained with this outgroup	List of nodes not retained with this outgroup	Number of nodes not retained with this outgroup	List of nodes not retained with this outgroup
Cyllecoris histionicus	1	23	6	15/17/18/19/20/23
Globiceps cruciata	6	5/15/17/18/19/20	3	15/17/23
Hadronema militare	2	18/23	3	19/20/23
Bomberia foliacea	1	23	4	5/19/20/23
Nycticapsus melanocephalus	5	15/17/18/19/20	2	5/23
Candidomiris albomaculata	5	5/18/19/20/23	3	19/20/23
Onconotellus buxtoni	5	17/18/19/20/23	8	5/9/11/15/17/19/20/23
Dimifacoris fasciatus	1	18	2	15/17
Neoloxops rubrosignatus	1	23	4	5/19/20/23
Mecomopsis cruciata	4	15/17/19/20	7	15/17/18/19/20/22/23
Falconia sp.	4	5/15/17/23	3	19/20/23
Zanchius alba	6	15/17/18/19/20/23	2	5/23
Tytthus sp.	3	17/18/23	3	18/22/23

Tables 31: Ingroup sensitivity analyses for *Hypseloecus.*

Outgroups: 41

Node	Cumulatively adding outgroups		Only using one outgroup at a time	
	Number of outgroups which do not retain the node	List of outgroups which do not retain the node	Number of nodes not retained with this outgroup	List of nodes not retained with this outgroup
1	0	n/a	0	n/a
2	1	34	11	14/19/21/29/30/31/32/33/34/36/38
3	1	34	34	0/1/2/3/4/5/6/7/8/9/10/12/13/14/15/16/17/18/19/20/21/24/25/26/29/30/31/32/33/34/35/36/38/39
4	1	34	33	0/1/2/3/4/5/6/7/8/9/10/12/13/14/15/16/17/18/19/20/24/25/26/29/30/31/32/33/34/35/36/38/39
5	15	1/3/10/11/12/13/14/15/16/17/1820/23/25/34	39	0/1/2/3/4/5/6/7/8/9/10/11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26/27/28/29/30/31/32/33/34/35/36/38/39
6	5	1/3/11/34/35	11	7/8/17/21/26/28/31/32/33/34/35
7	39	1/2/3/4/5/6/7/8/9/10/11/12/13/14/15/16/17/18/19/20/21/22/23/24/25/26/27/28/39/30/31/32/33/34/35/36/37/38/39	1	8
8	20	4/6/10/11/12/14/15/16/17/19/20/25/28/29/30/31/36/37/38/39	17	9/11/14/17/18/19/21/26/29/30/31/32/33/34/36/37/38
9	0	0	22	1/2/3/4/5/6/7/8/1014/17/21/22/23/26/27/28/31/32/33/34/35
10	0	0	1	28
11	1	35	1	35
12	1	35	1	35

Table 32: Outgroup impact analysis for *Hypseloecus.*

Nodes: 12

Outgroup	Cumulatively adding outgroups		Only using one outgroup at a time	
	Number of nodes not retained with this outgroup	List of nodes not retained with this outgroup	Number of nodes not retained with this outgroup	List of nodes not retained with this outgroup
Druthmarus philippinensis	0	n/a	3	3/4/5
Aloea australis	3	5/6/7	4	3/4/5/9
Aloea cunealis	1	7	4	3/4/5/9
Parambonea transvaalensis	3	5/6/7	4	3/4/5/9
Neoambonea cynanchi	2	7/8	4	3/4/5/9
Neoambonea uniformis	1	7	4	3/4/5/9
Neoambonea russeola	2	7/8	4	3/4/5/9
Neoambonea samara	1	7	5	3/4/5/6/9
Neoambonea yotvata	1	7	6	3/4/5/6/7/9
Pilophorus lestoni	1	7	4	3/4/5/8
Pilophorus samoanus	3	5/7/8	4	3/4/5/9
Pilophorus arboreus	4	5/6/7/8	2	5/8
Pilophorus pilosus	3	5/7/8	3	3/4/5
Pilophorus typicus	2	5/7	3	3/4/5
Pilophorus alstoni	3	5/7/8	6	2/3/4/5/8/9
Pilophorus culion	3	5/7/8	3	3/4/5
Pilophorus maculate	3	5/7/8	3	3/4/5
Pilophorus prolixus	3	5/7/8	6	3/4/5/6/8/9
Pilophorus heidemanni	2	5/7	4	3/4/5/8
Pilophorus uhleri	2	7/8	5	2/3/4/5/8

Table 32 continued

Outgroup	Cumulatively adding outgroups		Only using one outgroup at a time	
	Number of nodes not retained with this outgroup	List of nodes not retained with this outgroup	Number of nodes not retained with this outgroup	List of nodes not retained with this outgroup
Pilophorus lucidus	3	5/7/8	3	3/4/5
Pilophorus yunganensis	1	7	6	2/3/5/6/8/9
Pilophorus clavatus	1	7	3	4/5/9
Pilophorus miyamotoi	2	5/7	2	5/9
Pilophorus niger	1	7	3	3/4/5
Pilophorus chiricahuae	3	5/7/8	3	3/4/5
Pilophorus explanatus	1	7	6	3/4/5/6/8/9
Pilophorus longisetosus	1	7	3	4/5/9
Pilophorus juniper	2	7/8	5	4/5/6/9/10
Pilophorus discretus	2	7/8	5	2/3/4/5/8
Pilophorus piceicola	2	7/8	5	2/3/4/5/8
Pilophorus gracilis	2	7/8	6	2/3/5/6/8/9
Pherolepis aenescens	1	7	6	2/3/5/6/8/9
Pherolepis amplus	1	7	6	2/3/5/6/8/9
Sthenaridea piceoniger	6	2/3/4/5/6/7	7	2/3/4/5/6/8/9
Sthenaridea suturalis	4	6/7/11/12	7	3/4/5/6/9/11/12
Parasthenaridea arecae	2	7/8	5	2/3/4/5/8
Sthenaridea vulgaris	2	7/8	1	8
Sejanus albisignatus	2	7/8	5	2/3/4/5/8
Tuxedo drakei	2	7/8	3	3/4/5

Table 33: Ingroup sensitivity analyses for Lygaeoidea.

Outgroups: 10

Node	Cumulatively adding outgroups		Only using one outgroup at a time	
	Number of outgroups which do not retain the node	List of outgroups which do not retain the node	Number of nodes not retained with this outgroup	List of nodes not retained with this outgroup
1	0	n/a	0	n/a
2	0	n/a	0	n/a
3	0	n/a	0	n/a
4	0	n/a	0	n/a
5	0	n/a	0	n/a
6	0	n/a	0	n/a
7	0	n/a	0	n/a
8	2	4/8	4	0/1/4/6
9	3	3/5/6	4	4/5/7/8
10	3	3/5/6	3	5/7/8
11	7	3/4/5/6/7/8	7	0/1/4/5/6/7/8
12	7	0/3/4/5/6/7/8	7	0/1/4/5/6/7/8
13	6	0/3/4/5/6/7/8	7	0/1/4/5/6/7/8
14	3	3/5/6	4	5/6/7/8
15	4	0/4/7/8	6	0/1/4/5/6/7/8
16	4	0/4/7/8	6	0/1/4/5/6/7/8
17	0	n/a	0	n/a
18	0	n/a	0	n/a
19	1	3	0	n/a
20	2	3/6	0	n/a
21	0	n/a	1	8
22	0	n/a	0	n/a
23	0	n/a	0	n/a

Table 34: Outgroup impact analyses for Lygaeoidea.

Nodes: 23

Outgroup	Cumulatively adding outgroups		Only using one outgroup at a time	
	Number of nodes not retained with this outgroup	List of nodes not retained with this outgroup	Number of nodes not retained with this outgroup	List of nodes not retained with this outgroup
Alydidae	5	11/12/13/15/16	6	8/11/12/13/15/16
Rhopalidae	0	n/a	6	8/11/12/13/15/16
Stenocephalidae	0	n/a	0	n/a
Hyocephalidae	8	9/10/11/12/13/14/19/20	0	n/a
Larginae	6	8/11/12/13/15/16	7	8/9/11/12/13/15/16
Physopeltinae	5	9/10/11/12/14	8	9/10/11/12/13/14/15/16
Pyrrhocoridae	7	9/10/11/12/13/14/20	6	11/12/13/14/15/16
Pentatomoidea	5	11/12/13/15/16	8	9/10/11/12/13/14/15/16
Aradidae	6	8/11/12/13/15/16	8	8/9/10/11/12/13/14/21

Table 35: Ingroup sensitivity analyses for *Mcateella.*

Outgroups: 25

Node	Cumulatively adding outgroups		Only using one outgroup at a time	
	Number of outgroups which do not retain the node	List of outgroups which do not retain the node	Number of nodes not retained with this outgroup	List of nodes not retained with this outgroup
1	0	n/a	3	6/22/10
2	15	0/1/2/3/4/10/11/12/13/14/16/19/21/22/23	5	6/7/21/22/23
3	0	n/a	4	6/21/22/23
4	0	n/a	0	n/a
5	12	4/5/6/7/8/9/12/13/14/16/18/22	12	0/2/4/6/7/9/18/19/20/21/22/23
6	1	22	11	0/2/4/6/7/18/19/20/21/22/23
7	0	n/a	1	4
8	0	n/a	2	18/22
9	0	n/a	0	n/a
10	0	n/a	0	n/a

Table 36: Outgroup Impact analyses for *Mcateella.*

Nodes: 10

Outgroup	Cumulatively adding outgroups		Only using one outgroup at a time	
	Number of nodes not retained with this outgroup	List of nodes not retained with this outgroup	Number of nodes not retained with this outgroup	List of nodes not retained with this outgroup
Piesma maculatum	1	2	2	5/6
Piesma capitatum	1	2	0	n/a
Piesma xishaenum	1	2	2	5/6
Piesma linnavuori	1	2	0	n/a
Afropiesma jugatum	2	2/5	3	5/6/7
Parapiesma atriplicis	1	5	0	n/a
Parapiesma bificeps	1	5	5	1/2/3/5/6
Parapiesma ceramicum	1	5	3	2/5/6
Parapiesma cinererum	1	5	0	n/a
Parapiesma kherzneri	1	5	1	n/a
Parapiesma kochiae	1	2	0	n/a
Parapiesma kolenatii	1	2	0	n/a
Parapiesma pupula	2	2/5	0	n/a
Parapiesma quadratum	2	2/5	0	n/a
Parapiesma salsolae	2	2/5	0	n/a
Parapiesma silens	0	n/a	0	n/a
Parapiesma tenellum	2	2/5	0	n/a
Parapiesma unicolour	0	n/a	0	n/a
Parapiesma variabile	1	5	3	5/6/8

Table 36 continued

Outgroup	Cumulatively adding outgroups Number of nodes not retained with this outgroup	Only using one outgroup at a time List of nodes not retained with this outgroup	Number of nodes not retained with this outgroup	List of nodes not retained with this outgroup
Eopiesma trimerum	1	2	2	5/6
Heissiana serafini	0	n/a	2	5/6
Crompus sp.	1	2	5	1/2/3/5/6
Geocoris sp.	3	2/5/6	6	1/2/3/5/6/8
Nysius vinitor	1	2	4	2/3/5/6

CHAPTER 5

GENERAL DISCUSSION

My thesis reinforces the existing theory (Cassis et al. 2007, Cassis and Schuh 2012) that the orthotyline taxa of the West-Pacific region suffer from a significant taxonomic impediment. The thesis described 46 new species and eight new genera. The genus *Josemiris*, erected for the single species *Josemiris carvalhoi*, was synonymised with *Cyrtorhinus*, and a total of 22 other species from nine genera are redescribed. I investigated external and genitalic characters in detail and their homology was hypothesised in reference to other Orthotylini. *Cyrtorhinus* has been studied more than most mirid genera, but there were still 11 species that had not been described. This oversight was due to the fact that the last monograph of the genus was by Carvalho and Southwood (1955).

Character systems used to identify the genus *Cyrtorhinus* and most of its species have focused in the past on external characters (e.g., Carvalho and Southwood 1955, Kerzhner 1979, Eyles 1996). My study focused on male and female genitalic characters such as the endosomal membranous bag, the enlarged ductus seminis and enlarged secondary gonopore. The structure of the sensory lobe and apophysis of the right paramere and to a lesser extent the left paramere were also useful for defining species and their relationships.

The use of molecular data in mirid systematics is beginning to be realised (e.g., Jung et al. 2011, Schuh and Menard 2011, Jung and Lee 2012, Menard et al. 2014, Schuh et al. 2014). In this study most species were known from only a few specimens or only from very old specimens, which were not suitable for molecular analysis.

In my study of *Cyrtorhinus* (Chapter 2) I found it to be related to *Mecomma*, which has been previously hypothesised (Carvalho and Southwood 1955, Kerzhner 1979). I also found that it was related to *Orthotylus bilineatus*, which remains unplaced pending a broader study of the Orthotylini, which was beyond the scope of this thesis. The majority of species of *Cyrtorhinus* are divided into two distinct clades based on the size and shape of the lobes of the right paramere and the structure of the proximal endosomal spicule. External structure and vestiture, as well as the flange of the right paramere and minor genitalic structures were important in determining the relationships within *Cyrtorhinus*. *Cyrtorhinus caricis* and *Cyrtorhinus caricisoides* are basal to these two clades due to similarities of the left and right parameres with *Mecomma* and *Orthotylus bilineatus.*

Biogeographic analysis of *Cyrtorhinus* based on my phylogeny mostly supported Schuh and Stonedahl (1986) in that Africa is basal to the rest of the Indo-Pacific areas. It does not support their hypothesis that the subcontinent and mainland Asia are basal to Pacific islands, rather they form a group together which is the sister to the Pacific.

In Chapter 3 I recognised the *Candidomiris-Morobea* complex as monophyletic and comprised of 17 genera and 48 species. The *Morobea* subgroup is comprised of three previously described genera and the new genus *Flagellomiris*. There are seven new species and five previously described species. The *Candidomiris* group is comprised of eight new genera and five previously described genera. These genera are comprised of 28 new species and 8 previously described species. Most of the species are known from one or two collection events and from few specimens. There have only been two studies of these taxa (Carvalho 1987 and Wall 2007), partially due to a lack of collecting in the southwest Pacific and new species are almost certain to be found.

The genera and species in the *Candidomiris* group and *Morobea* subgroups share several unusual male genitalic characters, which are not universal within the groups. The thick ductus and enlarged secondary gonophore is shared with *Cyrtorhinus*, and the multilobed endosomal membrane and the endosomal lobal sclerites provide important character systems both for phylogenetic analysis and species and generic diagnoses. Like most other orthotylines the parameres are useful for generic and species level diagnoses and in certain parts of the phylogenetic analysis they provide useful phylogenetic characters. Detailed investigation of minute structures under the scanning electron microscope lead to new character systems being used at a generic and a species level, including those of the microtrichia, which undoubtedly requires more investigation.

The *Candidomiris-Morobea* phylogeny yielded support for the recognition of the *Candidomiris-Morobea* complex but further investigation is needed to formally recognise the group as a suprageneric taxon, especially given that findings in Chapter 4 of this thesis, which shows that their relationship is not robust in response to changing outgroup taxa. In contrast, the two generic subgroups, *Candidomiris* and *Morobea* received significant support and were robust to varying outgroup taxa. All the genera in the *Candidomiris-Morobea* group are significantly supported and most of them are supported by the outgroup test in Chapter 4. The relationship between the *Candidomiris-Morobea* group and the *Cyrtorhinus* group was found to be significant, and requires further investigation. .

My analysis of the *Candidomiris-Morobea* and the *Cyrtorhinus* phylogenies, benefited from outgroup selection protocol. Phylogenetic reconstruction for very diverse insect groups, like the Miridae, can be very challenging because of the difficulty in selecting an appropriate outgroup. Chapter 4 provides a quantifiable method for

doing this. The script that I developed to test the robustness of ingroup topologies as well as the impact of changing outgroups was written and its functionality was tested.

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Appendices

Appendix A: Measurements for *Cyrtorhinus* individual specimens. Abbreviations: AI-AIV = Antennal segment one to antennal segment four, CC = Lenth from cuneus to clypeus, CL = Length of cuneus, HL = Head length, IOD = Inter-ocellic dimension, LP = Length of pronotum, LS = Length of scutellum, PW = Width of pronotum, TL = Total length, WH = Width of head, WS = Width of the scutellum. Macropterous

		TL	HL	WH	IOB	AI	AII	AIII	AIV	LP	PW	LS	WS	CC	CL
Cyrtorhinus albidus sp. nov.															
	Male	2.82	0.40	0.50	0.29	0.25	0.73	0.68	0.56	0.39	0.51	0.45	0.94	1.85	0.27
	Male	2.76	0.27	0.46	0.29	0.25	0.73	0.78	0.56	0.42	0.55	0.47	0.92	2.27	0.22
	Male	2.55	0.34	0.47	0.27	0.25	0.70	0.74		0.46	0.38	0.43	0.73	2.37	0.36
	Male	3.19	0.32	0.48	0.19	0.21	0.83	0.77	0.55	0.32	0.52	0.51	0.96	1.67	0.26
	Male	2.91	0.30	0.48	0.21	0.22	0.67	0.72		0.36	0.45	0.52	0.89	1.81	0.30
	Female	2.79	0.36	0.53	0.32	0.26	0.72			0.37	0.52	0.45	0.77	2.07	0.36
	Female	2.76	0.25	0.63	0.37	0.23	0.77	0.64		0.25	0.56	0.45	0.81	1.47	0.30
	Female	2.75	0.26	0.78	0.30	0.24	0.79	0.64	0.56	0.41	0.44	0.34	0.67	1.66	0.30
	Female	2.49	0.29	0.71	0.33	0.23	0.78			0.36	0.50	0.38	0.86	2.09	0.33
	Female	2.92	0.30	0.42	0.35	0.19	0.69	0.75	0.35	0.36	0.46	0.34	0.92	1.82	0.31
Cyrtorhinus brunus sp. nov.															
	Male	3.33	0.32	0.75	0.30	0.24	0.62	0.82	0.56	0.42	0.52	0.63	0.69	2.05	0.34
	Male	3.35	0.35	0.85	0.31	0.25	0.74	0.78	0.48	0.51	0.49	0.62	0.77	2.17	0.21
	Male	3.17	0.39	0.75	0.31	0.24	0.64	0.66		0.34	0.40	0.48	0.58	1.97	0.27
	Male	3.71	0.44	0.66	0.30	0.23	0.82	0.69	0.42	0.49	0.52	0.58	0.62	1.75	0.35
	Male	3.65	0.34	0.70	0.29	0.25	0.85	0.57		0.44	0.62	0.49	0.55	2.23	0.31
	Female	3.26	0.35	0.92	0.31	0.23	0.80	0.65	0.64	0.45	0.54	0.54	0.77	1.89	0.28
	Female	3.70	0.38	0.68	0.33	0.24	0.85			0.48	0.43	0.61	0.64	2.11	0.30
	Female	3.68	0.40	0.77	0.30	0.24	0.67	0.72	0.33	0.46	0.51	0.64	0.77	2.39	0.25
	Female	3.30	0.33	0.67	0.31	0.23				0.48	0.46	0.65	0.72	2.40	0.31
	Female	3.43	0.42	0.54	0.32	0.22	0.75	0.79	0.34	0.39	0.36	0.48	0.67	2.10	0.33

Appendix A continued

	TL	HL	WH	IOB	AI	AII	AIII	AIV	LP	PW	LS	WS	CC	CL
Cyrtorhinus caricis Fallén 1807														
Male	3.15	0.36	0.78	0.39	0.33	1.11	0.90	0.44	0.32	0.72	0.37	0.64	2.03	0.45
Male	3.05	0.35	0.99	0.36	0.32	1.14	0.78	0.38	0.31	0.66	0.27	0.55	1.88	0.45
Male	3.30	0.30	0.62	0.48	0.34	1.13	0.82	0.43	0.32	0.72	0.36	0.63	2.18	0.40
Male	3.44	0.39	0.82	0.56	0.30	1.09	0.99	0.31	0.38	0.71	0.27	0.61	1.99	0.52
Male	2.98	0.37	0.80	0.48	0.35	1.27	0.75	0.44	0.28	0.77	0.37	0.64	2.22	0.42
Female	3.28	0.46	0.67	0.34	0.34	1.33	1.23	0.69	0.79	1.17	0.64	0.58	2.35	0.40
Female	3.28	0.17	1.13	0.51	0.43	1.42	0.88	0.19	0.19	0.93	0.47	0.43	2.17	0.88
Female	3.32	0.46	0.88	0.31	0.74	1.25	0.81	0.27	0.75	0.96	0.09	0.85	2.05	0.62
Female	3.24	0.29	1.06	0.37	0.41	1.09	0.92	0.49	0.66	1.08	0.57	0.95	2.04	0.37
Female	3.32	0.30	0.81	0.30	0.23	0.99	0.82	0.34	0.37	0.64	0.35	0.66	1.89	0.39
Cyrtorhinus caricisoides Ghauri 1970														
Male	3.41	0.24	0.72	0.31	0.29	1.03	0.94	0.34	0.43	0.86	0.35	0.43	2.39	0.53
Female	3.42	0.27	0.73	0.32	0.25	0.76	0.74	0.38	0.39	0.91	0.36	0.46	2.41	0.55

Appendix A continued

		TL	HL	WH	IOB	AI	AII	AIII	AIV	LP	PW	LS	WS	CC	CL
Cyrtorhinus carvalhoi Woodward 1957															
	Male	4.00	0.38	0.76	0.36	0.50	0.99	1.15	0.49	0.46	0.44	0.25	0.97	2.25	0.34
	Male	4.08	0.32	0.75	0.32	0.48	1.07	1.21	0.48	0.48	0.48	0.64	0.84	2.71	0.42
	Male	4.05	0.33	0.77	0.34	0.49	1.32	1.19	0.45	0.52	0.49	0.68	0.99	2.54	0.36
	Male	4.08	0.29	0.78	0.34	1.02	1.12			0.43	0.53	0.76	0.71	2.44	0.35
	Male	4.06	0.35	0.74	0.33	0.47	1.42	0.88		0.50	0.49	0.75	0.99	2.52	0.33
	Female	4.25	0.37	0.79	0.35	0.20	1.02	0.97		0.50	0.64	0.61	1.04	2.82	0.48
	Female	3.96	0.35	0.79	0.37	0.24	0.96			0.49	0.67	0.59	1.03	2.61	0.33
	Female	4.03	0.31	0.76	0.35	0.48	1.30	0.88	0.51	1.07	0.66	0.67	0.98	2.51	0.36
	Female	3.96	0.32	0.77	0.30	0.48	1.34	0.91	0.36	0.52	0.52	0.78	0.88	2.43	0.36
	Female	4.00	0.31	0.77	0.35	0.45	1.20	1.05	0.48	0.54	0.53	0.67	0.95	2.47	0.38
Brachypterous	Female	2.86	0.33	0.78	0.34	0.43	0.99	0.89	0.51	0.44	0.86	0.33	0.51	2.27	
	Female	2.83	0.31	0.81	0.37	0.45	1.04	1.06	0.80	0.45	0.90	0.31	0.49	2.30	
	Female	2.53	0.25	0.79	0.34	0.39	0.98	0.79	0.79	0.40	0.95	0.36	0.48	2.05	
Cyrtorhinus cumberi Woodward 1950															
	Male	3.31	0.21	0.69	0.23	0.21	0.86	0.81	0.69	0.33	0.53	0.45	0.73	1.90	0.34
	Male	3.20	0.25	0.76	0.39	0.22	0.69	0.70	0.44	0.36	0.56	0.49	0.93	1.97	0.27
	Female	3.23	0.40	0.59	0.32	0.23	0.58	0.74	0.57	0.36	0.56	0.51	0.78	2.10	0.27
Cyrtorhinus dimorphus Linnavuori 1994															
	Male	4.08	0.31	0.73	0.37	0.25	1.15	1.02	0.76	0.42	0.55	0.64	1.00	2.58	0.34
	Male	3.69	0.24	0.71	0.37	0.31	1.03	0.97		0.51	0.45	0.68	0.97	2.42	0.32
	Male	3.89	2.91	0.74	0.36	0.30	1.10	1.03	0.75	0.43	0.52	0.62	0.95	2.33	0.34
	Male	3.91	2.67	0.72	0.36	0.26	1.01	0.97		0.41	0.49	0.64	0.98	2.20	0.33
	Male	3.79	0.29	0.71	0.36	0.28	1.12	1.00		0.44	0.49	0.67	0.99	2.45	0.32

Appendix A continued

		TL	HL	WH	IOB	AI	AII	AIII	AIV	LP	PW	LS	WS	CC	CL
Cyrtorhinus dimorphus Linnavuori															
Brachypterous females	Female	2.97	0.32	0.82	0.50	0.23	0.63	0.96		0.41	0.50	0.31	1.01	2.33	
	Female	2.89	0.41	0.71	0.41	0.29	0.46	1.05	0.70	0.37	0.52	0.27	0.85	2.07	
	Female	3.06	0.29	0.81	0.46	0.29	0.55	1.02	0.66	0.42	0.51	0.31	0.88	2.21	
	Female	2.89	0.23	0.65	0.49	0.24	0.57	1.04	0.63	0.35	0.52	0.29	0.94	2.16	
	Female	3.03	0.45	0.80	0.47	0.22	0.51	1.04		0.37	0.49	0.29	0.93	2.16	
Cyrtorhinus defectus sp. nov.															
	Male	3.30	0.38	0.84	0.27	0.22	0.83	0.77	0.38	0.47	0.51	0.43	0.75	2.23	0.38
	Male	3.16	0.41	0.81	0.34	0.25	0.76	0.70	0.43	0.56	0.47	0.46	0.67	2.24	0.30
	Male	3.28	0.45	0.72	0.27	0.24	0.69	0.76		0.51	0.43	0.56	0.70	1.93	0.35
	Male	3.06	0.53	0.99	0.31	0.23	0.77	0.73	0.39	0.47	0.52	0.58	0.75	2.20	0.27
	Male	3.32	0.37	0.82	0.23	0.26	0.82			0.53	0.59	0.49	0.64	2.35	0.30
	Female	3.44	0.49	0.74	0.34	0.21	0.83	0.78	0.58	0.52	0.64	0.55	0.65	1.92	0.31
	Female	3.41	0.48	0.75	0.33	0.23	0.68	0.75		0.44	0.57	0.58	0.67	1.99	0.27
	Female	3.28	0.41	0.90	0.32	0.23	0.75	0.57		0.47	0.57	0.67	0.68	2.19	0.29
	Female	3.58	0.39	0.80	0.38	0.21	0.68	0.59	0.41	0.54	0.58	0.58	0.63	2.02	0.27
	Female	3.31	0.47	0.96	0.32	0.19				0.60	0.51	0.42	0.68	1.97	0.33
Cyrtorhinus eylesi comb. nov.															
	Male	4.06	0.57	0.90	0.46	0.28	0.65	1.45	0.23		0.53	0.39	1.27	3.37	0.68
Brachypterous female	Female	3.51	0.53	0.88	0.35	0.25	0.72	1.62			0.43	0.29	1.12	3.27	

AppendixA continued

	TL	HL	WH	IOB	AI	AII	AIII	AIV	LP	PW	LS	WS	CC	CL
Cyrtorhinus fulvus Knight 1935														
Male	2.94	0.36	0.84	0.26	0.23	0.77	0.52	0.50	0.37	0.45	0.65	0.58	2.32	0.24
Male	2.97	0.32	0.76	0.17	0.24	0.75	0.74	0.53	0.46	0.58	0.70	0.58	1.87	0.37
Male	2.90	0.35	0.54	0.24	0.23	0.68	0.77	0.59	0.50	0.40	0.59	0.64	1.74	0.37
Male	2.99	0.30	0.69	0.31	0.25	0.66	0.60	0.62	0.44	0.40	0.61	0.83	1.99	0.28
Male	3.01	0.37	0.66	0.26	0.21	0.68	0.79	0.49	0.45	0.49	0.45	0.71	2.02	0.29
Female	3.63	0.27	0.83	0.25	0.22	0.65	0.80	0.65	0.45	0.41	0.60	0.81	1.80	0.31
Female	3.73	0.35	0.62	0.19	0.21	0.78	0.67	0.50	0.39	0.40	0.75	0.67	2.06	0.27
Female	3.70	0.37	0.84	0.20	0.21	0.86	0.67	0.77	0.50	0.43	0.52	0.68	1.73	0.20
Female	3.79	0.43	0.64	0.24	0.23	0.73	0.84	0.39	0.52	0.55	0.62	0.73	2.02	0.37
Female	3.82	0.29	0.74	0.21	0.21	0.75	0.64	0.41	0.34	0.47	0.59	0.73	2.38	0.27
Cyrtorhinus geniculatus Reuter 1904														
Male	3.15	0.29	0.68	0.32	0.40	1.12	0.88	0.48	0.45	0.54	0.52	0.80	1.98	0.27
Male	3.37	0.26	0.72	0.35	0.42	1.21	1.02	0.48	0.48	0.65	0.55	0.87	2.32	0.33
Male	2.92	0.27	0.33	0.30	0.29	1.07			0.43	0.55	0.45	0.80	1.95	0.27
Male	3.30	0.32	0.71	0.35	0.30	0.95	0.87		0.41	0.69	0.40	0.93	2.28	0.38
Male	3.28	0.35	0.69	0.33	0.37	1.05	1.00		0.41	0.62	0.51	0.84	2.13	0.25
Female	3.41	0.34	0.70	0.33	0.36	1.03	0.87	0.63	0.44	0.67	0.50	0.90	2.00	0.33
Female	3.54	0.33	0.74	0.37	0.36	1.00	0.54		0.53	0.66	0.45	0.96	2.53	0.44
Female	2.93	0.36	0.66	0.31	0.34	1.00	0.94	0.58	0.37	0.50	0.51	0.80	2.02	0.27
Female	3.70	0.30	0.73	0.36	0.36	1.04	0.55		0.42	0.70	0.51	0.94	2.38	0.39
Female	3.59	0.34	0.23	0.35	0.33	0.93	0.85		0.42	0.64	0.57	0.94	2.42	0.38

Appendix A continued

		TL	HL	WH	IOB	AI	AII	AIII	AIV	LP	PW	LS	WS	CC	CL
Cyrtorhinus indi sp. nov.															
	Male	2.63	0.35	0.63	0.29	0.27	0.98			0.39	0.48	0.49	0.83	1.91	0.27
	Male	2.84	0.29	0.65	0.28	0.26	0.90			0.35	0.49	0.40	0.77	1.92	0.30
	Male	2.59	0.31	0.63	0.28	0.23	0.80	0.40		0.31	0.41	0.44	0.81	1.77	0.26
	Male	2.43	0.30	0.57	0.27	0.22	0.61	0.78	0.49	0.33	0.40	0.41	0.72	1.75	0.24
	Male	2.63	0.28	0.59	0.27	0.25	0.91	0.81		0.35	0.46	0.45	0.73	1.72	0.29
	Female	2.93	0.33	0.63	0.31	0.23	0.33			0.37	0.55	0.52	0.87	2.02	0.30
	Female	3.21	0.27	0.65	0.31	0.21	0.75	0.67		0.34	0.64	0.52	0.92	2.19	0.33
	Female	2.65	0.31	0.64	0.30	0.24	0.75	0.75	0.56	0.38	0.51	0.45	0.87	2.12	0.31
	Female	2.84	0.30	0.61	0.30	0.18	0.78	0.77	0.56	0.38	0.47	0.46	0.86	2.06	0.29
	Female	2.91	0.30	0.62	0.31	0.21	0.77	0.74	0.52	0.36	0.56	0.39	0.84	2.00	0.29
Cyrtorhinus lividipennis Reuter 1885															
	Male	2.82	0.23	0.58	0.29	0.30	0.87	0.85	0.36	0.36	0.82	0.20	0.29	1.87	0.45
	Male	2.80	0.33	0.61	0.29	0.30	0.94	0.79	0.38	0.35	0.78	0.28	0.38	1.95	0.44
	Male	2.78	0.23	0.62	0.28	0.28	0.72	0.37	0.70	0.30	0.79	0.29	0.37	1.79	0.45
	Male	2.93	0.34	0.67	0.31	0.30	1.07	0.91	0.56	0.37	0.80	0.29	0.37	2.08	0.53
	Male	2.65	0.28	0.65	0.30	0.28	0.88	0.57	0.84	0.36	0.82	0.24	0.33	1.84	0.41
	Female	2.87	0.28	0.67	0.33	0.26	0.82	0.64	0.28	0.38	0.93	0.29	0.43	1.03	0.49
	Female	3.08	0.24	0.69	0.33	0.24	0.86	0.95	0.40	0.36	0.98	0.30	0.43	2.15	0.48
	Female	3.27	0.33	0.68	0.32	0.28	0.87	0.68	0.43	0.41	0.88	0.27	0.42	2.28	0.48
	Female	3.35	0.41	0.65	0.30	0.33	0.90	0.64	0.42	0.42	0.93	0.37	0.46	2.34	0.52
	Female	3.29	0.27	0.72	0.34	0.30	0.80	0.78	0.53	0.40	0.95	0.34	0.46	2.32	0.51
Cyrtorhinus melanops Reuter 1905															
	Male	3.51	0.31	0.71	0.30	0.48	1.31			0.50	0.48	0.58	0.86	2.32	0.33
	Female	3.41	0.31	0.74	0.37	0.41	1.20	0.75	0.41	0.51	0.47	0.39	1.00	2.48	0.33

Appendix A continued

		TL	HL	WH	IOB	AI	AII	AIII	AIV	LP	PW	LS	WS	CC	CL
Cyrtorhinus novabritannia sp. nov.															
	Male	3.72	0.38	0.76	0.33	0.42	1.13			0.54	0.50	0.60	0.91	2.45	0.33
	Male	3.84	0.30	0.75	0.32	0.41	1.11	1.14	0.48	0.51	0.49	0.59	0.94	2.44	0.36
	Male	3.89	0.34	0.78	0.33	0.41				0.44	0.52	0.53	0.78	2.65	0.37
	Male	4.00	0.31	0.78	0.35	0.50	1.24			0.47	0.52	0.66	1.00	2.50	0.36
	Male	3.92	0.38	0.77	0.33	0.41	1.26			0.47	0.47	0.66	0.95	2.54	0.38
	Female	3.84	0.32	0.74	0.32	0.43	1.21	1.13		0.40	0.55	0.60	0.90	2.42	0.34
	Female	3.72	0.33	0.74	0.31	0.49	1.14			0.52	0.59	0.40	0.98	2.51	0.32
	Female	3.72	0.34	0.78	0.33	0.33	1.18	1.06	0.47	0.45	0.58	0.65	0.95	2.45	0.32
	Female	3.81	0.36	0.81	0.38	0.42				0.45	0.65	0.58	1.02	2.71	0.40
	Female	4.22	0.34	0.80	0.35	0.40	1.06	1.02		0.52	0.53	6.18	1.08	2.76	0.39
Cyrtorhinus palauensis sp. nov.															
	Male	2.84	0.25	0.66	0.29	0.23	0.72			0.46	0.62	0.50	0.89	1.77	0.33
	Male	2.96	0.38	0.79	0.35	0.19	0.67	0.62		0.30	0.51	0.49	0.96	1.58	0.25
	Male	3.27	0.34	0.60	0.38	0.26	0.92	0.73	0.55	0.42	0.57	0.56	0.91	2.05	0.23
	Male	2.94	0.37	0.60	0.30	0.22	0.68	0.84	0.41	0.41	0.64	0.47	0.88	1.68	0.37
	Male	3.05	0.24	0.53	0.31	0.21	0.82	0.72	0.47	0.29	0.57	0.50	0.99	1.97	0.37
	Female	2.62	0.24	0.63	0.20	0.22	0.62	0.70	0.58	0.36	0.46	0.53	0.81	2.18	0.30
	Female	3.01	0.27	0.59	0.30	0.27	0.91	0.86		0.44	0.50	0.31	0.69	2.18	0.35
	Female	3.13	0.35	0.65	0.37	0.25	0.66	0.77	0.57	0.39	0.45	0.54	0.82	2.16	0.29
	Female	3.20	0.29	0.60	0.23	0.28	0.82	0.86	0.53	0.46	0.55	0.50	0.92	2.10	0.31
	Female	3.10	0.36	0.73	0.23	0.26	0.77			0.30	0.55	0.43	0.88	2.48	0.37

Appendix A continued

		TL	HL	WH	IOB	AI	AII	AIII	AIV	LP	PW	LS	WS	CC	CL
Cyrtorhinus pilosus sp. nov.															
	Male	2.92	0.30	0.65	0.30	0.22	0.81	0.76	0.29	0.35	0.87	0.32	0.44	2.31	0.35
	Male	2.89	0.32	0.58	0.26	0.23	0.92	0.84	0.29	0.34	0.69	0.46	0.35	2.16	0.39
	Male	3.06	0.27	0.64	0.25	0.23	1.01	0.99	0.26	0.39	0.79	0.28	0.39	2.07	0.34
	Male	3.11	0.27	0.62	0.25	0.22	1.05	0.67	0.30	0.38	0.75	0.33	0.42	2.11	0.41
	Male	3.07	0.27	0.59	0.30	0.24	1.13	1.02	0.28	0.44	0.77	0.28	0.39	2.21	0.39
	Female	3.05	0.24	0.67	0.30	0.27	0.97	0.93	0.27	0.38	0.81	0.30	0.40	2.09	0.54
	Female	3.03	0.30	0.66	0.29	0.24	1.02	0.95	0.28	0.36	0.85	0.29	0.42	1.92	0.51
	Female	3.01	0.27	0.60	0.27	0.25	0.81	0.88	0.28	0.31	0.73	0.27	0.37	2.14	0.48
	Female	2.97	0.28	0.64	0.28	0.20	0.89	0.85	0.31	0.30	0.74	0.28	0.41	2.19	0.41
	Female	3.03	0.30	0.63	0.28	0.23	0.90	0.95	0.30	0.32	0.74	0.26	0.38	1.99	0.43
Cyrtorhinus solomonensis sp. nov															
	Male	3.19	0.38	0.86	0.40	0.21	0.73	0.63	0.56	0.39	0.46	0.55	0.88	1.90	0.32
	Male	3.17	0.32	0.68	0.22	0.20	0.68	0.79		0.46	0.65	0.40	0.82	2.46	0.26
	Male	3.11	0.31	0.81	0.30	0.22				0.35	0.53	0.40	0.67	2.03	0.26
	Male	3.22	0.36	0.81	0.29	0.24	0.96	0.75		0.37	0.50	0.36	0.70	2.04	0.26
	Male	3.08	0.33	0.74	0.25	0.20	0.80	0.77		0.38	0.44	0.50	0.94	1.85	0.28
	Female	3.10	0.33	0.84	0.32	0.25	0.83	0.75	0.59	0.32	0.52	0.54	0.90	2.00	0.29
	Female	2.75	0.35	0.67	0.26	0.24	0.85	0.72	0.41	0.37	0.51	0.46	0.83	1.91	0.26
	Female	2.61	0.35	0.61	0.36	0.21	0.92	0.78	0.44	0.35	0.53	0.44	0.73	2.21	0.27
	Female	2.50	0.33	0.82	0.31	0.23	0.93			0.35	0.59	0.52	0.69	1.89	0.27
	Female	3.16	0.44	0.54	0.38	0.26	0.73	0.61	0.43	0.47	0.60	0.30	0.85	2.38	0.27

Appendix A continued

		TL	HL	WH	IOB	AI	AII	AIII	AIV	LP	PW	LS	WS	CC	CL
Cyrtorhinus quatei sp. nov.															
	Male	2.89	0.27	0.63	0.30	0.31	0.81	0.67	0.55	0.30	0.77	0.30	0.38	2.04	0.38
	Male	2.84	0.23	0.62	0.28	0.32	0.90	0.72	0.39	0.30	0.74	0.28	0.34	1.94	0.41
	Male	2.83	0.33	0.62	0.72	0.33	0.80	0.83		0.33	0.74	0.27	0.49	2.00	0.37
	Male	2.72	0.33	0.63	0.30	0.23	0.92	0.86	0.26	0.42	0.80	0.27	0.35	1.85	0.32
	Male	2.43	0.22	0.60	0.28	0.31	0.92	0.89	0.37	0.31	0.72	0.26	0.37	1.60	0.42
	Female	2.96	0.29	0.60	0.29	0.25	0.79	0.54	0.48	0.32	0.78	0.31	0.39	2.06	0.44
	Female	2.94	0.37	0.64	0.30	0.26	0.70	0.77	0.29	0.36	0.82	0.31	0.40	2.04	0.36
	Female	2.94	0.36	0.62	0.32	0.16	0.90	0.80		0.41	0.87	0.30	0.39	2.04	0.43
	Female	2.85	0.29	0.65	0.31	0.29	0.84	0.80		0.35	0.83	0.33	0.39	1.95	0.42
	Female	2.72	1.39	0.58	0.28	0.26	0.64	0.71	0.49	0.35	0.74	0.30	0.38	1.82	0.36
Cyrtorhinus rarus sp. nov.															
	Female	3.04	0.26	0.62	0.23	0.24	1.07	0.82	0.63	0.28	0.40	0.42	0.85	2.11	0.24
	Female	3.57	0.34	0.39	0.19	0.25	1.07	0.75	0.47	0.33	0.49	0.50	0.69	2.11	0.34
	Female	3.18	0.28	0.69	0.27	0.20	0.83	0.69	0.48	0.41	0.42	0.45	0.84	2.10	0.29
	Female	3.35	0.39	0.74	0.23	0.20	0.84	0.75	0.42	0.30	0.45	0.49	0.90	1.95	0.28
	Female	3.35	0.38	0.65	0.28	0.22	0.90	0.70	0.43	0.30	0.54	0.29	0.81	2.02	0.27

Appendix A continued

	TL	HL	WH	IOB	AI	AII	AIII	AIV	LP	PW	LS	WS	CC	CL
Cyrtorhinus yunganensis sp. nov.														
Male	2.98	0.27	0.66	0.33	0.25	0.87	0.68		0.36	0.92	0.30	0.52	2.12	0.50
Male	2.90	0.26	0.63	0.28	0.21	0.82	0.65	0.25	0.36	0.87	0.32	0.41	2.12	0.47
Male	2.74	0.29	0.61	0.26	0.22	0.94			0.34	0.84	0.30	0.40	1.96	0.45
Male	2.81	0.26	0.64	0.30	0.24	0.88	0.61	0.28	0.34	0.87	0.34	0.45	1.97	0.44
Male	2.99	0.28	0.64	0.30	0.20	0.91	0.66	0.37	0.36	0.88	0.33	0.45	2.13	0.50
Female	2.85	0.22	0.62	0.34	0.23	0.98			0.30	0.88	0.34	0.44	2.01	0.53
Female	3.32	0.33	0.68	0.33	0.25	0.91	0.72	0.25	0.37	0.88	0.33	0.45	2.38	0.56
Female	3.33	0.31	0.68	0.29	0.28	0.94	0.63		0.43	0.95	0.35	0.53	2.35	0.53
Female	3.01	0.32	0.62	0.37	0.19	0.92	0.79		0.41	0.63	0.32	0.46	2.05	0.45
Female	2.81	0.23	0.60	0.32	0.16	0.98	0.73	0.28	0.31	0.86	0.34	0.47	2.14	0.34

Appendix B: Subtrees generated in *Cyrtorhinus* biogeographic analysis

38 Subtrees generated from the biogeographic analysis.

1: ((((((MICRONESIA,SULU SEA),(SUBCOTINENT,ASIA)),NEW ZEALAND),EAST AFRICA),LEMURIA),HOLARCTIC)

2: (HOLARCTIC,(LEMURIA,(MELANESIA,WEST AFRICA)))

3: (HOLARCTIC,(LEMURIA,(MELANESIA,EAST AFRICA)))

4: ((((((SULU SEA,MELANESIA),(POLYNESIA,NEW CALEDONIA)),NEW ZEALAND),EAST AFRICA),LEMURIA),HOLARCTIC)

5: (HOLARCTIC,(LEMURIA,(NEW ZEALAND,WEST AFRICA)))

6: ((((((MICRONESIA,SULU SEA),(SUBCOTINENT,ASIA)),NEW ZEALAND),EAST AFRICA),LEMURIA),HOLARCTIC)

7: (HOLARCTIC,(LEMURIA,(MELANESIA,WEST AFRICA)))

8: (HOLARCTIC,(LEMURIA,((MELANESIA,AUSTRALIA),EAST AFRICA)))

9: ((((((SULU SEA,MELANESIA),(POLYNESIA,NEW CALEDONIA)),NEW ZEALAND),EAST AFRICA),LEMURIA),HOLARCTIC)

10: (HOLARCTIC,(LEMURIA,(NEW ZEALAND,WEST AFRICA)))

11: (((((((SULU SEA,MELANESIA),(POLYNESIA,NEW CALEDONIA)),(SUBCOTINENT,ASIA)),NEW ZEALAND),EAST AFRICA),LEMURIA),HOLARCTIC)

12: (HOLARCTIC,(LEMURIA,(MELANESIA,WEST AFRICA)))

13: (HOLARCTIC,(LEMURIA,(MELANESIA,EAST AFRICA)))

14: ((((((MICRONESIA,ASIA),((SULU SEA,MELANESIA),(POLYNESIA,NEW CALEDONIA))),NEW ZEALAND),EAST AFRICA),LEMURIA),HOLARCTIC)

15: (HOLARCTIC,(LEMURIA,(NEW ZEALAND,WEST AFRICA)))

16: (((((((SULU SEA,MELANESIA),(POLYNESIA,NEW CALEDONIA)),(SUBCOTINENT,ASIA)),NEW ZEALAND),EAST AFRICA),LEMURIA),HOLARCTIC)

17: (HOLARCTIC,(LEMURIA,(MELANESIA,WEST AFRICA)))

18: (HOLARCTIC,(LEMURIA,((MELANESIA,AUSTRALIA),EAST AFRICA)))

19: ((((((MICRONESIA,ASIA),((SULU SEA,MELANESIA),(POLYNESIA,NEW CALEDONIA))),NEW ZEALAND),EAST AFRICA),LEMURIA),HOLARCTIC)

20: (HOLARCTIC,(LEMURIA,(NEW ZEALAND,WEST AFRICA)))

Appendix B continued

21: ((((((MICRONESIA,SULU SEA),(SUBCOTINENT,ASIA)),NEW ZEALAND),WEST AFRICA),LEMURIA),HOLARCTIC)

22: (HOLARCTIC,(LEMURIA,(MELANESIA,WEST AFRICA)))

23: ((((((SULU SEA,MELANESIA),(POLYNESIA,NEW CALEDONIA)),NEW ZEALAND),WEST AFRICA),LEMURIA),HOLARCTIC)

24: (HOLARCTIC,(LEMURIA,(NEW ZEALAND,WEST AFRICA)))

25: ((((((MICRONESIA,SULU SEA),(SUBCOTINENT,ASIA)),NEW ZEALAND),WEST AFRICA),LEMURIA),HOLARCTIC)

26: (HOLARCTIC,(LEMURIA,(MELANESIA,WEST AFRICA)))

27: (HOLARCTIC,(LEMURIA,((MELANESIA,AUSTRALIA),WEST AFRICA)))

28: ((((((SULU SEA,MELANESIA),(POLYNESIA,NEW CALEDONIA)),NEW ZEALAND),WEST AFRICA),LEMURIA),HOLARCTIC)

29: (HOLARCTIC,(LEMURIA,(NEW ZEALAND,WEST AFRICA)))

30: (((((((SULU SEA,MELANESIA),(POLYNESIA,NEW CALEDONIA)),(SUBCOTINENT,ASIA)),NEW ZEALAND),WEST AFRICA),LEMURIA),HOLARCTIC)

31: (HOLARCTIC,(LEMURIA,(MELANESIA,WEST AFRICA)))

32: ((((((MICRONESIA,ASIA),((SULU SEA,MELANESIA),(POLYNESIA,NEW CALEDONIA))),NEW ZEALAND),WEST AFRICA),LEMURIA),HOLARCTIC)

33: (HOLARCTIC,(LEMURIA,(NEW ZEALAND,WEST AFRICA)))

34: (((((((SULU SEA,MELANESIA),(POLYNESIA,NEW CALEDONIA)),(SUBCOTINENT,ASIA)),NEW ZEALAND),WEST AFRICA),LEMURIA),HOLARCTIC)

35: (HOLARCTIC,(LEMURIA,(MELANESIA,WEST AFRICA)))

36: (HOLARCTIC,(LEMURIA,((MELANESIA,AUSTRALIA),WEST AFRICA)))

37: ((((((MICRONESIA,ASIA),((SULU SEA,MELANESIA),(POLYNESIA,NEW CALEDONIA))),NEW ZEALAND),WEST AFRICA),LEMURIA),HOLARCTIC)

38: (HOLARCTIC,(LEMURIA,(NEW ZEALAND,WEST AFRICA)))

Appendix C: Raw measurement data for the species of *Candidomiris-Morobea*. Abbreviations: AI-AIV = Antennal segment one to antennal segment four, CC = Length from cuneus to clypeus, CL = Length of cuneus, IOD = Inter-ocellic dimension, LH = Head length, LM = Length of mesoscutum, LP = Length of pronotum, LS = Length of scutellum, PW = Width of pronotum, TL = Total length, WA = Width of anterior lobe of the pronotum, WC = Width of cuneus, WH = Width of head, WP = Width of posterior lobe of pronotum, WS = Width of the scutellum.

	TL	**CC**	**LH**	**LP**	**LPP**	**LM**	**LS**	**LC**	**WC**	**WH**	**WP**	**WA**	**WS**	**IOD**	**A1**	**A2**	**A3**	**A4**
Bucculagrandis Bucculagrandis morobiensis																		
Females																		
f1	3.43	2.24	0.28	0.29	0.34	0.08	0.30	0.58	0.26	0.67	0.86	0.62	0.34	0.33	0.27	1.19	0.94	0.85
f2	3.08	2.00	0.24	0.32	0.32	0.09	0.25	0.62	0.17	0.65	0.76	0.58	0.29	0.32	0.25	0.86	0.75	0.93
f3	3.40	2.17	0.23	0.30	0.35	0.06	0.29	0.60	0.21	0.62	0.78	0.58	0.34	0.32	0.33	0.72	0.68	0.97
f4	3.27	2.18	0.24	0.27	0.32	0.12	0.33	0.51	0.25	0.65	0.86	0.63	0.36	0.33	0.26	1.10	0.88	1.14
f5	3.00	1.98	0.18	0.29	0.29	0.10	0.28	0.56	0.25	0.57	0.67	0.49	0.30	0.28	0.32	1.01	0.82	0.91
Males																		
m1	2.84	1.91	0.20	0.25	0.31	0.08	0.24	0.43	0.23	0.58	0.66	0.41	0.32	0.25	0.30	0.94	0.80	0.84
m2	3.29	2.28	0.28	0.26	0.34	0.10	0.32	0.48	0.25	0.67	0.80	0.53	0.37	0.26	0.32	1.10	0.67	0.92
m3	3.25	2.23	0.34	0.22	0.34	0.07	0.30	0.54	0.22	0.61	0.80	0.44	0.36	0.22				
m4	3.23	2.34	0.28	0.25	0.34	0.09	0.31	0.45	0.22	0.60	0.77	0.47	0.35	0.26	0.35	1.20	0.74	
m5	3.27	2.26	0.31	0.24	0.34	0.08	0.31	0.51	0.23	0.64	0.80	0.49	0.36	0.24	0.32	1.10	0.59	0.92

Appendix C continued

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Candidomiris																		
Candidomiris albomaculata																		
Females																		
f1	3.71	2.50	0.25	0.22	0.37	0.09	0.37	0.63	0.30	0.56	0.89	0.42	0.44	0.22	0.41	1.26	0.64	0.99
f2	3.90	2.62	0.26	0.24	0.43	0.03	0.37	0.74	0.30	0.60	1.04	0.54	0.40	0.28	0.50	1.36		
Males																		
m1	4.21	2.87	0.36	0.24	0.43	0.06	0.38	0.75	0.20	0.65	0.87	0.51	0.38	0.22	0.69	1.75	0.44	0.27
m2	3.98	2.67	0.34	0.22	0.44	0.08	0.41	0.73	0.28	0.70	1.01	0.47	0.45	0.23	0.52	1.60	0.84	0.88
m3	4.30	2.78	0.29	0.23	0.44	0.04	0.37	0.75	0.23	0.65	0.97	0.56	0.44	0.24	0.61	1.68	0.59	1.16
Candidomiris clavatasclerita																		
Females																		
f1	4.03	2.63	0.27	0.25	0.46	0.04	0.38	0.69	0.34	0.70	1.03	0.53	0.45	0.35	0.47	1.36	0.86	1.00
f2	3.93	2.59	0.28	0.24	0.43	0.05	0.38	0.66	0.23	0.65	0.91	0.46	0.42	0.30	0.50	1.43	0.90	0.99
f3	3.52	2.43	0.29	0.24	0.34	0.10	0.36	0.50	0.34	0.68	0.91	0.53	0.41	0.34				
Males																		
m1	4.05	2.70	0.35	0.26	0.47	0.05	0.40	0.70	0.19	0.65	0.79	0.44	0.40	0.31	0.39	1.50	0.94	0.77
m2	3.77	2.53	0.24	0.24	0.45	0.04	0.38	0.63	0.32	0.69	0.95	0.48	0.44	0.33	0.45	1.57	0.96	0.99
m3	3.62	2.42	0.32	0.24	0.43	0.04	0.34	0.65	0.26	0.62	0.90	0.43	0.46	0.31				

Appendix C continued

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Candidomiris cyrtandraphila																		
Females																		
f1	4.08	2.74	0.27	0.20	0.42	0.05	0.41	0.75	0.30	0.60	0.98	0.45	0.50	0.27	0.50	1.30	0.78	1.28
Males																		
m1	4.05	2.85	0.27	0.23	0.48	0.09	0.37	0.68	0.37	0.61	0.98	0.43	0.43	0.29	0.52	1.63	1.09	1.16
Candidomiris macropiper																		
Females																		
f1	3.85	2.76	0.30	0.26	0.42	0.13	0.41	0.64	0.37	0.60	0.90	0.50	0.48	0.27	0.50	1.25	0.63	
Males																		
m1	4.28	2.93	0.31	0.26	0.46	0.03	0.45	0.73	0.22	0.74	1.07	0.56	0.49	0.23	0.46	1.74	0.89	1.44
m2	3.67	2.49	5.12	0.23	0.42	0.04	0.35	0.61	0.25	0.64	0.95	0.49	0.45	0.24	0.54	1.20		
m3	4.05	2.74	0.38	0.23	0.41	0.09	0.40	0.74	0.28	0.63	0.90	0.44	0.42	0.22	0.59	1.35	0.75	6.31
m4	3.60	2.54	0.29	0.25	0.41	0.03	0.37	0.61	0.30	0.63	0.91	0.47	0.46	0.21	0.56	1.37	0.60	0.90
Candidomiris missimensi																		
Females																		
f1	4.59	3.36	0.37	0.32	0.48	0.06	0.43	0.55	0.24	0.64	0.99	0.46	0.53	0.23	0.76	1.71		
f2	4.60	3.33	0.38	0.32	0.49	0.08	0.44	0.62	0.22	0.63	1.03	0.48	0.50	0.28	0.63	1.80	0.78	0.71
Males																		
m1	4.61	3.46	0.35	0.35	0.49	0.04	0.46	0.58	0.26	0.66	1.05	0.50	0.49	0.26	0.70	1.82		

Appendix C continued

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Candidomiris parasponius																		
Females																		
f1	4.69	3.23	0.32	0.33	0.45	0.09	0.49	0.72	0.34	0.65	1.02	0.59	0.51	0.30	0.40	1.80	1.17	1.08
Males																		
m1	4.57	3.02	0.39	0.24	0.47	0.05	0.44	0.77	0.21	0.64	1.01	0.41	0.52	0.14	0.44	2.04	0.93	1.46
m2	4.62	2.93	0.38	0.25	0.53	0.04	0.41	0.51	0.34	0.77	1.24	0.56	0.53	0.23	0.57	1.87	1.28	1.09
m3	4.45	2.94	0.31	0.24	0.44	0.05	0.53	0.80	0.28	0.73	1.10	0.60	0.49	0.25	0.53	2.09	1.02	0.97
m4	4.78	3.16	0.35	0.25	0.50	0.04	0.50	0.84	0.28	0.78	1.14	0.54	0.49	0.25	0.50	1.88		
m5	4.21	3.03	0.33	0.24	0.53	0.07	0.42	0.59	0.23	0.76	1.15	0.59	0.51	0.24	0.55	2.05	1.28	0.87
Candidomiris sinuata																		
Males																		
m1	4.20	2.74	0.31	0.19	0.44	0.03	0.39	0.88	0.29	0.71	1.00	0.49	0.48	0.22	0.40	1.61	0.67	0.71
m2	4.45	2.78	0.37	0.22	0.45	0.07	0.36	0.91	0.32	0.73	1.01	0.54	0.48	0.23	0.59	1.74	0.72	1.29
m3	4.43	2.91	0.37	0.18	0.41	0.04	0.45	0.86	0.27	0.70	0.96	0.55	0.48	0.23	0.50	1.56		
Dimifacoris Dimifacoris bifurcatus																		
Females																		
f1	4.28	2.98	0.32	0.29	0.41	0.04	0.43	0.72	0.26	0.55	0.97	0.62	0.47	0.25	0.63	1.78	1.29	
f2	4.38	3.12	0.34	0.31	0.41	0.05	0.41	0.74	0.32	0.63	0.98	0.64	0.53	0.30	0.65	1.84	1.05	0.89
f3	4.63	3.11	0.38	0.26	0.43	0.07	0.45	0.81	0.35	0.57	1.05	0.64	0.48	0.28	0.74	1.64	1.35	
f4	4.62	3.06	0.34	0.30	0.43	0.06	0.46	0.73	0.24	0.63	1.08	0.66	0.52	0.30	0.80	2.03	1.55	1.02
f5	4.67	3.16	0.33	0.33	0.39	0.04	0.48	0.86	0.33	0.62	1.00	0.62	0.51	0.31				

Appendix C continued

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Males																		
m1	4.25	3.01	0.36	0.30	0.35	0.05	0.42	0.61	0.21	0.57	0.88	0.54	0.45	0.25	0.54	1.49		
m2	4.17	2.84	0.25	0.25	0.39	0.07	0.44	0.65	0.26	0.57	0.94	0.58	0.49	0.28	0.63	1.72	1.14	0.99
m3	4.22	2.99	0.37	0.35	0.37	0.04	0.38	0.63	0.30	0.58	0.98	0.57	0.47	0.27	0.57	1.88	1.41	
m4	3.85	2.75	0.32	0.30	0.35	0.04	0.38	0.56	0.23	0.56	0.81	0.53	0.40	0.27	0.59	1.70	1.28	0.80
m5	3.96	2.82	0.33	0.27	0.36	0.06	0.38	0.56	0.27	0.55	0.88	0.55	0.47	0.26	0.67	1.55	1.32	0.92
Dimifacoris fasciatus																		
Females																		
f1	4.64	2.78	0.33	0.64	0.38	0.06	0.45	0.76	0.28	0.59	0.94	0.44	0.49	0.23	0.64	2.92	-	-
Males																		
m1	4.78	2.83	0.30	0.68	0.41	0.08	0.47	0.81	0.30	0.57	0.96	0.47	0.53	0.20	0.59	-	-	-
Dimifacoris leva																		
Females																		
f1	3.49	2.60	0.35	0.23	0.31	0.02	0.33	0.62	0.19	0.50	0.77	0.48	0.40	0.23	0.54	1.51	0.95	0.90
f2	3.73	2.58	0.35	0.25	0.36	0.02	0.32	0.55	0.23	0.53	0.76	0.51	0.37	0.24	0.51	1.34	1.04	
f3	3.40	2.25	0.27	0.22	0.30	0.03	0.33	0.68	0.20	0.47	0.67	0.43	0.33	0.20	0.51	1.17	0.66	0.34
f4	3.58	2.40	0.26	0.20	0.34	0.03	0.32	0.61	0.21	0.48	0.77	0.44	0.38	0.20	0.50	1.41		

Appendix C continued

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
m1	3.43	2.44	0.26	0.22	0.32	0.06	0.37	0.53	0.24	0.51	0.76	0.47	0.38	0.22	0.53	1.45	1.02	
m2	3.55	2.41	0.28	0.21	0.32	0.03	0.33	0.61	0.16	0.49	0.80	0.48	0.38	0.23	0.51	1.43	0.86	0.81
m3	3.85	2.60	0.31	0.26	0.32	0.04	0.32	0.69	0.24	0.48	0.84	0.48	0.39	0.22	0.53	1.33	1.04	0.79
m4	3.40	2.34	0.28	0.19	0.31	0.04	0.32	0.62	0.21	0.50	0.71	0.41	0.37	0.22	0.53	1.47	0.98	0.80
m5	3.38	2.35	0.25	0.23	0.32	0.02	0.31	0.70	0.18	0.51	0.72	0.45	0.29	0.22	0.44	1.48	0.95	0.86
Dimifacoris splendida																		
Females																		
f1	4.42	3.27	0.44	0.38	0.31	0.09	0.56	0.97	0.54	0.78	0.95	0.84	0.67	0.28	0.54	1.83	1.35	0.86
f2	4.55	3.13	0.47	0.36	0.27	0.08	0.57	0.91	0.51	0.69	0.99	0.82	0.62	0.30	0.61	1.80	1.35	0.94
f3	4.69	2.98	0.52	0.29	0.25	0.08	0.63	0.88	0.53	0.65	0.91	0.78	0.58	0.27	0.58	1.76	1.43	1.01
f4	4.70	3.07	0.58	0.27	0.29	0.08	0.66	0.79	0.58	0.60	0.85	0.88	0.53	0.30	0.67	1.86	1.38	1.00
Males																		
m1	4.53	3.21	0.47	0.38	0.29	0.10	0.48	0.92	0.49	0.69	1.00	0.78	0.64	0.32	0.63	1.72	1.25	0.94
m2	4.63	3.25	0.54	0.39	0.32	0.10	0.49	0.92	0.45	0.64	0.96	0.78	0.54	0.34	0.56	1.70	1.20	1.01
m3	4.73	3.21	0.55	0.37	0.29	0.08	0.49	0.87	0.43	0.58	0.96	0.73	0.61	0.33	0.64	1.76	1.11	0.93
m4	4.69	3.28	0.58	0.35	0.29	0.09	0.48	0.82	0.41	0.65	0.99	0.76	0.62	0.33	0.64	1.64	1.06	0.93
m5	4.81	3.31	0.65	0.39	0.30	0.07	0.56	0.85	0.43	0.72	0.90	0.67	0.61	0.34	0.71	1.56	1.00	0.98

Appendix C continued

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Dimifacoris trifurcatus																		
Females																		
f1	3.56	2.44	0.29	0.27	0.33	0.03	0.32	0.69	0.23	0.51	0.85	0.53	0.40	0.24	0.44	1.55	0.95	0.66
f2	3.88	2.50	0.25	0.16	0.33	0.05	0.35	0.82	0.24	0.51	0.88	0.53	0.42	0.25	0.51	1.57	0.99	0.81
f3	3.67	2.83	0.34	0.30	0.37	0.04	0.38	0.58	0.27	0.59	0.85	0.54	0.45	0.28	0.68	1.78	1.41	1.04
f4	3.62	2.42	0.27	0.22	0.32	0.04	0.29	0.67	0.14	0.50	0.77	0.44	0.36	0.22	0.42	1.41	0.70	0.85
f5	3.50	2.38	0.28	0.23	0.33	0.07	0.24	0.62	0.24	0.50	0.80	0.51	0.33	0.21	0.51	1.51	0.93	0.76
Males																		
m1	3.65	2.65	0.31	0.28	0.33	0.07	0.33	0.49	0.24	0.54	0.82	0.53	0.43	0.26	0.58	1.66	1.16	0.68
m2	3.85	2.75	0.32	0.30	0.35	0.04	0.38	0.56	0.23	0.56	0.81	0.53	0.40	0.27	0.59	1.70	1.28	0.80
m3	3.67	2.63	0.27	0.27	0.36	0.06	0.36	0.60	0.23	0.54	0.86	0.50	0.40	0.28	0.54	1.37	1.15	0.86
m4	3.62	2.42	0.27	0.22	0.32	0.04	0.29	0.67	0.14	0.50	0.77	0.44	0.36	0.22	0.42	1.41	0.70	0.85
m5	3.50	2.38	0.28	0.23	0.33	0.07	0.24	0.62	0.24	0.50	0.80	0.51	0.33	0.21	0.51	1.51	0.93	0.76
Elongatoductus Elongatoductus walli																		
Females																		
f1	3.91	2.84	0.35	0.31	0.35	0.08	0.40	0.59	0.25	0.73	0.96	0.60	0.47	0.35	0.60	1.91	1.37	1.20
f2	3.78	2.86	0.35	0.25	0.38	0.09	0.40	0.61	0.32	0.74	0.97	0.60	0.49	0.34	0.54	1.88	1.30	1.58
f3	4.06	2.87	0.37	0.28	0.37	0.07	0.38	0.65	0.32	0.75	0.98	0.57	0.46	0.36	0.57	1.59	1.41	1.36
Males																		

Appendix C continued

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
m1	3.53	2.53	0.34	0.24	0.36	0.07	0.36	0.59	0.27	0.72	0.92	0.56	0.43	0.33	0.61	1.87	1.19	1.38
m2	3.71	2.62	0.33	0.29	0.33	0.06	0.43	0.65	0.22	0.69	0.86	0.56	0.43	0.31	0.55	1.88	1.40	1.60
m3	3.36	2.54	0.31	0.23	0.32	0.06	0.40	0.52	0.27	0.67	0.79	0.52	0.49	0.29	0.56	1.76	1.14	1.62
Falcum gen. nov. Falcum austerum																		
Females																		
f1	5.32	3.32	0.37	0.25	0.43	0.05	0.46	0.98	0.32	0.66	1.09	0.65	0.54	0.28	0.70	1.78	1.15	1.61
Males																		
m1	5.26	3.28	0.36	0.25	0.42	0.06	0.46	0.95	0.33	0.66	1.08	0.63	0.53	0.28	0.69	1.74	1.15	1.58
Falcum bulldogensis																		
Females																		
f1	5.24	3.71	0.42	0.28	0.40	0.05	0.49	0.86	0.38	0.65	1.06	0.67	0.50	0.30				
Males																		
m1	5.39	3.83	0.33	0.36	0.48	0.04	0.44	0.87	0.35	0.76	1.17	0.68	0.59	0.29	0.74	1.97		
m2	5.56	3.79	0.48	0.25	0.44	0.06	0.51	1.06	0.33	0.72	1.22	0.63	0.55	0.28	0.86	2.09	1.28	1.81

Appendix C continued

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Falcum gagnei																		
Females																		
f1	5.12	3.23	0.32	0.25	0.40	0.04	0.45	1.08	0.36	0.61	1.04	0.65	0.50	0.28	0.63	1.65	1.10	
f2	4.95	3.26	0.39	0.23	0.43	0.06	0.43	1.00	0.32	0.62	1.03	0.58	0.51	0.26	0.71	1.74	1.20	1.85
f3	4.71	2.90	0.33	0.25	0.39	0.05	0.45	0.77	0.31	0.59	1.00	0.56	0.51	0.25	0.61	1.51	0.93	1.76
Males																		
Falcum kaindiensis																		
Females																		
f1	5.12	3.20	0.36	0.24	0.45	0.05	0.43	1.03	0.34	0.63	1.07	0.72	0.53	0.30	0.71	1.63	1.20	1.28
f2	5.53	3.38	0.31	0.26	0.42	0.04	0.46	1.16	0.12	0.63	1.04	0.66	0.57	0.30				
Males																		
m1	5.38	3.45	0.35	0.17	0.45	0.10	0.49	0.94	0.47	0.72	1.19	0.70	0.58	0.28	0.67	1.85	1.21	1.37
Falcum taiwanensis																		
Females																		
f1	5.65	3.54	0.39	0.28	0.45	0.06	0.50	1.03	0.35	0.70	1.15	0.72	0.58	0.31	0.76	1.87	1.22	1.70
f2	5.69	3.57	0.39	0.27	0.46	0.06	0.49	1.03	0.34	0.71	1.15	0.70	0.57	0.30	0.75	1.87	1.24	
f3	5.59	3.48	0.39	0.27	0.45	0.06	0.49	1.03	0.35	0.71	1.15	0.70	0.58	0.31	0.76	1.87		
m1	5.66	3.52	0.39	0.28	0.45	0.06	0.50	1.03	0.35	0.71	1.15	0.69	0.58	0.31	0.77	1.91	1.23	1.72
m2	5.67	3.54	0.38	0.27	0.46	0.06	0.50	1.03	0.35	0.71	1.16	0.72	0.58	0.30	0.75			
m3	5.65	3.51	0.39	0.27	0.46	0.06	0.50	1.03	0.35	0.69	1.18	0.69	0.58	0.31	0.75	1.90	1.25	

Appendix C continued

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Felisacodes Felisacodes bryocorina																		
Females																		
f1	4.24	2.65	0.31	0.26	0.15	0.04	1.78	0.80	0.29	0.37	0.93	0.48	0.58	0.28	0.55	1.67	0.69	0.81
Males																		
m1																		
Felisacodes diaboura	4.23	2.78	0.30	0.14	0.16	0.03	1.09	0.70	0.34	0.51	0.85	0.54	0.34	0.32	0.64	1.24	0.79	0.75
Females																		
f1	4.10	2.73	0.29	0.23	0.46	0.03	0.37	0.63	0.32	0.70	1.02	0.53	0.44	0.36	0.44	1.57	1.00	0.83
Males																		
m1	4.07	2.69	0.32	0.20	0.43	0.05	0.41	0.82	0.32	0.59	0.99	0.42	0.48	0.24	0.48	1.38	0.44	1.01
Felisacodes uganda																		
Females																		
f1	3.90	2.78	0.31	0.25	0.28	0.05	-0.61	0.72	0.33	0.57	0.98	0.42	0.35	0.35	0.68	1.36	0.68	0.78
f2	4.19	2.77	0.32	0.30	0.50	0.03	0.58	0.74	0.34	0.69	0.82	0.47	0.53	0.27	0.48	1.23	0.71	
f3	3.92	2.75	0.31	0.14	0.50	0.04	-0.35	0.94	0.37	0.75	1.10	0.50	0.39	0.27	0.41	1.80	0.76	
f4	4.24	2.75	0.29	0.13	0.55	0.05	0.07	0.89	0.35	0.78	1.21	0.50	0.54	0.22				
Males																		
m1	3.89	2.67	0.30	0.20	0.45	0.06	1.03	0.47	0.28	0.57	1.18	0.47	0.35	0.37	0.48	1.03	0.68	0.76
m2	4.22	2.62	0.30	0.22	0.61	0.04	-	0.98	0.34	0.60	1.22	0.41	0.42	0.29	0.55			

Appendix C continued

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Flagellomiris Flagellomiris sinuatum																		
Females																		
f1	6.47	4.49	0.46	0.76	0.44	0.19	0.50	0.85	0.41	0.79	1.02	0.63	0.62	0.30	0.81	1.83	-	-
Males																		
m1	6.23	4.38	0.43	0.78	0.41	0.16	0.47	0.83	0.38	0.75	1.00	0.59	0.65	0.28	0.80	-	-	-
Flagellomiris tasmaniensis																		
Females																		
f1	5.64	3.85	0.38	0.34	0.40	0.18	0.54	1.07	0.51	0.80	1.21	0.63	0.64	0.27	0.68	2.33	1.18	0.55
f2	5.70	4.02	0.42	0.30	0.44	0.17	0.60	0.93	0.40	0.84	1.22	0.69	0.62	0.33	0.65	2.29	1.21	0.38
f3	5.69	3.89	0.40	0.31	0.37	0.27	0.57	0.87	0.45	0.85	1.19	0.64	0.65	0.32	0.61	2.24	1.23	0.93
f4	5.47	4.00	0.48	0.34	0.45	0.11	0.56	0.87	0.35	0.81	1.17	0.58	0.61	0.31	0.72	2.32	1.15	0.53
f5	5.88	4.35	0.50	0.38	0.43	0.24	0.62	0.88	0.33	0.89	1.23	0.65	0.65	0.33	0.65	2.40	1.14	0.55
Males																		
m1	5.23	3.85	0.34	0.33	0.32	0.24	0.54	0.77	0.31	0.85	1.08	0.59	0.59	0.23	0.79	2.59	1.29	0.61
m2	4.99	3.58	0.40	0.30	0.41	0.14	0.46	0.80	0.38	0.85	1.05	0.67	0.55	0.26	0.71	2.20	1.21	0.39
m3	5.16	3.65	0.41	0.29	0.43	0.13	0.50	0.78	0.41	0.79	1.10	0.56	0.58	0.26	0.71	2.39	1.31	0.39
m4	5.09	3.05	0.39	0.33	0.33	0.21	0.45	0.77	0.33	0.86	1.00	0.88	0.56	0.30	0.69	2.25	1.21	0.45
m5	5.36	3.61	0.43	0.34	0.36	0.17	0.50	0.91	0.36	0.84	1.09	0.62	0.60	0.28	0.73	2.43	1.25	

Appendix C continued

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Jimia																		
Jimia bimaculata																		
Females																		
f1	2.97	2.16	0.30	0.23	0.21	0.08	0.39	0.43	0.42	0.59	1.04	0.65	0.53	0.27	0.29	0.94	0.57	1.08
f2	3.17	2.16	0.27	0.23	0.20	0.12	0.41	0.53	0.41	0.60	1.11	0.69	0.52	0.29	0.28	0.88	0.60	0.91
f3	3.23	2.34	0.28	0.23	0.24	0.11	0.46	0.51	0.36	0.59	1.08	0.66	0.54	0.29	0.27	0.88	0.62	0.92
f4	3.20	2.22	0.25	0.22	0.21	0.11	0.43	0.54	0.34	0.55	0.97	0.57	0.51	0.26	0.26	0.84	0.69	0.86
f5	3.06	2.17	0.26	0.17	0.19	0.12	0.43	0.47	0.37	0.59	1.05	0.62	0.51	1.97	0.27	0.92	0.65	0.91
Males																		
m1	3.02	2.11	0.22	0.21	0.22	0.15	0.41	0.47	0.26	0.56	0.94	0.58	0.50	0.26	0.23	0.93	0.64	1.00
m2	3.30	2.32	0.26	0.25	0.20	0.13	0.42	0.53	0.41	0.56	0.99	0.59	0.52	0.27	1.20	0.94	0.64	1.03
m3	3.08	2.27	0.29	0.26	0.22	0.13	0.42	0.46	0.32	0.56	0.98	0.58	0.51	0.25	0.29	0.93	0.67	0.94
m4	2.96	2.20	0.30	0.24	0.21	0.12	0.41	0.43	0.33	0.58	1.03	0.58	0.53	0.25	0.24	0.93	0.64	0.98
m5	2.98	2.05	0.22	0.20	0.22	0.13	0.40	0.55	0.39	0.60	1.02	0.56	0.51	0.26	0.25	0.95	0.65	0.89
Jimia spectabilis																		
Females																		
f1	2.75	2.09	0.26	0.18	0.23	0.09	0.39	0.42	0.28	0.59	0.99	0.64	0.49	0.24				
Males																		
m1	2.60	1.88	0.24	0.15	0.22	0.08	0.39	0.44	0.30	0.56	0.95	0.56	0.47	0.24				
m2	2.38	1.65	0.24	0.15	0.22	0.06	0.28	0.42	0.32	0.53	0.84	0.52	0.40	0.19	0.25	0.84	0.48	

Appendix C continued

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Morobea Morobea longipes																		
Females																		
f1	6.21	4.68	0.49	0.50	0.50	0.11	0.87	1.09	0.39	0.76	1.44	0.65	0.67	0.30	1.01	3.16	1.71	1.53
Males																		
m1	5.88	4.20	0.38	0.51	0.74	0.13	0.56	1.10	0.29	0.80	1.19	0.67	0.59	0.35	1.06	3.09	1.45	1.84
Morobea spectabilis																		
Males																		
m1	6.06	5.42	0.44	0.44	0.50	0.73	2.22	0.08	0.32	0.83	1.35	0.72	0.66	0.37	1.01	2.99	1.73	
m2	6.59	4.66	0.55	0.41	0.50	0.05	0.73	1.17	0.38	0.88	1.41	0.73	0.69	0.41	0.90	3.29	1.81	2.27
Nerubia Nerubia dentomembrana																		
f1	3.07	1.99	0.22	0.24	0.27	0.07	0.38	0.59	0.39	0.57	0.92	0.50	0.45	0.21	0.37	0.93	0.64	0.66
f2	3.21	2.17	0.28	0.26	0.26	0.10	0.28	0.54	0.42	0.63	0.98	0.57	0.41	0.22	0.40	0.95	0.66	0.66
f3	3.11	2.10	0.31	0.21	0.30	0.03	0.35	0.61	0.41	0.56	0.90	0.48	0.48	0.26	0.40	1.07	0.57	0.56
f4	3.21	2.16	0.28	0.25	0.28	0.05	0.37	0.57	0.38	0.63	0.96	0.48	0.49	0.19	0.40	1.02	0.68	
f5	2.91	1.92	0.26	0.20	0.27	0.05	0.33	0.55	0.44	0.57	0.90	0.44	0.44	0.24	0.41	0.90	0.59	

Appendix C continued

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
m1	2.76	1.86	0.24	0.22	0.22	0.05	0.37	0.58	0.37	0.55	0.87	0.46	0.42	0.21	0.37	0.97	0.62	0.59
m2	3.08	2.01	0.26	0.21	0.29	0.04	0.38	0.66	0.35	0.57	0.91	0.51	0.49	0.24	0.43	0.96	0.63	0.75
m3	2.82	1.96	0.27	0.22	0.28	0.04	0.37	0.51	0.41	0.55	0.83	0.47	0.44	0.22	0.44	1.00	0.57	0.61
m4	3.38	2.14	0.28	0.22	0.34	0.06	0.37	0.69	0.43	0.58	1.00	0.48	0.49	0.21	0.41	1.02	0.65	0.65
m5	2.75	1.84	0.26	0.16	0.29	0.03	0.33	0.55	0.32	0.55	0.87	0.45	0.41	0.18	0.39	0.98	0.69	0.77
Nerubia viridis																		
Females																		
f1	3.07	2.26	0.25	0.20	0.37	0.04	0.37	0.35	0.32	0.60	0.96	0.50	0.44	0.29	0.40			
Males																		
m1	2.58	2.02	0.26	0.11	0.35	0.06	0.36	0.28	0.25	0.54	0.85	0.46	0.39	0.21	0.36	1.17		
m2	2.49	1.95	0.27	0.18	0.33	0.03	0.34	0.21	0.27	0.60	0.89	0.56	0.41	0.27	0.33	1.23	0.54	
Novacalecoris Novacalecoris bisclerita																		
Females																		
f1	3.26	2.17	0.26	0.17	0.26	0.11	0.27	0.54	0.23	0.44	0.77	0.46	0.38	0.25	0.22	1.33	0.62	0.81
f2	3.11	2.07	0.21	0.19	0.25	0.05	0.19	0.43	0.29	0.43	0.79	0.45	0.30	0.23	0.23	1.23	0.66	0.61
f3	2.48	1.76	0.12	0.19	0.23	0.07	0.26	0.41	0.20	0.42	0.76	0.47	0.31	0.22	0.27	1.10	0.56	0.66
f4	3.11	2.15	0.26	0.14	0.25	0.11	0.34	0.54	0.24	0.47	0.76	0.42	0.39	0.26				

Appendix C continued

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
m1	3.14	2.08	0.25	0.16	0.29	0.08	0.32	0.58	0.24	0.47	0.76	0.42	0.36	0.26	0.25	1.14	0.68	0.98
m2	2.88	2.02	0.19	0.21	0.20	0.12	0.28	0.45	0.27	0.47	0.75	0.43	0.41	0.27	0.25	1.37	0.76	0.78
m3	2.71	1.96	0.19	0.17	0.22	0.06	0.28	0.50	0.21	0.47	0.79	0.43	0.37	0.26	0.24	1.22	0.74	0.81
m4	2.51	1.01	0.18	0.20	0.26	0.08	0.03	1.01	0.90	0.45	1.23	0.66	0.40	0.23	0.27	1.25	0.61	0.65
Novacalecoris gressiti																		
Females																		
f1	2.43	1.73	0.17	0.14	0.24	0.06	0.34	0.35	0.31	0.55	0.87	0.59	0.43	0.28	0.21	0.98	0.67	0.47
f2	2.48	1.78	0.22	0.19	0.22	0.08	0.29	0.37	0.32	0.52	0.82	0.54	0.41	1.95	0.22	0.97	0.58	
f3	2.42	1.85	0.22	0.18	0.27	0.04	0.29	0.27	0.29	0.52	5.39	0.55	0.42	0.28	0.20	1.09	0.64	0.40
f4	2.55	1.84	0.17	0.16	0.27	0.12	0.31	0.31	0.38	0.56	0.91	0.62	0.46	0.29	0.22	0.88	0.57	
Males																		
m1	2.56	1.82	0.19	0.18	0.25	0.08	0.32	0.35	0.28	0.57	0.91	0.60	0.50	0.28	0.25			
Novacalecoris kraussi																		
Females																		
f1	2.98	2.10	0.25	0.19	0.25	0.08	0.30	0.47	0.29	0.52	0.78	0.50	0.38	0.27	0.25	1.23	0.85	0.68
f2	3.08	2.13	0.25	0.20	0.25	0.08	0.31	0.48	0.28	0.50	0.76	0.52	0.37	0.26	0.26	1.27	0.86	0.66
Males																		
m1	3.00	2.06	0.26	0.19	0.24	0.08	0.31	0.46	0.30	0.50	0.77	0.48	0.40	0.27	0.24	1.25	0.89	0.65
m2	2.96	2.03	0.26	0.19	0.23	0.08	0.29	0.47	0.29	0.51	0.75	0.50	0.37	0.26	0.24			
m3	3.07	2.02	0.25	0.18	0.25	0.08	0.30	0.48	0.30	0.51	0.82	0.49	0.37	0.28	0.25	1.28	0.85	
m4	3.01	2.12	0.24	0.19	0.23	0.08	0.29	0.50	0.29	0.51	0.74	0.51	0.40	0.26	0.25	1.20	0.82	

Appendix C continued

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Novacalecoris macca																		
Females																		
f1	2.10	1.60	0.18	0.16	0.24	0.03	0.30	0.40	0.26	0.54	0.87	0.59	0.45	0.30	0.25	0.79	0.42	
f2	2.24	1.60	0.16	0.18	0.22	0.06	0.27	0.30	0.31	0.56	0.88	0.56	0.42	0.28	0.18	0.74	0.54	
f3	2.22	1.70	0.18	0.18	0.24	0.05	0.35	0.33	0.28	0.53	0.90	0.58	0.47	0.26	0.19	0.91	0.55	0.37
f4	2.84	2.03	0.22	0.19	0.30	0.02	0.38	0.45	0.39	0.56	0.95	0.61	0.52	0.29	0.27	0.80	0.50	0.47
f5	2.29	1.76	0.18	0.15	0.25	0.06	0.31	0.31	0.30	0.57	0.89	0.61	0.44	0.28	0.19	0.87		
Males																		
m1	2.70	1.85	0.19	0.18	0.26	0.03	0.36	0.44	0.38	0.55	0.88	0.59	0.47	0.28	0.25	0.81	0.67	0.35
m2	2.21	1.67	0.19	0.15	0.25	3.15	3.10	0.38	0.27	0.56	0.86	0.62	0.42	0.30	0.22	0.92	0.55	0.27
m3	1.98	1.58	0.21	0.16	0.21	0.02	0.26	0.36	0.24	0.45	0.73	0.45	0.37	0.23	0.20	0.80	0.55	0.44
m4	1.98	1.66	0.23	0.18	0.27	0.06	0.27	0.35	0.32	0.54	0.85	0.51	0.45	0.27	0.18	1.06	0.61	0.41
m5	2.72	2.05	0.26	0.20	0.27	0.07	0.34	0.31	0.31	0.54	0.91	0.57	0.46	0.27	0.21	0.95	0.51	
Novacalecoris monteithi																		
Females																		
f1	3.03	2.08	0.25	0.18	0.25	0.05	0.33	0.55	0.31	0.55	0.77	0.53	0.40	0.27	0.27	1.07	0.89	0.68
f2	2.89	2.03	0.22	0.18	0.25	0.08	0.33	0.47	0.39	0.53	0.77	0.52	0.38	0.25	0.25	1.15	1.00	0.70
f3	3.00	2.10	0.30	0.17	0.24	0.09	0.31	0.37	0.30	0.55	0.78	0.53	0.37	0.26	0.26	1.29	0.95	0.72
f4	2.79	1.95	0.21	0.18	0.21	0.10	0.30	0.51	0.27	0.55	0.77	0.54	0.40	0.27	0.22	1.26	0.82	0.64
f5	2.78	1.89	0.27	0.15	0.23	0.04	0.30	0.44	0.31	0.53	0.75	0.48	0.36	0.25	0.23	1.27	0.84	0.67

Appendix C continued

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Males																		
m1	2.99	2.01	0.28	0.19	0.21	0.04	0.26	0.49	0.31	0.55	0.83	0.55	0.38	0.26	0.30	1.28	0.97	0.76
m2	2.91	1.95	0.26	0.18	0.23	0.06	0.30	0.52	0.28	0.53	0.77	0.54	0.41	0.23	0.23	1.23	0.94	0.71
m3	2.90	1.97	0.25	0.17	0.26	0.06	0.31	0.52	0.30	0.58	0.82	0.55	0.39	0.28	0.25	1.30	0.95	0.81
m4	2.87	2.00	0.23	0.17	0.24	0.08	0.31	0.51	0.32	0.54	0.80	0.49	0.40	0.26	0.26	1.35	0.98	0.63
m5	2.57	1.81	0.21	0.18	0.23	0.06	0.30	0.48	0.32	0.50	0.70	0.43	0.38	0.19	0.26			
Novacalecoris rubrafasciae																		
Females																		
f1	2.83	2.10	0.28	0.23	0.25	0.09	0.28	0.47	0.32	0.57	0.82	0.53	0.41	0.30	0.26	1.35	1.05	0.74
f2	2.96	2.22	0.31	0.20	0.26	0.07	0.32	0.43	0.33	0.56	0.78	0.47	0.42	0.29	0.25	1.09	0.94	0.56
f3	3.15	2.21	0.33	0.19	0.27	0.07	0.31	0.53	0.31	0.58	0.83	0.53	0.40	0.31	0.28	1.27	1.00	0.68
f4	3.16	2.27	0.27	0.24	0.23	0.11	0.33	0.48	0.30	0.56	0.78	0.54	0.43	0.30	0.25	1.23	1.11	0.71
f5	3.24	2.35	0.29	0.25	0.25	0.10	0.35	0.49	0.32	0.58	0.77	0.51	0.41	0.32	0.20	1.31	0.64	0.67
Males																		
m1	2.66	1.98	0.28	0.22	0.23	0.07	0.29	0.44	0.30	0.57	0.82	0.52	0.41	0.30	0.27	1.33	1.00	0.80
m2	3.05	2.18	0.30	0.19	0.24	0.09	0.32	0.48	0.29	0.56	0.78	0.51	0.42	0.29	0.27	1.38	1.03	0.69
m3	2.87	2.14	0.30	0.18	0.26	0.09	0.33	0.41	0.32	0.57	0.79	0.48	0.41	0.33	0.24	1.34	0.97	0.75
m4	3.05	2.20	0.24	0.22	0.25	0.07	0.31	0.41	0.31	0.57	0.87	0.53	0.42	0.29	0.27	1.39	1.02	0.83
m5	2.96	2.23	0.27	0.20	0.24	0.19	0.33	0.41	0.32	0.57	0.84	0.51	0.42	0.31	0.28	1.44	1.09	0.76

Appendix C continued

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Novacalecoris tatarnici																		
Females																		
f1	2.89	2.03	0.20	0.21	0.22	0.06	0.31	0.47	0.32	0.57	0.78	0.49	0.42	0.26	0.25	1.35	1.13	0.79
f2	2.71	1.86	0.23	0.18	0.23	0.06	0.29	0.49	0.32	0.56	0.78	0.55	0.40	0.25	0.30	1.37	1.10	
f3	2.74	1.85	0.27	0.20	0.23	0.03	0.28	0.41	0.29	0.51	0.68	0.46	0.37	0.24	0.28	1.25	1.03	0.54
f4	2.57	1.83	0.28	0.20	0.22	0.04	0.27	0.39	0.35	0.49	0.68	0.43	0.34	0.19	0.26	1.16	1.18	0.70
f5	2.81	1.99	0.26	0.19	0.25	0.06	0.29	0.50	0.27	0.50	0.73	0.48	0.37	0.20	0.28	1.24	1.12	0.64
Males																		
m1	2.62	1.74	0.25	0.16	0.23	0.04	0.29	0.52	0.35	0.54	0.73	0.47	0.41	0.23	0.23	1.32	1.21	0.57
Novacalecoris turpa																		
Females																		
f1	2.83	1.95	0.25	0.19	0.24	0.08	0.28	0.50	0.34	0.52	0.81	0.49	0.39	0.26	0.26	1.30	0.96	0.75
f2	2.96	2.10	0.25	0.19	0.25	0.08	0.30	0.47	0.29	0.52	0.78	0.50	0.38	0.27	0.25	1.23	0.85	
Males																		
m1	2.51	1.01	0.18	0.20	0.26	0.08	0.03	1.01	0.90	0.45	1.23	0.66	0.40	0.23	0.27	1.25	0.61	
m2	2.66	1.98	0.28	0.22	0.23	0.07	0.29	0.44	0.30	0.57	0.82	0.52	0.41	0.30	0.27	1.33	1.00	

Appendix C continued

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Prosoponomiris mimetica																		
Females																		
f1	3.07	2.17	0.26	0.31	0.24	0.02	0.27	0.55	0.33	0.62	0.83	0.63	0.24	0.33	0.22	1.00	0.81	0.95
f2	2.79	2.03	0.25	0.16	0.31	0.02	0.29	0.42	0.28	0.58	0.77	0.57	0.33	0.31	0.26	1.11	0.75	0.90
f3	1.97	2.01	0.19	0.25	0.28	0.03	0.25	0.45	0.20	0.60	0.79	0.60	0.27	0.31	0.24	1.01	0.77	0.94
f4	2.96	2.38	0.25	0.27	0.31	0.07	0.35	0.34	0.26	0.61	0.80	0.58	0.33	0.29	0.25	1.17	0.79	1.06
f5	3.27	2.37	0.26	0.28	0.31	0.08	0.40	0.53	0.26	0.58	0.80	0.60	0.41	0.31	0.24	1.01	0.71	0.85
Males																		
m1	2.93	2.00	0.15	0.22	0.27	0.12	0.23	0.37	0.21	0.56	0.79	0.54	0.30	0.26	0.24	1.06	0.77	0.92
m2	2.99	2.14	0.24	0.31	0.27	0.01	0.32	0.47	0.24	0.71	0.81	0.61	0.41	0.23	0.25	1.16	0.78	1.03
m3	2.90	2.00	0.20	0.25	0.26	0.03	0.33	0.51	0.25	0.63	0.83	0.60	0.33	0.26	0.25	0.96	0.63	1.02
m4	2.97	2.20	0.29	0.23	0.32	0.05	0.30	0.43	0.23	0.68	0.83	0.55	0.41	0.23	0.25	1.05	0.69	0.94
m5	3.06	2.26	0.27	0.30	0.27	0.05	0.32	0.51	0.27	0.68	0.75	0.56	0.43	0.23	0.25	1.07	0.60	0.97
Saggitacopula Saggitacopula carvalhoi																		
Females																		
f1	4.65	3.17	0.41	0.33	0.51	0.06	0.51	0.71	0.45	0.70	4.24	0.54	0.52	0.32	0.73	2.03	1.46	1.60

Appendix C continued

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Saggitacopula rufescens																		
Females																		
f1	4.63	3.35	0.40	2.73	2.79	0.04	0.51	0.83	0.39	0.73	1.12	0.60	0.54	0.32	0.89	2.51	1.34	1.61
Males																		
m1	4.48	3.25	0.40	0.31	0.46	0.06	0.48	0.71	0.19	0.69	1.02	0.60	0.52	0.30	0.70	2.28		
m2	3.91	2.81	0.32	0.21	0.40	0.03	0.41	0.75	0.28	0.57	0.91	0.59	0.49	0.26	0.49			
m3	5.59	3.93	0.44	0.34	0.52	0.05	0.59	1.04	0.43	0.74	1.17	0.59	0.58	0.30	0.80			
Spinamifera raveni																		
Females																		
f1	3.72	2.65	0.30	0.24	0.30	0.02	0.43	0.62	0.32	0.58	0.99	0.56	0.56	0.24	0.42	1.34	1.04	1.39
f2	3.86	2.76	0.33	0.23	0.34	0.03	0.45	0.73	0.32	0.56	1.03	0.57	0.57	0.21	0.40	1.29	0.97	1.10
Males																		
m1	3.94	2.90	0.34	0.28	0.34	0.02	0.40	0.52	0.33	0.60	0.97	0.58	0.55	0.22	0.44	1.26	0.93	1.05
m2	3.52	2.50	0.29	0.18	0.29	0.02	0.41	0.59	0.27	0.60	1.03	0.59	0.56	0.20	0.36	1.20	1.06	1.11
m3	3.63	2.59	0.34	0.23	0.30	0.03	0.40	0.55	0.31	0.60	1.07	0.60	0.53	0.22	0.35	1.24	1.00	1.18

Appendix C continued

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Tudoris Tudoris solomonensis																		
Females																		
f1	3.26	2.46	0.28	0.34	0.37	0.03	0.29	0.51	0.20	0.54	0.75	0.37	0.30	0.19	0.70	1.03	0.43	
f2	3.15	2.44	0.29	0.47	0.46	0.02	1.37	0.68	0.17	0.78	0.93	0.34	0.39	0.13	0.36	0.87	0.47	
f3	3.12	2.56	0.27	0.31	0.33	0.04	0.43	0.57	0.16	0.20	0.79	0.32	0.29	0.10	1.02	0.96		
f4	3.43	2.36	0.27	0.39	0.29	0.02	0.84	0.27	0.20	0.28	0.67	0.31	0.40	0.20	0.73	1.23	0.45	0.46
f5	3.07	2.48	0.28	0.20	0.25	0.05	0.92	0.48	0.17	0.28	0.55	0.38	0.19	0.26	1.19	0.95	0.37	0.58
Mean	3.21	2.46	0.28	0.34	0.34	0.03	0.77	0.50	0.18	0.42	0.74	0.34	0.31	0.18	0.80	1.01	0.43	0.52
m1	3.45	2.42	0.28	0.47	0.31	0.04	-0.96	0.35	0.23	0.55	0.66	0.44	0.34	0.22	0.36	1.05	0.49	0.38
m2	3.10	2.56	0.28	0.51	0.49	0.04	-0.96	0.64	0.15	0.83	0.61	0.31	0.29	0.12	1.07	0.96	0.40	0.55
m3	3.34	2.49	0.28	0.18	0.23	0.05	0.84	0.44	0.22	0.23	0.60	0.32	0.35	0.18	0.68	1.09		
m4	3.08	2.13	0.25	0.20	0.25	0.08	0.31	0.48	0.29	0.52	0.78	0.52	0.38	0.27	0.26	1.27	0.86	
m5	2.98	2.10	0.25	0.19	0.25	0.08	0.30	0.47	0.28	0.50	0.76	0.50	0.37	0.26	0.25	1.23		

Appendix C continued

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Wumea																		
Wumea cassisi																		
Males																		
m1	5.36	3.76	0.39	0.30	0.51	0.09	0.50	1.02	0.22	0.72	1.17	0.60	0.55	0.32	0.66	2.01		
m2	5.21	3.54	0.49	0.30	0.60	0.06	0.51	0.98	0.26	0.71	1.12	0.61	0.57	0.30	0.80	2.11	1.44	
Wumea clypealis																		
Females																		
f1	4.99	3.35	0.31	0.27	0.45	0.07	0.49	0.80	0.24	0.65	1.01	0.65	0.43	0.30	0.65	2.04	1.31	
f2	5.09	3.87	0.50	0.32	0.50	0.07	0.64	1.03	0.21	0.73	1.11	0.56	0.72	0.33	0.75	2.15	1.41	1.75
f3	4.85	3.66	0.45	0.28	0.46	0.05	0.55	0.90	0.26	0.73	1.06	0.52	0.53	0.33	0.70	2.05		
Males																		
m1	4.64	3.35	0.36	0.24	0.48	0.07	0.50	0.82	0.28	0.69	1.00	0.50	0.52	0.25	0.66	2.06	1.30	1.69
m2	5.04	3.65	0.52	0.31	0.52	0.07	0.57	0.86	0.26	0.75	1.13	0.55	0.55	0.34	0.74	2.15	1.44	
m3	4.96	3.38	0.42	0.29	0.50	0.03	0.59	0.98	0.23	0.72	0.99	0.57	0.60	0.33	0.70	1.97	1.44	0.87
m4	4.92	3.66	0.40	0.29	0.53	0.07	0.57	0.85	0.23	0.71	1.12	0.57	0.54	0.31	0.70	2.28		
m5	4.90	3.69	0.42	0.29	0.47	0.09	0.52	1.00	0.24	0.63	1.15	0.50	0.62	0.31	0.71			
Wumea pilosa																		
Females																		
f1	4.66	3.13	0.32	0.25	0.36	0.04	0.42	0.84	0.20	0.54	0.91	0.54	0.44	0.25	0.57	1.37	0.88	1.13
f2	4.62	3.23	0.30	0.30	0.35	0.06	0.43	0.89	0.28	0.58	0.92	0.60	0.44	0.36	0.61	1.73	1.03	1.28
f3	5.75	3.95	0.39	0.31	0.55	0.03	0.58	1.09	0.22	0.73	1.24	0.71	0.62	0.31	0.77	2.44	1.42	1.30

Appendix C continued

	TL	CC	LH	LP	LPP	LM	LS	LC	WC	WH	WP	WA	WS	IOD	A1	A2	A3	A4
Zanchiella Zanchiella bowkeriae																		
Females																		
f1	4.13	2.81	0.29	0.17	0.35	0.06	0.48	0.75	0.41	0.68	0.96	0.50	0.67	0.25	0.32	1.23	0.79	-
Males																		
m1	3.99	2.69	0.28	0.13	0.30	0.02	0.56	0.81	0.24	0.66	0.92	0.51	0.64	0.28	0.35	1.17	0.83	0.42
Zanchiella sweeti																		
Males																		
m1	3.20	2.22	0.33	0.12	0.33	0.03	0.35	0.58	0.26	0.60	0.88	0.50	0.46	0.27	0.36	1.07	1.21	-

Appendix D: Outgroup analysis script.

```
warn-;
macro -;
macro [5000 ;
macro= ;
log out.out
mxram 1000
tgroup + 1000;
/****Declare variables****/
var:
 outfirst
 outlast
 treeno
 nodeno
 filename
 something [(ntax+900)]
 taxno
 inone
 outmore
 endprog
 type
 taxnot
 fuseno
 ratno
 driftno
 addvar
 backout
 goldst
 nodlabnum
 taxnott
;
/***read file***/
getfname filename read Input File;
```

Appendix D continued

```
Procedure $filename;
/**** set analysis****/
opendlg 80 30 450 125 Important ;
        showtxt 40 10 400 25  Your file must have your outgroups in order from the first you want to use to the last. Remember the first taxon is taxon #0;
        closedlg ;
if ( !exstatus ) proc/;
end;
macfloat 0;
opendlg 80 30 800 175 Choose the type of analysis
        choose type
          350 15 550 18 Ingroup sensitivity analysis reporting the number of times each node is not retained.
          350 35 550 18 Ingroup sensitivity analysis reporting a list of outgroups which do not retain each node.
          350 55 550 18 Outgroup impact analysis reporting the number of nodes not retained at each outgroup.
          350 75 550 18 Outgroup impact analysis reporting a list of nodes not retained at each outgroup;
        choose addvar
             40 10 300 18 Cumulatively adding outgroups at each iteration
          40 35 300 18 Replacing outgroup the outgroups with each iteration;
closedlg ;
if ( !exstatus ) proc/;
end;
opendlg 80 30 350 150 Declare the number of outgroups;
                showtxt 40 10 90 18  first outgroup taxon ;
        spin 0 32767 outfirst 200 10 40 18;
                showtxt 40 35 155 18  last outgroup taxon ;
        spin 1 32767 outlast 200 35 40 18 ;
                showtxt 40 60 155 18  Compared to outgroup ;
        spin 0 32767 goldst 200 60 40 18;
closedlg ;
```

Appendix D continued

```
if ( !exstatus ) proc/;
end;
opendlg 80 30 450 150 Important ;
                showtxt 40 10 190 18  Number of ratchet iterations;
        spin 100 32767 ratno 300 15 40 18;
                showtxt 40 35 190 18  Number of drift cycles;
        spin 10 32767 fuseno 300 35 40 18 ;
                showtxt 40 55 190 18  Number of tree fusing rounds;
        spin 10 32767 fuseno 300 55 40 18 ;
        closedlg ;
if ( !exstatus ) proc/;
end;
report-;

/****make taxa inactive****/
set inone ('outlast+1);
outgroup 'inone';
set endprog ('outlast'-'outfirst');
loop = inact 'outfirst' + 1 'outlast';
taxcode - #inact ;
stop;

/****loop****/
sect:slack 100;
loop = outloop 'outfirst'+ 1 'outlast';
/** set outgroup **/
taxcode + #outloop ;
outgroup #outloop ;
if ('addvar'==1)
if (#outloop > 0)
set backout (#outloop-1);
taxcode - 'backout';
end;
```

Appendix D continued

```
end;
/**run analysis**/
tsave/ ;
keep 0;
progress #outloop 'endprog';
xmult= fuse 'fuseno' ratchet 'ratno' drift 'driftno';

/**save tree**/
taxname = ;
tsave outtree#outloop.ctf ;
save  /;
tsave /;
stop;
end;
if ('addvar'==1)
loop = inloop 'outfirst'+ 1 'outlast';
taxcode + #inloop ;
stop;
end;
/****recover trees****/
keep 0;

set outmore ('outlast'+1);
loop = rectree 'outfirst' + 1 'outlast'
shortread =1 outtree#rectree.ctf;
nelsen * {1};
set treeno ntrees;
tgroup >'outmore' (trees) 'treeno';
stop;
tchoose {trees};

/****set node tag variables****/
```

Appendix D continued

```
set taxnot (ntax+2);
set nodeno (tnodes ['goldst'] + ntax + 1);
loop= someloop ntax + 1 'nodeno'
set something[#someloop] 0;
stop;
set treeno ntrees;

/******************** Test trees for outgroupnum ************************/

if ('type'== 0)
loop = grouploop 'taxnot' + 1 'nodeno'
loop = scoreloop 1 +1 'treeno'
agroup =0 @ 'goldst' #grouploop;
if (!ismono [#scoreloop {0}])
set something[#grouploop] ('something[#grouploop]' + 1);
end;
stop;
stop;

/****Tagging nodes****/
ttags- ;
ttags =;
ttags * 'goldst';
loop = labeloop 'taxnot' + 1 'nodeno'
ttags  + #labeloop 'something[#labeloop]';
set nodlabnum (#labeloop - 'taxnot');
ttags  + #labeloop _Node'nodlabnum';
tsave * finaltree.tre ;
save 'goldst';
ttags/;
tsave/;
stop;
```

Appendix D continued

```
end;

/******************** Test trees for outgrouplist ************************/
if ('type'== 1)
/**** Test trees ****/
ttags-;
ttags =;
ttags * 'goldst';
loop = grouploop 'taxnot' + 1 'nodeno'
loop = scoreloop 1 +1 'treeno'
agroup =0 @ 'goldst' #grouploop;
if (!ismono [#scoreloop {0}])
set something[#grouploop] (#scoreloop-1);
ttags  + #grouploop 'something[#grouploop]'/;
tsave * finaltree.tre ;
save 'goldst';
ttags/;
tsave/;
end;
stop;
stop;

loop = labelloop 'taxnot' + 1 'nodeno'
set nodlabnum (#labelloop - 'taxnot');
ttags  + #labelloop Node'nodlabnum';
tsave * finaltree.tre ;
save 'goldst';
ttags/;
tsave/;
stop;
end;
```

Appendix D continued

```
/*****************************Test for outnodnum*********************/
if ('type'== 2)
set taxnott ('taxnot'+1);
/**** Test trees ****/
loop = treeloop 1 +1 'treeno'
loop = nodeloop 'taxnott' + 1 'nodeno'
agroup =0 @ 'goldst' #nodeloop;
if (!ismono [#treeloop {0}])
set something[#treeloop] ('something[#treeloop]' + 1);
end;
stop;
stop;
/****Tagging nodes****/
ttags- ;
ttags =;
ttags * 'goldst' ;
loop = labeloop 1 +1 'treeno'
ttags  + #labeloop 'something[#labeloop]';
tsave * finaltree.tre;
save 'goldst';
ttags/;
tsave/;
stop;

loop = labelloop 'taxnott' + 1 'nodeno'
set nodlabnum (#labelloop - 'taxnot');
ttags  + #labelloop _Node'nodlabnum';
tsave * finaltree.tre ;
save 'goldst';
ttags/;
tsave/;
stop;
```

Appendix D continued

```
end;
/*****************************Test for outnodnum*********************/
if ('type'== 3)
set taxnott ('taxnot'+1);

ttags- ;
ttags =;
ttags * 'goldst';
loop = treeloop 1 +1 'treeno'
loop = nodeloop 'taxnott' + 1 'nodeno'
agroup =0 @ 'goldst' #nodeloop;
if (!ismono [#treeloop {0}])
set something[#treeloop] (#nodeloop-'taxnot');
ttags  + #treeloop 'something[#treeloop]'/;
tsave * finaltree.tre ;
save 'goldst';
ttags/;
tsave/;
end;
stop;
stop;
loop = labelloop 'taxnott' + 1 'nodeno'
set nodlabnum (#labelloop - 'taxnot');
ttags  + #labelloop Node'nodlabnum';
tsave * finaltree.tre ;
save 'goldst';
ttags/;
tsave/;
stop;
end;
warn=;
ttags;
```

Appendix E: *Mcateella* input file, as an example.

This is an example of an input file for this analysis. The data is taken from Elias and Cassis 2012.
Note how the closest outgroup *Miespa reddi.* Is the first taxon in the file, followed by the *Piesma* group of genera, which is a probably a monophyletic group and the sistergroup to *Mcateella-Miespa*. The ingroups are added after the furthest outgroup *Nysius vinitor*.

```
xread
44 36
Miespa_reddi                0010110110100100102001O?00001011111-01001001
Piesma_maculatum            1010102010102O?001-00101002110000001111111001
Piesma_capitatum            101?1020?01?00?001-0010?00?11100000111?1010
Piesma_xishaenum            101?1020?01?00???1-0010?00?11100?????11????0
Piesma_linnavuori           10101020?0100???01-001??00211100??0111101100
Afropiesma_jugatum          10101020?0102????1-0010?00111100??00?1111010
Parapiesma_atriplicis       11-0100010110O???1-00100001111000000??1111001
Parapiesma_bificeps         11-01000?00?0????1-0010?00?11100??0??11??010
Parapiesma_ceramicum        11-?1000?01?0??001-0010?00?1110000001?1??0?0
Parapiesma_cinererum        11-010101011010001-0010?00111100000011111100
Parapiesma_kherzneri        11-?1000?01??0???1-0010000?11100?????11???00
Parapiesma_kochiae          11-01000?01?00?001-0010100?1110000000111??110
Parapiesma_kolenatii        11-?1000101?00?001-0010000?111000000111?010
Parapiesma_pupula           11-0100010110O?001-00101001111000000011111010
Parapiesma_quadratum        11-0100010110O?0?1-00100001111000000?1111001
Parapiesma_salsolae         11-01000?01?00?001-00101001111000000111?1100
Parapiesma_silens           11-0100110110O?001-00101001111000000011111000
Parapiesma_tenellum         11-0?000?01?00???1-0010?00?11100???0?11???10
Parapiesma_unicolour        11-01011?01?00?001-0010?00?1110000?0111??010
Parapiesma_variabile        11-?1010?01?00?001-0010?00?1110000?0111??001
Eopiesma_trimerum           -0--0122?12121???1?111??0???1??0??????1?????
Heissiana_serafini          00??0102?1?12?1??1???1??0??01??????-??0?????
Crompus_sp.                 1---1222212?210111-1101--02110?1??1??1110001
Geocoris_sp.                1---1222210?210111-1101--00110?1??1??1110001
Nysius_vinitor              1--012122101210111-1101--02110?1??1??1110000
Mcateella_austera           00101111000111000011010100000111111-00010010
Mcateella_coolgardie        00010112101010100001010101100111111-00002001
Mcateella_elongata          00100112101000100011010l1-100111111-00011101
Mcateella_esperanceae       00100112100000000001101011-200111111-00011001
Mcateella_exocarposa        00010110101010100001010101200111111-00002111
Mcateella_gibber            00101111000111100011010100000111111-00010000
Mcateella_interioris        00101112101111100011010100000111111-00011000
Mcatella_kwoka              00010112101010100001010101100111111-00001101
Mcatella_reidi              00101111101111100011010100100111111-00001100
Mcateella_schuhi            00010111100010000001010101100111111-00001111
Mcateella_splendida         00100111101000000001010101100111111-00001011
;
```