

MYRMELEONTIDAE (NEUROPTERA): MOLECULAR PHYLOGENY AND
TAXONOMIC REVIEW OF THE SUBTRIBE PERICLYSTINA
(DENDROLEONTINI)

A Dissertation

by

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ABSTRACT

The family Myrmeleontidae, or antlions, is considered today as the largest family of the order Neuroptera. This cosmopolitan group comprises more than 1600 valid species and nearly 200 genera. The taxonomy of the family is still very confusing, but the most accepted Myrmeleontidae classification divides the group into three subfamilies, 14 tribes and 11 subtribes. In this dissertation, the first phylogenomic analysis for the antlions is presented, and the subtribe Periclystina is taxonomically revised based on morphological and molecular phylogenetic analyses.

The phylogenomic analysis of the antlions is presented, based on 325 genes captured using Anchored Hybrid Enrichment. 216 species of Myrmeleontiformia were tested under maximum likelihood. Myrmeleontidae was recovered paraphyletic without Ascalaphidae. The two largest subfamilies of Myrmeleontidae (Myrmeleontinae and Palparinae) and Ascalaphidae (Ascalaphinae and Haplogleniinae) were also recovered paraphyletic. All antlion tribes were recovered monophyletic (except Brachynemurini), but almost all subtribes were recovered paraphyletic. The results presented here are incongruent to the traditional Myrmeleontidae classification. In this sense, it is proposed here a new classification for the antlions, which synonymizes Ascalaphidae under Myrmeleontidae and divides the family into four subfamilies and 18 tribes. The new classification reflects the results presented here, and parts that need further studies are also discussed.

The subtribe Periclystina is fully revised. Prior to this work, this Australian group comprised 63 species placed in ten genera. After the review, six species names are considered as synonyms and 16 new species are proposed, summing 73 species. All 73 species were tested in a parsimony analysis based on 62 morphological characters, and 36 species were also included in a maximum likelihood analysis based on 534 genes. The results from both analyses are very congruent and both recovered Periclystina and the two largest genera, *Austrogymnocnemia* and *Glenoleon*, paraphyletic. Ten of the 73 species were recovered in a cluster with *Acanthoplectron*, and were transferred to the tribe Acanthoplectrini. The remaining 63 species formed a monophyletic clade composed by 14 genera (nine new genera); it is called here as the “*Periclystus* genus group” and is placed in the tribe Dendroleontini.

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CHAPTER I

GENERAL INTRODUCTION

The family Myrmeleontidae was described by Latreille in 1802 and classified within the order Neuroptera. It is the largest family of the order with more than 1600 described species, predominantly distributed in arid or semiarid regions worldwide (New 1986; Stange 2004). They are commonly known as antlions or doodlebugs (Stange 2004; Grimaldi & Engel 2005).

The adults are relatively large insects with long and slender bodies and wings. They are differentiated from other neuropterans by their relatively short, clubbed antennae (generally about as long as the head and thorax combined) and the presence of a hypostigmatic cell in each wing (New 1982). The adults are usually considered predators, but there are some records of species feeding on plant material, such as pollen (Guillette et al. 2009). They seem to be more active at night and many species are attracted to lights (New 1986). Males of many species are known to have glands that probably produce pheromones used to attract mates (Bergström et al. 1992).

Although adults are fairly common, the most well-known life stages are the larvae, from which the English common name of the group antlions derives. This name refers to the characteristic behavior of the larvae of some antlions of building conical pits in sandy soils (Badano & Pantaleoni 2014), where they lie and hide in order to feed on insects, often ants, and other small arthropods that fall into the traps.

Although pit building is the most well known behavior of the group, only about one third of all antlions species are believed to adopt this tactic. The great majority of the species capture their prey without the use of traps; these larvae are more active predators and can be found in a variety of different kinds of habitats, such as under sand or other debris, in tree holes, in caves, on rock surfaces, etc. (Stange 1980; Miller & Stange 1983; New 1986; Mansell 1996; 1999). The larvae are easily recognized by their rounded bodies and long jaws, which are used to capture prey (New 1986). There are three larval instars, the last of which builds a cocoon made of silk and surrounding debris, inside which the pupa develops.

The systematic position of the family within the order is very well established. Since the beginning of the last century it has generally been accepted that the Myrmeleontidae is closely related to four other families (Ascalaphidae, Nemopteridae, Nymphidae and Psychopsidae), which together comprise the suborder Myrmeleontiformia (Handlirsch 1906-1908; Tillyard 1916; Withycombe 1924) (or the superfamily Myrmeleontoidea (Stange 1994; Makarkin et al. 2013)). Most recent phylogenetic work, based on both morphological and molecular data, corroborates this grouping, and the monophyly of this suborder is very well supported within the Neuroptera (Aspöck et al. 2001; Aspöck 2002; Winterton 2003; Haring & Aspöck 2004; Aspöck & Aspöck 2008; Beutel et al. 2010; Winterton et al. 2010; Jones 2014; Badano et al. 2016; Wang et al. 2016; Michel et al. 2017). The only conflicting results involve the placement of the family Psychopsidae within the suborder (Yang *et al.* 2012; Makarkin *et al.* 2013). Within the suborder, the Myrmeleontidae have been placed close

related to the Ascalaphidae (owlflies), and together they are the most widespread and well-known families of the Myrmeleontiformia. The other three families are relatively small and are most common in Australia and Africa (Grimaldi & Engel 2005).

Despite all of the phylogenetic work that have included the Myrmeleontidae in interfamilial analyses, there are few studies on its internal classification. To date, only three phylogenetic analyses focusing on intrafamilial relationships of antlions have been published (Stange 1994; Badano et al. 2016; Michel et al. 2017). The results of these studies are conflicting in some points, and their restricted taxonomic coverage has resulted a confusing and complex internal classification.

Currently, the classification proposed by Stange (2004) in his catalogue of the world antlions is the most widely accepted taxonomic scheme, and is adopted here for the purpose of discussion. However, it is not universally accepted by all the neuropterists e.g., Krivokhatsky (1998; 2011).

The absence of a comprehensive phylogeny for the Myrmeleontidae has led to a poor overall understanding of the family. Questions related to the evolutionary history of the group and the current distributions of antlion taxa are good examples of issues that require a more robust phylogeny for resolution. The internal classification of Myrmeleontidae can only be adequately addressed with a global phylogeny. Historically, the suprageneric classification of the family has been confused by a large number of proposed family-group taxa and multiple conflicting classifications (Mansell 1985). This taxonomic confusion derives in part from the regional, rather than global, nature of prior revisionary and phylogenetic works (Hölzel 1969, 1976; Stange 1970; 1994; New

1985a; b; c; Mansell 1985; 1990; 1992; Miller & Stange 1989; 2009; Prost 1991; 1995; Myrmoayedi 2006; 2007; Michel & Mansell 2010; Krivokhatsky 2011).

In addition to the historical problem of conflicting internal classifications, the monophylies of many suprageneric taxa remain uncertain. A typical example of this problem is the Australian subtribe Periclystina. This group of 10 genera and 63 species is based fundamentally on the female terminalia, and the characters currently used to differentiate its genera appear to be very plastic (New 1985a; b; Stange 2004; Miller & Stange 2012). However, the adequacy of these characters can be analyzed by phylogenetic work followed by a robust taxonomic review. A systematic study of the Periclystina will permit the checking of these character's strength and consequently consolidate the definition and the internal classification of the group.

This dissertation is focused on two principal topics: (Chapter II) a molecular phylogeny of Myrmeleontidae, and (Chapter III) a systematic revision of the subtribe Periclystina. The results obtained here will be an important guide for future studies on the Myrmeleontidae, and will form the basis for a new classification of the family.

Nomenclature disclaimer

Publication of this dissertation is disclaimed for purposes of zoological nomenclature under Article 8.2 of the International Code of Zoological Nomenclature.

CHAPTER II
MOLECULAR PHYLOGENY OF THE ANTLIONS (NEUROPTERA:
MYRMELEONTIDAE)

Introduction

The placement of the family Myrmeleontidae within Neuroptera is unanimous with regard to the suborder (New 1989, Aspöck et al. 2012). The family is part of the suborder Myrmeleontiformia (or superfamily Myrmeleontoidea), in all recent phylogenetic analyses (Aspöck et al. 2001; Aspöck 2002; Winterton 2003; Haring & Aspöck 2004; Aspöck & Aspöck 2008; Beutel et al. 2010; Winterton et al. 2010; Zimmermann et al. 2011; Yang et al. 2012; Makarkin et al. 2013; Jones 2014; Randolph et al. 2014; Badano et al. 2016; Lan et al. 2016; Wang et al. 2016; Michel et al. 2017); and these recent analyses support earlier works dating from the beginning of the last century (Tillyard 1916; Withycombe 1924).

Within Myrmeleontiformia the family Psychopsidae is generally considered basal with respect the other four families (Ascalaphidae, Myrmeleontidae, Nemopteridae, Nymphidae) (Beutel et al. 2010; Winterton et al. 2010; Jones 2014; Randolph et al. 2014; Badano et al. 2016; Wang et al. 2016; Michel et al. 2017). However, some studies based on both morphological and molecular data, including fossil species, recovered Psychopsidae outside of the Myrmeleontiformia; but these results were considered controversial by their authors, who noted that further confirmation was needed (Yang et al. 2012; Makarkin et al. 2013). The position of Nemopteridae and

Nymphidae is still under discussion. Molecular data has suggested that Nemopteridae is the sister group of Ascalaphidae + Myrmeleontidae (Haring & Aspöck 2004; Winterton et al. 2010; Makarkin et al. 2013; Jones 2014; Wang et al. 2016; Michel et al. 2017), but morphological data has suggested Nymphidae as the group closest to Ascalaphidae + Myrmeleontidae (Aspöck et al. 2001; Aspöck 2002; Aspöck & Aspöck 2008; Beutel et al. 2010; Badano et al. 2016).

All studies agree that Myrmeleontidae and Ascalaphidae are the closest related families and are very similar in most aspects. According to Winterton et al (2010) these two were the last families to separate during the evolutionary history of Neuroptera, sometime in the late Jurassic, around 153 Ma. Other data suggest that this separation may have occurred more recently, during the Early Cretaceous (ca.138 Ma) (Michel et al. 2017). Nevertheless, doubt has remained about the monophyly of both families (Winterton et al. 2010; Jones 2014; Wang et al. 2016).

To date, all morphological analyses have presented both of the families Myrmeleontidae and Ascalaphidae as monophyletic (Stange 1994; Aspöck et al. 2001; Aspöck 2002; Aspöck & Aspöck 2008; Beutel et al. 2010; Zimmermann et al. 2011; Randolph et al. 2014; Badano et al. 2016). Winterton et al. (2010), however, showed a divergence between the Bayesian and parsimony topologies concerning Ascalaphidae and Myrmeleontidae. The Bayesian analysis supported the monophyly of both families, but the parsimony analysis indicated that Ascalaphidae was paraphyletic in relation to Myrmeleontidae. Clade support, however, was not strong for either resolution. Interestingly, another recent molecular analysis also provided similar results, with both

families as monophyletic in a maximum likelihood analysis, but a Bayesian analysis indicated Myrmeleontidae as paraphyletic (Michel et al. 2017). It is worthy to note that the Bayesian analysis result had much lower support and was based only in the enigmatic *Stilbopteryx* Newman. Another series of recent papers recovered Myrmeleontidae paraphyletic in relation to Ascalaphidae with strong support, leaving the question of the status of both families still open (Jones 2014; Lan et al. 2016; Wang et al. 2016).

A concern in evaluating these studies is the limited taxa sample; especially in Winterton et al (2010), Lan et al (2016) and Wang et al (2016), and the absence of some key taxa, such as the genus *Albardia*. The uncertain relationship between these two families was noted previously by Stange (1994), who mentioned that Ascalaphidae could possibly be considered a subfamily of Myrmeleontidae based on their similarities. Mansell (1992; 1996) addressed this idea and supported the proposition that Ascalaphidae was the sister taxon of Myrmeleontidae, but without additional phylogenetic analyses based on more extensive taxon sampling, was needed to confirm or refute the hypothesis of myrmeleontid paraphyly.

Central to disputes about relative phylogenetic relationships between Ascalaphidae and Myrmeleontidae is the placement of two controversial groups: Stilbopteryginae (today placed within Myrmeleontidae) and Albardiinae (today placed within Ascalaphidae) (Riek 1968; 1976; New 1982; Penny 1983; Stange 2004). Stilbopteryginae is a small group of insects known only from two Australian genera: *Aeropteryx* Riek (3 species) and *Stilbopteryx* (7 species). They are large insects that

share several characteristics with Ascalaphidae, such as clubbed antennae and the hypostigmatic cells. Albardiinae contains only one species, *Albardia furcata* Weele, known only from Brazil (Riek 1976; New 1982; Penny 1983). This odd species has some characteristics (venation and terminalia) in common with Stilbopteryginae, and a close relationship between them has been suggested by some authors (Tillyard 1926; Riek 1968, 1976).

Historically the placement of these two groups has varied; Stilbopteryginae has sometimes been classified as a subfamily of Ascalaphidae (Rambur 1842; Navás 1913), while other authors have considered them to be a separate family, the Stilbopterygidae, also including *A. furcata* (Tillyard 1926; Riek 1968; 1976). Van der Weele (1909) treated them as an archaic family near the base of both the Ascalaphidae and Myrmeleontidae.

Most cladistics analyses that have included *Stilbopteryx* have corroborated its position within Myrmeleontidae. The morphological analysis of Stange (1994) resulted in *Stilbopteryx* nested within the subfamily Palparinae; the molecular analysis of Winterton et al. (2010) grouped the genus with other Myrmeleontidae species; and the analysis based on larval morphology by Badano et al (2016), placed *Stilbopteryx* as the sister group of the remaining Myrmeleontidae. The study of Michel et al (2017) also recovered *Stilbopteryx* as the sister group of the remaining antlions. However, this result was only apparent in the Maximum Likelihood analysis, the Bayesian analysis grouped the genus with Ascalaphidae. The phylogenetic positions of Albardiinae and *Aeropteryx* (Stilbopteryginae) have not previously been tested in any cladistics analysis.

Despite general agreement about the phylogenetic position of Myrmeleontidae within Neuroptera, its internal relationships are far from well understood (Mansell 1985; Krivokhatsky 2011; Badano & Pantaleoni 2014). Suprageneric groups recognized within the Myrmeleontidae remain unstable and lack a comprehensive phylogenetic framework. Since the earliest studies of the family, a wide variety of different and often conflicting family-group taxa (subfamily, tribe, subtribe) have been proposed (Banks 1899; 1911; 1927; Navás 1912; Tillyard 1916; Esben-Petersen 1918; Markl 1954; Hölzel 1976; Stange 1976, 1994, 2004; Stange & Miller 1985; 1990; Mansell 1985; 1992; 1996; 1999; 2004; Krivokhatsky 1998; 2011).

The first attempt to provide a discussion of the internal classification of Myrmeleontidae was made by Banks (1899). In this paper, Banks proposed the division of the family into two groups, Myrmeleoni and Dendroleoni, based on the position of the RS origin in the forewing. Many subsequent papers have focused additional attention on myrmeleontid classification, paying special attention to adult wing venation characters, and many additional supra-generic groups have been proposed, some of which are widely recognized as valid today, e.g.: Acanthaclisini, Brachynemurini, Dimarini, Nemoleontini, Porrerini and Palparini.

Notwithstanding all these early papers, the internal classification of Myrmeleontidae remained confused, at least in part because early studies were based on regional faunas and the supra-generic groups proposed were not easily recognized in other extralimital regions. The first comprehensive study of Myrmeleontidae was published by Markl (1954). This work was a milestone as it was the first publication to

synthesize information broadly on a global scale and it included all Myrmeleontidae genera known at that time (except *Stilbopteryx*). Markl did not use subfamilies in his classification, opting rather to divide the group into tribes (23 in total), of which 10 were newly described.

The classification of Markl was not universally accepted, and some subsequent authors, e.g., Hölzel (1969; 1976), and particularly Stange (1970; 1976; Stange & Miller 1985; 1990) criticized many parts of it. Stange (1970) noted that many of the tribes proposed by Markl were based on wing characters, and while these characters might work for the European fauna, they did not apply well to the New World fauna. Furthermore he also mentioned that some of the tribes proposed by Markl should be invalidated and divided the group into three subfamilies: Acanthaclisinae, Myrmeleontinae and Palparinae. Subsequently, Stange published a series of papers based mainly on larval characters, in which he redefined some of the tribes and subfamilies (Stange 1976; 1994; Stange & Miller 1985; 1990).

Following publication of the papers of Stange, and the inclusion of Stilbopteryginae within the family (New 1982), Mansell (1999) suggested that some consensus regarding the internal classification of Myrmeleontidae was beginning to emerge, though still with little phylogenetic basis. Mansell (1999) proposed a new classification of the family based on larval habitat and behavior. He divided the family into two subfamilies, Myrmeleontinae and Dendroleontinae, a division similar to the much earlier scheme of Banks (1899).

The first cladistics analysis of the Myrmeleontidae was published by Stange (1994), who used both adult and larval characters to provide a morphological parsimony analysis. The study focused heavily on the Brachynemurini, but the phylogenetic relationships discussed for subfamilies, tribes and subtribes were the first to be based on cladistic results, and formed the basis for Stange's subsequent (2004) world catalogue of the family.

In that catalogue, Stange conservatively divided the family into three extant subfamilies (Myrmeleontinae, Palparinae, and Stilbopteryginae), 14 tribes, and 11 subtribes. He also recognized two extinct subfamilies, Araripeneurinae and Palaeoleontinae, which now sometimes are considered to be separate families (Dobruskina et al. 1997; Martins-Neto & Rodrigues 2010). Stange's classification is today the most widely accepted arrangement for the world Myrmeleontidae (Mansell 2004; Michel & Akoudjin 2012; Badano & Pantaleoni 2014; Letardi 2014; Michel 2014; Badano et al. 2016, Oswald 2015), but it has not been unanimously adopted. For example, recent work by Krivokhatsky (1998; 2011) adopts a different classification, based mostly in Markl's work, with the addition of several additional tribes. Krivokhatsky (1998; 2011) divided Myrmeleontidae into 12 subfamilies and 36 tribes. However, these works do not provide a strong phylogenetic justification for the classification adopted and discuss intrafamilial relationships primarily on basis of the presectorial area of the wings.

Despite the discordant nature of the two mostly commonly used classifications of the Myrmeleontidae (Stange 2004; Krivokhatsky 2011), there appears to be broad

agreement about many of the major lineages within the family. This somewhat non-intuitive result arises from the fact many similar groupings of taxa occur in both classification, but are recognized at different ranks.

Until recently, the study of Stange (1994) was the most complete phylogenetic analysis of the family. However, a more comprehensive phylogenetic study of the antlions (the first to extensively use molecular data) has just been published (Michel et al. 2017). In this paper, Michel et al, used seven genes (five mitochondrial and two nuclear) across 91 antlions species to broadly evaluate the phylogeny of Myrmeleontidea. The family was recovered as monophyletic in a Maximum Likelihood analysis and four subfamilies were recognized: the three used by Stange (2004) (Myrmeleontinae, Palparinae and Stilbopteryginae) and Acanthaclisinae. The later is a well-defined group that has been recognized by many authors at tribal or subfamilial rank in the (Navás 1912; Markl 1954; Hölzel 1976; Stange and Miller 1985; 1990; New 1985c; Krivokhatsky 1998; 2011; Stange 2004; Oswald 2015). The taxon sampling in Michel et al is reasonably good, but is heavily weighted toward the Old World fauna (particularly Africa and Europe), with only eight antlion species from other areas, USA (7) and Australia (1). For this reason, some diverse clades of antlions, e.g. Brachynemurini and Dendroleontini, are distinctly under represented, and some key tribes (Dimarini, Gnopholeontini, Maulini, Palparidini) and subtribes (Acanthoplectrina, Dimarellina, Obina, Periclystina) are lacking in the analysis.

The study by Michel et al contains a large amount of missing data. Seven genes were used to infer the Myrmeleontidae phylogeny. However, no antlion species had the

full set of genes sequenced, and only two genes (COI and 16S) were sequenced for at least 75% of the species. The remaining five genes were sequenced for less than 50% of the species, and two genes (COIII and 18S) were sequenced from less than 20% of the species. The impact of adding taxa with many missing data may not be a problem in the final analysis as suggested by some authors (Wiens & Tiu 2012), however it might explain some of the conflicting results and the low support values for many of the clades identified in this work.

It is clear from the history of the development of taxonomic and phylogenetic knowledge within the Myrmeleontiformia and Myrmeleontidae, as reviewed above, that a major new analysis is needed to help resolve the many questions that remain outstanding. Some desirable features of such an analysis include augmented taxon sampling, the inclusion of key taxa (those whose positions have previously been contentious), broad geographical representation, increased character set size, and expanded application of molecular phylogenetic data and technologies, as suggested by Badano et al (2017). With these factors in mind I present below the largest phylogenetic analysis at the Myrmeleontidae to be undertaken to date, and the first analysis at this group to use a phylogenomics approach – anchored hybrid enrichment (AHE).

In recent years, high-throughput sequencing technologies have become more and more accessible to molecular systematists. These techniques are becoming more cost effective, and are capable of generating very large data sets in relatively short periods of time (Lemmon et al. 2012; Lemmon & Lemmon 2013; McCormack et al. 2013). In addition to the advantages at larger datasets, the use of the next-generation sequencing

technologies is allowing researches to explore areas of the genome that were previously difficult to assess, especially for non-model organisms such as antlions.

Among the new techniques that have in recent years been applied to phylogenetic inference studies is the Anchored Hybrid Enrichment (AHE). The technique was first described by Lemmon et al (2012) and is focused on highly conserved regions of the genome. In AHE, a series of project specific probes are designed to target and hybridize with selected highly conserved regions of the genome. In addition to conserved regions, the probes also target the less conserved flanking regions that evolve at higher rates. Subsequently only the DNA that hybridized with the probes is selected to be sequenced using high-throughput technology (Lemmon et al. 2012). Because this method accesses highly conservative and less conservative regions, it is suitable for studies that require resolution of both shallow and deep level phylogenetic splits (such as the Myrmeleontiformia). In this way AHE differs from some other modern techniques, such as the ultraconserved elements (UCE) approach, which are more suitable to deep level only phylogenies (Faircloth et al. 2012).

Another important characteristic of AHE is its ability to use DNA from material preserved in ethanol, frozen, or even old specimens because probes sequences are relatively short, they have a higher probability of successful use on degraded samples (Lemmon & Lemmon 2013). It is much easier for researches to store and extract DNA, than it is to isolate the RNAs required by other modern techniques such as transcriptome analyses. AHE has proven successful for the inference of phylogenetic relationships in several groups, e.g., snakes, lizards, fishes, frogs, birds and spiders (Pyron et al. 2014;

Brandley et al. 2015; Eytan et al. 2015; Peloso et al. 2015; Prum et al. 2015; Hamilton et al. 2016), and more recently has been used with insects for the first time (Young et al. 2016).

Materials and methods

Material acquisition

Fresh specimens of ingroup and outgroup were obtained from a number of collaborators around the world and from targeted collecting trips to Australia, Mexico and the southwestern USA. All specimens collected or received from collaborators were preserved in 100% ethanol and stored in freezers. Voucher specimens are deposited in the Texas A&M University insect collection (TAMUIC) or other collections as appropriate.

Ingroup

A total of 171 antlion species from around the world are included in this study (A1 table 1). These include representatives of nearly all supra-generic taxa recognized by Stange (2004) including: all three subfamilies, 12 of 14 tribes (lacking only Lemolemini [South America] and the monospecific Pseudimarini [Iran]) and eight of 11 subtribes (lacking only monogeneric subtribes Nuglerina [southeast Asia], Porrerina [South America], and Voltorina [Madagascar]).

Outgroups

The analysis included 33 putative near outgroup taxa selected from the four Myrmeleontiformia families, Ascalaphidae (18 species), Nemopteridae (8 species), Nymphidae (4 species) and Psychopsidae (3 species); with representatives of all

subfamilies belonging to these families. An additional 12 far outgroup taxa selected from three non-Myrmeleontiformia families (Chrysopidae, Hemerobiidae, Ithonidae) were used to root the tree (A1 table 1). Taxa from the latter three families were chosen because based on their putative close relationship with Myrmeleontiformia (Winterton et al. 2010; Wang et al. 2016).

DNA extraction

Genomic DNA was extracted through a minimally-destructive DNA extraction process using a Genra Puregene Tissue Kit (Qiagen, CA, USA) in Dr. Hojun Song's laboratory at Texas A&M University. DNA was extracted from legs and thoracic muscle, but all remaining parts were not destructed. The standard kit protocol was used throughout the extraction process, except for the addition of a final step to dry the DNA pellet (5 minutes at 30°C in an evaporation centrifuge). The final elution was reduced to 31µl to avoid diluting the DNA solution. 1µl of each solution was used in an initial quantity and quality check on a nanodrop using a Denovix spectrophotometer. Samples with final concentrations over 40ng and quality tests (260/280 and 260/230) over or near 1.8 were sent to the Center for Anchored Phylogenomics at the Florida State University (www.anchoredphylogeny.com), for further processing.

AHE probe design

Working in collaboration with Dr. Shaun Winterton (CDAS), 10 species from different families were chosen to represent the diversity of Neuroptera (A1 table 2). For one of these species, *Nevrorthus apatelios* (Nevrorthidae) an assembled transcriptome is available (Peters et al. 2014) and was used. Low coverage whole genome data were

collected for the remaining nine species as follows. Illumina libraries were prepared at the Center for Anchored Phylogenomics from extracted DNA and indexed following Lemmon et al. (2012) and Prum et al (2015). The libraries were then pooled in equal proportion and sequenced on one PE150 Illumina lane using C-bot clustering and 8bp indexing. Following quality filtering with the CASAVA high-chastity filter, reads from this initial lane were demultiplexed (no mismatches tolerated) then merged following Rokyta et al (2012). The merged reads were then used to estimate per-sample coverage as the mean of the 30-mer count distribution. Coverage estimates were then used to determine the number of additional reads needed to obtain 15x total coverage for each sample. Libraries were then re-pooled accordingly and sequenced on two additional PE150 lanes. Reads were demultiplexed, quality filtered, and merged as indicated above.

Merged reads were mapped to 962 insect-wide anchor target regions identified by Young et al (2016). In brief, spaced 20-mers from *Tribolium castenatum* (Coleoptera: Tenebrionidae) were compared to the merged reads for each individual. Those reads with at least 17 matches to a spaced 20-mer were aligned to the corresponding *T. castenatum* reference sequence and verified if at least 55 of 100 consecutive bases matched. Consensus sequences including the reference region and flanks were then isolated. Homologous transcripts were identified in the *N. apatelos* transcriptome (Peters et al. 2014) using the approach described above (17 matches to a spaced *T. castenatum* 20-mer, verified by a 55% match to the corresponding reference sequence). In the event of multiple matches, the transcript with the best match to the reference sequence was chosen. For each locus, sequences recovered for the 10 reference

species (plus the *T. castenatum* reference sequence) were aligned using MAFFT (v7.023b; Katoh & Standley 2013). Alignments were visually inspected in Geneious (v.7 Kears et al. 2012) and problematic sequences were removed. Alignments were then reduced to appropriate anchor regions by extending out from the region occupied by the *T. castenatum* reference sequence in both directions until an intron greater than 200bp or an exon < 120bp was encountered. Anchor regions were then checked for overlap and loci were removed to avoid overlap. The resulting set of unique targets was comprised of 570 target loci with an average length of 527 bp and an average pairwise sequence identity of 66%. Following the approach of Hamilton et al. (2016) repetitive regions of the sequences in the alignment were masked after identification using 15-mer counts in the raw reads / transcriptome. Probes were then tiled uniformly at 5x density (new probe began every 25bp) across each of the 10 Neuroptera reference sequences for each locus, producing 50,239 probes in total. The total target size covered by probes was 233,234 bp.

Sample preparation

The DNA extracted at TAMU was used to produce Illumina libraries following Lemmon et al (2012) and Prum et al (2015). In brief, DNA was sonicated to a fragment size of ~200-800bp using the Covaris E220 Focused-ultrasonicator with Covaris microTUBES. Libraries were performed on a Beckman-Coulter Biomek FXp robot following a protocol originally derived from Meyer and Kircher (2010), but with library fragments being size selected using SPRI select beads (Beckman-Coulter Inc) at a 0.9x ratio of bead to sample volume. Following addition of 8bp indexes, libraries were pooled

in groups of ~16 and enriched using an Agilent Custom SureSelect XT kit (ELID 3005721). Following enrichment, library pools were pooled into single sequencing pool and sequenced on 1 PE150 Illumina 2500 lanes. Sequenced library fragments contained inserts between 150bp and 300bp in length.

Ready assembly

After quality filtering using the CASAVA high-chastity filter, raw reads were demultiplexed using the 8bp indexes with no mismatches tolerated. Overlapping reads were merged following Rokyta et al (2012). Reads were assembled using the divergent reference assembly approach (*quasi-de-novo* assembly) described in Prum et al (2015), which recovers the probe region and flanks for each sample. References used for the assembly included *Nymphes myrmeleonoides* (Nymphidae), *Thaumatomyilus delicatus* (Osmylidae), *Palpares sp.* (Myrmeleontidae), and *Nothancyla verreauxi* (Chrysopidae). Assembled contigs derived from fewer than 20 reads were removed in order to reduce the effects of both rare sequencing errors in index reads and cross-contamination.

Alignment generation

After grouping homologous consensus sequences obtained during the assembly process, putative orthologs were identified for each locus following Prum et al (2015), which uses a neighbor-joining-based clustering algorithm based on alignment free pairwise sequence divergences. Clusters formed through this process were then screened for taxon presence.

Clusters containing fewer than 50% of the species in the taxon set were removed from downstream processing. Sequences in each remaining cluster were then aligned

using MAFFT (v7.023b; Katoh & Standley 2013) with `-genafpair` and `-maxiterate 1000` flags utilized. Each alignment was trimmed and masked following Prum et al (2015), with 50% identity required for each site to be considered reliable and 20bp regions containing matches at fewer than 12 reliable sites were masked. After masking, sites containing less than 50% unambiguous bases were removed from the alignment.

Phylogenetic estimation

Both the super matrix and species trees approaches were used to estimate the relationships among the taxa. More specifically, RaxML (v.8; Stamatakis 2014) was used to estimate both locus-specific gene trees as well as a phylogeny based on the full, concatenated matrix (GTRGAMMA model was used for both types of analysis, but the concatenated matrix was partitioned by locus). Branch support values were estimated using by performing 100 bootstrap replicates. The gene trees were then used as input in a species tree analysis conducted in ASTRAL-II (v.4.9.7; Mirarab & Warnow 2015) using bootstrap replicates from the RAxML-estimated gene trees.

Results

Analytical results

Trimmed alignments contained 216 species and 133,031 sites (across 325 chosen loci), of which 56,529 sites were parsimony-informative (62,517 variable sites). The concatenated dataset presented 26.31% missing data. This percentage of missing data could be considered as relatively high, but according to recent tests this percentage of missing data seems to do not negatively interfere in the results generated by large phylogenomic analyses, particularly for concatenated data (Hosner et al. 2016; Streicher

et al. 2016). Furthermore, we also conducted a preliminary test using more stringent parameters to compare the results. In this analysis the trimmed alignments contained 229 loci with 13.35% of missing data, but the number of informative sites on this test was much lower, 32,498. The results of both analyses were almost identical; the only small differences were in the genus or species level within a few clades. The larger data set resulted in more robust clades at the shallow level of the tree, likely because of the higher number of informative characters, which justifies our choice for the larger dataset.

Maximum likelihood estimation of the chosen dataset produced a fully resolved tree, with near 91% of the nodes supported by >95% bootstrap support (BS) values (A2 Fig 1). The species tree estimation (ASTRAL) also presented a fully resolved tree. The bootstrap support values were also very high, but lower when compared to the ML tree, with near 79% of the nodes supported by >95% BS values (A2 Fig 2). Besides the generally lower bootstrap values, the tree generated by ASTRAL presented a few unusual results in the preliminary analysis, which might be justified by recent studies, which demonstrated that summary coalescence methods like ASTRAL are susceptible to negative effects, particularly in deep phylogenies analysis (Meiklejohn et al. 2016; Springer & Gatesy 2016). These same studies demonstrated that concatenation seems to outperform shortcut coalescence methods in different analysis, and for those reasons the ML tree is the preferred here, and will be one used in the discussion below. However, the results from both trees were almost identical, which reinforces the robustness of our results.

Despite the overall concordance between ML and ASTRAL analyses, the two trees present three major differences. The first was referent to Brachynemurini placement, which was recovered as sister to (Myrmeleontini (Acanthaclisini (Myrmecaelurini, Nesoleontini))) in the ML tree, but in ASTRAL it was sister to Nemoleontinae + Dendroleontinae (A2 Figs 1-4). The second difference refers to the position of *Megistopus* (Megistopini) which was recovered sister to Protoplectrini + Glenurini in ML, while in ASTRAL it as sister to Glenurini. The last one is relative to two genera, *Maula* and *Isonemurus* (Maulini sensu Stange (2004)), which formed a monophyletic clade in ML, while in ASTRAL were recovered paraphyletic (A2 Figs 1-4). In all cases the support values in the ASTRAL tree were lower compared to ML. The other differences between the two analyses were at the genus or species level, which did not affect the major structure of the tree. More details about the differences between the trees and discussions about all the major clades are presented below.

Phylogenetic relationships

Myrmeleontiformia (A2 Figs 1-3) – Our results failed to recover the monophyly of the traditional five-family composition of Myrmeleontiformia. Instead, a monophyletic six-family grouping was recovered, which included the Ithonidae as sister to Nymphidae in a clade together with Psychopsidae with high support (A2 Figs 1-3,5). The results for each Myrmeleontiformia family are present in topics below.

Psychopsidae (A2 Figs 1-3, 5) – In our analysis the three included silky lacewing species were retrieved as a monophyletic family. The current division of the family into two subfamilies, supported by morphological data (Oswald 1993), was also

supported. However, only the monophyly of the Psychopsinae was actually tested and confirmed, since only one species of Zygophlebiinae was included in the analyses (A2 Fig 5). The family was recovered as sister to the monophyletic Ithonidae + Nymphidae (A2 Fig 5), but with relative low support value (81 BS).

Nymphidae (A2 Figs 1-3, 5) – The four included species of split-footed lacewings were recovered as a monophyletic family in our analysis. The division of Nymphidae into two subfamilies was also supported, corroborating with the recently proposed classification of Shi et al (2015) (A2 Fig 5). Myiodactylinae was recovered as monophyletic, but the monophyly of Nymphinae was not tested here, since only one species was included in the analysis. Nymphidae was recovered here sister to the non-Myrmeleontiformia Ithonidae with high support (98 BS).

Nemopteridae (A2 Figs 1-3, 5) – The eight included species of the family Nemopteridae were recovered as monophyletic with very high support (100 BS for all clades). The two long recognized subfamilies, Crocinae (thread lacewings) and Nemopterinae (spoon lacewings), were also recovered as monophyletic. The thread lacewings are currently divided into three tribes and representatives of each were included in the analyses. The monophyly of the Necrophylini and Pastranaiini were not tested, since only one species of each was included. However, Crocini was recovered as paraphyletic, with the *Pterocroce* (Necrophylini) nested within it. Within Crocinae the basal lineage was the South American *Pastranaia*, which was sister to two clades: an Australian clade formed by a monophyletic *Austrocroce* and an Old World clade with *Pterocroce* and *Concroce*. Nemopterinae is not currently divided into tribes, but our

results place the Australian *Chasmodon*, sister to the Old World *Lertha* and *Nemoptera*, in a biogeographic division (A2 Fig 5). Nemopteridae was recovered sister to the complex Myrmeleontidae + Ascalaphidae with high support (100 BS).

Myrmeleontidae + Ascalaphidae (A2 Figs 1-4) – Our analyses failed to recover the monophyly of the current generally accepted circumscriptions of both the Ascalaphidae (owlflies) and the Myrmeleontidae (antlions). Ascalaphidae was nested deeply within one of the clades of Myrmeleontidae, making the later paraphyletic. Additionally the long recognized Stilbopteryginae, a subfamily of Myrmeleontidae, was recovered among the owlflies, making Ascalaphidae paraphyletic too. The results obtained here show that the relationship between these two families is more complex than was previously expected. Our results also failed to recover the monophyly of the subfamilies traditionally recognized into these two families (except Stilbopteryginae).

The results obtained here indicate that the owlflies can be considered as derived antlions. Our results strongly suggest that a number of major modifications in the classification of the current recognized Myrmeleontidae and Ascalaphidae are necessary. To date, the study of Michel et al (2017) is the only large-scale phylogenetic work of the antlions that has been published, but, the differences between this study and ours are enormous. Michel et al (2017) analysis comprised 106 Myrmeleontiformia species, 7 genes, and 3,942 aligned nucleotides (1174 parsimony informative sites), while our analysis included 202 Myrmeleontiformia species, 325 genes, and 133,031 aligned nucleotides (56,529 parsimony informative sites). In summary, the taxon sampling of our analysis was almost the double and we had near 50 times more informative sites than

the largest antlion dataset to date. Based on the size of our dataset we felt justified to propose a new tribal level classification for the antlions. The classification proposed here is totally based on our results, and synonymizes Ascalaphidae under Myrmeleontidae.

New classification of the Myrmeleontidae (A1 Table 3) – The new classification proposed here was based in five main principles. (1) All taxa monophyletic: all tribes and subfamilies proposed here only reflect monophyletic groups recovered in our ML analysis; (2) sequenced classification: the groups proposed here reflects a gradual branching in the backbone of our phylogenetic analysis, in this sense, in each particular taxonomical rank (A1 Table 3) each taxon is the sister to all listed below it; (3) anticipate expansion areas: our classification was designed to allow expansions that are likely to happen in future phylogenetic works comprising broader taxon samplings, particularly at the subtribal level; (4) reasonable sized groups: each subfamilies proposed here were thought to contain a rather similar diversity; (5) preference to keep taxonomic stability: we are preserving the oldest and well-known suprageneric names although the circumscription of the taxa under these names may vary from earlier usage (2004).

This new classification divides the Myrmeleontidae into 18 tribes and four subfamilies. We opted to do not use subtribes in the new classification, mostly because our taxon sample was not focused on this level of resolution, which is particularly to the owlflies. Besides it, almost all antlion subtribes recognized by Stange (2004) were recovered strongly paraphyletic here. Furthermore, our results also recovered many of the current recognized antlion genera as highly paraphyletic. In this sense, we believe

that a robust subtribal division of the richest tribes can only be achieved after major taxonomic review at generic level in many parts of our tree. Results for each of one of the proposed tribes are discussed in the topics below.

Dimarini (A2 Figs 1-4, 6) – *Dimares elegans*, a common and widespread species in South America, was the only representative of this tribe included here. It was recovered with high support (100 BS) as the basal lineage in the subfamily Ascalaphinae.

Palparini (A2 Figs 1-4, 6) – The 13 included species of Palparini were recovered as monophyletic with very high support (100 BS). Within the tribe its most diverse lineage presented the richest genus, *Palpares*, is strongly paraphyletic without *Crambomorphus*, *Palparellus*, and *Pamexis*.

Ululodini (A2 Figs 1-4, 6) – Seven owlflies species from the New World were recovered monophyletic here, forming the tribe Ululodini with very high support (100 BS). The tribe as recognized here comprises specimens that were traditionally placed in two groups Albardiinae and Ululodini (sensu Oswald 2015). Within the tribe *Ameropterus* is paraphyletic without *Cordulecerus*, and *Ululodes* monophyletic.

Stilbopterygini (A2 Figs 1-4, 6) – The three included species at this tribe were recovered as monophyletic and *Stilbopteryx* was also monophyletic, both with high support (100 BS). The monophyly of *Aeropteryx* was not tested (only one species was included).

Melambrotini (A2 Figs 1-4, 6) – This tribe is formed here by two African species formerly placed in Haplogleniinae (Oswald 2015), and was recovered monophyletic with high support (100 BS).

Haplogleniini (A2 Figs 1-4, 6) – This tribe is formed here by two New World species formerly placed in Haplogleniinae (Oswald 2015), and as recovered monophyletic with high support (100 BS).

Ascalaphini (A2 Figs 1-4, 6) – The seven included species at this tribe were recovered as monophyletic with high support (100 BS), and is formed by split-eyed owlflies that were formerly placed in Ascalaphinae (Oswald 2015). Some of the generic relationships within the tribe were recovered with low support, but the four Australian species formed a monophyletic clade (100 BS).

Brachynemurini (A2 Fig 3, 4, 7) – This large New World tribe was recovered monophyletic with 100 BS, as all its internal clades. Within the tribe, all included genera that the monophyly was tested (represented by more than one species) were recovered paraphyletic, *Clathroneuria*, *Brachynemurus* and *Scotoleon*. However, with minor taxonomic changes both *Scotoleon* and *Brachynemurus*, the largest North American antlion genera, could be made monophyletic. The internal branching of Brachynemurini placed the Neotropical species in the base and the Nearctic species in a derived monophyletic lineage. *Gnopholeon delicatulus*, formerly placed in Gnopholeontini by Stange (2004), was recovered deeply nested within the Nearctic clade. The placement of the whole tribe differed between the ML and ASTRAL analyses as mentioned above, but ASTRAL presented lower support (ML = 100 BS and ASTRAL = 93 BS).

Myrmeleontini (A2 Fig 3, 4, 8) – The 22 included species of the Myrmeleontini were recovered as monophyletic with high support (100 BS). *Myrmeleon* the largest genus of antlions, was recovered here as multiply paraphyletic (A2 Fig 8), with all of the smaller genera tested here, *Baliga*, *Callistoleon*, *Euroleon*, and *Hagenomyia*, recovered nested within *Myrmeleon* (A2 Fig 8). Among the four smaller genera included here, *Callistoleon* and *Euroleon* were represented by a single species each; while *Baliga* and *Hagenomyia* were represented by two species each, but only *Baliga* was recovered as monophyletic (A2 Fig 8).

Acanthaclisini (A2 Fig 3, 4, 9) – The 12 included species of Acanthaclisini were recovered as monophyletic, with very high support (100 BS). However, The ML and ASTRAL analyses recovered slightly different internal arrangements within the tribe (A2 Figs 1, 2). The ML tree recovered *Vella* basally, followed by a monophyletic *Paranthaclisis* (A2 Fig 9), then *Heoclisis* (paraphyletic without *Cosina*). The *Heoclisis* + *Cosina* clade recovered the *Heoclisis* species from Vietnam as basal, and *H. fundata*, in a group with a monophyletic *Cosina*, forming an Australian branch (A2 Fig 9). The remaining species formed a clade with *Jaya* sister to a monophyletic *Centroclisis*. The ASTRAL tree recovered a New World group composed of *Vella* and *Paranthaclisis*, which was sister to the clade *Heoclisis* + *Cosina*, and this combined group placed sister to *Jaya* + *Centroclisis*.

Nesoleontini (A2 Fig 3, 4, 9) – The six included species of this tribe, were recovered monophyletic with high support (100 BS). The richest genus in this tribe

Cueta, was also recovered monophyletic with high support (100 BS), and among the five included species the single European species as recovered sister to the four African ones.

Myrmecaelurini (A2 Fig 3, 4, 9) – The two included species of this tribe, both in the large genus *Myrmecaelurus*, were recovered monophyletic (100 BS), and sister to Nesoleontini (100 BS).

Acanthoplectrini (A2 Fig 3, 4, 10) – This new tribe was represented here by eight species recovered in a monophyletic clade with 100 BS, as all its internal clades. Within the tribe two lineages can be recognized, one formed by the Asian *Layahima elegans*, and an Australian clade represented by seven genera. Within the Australian clade *Acanthoplectron tenellum* was basal to a clade composed by six species formerly placed in Periclystina (Stange 2004).

Dendroleontini (A2 Fig 3, 4, 10) – This tribe was represented here by 27 species recovered in a monophyletic clade with 100 BS. The members of this tribe comprises the species formerly placed in two groups recognized by Stange (2004), Dendroleontina and Periclystina. The tribal internal arrangement presents the three Old World species placed in two basal while the 24 Australian species formed a monophyletic clade (100 BS). The taxonomy of this clade is discussed in the detail in Chapter III.

Nemoleontini (A2 Fig 3, 4, 11) – The 15 included species formed a monophyletic clade recovered with 100 BS, as all its internal clades. Within Nemoleontini, only the two Australian *Distoleon* are not from the Old World among the included species. Among the genera with the monophyly tested here (represented by

more than one species) *Distoleon* was recovered paraphyletic, while *Creoleon*, *Macronemurus*, and *Neuroleon* were recovered monophyletic (all with 100 BS).

Megistopini (A2 Fig 3, 4, 11) – This tribe was represented here by a single species, *Megistopus flavicornis*, a relatively common species with a broad distribution (Europe, Middle East and Northern Africa). The placement of the whole tribe differed between our analyses; it was recovered sister to Glenurini + Protoplectrini in the ML tree, but sister to Glenurini in ASTRAL, with extreme low support though (ML = 100 BS and ASTRAL = 38 BS).

Protoplectrini (A2 Fig 3, 4, 11) – This tribe was represented here by 15 species that formed a monophyletic Australian clade (100 BS). Among the genera with the monophyly tested here (represented by more than one species) *Stenoleon* was recovered monophyletic, while *Bandidus*, *Escura*, and *Protoplectron* were recovered paraphyletic.

Glenurini (A2 Fig 3, 4, 11) – This tribe was represented here by 15 species that formed a monophyletic New World clade (100 BS). Among the genera with the monophyly tested here (represented by more than one species) only *Glenurus* and *Purenleon* were recovered monophyletic. *Eremoleon*, *Euptilon*, and *Dimarella* were recovered paraphyletic. Furthermore, the division of *Dimarella* into two subgenera is not supported as both would be paraphyletic (A2 Fig 11).

Discussion

Phylogenetic relationships

This section will focus on the taxonomic treatment of the major clades recovered in our analysis and how they are related to previous studies comprising

Myrmeleontiformia. Within Myrmeleontidae the new classification proposed here will be compared to recent phylogenetic works (Jones 2014; Badano et al 2016; Michel et al 2017), and to the most accepted antlion classification to date (Stange 2004).

Myrmeleontiformia (A2 Figs 1-3) – The suborder as traditionally accepted was recovered paraphyletic, with Ithonidae nested within the group. Ithonidae (moth lacewings) is a very enigmatic family of Neuroptera, with a complex taxonomical history. The group was recognized as three families until recently, when Polystoechotidae and Rapismatidae were synonymized with Ithonidae (Winterton & Makarkin 2010). Some different sets of morphological data based on the larval head capsule (MacLeod 1964) and adult terminalia (Aspöck & Aspöck 2008) recovered the family sister to Myrmeleontiformia, which was later supported by molecular data (Winterton et al 2010; Wang et al. 2016).

The existence of a close relationship between Ithonidae and Myrmeleontiformia is not particularly surprising based on the recent studies, and was one reason why the family was chosen to be part of our outgroup. However the current analysis is the first time that the moth lacewings have been recovered within the suborder. The odd placement of Ithonidae merits additional study, and its inclusion in a broader study that includes the basal lineages of Myrmeleontiformia and a more complete cross-section of neuropteran outgroups will be necessary to confirm its proper relationships to other families.

Psychopsidae (A2 Figs 1-3, 5) – Despite the monophyletic status of the family, its placement close to Ithonidae requires a wider discussion. Psychopsidae was not

recovered as the basal clade of Myrmeleontiformia, as it usually is (Haring & Aspöck 2004; Beutel et al. 2010; Winterton et al. 2010; Zimmermann et al. 2011; Jones 2014; Randolph et al. 2014; Badano et al. 2016; Wang et al. 2016; Michel et al. 2017). Other recent studies have recovered the Psychopsidae in a variety of places relative to other Myrmeleontiformia taxa. Aspöck et al. 2001 and Aspöck & Aspöck 2008 recovered Psychopsidae as sister to Nemopteridae. Yang et al (2012), working with a combination of molecular and morphological data from extant and fossil species, recovered Psychopsidae in a clade with six other fossil families, often called Psychopsoidea. This group was, in turn not close to Myrmeleontiformia, but the sister group of a clade containing several other fossil families and the current Ithonidae, Chrysopidae, and the rest Myrmeleontiformia. This result was latter discussed in another study of fossil taxa (Makarkin et al. 2013), and was regarded as controversial by those authors.

Wang et al (2016) in their recent study focused on mitochondrial genomes recovered the silky lacewings as the basal lineage of Myrmeleontiformia, but its position was not consistent among the different analysis conducted. Its basal placement was recovered only in one Bayesian analysis (adopted by the authors), which had the most robust results. However, the results from Parsimony and homogeneous models (ML and Bayesian) analyses obtained different results, with Psychopsidae grouping together with Ithonidae, Chrysopidae and Hemerobiidae. But, the results obtained in these last analyses were considered very problematic by their authors, since they also contained unusual results in different parts of the Neuropterida tree.

We consider the results obtained here as unclear about the position of Psychopsidae, leaving this question open for future studies. The results of Wang et al (2016) suggest that the family may be very susceptible to different analysis artifacts, and its true position within the Myrmeleontiformia is a question that will require analysis that includes a broader cross-section of neuropteran taxa.

Nymphidae (A2 Figs 1-3, 5) – The internal division of Nymphidae in two subfamilies recovered here confirms some earlier and more recent results (Handlirsch 1906-1908; Withycombe 1924; 1926; Shi et al 2015; Wang et al 2016). However, the position of Nymphidae within the Myrmeleontiformia has still not stabilized. The family is recovered here as sister to Ithonidae, in a clade that also contains a basal Psychopsidae. Most morphological analyses recover Nymphidae as sister to Myrmeleontidae + Ascalaphidae, and many characters, especially from the head of both adults and larvae support this idea (Aspöck et al. 2001; Aspöck 2002; Beutel et al. 2010; Zimmermann et al. 2011; Randolph et al. 2014; Badano et al. 2016). Another set of morphological characters, focused on the terminalia recovered Nymphidae as sister to Nemopteridae + Psychopsidae (Aspöck & Aspöck 2008). All molecular analyses involving the Myrmeleontiformia have recovered Nemopteridae as sister to Myrmeleontidae + Ascalaphidae, with Nymphidae sister to these three families (Winterton et al. 2010; Jones 2014; Wang et al. 2016; Michel et al. 2017). The placement of Nymphidae suggested by molecular data, has also been recovered in a few phylogenetic analyses involving morphological characters (Stange 1994), and including fossil species (Yang et al. 2012; Makarkin et al. 2013).

The inclusion of a larger number of extant nymphid species in a broader neuropteran or Myrmeleontiformia analysis is needed to help solve the question of the placement of the Nymphidae. Despite the inconsistent placements noted above, it is becoming more clear that the traditional placement of Nymphidae as sister to Myrmeleontidae + Ascalaphidae is likely not correct.

Nemopteridae (A2 Figs 1-3, 5) – The monophyly of Nemopteridae, and both of its subfamilies, obtained here supports the results of most previous phylogenetic work (Stange 1994; Haring & Aspöck 2004; Winterton et al. 2010; Yang et al. 2012; Sole et al. 2013; Badano et al. 2016; Lan et al. 2016; Wang et al. 2016; Michel et al. 2017). Beutel et al. (2010) and Zimmermann et al. (2011) recovered Nemopteridae as paraphyletic based on morphological data, but both believed that result to be an artifact of the striking differences between the larvae of the two subfamilies. All this morphological differences might explain the notably long branch lengths recovered in our analysis, a feature also noted by Winterton et al (2010).

Nemopteridae has been recovered at several different positions within the Myrmeleontiformia in prior phylogenetic analyses. Morphological data have recovered Nemopteridae as sister to Nymphidae (Ascalaphidae + Myrmeleontidae) (Aspöck et al. 2001; Aspöck 2002; Beutel et al. 2010; Zimmermann et al. 2011; Randolph et al. 2014; Badano et al. 2016) or as sister to Psychopsidae (Aspöck et al. 2001; Aspöck & Aspöck 2008), but molecular data have consistently placed Nemopteridae as sister to Ascalaphidae + Myrmeleontidae (Winterton et al. 2010; Yang et al. 2012; Makarkin et al. 2013; Jones 2014; Wang et al. 2016; Michel et al. 2017). The latter result is supported

here and strongly suggests that it represents the correct placement of Nemopteridae, thus confirming Stange's (1994) morphological hypothesis.

Myrmeleontidae (A2 Figs 1-4) – To date all morphological studies have recovered both formerly recognized families Myrmeleontidae and Ascalaphidae as monophyletic, using both larval and adult characters (Stange 1994; Aspöck et al. 2001; Aspöck 2002; Aspöck & Aspöck 2008; Beutel et al. 2010; Zimmermann et al. 2011; Randolph et al. 2014; Badano et al. 2016). Recent studies based on molecular data, however, have given conflicting results on the monophyly of both.

Winterton et al (2010) recovered Ascalaphidae as paraphyletic relative to Myrmeleontidae. This result, however, was obtained only in a parsimony analysis, a Bayesian analysis in the same paper recovered both families monophyletic, but with very low support values. The results of this study were not strongly compelling as taxon sampling (only two species for each family). Jones (2014), in a larger morphological and molecular analyses that focused mostly on owlflies, always recovered Myrmeleontidae as paraphyletic in relation to Ascalaphidae. A paraphyletic Myrmeleontidae was also recovered in two subsequent studies, Lan et al (2016) and Wang et al (2016), both based in mitochondrial DNA. The molecular study of Michel et al (2017) the largest previous phylogenetic assessment of Myrmeleontidae recovered both families as monophyletic, in some analyses of their extensive dataset (7 genes and 106 Myrmeleontiformia, including 94 Myrmeleontidae). The ML analysis of these authors recovered both families monophyletic, but their Bayesian analysis recovered *Stilbopteryx* sister to Ascalaphidae, making Myrmeleontidae paraphyletic.

As noted in the introduction, the Michel et al (2017) study contained a large amount of missing data, which may explain the low support values for all backbone clades in their cladogram. No major clades in their tree have bootstrap values > 85, including the values supporting the monophyly of owlflies and antlions. The Michel et al study also suffers from the fact that > 95% of its taxa are from the Old World; the rich faunas of the New World and Australia are significantly underrepresented, and many large groups from both families are absent. All these technical problems are likely the explanation for the discrepant results between Michel et al (2017) and the results obtained here and all other recent molecular studies (Winterton et al 2010; Jones 2014; Lan et al 2016; Wang et al 2016).

Ascalaphinae (A2 Figs 1-4, 6) – The subfamily as proposed here comprises species from some distinctive clades traditionally recognized: all owlflies (former Ascalaphidae), two formerly antlion subfamilies (Palparinae and Stilbopteryginae) and the former tribe Maulini (in Myrmeleontinae according to Stange 2004)). The results obtained here were very similar to the Bayesian analysis of Jones (2014), who recovered the same clade, but with Stilbopterygini sister to all owlflies. The placement of these species in this subfamily is supported by the general habitus of their members, which are mostly robust and bulky Myrmeleontiformia insects in both larval and imago stages. They are also the most powerful flyers within Myrmeleontiformia. Another important feature to support Ascalaphinae is the karyotype. Kuznetsova et al (2015) summarized the known karyotypes of the former Myrmeleontidae and Ascalaphidae, and showed that the representatives of Ascalaphinae have a large number of chromosomes ($2n = 22, 24,$

26), whereas the remaining antlions have a smaller number ($2n = 14, 16, 18$), probably because of chromosomal fusion (Kuznetsova et al. 2015).

The internal arrangement of Ascalaphinae also carries some interesting biogeographic information. Dimarini is mostly diverse in South America; Palparini is most diverse in Africa, with a few species in southern Europe and Asia; Ululodini is present throughout the Americas, but is especially diverse in the Neotropics; Stilbopterygini occurs only in Australia. All of these distributions suggest a strong Gondwanan element to this clade. Apparently the group originated in Gondwana, where its basal clades are most diverse today, as discussed by Mansell (1992). The remaining, more derived, owlflies species probably dispersed later to all of the other parts of the globe, accounting for the current broad distribution of some genera.

When compared to the traditional classification of antlions (Stange 2004) the formerly subfamily Palparinae was recovered highly paraphyletic here. However, this paraphyly was not surprising, several earlier authors have pointed out that the characters used to support this subfamily are not very strong (Markl 1954; Insom & Carfi 1988; Mansell 1992; 1996; 2004; Stange 1994; Krivokhatsky 1998; 2011; Badano & Pantaleoni 2014). The only molecular phylogenetic studies to test the monophyly of the former Palparinae were Jones (2014) and Michel et al (2017), and both recovered it monophyletic. However, this can be explained by the absence of some key groups in both studies, e.g. *Dimares*, *Isonemurus*, *Maula*, and *Palparidius*, all included here.

Among the owlflies the two largest subfamilies formerly recognized (Ascalaphinae and Haplogleniinae) were also recovered paraphyletic. The traditional

Ascalaphinae was split into two monophyletic tribes recognized here, the basal Ululodini and Ascalaphini. The former Haplogleniinae was also divided into two tribes here, an Old World clade (Melambrotini) and a New World clade (Haplogleniini), which was recovered sister to Ascalaphini. The owlflies division recovered here is the same as that recovered by Jones (2014), with the exception of Stilbopterygini, (Ululodini (Old World Haplogleniinae (New World Haplogleniinae + Ascalaphini))). The general concordance related to the owlflies arrangement between Jones' results and ours, supports the classification proposed here. The same tribal division recovered here can be perfectly applied in Jones (2014) trees, which were based in a broader owlfly taxon sampling. The tribal division of the owlflies as recognized by the traditional classification, was not the focus of this study, and was not incorporated in our new classification. Furthermore, Jones (2014) recovered almost all owlflies traditional tribes as paraphyletic, strongly suggesting that more studies are needed to solve this question.

Dimarini (A2 Figs 1-4, 6) – The current analysis was the first to include a representative of this tribe in a molecular phylogenetic analysis. At the generic level Dimarini as proposed here is identical or nearly to what is recognized by Stange (2004). It contains three small genera: two from South America, *Dimares* and *Millerleon*, and *Echthromyrmex* from the Middle East and Asia. The placement of the two genera not test here (*Millerleon*, and *Echthromyrmex*) in this tribe was made in order to keep a taxonomic stability. *Millerleon* is very similar to *Dimares* and it can be confidently placed in Dimarini. However, the placement of *Echthromyrmex* still needs to be tested. Different from Stange (2004), the genus has been classified by other authors in a variety

of ways, including as a separate subfamily, Echthromyrmicinae (Markl 1954), or in a clade together with the Dendroleontinae and Nemoleontinae (Krivokhatsky 2011).

Palparini (A2 Figs 1-4, 6) – Within Palparini tree distinctive lineages can be recognized, which are correspondent to former tribes recognized by Stange (2004). The basal clade in Palparini is a monophyletic clade formed by two species formerly placed in Maulini (Stange 2004). The two species were recovered paraphyletic in the ASTRAL, but with low support (65 BS). The next lineage to branch out is formed by *Palparidius capicola*, formerly placed in Palparidiini according to Stange (2004). The third and richest lineage is formed by the Palparini sensu Stange (2004), which was previously tested in two studies (Jones 2014; Michel et al. 2017) and recovered monophyletic.

The lineage formed by *Isonemurus* + *Maula* (former Maulini) is a relic group known only from Southern Africa, and its taxonomic position has been the subject of long debate, particularly as its larvae is still unknown, and was never tested in a molecular context. Stange (2004) suggested this lineage close to Dendroleontinae based on characters of the legs and palpi, while Krivokhatsky (1998; 2011) placed it closer to Myrmelontini. However, the only hypothesis supported by our analysis was made by Markl (1954) who placed it closely related to the former Palparinae, based on the wing venation.

The second lineage represented here by *Palparidius capicola* is another group whose phylogeny was tested in a molecular analysis for the first time here. This species is one of three of the genus *Palparidius* from Southern Africa. This small group is characterized by highly modified male terminalia and was recognized as distinctive tribe

by Stange (2004). Because of its unusual terminalia the position of this genus was highly debated by earlier authors. Mansell (1996) suggested that it was closely related to Dimarini, while Markl (1954) and Krivokhatsky (2011) placed it close to the enigmatic *Pseudimaris* (not included here). However, Stange (1994) recovered the genus close to Palparini sensu Stange (2004), which was supported here.

The third lineage is the largest one within Palparini, with 16 genera and 124 species (Oswald 2015). It is widespread in Africa, with a few additional species in the southern Palearctic region and parts of southern Asia. The group contains the largest and most colorful antlions, which are grouped into genera based on a variety of morphological characters present in both adults and larvae (Insom & Carfi 1988; Mansell 1992; 1996; 2004; Stange 1994). The monophyly of this lineage has never been seriously questioned and is widely recognized, but its internal classification is unsettled, especially the taxonomical status of its largest genus *Palpares*. *Palpares* was noted by Mansell (2004) to be a polyphyletic assemblage of taxa, and its classification has been historically contentious as discussed by Insom & Carfi (1988). The paraphyly of traditional *Palpares* was also recovered by Michel et al. (2017), with the *Palpares* species distributed within a clade that included members currently assigned to five other genera. All these results indicate that the genus *Palpares* is in need of a comprehensive revision.

One remaining question regarding Palparini include the placement of the monospecific Middle Eastern genus *Pseudimares*, whose taxonomic placement have been the subject of long debate. Stange (2004) recognize it as a separate tribe near to

Dimarini, while Krivokhatsky (2011) place it in a subfamily with *Palparidius*. Unfortunately *Pseudimares* was not available for this study, and its placement needs to be confirmed.

Ululodini (A2 Figs 1-4, 6) – The basal position of Ululodini among the owlflies recovered here was also obtained by Jones (2014). The placement of the genera included in both studies, Jones' and ours, were almost identical: *Ameropterus* paraphyletic without *Cordulecerus*, and *Ululodes* monophyletic. Despite the general agreement between both studies the most interesting result within this clade was the placement of *Albardia furcata*, which was not present in Jones (2014). The phylogenetic position of this species was tested here by the first time in a cladistics analysis. The species was recovered basal to the remaining Ululodini, forming this New World clade. The position of *Albardia* has long been debate among neuropterists, but it is more recently recognized as the single representative of the owlfly subfamily Albardiinae (New 1982; Penny 1983; Stange & Miller 1990; Stange 2004; Krivokhatsky 1998; 2011). However, *Albardia* has also been considered as separated family, together with Stilbopterygini (Tillyard 1926; Riek 1968; 1976), which was rejected by our results.

Stilbopterygini (A2 Figs 1-4, 6) – The tribe as proposed here is identical to what is recognized by Stange (2004) as the subfamily Stilbopteryginae. It contains only two small genera *Aeropteryx* and *Stilbopteryx* from Australia. The monophyly of this clade was also recovered by Jones (2014), but different of our analysis *Stilbopteryx* was paraphyletic without *Aeropteryx*, in his study. The placement of Stilbopterygini is a long debate among neuropterists as mentioned in the introduction and in the topic above. The

representatives of this tribe present a series of intermediate characters that can either justify their placement near the antlions or the owlflies. Male and female terminalic characters, and a few larval characteristics, suggest Stilbopteryginae closer to the former Myrmeleontidae (Riek 1976; New 1982; Stange 1994; Badano et al. 2016). But, different larval characters, the overall adult habitus (Jones 2014; Badano et al. 2016), and behavior tend placed the group closer to the former Ascalaphidae. This close relationship between Stilbopteryginae and the owlflies was also recovered by Jones (2014), who placed Stilbopterygini as sister to former Ascalaphidae, different from what as recovered here. Our results placed the Stilbopterygini branching out right after Ululodini, and both tribes are characterized by a series of shared putatively plesiomorphic wing characters according to Jones (2014), such as hind wing with MP 2 fork not distinctive and CuA first sinuous and then continuing down the length of the wing.

Melambrotini and Haplogleniini (A2 Figs 1-4, 6) – The two tribes recognized here were formerly parts of the traditional entire-eyed owlfly subfamily Haplogleniinae, which was recovered paraphyletic here. As mentioned above the results obtained here are very similar to what Jones (2014) recovered, the entire entire-eyed owlfly divided in an Old World clade and a New World clade. The taxon sampling of Jones was much larger than ours in this section of the tree, but all the extra species tested in his study can be perfectly placed in our new classification. The traditional division of the entire-eyed owlfly into seven small tribes were not tested here but the genera classified in each one of those can be also easily assigned in the new classification.

Ascalaphini (A2 Figs 1-4, 6) – At the generic level, Ascalaphini as recognized here comprises all species placed in the former subfamily Ascalaphinae with the exception of Ululodini. Ascalaphini as recognized here represents all split-eyed owlflies except the ones from the New World (Ululodini). The arrangement of the internal lineages of Ascalaphini was not the focus of our study, but according to the traditional classification all species placed here in the tribe Ascalaphini were divided into six small formerly recognized tribes. This former tribes might be used in the future as a starting point to a subtribal division, but much more studies are needed in order to do this, since most of them were recovered paraphyletic by Jones (2014).

Myrmeleontinae (A2 Figs 1-4) – Myrmeleontinae as recognized here is represented by five tribes: Brachynemurini, Myrmeleontini, Acanthaclisini, Nesoleontini and Nemoleontini. This concept is different from what was previously proposed by Stange (2014), who recognized Myrmeleontinae in a broader sense, which also included the former tribe Maulini and other two distinctive subfamilies recognized here, Dendroleontinae and Nemoleontini. In fact, the name Myrmeleontinae has changed dramatically since its earlier characterizations by Banks (1899, 1911).

Myrmeleontinae as recognized here was sister to the clade Dendroleontinae + Nemoleontini, but the monophyly of this large clade was not particularly surprising. The morphological studies of Stange (1994) and Badano et al (2016) also recovered this clade monophyletic. However, the results of Michel et al (2017) recovered a different arrangement, but with an overall low support values as discussed before. The tribal arrangement of Myrmeleontinae recovered here reflects some earlier studies. The clade

formed by Myrmeleontini, Acanthaclisini, Myrmecaelurini, and Nesoleontini (A2 Figs 1-4), is very close to what was obtained by Stange (1994), was recovered by Badano et al (2016), and had been previously suggested by other authors (Markl 1954; Badano & Pantaleoni 2014). Badano et al (2016) called the clade formed by these four tribes the “specialized diggers” based on their larval behavior. They mentioned this group as one of the major radiations of antlions, and they are particularly diverse in xeric areas. The larvae are particularly well adapted to a fossorial lifestyle, and the group includes all of the pit-building antlions (Badano et al. 2016).

Brachynemurini (A2 Figs 1-4, 7) – Brachynemurini is restricted to the New World and is the most diverse clade in this part of the world being the dominant tribe in the Nearctic. At the generic level, Brachynemurini as recognized here is identical or nearly to its initial concept when created by Banks (1927) and later recognized by Markl (1954). However, Stange (1994; 2004) considered this clade as three distinctive tribes, Brachynemurini (sensu stricto), Gnopholeontini, and Lemolemini. Stange (1994) erected the later two tribes based on both larval and female terminalia characters. Former Gnopholeontini was represented by four small genera, which are found primarily in the Sonoran region, particularly Mexico; and former Lemolemini was represented by seven genera found only in South America, especially Chile. One species of *Gnopholeon* was included in a molecular phylogenetic analysis for the first time here, and was recovered deeply nested within Brachynemurini (sensu stricto) with high support (100 BS), which is incongruent with Stange’s classification. To date, no species formerly placed in

Lemolemini was included in any molecular study (including ours), and their placement within Brachynemurini as proposed here still need to be confirmed.

The position of the Brachynemurini was a long debate among the neuropterists during the last century, but it was only initially tested in a cladistics analysis by Stange (1994), who divided the clade in the tree tribes mentioned above. Michel et al (2017) recovered an association between Brachynemurini and Dendroleontinae, but this result is weakly supported because of the low number of species included in Michel et al (2017). Despite the discrepant results regarding the Brachynemurini placement in our analyses (discussed above), it was recorded within Myrmeleontinae with 100 BS in the ML analysis, which is supported by the number of presectoral crossveins in the hind wing. All tribes placed in Myrmeleontinae have > 3 presectoral crossveins, while both Nemoleontini and Dendroleontini have 1-3.

Within Brachynemurini, the results found here are very similar to those obtained by Stange (1994). He recovered the Neotropical genera of Brachynemurini basal to the Nearctic ones, a result also found here (A2 Fig 7). Stange further suggested the division of the Neotropical fauna in two groups, a result also supported here (A2 Fig 7). One of Stange's groups comprised the genera *Ameromyia* and *Venezueleon*. Of this group only *Ameromyia* was included here, and it was recovered basal to the rest of the Brachynemurini. Stange's second group was comprised of *Argentoleon*, *Austroleon*, *Peruveleon*, and *Ensorra*, a group in that was also recovered as monophyletic here (except that *Ensorra* was not included) (A2 Fig 7). Within the largely Nearctic group the close relationship between *Clathroneuria* and *Mexoleon* recovered here, differs from that

suggested by Stange (1994), who placed *Mexoleon* close to *Chaetoleon*. The close association between *Scotoleon* and *Brachynemurus* is very similar to what was recovered by Stange (1994).

Myrmeleontini (A2 Figs 1-4, 8) – At the generic level, Myrmeleontini as recognized here is identical or nearly so to what it is by Stange (2004). The tribe is composed of a large number of species that are very similar morphologically. This homogeneity is particularly striking in the larvae, which are all obligate pit builders (Stange 2004; Badano & Pantaleoni 2014). Because of this monophyly of the clade has never been seriously challenged, but its phylogenetic position within Myrmeleontidae has been variously interpreted. Mansell (1996) suggested that the Myrmeleontini was one of the basal lineages of antlions, based on its current cosmopolitan distribution. This hypothesis was supported by Stange (1994), who recovered Myrmeleontini in a basal position. Krivokhatsky (1998; 2011), suggested that Myrmeleontini was closely related to former Gepini (currently part of Myrmecaelurini) and former Maulini, a hypothesis that is not supported here. Michel et al (2017) recovered Myrmeleontini as sister to Brachynemurini + Dendroleontinae, with low support though (67 BS). The only previous study to place Myrmeleontini in a position similar to that obtained here is Badano et al. (2016), who also recovered Myrmeleontini in a clade with Acanthaclisini, Myrmecaelurini and Nesoleontini.

Myrmeleontini as recognized by Stange (2004) is divided into two subtribes, Myrmeleontina and Porrerina, which as not tested here. Unfortunately, no representatives of Porrerina were available for inclusion in this study. Porrerina is a

monogeneric group containing five species (Stange 2004). It is restricted to South America and has yet to be analyzed in a rigorous phylogenetic context. Myrmeleontina is a much larger taxon (ca. 200 species) whose internal phylogeny has been unclear. The subtribe is numerically dominated by the largest genus of antlions, *Myrmeleon*, but also contains 11 additional small genera that are distinguished by a few distinctive characteristics. *Myrmeleon* comprises nearly 180 species (Oswald 2015), is distributed worldwide, and in many parts of the world are the most common and conspicuous antlions. The genus was recovered here as multiply paraphyletic (A2 Fig 8), similar to the result obtained by Michel et al (2017).

Other interesting result from our analysis was the placement of *Callistoleon*, which was surprisingly recovered close to the base. The larvae of this small Australian genus (3 species) are the only larvae known to build “star-pits” (pits with side trenches that direct prey toward the central pitfall trap where the larva stations itself. Because of this complex behavior, Mansell (1988) hypothesized that this genus should occupy a relatively derived phylogenetic position within the tribe, a hypothesis that is not supported here.

Although the present analyses recovered several small clades that are restricted to single continents (A2 Fig 8), no continents included species were entirely monophyletic. The included New World species belong to two separate clades, one of which is the most basal lineage of the tribe (A2 Fig 8). Michel et al (2017) also recovered a small New World clade as the basal lineage in their analyses. The species treated by Michel et al (2017) were different from those included here, but they all belong to the same species

group (Oswald personal communication). Some of the South African clustered in a small near basal clade, but other species grouped with different species from Europe and Asia (A2 Fig 8). Most Australian species were united in one clade; but *M. regularis* grouped with a species from Thailand (A2 Fig 8). *Baliga*, *Euroleon*, and *Hagenomyia*, were recovered in slightly different places in our two analyses, but always deeply nested within *Myrmeleon*. The results obtained here strongly reinforce the statement made by Michel et al (2017) that *Myrmeleon* is in urgent need of further taxonomic and phylogenetic studies. The polyphyletic nature of the continental *Myrmeleon* faunas represented in our analysis suggests that continents have been multiply colonized by different *Myrmeleon* lineages at different times in their evolutionary histories

Acanthaclisini (A2 Figs 1-4, 9) – At the generic level, Acanthaclisini as recognized here is identical or nearly so to what it is by Stange (2004). This is a cosmopolitan clade, very well defined group, and is composed of a very homogeneous set of genera and species (Stange & Miller 1985; 1990). In general, its representatives are much larger and more robust specimens, which easily distinguished them from the remaining antlions. Because of these characteristics the monophyly of this clade was never seriously contested, but its phylogenetic position within the Myrmeleontidae has been extensively debated. This group has already been classified as a separate subfamily, Acanthaclisinae, by many authors (Markl 1954; Stange 1970; Hölzel 1976; New 1985b; Oswald & Penny 1991; Krivokhatsky 1998; 2011). In addition, Krivokhatsky (2011) considered Acanthaclisinae as the most basal lineage of the antlions, which was very similar to what was recovered by the molecular data of Michel et al (2017), with low

support tough (70 BS). However, the tribe was recovered here as part of a larger monophyletic clade that also included Myrmecaelurini, Nesoleontini, and Myrmeleontini (100 BS), the “specialized diggers” as defined by Badano et al (2016).

Nesoleontini (A2 Figs 1-4, 9) – At the generic level, Nesoleontini as recognized here is also identical or nearly so to what it is by Stange (2004). This is a small tribe containing three genera; *Nesoleon* and *Nadus* are very small genera that are restricted to Africa, but the third genus, *Cueta* includes ca. 80 species and is widespread in Africa, and parts of southern Europe and Asia. The monophyly of this tribe is in agreement with other phylogenetic works (Badano et al. 2016; Michel et al. 2017).

Not surprisingly Nesoleontini was recovered here as sister to Myrmecaelurini with high support (100 BS). Historically, this arrangement has been suggested by multiple authors (Markl 1954; Hölzel 1976; Stange 1994; 2004; Krivokhatsky 1998; 2011; Badano & Pantaleoni 2014; Badano et al. 2016; Michel et al. 2017), and Nesoleontini was once considered as a subtribe of Myrmecaelurini (Stange & Miller 1990). The species belonging to these tribes are very similar morphologically, particularly their larvae, all of which are psammophilous. Badano & Pantaleoni (2014) noted that the larvae of these clades are difficult to separate. They are also very similar to Myrmeleontini larvae, probably because of similar adaptations to pit building. Many species of both Myrmecaelurini and Nesoleontini are pit builders, but apparently not obligatorily so, as in the Myrmeleontini (Mansell 1996).

Myrmecaelurini (A2 Figs 1-4, 9) – At the generic level, Myrmecaelurini as recognized here is also identical or nearly so to what it is by Stange (2004). As

characterized by Stange (2004) Myrmecaelurini comprises species from three former tribes: Gepini, Isoleontini and Myrmecaelurini, which are still recognized by Krivokhatsky (1998; 2011). According to Stange (2004) the tribe is composed today of a total of 16 genera and ca. 150 species; it is restricted to the Old World, but is particularly diverse in the Middle East. More than half of the species belonging to the tribe are included in one genus, *Myrmecaelurus*, which was the only genus included here (A2 Fig 9). Our analyses recovered a monophyletic *Myrmecaelurus* as sister to Nesoleontini as mentioned above.

Despite the monophyletic Myrmecaelurini recovered here, the tribe has been recovered as not monophyletic in studies with broader tribal taxon sampling (Badano et al. 2016; Michel et al. 2017). Michel et al (2017) recovered *Myrmecaelurus* and *Lopezus* (Myrmecaelurini sensu Krivokhatsky (2011)) as sister to Nesoleontini, while *Gepus* and *Solter* (Gepini sensu Krivokhatsky (2011)) were recovered together in a different part of their tree. Based on those results Michel et al (2017) proposed the reestablishment of tribal status for the Gepini. Badano et al (2016) recovered Myrmecaelurini as polyphyletic, *Gepus* and *Solter* in a basal position, but paraphyletic, and three Myrmecaelurini (sensus Krivokhatsky 2011) genera tested, *Myrmecaelurus*, *Nohoveus* and *Nophis*, recovered as polyphyletic. The first two genera were sister to Nesoleontini, as in our results, but *Nophis* was grouped with Acanthaclisini (Badano et al. 2016).

Unfortunately, the Myrmecaelurini is the weakest part of our tree; only two species from this diverse and complex clade were available for inclusion here. The taxonomic difficulties contained in this tribe were mentioned by Stange (2004), who

noted that generic limits within Myrmecaelurini remain unclear, and that phylogenetic studies are required to solve this problem. The most recent phylogenetic studies suggest that the earlier division of the tribe into three clades might be useful (Badano et al. 2016; Michel et al. 2017), but additional studies with broader taxon sampling are needed to address these issues. In this sense, we decided to use a conservative approach for this tribe and we are considering it as recognized by Stange (2004).

Dendroleontinae (A2 Figs 1-4, 10) – At the generic level, Dendroleontinae as recognized here is identical or nearly so to what Stange (2004) recognized as the tribe Dendroleontini. This is a relatively old family-group name within the Myrmeleontidae, and its definition has changed over the years. The name was first proposed by Banks (1899; 1911) in a very broad sense. Subsequently Tillyard (1916) started to divide the group in smaller clades, which are today part of the other subfamilies here recognized. The definition of this group as recognized here was defined by Stange (1976), who did a major taxonomic review of the clade and established its boundaries.

Although the subfamily was recovered as strongly monophyletic here on the basis of molecular data, morphological apomorphies for the clade are unclear. Dendroleontinae has been defined mostly on the basis of larval characters, especially the presence of a specialized medial tuft of setae dorsally on the thorax (Stange 2004). However, the larvae of only a few genera are known and some of them do not exhibit this character (Stange 1976; 1994; 2004). Stange (1976) revised the group and divided it into five subtribes, which are recognized in the traditional classification of the antlions (Stange 2004). These divisions were based on female terminalic traits, and divided the

clade into two large, diverse groups: former Dendroleontina (23 genera) and former Periclystina (10 genera), and three small former monogeneric, groups: Acanthoplectrina, Neglurina, and Voltorina. According to Stange (2004), former Dendroleontina is the largest group and is subcosmopolitan in distribution (absent in South America). Former Periclystina and Acanthoplectrina are restricted to Australia and some nearby islands. Former Voltorina is known from one described species from Madagascar, which Stange (1976) considered the basal lineage within the tribe (unfortunately it was not available for inclusion here). Former Nuglerina comprises four enigmatic species from Southeast Asia and India (it was also not available for, phylogenetic analyses here).

The division of the Dendroleontinae into these five smaller clades was not supported by our results, which recovered the two major clades (former Dendroleontina and Periclystina) strongly paraphyletic. Alternatively, our results strongly suggest that Dendroleontinae, is divided into two groups, which we are considering here as the tribes Acanthoplectrini and Dendroleontini. Unfortunately, neither *Nuglerus* nor *Voltor* (both formerly recognized as distinctive subfamilies) were available to this study. In this sense, we opted to use a conservative approach and we a placing these two relic genera in the most diverse tribe, Dendroleontini, but more studies are needed to confirm it.

Dendroleontinae was recovered here as sister to Nemoleontinae, with high support (A2 Figs 1-4), a result anticipated in the work of several earlier authors (Banks 1899; 1911; Tillyard 1916; Markl 1954; Stange 1970) who noted associations between these groups. Morphological characters have been used to justify this association, including Stange & Miller (1990), who stated that larval characters support a close

association between these two clades. The larval study of Badano et al (2016) also recovered Dendroleontinae as sister to Nemoleontinae. The results presented by Michel et al (2017) are of odds with other recent work, and may be due to the fact that those authors had only one species of Dendroleontinae in their analysis.

Acanthoplectrini (A2 Figs 1-4, 10) – Acanthoplectrini as recognized here is much broader than what Stange (2004) recognized as the former subtribe Acanthoplectrina. The tribe was initially proposed by Markl (1954) to place the small Australian genus *Acanthoplectron*, which was followed by Stange (1976; 2004). The group was defined based on the odd tibial spurs, which has different lengths in each pair of legs. However, this distinctive nature of *Acanthoplectron* was not supported by our results. The genus was recovered here together with most of the small Australian genera that were previously placed in the former Periclystina, and the Asian *Layahima*, previously placed in the former Dendroleontina (Stange 2004). See Chapter III for more details on this tribe.

Dendroleontini (A2 Figs 1-4, 10) – Dendroleontini as recognized here is much broader than what Stange (2004) recognized as the former subtribe Dendroleontina. Our definition of Dendroleontini also includes the members of the former subtribes Nuglerina and Voltorina, and most of the species of the former Periclystina. Dendroleontina as recognized by Stange (2004) was recovered paraphyletic in our analysis. In fact, our results recovered the non Australian Dendroleontina, basal to a monophyletic lineage formed by the Australian species formerly placed in

Dendroleontina and Periclystina. By this reason we opted for a conservative approach and combined all these genera in one tribe, Dendroleontini.

Unfortunately, many genera missing from our study include several diverse groups from the Old world, and a variety of small genera from the Old World and Australia (A2 Fig 10). In this sense, these missing genera will need further studies to confirm their placement within Dendroleontini, which is particular true for the small Old World genera, similar to *Layahima* (Acanthoplectrini) (A2 Fig 10).

Nemoleontinae (A2 Figs 1-4, 11) – At the generic level, Nemoleontinae as recognized here is identical to what Stange (2004) recognized as the tribe Nemoleontini. This groups has a cosmopolitan distribution and comprises, 61 genera and > 640 species (Stange 2004; Oswald 2015). The monophyly of Nemoleontinae recovered here was somewhat surprising, given that some previous authors have suggested that the group was probably not monophyletic (Stange & Miller 1985; 1990; Stange 1994; Mansell 1996; 1999), and was recovered paraphyletic by Badano et al (2016). However, the results obtained here are congruent with Michel et al (2017), who also recovered the group as monophyletic, but only members of the now recognized Nemoleontini were present in this study.

The taxonomic history of Nemoleontinae is relatively complex. The clade was created by Banks (1911) for a small group of four African genera. All of the other genera that are currently included in Nemoleontinae were initially contained in other small groups proposed by a variety of authors (Navás 1912; Tillyard 1916; Esben-Petersen 1918; Banks 1927; Markl 1954; Hölzel 1976; Krivokhatsky 1998). Markl (1954)

included the species placed today in Nemoleontinae in eight different tribes. Stange (1970), and Stange & Miller (1985; 1990), criticized many of the groups proposed by Markl (1954), noting that many were weakly defined and that most could not be applied to the New World fauna, and for this reason decided to merge all of them into one large group.

According to Stange (2004) Nemoleontinae can be divided into four lineages, which he called as the former subtribes: Dimarellina, Nemoleontina, Neuroleontina and Obina. Members of all of these four clades were included in our analysis, but our results strongly rejected this division. In the present analysis, considering the traditional subtribes, only Dimarellina was recovered as monophyletic (A2 Fig 11). Both Nemoleontina and Neuroleontina were strongly polyphyletic (A2 Fig 11). We were not able to test the monophyly of Obina because only one species was studied. Some recent phylogenetic studies also recovered Nemoleontina and Neuroleontina as polyphyletic (Badano et al. 2016; 2017; Michel et al. 2017).

In general our results suggested the division of this large subfamily into four lineages that we are calling here as the tribes: Nemoleontini, Megistopini, Protoplectrini and Glenurini. The division of Nemoleontinae in four tribes is distinctive from the four subtribes recognized by Stange, since the largest subtribes were recovered strongly polyphyletic here. The four tribes proposed here actually present a strong geographical component, with the exception of Nemoleontini; each one of the other three are restricted to only one part of the world.

Nemoleontini (A2 Figs 1-4, 11) – Nemoleontini as recognized here is very different of what Stange (2004) recognized as the former subtribe Nemoleontina. The tribe as recognized here includes the genera placed in the former Obina, the Old World genera of the former Nemoleontina and most of the Old World genera of the former Neuroleontina. Nemoleontini as recognized here comprises all the Old World genera of the Nemoleontinae (except *Megistopus*) and the Australian species of the subcosmopolitan and diverse genus *Distoleon*. The analysis of Michel et al (2017), which included a larger number of Nemoleontini species, also recovered the tribe monophyletic.

Our analysis recovered *Obus* as the basal lineage (A2 Fig 11), followed by a monophyletic *Macronemurus*. The basal placement and the monophyly of *Macronemurus* were also recovered by Michel et al (2017). The next branch was a Southern African clade formed by one species of *Nemoleon* and one species of *Distoleon* (A2 Fig 11). The placement of *Nemoleon* in this clade renders the former Nemoleontina (Stange 2004) polyphyletic, which was also recovered by Michel et al (2017). *Banyutus* branches next, followed *Distoleon* species (the only Australian species in this clade). The polyphyly of *Distoleon* is not surprising; this is the second largest genus of antlions, it is poorly defined, and was also recovered as polyphyletic by Michel et al (2017). The rest of the species in this clade were divided into two monophyletic genera *Neuroleon* and *Creoleon*, which are, respectively, the third and fourth most diverse genera of antlions. *Creoleon* was also recovered as monophyletic by Michel et al (2017), but *Neuroleon* was paraphyletic, with three other genera placed within the 12 species

analyzed by those authors. In summary the results obtained here and by Michel et al (2017), strongly suggest that the most diverse genera in this tribe are in need of comprehensive taxonomic review.

Many small and poorly known genera of Nemoleontinae from the Old World were not included in this study, and their placement still need to be confirmed. However, we decided to adopt a conservative approach and included most of these non-tested genera from the Old World in the most diverse tribe Nemoleontini, but some of them likely to be transferred to Megistopini in future studies.

Megistopini (A2 Figs 1-4, 11) – This tribe was represented here by only one species of the genus *Megistopus*, which was the only genus from the Old World to not be placed in the larger Old World clade recovered here, Nemoleontini. In fact, Megistopini was recovered closer to the Australian and New World tribes. Actually, this distinctive position of *Megistopus* in relation to the other Old World genera was recently addressed by Badano et al (2017). The authors recovered *Megistopus* in a monophyletic clade with *Gymnocnemia* and *Nedroledon*, separated from the other Old World Nemoleontinae. The result obtained here reinforces the distinctive nature of *Megistopus*, and by this reason it is classified here in a separate tribe, together with *Gymnocnemia* and *Nedroledon*.

Protoplectrini (A2 Figs 1-4, 11) – Protoplectrini as recognized here comprises all the Australian species of the subfamily, except the *Distoleon* species (Nemoleontini). Protoplectrini as defined here is broader than its traditionally recognized (Tillyard 1916; Markl 1954; New 1985a; Krivokhatsky 1998; 2011). Customarily the Australian Nemoleontinae has been divided into two clades, Protoplectrini (*sensu stricto*) and

Distoleontini (New 1985a) / Bandidini (Krivokhatsky 1998; 2011). Stange (2004) also divided the Australian Nemoleontinae into two clades in his subtribal classification, the former Nemoleontina and Neuroleontina. However, our results do not support any of these traditional divisions. Actually, none of these suprageneric clades mentioned above were recovered monophyletic here; in fact they are both paraphyletic in relation to each other. In this sense, we opted to keep this group in a single tribe, Protoplectrini.

All Nemoleontinae small genera from Australia that were not included here are very similar to the ones included, and future phylogenetic studies will likely place them in the same clade recovered here. In this sense, we are also including these genera in Protoplectrini. Our results indicate that Protoplectrini might be split into two smaller lineages (A2 Fig 11). However, in order to do this, it is clear that a comprehensive taxonomic review at the genus level is needed, since most of the current recognized genera were recovered as paraphyletic, with representatives placed in both lineages (A2 Fig 11).

Glenurini (A2 Figs 1-4, 11) – Glenurini as recognized here comprises all the New World species of the subfamily. Glenurini as defined here is smaller than its traditionally recognized, because it excludes the Old World species placed in this group by earlier authors (Markl 1954; Krivokhatsky 1998; 2011). When compared to Stange's classification (2004), Glenurini corresponds to all species of the former Dimarellina and the New World species of the former Neuroleontina. The former Dimarellina was actually recovered as monophyletic here but nested within the remaining New World

genera, which justify our decision to keep the New World lineage as a single tribe, Glenurini.

The internal relationships of Glenurini were recovered slightly differently in our two analyses, mostly because of the position of the monophyletic genus *Glenurus*. ML recovered *Glenurus* as sister to Dimarellina, while ASTRAL placed it basal to all other species in the clade, in both cases with low support. Our results also demonstrate that some of the genera classified in this tribe are also in need of taxonomic reviews.

All Nemoleontinae small genera from the New World that were not included here, are very similar to the ones included, and future phylogenetic studies will likely place them in the same clade recovered here. In this sense, we are also including these genera in Glenurini.

Conclusion

This study represents the largest phylogenetic data set on the Myrmeleontidae analyzed to date. It contains approximately twice the number of ingroup taxa and ca. 50 times the number of informative characters, as the next largest analysis. It was the first genomic phylogenetic study for the family and included many key taxa never before included in a Myrmeleontiformia phylogeny. The results obtained are broadly consistent with previous phylogenetic analyses and taxonomic classifications to the tribal rank, though with many exceptions, which were addressed in the new classification proposed.

We test the monophyly of the traditional suborder Myrmeleontiformia, which we failed to recover. Ithonidae was recovered within the suborder in a close relationship with Nymphidae and Psychopsidae. Nemopteridae was recovered as sister to the

complex Ascalaphidae + Myrmeleontidae, which is in accordance with recent molecular results. Either Ascalaphidae or Myrmeleontidae were recovered paraphyletic in their traditional forms, which was also expected based on previous molecular data.

The division of the former Ascalaphidae and Myrmeleontidae in subfamilies were also not recognized here, but the monophyly of some traditional antlion tribes were recovered as monophyletic. Despite the absence of some key myrmeleontid taxa in the analyses, our results strongly suggest that a number of major modifications in the classification of Myrmeleontidae and Ascalaphidae were necessary. To this end we presented here a new classification that better fits our results.

Future studies

Based on the results obtained here we suggest the following focal areas as priorities for future research.

Nymphidae and *Psychopsidae*. The placement of these two tribes close Ithonidae needs to be investigated.

Nemopteridae. The apparent paraphyly of the tribe Crocini needs to be addressed.

Myrmeleontidae

The historically anomalous genera *Echthromyrmex* and *Pseudimares* were not examined. Their positions within the Palparini would be of considerable interest.

Ascalaphini as defined here was traditionally divided into six lineages, which were not tested here. Testing the monophyly of these lineages would be interesting.

The historically anomalous genera belonging the former Lemolemini were not examined. Their positions within the Brachynemurini needs further confirmation.

Myrmecaelurini was underrepresented here. A study comprising a more diverse taxon sampling will be crucial its monophyly.

Some genera of Dendroleontini were not included in our analyses, and their placement still need to be confirmed. Particularly, the historically anomalous genera *Nuglerus* and *Voltor*.

Some genera of Nemoleontni were not included in our analyses, and their placement still need to be confirmed. Particularly, the historically anomalous small genera from the Old World.

The boundaries of some of the largest genera of Myrmeleontidae, such as: *Bandidus*, *Distoleon*, *Myrmeleon*, *Neuroleon*, and *Palpares* and are in urgent needing of comprehensive taxonomic reviews.

The data set compiled for this work constitutes a solid base that can be augmented with additional taxa in future AHE analyses. The construction of specific probes for Neuroptera, which is the most difficult and expensive part of AHE works, is already done. We invite neuropterists around the world to collect additional taxa and join in collaborative effort to expand the already massive data set created here, to try to solve some of the issues mentioned above.

CHAPTER III
PHYLOGENY AND REVISION OF THE ANTLION SUBTRIBE PERICLYSTINA
(NEUROPTERA: MYRMELONTIDAE)

Introduction

The Periclystina was erected by Stange (1976) as one of five subtribes of the Dendroleontini. Until now, this group of antlions contained 63 valid species divided into ten genera and distributed throughout Australia, with only one species known from outside the country, *Periclystus vicinus* New from Papua New Guinea (New 1985d; Stange 2004).

Five of the current genera placed in Periclystina were included in the original description of the subtribe (Stange 1976): *Austrogymnocnemia* Esben-Petersen, *Ceratoleon* Esben-Petersen, *Franzenia* Esben-Petersen, *Glenoleon* Banks, and *Periclystus* Gerstaecker, which were grouped mostly on the basis of characters of the female terminalia. In the same work, Stange suggested that *Chrysoleon* Banks and *Compsoleon* Banks should also be included in the subtribe, but latter transferred these two genera to Dendroleontina (Stange 2004). In his initial study, Stange left two current Periclystina genera as unplaced, *Anomaloplectron* Esben-Petersen and *Platyleon* Esben-Petersen. Stange, however, regarded the placement of these last four genera as dubious, as no females were available for examination at that time (Stange 1976).

Subsequently New (1985a;b;c) published a comprehensive taxonomic revision of the Australian antlion fauna. New described 39 new species and three new genera

(*Csiroleon* New, *Fusoleon* New, and *Riekoleon* New), which are currently placed in Periclystina (Stange 2004; Oswald 2015). New (1985a; b) opted to not use the subtribe classification proposed by Stange, noting that its divisions were not very clear, and were focused only on the female terminalia.

In fact, the diagnostic characters of the Periclystina mentioned by Stange (1976) are all found in the female, e.g.: sternite VII not emarginate, most of tergite VIII membranous, anterior gonapophyses absent, posterior gonapophyses mostly enlarged, digging setae absent on gonocoxite IX and ectoproct. However, despite this seemingly long list of characters, all of the characters were quite variable within the subtribe, and overall the tribe's defining characters were very plastic.

In addition to the problematic definition of Periclystina, its internal classification also presents some issues. The two largest genera of the Periclystina, *Austrogymnocnemia* and *Glenoleon*, which together contain 50 of the 63 valid species, are poorly defined. The species classified within these genera are very diverse in terms of terminalic and wing characters, and are separated only based on the presence (*Glenoleon*) or absence (*Austrogymnocnemia*) of tibial spurs. However, tibial spurs are known to be a very plastic character within many different lineages of the Myrmeleontidae (New 1985b; Stange 1994; 2004). The use of tibial spurs as diagnostic traits within the family has been contested since the end of the 19th century (Banks 1899), and Tillyard (1916) specifically mentioned *Glenoleon* as a good example of the problem. Furthermore, New (1985b) acknowledge that he interpreted these two genera in

a very broad sense, pointing out that both genera might need to be divided in future studies.

The challenging taxonomic situation for these antlions was noted by Stange & Miller (1990), who stated that one of the least understood groups within Myrmeleontidae was the Australian Dendroleontini, a point that is corroborated by all of the taxonomic issues mentioned above. The presence of numerous unidentified species in collections worldwide also reinforces the need for a broad systematic study of the group. The results obtained in Chapter II also reinforce the need for the revision of the group.

Chapter III of this dissertation thus, focuses on the systematics of the subtribe Periclystina. The taxonomy of the group is comprehensive revised and the first detailed molecular and morphological phylogenetic analyses of its internal structure are presented.

Materials and methods

Taxonomy

The > 5500 specimens examined for this study were obtained on loan from many of the major entomological research collections of Australia, Europa, and the United States (see list below). Two extended collecting trips to different areas of Australia also added a significant number of new specimens, particularly fresh material for molecular phylogenetic studies. The type specimens of all Periclystina species were reexamined, with only one exception (the holotype of *Glenoleon pulchellus*).

All specimens were visualized using stereomicroscopes with magnifications from 8 to 50 times. Selected specimens were dissected for examination of external and

internal terminalic characters, both male and female. For dissection, abdomens were cut off with microscissors between the 6th and 7th sclerites. Removed parts were placed in carefully labeled vials with a 10% solution of potassium hydroxide (KOH), and left to macerate overnight. After maceration the abdominal pieces were washed in 80% ethanol then transferred to glycerin in spot places for detailed examination. After examination dissected pieces were placed in plastic microvials and pinned below their original specimens.

Each species was (re)described in detail following the general terminology of New (1985a) and Stange (1994); see figures for generalized Dendroleontinae wings and terminalias (A4 Figs 4-5). In the revision treatment all genera are presented in alphabetical order, as are the species under each genus. Each species treatment includes an annotated synonymical listing, diagnosis, (re)description, notes on the primary types, statements on distribution, adult activity period and biology, list of examined specimens, and a general comments section. The classification adopted here follows the one proposed in Chapter II. Identification keys for the subfamilies and tribes of Australian Myrmeleontidae and the genera of Acanthoplectrini and Dendroleontini (according to Chapter II), and the species of all revised genera are also presented.

Images of external morphology were taken with a digital camera (Leica DFC295) attached to a stereomicroscope (Leica M125). For each structure of interest many photographs at different focal depths were taken, were subsequently flattened using Combine ZM, and finally edited in Adobe Illustrator. Terminalic images were prepared in Adobe Illustrator based on tracings from digital images. Conspecific images were then

composed into two plates for each species, one for the head thorax and wings and a second for terminalic structures. Distribution maps were prepared using the website SimpleMappr (www.simplemappr.net) and later edited in Adobe Illustrator.

Synonymic list abbreviations

cat.: catalogue; *cit.*: citation; *ill.*: illustration; *im.*: immature; *key.*: identification key; *n. cb.*: new combination; *OD.*: original description; *rd.*: redescription; *syn.*: synonym, synonymized

Morphology abbreviations

Legs.: T = tarsomere; *Wings.*: FW = forewing, HW = hind wing, Sc = subcostal, Radial sector = Rs, MA = medial anterior, MP = medial posterior, CuA = cubital anterior, CuP = cubital posterior, A = anal.

Australian state abbreviations

ACT: Australia Capital Territory; NSW: New South Wales; NT: Northern Territory; QLD: Queensland; SA: South Australia; TAS: Tasmania; VIC: Victoria; WA: Western Australia

Collections

AMSA: Australian Museum, Sydney, Australia

ANIC: Australian National Insect Collection, Canberra, Australia

BMNH: The Natural History Museum, London, England

CSCA: California State Collection of Arthropods, Sacramento, USA

EMAU: Ernst-Moritz-Ardnt Universität Greifswald, Greifswald, Germany

FSCA: Florida State Collection of Arthropods, Gainesville, USA

MNHN: Museum National d'Histoire Naturelle, Paris, France

MVM: Victoria Museum, Melbourne, Australia

NHRS: Naturhistoriska Riksmuseet Sektionen fur Entomologi, Stockholm, Sweden

OSU: Oregon State University, Corvallis, USA

QLDM: Queensland Museum, South Brisbane, Australia

SAMA: South Australian Museum, Adelaide, Australia

TAMU: Texas A&M University, College Station, USA

WAM: Western Australia Museum, Perth, Australia

ZMHB: Musuem für Naturkunde, Berlin, Germany

ZMUC: Zoologisk Museum, Copenhagen, Denmark

Molecular phylogeny

Material acquisition – Fresh specimens were personally collected on two expeditions to Australia, and additional specimens were sent by colleagues. All specimens collected or received from collaborators were preserved in 100% ethanol and stored in freezers. Voucher specimens are deposited in the TAMUIC.

Taxon sampling – A total of 41 Australian species of antlions are included in this study (A3 Table 1). 36 of the species represent the ingroup, all placed in the former Periclystina according to the preexisting classification. The ingroup taxa included representatives of all genera previously recognized in Periclystina, with the sole exception of *Platyleon*. Four near-outgroup species of Australian Dendroleontinae, representing the tribes Acanthoplectrini and Dendroleontini were included. And one far-outgroup species from the tribe Protoplectrini was used to root the tree.

All other molecular phylogeny methods followed the material and methods described in Chapter II; except as noted below. The read assembly and the alignment generation also followed Chapter II steps, but the alignment was slightly different. Each alignment was trimmed and masked following Prum et al (2015), with 30% conservation required for each site to be considered reliable and 20bp regions containing matches at fewer than 12 reliable sites were masked. After masking, sites containing less than 63% unambiguous bases were removed from the alignment.

The phylogeny estimation methods used were the same as those followed in Chapter II, where two trees were generated, one derived from a super matrix in RaxML (v.8; Stamatakis 2014) and a species tree from ASTRAL-II (v.4.9.7; Mirarab & Warnow 2015).

Morphological phylogeny

Taxon sampling – A total of 82 Australian species of antlions were included in this part of the study (A3 Table 2). 73 of these species represented the ingroup, all placed in Periclystina according to the preexisting classification. Within the ingroup, all species taxonomically treated here were included, which also comprised all new species discovered here. The outgroup was composed of other seven Dendroleontinae species, representing the two remaining Australian tribes, Acanthoplectrini and Dendroleontini. The two last species were representatives from Protoplectrini and Myrmeleontini, which were used to root the tree.

Morphological characters – A total of 62 characters from all major body regions were selected for analysis. The character states for each of the species were

coded and combined in a matrix (A3 Table 2) produced in Mesquite (Maddison & Maddison, 2015). All characters and states are listed below. An additional paragraph containing information on the distributions of the character states across taxa (based on the results obtained here) is presented for each character.

Head

1. *Gena, distance between eye ventral margin and mandible base.* (0) < pedicel height; (1) \geq pedicel height.

Height of the gena is variable among the species. It is short in some species, with the mandible base almost touching the ventral margin of the eye, but high in other species, with the gena clearly separating these two structures.

Homoplastic character: state 1 present in *Anomaloplectron* and *Fusoleon* (Acanthoplectrini) and *Glenoleon*, *Minyleon* some *Fossorioleon*, *Periclystus* and *Tanyleon* (Dendroleontini).

2. *Labial palpus, length.* (0) < head width; (1) \geq head width.

Head width is defined as the maximum width of the head in frontal view, including the eyes. Short labial palpi have three short segments of similar length. Elongate palpi have the distal segments much longer, which combined are longer than head width.

Synapomorphic character: state 1 present in *Csiroleon* (Acanthoplectrini).

3. *Labial palpus, apical segment, tip.* (0) rounded; (1) acuminate.

A rounded tip is defined as a tip in which the dorsal and ventral margins of the distal half of the palpomere run parallel for most of their length and are joined near the

apex by a convex rounding. In the species with acuminate apices the dorsal and ventral margins of the distal half of the palpomere converge towards the apex.

Synapomorphic character: state 0 present only in *Csiroleon* (Acanthoplectrini).

4. *Labial palpus, apical segment, palpimacula pit outline.* (0) oval; (1) slit-like.

An oval pit outline has a long axis no more than twice its short axis. A slit-like pit outline has its long axis more than twice its short axis.

Homoplastic character: state 1 present in *Acanthoplectron*, *Csiroleon*, and *Fissuleon* (Acanthoplectrini).

5. *Frons between antennae, long seta.* (0) absent; (1) present.

The frontal area between the antennae may contain two types of setae: regular-length setae (same length as setae on vertex), or long setae (at least twice longer than setae on vertex). Long setae when present, are white in most species.

Homoplastic character: state 1 present in many genera: *Csiroleon*, and *Franzenia* (Acanthoplectrini), *Minyleon*, *Chrysoleon*, *Mossega*, and part of *Austrogymnocnemia*, *Glenoleon*, *Aplectrinia*, *Aurantlion*, and *Tanyleon* (Dendroleontini).

6. *Vertex, ocular setae.* (0) absent; (1) present.

Homoplastic character: state 1 present in all Acanthoplectrini genera except *Anomaloplectron*, and present in *Ceratoleon* and *F. striatus* (Dendroleontini).

Ocular setae are elongate setae located dorsally in the ocular rim. These setae are longer than regular setae and extend laterally over the eyes. They are usually white, but can be black in some species.

7. *Vertex, height above eye.* (0) < pedicel height (1) ≥ pedicel height.

The maximum height of the vertex above a line drawn across the top of the eyes varies among species.

Homoplastic character: state 0 present in many genera *Fusoleon*, *Latileon*, *Franzenia* (Acanthoplectrini), and *Riekoleon* (Dendroleontini).

Thorax

8. *Pronotum, length/width ratio.* (0) < 0.8 ; (1) $\geq 0.8 \leq 1.2$; (2) > 1.2 .

Length is measured along the sagittal line. Width is measured perpendicular to, and at the longitudinal midpoint of the sagittal line.

Homoplastic character: state 0 present in genera such as *Anomaloplectron* (Acanthoplectrini) and *Manselleon* (Dendroleontini). State 1 present in genera such as *Fusoleon* (Acanthoplectrini) and *Ceratoleon* (Dendroleontini). State 2 present in genera such as *Glenoleon* (Dendroleontini) and former Dendroleontina.

9. *Pronotum, lateral margins.* (0) parallel; (1) converging anteriorly.

This character involves the relative widths of the pronotum posteriorly and anteriorly. In parallel margins the anterior and posterior widths are equal or very nearly so. In converging margins the posterior width is greater than the anterior width.

Homoplastic character: state 1 present only in Dendroleontini genera, e.g. all former Dendroleontina, *Minyleon* and part of *Glenoleon* and *Tanyleon*.

10. *Pronotum, setal length.* (0) all short; (1) $< 50\%$ long, long setae mostly concentrated along margins; (2) $> 50\%$ long, long setae not concentrated along margins.

Short pronotal setae have the same length as setae of the head vertex. Long setae are more than twice the length of short setae. In most species, long setae are

concentrated along the pronotal margins, primarily the anterior and lateral margins, and are generally white.

Homoplastic character: state 0 present in *Anomaloplectron* and *Fusoleon* (Acanthoplectrini). State 1 present in almost all genera. State 2 present in few genera, e.g., *Franzenia* (Acanthoplectrini) *Austrogymnocnemia* (Dendroleontini).

11. *Mesonotum, blade-like setae.* (0) absent; (1) present.

Blade-like setae are long setae in which the distal half is flattened. These setae are generally set in a line and located dorsally on the mesonotum.

Homoplastic character: state 1 present in few genera *Franzenia*, part of *Csiroleon* (Acanthoplectrini). *C. brevicornis* and *F. tipularia* (Dendroleontini).

12. *Mesonotum, scutum, vestiture.* (0) microtrichia present, surface appearing dull; (1) microtrichia absent, surface appearing lustrous.

In some species, the mesonotum and most of the thorax lack microtrichia and the thorax surfaces are very shiny, reflecting incident light. In the remaining species microtrichia are present, making the surface dull.

Synapomorphic character: state 1 present only in *Perichlystus* (Dendroleontini).

13. *Mesothorax, pleuron vestiture.* (0) < 50% long setae; (1) > 50% long setae.

Long setae are setae that are longer than width of the midfemur at mid length. These setae are generally white and concentrated on the anterior sclerites of the mesothoracic pleura.

Homoplastic character: state 0 present in many genera like *Fusoleon* (Acanthoplectrini) and *Riekoleon* (Dendroleontini). State 1 present in many genera like *Csiroleon* (Acanthoplectrini) and *Austrogymnocnemia* (Dendroleontini).

14. *Metathorax, Miller's organ.* (0) absent; (1) present.

Miller's organ is a small glandular-like structure located on the metathoracic pleuron; it was described by Miller and Stange (2012). In Periclystina, when present, it is a small, elongate, membranous structure, white to brown, variable in size, and situated between the metathorax and basal abdominal margin.

Homoplastic character: state 1 present in almost all Dendroleontini genera except, *Periclystus*, *Froggattisca*, *Mossega*, *Chrysoleon*. State 0 present in all Acanthoplectrini.

Legs

15. *Foreleg, femur/coxa length ratio.* (0) < 2 ; (1) $\geq 2 \leq 2.5$; (2) $> 2.5 < 3.5$; (3) ≥ 3.5 .

The length of the forefemur relative to the forecoxa varies among the species. Lengths are measured from the base to the apex of each leg segment.

Homoplastic character: state 0 present in Acanthoplectrini except *Fissuleon*. State 1 present in genera such as *Fissuleon* (Acanthoplectrini) and *Austrogymnocnemia* (Dendroleontini). State 2 present in genera such as *Normanleon* and *Aurantoleon* (Dendroleontini). State 3 present in genera such as *Glenoleon* and *Tanyleon* (Dendroleontini).

16. *Forefemur, maximum width.* (0) \leq maximum foretibia width; (1) $>$ maximum foretibia width.

In most species the femur and tibia have approximately the same maximum width. In a few species the forefemur is swollen and its maximum width is much wider than the foretibia.

Synapomorphic character: state 1 shared only by *Acanthoplectron*, *Anomaloplectron*, *Fusoleon* and *Latoleon* (Acanthoplectrini).

17. *Forefemur, sensorial hair.* (0) absent; (1) present, $\leq 0.75x$ femur length; (2) present, $> 0.75x$ femur length.

The femoral sensorial hair is a slender, elongate, seta located basally on the ventral margin of each forefemur. This seta is present in most antlions, but its length varies among different species. It is absent in some groups, short in others, but very long in still others. It is located closer mid femoral length in some species, and other groups, e.g., *Acanthoplectron* there are two sensorial hairs on each forefemur.

Homoplastic character: state 0 present only in Dendroleontini, in genera such as *Riekoleon*. State 1 present in genera such as *Fissuleon* (Acanthoplectrini) and *Austrogymnocnemia* (Dendroleontini). State 2 present only in Acanthoplectrini such as *Fusoleon*.

18. *Forefemur, dorsal surface, vestiture.* (0) all setae short; (1) $< 50\%$ of setae long (2) $\geq 50\%$ of setae long.

Short setae are setae that are \leq maximum femur width. Long setae are longer than maximum femur width. Long setae are usually white; they can be present as only a

few setae, generally forming a medial line, or they can be broadly distributed across the surface of the forefemur.

Homoplastic character: state 0 present in genera such as *Fusoleon* (Acanthoplectrini) and *Acutoleon* (Dendroleontini). State 1 present in genera such as *Latoleon* (Acanthoplectrini) and *Tanyleon* (Dendroleontini). State 2 present in genera such as *Franzenia* (Acanthoplectrini) and *Austrogymnocnemis* (Dendroleontini).

19. *Foreleg, tibia/tarsus length ratio*. (0) ≤ 1 ; (1) $> 1 < 1.6$; (2) ≥ 1.6 .

Homoplastic character: state 0 present in genera such as *Csiroleon* (Acanthoplectrini) and *Austrogymnocnemis* (Dendroleontini). State 1 present in genera such as *Latoleon* (Acanthoplectrini) and *Acutoleon* (Dendroleontini). State 2 present only in Dendroleontini in genera such as *Glenoleon*.

The length of the tibia relative to the tarsus varies among the species. Both lengths are measured from the base to the apex of each leg segment.

20. *Foretibia, antennal cleaning setae*. (0) absent; (1) present.

Antennal cleaning setae are small golden setae that are grouped on the ventroapical surface of the foretibia. They are absent in some groups, but can occupy most of the ventroapical surface of the foretibia in some small species.

Homoplastic character: state 0 present in few isolated species of Dendroleontini such as *M. pygmaeus*, *F. striatus*, and *P. aureolatus*.

21. *Foretibia, spurs*. (0) absent; (1) present, $\leq 0.5x$ length of tarsomere 1 length; (2) present, $> 0.5x$ length of tarsomere 1 to $<$ combined lengths of tarsomeres 1-3; (3) present, \geq combined lengths of tarsomeres 1-3.

Tibial spurs are two tapered, seta-like structures located just beyond the apex of the tibia. They are one of the most commonly used characters to separate taxa in Myrmeleontidae. The character refers to the position of the apex of the spur relative to the adjacent tarsomeres (tarsomere 1 is basal).

Homoplastic character: state 0 present in genera such as *Franzenia* (Acanthoplectrini) and *Austrogymnocnemia* (Dendroleontini). State 1 present only Dendroleontini, e.g., as most of *Manselleon*. State 2 present in genera such as *Csiroleon* (Acanthoplectrini) and *Perichlystus* (Dendroleontini). State 3 is synapomorphic shared only by *Acanthoplectron*, *Anomaloplectron*, *Fusoleon* and *Latileon* (Acanthoplectrini).

22. *Foretarsus, tarsomere 5, length.* (0) \leq length of tarsomere 1; (1) $>$ length of tarsomere 1 to $<$ 2x length of tarsomere 1; (2) \geq 2x length of tarsomere 1 to $<$ combined lengths of tarsomeres 1-4; (3) \geq combined lengths of tarsomeres 1-4.

The length of the T5 relative to the combined tarsomeres 1-4 lengths varies among the species. Both lengths are measured from the base to the apex of each leg segment.

Homoplastic character: state 0 present only Dendroleontini, e.g., as most of *Aplectrinia*. State 1 present in most genera such as *Csiroleon* (Acanthoplectrini) and *Perichlystus* (Dendroleontini). State 2 present in genera such as *Fissuleon* (Acanthoplectrini) and *Perichlystus* (Dendroleontini). State 3 is synapomorphic shared only by *Acanthoplectron*, *Anomaloplectron*, *Fusoleon* and *Latileon* (Acanthoplectrini).

23. *Foretarsus, tarsomere 5, ventral setae, length.* (0) $<$ width of tarsomere 5 (1) \geq width of tarsomere 5.

Homoplastic character: state 0 present in few isolated genera such as *Franzenia* (Acanthoplectrini) and *Riekoleon* (Dendroleontini).

24. *Forepretarsus, pretarsal claws*. (0) tooth absent; (1) tooth present.

In most species the pretarsal claws are evenly curved with no extensions or projections, but in some groups the pretarsal claws have a short tooth on the ventral margin.

Synapomorphic character: state 1 present only in the outgroup (*Protoplectron*).

25. *Forepretarsus, pretarsal claws, length*. (0) $\leq 0.5x$ length of tarsomere 5; (1) $> 0.5x$ length of tarsomere 5 to $<$ length of tarsomere 5; (2) \geq length of tarsomere 5.

In most species the pretarsal claws are short, less than $\frac{1}{2}$ the length of tarsomere 5, but in some species they are elongate, sometimes longer than the length of tarsomere 5.

Homoplastic character: state 0 present in most genera such as *Franzenia* (Acanthoplectrini) and *Riekoleon* (Dendroleontini). State 1 present in genera such as *Fissuleon* (Acanthoplectrini) and *Glenoleon* (Dendroleontini). State 2 present in genera such as *Csiroleon* (Acanthoplectrini) and *Froggattisca* (Dendroleontini).

26. *Forepretarsus, pretarsal claws, medial region*. (0) curved; (1) straight.

The shape (curvature) of the pretarsal claws is related to the capacity of the claws to close against the ventral surface of tarsomere 5. In species capable of closing the claws against the tarsomere, the pretarsal claws are relatively straight, particularly near mid length. Claws that are not capable of closing against the tarsomere are evenly curved over the rest of their length, including near mid length.

Homoplastic character: state 1 present only in *Csiroleon* (Acanthoplectrini), and *Compsoleon* and *Froggattisca* (Dendroleontini).

Wings

27. *Forewing, costal area, distal subcostal veinlets.* (0) < 5 forked; (1) ≥ 5 forked.

The veins located in the costal area between the humeral vein and the pterostigma are called subcostal veinlets. In most species, these veinlets are simple, or with just one or two forked near the wing margin in larger specimens. Other species show consistent forking at many veinlets.

Homoplastic character: state 1 present in a few genera such as *Csiroleon* (Acanthoplectrini), and part of *Glenoleon* (Dendroleontini).

28. *Forewing, costal area, basal half.* (0) uniareolate; (1) biareolate.

The costal area is said to be uniareolate if it consists of a row of simple cells separated by subcostal veinlets, i.e., the veinlets are not joined by longitudinal crossveins. The costal area is said to be biareolate if the cells between adjacent subcostal veinlets are joined by longitudinal crossveins creating to parallel rows of cells.

Homoplastic character: state 1 present only in *Ceratoleon* and *G. froggatti* (Dendroleontini) and *Protoplectron* (out group).

29. *Forewing, costal area, width at MA origin.* (0) ≤ width of intraradial area; (1) > width of intraradial area.

Costal area width varies among the former Periclystina species, to the more consistent width of the intraradial area.

Homoplastic character: state 1 present in a few genera such as *Csiroleon* (Acanthoplectrini), and most of *Glenoleon* (Dendroleontini).

30. *Forewing, 1A base.* (0) gently curved, not fused with CuP; (1) sharply curved, fused with CuP.

This character is one of the most important to separate tribes of Myrmeleontidae. A gently curved 1A is one of the synapomorphies of the Australian Dendroleontinae. It separates them from the remaining Australian antlions, in which the 1A is sharply curved and fuses with the CuP after a short distance.

Synapomorphic character: state 0 present in all Dendroleontinae.

31. *Forewing, posterior area, width at Cu fork.* (0) \leq width of prefork area; (1) $>$ width of prefork area.

In most species the posterior area is narrower than the prefork area, but it is wider in other species. The widths compared here are measured at the wing length level of the Cu fork.

Homoplastic character: state 1 in all Acanthoplectrini except *Acanthoplectron*, and few Dendroleontini, such as *Periclystus*.

32. *Forewing, prefork longitudinal crossveins.* (0) < 3 ; (1) ≥ 3 .

In most species the prefork area has a single row of cells, in which all crossveins are transverse not linked, except occasionally by one or two longitudinal crossveins in larger specimens. In other species some of the transverse crossveins are consistently linked by longitudinal crossveins, forming two or more longitudinal rows of cells in the prefork area.

Homoplastic character: state 1 only present in a few Dendroleontini, such as *Ceratoleon* and *Paraustrogymnocnemia*.

33. *Forewing, anterior Banksian line.* (0) absent; (1) present.

The anterior Banksian line is a “pseudovein” formed by parts of multiple adjacent RS branches that bend in such a way that they form an almost straight line in the central part of the radial area. This line is believed to facilitate longitudinal flexion of the elongate wing.

Synapomorphic character: state 1 present in all Dendroleontini.

34. *Forewing, posterior Banksian line.* (0) absent; (1) present.

The posterior Banksian line is formed in a manner similar to the anterior Banksian line but is located in the central part of the cubital area, and is formed by the bending of adjacent CuA1 branches.

Homoplastic character: state 1 only present in a few Dendroleontini, such as *Ceratoleon* and *Austrogymnocnemia*.

35. *Forewing, costal area, dark marks.* (0) absent; (1) present.

In most species the forewing costal area is hyaline, but in a few genera the basal region of the costal area is marked with dark spots.

Homoplastic character: state 1 only present in a few genera such as *Anomaloplectron* (Acanthoplectrini) and *Riekoleon* (Dendroleontini).

36. *Forewing, subcostal area, dark marks.* (0) < 50% dark marked; (1) \geq 50% dark marked.

In most species the forewing subcostal area is hyaline, or contains small, scattered, dark marks. In some groups the subcostal area is completely dark, or contains large dark areas.

Homoplastic character: state 1 only present in a few genera such as *Fusoleon* (Acanthoplectrini) and *Riekoleon* (Dendroleontini).

37. *Forewing, mediocubital area, dark marks.* (0) < 50% dark marked; (1) ≥ 50% dark marked.

In most species the forewing mediocubital area is hyaline, or contains small, scattered, dark marks, but in some groups it is entirely filled by a longitudinal dark line, which can be briefly interrupted in some species.

Homoplastic character: state 1 only present in a few genera such as *Anomaloplectron* (Acanthoplectrini) and most of *Fossorioleon* (Dendroleontini).

38. *Forewing, apex.* (0) not falcate; (1) falcate.

Falcate wings are distinguished by the presence of a concavity on the posterior wing margin near the wing apex. In non-falcate wings the distal half of the wings is continuously convex.

Synapomorphic character: state 1 present in all *Periclystus* (Dendroleontini).

39. *Forewing, length/width ratio.* (0) ≤ 3.85; (1) > 3.85.

The species can be divided into two groups based on wings shape: broad-winged (length/width ratio ≤ 3.85) or narrow-winged (length/width ratio > 3.85). Length was measured in a straight line from the base to the apex; width was measured perpendicular to the length line at the widest point along the wing.

Homoplastic character: state 0 present in some genera such as *Csiroleon* (Acanthoplectrini) and most of *Aurantileon* (Dendroleontini). State 1 present in some genera such as *Franzenia* (Acanthoplectrini) and most of *Acutoleon* (Dendroleontini).

40. *Forewing/hind wing, length ratio*. (0) ≤ 1.15 ; (1) > 1.15 .

The species can be divided into two groups based on the length of the forewing relative to that of the hind wing. All species of the former Periclystina have the hind wing shorter than the forewing. Generally this difference is very small (≤ 1.15), but in some groups the hind wing can be much shorter (> 1.15). Length was measured in a straight line from the base to the apex in both wings.

Homoplastic character: state 1 present in some Dendroleontini genera such as *Acutoleon* and *Austrogymnocnemia*.

41. *Hind wing, presectoral crossveins number*. (0) 1 or 2; (1) ≥ 3 .

The number of presectoral crossveins is important to separate the tribes of Myrmeleontidae. Most Australian Dendroleontinae have only one presectoral crossvein, except for occasional adventitious specimens with two crossveins. In some other groups the presectoral area is larger with many more presectoral crossveins.

Synapomorphic character: state 1 present in all Dendroleontinae.

42. *Hind wing, presectoral crossveins spur*. (0) absent; (1) present.

Some species of the former Periclystina possess a small longitudinal extension (= “spur”) medially the presectoral crossvein.

Homoplastic character: state 1 present only in *Normanleon* and *Glenoleon* (Dendroleontini).

43. *Hind wing, apical half, dark marks.* (0) absent; (1) narrow longitudinal lines; (2) small rhegmal infuscation; (3) large rhegmal mark or band.

The color pattern of the wing membrane in the apical part of the hind wing varies among the species, and can be divided in four categories: a) hyaline, membrane entirely transparent, or with only minute brown spots along the posterior margin; b) with a prominent longitudinal line present, generally superimposed on the anterior and/or posterior Banksian lines; c) rhegmal area with a small infuscation, generally small and rounded; or d) with one large mark present, the mark is usually in the rhegmal area, is large, very dark, and expanded to form a transverse band in some species.

Homoplastic character: state 0 present only Acanthoplectrini, e.g., *Fissuleon* and *Latileon*. State 1 present only Dendroleontini, e.g., *Paraustrogymnocnemia* and part of *Aplectrinia*. State 2 present in genera such as *Anomaloplectron* (Acanthoplectrini) and *Manselleon* (Dendroleontini). State 3 present only Dendroleontini, e.g., *Normanleon* and part of *Periclystus*.

44. *Hind wing, male, pilula axillaris.* (0) absent; (1) present.

The pilula axillaris, sometimes called Eltringham's organ, is club-like projection located basally along the posterior margin of the hind wing; it functions in pheromone dispersal. It is present only in males and is a good sex-determination in Dendroleontinae.

Synapomorphic character: state 1 present in all Dendroleontinae.

Male Terminalia

45. *Ectoproct, ventral margin [lateral view].* (0) rounded; (1) straight, slightly longer than dorsal margin; (2) very long, forming a distal lobe.

In most former Periclystina species the male ectoproct is a rounded structure, with no ventral expansions. In few species the ventral margin is straight and slightly longer than the rounded dorsal margin, or the ventral margin is elongate, forming distinctive lobe.

Homoplastic character: state 1 present only in *Fossorioleon* and *Periclystus* (Dendroleontini). State 2 present only in *Riekoleon* and *Chrysoleon* (Dendroleontini).

46. 9th sternite, distal margin, medial invagination [ventral view]. (0) absent; (1) with a short medial invagination; (2) emarginated, with lateral margins extended.

In most species the distal margin of the male 9th sternite is straight or even slightly protruded medially. But in some species it has a very distinctive medial invagination. In other species the medial region is deeply excavated (“U” shaped).

Homoplastic character: state 1 present only in *Glenoleon* (Dendroleontini), except *G. froggatti*. State 2 synapomorphic for *N. berthoudi* and *N. meteoricus* (Dendroleontini).

47. *Gonarcus* shape:

(0) tubular (dorsal view);

(1) semi triangular (dorsal view);

(2) arch (dorsal view), > 5x wider than tall at mid point (posterior view), height mostly constant throughout its length (lateral view);

(3) arch (dorsal view), > 5x wider than tall at mid point (posterior view), height mostly constant throughout its length, but “C” shaped (lateral view);

(4) arch (dorsal view), $> 5x$ wider than tall at mid point (posterior view), lateral margins ≥ 3 taller than medial region (posterior view);

(5) arch (dorsal view), $\leq 5x$ wider than tall at mid point (posterior view), anterior margin rounded (lateral view);

(6) arch (dorsal view), $\leq 5x$ wider than tall at mid point (posterior view), anterior margin acute and straight (lateral view);

(7) arch (dorsal view), $\leq 5x$ wider than tall at mid point (posterior view), anterior margin acute and bent vertically (lateral view).

The male gonarcus single structure usually arched and located dorsal to the paramere. It has significantly different forms among the antlions. The simplest form is a thin arch, but in some species is tubular or semi triangular in dorsal view. The gonarcus in lateral view can present a constant height throughout its length, but sometimes the anterior region is taller than posterior, or vice versa. Gonarcus anterior margin in lateral view is mostly rounded but acute (straight or bent) in some species.

Homoplastic character: state 0 present in *Riekoleon*, *G. pulchellus* and *G. froggatti*. State 1 present in *Aurantilion* and *G. aurora*. State 2 present in all species except all *Periclystus* genus group. State 3 synapomorphic for *T. cahillensis* and *T. newi*. State 4 present in *Manselleon* and most of *Aplectrinia*. State 5 present in some, e.g., *Ceratoleon* and most of *Acutoleon*. State 6 present in *Paraustrogymnocnemia* and *Normanleon*. State 7 synapomorphic for *Austrogymnocnemia*.

48. *Mediuncus* shape:

(0) absent;

- (1) present, entirely weakly sclerotized (mostly membranous);
- (2) present, mostly weakly sclerotized except for a small central region;
- (3) present, entirely sclerotized, vertically extended (lateral view), shorter than gonarcus height;
- (4) present, entirely sclerotized, vertically extended (lateral view), taller than gonarcus height, constant width throughout its length;
- (5) present, entirely sclerotized, vertically extended (lateral view), taller than gonarcus height, apex acute;
- (6) present, entirely sclerotized, longitudinally extended (lateral view), longer than gonarcus height; apex rounded and narrower than base.

The male mediuncus is usually a small structure fused to the gonarcus medial region. Mediuncus presents significantly different forms, particularly in the former Periclystina species. In some species it is absent, very weakly (mostly membranous), or entirely sclerotized. The weakly sclerotized mediuncis, sometimes present a small central area more sclerotized. Sclerotized mediuncus, can be very small, just a medial vertical projection of the gonarcus, or they can be very long (with apex rounded or acute). In some species the sclerotized mediuncus are longitudinally extended.

Homoplastic character: state 0 present in some genera, e.g., *Paraustrogymnocnemia* and *Fossorioleon*. State 1 synapomorphic for Acanthoplectrini. State 2 synapomorphic for *Aplectrinia* except *A. oombulgurriensis*. State 3 present in some, e.g., *Ceratoleon* and most of *Normanleon*. State 4 present in present in some, e.g.,

Tanyleon and most of *Manselleon*. State 5 present in *Acutoleon*, *A. pseudomaculata*, and *N. dissolutus*. State 6 present in part of *Glenoleon* and *Aurantoleon*.

49. *Paramere shape*:

(0) absent

(1) present, $\geq 4x$ longer than tall (lateral view), located beneath the gonarcus + mediuncus complex (dorsal view), apex rounded;

(2) present, $\geq 4x$ longer than tall (lateral view), located distal to gonarcus gonarcus + mediuncus complex (dorsal view), apex acute;

(3) present, $< 4x$ longer than tall (lateral view), apex bifurcated;

(4) present, $< 4x$ longer than tall (lateral view), longer and wider than gonarcus (lateral view);

(5) present, $< 4x$ longer than tall (lateral view), longer and narrower than gonarcus (lateral view), posterior margin rounded and anterior acute (lateral view);

(6) present, $< 4x$ longer than tall (lateral view), shorter than gonarcus (lateral view), anterior margin rounded (lateral view);

(7) present, $< 4x$ longer than tall (lateral view), shorter than gonarcus (lateral view), posterior margin rounded (lateral view), but curving inward (posterior view).

(8) present, $< 4x$ longer than tall (lateral view), shorter than gonarcus (lateral view), posterior margin with an upward bent hook (lateral view);

(9) present, $< 4x$ longer than tall (lateral view), shorter than gonarcus (lateral view), posterior margin with a downward bent hook (lateral view);

The male paramere is a paired sclerotized structures generally located beneath the gonarcus. Parameres present significantly different forms, and can become considerably complex or mostly obsolete, or even absent. In most species they are a large and wide structures, but in few species they elongate and thin (sometimes hidden beneath gonarcus + mediuncus). The large parameres can be bigger or smaller than gonarcus. The parameres apices are usually rounded, but in some species they are acute, bifurcated or bearing a small hook.

Homoplastic character: state 0 present in few species, e.g., *A. punctatus* and most of *Acutoleon*. State 1 present in most species of *Aurantileon*. State 2 present in some genera, e.g., *Gleonleon* and most of *Riekoleon*. State 3 synapomorphic for *Periclystus*. State 4 synapomorphic for Acanthoplectrini. State 5 present in some genera, e.g., *Ceratoleon* and *Paraustrogymnocnemia*. State 6 present in some genera, e.g., *Normanleon* and *Manselleon*. State 7 present only in *Fossorioleon* (*F. rudda*, *F. edwardsi*, and *F. distivenus*). State 8 synapomorphic for *Aplectrinia* except *A. oombulgurriensis* and *A. cardaleae*. State 9 synapomorphic for *Austrogymnocnemia*.

Female Terminalia

50. 7th tergite, width, lateral view. (0) < 2x width of 8th tergite; (1) ≥ 2x width 8th tergite.

The 7th tergite is narrow in some species, about the same width or slightly wider, than the width of the 8th tergite. But, in some species, it is much wider, more than twice the width of the 8th tergite.

Homoplastic character: state 0 present only in some genera of *Periclystus* genus group, e.g., *Austrogymnocnemia* and *Ceratoleon*.

51. 7th sternite, apical setae, length. (0) $\leq 1.5x$ length of non-apical setae (1) $> 2x$ length of non-apical setae.

The setae on the posterior margin of the 7th sternite vary in length among the species. In some species they are the same length as non-apical setae, or slightly longer; in other species they are much longer than non-apical setae.

Homoplastic character: state 0 present in a few genera, e.g., *Fissuleon* (Acanthoplectrini) and *Manselleon* (Dendroleontini). State 1 present in many genera, e.g., *Fusoleon* (Acanthoplectrini) and *Glenoleon* (Dendroleontini).

52. 9th somite, ventral digitiform process. (0) absent; (1) present, $<$ length of lateral gonapophyses; (2) present, \geq length of lateral gonapophyses.

The digitiform process is a membranous structure located ventral to the 9th tergite. It is very common in former Periclystina and was mentioned as a major diagnostic character of the subtribe by Stange (1976). This character can be divided in three states: totally absent; present as a short and broad lobe; or present as an elongate digitiform lobe (sometimes longer than the posterior gonapophyses).

Homoplastic character: state 0 present in all Acanthoplectrini and few genera of Dendroleontini e.g., *Aurantoleon*. State 1 present in many genera, e.g., *Fossorioleon* and *Riekoleon*. State 2 present in many genera, e.g., *Austrogymnocnemia* and *Paraustrogymnocnemia*.

53. 9th tergite, thickened setae. (0) absent; (1) present.

Some antlion species possess a few thickened setae on the female 9th tergite at the ventral margin. They are straight but slightly longer and thicker than normal macrotrichia. They are more heavily sclerotized than normal macrotrichia, but much less so than the curved cavisetae.

Homoplastic character: state 1 only in few genera of Dendroleontini e.g., *Tanyleon* and most of *Aurantileon*.

54. *Ectoproct, cavisetae*. (0) absent; (1) present.

The cavisetae, sometimes called digging setae, are thick, dark, curved, and heavily sclerotized setae that are present on the ectoprocts of many antlion species. Cavisetae are used by the female during the oviposition to excavate the substrate.

Homoplastic character: state 1 present in all Acanthoplectrini (except *Acanthoplectron*) and in the clade formed by *Tanyleon*, *Aurantileon*, *Manselleon*, and *Aplectrinia* (except *M. tillyardi*, *M. longidigitus*, and *T. cahillensis*).

55. *Anterior gonapophyses*. (0) absent; (1) present, pulvinate; (2) present, digitiform.

The anterior gonapophyses are a pair of outgrowths of the ventral body wall of the 8th somite that when present, constitute an important component of the female terminalia. In most antlions these structures are short, digitiform, lobes, but in former Periclystina they are generally absent, or small, rounded, sclerotized plates, that are set with many elongate setae.

Homoplastic character: state 0 present in all Acanthoplectrini (except *Acanthoplectron*) and most *Periclystus* genus group, e.g., *Aurantileon* and

Austrogymnocnemia. State 1 present in some genera of *Periclystus* genus group, e.g., *Periclystus* and *Riekoleon*. State 2 synapomorphic for the former Dendroleontina.

56. *Posterior gonapophyses, shape.*

- (0) absent;
- (1) present, shorter than lateral gonapophyses length, $< 2x$ longer than wide, base wider than apex;
- (2) present, shorter than lateral gonapophyses length, $\geq 2x$ longer than wide, constant width throughout its length;
- (3) present, longer than lateral gonapophyses length, $< 2x$ longer than wide, apex wider than base;
- (4) present, longer than lateral gonapophyses length, $\geq 2x$ longer than wide to $\leq 3x$ longer than wide, constant width throughout its length;
- (5) present, longer than lateral gonapophyses length, $> 3x$ longer than wide, constant width throughout its length;
- (6) present, longer than lateral gonapophyses length, $> 3x$ longer than wide, apex wider than base and rounded;
- (7) present, longer than lateral gonapophyses length, $> 3x$ longer than wide, apex wider than base and anterior margin recurved.

The posterior gonapophyses are a pair of outgrowths of the ventral body wall of the 8th somite that when present, constitute an important component of the female terminalia. In most antlions these structures are short and digitiform, but in Dendroleontinae they present significantly different forms. In most species of the former

Periclystina they are large, elaborated, and usually bearing cavisetae, but in some species they are simple digitiform lobes, and almost obsolete or absent in few species.

Homoplastic character: state 0 present only in *Aurantileon* (*A. banksi*, *A. roseipennis*, and *A. punctatus*). State 1 present in most Acanthoplectrini genera, e.g., *Franzenia* and *Csiroleon* and *A. pingrupensis* (Dendroleontini). State 2 present only in the clade formed by *Tanyleon*, *Aurantileon*, *Manselleon*, and *Aplectrinia* (except the species mentioned in states 0 and 1). State 3 synapomorphic for *Fossorioleon* (*F. striatus*, *F. edwardsi*, and *F. distivenus*). State 4 present only in the clade formed by *Periclystus*, *Riekoleon*, and *Fossorioleon* (except the species mentioned in state 3). State 5 present in some genera, e.g., *Anomaloplectron* and *Acutoleon*. State 6 present in some genera, e.g., *Glenoleon* and *Ceratoleon*. State 7 synapomorphic for *Austrogymnocnemis*.

57. *Posterior gonapophyses, cavisetae number.* (0) 0; (1) ≤ 10 ; (2) > 10 .

In some species cavisetae are absent on the posterior gonapophyses; only regular setae are present. In other species there are a few cavisetae on the apex of the posterior gonapophyses, but they do not cover it completely. In some species there are many cavisetae, which completely cover the apex of the posterior gonapophyses. See also character 54.

Homoplastic character: state 0 present in all Acanthoplectrini and most Dendroleontini, e.g., *Aurantileon* and *Tanyleon*. State 1 present in some genera of Dendroleontini, e.g., *Austrogymnocnemis* and *Paraustrogymnocnemis*. State 2 present in some genera of *Periclystus* genus group, e.g., *Periclystus* and *Riekoleon*.

58. *Lateral gonapophyses, height [lateral view]*. (0) < height ectoproct (1) \geq height of ectoproct.

The lateral gonapophyses are a pair of rounded structures that are located ventral to the ectoprocts, which are commonly homologized with the 9th gonocoxites. In most species they are much smaller (not as tall) as the ectoprocts than it, but in some other they are larger (taller) than the ectoproct.

Homoplastic character: state 1 in the clade formed by *Tanyleon*, *Aurantoleon*, *Manselleon*, and *Aplectrinia* (except *M. tillyardi* and *M. longidigitus*), and *N. berthoudi* and *N. meteoricus*.

59. *Lateral gonapophyses, vestiture*. (0) only regular setae; (1) with ≥ 5 thickened setae; (2) with ≥ 5 cavisetae setae.

The conformation of the setae on the lateral gonapophyses varies among the species. Some species bear only regular setae (unmodified macrotrichia), such as found on the 7th sternite. Some species bear a few setae that are straight, slightly longer, slightly thicker and more heavily sclerotized than regular setae, but less sclerotized and curved than cavisetae. Others species bear a few to many cavisetae. See also character 54.

Homoplastic character: state 0 present in a few Dendroleontini genera, e.g., *Periclystus* and *Fossorioleon*. State 1 present only *Austrogymnocnemia*, *Paraustrogymnocnemia*, and *Riekoleon*. State 2 present in the remaining species.

60. *Pregenital plate, width [ventra view]*. (0) $\leq 0.25x$ width of 7th sternite (1) $> 0.25x$ width of 7th sternite.

Pregenital plates can be divided into two size classes: small, much narrower than width of 7th sternite, and generally weakly sclerotized; and large width generally larger greater than 0.5x width of 7th sternite, and usually more heavily sclerotized.

Homoplastic character: state 0 present in all Acanthoplectini genera and some Dendroleontini genera, e.g., *Periclystus* and *Fossorioleon*. State 1 present in some Dendroleontini genera, e.g., *Aurantileon* and *Normanleon*.

61. *Pregenital plate, shape*. (0) flat (1) concave.

In most species the pregenital plate is a flat sclerotized plate lying in the membrane of the ventral body wall. However, in some species, it is concave medially, mostly shallowly concave, but sometimes more deeply so.

Homoplastic character: state 1 present only in *Aurantileon* (except *A. drysdalensis*), *A. cardaleae*, *G. pulchellus* and *G. froggatti*.

62. *Ventromedial plate [ventra view]*. (0) absent; (1) present.

The ventromedial plate is a sclerotized structure located medially between the posterior gonapophyses. It is generally subtriangular and is always covered with many elongate setae, and sometimes a few thick setae in some species.

Homoplastic character: state 1 present only in Acanthoplectrini genera: *Fusoleon*, *Franzenia*, *Csiroleon* and *Fissuleon*.

Phylogenetic analysis – A parsimony analysis was conducted in TNT (Goloboff et al. 2008). The analysis was run using the “New Technology” option with all algorithms under default settings. General RAM was set to 1000 Mbytes, and memory was set to hold 10000 trees. No characters were designated as additive, and all multistate

characters were treated as unordered. Not applicable characters were coded in the matrix as “-” and unknown characters as “?”. Bremer support was calculated in TNT with TBR from existing trees, set to retain suboptimal trees by 10000 steps with a relative fit difference of 1.0. Bootstrap support was calculated with “Traditional Search” from 1000 replicates. Consistency and retention indices were calculated in Mesquite.

Results

Taxonomy

More than 5500 specimens previously classified in Periclystina or in closely associated genera, were examined for this work. These specimens included representatives of all of the 63 species names known before this study, and 16 new species. All previous four synonyms were confirmed here and six new synonyms are proposed, bringing the number of valid species analyzed here to 73. These 73 species were rearranged among nine of the existing genera and 14 new genera, according to the results for both phylogenetic analyses.

Molecular phylogeny

(A4 Figs 1-2): The trimmed alignments contained 41 species and 349,587 sites (across 534 chosen loci), of which 81,358 sites were informative (113,778 variable sites). The concatenated dataset contained 12.73% missing data. Each analysis produced one fully resolved tree, which recovered identical taxon relationships, but had significant differences in bootstrap support values. The tree produced by maximum likelihood estimation had 89.5% of its nodes supported by >95 % bootstrap values (BS), while the ASTRAL tree had 74% of its nodes supported by >95 % BS.

Morphological phylogeny

(A4 Figs 3): The morphological analysis recovered six most parsimonious trees, each with length of 416 steps, a consistency index of 0.299, and a retention index of 0.746. The strict consensus tree is presented here together with the associated clade support values.

The results from all analyses were very congruent. All trees recovered the species divided into three major clades. While this division in some ways mimics the former tripartite subtribal division of the Australian Dendroleontinae (*Acanthoplectrina*, *Dendroleontina*, and *Periclystina*) the *Periclystina* was not recovered as monophyletic. The former *Periclystina* was recovered as polyphyletic in both morphological and molecular datasets (congruent to the results from Chapter II). In general the members of the former *Periclystina* split between two clades: 10 species were placed in a monophyletic group with *Acanthoplectron* (*Acanthoplectrini*) and the remaining 63 species were placed within *Dendroleontini* in a group called here as “*Periclystus* genus group”, sister to the former Australian *Dendroleontina* (A4 Figs 1-3).

The several included species of the former *Dendroleontina* (outgroup) were recovered as monophyletic in all analyses, and the clade was placed as sister to major part of former *Periclystina* (*Periclystus* genus group). In both analyses *Froggattisca* was recovered paraphyletic (A4 Figs 1-3).

Acanthoplectron was recovered in a basal clade together with four previous *Periclystina* genera, (*Anomaloplectron*, *Csiroleon*, *Franzenia* and *Fusoleon*), three species of *Glenoleon* (placed here in the new genus *Fissuleon*), and a new genus

composed of two new species (*Latileon*) (A4 Figs 1-3). The placement of these six genera together with *Acanthoplectron* caused the polyphyly of the former Periclystina. In this sense, all 10 species classified within these six genera were here transferred to Acanthoplectrini.

The remaining 63 species of the former Periclystina were recovered in a monophyletic clade sister to the included Australian species of former Dendroleontina. However, the relationships within this clade recovered here are very different from the current classification. The species currently classified in *Austrogymnocnemia* and *Glenoleon* were recovered in several small distinctive clades. *Austrogymnocnemia* is divided here into three major clades composed only of some of its former species: *Aplectrinia*, *Austrogymnocnemia s. str.*, *Minyleon*, and *Paraustrogymnocnemia*. A few other species are transferred to other genera (*Fossorioleon* and *Riekoleon*). *Glenoleon* is divided here into six small monophyletic genera: *Acutoleon*, *Aurantoleon*, *Glenoleon s. str.*, *Manselleon*, *Normanleon* and *Tanyleon*, with a few other species transferred to other genera *Fossorioleon* and *Fissuleon* (Acanthoplectrini). Three other previous Periclystina genera are maintained here *Ceratoleon*, *Periclystus* and *Riekoleon*, and one (*Platyleon*) is synonymized (under *Glenoleon*). This monophyletic clade contains 14 genera comprising the here called “*Periclystus* species group” (A4 Figs 1-3). The group is placed in the tribe Dendroleontini according to the classification proposed in Chapter II.

Discussion

According to the new classification presented in Chapter II, the Australian Dendroleontinae fauna is divided into two tribes (Acanthoplectrini and Dendroleontini), what was confirmed here by the results from both analyses.

The Australian Acanthoplectrini is now represented by 12 species (the 10 transferred species and the two species of *Acanthoplectron*). Acanthoplectrini was created by Markl (1954) and initially contained only *Acanthoplectron* (based on the odd medial tooth of the tibial spur). Stange (1976) in his review of Dendroleontini also mentioned the unusual spurs as the only character to define the group (its female terminalia were unknown at that time). However, Stange noted that because of the diversity of leg structures presented in some genera of the former Periclystina, it was possible that *Acanthoplectron* could be associated with some of the species in the former Periclystina. That statement is corroborated in here; where *Acanthoplectron* is shown to form a clade with 10 species previously placed in Periclystina (A4 Figs 1-3).

The Australian species placed in the former Dendroleontina were recovered in a monophyletic clade here. However, when the former subtribe was analyzed in a larger context (Chapter II) it was not recovered as monophyletic. The former Australian Dendroleontina, however, was also recovered as monophyletic in the larger analysis, but it not group with the rest of Dendroleontina from the Old World and North America. Even though the former Dendroleontina was not a primary focus of this study, the results recovered here strongly suggest that the group is in need of a detailed taxonomic review, with particular emphasis on the subcosmopolitan genus *Dendroleon*. The former

Australian Dendroleontina can be separated from the “*Periclystus* species group” based on the elongate anterior gonapophyses of the female terminalia, which was the character that Stange (1976) used to distinguish the group.

Despite the species transferences mentioned above it was within the “*Periclystus* genus group” that the major taxonomic changes happened. The polyphylies of *Austrogymnocnemia* and *Glenoleon* recovered here (A4 Figs 1-3), confirmed previous statements made by New (1985b) and Stange (2004) about their respective taxonomical status. As thought by these authors, both genera were divided in various small clades, which were used to create the nine new genera proposed here. The division of these two genera also confirms the enormous evolutionary plasticity of the tibial spurs, which were apparently lost and regained in many different occasions within this group. The tibial spurs are still useful to differentiate species or even small species groups, but they should not be used to separate large diverse clades. In this sense, the tibial spurs were used in the keys here to help identify small clades, but all the new genera proposed here are mostly based on both male and female terminalic characters, which are historically more stable characters.

It is also within the “*Periclystus* genus group” that some discrepancies between the morphological and molecular analyses are noted. Some of the clades recovered in the morphological analysis were different from the molecular ones, particularly at the species level, but also with a few discrepancies at genus level. However, in a broader sense the results were quite similar, since the morphological analysis resulted in three major clades within the group, which can also be noticed in the molecular analysis. The

monophyletic clade composed by *Aplectrinia*, *Aurantileon*, and *Manselleon* was recovered in both datasets, as well as the clade composed by *Acutoleon*, *Austrogymnocnemia*, *Ceratoleon*, *Normanleon* and *Paraustrogymnocnemia*. The third clade was formed by *Fossorioleon*, *Glenoleon*, *Periclystus* and *Riekoleon*, but unlike the previous two it was not monophyletic in the molecular analysis, but these four genera were all placed at the base of the tree. In general, the major differences are related to three genera: *Ceratoleon*, *Fossorioleon*, and *Normanleon*. These three clades were recovered as monophyletic in the morphological analysis but not in the molecular (A4 Figs 1-3).

One of the main reasons for these different phylogenetic positions is the number of species included in the two analyses. “*Periclystus* genus group” is composed by 63 species (counting the new species and synonyms proposed here), which were all incorporated into the morphological analysis. The molecular analysis included only 28 species from the group.

Another notable issue is that the areas where these genera are placed in the molecular trees are characterized by extremely short branch lengths. This particular characteristic of the tree is in concordance with the results from the Chapter II, where this group presented the shortest distance among the whole Myrmeleontidae tree. These extreme short branches indicate that these species evolved in a very fast rate and probably very recently (according to results in Chapter II). Groups evolved recently with fast evolutionary rates are known to be problematic in molecular analysis, and are generally recovered with low definition when the taxon sampling is incomplete. This

low definition seems to be more evident in the ASTRAL tree, where some of these clades are recovered with very low bootstrap support values (A4 Fig 2). The main differences between the morphological and molecular trees are actually associated with the regions of the molecular tree containing many missing taxa and very short branches. Because of these issues, the classification adopted here derived primarily from the morphological analysis, which has the complete taxon sampling. The 10 species (six genera) transferred to Acanthoplectrini and the 63 species (14 genera) of the “*Periclystus* species group” are detailed in the revision below.

Taxonomy

Key to the Australian tribes of Myrmeleontidae (modified from New 1985b)

- 1 Hypostigmatic cell long (length > 4x width); antennae clubed.....2
- 1' Hypostigmatic cell short (length ≤ 4x width); antennae capitate.....(Ascalaphinae).....8
- 2 Hind wing Rs arising well before medial fork; 1 (rarely 2 or more) presectoral crossveins.....3
- 2' Hind wing Rs arising opposite or beyond medial fork; usually 4 or more presectoral crossveins.....(Myrmeleontinae).....7
- 3 Forewing 2A runs in fairly even curve toward 3A.....(Dendroleontinae).....4
- 3' Forewing 2A runs close to 1A for a short distance, then bends at sharp angle toward 3A.....(Nemoleontinae).....5
- 4. Wings: Banksian lines absent; metathorax: Miller's organ absent; female terminalia: anterior gonapophyses and membranous digitiform processes absent;

- Male terminalia: gonarcus a simple arch; parameres always larger than gonarcus (lateral view).....Acanthoplectrini
- 4' Wings: at least anterior Banksian line present; metathorax: Miller's organ mostly present; female terminalia: anterior gonapophyses sometimes present; membranous digitiform processes usually present; male terminalia: gonarcus generally more than a simple arc; parameres usually smaller than gonarcus + mediuncus in lateral view.....Dendroleontini
- 5 Forewing veins CuA2 and CuP + 1A elongate, running parallel to CuA1 and hind margin of wing for considerable length.....Protoplectrini
- 5' Forewing veins CuA2 and CuP + 1A short, not as above.....6
- 6 Tibial spurs short (extending to apex of T2); male parameres not fused (two separate plates).....Protoplectrini
- 6' Tibial spurs long (extending to or beyond apex of T4); male parameres fused (forming a "Y" shaped structure).....Nemoleontini
- 7 Hind wing CuA not fused with posterior fork of MP2 (linked by one or more crossveins or not reaching fork); hindfemur without an elongate sense hair; tarsal claws not strongly arched near base.....Myrmeleontini
- 7' Hind wing CuA fuses with posterior fork of MP2 a short distance beyond; hindfemur with an elongate sense hair; tarsal claws strongly arched near baseAcanthaclisini
- 8 Antennae longer than length of head and thorax combined; eyes dividedAscalaphini

8' Antennae shorter than length of head and thorax combined; eyes not divided
.....Stilbopterygini

Acanthoplectrini Markl 1954

Type genus: *Acanthoplectron* Esben-Petersen 1918.

Description – Head: ocular setae generally present. Metathorax: Miller’s organ absent. Wings: Banksian lines absent. Legs: generally short (forefemur < 2x longer than forecoxa length). Male terminalia: gonarcus as a simple narrow arch; mediuncus weakly sclerotized (mostly membranous); paramere well developed (most prominent structures). Female terminalia: anterior gonapophyses absent; posterior gonapophyses without cavisetae; 9th tergite without the ventral digitiform process; ventromedial plate usually present.

Distribution – Australia: NSW, NT, QLD, SA, VIC, and WA.

Comments – This tribe previously contained only one Australian genus, *Acanthoplectron*, but six additional genera from Australia are included here, *Anomaloplectron*, *Csiroleon*, *Fissuleon*, *Franzenia*, *Fusoleon* and *Latileon* (all formerly placed in Periclystina). This study focused only on the Australian fauna, but the results from Chapter II indicate that the southeast Asian genus *Layahima* is also part of Acanthoplectrini. Only the six genera formerly placed in Periclystina were reviewed here. For phylogenetic relationships see (A4 Figs 1-3).

Key to the Australian genera of Acanthoplectrini (modified from New 1985b)

1 Tibial spurs, if present, smoothly curved, without inner side projections.....2

- 1' Tibial spurs with pronounced hook on inner side.....*Acanthoplectron*
- 2 Labial palpus short (as long as maxillary palpus and shorter than head width)....3
- 2' Labial palpus elongate (longer than maxillary palpus and head width) (A4 Fig 10b).....*Csiroleon*
- 3 Forefemur swollen (much wider than foretibia) (A4 Fig 20b); foretibial spurs long (reaching apex of T4) and strongly curved.....4
- 3' Forefemur not swollen (about as wide as foretibia); foretibial spurs, if present, short (only reaching apex of T2) and gently curved.....6
- 4 Tibial spurs of same relative length in all legs.....5
- 4' Tibial spurs of different relative length on each pair of legs.....*Anomaloplectron*
- 5 Female terminalia without ventromedial plate (A4 Fig 23b); body mostly pale; forewing subcostal area without brown marks (A4 Fig 22c).....*Latileon*
- 5' Female terminalia with ventromedial plates (A4 Fig 21e); body mostly dark; forewing subcostal area with brown marks (A4 Fig 20d).....*Fusoleon*
- 6 Foretibial spurs present; midtibia not expanded (about as wide as femur); labial palpus: palpimacula slit-like.....*Fissuleon*
- 6' Foretibial spurs absent; midtibia expanded (wider than femur) (A4 Fig 18c); labial palpus: palpimacula oval.....*Franzenia*

***Anomaloplectron* Esben-Petersen 1918**

Type species: *Anomaloplectron lineatipenne* Esben-Petersen 1918, by original designation.

Diagnosis – Ocular setae absent [not present]; forefemur swollen, much wider than tibia [not just as wide as tibia]; tibial spurs of different relative length on each pair of legs [not of equal length on all pairs legs].

Description – Head: *Vertex* raised. *Ocular rim* setae absent. *Antennae* clubbed and elongate; flagellomeres almost as long as wide at base, apical ones slightly wider than long. *Palpimacula* oval-shaped, located medially. Thorax: *Pronotum* about as long as wide and set with short setae. Miller's Organ absent. Wings: rather narrow with tip acute. *Forewing* cubital fork located beyond origin of Rs; two presectoral crossveins; subcostal veinlets simple; posterior area larger than prefork area. *Hind wing* medial fork located beyond the origin of Rs; one presectoral crossvein. *Male pilula axillaris* present. Legs: *Foreleg* short and very stout, especially the swollen femur, much broader than tibia; tarsi and tibia about the same length; tibial spurs reaching T4 apex; sense hair about one half femur length. *Midleg* slightly longer than foreleg; femur not enlarged; tibial spurs reaching T2 apex. *Hindleg* slightly longer than midleg; tibial spurs shorter than T1. *T5* about as long as T1-T4. *Pretarsal claws* much shorter than T5 length. Male Terminalia: *Ectoproct* rounded; *gonarcus* simple, thin and arched. Female Terminalia: *Ectoproct* and *lateral gonapophyses* set with cavisetae; *posterior gonapophyses* elongate; *anterior gonapophyses* absent; 9th *tergite* without membranous digitiform process; pregenital plate reduced.

Distribution (A4 Fig 152) – Australia: QLD, SA, WA.

Comments – This genus is known from only one species, *Anomaloplectron lineatipenne*, which is easily distinguished from other Australian antlions by the

different lengths of its tibial spurs, which inspired the name of the genus. So far, nothing is known about the biology. For phylogenetic relationships see (A4 Figs 1-3).

Biology – Unknown.

***Anomaloplectron lineatipenne* Esben-Petersen 1918**

(A4 Figs 6-7)

Anomaloplectron lineatipenne Esben-Petersen 1918:9 (OD); Esben-Petersen 1923:587 (cit); Stange 1976:309 (cat); New 1985b:30 (key, rd, ill); New 1996:66 (cat); Stange 2004:98 (cat); Oswald 2015 (cat).

Diagnosis – Ocular setae absent [not present]; forefemur swollen, wider than tibia [forefemur as wide as tibia]; tibial spurs of different length on each pair of legs [not of equal length on all pair of legs]; forewing with most of the subcostal and mediocubital areas brown [not hyaline]; female posterior gonapophyses digitiform [not stout].

Description – Lengths: forewing: 15 – 18 mm; hind wing: 13 – 16 mm.

Head (A4 Figs 6a-b): *Labrum* pale, with a line of elongate setae. *Clypeus* pale, with two small rounded dark brown spots, with few short black setae. *Frons* mostly pale, with four small dark brown marks as follows: a medial mark at the ventral area, a mark beneath each antennae, a mark between the antennae; dorsal margin dark brown; mostly glabrous, with few short pale setae. *Gena* pale. *Vertex* raised; mostly pale except by the dome dark brown, a rounded medial brown mark at posterior margin in male specimens; set with few black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, > 2x pronotum length; distance between antennae wider than scape width; apex dark brown

but remaining parts with anterior surface pale and posterior surface dark brown; all segments set with few pale setae. *Mandible* pale with tip dark. *Palpi*, maxillary and labial pale; apical labial palpomere fusiform, palpimacula oval-shaped, located medially. Thorax (A4 Fig 6b): *Pronotum* slightly wider than long; posterior margin as wide as anterior; subapical furrow present; mostly pale with dark brown areas; a broad longitudinal medial line; two sinuous longitudinal lines around midline, sometimes connected with the medial line at the posterior half; two lateral lines that end at furrow; set with short black setae. *Mesonotum* mostly dark brown, except some irregular pale marks around midline; set with short black setae. *Metanotum* dark brown; set with few short black setae. *Pterothoracic pleura* dark brown; set with few short black setae; Miller's organ absent.

Wings (A4 Fig 6c): Narrow with tip acute. Banksian lines absent in both wings. Veins mostly dark brown, but some intercalated with white spots; beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline; dark brown marks as follows: most of subcostal area (mainly in basal half); most of mediocubital area, near gradate veins, a line starting at Rs origin and ending at posterior area apex; posterior margin with some brown infuscations; cubital fork located near MA origin; two presectoral crossveins; subcostal veinlets simple; posterior area wider than prefork area. *Hind wing* membrane hyaline with a small brown rhegmal mark; medial fork located between origins of Rs and MA; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Fig 6a): *All pairs* of legs with tibial spurs of different lengths. *Foreleg* sense hair elongate, more than half femur length; coxa elongate, slightly shorter than femur,

pale with external surface mostly dark brown, covered with short white setae and few short black setae; trochanter pale basally but dark brown apically, covered with short black setae; femur swollen and short, with dorsal surface pale but ventral surface dark brown, dorsally covered by short white setae, laterally with few short black setae and ventrally glabrous, except base with few short black setae; tibia shorter than femur, mostly pale but apex and a medial ring dark brown, dorsal surface covered with black setae, lateral areas with few short white setae, and ventral surface with antennal cleaning setae on apical half and full of short black setae on basal half; tibial spurs strongly curved and extending beyond T4 apex; tarsi slightly shorter than tibia, T2, T3 and T4 about the same size, T1 slightly longer than T2, T5 about as long as T1 - T4 combined; all tarsomeres pale, covered with black setae; T5 ventrally with two rows of thick, long black setae; pretarsal claws short, about $\frac{1}{4}$ length of T5. *Midleg* similar to foreleg, but coxa shorter, dark brown, and covered with short black setae; femur not swollen, entirely dark brown, covered by short black setae and few elongate setae at base; tibia slightly shorter than femur, base dark brown, medially pale, apex brown, covered with short black setae and few white setae on internal margin; tibial spurs extending to T2 apex. *Hindleg* similar to midleg except with femur, tibia and tarsi slightly longer; tibia entirely pale, white setae absent, tibial spurs extending to midlength of T1.

Abdomen: Tergites with distal halves dark brown, basal halves pale with irregular dark marks. Sternites mostly pale with lateral margins dark brown. Covered with short black setae.

Male Terminalia (A4 Figs 7a-c): *Ectoproct* rounded in lateral view; set with elongate black setae, mainly in ventral area. 9th *sternite* broad, with posterior margin rounded, in ventral view; covered with long black setae. *Gonarcus* thin, an arched transverse bar in posterior view. *Mediuncus* membranous. *Paramere* broad and elongate in lateral view, apex more sclerotized, base rounded.

Female Terminalia (A4 Figs 7d-f): *Ectoproct* rounded, set with thin elongate setae dorsally and few cavisetae on ventral area. *Lateral gonapophyses* smaller than ectoproct, beset with long cavisetae on apex, full of pale setae on ventral margin. 9th *tergite* rounded on ventral margin, full of pale elongate setae. 8th *tergite* with ventral margin acute in lateral view. 7th *sternite* long with distal border straight in ventral view; covered with short setae. *Pregenital plate* weakly sclerotized, small, and triangular in ventral view. *Posterior gonapophyses* elongate, digitiform, beset with long black setae, and full of long pale setae on dorsal surface. 9th *tergite* without the membranous digitiform process. *Anterior gonapophyses* absent. *Ventral membrane* covered with many pale setae, gonapophyseal plates present.

Distribution (A4 Fig 152) – Australia: QLD, SA, WA.

Adult activity period – Records for February - April, November, and December.

Biology – unknown, larva unknown.

Primary type – Holotype (by explicit monotypy), male (NHRS), high-resolution images examined. From original description, Esben-Petersen (1918): “One specimen from Kimberley district, N. W. Australia, May”. From New (1985b): “Holotype, ♂, Western Australia, Kimberley District, May, Mjoberg (labeled *Anomaloplectron liniatipenne*)”

(Stockholm) (seen)". Condition: good, left antenna and right antenna tip missing; terminalia dissected.

Material examined – (3♂, 2♀). **AUSTRALIA: South Australia:** *Musgrave Rg*: 25 mi Bore, 9.ii.1966, at lights, P. Aitken & N.B. Tindale (1♂, SAMA); **Queensland:** *Miles*: 17 km E, 11.xii.1990, T.A. Lambkin (1♂, QLDM); **Western Australia:** *Carnarvon*: Manberry Station, 22.iv.1955 (1♀, MVM); *Gascoyne Junction*: 70 air km WNW, 24.87559°S – 114.55150°E ± 90 m, 21.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #613 (1♀, TAMU); *Millstream*: 3.xi.1970, M.S. Upton (1♂, ANIC).

Comments – see comments for *Anomaloplectron*.

***Csiroleon* New 1985**

Type species: *Csiroleon tumidipalpus* New 1985, by original designation.

Diagnosis – Ocular setae present [not absent]; labial palpi much longer than maxillary palpi [not same size or shorter]; palpimacula a long slit [not oval]; tibial spurs reaching the apex of T1 [not absent or longer than T1]; pretarsal claws capable of closing against T5 [not incapable of closing].

Description – Head: *Vertex* moderately domed. *Ocular rim* setae elongate. *Antennae* short with club well developed, flagellomeres almost as long as wide at base, much wider than long at apex. *Labial palpi* greatly elongate, with tip rounded. *Palpimacula* slit-like, located apically. Thorax: *Pronotum* slightly wider than long. *Miller's organ* absent. Wings: Fairly broad, Banksian lines absent. *Forewing* with cubital fork located near origin of Rs; two or three presectoral crossveins; subcostal veinlets simple;

posterior area about the same width as prefork area. *Hind wing* medial fork located near Rs origin; one presectoral crossvein. *Male pilula axillaris* present. Legs: *Femur* slightly enlarged; short, about same length as head width. *Foreleg sense hair* elongate, longer than femur. *Tibial spurs* long, extending to T1 apex. *Pretarsal claws* capable of closing against T5. Male Terminalia: *Ectoproct* rounded in lateral view; *gonarcus* thin and arched; *mediuncus* absent; *paramere* simple, with tip more sclerotized than base. Female Terminalia: *Ectoproct* rounded, with some cavisetae ventrally; *lateral gonapophyses* rounded, beset with cavisetae; *posterior gonapophyses* stout set with long black setae; *anterior gonapophyses* absent; *9th tergite* without membranous digitiform process; *ventral membrane* with a central structure covered with short setae; *pregenital plate* small.

Distribution (A4 Fig 152) – Australia: ACT, NSW, NT, QLD, SA, WA.

Distribution – unknown

Comments – The genus is known from two species, *C. tumidipalpus* and the new species *C. fasciatus*. These species are very distinct from the other Australian antlions, because of their elongate labial palpi, a unique character among Dendroleontini. For phylogenetic relationships see (A4 Figs 1-3).

Key to species of *Csiroleon*

- 1 Thorax with a dark longitudinal line medially (A4 Fig 10c); mesonotum with a line of elongate and flattened setae; forewing with brown marks in subcostal area (A4 Fig 10d); abdomen color pattern not transversally banded.....*C. tumidipalpus*

1' Thorax mostly pale, with few dark marks medially (A4 Fig 8b); mesonotum without a line of elongate and flattened setae; forewing with subcostal area hyaline (A4 Fig 8c); abdomen pale with transversal brown banded....*C. fasciatus*

Csiroleon fasciatus, new species

(A4 Figs 8-9)

Diagnosis – labial palpi much longer than maxillary palpi [not same size or shorter]; wings hyaline [not with prominent dark brown marks]; thorax mostly pale with brown marks [not with a dark sagittal line]; mesonotum without flattened setae [not present]; abdomen transversally banded, pale and brown [not dark with scattered pale marks].

Description – Lengths: forewing: 16 – 19 mm; hind wing: 14 – 18 mm.

Head (A4 Figs 8a-b): *Labrum* pale, set with a line of pale setae. *Clypeus* pale, with few pale elongate setae. *Frons* with ventral area pale and remaining area black but enclosing a short transversal pale mark between antennae; black area with ventral margin excavated medially; beset with short white setae. *Gena* pale. *Vertex* raised; in frontal view mostly pale with some irregular light brown marks; in dorsal view pale with two medial perpendicular black marks; set with short black setae. *Ocular rim* setae elongate and white. *Antennae* clubbed; short, slightly longer than pronotum; distance between width; scape pale, remaining segments with anterior surface pale but posterior surface dark brown; torular membrane yellow; flagellomeres slightly wider than long at base, but apical ones much wider than long; flagellum set with short black setae, scape and pedicel set with short white setae. *Mandibles* pale with tip dark brown. *Maxillary Palpus*

short and pale. *Labial Palpus* extremely elongate, basal segment short and pale, second segment about as long as forefemur, mostly pale but dorsal margin dark brown apically; distal palpomere about as long as half of second segment length, narrow basally but rounded and broad apically, pale but tip slightly darker, palpimacula as slit-like and extending around the apex.

Thorax (A4 Fig 8b): *Pronotum* about as long as wide; posterior margin as wide as anterior; subapical furrow present; mostly pale with some dark brown areas; lateral margins at posterior half, a broad central line extending from the posterior margin up to furrow, two small rounded marks at furrow (near central area), and two large spots around central line at anterior area; set with short black setae and some long white setae on margins. *Mesonotum*, prescutum mostly pale but anterior margin dark brown; scutellum pale except for the dark posterior margin; prescutum set with many short black setae and few long white setae. *Metanotum* mostly pale, except for dark brown marks on scutum (laterally and small rounded central marks), scutellum entirely brown; set with few short black setae. *Pterothoracic pleura*, all segments dark brown dorsally but pale ventrally; covered with white setae. Miller's organ absent.

Wings (A4 Fig 8c): Fairly broad; Banksian lines absent in both wings; veins dark brown intercalated with white spots; beset with short black setae. *Forewing* membrane hyaline; pterostigma mostly white but base brown; cubital fork located slightly beyond Rs origin; two to three presectoral crossveins; subcostal veinlets mostly simple but some apical ones forked; posterior area wider than prefork area at cubital fork level. *Hind wing*

membrane hyaline; pterostigma white; medial fork located near Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Fig 8a): *All pairs*, femur short ($< 2x$ length of coxa); tibia slightly shorter than femur and about the same size of tarsi; tibial spurs long, reaching T1 apex; T2, T3 and T4 about the same size, $T1 > 2x$ length of T2, T5 slightly longer than T1; claws about as long as T5 and capable of closing against T5; coxa, trochanter, femur and tibia covered with many short white setae and some long white setae; femur, tibia and tarsi set with short black setae and some long setae at tibia; T5 ventrally full of thick, long black setae.

Foreleg sense hair longer than femur length; tibia with a antennal cleaning setae in most of ventral surface; coxa mostly pale with scattered brown marks at external surface; trochanter pale; femur slightly broader than in the other legs, mostly pale, but external surface slightly darker, tibia pale with two dark rings (an apical and a medial); tarsi dark brown except for base of T1 and T5 pale. *Midleg* similar to foreleg, except for coxa entirely pale; femoral sense hair longer than femur length. *Hindleg* similar to other legs except with T1 slightly longer; color similar to midleg, except for tibia with dark brown rings smaller, and T1 mostly pale (except tip, dark brown).

Abdomen: Sternites pale. Tergite I pale except for lateral margins brown; tergite II brown except for anterior corners pale; remaining tergites with posterior halves brown, anterior halves mostly pale (forming a banded pattern). Covered with short black setae.

Male Terminalia: *Unknown*.

Female Terminalia (A4 Fig 9): *Ectoproct* rounded, set with thin elongate setae and some cavisetae ventrally. *Lateral gonapophyses* rounded, smaller than ectoproct, beset with

cavisetae. 7th sternite long and with distal border straight, in ventral view; covered with short setae. Pre genital plate small sclerotized mark in ventral view. Posterior gonapophyses stout, beset with very long black setae. 9th tergite membranous digitiform process absent. Anterior gonapophyses absent. Ventral membrane covered with short setae medially.

Distribution (A4 Fig 152) – Australia: SA.

Adult activity period – Records for February and November.

Biology – unknown, larva unknown.

Etymology – From latin *fascia* (= band, stripe) and *atus* (having the nature of) in reference to the banded pattern of the abdomen.

Primary type – Holotype, (by present designation), female, SAMA. **AUSTRALIA: South Australia: Farina Creek:** 20.ii.1966, N. McFarland; SAMA Database No. 24-000114. Condition: good; pinned; left antennal flagellum broken; terminalia dissected, preserved with glycerin in a micro vial pinned below the specimen.

Paratypes: AUSTRALIA: South Australia: Cooper Pedy: 25.xi.1989, R.B. Miller (1♀, FSCA, pinned); *Finke River:* 1953, J.W. Rose (1♀, SAMA, pinned).

Comments – *Csiroleon fasciatus* is clearly associated with *C. tumidipalpus*, both share the extremely elongate labial palpi, which seems to be unique among Dendroleontini. Pretarsal claws, ocular setae, and terminalia are also very similar in both species. Despite all the shared similarities, *C. fasciatus* is easily distinguished from *C. tumidipalpus* by the much paler body, hyaline wings, reduced number of elongate setae on legs and mesonotum, and particularly by the banded pattern of the abdomen. The description of

this new species is justified by all these remarkable different characters, despite the fact that the males of *C. fasciatus* are still unknown. For phylogenetic relationships see (A4 Figs 1-3).

***Csiroleon tumidipalpus* New 1985**

(A4 Figs 10-11)

Csiroleon tumidipalpus New 1985b:62 (OD); New 1996:76 (cat); Stange 2004:101 (cat); Oswald 2015 (cat).

Diagnosis – Labial palpi much longer than maxillary palpi [not same size or shorter]; wings with prominent dark marks [not hyaline]; thorax with a dark, continuous sagittal line [not with scattered marks or an interrupted line]; mesonotum with a line of long, flattened setae [not absent].

Description – Lengths: forewing: 16 – 19 mm; hind wing: 15 – 18 mm.

Head (A4 Figs 10a-c): *Labrum* pale, with a line of elongate setae. *Clypeus* pale, set with pale elongate setae. *Frons* with area between antennae and ventral area pale, remaining areas black; black area with ventral margin excavated medially; beset with short white setae. *Gena* pale. *Vertex* raised; mostly pale, except for a transversal medial black line connected to a medial posterior spot, in dorsal view; set with short black setae. *Ocular rim* setae elongate and white. *Antennae* clubbed; short, slightly longer than pronotum; distance between antennae about the same size of scape width; all segments with anterior surface pale, (except for apical ones with irregular dark brown marks), and posterior surface dark brown with distal margin pale; torular membrane yellow; flagellomeres

almost as long as wide at base, apical ones much wider than long; flagellum set with short black setae, scape and pedicel set with short white setae. *Mandibles* pale with tip dark brown. *Maxillary Palpus* short and pale. *Labial Palpus* extremely elongate, basal segment short and pale, second segment about as long as forefemur, mostly pale with dorsal margin dark brown; apical palpomere about as long as half of forefemur length, narrow basally but rounded and broad apically, mostly brown, with basal ventral margin pale, palpimacula a long slit extending around the apex.

Thorax (A4 Figs 10b-c): *Pronotum* about as long as wide; posterior margin as wide as anterior; subapical furrow present; mostly pale with some dark brown areas; a broad sagittal line, lateral margins at posterior half, four irregular marks (two at posterior margin and two at anterior margin), in some specimens these marks are linked by a sinuous longitudinal line; set with small black setae, some long black setae and few long white setae on margins. *Pterothoracic tergites* mostly dark brown, with two longitudinal pale lines around midline, which extend from anterior half of mesoprescutum to posterior margin of metascutellum, pale lines enclose a thin longitudinal dark line at mesoscutum; set with short black and white setae; anterior margin of mesoscutum bearing few elongate, flattened, black setae. *Pterothoracic pleura* sclerites dark brown dorsally, pale ventrally; covered with long white setae. Miller's organ absent.

Wings (A4 Fig 10d): Fairly broad with tip acute; Banksian lines absent; veins mostly dark brown, but some veins intercalated with white spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline; dark marks as follows: at subcostal area, gradate crossveins, tip of prefork area, some brown

infuscation at inferior margin, apex, and around some crossveins; pterostigma brown; cubital fork located near Rs origin; three presectoral crossveins; subcostal veinlets mostly simple, few apical ones forked; posterior and prefork areas about the same size. *Hind wing* membrane color pattern similar to forewing, except for infuscated brown areas absent; medial fork located near Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 10a-b): *All pairs of legs*, femur short ($< 2x$ length of coxa); tibia shorter than femur and about same size of tarsi; tibial spurs long (reaching T1 apex); T2, T3 and T4 about the same size, $T1 > 2x$ length of T2, T5 longer and broader than T1; claws about as long as T5 and capable of closing against T5; coxa, trochanter, femur and tibia covered with many short white setae and some long white setae, mainly on coxa and femur; femur, tibia and tarsi set with short black setae and some long ones at tibia; T5 ventrally full of thick, long, black setae. *Foreleg* sense hair longer than femur length; tibia with antennal cleaning setae in most of ventral surface; coxa mostly pale with scattered brown marks at external surface; trochanter pale; femur slightly broader than in the other legs, mostly pale, but external surface slightly darker, tibia pale with two small dark marks medially and tip dark; tarsi with T2 - T4 dark brown dorsally, T1 and T5 pale. *Midleg* similar to foreleg, except for coxa entirely pale; femoral sense hair longer than femur length. *Hindleg* similar to other legs except T1 slightly longer; color very similar to other legs, except tibia mostly pale with tip dark brown, and a dorsal brown mark medially.

Abdomen: Sternites mostly pale with dark brown scattered marks mainly at lateral margins. Tergites mostly dark brown with two longitudinal pale lines around midline and some other small irregular pale marks. In some darker specimens the abdomens can be almost entirely dark brown. Covered with short black setae.

Male Terminalia (A4 Figs 11a-c): *Ectoproct* rounded in lateral view; set with elongate black setae, mainly at ventral area. *9th sternite* short, posterior margin with a small medial elongation in ventral view; covered with long black setae. *Gonarcus* thin, a transversal bar with a small curve medially in dorsal view. *Mediuncus* membranous. *Paramere* broad and elongate in lateral view, ventral margin and apex more sclerotized.

Female Terminalia (A4 Figs 11d-e): *Ectoproct* rounded, set with thin elongate setae and some cavisetae ventrally. *Lateral gonapophyses* rounded, smaller than ectoproct, beset with cavisetae. *7th sternite* long, with distal border straight in ventral view; covered with short setae. *Pregenital plate* weakly sclerotized, very small, triangular in ventral view. *Posterior gonapophyses* stout, beset with long black setae. *9th tergite* membranous digitiform process absent. *Anterior gonapophyses* absent. *Ventral membrane* covered with short setae medially.

Distribution (A4 Fig 152) – Australia: NSW*, NT, QLD*, SA*, and WA. * = new record.

Adult activity period – Records for August to April.

Biology – Unknown; larva unknown.

Primary type – Holotype (by original designation), female (ANIC), examined. From original description, New (1985b): “Holotype, ♀, Northern Territory, 17°29’S., 133°30’E., 8 km NW. by N. Elliott, 14.x.1972, M. S. Upton (ANIC)”. Condition: good.

Material examined – (16♂, 30♀). **AUSTRALIA: New South Wales:** *Culgoa NP:* i.2010 (2♀, QLDM); **Northern Territory:** *Barkly Hwy:* 75 km ESE of junction with Tablelands Hwy, 4.i.1987, M.S. & B.J. Moulds (1♀, AMSA); *Devil’s Marbles:* x.1960 (2♀, FSCA); *Elliott:* 8 km, NW, 17°29’S., 133°30’E., 14.x.1972, M.S. Upton (3♀, ANIC); *Three Ways:* 160 km E, 7.x.1972, E.F. Riek (1♂ PT, ANIC); **Queensland:** *Cunnamulla:* i.1941 (1♂, QLDM); *Dynevour Lakes:* 88 km W Eulo, 28°05’S – 144°12’E, 25.x.1991, G. Daniels, mv lamp (1♂, 1♀, QLDM); **South Australia:** *Musgrave Rg:* 21 mi Bore, 9.ii.1966 (1♀, SAMA); **Western Australia:** *Barradale:* 23 km, WSW, 22°56’S., 114°45’E., 30.iii.1971, E. F. Riek (2♀, 1♀ PT, 1♂ PT, ANIC); *Gascoyne Junction:* 70 air km WNW, 24.87559°S – 114.55150°E±90m, 21.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #613 (3♂, 4♀, TAMU); *Great Central Road:* track W off, 6 km air NNNE Laverton, 28.58435°S – 122.41038°E ±100m, 470m, 27.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #618 (1♀, TAMU); *Landrigan Cliffs:* ix.1953 (3♂, 2♀, SAMA); *Liveringa Stn:* viii.1953 (1♀, SAMA); ix.1953 (1♂, SAMA); *Millstream:* 5 km, SE, 21°37’S., 117°06’E., 8.xi.1970, Upton & feehan (1♀, 1♂, ANIC); *Minilya Stn:* iv.1953 (2♀, MVM); *Mural Crescent:* Gill Pinnacle, xi.1956 (1♂, SAMA); ix.1963 (5♀, SAMA); x.1963 (1♀, SAMA); *Warburton:* 66 km, EN, 26°03’S., 127°14’E., 15.xi.1977, M.S. Upton (1♂, ANIC); *Wittenoom:* 20 km ESE, 11.xi.1970, M.S. Upton (1♂, FSCA, 1♂ PT, ANIC).

Comments – See comments for *C. fasciatus*.

***Fissuleon* new genus**

Type species: *Glenoleon nigristriatus* New 1985, by present designation.

Diagnosis – Ocular setae present [not absent]; palpimacula slit-like [not oval]; forewing posterior area wider than prefork area [not equal or narrower]; tibial spurs extending to T2 apex [not absent or reaching T4]; female ectoproct and lateral gonapophyses with cavisetae [not without cavisetae]; 9th tergite membranous digitiform process absent [not present].

Description – Head: *Vertex* raised, set with short setae. *Ocular rim* setae elongate. *Antennae* clubbed and elongate; distance between antennae about same size of scape width, flagellomeres almost as long as wide at base, apical ones much wider than long, all segments set with short black setae. *Palpimacula* a small longitudinal slit, located medially. Thorax: *Pronotum* about as long as wide. Miller's organ absent. Wings: *Tip* acute. *Banksian* lines absent. *Forewing* cubital fork located near Rs origin; three presectoral crossveins; costal crossveins simple; posterior area wider than prefork area. *Hind wing* medial fork located near Rs origin; one presectoral crossvein. *Male pilula axillaris* present. Legs: *Femur* slightly enlarged, wider than the remaining leg segments. *Tibial spurs* long, extending to T2 apex. *Pretarsal claws* slightly shorter than half of T5 length. *Sense hair* about half of forefemur length. *Tibia* with antennal cleaning setae ventroapically. Male Terminalia: *Ectoproct* rounded in lateral view; *gonarcus* thin and arched; *mediuncus* absent or reduced; *paramere* simple, with tip more sclerotized.

Female Terminalia: *Ectoproct* and *lateral gonapophyses* beset with cavisetae; *posterior gonapophyses* short and set with long black setae; *anterior gonapophyses* absent; 9th *tergite* without membranous digitiform process; *ventromedial plate* present.

Distribution (A4 Fig 153) – Australia: NSW, NT, QLD, SA, WA.

Comments – The genus contains three species previously described in *Glenoleon* by New (1985b). The presence of ocular setae, the shape of forewing posterior area, and general shape of male and female terminalia structures, are all characters that place these three species Acanthoplectrini. Within Acanthoplectrini these three species can be easily separated by the palpimacula slit-like and positioned at the medial region of the apical palpomere. Additionally, molecular data also support the creation of this new genus. For phylogenetic relationships see (A4 Figs 1-3).

Biology – unknown.

Etymology – The specific name is derived from the Latin word *fissus* (= slit, fissure, cut) and refers to the slit-like shape of the palpimacula.

Key to species of *Fissuleon*

- 1 Body dark (mostly grey with black marks); pronotum set with many long white setae (A4 Fig 16b); forefemur covered with white setae; forewing subcostal area completely dark (A4 Fig 16c).....*F. nigristriatus*
- 1' Body not dark (mostly yellow with few black marks); pronotum set with short black setae; forefemur not covered with white setae, forewing subcostal area not entirely dark (A4 Fig 14c).....2

- 2 Frons with black marks circling antennae (A4 Fig 12a); pronotum with a broad black longitudinal line medially (A4 Fig 12b); forewing subcostal area with dark marks (A4 Fig 12c); male paramere narrow (posterior view) (A4 Fig 13c)
*F. brevigonarcus*
- 2' Frons with a curved black line above antennae (A4 Fig 14a); pronotum without a longitudinal line (only small black marks) (A4 Fig 14b); forewing subcostal area hyaline (A4 Fig 14c); male paramere broad (posterior view) (A4 Fig 15c)
*F. mouldsorum*

***Fissuleon brevigonarcus* (New 1985), new combination**

(A4 Fig 153)

Glenoleon brevigonarcus New 1985b:43 (OD); New 1996:81 (cat); Stange 2004:103 (cat); Oswald 2015 (cat).

Diagnosis – Ocular setae present [not absent]; palpimacula slit-like [not oval]; body mostly pale [not grey or black]; forewing subcostal area hyaline [not brown]; frons pale with antennae surrounded by brown marks [not fully brown or brown only above antennae]; pronotum with a broad, black, longitudinal line [not without line].

Description – Lengths: forewing: 22 – 26 mm; hind wing: 20 – 24 mm.

Head (A4 Figs 12a-b): *Labrum* pale, set with a line of elongate setae. *Clypeus* pale, with elongate setae. *Frons* mostly pale, with a black transversal band enclosing antennae (except area between antennae, pale); beset with small white setae. *Gena* pale. *Vertex* raised; in frontal view pale, with a weak transversal central dark line, which is generally

interrupted by pale marks; in dorsal view mostly pale with an irregular transversal black line and a central black spot on posterior border; set with small black setae. *Ocular rim* setae elongate and white. *Antennae* clubbed; elongate, > 2x length of pronotum; distance between antennae about same size of scape width; in general pale with flagellum slightly darker; torular membrane yellow; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae. *Mandibles* pale with tip dark brown. *Palpi*, maxillary and labial pale, apical labial palpomere fusiform, palpimacula a small longitudinal slit, located medially.

Thorax (A4 Fig 12b): *Pronotum* about as long as wide; posterior margin as wide as anterior; subapical furrow present; mostly pale with a broad, black sagittal band, and scattered black spots laterally; covered with small black setae. *Mesonotum* with the same sagittal band of pronotum and some black lateral lines at the scutum, remaining areas pale; covered with short black setae. *Metanotum* with the same sagittal band, surrounded by two pale bands, lateral area grey, set with few short black setae. *Pterothoracic pleura* mostly pale with three longitudinal thin black lines; set with few short black setae. Miller's organ absent.

Wings (A4 Fig 12c): Rather narrow with tip acute. Banksian lines absent in both wings. Veins mostly dark brown, but some veins intercalated with pale spots, set with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline; small dark scattered marks as follows: at mediocubital area, inferior margin, subcostal area, gradate crossveins, around the crossveins at the end of prefork area (in some specimens); cubital fork located near the Rs origin; three presectoral crossveins; subcostal veinlets

simple; posterior area almost twice wider than prefork area. *Hind wing* membrane hyaline; medial fork located near Rs origin; medial area with few crossveins, and about as wide as posterior area; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Fig 12a): *All pairs of legs*, femur long ($> 2x$ length of coxa), slightly wider than remaining leg segments; femur and tibia about the same size but slightly longer than tarsi; tibial spurs long, surpassing T2 apex; T2, T3 and T4 about the same size, T1 slightly longer than T2, T5 $> 2x$ length of T1; claws slightly longer than half of T5 length; all segments covered with many short white setae (except tarsi); some long white setae on femur and tibia, and some long black setae on femur, tibia and tarsi; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair about half of femur length; tibia with antennal cleaning setae ventroapically; coxa mostly pale with dark marks laterally; trochanter pale, femur and tibia pale with small rounded dark spot on base of the setae; tarsi pale with tip of all segments slightly darker. *Midleg*, same color pattern of foreleg. *Hindleg*, femur, tibia and T1 slightly longer than in other legs; same color pattern.

Abdomen: Mostly black, with scattered yellow marks generally at sternites and laterally on tergites, in some specimens entirely black; covered with short black setae.

Male Terminalia (A4 Figs 13a-c, e): *Ectoproct* rounded in lateral view; set with elongate black setae. *9th sternite* very long with posterior border curved in ventral view; set with elongate black setae. *Gonarcus* arched, with constant width. *Mediuncus* membranous. *Paramere* broad, curved, with tip sclerotized in lateral view.

Female Terminalia (A4 Figs 13d, f): *Ectoproct* rounded, set with thin elongate setae and some cavisetae ventrally. *Lateral gonapophyses* rounded, smaller than ectoproct, beset with cavisetae. *7th sternite* elongate with the distal border straight in ventral view; covered with short thickened setae. *Pregenital plate* very small and triangular. *Posterior gonapophyses* stout, beset with very long black setae; apex rounded and thinner than base in lateral view. *9th tergite* membranous digitiform process absent. *Anterior gonapophyses* absent. *Ventral membrane*, ventromedial plate present.

Distribution (A4 Fig 153) – Australia: NSW*, NT*, QLD*, SA, WA. * = new records.

Adult activity period – Records for October to March.

Biology – Unknown, larva unknown.

Primary type – Holotype (by original designation), female (ANIC), examined. From original description, New (1985b): “Holotype, ♀, Western Australia, 26°03’S., 127°14’E., 66 km E. by N. of Warburton, 15.xi.1977, M.S. Upton (ANIC)”. Condition: good; terminalia dissected.

Material examined – (18♂, 17♀). **AUSTRALIA: New South Wales:** *Bourke*: 80mi W, 31.x.1967, R. McInnes (1♂, ANIC); *Talyealye Hsd*: 29°05’28’’S - 144°27’59’’E, 17.i.1999, M.S. & B.J. Moulds (1♀, AMSA); *Wanaaring*: 32 km E, 9.xi.1971, R.C. Lewis (1♂, ANIC); **Northern Territory:** *Alice Spring*: 4mi SW, 18.ii.1966, Britton, Upton & McInnes (1♂, 1♀, ANIC); xi.1965 (1♂, 1♀, FSCA); *Reedy Rockhole*: nr Kings Canyon, George Gill Rg, 31.i.1984, M.S. & B.J. Moulds (1♂, AMSA); *Stuart H’way*: 296 km S of Tennant Creek, 29.xi.1972, D.H. Colless (1♀, ANIC); *Tennant Creek*: 6mi N, 9.xi.1966, A. & R. Mesa (1♀, ANIC); *Yuendumi*: 10mi NW, 20.ii.1968, at light in

creek bed (1♂, 1♀, SAMA); **Queensland:** *Barakula State Forest*: 28.5 air km NNW Chinchilla, 26.49661°S 150.52354°E, R Machado, MV light, 19.xii.2015, AustRM#04 (1♂, TAMU); *St George*: 80 km NNE, 21.xi.1986, M.S. & B.J. Moulds (1♂, AMSA); *South Hedge Mareeba*: xi.1978 (1♀, QLDM); **South Australia:** *Finke River*: 1933 (2♂, SAMA); *Mount Freeling Stn*: xi.1998 (1♀, SAMA); *Wilpena*: ii.1956 (1♂, SAMA); **Western Australia:** *Comet Vale*: 130 km N of Kalgoorlie, MV light, A. Sundholmi & J. Bugeja (5♂, 5♀, AMSA); *Dedari Pump Stn*: 14.i.1992, J. Bugeja (1♀, 1♂, ANIC); *Gill Pinnacle*: Kathleen Ra., 31.x.1963, P. Atken & N.B. Tindale (1♀, SAMA); xi.1963 (1♀, SAMA); *Kalgoorlie*: 160 km E, Trans Aust. Railway, 21.i.1991, M.S. & B.J. Moulds (1♂, AMSA); *Wave Rock*: 32.27S – 118.53E, 1.ii.1993, E.D. Edwards & E.S. Nielsen (1♀, ANIC).

Comments – *Fissuleon brevigonarcus* is more associated with *F. mouldsorum* than *F. nigristriatus*, because of their body color and wings pattern. However it can be easily differentiated from its closer species because of the longitudinal black line located in the medial area of pronotum, and the brown marks around the antennae. For phylogenetic relationships see (A4 Figs 1-3).

***Fissuleon mouldsorum* (New 1985), new combination**

(A4 Figs 14-15)

Glenoleon mouldsorum New 1985b:44 (OD); New 1996:83 (cat); Stange 2004:105 (cat);

Glenoleon dannya New 1985 **New synonym.** *Glenoleon dannya* New 1985:56 (OD);

New 1996:82 (cat); Stange 2004:103 (cat); Oswald 2015 (cat).

Diagnosis – Ocular setae present [not absent]; palpimacula slit-like [not oval]; body mostly pale [not grey or black]; forewing subcostal area hyaline [not black]; frons pale with a curved brown line above antennae [not circling antennae].

Description – Lengths: forewing: 24 – 27 mm; hind wing: 22 – 25 mm.

Head (A4 Figs 14a-b): *Labrum* pale, set with a line of elongate setae. *Clypeus* pale, with few short pale setae. *Frons* mostly pale except for a transversal dark brown line above antennae. *Gena* pale. *Vertex* raised; in frontal view pale, with two short transversal dark marks laterally and a small medial dark mark; in dorsal view mostly pale with two central perpendicular dark lines; covered with short black setae. *Ocular rim* setae white and elongate. *Antennae* clubbed; elongate, $\geq 2x$ length of pronotum; distance between antennae wider than scape width; all segments anterior surface pale, posterior brown; torular membrane pale; flagellomeres almost as long as wide at base, apical ones wider than long; all segments set with short black setae. *Mandibles* pale, with tip black. *Palpi*, maxillary and labial pale, except for maxillary apical segment, brown; covered with short black setae, apical labial palpomere fusiform, palpimacula slit-like and located medially.

Thorax (A4 Fig 14b): *Pronotum* about as long as wide; posterior margin as wide as anterior; subapical furrow present; mostly pale, with dark brown areas as follows: lateral margins, two longitudinal curved lines near lateral region, two broad longitudinal lines around center (interrupted at furrow); covered with short black setae. *Mesonotum* mostly dark brown, except for two rounded pale marks on prescutum, few longitudinal pale lines on scutum, and scutellum posterior margin pale; all segments set with short black

setae. *Metanotum*, prescutum pale but with two central, dark brown marks, scutum dark brown with two longitudinal, pale lines, scutellum black with medial and posterior lines pale; set with short black setae. *Pterothoracic pleura* dorsal sclerites mostly dark brown with small pale areas, ventral sclerites mostly pale with dorsal margin dark brown; set with short white setae; Miller's organ absent.

Wings (A4 Fig 14c): Fairly broad; Banksian lines absent; veins mostly brown, but some veins intercalated with white spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline with small brown infuscations at vein forks near the posterior margin, and at mediocubital area; pterostigma white, with center dark brown; cubital fork located near Rs origin; three presectoral crossveins; subcostal veinlets simple (sometimes a few apical veinlets forked); posterior area wider than prefork area. *Hind wing* membrane hyaline; medial fork located near Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs: *All pairs of legs*, femur elongate ($> 2x$ length of coxa); tibia about as long as femur; but slightly longer than tarsi; tibial spurs elongate, reaching T2 apex; T2, T3 and T4 about the same size; T1 longer than T2; T5 $> 2x$ length of T1; claws slightly shorter than half of T5 length; coxa, trochanter and femur covered with short white setae, and some long white setae on femur; tibia set with short white and black setae, and some long white setae; tarsi set with short black setae. *Foreleg* sense hair short, slightly longer than femur width; tibia with antennal cleaning setae ventroapically; coxa predominantly pale with small dark brown marks on external surface; trochanter pale, femur slightly enlarged, mostly pale, but with dorsal surface darker (mainly at tip); tibia generally pale

with two dark brown marks, one at base and another at tip (in few specimens the brown marks are reduced, like the holotype), T2, T3, T4 and tip of T5 dark brown, remaining areas pale. *Midleg* with same color pattern of foreleg. *Hindleg*, femur and tibia slightly longer than midleg; color pattern equal to other legs, except for reduced tibial dark areas. Abdomen: Mostly black with some pale marks on anterior margin of basal segments; covered with short black setae.

Male Terminalia (A4 Fig 15a-c): *Ectoproct* rounded in lateral view; set with elongate black setae, mainly at the ventral area. *9th sternite* short, with posterior margin extended medially in ventral view; covered with long black setae. *Gonarcus* thin, an arched bar in posterior view; medial area narrower than lateral in posterior view. *Mediuncus* membranous. *Paramere* broad, wider than gonarcus in lateral view; apex and ventral margin more sclerotized.

Female Terminalia (A4 Fig 15d-e): *Ectoproct* rounded, covered with thin elongate setae and some cavisetae ventrally. *Lateral gonapophyses* rounded, smaller than ectoproct, covered with cavisetae. *7th sternite* elongate, with distal margin rounded, covered with short black setae. *Pregenital plate* in ventral view, an inverse triangle, with dorsal margin elongate. *Posterior gonapophyses* very short, covered with long black setae. *9th Tergite* membranous digitiform process absent. *Anterior gonapophyses* absent. *Ventral membrane* with gonapophyseal plates present, and ventromedial plate covered with short black setae.

Distribution (A4 Fig 153) – Australia: NT* and WA. * = new records.

Adult activity period – Records for March, October and November.

Biology – Unknown, larva unknown.

Primary type – *Glenoleon mouldsorum*: Holotype (by original designation), male (AMSA), high-resolution images examined. From original description, New (1985b): “Holotype, ♂, Western Australia, Tunnel Creek, E. of Derby, 1.xi.1978, M. S. and B. J. Moulds (AM)”. Condition: excellent, terminalia dissected.

Glenoleon dannyae: Holotype (by original designation), female (ANIC), examined. From original description, New (1985b): “Holotype, ♀, Northern Territory, 16°28’S., 136°09’E., 46 km SSW. Borroloola, 28.x.1975, M. S. Upton (ANIC). Condition: excellent, terminalia dissected.

Material examined – (5♂, 14♀). **AUSTRALIA: Western Australia: Cane River HS:** 8 km SWbyW, 22.07S – 115.33E, 31.iii.1971, E.F. Riek (5♂, 13♀, ANIC); *Louisa:* 28 km W, x.1960 (1♀, FSCA).

Comments – *Glenoleon mouldsorum* and *Glenoleon dannyae* were described in the same paper (New 1985b); both descriptions were based on single specimens, a male and a female respectively. The only difference is the dark brown marks on the *G. dannyae* holotype fore and mid tibia. *F. mouldsorum* is identified by the presence of two median black stripes in the pronotum. *G. dannyae* is recognized based on the tibial spurs reaching the apex of T2. The studies of new specimens here, also reinforce the synonym of these two species; among the 18 specimens from Cane River (WA), there are males and females and their respective terminalia match the ones from both holotypes. In this sense, these two species are considered here as synonyms. According to Zoological

Nomenclatural Code the name that must prevail is the one presented first, in this case *G. mouldsorum*, described at page 44, while *G. dannyae* was described at page 56.

***Fissuleon nigristriatus* (New 1985), new combination**

(A4 Figs 16-17)

Glenoleon nigristriatus New 1985b:49 (OD); New 1996:84 (cat); Stange 2004:106 (cat); Oswald 2015 (cat).

Diagnosis – Ocular setae present [not absent]; palpimacula slit-like [not oval]; body mostly dark [not pale]; subcostal area of forewing brown [not hyaline]; pronotum covered with long white setae [not black or short].

Description – Lengths: forewing: 24 – 38 mm; hind wing: 22 – 37 mm.

Head (A4 Figs 16a-b): *Labrum* pale, set with a line of elongate setae. *Clypeus* pale, with elongate setae. *Frons* with ventral half pale, dorsal half black, in some specimens there are some pale spots on the black area; beset with short white setae. *Gena* pale. *Vertex* raised; in frontal view pale, with a central black line; in dorsal view mostly yellow with some black marks posteriorly; set with small black setae. *Ocular rim* setae elongate and white. *Antennae* clubbed; elongate, > 2x length of pronotum; distance between antennae narrower than scape width; flagellomeres black with a distal pale ring (in some specimens pale rings absent on distal flagellomeres); torular membrane yellow; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae. *Mandibles* pale with tip dark brown. *Palpi*,

maxillary and labial with basal segments light brown, remaining segments black, apical labial palpomere fusiform, palpimacula a longitudinal slit, located medially.

Thorax (A4 Fig 16b): *Pronotum* about as long as wide; posterior margin as wide as anterior; subapical furrow present; mostly pale with two large longitudinal black bands around central region and some small spots on pale area; covered with short black setae and some white elongate setae on borders. *Mesonotum* mostly pale (grey in darker specimens), with a central longitudinal black band and scattered black spots, mostly covered with short black setae, and some white setae. *Metanotum* grey with a central longitudinal black band, covered with small white setae. *Pterothoracic pleura* mostly black with scattered pale spots, in some specimens the pale areas are large, mostly ventrally; covered with long white setae. Miller's organ absent.

Wings (A4 Fig 16c): Rather narrow, with tip acute; Banksian lines absent in both wings; veins set with short black setae, most of longitudinal veins white, but Sc and R black intercalated by numerous short white regions, crossveins black. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline except for the dark subcostal area and scattered mark at mediocubital area; cubital fork located near Rs origin; three or four presectoral crossveins (distal crossvein with a medial veinlet connecting with RS+MA); subcostal veinlets simple; posterior area almost twice as wider as prefork area. *Hind wing* membrane hyaline except for small brown marks at rhegmal region, and pterostigma; medial fork located near Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Fig 16b): *All pairs of legs*, femur enlarged ($> 2x$ length of coxa); tibia slightly shorter than femur but slightly longer than tarsi; tibial spurs long, surpassing T2 apex; T2, T3 and T4 about the same size, T1 slightly longer than T2, $T5 \geq 2x$ length of T1; claws about half of T5 length; all segments covered with many short white setae and scattered long white setae (mainly on femur); tibia and tarsi set with short black setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair about half of femur length; tibia with antennal cleaning setae ventroapically; coxa mostly dark brown with pale marks; trochanter and femur dark brown, femur apex pale in some specimens; tibia dark brown with three pale rings; T1 and basal half of T5 pale, remaining areas dark brown. *Midleg* with same color pattern of foreleg. *Hindleg* femur, tibia and T1 slightly longer than in other legs; color pattern very similar to other legs, except tibia, with the anterior surface mostly pale.

Abdomen: Mostly grey, with scattered yellow marks generally at the sternites and distal tergites; anterior segments with some white setae, remaining segments covered with short black setae.

Male Terminalia (A4 Figs 16a-c): *Ectoproct* rounded in lateral view; set with elongate black setae. *9th sternite* posterior border curved; set with elongate black setae. *Gonarcus* thin and elongate in lateral view, arched in posterior view. *Mediuncus* membranous. *Paramere* enlarged with tip and ventral margin more sclerotized.

Female Terminalia (A4 Figs 16d-e): *Ectoproct* rounded set with thin elongate setae and some cavisetae ventrally. *Lateral gonapophyses* rounded, smaller than ectoproct, beset with cavisetae. *7th sternite* with distal border straight in ventral view; covered with short

setae. *Pregenital plate* broad and transversally extended. *Posterior gonapophyses* stout, beset with very long black setae. *9th tergite* membranous digitiform process absent. *Anterior gonapophyses* absent. *Ventral membrane* with a ventromedial plate covered with short setae.

Distribution (A4 Fig 153) – Australia: NSW*, NT, QLD*, SA*, WA*. * = new records.

Adult activity period – Records for August to February.

Biology – Unknown, larva unknown.

Primary type – Holotype (by original designation), female (SAMA), examined. From original description, New (1985b): “Holotype, ♀, Northern Territory, The Gorge WH. between Hatches Creek and Elkedra, 7.x.1977, J. A. Forrest (SAM)”. Condition: good, with terminalia dissected.

Material examined – (73♂, 86♀). **AUSTRALIA: New South Wales:** *Nombinnie Nature Reserv.:* 18 air km SSE Mount Hope, 160m, 32.99613°S – 145.94006°E±70m, 3.i.2013, M.V., Oswald, Diehl & Machado, Oswald #626 (10♂, 11♀, TAMU); *Talyealye Hsd:* 4 km N, 29°05'28''S - 144°27'59''E, 17.i.1999, M.S. & B.J. Moulds (1♂, 2♀, AMSA); **Northern Territory:** *Alice Springs:* Emily Gap, 17.ii.1966, Upton (1♀, 1♂, ANIC); 6.x.1978, Upton (1♂, ANIC); *Barrow Creek:* 12.x.1972, Upton (1♂, ANIC); 13.ii.1966 (1♀, 2♂, ANIC); *Borroloola:* 1.xi.1975, Upton (2♀, 1♂, ANIC); *Darwin:* ix.1953 (1♀, SAMA); *Devil's Marbels:* xi.1960 (1♂, FSCA); 27.ii.1962 (1♀, FSCA); *Gorge WH:* Between Hatches Ck and Elkedra, 7.x.1977 (2♂, 1♀ PT, SAMA); *Ooratippra:* 31.x.1962, E.S. Ross (2♂, 1♀, FSCA); *Ready Rockhole:* nr Kings Canyon, George Gill Rg., 31.i.1984, M.S. & B.J. Moulds (1♂, 2♀, AMSA); *Tennant Creek:*

9.xi.1966, A & E Mesa (1♀, 1♂, ANIC); *Three Ways*: 7.x.1972, E. F. Riek (1♀, 1♂, ANIC); *Victoria River Downs*: 8 km WSW, 12.viii.1973, L.P. Kelsey (1♀, ANIC); **Queensland**: *Blackdown Tableland Nat. Pk.*: Charlevue Rd, 17 air km SSSE Bluff 23.72965°S 149.11972°E±30m, R Machado, MV light, 21.xii.2015, AustRM#06 (1♂, TAMU); *Miles*: xi.1990 (1♀, QLDM); **South Australia**: *Alawoona*: 13 km S, 6.i.1996, M.S. & B.J. Moulds & K.A. Kopestonsky (1♂, AMSA); *Cungena*: nr. Landfill, 100m, 32.58559°S – 134.72105°E±50m, 30.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #622 (1♂, TAMU); *Everard Pk*: x.1970 (1♂, 2♀, SAMA); xi.1970 (2♂, 2♀, SAMA); *Kychering Soak*: (1♀, MVM); *Lake Gilles*: xii.1980 (1♀, SAMA); *Mount Davis*: xi.1963 (1♂, SAMA); *Musgrave Range*: ii.1966 (1♂, 1♀, SAMA); *Petermann Range*: x.1963 (1♀, SAMA); **Western Australia**: *Browne Ra*: Mt Gordon, 7.x.1960 (1♀, ANIC); *Cosmo Newberry*: 80 km E, 27.55S – 123.29E, 27.xii.1995, M.S. & B.J. Moulds & K.A. Kopestonsky (3♂, 1♀, AMSA); 28.xii.1995 (1♀, AMSA); *Dampier*: 18.x.1970, Upton (2♀, ANIC); *Deeba Rock Hole*: 34 km NEbyN of Laverton, 28.22S – 122.37E, 12.xi.1977, M.S. Upton (1♂, 1♀, ANIC); *Flora Valley Stn*: x.1953 (1♀, SAMA); *Gascoyne Junction*: 70 air km WNW, 24.87559°S – 114.55150°E±90m, 21.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #613 (7♂, 9♀, TAMU); *Glenroy H.S.*: 6.ix.1964 (1♀, 2♂, ANIC); *Halls Creek*: 1.x.1953, N.B. Tindale (1♂, 2♀, SAMA); 14.x.1953 (1♂, SAMA); 10.x.1953 (1♂, SAMA); *Lansdowne H S*: 21.ix.1964, Plumb (2♀, ANIC); *Leinster*: 18 km SE, 28.05S – 120.51E, 16.i.1989, M.S. & B.J. Moulds (1♀, AMSA); *Liveringa Stn*: ix.1953 (3♂, 2♀, SAMA); *Louisa*: DNS 15 mi W, 18.x.1962 (1♂, 1♀, FSCA); *Marvel Loch*: 27.xii.1983, K. & E. Carbony (1♂,

1♀,AMSA); *Millstream*: 24.x.1970, J.C. Cardale (3♂, 3♀, ANIC, TAMU); 2 km NE, 21.35S – 117.04E, 30.x.1970, Upton & Feehan (6♂, 8♀, ANIC); 23.x.1970, J.C. Cardale (1♀, FSCA); 21.35S – 117.04E, 2.xi.1970, Upton & Feehan (2♂, ANIC); *Morgan Falls*: 15.02S – 126.40E, 16-17.viii.1975, I.F.B. Common & M.S. Upton (1♀, ANIC); *Murdoch District*: ii.1892 (1♂, 3♀, SAMA); *Nanutarra Roadhouse*: hwy 136, 13 air km NENE, 22.47124°S – 115.60040°E±70m, 22.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #614 (1♂, 1♀, TAMU); *Norseman*: track S off hwy 1, 79 air km EENE, 32.08056°S – 122.60297°E±90m, 28.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #619 (4♂, 3♀, TAMU); Jimberlana Hill, 1 km W, 32.09S – 121.48E, 17.i.1993, E.D. Edwards & E.S. Nielsen (4♀, ANIC); *Pungkulpirri Waterhole*: 0.5 km E, Walter James Rg, 24°39'15''S – 128°45'18''E, 26.ix.2006, at light, Central Ranges Sur. Camp 1 (1♀, SAMA); *Warburton*: 40 km W, 26.13S – 126.19E, 29.xii.1995, M.S. & B.J. Moulds & K.A. Kopestonsky (2♂, 2♀, AMSA); *Wittenoom*: 11.xi.1970, Upton (2♂, ANIC).

Comments – *Fissuleon nigristriatus* is the largest and most common species in the genus, and can be easily separated from the other two species by the darker body, and the presence of many long white setae covering many parts of the body. For phylogenetic relationships see (A4 Figs 1-3).

***Franzenia* Esben-Petersen 1929**

Type species: *Franzenia irrorata* Esben-Petersen 1929, by original designation.

Diagnosis – Legs relatively short [not long]; ocular setae present [not absent]; tibial spurs absent [not present]; mid tibia expanded, broader than femur [not as wide as femur].

Description – Head: *Vertex* not raised. *Ocular rim* setae present. *Antennae* clubbed and elongate; flagellomeres almost as long as wide at base, apical ones slightly wider than long, all segments set with short black setae. *Palpimacula* oval-shaped, located medially. Thorax: *Pronotum* longer than wide. Mesonotum with a line long flattened setae. Miller's Organ absent. Wings: tip acute. *Forewing* cubital fork located near Rs origin; with three presectoral crossveins; posterior area wider than prefork area. *Hind wing* medial fork located near Rs origin; one presectoral crossvein. *Male pilula axillaris* present. Legs: *Femur* short, smaller than head width. *Tibial spurs* absent. *Pretarsal claws* slightly shorter than half of T5 length. *Foreleg sense hair* shorter than half of femur length. Midleg tibia expanded. Male Terminalia: *Gonarcus* simple, thin, and arched. Female Terminalia: *Ectoproct* and *lateral gonapophyses* set with cavisetae; *posterior gonapophyses* stout, set with long setae; *anterior gonapophyses* absent; *9th tergite* without membranous digitiform process; pregenital plate reduced.

Distribution (A4 Fig 154) – Australia: NSW, NT, QLD, SA, VIC, WA.

Comments – This genus contains only one species, *Franzenia irrorata*, which is easily distinguished from other Australian antlions by its expanded mid tibia.

Biology – One female deposited in the FSCA was reared by Robert B. Miller in 1989 from a larva collected in a tiny tree hole in fine organic matter. This record suggests that,

as for many other Dendroleontini species, *F. irrorata* larvae may be found mostly in tree holes, and not in sand.

***Franzenia irrorata* Esben-Petersen 1929**

(A4 Figs 18-19)

Franzenia irrorata Esben-Petersen 1929:32 (OD); Stange 1976:304 (cat); New 1985b:27 (key, rd, ill); New 1996:80 (cat); Stange 2004:101 (cat); Oswald 2015 (cat).

Diagnosis – Legs relatively short [not long]; ocular setae present [not absent]; tibial spurs absent [not present]; midtibia expanded [not regular]; male gonarcus thin and simple [not strongly arched]; female posterior gonapophyses short [not long].

Description – Lengths: forewing: 18 – 21 mm; hind wing: 17 – 20 mm.

Head (A4 Figs 18a-b): *Labrum* pale, set with a line of elongate setae. *Clypeus* pale to brown, set with some pale and black elongate setae. *Frons* dark brown with interantennal space pale; beset with short white setae. *Gena* pale. *Vertex* not raised; entirely dark brown; set with short black setae. *Ocular rim* setae elongate and white. *Antennae* clubbed; long, $\geq 4x$ length of pronotum; distance between antennae about the same size of scape width; all segments dark brown with distal margin pale, (except for anterior surface of scape and pedicel, pale); torular membrane pale; flagellomeres almost as long as wide at base, apical flagellomeres much wider than long; flagellum set with short black setae, scape and pedicel set with short white setae. *Mandible* short, pale with tip dark. *Palpi*, maxillary and labial mostly pale, with irregular dark brown marks mainly

around palpimacula; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 18b): *Pronotum* about as long as wide; posterior margin about as wide as anterior; subapical furrow present; mostly dark brown with pale areas: a large rounded medial mark at anterior region, and two longitudinal sinuous lines around midline on area before furrow; set with short black setae, some long black setae and few long white setae on margins and medial area. *Pterothoracic tergites* grey to dark brown, with irregular pale marks on medial region in some specimens. *Mesonotum* set with short black setae, few elongate white setae, and a line of elongate black flattened setae at scutum anterior margin. *Metanotum* with few short black and white setae, mainly at scutellum. *Pterothoracic pleura* dark brown dorsally; covered with long white setae. Miller's organ absent.

Wings (A4 Fig 18d): Narrow with tip acute; Banksian lines absent in both wings; veins mostly dark brown, but some veins intercalated with white spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline; brown marks as follows: tip of prefork area, around gradate crossveins, around mediocubital and radial crossveins, subcostal area, some brown infuscation at posterior margin and apex; pterostigma brown with tip white; cubital fork located between the origins of Rs and MA; three presectoral crossveins; subcostal veinlets mostly simple but few apical ones forked; posterior area wider than prefork area. *Hind wing* membrane hyaline, except by a small brown infuscation at rhegmal area, and around gradate veins; medial fork located near Rs origin; costal crossveins simple; one presectoral crossvein.

Legs (A4 Figs 18a, c): *All pairs of legs*, femur short ($< 2x$ length of coxa); tibia slightly shorter than femur and about same size of tarsi; tibial spurs absent; T2, T3 and T4 about the same size, $T1 \geq 3x$ length of T2, T5 slightly longer than T1; claws shorter than T5 length; *Foreleg* sense hair shorter than half of femur length; coxa pale to grey and covered with long white setae; trochanter pale to brown, set with short black and white setae; femur broad, mostly brown but base pale and apex dark, covered with some short black and white setae, and many long black and white setae (basally); tibia slightly enlarged medially, mostly dark brown (except base, pale), with antennal cleaning setae at distal half of ventral surface, covered with short black setae, few long white setae and some long black setae; tarsi dark brown except for T1 pale, covered with short black setae and few short white setae. *Midleg* similar to foreleg, except for coxa entirely dark brown; femur not broad, and white setae not as long; tibia very enlarged distally, set with short black setae, some white setae at medial and distal areas, and few elongate black setae. *Hindleg* similar to midleg, except for tibia and T1 slightly longer; tibia pale except for dark brown apex, and without white setae.

Abdomen: Sternites mostly dark brown with medial area pale (in some specimens, pale areas larger, taking most of the segment). Tergites mostly dark brown with a pale rectangular mark (medially divided by a thin, dark brown line) at base of segments; distal margin pale. Covered with short black setae, and some white setae on basal sternites, (mainly tergite 1).

Male Terminalia (A4 Figs 19a-c): *Ectoproct* rounded in lateral view, covered with elongate black setae. 9^{th} sternite short, with posterior margin slightly elongate medially,

proximal margin curved in ventral view; covered with long black setae, mainly medially. *Gonarcus* thin, a transversal bar with a small medial curve in dorsal view; arched in posterior view; in lateral view elongate with anterior margin rounded. *Mediuncus* membranous. *Paramere* broad and elongate in lateral view, with ventral margin and particularly the apex more sclerotized.

Female Terminalia (A4 Figs 18d-e): *Ectoproct* rounded, set with thin elongate setae and some cavisetae ventrally. *Lateral gonapophyses* rounded, slightly shorter than ectoproct, beset with cavisetae, and some elongate setae ventrally. *9th tergite* set with some thickened setae. *7th sternite* very long, with distal border rounded in ventral view; covered with short setae. *Pregenital plate* weakly sclerotized, very small and triangular in ventral view. *Posterior gonapophyses* stout, beset with long black setae. *9th tergite* membranous digitiform process absent. *Anterior gonapophyses* absent. *Ventral membrane* ventromedial plate covered with many short setae; gonapophyseal plates present.

Distribution (A4 Fig 154) – Australia: NSW*, NT*, QLD, SA*, VIC*, WA*. * = new records.

Adult activity period – Records for April, September, November to February.

Biology – As for genus.

Primary type – Holotype (by original designation), sex undetermined (QLDM), examined. From original description, Esben-Petersen (1929): “Two specimens at Brisbane, 2/1/1927 (L. Franzen leg.). The type specimen in the collection of Mr. L. Franzen, the other in the collection of the author”. From New (1985b): “Holotype (sex

not now determinable), Queensland, 'Brisbane 7.xi.26, L.F.' (Franzen) (QM). Bears red 'Type' label but no 'det. Esben-Petersen' label. The specimen is very fragile; antennae and left HW missing; 2 legs on card below specimen; abdomen fragmented and held together by longitudinal rod. Despite the discrepancy in collecting data (types listed by Esben-Petersen, 2.i.1927) I have no doubt that this specimen is either the true type or one subsequently labeled as such by Franzen". The holotype statement presented by New (1985b) is confirmed here, the specimen at QLDM bears all the holotype labels mentioned above. Condition: poor, many parts missing, impossible to determine its sex.

Material examined – (5♂, 14♀). **AUSTRALIA: New South Wales:** *Narrabri:* 25.i.1961, M. Nikitin (1♀, FSCA); **Northern Territory:** *Bachelor Camp:* 12.iv.1966, McFarland (1♀, SAMA); *Wigley Waterhole:* 5 mls N, 17.ii.1966, E. Britton (1♂, ANIC); **Queensland:** *Forsayth:* 27 km E, 18.xi.1978, R.I. Storey (1♀, QLDM); *Miles:* 17 km E, 11.xii.1990, T.A. Lambkin (1♂, QLDM); *Sarina:* 42 km SW, xi.1961, M. Nikitin (1♂, FSCA); **South Australia:** *Cooper Pedy:* 230 km S, 25.ii.1989, R.B. Miller, found in tiny tree hole in fine organic matter (1♀, FSCA); *Margaret River:* Coward Spring, xii.1974 (1♀, SAMA); *Musgrave Range:* ii.1966 (1♀, SAMA); **Victoria:** *Lake Hattah:* 28.xi.1967 (1♀, MVM); **Western Australia:** *Cane Grass Swamp x-ing:* 2 km N, 30:11S – 121.10E, 25.xii.1995, M.S. & B.J. Moulds & K.A. Kopestonsky (1♀, AMSA); *Goldfields Woodlands Nat. Park:* 69 air km WSW Coolgardie, 380m, 31.18428°S – 120.49041°E±80m, 15.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #603 (1♂, TAMU); *Millstream:* x.1970 (4♀, ANIC); *Moola Bulla:* ix.1953 (1♀, SAMA); *Norseman:* track S off hwy 1, 79 air km EENE, 32.08056°S – 122.60297°E±90m,

28.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #619 (1♂, TAMU). No Label (1♀, FSCA).

Comments – See comments for *Franzenia*.

***Fusoleon* New 1985**

Type species: *Fusoleon stigmatus* New 1985, by original designation.

Diagnosis – Forefemur swollen, much wider than tibia [not as wide as tibia]; foreleg tibial spurs strongly arched and reaching apex of T4 [not evenly curved; not absent or only reaching T2 apex]; tibial spurs of same length in all legs [not of different lengths in each pairs of legs]; female ventromedial plate present [not absent].

Description – Head: *Vertex* not strongly raised. *Ocular rim* setae present. *Antennae* clubbed and elongate; flagellomeres almost as long as wide at base, apical ones much wider than long. *Palpimacula* oval-shaped, located medially. Thorax: *Pronotum* about as long as wide. Miller's Organ absent. Wings: rather narrow, with tip acute; Banksian lines absent. *Forewing* cubital fork located slightly beyond Rs origin; three presectoral crossveins; some distal subcostal veinlets forked. *Hind wing* medial fork located slightly beyond Rs origin; one or two presectoral crossvein. *Male pilula axillaris* present. Legs: *Foreleg* short and stout, specially the swollen femur, much broader than remaining segments; femoral sense hair as long as femur; tibia slightly longer than tarsi; tibial spurs strongly arched and reaching T4 apex; sense hair as long as femur. *Tibial spurs* of same length in all legs. *T5* about as long as T1 – T4 combined. *Pretarsal claws* much shorter than T5 length. Male Terminalia: *Ectoproct* rounded; *gonarcus* simple, thin, and arched.

Female Terminalia: *Ectoproct* and *lateral gonapophyses* set with cavisetae; *posterior gonapophyses* short; *anterior gonapophyses* absent; 9th *tergite* without membranous digitiform process; *Ventral membrane* ventromedial plate setose; pregenital plate small.

Distribution (A4 Fig 154) – Australia: NSW, NT, WA.

Comments – This genus contains only one species, *F. stigmatus*, which is easily distinguished from most other Australian antlions by its swollen forefemur and elongate and strongly arched tibial spurs. However, these characteristics are found in the genus *Latileon*, the species of which appear to be smaller, paler, versions of *Fusoleon*. The ventromedial plate of *Fusoleon* separates it from *Latileon*. *Fusoleon* is phylogenetically closely related to *Anomaloplectron* (A4 Figs 1-3). The shape of the foreleg seems to be the main character joining these two genera, but *Anomaloplectron* can be distinguished by its tibial spurs of different lengths and elongate female posterior gonapophyses.

Biology – Unknown.

***Fusoleon stigmatus* New 1985**

(A4 Figs 20-21)

Fusoleon stigmatus New 1985b:70 (OD); New 1996:81 (cat); Stange 2004:102 (cat); Oswald 2015 (cat).

Diagnosis – forefemur swollen, much wider than tibia [not as wide as tibia]; foreleg tibial spurs strongly arched and reaching apex of T4 [not evenly curved; not absent or only reaching T2 apex]; body mostly dark [not mostly pale]; forewing subcostal area with brown marks [not hyaline]; Female ventromedial plate present [not absent].

Description – Lengths: forewing: 23 – 29 mm; hind wing: 22 – 28 mm.

Head (A4 Figs 20a, c): *Labrum* pale, with a line of elongate setae. *Clypeus* pale, with two small rounded black spots, beset with elongate pale setae. *Frons* mostly black except by interantennal space and ventral area pale (sometimes with a thin medial, dark, longitudinal line on ventral pale area); beset with short white setae. *Gena* pale. *Vertex* weakly raised; in frontal view pale with two short transversal dark brown marks laterally and a rounded central dark spot; in dorsal view mostly pale with a large mark “T” shaped, with the longitudinal region broad, and the extremities of the transversal region bending ventrally; set with short black setae. *Ocular rim* setae elongate and white. *Antennae* clubbed; elongate, about twice longer than pronotum; distance between width; all segments dark brown, except for anterior surface of scape, pedicel, and basal flagellomeres pale; torular membrane black; flagellomeres almost as long as wide at base, apical ones much wider than long; flagellum set with short black setae, scape and pedicel set with short white setae. *Mandible* pale with tip dark. *Palpi*, maxillary and labial pale except for the basal segment and some irregular, black marks on maxillary palpi; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 20c): *Pronotum* about as wide as long; posterior margin about as wide as anterior; subapical furrow present; mostly black; pale areas as follows: a thin sagittal line, two curved longitudinal lines laterally, two marks on anterior area; set with short black setae. *Mesonotum* mostly black, except for some pale areas: anterior margin, two thin longitudinal lines medially on each side of scutum; covered with short black setae. *Metanotum* mostly black, except for two thin longitudinal pale lines at scutum; set with

few short black setae. *Pterothoracic pleura* mostly black with dorsal area pale; covered with short black setae; Miller's organ absent.

Wings (A4 Fig 20d): Rather narrow with apex acute; Banksian lines absent; veins mostly dark brown, but some veins intercalated with white spots; beset with short black setae.

Male pilula axillaris present. *Forewing* membrane mostly hyaline; dark marks as follows: a large brown at prefork area tip, two small brown marks (one at rhegmal area and another at hypostigmatic cell tip), brown marks along subcostal area; pterostigma white; cubital fork located near Rs origin; three presectoral crossveins; subcostal veinlets simple (few distal forked); posterior area larger than prefork area. *Hind wing* membrane hyaline with a small rhegmal mark; medial fork located between origins of Rs and MA, but closer to Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 20a-b): *All pairs of legs*, femur short ($< 2x$ length of coxa); tibia slightly shorter than femur but slightly longer than tarsi; tibial spurs strongly arched and long, extending over T4 apex; T2, T3 and T4 about the same size, T1 slightly longer than T2, T5 about as long as T1 – T4 combined; claws shorter than T5. *Foreleg* sense hair longer than femur length; coxa pale with irregular dark marks, covered with long white setae; trochanter pale with short black and white setae; femur swollen, broader than tibia; mostly pale with small brown marks at dorsal surface, covered with short black and white setae and scattered long white setae at base; tibia with antennal cleaning setae in most of ventral surface, pale but with tip and a sub basal ring, dark brown; tarsi pale with tip of T5 brown; T5 ventrally with two rows of thick, long, black setae. *Midleg* similar to foreleg, except with femur narrower, mostly dark brown, with base, tip and dorsal area

pale, all setae black; sense hair longer than femur length. *Hindleg* similar to midleg except for tibia slightly longer, without white setae; sense hair absent.

Abdomen: Mostly dark brown except for irregular pale marks on tergites and medial region of sternites. Covered with short black setae.

Male Terminalia (A4 Figs 21a-c, f): *Ectoproct* rounded, in lateral view; set with elongate black setae, mainly at ventral area. 9th sternite short, with posterior margin rounded in ventral view; covered with long black setae. *Gonarcus* thin, a transversal bar with small lateral curves in dorsal view; arched in posterior view. *Mediuncus* membranous. *Paramere* broad and elongate in lateral view, with ventral margin and apex more sclerotized.

Female Terminalia (A4 Figs 21d-e): *Ectoproct* rounded, set with thin elongate setae and some cavisetae ventrally. *Lateral gonapophyses* rounded, slightly smaller than ectoproct, full of cavisetae. 9th tergite set with long thickened setae. 7th sternite very long, with distal border straight in ventral view, covered with short setae. *Pregenital plate* weakly sclerotized, small, rounded with an acute extension on anterior margin. *Posterior gonapophyses* stout, beset with very long black setae, tip rounded and thinner than base. 9th tergite membranous digitiform process absent. *Anterior gonapophyses* absent. *Ventral membrane*, ventromedial plate setose and triangular, set with some long thickened setae on anterior margin; other areas of membrane with few elongate setae.

Distribution (A4 Fig 154) – Australia: NSW*, NT, WA. * = new records.

Adult activity period – Records for January, March, April, October and November.

Biology – Unknown, larva unknown.

Primary type – Holotype (by original designation), female (ANIC), examined. From original description, New (1985b): “Holotype, ♀, Western Australia, Millstream HS. (area), 21°35'S., 117°04'E., 10.iv.1971, Upton and Mitchell (ANIC)”. Condition: good, terminalia dissected.

Material examined – (5♂, 6♀). **AUSTRALIA: New South Wales:** *Deriah Aboriginal Area*: 20.9 km E of Narrabi, stand of Ooline, -30.368S – 149.991E, 11.xi.2009, 330m, D.R. Britton & J. Recsei, black light bucket, SEVT2009017 (2♀, AMSA); *Nombinnie Nature Reserv.*: 18 air km SSE Mount Hope, 160m, 32.99613°S – 145.94006°E±70m, 3.i.2013, M.V., Oswald, Diehl & Machado, Oswald #626 (2♂, 1♀, TAMU) **Northern Territory:** *Devil’s Marbles*: x.1960 (1♂, 1♀, FSCA); *Emily Gap*: 6 miles SE of Alice Springs, 17.ii.1966, Britton, Upton & McInnes (1♂ PT, ANIC); *Ruby Gap NP*: 23°28’50’’S – 134°59’00’’E, 21.iii.1993, JA Forrest & D. Hirst (1♀, SAMA); **Western Australia:** *Millstream HS*: 21°35'S - 117°04'E, 2.iv.1971, Upton and Mitchell (1♂ PT ANIC); 19.iv.1971 (1♀ PT, ANIC).

Comments – See comments for *Fusoleon*.

***Latoleon* new genus**

Type species: *Latoleon setosus*, sp. nov.; by current designation.

Diagnosis – forefemur swollen, wider than tibia [not as wide as tibia]; tibial spurs in foreleg arched and reaching apex of T4 [not evenly curved; not absent or only reaching T2 apex]; tibial spurs of same length in all legs [not of different sizes in different pairs of legs]; female ventromedial plate absent [not present].

Description – Head: *Vertex* not strongly raised. *Antennae* clubbed and elongate; flagellomeres almost as long as wide at base, apical ones much wider than long. *Palpimacula* oval-shaped, located medially. Thorax: *Pronotum* slightly wider than long; covered with long setae; Miller's Organ absent. Wings: fairly broad, with tip acute; Banksian lines absent. *Forewing* cubital fork located between origins of Rs and MA; three presectoral crossveins; some distal subcostal veinlets forked. *Hind wing* medial fork located between origins of Rs and MA; one or two presectoral crossvein. *Male pilula axillaris* present. Legs: *Foreleg* short and stout, specially the swollen femur, broader than remaining leg segments; tibia slightly longer than tarsi; tibial spurs arched and reaching T4 apex; sense hair as long as femur. *Tibial spurs* with same length in all legs. *T5* about as long as T1 – T4 combined. *Pretarsal claws* shorter than T5 length. Male Terminalia: *Ectoproct* rounded; *gonarcus* simple, thin, and arched; mediuncus membranous. Female Terminalia: *Ectoproct* and *lateral gonapophyses* set with cavisetae; *posterior gonapophyses* without cavisetae; *anterior gonapophyses* absent; 9th *tergite* without membranous digitiform process; *ventromedial plate* absent; *pregenital plate* small.

Distribution (A4 Fig 154) – Australia: NT and WA.

Comments – *Latileon* contains two new species *L. hyalinus* and *L. setosus*. See discussion for *Fusoleon* for general comments.

Biology – Unknown.

Etymology – The genus name is derived from the Latin word *latus* (= broad, wide) and refers to the broad forefemur characteristic from its species.

Key to species of *Latileon*

- 1 Thorax notum set with many long white setae; foreleg: lateral margin of coxa and dorsal margin of femur with a line of long and curved white setae (A4 Fig 24a); forewing with a brown line surrounding the gradate crossveins (A4 Fig 24c)*L. setosus*
- 1' Thorax notum set with black setae and few white setae restricted to pronotum margins; foreleg: coxa and femur with scattered straight white setae (A4 Fig 22a); forewing hyaline (A4 Fig 22c).....*L. hyalinus*

***Latileon hyalinus*, new species**

(A4 Figs 22-23)

Diagnosis – forefemur swollen, much wider than tibia [not as wide as tibia]; foreleg tibial spurs strongly arched and reaching apex of T4 [not evenly curved; not absent or only reaching T2 apex]; body mostly pale [not mostly dark]; forewing membrane hyaline [not with brown marks]; forewing posterior area wider than prefork area [not equal or thinner].

Description – Lengths: forewing: 17 – 19 mm; hind wing: 15 – 17 mm.

Head (A4 Figs 22a-b): *Labrum* pale, with a line of elongate setae. *Clypeus* pale, beset with elongate pale setae. *Frons* pale except for area circling antennae, dark brown; beset with small white setae. *Gena* pale. *Vertex* weakly raised; in frontal view pale with two short transversal dark brown marks laterally and a rounded central dark spot; in dorsal view mostly pale with two dark medial perpendicular lines, and a central rounded mark

on posterior margin; set with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, > 2x length of pronotum; distance between antennae about as wide as scape; scape pale; pedicel pale anteriorly, brown posteriorly; most flagellomeres similar to pedicel, but central segments are almost entirely brown and few subapical segments are partially pale posteriorly; torular membrane pale; flagellomeres almost as long as wide at base, apical ones much wider than long; flagellum set with short black setae, scape and pedicel set with short white setae. *Mandible* pale with tip dark. *Palpi*, maxillary and labial pale; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 22b): *Pronotum* slightly wider than long; posterior margin as wide as anterior; subapical furrow present; mostly pale except for some brown areas: lateral margins, two curved longitudinal lines and four rounded marks around central line (two before furrow and two after); set with black setae, and few longer white setae on margins. *Mesonotum* mostly pale, except for some brown areas: two rounded central marks on prescutum, central and lateral areas of scutum, posterior margin of scutellum; covered with short black setae. *Metanotum* mostly pale, except for two longitudinal brown lines surrounding the central line and two lateral longitudinal at scutum; set with few short black setae. *Pterothoracic pleura* mostly pale with some irregular brown areas mainly on anterior segments; covered with short white setae; Miller's organ absent.

Wings (A4 Fig 22c): Fairly broad; Banksian lines absent; veins mostly brown, but some veins intercalated with pale areas, beset with short black setae. *Forewing* membrane hyaline with a weak rhegmal spot; pterostigma pale; cubital fork located between origins

of Rs and MA; three presectoral crossveins; basal subcostal veinlets simple but mostly forked in distal half; posterior area wider than prefork area. *Hind wing* membrane hyaline; medial fork located between the origins of Rs and MA; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 22a-b): *All pairs of legs*, femur < 2x length of coxa; tibia slightly shorter than femur but slightly longer than tarsi; tibial spurs arched and long, extending over T4 apex; T2, T3 and T4 about the same size, T1 slightly longer than T2, T5 about same size of T1 – T4 combined; claws about half of T5 length. *Foreleg* sense hair longer than femur length; coxa pale with brown marks on external surface, set with scattered white setae; trochanter pale with short black setae; femur swollen, much wider than tibia, pale except for dorsal apex, brown; covered with short black setae and scattered long white setae; tibia with a patch antennal cleaning setae in most of ventral surface, pale except by tip and a sub basal brown mark on dorsal surface, covered with short and some long black setae; tarsi mostly brown except by basal half of T5, pale; all tarsomeres covered with short, black setae and long, black setae ventrally. *Midleg* similar to foreleg, except for femur, narrower. *Hindleg* similar to midleg except with femur and tibia slightly longer, and tibia without a sub basal brown mark; sense hair absent.

Abdomen: Tergite 1 pale; tergite 2 brown; remaining tergites pale on basal half and brown on apical half. All sternites pale except for few irregular brown marks (mainly basal sternites). All segments covered with short black setae.

Male Terminalia: *Unknown*.

Female Terminalia (A4 Figs 23a-b): *Ectoproct* rounded, set with thin elongate setae and few short cavisetae ventrally. *Lateral gonapophyses* rounded, slightly smaller than ectoproct, set with some elongate cavisetae apically. *7th sternite* long, with distal border straight in ventral view; covered with short setae. *Pregenital plate* weakly sclerotized, a small inverse triangle in ventral view. *Posterior gonapophyses* stout, beset with long black setae, tip rounded and thinner than base. *9th tergite* without membranous digitiform process. *Anterior gonapophyses* absent. *Ventral membrane* gonapophyseal plates present.

Distribution (A4 Fig 154) – Australia: NT.

Adult activity period – Records for October.

Biology – Unknown, larva unknown.

Etymology – The specific name is derived from the Latin word *hyalos* (= transparent, hyaline) and refers to the hyaline wings.

Primary types – Holotype (by present designation), female (ANIC). **AUSTRALIA: Northern Territory:** 14.19S – 132.25E, Katherine Gorge, N.T., 24 km NE of Katherine, 16.Oct.1972, M.S. Upton (1♀, ANIC, pinned). Condition: pinned, perfect, no parts missing.

Paratype: AUSTRALIA: Northern Territory: *Cattle Creek:* 54 km S by W of Borroloola, 16.32S – 136.10E, 27.x.1975, J.C. Cardale (1♀, ANIC, pinned).

Comments – *Latileon hyalinus* can be distinguished from *L. setosus* by the following characters (in *L. hyalinus*): forewing membrane hyaline, fewer white setae on thorax, wings slightly broader, female posterior gonapophyses shorter. The two species are also

geographically allopatric, with *L. hyalinus* in northern NT and *L. setosus* in western WA, based on currently known records. For phylogenetic relationships see (A4 Figs 1-3).

***Latoleon setosus*, new species**

(A4 Figs 24-25)

Diagnosis – Forefemur swollen, wider than tibia [not as wide as tibia]; foreleg tibial spurs arched and reaching apex of T4 [not evenly curved; not absent or only reaching T2 apex]; foreleg with a line of long white setae [not scattered long setae]; body mostly pale [not mostly dark]; forewing membrane with a brown line surrounding the gradate crossveins [not without brown line].

Description – Lengths: forewing: 15 – 18 mm; hind wing: 13 – 16 mm.

Head (A4 Figs 24a-b): *Labrum* pale, set with a line of elongate setae. *Clypeus* pale, beset with elongate pale setae. *Frons* pale with a large transversal dark brown band around antennae, brown area with a thin transversal pale line above antennae (some specimens with ventral margin of brown line with a medial invagination); beset with small white setae. *Gena* pale. *Vertex* weakly raised; in frontal view pale with two short transversal dark brown marks laterally and a rounded central dark spot; in dorsal view mostly pale with scattered brown marks, and a central rounded mark on posterior margin; set with few short white setae on frontal view and black ones in dorsal view. *Ocular rim* setae white and long (short in few specimens). *Antennae* clubbed; elongate, about three times longer than pronotum; distance between antennae about as wide as scape width; scape pale; pedicel pale anteriorly, brown posteriorly; most flagellomeres pale with dorsal

margin brown, few subapical segments entirely brown and apical segments with anterior surface pale and posterior surface brown; torular membrane pale; flagellomeres almost as long as wide at base, apical ones much wider than long; flagellum set with short black setae, scape and pedicel set with short white setae. *Mandible* pale with tip dark. *Palpi*, maxillary and labial pale; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 24b): *Pronotum* slightly wider than long; posterior margin wider than anterior; subapical furrow present; mostly pale except for a broad sagittal brown line, some specimens with a thin central pale line at anterior area; set with long white setae, and scattered black setae. *Mesonotum* with prescutum dark brown except for pale lateral margins; scutum mostly dark brown with two longitudinal lines near central area, and margins pale; scutellum pale with a sagittal dark brown line; covered with short white setae, and few black flattened setae at scutum. *Metanotum* with prescutum pale with two brown marks near central area, scutum dark brown with two longitudinal pale lines near center, scutellum dark brown with pale margins; set with few short white setae. *Pterothoracic pleura* mostly dark brown with some irregular pale areas near margins; covered with white setae; Miller's organ absent.

Wings (A4 Fig 24c): Fairly broad; Banksian lines absent; veins mostly brown, but some veins intercalated with pale areas, beset with short black setae. *Forewing* membrane mostly hyaline except for a small weak brown spot at end of prefork area and a brown line surrounding some gradate crossveins; some specimens with few marks on mediocubital area; pterostigma pale with small brown mark at base; cubital fork located

between the origins of Rs and MA; three presectoral crossveins; basal subcostal veinlets simple but with few forked in distal half; prefork area slightly larger than posterior area, (about the same size in few specimens). *Hind wing* membrane hyaline; medial fork located between the origins of Rs and MA; subcostal veinlets simple; two presectoral crossveins.

Legs (A4 Fig 24a): *All pairs of legs*, femur short ($< 2x$ length of coxa); tibia slightly shorter than femur but slightly longer than tarsi; tibial spurs arched and long, extending over T4 apex; T2, T3 and T4 about the same size, T1 slightly longer than T2, T5 about the same size of T1 – T4 combined; claws about half of T5 length. *Foreleg* sense hair longer than femur length; coxa pale with brown marks on external surface, covered with short white setae and a line of long curved white setae on external surface; trochanter pale with short white setae; femur very broad, pale except for dorsal apex, brown and scattered small brown marks, covered with short black and long curved white setae; tibia with antennal cleaning setae in most of ventral surface, pale except for tip and a sub basal brown mark on dorsal surface, covered with short and long black setae and few long white setae; tarsi pale except by most part of T5, brown; all tarsomeres covered with short black setae and long black setae ventrally. *Midleg* similar to foreleg, except with narrower femur. *Hindleg* similar to midleg except with femur and tibia slightly longer, without sub basal brown mark on tibia, and sense hair absent.

Abdomen: All segments dark brown, but tergites with lateral pale marks on basal half, and sternites with central pale marks. All segments covered with short black setae.

Male Terminalia (A4 Figs 25a-c): *Ectoproct* rounded in lateral view; set with elongate black setae, mainly at ventral area. 9th *Sternite* short, with posterior margin rounded in ventral view; covered with long black setae. *Gonarcus* thin, an arched bar in posterior view; and small and curved in lateral view. *Mediuncus* membranous. *Paramere* rectangular in posterior view, with tip more sclerotized; in lateral view vertically extended and with posterior margin rounded.

Female Terminalia (A4 Figs 25d-e): *Ectoproct* rounded, set with thin elongate setae and some elongate cavisetae ventrally. *Lateral gonapophyses* rounded, slightly smaller than ectoproct, with some elongate cavisetae apically. 7th *sternite* long; distal border straight in ventral view; covered with short setae. *Pregenital plate* weakly sclerotized, small, diamond shaped in ventral view. *Posterior gonapophyses* short and digitiform, beset with very long black setae; tip rounded. 9th *tergite* without membranous digitiform process. *Anterior gonapophyses* absent. *Ventral membrane*, gonapophyseal plates present.

Distribution (A4 Fig 154) – Australia: WA.

Adult activity period – Records for February to April and December.

Biology – Unknown, larva unknown.

Etymology – The specific name is derived from the Latin word *setosus* (= bristly) and refers to the long setae on forefemur.

Primary type – Holotype (by present designation), male (ANIC). **AUSTRALIA:**

Western Australia: 8 km SWbyW of Cane R. HS., WA. 22.07S - 115.33E,

31.Mar.1971, E.F. Riek (1♂ ANIC). Condition: pinned, good, left antenna missing; Terminalia dissected and stored in glycerin in a microvial pinned below the specimen.

Paratypes: AUSTRALIA: Western Australia: *Cane R.HS.*: 8 km SWbyW, 22.07S – 115.33E, 31.iii.1971, E.F. Riek (5♀, ANIC, pinned); *Nanutarra Roadhouse*: hwy 136, 13 air km NENE, 22.47124°S – 115.60040°E±70m, 22.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #614 (1♂, TAMU, 100% ETOH); *Narrogin*: 1.iv.1970, P. Holbeach (1♀, MVM, pinned); *Whim Creek Hotel*: 20°50'26.6''S – 117°56'4.7''E, 27.ii.1994, R. Miller & L. Stange (1♀, FSCA, pinned).

Comments – See comments for *L. hyalinus*.

Dendroleontini Banks 1899

Type genus: *Dendroleon* Brauer 1866.

Description – Metathorax: Miller's organ usually present. Wings: forewing Banksian lines present. Legs: generally long (forefemur > 2x longer than forecoxa length). Male terminalia: gonarcus usually elaborated; mediuncus usually present. Female terminalia: anterior gonapophyses present in some species; posterior gonapophyses generally long and well developed cavisetae; 9th tergite ventral digitiform process generally present; ventromedial plate absent.

Distribution – Dendroleontini and is found in all continents except South America. The “*Perichlystus* genus group” is known from all Australian states, and tree isolated records for Papua New Guinea, New Caledonia, and Solomon Islands.

Comments – Dendroleontini is the largest tribe in the subfamily Dendroleontinae, it is particularly diverse in Australia and contain most of the species previously placed in the former subtribe Periclystina. The Dendroleontini Australian fauna contains 20 genera: six genera previously placed in the former subtribe Dendroleontina (*Chrysoleon*, *Compsoleon*, *Dendroleon*, *Froggattisca*, *Mossega*, and *Parvoleon*), which were not covered here; and 14 genera that form the monophyletic “*Periclystus* genus group” containing *Austrogymnocnemia*, *Ceratoleon*, *Glenoleon*, *Periclystus*, *Riekoleon*, and nine new genera, *Acutoleon*, *Aplectrinia*, *Aurantoleon*, *Fossorioleon*, *Manselleon*, *Minyleon*, *Normanleon*, *Paraustrogymnocnemia* and *Tanyleon*. For phylogenetic relationships see (A4 Figs 1-3).

Key to the Australian genera of Dendroleontini.

- 1 Pretarsal claws not capable of closing against T5.....2
- 1’ Pretarsal claws capable of closing against T5.....16
- 2 Hind wing shorter than forewing.....“*Periclystus* genus group”..... 3
- 2’ Hind wing longer than forewing.....18
- 3 Thorax dull, covered with microtrichia; forewing not falcate.....4
- 3’ Thorax lustrous, not covered with microtrichia; forewing falcate.....*Periclystus*
- 4 Forewing costal area, basal half usually uniareolate; if biareolate, then tibial spurs present.....5
- 4’ Forewing costal area, basal half biareolate; tibial spurs absent.....*Ceratoleon*
- 5 Mandible clearly visible (anterior view); gena, not extended (at most reaching clypeus ventral margin); legs, T5 < length of T1; specimens with variable sizes..6

5'	Mandible very small, hidden behind labrum and clypeus (anterior view); gena, extended (reaching labrum ventral margin); legs, T5 \geq length of T1; minute specimens.....	<i>Minyleon</i>
6	Forefemur length \geq 3.5x length of forecoxa.....	7
6'	Forefemur length < 3.5x length of forecoxa.....	9
7	Male ectoproct rounded; female anterior gonapophyses absent or narrower than posterior gonapophyses basal width; forewing, fairly broad (if not specimens minute); forewing costal area height \geq height of intraradial area; hind wing mostly hyaline (if not with broad apical bands).....	8
7'	Male ectoproct with a ventral elongate lobe; female anterior gonapophyses large, about the same width of posterior gonapophyses base; forewing, rather narrow; forewing, costal area height < height of intraradial area; hind wing with large stigmal and rhegmal spot.....	<i>Riekoleon</i>
8	Female lateral gonapophyses height < height of ectoproct; female posterior gonapophyses broad, with apical cavisetae; male mediuncus narrow; male paramere not divided.....	<i>Glenoleon</i>
8'	Female lateral gonapophyses height \geq height of ectoproct; female posterior gonapophyses thin, without cavisetae; male mediuncus fairly broad; male paramere divided in a rounded and an acute areas.....	<i>Tanyleon</i>
9	Tibial spurs absent; forefemur length < 2.5x length of forecoxa	10
9'	Tibial spurs usually present; forefemur length \geq 2.5x length of forecoxa	12

- 10 Female ectoproct height > height of lateral gonapophyses, and cavisetae absent; female, posterior gonapophyses very broad, with few cavisetae at apex; male gonarcus anterior margin acute (lateral view); forewing posterior Banksian line present.....11
- 10' Female ectoproct height \leq height of lateral gonapophyses, and cavisetae present; female, posterior gonapophyses thin, cavisetae absent; male gonarcus anterior margin rounded (lateral view); forewing posterior Banksian line absent*Aplectrinia*
- 11 Female posterior gonapophyses apex recurved (anterior margin extended); male gonarcus, anterior margin curving down, male, mediuncus with an apical hook; forewing with no longitudinal lines.....*Austrogymnocnemia*
- 11' Female posterior gonapophyses apex rounded; male gonarcus, anterior margin straight; male, mediuncus without apical hook, forewing with a longitudinal dark line at mediocubital area, or surrounding anterior Banksian line*Paraustrogymnocnemia*
- 12 Male ectoproct apex rounded (lateral view); male mediuncus present; female lateral gonapophyses with cavisetae; female posterior gonapophyses apex usually without cavisetae (if present, posterior gonapophyses digitiform); foretibia usually short, < 1.6x length of foretarsi; pretarsal claws usually long (> 0.5x length of T5)13
- 12' Male ectoproct ventral margin straight, slightly longer than dorsal margin (lateral view); male, mediuncus absent; female lateral gonapophyses without cavisetae;

- female posterior gonapophyses broad and apex covered by long cavisetae; foretibia usually long, $\geq 1.6x$ length of foretarsi; pretarsal claws usually short, ($\leq 0.5x$ length of T5).....*Fossorioleon*
- 13 Foretarsi shorter than foretibia; tibial spurs reaching T1 apex, or absent (except *N. ceciliae*: spurs $< 0.5x$ length of T1); relative large specimens, forewing usually $> 25mm$14
- 13' Foretarsi longer than foretibia; tibial spurs usually $< 0.5x$ length of T1 (except *M. rebellis*: reaching T1 apex); relative small specimens, forewing usually $\leq 25mm$ *Manselleon*
- 14 Female ectoproct without cavisetae; female posterior gonapophyses long, digitiform or with apex broad, and cavisetae might be present; male gonarcus + mediuncus complex not triangular (dorsal view); forewing usually thin, posterior margin at cubital area almost straight (except *N. convergens* and *N. dissolutus*); forewing posterior area height $<$ height of prefork area at cubital fork level.....15
- 14' Female ectoproct with cavisetae; female posterior gonapophyses, absent or very thin without cavisetae; male gonarcus + mediuncus complex semi triangular (dorsal view); forewing broad, posterior margin at cubital area strongly convex; forewing posterior area usually height \geq height of prefork area at cubital fork level (except *Au. radialis* and *Au. stigmatus*).....*Aurantileon*
15. Male paramere well developed, about as broad as gonarcus and well sclerotized (lateral view); male mediuncus usually very short (if long, base much wider than apex); forewing posterior Banksian line usually present; forewing prefork area

- with two rows of cells; hind wing presectoral crossvein usually with a medial spurs; forefemur sensorial hair short; forefemur with some long setae dorsally (mainly at apex).....*Normanleon*
- 15'. Male paramere usually weakly developed, much narrower than gonarcus; male mediuncus narrow and long; forewing posterior Banksian line absent; forewing p refork area with one row of cells (except *Ac. secula*); hind wing presectoral crossvein without medial spurs; forefemur sensorial hair absent; forefemur with few long setae dorsally.....*Acutoleon*
- 16 Forewing, MA origin on the distal half of the wing; minute specimens (forewing $\leq 13\text{mm}$).....*Parvoleon*
- 16' Forewing, MA origin on the basal half of the wing; large specimens (forewing $> 13\text{mm}$).....17
- 17 Tibial spurs absent.....*Compsoleon*
- 17' Tibial spurs present (usually $\leq 0.5\text{x}$ length of T1).....*Froggattisca*
- 18 Forewing much wider than hindwing; forewing costal area height $\geq 1.5\text{x}$ height of intraradial area; pronotum covered with long setae.....19
- 18' Forewing as wide as hindwing; forewing costal area height $< 1.5\text{x}$ height of intraradial area; pronotum with few long setae only at margins.....*Dendroleon*
- 19 Tibial spurs present; male ectoproct rounded.....*Mossega*
- 19' Tibial spurs absent; male ectoproct ventral margin elongated.....*Chrysoleon*

***Acutoleon* new genus**

Type species: *Glenoleon secula* New 1985, by present designation.

Diagnosis – Wings narrow [not broad]; pronotum as long as wide [not wider or longer] male mediuncus long, thin and acute [not short or with apex straight]; female ectoproct without cavisetae [not present]; female lateral gonapophyses smaller than ectoproct and with few cavisetae [not same size as ectoproct and cavisetae not absent].

Description – Head: *Vertex* raised. *Ocular rim* setae absent. *Antennae* clubbed and elongate; flagellomeres almost as long as wide at base, apical ones wider than long. *Palpimacula* oval-shaped, located medially. Thorax: Pronotum almost as long as wide, anterior and posterior margins with same width. Miller's organ present. Wings: narrow and acute. *Anterior Banksian* line present in both wings, posterior absent. *Forewing* prefork area about slightly wider than posterior area; subcostal veinlets simple. *Hind wing* with one presectoral crossvein. *Male pilula axillaris* present. Legs: *Forefemur* > 2.5x length of forecoxa. *Foretibia* longer than foretarsi. *Sense hair* absent or slightly longer than forefemur width. Male Terminalia: *Ectoproct* rounded; *gonarcus* arched; *paramere* elongate and usually weakly sclerotized; mediuncus long and acute. Female Terminalia: *Ectoproct* rounded without cavisetae; *lateral gonapophyses* smaller than ectoproct and set with few cavisetae; *posterior gonapophyses* long and digitiform; *pregenital plate* small; *Ventral membrane* gonapophyseal plates present.

Distribution (A4 Fig 155) – Australia: NSW, NT, QLD, SA, WA.

Comments – All *Acutoleon* species were formerly placed in *Glenoleon* except the new species *A. tatarnici*. The male terminalia of the four *Acutoleon* species are distinctive for their long, pointed mediuncus. The male paramere is very weakly sclerotized and

sometimes are hard to be noticed, except in the new species. The length of legs and pronotum, and the shape of wings are consistent among *Acutoleon* species and help to distinguish the genus. New (1985b) noted the similarities of *Acutoleon* based on the general form of the male terminalia. The group formed by these species is also highly supported by molecular data. For phylogenetic relationships see (A4 Figs 1-3).

Biology – Unknown.

Etymology – The genus name is derived from the Latin word *acutus* (= sharp, pointed) and refers to the long, acute, male mediuncus.

Key to species of *Acutoleon*

- 1 Tibial spurs present reaching T1 apex; forewing with dark marks (A4 Fig 30c)...2
- 1' Tibial spurs absent; forewing hyaline (A4 Fig 32c).....*A. tatarnici*
- 2 Mesonotum black with broad longitudinal pale lines (A4 Fig 28b); hind wing with small rhegmal mark (A4 Fig 28c); female posterior gonapophyses without cavisetae (A4 Fig 29e).....3
- 2' Mesonotum mostly black (A4 Fig 30b); hind wing with a large rhegmal mark (A4 Fig 30c); female posterior gonapophyses with few cavisetae apically (A4 Fig 31e).....*A. secula*
- 3 Frons pale with a thin black line circling the antennae dorsal margin (A4 Fig 28a); pronotum set with short white setae; foretarsi mostly brown; hind wing with a mark on poststigmatal area (A4 Fig 28c).....*A. parviproctus*

3' Frons basal half pale and distal half (A4 Fig 26a); pronotum set with short black setae; foretarsi mostly pale; hind wing without mark on poststigmatal area (A4 Fig 26c).....*A. mulesi*

***Acutoleon mulesi* (New 1985) new combination**

(A4 Figs 26-27)

Glenoleon mulesi New 1985b:47 (OD); New 1996:83 (cat); Stange 2004:105 (cat); Oswald 2015 (cat).

Diagnosis – Tibial spurs present [not absent]; forewing full of brown marks [not hyaline]; hind wing without an apical mark on anterior margin [not with a mark]; mesonotum with broad pale longitudinal lines [not without lines]; pronotal short setae black [not white]; female posterior gonapophyses without cavisetae [not with cavisetae]; male paramere almost indistinguishable [not clearly seen].

Description – Lengths: forewing: 24 – 27 mm; hind wing: 21 – 24 mm.

Head (A4 Figs 26a-b): *Labrum* pale; with a line of elongate setae. *Clypeus* pale; with few elongate black setae. *Frons* predominantly pale, except for area between and above antennae, black; covered with few white setae. *Gena* pale with small black marks. *Vertex* raised; in frontal view pale, with a median black line interrupted centrally; in dorsal view mostly pale except for two perpendicular median dark lines and two black small spots posterolaterally; set with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, longer than pronotum; distance between width; scape and pedicel generally pale with dark brown marks, flagellum brown with anterior surface generally lighter than

posterior (some specimens apical segments darker); torular membrane pale with brown marks in some specimens; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae. *Mandibles* mostly pale, with tip black. *Palpi*, maxillary and labial mostly pale with scattered small dark spots, mainly on the basal segment of each palpi; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 26b): *Pronotum* about as wide as long; posterior margin as wide as anterior; subapical furrow present; mostly pale except by some dark brown longitudinal bands, a central “Y” shaped, and two sinuous around center (enclosing a pale mark on posterior half), in some specimens the lateral bands are anteriorly connected with the central; beset with short black setae, usually marginal setae longer. *Mesonotum* with three longitudinal dark brown bands intercalated by two pale bands, in scutum the lateral dark bands have a small rounded pale mark on the base of wings and the pale bands have a thin longitudinal dark line medially; covered with short white or black setae. *Metanotum* mostly dark brown, except for small pale areas mostly around borders; covered with short white setae. *Pterothoracic pleura* mostly dark brown with some pale areas particularly on dorsal segments and between segments; set with few white setae; Miller’s organ present.

Wings (A4 Fig 26c): Rather narrow with tip acute. Anterior Banksian line present in both wings, posterior absent. Veins mostly dark brown, but with some veins intercalated with white spots (in hind wing veins mostly white), beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline with brown marks

concentrated on tip, inferior margin, pterostigma, and around radial crossveins; mediocubital area entirely brown; pterostigma tip with a small white mark; cubital fork located before or in the same position of Rs origin; three or four presectoral crossveins; subcostal veinlets simple; posterior area narrower than prefork area. *Hind wing* membrane mostly hyaline except for brown marks at rhegmal area, small marks on apical posterior margin, and area around anterior banksian line; pterostigma apex white; medial fork located just after Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Fig 26a): *All pairs of legs*, femur elongate ($> 2.5x$ length of coxa); tibia slightly longer than femur, which is longer than tarsi; tibial spurs long, surpassing T1 apex; T2, T3 and T4 about the same size, T1 slightly longer than T2, T5 longer than T1; claws about half of T5 length; coxa, trochanter, femur and tibia set with short white setae; femur, tibia and tarsi set with short black setae, and scattered longer black setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair absent; tibia with antennal cleaning setae ventroapically; coxa dark brown with most part of anterior surface pale, trochanter pale, femur pale on ventral and dorsal surfaces, remaining areas reddish brown, tibia mostly pale with three reddish brown rings; tarsi pale with tips of each tarsomere dark. *Midleg* with same color pattern of foreleg, except for coxa, entirely pale. *Hindleg* with femur, tibia and T1 slightly longer than in other legs; color pattern similar to midleg, except for tibia pale, with tip and a sub basal ring, reddish brown.

Abdomen: Entirely black (some specimens with scattered pale marks, mainly on sternites medial area). Beset with short white setae.

Male Terminalia (A4 Figs 27a-c): *Ectoproct* rounded in lateral view; set with elongate black setae. 9th sternite posterior margin straight in ventral view, set with elongate black setae. *Gonarcus* broad and arched. *Mediuncus* elongate with tip acute. *Paramere* elongate in posterior view, weakly sclerotized, almost indistinguishable.

Female Terminalia (A4 Figs 27d-e): *Ectoproct* rounded, covered with thin elongate setae. *Lateral gonapophyses* rounded, smaller than ectoproct, set with few cavisetae. 7th sternite distal margin straight in ventral view; covered with long black setae. *Pregenital plate* small and semi triangular. *Posterior gonapophyses* broad, elongate, with ventral margin longer apically; covered with long black setae. 9th tergite with an elongate membranous digitiform process. *Anterior gonapophyses* absent. *Ventral membrane*, gonapophyseal plates present.

Distribution (A4 Fig 155) – Australia: NSW*, SA, WA. * = new records.

Adult activity period – Records for December to April (but one specimen collected in August).

Biology – Unknown, larva unknown.

Primary type – Holotype (by original designation), female (MVM), examined. From original description, New (1985b): “Holotype, ♀, South Australia, Yunta, Feb. 1943, M.W. Mules (MVM)”. Condition: good, right antennae, right foretarsi and both midlegs missing; terminalia dissected.

Material examined – (7♂, 10♀). **AUSTRALIA: New South Wales:** *Tintinalloy Stn:* - 31.99947° – 143.01706°, 15.i.2010, S. Winterton (1♀, CSCA); *Wanaaring:* 37 km E, 10.ii.1972, at light, R.C. Lewis (1♀, ANIC); **South Australia:** *Iron Knob:* 6 miles W,

16.iii.1968, I.F.B. Common & M.S. Upton (1♀, ANIC); *Levi Ck*: Big Perry Spring, xii.1974 (1♀, SAMA); *Yunta*: ii.1943, MW Mules (1♀ PT, MVM); **Western Australia**: *Agnew*: 85 km N, 6.viii.1983, K. & E. Carnaby (1♂, AMSA); *Comet Vale*: 130 km N of Kalgoorlie, MV light, A. Sundholmi & J. Bugeja (1♀, AMSA); *Kalgoorlie*: 160 km E, Trans Aust. Railway, 21.i.1991, M.S. & B.J. Moulds (1♀, AMSA); *Kalgoorlie*: 20.i.1976, K.E. Carnaby (1♀, AMSA); *Lake Douglas*: 12 km SW of Kalgoorlie, 13.i.1989, M.S. & B.J. Moulds (1♀, AMSA); 20.1.1991 (5♂, 1♀, AMSA) *Sandstone*: 25 km E, 17.i.1989, M.S. & B.J. Moulds (1♂, AMSA).

Comments – *Acutoleon mulesi* is closely related to *A. parviproctus* (A4 Figs 1-3). They best separated based on the color patterns of the head, wings, legs, and pronotal setae.

***Acutoleon parviproctus* (New 1985), new combination**

(A4 Figs 28-29)

Glenoleon parviproctus New 1985b:48 (OD); New 1996:83 (cat); Stange 2004:105 (cat); Oswald 2015 (cat).

Diagnosis – Tibial spurs present [not absent]; forewing full of brown marks [not hyaline]; hind wing with an apical mark on anterior margin [not without a mark]; mesonotum with broad pale longitudinal lines [not without lines]; pronotal short setae white [not black]; female posterior gonapophyses without cavisetae [not with cavisetae]; male paramere almost indistinguishable [not clearly seen].

Description – Lengths: forewing: 20 – 25 mm; hind wing: 18 – 22 mm.

Head (A4 Figs 28a-b): *Labrum* pale; with a line of elongate setae. *Clypeus* pale; with few elongate black setae. *Frons* predominantly pale, except for two curved black bands extending from the midline to above antennae; covered with few white setae. *Gena* pale. *Vertex* raised; in frontal view pale with a median black line interrupted centrally; in dorsal view mostly pale except for a black central transversal line and three black small spots posteriorly; set with short white setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, longer than pronotum; distance between antennae wider than scape width; scape and pedicel dark brown, flagellum brown with anterior surface generally lighter than posterior; torular membrane pale; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae. *Mandibles* mostly pale to brown, with tip black. *Palpi*, maxillary and labial mostly pale, with scattered small dark spots; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 28b): *Pronotum* about as long as wide; posterior margin as wide as anterior; subapical furrow present; mostly pale except for some dark brown longitudinal bands, a central “Y” shaped, and two sinuous around center (enclosing a pale mark on posterior half), in some specimens the lateral bands are distally connected with the central; beset with few short black setae and many short white setae, marginal white setae usually longer. *Mesonotum* mostly dark brown, with two longitudinal pale bands around central region, and two rounded pale spots near wing’s base; covered with short white setae. *Metanotum* mostly dark brown, except for small pale areas (mostly around borders), covered with short white setae. *Pterothoracic pleura* mostly dark brown with

some pale areas (particularly on dorsal segments and between segments); covered with white setae; Miller's organ present.

Wings (A4 Fig 28c): Rather narrow with tip acute; anterior Banksian line present in both wings, posterior absent; veins mostly dark brown, but with some veins intercalated with white spots; beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline with brown marks concentrated in tip, posterior margin, pterostigma, around radial crossveins, and mediocubital area (entirely brown in some specimens); tip of pterostigma white; cubital fork located before or in the same position of Rs origin; three or four presectoral crossveins; subcostal veinlets simple; posterior area narrower than prefork area. *Hind wing* membrane mostly hyaline except for brown marks beneath pterostigma, rhegmal area, and apex with small marks on posterior margin and a larger one on poststigmatal area; pterostigma apex white; medial fork located just after Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs: *All pairs of legs*, femur elongate ($> 2.5x$ length of coxa); tibia slightly longer than femur, which is longer than tarsi; tibial spurs surpassing T1 apex; T2, T3 and T4 about the same size, T1 slightly longer than T2, T5 longer than T1; pretarsal claws about half of T5 length; coxa, trochanter, femur and tibia set with short white setae; femur, tibia and tarsi set with short black setae, and scattered long black setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair absent; tibia with antennal cleaning setae ventroapically; coxa dark brown with most part of anterior surface pale, trochanter pale, femur reddish brown except for base and part of posterior surface pale, tibia with posterior surface pale, anterior with three reddish brown rings; tarsi reddish brown,

except for base of T1 and T5, pale. *Midleg* with same color pattern of foreleg. *Hindleg* with femur, tibia and T1 slightly longer than in other legs; color pattern similar to anterior legs, except for tibia pale with tip and a sub basal ring reddish brown.

Abdomen: Mostly black with scattered pale marks, (mainly on sternites medial area). Beset with short white setae.

Male Terminalia (A4 Figs 29a-c): *Ectoproct* rounded in lateral view; set with elongate black setae. *9th sternite* posterior margin straight in ventral view; set with elongate black setae. *Gonarcus* broad and arched in posterior view. *Mediuncus* elongate with tip acute in lateral and posterior view. *Paramere* elongate in posterior and lateral view, weakly sclerotized.

Female Terminalia (A4 Figs 29d-e): *Ectoproct* rounded, covered with thin elongate setae. *Lateral gonapophyses* rounded, smaller than ectoproct, set with few cavisetae. *7th sternite* distal margin straight in ventral view; covered with short black setae. *Pregenital plate* small and semi triangular. *Posterior gonapophyses* broad, elongate, with ventral margin elongate apically; covered with long black setae. *9th Tergite* with elongate membranous digitiform process. *Anterior gonapophyses* absent. *Ventral membrane*, gonapophyseal plates present.

Distribution (A4 Fig 155) – Australia: SA and WA*. * = new records.

Adult activity period – Records for November to March.

Biology – Unknown, larva unknown.

Primary type – Holotype (by original designation), female (SAMA), examined. From original description, New (1985b): “Holotype, ♀, South Australia, 5.5 km WNW.

Myrtle Springs, 2-3.iii.1975, E. G. Matthews (SAM)”. Condition: relatively good, left foreleg and both hindlegs missing; head and pronotum almost broken; terminalia dissected.

Material examined – (76♂, 56♀). **AUSTRALIA: South Australia:** *Anna Creek*: 37 km W, 8-9.iii.1975, E.G. Mathews (1♂, 1♀, SAMA); 8-9.iii.1975, E.G. Matthews (1♀ PT, SAMA); *Clifton Hills*: xi.1993 (1♀, SAMA); *Cooper Crossing*: 21.ii.1956, at light G.F. Gross (1♂, SAMA); *El Alamein*: 18.ii.1964, R.V. Southcott & R.H. Fisher (1♀ PT, SAMA); *Jimmy's Well*: 15 miles E. Tintinara, 3.ii.1965, P. Aitken and Tindale (1♂ PT, SAMA); *Johnsons No 3 Bore*: xii.1971 (1♀, SAMA); *Lake Appadare*: L. Hope Chanell, iv.1997 (1♂, 1♀, SAMA); *Lake Eyre*: N of Prescott Point, 27.ii.1965, MV light, N. McFarland & J. Mitchel (19♂, 8♀, SAMA); *Lake Lettie Bore*: 21.ii.1966, N. McFarland (1♀ PT SAMA); 4.iii.1965 (20♂, 5♀, SAMA); ii.1956 (2♂, 5♀, SAMA); *Lake Palankarinna*: 2.iii.1972 (1♀, SAMA); *Leigh Creek*: 12.ii.1967; G.C. Gregory (2♂, ANIC); *Madigan Gulf*: L. Eyre, 16.ii.1956, at light G.F. Gross (4♂, 3♀ SAMA); *Mulka Stn*: iv.2001 (1♂, SAMA); *Muloorina HS*: 24.i.1966, A.N. McFarland (1♂, 4♀ PT, SAMA); iii.1965 (1♀, SAMA); *New Kalamurina Stn*: Warburton Ra., 8.iii.1972, E.G. Matthews (1♀ PT SAMA); *Pinkawillinia Dst*: x.1989; A. Sundholmi & J. Bugeja (1♂, 1♀, AMSA); *Prescott Point*: 2.iii.1965, N. McFarland & J. Mitchel (1♂, SAMA); ii.1965 (1♂, SAMA); ii.1968 (1♂, SAMA); *Sandhills*: S of Muloorina, ii.1966 (1♀, SAMA); 10.iii.1965 (5♂, 5♀, SAMA); *Singer Dam*: iv.2002 (1♀, SAMA); *Stratheam HS*: Berry Taverner, 22.i-8.ii.1979 (1♂, SAMA); *Tintinara*: Jimmy's Well, 3.ii.1965, P. Aitken & Tindale (1♂ PT, SAMA); *Yunta*: ii.1943 (1♀, MVM); **Western Australia:**

Barradale: 22.56S – 114.45E, 30.iii.1971; E.F. Riek (9♂, 11♀, ANIC); *Warrora*: 16.iv.1978, at light, J. Howard (1♂, ANIC).

Comments – See comments for *A. mulesi*.

***Acutoleon secula* (New 1985), new combination**

(A4 Figs 30-31)

Glenoleon secula New 1985b:47 (OD); New 1996:84 (cat); Stange 2004:106 (cat); Oswald 2015 (cat).

Diagnosis – Tibial spurs present [not absent]; forewing full of brown marks [not hyaline]; hind wing with large rhegmal mark [not small]; mesonotum mostly black [not with pale longitudinal lines]; female posterior gonapophyses with few cavisetae apically [not without cavisetae]; male paramere almost indistinguishable [not clearly seen].

Description – Lengths: forewing: 29 – 32 mm; hind wing: 25 – 29 mm.

Head (A4 Figs 30a-b): *Labrum* pale; with a line of elongate setae. *Clypeus* pale; with few elongate white setae. *Frons* predominantly pale, except for a large black band around antennae; covered with few black setae. *Gena* pale. *Vertex* raised; in frontal view pale, with a median black line interrupted centrally; in dorsal view mostly black except for two small pale spots around center posteriorly; set with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, about twice longer than pronotum; distance between width; mostly dark brown except for pale anterior surface of flagellum basal half; torular membrane black; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae. *Mandibles* mostly pale,

with tip black. *Palpi*, maxillary and labial basal segments black, second segments pale, and apical segments brown; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 30b): *Pronotum* about as long as wide; posterior margin as wide as anterior; subapical furrow present; mostly black except for posterior half with two pairs of small longitudinal pale bands around center, and anterior half with a small rounded central pale spot and two small pale curved bands around center, margins generally pale; beset with short black setae. *Mesonotum* mostly black, with some small pale marks around central region of all segments; covered with short black setae. *Metanotum* black, covered with short black setae. *Pterothoracic pleura* mostly black with some pale areas generally on ventral segments; dorsal segments covered with black setae, ventral segments covered with white setae; Miller's organ present.

Wings (A4 Fig 30c): Rather narrow with tip acute; anterior Banksian line present in both wings, posterior absent; veins mostly dark brown, but with some veins intercalated with white spots; beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline but with brown marks concentrated on tip, inferior margin, pterostigma, some punctuation at subcostal area; and the dark brown mediocubital area; cubital fork located between the origins of Rs and MA; four presectoral crossveins; subcostal veinlets simple; posterior area narrower than prefork area. *Hind wing* membrane mostly hyaline except for brown marks around pterostigma, some brown infuscations at tip, and a large spot on rhegmal area; medial fork located between the origins of RS and MA; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 30a-b): *All pairs of legs*, femur elongate (> 2.5x length of coxa); tibia slightly longer than femur, which is slightly longer than tarsi; tibial spurs surpassing T1 apex; T2, T3 and T4 about the same size, T1 about twice as long as T2, T5 longer T1; claws about half of T5 length; coxa, trochanter, and femur set with short white setae; femur, tibia and tarsi set with short black setae, and scattered long black setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair slightly longer than femur width; tibia with antennal cleaning setae ventroapically; coxa dark brown with some pale areas on anterior surface, trochanter pale, femur dark brown, tibia with posterior surface pale, anterior with three dark brown rings; tarsi dark brown, except for T1 base, pale. *Midleg* with same color pattern of foreleg, except posterior surface of femur, pale. *Hindleg* with femur, tibia and T1 slightly longer than in other legs; color pattern similar to midleg, except for tibia pale with tip dark brown.

Abdomen: Mostly black with scattered pale marks, mainly on sternites medial area. Ectoproct tip pale. Beset with short white setae.

Male Terminalia (A4 Figs 31a-c): *Ectoproct* rounded in lateral view; set with elongate black setae. *9th sternite* posterior margin concave in ventral view; set with elongate black setae. *Gonarcus* broad and arched in posterior view. *Mediuncus* very long, with tip acute; in lateral view medially curved. *Paramere* weakly sclerotized, but elongate in lateral view.

Female Terminalia (A4 Figs 31d-e): *Ectoproct* rounded, covered with thin elongate setae. *Lateral gonapophyses* rounded, smaller than ectoproct, set with few cavisetae. *7th sternite* distal margin with small acute spines medially in ventral view; covered with

long black setae. *Pregenital plate* a transversal band with anterior margin curved, and posterior margin extended in medial area. *Posterior gonapophyses* broad, elongate, with tip slightly larger than base; covered with long black setae, and few cavisetae on apex. *9th tergite* with a short membranous digitiform process. *Anterior gonapophyses* a small rounded plate covered with long black setae. *Ventral membrane*, gonapophyseal plates present.

Distribution (A4 Fig 155) – Australia: NSW*, NT, QLD*, SA*, WA. * = new records.

Adult activity period – Records for September to January and March.

Biology – Unknown, larva unknown.

Primary type – Holotype (by original designation), male (ANIC), examined. From original description, New (1985b): “Holotype, ♂, Northern Territory, Larrimah, 8.x.1972, E. F. Riek (ANIC)”. Condition: good, terminalia dissected.

Material examined – (7♂, 6♀). **AUSTRALIA: Queensland:** *Charleville:* 16 km SSW, 26.35S – 146.11E, 14.iii.1990, E.D. Edwards & J.H. Fisk (2♀, ANIC); **New South Wales:** *Nombinnie Nature Reserv.:* 18 air km SSE Mount Hope, 160m, 32.99613°S – 145.94006°E±70m, 3.i.2013, M.V., Oswald, Diehl & Machado, Oswald #626 (1♀, TAMU); *Round Hill:* near Euabalong, 24.xi.1967, C.N. Smithers (1♀, AMSA); **Northern Territory:** *Larrimah:* 8.x.1972, E.F. Riek (1♂ PT, 1♀ PT, SAMA); *Newry:* 42 km E, x.1960 (1♂, FSCA); **South Australia:** *Danggali CP:* 3 km N Tomahawk Dan, 20.xi.1996, I.A. Forrest (1♂, SAMA); ix.1996 (1♀, SAMA); *Mount Lindsay:* 18.x.1996 (1♂, SAMA); *Renmark:* 24 km NbyW, 13.xii.1995, K.R. Pullen (1♂, ANIC); **Western Australia:** *Port Hedland:* 1 km, 15-17.i.1965, A.W. Forbes (1♂ PT, SAMA);

Warburton: 40 km W, 26.13S – 126.19E, 29.xii.1995; M.S. & B.J. Moulds & K.A. Kopestonsky (1♂, AMSA).

Comments – Among the four *Acutoleon* species, *A. secula* is most closely related to *A. mulesi* and *A. parviproctus* (A4 Figs 1-3). These three species share the presence of tibial spurs and the heavily marked forewings. *Acutoleon secula* is the most widespread species in the genus, but appears to be less common than *A. parviproctus* and *A. mulesi*.

***Acutoleon tatarnici*, new species**

(A4 Figs 32-33)

Diagnosis – Tibial spurs absent [not present]; forewing hyaline [not full of brown marks]; hind wing with a longitudinal brown line [not a rhegmal spot]; male paramere sclerotized [not almost indistinguishable].

Description – Lengths: forewing: 22 mm; hind wing: 19 mm.

Head (A4 Figs 32a-b): *Labrum* pale, set with a line of elongate setae. *Clypeus* pale, with some elongate black setae. *Frons* with ventral area pale, remaining areas dark brown; set with few short white setae. *Gena* pale. *Vertex* strongly raised; in frontal view pale with a line of five short transversal marks; in dorsal view mostly pale with two central perpendicular dark brown lines; covered with short white setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, about twice longer than pronotum; distance between antennae about twice scape width; scape and pedicel dark brown; flagellomeres brown with irregular pale marks, except for apical segments mostly pale on anterior surface; torular membrane dark brown; flagellomeres almost as long as wide at base, apical ones

much wider than long; all segments set with short black setae. *Mandibles* pale, with tip black. *Palpi*, maxillary and labial pale; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 32b): *Pronotum* about as long as wide; posterior margin as wide as anterior; subapical furrow present; mostly pale with dark brown areas on posterior half (margins and five longitudinal lines, being the central one longer and reaching furrow); two small lateral dark marks in furrow and two brown infuscations near center of anterior area; beset with short pale setae, and few black setae. *Mesonotum* with prescutum mostly dark brown with two rounded pale spots; scutum mostly dark brown with two longitudinal pale line around midline; scutellum mostly pale except for a central longitudinal dark brown line; all segments covered with short pale setae. *Metanotum* mostly dark brown except for two longitudinal pale areas on scutum; scutellum mostly pale except for a central dark line; set with short white setae. *Pterothoracic pleura* dark brown; covered with white setae; Miller's organ present.

Wings (A4 Fig 32c): Rather narrow with tip acute; anterior banksian lines present in both wings, posterior absent; veins mostly pale, but with some veins intercalated with brown spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline except for small brown shades around anterior Banksian line and forks near distal margin; pterostigma white; cubital fork located near Rs origin; three presectoral crossveins; subcostal veinlets simple; posterior area about the same size of prefork area. *Hind wing* membrane mostly hyaline except for a broad longitudinal line at

the rhegmal area; medial fork located near Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs: *All pairs of legs*, femur elongate (> 2.5x length of coxa); tibia about as long as femur but longer than tarsi; tibial spurs absent; T2, T3 and T4 about same size but shorter than T1; T5 longer than T1; claws slightly shorter than half of T5 length; coxa, trochanter and femur set with short white setae; dorsal area of femur, tibia and tarsi set with short black setae, and scattered long setae (mainly at tibia). *Foreleg* sense hair absent; tibia with antennal cleaning setae ventroapically; all segments pale except for the darker apex of tibia and tarsomeres, and some brown punctuations. *Midleg* with color pattern similar to foreleg. *Hindleg* with femur and tibia slightly longer than in other legs; color pattern similar to midleg except for a basal brown mark at tibia, and the absence of the punctuations.

Abdomen: Dark brown except by distal pale marks at central area of sternites; covered with short white setae.

Male Terminalia (A4 Figs 33a-d): *Ectoproct* rounded in lateral view; set with elongate black setae. *9th sternite* in ventral view with anterior margin straight and posterior with central area elongate, set with a line of long black setae medially. *Gonarcus* broad and arched; in posterior view with medial region thinner than lateral regions. *Mediuncus* large, with tip acute and curved in lateral view. *Paramere* large and thin in lateral; in ventral view curved; in posterior view elongate with tip sclerotized.

Female Terminalia: *Unknown*

Distribution – Australia: WA.

Adult activity period – The only record is for September.

Biology – Unknown, larva unknown.

Etymology – The species is named after Dr. Nikolai Tatarnic, who collected the holotype, and was extremely helpful during the development of this study, sending specimens and images from WAM specimens.

Primary type – Holotype (by present designation), male (WAM). **AUSTRALIA: Western Australia:** *Kiwirrkurra IPA*: Visitor Center, 22.81979°S – 127.76564°E, 430m, 7.ix.2015, N. Tatarnic, [BBKIWI L03]. Condition: pinned, good, abdomen and antennae broken but glued on a white card and pinned below specimen; terminalia dissected; left foreleg was removed and used for DNA extraction.

Comments – *Acutoleon tatarnici* differs from its three congeners in lacking tibial spurs and possessing a well-sclerotized male paramere. Inclusion of this species in *Acutoleon* is justified by its long and acute male mediuncus, the general shape of its legs, pronotum and wings, and molecular data (A4 Figs 1-3). *Acutoleon tatarnici* is clearly distinguishable for its congeners and for rest of “*Periclystus* genus group” species. The general color patterns of wings and pronotum, and the general shape of male terminalia are unique among the genus group. The holotype was collected in a relative remote area.

***Aplectrinia* new genus**

Type species: *Gymnocnemia pentagramma* Gerstaecker 1885, by present designation.

Diagnosis – Tibial spurs absent [not present]; male gonarcus with lateral region wider than central region in posterior view [not same size]; male mediuncus mostly

membranous [not entirely sclerotized]; female posterior gonapophyses without cavisetae [not present]; female lateral gonapophyses about the same size of ectoproct, both covered with cavisetae [not smaller or without cavisetae].

Description – Head: *Vertex* raised. *Ocular rim* setae absent (very small in some species). *Antennae* clubbed and elongate; flagellomeres almost as long as wide at base, apical ones wider than long. *Palpimacula* oval-shaped, located medially. Thorax: Pronotum almost as long as wide. Miller's organ present. Wings: hyaline with brown marks. *Anterior Banksian* line present in both wings. *Forewing* prefork and posterior area about same size. *Hind wing* with one presectoral crossvein. *Male pilula axillaris* present. Legs: *Forefemur* about twice longer than forecoxa. *Foretibia* and foretarsi about same size. *Sense hair* absent or slightly longer than forefemur width. Male Terminalia: *Ectoproct* rounded; *gonarcus* lateral region wider than medial; *paramere* shorter than gonarcus; mediuncus usually mostly membranous. Female Terminalia: *Ectoproct* rounded and set with few cavisetae; *lateral gonapophyses* about same size of ectoproct and set with cavisetae; *posterior gonapophyses* long, thin, without cavisetae; *anterior gonapophyses* usually absent; *pregenital plate* rounded.

Distribution (A4 Figs 156-157) – Australia: NSW, NT, QLD, SA, WA.

Comments – This new genus originated from the division of *Austrogymnocnemia*. All species classified in *Aplectrinia* were transferred from this previous genus, except by one new species. The male and female terminalia of the seven species transferred to this new genus are very distinctive from the species classified in *Austrogymnocnemia* sensu New (1985b). In fact the female terminalia with larger lateral gonapophyses and thin posterior

gonapophyses place *Aplectrinia* closer to *Aurantileon* (entirely composed by species previously placed in *Glenoleon*) (A4 Figs 1-3). The only character uniting the *Aplectrinia* and *Austrogymnocnemia* species was the absence of the tibial spurs. *Aplectrinia* and *Aurantileon* can be differentiated based on the overall shape of the male terminalia, and tibial spurs.

Etymology – The genus name is derived from the combination of the Greek prefix “a” (= without, absent) and the Greek word *plektron* (= spur, point) and refers to the absence of the tibial spurs.

Key to species of *Aplectrinia*

- 1 Forewing with dark bands or scattered dark marks (A4 Fig 46c); female anterior gonapophyses absent; male parameres not fused medially.....2
- 1’ Forewing hyaline (A4 Fig 40c); female anterior gonapophyses as a pulvinate plate (A4 Fig 41d); male parameres fused medially (A4 Fig 41c)*A. oombulgurriensis*
- 2 Hind wing with at least one dark longitudinal line (A4 Fig 38c).....3
- 2’ Hind wing with without dark longitudinal lines (A4 Fig 42c).....6
- 3 Forewing mediocubital area not entirely brown (A4 Fig 46c).....4
- 3’ Forewing mediocubital area entirely brown (A4 Fig 36c).....*A. lulinguensis*
- 4 Clypeus entirely pale (A4 Fig 44a); forewing crossveins not dark shaded (A4 Fig 44c).....5
- 4’ Clypeus pale with two brown spots (A4 Fig 46a); forewing crossveins mostly dark shaded (A4 Fig 46c).....*A. tindalei*

- 5 Frons entirely black (A4 Fig 44a); male paramere medially acute (lateral view) (A4 Fig 45c).....*A. sarahae*
- 5' Frons mostly pale (A4 Fig 34a); male paramere medially rounded (lateral view) (A4 Fig 35b).....*A. cardaleae*
- 6 Clypeus with two dark spots (A4 Fig 38a); forewing with large marks including longitudinal lines (A4 Fig 38c).....*A. nigrescens*
- 6' Clypeus entirely pale (A4 Fig 42a); forewing with no large marks (only crossveins shaded) (A4 Fig 42c).....*A. pentagramma*

***Aplectrinia cardaleae* (New 1985), new combination**

(A4 Figs 34-35)

Austrogymnocnemia cardaleae New 1985:22 (OD); New 1996:68 (cat); Stange 2004:98 (cat); Oswald 2015 (cat).

Diagnosis – Both wings with an apical longitudinal line [line not absent or with other large marks]; frons mostly pale with black marks [not entirely black]; tibial spurs absent [not present]; female lateral gonapophyses about same size of ectoproct [not smaller]; female posterior gonapophyses cavisetae absent [not present]; male paramere curved medially in lateral view [not acute medially].

Description – Lengths: forewing: 21 – 22 mm; hind wing: 19 – 20 mm.

Head (A4 Figs 34a-b): *Labrum* pale, set with a line of elongate setae. *Clypeus* pale, with few long and short black setae. *Frons* mostly pale except for a circling dark brown mark around each antennal base; covered by short black setae. *Gena* pale. *Vertex* raised; in

frontal view pale with two short transversal dark marks laterally and a small central dark mark; in dorsal view mostly pale with two central perpendicular dark lines and two irregular dark marks posterolaterally; covered with short black setae and few pale setae posteriorly, sometimes the pale setae are more numerous. *Ocular rim* setae very short and black. *Antennae* clubbed; elongate, $> 3x$ length of pronotum; distance between width; all segments dark brown with distal margin pale, except for few subapical flagellomeres with anterior surface entirely pale; torular membrane pale; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae. *Mandibles* pale, with tip black. *Palpi*, maxillary and labial pale; covered with short black setae, apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 34b): *Pronotum* as long as wide; posterior margin as wide as anterior; subapical furrow present; mostly pale with dark brown areas as follows: a longitudinal medial line “Y” shaped, two lateral longitudinal lines extending until furrow, two curved marks around midline at posterior margin, two small rounded marks at furrow; covered with pale setae. *Mesonotum* with prescutum mostly dark brown with two rounded pale spots; scutum mostly dark brown with irregular two large pale marks enclosing a small longitudinal dark line; scutellum mostly pale with a broad longitudinal medial dark brown line; all segments set with short pale setae. *Metanotum* mostly dark brown except for two rounded large pale areas at scutum around midline and posterior margin of scutellum; set with short pale setae. *Pterothoracic pleura* dark brown; covered with white setae; Miller’s organ present.

Wings (A4 Fig 34c): Rather narrow with tip acute; anterior Banksian line present in both wings, posterior absent; veins mostly pale, but some veins intercalated with brown spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline with a longitudinal line surrounding the gradate crossveins at apical area; and some small brown shades at vein forks near posterior margin; pterostigma white; cubital fork located at Rs origin; three presectoral crossveins; subcostal veinlets simple; posterior area about as wide as of prefork area. *Hind wing* membrane mostly hyaline except for a longitudinal line at apical area surrounding gradate veins (shorter than forewing line); medial fork located near Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 34a-b): *All pairs of legs*, femur elongate (about two times longer than coxa); tibia slightly shorter than femur, but slightly longer than tarsi; tibial spurs absent; T3 and T4 about the same size, T2 slightly longer than T3, T1 about twice longer than T2 and T5 longer than T1; claws slightly longer than half of T5 length; coxa set with white setae; all other segments set with short black setae, and scattered longer setae at femur and tibia. *Foreleg* sense hair absent; tibia with antennal cleaning setae ventroapically; coxa predominantly pale with dark brown marks at external surface, all other segments light brown except for apex of tibia and T5 dark brown, and two brown rings at tibia. *Midleg* with femur and tibia slightly longer than foreleg. *Hindleg* with femur and tibia slightly longer than midleg; color pattern equal to other legs.

Abdomen: Mostly dark brown except by posterior margin of sclerites, pleura, and terminalia pale; covered with short white setae and some black setae at distal segments.

Male Terminalia (A4 Figs 35a-c): *Ectoproct* rounded in lateral view; set with elongate black setae. 9th sternite short, with posterior margin straight in ventral view; set with elongate black setae. *Gonarcus* arched, with anterior margin broad and rounded, and with a small lateral prolongation in posterior view. *Mediuncus* very broad, with tip rounded, and ventral margin concave. *Paramere* in lateral view, thin and curved; in posterior view rounded and medially concave.

Female Terminalia (A4 Figs 35d-e): *Ectoproct* rounded, set with thin elongate setae and some cavisetae ventrally. *Lateral gonapophyses* rounded, about same size of ectoproct, beset with cavisetae. 7th sternite elongate, with distal margin straight in ventral view; covered with short black setae. 9th tergite with few thickened setae ventrally in lateral view; membranous digitiform process absent. *Pregenital plate* large, concave in lateral view, rounded with posterior margin curved in ventral view. *Posterior gonapophyses* thin, slender, covered with black setae. *Anterior gonapophyses* absent. *Ventral membrane* gonapophyseal plates present.

Distribution (A4 Fig 156) – Australia: NT* and WA. * = new records.

Adult activity period – Records for September and October.

Biology – Unknown, larva unknown.

Primary type – Holotype (by original designation), female (ANIC), examined. From original description, New (1985b): “Holotype, ♀, Western Australia, 15 km E. Millstream, 20.x.1970 J. C. Cardale (ANIC)”. Condition: good.

Material examined – (2♂, 1♀). **AUSTRALIA: Northern Territory: Kings Canyon:** 19.ix.2005, R. Miller & L. Stange (1♂, FSCA, 1♂, 1♀, TAMU).

Comments – *Aplectrinia cardaleae* is closely related to *A. sarahae*; both possess similar longitudinal lines on the wings and general body color pattern. However *A. cardaleae* has more setae on the pronotum and head; frons color pattern; darker antennae; and distinctive male paramere. For phylogenetic relationships see (A4 Figs 1-3).

***Aplectrinia lulinguensis* (New 1985), new combination**

(A4 Figs 36-37)

Austrogymnocnemia lulinguensis New 1985:21 (OD); New 1996:68 (cat); Stange 2004:99 (cat); Oswald 2015 (cat).

Diagnosis – Forewing mediocubital entirely dark brown [not hyaline]; hind wing with longitudinal brown lines [lines not absent]; tibial spurs absent [not present]; female lateral gonapophyses about the same size of ectoproct [not smaller]; female posterior gonapophyses cavisetae absent [not present]; male mediuncus mostly membranous with a central sclerotized triangle [mediuncus not entirely membranous].

Description – Lengths: forewing: 24 – 28 mm; hind wing: 20 – 26 mm.

Head (A4 Figs 36a-b): *Labrum* pale, set with a line of elongate setae. *Clypeus* pale, with some elongate black setae. *Frons* beneath antennae pale, remaining areas dark brown; covered with short white setae. *Gena* pale. *Vertex* raised; in frontal view pale, with five rounded dark spots forming a transversal line medially; in dorsal view mostly pale with two central perpendicular dark lines and two dark marks posterolaterally; covered with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, > 3x length of pronotum; distance between antennae wider than scape width; brown with distal margin

of segments pale; torular membrane pale; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae. *Mandibles* pale, with tip black. *Palpi*, maxillary and labial pale with irregular brown marks; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 36b): *Pronotum* about as long as wide; posterior margin as wide as anterior; subapical furrow present; mostly pale but with a broad medial dark brown line, enclosing a thin pale line in some specimens; two pale longitudinal lines around the midline; and two lateral dark lines; beset with short white setae and some long white setae on the borders. *Mesonotum* mostly grey with two longitudinal pale lines around the midline of all segments, central area of scutellum dark grey; covered with short white setae. *Metanotum* dark brown with irregular pale marks medially; set with short white setae. *Pterothoracic pleura* grey; covered with white setae; Miller's organ present.

Wings (A4 Fig 36c): Rather narrow with tip acute; anterior Banksian line present in both wings, posterior absent; veins mostly brown, but some veins intercalated with white spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline, but mediocubital area entirely dark brown, and a dark brown line on poststigmal area and other at anterior margin, area beneath mediocubital area surrounding gradate crossveins light brown; pterostigma white; cubital fork located between the origins of Rs and MA; three presectoral crossveins; subcostal veinlets simple; posterior area about same size of prefork area. *Hind wing* membrane mostly hyaline except for two longitudinal light brown lines, one beneath CuA1 and other surrounding gradate crossveins; pterostigma mostly brown with apex white; forks near

posterior margin brown shaded; medial fork located between the origins of Rs and MA, but closer to Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 36a-b): *All pairs of legs*, femur elongate (near twice longer than coxa); tibia and tarsi about same size, but slightly shorter than femur; tibial spurs absent; T3 and T4 about same size, T2 slightly longer than T3, T1 and T5 about same size but twice longer than T2; claws slightly longer than half of T5 length; coxa, trochanter and femur set with short white setae; femur, tibia and tarsi set with short black setae, and scattered long setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair absent; tibia with antennal cleaning setae ventroapically; coxa grey with internal surface pale, remaining segments pale, but femur apex dark. *Midleg* with color pattern similar of foreleg. *Hindleg* with femur, tibia and T1 slightly longer than in other legs; color pattern similar to anterior legs.

Abdomen: All sclerites grey but pleura pale; covered with short white setae.

Male Terminalia (A4 Figs 37a-d): *Ectoproct* rounded in lateral view; set with elongate black setae. *9th sternite* short, with posterior margin concave medially in ventral view; set with elongate black setae. *Genitalia* with a large membranous sac ventrally. *Gonarcus* in dorsal view simple and arched, in lateral view anterior margin extending downwards, in posterior view with a lateral extension. *Mediuncus* mostly membranous, with a central sclerotized triangle. *Paramere* short, with tip acute and curving upwards in lateral view.

Female Terminalia (A4 Figs 37e-f): *Ectoproct* rounded, set with thin elongate setae and some cavisetae ventrally. *Lateral gonapophyses* rounded, about same size of ectoproct,

beset with cavisetae. 9th tergite in lateral view with few elongate cavisetae and a ventral membranous digitiform process. 7th sternite elongate, with distal margin rounded in ventral view, with a small central concavity where the pregenital plate fits; covered with short black setae. *Pregenital plate* small and rounded in ventral view. *Posterior gonapophyses* thin, elongate, covered with black setae. *Anterior gonapophyses* absent. *Ventral membrane* gonapophyseal plates present.

Distribution (A4 Fig 156) – Australia: NT, QLD, SA*, WA. * = new record.

Adult activity period – Records for April to November.

Biology – Unknown, larva unknown.

Primary type – Holotype (by original designation), female (ANIC), examined. From original description, New (1985b): “Holotype, ♀, Western Australia, W. Kimberley, Lulingui Station, near Derby, 26.viii.1929, I. M. Mackerras and T. G. Campbell (ANIC)”. Condition: good, terminalia dissected.

Material examined – (9♂, 29♀). **AUSTRALIA: Northern Territory:** 50 km SE Kununurra: 16°04'26''S – 129°05'20''E, 12.iv.1998, M.V., JDOswald (1♂, FSCA, 1♂, TAMU); Gorge WH: between Hatches Creek and Elkedra, at light, 7.x.1977, J. A. Forrest (1♀ PT, SAMA); Kings Canyon: 19.ix.2005, R. Miller & L. Stange (1♀, FSCA); Leila Lagoon: McArthur Stn, ix.1977 (1♀, SAMA); Victoria River Downs: 4 mi WSW 15.viii.1973, L. P. Kelsey (1♀, ANIC); **Queensland:** Chillagoe: x.1965 (1♂, ANIC); Kundala: (1♂, 1♀, MVM); Norman: v.1980 (2♂, 1♀, ANIC); Townsville: ix.1967, PW. Holbeach (1♂ PT, MVM); **South Australia:** Maryvale Hs: x.1989 (1♀, SAMA); **Western Australia:** Blackstone: x.2006 (1♀, SAMA); Kiwirrkurra IPA: Visitor Center,

22.81979°S – 127.76564°E, 430m, 12.ix.2015, N. Tatarnic (1♀, WAM); *Lansdowne Station*: vii.1964 (3♀, ANIC); viii.1964 (1♀, ANIC); *Louisa*: 24 km W, x.1960 (1♀, FSCA); *Lulingui Station*: viii.1929 (2♀, ANIC, 1♀, ANIC); *Millstream*: x.1970 (2♂, 4♀, ANIC); xi.1970 (8♀, ANIC); *Pungkulpirri Waterhole*: 0.5 km E, Walter James Rg, 24°39'15''S – 128°45'18''E, 26.ix.2006, at light, Central Ranges Sur. Camp 1 (1♂, SAMA).

Comments –New (1985b) noted that the intensity of the marks on the forewing varies within the species, which is confirmed here. In some specimens the apical line on poststigmatal area is very reduced, while other specimens lack the brown shading beneath the dark mediocubital area. *Aplectrinia lulinguensis* can be distinguished from its congeners species by its forewing marks, particularly the dark brown mediocubital area. The general structure of the male terminalia also separates *A. lulinguensis* from other species. For phylogenetic relationships see (A4 Figs 1-3).

***Aplectrinia nigrescens* (New 1985), new combination**

(A4 Figs 38-39)

Austrogymnocnemia nigrescens New 1985:24 (OD); New 1996:68 (cat); Stange 2004:99 (cat); Oswald 2015 (cat).

Diagnosis – Forewing full of brown marks [not only with a apical longitudinal line]; hind wing with a small rhegmal spot [not a longitudinal line]; clypeus with two dark brown spots [not entirely pale]; tibial spurs absent [not present]; female lateral gonapophyses about same size of ectoproct [not smaller]; female posterior gonapophyses

cavisetae absent [not present]; male mediuncus mostly membranous with a central sclerotized triangle [mediuncus not entirely membranous].

Description – Lengths: forewing: 20 – 22 mm; hind wing: 18 – 21 mm.

Head (A4 Figs 38a-b): *Labrum* pale to light brown; set with a line of elongate setae. *Clypeus* pale with two lateral curved brown spots dorsally; set with some elongate black setae. *Frons* dark brown, covered with many white setae. *Gena* pale. *Vertex* raised; in frontal view pale, with two short transversal dark brown marks laterally and a rounded central dark spot; in dorsal view mostly pale with two central perpendicular dark brown lines and two black marks posterolaterally; covered with short black setae, and few white ones on posterior margin. *Ocular rim* setae very short and white. *Antennae* clubbed; elongate, > 3x length of pronotum; distance between width; mostly dark brown, with distal margin of basal flagellomeres pale, and three or four subapical flagellomeres pale on anterior surface; torular membrane pale; flagellomeres almost as long as wide at base, apical ones much wider than long; scape and pedicel covered with short white setae, flagellum set with small black setae. *Mandibles* mostly pale, with tip black. *Palpi*, maxillary and labial mostly pale with dark brown marks (entirely dark brown in some specimens); apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 38b): *Pronotum* wider than long; posterior margin as wide as anterior; subapical furrow present; mostly pale except for some dark brown areas as follows: a broad medial band, and two sinuous bands laterally encircling a pale area on posterior half; beset with white setae mostly short with some marginal long setae, some specimens

with few black setae in posterior margin. *Mesonotum* mostly dark brown to grey (in general medial area darker) with two longitudinal yellow bands around central area; covered with short white setae and some black setae on prescutum. *Metanotum* color similar to mesonotum; covered with short white setae. *Pterothoracic pleura* dark brown with some pale areas on sclerites borders in some specimens; covered with white setae; Miller's organ present.

Wings (A4 Fig 38c): Fairly broad with tip acute, anterior and posterior Banksian lines present in both wings, veins mostly dark brown, but some veins intercalated with white spots, and others completely white, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline but full of brown marks in posterior margin, pterostigma, subcostal area, mediocubital area, around radial crossveins, and two apical lines surrounding gradate veins; tip of pterostigma white; cubital fork located near Rs origin; three or four presectoral crossveins; subcostal veinlets simple; posterior area narrower than prefork area. *Hind wing* membrane mostly hyaline except for a small brown mark beneath pterostigma, and a small rhegmal spot; pterostigma tip white; medial fork located near Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 38a-b): *All pair of legs*, femur elongate (about twice longer than coxa); tibia, femur and tarsi about same size; tibial spurs absent; T2, T3 and T4 about same size, T1 and T5 about same size, near twice longer than T2; claws slightly longer than half of T5 length; coxa, trochanter, femur, and tibia set with short white setae; femur, tibia and tarsi set with short black setae, and scattered long black setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair absent; tibia with antennal

cleaning setae ventroapically; coxa dark brown, trochanter light brown, femur dark brown with internal surface pale, tibia mostly pale with three dark brown marks on anterior surface; tarsi dark brown, except T1, pale. *Midleg* with same color pattern of foreleg, except for tibia in some specimens, dark brown with three pale rings. *Hindleg* with femur, tibia and T1 slightly longer than in other legs; color pattern similar to anterior legs, except for tibia pale with tip dark brown.

Abdomen: Dark brown; set with short white setae.

Male Terminalia (A4 Figs 39a-d): *Ectoproct* rounded in lateral view; set with elongate black setae. *9th sternite* short, with posterior margin concave in ventral view; set with elongate black setae. *Gonarcus* simple, arched, with anterior margin enlarged ventrally in lateral view. *Mediuncus* mostly membranous except by a central sclerotized triangle in posterior view. *Paramere* in lateral view “C” shaped, with ventral area long and acute.

Female Terminalia (A4 Figs 39e-f): *Ectoproct* rounded, set with thin elongate setae and some cavisetae ventrally. *Lateral gonapophyses* rounded, about same size of ectoproct, beset with cavisetae. *7th sternite* elongate with distal border straight in ventral view; covered with short setae. *Pregenital plate* small, weakly sclerotized, rounded anteriorly. *Posterior gonapophyses* thin, elongate, and with apex slightly wider than base, beset with black setae. *9th tergite* with a very short membranous digitiform process. *Anterior gonapophyses* absent. *Ventral membrane* covered with short setae medially.

Distribution (A4 Fig 157) – Australia: NT, QLD, WA. New (1985b) mentioned two specimens from SA and one from ACT, but these specimens actually belong to the new species *Austrogymnocnemia pseudomaculata*.

Adult activity period – Records for March to June, August to October and December.

Biology – Unknown, larva unknown.

Primary type – Holotype (by original designation), female (MVM), examined. From original description, New (1985b): “Holotype, ♀, Western Australia, Forrest R. Mission, 20.viii.1953, K.J.C. (MVM)”. Condition: good; terminalia dissected.

Material examined – (28♂, 49♀, 1?). **AUSTRALIA: Northern Territory:** *Alice Springs*: x.1972 (1♂, ANIC); *Borrooloola*: 46 km SSW, 16.28S – 136.09E, 28.x.1975, M.S. Upton (1♂, 1♀, ANIC); *Devil’s Marbles*: 7mi N of Wauchope, 22.iv.1966, N. McFarland (1♂, 4♀, SAMA); xi.1961 (1♂, 1♀, FSCA); ix.1967 (1♀, MVM); *Roper Bar*: iv.1966 (1♀, SAMA); **Queensland:** *Lawn Hill NP*: v.1995 (1♀, 1♂, ANIC); **Western Australia:** *Broome*: 145 km SE, 18.55S – 123.27E, viii.1976, I.F.B. Common (5♂, 17♀, ANIC); *Cane R.HS*: 8 km SWbyW, 22.07S – 115.33E, 31.iii.1971, E.F. Riek (1♀, TAMU; 7♂, 5♀, ANIC); 21.56S – 115.39E, 27.iv.1971, Upton & Mitchell (2♂, ANIC); iv.1971 (1♂, ANIC); *Fitzroy Crossing*: ix.1953 (1♂, 1♀, SAMA); *Halls Creek*: 1.x.1953, N.B. Tindale (1♀, SAMA); v.1964 (1♀, ANIC); 85 km ESE, 18°24’S – 128°28’E, 4.vi.1998, M.V., JD Oswald (1♂, 2♀, TAMU); *Halls Ck*: x.1953 (1♀, SAMA); *Kununurra*: 70 mi ESE, iv.1965 (2♂, 1♀, SAMA); *Lullingui Station*: nr Derby, 26.viii.1929, I.M. Mackerras & T.G. Campbell (2♀, ANIC); *Millstream Chichester National Park*: Python Pool, 21.33309°S – 117.23930°E±130m, 180m, 23.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #615 (1♂, 2♀, TAMU); *Minilya Station*: iv.1953, A. Snell (1♂ PT, MVM); iv.1953 (1♂, MVM); *Moola Bulla stn*: viii.1994 (1♀, ANIC); *Nanutarra Roadhouse*: hwy 136, 13 air km NENE, 22.47124°S –

115.60040°E±70m, 130m, 22.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #614 (1♂, 2♀, TAMU); *Palm Springs*: 38 rd km SE Halls Creek, 18°25'23''S – 127°50'45''E, 11.vi.1998, M.V., JD Oswald (1♀, TAMU); *Pilgangoora Well*: v.1953 (1♀, SAMA); *Pungkulpirri Waterhole*: 0.5 km E, Walter James Rg, 24°39'15''S – 128°45'18''E, 26.ix.2006, at light, Central Ranges Sur. Camp 1 (2♀, SAMA); *Winttenoon*: x.1961 (1♀, FSCA).

Comments – New (1985b) noted that *A. nigrescens*, that it was similar to *Austrogymnocnemia maculate*, based on the heavily marked forewing. But, the specimens compared by New are referred here to the new species *Austrogymnocnemia pseudomaculata*. While these two species are superficially similar, they vary significantly in the shape of male and female terminalia. Within *Aplectrinia* it can be distinguished based on overall coloration and terminalia shape. For phylogenetic relationships see (A4 Figs 1-3).

***Aplectrinia oombulgurriensis*, new species**

(A4 Figs 40-41)

Diagnosis – Forewing hyaline [not with brown marks]; hind wing with a longitudinal line at rhegmal region [not with a large spot or brown infuscated]; female anterior gonapophyses a small plate [not absent]; male mediuncus sclerotized [not mostly membranous]; male parameres fused [not separated].

Description – Lengths: forewing: 25 – 29 mm; hind wing: 22 – 26 mm.

Head (A4 Figs 40a-b): *Labrum* pale; with a line of elongate setae. *Clypeus* pale; with few elongate black setae. *Frons* predominantly pale with irregular brown marks, mainly surrounding antennae; set with short black setae. *Gena* pale. *Vertex* raised, in frontal view pale with five brown spots placed transversally on center; in dorsal view pale with a large brown spot located medially on posterior margin (spot connected to a thin central longitudinal line in most specimens), some specimens with a transversal central brown line (interrupted with pale areas in some specimens); covered with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, > 3x length of pronotum; distance between width; scape and pedicel mostly pale but full of irregular brown marks, flagellomeres basal half brown, apical half pale, generally flagellomeres darken towards antennal apex; torular membrane pale; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae. *Mandibles* pale, with tip black. *Palpi*, maxillary and labial pale, with a small brown mark on basal segments; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 40b): *Pronotum* about as long as wide; posterior margin as wide as anterior; subapical furrow present; mostly pale except for a central longitudinal line “Y” shaped, two lateral brown spots on posterior area and other two on anterior area; beset with short white setae and some long white setae on borders, mainly on anterior corners. *Ptherothorax notum* pale with a central longitudinal brown line, and a small lateral line at each side of prescutum; covered with short white setae. *Pterothoracic pleura* pale but full of small brown spots; covered with short white setae; Miller’s organ present.

Wings (A4 Figs 40c): Rather narrow with tip acute; anterior Banksian line present in both wings, posterior absent; veins mostly pale, but with some veins intercalated with brown spots; beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane hyaline but with tiny brown marks around marginal forks, and tip of hypostigmatic cell; cubital fork located between the origins of Rs and MA; three presectoral crossveins; subcostal veinlets simple; prefork area slightly wider than posterior area at cubital fork level. *Hind wing* membrane hyaline except for a brown longitudinal line at rhegmal area; medial fork located between origins of Rs and MA; subcostal veinlets simple; one presectoral crossvein.

Legs: *All pairs of legs*, femur elongate ($> 2.5x$ length of coxa) tibia, femur and tarsi about same size; tibial spurs absent; T3 and T4 about same size, T2 slightly longer than T3, T1 and T5 about same size, but longer than T2; claws about half of T5 length; coxa covered with short white setae; trochanter set with short black setae; femur with short white setae on ventral surface and black short setae on dorsal surface, basal area with few elongate white setae and long black setae on apical area; tibia and tarsi covered white short black setae, with few long black setae on tibia; T5 ventrally with two rows of thick, black setae. All segments pale except for few irregular brown marks on coxa. *Foreleg* sense hair absent; tibia with antennal cleaning setae ventroapically. *Hindleg* with femur and tibia slightly longer than in other legs.

Abdomen: Tergites pale, except for a sagittal brown line (connected to thoracic line). Sternites brown but full of irregular pale areas (some specimens with larger pale areas).

All segments covered with short white setae (some specimens, few tergites with some short black setae).

Male Terminalia (A4 Figs 41a-c): *Ectoproct* rounded in lateral view, set with elongate black setae. *9th sternite* large, with posterior margin straight in ventral view; set with elongate black setae. *Gonarcus* broad and arched in lateral view; anterior area wider than basal, curved and acute. *Mediuncus* broad, long, with tip rounded in posterior view; but sinuous and acute in lateral view. *Paramere* more sclerotized than other structures; vertically elongate in lateral view; broad and medially fused in posterior view.

Female Terminalia (A4 Figs 41d-e): *Ectoproct* rounded, covered with long black setae and some cavisetae ventrally. *Lateral gonapophyses* rounded, about same size of ectoproct, covered with cavisetae. *7th sternite* long, with a curved concavity at distal margin in ventral view; covered with short black setae. *Pregenital plate* in ventral view, elongate transversally, with lateral margin acute, anterior margin curved but posterior margin with medial region elongate and curved. *Posterior gonapophyses* thin and long, with tip rounded and covered with long black setae. *9th tergite* without digitiform process. *Anterior gonapophyses* a small rounded plate covered with many black setae. *Ventral membrane* gonapophyseal plates present.

Distribution (A4 Fig 156) – Only known from the Forrest River Mission (currently known as Oombulgurri) Australia: WA.

Adult activity period – Records for July and August.

Biology – Unknown, larva unknown.

Etymology – The species is named after the type location Oombulgurri, northeastern WA.

Primary type – Holotype (by present designation), male, (MVM). **AUSTRALIA: Western Australia:** Forrest River Mission, 20.8.53, KJC // collection A. N. Burns // NEU – 2029. Condition: good; tip of antennae missing, right foreleg missing, left forewing with apex slightly damaged.

Paratypes: same location and collector from holotype: 20.8.53, NEU – 2030 (1♀ MVM, pinned); 20.8.53, NEU – 2028 (1♀ MVM, pinned); 2.8.53, NEU – 2025 (1♀ MVM, pinned); 20.8.53, NEU – 2024 (1♀ MVM, pinned); 10.7.53, NEU – 2026 (1♀ MVM, pinned); 10.7.53, NEU – 2027 (1♂ MVM, pinned); 20.7.53, NEU – 2031 (1♀ MVM, pinned); July 1954, NEU – 2032 (1♀ MVM, pinned).

Comments – *Aplectrinia oombulgurriensis* is the most distinctive species in the genus. The female anterior gonapophyses present as a small plate, and the male mediuncus is sclerotized. The overall shape of the female terminalia, and the absence of tibial spurs, place this species within *Aplectrinia*. The vertically elongate male paramere suggests a close association with *A. cardaleae* and *A. sarahae*; two other species with relatively weakly marked wings. For phylogenetic relationships see (A4 Figs 1-3).

***Aplectrinia pentagramma* (Gerstaecker 1885), new combination**

(A4 Figs 42-43)

Gymnocnemia pentagramma Gerstaecker 1885:34 (OD); Esben-Petersen 1915:63 (cit).

Austrogymnocnemia pentagramma (Gerstaecker): Esben-Petersen 1917:206 (n. cb.); Esben-Petersen 1923:580 (rd, ill); Esben-Petersen 1926:12 (cit); Stange 1976:302 (cat); New 1985b:25 (key, rd, ill); New 1996:68 (cat); Stange 2004:100 (cat); Oswald 2015 (cat).

Diagnosis – Wings longitudinal brown lines absent [lines not present]; clypeus entirely pale [not with two brown spots]; tibial spurs absent [not present]; female lateral gonapophyses about same size of ectoproct [not smaller]; female posterior gonapophyses cavisetae absent [not present]; male mediuncus mostly membranous with a central sclerotized triangle [mediuncus not entirely membranous].

Description – Lengths: forewing: 22 – 29 mm; hind wing: 20 – 27 mm.

Head (A4 Figs 42a-b): *Labrum* pale; set with a line of elongate setae. *Clypeus* pale; with some elongate black setae. *Frons* dark brown, except for ventral margin pale, but with a medial thin dark line, in some specimens there is a small rounded pale spot between antennae; covered with short white setae. *Gena* pale. *Vertex* raised; in frontal view pale, with five dark brown spots in central area (some specimens lateral spots are connected); in dorsal view mostly pale with two central perpendicular dark brown lines and two black marks posterolaterally; covered with short black setae. *Ocular rim* setae very short and white. *Antennae* clubbed; elongate, about four times longer than pronotum; distance between width; mostly dark brown, but scape and pedicel with irregular pale areas, and four or five subapical flagellomeres pale (some specimens with distal margin of flagellomeres pale); torular membrane pale; flagellomeres almost as long as wide at base, apical ones much wider than long; scape, pedicel and first flagellomere covered

with short white setae, remaining segments set with short black setae. *Mandibles* mostly pale, with tip black. *Palpi*, maxillary and labial mostly pale with dark brown marks mainly in basal segments and around palpimacula; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 42b): *Pronotum* slightly wider than long; posterior margin wider than anterior; subapical furrow present; mostly pale except for some dark brown areas: a broad medial band, and two sinuous bands laterally that encircle a pale area on proximal half (size of dark brown marks varies among specimens with some almost entirely dark); beset with short black setae with some marginal long setae (some specimens with few pale setae on anterior margin). *Mesonotum* mostly dark brown with some pale areas on different segments: a central and two lateral spots on prescutum, two longitudinal bands around central area and a spot near wing base on scutum, and two lateral marks on scutellum; covered with short black setae. *Metanotum* dark brown with irregular pale spots in some specimens; covered with short black setae. *Pterothoracic pleura* dark brown with some pale areas on sclerites margins in some specimens; covered with white setae; Miller's organ present.

Wings (A4 Fig 42c): Rather narrow with tip acute; anterior Banksian line present in both wings, posterior absent; veins mostly dark brown, but some veins intercalated with white spots; beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline but area around crossveins brown infuscated, and some larger markers at pterostigma, gradate veins and tip of prefork area; tip of pterostigma white; cubital fork located between the origins of Rs and MA; three presectoral crossveins (distal vein

irregularly forked and linked in some specimens); subcostal veinlets mostly simple with few distal ones forked; costal area large; posterior area narrower than prefork area. *Hind wing* membrane mostly hyaline except for small brown marks on pterostigma and rhegmal area (some specimens with small marks around crossveins and tip); pterostigma tip white; medial fork located between the origins of Rs and MA; subcostal veinlets simple; one presectoral crossvein (some specimens with a short medial spur).

Legs (A4 Fig 42a): *All pairs of legs*, femur elongate (about twice longer than coxa); tibia, femur and tarsi about same size; tibial spurs absent; T3 and T4 about same size, T2 slightly longer than T3, T1 and T5 about same size but slightly longer than T2; claws about half of T5 length; coxa, trochanter and femur, set with short white setae; femur, tibia and tarsi set with short black setae, and scattered long black setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair absent; tibia with antennal cleaning setae ventroapically; coxa, trochanter and femur dark brown but internal surface pale; tibia mostly pale with three dark brown marks on anterior surface; tarsi dark brown, except T1 and T5 bases pale. *Midleg* with same color pattern of foreleg, except for femur dark brown with a subapical pale ring, and some pale areas near base in some specimens. *Hindleg* with femur, tibia and T1 slightly longer than in other legs; color pattern similar to midleg, except for tibia pale with tip and anterior surface dark brown; in some specimens tarsi pale with tarsomeres tip dark.

Abdomen: All segments dark brown with posterior margin pale; set with short white setae.

Male Terminalia (A4 Figs 43a-d): *Ectoproct* rounded in lateral view, set with elongate black setae. 9th *sternite* short, with anterior margin concave in ventral view; set with elongate black setae. *Gonarcus* simple, arched, with anterior margin enlarged ventrally in lateral view, and curved in posterior view. *Mediuncus* mostly membranous but with a medial sclerotized triangle in posterior view. *Paramere* in lateral view “C” shaped, with ventral area long and acute.

Female Terminalia (A4 Figs 43e-f): *Ectoproct* rounded, set with thin elongate setae and some cavisetae ventrally. *Lateral gonapophyses* rounded, about same size of ectoproct, beset with cavisetae. 7th *sternite* elongate with distal border straight in ventral view; covered with short setae. *Pregenital plate* small, rounded and weakly sclerotized. *Posterior gonapophyses* thin, elongate, beset with long black setae. 9th *Tergite* with a membranous digitiform process. *Anterior gonapophyses* absent. *Ventral membrane* covered with short setae medially; gonapophyseal plates present.

Distribution (A4 Figs 157) – Australia: NSW*, NT*, QLD, SA*, WA. * = new record.

Adult activity period – Records for October to April, and June.

Biology – Unknown, Larva unknown.

Primary type – Syntypes, male and female (ZIMG), high-resolution image of the male syntype examined. From original description, Gerstaecker (1885): “(mas, fem) -- Patria: Peak Downs Australiae”. From Esben-Petersen (1923): “Gerstaecker's type-specimen is from Peak Downs”. From Esben-Petersen (1926): “I have only seen the type-specimen of this species”. From New (1985b): “Holotype, ?sex, 'Peak Downs' (Greifswald) (not

seen) (diagnosis based on Esben-Petersen's (1923b) detailed description and photograph of the type)".

In the original description Gerstaecker mentioned that the species was based on at least two specimens, male and female (Gerstaecker 1885). However, all, of the subsequent references to the type specimens cite only one specimen, which is sometimes, incorrectly called the holotype (New 1985b; 1996; Stange 2004). For this study, the female syntype was not found and is probably lost; the male specimen still in very good condition, except by the missing midlegs, and it is probably the specimen mentioned by all other authors.

Material examined – (49♂, 54♀). **AUSTRALIA: New South Wales:** *Bourke:* x.1957 (1♀, ANIC); *Nombinnie Nature Reserv.:* 18 air km SSE Mount Hope, 160m, 32.99613°S – 145.94006°E±70m, 3.i.2013, M.V., Oswald, Diehl & Machado, Oswald #626 (20♂, 18♀, TAMU); **Northern Territory:** *Mount Cahill:* iii.1973 (1♂, ANIC); vi.1973 (1♂, ANIC); *Timber Ck Stone:* iv.1965 (1♀, SAMA); **Queensland:** *Alpha:* 37 km W, 23:37.4S – 146:16.2E, 12.i.2002, Cooley, Cowan, Hill, Marshall & Moulds (1♀, AMSA); *Augathella:* 33 km N, 7.xii.1989, R.B. Miller (1♀, FSCA); *Brisbane:* 24.x.1926 (2♂, 2♀, QLDM); 8.i.1927 (1♂, 1♀, AMSA; 1♂, ZMUC); 27.ii.1931, Col. L. Franze (1♀, QLDM); *Carnarvon Ra:* ii.1944, N. Geary (1♀, AMSA); *Eidsvold:* x.1966 (2♀, ANIC); *Emerald:* (1♀, ANIC); *Normanton:* 40 mi SE, 13.x.1965, A. Mesa & R. Sandulski (1♂, ANIC); *Riversleigh:* i.1986 (1♀, SAMA); *Stradbroke Is:* 15.x.39 (1♂, QLDM); *Westwood:* 19.ix.1923 (1♂, MVM); **South Australia:** *Everard Pk:* x.1970 (2♂, SAMA); *Oraparinna:* ii.1956 (1♀, SAMA); *White Bull Yard:* Kalamurina Stn x.1999

(1♂, SAMA); *Wilpena*: ii.1956 (1♀, SAMA); **Western Australia**: *Cambonn Park*: 11.ii.1957 (1♂, MVM); *Carnarvon*: iv.1958 (1♂, MVM); *Fraser Range HS*: xi.1969 (1♂, ANIC); *Gascoyne Junction*: 70 air km WWNW, 24.87559°S – 114.55150°E±90m, 21.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #613 (1♂, TAMU); *Goongarrie*: 5 km S, 30.05S – 121.09E, 15.xi.1970, Upton & Feehan (4♂, 7♀, ANIC); *Halls Ck*: x.1953 (1♀, SAMA); *Karonie*: xi.1969 (1♂, ANIC); *Kununurra*: 70 mi ESE, iv.1966 (1♀, SAMA); *Yokine*: Mount Yokine, 26.i.1957 (4♂, 5♀, MVM); 26.iii.1957 (4♂, 5♀, MVM); 27.i.1958 (2♀, MVM).

Comments – *Aplectrinia pentagramma* is the only *Aplectrinia* species without longitudinal brown lines in the wings; it possesses only a moderately sized rhegmal spot in hind wing and only small dark punctuations in forewing. For phylogenetic relationships see (A4 Figs 1-3).

***Aplectrinia sarahae* (New 1985), new combination**

(A4 Figs 44-45)

Austrogymnocnemia sarahae New 1985:23 (OD); New 1996:68 (cat); Stange 2004:100 (cat); Oswald 2015 (cat).

Diagnosis – Both wings with an apical longitudinal line [line not absent or with other large marks]; Frons entirely black [not mostly pale]; tibial spurs absent [not present]; female lateral gonapophyses about same size of ectoproct [not smaller]; female posterior gonapophyses cavisetae absent [not present]; male paramere medially acute in lateral view [not medially curved].

Description – Lengths: forewing: 20 – 21 mm; hind wing: 18 – 19 mm.

Head (A4 Figs 44a-b): *Labrum* pale, set with a line of elongate setae. *Clypeus* pale, with few elongate black setae. *Frons* black, except for pale ventral margin; covered with few short black setae. *Gena* pale. *Vertex* raised; in frontal view pale, with a medial, transversal, and dark brown line; in dorsal view mostly pale with three rounded dark brown marks on posterior margin, and some irregular dark brown marks on central area; covered with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, > 4x length of pronotum; distance between width; scape and pedicel mostly dark brown with irregular brown areas; flagellomeres brown with distal margin pale, except for few subapical segments entirely pale and apical ones slightly darker; torular membrane pale; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae. *Mandibles* pale, with tip black. *Palpi*, maxillary and labial pale; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 44b): *Pronotum* about as long as wide; posterior margin as wide as anterior; subapical furrow present; mostly pale with dark grey areas as follows: a broad longitudinal medial line “Y” shaped, two lateral longitudinal lines and two curved marks around midline on posterior margin; beset with short pale setae. *Mesonotum* with prescutum mostly grey with two rounded pale spots and some irregular dark brown areas around midline; scutum mostly grey with irregular dark brown spots and a small longitudinal pale line around midline; scutellum mostly pale with a broad longitudinal medial dark brown line; all segments covered with short pale setae. *Metanotum* mostly grey with some small rounded dark brown spots at scutum, and some irregular pale areas

as follows: a large rounded mark on medial area, two small marks at wings base, and posterior margin of scutellum; set with short pale setae. *Pterothoracic pleura* grey; covered with white setae; Miller's organ present.

Wings (A4 Fig 44c): Rather narrow with tip acute; anterior Banksian line present in both wings, posterior absent; veins mostly pale, but some veins intercalated with brown spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline with a longitudinal line surrounding gradate crossveins on apical area; and some small brown infuscations on vein forks near posterior and apical margins; pterostigma white; cubital fork located near Rs origin; three presectoral crossveins; subcostal veinlets simple; prefork area slightly larger than posterior area. *Hind wing* membrane mostly hyaline except for a longitudinal line surrounding gradate crossveins on apical area; medial fork located near Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 44a-b): *All pairs of legs*, femur elongate (about twice longer than coxa); tibia slightly shorter than femur; but about same size of tarsi; tibial spurs absent; T3 and T4 about same size, T2 slightly longer than T3, T1 longer than T2 and T5 longer than T1; claws about half of T5 length; coxa set with white setae; all other segments set with short black setae, and scattered long ones at tibia. *Foreleg* sense hair absent; tibia with antennal cleaning setae ventroapically; coxa predominantly pale but external surface mostly brown, all other segments light brown except for apex of tibia and tarsomeres, dark. *Midleg* with color pattern similar of foreleg, except for coxa external surface, grey. *Hindleg* with femur and tibia slightly longer than in other legs; color pattern equal to midleg.

Abdomen: Mostly dark grey except for sclerites distal margins, pleura, and ectoproct pale; covered with short white setae.

Male Terminalia (A4 Figs 45a-d): *Ectoproct* rounded in lateral view, set with elongate black setae. *9th sternite* short, with posterior margin straight in ventral view; set with elongate black setae. *Gonarcus* broad, arched, with anterior margin very broad and marginally rounded in lateral view; in posterior view with medial region narrow and lateral regions broad. *Mediuncus* large, less sclerotized and with tip acute. *Paramere* large, in lateral view with medial region acute; in dorsal view as two acute semi triangles; with medial region fused in posterior view.

Female Terminalia (A4 Figs 45e-f): *Ectoproct* rounded, set with thin elongate setae and some cavisetae ventrally. *Lateral gonapophyses* rounded, about same size of ectoproct, beset with cavisetae. *9th tergite* with few thickened setae on ventral area in lateral view. *7th sternite* elongate, with distal margin straight in ventral view; covered with short black setae. *Pregenital plate* concave in lateral view, but rounded with distal margin curved in ventral view. *Posterior gonapophyses* thin, slender, covered with long black setae. *Anterior gonapophyses* absent. *Ventral membrane* gonapophyseal plates present.

Distribution (A4 Figs 156) – Australia: WA.

Adult activity period – Records for March, April and December.

Biology – Unknown, larva unknown.

Primary type – Holotype (by original designation), female (SAMA), examined. From original description, New (1985b): “Holotype, ♀, Western Australia, 70 miles ESE.

Kununurra (N.T.), 17.iv.1966, N. McFarland (SAM)". Condition: good, terminalia dissected.

Material examined – (3♂, 1♀). **AUSTRALIA: Western Australia:** *Millstream HS:* 5 km SE, 21.37S – 117.06E, 17.iv.1971, Upton & Mitchell (1♂, ANIC); 1 km NE, 21.35S – 117.04E, 8.iv.1971 (1♀, ANIC); *Newman:* hwy 138, 9 air km EENE, 520m, 23.34699°S – 119.82137°E±80m, 25.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #616 (1♂, TAMU); 25°51'17''S - 119°04'39.4''E, 2.iii.1994, L. Stange (1♂, FSCA).

Comments – See discussion for *A. cardaleae*.

***Aplectrinia tindalei* (New 1985), new combination**

(A4 Figs 46-47)

Austrogymnocnemia tindalei New 1985:19 (OD); New 1996:69 (cat); Stange 2004:100 (cat) Oswald 2015 (cat).

Diagnosis – Both wings with an apical brown line [lines not absent]; forewing crossveins brown shaded [not with shades absent]; clypeus with two brown spots [not entirely pale]; tibial spurs absent [not present]; female lateral gonapophyses about same size of ectoproct [not smaller]; female posterior gonapophyses cavisetae absent [not present]; male mediuncus mostly membranous with a central sclerotized triangle [mediuncus not entirely membranous].

Description – Lengths: forewing: 22 – 26 mm; hind wing: 19 – 23 mm.

Head (A4 Figs 46a-b): *Labrum* pale, with a line of elongate setae. *Clypeus* pale with two lateral brown spots (in some paler specimens marks are reduced); with few elongate pale

setae. *Frons* with ventral margin pale, but remaining areas dark brown (dorsal margin curved and ventral medially excavated); covered with short white setae. *Gena* pale. *Vertex* raised; in frontal view pale with two short transversal dark brown marks laterally and a rounded central dark spot (in some specimens transversal marks divided medially); in dorsal view mostly pale with two central perpendicular dark brown marks, and four posterior dark rounded spots; covered with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, > 3x length of pronotum; distance between width; all segments brown with a pale ring on distal margins, except for four to five subapical flagellomeres mostly pale; torular membrane pale; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae, except for scape, pedicel and first flagellomeres, set with white setae. *Mandibles* pale to brown, with tip black. *Palpi*, maxillary and labial pale with some irregular brown marks, mainly near palpimacula; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 46b): *Pronotum* about as wide as long; posterior margin as wide as anterior; subapical furrow present; mostly pale except for some dark brown areas as follows: a broad central line “Y” shaped, two sinuous lines (sometimes connected to the central line anteriorly), and two lateral lines on posterior half; beset with short black setae, long black setae on borders, and some long white setae mainly on anterior margin. *Mesonotum* coloration mostly dark brown with two pale longitudinal lines around central area (enclosing two thin dark lines at scutum), and two rounded spots near wing bases; covered with short black setae. *Metanotum* mostly dark brown, except by irregular pale

areas, mostly around midline and posterior margin of scutellum, covered with few short black setae. *Pterothoracic pleura* dark brown; covered with white setae; Miller's organ present.

Wings (A4 Fig 46c): Rather narrow with tip acute; anterior Banksian line present in both wings, posterior absent; veins mostly dark brown, but some veins intercalated with white spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane hyaline but full of brown marks as follows: at tip, posterior margin, around crossveins (mainly radial and mediocubital areas), pterostigma, and a longitudinal line surrounding gradate crossveins; tip of pterostigma white; cubital fork located between origins of Rs and MA; three presectoral crossveins; subcostal veinlets simple; posterior area slightly narrower than prefork area. *Hind wing* membrane mostly hyaline except for some brown marks near inferior margin, around crossveins on mediocubital area and small longitudinal line on rhegmal area; pterostigma white; medial fork located between origins of Rs and MA, but closer to Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 46a-b): *All pairs of legs*, femur elongate (about twice longer than coxa); tibia, femur, and tarsi about same size; tibial spurs absent; T3 and T4 about same size, T2 slightly longer than T3, T1 slightly longer than T2, and T5 longer than T1; claws about half of T5 length; coxa, trochanter, and femur set with short white setae; femur, tibia and tarsi set with black setae and scattered long black setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair absent; tibia with antennal cleaning setae ventroapically; coxa internally pale, externally dark brown, trochanter pale, femur

dorsally brown with a subapical spot and ventral surface pale, tibia with three brown marks dorsally and remaining areas pale; tarsi mostly pale with tip dark, mainly at T5. *Midleg* with color pattern similar to foreleg, except for tibia slightly darker. *Hindleg* with femur and tibia slightly longer than in other legs; color pattern similar to anterior legs, except for pale tibia with tip and internal surface midline dark brown.

Abdomen: Mostly dark brown with scattered pale marks, mainly on sternites medial area and tergites distal margin; pleura pale. Beset with short white setae, and few black setae on distal segments.

Male Terminalia (A4 Figs 47a-d): *Ectoproct* rounded in lateral view, set with elongate black setae. *9th sternite* short, with posterior margin concave in ventral view; beset with elongate black setae. *Genitalia* with a large ventral membranous sac. *Gonarcus* simple, arched, with anterior margin broad and curved distoventrally in lateral view. *Mediuncus* mostly membranous with a small central sclerotized triangle in posterior view. *Paramere* small, broad with tip acute and curving upwards in lateral view.

Female Terminalia (A4 Figs 47e-f): *Ectoproct* rounded set with thin elongate setae and some cavisetae ventrally. *Lateral gonapophyses* rounded, about same size of ectoproct, beset with long cavisetae. *7th sternite* elongate, distal margin with a small concavity in ventral view; covered with short black setae. *Pregenital plate* weakly sclerotized and rounded. *Posterior gonapophyses* thin, elongate, covered with long black setae. *9th tergite* with a short membranous digitiform process. *Anterior gonapophyses* absent. *Ventral membrane* gonapophyseal plates present.

Distribution (A4 Figs 156) – Australia: SA and WA*. * = new record.

Adult activity period – Records for January, March, September, October and December.

Biology – Unknown, larva unknown.

Primary type – Holotype (by original designation), female (MVA), examined. From original description, New (1985b): “Holotype, ♀, no data (NMV)”. Condition: good; right antenna and midleg missing; terminalia dissected.

Material examined – (8♂, 11♀). **AUSTRALIA: South Australia:** *Alawoona*: 12 km WSW, 34:46S – 140:22E, 6.i.1996, M.S. & B.J. Moulds (1♀, AMSA); *Blue Hills Bore*: iii.1993 (1♂, SAMA); *Danggali*: Tomahawk Dam ix.1996 (1♀, SAMA); *Danggali CP*: iii.2001 (1♂, 3♀, SAMA); *Karoonda*: G.E.H. Wright (2♂, 3♀, SAMA); *Karoonda to Peebinga*: G.E.H. Wright (1♂ PT, SAMA); *Scorpion Springs C.P.*: 5 km SW, Nanam’s Well, 17.xii.1983 (1♂, 1♀, SAMA); *Yurgo*: i.1956, at light, M.H. Hopgood Mallee (1♀ PT, SAMA); *Welbourne Hills*: 24.x.1953, N.B. Tindale (1♂, 1♀, SAMA); **Western Australia:** *Cosmo Newberry Mission*: x.1960 (1♂, ANIC).

Comments – Based on overall body coloration *A. tindalei* seems closely related to *A. pentagramma*, but they are distinguished by the marks on wings and clypeus, and male terminalia shape. For phylogenetic relationships see (A4 Figs 1-3).

***Aurantileon* new genus**

Type species: *Glenoleon roseipennis* Tylliard 1916, by present designation.

Diagnosis – Ocular setae present [not absent]; palpimacula oval [not slit-like]; forewing broad [not thin]; femoral sense hair slightly longer than femur width [not absent or

longer than half of femur length]; female ectoproct and lateral gonapophyses with cavisetae [not without cavisetae]; lateral gonapophyses as large as ectoproct [not smaller]; anterior gonapophyses absent [not present as plate or a digitiform lobe]; male gonarcus+mediuncus complex triangular in dorsal view [not arched].

Description – Head: *Vertex* raised and set with short setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, distance between width, flagellomeres almost as long as wide at base, apical ones much wider than long. *Palpimacula* oval and located medially. Thorax: *Pronotum* slightly wider than long. Miller's organ present. Wings: *Tip* broad. *Anterior Banksian* line present in both wings, posterior absent. *Forewing* cubital fork located near Rs origin; three presectoral crossveins; subcostal veinlets mostly simple; posterior area generally wider than prefork area. *Hind wing* medial fork located near Rs origin; one presectoral crossvein. *Male pilula axillaris* present. Legs: *Forefemur* about three times longer than forecoxa. Femoral sense hair, short, about same size of femur width. *Tibial spurs* long, surpassing T1 apex, except in *A. drysdalensis* (absent). *Pretarsal claws* slightly longer than half of T5 length. *Tibia* with antennal cleaning setae ventroapically. Male Terminalia: *Ectoproct* rounded in lateral view; gonarcus+mediuncus complex, elongate, and subtriangular in dorsal view; *paramere* simple, long and thin, most times hidden beneath the gonarcus+mediuncus complex. Female Terminalia: *Ectoproct* and *lateral gonapophyses* about same size, beset with cavisetae; *posterior gonapophyses* absent or reduced to a thin structure covered with short setae; *anterior gonapophyses* absent; 7th sternite long, with tip covered by short setae.

Distribution (A4 Figs 158-159) – Australia: NSW, NT, QLD, SA, WA.

Comments – *Aurantileon* is one of the several new genera split out the earlier broad concept of *Glenoleon* (see discussion under that genus). It contains seven species previously placed in *Glenoleon* and one new species (*A. annulatus*, *A. banksi*, *A. drysdalensis*, *A. pingrupensis*, *A. punctatus* n. sp., *A. radialis*, *A. roseipennis*, and *A. stigmatus*) (A4 Figs 1-3). *Aurantileon* species are united based on relatively broad forewing and shape of male and female terminalia.

Biology – *Unknown*.

Etymology – The genus name is derived from the Latin word *aurantius* (= orange-colored) and refers to the body color of most of its species.

Key to species of *Aurantileon*

- 1 Tibial spurs present (reaching apex of T1).....2
- 1' Tibial spurs absent.....*A. drysdalensis*
- 2 Body mostly black with small pale areas.....3
- 2' Body mostly pale to orange, with small black areas.....4
- 3 Hind wing with some radial crossveins shaded; hind wing with rhegmal and stigmal marks about the same size (A4 Fig 58c); clypeus mostly black (A4 Fig 58a).....*A. radialis*
- 3' Hind wing radial crossveins not shaded; hind wing with stigmal mark larger than rhegmal mark (A4 Fig 62c); clypeus pale (A4 Fig 62a).....*A. stigmatus*

- 4 Forewing subcostal and mediocubital areas hyaline or with few crossveins shaded (A4 Fig 60c); female terminalia ventral membrane without thickened setae.....5
- 4' Forewing subcostal and mediocubital areas with a series of rounded dark marks (A4 Fig 56c); female terminalia ventral membrane full of long thickened setae (A4 Fig 57e).....*A. punctatus*
- 5 Female pregenital plate conical (A4 Fig 61e); male gonarcus+mediuncus complex long and covering the paramere in dorsal view (A4 Fig 61c).....6
- 5' Female pregenital plate “U” shaped (A4 Fig 51f); male gonarcus+mediuncus complex short, anterior margin of paramere visible in dorsal view (A4 Fig 51d)7
- 6 Area between antennae mostly black (A4 Fig 60a); male paramere only visible ventral view (A4 Fig 61d); female posterior gonapophyses absent; female 7th sternite posterior margin with two rectangular plates covered with short setae (A4 Fig 61g).....*A. roseipennis*
- 6' Area between antennae mostly pale to orange (A4 Fig 48a); male paramere visible in ventral and lateral view (A4 Fig 49c); female posterior gonapophyses present (A4 Fig 49f); 7th sternite posterior margin without rectangular plates*A. annulatus*
- 7 Area above antennae pale to orange (A4 Fig 50a); forefemur and basal abdominal segments full of long white setae.....*A. banksi*

7' Area above antennae mostly black (A4 Fig 54a); forefemur and basal abdominal segments set with short white setae and few long black setae.....*A. pingrupensis*

***Aurantileon annulatus* (Esben-Petersen 1918), new combination**

(A4 Figs 48-49)

Glenoleon annulatus Esben-Petersen 1918:7 (OD); Esben-Petersen 1923:586 (cit); Stange 1976:304 (cat); New 1985b:50 (key, rd, ill); New 1996:81 (cat); Whittington 2002:382 (cit); Stange 2004:102 (cat); Oswald 2015 (cat).

Diagnosis – Forewing broad [not thin]; body mostly orange [not dark]; tibial spurs present [not absent]; frons with a small dark mark beneath the eyes [not a large mark surrounding the eyes]; posterior gonapophyses short and thin [not absent or long]; pregenital plate large and conical [not in a different format].

Description – Lengths: forewing: 28 – 32 mm; hind wing: 26 – 29 mm.

Head (A4 Figs 48a-b): *Labrum* pale; with a line of white setae. *Clypeus* pale; with few elongate white setae. *Frons* orange to pale except by a transversal dark brown line below antennae, which extends to area between antennae (some specimens the line is reduced to small brown marks below antennae); set with short white setae. *Gena* pale to orange. *Vertex* raised; in frontal view mostly orange to pale with a small medial longitudinal dark brown line and two rounded dark brown spots on each side; in dorsal view mostly orange to pale with a central longitudinal dark brown line, and three rounded dark marks on posterior border; vertex mostly covered with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, about three times longer than pronotum; distance

between width; all segments orange but posterior surface slightly darker; torular membrane orange; flagellomeres almost as long as wide at base, apical ones much wider than long; scape, pedicel and two basal flagellomeres covered with short white setae, remaining flagellomeres set with short black setae. *Mandibles* pale with tip black. *Palpi*, maxillary and labial entirely pale to orange but area around palpimacula darker; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 48b): *Pronotum* slightly wider than long; posterior margin as wide as anterior; subapical furrow present; mostly orange except by small dark spots on setal base, and some larger dark brown marks as follows: a central and two lateral curved marks on posterior region, two small marks at furrow and other two on medial anterior area; beset with short black setae, and some long black and white setae on margins.

Mesonotum orange with small dark rounded spots on setal bases, and some irregular larger dark brown marks on medial area, and two small longitudinal lateral lines at scutum; covered with short black setae, and some long white setae in some specimens.

Metanotum very similar to mesonotum, but dark areas concentrated at scutum medial area and border of scutellum. *Pterothoracic pleura* orange with scattered dark brown spots on anterodorsal sclerites; covered with long white setae; Miller's organ present.

Wings (A4 Fig 48c): Broad; anterior Banksian line present in both wings, posterior absent; veins orange but intercalated with brown spots, beset with short black setae.

Male pilula axillaris present. *Forewing* membrane hyaline; cubital fork located near Rs origin; three presectoral crossveins; subcostal veinlets simple, but few distal crossveins forked; posterior area about as wide as prefork area at cubital fork level; pterostigma

pale. *Hind wing* membrane hyaline, except by a small rhegmal mark; medial fork located near Rs origin; subcostal veilets simple; one presectoral crossvein.

Legs (A4 Figs 48a-b): *All pairs of legs*, femur elongate (near three times longer than coxa); tibia about as long as femur, but about twice longer than tarsi; tibial spurs long, extending over T1 apex; T3 and T4 about same size, T2 slightly longer than T3, T1 longer than T2, T5 longer than T1; claws longer than half of T5 length. *Foreleg* coxa orange with small black marks on posterior surface, covered with elongate white setae; trochanter orange, covered with short white setae; femur mostly orange, except by two brown areas on dorsal surface (an apical and a medial), covered with short white setae, few black setae and scattered long white setae, sense hair short, about as long as femur width; tibia orange but dorsal surface intercalated with three brown marks, covered with many short black setae, few short white setae, and scattered long white setae; tarsi mostly orange but T3, T4 and tip of T5 dark brown, covered with short black setae, T5 ventrally with two rows of thick, long, black setae. *Midleg* very similar to foreleg, except for coxa entirely orange. *Hindleg* with femur and tibia slightly longer than in other legs; all segments orange, except for dark brown tip of tibia, T3, T4 and T5; long setae on tibia are black.

Abdomen: Sternites orange with few irregular brown marks. First abdominal tergite orange with lateral area brown; second tergite mostly brown with few orange marks; remaining tergites with basal halves orange and distal halves brown (some specimens orange areas have few irregular brown marks). Beset with short black setae, and some short white setae on basal sternites.

Male Terminalia (A4 Figs 49a-e): *Ectoproct* large and rounded in lateral view, set with elongate black setae. *9th tergite* large, in lateral view with ventral margin rounded and elongate, covering part of the *9th sternite*. *9th sternite* posterior margin medially straight with lateral areas rounded in ventral view; set with long black setae. *Gonarcus* with anterior margin elongate and straight in posterior view. *Mediuncus* broad and elongate in lateral and posterior view, tip straight. *Paramere* reduced, hidden behind mediuncus in posterior view, in lateral view vertically elongate with tip more sclerotized.

Female Terminalia (A4 Figs 49f-g): *Ectoproct* rounded, set with thin elongate setae and some elongate cavisetae ventrally. *Lateral gonapophyses* rounded, about same size of ectoproct, beset with elongate cavisetae. *9th tergite* set with few elongate cavisetae. *7th sternite* very long with distal margin medially elongate in ventral view (size of elongation varies in different specimens); covered with short black setae, and few thickened setae on elongation tip. *Pregenital plate* a long conical sclerotized structure, in lateral view with tip rounded and curved dorsally. *Posterior gonapophyses* mostly reduced as a small, thin lobe; covered with short setae in some specimens. *9th tergite* without membranous digitiform process. *Anterior gonapophyses* absent. *Ventral membrane* gonapophyseal plates absent, full of short black setae.

Distribution (A4 Fig 158) – Australia: NT, QLD, and WA. New (1985b) presented a series of records for the same states and SA, but these records should be treated carefully because many of specimens studied by him were analyzed here, and most of them actually belong to other species, particularly *A. banksi*. In this sense, New's records are not presented in the distribution map.

Adult activity period – Records from July, August and September.

Biology – Unknown, larva unknown.

Primary type – Holotype (by monotypy), female (NHRS), high-resolution images examined. From original description, Esben-Petersen (1918): “One specimen in alcohol from Cape York, Queensland”. From New (1985b): “Holotype, ♀, (in alcohol), Queensland, Cape York (Stockholm) (seen)”. Condition: in alcohol, good; terminalia dissected.

Material examined – (1♂, 13♀). **AUSTRALIA: Northern Territory:** *Border Waterhole:* Margaret Stn, 27.viii.1967 (1♀, ANIC); *West from Camooweal QLD:* 20.vii.1968, K. Armstrong (1♀, ANIC); *Finke:* 10 km SE, 30.ix.1972 (1♀, FSCA); **Queensland:** *Cloncurry District:* 1940 (1♀, MVM); *Kundala:* (1♀, MVM); *Mount Isa:* 7.viii.1947 (1♀, MVM); **Western Australia:** *Carson escarpment:* 14.49S – 126.49E, 9-15.viii.1975, IFB Common & MS Upton (1♀, 1♂, ANIC); *Elvine Stn Halls Ck:* 1959 (1♀, SAMA); *Forrest River:* 2.viii.1953 (1♀, MVM); *Kimberley:* Margaret Stn, 24.viii.1929, IM MacKerras, TG Campbell (1♀, ANIC); *Lansdowne HS:* 8 mi S, 12-17.vii.1964, R. Plumb (3♀, ANIC).

Comments – New (1985b) discussed the fact that no males were known for *A. annulatus*, and that females exhibited a wide variation in frontal marks. However, with the discovery of the first male and the study of a larger series of the *Aurantileon* species, it is clear that much of the variations noted by New (1985b) resulted from specimens misidentified as *Au. annulatus*. Most of these misidentifications are assigned here to the widespread species *A. banksi*.

Despite its superficial similarity with *A. banksi*, *A. annulatus* is actually more closely related to *A. roseipennis* and *A. punctatus*, based on the large, conical, pregenital plate. However, it can be separated from the later two species based on the presence of the posterior gonapophyses, the shape of male terminalia, and head frontal marks. For phylogenetic relationships see (A4 Figs 1-3).

***Aurantileon banksi* (New 1985), new combination**

(A4 Figs 50-51)

Glenoleon banksi New 1985b:53 (OD); New 1996:81 (cat); Stange 2004:103 (cat); Oswald 2015 (cat).

Diagnosis –Forewing broad [not thin]; body mostly orange [not dark]; forefemur full of long white setae [not few or absent]; tibial spurs present [not absent]; frons with large dark area below and between antennae [not a short mark or surrounding antennae]; posterior gonapophyses absent [not present]; pregenital plate “U” shaped in posterior view [not in a different format]; male paramere with anterior margin visible in dorsal view [not entirely hidden].

Description – Lengths: forewing: 22 – 29 mm; hind wing: 20 – 27 mm.

Head (A4 Figs 50a-b): *Labrum* orange; with a line of elongate setae. *Clypeus* orange to pale; with few elongate pale setae. *Frons* predominantly orange with two curved black bands around ventral and medial part of antennal base; set with short white setae. *Gena* orange to pale. *Vertex* raised; in frontal view mostly orange with two small transversal dark brown marks laterally (intercalated with a small orange region in some specimens),

and a small medial spot; in dorsal view mostly orange with a central longitudinal dark brown spot and three marks on posterior border; set with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, > 3x length of pronotum; distance between width; anterior surface orange, posterior light brown; torular membrane orange; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae. *Mandibles* mostly pale, with tip black. *Palpi*, maxillary and labial entirely orange, but with dark brown marks in some specimens mainly around palpimacula; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 50b): *Pronotum* slightly wider than long; posterior margin as wide as anterior; subapical furrow present; mostly orange except for small dark spots on setal bases (some darker specimens with a central longitudinal band, and two curved longitudinal lines near center); beset with long black or white setae. *Mesonotum* orange with small dark rounded spots on setal bases (some darker specimens with few dark brown longitudinal bands, near midline); covered with long black setae, some long setae on prescutum. *Metanotum* very similar to mesonotum, but darker areas larger; set with short black setae. *Pterothoracic pleura* mostly orange with scattered dark brown areas around margins, and some small rounded spots on setal bases on anterior sclerites; covered with short white setae; Miller's organ present.

Wings (A4 Fig 50c): Broad; anterior Banksian line present in both wings, posterior absent; veins mostly orange, but some veins intercalated with brown spots; beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane hyaline with small

brown marks on pterostigma (some specimens with area surrounding some crossveins dark infuscated); cubital fork located between origins of Rs and MA, but much closer to Rs origin; three presectoral crossveins (some specimens crossveins are linked by a short longitudinal veinlet); subcostal veinlets mostly simple but few distal ones forked in some specimens; posterior area slightly wider than prefork area. *Hind wing* membrane color similar to forewing; medial fork located between the origins of Rs and MA; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 50a-b): *All pairs of legs*, femur elongate (about three times longer than coxa); tibia and femur about same size, but longer than tarsi; tibial spurs surpassing T1 apex; T2, T3 and T4 about same size, T1 about twice longer than T2, T5 about twice longer than T1; claws about half of T5 length; coxa, trochanter, femur and tibia set with many short white setae, femur, tibia and tarsi set with short black setae and scattered long black setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair present, slightly longer than femur width; tibia with antennal cleaning setae ventroapically; coxa orange with some dark brown marks, trochanter orange, femur with tip and most of dorsal surface dark brown, remaining areas orange, tibia with three orange and three dark brown rings, tarsi with T3, T4 and tip of T5 and T2 dark brown, remaining areas orange. *Midleg* with same color of foreleg. *Hindleg* with femur, tibia and T1 slightly longer than in other legs; color same of other legs except for tibia, orange with tip dark brown.

Abdomen: Mostly dark brown with scattered orange marks mainly on tergites bases, size of marks varies among specimens (some specimens with sternites fully orange); beset

with short black setae, and some short white setae mainly on segments anterior halves.

Male Terminalia (A4 Figs 51a-d): *Ectoproct* rounded in lateral view; set with elongate black setae. *9th sternite* posterior margin straight in ventral view; set with elongate black setae. *Gonarcus* and *Mediuncus* fused in a large triangular structure with tip elongate and rounded in lateral and ventral view. *Paramere* longitudinally elongate in ventral view, mostly hidden behind gonarcus + mediuncus complex in lateral and dorsal view.

Female Terminalia (A4 Figs 51e-f): *Ectoproct* rounded, set with thin elongate setae and some cavisetae ventrally. *Lateral gonapophyses* rounded, about same size of ectoproct, beset with cavisetae. *9th tergite* with some thickened setae in lateral view. *7th sternite* distal margin with a bilobate structure, in ventral view (size of lobes varies among specimens); covered with short black setae. *Pregenital plate* large and “U” shaped in posterior view. *Posterior gonapophyses* absent. *9th Tergite* membranous digitiform process absent. *Anterior gonapophyses* absent. *Ventral membrane* gonapophyseal plates absent.

Distribution (A4 Fig 158) – Australia: NSW*, NT, QLD*, SA*, WA. * = new record.

Adult activity period – Records for August to April, and June.

Biology – Unknown, larva unknown.

Primary type – Holotype (by original designation), female (WAM), high-resolution images examined. From original description, New (1985b): “Holotype, ♀, Western Australia, Belele (WAM)”. Condition: good, with some legs missing.

Material examined – (76♂, 128♀). **AUSTRALIA: New South Wales:** *Avon Downs:* 14 mi NW, 23.viii.1960, MJD White (1♂, 1♀, ANIC); *Broken Hill:* 10.ii.1902 (3♂, 3♀, ANIC, 2 PT of *G. aurora*); 19.xi.1949 (1♀, ANIC); 11.iii.1944 (1♂, ANIC); *Mount Boopy:* 27.x.1957 (1♀, ANIC); **Northern Territory:** *Alice Springs:* 19.x.1966, A & R. Mesa (1♀, ANIC); 41 km SbyE, 24.03S – 133.59E, 4.x.1978, MS Upton & RA Barret (1♀, ANIC); *Andado HS:* 2 km WSW, Simpson Desert, 26.ix.1972, Z. Liepa (1♂, ANIC); 13 km EbyN, 25.23S – 135.25E, 27.ix.1972, MS Upton (1♀, ANIC); *Erlunda:* ix.1967 (2♂, MVM); *Finke:* 10 km SE, 25.39S – 134.38E, 30.ix.1972, MS Upton (5♀, ANIC); 10 km SE, 30.ix.1972, Z. Liepa (1♂, ANIC); *Horseshoe Bend:* 8.ix.1963, P. Ranford (2♀, ANIC); *Kulgera:* 8 km N, 25.46S – 133.17E, 21.ix.1978, MS Upton & RA Barret (1♂, ANIC); *Murchison Rg:* 1932 (1♀, SAMA); *Palm Valley:* 30.ix.1959 (1♂, SAMA); *Reedy Rockhole:* Amadeus Basin, 24.20S – 131.35E, 26.ix.1962, P. Ranford (2♂, ANIC); *Tempe Downs:* 14.ix.1963, P. Ranford (1♂, ANIC); **Queensland:** *Avon Downs:* 14 mi NW, 23.viii.1960, MJD White (1♂, 1♀, ANIC); *Cunnamulla:* 23.x.1957 (1♀, ANIC); *Mount Lamington:* xii.1948 (1♂, SAMA); *Windorah:* 204 km west, 25°42'S – 140°53'E, 3.ix.1997, C. Lambkin (1♂, 1♀, QLDM); 84 km east, 25°42'04''S – 143°18'18''E, 5.ix.1997, J & A Skevington (2♂, 2♀, QLDM); **South Australia:** *Allendale Stn:* ix.2005 (2♂, 1♀, SAMA); *Andamooka HS:* 9 km WNW (sandhills), 31.x.1975, at light, H. Herridge (1♂, SAMA); 1.xi.1975 (1♀, SAMA); *Arkaroola HS:* 1.xi.1969, UV light, N. McFarland (2♂, 1♀, SAMA); x.1999 (2♀, SAMA); *Arrona Dam:* S of Copley, 3.xi.1969, UV light, N. McF (1♂, 1♀, SAMA); *Ban Ban Stn:* 24.x.2010 (1♂, SAMA); *Bimbowrie:* ix.1962 (8♀, 4♂, SAMA); *Bookaloo:*

12.x.1966, A & R Mesa (1♂, ANIC); *Chambers Gorge*: x.1961 (1♀, 5♂, SAMA); *Cook Pitfalls*: iv.1984 (1♂, 2♀, SAMA); *Cooper's Ck*: (1♀, SAMA); *Copley*: x.1967 (1♂, SAMA); *Dulkaninna*: ix.1989 (1♂, SAMA); i.2001 (1♂, SAMA); *Farina*: x.1970 (1♀, SAMA); *Gammon Ranges Nt Pk*: Ranger HQ, 30°32'S – 139°18'E, 12.x.1997, S Winterton, J Skevington, C. Lambkin (1♀, QLDM); *Glendambo*: 21.ix.2005, L. Stange & R. Miller (1♀, FSCA); 5.xi.2005, L. Stange (4♀, FSCA); *Grasmere Stn*: ix.1962 (7♀, 5♂, SAMA); *Hawker*: on Orroroo Rd, x.1970 (1♀, SAMA); *Hergott*: (2♀, SAMA); *Indulkana Ck*: ix.2001 (3♂, 3♀, SAMA); *Innaminka*: ix.1962 (1♀, 1♂, SAMA); x.1962 (2♀, 1♂, SAMA); *Iron Knob*: 10 mi NE by E, 23.x.1968, Britton, Upton, Balderson (1♂, ANIC); *Kelchowla Stn*: x.1973 (1♂, SAMA); *Kenmore Park HS*: 8 mi SE, 27.ix.1960, Chinnick, McCabe, Corby (1♂, 1♀, ANIC); *Lake Torrens*: x.1971 (2♀, SAMA); *Leigh Creek*: aerodrome, 28.viii.1967, G. Gregory (1♂, 1♀, SAMA); 17.x.1966, G.C. Gregory (1♂, 11♀, ANIC); ix.1965 (4♀, 4♂, SAMA); viii.1967 (3♀, 3♂, SAMA); *Mabel Ck*: x.1953 (6♀, 4♂, SAMA); *Marree*: xi.1955 (1♀, SAMA); *Marryat Crk*: 48 km S Cavanagh, 28.x.1963, at light, P. Altken & NB Tindale (1♀, SAMA); *McDonalds Downs*: 1930 (2♂, SAMA); *Mirra Mitta Bore*: ix.1976 (1♂, SAMA); *Moolawatana*: ix.1992 (1♂, 3♀, SAMA); *Moolooloo*: (1♀, SAMA); *Moonaree HS*: x.1988 (1♀, SAMA); x.2006 (1♂, SAMA); *Mount Barr*: 24 km SSE of Abminga, 26.20S – 134.56E, 25.ix.1972, Z Liepa (3♀, ANIC); *Mount Barry*: ix.1996 (1♀, SAMA); *Mount Sarah*: 6 km N by W N of Oodnadatta, 24.ix.1972, Z. Liepa (1♀, ANIC); viii.1976 (1♂, SAMA); *Musgrave Park*: 5mi SE, 15.x.1972, H.E. Evans & T. Houston (1♀, SAMA); *Myrtle Ck*: xi.1969 (2♀, SAMA); *Nullarbor Region*: Maralinga Village, xi.2010 (1♂, 2♀, SAMA);

Oodnadatta: 33 km SE by S, 27.47S – 135.39E, 23.ix.1972, MS Upton (2♀, ANIC);
South Gap: Lake Dam, xi.1996 (1♀, SAMA); *Uno Stn*: xi.2008 (1♀, SAMA); *Uro Bluff*:
W of lake Towells, 21.x.1971, H. Mincham (2♀, SAMA); *Yunta*: 28mi S, 27.x.1971,
S.C. Pfeiffer, NACKARA (1♀, SAMA); : x.1972 (1♀, SAMA); *Wabma Springs*:
viii.1970 (1♀, SAMA); *Whywhyana Pk*: x.1969 (2♀, 1♂, SAMA); *Wirraminna*: x.1953
(1♀, SAMA); *Witchelin Stn Reserve*: 22.x.2010 (4♂, SAMA); **Western Australia**:
Balgo Hills: 29.viii.1985 (1♀, ANIC); *Billiluna*: 7 km N, 19°30'39''S – 127°39'47''E,
5.vi.1998, JD Oswald (1♀, FSCA); *Blackstone*: x.2006 (1♀, SAMA); *Carnarvon*:
viii.1971 (1♀, SAMA); *Kalgoorlie*: Minefields, 1969 (1♀, MVM); *Moola Bulla Stn*:
ix.1953 (1♀, SAMA); *Tickalara*: 14.xi.1949 (1♀, ANIC); **NO LABEL**: (1♂, ANIC).

Comments – *Aurantileon banksi* was described based on only few specimens and was mentioned by New (1985b) as closely related to *A. annulatus* and *A. roseipennis*. The current mark reveals it to be more closely related to *A. pingrupensis* (A4 Figs 1-3), in which the male and female terminalia are almost identical, and only a few marks on the body (key). This species is much more common than noted by New (1985b), perhaps because many *A. banksi* specimens were missidentified in that work as *A. annulatus*. In fact, this species appears to be the most common and widely distributed species of *Aurantileon*.

***Aurantileon drysdalensis* (New 1985), new combination**

(A4 Figs 52-53)

Glenoleon drysdalensis New 1985b:45 (OD); New 1996:82 (cat); Stange 2004:104 (cat); Oswald 2015 (cat).

Diagnosis –Forewing broad [not thin]; body mostly orange [not dark]; tibial spurs absent [not present]; frons mostly dark [not mostly orange to pale]; posterior gonapophyses long and thin [not absent or present and short].

Description – Lengths: forewing: 20 – 25 mm; hind wing: 18 – 23 mm.

Head (A4 Figs 52a-b): *Labrum* pale; with a line of elongate setae. *Clypeus* pale; with few elongate black setae. *Frons* predominantly black with ventral margin orange to pale (some specimens with orange to pale marks between antennae); set with few black setae. *Gena* pale. *Vertex* raised; in frontal view mostly orange with a medial transversal dark brown line (interrupted medially in some specimens); in dorsal view mostly orange with scattered dark brown marks, mainly on posterior margin and medially; set with some short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, > 3x length of pronotum; distance between width; four to five subapical flagellomeres completely pale (some specimens apical flagellomeres and scape, entirely dark brown), remaining segments light brown with a dorsal pale ring; torular membrane orange to pale; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae. *Mandibles* mostly pale, with tip black. *Palpi*, maxillary and labial pale; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 52b): *Pronotum* wider than long; posterior margin as wide as anterior; subapical furrow present; mostly orange to pale except for some dark brown marks as

follows: a central large “X” shaped, two curved and thin surrounding central one, and two small located on margins (some specimens with darker areas larger, often linked); beset with short black setae and some long ones at borders. *Mesonotum* coloration mostly orange to pale, with some dark brown areas distributed on segments, scutum with a broad central mark and thin longitudinal lines laterally; covered with short black setae. *Metanotum* orange, with few small dark brown marks, mainly near wings bases and midline. *Pterothoracic pleura* mostly orange to pale with scattered dark brown areas (in darker specimens these areas are larger); covered with white and black setae; Miller’s organ present.

Wings (A4 Fig 52c): Broad; anterior Banksian line present in both wings, posterior absent; veins mostly pale, but some veins intercalated with brown spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane hyaline with small amber marks on pterostigma and rhegmal area (some specimens with marks darker and area surrounding crossveins marked); cubital fork located between origins of Rs and MA; three presectoral crossveins; most of subcostal veinlets simple but some forked; posterior area about same size as prefork area. *Hind wing* membrane hyaline with small amber rhegmal spot; medial fork located between origins of Rs and MA origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 52a-b): *All pairs of legs*, femur elongate (near three times longer than coxa); tibia and femur about same size but slightly longer than tarsi; tibial spurs absent; T2, T3 and T4 about same size, T1 twice longer than T2, T5 slightly longer than T1; claws about half of T5 length; coxa set with many short white setae, remaining segments

set whit short black setae and scattered long black setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair short, almost as long as femur width; tibia with antennal cleaning setae ventroapically; coxa pale with some dark brown marks, trochanter pale, femur pale with tip and part of dorsal surface dark brown, tibia pale with tip and a medial ring dark brown, tarsi pale with tip of T5 dark brown in some specimens. *Midleg* with same color of foreleg. *Hindleg* with femur, tibia and T1 slightly longer than in other legs; color same of other legs except for tibia that lacks the dark medial ring in some specimens.

Abdomen: Tergites mostly orange with scattered dark brown marks, size of these marks varies among specimens. Sternites pale to orange, with a few dark brown marks in some specimens. Beset with short black setae.

Male Terminalia (A4 Figs 53a-c): *Ectoproct* rounded in lateral view, set with elongate black setae. *9th sternite* posterior margin rounded in ventral view; set with elongate black setae. *Gonarcus* simple and arched in lateral view. *Mediuncus* long, and fused with gonarcus. *Paramere* weakly sclerotized, vertically elongate and curved in lateral view.

Female Terminalia (A4 Figs 53d-e): *Ectoproct* rounded, set with thin elongate setae and some cavisetae ventrally. *Lateral gonapophyses* rounded, about same size of ectoproct, beset with cavisetae. *9th tergite* with some cavisetae on ventral area in lateral view. *7th sternite* distal margin straight in ventral view; covered with short black setae. *Pregenital plate* transversally elongate with anterior margin rounded in ventral view. *Posterior gonapophyses* thin, elongate, curved, and covered with long black setae and few

thickened setae. 9th tergite without membranous digitiform process. *Anterior gonapophyses* absent. *Ventral membrane* gonapophyseal plates absent.

Distribution (A4 Fig 158) – Australia: NT*, QLD*, SA*, WA. * = new record.

Adult activity period – Records for February to March, May, August and October to December.

Biology – Unknown, larva unknown.

Primary type – Holotype (by original designation), female (ANIC), examined. From original description, New (1985b): “Holotype, ♀, Western Australia, 14°39’S., 126°57’E., Drysdale River, 18-21.viii.1975, I. F. B. Common and M. S. Upton (ANIC)”. Condition: good; terminalia dissected.

Material examined – (11♂, 8♀). **AUSTRALIA: Northern Territory:** *Borroloola*: 46 km SSW, 16.28S – 136.09E, 28.x.1975, M.S. Upton (1♂, ANIC); *Renner Springs*: 20 km N, 17.xi.1989, R.B. Miller (1♂, 1♀, FSCA); **Queensland:** *Charter Towers*: 13 km W, 11.xii.1989, R.B. Miller (1♀, TAMU); *Mt. Isa*: 61 km E, 7.xii.1989, R.B. Miller (1♂, FSCA); **South Australia:** *Musgrave Rg*: x.1994 (1♂, SAMA); **Western Australia:** *Carson escarpment*: 14.49S – 126.49E, 9-15.viii.1975, I.F.B. Common & M.S. Upton (1♀, ANIC); *Drysdale River*: 14°39’S - 126°57’E, 18-21.viii.1975, I.F.B. Common and M.S. Upton (2♂PT, 1♀PT, ANIC) *Newman*: 57 km W, 25°51’17.0’’S - 119°04’39.4’’E, 2.iii.1994, L. Stange (1♂, 1♀, FSCA); *Whim Creek Hotel*: 28°50’26.6’’S - 117°56’4.7’’E, 27.ii.1994, R. Miller & L. Stange (1♂, TAMU); *Whim Creek Pub*: 25 km NE, 20°51’33.0’’S - 118°03’23.0’’E, 28.ii.1994, L. Stange & R. Miller (2♂, 1♀, FSCA; 1♂, TAMU); *Wittenoom*: 4.v.1996, L. Stange (1♀, FSCA).

Comments – The relatively small size of *Aurantileon drysdalensis* and absence of tibial spurs clearly distinguish it from other species of *Aurantileon*. For phylogenetic relationships see (A4 Figs 1-3).

***Aurantileon pingrupensis* (New 1985); new combination**

(A4 Figs 54-55)

Glenoleon pingrupensis New 1985b:53 (OD); New 1996:83 (cat); Stange 2004:105 (cat); Oswald 2015 (cat).

Diagnosis – Forewing broad [not thin]; body mostly orange [not dark]; forefemur with some short white setae [not full of long setae]; tibial spurs present [not absent]; frons with large dark mark surrounding antennae [not a short mark not surrounding antennae]; pregenital plate “U” shaped in posterior view [not in a different format]; male paramere with anterior margin visible in dorsal view [not entirely hidden].

Description – Lengths: forewing: 20 – 26 mm; hind wing: 18 – 24 mm.

Head (A4 Figs 54a-b): *Labrum* orange to pale; with a line of elongate setae. *Clypeus* orange to pale; with few elongate black setae. *Frons* predominantly orange to pale with a large dark brown transversal band enclosing antennae, but interantennal space orange to pale; set with some short white setae. *Gena* orange to pale. *Vertex* raised; in frontal view mostly orange to pale with two small transversal dark brown marks laterally, and a small medial spot; in dorsal view mostly orange with a central longitudinal dark brown line and three marks on posterior border; set with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, > 2x length of pronotum; distance between width; with

anterior surface orange and posterior brown; torular membrane orange; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae. *Mandibles* mostly pale, with tip black. *Palpi*, maxillary and labial entirely orange, but with dark brown marks or completely dark brown in some specimens; apical labial palpomere fusiform, palpimacula oval-shaped, located medially. Thorax (A4 Fig 54b): *Pronotum* slightly wider than long; posterior margin as wide as anterior; subapical furrow present; mostly orange except for small dark spots on setal bases (some darker specimens with a central longitudinal band on posterior half, and two curved longitudinal lines near center); beset with long black and white setae, white setae longer mainly at margins. *Mesonotum* coloration orange to pale with small dark rounded spots on setal bases (darker specimens with few dark brown longitudinal bands, mainly near midline); covered with long black setae, with ones at prescutum longer. *Metanotum* very similar to mesonotum, but with darker areas larger; set with short black setae. *Pterothoracic pleura* mostly orange to pale with scattered dark brown areas around margins, anterior segments with small rounded spots on setal bases; covered with short white setae; Miller's organ present.

Wings (A4 Fig 54c): Broad; anterior Banksian line present in both wings, posterior absent; veins mostly orange, but some veins intercalated with brown spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane hyaline but some specimens with area surrounding some crossveins and subcostal area light brown infuscated; pterostigma light brown, but with base darker in some specimens; cubital fork located between origins of Rs and MA, but closer to Rs origin; three presectoral

crossveins, in some specimens these veins are fused by a short longitudinal veinlet; subcostal veinlets mostly simple but with few forked in some specimens; prefork area slightly narrower than prefork area; prefork crossveins simple. *Hind wing* membrane color like in forewing; medial fork located between origins of Rs and MA; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 54a-b): *All pairs of legs*, femur elongate (near three times longer than coxa); tibia and femur about same size, but longer than tarsi; tibial spurs surpassing T1 apex; T2, T3 and T4 about same size, T1 twice longer than T2, T5 about twice longer than T1; claws about half of T5 length; coxa, trochanter and femur set with many short white setae, femur, tibia and tarsi set with short black setae and scattered long black setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair about twice femur width; tibia with antennal cleaning setae ventroapically; coxa orange to pale with some dark brown marks, trochanter orange to pale, femur with tip and most of dorsal surface dark brown, remaining areas orange to pale, tibia with three orange and three dark brown rings, tarsi with T2, T3, T4 and tip of T5 dark brown remaining areas orange to pale. *Midleg* with same color of foreleg. *Hindleg* with femur, tibia and T1 slightly longer than in other legs; color pattern similar to other legs except for tibia and femur entirely orange to pale, but tip dark brown.

Abdomen: Sternite mostly orange to pale. Basal two tergites almost entirely dark brown remaining tergites with basal halves orange to pale, apical halves dark brown. In some specimens size of tergite dark marks much smaller. Beset with short white setae.

Male Terminalia (A4 Figs 55a-d): *Ectoproct* rounded in lateral view, set with elongate black setae. 9th sternite posterior margin straight, in ventral view; with elongate black setae. *Genitalia* semi triangular in dorsal view. *Gonarcus* broad, arched, with anteroventral margin straight in posterior view. *Mediuncus* broad with tip rounded in posterior view, and acute in lateral view. *Paramere* longitudinally elongate, with posterior half hidden beneath the gonarcus+mediuncus complex in dorsal view.

Female Terminalia (A4 Figs 55e-f): *Ectoproct* rounded, set with thin elongate setae and some cavisetae ventrally. *Lateral gonapophyses* rounded, about same size of ectoproct, beset with cavisetae. 7th sternite very long with distal margin straight in ventral view; covered with short black thickened setae. *Pregenital plate* large and concave in posterior view. *Posterior gonapophyses* very small, almost imperceptible, absent in some specimens. 9th tergite membranous digitiform process absent. *Anterior gonapophyses* absent. *Ventral membrane* gonapophyseal plates absent.

Distribution (A4 Figs 158) – Australia: NT*, QLD*, WA. * = new record.

Adult activity period – Records for March to November.

Biology – Unknown, larva unknown.

Primary type – Holotype (by original designation), female (ANIC), examined. From original description, New (1985b): “Holotype, ♀, Western Australia, 1 mile W. Duggan, 20.x.1954, J. H. Calaby (ANIC)”. Condition: good; left foreleg missing.

Material examined – (43♂, 24♀). **AUSTRALIA:** (1♂, ZMHB); **Northern Territory:** *Banka Banka:* vi.1942 (1♂, SAMA); *Kings Canyon:* (Au 12), 19.ix.2005, IR. Miller & L. Stange (1♀, FSCA); *Tanami Borehole:* 19.59S – 120.42E, vii-ix.1971, J Hodgson

(2♂, ANIC); **Queensland:** *Camooweal*: 4 km E, 19.56S – 138.09E, 12.v.1973, MS Upton & RS McInnes (7♂, 4♀, ANIC); *Cloncurry*: (1♀, SAMA); **Western Australia:** *Barradale*: 23 km WSW, 22.56S – 114.45E, 30.iii.1971, EF Riek (1♀, ANIC); *Billihuna*: 7 km N, 19°30'39''S - 127°39'47''E, 5.vi.1998, MV, JD Oswald (3♂, 3♀, TAMU); *Cane River HS*: 17 km NbyE, 21.56S – 115.39E, 27.iv.1971, Upton & Mitchell (1♀, ANIC); *Halls Creek (town)*: ca 85 km ESE, 18°24S - 128°28E, 4.vi.1998, MV, JD Oswald (2♂, 2♀, FSCA, 27♂, 9♀, TAMU); *Halls Creek*: 40 km SW, 18°29'31''S - 127°24'05''E, 6.vi.1998, MV, JD Oswald (2♀, TAMU)

Comments – *Aurantileon pingrupensis* was described by New (1985b) based on four females. New noted that the species was closely related to *A. banksi* based on female terminalia, but the marks on frons and pterostigma supported their separation. The discovery of the male corroborates New's hypothesis, confirming a close relationship between the two species. In fact, *A. pingrupensis* and *A. banksi* are similar enough that future population level work might justify synonymizing them. However, for now we have decided to retain both species, based on differences in body color pattern and presence of small posterior gonapophyses in *A. pingrupensis*.

The four females of the type series are slightly paler than average and the mark on pterostigma base is more evident than in most specimens studied here. But, the shape of female terminalia, the constant form of head marks, and chaetotaxy clearly group these specimens with others identified here as *A. pingrupensis*. For phylogenetic relationships see (A4 Figs 1-3).

***Aurantileon punctatus*, new species**

(A4 Figs 56-57)

Diagnosis –Forewing broad [not thin]; forewing full of brown punctuations [not hyaline, or with large brown marks]; tibial spurs present [not absent]; posterior gonapophyses absent [not present]; pregenital plate large and conical [not in a different format]; female ventral membrane full of long thickened setae [not full of regular setae]; male gonarcus+mediuncus complex very long [not short]; male paramere absent [not present].

Description – Lengths: forewing: 25 – 28 mm; hind wing: 23 – 26 mm.

Head (A4 Figs 56a-b): *Labrum* mostly brown, except for ventral margin and a central longitudinal orange line; set with a line of elongate setae. *Clypeus* pale to orange; with some elongate black setae. *Frons* with a dark brown area surrounding antennae, but with ventral margin and a rounded spot between antennae orange; covered with short white setae. *Gena* orange. *Vertex* raised; in frontal view mostly orange with five dark brown spots set in a central transversal line (in some specimens external spots connected forming two short transversal lines); in dorsal view mostly orange with a central longitudinal dark brown line, and some irregular dark marks on posterior border; vertex mostly covered with short black setae and few short white setae laterally. *Ocular rim* setae absent. *Antennae* clubbed; elongate, about three times longer than pronotum; distance between width; all segments orange but posterior surface of scape, pedicel and first flagellomere slightly darker; torular membrane orange; flagellomeres slightly wider than long, mainly apical ones; scape and pedicel covered with short white setae, remaining segments set with small black setae. *Mandibles* mostly pale, with tip black.

Maxillary Palpi mostly orange but with dark spots on basal segments and great part of second segments. *Labial Palpi* orange but with large areas of basal segments and around palpimacula dark brown; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 56b): *Pronotum* slightly wider than long; posterior margin as wide as anterior; subapical furrow present; orange but full of small dark spots on setal bases, and some larger dark brown marks mainly on posterior margin and central region; beset with black setae and some long white setae at marginal region. *Mesonotum* orange but full of small dark punctuations on setal bases and some irregular larger dark brown marks at medial area and segments margins, some specimens with lateral longitudinal dark lines at scutum; covered with long black setae with prescutum setae long. *Metanotum* orange, but with dark punctuations on setal bases, mainly at prescutum, and some lateral longitudinal lines at scutum. *Pterothoracic pleura* orange with dark punctuations on setal bases on anterior segments, and some irregular dark marks on sclerites margins; covered with long white setae, and some long black setae on black punctuations; Miller's organ present.

Wings (A4 Fig 56c): Fairly broad; anterior Banksian line present in both wings, posterior absent; veins mostly orange but intercalated with light brown areas, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline (slightly darker than hind wing) but with rounded brown spots surrounding some of the crossveins at cubital and radial areas; spots on radial area generally expanding to subcostal area; cubital fork located near Rs origin; three presectoral crossveins, in some

specimens there is a longitudinal veinlet connecting RS+MA with the distal presectoral vein; subcostal veinlets simple, but with few crossveins forked near pterostigma; posterior area generally slightly wider than prefork area at cubital fork level; prefork crossveins simple. *Hind wing* membrane hyaline, with a rounded brown rhegmal spot; medial fork located near Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs: *All pair of legs*, femur elongate (near three times longer than coxa); tibia slightly longer than femur; femur slightly longer than tarsi; tibial spurs long, reaching apex of T1; T3 and T4 about same size, T2 slightly longer than T3, T1 slightly longer than T2, T5 longer than T1; claws about as long as half of T5 length. *Foreleg* coxa and trochanter orange except for small dark marks on posterior surface of coxa, both covered with white setae; femur proximal half orange but distal half dark brown with medial area orange, sense hair about as long as femur width, covered with short white setae, some long white setae and scattered long black; tibia orange with three brown rings, two on proximal half and one at distal apex; ventral surface covered with short white setae and antennal cleaning setae ventroapically, dorsal surface covered with short black setae, and few long black and white setae; tarsi mostly orange but T3, T4 and tip of T5 dark brown, covered with short black setae, T5 ventrally with two rows of thick, long, black setae. *Midleg* similar to foreleg. *Hindleg* with femur and tibia slightly longer than in other legs; color similar except for tibia and femur entirely orange but tip dark brown, and T3 and T4 orange.

Abdomen: Mostly orange but full of irregular dark brown areas; in some darker specimens these marks are larger, covering most part of some sclerites. Sclerites mostly covered by short white setae, and some short black setae, mainly at distal tergites.

Male Terminalia (A4 Figs 57a-d): *Ectoproct* rounded in lateral view, set with elongate black setae. 9th sternite posterior margin with tip curved, in ventral view; set with elongate black setae. *Genitalia* very elongate, with tip exposed. *Gonarcus* and *Mediuncus* fused, elongate with tip rounded. *Paramere* absent.

Female Terminalia (A4 Figs 57e-f): *Ectoproct* rounded, set with thin elongate setae and some elongate cavisetae ventrally. *Lateral gonapophyses* rounded, about same size of ectoproct, beset with elongate cavisetae. 7th sternite long with medial region of distal margin elongate and acute in lateral view; covered with black thick setae on distal area. Ventral membrane and distal margin of pleura between 7th sternite and 8th tergite, full of black thick setae. *Pregenital plate* a long conical sclerotized structure; in lateral view with tip curved. *Posterior* and *anterior gonapophyses* absent. 9th tergite membranous digitiform process absent. *Ventral membrane* gonapophyseal plates absent.

Distribution (A4 Figs 159) – Australia: NT, QLD, and WA.

Adult activity period – Records for March to May and August to December.

Biology – Unknown, larva unknown.

Etymology – The specific name is derived from the Latin words *punctum* (= spot, punctuation) and refers to the series of brown spots in the forewing.

Primary types – Holotype (by present designation), female, (WAM). **AUSTRALIA:**

Western Australia: *Kiwirrkurra IPA*: Survey Site 2, south face of sand dune,

22.81222°S – 127.83119°E, 425m, 15/09/2015, N. Tatarnic, [BBKIWI_L01] // ENT1161. Condition: pinned, excelent.

Paratype: AUSTRALIA: Northern Territory: *King Canyon (Au 12)*: 19.ix.2005, R. Miller & L. Stange (1♀, FSCA, pinned); *Renner Springs*: 18.19S – 133.48E, 13.Aug.1990, M.S. Upton (1♂, ANIC, pinned); **Queensland:** *3 km West Windorah*: 27°25'S – 152°50'E, 5.ix.1997, C. Lambkin, S. Winterton, J & A Skevington, A. Zwick (2♀, QLDM, pinned); **Western Australia:** *Broome*: 186 km SEbyE, 18.53S – 123.43E, 11.August.1976, I.F.B. Common (1♀, ANIC, pinned); *Broome*: 150 km SEbyE, 18.55S – 123.14E, 12.August.1976, I.F.B. (1♂, ANIC, pinned); *Broome*: 163 km SEbyE, 18.49S – 123.17E, 4.August.1976, I.F.B. (1♀, ANIC, pinned); *Kiwirrkurra IPA*: Visitor Centre, 22.81979°S – 127.76564°E, 430m, 07/09/2015, N. Tatarnic, [BBKIWI_L03] // ENT1161 (1♂, WAM, pinned); *Pungkulpirri Waterhole*: 0.5 km E, Walter James Rg, 24°39'15''S – 128°45'18''E, 26.sep.2006, at light, Central Ranges Sur. Camp 1 // 24-000113 (1♂, SAMA, pinned).

Extra material examined – (3♀, 1?). **AUSTRALIA: Northern Territory:** *Haast Bluff Stn*: C. Aust. 2000 ft, 4.ix.1957, N.B. Tindale (1?, SAMA); **Western Australia:** *Broome*: 163 km SEbyE, 18.49S – 123.17E, 4.viii.1976, IFB Common (3♀, ANIC);

Comments – *Aurantoleon punctatus* is clearly associated with *A. annulatus*, and *A. roseipennis*, based on female and male terminalia. However, it also seems to be closely related to *A. roseipennis*, based on the absence of posterior gonapophyses and male genitalia, which stick out of the end of the abdomen. The latter trait is unique among the “*Perichlystus* genus group”. The long, thick, setae of the female terminalia and the two

rows of brown punctuations on the forewing easily distinguish *A. punctatus* from other *Aurantileon* species. For phylogenetic relationships see (A4 Figs 1-3).

***Aurantileon radialis* (Banks 1913), new combination**

(A4 Figs 58-59)

Glenoleon radialis Banks 1913:224 (OD); Stange 1976:306 (cat); New 1985b:33 (key, rd, ill); New 1996:84 (cat); Stange 2004:106 (cat); Oswald 2015 (cat).

Diagnosis – Body mostly black [not mostly pale]; clypeus mostly black [not mostly pale]; hind wing with some radial crossveins brown shaded [not crossveins without marks]; tibial spurs present [not absent]; hind wing rhegmal and stigmal marks about same size [not stigmal much larger]; posterior gonapophyses elongate and thin [not absent or broad].

Description – Lengths: forewing: 33 – 36 mm; hind wing: 30 – 33 mm.

Head (A4 Figs 58a-b): *Labrum* black centrally and pale marginally, set with a line of elongate setae. *Clypeus* pale with central brown marks; set with few elongate black setae. *Frons* predominantly black, except for ventrolateral margin pale; some specimens with area between antennae pale; beset with short white setae. *Gena* pale. *Vertex* raised; in frontal view pale, with a median black line interrupted centrally; in dorsal view mostly black except by some pale areas around central region posteriorly; set with short black or white setae. *Ocular rim* setae very short, black or white. *Antennae* clubbed; elongate, > 2x length of pronotum; distance between width; entirely dark-brown to black; torular membrane yellow; flagellomeres almost as long as wide at base, apical ones much wider

than long; all segments set with short black setae. *Mandibles* dark brown, with some pale areas externally. *Palpi*, maxillary and labial dark brown with distal margin of segments generally pale, apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 58b): *Pronotum* about as long as wide; posterior margin as wide as anterior; subapical furrow present in some specimens; generally pale with a broad black longitudinal band on midline (flanked on each side by a thinner pale longitudinal band), margins generally black; set with many short or long black setae, and some long white setae mostly located at margins. *Mesonotum* generally black, with some small longitudinal yellow bands on each side, scutellum mostly pale with black dorsal marks, but entirely black in some specimens; covered with short black or white setae. *Metanotum* usually black with some pale areas, mostly at sclerites margins; covered with short white setae. *Pterothoracic pleura* black with some pale areas generally between sclerites; set with white setae; Miller's organ present.

Wings (A4 Fig 58c): Fairly broad; anterior and posterior Banksian lines present in both wings; veins mostly brown but intercalated with white spots, set with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline with brown marks generally concentrated at tip, pterostigma, and around crossveins (mainly radial crossveins); cubital fork located near origin of Rs; three presectoral crossveins; subcostal veinlets simple; prefork area slightly wider than posterior area. *Hind wing* membrane mostly hyaline except by brown marks around crossveins, tip and rhegmal and stigmal

areas; medial fork located between origins of Rs and MA; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 58a-b): *All pairs of legs*, femur elongate (near three times longer than coxa); tibia and femur about same size but longer than tarsi; tibial spurs reaching apex of T1; T2, T3 and T4 about same size, T1 about twice longer T2, T5 about twice longer T1; claws about half of T5 length; coxa, trochanter, and femur set with short white setae; femur, tibia and tarsi set with short black setae, and scattered long black setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair as long as femur width; tibia with antennal cleaning setae ventroapically; coxa, trochanter, and femur dark brown, some specimens with a pale area on femur anterior surface; tibia dark brown with three pale rings; tarsi dark brown, except for base of T1, pale. *Midleg* with same color pattern of foreleg. *Hindleg* with femur, tibia and T1 slightly longer than in other legs; color pattern similar to anterior legs, except for tibia pale but tip and ventral surface, dark brown.

Abdomen: Usually entirely black or dark brown, but occasionally with irregular pale spots on sclerites posterior margins. Beset with short white setae.

Male Terminalia (A4 Figs 59a-c): *Ectoproct* rounded in lateral view, set with elongate black setae. *9th sternite* posterior margin with medial region acute in ventral view; set with elongate black setae. *Genitalia* semi triangular in dorsal view. *Gonarcus* broad and connected to *Mediuncus*, which is acute apically in lateral view. *Paramere* weakly sclerotized, thin, and elongate in lateral view.

Female Terminalia (A4 Figs 59d-e): *Ectoproct* rounded, set with thin elongate setae and some long cavisetae ventrally. *Lateral gonapophyses* rounded, about same size of ectoproct, beset with elongate cavisetae. 8th and 9th *tergite* with few thickened setae on ventral area in lateral view. 7th *sternite* distal margin with a small invagination in ventral view; covered with short black setae. *Pregenital plate* large, with ventral margin curved in lateral view; curved and concave in posterior view. *Posterior gonapophyses* thin, elongate, covered with short black setae. 9th *tergite* with a short membranous digitiform process. *Anterior gonapophyses* absent. *Ventral membrane* gonapophyseal plates absent.

Distribution (A4 Fig 159) – Australia: NT, QLD, and WA.

Adult activity period – Records for March to June.

Biology – Unknown, larva unknown.

Primary type – Holotype (by original designation), female (ANIC), examined. From original description, Banks (1913): “*Type* - ♀. From Port Darwin, Australia, 12th May (Dodd)”. From New (1985b; 1986): “Holotype, ♀, Northern Territory, Darwin, 12 May (Dodd) (formerly MCZ, now ANIC) (seen)”. Condition: good; terminalia dissected.

Material examined – (17♂, 37♀). **AUSTRALIA: Northern Territory:** *Batchelor*: ½ mi. S.E., Camp 9, 12.iv.1966, U.V. light, N. McFarland (5♀, 8♂, SAMA); *Creswell Downs*: 9.iv.1986, J. Howard (3♀, QLDM); *Daly Watters*: iv.1966 (1♀, SAMA); *Hiway Inn*: 3.iv.2008, ex woodland, at light, G. Williams and W. Pulawski (1♂, 4♀, AMSA); *Katherine*: 98 km SW, 15.07S – 131.42E, 1.iv.1995, E.D. Edwards & M. Matthews (1♀, ANIC); *Nabarlek Dam*: 14 km SSW of Nimbuwah Rock, 12.19S – 133.19E, 2.vi.1973, M.S. Upton (2♀, ANIC); **Queensland:** *Georgetown*: Newcastle

Range, 18.18S -143.44E, 21.iii.1995, E.D. Edwards & M. Matthews (2♂, ANIC); *Mica Creek*: 16.iii.2001 (1♂, 6♀, QLDM); *Mornington Island Mission*: 11-12.v.1963, at light, P. Aitken & N.B. Tindale (1♂, 6♀, SAMA); *Normanton*: 14.iv.1961, at light, E.N. Marks (1♂, 1♀, ANIC, QLDM); *Riversleigh HS*: iv.1986 (1♀, SAMA); **Western Australia**: *70 mi. ESE Kununurra*: 17.iv.1966, U.V. light, N. McFarland (2♀, 1♂, SAMA); *Fitzroy Crossing area*: 24.iii.1984, at light, K. & E. Carnaby (2♀, AMSA); *Lissadell*: 24 km NNW, 16.33S – 128.12E, 7.iv.1995, E.D. Edwards & M. Matthews (1♀, 2♂, ANIC).

Comments – *Aurantileon radialis* is clearly associated with *A. stigmatus* as previously mentioned by New (1985b). Both species appear to be restricted to the northern part of Australia. They have dark bodies and both female and male terminalia share many similarities. They can be easily separated based on wing and clypal markings. For phylogenetic relationships see (A4 Figs 1-3).

***Aurantileon roseipennis* (Tillyard 1916), new combination**

(A4 Figs 60-61)

Glenoleon roseipennis Tillyard 1916:57 (OD); Esben-Petersen 1923:586 (cit); Stange 1976:306 (cat); New 1985b:51 (key, rd, ill); New 1996:84 (cat); Stange 2004:106 (cat); Oswald 2015 (cat).

Diagnosis –Forewing broad [not thin]; forewing hyaline [not with brown punctuations]; tibial spurs present [not absent]; posterior gonapophyses absent [not present]; pregenital plate large and conical [not in a different format]; posterior margin of 7th sternite with

two rectangular plates [plates not absent]; male gonarcus+mediuncus complex very long [not short].

Description – Lengths: forewing: 28 – 34 mm; hind wing: 26 – 32 mm.

Head (A4 Figs 60a-b): *Labrum* orange; with a line of elongate setae. *Clypeus* pale to orange; with few elongate pale setae. *Frons* predominantly orange with some dark brown areas, generally with two small curved marks near antennal base, but in some specimens marks are much larger, fused and covering interantennal space; set with short white setae. *Gena* pale to orange. *Vertex* raised; in frontal view mostly orange with a small medial longitudinal dark brown line and two rounded dark brown spots on each side; in dorsal view mostly orange with a central longitudinal dark brown line, three rounded dark marks on posterior border, and some irregular dark small marks at central area; vertex covered with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, > 4x length of pronotum; distance between width; all segments orange but with posterior surface slightly darker; torular membrane orange; flagellomeres almost as long as wide at base, apical ones much wider than long; scape, pedicel and two basal flagellomeres covered with short white setae, remaining flagellomeres set with short black setae. *Mandibles* mostly pale, with tip black. *Palpi*, maxillary and labial entirely pale to orange but with area around palpimacula darker; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 60b): *Pronotum* wider than long; posterior margin as wide as anterior; subapical furrow present; mostly orange except for small dark spots on setal bases, and some dark brown marks as follows: a central and two curved marks on posterior region

and two small marks at furrow; beset with short black setae, and some long black setae on margins; sometimes with few elongate white setae on anterior margin corners. *Mesonotum* orange with small dark rounded spots on setal bases, some irregular larger dark brown marks at medial area, and two small longitudinal lateral lines at scutum; covered with long black setae, with ones at prescutum longer. *Metanotum* very similar to mesonotum, but with darker areas larger, and with less short black setae. *Pterothoracic pleura* orange with scattered dark brown spots at anterior sclerites; covered with long white setae; Miller's organ present.

Wings (A4 Fig 60c): Broad, anterior Banksian line present in both wings, posterior absent; veins mostly orange, but some veins intercalated with brown spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane hyaline; cubital fork located close to Rs origin; three presectoral crossveins, in some specimens there is a longitudinal veinlet connecting RS+MA with the distal presectoral vein; subcostal veinlets simple; posterior area as wide as prefork area at cubital fork level, but slightly wider in some specimens. *Hind wing* membrane hyaline; medial fork located between origins of Rs and MA, but closer to Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Fig 60a): *All pairs of legs*, femur elongate (near three times longer than coxa); tibia slightly longer than femur, and longer than tarsi; tibial spurs surpassing T1 apex; T3 and T4 about same size, T2 slightly longer than T3, T1 longer than T2, T5 longer than T1; claws longer than half of T5 length. *Foreleg* coxa orange with small black marks on posterior surface, covered with elongate white setae; trochanter orange, covered with

short white setae; femur mostly orange, except for two brown areas on dorsal surface (one at apex and other medial), sense hair short, about as long as femur width, covered with short white setae, scattered long setae, and few short black setae at apex of dorsal surface; tibia orange with three brown rings, ventral surface covered with short white setae and antennal cleaning setae ventroapically, dorsal surface covered with short black setae, and scattered long black and white setae; tarsi mostly orange but T3, T4 and tip of T5 dark brown, covered with short black setae, T5 ventrally with two rows of thick, long, black setae. *Midleg* very similar to foreleg, except for coxa entirely orange. *Hindleg* with femur and tibia slightly longer than in other legs; color similar to midleg except for tibia and femur entirely orange, but tip dark brown.

Abdomen: Mostly orange but full of dark brown areas. Dark areas mostly on tergites posterior halves, in some darker specimens the whole area is dark brown, but in other specimens this area is full of irregular orange marks. Anterior sternites dark brown, but posterior ones mostly orange with irregular brown marks. Beset with short black setae, and some short white setae mostly on basal segments.

Male Terminalia (A4 Figs 61a-d): *Ectoproct* rounded in lateral view; set with elongate black setae. *9th sternite* posterior margin medially elongate with tip rounded in ventral view; set with long black setae. *Genitalia* elongate with tip always exposed. *Gonarcus* and *Mediuncus* fused, very long, with tip rounded in posterior view and acute in lateral view. *Paramere* weakly sclerotized, as two parallel longitudinal lines, located beneath gonarcus + mediuncus complex in ventral and lateral view.

Female Terminalia (A4 Figs 61e-g): *Ectoproct* rounded, set with thin elongate setae and some long cavisetae ventrally. *Lateral gonapophyses* rounded, about same size of ectoproct, beset with elongate cavisetae. 7th *sternite* very long but covered with short black setae; posterior region with two large rectangular plates that bend over distal margin; plates covered with many short setae. *Pregenital plate*, a long conical sclerotized structure; tip rounded but with a small dorsal expansion in lateral view. *Posterior* and *anterior gonapophyses* absent. 9th *Tergite* membranous digitiform process absent. *Ventral membrane* gonapophyseal plates absent.

Distribution (A4 Figs 159) – Australia: NT, QLD, SA, and WA. The records presented by New (1985b) are not considered here, many specimens studied by the author were checked during this study, and most of them actually belong to other species, particularly *A. punctatus* and *A. banksi*.

Adult activity period – Records for March, June to October.

Biology – Unknown, larva unknown.

Primary type – Holotype (by original designation), male [not female], (BMNH), high-resolution images examined. From original description, Tillyard (1916): “Hab.--- Winton, Q. A unique ♀, taken by Mr. R. L. Higgins, in 1912. Type in Coll. Tillyard”. From New (1985b): “Holotype, ♀ (end of abdomen missing), Queensland, Winton, R. L. Higgins, 1912 (BMNH) (seen)”. From Stange (2004): “holotype male, Winton, Queensland 1912, Higgins (BMNH!)”. Notes: Tillyard (1916) in the original description mentioned that the holotype was a female, which was also stated by New (1985b) despite the missing tip of the abdomen. Stange (2004) noted the specimen to be a male.

The images examined for this work clearly show a pilula axillaris as present, indicating that the specimen is a male. The imaged specimen examined matches the original description, has the same labels as described by Tillyard, and bears a holotype label, leaving no doubt that the imaged specimen is the holotype.

Material examined – (25♂, 19♀). **AUSTRALIA:** (1♂, ZMHB); **Northern Territory:** *Arltunga:* 1930 (1♀, SAMA); *Elkedra:* x.1977 (1♀, SAMA); *Gorge WH:* bet. Hatches Creek and Elkedra, 7.x.1977, at light, J.A. Forrest (1♀, SAMA); *Mount Sanford:* 17.7 km WSW, 8.viii.1973, LP Kelsey (1♂, ANIC); *Palm Valley:* 26.ix.1959, mus. expedition (1♂, SAMA); 30.ix.1959 (1♀, SAMA); *Reedy Rockhole:* Amadeus Basin, 21.20S – 131.35E, 23.ix.1962, P. Ranford (1♂, ANIC); *Tempe Downs:* ix.1962 (1♀, ANIC); ix.1963 (1♀, ANIC); **Queensland:** *Chilagoe:* viii.1967 (1♂, ANIC); *Clermont:* (2♀, ZMBH); *Cloncurry:* 3 mi S, 29.vi.1969, D. Hill (1♂, ANIC); *Cudmore NP:* x.2010 (1♂, QLDM); **South Australia:** *Ernabella Mission:* 30.ix.1960, Chinnick, McCabe, Corby (1♀, ANIC); *McDonald Downs:* 1930 (1♀, SAMA); *Musgrave Rg:* x.1994 (1♀, SAMA); **Western Australia:** *Balfour Downs HS:* 20 mi SW, 16.vii.1964, R. Plumb (1♂, ANIC); *Blackstone Rg:* ix.1956 (1♂, SAMA); *Broome:* 186 km SEbyE, 18.53S – 123.43E, 10.viii.1976, IFB Common (1♂, 2♀, ANIC); 11.viii.1976 (1♂, ANIC); *Great Sandy Desert:* 130 miles SE of Broome, 15.ix.1924 (3♂, 2♀, MVM); *Lansdowne H.S.:* 8 mi S, 23.viii.1964, R. Plumb (1♂, ANIC); *Milstream:* 1 km SSW, 21.35S – 117.04E, 31.x.1970, Upton & Feehan (1♀, ANIC); 28.x.1970 (1♀, ANIC); *Pungkulpirri Waterhole:* 0.5 km E, Walter James Rg, 24°39'15''S – 128°45'18''E, 26.ix.2006, at light, Central Ranges Sur. Camp 1 (5♂, 1♀, SAMA); *Rawlinson Rg:* 21.viii.2012 (1♀,

SAMA); *Wittenoona*: 4.iii.1994, Miller & Stange (4♂, FSCA); x.1960 (1♂, TAMU); *Wolf Ck Meteor Crater*: ix.1953 (1♂, SAMA).

Comments – In the original description of *A. roseipennis*, Tillyard (1916) noted that the wing membrane was lightly washed with rose-pink in different areas, from which the name of the species derives. However, after examining a series of high-resolution images of the holotype, it is clear that those marks are not natural. The marks are very intense on the left wings, but not on the right wings, particularly the hind wing where the marks are absent. The marks appear to be some form of artificially applied pigment of unknown origin. No other specimens of *A. roseipennis*, or any of its close related species, have similar pinkish membranes. *Aurantoleon roseipennis* is clearly associated with *A. annulatus* and *A. punctatus*, based on the large conical pregenital plate. For phylogenetic relationships see (A4 Figs 1-3).

***Aurantoleon stigmatus* (Banks 1910), new combination**

(A4 Figs 62-63)

Glenurus stigmatus Banks 1910:40 (OD); Navás 1929:47 (cit).

Glenoleon stigmatus (Banks): Banks 1913:224 (n. cb., key) [as “*stigmaticus*”]; Esben-Petersen 1915:72 (cit) [as “*stigmatum*”]; Esben-Petersen 1923:586 (cit); Stange 1976:307 (cat); New 1985b:38 (key, rd, ill); New 1996:84 (cat); Stange 2004:106 (cat); Oswald 2015 (cat).

(non) *Glenoleon dissolutus* (Gerstaecker 1885a): Esben-Petersen (1915); New (1985b).

Diagnosis – Body mostly black [not mostly pale]; clypeus mostly pale [not mostly black]; hind wing with no shaded radial crossveins [not with some shaded]; tibial spurs present [not absent]; hind wing stigmal mark much larger than rhegmal [not about same size]; posterior gonapophyses elongate and thin [not absent or broad].

Description – Lengths: forewing: 30 – 38 mm; hind wing: 28 – 35 mm.

Head (A4 Figs 62a-b): *Labrum* black; with a line of elongate setae. *Clypeus* pale; with few elongate black setae. *Frons* predominantly black, except for ventrolateral margin pale; beset with short white or black setae. *Gena* mostly pale with small dark areas. *Vertex* raised; in frontal view pale, with a median black line (interrupted centrally in some specimens); in dorsal view mostly black except for some pale marks around central area posteriorly; set with short black or white setae. *Ocular rim* setae very reduced, black or white. *Antennae* clubbed; elongate, > 3x length of pronotum; distance between width; entirely dark-brown to black, (in some specimens posterior surface of basal flagellomeres pale); torular membrane yellow; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae. *Mandibles* black, with some brown areas at base. *Palpi*, maxillary and labial black with segments distal margins generally brown, apical labial palpomere fusiform, palpmacula oval-shaped, located medially.

Thorax (A4 Fig 62b): *Pronotum* about as long as wide; posterior margin as wide as anterior; subapical furrow present; generally pale with a broad black longitudinal band (“Y” shaped in some specimens) on midline that is flanked by a thinner pale longitudinal band, margins generally black; beset with many short black setae, and some long white

or black setae, mostly located at margins. *Mesonotum* mostly black, with some small longitudinal yellow bands on each side, prescutum and scutellum mostly black with pale spots on borders; covered with small black or white setae. *Metanotum* usually black with some yellow areas, mostly on sclerites margins; covered with small white setae. *Pterothoracic pleura* black with some pale areas generally between sclerites; set with white setae; Miller's organ present.

Wings (A4 Fig 62c): Fairly broad; anterior Banksian line present in both wings, posterior absent; veins brown, but many of them intercalated with white spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline with brown marks generally concentrated at tip, pterostigma, and around some crossveins (mainly radial crossveins); cubital fork located between origins of Rs and MA; three presectoral crossveins; subcostal veinlets simple, but few distal forked; posterior area slightly wider than prefork area. *Hind wing* membrane mostly hyaline except for a large brown stigmal mark, and small marks around apical crossveins and rhegmal area; medial fork located between origins of Rs and MA; subcostal veinlets simple, but few distal forked; one presectoral crossvein.

Legs (A4 Figs 62a-b): *All pairs of legs*, femur elongate (near three times longer than coxa); tibia and femur about same size but longer than tarsi; tibial spurs surpassing T1 apex; T2, T3 and T4 about same size, T1 about twice as long as T2, T5 slightly longer than T1; claws slightly shorter than T5 length; coxa, trochanter, and femur set with short white setae; femur, tibia and tarsi set with short black setae, and scattered long black setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair slightly

longer than femur width; tibia with antennal cleaning setae ventroapically; coxa, trochanter, and femur dark brown, except for a subapical pale spot on femur dorsally; tibia dark brown with three pale rings; tarsi dark brown, except for pale base of T1 and T5, in some specimens base of T5 is dark brown. *Midleg* with same color pattern of foreleg. *Hindleg* with femur, tibia and T1 slightly longer than in other legs; color pattern similar to anterior legs, except for tibia pale with tip dark brown.

Abdomen: Usually entirely black or dark brown, occasionally with irregular pale spots on posterior margin of tergites and medial area of sternites. Beset with short white setae.

Male Terminalia (A4 Figs 63a-d): *Ectoproct* rounded in lateral view; set with elongate black setae. *9th sternite* posterior margin with short medial acute extension in ventral view; set with elongate black setae. *Genitalia* semi triangular in dorsal view. *Gonarcus* broad with anterior margin almost straight in dorsal view. *Mediuncus* enlarged, elongate, curved, with tip acute in lateral view; in posterior view tip rounded. *Paramere* weakly sclerotized, thin, elongate in lateral view, and hidden beneath gonarcus +mediuncus complex in dorsal view.

Female Terminalia (A4 Figs 63e-f): *Ectoproct* rounded, set with thin elongate setae and some long cavisetae ventrally. *Lateral gonapophyses* rounded, about same size of ectoproct, beset with elongate cavisetae. *9th tergite* with few thickened setae on ventral area in lateral view. *7th sternite* distal margin with small invagination in ventral view; covered with short black setae. *Pregenital plate* large, bent in lateral view but in ventral view with anterior margin curved and posterior straight. *Posterior gonapophyses* thin, elongate, covered with short black setae and few thickened setae at apex. *9th tergite* with

a short membranous digitiform process. *Anterior gonapophyses* absent. *Ventral membrane* gonapophyseal plates present.

Distribution (A4 Figs 159) – Australia: NSW* and QLD. * = new record.

Adult activity period – Records for November to July.

Biology – Unknown, larva unknown.

Primary type – Holotype (by monotypy), female (ANIC), examined. From original description, Banks (1910): "From Kuranda, Queensland, Australia, March, (Dodd)". From New (1985b): "Holotype, ♀, Queensland, Kuranda, March (Dodd) (formerly MCZ, now ANIC) (seen)". Condition: good; terminalia dissected.

Material examined – (36♂, 32♀, 6?). **AUSTRALIA: New South Wales: Kenthurst:** December (1♂, ANIC); *Singleton*: 5.i.1956, I.F.B. Common (1♀, ANIC); **Queensland:** *Archer River x-ing*: 13°25'S – 142°56'E, 5.iv.1989, mv lamp, G. & A. Daniels (4♂, 5♀, QLDM); *Bin Bin Range*: via Didcot, 15-19.xii.1974, H. Frauca (1♂, ANIC); *Binggenden*: Mt Walsh NP, 15.iii.1978, H. Frauca (1♀, ANIC); *Blackdown Tableland Nat. Pk.*: Charlevue Rd, 17 air km SSSE Bluff 23.72965°S 149.11972°E±30m, R Machado, MV light, 21.xii.2015, AustRM#06 (1♂, TAMU); *Bluff*: (1♂, SAMA); *Brisbane*: (3♂, 2♀, 6?, QLDM); 30.iii.1925 (1♂, QLDM); 18.i.1925 (1♂, 1♀, QLDM); 15.ii.1916, H. Hacker (1♂, QLDM); 19.ii.1927 (1♀, AMSA); 20.ii.1927 (1♂, 2♀, ZMUC); 12.iii.1927 (1♂, AMSA); 9.xii.1922 (1♂, MVM); *Carnarvon Ra*: xi.1944, N. Geary (1♀, AMSA); *Clermont*: 8 km south, 18.iii.1982, M.S. & B.J. Moulds (2♂, 1♀, AMSA); *Cooktown*: 31 km NW, 15.18S - 145.01E, 20.iii.1977. I.F.B. Common & E.D. Edwards (2♀, ANIC); *Eton Range*: nr. Mackay M.E.Q., 6.vi.1971, E.C. Dahms /

Glenoleon dissolutus det. by T.R. New (1♂, QLDM); *Forty Mile Scrub*: 65 km NW of Mt Garnet, 15.iii.1982, M.S. & B.J. Moulds (2♂, 8♀, AMSA); 18.05S – 144.51E, 20.iii.1995, E.D. Edwards & M. Matthews (1♂, ANIC); *Horn Is*: Torres Strait, 23.vii.1975, H. Heatwole (1♂, ANIC); *Injune*: 55 km NNE, 23.xi.1986, M.S. & B.J. Moulds (1♂, AMSA); *Laura*: 18 mi south, 18.v.1975, R. Storey & D. Hancock (1♂, QLDM); *Mingela*: 21.iv.1955, Norris & Common (1♂, ANIC); *Monto*: 27 km W, xi.1960 (1♂, FSCA); *Mount Cabine*: iv.1982 (1♂, QLDM); *Mount Garmet*: 7 miles SW, 20.iv.1969, I.F.B. Common & M. Upton (2♀, 3♂, ANIC, 1♀, FSCA); *Mutchilba*: iii.1933 (4♂, MVM); *Normanby River*: 5 km E, on Battle Camp Rd NW of Cooktown, 15°17'S – 144°52'E, 6.vi.1997, J & A Skevington (1♀, QLDM); *Palmer R.*: 3 mile south, Cooktown Hwy, 22.v.1975, at light, R.J. Storey & D.L. Hancock (1♂, 1♀, QLDM); *Prince of Wales Island*: 20.x.1900 (1♀, ANIC); *Springaure*: 3.iv.1957, E.F. Riek (1♂, ANIC); *Stanthorpe*: (1♀, QLDM).

Comments – See comments of *A. radialis*.

***Austrogymnocnemia* Esben-Petersen 1917**

Type species: *Gymnocnemia bipunctata* New 1915, by original designation.

Diagnosis – Ocular setae absent [not present]; tibial spurs absent [not present]; male gonarcus with acute anterior margin curving down [anterior margin not straight]; male paramere with an apical hook curving down [hook not absent or present but curving up]; anterior gonapophyses absent [not present as plate or digitiform]; posterior gonapophyses recurved [not absent or present and digitiform].

Description – Head: *Vertex* strongly raised. *Ocular rim* setae absent. *Antennae* clubbed and elongate; flagellomeres almost as long as wide at base, apical ones slightly wider than long. *Palpimacula* oval-shaped, located medially. Thorax: Pronotum almost as long as wide. Miller’s Organ present. Wings: rather narrow and acute. *Anterior Banksian* line present in both wings, posterior present in the forewing. *Forewing* prefork area wider than posterior area. *Hind wing* with one presectoral crossvein. *Male pilula axillaris* present. Legs: *Forefemur* > 2x length of forecoxa. *Foretibia* and foretarsi about same size. *Sense hair* slightly longer than forefemur width. Male Terminalia: *Ectoproct* rounded; *gonarcus* with anterior margin long and curving down; *paramere* with an apical hook curving down. Female Terminalia: *Ectoproct* rounded; *lateral gonapophyses* small and set with few thickened setae; *posterior gonapophyses* recurved, with few cavisetae; *anterior gonapophyses* absent; 9th *tergite* with a membranous digitiform process.

Distribution (A4 Figs 160-162) – Australia: NSW, NT, QLD, SA, VIC, WA. New Caledonia*: Anse Vata (* = new record).

Comments – Esben-Petersen (1917) created *Austrogymnocnemia* to accommodate the Australian species previously placed in *Gymnocnemia* (today placed in Nemoleontinae: Megistopini). In the original description, Esben-Petersen mentioned a series of characters to define the genus: body stout, antennae clavate, abdomen shorter than wings, hind wing shorter than forewing, banksian line present, legs short and strongly haired, tarsi almost as long as tibia, tarsomere 5 the longest, and tibial spurs absent. Esben-Petersen included five species within the genus at that time, the type species *G.*

bipunctata (type species), and *G. interrupta*, *G. maculata*, *G. pentagramma* and *G. tipularia* (today placed in *Froggattisca*). After this initial paper, almost nothing was published about the genus until the large taxonomic review of New (1985b). In this paper New (1985b) described numerous new species 14 of which were placed in *Austrogymnocnemia*, bringing the total number to 18 at the beginning of this study.

New (1985b) noted *Austrogymnocnemia* species are very diverse, and that the genus might need to be divided into additional genera at a future date. The need to split *Austrogymnocnemia* is confirmed in this study, based on both morphological and molecular phylogenetic data. The genus as used by New (1985b), is divided here into several new genera, and some species are transferred to preexisting genera. *Austrogymnocnemia* sensu novo now contains six species (A4 Figs 1-3), united by the characters mentioned in the genus description above: *A. arcuata*, *A. bipunctata*, *A. forcipata*, *A. maculata*, *A. pallida* and *A. pseudomaculata* n. sp..

Biology – Stange (2004) noted that the larva of one species is known, and is characterized by two mandibular teeth. However the larva is not associated with any species, and it might not belong to a species that is classified here in *Austrogymnocnemia* anymore. Nothing more is known about the biology of the group.

Key to species of *Austrogymnocnemia*, sensu novo

- 1 Forefemur with a series of long white setae along dorsal surface (A4 Fig 66a)...2
- 1' Forefemur dorsal surface set with short white setae, or few long setae at base....4
- 2 Hind wing apical half without a transversal line, just a rounded mark.....3

- 2' Hind wing apical half with a broad transversal dark line (A4 Fig 64c)...*A. arcuata*
- 3 Body mostly dark with small yellow marks; forewing full of brown marks around the crossveins (A4 Fig 66c).....*A. bipunctata*
- 3' Body mostly grey with large yellow areas; forewing hyaline (A4 Fig 72c)*A. pallida*
- 4 Pronotum with a medial, continuous, longitudinal, dark line (A4 Fig 74b); forewing with dark marks; male gonarcus anterior bent margin shorter than gonarcus in lateral view (A4 Fig 71b).....5
- 4' Pronotum with a medial, discontinuous, longitudinal dark line (A4 Fig 68a); forewing hyaline; male gonarcus anterior arm longer than gonarcus in lateral view (A4 Fig 69a).....*A. forcipata*
- 5 Frons and pronotum mostly dark brown (A4 Fig 74a, b); forewing with transversal light brown lines (A4 Fig 74c); male genitalia with mediuncus (A4 Fig 75c).....*A. pseudomaculata*
- 5' Frons and pronotum mostly yellow (A4 Fig 70a, b); forewing without transversal lines (A4 Fig 70c); male genitalia without mediuncus (A4 Fig 71c)...*A. maculata*

***Austrogymnocnemia arcuata* New 1985**

(A4 Figs 64-65)

Austrogymnocnemia arcuata New 1985:15 (OD); New 1996:67 (cat); Stange 2004:98 (cat); Oswald 2015 (cat).

Diagnosis –Body mostly dark [not mostly pale]; forewing full of few brown marks [not hyaline]; hind wing with a broad transversal subapical line [not hyaline or only infuscated]; forefemur with a series of long white setae on dorsal surface [setae not absent, or present only in the base].

Description – Lengths: forewing: 17 – 22 mm; hind wing: 15 – 21 mm.

Head (A4 Figs 64a-b): *Labrum* pale (dark brown in few darker specimens); set with a line of elongate setae. *Clypeus* pale with two lateral dark brown spots (in some paler specimens marks almost indistinguishable); set with few elongate black setae. *Frons* predominantly shiny black, except for pale ventral corners; set with few short black setae. *Gena* pale. *Vertex* raised with lateral corners straight; in frontal view pale with two short transversal dark brown marks laterally and a rounded central dark spot (in some specimens dark marks all connected forming a line); in dorsal view mostly dark brown with two pale marks posterolaterally; covered with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, > 3x length of pronotum; distance between width; in general entirely dark brown with a pale ring at distal margin of scape; torular membrane pale; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae. *Mandibles* pale to brown, with tip black. *Palpi*, maxillary and labial mostly dark brown with pale marks; apical labial palpomere fusiform, palpimacula oval and located medially.

Thorax (A4 Fig 64b): *Pronotum* about as wide as long; posterior as wide as anterior; subapical furrow present; mostly dark brown except by some pale areas, as follows: a thin central line on anterior margin, two sinuous marks on posterior half, two spots on

anterior half (some specimens with pale areas larger and sometimes fused); beset with short black setae, and few long black or white setae on borders. *Mesonotum* mostly dark brown with pale areas, as follows: two lateral rounded spots on prescutum, two rounded spots near wing base (some specimens with marks around central area) at scutum, a medial line on scutellum; covered with short black setae, and few white setae on posterior margin of prescutum. *Metanotum* mostly dark brown, except for irregular pale areas mostly around midline and posterior margin of scutellum, covered with few short black setae. *Pterothoracic pleura* dark brown; covered with long white setae; Miller's organ present.

Wings (A4 Fig 64c): Rather narrow with tip acute; anterior and posterior Banksian line present in both wings; veins mostly dark brown, but some veins intercalated with white spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline with small brown marks as follows: marks at tip, posterior margin, around crossveins (mainly at radial and mediocubital areas), pterostigma, subcostal area, and gradate crossveins; tip of pterostigma white; cubital fork located between origins of Rs and MA, but closer to Rs origin; three presectoral crossveins; subcostal veinlets simple; some specimens with costal area large and basal veinlets sinuous; prefork area wider than posterior area, with many longitudinal crossveins. *Hind wing* membrane mostly hyaline except for two large brown marks (sometimes fused), one on rhegmal area and another on pterostigma; medial fork located near Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 64a-b): *All pairs of legs*, femur elongate ($> 2x$ length of coxa); tibia, femur and tarsi about same size; tibial spurs absent; T3 and T4 about same size, T2 slightly longer than T3, T1 about twice longer than T2, and T5 longer than T1; claws about half of T5 length; coxa, trochanter, femur and tibia set with white setae, mainly at femur with longer setae dorsally; femur, tibia and tarsi set with black setae, and scattered long black setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair slightly longer than femur width; tibia with antennal cleaning setae ventroapically; coxa, trochanter and femur with external surface dark brown, internal surface pale, in some specimens with irregular pale areas on external surface, tibia pale with three dark brown rings on external surface; tarsi mostly dark brown, but base of T1 and T5 pale, in some specimens base of T2 also pale. *Midleg* with color pattern similar to foreleg, except for coxa, trochanter and femur entirely dark brown; and tibia dark brown with three pale rings. *Hindleg* with femur and tibia slightly longer than in other legs; color pattern similar to midleg, except for tibia pale with tip and internal surface midline dark brown, some specimens with irregular pale marks, mainly at femur.

Abdomen: Mostly black with scattered pale marks, mainly on sternites medial areas and tergites posterior margins. Beset with short white setae.

Male Terminalia (A4 Figs 65a-c): *Ectoproct* rounded in lateral view, set with elongate black setae. *9th sternite* short, with posterior margin straight in ventral view; set with elongate black setae. *Genitalia* with a large membrane ventrally, bearing few short setae. *Gonarcus* broad, arched, with anterior margin thin and curving downwards in lateral

view. *Mediuncus* absent. *Paramere* broad in lateral view, with an apical hook curving downwards.

Female Terminalia (A4 Figs 65d-e): *Ectoproct* rounded covered with thin elongate setae. *Lateral gonapophyses* rounded, much smaller than ectoproct, set with few thickened setae. *7th sternite* small, with distal margin curved in ventral view; covered with long black setae. *Pregenital plate* broad, “Y” shaped, with a short and sclerotized extension between the “Y” arms, with a basal rounded expansion in ventral view. *Posterior gonapophyses* broad, long, with tip recurved; covered with long black setae, and few cavisetae posteroapically. *9th tergite* with a long membranous digitiform process. *Anterior gonapophyses* absent. *Ventral membrane* gonapophyseal plates present.

Distribution (A4 Fig 160) – Australia: NSW*, SA*, VIC*, WA. * = new record.

Adult activity period – Records for September to January and April to May.

Biology – Unknown, larva unknown.

Primary type – Holotype (by original designation), male (WAM), high-resolution images examined. From original description, New (1985b): “Holotype, ♂, Western Australia, Wilroy (WAM)”. Condition: good; antennae and few legs missing; terminalia dissected.

Material examined – (12♂, 17♀). **AUSTRALIA: New South Wales:** *Nombinnie Nature Reserv.:* 18 air km SSE Mount Hope, 160m, 32.99613°S – 145.94006°E±70m, 3.i.2013, M.V., Oswald, Diehl & Machado, Oswald #626 (3♀, TAMU); **South Australia:** *Alawoona:* 12 km WSW, 34:46S – 140:22E, 6.i.1996, M.S. & B.J. Moulds (1♂, 2♀, AMSA); 13 km S, M.S. & B.J. Moulds & K.A. Kopestonsky (3♂, 2♀,

AMSA); *Danggali*: 8 km S of Tomahawk Dam, ix.1996 (1♀, SAMA); *Gluepot Reserve*: near Stella Camp, xii.2000 (2♀, SAMA); i.2000 (1♀, SAMA); *Loxton*: 18.i.1958, at m.v.l., N.B. Tindale (1♀, SAMA); *Pinkawillinia Dst*: late x.1989; A. Sundholmi & J. Bugeja (1♂, 2♀, AMSA); *Purnong*: Near Murray River, 29.xii.1911 (4♂, 1♀, MVM); *Yurgo*: i.1956 (1♂, SAMA); *Weetara Tank*: Wirrulla, ix.1995 (1♂, SAMA); **Victoria**: *Lake Hattah*: 28.xi.1967 (1♂, MVM); *Murray-Sunset Nat. Pk*: -34.63207° – 141.97935°, 10.i.2010, S. Winterton (1♀, CSCA); **Western Australia**: *Gillford Creek Stn.*: 15 km W, Malaise trap nr Drying pool in Yangibana Cr, 23°56.8'S – 116°07.6'E 26.iv-10.v.2003, M.E. Irwin & F.D. Parker (1♀, FSCA).

Comments – *Austrogymnocnemia arcuata* is the smallest species in the genus, and is closely associated with *A. bipunctata*. It is easily separated from the other *Austrogymnocnemia* species by the broad dark, transverse band on hind wings. For phylogenetic relationships see (A4 Figs 1-3).

***Austrogymnocnemia bipunctata* (Esben-Petersen 1915)**

(A4 Figs 66-67)

Gymnocnemia bipunctata Esben-Petersen 1915:63 (OD).

Austrogymnocnemia bipunctata (Esben-Petersen): Esben-Petersen 1917:206 (n. cb); Esben-Petersen 1918:8 (cit); Esben-Petersen 1923:580 (cit); Stange 1976:302 (cat); New 1985b:12 (key, rd, ill); New 1996:67 (cat); Stange 2004:98 (cat); Oswald 2015 (cat).

Austrogymnocnemia australis Esben-Petersen 1923:579 (OD); Stange 1976:302 (cat); New 1985b:12 (syn); New 1996:67 (cat); Stange 2004:98 (cat); Oswald 2015 (cat).

Diagnosis –Body mostly dark [not mostly pale]; forewing full of brown marks [not hyaline]; hind wing with rhegmal area brown infuscated [not hyaline or with a broad transversal mark]; forefemur with a series of long white setae on the dorsal surface [setae not absent, or present only in the base].

Description – Lengths: forewing: 19 – 30 mm; hind wing: 17 – 26 mm.

Head (A4 Figs 66a-b): *Labrum* pale to brown; set with a line of elongate setae. *Clypeus* pale to brown; set with few elongate black setae. *Frons* predominantly shiny black, except for pale ventral corners (some specimens whole ventral margin pale); set with white setae. *Gena* pale. *Vertex* raised with lateral corners straight; in frontal view pale with two short transversal dark brown marks laterally and a rounded central dark spot; in dorsal view mostly pale with two central perpendicular dark brown lines and two black marks posterolaterally; covered with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, > 3x length of pronotum; distance between antennae wider than scape width; scape mostly pale with basal margin dark brown in some specimens, but almost entirely dark brown in others, pedicel pale in most specimens but sometimes dark brown, flagellomeres dark brown but distal margin pale, some specimens with basal flagellomeres entirely pale, mainly on anterior surface; torular membrane pale; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae. *Mandibles* pale, with tip black. *Palpi*, maxillary and labial mostly pale with scattered small dark spots, mainly on apical segments; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 66b): *Pronotum* about as wide as long; posterior margin as wide as anterior; subapical furrow present; mostly dark brown except for some pale areas as follows: a thin central line, four sinuous marks on posterior half, two on anterior (some specimens pale areas larger and sometimes fused); beset with few short black setae and long white setae on borders. *Mesonotum* coloration mostly dark brown with pale areas as follows: two lateral rounded spots on prescutum, two small longitudinal lines near midline, two rounded spots near wing base on scutum, a medial line and two rounded lateral spots on scutellum; covered with short black setae, and few white setae (some specimens with pale areas larger and sometimes fused). *Metanotum* mostly dark brown, except by irregular pale areas mostly around midline, covered with few short white setae and some black setae posteriorly. *Pterothoracic pleura* dark brown with irregular pale marks between sclerites; covered with many long white setae; Miller's organ present.

Wings (A4 Fig 66c): Rather narrow with tip acute; anterior and posterior Banksian lines present in both wings; veins mostly dark brown, but some veins intercalated with white spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline with small brown marks concentrated at tip, posterior margin, around crossveins, and some larger areas mainly at pterostigma, mediocubital area, and gradate crossveins; tip of pterostigma white; cubital fork located near Rs origin; subcostal veinlets simple, but few distal ones forked; most specimens with costal area large with basal veinlets sinuous; prefork area wider than posterior area, with many longitudinal crossveins. *Hind wing* membrane mostly hyaline except by a large brown infuscations on

rhegmal area, and small marks at pterostigma and posterior margin; medial fork located near Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 66a-b): *All pairs of legs*, femur elongate (> 2x length coxa); tibia, femur and tarsi about same size; tibial spurs absent, but some specimens with a unique very short spur particularly on hindlegs; T3 and T4 about same size, T2 slightly longer than T3, T1 and T5 about same size, but twice longer than T2; claws about half of T5 length; coxa, trochanter, femur and tibia set with white setae, mainly at femur (setae longer and more numerous); femur, tibia and tarsi set with black setae, and scattered long black setae, mainly at femur apex; T5 ventrally with two rows of thick, long, black setae.

Foreleg sense hair slightly longer than femur width; tibia with antennal cleaning setae ventroapically; coxa, trochanter and femur with external surface dark brown but internal pale, in some specimens with irregular pale areas on external surface, tibia pale with three dark brown rings on external surface; tarsi mostly pale with tip dark brown, mainly T5 (some specimens T2-T4 entirely dark brown). *Midleg* with color pattern similar to foreleg, except for tibia dark brown with three pale rings and tarsi usually darker than other legs. *Hindleg* with femur and tibia slightly longer than in other legs; color pattern similar to anterior legs, except for tibia pale with tip and internal surface midline dark brown.

Abdomen: Mostly black with scattered pale marks, mainly on sternites medial areas and tergites distal margins. Beset with short white setae.

Male Terminalia (A4 Figs 67a-d): *Ectoproct* rounded in lateral view, set with elongate black setae. *9th sternite* short, with posterior margin straight in ventral view; set with

elongate black setae. *Gonarcus* broad, arched, with anterior margin narrow and curving downwards in lateral view. *Mediuncus* absent. *Paramere* broad in lateral view, with an apical hook curving downwards.

Female Terminalia (A4 Figs 67e-f): *Ectoproct* rounded, covered with thin elongate setae. *Lateral gonapophyses* rounded, much smaller than ectoproct, with few thickened setae. *7th sternite* small, with distal margin medially extended in ventral view; covered with black setae. *Pregenital plate* broad, with shape similar to a T-shirt with collar region more sclerotized in ventral view. *Posterior gonapophyses* broad, long, with tip recurved; covered with long black setae, and with few cavisetae posteroapically. *9th tergite* with a long membranous digitiform process. *Anterior gonapophyses* absent. *Ventral membrane gonapophyseal plates* present.

Distribution (A4 Figs 161) – Australia: NSW, NT, QLD, SA, VIC, and WA.

Adult activity period – Records extend along the whole year, but most of records between October to March.

Biology – Unknown, larva unknown.

Primary type – *Gymnocnemia bipunctata*: Holotype (by original designation), male (ANIC), examined. From original description, Esben-Petersen (1915): “Narromine, N. S. W.; two specimens, 14.x.1905 (W. W. Froggatt leg.); Broken Hill, N. S. W.; one specimen. / Type in Coll. Froggatt; cotype in Coll. Tillyard”. From New (1985): “Holotype of *Gymnocnemia bipunctata* Esben-Petersen, New South Wales, Narromine, 14.x.1905 (Froggatt) (ANIC) (seen). Abdomen broken and reglued in 3 places, antennae missing”. Condition: as mentioned by New (1985b).

Austrogymnocnemia australis: Lectotype (by subsequent designation), female (ANIC), examined. From original description, Esben-Petersen (1923): “One ♀, Hay, N. S. Wales, 20.1.1916 (W. W. Froggatt leg.). Coll. Froggatt. One ♀, N. W. Australia (Dr. E. Mjöberg leg.). Stockholm Museum”. From New (1985b): “Holotype, ♀, of *Austrogymnocnemia australis*, New South Wales, Hay, 20.i. 1916 (Froggatt) (ANIC) (seen). Now very mouldy, antennae missing”. From Stange (2004): “Syntype female, Hay, New South Wales, 20.I.1916 (ANIC!); syntype female, N.W. Australia, Mjöberg (NHRS)”. In the original description Esben-Petersen (1923) mentions two females, but did not fix a holotype. However, New (1985b) pointed out that the specimen in ANIC as the holotype. New’s (1985b) indication of a holotype is considered here as an explicit differentiation among the type series, what according to the nomenclatural code (article 74.5), should be considered as a lectotype designation. By this reason the specimen stated by New (1985b) is considered here as the lectotype. The lectotype bears two large red type labels, and its condition is the same mentioned by New (1985b). The specimen from NHRS is here considered as a paralectotype.

Material examined – (236♂, 340♀, 12?). **AUSTRALIA: New South Wales:** *Adam’s Scrub*: 14.6 km S of Warialda, -29.667S - 150.567E, 18.xi.2009, 385m, Callitris/schleorphyll forest, D.R. Britton & J. Recsei (1♂, AMSA); *Barrier Range*: 10.i.1986 (3♀, AMSA); *Baradine Rd and Newell Hwy junction*: 30°56’S – 149°25’E, 11.xii.1987, M.S. & B.J. Moulds (1♀, AMSA); *Brewarrina*: (1♀, ANIC); *Broken Hill*: nr. race track, 280m, 31.96445°S – 141.41817°E±70m, 2.i.2013, M.V., Oswald, Diehl & Machado, Oswald #625 (1♂, 5♀, TAMU); ii.1925, F.W. Shepherd (2♂, AMSA); iii.1963

(3♀, SAMA); *Calumet*: 26mi NE of Binnaway, 28.xii.1931, C.F. Garnsey (1♀, AMSA); *Cobar*: 65 km W, 28.i.1976, M.S. & B.J. Moulds (1♀, AMSA); *Deriah Aboriginal Area*: 20.9 km E of Narrabri, stand of Ooline -30.367S - 149.992E, 11.xi.2009, 335m, D.R. Britton & J. Recsei (2♀, AMSA); *Fowler's Gap*: 17.i.1980, A. Smith (1♂, AMSA); *Gol Gol S. Forest*: 25 km E of Mildura, 2.i.1989, M.S. & B.J. Moulds (2♂, 1♀, AMSA); *Kinchega Nat. Pk.*: 7 air km WSSW Menindee, 32.44396°S - 142.37947°E±100m, 60m, 1.i.2013, M.V., Oswald, Diehl & Machado, Oswald #624 (1♂, 4♀, TAMU); *Lake Mungo*: ii.1998 (2♀, ANIC); *Lightning Ridge*: 30 km S, 27.xii.1988, M.S. & B.J. Moulds (1♀, AMSA); *Medindee Lakes*: xii.1973 (2♂, SAMA); *Mendooran*: 8 km S, 31°53'S - 149°03'E, 11.ii.1992 (1♂, QLDM); *Moema NP*: 36.5 km NE of Narrabri, -30.064S - 149.965E, 13.xi.2009, Semi evergreen vine thicket, black light bucket, D.R. Britton & J. Recsei (1♂, AMSA); *Mogriguy*: 20.i.1979 (1♀, AMSA); *Nombinnie Nature Reserv.*: 18 air km SSE Mount Hope, 160m, 32.99613°S - 145.94006°E±70m, 3.i.2013, M.V., Oswald, Diehl & Machado, Oswald #626 (6♂, 13♀, TAMU); *Papepabinbilla Ck*: 70 km ENE of Wilcannia, 30.xii.1988, M.S. & B.J. Moulds (1♂, 1♀, AMSA); *Pilliga*: 1925 (1♀, ANIC); *Springs Ck*: 75 km WSW of Wilcannia, 31.xii.1988, M.S. & B.J. Moulds (4♀, AMSA); *Stephens Creek*: approx. 24 km ENE of Broken Hill, 27.i.1976, M.S. & B.J. Moulds (5♂, 2♀, AMSA); *Talyealye Hsd*: 4 km N, 29°05'28''S - 144°27'59''E, 17.i.1999, M.S. & B.J. Moulds (6♂, 7♀, AMSA); *Tamworth*: 2.i.1966, C.N. Smithers (1♀, AMSA); *Tibooburra*: 8.i.1994, M.H. Dunn (1♂, AMSA); *Tintinallogy Stn*: -31.99947° - 143.01706°, 15.i.2010, S. Winterton (2♂, 2♀, CSCA); *Yanga State Conserv. Ar.*: Willows cpgd, 22.6 air km SESE

Balranald, 70m, 34.76051°S - 143.76152°E±100m, 11.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #599 (3♀, TAMU); *Wentworth*: 30 km NNW, 1.i.1989, M.S. & B.J. Moulds (1♂, 7♀, AMSA); **Northern Territory**: *Alice Spring*: (1?, QLD); 19.xi.1989, R.B. Miller (3♂, 1♀, FSCA; 1♀ TAMU); xi.1965 (1♀, ANIC); ii.1966 (1♂, 2♀, ANIC); x.1966 (1♂, 4♀, ANIC); i.1926 (2♀, SAMA); x.1953 (1♂, SAMA); 27.xi.1954 (1♂, MVM); 15.xi.1954 (1♀, MVM); *Barron Creek*: x.1972 (1♂, 1♀, ANIC); ii.1966 (2♂, ANIC); *Brunette Downs*: via freewina, 16.i.1983, R. Parterson (1♂, 1♀, ANIC); *Center of Australia Marker*: iii.1993 (1♂, SAMA); *Charlotte Waters*: 17.ii.1911 (1♀, MVM); *Daly Waters*: xi.1972 (2♂, 2♀, ANIC); *Dingo Hole Dam*: x.1977 (1♂, SAMA); *Emily Gap*: ii.1966 (7♂, 4♀, ANIC); *Illamurta Spr*: iii.1993 (2♂, SAMA); *Larrimah*: x.1972 (2♂, 1♀, ANIC); *Lubras Lookout*: nr Renner Springs, 12.i.1992, M.S. & B.J. Moulds (1♀, AMSA); *Kings Canyon*: (Au 12), 19.ix.2005, R. Miller & L. Stange (1♂, FSCA; 1♀ TAMU); *Kings Creek Campground*: nr. Kings Canyon Nat. Park (A22), 22.xi.1989, R.B. Miller (1♂, 1♀, TAMU; 4♂, 5♀, FSCA); *Mt Ebenezer*: 30 km W, 1.i.1996, M.S. & B.J. Moulds & K.A. Kopestonsky (3♂, 5♀, AMSA); *Murray Downs Stn*: x.1977 (1♂, SAMA); *Pillaga Scrub*: 30:56S – 149:23E, 10.ii.1997, M.S. & B.J. Moulds (1♂, AMSA); *Ready Rockhole*: nr Kings Canyon, George Gill Rg., 31.i.1984, M.S. & B.J. Moulds (14♂, 14♀, AMSA); viii.1962 (1♀, ANIC); *Soudan Hsd*: 16 km W, 13.i.1992, M.S. & B.J. Moulds (1♂, AMSA); *Tablelands & Barky Hwy junction*: 21.xii.1986, M.S. & B.J. Moulds (1♂, AMSA); *Talyors Creek*: 47 km N of Barrow Creek township, 22.i.1984, M.S. & B.J. Moulds (1♂, 2♀, AMSA); *Tennant Creek*: xi.1972 (1♂, ANIC); xi.1966 (1♂, ANIC); 296 km S, 29.xi.1972, D.H. Collens (1♀, ANIC); *Three Ways*:

x.1972 (3♂, ANIC); *Tilmouth Well*: Napperby Creek, 22:48:40S – 132:35:40E, 13.i.2001, M.S. & B.J. Moulds (1♂, AMSA); *Trephina Gorge*: 70 km W ENE of Alice Spring, 29.i.1984, M.S. & B.J. Moulds (1♂, 1♀, 1?, AMSA); *Victoria River Downs*: vii.1973 (1♀, ANIC); ix.1973 (1♀, ANIC); *Yalara Resort*: Ayres Rock, 2.ii.1984, M.S. & B.J. Moulds (1♂, 3♀, AMSA); *Wauchope*: x.1972 (3♀, ANIC); **Queensland**: *Barcaldine*: 40 km E, 23:34:25S – 145:40:32E, 12.i.1999, M.S. & B.J. Moulds (2♀, AMSA); 9.5 air km S, Botanical Walk, 23.63733°S 145.28137°E±30m, R Machado, MV light, 23.xii.2015, AustRM#08 (3♂, 6♀, TAMU); *Barkley Hwy*: ix.1977 (1♂, SAMA); *Blackwater*: 70 km S, 19.i.1987, M.S. & B.J. Moulds (1♀, AMSA); *Brisbane*: (6♂, 7♀, QLDLM); 9.xi.1927 (1♀, ZMUC); 3.ii.1929 (1♂, QLDLM); *Butcher Creek*: 20 km W of Cloncurry, 21.i.1977, M.S. & B.J. Moulds (1♂, AMSA); *Carnarvon Nt Pk*: Mount Moffat, Malaise, 25°03'52''S – 148°01'06''E, 30.xi.1997, J Skevington, C Lambkin (1♀, QLDLM); *Charleville*: 13.ii.1938 (1♂, QLDLM); x.1957 (1♀, ANIC); 20.x.1957 (1♂, FSCA); 15 km S by W, 26:32S – 146:12E, 21.x.1975, M.S. Upton (2♀, ANIC); 15 km S by W, 26.32S – 146.12E, 21.x.1975, M.S. Upton (1♂, 1♀, ANIC); 2 km N, 26.23S -146.14E, 16.iii.1990, E.D. Edwards & J.H. Fisk (1♂, ANIC); 70 km, 26°52'S – 146°35'E, 28.x.1991, G Daniels (1♀, QLDLM); *Clermont*: Dr. K.K. Spence (1♀, AMSA); ii.1916 (1♀, ANIC); x.1922 (1♀, ANIC); 8 km S, 18.iii.1982, M.S. & B.J. Moulds (1♀, AMSA); x.1920 (1♀, ANIC); *Cloncurry*: (1♂, 1♀, MVM); *Cunnamulla*: i.1944 (1♂, 3♀, QLDLM); *Dalby*: nr Lake Broadwater, 27:21S – 151:06E, 10.i.2002, Cooley, Cowan, Hill, Marshal & Moulds (1♂, AMSA); *Emerald*: xii.1916 (1♀, ANIC); *Goondiwindi*: 40 km WNW, 17.xii.1983, M.S. & B.J. Moulds (1♂, AMSA); *Kuranda*:

2.iii.1908 (1♀, MVM); *Miles*: 20.i.1982, M.S. & B.J. Moulds (1♂, AMSA); 17.xii.1990 (10?, QLDM); *Milmerran*: 13.xii.1944 (1♀, MVM); 16.i.1944 (1♂, MVM); *Mitchell*: 116 km S, 18.xii.1983, M.S. & B.J. Moulds (1♂, AMSA); *Mount Isa*: 30.xi.1940 (1♀, QLDM); *Mutchilba*: x.1933 (1♀, MVM); *Nine Mile Ck*: 14 km NNW of Miles, 24.i.1990, M.S. & B.J. Moulds (1♂, AMSA); *Noombah Stn*: SW of longreach, 24:05.2S – 143:08.7E, 14.i.2002, Cooley, Hill, Marshal & Moulds (1♀, AMSA); *Roma*: 11.xi.1938 (1♂, QLDM); *St. George*: i.1944, N. Geary (1♀, AMSA); *Taroom*: 6 km N, 25°36'S – 149°46'E, 2.x.1991, 200 m, G. Daniels (1♂, QLDM); **South Australia**: *Alawoona*: 13 km S, 6.i.1996, M.S. & B.J. Moulds & K.A. Kopestonsky (1♀, AMSA); *Arkaba Creek*: 26 air km ENNE Hawker, 390m, 31.68717°S – 138.57257°E±70m, 31.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #623 (3♂, 4♀, TAMU); *Arkaroola*: northern Flinders Ranges, 21.i.1976, M.S. & B.J. Moulds (2♂, 1♀, AMSA); 22.i.1976 (1♂, AMSA); *Aroona Dam*: xi.1969 (3♂, 1♀, SAMA); *Balcanoona*: xi.1975 (1♀, SAMA); *Big Peery Spr*: xii.1974 (1♀, SAMA); *Copper Hill*: ii.1962 (2♀, SAMA); *Cungena*: nr. Landfill, 100m, 32.58559°S – 134.72105°E±50m, 30.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #622 (5♂, 11♀, TAMU); *Everard Pk*: x.1970 (1♂, SAMA); *Eyre Pen.*: xi.2005 (2♂, SAMA); *Finke River*: 1933 (1♂, 1♀, SAMA); *Flinders Ranges*: 10 km NW Maynards Well, 11.xii.1974, at light, J.A. Herridge (1♀, SAMA); x.1974 (1♀, SAMA); *Gairdner Torrens*: iii.2007 (1♂, SAMA); *Gawler Rg*: xii.1989 (2♂, 4♀, SAMA); *Glendambo*: iv.2007 (1♀, SAMA); 16.i.2012, L. Stange (1♀, FSCA); *Gluepot Res.*: ix.2000 (1♂, 1♀, SAMA); xii.2000 (1♂, 3♀, SAMA); *Innaminka*: 17.i.2002, Cooley, Cowan, Hill, Marshal & Moulds (1♂, 1♀, AMSA); *Innamincka*:

Cooper Ck, 24.i.1976, M.S. & B.J. Moulds (1♂, 1♀, AMSA); *Iron Knob*: iii.1968 (2♂, ANIC); *Kimba*: hwy 1 pulloff, 1.6 air km ENNE, 220m, 33.12763°S – 136.43115°E±80m, 12.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #600 (3♂, 3♀, TAMU); *Kingoonya*: (2♀, ANIC); *Koonamore Stn*: ii.1956 (1♀, SAMA); *Kyancutta*: ii.1957 (1♂, SAMA); *Lake Eyre*: (1♀, MVM); *Lake Gilles*: x.72 (1♀, SAMA), *Lake Killapontana*: (1♀, MVM); *Leigh Creek*: i.1965 (2♂, 1♀, SAMA); x.1965 (1♀, SAMA); xi.1965 (1♂, 1♀, SAMA); xii.1965 (3♂, 2♀, SAMA); xii.1966 (3♂, ANIC); ix.1969 (1♂, SAMA); *Loxton*: i.1958 (1♀, SAMA); *Madigan Gulf*: ii.1956 (1♀, SAMA); *Malboona Hs*: x.1988 (1♂, SAMA); *Maryinna Hill*: iii.1995 (1♀, SAMA); *Mimili*: x.1998 (1♂, SAMA); *Moomba Gas Field*: approx., 28°26'S – 140°11'E, 23.i.1976, M.S. & B.J. Moulds (1♀, AMSA); *Moonaree Stn*: x.2006 (2♀, SAMA); *Moralana Creek*: 40 km NNW of Hawker, 26.i.1976, M.S. & B.J. Moulds (1♂, 2♀, AMSA); *Mount Christie Siding*: 6.xi.1975, at light, J.A. Herridge (2♂, 1♀ SAMA); *Musgrave Range*: 13.x.1994 (2♂, 1♀, SAMA); ii.1966 (2♀, SAMA); *Oolarinna*: iii.1996 (1♀, SAMA); *Pichi Richi Pass*: nr Port Augusta, 25.i.1991, M.S. & B.J. Moulds (1♂, AMSA); *Pinkawillinie*: xi.1995 (1♂, SAMA); *Prices Bore*: iv.2007 (1♂, SAMA); *Purnong*: Near Murray River (1♂, MVM); *Rev. A.P. Burgess*: (1♀, SAMA); *Stuart Hwy*: 56 km S of NT border, 4.ii.1984, M.S. & B.J. Moulds (1♀, AMSA); *Tingatingana Crossing*: Strelecki Creek, approx., 28°48'S – 140°10'E, 25.i.1976, M.S. & B.J. Moulds (2♀, AMSA); *Twins Stn*: x.1953 (1♀, SAMA); *Uno Stn*: xi.2008 (1♂, 2♀, SAMA); i.2009 (2♂, 3♀, SAMA); *Yalata Mission*: 14 km NNW, 31.22S – 131.47E, 10.v.1983, E.S. Nielsen & E.D. Edwards (1♀, ANIC); *Yaninee*: ii.1957 (1♂, SAMA); *Yardea Stn*:

approx. 10mi S of Lake Acraman, 1.iv.1972, J.A. Herridge (1♀, SAMA);
Yelpawralinna: ix.1993 (1♀, SAMA); *Yumbarra*: xi.1975 (1♂, SAMA); iii.1995 (1♂,
 2♀, SAMA); *Yunta*: i.1943 (2♂, 5♀, MVM); ii.1943 (2♂, 2♀, MVM); *Warooka*: i.1962
 (1♂, SAMA); *Warraweenna*: iv.1997 (1♂, SAMA); *Wataru campsite*: x.1998 (1♀,
 SAMA); *Watercress Crossing*: iii.1970 (1♂, SAMA); *White Bull Yard*: Kalamurina Stn,
 x.1999 (3♂, 2♀, SAMA); *William Ck*: 55 km S, 29:13S – 136:38E, 3.i.1996, M.S. &
 B.J. Moulds & K.A. Kopestonsky (3♀, AMSA); *Wilpena Pound*: Flinders Ranges,
 20.i.1976, M.S. & B.J. Moulds (2♀, AMSA); *Windy Cr*: Just below Aroona Dam 10 km
 SW of Copley, 24.xi.1975, at light, G.F. Gross (1♀ SAMA); *Wirraminna Stn*: iv.2006
 (1♂, SAMA); **Victoria**: *Lake Hattah*: 28.xi.1967 (2♀, MVM); 15.ii.1969 (1♀, MVM);
Mallee: 2.ii.1914 (1♂, 1♀, MVM); *Red Cliffs*: 1.i.1955 (1♀, MVM); *Murray-Sunset
 Nat. Pk*: -34.63207° – 141.97935°, 10.i.2010, S. Winterton (1♂, 1♀, CSCA); *Rocket
 Lake*: 5 km S, Murray Sunset Nat. Pk., 34:39S – 141:49E, 24.xi.1992, at light, Moulds,
 McAlpine & McEvey (1♀, AMSA); 2.xii.1992 (3♂, 8♀, AMSA); **Western Australia**:
Beverley: (1♀, SAMA); *Broome*: 5.xi.1978, M.S. & B.J. Moulds (1♂, AMSA); *Cane
 Grass Swamp x-ing*: 2 km N, 30:11S – 121.10E, 25.xii.1995, M.S. & B.J. Moulds &
 K.A. Kopestonsky (3♂, 4♀, AMSA); *Cane River HS*: iii.1971 (2♀, ANIC); *Carnarvon*:
 iv.1968 (1♂, 1♀, ANIC); *Cave Rock Camp*: 28.6 km S of Burra Rock, -31.640S -
 121.209E, 17.xi.2007, 380m, at light, D.R. Britton & D.J. Bicket (1♂, AMSA); *Cave
 Hill*: iii.1996 (1♀, 1♂, SAMA); *Coolgardie*: xi.1969 (1♂, 1♀, ANIC); v.1984 (1♀,
 ANIC); *Cosmo Newberry*: 80 km E, 27.55S – 123.29E, 27.xii.1995, M.S. & B.J. Moulds
 & K.A. Kopestonsky (4♂, 1♀, AMSA); *Crawley*: ii.1935 (1♂, ANIC); Ellavalla Stn,

ii.1955 (1♂, MVM); *Gascoyne Junction*: 70 air km WNW, 24.87559°S – 114.55150°E±90m, 21.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #613 (4♂, 10♀, TAMU); *Goldfields Woodlands Nat. Park*: 69 air km WSW Coolgardie, 380m, 31.18428°S – 120.49041°E±80m, 15.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #603 (1♀, TAMU); *Great Central Road*: track W off, 6 km air NNNE Laverton, 28.58435°S – 122.41038°E±100m, 470m, 27.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #618 (6♂, 10♀, TAMU); *Kalgoorlie*: 30.i.1976, K.E. Cawaby (1♂, AMSA); 30.xi.1985, M.S. & B.J. Moulds (1♀, AMSA); 1.xii.1985 (1♀, AMSA); 12.i.1989 (1♂, 1♀, AMSA); 13.i.1989 (2♀, AMSA); 15.i.1986, A.J. Graham (1♂, AMSA); 22.ix.1986 (1♀, AMSA); 6.i.1989 (2♀, AMSA); 15.i.1989 (1♂, AMSA); 20.i.1989 (1♀, AMSA); 160 km E Trans. Aust. Railway, 21.i.1991, M.S. & B.J. Moulds (1♂, AMSA); 70 km NNW, 30.11S – 121.10E, 11.xi.1977, M.S. Upton (1♂, 1♀, ANIC); *Karonie*: xi.1969 (1♀, ANIC); *Kununurra*: 70 mi ESE, iv.1966 (1♀, SAMA); *Lake Johnston*: nr N end, 20 km SW of Coolgardie/Norseman roadfork, 19.i.1991, M.S. & B.J. Moulds (1♀, AMSA); iii.1996 (1♀, SAMA); *Marble Bar*: i.1914 (2♀, ANIC); *Marloo Station Wurarga*: i.1935, Gebr. Goerling S.G. (1♀, ZMHB); *Menzies*: 10 km N, 14.i.1989, M.S. & B.J. Moulds (1♂, AMSA); 25 km S, 29.54S – 121.07E, 5.v.1984, E.S. Nielsen & E.D. Edwards (1♂, ANIC); *Millstream*: x.1970 (1♂, ANIC); iv.1971 (2♀, ANIC); *Moola Bulla Stn*: ix.1953 (1♀, SAMA); *Mount Davies*: xi.1956 (1♀, SAMA); *Mount Magnet*: 110 km S, 19.i.1989, M.S. & B.J. Moulds (1♂, 2♀, AMSA); 25 km W, 28°09'50''S – 117°39'04''E, 13.xii.1999, J. Skevington (1♀, CSCA); *Norseman*: track S off hwy 1, 79 air km EENE, 32.08056°S – 122.60297°E±90m, 28.xii.2012, M.V., Oswald, Diehl &

Machado, Oswald #619 (2♂, 2♀, TAMU); 63 km EbyN, 32.04S – 122.25E, 6.v.1983, E.S. Nielsen & E.D. Edwards (1♂, ANIC); i.1993 (1♀, ANIC); *Perth*: Nedlands, 3-4.i.1961, malaise trap in Eucalyptus for 40m (1♂, FSCA); i.1967 (1♂, ANIC); *Port Headland*: x.1960 (1♀, FSCA); *Wittenoom*: 4.iii.1994, L. Stanage & R. Miler (1♂, FSCA); *Wyndham*: iii.1968 (1♀, ANIC). NO LABEL: (1♀, ANIC).

Comments – *Austrogymnocnemia bipunctata* is one of the most common antlion species in Australia, and can be easily collected in larger numbers at light. The species is easily distinguished from others *Austrogymnocnemia* species by its mostly dark body, large number of long white setae on the and large rhegmal infuscation on hind wings. The synonymy of *A. australis* with *A. bipunctata* proposed by New (1985b) is confirmed here. The differences in the shapes of wings proposed by Esben-Petersen (1923) are considered to represent intraspecific variation, as discussed by New (1985b). For phylogenetic relationships see (A4 Figs 1-3).

***Austrogymnocnemia forcipata* New 1985**

(A4 Figs 68-69)

Austrogymnocnemia forcipata New 1985:14 (OD); New 1996:67 (cat); Stange 2004:99 (cat) Oswald 2015 (cat).

Diagnosis –Body mostly pale [not mostly dark]; pronotum with a medial discontinuous longitudinal line [not continuous]; hind wing with small rhegmal infuscation [not hyaline or with a broad transversal mark]; forefemur without a series of long white setae [not with a series of long white setae].

Description – Lengths: forewing: 19 mm; hind wing: 16 mm.

Head (A4 Fig 68a): *Labrum* pale, set with a line of elongate setae. *Clypeus* pale with a longitudinal median black line; set with few elongate black setae. *Frons* mostly pale (area between antennae slightly darker), except for two black lines, a median longitudinal and a transversal above antennae; set with some short black setae. *Gena* pale. *Vertex* strongly raised; in frontal view pale, with a transversal dark line and a median longitudinal dark line; in dorsal view mostly pale but with a longitudinal median line, and some faded dark marks posteriorly; covered with short pale setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, > 2x length of pronotum; distance between antennae wider than scape width; scape and pedicel pale, flagellum light brown; torular membrane pale; flagellomeres almost as long as wide at base, apical ones wider than long; all segments set with short black setae. *Mandibles* pale, with tip black. *Palpi*, maxillary and labial pale; covered with short black setae, apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 68a): *Pronotum* about as long as wide; posterior margin as wide as anterior; subapical furrow present; mostly pale except for lateral margins dark brown, a discontinuous longitudinal medial brown line, and two longitudinal curved brown lines laterally; set with pale setae, which are longer on margins. *Mesonotum* pale with some dark brown marks as follows: two central longitudinal lines on prescutum; lateral areas of scutum; two curved longitudinal lines on scutellum; all segments set with short pale setae. *Metanotum* mostly pale except for two rounded dark brown spots on prescutum

and the dark brown lateral areas of scutum. *Pterothoracic pleura* mostly dark brown with irregular pale marks; covered with elongate white setae; Miller's organ present.

Wings (A4 Fig 68b): Rather narrow with tip acute; anterior Banksian line present in both wings, posterior only present in the forewing; veins mostly pale, but apical veins intercalated with brown spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane hyaline; pterostigma white; cubital fork located basal to Rs origin; three presectoral crossveins; subcostal veinlets simple; posterior area narrower than prefork area. *Hind wing* membrane hyaline with small brown infuscations on rhegmal area; medial fork located near Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Fig 68a): *All pairs of legs*, femur elongate ($> 2x$ length of coxa); tibia and tarsi about same size of femur; tibial spurs absent; T3 and T4 about same size, T2 slightly longer than T3, T1 about twice longer than T2 and T5 slightly longer than T1; claws as long as half of T5 length; coxa set with white setae. *Foreleg* sense hair as long as femur width; tibia with antennal cleaning setae ventroapically; all segments pale except for two small brown marks on anterior surface of tibia; coxa, trochanter and femur set with short pale setae, and some long pale setae on dorsal surface of femur; tibia and tarsi set with short black setae with scattered long black setae on tibia. *Mid and hindleg* with same color pattern of foreleg. *Hindleg* with femur and tibia slightly longer than in anterior legs.

Abdomen: Mostly pale except for lateral areas around pleura, dark brown; covered with short pale setae.

Male Terminalia (A4 Fig 69a-b): *Ectoproct* rounded in lateral view, set with elongate black setae. 9th sternite short, with posterior margin rounded in ventral view; set with elongate black setae medially. *Gonarcus* broad, arched, with anterior margin narrow, very long and curving downwards in lateral view; in posterior view anterior margins point medially. *Mediuncus* absent. *Paramere* broad in lateral view, with an elongate apical hook curving downwards; posterior margin curved with dorsal region longer.

Female Terminalia: *Unknown*.

Distribution (A4 Fig 160) – Known only for the male holotype from Elliott, NT.

Adult activity period – Record for October.

Biology – Unknown, larva unknown.

Primary type – Holotype (by original designation), male (ANIC), examined. From original description, New (1985b): “Holotype, ♂, Northern Territory, 17°29’S., 133°30’E., 8 km NW. by N. Elliott, 14.x.1972, M.S. Upton (ANIC)”. Condition: good; apical half of right antenna missing, terminalia dissected.

Comments – *Autrogymnocnemia forcipata*, is known only from the male holotype, but the genitalia shape clearly distinguishes this specimen from other *Autrogymnocnemia* species. It is also easily distinguished from its congeners by its hyaline wings, and mostly pale body with distinctive dark marks. Female is still unknown, but the elongate anterior margin of male gonarcus and the apical hook on male paramere support placement of this species in *Austrogymnocnemia*. For phylogenetic relationship see (A4 Figs 1-3).

***Austrogymnocnemia maculata* (Tillyard 1916)**

(A4 Figs 70-71)

Gymnocnemia maculata Tillyard 1916:57 (OD).

Austrogymnocnemia maculata (Tillyard): Esben-Petersen 1917:206 (n. cb.); Esben-Petersen 1923:587 (cit); Stange 1976:302 (cat); New 1985b:16 (key, rd, ill); New 1996:68 (cat); Stange 2004:99 (cat); Oswald 2015 (cat).

Diagnosis –Body mostly pale [not mostly dark]; pronotum with a medial continuous longitudinal line [not discontinuous]; wings with many brown marks [not hyaline or just infuscations]; forefemur without a series of long white setae [not with a series of long white setae]; male mediuncus absent [not present].

Description – Lengths: forewing: 18 – 25 mm; hind wing: 16 – 23 mm.

Head (A4 Figs 70a-b): *Labrum* pale; set with a line of elongate setae. *Clypeus* pale; set with some elongate black setae. *Frons* mostly pale with two shiny black curved marks on antennae inner margin (marks reduced or absent in few specimens), covered with few short black setae. *Gena* pale. *Vertex* raised; in frontal view pale, with two short transversal dark brown marks laterally and a rounded central dark spot; in dorsal view mostly pale with two central perpendicular dark brown lines (transversal line short and curved) and two black marks posterolaterally in some specimens; covered with short black setae, and some white seta posteriorly. *Ocular rim* setae absent. *Antennae* clubbed; elongate, about three times longer than pronotum; distance between antennae wider than scape width; mostly dark brown except for scape and anterior surface of apical flagellomeres pale, in some specimens flagellomeres distal margin pale; torular

membrane pale; flagellomeres almost as long as wide at base, apical ones much wider than long; set with short black setae. *Mandibles* pale, with tip black. *Palpi*, maxillary and labial mostly pale with apical segments dark, in some specimens other segments are also dark; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 70b): *Pronotum* about as wide as long; posterior margin as wide as anterior; subapical furrow present; mostly pale with three dark brown lines as follows: two short lateral on posterior area, and a broad medial line enclosing a pale line on anterior half; beset with white setae and some long setae at margins. *Mesonotum* with prescutum mostly dark brown but corners pale, scutum pale with two longitudinal dark brown lines and a central spot, scutellum pale with medial area dark brown; covered with short white setae. *Metanotum* with prescutum mostly pale with two lateral dark brown spots, scutum pale with lateral margins and mid area dark brown, scutellum pale with two dark brown lines on mid line; set with few short white setae. *Pterothoracic pleura* dark brown to grey, sclerites ventral area pale; covered with white setae; Miller's organ present.

Wings (A4 Fig 70c): Rather narrow with tip acute; anterior and posterior Banksian lines present in both wings; veins mostly white, but some veins intercalated with dark brown spots. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline with some brown marks beneath pterostigma, radial crossveins, posterior margin, apex, and tip of prefork area; cubital fork located about same place of Rs origin; three presectoral crossveins; subcostal veinlets simple; prefork area wider than posterior area, with many longitudinal crossveins. *Hind wing* membrane mostly hyaline except for brown marks on

rhegmal area, beneath pterostigma, tip of hypostigmatic cell, and apex; medial fork located near Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 70a-b): *All pairs of legs*, femur elongate (> 2x length of coxa); tibia and tarsi about same size, but femur slightly longer than tibia; tibial spurs absent; T3 and T4 about same size, T2 slightly longer than T3, T1 and T5 about same size, but twice longer than T2; claws slightly longer than half of T5 length; coxa, trochanter, femur and tibia set with short white setae, with few long setae at femur base; femur, tibia and tarsi set with short black setae, and scattered long setae at tibia; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair about twice femur width; tibia with antennal cleaning setae ventroapically; coxa pale with irregular dark brown marks, trochanter pale, femur pale with tip dark brown, tibia pale with three dark brown marks on anterior surface; tarsi pale with tip of segments dark brown, mainly in T5. *Midleg* with same color pattern of foreleg, except for femur with anterior surface dark brown, and posterior pale. *Hindleg* with femur, tibia and T1 slightly longer than in other legs; color pattern similar to midleg, except for tibia pale with a dark brown line on anterior surface.

Abdomen: Mostly dark brown with irregular pale marks, mainly on segments distal margins and near midline in some specimens; covered with short white setae.

Male Terminalia (A4 Figs 71a-c): *Ectoproct* rounded in lateral view, set with elongate black setae. *9th sternite* short, with posterior margin straight in ventral view; set with elongate black setae. *Gonarcus* broad, arched, with anterior margin narrow and curving downwards in lateral view. *Mediuncus* absent. *Paramere* broad in lateral view, with an apical hook curving downwards.

Female Terminalia (A4 Figs 71d-e): *Ectoproct* rounded, covered with thin elongate setae. *Lateral gonapophyses* rounded, much smaller than ectoproct, set with few thickened setae. *7th sternite* small, with distal margin medially extended in ventral view, and with an acute projection on medial region distally; covered with long black setae. *Pregenital plate* large with a transversal line arched medially, where fits a short sclerotized curved band. *Posterior gonapophyses* broad, elongate, with tip recurved; covered with long black setae, and with few elongate cavisetae posteroapically. *9th tergite* with an elongate membranous digitiform process. *Anterior gonapophyses* absent. *Ventral membrane* gonapophyseal plates present.

Distribution (A4 Fig 162) – Australia: NSW, NT, QLD, SA, VIC, and WA. New Caledonia*: Anse Vata (* = new record). The specimen from Anse Vata was collected in 1962 by G. Gross, who had collected and worked with insects from this country at that time. This is the first record of “*Periclystus* genus group” for New Caledonia, but the distance between this country and Australia suggests is an introduction. Records treated by New (1985b) were reexamined here and found to be misidentifications of *A. pseudomaculata*.

Adult activity period – Records for September to June.

Biology – Unknown, larva unknown.

Primary type – Holotype (by original designation), female (BMNH), high-resolution images examined. From original description, Tillyard (1916): “Hab.---Broken Hill, N.S.W. Four specimens taken by Mr. O. Lower (undated). Type in Coll. Tillyard”. From New (1985b): “Holotype, New South Wales, Broken Hill (O. Lower) (left antenna

missing) (BMNH). Paratype, 1 ex. (♀), same data (BMNH) (seen)". From Stange (2004): "Holotype, Broken Hill, New South Wales, Lower (BMNH!)". Condition: good; left antenna and right foreleg missing. The other three specimens from the original description are paratypes; they are females, one in the BMNH and two in the ANIC, they all bear blue paratype labels, and were all examined for this study.

Material examined – (137♂, 211♀, 2?). **AUSTRALIA: New South Wales:** *Barrier Range*: 10.i.1986 (1♀, AMSA); *Bourke*: x.1967 (1♀, ANIC); *Brewarrina*: iii.1919 (1♂, ANIC); *Broken Hill*: ii.1925, Fraiyer (1♂, AMSA); Coll. Lower (2♀ PT, ANIC); ix.1949 (2♀, ANIC); ii.1913 (1♀, ANIC); i.1964 (1♂, 3♀, SAMA); 26.ii.1976 (1♂, MVM); nr. race track, 31.96445°S - 141.41817°E±70m, 280m, 2.i.2013, M.V., Oswald, Diehl & Machado, Oswald #625 (13♂, 23♀, TAMU); *Duckshot Stn*: i.1968 (6♂, 4♀, SAMA); *Fawlers' Gap*: 30.i.1980, M. Graham (1♀, AMSA); 4.ii.1980, A. Smith (1♀, AMSA); 4.xii.1981, J. Brahl (1♂, 1♀, AMSA) *Kinchega Nat. Pk.*: 7 air km WSSW Menindee, 32.44396°S - 142.37947°E±100m, 60m, 1.i.2013, M.V., Oswald, Diehl & Machado, Oswald #624 (2♂, TAMU); *Lake Mungo*: ii.1998 (3♂, ANIC); *Menindee Lakes*: x.1973 (3♀, SAMA); *Papepabinbilla Ck*: 70 km ENE of Wilcannia, 30.xii.1988, M.S. & B.J. Moulds (1♂, 1♀, AMSA); *Silverton*: ii.1964 (1♀, SAMA); *Stephens Creek*: approx. 24 km ENE of Broken Hill, 27.i.1976, M.S. & B.J. Moulds (7♂, 6♀, AMSA); *Tiboburra*: xi.1949 (3♂, 3♀, ANIC); 8.i.1994, M.H. Dunn (1♀, AMSA); ix.1949 (1♀, ANIC); *Trangie*: xi.1982 (1♂, ANIC); *Yanga State Conserv. Ar.*: Willows cpgd, 22.6 air km SESE Balranald, 70m, 34.76051°S - 143.76152°E±100m, 11.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #599 (2♂, 1♀, TAMU); *Wentworth*: 30 km NNW,

1.i.1989, M.S. & B.J. Moulds (1♂, 1♀, AMSA); *Willandra Bridge*: xii.1970 (1♀, ANIC); *Wilcannia*: xi.1949 (2♀, ANIC); i.1970 (1♂, MVM); *Wittabrenna Ck*: xi.1971 (1♂, 1♀, ANIC); **Northern Territory**: *Alice Springs*: ii.1966 (1♂, 1♀, ANIC); *Kings Canyon*: (Au 12), 19.ix.2005, R. Miller & L. Stange (1♀, FSCA); *M. Austral Downs*: xi.1961 (1♂, TAMU, 1♀, FSCA); **Queensland**: *Bettota*: x.1936, S. Mann (2♀, QLDM); xi.1931 (1♀, QLDM); *Bransby*: iv.1966 (3♂, ANIC); *Boulia*: x.1978 (1♀, ANIC); *Cacoory Ruins*: v.1993 (1♀, QLDM); *Carnarvon Rge*: iii.1944, N. Geary (1♂, AMSA); *Cunnamulla*: i.1941 (2♂, QLDM); *Durham Downs*: xi.1949 (1♀, ANIC, 1♀, FSCA); *Hamilton Hotel*: x.1972 (3♂, ANIC); *Hungerford*: 45 km ESE, 15.xi.1971, R.C. Lewis (5♂, 5♀, ANIC); *Nockatunga*: xi.1949 (3♀, ANIC, 1♂ FSCA); *Noccundra*: iii.1965 (1♂, 1♀, ANIC); *Old Bundeena*: xi.1971 (2♀, ANIC); **South Australia**: *Arkaba Creek*: 26 air km ENNE Hawker, 390m, 31.68717°S – 138.57257°E±70m, 31.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #623 (2♀, TAMU); *Big Perry Spring*: xii.1974 (1♂, SAMA); *Billa Kalina*: xii.1974 (3♂, 1♀, SAMA); *Birchmore Lagoon*: 15mi from Kingscote, Kangooro Is, E. Troughton (1♀, AMSA); *Bucharinga Gorge*: xii.1985 (1♂, ANIC); *Cardillo Downs Stn*: ix.1995 (1♀, SAMA); *Cooper Crossing*: xi.1955 (1♂, 1♀, SAMA); *Coward Spring*: xi.1966 (1♂, 3♀, SAMA); *Cullyamurra Waterhole*: x.1991 (1♀, SAMA); *Cungena*: nr. Landfill, 100m, 32.58559°S – 134.72105°E±50m, 30.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #622 (1♀, TAMU); *El Alamein*: ii.1964 (1♂, 2♀, SAMA); *Farina Ck*: ii.1966 (1♂, 2♀, SAMA); *Hammond*: 3.iii.1909, V.H. Mircham (1♂, AMSA); *Innamincka*: x.1987 (1♀, SAMA); *Innamincka Cooper Ck*: 24.i.1976, M.S. & B.J. Moulds (2♂, 1♀, AMSA); *Kalamurina*: xii.1964 (1♂, SAMA);

White Bull Yard, x.1999 (1♀, SAMA); *Konamore*: xii.2000 (1♀, SAMA); *Lake Eire*:
 ii.1965 (6♂, 3♀, SAMA); xi.1966 (1♀, SAMA); *Lake Lettie Bore*: ii.1966 (1♂, 1♀,
 SAMA); *Leigh Ck*: 3.iii.1967, G.C. Gregory (20♂, 27♀, ANIC); i.1965 (1♂, 3♀,
 SAMA); x.1965 (1♀, SAMA); xi.1965 (1♀, SAMA); xii.1965 (1♂, 3♀, SAMA);
 xi.1969 (2♂, 1♀, SAMA); *Loxton*: ii.1953 (1♀, SAMA); *Marree*: xii.1964 (1♂, 1♀,
 SAMA); *Minnie Downs*: (1♂, SAMA); *Moomba Gas Field*: approx., 28°26'S –
 140°11'E, 23.i.1976, M.S. & B.J. Moulds (1♀, AMSA); *Mount Barr*: ix.1972 (3♀,
 ANIC); *Moralana Creek*: 40 km NNW of Hawker, 26.i.1976, M.S. & B.J. Moulds (1♀,
 AMSA); *Mount James*: xi.1950 (1♀, SAMA); *Mount Serle*: i.1965 (1♀, SAMA); *Mudla
 Bore*: xii.1972 (1♀, SAMA); *Muloorina HS*: iii.1965 (10♂, 19♀, SAMA); *Mundowdna
 Stn*: ii.1956 (1♀, SAMA); *New Kalamurina Stn*: iii.1972 (1♂, 2♀, SAMA);
Pinkawillinia Dst: x.1989; A. Sundholmi & J. Bugeja (1♀, AMSA); *Prescott*: ii.1965
 (2♂, 1♀, SAMA); *Rev. A. P. Burgess*: (1♂, 3♀, SAMA); *Singer Dam*: iii.2003 (1♀,
 SAMA); *Tingatingana Crossing*: Strelecki Creek, approx., 28°48'S – 140°10'E,
 25.i.1976, M.S. & B.J. Moulds (2♀, AMSA); *Yelpawaralinna*: ix.1993 (1♂, SAMA);
Yunta: i.1943 (2♂, 2♀, 2 ?, MVM); ii.1943 (1♂, 4♀, MVM); *White Bull Yard*:
 Kalamurina Stn x.1999 (2♀, SAMA); *William Creek*: xii.1974 (1♀, SAMA); **Victoria**:
Corbram: i.1944 (1♀, MVM); *Kewell*: (1♂, MVM); *Kyabram*: ii.1947 (1♀, MVM);
Malle: 2.ii.1914 (2♀, MVM); *Mildura*: ix.1937 (1♂, MVM); **Western Australia**:
Carnarvon: 24.ii.1977, M.S. & B.J. Moulds (1♂, 1♀, AMSA); 4.xii.1970 (2♀, MVM);
 25.ii.1977 (1♂, 1♀, AMSA); 26.ii.1977 (1♂, 1♀, AMSA); iii.1978 (2♀, QLDM);
Kalgoorlie: 18.vi.1986, A.J. Graham (1♀, AMSA); 15.i.1989 (1♀, AMSA); 12.i.1989,

M.S. & B.J. Moulds (1♀, AMSA) ; 13.i.1989 (1♀, AMSA); *Meekathurra*: 5.iii.1994, L. Stange (1♀, FSCA); *Roebourne*: iii.1914 (2♀, ANIC); *Woogan Hills*: N of Northam 20.i.1989, M.S. & B.J. Moulds (1♂, 1♀, AMSA); **NEW CALEDONIA: South Province**: *Anse Vata*: 18-20.ix.1962, GF Gross (1♂, SAMA).

Comments – *Austrogymnocnemia maculata* is easily distinguished from congeners by its body color pattern and wings marks. See also comments for *A. pseudomaculata*. For phylogenetic relationships see (A4 Figs 1-3).

***Austrogymnocnemia pallida* New 1985**

(A4 Figs 72-73)

Austrogymnocnemia pallida New 1985:14 (OD); New 1996:68 (cat); Stange 2004:100 (cat); Oswald 2015 (cat).

Diagnosis –Body mostly grey [not mostly dark brown]; forewing hyaline [not with brow marks]; hind wing with rhegmal area brown infuscated [not hyaline or with a broad transversal mark]; forefemur with a series of long white setae on dorsal surface [setae not absent, or present only in the base].

Description – Lengths: forewing: 21 – 28 mm; hind wing: 18 – 25 mm.

Head (A4 Figs 72a-b): *Labrum* pale; set with a line of elongate setae. *Clypeus* pale; set with few elongate black setae. *Frons* predominantly yellow with dark brown marks; generally surrounding antennae, mainly inner and dorsal surface (some specimens marks are larger and fused, but in others marks are very weak, just an infuscation); set with black setae. *Gena* pale. *Vertex* strongly raised with lateral corners straight; in frontal

view pale with two short transversal dark brown marks laterally and a rounded central dark spot; in dorsal view mostly pale with two central perpendicular dark brown lines and two black marks posterolaterally; covered with short black setae and few white setae on corners. *Ocular rim* setae absent. *Antennae* clubbed; elongate, about three times longer than pronotum; distance between antennae wider than scape width; scape and pedicel pale with posterior surface brown in some specimens, flagellomeres with basal half brown but apical half pale, in general posterior surface darker but four to five subapical flagellomeres entirely pale on anterior surface; torular membrane pale; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae. *Mandibles* pale, with tip black. *Palpi*, maxillary and labial pale; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 72b): *Pronotum* as long as wide; posterior margin as wide as anterior; subapical furrow present; mostly pale except for some grey marks as follows: a broad longitudinal central line enclosing a thin pale line (sometimes interrupted at furrow), lateral margins enclosing a pale spot on posterior surface, two small spots at furrow, two small spots on posterior margin; beset with short black setae and long white setae on borders. *Mesonotum* mostly grey with pale areas as follows: two lateral rounded spots on prescutum, two broad longitudinal lines near midline (enclosing a short longitudinal grey line), two rounded spots near wing base at scutum, a medial line and two rounded lateral spots at scutellum; covered with short white setae. *Metanotum* mostly grey, except for irregular pale areas (mostly around midline on scutum), covered with few short white

setae. *Pterothoracic pleura* grey to brown with irregular pale marks between sclerites; covered with many long white setae; Miller's organ present.

Wings (A4 Fig 72c): Rather narrow with tip acute; anterior and posterior Banksian lines present in both wings; veins mostly pale, but some veins intercalated with brown spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline with small brown marks concentrated at tip and posterior margin; pterostigma white; cubital fork located near Rs origin; three presectoral crossveins; subcostal veinlets simple; some specimens with costal area large with some veinlets sinuous; prefork area wider than posterior area, with many longitudinal crossveins. *Hind wing* membrane mostly hyaline except for rhegmal area brown infuscated; medial fork located near Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 72a-b): *All pairs of legs*, femur elongate ($> 2x$ length of coxa); tibia, femur and tarsi about same size; tibial spurs absent, but some specimens with a unique very short spur, particularly on hindleg; T3 and T4 about same size, T2 slightly longer than T3, T1 and T5 about same size, but twice longer than T2; claws about half of T5 length; coxa, trochanter, femur and tibia set with white setae, mainly at femur where setae are longer and numerous; femur, tibia and tarsi set with black setae, and scattered long black setae, mainly at femur apex; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair short, slightly longer than femur width; tibia with antennal cleaning setae ventroapically; coxa, trochanter and femur with external surface light brown and internal pale, tibia posteriorly pale but anteriorly light brown with a pale subbasal mark; tarsi mostly pale. *Midleg* with color pattern similar to foreleg, except for

tibia and femur with brown areas are larger. *Hindleg* with femur and tibia slightly longer than in other legs; color pattern similar to midleg, except for tibia pale with base brown.

Abdomen: Mostly grey with scattered pale marks, mainly on sternites medial areas and tergites distal margins. Beset with short white setae.

Male Terminalia (A4 Figs 73a-c): *Ectoproct* rounded in lateral view, set with elongate black setae. 9th *Sternite* short, with posterior margin rounded in ventral view; set with elongate black setae. *Gonarcus* broad, arched, with anterior margin thin and curved, in lateral and posterior view. *Mediuncus* absent. *Paramere* broad in lateral view, with an elongate apical hook curving downwards.

Female Terminalia (A4 Figs 73d-e): *Ectoproct* rounded, covered with thin elongate setae. *Lateral gonapophyses* rounded, much smaller than ectoproct, set with few thickened setae. 7th *sternite* small, with distal margin sclerotized and with a small medial concavity in ventral view; covered with black setae. *Pregenital plate* a transversal bar, in ventral view. *Posterior gonapophyses* broad, long, with tip recurved; covered with long black setae, and with few cavisetae dorsoapically. 9th *tergite* with a long membranous digitiform process. *Anterior gonapophyses* absent. *Anterior gonapophyses* absent. *Ventral membrane* gonapophyseal plates present.

Distribution (A4 Figs 160) – Australia: NT, QLD, and WA.

Adult activity period – Records for October to January.

Biology – Unknown, larva unknown.

Primary type – Holotype (by original designation), female (MVM), examined. From original description, New (1985b): “Holotype, ♀, Northern Territory, Alice Springs,

27.xi.1954, WH (MVM)”. Condition: good, mid and hindlegs missing, terminalia dissected.

Material examined – (18♂, 34♀). **AUSTRALIA: Northern Territory:** *Alice Spring:* 19.xi.1989, R.B. Miller (2♀, TAMU; 3♀, FSCA); x.1966 (1♀, ANIC); xi.1954 (1♂ PT, MVM); *Tilmouth Well:* Napperby Creek, 22:48:40S – 132:35:40E, 13.i.2001, M.S. & B.J. Moulds (1♂, 1♀, AMSA); **Queensland:** *Bollon:* x.1957 (1♀, ANIC); *Lawn Hill:* Adels Grove, W of Gregory Downs, 19.xii.1986, M.S. & B.J. Moulds (1♂, 2♀, AMSA); *Mount Isa:* 110 km NW, 27.xi.1990, at light, W.F. Chamberlain (1♂, FSCA); xi.1940 (1♀, QLDM); **Western Australia:** *Fitzroy Crossing:* Derby-Broome road, 3.xi.1978, M.S. & B.J. Moulds (2♂, 6♀, AMSA). *Gascoyne Junction:* 70 air km WNW, 24.87559°S – 114.55150°E±90m, 21.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #613 (3♂, 3♀, TAMU); *Langi Crossing:* x.1960 (2♀ FSCA); *Marble Bar:* i.1914 (1♀, ANIC); *Millstream:* x.1970 (1♂, 2♀, ANIC); *Nanutarra Roadhouse:* hwy 136, 13 air km NENE, 22.47124°S – 115.60040°E±70m, 22.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #614 (4♂, 2♀, TAMU); *Newman:* hwy 138, 9 air km EENE, 520m, 23.34699°S – 119.82137°E±80m, 25.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #616 (2♂, 2♀, TAMU); *Tunel Creek:* E of Derby, 1.xi.1978, M.S. & B.J. Moulds (2♂, 5♀, AMSA); *Wittenom:* xi.1970 (2♂, ANIC).

Comments – *Austrogymnocnemia pallida*, seems to be the larger species in the genus, and its wings are more acute than in the other species. The body and wings color pattern clearly distinguished this species from the other ones in the genus. For phylogenetic relationships see (A4 Figs 1-3).

***Austrogymnocnemia pseudomaculata* new species**

(A4 Figs 74-75)

Diagnosis –Body mostly dark [not mostly pale]; pronotum with a medial continuous longitudinal line [not discontinuous]; wings with many brown marks [not hyaline or just infuscations]; forefemur without a series of long white setae [not with a series of long white setae]; male mediuncus present [not absent].

Description – Lengths: forewing: 19 – 22 mm; hind wing: 17 – 19 mm.

Head (A4 Figs 74a-b): *Labrum* pale to brown; set with a line of elongate setae. *Clypeus* pale to brown; set with some elongate black setae. *Frons* mostly shiny black with ventral margin and a central dorsal spot pale, (some specimens pale areas larger); covered with short white setae. *Gena* pale. *Vertex* strongly raised; in frontal view pale, with two short transversal dark brown marks laterally and a rounded central dark spot; in dorsal view mostly pale with two central perpendicular dark brown lines and two black marks posterolaterally in some specimens; covered with short black setae, and some white setae posteriorly. *Ocular rim* setae absent. *Antennae* clubbed; elongate, about three times longer than pronotum; distance between antennae wider than scape width; mostly dark brown except for pale areas as follows: parts of pedicel, anterior surface of apical flagellomeres, distal margin of flagellomeres, anterior surface of basal flagellomeres (in some specimens); torular membrane pale; flagellomeres almost as long as wide at base, apical ones much wider than long; scape, pedicel and first flagellomere covered with white setae, remaining segments set with short black setae. *Mandibles* pale, with tip

black. *Palpi*, maxillary and labial mostly pale with apical segments dark, in some specimens other segments are dark too; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 74b): *Pronotum* wider than long; posterior margin as wide as anterior; subapical furrow present; mostly pale with dark brown areas as follows: a broad medial line, two lateral lines, anterior margin, two spots at furrow, two on posterior margin; beset with long white setae, and scattered short setae. *Mesonotum* with three longitudinal dark brown bands (a central and two lateral) intercalated by two pale lines; the central line generally is darker, and in some specimens there is small black line on each of pale lines; covered with short white setae. *Metanotum* mostly dark brown with two pale marks near midline; set with short white setae. *Pterothoracic pleura* dark brown with margins pale; covered with white setae; Miller's organ present.

Wings (A4 Fig 74c): Rather narrow with tip acute; anterior and posterior Banksian lines present in both wings; veins mostly dark brown, but some veins intercalated with white spots. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline with some brown marks on posterior margin, apex, around gradate crossveins, few areas at mediocubital area, and tip of prefork area; cubital fork located about same place of Rs origin; three presectoral crossveins; subcostal veinlets simple; prefork area wider than posterior area, with many longitudinal crossveins. *Hind wing* membrane mostly hyaline except for brown marks on rhegmal area, base of hypostigmatic cell, and apex; medial fork located near Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 74a-b): *All pairs of legs*, femur elongate (> 2x length of coxa); femur, tibia and tarsi about same size; tibial spurs absent; T3 and T4 about same size, T2 slightly longer than T3, T1 and T5 about same size, but twice longer than T2; claws about half of T5 length; coxa, trochanter, femur and tibia set with short white setae, with few longer setae at femur; femur, tibia and tarsi set with short black setae, and scattered long setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair short, slightly longer than femur width; tibia with antennal cleaning setae ventroapically; coxa dark brown with internal surface pale, trochanter pale, femur internal surface pale but external reddish brown, tibia pale with three dark brown marks on anterior surface; tarsi with T1 and T2 pale, remaining reddish brown except for tip of T5, dark brown. *Midleg* with same color pattern of foreleg, except for femur mostly reddish brown. *Hindleg* with femur, tibia and T1 slightly longer than in other legs; color pattern similar to midleg, except for tibia pale at apex and dark reddish brown at base.

Abdomen: Dark brown with irregular pale marks, mainly segments distal margins; covered with short white setae.

Male Terminalia (A4 Figs 75a-c): *Ectoproct* rounded in lateral view, set with elongate black setae. *9th sternite* short, with posterior margin straight in ventral view; set with elongate black setae. *Gonarcus* broad, arched, with anterior margin narrow, elongate, and extending ventrally in lateral view. *Mediuncus* triangular in posterior view, with tip acute; connected to gonarcus, but less sclerotized. *Paramere* broad in lateral view, with an apical hook, curving downwards and more sclerotized.

Female Terminalia (A4 Figs 75d-e): *Ectoproct* rounded, covered with thin elongate setae. *Lateral gonapophyses* rounded, much smaller than ectoproct, set with few thickened setae. *7th sternite* short with distal margin medially extended in ventral view and a small concavity medially; covered with black setae. *Pregenital plate* large with a transversal line bearing a medial acute expansion anteriorly, and a curved small band posteriorly. *Posterior gonapophyses* broad, elongate, with tip recurved, covered with long black setae, and with few cavisetae posteroapically. *9th tergite* with an elongate membranous digitiform process. *Anterior gonapophyses* absent. *Ventral membrane gonapophyseal plates* present.

Distribution (A4 Figs 160) – Australia: ACT, NSW, NT, QLD, SA, and WA.

Adult activity period – Records for September to June.

Biology – Unknown, larva unknown.

Etymology – The specific name is derived from the Greek word *pseudo* (= false) and refers to the fact that this species shares many similarities with *A. maculata*, being easily confused.

Primary type – Holotype (by present designation), male, (AMSA). **AUSTRALIA:**

Western Australia: *Cosmo Newberry*: 140 km ENE, 27:41S – 124:13E, 28.Dec.1995, M.S. & B.J. Moulds. Condition: pinned, good.

Paratypes: **AUSTRALIA:** **Northern Territory:** 60 mi N of *Barrow Creek*, UV light, 7.iv.1966, N. Mcfarland (1♂ SAMA, pinned); **Western Australia:** same as holotype (1♀, AMSA, pinned); *Kiwirrkurra IPA*: Visitor Center, 22.81979°S – 127.76564°E, 430m, 7.ix.2015, N. Tatarnic, [BBKIWI L03] (1♂, WAM, pinned); *Meekatharra*: 111

km N, 4.iii.1994, L. Stange (1♂, FSCA, pinned); *Millstream*: 21.35S – 117.04E, 4.Nov.1970, Upton & Feehan (1♀, ANIC, pinned); Hwy 138, 9 air km EENE *Newman*, 520m, 23.34699°S – 119.82137°E±80m, 25.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #616 (1♂, 1♀, TAMU, pinned).

Extra material examined – (149♂, 199♀, 16?). **AUSTRALIA: ACT:** *Canberra*: ii.1960 (1♀, ANIC); **New South Wales:** *Bourke*: x.1957 (7♂, 12♀, ANIC); *Cobar*: x.1957 (2♂, ANIC); *Nature Tooma*: iv.1972 (1♀, SAMA); **Northern Territory:** *Barkly Hwy*: 75 km ESE of junction with Tablelands Hwy, 4.i.1987, M.S. & B.J. Moulds (1♂, 7♀, AMSA); *Barrow Creek*: iv.1966 (2♂, 2♀, SAMA); *Barry Caves*: ix.1976 (1♂, 1♀, MVM); *Center of Australia Marker*: iii.1993 (1♀, SAMA); *Elliott*: 3 km S, 1.iv.2008, at light in grassland-shrub complex, G. Williams & W. Pulawski (1♀, AMSA); *Finke*: ix.1972 (1♀, ANIC); *Illamurta Spring*: iii.1993 (5♂, 5♀, SAMA); *Kings Canyon*: 9.ix.2005 (1♂, FSCA); *Lubras Lookout*: nr Renner Springs, 12.i.1992, M.S. & B.J. Moulds (2♂, AMSA); *Milton PK*: xi.1968 (1♂, ANIC); *Mount Ebenezer*: 30 km W, 1.i.1996, M.S. & B.J. Moulds & K.A. Kopestonsky (1♂, AMSA); *Palm Valley*: 26.xi.1954 (1♀, MVM); *Rabbit Flat*: 27 km S, 20:22:52S – 130:08:54E, 12.i.2002, M.S. & B.J. Moulds (1♂, AMSA); *Renner Springs*: 5 km S, 18°21'05''S - 133°48'58''E, 26.i.2004, 260m, M. Moulds & S. Cowan (1♀, AMSA); *Tablelands & Barkly Hwy junction*: 21.xii.1986, M.S. & B.J. Moulds (1♀, AMSA); *Tennant Creek*: xi.1966 (2♂, ANIC); *Tilmouth Well*: Napperby Creek, 22:48:40S – 132:35:40E, 13.i.2001, M.S. & B.J. Moulds (4♂, AMSA); *Three Way*: 16.xi.90, at light, W.F. Chamberlain (2♂, TAMU); x.1972 (2♀, ANIC); *Yalara Resort*: Ayres Rock, 2.ii.1984, M.S. & B.J. Moulds

(1♀, AMSA); *Wauchope*: 2 km S, 31.iii.2008, at light in spinifex plain, G. Williams & W. Pulawski (1♂, 1♀, AMSA); x.1972 (1♂, 1♀, ANIC); **Queensland**: *Barcaldine*: 10.ii.1981, M.S. & B.J. Moulds (1♂, AMSA); 9.5 air km S, Botanical Walk, 23.63733°S 145.28137°E±30m, R Machado, MV light, 23.xii.2015, AustRM#08 (1♂, TAMU); *Barrey Caves*: 12.x.1963, R. Lossin (1? AMSA); *Blackwater*: 70 km S, 19.i.1987, M.S. & B.J. Moulds (1♀, AMSA); *Charleville*: x.1957 (1♂, 1♀, ANIC); 5 km NW, 26°23'S – 146°12'E, 3-5.iii.2003, G. Monteith & C. Bunwell (1♀, CSCA); *Clement*: Dr. K.K. Spance (1♀, 1? AMSA); *Clermont*: 8 km S, 18.iii.1982, M.S. & B.J. Moulds (1♂, AMSA); ii.1924 (2♂, 1♀, ANIC); 22.x.1924 (1♀, QLDM); *Cloncurry*: (1?, MVM); *Dynevor Lakes*: 88 km W Eulo, 28°05'S – 144°12'E, 27.ix.1991, 150 m G. Daniels (12 ?, QLDM); *Hebel*: x.1957 (3♂, 2♀, ANIC); *Hughenden*: 65 km E, 4.ii.1981, M.S. & B.J. Moulds (1♀, AMSA); *Kundala*: (1♂, 3♀, MVM); *Lawn Hill*: Adels Grove, W of Gregory Downs, 19.xii.1986, M.S. & B.J. Moulds (3♀, AMSA); *Noombah Stn.*: SW of longreach, 24.05.2S – 143.08.7E, 14.i.2002, Cooley, Hill, Marshal & Moulds (1♂, AMSA); *Yanna*: v.1973 (1♂, ANIC); **South Australia**: *Agnes Creek Stn.*: 11.x.1977, at light, G.F. Gross & J.A. Forrest (5♀, SAMA); *Allendale Stn.*: ix.2005 (1♂, SAMA); *Coober Pedy*: xi.1977 (1♀, ANIC); *Everard Pk.*: x.1970 (3♂, 4♀, SAMA); xi.1970 (2♂, 9♀, SAMA); *Innaminka*: 17.i.2002, Cooley, Cowan, Hill, Marshal & Moulds (1♂, AMSA); *Lake Eyre*: Prescott Point, iii.1965 (1♂, SAMA); *Maralinga Tjarutja*: SW lake Bring, xi.2005 (1♀, SAMA); *Mount Lindsay*: Wartaru, x.1996 (13♂, 17♀, SAMA); *Muloorina*: iii.1965 (1♀, SAMA); *Musgrave Rg*: SE Mitchell Knob, x.1994 (1♂, 3♀, SAMA); *Vokes Hill*: iv.2002 (1♂, SAMA); *Welbourne Hill*: xi.1977

(1♀, ANIC); x.1953 (1♂, SAMA); *Willaim Ck*: xii.1974 (1♀, SAMA); *Wychinga Bore*: ix.1999 (1♀, SAMA); **Western Australia**: *Barrow Crk.*: 60mi N, 7.iv.1966, UV light, N. McFarland (1♂, 1♀, SAMA); *Billiluna*: 7 km N, 19°30'39''S - 127°39'47''E, 5.vi.1998, MV, JD Oswald (1♀, FSCA, 9♂, 9♀, TAMU); *Billiluna Pool*: iv.1930 (1♀, SAMA); *Blackstone*: x.2006 (4♂, 7♀, SAMA); *Broome*: 130 mi SE, 15.ix.1924 (1♀, MVM); *Cane River HS*: iv.1971 (1♂, 3♀, ANIC); *Cosmo Newberry*: 140 km ENE, 27:41S - 124:13E, 28.xii.1995, M.S. & B.J. Moulds (1♂, 4♀ AMSA); 80 km E, 27:55S - 123:29E, 27.xii.1995, M.S. & B.J. Moulds & K.A. Kopestonsky (3♂, AMSA) *Gascoyne Junction*: 70 air km WNW, 24.87559°S - 114.55150°E±90m, 21.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #613 (12♂, 14♀, TAMU); *Great Sandy Desert*: 130 miles SE of Broome, 15.ix.1924 (1? MVM); *Halls Creek*: ca 85 km ESE, 18°24S - 128°28E, 4.vi.1998, MV, JD Oswald (1♀, TAMU); 40 km SW, 18°29'31''S - 127°24'05''E, 6.vi.1998, MV, JD Oswald (1♀, TAMU); v.1964 (1♂, ANIC); *Kalgoorlie*: 30.xi.1985, M.S. & B.J. Moulds (2♂, AMSA); *Karijini Natl. Pk.*: Karijini Dr. 8 km WNW Great Northern Hwy, 750m, 22°37.1'S - 118°22.3'E, 22-23.iv.2003, Malaise Trap in Dry Wash, M.E. Irwin & F.D. Parker (1♀, FSCA); *Karonie*: xi.1969 (1♀, ANIC); *Lake Austin*: 24.iii.2005 (1♀, FSCA); *Lake Marmion*: iii.1996 (2♂, 1♀, SAMA); *Millstream Chichester National Park*: Python Pool, 21.33309°S - 117.23930°E±130m, 180m, 23.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #615 (1♂, TAMU); *Millstream*: 1 km NE, 21.35S - 117.04E, x.1970, Upton & Feehan (2♂, 2♀, ANIC); xi.1970 (3♀, ANIC); iv.1971 (1♀, ANIC); *Minilya River*: iii.1971 (1♀, ANIC); *Mount Aloysius*: xi.1977 (4♂, 2♀, ANIC); xi.1963 (2♂, 2♀, SAMA); *Mount*

Davis: xi.1956 (2♂, SAMA); x.1972 (1♂, SAMA); *Mundiwindi*: x.1961 (1♀, FSCA); *Nanutarra Roadhouse*: hwy 136, 13 air km NENE, 22.47124°S – 115.60040°E±70m, 22.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #614 (2♂, 3♀, TAMU); *Newman*: hwy 138, 9 air km EENE, 520m, 23.34699°S – 119.82137°E±80m, 25.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #616 (22♂, 18♀, TAMU); *Port Headland*: x.1960 (1♂, FSCA); *Pungkulpirri Waterhole*: 0.5 km E, Walter James Rg, 24°39'15''S – 128°45'18''E, 26.ix.2006, at light, Central Ranges Sur. Camp 1 (1♂, 3♀, SAMA); *Tea Tree*: 48 km S, 23.i.1984, M.S. & B.J. Moulds (3♂, 3♀, AMSA); *Tom Price Rd.*: 15 km North along, 150m East of Tom Price Rd., -22.6736S – 117.7725E, 17.ii.2005, 710m, light trap on slope of small hill above dry creek bed dominated by Acacia, M. Bulbert & S.G. Ginn (3♀, AMSA); *Warburton*: 40 km W, 26.13S – 126.19E, 29.xii.1995, M.S. & B.J. Moulds & K.A. Kopestonsky (1♂, 3♀, AMSA); *Werburton*: xi.1977 (1♂, 3♀, ANIC); *Zanthus*: xi.1969 (1♀, ANIC).

Comments – Despite being described here for the first time, many specimens of *A. pseudomaculata* were collected a long time ago and were deposited in many collections around the world. In fact, few specimens were unidentified, and at least two in QLDM had labels saying new species, but most of these specimens were identified as *A. maculata*. Indeed, these two species are very similar, mainly because of marks on the wings and shape of female terminalia. However, these two species can be clearly distinguished, mostly based on the darker pattern of *A. pseudomaculata*. The frons, pronotum, and forewing, of the new species present much larger and darker marks than *A. maculata*, but the main difference between this two is on the male terminalia, with *A.*

pseudomaculata having a large mediuncus that is absent in of *A. maculata*. For phylogenetic relationships see (A4 Figs 1-3).

***Ceratoleon* Esben-Petersen 1917**

Type species: *Ceratoleon brevicornis* Esben-Petersen 1917, by original designation.

Diagnosis – Ocular setae present [not absent]; tibial spurs absent [not present]; forewing costal area biareolate at least basal third [not uniareolate or entirely biareolate].

Description – Head: *Vertex* strongly raised. *Ocular rim* setae present. *Antennae* almost fusiform. Thorax: *Pronotum* slightly wider than long. Miller's organ present. Wings: rather narrow with tip acute. Anterior and posterior *Banksian lines* present in both wings. *Forewing* with at least basal third of costal area biareolate; prefork area biareolate and wider than posterior area. *Male pilula axillaris* present. Legs: femur short, about same size of head width. *Foreleg sense hair* elongate, about half of femur length. *Tibial spurs* absent. *Pretarsal claws* shorter than half of T5 length. Male Terminalia: *Ectoproct* rounded in lateral view; *gonarcus* broad and arched; *mediuncus* acute and fused to gonarcus; *paramere* broad. Female Terminalia: *Ectoproct* rounded without cavisetae; *lateral gonapophyses* rounded, set with few cavisetae; *posterior gonapophyses* long, broad and with some cavisetae apically; *anterior gonapophyses* absent; *9th tergite* with a short membranous digitiform process; *pregenital plate* well developed.

Distribution (A4 Fig 163) – Australia: NSW, NT, QLD, SA, VIC, and WA.

Comments – The genus contains two species, *C. brevicornis* and *C. mjobergi*. These two species are very distinctive from each other, with many differentiating characters,

which was corroborated by the molecular data. However, the shape of the forewing costal area, and prefork area, together with the absence of the tibial spurs justify their placement in their own genus, as reinforced by the morphological phylogeny results. This is another small genus that was placed on the problematic area of the molecular tree. *Ceratoleon mjobergi* was placed close to *Austrogymnocnemia*. However, *C. brevicornis* was recovered sister to *M. meteoricus*, which was quite unexpected; both species are very different, particularly the female terminalia. The Placement of *C. brevigonarcus* actually varied during initial analysis, and was once recovered close to *C. mjobergi*. Although, this variable behavior of *C. brevicornis* is not a great surprise, since the species is very unique among “*Periclystus* species group”, particularly the antennal shape. Despite the results recovered in the molecular phylogeny, the genus will still be considered as valid here, mostly because this area of the molecular tree needs further investigation and because it was recovered monophyletic in the morphological phylogeny (A4 Figs 1-3).

Biology – Unknown.

Key to species of *Ceratoleon*

- 1 Antennae short, medial flagellomeres much wider than long (A4 Fig 76a); ocular setae short and white; forewing membrane mostly hyaline with small brown marks; hind wing apex without a transversal band (A4 Fig 76c).....*C. brevicornis*
- 1' Antennae long, medial flagellomeres about as wide as long (A4 Fig 78a); ocular setae long and black; forewing membrane mostly brown with small hyaline areas; hind wing with a broad, dark, subapical stripe (A4 Fig 78c).....*C. mjobergi*

***Ceratoleon brevicornis* Esben-Petersen 1917**

(A4 Figs 76-77)

Ceratoleon brevicornis Esben-Petersen 1917:207 (OD); Esben-Petersen 1923:587 (cit); Stange 1976:303 (cat); New 1985b:6 (key, rd, ill); New 1996:74 (cat); Stange 2004:101 (cat); Oswald 2015 (cat).

Diagnosis – Antennae short and fusiform [not elongate and clubbed]; ocular setae short and white [not long and black]; tibial spurs absent [not present]; forewing costal area biareolate at least basal third [not uniareolate or mostly biareolate]; forewing mostly hyaline but full of brown marks [not mostly brown with hyaline marks].

Description – Lengths: forewing: 14 – 19 mm; hind wing: 13 – 17 mm.

Head (A4 Figs 76a-b): *Labrum* pale with two medial brown spot in some specimens; set with a line of elongate setae. *Clypeus* pale; with some elongate black setae. *Frons* black; set with few black setae. *Gena* pale. *Vertex* raised; in frontal view pale, with two lateral transversal black lines and a central spot; in dorsal view mostly pale with two central perpendicular black lines and two black marks posterolaterally; covered with short black setae. *Ocular rim* setae white and short. *Antennae* fusiform; about twice longer than pronotum; distance between antennae about as wide as scape; scape, pedicel and first flagellomere dark brown, other flagellomeres with ventral half dark brown but dorsal half pale, in some specimens apical flagellomeres entirely dark brown; torular membrane pale; flagellomeres much wider than long, mainly medial ones; all segments set with short black setae, and some elongate setae on posterior surface. *Mandibles* mostly pale,

with tip dark. *Palpi*, maxillary and labial mostly pale with irregular brown marks, but in some specimens segments almost entirely brown; apical labial palpomere elongate, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 76b): *Pronotum* about as long as wide; posterior margin as wide as anterior; subapical furrow present; mostly dark brown except for some irregular pale areas, mainly on lateral parts of posterior half and around central area on anterior half; beset with long black setae. *Mesonotum* mostly grey to dark brown, with some pale areas in some specimens as follows: small rounded marks on prescutum and scutellum and longitudinal lines at scutum; set with short black setae, and some long setae on prescutum, and a few long and thickened setae on scutum and scutellum. *Metanotum* grey to dark brown, with scattered pale marks; covered with short black setae. *Pterothoracic pleura* dark brown to grey with irregular small pale areas; covered with long white setae; Miller's organ present.

Wings (A4 Fig 76c): Rather narrow with tip acute; anterior and posterior Banksian lines present in both wings; veins mostly dark brown, but some veins intercalated with white spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline with brown marks concentrated at tip, posterior margin, gradate crossveins, subcostal area, around radial crossvein; cubital fork located between origins of Rs and MA; three to five presectoral crossveins, in some specimen the distal vein has a medial veinlet connecting with RS+MA; basal part of costal area biareolate; posterior area narrower than prefork area. *Hind wing* membrane mostly hyaline except for brown marks beneath pterostigma and rhegmal area, some specimens with small brown marks

around radial crossveins and tip of hypostigmatic cell; medial fork located between origins of Rs and MA origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 76a): *All pairs of legs*, femur short (< 2x length of coxa); tibia and femur about same size, but slightly longer than tarsi; tibial spurs absent; T2, T3 and T4 about same size, T1 slightly longer than T2, T5 about twice longer than T1; claws shorter than half of T5 length; coxa, trochanter, femur, and tibia set with long white setae, mainly on femur (some setae on dorsal surface can be longer than femur); femur, tibia and tarsi also set with long black setae. *Foreleg* sense hair about half of femur length; tibia with antennal cleaning setae ventroapically; coxa dark brown but with some pale areas on anterior surface, trochanter brown, femur brown with anterior surface pale, tibia with anterior surface mostly dark brown with three pale spots, and posterior surface pale; tarsi dark brown, except for T1, pale. *Midleg* with coxa shorter than foreleg, color pattern similar to foreleg, except for anterior surface of femur and tibia, dark brown. *Hindleg* with femur, tibia and T1 slightly longer than in other legs; color pattern similar to midleg, except for tibia pale with tip and anterior surface dark brown.

Abdomen: Mostly dark brown with scattered pale marks mainly in the sternites; beset with short black setae, and some white setae on basal segments.

Male Terminalia (A4 Figs 77a-c): *Ectoproct* rounded in lateral view, set with elongate black setae. *9th sternite* posterior margin curved, in ventral view; set with elongate black setae. *Gonarcus* arched and very broad in lateral view. *Mediuncus* small and acute. *Paramere* broad with base curved and tip acute.

Female Terminalia (A4 Figs 77d-e): *Ectoproct* rounded covered with thin elongate setae. *Lateral gonapophyses* rounded, much smaller than ectoproct, set with few cavisetae. 7th *sternite* distal margin curved in ventral view, covered with long black setae. *Pregenital plate* large, “goblet” shaped. *Posterior gonapophyses* broad, elongate, with tip enlarged; covered with long black setae, and some cavisetae apically. 9th *tergite* with a membranous digitiform process. *Anterior gonapophyses* absent. *Ventral membrane* gonapophyseal plates present.

Distribution (A4 Figs 163) – Australia: NSW, NT, QLD, SA, VIC*, and WA. * = new record.

Adult activity period – Records for September to May.

Biology – Unknown, larva unknown.

Primary type – Holotype (by original designation), female (ANIC), examined. From original description, Esben-Petersen (1917): “Brewarrina, N.S.W.; one female specimen (type), 1914 (W. W. Froggatt leg.); Coll. Froggatt. Narromine, N.S.W.”. From New 1985: “Holotype, ♀, New South Wales, Brewarrina, 1914, W.W. Froggatt leg. (ANIC)”. Condition: good (no parts missing) but covered with some white mold.

Material examined – (69♂, 112♀). **AUSTRALIA: New South Wales:** *Bourke*: 30 S, 24.x.1957, E.F. Riek (5♂, 21♀, ANIC, 2♀, FSCA); *Broken Hill*: nr. race track, 280m, 31.96445°S – 141.41817°E±70m, 2.i.2013, M.V., Oswald, Diehl & Machado, Oswald #625 (1♀, TAMU); *Cobar*: 26.x.1957, E.F. Riek (1♂, 2♀, ANIC); *Mt Boppy*: 27.x.1957, E.F. Riek (1♀, ANIC); *Nombinnie Nature Reserv.*: 18 air km SSE Mount Hope, 160m, 32.99613°S – 145.94006°E±70m, 3.i.2013, M.V., Oswald, Diehl & Machado, Oswald

#626 (2♂, 2♀, TAMU); *North Bourke*: 14.xii.1977, at light, K.J. & C.L. Lambkin (1♂, 1♀, QLD); *Talyealye Hsd*: 4 km N, 29°05'28''S - 144°27'59''E, 17.i.1999, M.S. & B.J. Moulds (1♂, AMSA); **Northern Territory**: *Alice Springs*: 39 km E, 23.41S - 134.15E, 5.x.1978, M.S. Upton & R.A. Barrett (2♂, 4♀, ANIC); 19.xi.1989, R.B. Miller (1♂, FSCA); 22.xi.1989 (1♀, FSCA); *Andado Stn*: iii.1993 (1♀, SAMA); *Barrow Creek*: iv.1966 (1♀, SAMA); *Bitter Spr Ck*: iii.1993 (1♂, SAMA); *Kings Canyon*: 19.ix.2005, R. Miller & L. Stange (1♂, FSCA); *Narwietooma HS*: iv.1972 (1♀, SAMA); *Tennant Creek*: iii.1906 (1♂, ANIC); *Three Ways*: 160 km E, 7.x.1972, E.F. Riek (4♂, 3♀, ANIC); **Queensland**: *Amby*: W of Roma, 12.ii.1981, M.S. & B.J. Moulds (1♂, AMSA); *Barcaldine*: 10.ii.1981, M.S. & B.J. Moulds (2♂, 4♀, AMSA); 9.5 air km S, Botanical Walk, 23.63733°S 145.28137°E±30m, R Machado, MV light, 23.xii.2015, AustRM#08 (1♂, 1♀, TAMU); *Blackwater*: 70 km S, 19.i.1987, M.S. & B.J. Moulds (1♀, AMSA); *Boullia*: 62 km WS, 23.02S - 139.18E, 16.x.1978, E.F. Riek (1♂, ANIC); *Charleville*: 13.xi.1938 (2♀, QLD); *Clermont*: 17.xi.1924 (1♀, QLD); 19.xi.1924 (2♀, ANIC); *Cunnamulla*: 22.x.1938, N. Geary (1♂, AMSA); 10.xi.1938 (1♀, AMSA); *Hebel*: 16.x.1957, E.F. Riek (3♂, 5♀, ANIC); *Noombah Stn*: SW of Longreach, 24:05.2S - 143:08.7E, 14.i.2002, Cooley, Hill, Marshall & Moulds (1♀, AMSA); *Roma*: 11.xi.1938 (1♀, QLD); *Simpson Desert*: x.1987 (1♀, SAMA); **South Australia**: *Cooper Pedy*: 91 km SE, 29.49S - 134.54E, 22.xi.1977, M.S. Upton (1♀, ANIC); *Emu Junction*: x.1976 (1♀, SAMA); *Everard Pk*: xi.1970 (1♂, 5♀, SAMA); *Mount Barr*: 24 km SSE of Abminga, 22.ix.1972, Z. Liepa (1♀, ANIC); *Mount Lindsay*: 18.x.1996 (1♂, 2♀, SAMA); *Mount Serle*: i.1965 (1♀, SAMA); *Mulgathing HS*: xi.1977 (1♀, SAMA);

Pirramimma: x.1953 (3♂, 1♀, SAMA); xi.1975 (1♂, SAMA); *Price Bore*: iv.2007 (1♀, SAMA); *White Bull Yard*: Kalamurina Stn x.1999 (3♀, SAMA); **Victoria**: *Hattah*: 44 km E, 34°45.3'S – 142°40.9E, 3.ii.2004, M. Moulds & S. Cowan (1♀, AMSA); **Western Australia**: *Barradale*: 23 km WSW, 23.56S – 114.45E, 28.iv.1971, Upton & Mitchell (1♀, ANIC); *Blackstone*: x.2006 (1♂, SAMA); *Beverley*: (1♀, SAMA); *Cunderdin*: ii.1914 (1♀, ANIC); *Fraser Rge HS*: 34mi NNW, 31.34S – 122.35E, 8.xi.1969, Key & Upton (1♀, ANIC); *Gascoyne Junction*: 70 air km WNW, 24.87559°S – 114.55150°E±90m, 21.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #613 (22♂, 6♀, TAMU); *Goldfields hwy*: 85 km SSE Wiluna, 27.32886°S - 120.50593°E±70m, 560m, 26.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #617 (1♂, 2♀, TAMU); *Great Central Road*: track W off, 6 km air NNNE Laverton, 28.58435°S – 122.41038°E±100m, 470m, 27.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #618 (1♂, 1♀, TAMU); *Karonie*: 13mi ES, 9.xi.1969, Key & Upton (1♂, ANIC); *Kalgoorlie*: 22.ix.1986, A.J. Graham (1♀, AMSA); *Lake Marmion*: iii.1996 (1♂, 2♀, SAMA); *Laverton*: Deeba Rock Hole, 34 km NE, 28.22S – 122.37E, 12.xi.1977, M.S. Upton (4♀, ANIC); *Mt Aloysius*: 35 km N, 25.43S – 128.34E, 16.xi.1977, M.S. Upton (1♂, ANIC); *Milstream*: 5 km SE, 21.37S – 117.06E, 8.xi.1970, Upton & Feehan (2♀, 1♂, ANIC); 29.x.1970 (2♀, ANIC); *Monkey Mia*: 31.v.2000 (1♀, SAMA); *Mount Keith HS*: 6 km S, 27.20S – 120.30E, 14.xi.1970, Upton & Feehan (1♂, 1♀, ANIC); *Mundiwindi*: 135 SW, x.1960 (1♀, FSCA); *Murchison R*: 23.49S – 114.41E, 27.iii.1971, E.F. Riek (1♀, ANIC); *Nanutarra Roadhouse*: hwy 136, 13 air km NENE, 22.47124°S – 115.60040°E±70m, 22.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #614

(1♂, TAMU); *Norseman*: 25.xi.1958, E.F. Riek (1♂, ANIC); *Pungkulpirri Waterhole*: 0.5 km E, Walter James Rg, 24°39'15''S – 128°45'18''E, 26.ix.2006, at light, Central Ranges Sur. Camp 1 (1♂, 1♀, SAMA); *Warburton*: 66 km EN, 26.03S – 127.14E, 15.xi.1977, M.S. Upton (1♀, ANIC); *Widgiemooltha*: 19mi NNW, 31.14S – 121.28E, 6.xi.1969, Key & Upton (2♂, ANIC); *Zanthus*: 36mi SE, 31.29S – 123.53E, 10.xi.1969, Key & Upton (1♀, ANIC).

Comments – *Ceratoleon brevicornis* is easily distinguished from any other Australian antlions, because of its small body size, and the peculiar antennal shape. Seems to be very common and widespread throughout the central area of Australia. For phylogenetic relationships see (A4 Figs 1-3).

***Ceratoleon mjobergi* Esben-Petersen 1923**

(A4 Figs 78-79)

Ceratoleon mjobergi Esben-Petersen 1923:579 (OD); Handschin 1935:690 (cit); Stange 1976:303 (cat); New 1985b:7 (key, rd, ill.); New 1996:74 (cat); Stange 2004:101 (cat).

Diagnosis – Antennae long [not short]; ocular setae long and black [not short and white]; tibial spurs absent [not present]; forewing costal area biareolate at least basal third [not uniareolate or mostly biareolate]; forewing mostly brown but full of hyaline areas [not mostly hyaline with brown marks]; hind wing with a broad brown subapical stripe [not absent, or full of small marks].

Description – Lengths: forewing: 18 – 29 mm; hind wing: 16 – 25 mm.

Head (A4 Figs 78a-b): *Labrum* brown; set with a line of elongate setae. *Clypeus* pale, with a central brown mark; and some elongate white setae. *Frons* black; set with few white setae. *Gena* pale. *Vertex* raised; dark brown with ventral margin pale, and two posterior spots in some specimens; covered with short black setae. *Ocular rim* setae black and elongate. *Antennae* clubbed; elongate, > 3x length of pronotum; distance between antennae wider than scape width; totally dark brown, with a small pale ring on basal segments in some specimens; torular membrane pale; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae. *Mandibles* mostly pale, with tip black. *Palpi*, maxillary and labial mostly pale with irregular dark brown marks mainly on basal segments; apical labial palpomere fusiform, palpimacula oval-shaped, located medially

Thorax (A4 Fig 78b): *Pronotum* about as long as wide; posterior margin as wide as anterior; subapical furrow present; mostly dark brown except for four pale spots, two on posterior and two on anterior areas, in some specimens there is thin longitudinal pale line medially; beset with short black setae, and some elongate setae mainly on margins. *Mesonotum* dark brown, with few pale areas in some specimens: two small rounded marks on prescutum, two longitudinal lines at scutum, and posterior margin of scutellum; beset with short black setae. *Metanotum* dark brown, except for margin between prescutum and scutum, pale; covered with short black setae. *Pterothoracic pleura* dark brown with few irregular small pale areas; covered with long white setae, and some black ones on anterior segments; Miller's organ present.

Wings (A4 Fig 78c): Rather narrow with tip acute; anterior and posterior Banksian lines present in both wings; veins mostly dark brown, but some veins intercalated with white spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly amber with some hyaline areas: at tip, posterior margin, subcostal and mediocubital areas, and pterostigma; cubital fork located near Rs origin; four to five irregular presectoral crossveins, all curved with transversal crossveins connecting each other; most part of costal area biareolate; some subcostal veinlets forked; posterior area narrower than prefork area. *Hind wing* membrane mostly hyaline with a broad subapical brown band, pterostigma tip white; medial fork located near Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 78a-b): *All pairs of legs*, femur elongate ($> 2x$ length of coxa); tibia slightly longer than tarsi but shorter than femur; tibial spurs absent; T3 and T4 about same size, T2 slightly longer than T3, T1 twice longer than T2, T5 about twice longer than T1; claws about half of T5 length; coxa, trochanter, femur, and tibia set with short white setae and scattered long white setae; femur, tibia and tarsi set with long and short black setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair elongate, slightly shorter than half of femur length; tibia with antennal cleaning setae ventroapically; coxa and femur dark brown with pale areas on anterior surface, trochanter brown, tibia with anterior surface mostly dark brown with three pale spots, and posterior surface pale; tarsi dark brown. *Midleg* color pattern similar to foreleg, except for tibia, mostly dark brown with a subbasal pale spot. *Hindleg* with femur, tibia and T1 slightly longer than in other legs; color pattern similar to midleg, except for tibia

pale with dark brown tip, and tarsi pale with T5 tip dark, in some specimens the femur is mostly pale.

Abdomen: Dark brown with posterior margins of distal tergites pale; beset with short black setae, and some white setae on basal segments, mainly on sternites.

Male Terminalia (A4 Figs 79a-c): *Ectoproct* rounded in lateral view; set with elongate black setae. *9th sternite* short with posterior margin curved, in ventral view; set with very long black setae (longer than sternite). There is a small rounded membranous lobe located beneath the ectoproct. *Gonarcus* very broad with lateral margin rounded. *Mediuncus* acute in lateral view, broad and rounded in posterior view. *Paramere* broad with base acute and tip sclerotized in lateral view.

Female Terminalia (A4 Figs 79d-e): *Ectoproct* rounded, covered with thin elongate setae. *Lateral gonapophyses* rounded, much smaller than ectoproct, set with few cavisetae. *7th sternite* distal margin straight in ventral view, covered with long black setae. *Pregenital plate* a transversal arched bar connected medially to an up side down triangle on distal margin. *Posterior gonapophyses* broad, elongate, with tip enlarged; covered with long black setae, and with some elongate cavisetae apically. *9th Tergite* with a membranous digitiform process. *Anterior gonapophyses* absent. *Ventral membrane* gonapophyseal plates present.

Distribution (A4 Fig 163) – Australia: NT, QLD, and WA.

Adult activity period – Records for November to March.

Biology – Unknwon, larva unknown.

Primary type – Holotype (by monotypy), male (NHRS), high-resolution images examined. From original description, Esben-Petersen (1923): “One ♂, N. W. Australia, January (Dr. E. Mjöberg leg.). Stockholm Museum. / The specimen of this peculiar species comes from the material brought home by Dr. E. Mjöberg from his expedition to Australia, 1910-1913”. From New 1985: “Holotype, ♂, ‘N.W. Australia’, Mjöberg (Stockholm) (seen)”. Condition: good; antennae missing and right hind wing damaged.

Material examined – (31♂, 64♀, 8?). **AUSTRALIA: Northern Territory:** *Borroloola*: 16:04S – 136:18E, 22.xii.1991, M.S. & B.J. Moulds (1♀, AMSA); 65 km W, on rd. to Roper Bar, nr Tawallah Station, 13.xi.2011, MV light, K.H. & D. Marshall (2♂, TAMU); *Cooper Ck*: 19 km E Mt Borradaile, 12:06S – 133:04E, 9-10.xi.1972, J.C. Cardale (3♀, AMSA); *Daly River*: (1♀, SAMA); *Katherine*: 24.xi.1978 (? , QLDM); *Maud Ck*, 3.xii.1978 (1?, QLDM); *Larrimah*: 4.xii.1978 (1?, QLDM); *Renner Springs*: 5 km S, 18°21'05''S – 133°48'58''E, 260m, 26.i.2004, M. Moulds & S. Cowan (2♀, AMSA); *Roper R. x-ing*: 2 km W of Mataranka, 14:56S – 133:04E, 11.i.1992, M.S. & B.J. Moulds (2♀, AMSA); *Tindal*: 14°31'S – 132°22'E, 1-10.xii.1967, light trap, W.J.M. Vestjens (2♀, ANIC); *Victoria R.*: 18 km W of Timber Creek township, 25.xii.1991, M.S. & B.J. Moulds (1♂, 1♀, AMSA); *Waterhouse River*: Mataranka Hsd, 23.xii.1986, M.S. & B.J. Moulds (1♀, AMSA); **Queensland:** *Alpha*: 37 km W, 23:37.4S – 146:16.2E, 12.i.2002, Cooley, Cowan, Hill, Marshall & Moulds (1♂, AMSA); *Archer River x-ing*: 60 km N of Coen, 9.i.1988, M.S. & B.J. Moulds (1♀, AMSA); *Archer River*: roadhouse, 13°26'S – 142°56'E, 10.i.1994, G & A Daniels (1♂, 1?, QLDM); *Bald Hills Stn*: nr turnoff to Laura, N. of Cooktown, 3.i.1981, M.S. & B.J. Moulds (2♂, 1♀,

AMSA); *Barcaldine*: 10.ii.1981, M.S. & B.J. Moulds (1♂, AMSA); *Burra Range*: between Hughenden & Charters Towers, 2.ii.1981, M.S. & B.J. Moulds (1♂, 12♀, AMSA); *Carnarvon Nt Pk*: Rangers Stn, Mount Moffat, 25°01'06''S – 147°57'08''E, 23-24.xii.2005, 720 m, G & A Daniels (1♂, 1♀, QLD); *Chillagoe*: 20.i.1988, M.S. & B.J. Moulds (1♂, AMSA); *Coleman R.*: nr Musgrave Hsd, 31.xii.1993, M.S. & B.J. Moulds (1♂, AMSA); *Dawson R.*: N of Injune, 14:23:02S – 148:38:44E, 11.i.1999, M.S. & B.J. Moulds (1♀, AMSA); *Hughenden*: 8.xii.1978 (2?, QLD); 65 km E, 3.ii.1981, M.S. & B.J. Moulds (4♂, 12♀, AMSA); *Injune*: 55 km NNE, 23.xi.1986, M.S. & B.J. Moulds (1♂, AMSA); *Isabella Ck*: swamp, 12 km N of Bald Hills Stn. Hsd., 30 km N of Cooktown, 14.ii.1982, M.S. & B.J. Moulds (1♀, AMSA); *Laura R.*: nr Laura (1?, QLD); 30.xii.1983, M.S. & B.J. Moulds (1♂, 1♀, AMSA); *Morehead R. x-ing*: 110 km NW of Laura, 10.i.1988, M.S. & B.J. Moulds (1♂, AMSA); *Mount Lamond*: 4mi NE, Iron Range, 8.i.1972, mv light, D.K. McAlpine & G.A. Holloway (1♀, AMSA); *Pine Trees Pony Stud*: Wild R., 10 km E Innot Hot Springs, 29.xii.1983 – 5.i.1984, at light, D. Rugg (2♂, 2♀, QLD); **Western Australia**: *Broome*: 29.xii.1985, M.S. & B.J. Moulds (1♂, AMSA); Rocbuck Roadhouse, 33 km E, 1.iii.1994, R. Miller & L. Stange (1♂, 1♀, FSCA); *Dunham River*: 100 km S of Wyndham, 3.i.1986, M.S. & B.J. Moulds (1♂, 2♀, AMSA); *Durak R. x-ing Gibb River*: road E. Kimberley, 29.xii.1991, M.S. & B.J. Moulds (2♀, AMSA); *Great Northern Hwy*: 100 km SE of Derby, 31.xii.1985, M.S. & B.J. Moulds (1♀, AMSA); *Kununurra*: 7.i.1986, M.S. & B.J. Moulds (4♂, 7♀, AMSA); *Mary R. x-ing*: 100 km SW of Hails Creek township, 1.i.1986, M.S. & B.J. Moulds (1♀, AMSA); *Pentecost R. x-ing*: 21 km W, Gibb R. rd., 30.xii.1991, M.S. &

B.J. Moulds (1♀, AMSA); *Wyndham*: 7.xii.1929, T.G. Campbell (3♂, ANIC); 1.i.1930 (1♀, ANIC); *Zebidee Springs*: El Questo Stn, E. Kimberley, 28.xii.1991, M.S. & B.J. Moulds (2♀, AMSA).

Comments – *Ceratoleon mjobergi* is very different from its congeneric species, being bigger and darker. Its distribution is also different from *C. brevicornis*, which is widespread throughout the central and southern areas of Australia, whereas *C. mjobergi* seems to be restricted to the northern forests near coast. For phylogenetic relationships see (A4 Figs 1-3).

***Fossorioleon* new genus**

Type species: *Glenoleon rudda* New 1985, by present designation.

Diagnosis – Wings rather narrow [not broad]; male mediuncus absent or very short [not present and long]; male ectoproct in lateral view with ventral margin straight and slightly longer than dorsal margin [not rounded]; female ectoproct and lateral gonapophyses cavisetae absent [not present]; female lateral gonapophyses smaller than ectoproct [not same size as ectoproct]; female posterior gonapophyses broad with apex covered by long cavisetae [not thin or with just a few cavisetae].

Description – Head: *Vertex* raised. *Frons* mostly black. *Antennae* clubbed and elongate; flagellomeres almost as long as wide at base, apical ones wider than long. *Palpimacula* oval-shaped, located medially. Thorax: Pronotum mostly set with short black setae but a few long setae at margins. Miller's organ present. Wings: narrow and acute; hyaline but full of brown marks, particularly a longitudinal line in forewing. *Anterior Banksian* line

present in both wings, but posterior absent. *Forewing* prefork area slightly wider than posterior area. *Hind wing* with one presectoral crossvein. *Male pilula axillaris* present. Legs: *Forefemur* > 2.5x length of forecoxa. *Foretibia* longer than foretarsi. *Sense hair* absent or slightly longer than forefemur width. Male Terminalia: *Ectoproct* in lateral view with ventral margin straight and slightly longer than dorsal margin; *gonarcus* arched; *paramere* sclerotized and curved in lateral view; mediuncus absent or very small and acute. Female Terminalia: *Ectoproct* rounded with no cavisetae; *lateral gonapophyses* smaller than ectoproct without cavisetae; *posterior gonapophyses* broad and set with numerous cavisetae apically; *pregenital plate* small; *Ventral membrane gonapophyseal plates* present.

Distribution (A4 Fig 164) – Australia: NSW, QLD, SA and WA.

Comments – This new genus is closely associated with *Riekoleon* as suggested by both molecular and morphological phylogenies. But, unfortunately only a few species from these two genera were present in the molecular phylogeny. Their female terminalia are very similar, particularly the posterior gonapophyses. However, the shape of the male terminalia and the color pattern of the wings can clearly separate them. *Fossorioleon* contains two new species, two species previously placed in *Austrogymnocnemia* and one in *Glenoleon*. The last three species share all the distinctive characteristics of *Fossorioleon*, but were formerly placed in different genera based on the presence or absence of tibial spurs. This character however, was demonstrated here as very plastic by both phylogenies. This is particularly true for *F. edwardsi*, which has specimens with or without tibial spurs.

Biology – Unknown.

Etymology – The genus name is derived from the Latin word *fossorius* (= adapted to dig) and refers to numerous cavisetae present on female posterior gonapophyses.

Key to species of *Fossorioleon*

- 1 Forewing, MA origin on the anterior half of the wing (A4 Fig 82c); female anterior gonapophyses as small rounded plate (A4 Fig 83f).....2
- 1' Forewing, MA origin on the posterior half of the wing (A4 Fig 80c); female anterior gonapophyses absent (A4 Fig 81e).....*F. distivenus*
- 2 Ocular rim setae absent; pronotum as long as wide or slightly longer; male mediuncus absent (A4 Fig 83d).....3
- 2' Ocular rim setae present (white); pronotum wider than long (A4 Fig 88b); male mediuncus small (A4 Fig 89b).....*F. striatus*
- 3 Forewing, mediocubital dark line continuing around gradate veins; hind wing rhegmal area with a large brown spot (A4 Fig 82c).....4
- 3' Forewing, mediocubital dark line not continuing around gradate veins; hind wing rhegmal without a large spot (only a dark infuscations) (A4 Fig 86c).....*F. rudda*
- 4 Hind wing with an apical spot as large as the rhegmal spot (A4 Fig 84c); pronotum mostly pale with a longitudinal, central, dark line (A4 Fig 84b); forefemur mostly pale; female posterior gonapophyses longer than wide (A4 Fig 85b).....*F. longitudinalis*

- 4' Hind wing with an apical spot much smaller than rhegmal spot (A4 Fig 82c); pronotum mostly black (A4 Fig 82b); forefemur entirely black; female posterior gonapophyses wider than long (A4 Fig 83f).....*F. edwardsi*

***Fossorioleon distivenus*, new species**

(A4 Figs 80-81)

Diagnosis – Pronotum longer than wide [not as wide as long or wider]; forewing, MA origin on distal half of wing [not proximal half]; tibial spurs absent [not present]; male, ectoproct ventral margin straight [not rounded]; female posterior gonapophyses wider than long [not longer than wide]; female anterior gonapophyses absent [not as a small plate].

Description – Lengths: forewing: 15 – 18 mm; hind wing: 13 – 16 mm.

Head (A4 Figs 80a-b): *Labrum* white to pale, with a line of elongate setae. *Clypeus* white to pale, with few elongate pale setae. *Frons* ventral margin pale (with a thin central longitudinal dark brown line in some specimens), remaining areas shiny black (dorsal margin curved and ventral medially excavated); covered with short white setae. *Gena* white to pale. *Vertex* raised; in anterior view white to pale with dark brown marks, mainly on medial line; in dorsal view dark brown with posterior margin pale; covered with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, about twice longer than pronotum; distance between antennae wider than scape width; scape, pedicel and most flagellomeres dark brown with a white to pale ring on distal margin, apical segments entirely dark brown, in some specimens three to four subapical flagellomeres

entirely pale; torular membrane white to pale; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae. *Mandibles* white to pale, with tip dark. *Palpi*, maxillary and labial with all segments dark brown but connection between them white to pale; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 80b): *Pronotum* much longer than wide; posterior margin wider than anterior; subapical furrow present; mostly dark brown with pale to white areas as follows: two sinuous longitudinal lines that are medially fused after furrow, a small central mark posteriorly; beset with short black setae and few long black setae on borders. *Mesonotum* mostly dark brown with white to pale areas as follows: two square marks on prescutum, two longitudinal lines near midline, a rounded spot at wings base at scutum, two posterior triangular marks at scutellum; covered with short black setae. *Metanotum* color similar to mesonotum, covered with few short black setae. *Pterothoracic pleura* mostly dark brown with some irregular pale marks, mainly on dorsal segments; covered with white setae; Miller's organ present.

Wings (A4 Fig 80c): Rather narrow with tip acute; anterior Banksian line present in both wings, posterior absent; veins mostly dark brown, but some veins intercalated with white spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline but full of irregular large brown marks particularly around crossveins but with a large mark beneath pterostigma; basal costal and subcostal areas brown shaded; cubital fork located near Rs origin; MA origin on distal half of wing; three to five presectoral crossveins; subcostal veinlets simple; posterior area narrower than prefork

area. *Hind wing* membrane mostly hyaline except for large rhegmal and stigmal marks and some irregular brown marks around major crossveins; central and inferior areas brown shaded; medial fork located between origins of Rs and MA; MA origin on distal half of wing; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 80a-b): *All pairs of legs*, femur elongate ($> 2.5x$ length of coxa); tibia slightly longer than femur and longer than tarsi; tibial spurs absent; T3 and T4 about same size, T2 slightly longer than T3, T1 and T5 about same size but near twice longer than T2; claws shorter than half of T5 length; coxa, trochanter, and femur set with short white setae, and scattered long setae; femur, tibia and tarsi set with black setae, and scattered long black setae; T5 ventrally with two rows of thick, long, black setae.

Foreleg sense hair absent; tibia with antennal cleaning setae ventroapically; coxa externally dark brown but internally white to pale, trochanter brown, femur mostly brown with internal surface white to pale particularly at base, tibia brown with two white to pale rings, both at basal half, but some specimens with a ventroapically pale mark; tarsi dark brown. *Midleg* with color pattern similar to foreleg, except for femur mostly white to pale with apex and part of dorsal surface brown, and tibia generally darker. *Hindleg* with femur and tibia slightly longer than in other legs; color pattern similar to midleg, except for tibia white to pale with tip and internal surface midline dark brown, and tarsi paler.

Abdomen: Mostly black with scattered white to pale marks, mainly on sternites medial and lateral areas, and tergites proximal halves. Beset with short black setae.

Male Terminalia (A4 Figs 81a-c): *Ectoproct* with ventral margin straight and longer than dorsal margin in lateral view, set with elongate black setae. *9th sternite* posterior margin rounded in ventral view; covered with elongate black setae. *Gonarcus* broad and arched, in dorsal view; in posterior view there is a small expansion at corners of ventral margin. *Mediuncus* absent. *Paramere* large, in lateral view curving backwards; in posterior view with tip straight and internal margin curved.

Female Terminalia (A4 Figs 81d-e): *Ectoproct* rounded covered with thin elongate setae. *Lateral gonapophyses* rounded, much smaller than ectoproct, set with few elongate setae. *7th sternite* elongate, with distal margin rounded, in ventral view; set with long black setae. *Pregenital plate* a small curved transversal bar in ventral view. *Posterior gonapophyses* broad, wider than long covered with long black setae and full of cavisetae apically. *9th tergite* with a broad membranous digitiform process. *Anterior gonapophyses* absent. *Ventral membrane* gonapophyseal plates absent.

Distribution (A4 Fig 164) – Australia: WA.

Adult activity period – Records for November and December.

Biology – Unknown, larva unknown.

Etymology – The specific name is derived from the combination of two Latin words, *distantia* (= distal, far) and *vena* (= vein), and refer to the MA origin on wings distal halves.

Primary type – Holotype (by present designation), female, (AMSA). **AUSTRALIA:**

Western Australia: 25 km S of Balladonia Roadhouse; 32:33:65S – 123.37:10, 16.Dec.1995, M.S. & B.J. Moulds. Condition: pinned; perfect; terminalia dissected.

Paratype: AUSTRALIA: Western Australia: *Cave Rock Camp*: 28.6 km S of Burra Rock, -31.640S - 121.209E, 17.xi.2007, 380m, at light, D.R. Britton & D.J. Bicket (2♂, AMSA, pinned); *Dundas Natr. Reserve*: 22,8 air km SWSW Balladonia Roadhouse, 190m; 32.46528°S – 123.41505°E±110m, 14.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #602 (1♂, 1♀, TAMU, in ETOH); *Goongarrie*: 5 km S, 30.05S – 121.09E, 15.xi.1970, Upton & Feehan (1♀, ANIC, in ETOH); *Swan View*: Talbot Road Nature Reserve, 50m; 31.87351°S – 116.04483°E±180m, 16.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #604 (1♂, TAMU, in ETOH); *Wandoo Nat. Pk.*: Kent Rd, 26 km air SWSW York, 270m; 31.99773°S – 116.52801°E±70m, 17.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #606 (3♂, 11♀, TAMU, in ETOH).

Comments – *Fossorioleon distivenus* is the most distinct species of the genus, particularly by the odd distal position of MA origin and the long pronotum. However it presents all the diagnostic characters of the genus, like: the male terminalia with the ectoproct straight ventrally and the mediuncus absent; female terminalia with posterior gonapophyses very broad and with apex entirely covered by numerous cavisetae. The general body color, leg and wing shape also approximate *F. distivenus* and the other four species.

The morphological phylogeny recovers *F. distivenus* together with the other species in the genus, but the molecular tree did not corroborate it. In the molecular tree the species was placed separated from the only congeneric species, *F. rudda*. However the results from this particular region of the molecular tree have to be treated carefully. The support for the *F. distivenus* placement is very low and the branch length separating

the species is very reduced, almost imperceptible. Other major concerning for this specific region of the tree is the high number of missing taxa; both *Perichlystus* and *Riekoleon* were represented by only one species and *Fossorioleon* by two.

The result from the molecular phylogeny confirms the overall distinctiveness of the species. However, because of all molecular issues mentioned above, and all shared similarities with the other four species we decided to classify this new species in *Fossorioleon*. Possible future molecular studies comprising a larger taxon sampling, might confirm that the species is generically distinctive, but until there it will be retained in *Fossorioleon*. For phylogenetic relationships see (A4 Figs 1-3).

***Fossorioleon edwardsi* (New 1985), new combination**

(A4 Figs 82-83)

Austrogymnocnemia edwardsi New 1985b:17 (OD); New 1996:67 (cat.); Stange 2004:99 (cat.)

Diagnosis – Forewing, MA origin on wings proximal half [not distal half]; forewing with a continuous longitudinal line [not interrupted]; hind wing with a large rhegmal mark [not a small infuscations]; male, ectoproct ventral margin straight [not rounded]; female posterior gonapophyses wider than long [not longer than wide]; female anterior gonapophyses as a small plate [not absent].

Description – Lengths: forewing: 21 – 26 mm; hind wing: 19 – 24 mm.

Head (A4 Figs 82a-b): *Labrum* pale to brown, with a line of elongate setae. *Clypeus* pale, with a thin longitudinal black line medially on dorsal half, some specimens with

irregular lateral brown marks, set with few elongate black setae. *Frons* with ventral area pale with a thin longitudinal black line medially, remaining areas black; set with few small white setae. *Gena* pale. *Vertex* raised; mostly pale with a transversal dark brown band posteriorly; set with small black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, about twice longer than pronotum; distance between antennae wider than scape width; all segments dark brown, torular membrane yellow; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae; scape and pedicel with some white setae. *Mandibles* pale with tip dark brown. *Palpi*, maxillary and labial with basal segment dark brown but remaining areas pale with irregular brown areas, in some specimens the whole maxillary palpi is dark brown, apical labial palpomere fusiform, palpmacula large and rounded, located medially.

Thorax (A4 Fig 82b): *Pronotum* slightly longer than wide; posterior margin wider than anterior; subapical furrow present; mostly pale with some dark brown areas as follows: a broad longitudinal medial line, two longitudinal sinuous lines that connect with medial line on anterior margin, posterior half with two lateral sinuous lines that connect with the longer sinuous lines on furrow; covered with short black setae. *Mesonotum* mostly dark brown, with two rounded pale spots at prescutum, two large pale areas enclosing a longitudinal dark brown line at scutum, small pale spots near wing bases, and posterior margin of scutellum pale, covered with short black setae. *Metanotum* dark brown with irregular pale marks near midline, covered with short black setae. *Pterothoracic pleura* black; covered with short black setae and few white setae. Miller's organ present.

Wings (A4 Figs 82c): Rather narrow with tip acute; anterior Banksian line present in both wings, posterior absent; veins set with short black setae, in general brown, but the main longitudinal veins are intercalated by numerous short white regions. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline with a long longitudinal brown line, starting costal area base and extending on subcostal area base, base of presectoral area, whole mediocubital area, and gradate veins up to apex, this line bifurcates at the cubital fork and follows CuA2 and the curved vein at cubital area; with some irregular brown marks, at the inferior margin, apex, and base of pterostigma; tip of pterostigma white; cubital fork located near Rs origin; three presectoral crossveins; subcostal veinlets simple; posterior area narrower than prefork area. *Hind wing* membrane mostly hyaline except for small brown marks at apex, and a large brown mark on rhegmal region; pterostigma base brown and apex white; medial fork located near Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 82a-b): *All pairs of legs*, femur elongate ($> 2.5x$ length of coxa); tibia slightly longer than femur but twice longer than tarsi; tibial spurs absent in some specimens but extending to T2 apex in others; T2, T3 and T4 about same size, T1 longer than T2, T5 longer than T1; claws about half of T5 length; all segments set with short black setae, with scattered longer black setae at femur, tibia, and tarsi; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair slightly longer than femur width; tibia with antennal cleaning setae ventroapically; coxa black; trochanter brown; femur dark brown; tibia mostly dark brown with pale marks on dorsal surface: two small marks on basal half and a large one apically, part of ventral surface pale in some specimens;

tarsi entirely dark brown, but with the base of T1 pale in some specimens. *Midleg* with coloration similar to foreleg, except for femur with pale marks at basal part of ventral surface in some specimens. *Hindleg* femur and tibia slightly longer than in other legs, color pattern similar to midleg except for pale tibia with tip dark brown and some specimens with a brown line on ventral surface; tarsi generally paler.

Abdomen: black, with some pale areas on sternites midline in some specimens; beset with short black setae.

Male Terminalia (A4 Figs 83a-d): *Ectoproct* with ventral margin straight and longer than dorsal margin in lateral view; set with elongate black setae. *9th sternite* with posterior margin elongate medially in ventral view; ventrally extended in lateral view. *Gonarcus* broad and arched; in lateral view with anterior margin smaller and in posterior view with dorsal margin straight medially. *Mediuncus* absent. *Paramere* large, triangular in lateral view; in posterior view curving inwards, with apex rounded and more sclerotized.

Female Terminalia (A4 Figs 83e-g): *Ectoproct* rounded, set with long black setae. *Lateral gonapophyses* rounded, shorter than ectoproct, beset with short black setae. *7th sternite* long, distal margin with a rounded expansion medially, set with elongate black setae. *Pregenital plate* with posterior part thin and anterior margin enlarged in posterior view; curved in ventral view. *Posterior gonapophyses* broader than long, with distal margin wider than basal; beset with very long black setae and numerous cavisetae at apex. *9th tergite* with a broad membranous digitiform process. *Anterior gonapophyses* a small plate covered with long setae. *Ventral membrane* gonapophyseal plates present.

Distribution (A4 Fig 164) – Australia: NSW, QLD, and WA.

Adult activity period – Records for November to January.

Biology – Unknown, larva unknown.

Primary type – Holotype (by original designation), female (ANIC), examined. From original description, New (1985b): “Holotype, ♀, New South Wales, 6 km WSW. Bingara, 8.xii.1974, I. F. B. Common, E. D. Edwards (150°31'E., 29°53'S.) (ANIC)”. Condition: good; right antenna missing; body covered with some white mold; terminalia dissected.

Material examined – (5♂, 10♀). **Western Australia:** *Leonora*: 16.i.1989, M.S. & B.J. Moulds (1♂, AMSA); *Menzies*: 10 km N, 14.i.1989, M.S. & B.J. Moulds (3♀, AMSA); *Mount Magnet*: 55 km ESE, 18.i.1989, M.S. & B.J. Moulds (3♂, 2♀, AMSA); *Oakford*: Ankeletes Rd, 32.13S – 115.54E, 28.i.1998, E.D. Edwards & E.S. Nielsen (3♀, ANIC); *Sandstone*: 25 km E, 17.i.1989, M.S. & B.J. Moulds (1♂, 2♀, AMSA).

Comments – *Fossorioleon edwardsi* seems to be close related to *F. rudda*, based on the overall shape of the male terminalia and the length of the pronotal setae. However than can be easily separated based on the longitudinal line in the forewing of *F. edwardsi*.

The whole type series of *F. edwardsi* was described with tibial spurs absent, what was confirmed here. This was actually the reason why the species was originally placed in *Austrogymnocnemia* (New 1985b). However, most of new specimens analyzed here actually have long tibial spurs, reaching T2 apex. There is no doubt that those specimens belong to *F. edwardsi*, both male and female terminalia, and the general body color patterns confirm it. The tibial spurs in this species seem to be a very plastic characteristic. For phylogenetic relationships see (A4 Figs 1-3).

***Fossorioleon longitudinalis*, new species**

(A4 Figs 84-85)

Diagnosis – Forewing, MA origin on proximal half [not distal half]; forewing with longitudinal line extending over gradate crossveins [not interrupted at end of mediocubital area]; hind wing with an apical mark as big as rhegmal mark [not absent or smaller than rhegmal]; female posterior gonapophyses longer than wide [not wider than long]; female anterior gonapophyses a large plate [not absent].

Description – Lengths: forewing: 32 – 33 mm; hind wing: 29 – 30 mm.

Head (A4 Figs 84a-b): *Labrum* pale with a line of elongate setae. *Clypeus* pale; with few elongate pale setae. *Frons* beneath antennae pale but remaining areas black; set with few pale setae. *Gena* pale. *Vertex* raised; in frontal view pale except for two black longitudinal marks around the central region; in dorsal view pale except for two black longitudinal lines surrounding central area, and a black transversal medial line; covered with short black setae. *Ocular rim* setae absent. *Antennae* almost twice longer than pronotum; basal flagellomeres almost as long as wide, apical ones wider than long; scape, pedicel and first flagellomere black, remaining segments light brown; flagellum covered with short black setae; scape and pedicel set with short pale setae; torular membrane black. *Mandibles* pale with tip black. *Palpi*, maxillary and labial pale, except for basal maxillary segment black, and area around palpimacula slightly darker; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 84b): *Pronotum* about as long as wide; posterior margin as wide as anterior; subapical furrow present; pale except by a broad black longitudinal streak that enclose a thin pale line on medial area, two thin black lateral lines on posterior area (lines interrupted on their medial length), and posterior corners black; beset with many short black setae and a few long setae on margins. *Pterothoracic notum* pale except for a broad black line that extends from pronotum throughout pterothorax; mesoscutum with two thin longitudinal black lines; covered with short black setae. *Pterothoracic pleura* mostly black but ventral area of ventral segments pale; dorsal segments covered with black setae and ventral segments with white setae; Miller's organ present.

Wings (A4 Fig 84c): Rather narrow with tip acute, anterior Banksian line present in both wings, posterior absent; veins mostly brown, but with some veins intercalated with white spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline but with a longitudinal brown line starting on costal area base, continuing throughout mediocubital area and extending over gradate crossveins up to apex, line interrupted by some small hyaline areas; there is also a small stigmal brown mark, and tiny brown marks on posterior and apical margins; pterostigma with apex white and base brown; cubital fork located between origins of Rs and MA; three presectoral crossveins, distal crossvein with a medial veinlet connecting to RS; subcostal veinlets simple, but few distal sometimes forked; posterior area narrower than prefork area at cubital fork level. *Hind wing* membrane mostly hyaline except for two large brown spots, an apical and other on rhegmal area; pterostigma mostly white; medial fork located between origins of Rs and MA; subcostal venlets simple; one presectoral crossvein.

Legs (A4 Figs 84a-b): *All pairs of legs*, femur elongate (> 2.5x length of coxa); tibia slightly longer than femur and about twice longer than tarsi; tibial spurs extending to T2 apex; all tarsomeres about same size, except for T5 slightly longer; claws about half of T5 length; coxa and trochanter set with white setae and few black setae; femur with internal surface covered with short white setae but remaining areas covered with short black setae, and scattered long black and white setae; tibia and tarsi set with short black setae, and scattered long black setae, mainly at tibia; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair absent; tibia with antennal cleaning setae ventroapically; coxa, trochanter and femur with internal surface pale but external dark brown, femur apex completely dark brown, tibia mostly pale except for three dark brown marks on external surface; tarsi brown but T5 slightly lighter. *Midleg* with same color pattern of foreleg, except for coxa, trochanter and femur entirely pale (femur apex brown). *Hindleg* with femur, tibia and T1 slightly longer than in other legs; color pattern similar to midleg, except for tibia pale with apex brown.

Abdomen: Tergites mostly dark brown with some irregular pale marks; beset with short black setae. Sternites mostly pale with scattered dark marks; set mostly with short white setae.

Male Terminalia: *Unknown*.

Female Terminalia (A4 Figs 85a-b): *Ectoproct* rounded covered, with thin elongate setae. *Lateral gonapophyses* rounded, smaller than ectoproct, covered with elongate setae. *7th sternite* distal margin straight in ventral view; set with long black setae. *Pregenital plate* shaped a small arrowhead. *Posterior gonapophyses* broad and elongate,

semi rectangular; covered with long black setae, and numerous long cavisetae at apex. 9th tergite with a membranous digitiform process. Anterior gonapophyses large rounded plate, covered with many long setae. Ventral membrane gonapophyseal plates present.

Distribution (A4 Figs 164) – Australia: QLD.

Adult activity period – Records for January, September and November.

Biology – Unknown, larva unknown.

Etymology – The specific name is derived from the Latin word, *longitudinalis* (= longitudinal) and refers to the long longitudinal lines in the pronotum and forewing.

Primary type – Holotype (by present designation), female, (AMSA). **AUSTRALIA:**

Queensland: *Routh Ck*: 21 km E of Georgetown, 4.jan.1990, M.S. & B.J. Moulds.

Condition: pinned; good; but antennae missing; terminalia dissected.

Paratypes: **AUSTRALIA: Queensland:** *Magnetic Island*: Sept., A.M. Lea, *Glenoleon sp ? berthoudi*, det. T.R. New 1982 (1♀, SAMA, pinned); *Millstream Falls*: 5 km W of Ravenshoe, 820m, 17.39S – 145.27W, 25.xi.1998, E.D. Edwards & H. Sutrisno (1♀, ANIC, pinned).

Comments – *Fossorioleon longitudinalis* is the largest species in the genus and is easily identified based on the longitudinal lines of the forewing and pronotum. The large and rectangular posterior gonapophyses in the females place this species close to *F. rudda*. The mostly short pronotal setae are also shared with the later. The shape of the longitudinal line in the forewing might confuse this species with *N. berthoudi*, but the large apical spots in the hind wing and general shape of female terminalia, clearly separate them. For phylogenetic relationships see (A4 Figs 1-3).

***Fossorioleon rudda* (New 1985), new combination**

(A4 Figs 86-87)

Glenoleon rudda New 1985b:46 (OD); New 1996:83 (cat); Stange 2004:105 (cat); Oswald 2015 (cat).

Diagnosis – Forewing, MA origin on proximal half [not distal half]; forewing mediocubital line interrupted [not continuing to gradate crossveins]; hind wing, rhegmal area brown infuscated [not with a large spot]; tibial spurs present [not absent]; Male, ectoproct ventral margin straight [not rounded]; female posterior gonapophyses longer than wide [not wider than long]; female anterior gonapophyses a small plate [not absent].

Description – Lengths: forewing: 24 – 32 mm; hind wing: 21 – 29 mm.

Head (A4 Figs 86a-b): *Labrum* pale, with a line of elongate setae. *Clypeus* pale, with elongate black setae. *Frons* with ventral half pale but dorsal half black; beset with short white setae. *Gena* pale. *Vertex* raised; in frontal view pale, with a dorsal black line; in dorsal view mostly black except for some small pale areas posteriorly; set with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, > 2x length of pronotum; distance between antennae wider than scape width; most flagellomeres black with distal half pale, two or three subapical flagellomeres entirely pale, apical flagellomeres entirely black, torular membrane yellow; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae. *Mandibles* pale with tip dark brown. *Palpi*, maxillary and labial with basal segment

black but remaining areas pale, apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 86b): *Pronotum* slightly longer than wide; posterior margin as wide as anterior; subapical furrow present in some specimens; mostly black with two thin pale longitudinal bands around central region and two smaller ones near border; covered with short black setae. *Mesonotum* mostly black, with small longitudinal pale lines around segments central area, some specimens with two small pale spots near wing bases, covered with short black setae. *Metanotum* entirely black, with some pale marks on anterior margin in some specimens, covered with short black setae. *Pterothoracic pleura* with dorsal segments black, but ventral segments mostly pale, with some black marks, mainly on dorsal margin; covered with short white setae and few short black setae. Miller's organ present.

Wings (A4 Fig 86c): Rather narrow with tip acute; anterior Banksian line present in both wings, posterior absent; veins set with short black setae, in general black, but the main longitudinal veins are intercalated by numerous short white regions. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline with small brown marks generally concentrated on posterior margin and tip, and a longitudinal brown line on mediocubital area and costal area base; cubital fork located between origins of Rs and MA origin; four presectoral crossveins, distal crossvein with a medial veinlet connecting with RS+MA; costal area large, with few subcostal veinlets forked; posterior area narrower than prefork area. *Hind wing* membrane mostly hyaline except for rhegmal region brown

infuscated; medial fork located between origins of Rs and MA; subcostal veinlets mostly simple but few distal ones forked; one presectoral crossvein.

Legs (A4 Figs 86a-b): *All pairs of legs*, femur elongate (> 2.5x length of coxa); tibia as long as femur but longer than tarsi; tibial spurs surpassing T1 apex; T2, T3 and T4 about same size, T1 slightly longer than T2, T5 about twice as long as T1; claws about half of T5 length; coxa, trochanter, and femur set with short white setae; femur, tibia and tarsi set with short black setae, and scattered long black setae, femur and tibia with few long white setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair absent; femur tip and tibia base slightly enlarged; tibia with antennal cleaning setae ventroapically; coxa, tibia and tarsi entirely black; trochanter pale; femur mostly black with basal half of ventral and internal surfaces pale. *Midleg* color pattern very similar to foreleg, except coxa pale, and femur pale areas (larger in some specimens). *Hindleg* femur, tibia and T1 slightly longer than in other legs; coxa, trochanter, T1, most of femur and tibia (except apex) pale, remaining areas black.

Abdomen: Mostly black, with scattered yellow marks generally on sternites; ectoproct pale with tip black; beset with short white setae.

Male Terminalia (A4 Figs 87a-c): *Ectoproct* ventral margin straight and slightly longer than dorsal margin in lateral view; set with elongate black setae. *9th sternite* with posterior border straight in ventral view; with some black setae. *Gonarcus* broad and arched, with medial region less sclerotized in posterior view; anterior margin elongate and rounded. *Mediuncus* absent. *Paramere* large, with tip elongate, rounded, and curving inwards in posterior view.

Female Terminalia (A4 Figs 87d-e): *Ectoproct* rounded, set with long black setae. *Lateral gonapophyses* rounded, shorter than ectoproct, beset with long black setae. *7th sternite* elongate, with distal border rounded in ventral view; covered with short setae. *Pregenital plate* relatively small, shaped as upside down “U” in ventral view. *Posterior gonapophyses* broad, elongate, beset with very long black setae and a large group of cavisetae at apex, and some small thickened black setae on internal margin. *9th tergite* with a membranous digitiform process. *Anterior gonapophyses* very small, a minute sclerotized plate, covered with short setae. *Ventral membrane* gonapophyseal plates present and connected basally by a short transversal bar.

Distribution (A4 Fig 164) – Australia: ACT, NSW*, QLD*, and WA*. * = new record.

Adult activity period – Records for October to May.

Biology – Unknwon, larva unknown.

Primary type – Holotype (by original designation), female (ANIC), examined. From original description, New (1985b): “Types / Holotype, ♀, Australian Capital Territory, Canberra, 19.xii.1957, E. F. Riek (ANIC)”. Condition: good, terminalia dissected.

Material examined – (48♂, 62♀, 8?). **AUSTRALIA: ACT:** *Black Mtn:* ii-iii.1967, light trap (1♂, ANIC); *Canberra:* i.1952 (1♀, PT ANIC); ii.1952 (1♀, PT ANIC); i.1955 (1♀, SAMA); ii.1957 (1♀, 1♂, PT ANIC); ii.1957 (1♂, PT ANIC); i.1960 (1♀, PT ANIC); ii.1960 (11♀, 11♂, PT ANIC, 1♂, FSCA); i.1961 (2♀, 1♂, PT ANIC); ii.1961 (3♀, PT ANIC); ii.1963 (9♀, 4♂, PT ANIC, 1♀, FSCA); iii.1963 (4♀, 4♂, PT ANIC); i.1966 (4♀, 5♂, PT ANIC); **New South Wales:** *Mendooran:* 8 km S, 31°53’S – 149°03’E, 12.ii.1992, G. Daniels & C.J. Burwell (1♂, QLDM); *Nombinnie Nature*

Reserv.: 18 air km SSE Mount Hope, 160m, 32.99613°S – 145.94006°E±70m, 3.i.2013, M.V., Oswald, Diehl & Machado, Oswald #626 (10♂, 7♀, TAMU); *Pillaga Scrub*: 30:56S – 149:23E, 10.ii.1997, M.S. & B.J. Moulds (1♀, AMSA); **Queensland**: *Brisbane*: (8?, QLDM); 2.ii.1925, H Hacker (1♀, QLDM); 6.xi.1926 (2♀, QLDM); 21.i.1927 (1♂, QLDM); 3.ii.1927 (1♀, ZMUC); 12.iii.1927 (1♂, ZMUC; 1♀, QLDM); 18.x.1927 (1♀, ZMUC); 1.xi.1930 (1♀, QLDM); 29.x.1936 (1♀, MVM); *Goondiwindi*: 40 km WNW, 17.xii.1983, M.S. & B.J. Moulds (1♀, AMSA); *Miles*: 17 km W, 11.xii.1990, T.A. Lambkin (1♂, QLDM); *Millmerran*: 12.xi.1987, at light, T.A. Lambkin (1♂, QLDM); *Mount Coot-tha*: Hilltopping, 27°29'S – 152°57'E, 10.v.1997, J.A. Skevington (1♀, QLDM); *Nine Mile Ck*: 14 km NNW of Miles, 24.i.1990, M.S. & B.J. Moulds (3♀, AMSA); *Rocky Bar via Eldsvold*: 18-19.i.1996, at light, K.J. Lambkin (2♀, QLDM); **Western Australia**: *Millstream*: 1 km NE, 21.35S – 117.04E, 6.xi.1970, Upton & Feehan (1♂, ANIC); 23.x.1970, J.C. Cardale, at light (1♂, ANIC); iv.1971 (1♂, ANIC); *Norseman*: i.1966 (1♀, ANIC).

Comments – *Fossorioleon rudda* seems to be commonly found, particularly near eastern coast. The species shares a lot of characteristics with the other four *Fossorioleon* species, but it can be easily distinguished based on the color pattern of the wings, the large costal area in the forewing, and the general shape of both male and female terminalia. For phylogenetic relationships see (A4 Figs 1-3).

***Fossorioleon striatus* (New 1985), new combination**

(A4 Figs 88-89)

Austrogymnocnemia striata New 1985:18 (OD); New 1996:68 (cat); Stange 2004:100 (cat); Oswald 2015 (cat).

Austrogymnocnemia emmae New 1985 **New Synonym.** *Austrogymnocnemia emmae* New 1985b:26 (OD); New 1996:67 (cat); Stange 2004:99 (cat); Oswald 2015 (cat).

Diagnosis – Forewing, MA origin on proximal half [not distal half]; forewing mediocubital line interrupted [not a continuous line]; ocular rim setae present [not absent]; tibial spurs absent [not present]; male, ectoproct ventral margin straight [not rounded]; female posterior gonapophyses wider than long [not longer than wide]; female anterior gonapophyses as a small plate [not absent].

Description – Lengths: forewing: 21 – 23 mm; hind wing: 18 – 21 mm.

Head (A4 Figs 88a-b): *Labrum* pale, with a line of elongate setae. *Clypeus* pale, with few elongate pale setae. *Frons* dark brown with ventral corners yellow; covered with short black setae. *Gena* pale. *Vertex* raised; with posterior margin elongate (area above antennae broader) in frontal view pale with two short curved transversal dark brown marks laterally and a rounded central dark spot; in dorsal view mostly pale with two central perpendicular dark brown marks; set with some short black setae. *Ocular rim* setae white and elongate. *Antennae* clubbed; elongate, about twice longer than pronotum; distance between antennae wider than scape width; in general dark brown except for scape and pedicel mostly pale; torular membrane pale; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae, except for scape and pedicel, with white setae. *Mandibles* pale to brown,

with tip black. *Palpi*, maxillary and labial pale; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 88b): *Pronotum* wider than long; posterior margin wider than anterior; subapical furrow present; mostly pale except for some dark brown areas as follows: a broad medial longitudinal line, two sinuous lines connected to the central line anteriorly, two lateral sinuous line on posterior half; beset with short black setae and few long black setae on borders. *Mesonotum* mostly dark brown with two pale marks at prescutum, some irregular pale lines at scutum, and scutellum marginally pale; covered with short black setae. *Metanotum* mostly dark brown, except for irregular pale areas mostly around midline and posterior margin of scutellum, set with few short black setae. *Pterothoracic pleura* dark brown; covered with white setae and some black setae on anterior segments; Miller's organ present.

Wings (A4 Fig 88c): Rather narrow with tip acute; anterior Banksian lines present in both wings; posterior absent; veins mostly dark brown, but some veins intercalated with white spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane hyaline with some large brown marks at tip, posterior margin, mediocubital area, and beneath pterostigma; cubital fork located near Rs origin; four presectoral crossveins with the last ones connected by short veinlets; subcostal veinlets simple; posterior area narrower than prefork area. *Hind wing* membrane mostly hyaline except for some irregular brown marks at tip and rhegmal area; medial fork located near Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 88a-b): *All pairs of legs*, femur elongate (> 2.5x length of coxa); tibia and femur about same size, but longer than tarsi; tibial spurs absent; T2, T3 and T4 about same size, T1 slightly longer than T2, T5 slightly longer than T1; claws about half of T5 length; coxa, trochanter, femur and tibia set with short white setae and scattered long white setae at tibia; femur, tibia and tarsi set with black setae, and scattered long black setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair absent; tibia with no antennal cleaning setae; coxa and trochanter internally pale but externally dark brown, femur dark brown with anterior surface base pale, tibia with three brown marks dorsally but remaining areas pale; tarsi dark brown, with base of T1 pale. *Midleg* with color pattern similar to foreleg, except for tibia slightly darker. *Hindleg* with femur and tibia slightly longer than in other legs; color pattern similar to anterior legs, except tibia pale with tip dark brown.

Abdomen: Mostly dark brown with scattered pale marks, mainly on sternites medial area. Beset with short black setae.

Male Terminalia (A4 Figs 89a-c): *Ectoproct* in lateral view with ventral margin straight and longer than dorsal margin; set with elongate black setae. *9th sternite* with posterior margin curved in ventral view; and covered with short black setae. *Gonarcus* broad and arched; with anterior margin acute in lateral view. *Mediuncus* small, a sharp triangle lobe on gonarcus medial area in posterior margin. *Paramere* large, with ventral margin more sclerotized in lateral view; and semi triangular in ventral view.

Female Terminalia (A4 Figs 89d-e): *Ectoproct* rounded covered with thin elongate setae. *Lateral gonapophyses* rounded, smaller than ectoproct, covered with elongate setae. *7th*

sternite small, with distal margin concave in ventral view; covered with long black setae. *Pregenital plate* semi triangular in ventral view. *Posterior gonapophyses* large, wider than long in ventral view, set with elongate setae but apex covered with numerous cavisetae. *9th tergite* with a long membranous digitiform process. *Anterior gonapophyses* present, a small rounded plate covered with short setae. *Ventral membrane gonapophyseal plates* present.

Distribution (A4 Figs 164) – Australia: QLD*, SA, and WA. * = new record.

Adult activity period – Records for September to January.

Biology – Unknown, larva unknown.

Primary type – *Austrogymnocnemia striata*: Holotype (by original designation), female (SAMA), examined. From original description, New (1985b): “Holotype, ♀, Western Australia, Gill Pinnacle, Mural Crescent, 3.xi.1963, P. Aitken, N. B. Tindale (SAM)”. Condition: good; terminalia dissected.

Austrogymnocnemia emmae: Holotype (by original designation), male (AMSA), high-resolution images examined. From original description, New (1985b): “Holotype, ♂, South Australia, Flinders Ranges, Wilpena Pound, 18.i.1976, M.S. and B.J. Moulds (AM)”. From New (1996): “Type data: holotype AM ♂ . / Type locality: Wilpena Pound, Flinders Ranges, SA”. Condition: good; apical half of left hind wing missing; terminalia dissected.

Material examined – (2♂, 2♀). **AUSTRALIA: Queensland:** *Carnarvon Nat Pk:* Rangers Stn, Mt Moffatt Sect, 25°01'06''S – 147°57'08''E, 25.xii.2005, 720 m, G & A Daniels (1♀, QLDM); *Charleville:* Charleville –Bolton Rd, 70 km SE, 26°52'S –

146°35'E, 29.ix.1991, 300 m, mv lamp, G Daniels (1♂, QLDM); *Cudmore NP*: nr Homestead, -22.9419S – 146.3786E, 28.x.2010, 320m, heath-shrubland G. & B. Williams, ENT.QLD.2010.09 [at light] (1♀, AMSA); **Western Australia**: *South Perth*: 31°58'S – 115°51'E, 18.i.1985, P. Hutchinson (1♂, QLDM).

Comments – Because the species was originally described in *Austrogymnocnemia*, a female word, the specific name also had to be female, “*striata*”. However, because of the transference to *Fossorioleon* (male word), the name is required to be changed in order to match the genus gender, therefore it must be called now *Fossorioleon striatus*.

Fossorioleon striatus and *A. emmae* were described in the same paper (New 1985b) and both descriptions were based on few specimens, a couple and a male respectively. However it is clear that these three specimens are very similar, and their respective descriptions corroborate with it. In the description of *F. striatus*, New (1985b) highlighted the differences between the male and the female specimens, pointing out that the male was paler, particularly on the wings, but he had no doubt that they belong to the same species. The studies of new specimens here corroborates with this statement, the males examined are in general paler than females, mainly in forewing, where the mediocubital brown line is reduced. After studying the type series of both species, it is very clear that *A. emmae* holotype is almost identical to males of *F. striatus*, it seems to be just slightly smaller and paler, but all remaining characteristics are present, like: the shape of pronotum, flagellomeres and wings, the comparative sizes of leg segments, the marks on the head, and the presence of the ocular rim setae. New (1985b) mentioned that details on the wing and genitalia were sufficient to separate *A. emmae* in a different

species, which is not confirmed here. The wings of *A. emmae* is indeed slightly paler than *F. striatus* males, but the genitalia are identical, specially the shape of the ectoproct. The illustrations of *A. emmae* terminalia presented by New (1985b) are not very accurate, and might cause some confusion. In this sense, these two species are considered as synonyms here, and according to Zoological Nomenclatural Code the name that must prevails is the one presented first, in this case is “*A. striata*”, described at page 18, while *A. emmae* was described at page 26. Concluding *Austrogymnocnemia emmae* is considered here as a junior synonym of *Fossorioleon striatus*.

Among its congeneric species *F. striatus* can be easily identified based on the short pronotum and the presence of the ocular rim setae, which is rarely present in “*Periclystus* genus group”. However, despite the dissimilar characters, the species presents all the distinctive characters of *Fossorioleon*. For phylogenetic relationships see (A4 Figs 1-3).

***Glenoleon* Banks 1913, sensu novo**

Platyleon Esben-Petersen 1923, **New Synonym.**

Type species: *Glenoleon: Myrmeleon pulchellus* (Rambur 1842), by original designation; *Platyleon: Platyleon froggatti* Esben-Petersen 1923, by original designation.

Diagnosis – Ocular setae absent [not present]; tibial spurs present [not absent]; legs more than three and half times longer than coxa [not shorter]; pronotum longer than wide [not wider than long]; lateral gonapophyses smaller than ectoproct [not larger or

with same size]; posterior gonapophyses broad, long and set with cavisetae [not thin or with cavisetae absent].

Description – Head: *Vertex* raised. *Ocular rim* setae absent. *Antennae* clubbed and elongate; flagellomeres almost as long as wide at base, apical ones slightly wider than long. *Palpimacula* oval-shaped, located medially. Thorax: Pronotum longer than wide. Miller's Organ present. Wings: usually broad with tip acute. *Anterior Banksian* line present in both wings, posterior absent. *Forewing* prefork area wider than posterior area. *Hind wing* with one presectoral crossvein. *Male pilula axillaris* present. Legs: *femur* > 3.5x coxa length. *Femoral sense hair* absent. *Foretibia* and *foretarsi* about same size. *Foretibia* with antennal cleaning setae. *Tibial spurs* present. Male Terminalia: *Ectoproct* rounded; set with long black setae; 9th *sternite* usually with a small medial invagination at the posterior margin. Female Terminalia: *Ectoproct* rounded set with long black setae; *lateral gonapophyses* smaller than ectoproct and set with cavisetae; *posterior gonapophyses* broad, long, with a group of apical cavisetae; *anterior gonapophyses* usually present; 9th *tergite* with a membranous digitiform process.

Distribution (A4 Figs 165-166) – Australia: NSW, NT, QLD, SA, VIC, and WA.

Comments – *Glenoleon* was created by Banks (1913) to accommodate the Australian species previously placed in *Glenurus* Schneider (today in Nemoleontinae: Glenurini). In the original description the author included six species in the genus and mentioned a series of characters to define it, like: Rs arises before cubital fork; forewing and hind wing with three and one presectoral crossveins respectively; hind wing anal vein not running parallel to CU2; anterior Banksian line present; legs slender, spurs long.

However, all these characters are very vague, and could be applied to almost all Dendroleontini species of Australia, there was no definitive and strong character to distinguish the group. Just after the initial paper five new species were described, but was only with the taxonomic review of New (1985b), that the number of species increased considerably bringing it to 32 species as in the beginning of this study.

Despite the large number of *Glenoleon* species described by New (1985b), the author discussed about the complex diversity among the species, and cited that he decided to treat the genus very broadly. The author mentioned that some species are superficially very similar but differed significantly in terminalia structures. However, these patterns of variation were not well understood, and then decided to keep all species in just one genus, mostly based on presence of tibial spurs. Furthermore, he also mentioned that based on the diversity of terminalia shapes was reasonable to think that they represent distinctive genera, but more studies were needed to confirm this. Idea also suggested by Stange (2004).

After studying all the species placed in *Glenoleon*, and analyzed both morphological and molecular data, it is clear that the genus must be split in few new genera and few species should be transferred to other described genera (A4 Figs 1-3). By this reason *Glenoleon* is represented now, by only six species that are close related to the type species *G. pulchellus*.

Among the species closely associated with *G. pulchellus*, is *G. froggatti*, which until now was the only representative of the genus *Platyleon*. The genus was described by Esben-Petersen (1923), who mentioned the close relationship among *Platyleon*,

Glenoleon and *Mossega* Navás. The association between *Platyleon* and *Mossega* was visibly based on the large and biareolate costa area, but the overall shape of the female terminalia completely separates them.

Alternatively, the association between *Glenoleon* and *Platyleon* is very clear. The overall body color pattern associated with the wings shape, perceptibly approximate these two genera. Furthermore, the male terminalia with an elongate gonarcus+mediuncus complex and the posterior placement of the paramere strongly suggest an intimate relationship between *G. froggatti* and *G. pulchellus*. However, in a brief external examination, *G. froggatti* is almost identical to *G. osmyloides*; the biareolate costal area is the only character that separates them apart. The intimate association between these two genera was also noticed by Stange (1976; 2004) and New (1985b). New, actually mentioned that he decided to keep *Platyleon* as a distinct genus, only because of his broad interpretation of *Glenoleon*, which was based only external characters.

Although, after a detailed analyses of all these species it is clear that *Platyleon* should be synonymized with *Glenoleon*. The representatives of both genera share many similarities, like the overall shape of female terminalia, and the elongate legs and pronotum. The synonym is also corroborated by the results from the morphological phylogeny, which recovered *G. froggatti* deeply nested within *Glenoleon* (A4 Fig 3). Unfortunately, *G. froggatti* was not present in the molecular analysis.

Biology – Little is know about the biology, but both *G. froggatti* and *G. pulchellus* were collected as larvae in the field and posteriorly reared in laboratory. See comments for both species.

Key to species of *Glenoleon*

- 1 Forewing costal area uniareolate (A4 Fig 90d).....2
- 1' Forewing costal area biareolate (A4 Fig 92c).....*G. froggatti*
- 2 Hind wing without two transversal bands on the distal half.....3
- 2' Hind wing with two transversal dark bands on the distal half (A4 Fig 100c)
.....*G. pulchellus*
- 3 Tibial spurs long (reaching T1 apex); forewing radial crossveins simple (A4 Fig 90d); forewing mostly hyaline (if with brown marks, not rounded).....4
- 3' Tibial spurs short, (about half of T1 length); forewing radial crossveins irregularly linked (A4 Fig 94a); forewing full of large, dark, rounded spots.....*G. maculatus*
- 4 Specimens relatively large, forewing ≥ 16 mm; wings fairly broad, posterior margin convex apically; forewing without large stigmal mark (A4 Fig 90d).....5
- 4' Specimens small, forewing < 16 mm; wings rather narrow, inferior margin almost straight; forewing with a large stigmal mark (A4 Fig 96c)....*G. minutillus*
- 5 Forewing rhegmal area and apex of prefork area with a short dark line (A4 Fig 98c); forewing subcostal area, intercalating hyaline and brown regions; male mediuncus forked apically (posterior view) (A4 Fig 99c).....*G. osmyloides*

5' Forewing rhegmal area and apex of prefork area with small infuscations; forewing subcostal area hyaline (A4 Fig 90d); male, mediuncus not forked in posterior view (A4 Fig 91c).....*G. aurora*

***Glenoleon aurora* Tillyard 1916**

(A4 Figs 90-91)

Glenoleon aurora Tillyard 1916:56 (OD); Esben-Petersen 1923:586 (cit); Stange 1976:305 (cat); New 1985b:52 (key, rd, ill); New 1996:81 (cat); Stange 2004:103 (cat); Oswald 2015 (cat).

Glenoleon pictus New 1985 **New Synonym.** *Glenoleon pictus* New 1985b: 56 (OD); New 1996:83 (cat); Stange 2004:105 (cat); Oswald 2015 (cat).

Glenoleon tergitus New 1985 **New Synonym.** *Glenoleon tergitus* New 1985b: 57 (OD); New 1996:84 (cat); Stange 2004:106 (cat); Oswald 2015 (cat).

Diagnosis – Legs elongate [not short]; tibial spurs reaching T2 apex [not absent or shorter]; forewing costal area uniareolate [not biareolate]; hind wing with no broad bands on apical half [not with bands]; male genitalia elongate [not short]; female pregenital small and rounded [not large and elongate]; male genitalia semi triangular in posterior view [not in different shape].

Description – Lengths: forewing: 23 – 27 mm; hind wing: 21 – 25 mm.

Head (A4 Figs 90a-b): *Labrum* pale; with a line of elongate setae. *Clypeus* pale to orange; with few elongate black setae. *Frons* predominantly pale to orange with a large dark brown mark around antennae (in some specimens mark is smaller and present only

on ventral margin of antennal base); set with few short black setae. *Gena* pale. *Vertex* raised; in frontal view mostly orange with two small transversal light brown marks laterally, and a small medial line (marks almost imperceptible in some specimens); in dorsal view mostly pale with three dark brown rounded marks, a medial one on posterior margin and other two anterior to that; set with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, about twice longer than pronotum; distance between antennae wider than scape width; scape, pedicel and apical flagellomeres (about eight) black; four to five subapical flagellomeres pale, remaining segments brown; torular membrane pale; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae. *Mandibles* mostly pale, with tip black. *Palpi*, maxillary and labial pale with scattered dark brown marks, mainly on apical segments; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 90b): *Pronotum* longer than wide; posterior margin about as wide as anterior; subapical furrow present; mostly pale except for some dark brown marks as follows: a central longitudinal line (discontinuous at furrow in some specimens), two short curved lines on posterior area, anterior margins; beset with short black setae but with some long setae at borders. *Mesonotum* mostly pale, with some dark brown areas distributed on segments as follows: prescutum with two marks on anterior and posterior margins (connected in some darker specimens), scutum with a large longitudinal central mark and two narrow longitudinal lines on each side, scutellum with two rounded spots on anterior margin and three small lines on posterior margin (central line generally larger); covered with short black setae. *Metanotum* mostly pale, with some dark brown

marks as follows: a large rounded mark on each side of prescutum, a large longitudinal lateral line on each side of scutum, two large marks on anterior margin of scutellum and a central mark on posterior margin. *Pterothoracic pleura* mostly pale with scattered dark brown areas around some sclerites margins, mainly anterior ones; covered with white setae; Miller's organ present.

Wings (A4 Fig 90d): Fairly broad; anterior Banksian line present in both wings, posterior absent; veins mostly pale, but some veins intercalated with brown spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane hyaline with amber infuscations around some crossveins, inferior margin and tip; pterostigma pale, with a small amber mark at base in some specimens; cubital fork located between origins of Rs and MA; two or three presectoral crossveins; subcostal veinlets mostly simple, but in some specimens with some forked veinlets; posterior area narrower than prefork area. *Hind wing* membrane color hyaline, with a rounded rhegmal mark, and few amber marks at tip, in some darker specimens all these marks are larger, particularly the rhegmal spot, but in a few paler specimens marks extremely reduced or absent; medial fork located between origins of Rs and MA; subcostal veinlets simple; one presectoral crossvein with a medial spur.

Legs (A4 Figs 90a-b): *All pairs of legs*, femur elongate (> 3.5x length of coxa); tibia slightly longer than femur, and about twice longer than tarsi; tibial spurs extending over T2 apex; T2, T3 and T4 about same size, T1 slightly longer than T2, T5 twice longer than T1; claws about half of T5 length; coxa and trochanter set with short white setae; femur, tibia and tarsi set with short black setae and scattered long black setae (some

specimens with few short white setae on femur internal surface); T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair absent; tibia with antennal cleaning setae ventroapically; coxa pale with some dark brown marks on external surface, trochanter pale, femur pale with tip dark brown and a subapical brown mark on internal surface of some specimens, tibia pale with three dark brown rings, tarsi pale with T3, T4 and tip of T5 dark brown. *Midleg* with same color pattern of foreleg. *Hindleg* with femur and tibia slightly longer than in other legs; color similar to other legs except for tibia with only tip dark brown, and tarsi entirely pale in some specimens.

Abdomen (A4 Figs 90c): Tergites with posterior area brown with scattered irregular pale marks, but anterior area mostly pale with few dark brown marks. Sternites in general entirely pale, but some specimens with few dark brown marks in some sternites. Tergites and distal sternites set with short black setae, remaining sternites covered with short white setae.

Male Terminalia (A4 Figs 91a-d): *Ectoproct* rounded in lateral view, covered with elongate black setae. *9th sternite* posterior margin with a medial excavation in ventral view, but rounded in lateral view; set with elongate black setae. *Gonarcus* broad, arched, with anterior margin elongate. *Mediuncus* fused with gonarcus forming a semi triangular structure. *Paramere* elongate in lateral view and with tip acute and more sclerotized.

Female Terminalia (A4 Figs 90c, 91e-f): *Ectoproct* rounded covered with thin elongate setae. *Lateral gonapophyses* rounded, smaller than ectoproct, set with cavisetae. *7th tergite* with the posterior ventral corner elongate and acute in lateral view. *7th sternite* distal margin with a medial short invagination in ventral view; covered with long black

setae. *Pregenital plate* small, curved in lateral view, but rounded in ventral view. *Posterior gonapophyses* broad and elongate,; covered with long black setae, and many cavisetae on the apex. *9th tergite* with a small membranous digitiform process, ventral margin covered with many elongate pale setae. *Anterior gonapophyses* a small lobe, beset with very short sclerotized setae. *Ventral membrane*, gonapophyseal plates absent.

Distribution (A4 Figs 165) – Australia: NSW, NT, SA, and WA.

Adult activity period – Records for October to April.

Biology – Unkonwn, larva unknown.

Primary type – *Glenoleon aurora*: Lectotype (by subsequent designation), male (BMNH), high-resolution image examined. From original description, Tillyard (1916): “Hab.---Broken Hill, N.S.W. Several specimens taken by Mr. O. Lower, in 1900 and 1902. Types, ♂♀, in Coll. Tillyard; (♂, December 4th, 1900; ♀, November 10th, 1902; Broken Hill; O. Lower)”. From New (1985b): “Holotype, ♂ (end of abdomen missing), New South Wales, Broken Hill, 4.xii.1900, O. Lower (BMNH). [Paratype, ♀, same locality, 10.xi.1902 (BMNH); another ♀ labeled as paratype, same data (ANIC); neither ♀ is truly *aurora* (see below); they are likely to represent *G. tillyardi*, sp. nov.]”. From Stange (2004): “Holotype male, Broken Hill, New South Wales, 4.xii.1900, Lower (BMNH!)”. In the original description two specimens were mentioned as the “types”, but there was no clear distinguishment of a holotype. However, the holotype and paratype statements made by New (1985b) is considered here as an explicit designation of a Lectotype according to the nomenclatural code (article 74.5). He mentioned the sex and the data from label of the specimen considered as “holotype”, what distinguish it

from the other specimen mentioned in the original description. By this reason the specimen mentioned as the holotype by New (1985b) and Stange (2004), is here considered as the Lectotype. This specimen is the one illustrated in the original description and also bears a holotype label on it, what was probably the reason why New (1985b) indicated this specimen as the “holotype”. New (1985b) also discussed about the situation of the female paratype (considered here as paralectotype). He mentioned that this specimen and another female from ANIC (labeled as cotype) are not truly *G. aurora*. These two specimens were also seen in this study, and in fact they are not *G. aurora*, but differently from New (1985b), who stated that they were likely *M. tillyardi*, they are actually representatives of *A. banksi*. The lectotype is in relative good condition, with four legs and both antennae missing.

Glenoleon pictus: Holotype (by original designation), female (ANIC), examined. From original description, New (1985b): “Holotype, ♀, ‘W. Australia, 12.x.1915’ ‘229’ (ANIC)”. Condition: good, left antenna, right mid and hindleg, and left hindtarsi broken; left wings damaged, mainly at distal dorsal area; right hind wing with tip missing; terminalia dissected.

Glenoleon tergitus: Holotype (by original designation), female (ANIC), examined. From original description, New (1985b): “Holotype, ♀, Western Australia, 12 [miles] N. Norseman, 25.xi.1958, E. F. Riek (ANIC)”. Condition: good; terminalia dissected.

Material examined – (36♂, 47♀). **AUSTRALIA: New South Wales: Broken Hill:** 13m E, 13.iii.1963, K. Dansie (1♀, SAMA); *Tibooburra*: 27 mi, 1.xi.1967, R. McInnes (1♂, ANIC); 2.xi.1949, EF Riek (1♂, ANIC); **Northern Territory: Alice Springs:** 17

km NE Yambah, xi.1965 (1♂, FSCA); 1mi E, 23.iv.1966, N. McFarland (1♂, SAMA); 4
 mi SW, 18.ii.1966, Britton, Upton & McInnes (1♂, ANIC); *Emily Gap*: 6 mi SE of Alice
 Springs, 17.ii.1966, Britton, Upton & McInnes (1♂, 2♀, ANIC); *Standley Chasm*: 42
 km W of Alice Springs, 11.x.1972, MS Upton (1♂, 1♀, ANIC); ii.1966 (1♀, ANIC);
Trephina Gorge: 70 km ENE of Alice Springs, 29.i.1984, M.S & B.J. Moulds (1♂,
 AMSA); **South Australia**: *Aroona Dam*: 3.xi.1969 (1♂, SAMA); *Blackwood*: 850ft.,
 8.ii.1966, N. McFarland (1♀, AMSA); 27.ii.1966 (1♀, SAMA); 29.i.1969 (1♂, MVM);
 ii.1969 (1♂, 1♀, SAMA); iii.1969 (1♀, SAMA); i.1969 (2♀, SAMA); *Bucharinga*
Gorge: 30 km NNW Quorn, 18.xii.1985, C. Reid (2♀, ANIC); *Coober Pedy*:
 25.xi.1989, R.B. Miller (1♂, 1♀, FSCA); *Kurlge*: 850ft, M.V.L., N.B. Tindale (1♀,
 SAMA); i.1966 (1♂, SAMA); ii.1962 (4♂, 3♀, SAMA); *Ediacara*: iii.1958 (1♂,
 SAMA); *Everard Pk*: xi.1970 (1♀, SAMA); *Gauler Ranges*: xii.1989 (1♂, 1♀, SAMA);
Innamincka: xi.1996 (1♂, SAMA); 7.2 km SW Table Hill, 27°37'57''S - 140°49'46''E,
 04-09.xi.1996, Stony Des. Sur. IN camp (1♀, SAMA); *Leigh Ck*: x.1964 – iii.1965, G.C.
 Gregory (1♀, ANIC); x.1968 (1♀, SAMA); *Maree Picnic Gd.*: 2.xi.1955, at light, E.T.
 Giles (1♂, SAMA); *Mount Aroona*: 29.xi.1951 (1♂, MVM); *Mount Davies*: xi.1963
 (1♀, SAMA); *Mount Painter*: Flinders Range, H.G. Stokes (5♀, 6♂, SAMA); *Mount*
Serle: 16.i.1965 (1♂, 1♀, SAMA); *Mudla Bore*: xii.1974 (2♀, SAMA); *Musgrave Rg*:
 ii.1966 (1♂, 1♀, SAMA); 8 km NE Mount Woodroole, 26°17'10''S – 131°48'20''E,
 Pitjantjatjara Lands survey, 15.x.1994 (2♂, 3♀, SAMA); *Port Augusta*: Pichi Richi Pass,
 17.i.1976, M.S. & B.J. Moulds (1♂, AMSA); *Rev. A.P. Burgess*: (1♂, SAMA); *Uno Stn*:
 ii.2009 (1♀, SAMA); iii.2010 (1♀, SAMA); *Yunta*: xii.1942 (1♂, 5♀, MVM);

Wirreandah Crk. Crossing: 30 km S. Hawker, 26.xi.1975, at light, G.F. Gross & V. Potezny (1♀, SAMA); **Western Australia**: *Blackstone Rg*: iii.1956 (2♀, 1♂, SAMA); *Dampier*: 20.iv.1971, MS Upton (1♀, ANIC); *Duri*: 31.i.1976, K.E. Carbany (1♂, AMSA); **NO LABEL**: (1♀, SAMA).

Comments – In the original description of *G. tergitus* (New 1985b) the author mentioned that this species was very similar to *G. aurora*, but decided to describe it based on distinctive details on body marks and terminalia. However it was also stated that the full range of intraspecific variation in many species of this group was not clear and that these two species could be simple divergent forms of the same species (New 1985b). After the analysis of all the type series and a large range of other specimens from this complex, it is possible to conclude that they indeed represent an intraspecific variation. Based on the body marks, *G. tergitus* is only a slightly darker version of regular *G. aurora*, it has the same defining marks, but somewhat more intense, nevertheless the remaining characters are very similar, like the shape of pronotum, wing venation, and form of male and female terminalia. The main difference pointed by New (1985b) between these two species was the presence of a bilobed process at the distal margin of sternite VII of *G. tergitus*. However, this characteristic seems to be very plastic among the series analyzed here; many specimens bear the same structure with different levels of development, some are very short and others elongate as in the *G. tergitus* holotype. Furthermore, the specimens bearing this structure shows different body marks intensity, but most of them with colors like the usual *G. aurora*, and some even darker than *G. tergitus* types. This same character is also present in many

specimens of *A. banksi* (also showing different development levels). In this sense, *Glenoleon tergitus* is here considered as a junior synonym of *Glenoleon aurora*.

After studying *G. pictus* holotype it is possible to conclude that this species is another synonym of *G. aurora*. Like discussed above *G. pictus* also fits in the intraspecific variation range of *G. aurora*; it is only an extreme dark specimen. This specimen has all the main characters of a regular *G. aurora*, but with the body marks much more intense, mainly at hind wing. The larger rhegmal spot seems to be the main difference between this specimen and all others analyzed here. New (1985b) more the once mentioned the similarities shared by *G. pictus*, *G. tergitus* and *G. aurora*, but he decided to separate them based on the strongly patterned hind wings, which is an intensively variable character among many species of “*Periclystus* genus group”. New (1985b) also discussed the similarities on female terminalia among these “three” species, but pointed out that *G. pictus* posterior gonapophyses has no equivalent ventral ornamentation. However it is not clear what ornamentation the author is referring to, there is nothing unusual on the holotype terminalia. The distal margin of sternite VII also bears a short bilobed structure, but not as long as in *G. tergitus*. For all these reasons *Glenoleon pictus* is also considered here as another junior synonym of *Glenoleon aurora*.

Among *Glenoleon*, the species is closely related to *G. froggatti*, *G. minutillus* and *G. osmyloides* based on the general body color pattern. However they can all be easily separated based on the shape of both male and female terminalia. For phylogenetic relationships see (A4 Figs 1-3).

***Glenoleon froggatti* (Esben-Petersen 1923), new combination**

(A4 Figs 92-93)

Platyleon froggatti Esben-Petersen 1923:578 (OD); Stange 1976:312 (cat); New 1985b:10 (key, rd, ill); New 1996:91 (cat); Stange 2004:107 (cat); Oswald 2015 (cat).

Diagnosis – Legs elongate [not short]; tibial spurs reaching T2 apex [not absent or shorter than T2]; forewing costal area biareolate [not uniareolate]; hind wing with no broad bands on apical half [not with bands]; male paramere located posterior to the gonarcus + mediuncus complex [not below]; female pregenital plate conical [not reduced or in different shapes].

Description – Lengths: forewing: 24 – 28 mm; hind wing: 22 – 26 mm.

Head (A4 Figs 92a-b): *Labrum* pale; set with a line of elongate setae. *Clypeus* pale, with some elongate pale setae. *Frons* dark brown except for ventrolateral corners pale; set with short white setae. *Gena* pale. *Vertex* raised; pale except for two rounded dark brown marks around midline in dorsal view, and some irregular lateral dark marks on posterior border; covered with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, > 2x length of pronotum; distance between antennae wider than scape width; scape and pedicel brown with distal margin pale; flagellum mostly brown, except for five to six subapical segments pale and apex dark brown; torular membrane dark brown; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae, except for scape and pedicel with few short white setae. *Mandible* pale to brown, with tip black. *Palpi*, maxillary and labial mostly pale

with irregular dark brown marks mainly on basal segments; apical labial palpomere fusiform, palpimacula oval-shaped, located medially

Thorax (A4 Fig 92b): *Pronotum* longer than wide; posterior margin slightly wider than anterior; subapical furrow present; mostly pale except for some dark brown areas: a broad sagittal line (forked on anterior margin in some specimens), two thin and sinuous longitudinal lines near midline (interrupted medially in some specimens), and longitudinal marks on lateral margin; beset with short black setae, and some elongate setae on margins. *Mesonotum* mostly dark brown, with pale areas on each segment: two curved marks on prescutum, two large marks around midline but enclosing a short dark brown line, and a sinuous line laterally at scutum; beset with short black setae. *Metanotum* dark brown, except for large pale marks at scutum, and some irregular pale areas on scutellum of some specimens; covered with short black setae. *Pterothoracic pleura* mostly pale, except for dark brown marks, mainly at ventral margin of sclerites; covered with white setae; Miller's organ present.

Wings (A4 Fig 92c): Fairly broad; anterior Banksian line present in both wings, but posterior absent; veins mostly dark brown, but some veins intercalated with white spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline with some brown areas as follows: surrounding veins at tip of prefork area, beneath pterostigma, around gradate veins, posterior margin and tip with small brown infuscations; cubital fork located between origins of Rs and MA; three presectoral crossveins; costal area large, biareolate, with most of subcostal veinlets forked; posterior area narrower than prefork area. *Hind wing* membrane mostly hyaline except for a small

brown mark hypostigmatic cell base, a large mark on rhegmal area, and small brown infuscations at tip; medial fork located between origins of Rs and MA; subcostal veinlets mostly simple but few forked; one presectoral crossvein with a medial spur in some specimens.

Legs (A4 Figs 92a-b): *All pairs of legs*, femur elongate ($> 3.5x$ length of coxa); tibia slightly longer than femur and about $1.5x$ longer than tarsi; tibial spurs reaching T2 apex; T2, T3 and T4 about same size, T1 about twice longer than T2, T5 $> 2x$ length of T1; claws about half of T5 length; coxa, trochanter, and femur set with short white setae and few scattered long white setae at femur; femur, tibia, and tarsi set with long and short black setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair slightly longer than femur width; tibia with antennal cleaning setae ventroapically; coxa pale with irregular dark marks; trochanter pale, femur and tibia pale to brown with apex dark brown; tarsi pale with T3, T4, and apex of T5 dark brown. *Midleg* color pattern similar to foreleg, except for coxa entirely pale. *Hindleg* similar to midleg except with femur and tibia slightly longer than in other legs.

Abdomen: Mostly dark brown with irregular pale marks, mainly at lateral margins on tergites and medial areas of sternites. Beset with short black setae, and some white ones on basal segments, mainly sternites.

Male Terminalia (A4 Figs 93a-d): *Ectoproct* rounded in lateral view, in posterior view with inner ventral margin enlarged; covered with elongate black setae. *9th sternite* short with posterior margin rounded, in ventral view; set with very long black setae. *Gonarcus*

+ *Mediuncus* complex long and tubular. *Paramere* strongly sclerotized, fused at apex of gonarcus + mediuncus complex; curved with tip acute.

Female Terminalia (A4 Figs 93e-f): *Ectoproct* rounded, covered with thin elongate setae. *Lateral gonapophyses* rounded, smaller than ectoproct, covered with cavisetae. 7th *sternite* long with distal margin straight in ventral view, covered with long black setae. *Pregenital plate* large and conical. *Posterior gonapophyses* broad, elongate, curved and with tip rounded; covered with long black setae, and many elongate cavisetae apically. 9th *tergite* with a short membranous digitiform process. *Anterior gonapophyses* as two internal small lobes located at base of posterior gonapophyses, bearing short thickened setae; only seen in ventral view. *Ventral membrane* with gonapophyseal plates present, and with a sclerotized rectangular bar ventral to the anterior gonapophyses, also bearing short thickened setae.

Distribution (A4 Fig 165) – Australia: NSW, NT*, QLD, and VIC*. * = new record.

Adult activity period – Records for December and February.

Biology – Nothing has been published about its biology, but one male deposited in FSCA was reared from a larvae collected in a tree hole near a river in Queensland, by Robert B. Miller in 1998. The place where the larva was collected suggested that *G. froggatti* larvae might develop in tree holes like many other Dendroleontini species. The exuvia also shows that the larvae possess three large mandibular teeth, and the typical Dendroleontini setal tuft located medially on mesonotum (Stange & Miller 1990).

Primary type – Holotype (by monotypy), female (ANIC), examined. From original description, Esben-Petersen (1923): “One ♀, N.S. Wales, 20.12.1915 (W. W. Froggatt

leg.). Coll. Froggatt". From New 1985b: "Holotype, ♀, New South Wales, Hay (Eucalyptus), 20.xii.1915, W. W. Froggatt leg. (ANIC) (seen) (antennae missing)".

Condition: relatively good; antennae missing, abdomen broken but stored with the specimen, body with some white mold.

Material examined – (9♂, 18♀). **AUSTRALIA: New South Wales:** *Deniliquin*: 1.i.1944 (1♀, MVM); *Hay*: 1917, W.W. Froggatt (1♀, ANIC); *Niemur River*: Near Wakool, 28.xii.1954 (1♂, MVM); *Wentworth*: Murray River 50 mi W, 22.xi.1967 (1♀, MVM); **Northern Territory:** *Alice Springs*: Stuart Hwy roadhouse rest area, 19.xi.1989, R.B. Miller (1♂, FSCA); **Queensland:** *Brisbane*: (3♀, QLDM); *Dalby*: 3.ii.1932 (4♂, 5♀, QLDM); *Roma*: 30.i.1932 (2♂, 3♀, QLDM); 30.ii.1930, Franzen leg. (1♀, QLDM); Coll. Esben-Petersen (1♀, ZMUC); *Stradbroke Is*: xii.1912 (1♀, ANIC); *White Mountain Natural Park*: Julia Creek, xii.1998, R.B. Miller, in tree along river (in tree hole) (1♂, FSCA); **Victoria:** *Yarrawonga*: 4.i.1948 (1♀, MVM).

Comments – See comments for *Glenoleon*.

***Glenoleon maculatus* New 1985**

(A4 Figs 94-95)

Glenoleon maculatus New 1985:58 (OD); New 1996:67 (cat); Stange 2004:104 (cat).

Diagnosis – Legs elongate [not short]; tibial spurs reaching half of T1 length [not longer]; forewing costal area uniareolate [not biareolate]; forewing radial crossveins linked [not simple]; wings full of rounded brown marks [not hyaline or with bands];

female pregenital plate conical [not reduced or in different shapes]; female lateral gonapophyses cavisetae absent [not present].

Description – Lengths: forewing: 19 mm; hind wing: 18 mm.

Head (A4 Fig 94a): *Labrum* pale, set with a line of elongate setae. *Clypeus* pale, with few short pale setae. *Frons* ventrally pale but area around and between antennae dark brown; set with short pale setae. *Gena* pale. *Vertex* raised; in frontal view pale, with two short transversal dark marks laterally and a small central dark mark; in dorsal view with anterior half pale except for a central longitudinal black line, and posterior half black; set with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, > 2x length of pronotum; distance between antennae wider than scape width; all segments dark brown; torular membrane dark brown; flagellomeres almost as long as wide at base, apical ones wider than long; all segments set with short black setae. *Mandibles* pale, with tip black. *Palpi*, maxillary and labial brown, with apical segments dark brown; covered with short black setae, apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 94a): *Pronotum* slightly longer than wide; posterior margin wider than anterior; subapical furrow present; pale with lateral areas black, mainly on posterior half, and a broad longitudinal medial line “Y” shaped; set with short black setae. *Mesonotum* mostly black except for scutellum pale and two rounded pale spots on prescutum; all segments set with short black setae. *Metanotum* mostly black except for most part of scutellum pale, and two rounded pale areas at scutum. *Pterothoracic pleura* mostly dark

brown, with scattered pale areas, mainly on ventral sclerites; covered with white setae; Miller's organ present.

Wings (A4 Figs 94a-b): Rather broad, with tip rounded; anterior Banksian line present in both wings, posterior absent; veins mostly black, but some veins intercalated with white spots, mainly at the forewing, beset with short black setae. *Forewing* membrane mostly hyaline but full of large rounded brown marks on whole wing; pterostigma tip white; cubital fork located between origins of Rs and MA; four presectoral crossveins, with a veinlet connecting the last two; basal subcostal veinlets simple, but apical ones sometimes forked and linked; radial crossveins irregularly linked; posterior area about as wide as prefork area. *Hind wing* membrane mostly hyaline except for three large rounded brown spot at apical region, and scattered smaller brown marks; medial fork located between origins of Rs and MA; subcostal veinlets simple; one presectoral crossvein, with a medial spur.

Legs: *All pairs of legs*, femur elongate ($> 3.5x$ length of coxa); tibia slightly longer than femur; but longer than tarsi; tibial spurs reaching half of T1; T2, T3 and T4 about same size, T1 slightly longer than T2 but T5 about twice longer than T1; claws near half of T5 length; coxa and trochanter set with short white setae; all other segments set with short black setae, and scattered long black setae at femur and tibia. *Foreleg* sense hair absent; tibia with antennal cleaning setae ventroapically; coxa predominantly pale but external surface with dark brown marks, femur and tarsomeres pale with tip black, tibia pale with three black rings, one at apex and two on basal half. *Midleg* with same color pattern of

foreleg. *Hindleg* with femur and tibia slightly longer than anterior legs; color pattern equal to other legs, except for the absence of the two basal dark rings in tibia.

Abdomen: Mostly dark brown but full of irregular pale marks; covered with short black setae.

Male Terminalia: *Unknown*.

Female Terminalia (A4 Fig 95a-b): *Ectoproct* rounded covered with thin elongate setae.

Lateral gonapophyses rounded, smaller than ectoproct and covered with elongate setae.

7th sternite with distal margin straight, and set with elongate black setae distally.

Pregenital plate in ventral view, with a large posterior central knob, anterior margin with a small invagination medially, lateral margins acute. *Posterior gonapophyses* broad, elongate, with tip rounded; covered with long black setae, and cavisetae apically. *9th tergite* with a broad membranous digitiform process. *Anterior gonapophyses* absent.

Ventral membrane, gonapophyseal plates absent.

Distribution (A4 Fig 165) – Known only by the type locality, Australia: Pyramid Hill VIC.

Adult activity period – Record for March.

Biology – Unknown, larva unknown.

Primary type – Holotype (by original designation), female (ANIC), examined. From original description, New (1985b): “Holotype, ♀, Victoria, 4 miles N. of Pyramid Hill, 3.iii.1956, I.F.B. Common (ANIC)”. Condition: good, antennae and left midleg broken, terminalia dissected.

Comments – *Glenoleon maculatus* is very distinctive among all species of “*Perichlystus* genus group”, particularly because of the unusual marks on the wings. However, the species is clearly associated with some of the *Glenoleon* species, as previously noticed by New (1985b), who mentioned a close relationship with *G. aurora*, based on the shape of the wings. For phylogenetic relationships see (A4 Fig 1-3).

***Glenoleon minutillus* New 1985**

(A4 Figs 96-97)

Glenoleon minutillus New 1985b:41 (OD); New 1996:83 (cat); Stange 2004:104 (cat); Oswald 2015 (cat).

Diagnosis – Legs elongate [not short]; tibial spurs reaching T2 apex [not absent or shorter]; forewing costal area uniareolate [not biareolate]; forewing length \leq 16mm [not longer]; forewing with a large stigmal mark [not absent or small]; hind wing with no broad bands on apical half [not with bands]; wings rather narrow [not broad].

Description – Lengths: forewing: 11 – 15 mm; hind wing: 10 – 13 mm.

Head (A4 Figs 96a-b): *Labrum* pale; with a line of elongate setae. *Clypeus* pale; with some elongate setae. *Frons* predominantly black, except for ventral area orange (some specimens with a thin medial longitudinal black line on orange area); set with few pale setae. *Gena* pale. *Vertex* raised; in frontal view mostly pale to orange but with two small lateral transversal dark brown bands; in dorsal view mostly pale to orange with scattered dark brown marks centrally and posterolaterally; set with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, $>$ 2x length of pronotum; distance between

antennae wider than scape width; scape and four to five subapical flagellomeres completely pale, pedicel and five to six apical flagellomeres entirely dark brown, remaining segments light brown with a dorsal pale ring, posterior face of these segments slightly darker than anterior surface; torular membrane pale; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae. *Mandibles* mostly pale, with tip black. *Palpi*, maxillary and labial pale; except for some dark brown marks on basal segment of each palpi; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 96b): *Pronotum* longer than wide; posterior margin slightly wider than anterior; subapical furrow present; mostly pale to orange except for some dark brown marks as follows: a central large “Y” shaped, two curved and thin surrounding the central one, and margins; beset with short black setae with some long setae at margins.

Mesonotum mostly pale to orange, with some small black areas as follows: two longitudinal bands around midline on prescutum, a long and curved transversal line with four short longitudinal lines on scutum, and anterior margin and midline of scutellum; covered with short black setae. *Metanotum* mostly black, with some pale to orange areas as follows: around midline on prescutum, rounded spots near wing base, and scutellum laterally; set with few short black setae. *Pterothoracic pleura* mostly black with some pale areas mainly on ventral sclerites; covered with white setae; Miller’s organ present.

Wings (A4 Fig 96c): Rather narrow with tip acute; anterior Banksian line present in both wings, posterior absent; veins mostly black, but some veins intercalated with pale spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane hyaline

with brown marks mainly on posterior margin, tip and surrounding some crossveins, pterostigma with a large brown mark and tip white; cubital fork located between origin of Rs and MA; most subcostal veinlets simple but some distal ones forked in some specimens; posterior area narrower than prefork area. *Hind wing* membrane hyaline but with brown marks and distal posterior margin, and base of hypostigmatic cell; medial fork located between origins of Rs and MA; subcostal veinlets simple; one presectoral crossvein, with a medial spur.

Legs: *All pairs of legs*, femur elongate ($> 3.5x$ length of coxa); tibia and femur about same size, but longer than tarsi; tibial spurs extending to T2 tip; T2, T3 and T4 about same size, T1 twice longer than T2, T5 twice longer than T1; claws about half of T5 length; coxa, trochanter and femur basal half set with white setae, remaining areas set with short black setae and scattered long black setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair absent; tibia with antennal cleaning setae ventroapically; coxa mostly dark brown with internal surface pale, trochanter light brown, femur with tip dark brown and a subapical ring pale, remaining areas light brown, tibia pale with three dark brown rings, T3, T4 and tip of T5 dark brown tarsi remaining areas pale. *Midleg* with same color of foreleg. *Hindleg* with femur, tibia and T1 slightly longer than in other legs; color same of other legs except for tibia completely pale with tip and a ring near base, dark brown.

Abdomen: Segments mostly pale to orange with dark brown marks on posterior margins. Darker areas larger in sternites. Beset with short black or pale setae.

Male Terminalia (A4 Figs 97a-d): *Ectoproct* rounded in lateral view, set with elongate black setae. *9th sternite* posterior margin concave, in ventral view; set with elongate black setae. *Gonarcus* broad, arched, with anterior margin rounded in lateral view. *Mediuncus* small and rounded in posterior view. *Paramere* large in lateral view with an apical concavity, and semi triangular in ventral view.

Female Terminalia (A4 Figs 97e-f): *Ectoproct* rounded covered with thin elongate setae. *Lateral gonapophyses* rounded, smaller than ectoproct, set with some cavisetae. *7th sternite* distal margin straight in ventral view; covered with elongate black setae. *Pregenital plate* small, elongate with posterior margin rounded, anterior margin slightly wider and straight, in ventral view. *Posterior gonapophyses* broad and elongate; with the tip enlarged dorsally, covered with long black setae, and cavisetae at apex. *9th tergite* with a short membranous digitiform process. *Anterior gonapophyses* present, a small rounded plate covered with short pale setae. *Ventral membrane*, gonapophyseal plates present.

Distribution (A4 Figs 165) – Australia: NSW and SA.

Adult activity period – Records for September to March.

Biology – Unknown, larva unknown.

Primary type – Holotype (by original designation), female (ANIC), examined. From original description, New (1985b): “Holotype, ♀, New South Wales, 10 [miles] N. Broken Hill, 17.xi.1949, E.F. Riek (ANIC)”. Condition: good.

Material examined – (7♂, 10♀). **AUSTRALIA: New South Wales: Broken Hill:** nr. race track, 31.96445°S - 141.41817°E±70m, 280m, 2.i.2013, M.V., Oswald, Diehl &

Machado, Oswald #625 (2♂, 3♀, TAMU); *Glendambo*: 16.i.2012, L. Stange (1♀, FSCA); *Wilcannia*: 60 miles W, 22.xi.1949, E.F. Riek (1♀ PT, ANIC) **Northern Territory**: *Erlinda Stn*: x.1953 (1♀, SAMA); **South Australia**: *Coward Spring*: 9.xi.1966, G.F. Gross (1 ♀ PT, SAMA); ix.1966 (1♀, SAMA); *Lake Eyre*: N. Prescott Point, 2.ii.1965, McFarland & J. Mitchell (1♂, SAMA); *Leigh Ck*: 13.xii.1965 (1♀, SAMA); *Levi Creek*: 8 km NW. Big Perry Spring, 28°19.2'S – 136°16.1'E, 7.xii.1974, J.A. Horridge (1 ♂ PT, SAMA); *Maree*: 28.x.1972 (1♂, SAMA); Muloorina Station: 3.iii.1966, N. McFarland (1 ♂ PT, 1♀, SAMA); *Mutooroo Homeslead*: 30.i.1972 (1♂, SAMA).

Comments – *Glenoleon minutillus* is very similar to most of its congeneric species, as confirmed by both molecular and morphological phylogeny. In fact, it looks a smaller version of *G. aurora*. However the shape of wings and the overall male terminalia clearly separate them. For phylogenetic relationships see (A4 Figs 1-3).

***Glenoleon osmyloides* (Gerstaecker 1885)**

(A4 Figs 98-99)

Myrmeleon osmyloides Gerstaecker 1885a:27 (OD); Gerstaecker 1885b:114 (cit).

Glenoleon osmyloides (Gerstaecker): Esben-Petersen 1918:7 (n. cb.); Esben-Petersen 1923:578 (cit); Handschin 1935:690 (cit); Stange 1976:306 (cat); New 1985b:44 (key, rd, ill); New 1996:83 (cat); Stange 2004:105 (cat); Oswald 2015 (cat).

Glenoleon annulicorne Esben-Petersen 1915:72 (OD); Esben-Petersen 1917:205 (cit) [as “*annulicornis*”]; Esben-Petersen 1918:7 (cit) [as “*annulicornis*”]; Esben-Petersen

1923:578 (syn) [as “*annulicornis*”]; Stange 1976:306 (cat); New 1985b:44 (cit); New 1996:83 (cat); Stange 2004:105 (cat); Oswald 2015 (cat).

Glenoleon gerstaeckeri New 1985 **New Synonym.** *Glenoleon gerstaeckeri* New 1985b:42 (OD); New 1996:82 (cat); Stange 2004:104 (cat); Oswald 2015 (cat).

Diagnosis – Legs elongate [not short]; tibial spurs reaching T2 apex [not absent or shorter]; forewing costal area uniareolate [not biareolate]; hind wing with no broad bands on apical half [not with bands]; wings broad [not narrow]; male mediuncus forked apically in posterior view [not simple].

Description – Lengths: forewing: 19 – 24 mm; hind wing: 18 – 23 mm.

Head (A4 Figs 98a-b): *Labrum* and *Clypeus* pale and set with a line of elongate setae. *Frons* mostly black, except for ventrolateral corners pale (some specimens pale area little larger, taking part of ventral half); covered with short white setae. *Gena* pale. *Vertex* raised; mostly pale with two central and one posterior black marks in dorsal view (some species central marks fused); set with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, > 2x length of pronotum; distance between antennae wider than scape width; apical flagellomeres dark brown, four to five subapical flagellomeres pale, remaining segments mostly light brown with pale areas, mainly on anterior surface of basal segments; torular membrane pale; flagellomeres almost as long as wide at base, but apical ones much wider than long; all segments set with short black setae. *Mandibles* pale with tip dark brown. *Palpi*, maxillary and labial pale, in some specimens the labial palpi segments are dark brown; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 98b): *Pronotum* longer than wide; posterior margin slightly wider than anterior; subapical furrow present; mostly pale with a central longitudinal black “Y” shaped line, and two longitudinal thin bands surrounding the central one (some darker specimens black areas larger and fused); set with many short and long black setae, but with few long white setae at anterior margin. *Mesonotum* with prescutum and scutellum pale with a central black longitudinal band, scutum pale with black longitudinal bands (some darker specimens mostly black with small pale spots); covered with short black setae, and some elongate black setae, mainly on prescutum anteriorly. *Metanotum* with three longitudinal black bands, a central and two marginal, intercalated with pale bands; covered with short black setae. *Pterothoracic pleura* dorsal segments mostly black with scattered pale spots but ventral segments mostly pale with some black marks, mainly on dorsal margins (some darker specimens black areas larger); covered with elongate white setae. Miller’s organ present.

Wings (A4 Fig 98c): Fairly broad with tip acute; anterior Banksian line present in both wings, posterior absent; veins set with short black setae, in general brown, except by the main longitudinal veins that are intercalated by numerous short white regions. *Male pilula axillaris* present. *Forewing* membrane almost hyaline with small brown marks as follows: on posterior margin, tip, pterostigma, subcostal area, around mediocubital crossveins, one small brown line on prefork area apex, and another on rhegmal area; cubital fork located between origins of Rs and MA; three or four presectoral crossveins (specimens with four the distal one bifurcates); costal area large; with many subcostal veinlets forked; posterior area narrower than prefork area. *Hind wing* membrane hyaline

except for a small brown mark on rhegmal area; medial fork located between origins of Rs and MA; subcostal veinlets simple but few distal ones forked in some specimens; one presectoral crossvein.

Legs (A4 Figs 98a-b): *All pairs of legs*, femur elongate (> 3.5x length of coxa); tibia about same size of femur but longer than tarsi; tibial spurs surpassing T2 tip; T2, T3 and T4 about same size, T1 about twice as long as T2, T5 about twice as long as T1; claws about half of T5 length; coxa, trochanter, and femur set with short white setae; femur, tibia and tarsi set with short black setae, and scattered long black setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* femur sense hair absent; tibia with antennal cleaning setae ventroapically; coxa mostly pale with irregular black marks; trochanter pale; femur pale with tip dark brown; tibia mostly pale with three dark brown rings; tarsi with T3, T4 and tip of T5 dark brown, remaining areas pale. *Midleg* with same color pattern of foreleg. *Hindleg* with femur, tibia and T1 slightly longer than in other legs; coloration similar to other legs, except for tibia pale, with tip dark brown.

Abdomen: In general mostly black with many irregular pale marks, but in some specimens the pale marks are dominant. Beset with short black setae.

Male Terminalia (A4 Figs 99a-d): *Ectoproct* rounded in lateral view, set with elongate black setae. *9th sternite* in ventral view, with large medial invagination; covered with elongate black setae. *Gonarcus* arched with lateral areas broad in posterior view; curved in lateral view. *Mediuncus* short and forked at tip. *Paramere* broad with an acute medial extension in lateral view.

Female Terminalia (A4 Figs 99e-f): *Ectoproct* rounded and covered with thin elongate setae. *Lateral gonapophyses* rounded, smaller than ectoproct, set with cavisetae. *7th sternite* distal margin straight in ventral view; covered with long black setae. *Pregenital plate* elongate longitudinally, with posterior margin rounded in ventral view. *Posterior gonapophyses* broad, elongate, with tip slightly enlarged; covered with long black setae, and cavisetae on apex. *9th tergite* with an elongate membranous digitiform process. *Anterior gonapophyses* as two small rounded lobes, set with few thickened setae. *Ventral membrane*, gonapophyseal plates present.

Distribution (A4 Figs 166) – Australia: NSW, NT, QLD, SA, VIC, and WA.

Adult activity period – Records for throughout the whole year, but most records for October to February.

Biology – Unknown, larva unknown.

Primary type – *Myrmeleon osmyloides*: Holotype (by implicit monotypy), male [not female] (ZIMG), high-resolution images examined. From original description, Gerstaecker (1885a): “(Fem.). – Patria: Australia”. From New (1985b): “Types / Holotype of *Myrmeleon osmyloides* 'Australia' (Greifswald, not seen)”. From New (1996): “Type data: holotype EMAG adult sex indet.*. / Type locality: Australia.” Gerstaecker’s (1885a) statement that the holotype is a female is incorrect; the presence of pilula axillaris at the base of the remaining right hind wing demonstrate that the type is a male. Condition: good, missing left hind wing and hindleg.

Glenoleon annulicorne: Holotype (by original designation), female (BMNH), high resolution images examined. From original description, Esben-Petersen (1915):

“Victoria; one specimen (Coll. Esben-Petersen), the other not labeled. Type in Coll. West Australian Museum, Perth; cotype in Coll. Esben-Petersen”. From New (1985b): “*G. annulicorne* was described from two specimens: the type, designated as having no data, stated to be in WAM. I did not find any such specimen in WAM. There is in BMNH, though, a specimen of this species, tallying exactly in leg positions with Esben-Petersen's photograph, and also lacking abdomen (also now antennae): labelled as Type (seen). I believe this to be the type”. From (New 1996): “Type data: syntypes BMNH 1 adult sex indet., (whereabouts of other syntypes unknown)”. The statement made by New (1985b) was confirmed here; the holotype mentioned as deposited at WAM by Esben-Petersen (1915), is actually at BMNH. The specimen is identical to the picture presented in the original description and also has a type label on it. The sex of the holotype was never mentioned but it is clearly a female because of the absence of pilula axilaris. The “cotype” (a paratype) with location unknown, as mentioned by New (1996), was found in this study. It is a male deposited at ZMUC; labels: Vict. (small pale square), *Glenoleon annulicorne* n. sp. Esben Petersen Cotype (large white rectangle), cotype (elongate red rectangle). Specimen in general well preserved: right midleg missing, and tip of the wings damaged.

Glenoleon gerstaeckeri: Holotype (by original designation), male (AMSA), high-resolution images examined. From original description, New (1985b): “Holotype, ♂, Western Australia, Kalbarrie, 22.xi.1978, M.S. and B.J. Moulds (AM)”. Condition: good; right hindleg missing; terminalia dissected.

Material examined – (97♂, 172♀, 13?): **AUSTRALIA: ACT:** *Canberra:* 16.ix.1957, E. F. Riek (1♀, FSCA); 4.i.1931, T. Greaves (1♂, ANIC); 16.xii.1958, E.F. Riek (1♀, ANIC); 20.ii.1960 (1♀, ANIC); 1.iv.1957 (1♀, ANIC); 15.xii.1960 (1♀, ANIC); 19.xi.1959 (1♀, ANIC); 12.i.1960 (1♂, ANIC); 4.i.1960 (1♂, ANIC); 8.ii.1961 (1♀, 1♂, FSCA); **New South Wales:** *Albury:* xii.1960 (1♀, FSCA); *Bourke:* 27.x.1949, E.F. Riek (1♀, 1♂, ANIC); 19.xi.1949 (3♀, 1♂, ANIC); *Broken Hill:* nr. race track, 280m, 31.96445°S – 141.41817°E±70m, 2.i.2013, M.V., Oswald, Diehl & Machado, Oswald #625 (1♀, TAMU); Coll. Lower (1♀, ANIC); 20.xi.1949, E.F. Riek (10♀, ANIC); 19.xi.1949 (7♀, 2♂, ANIC); vi.1946, (1♀, ANIC); *Canowindra:* 1.i.1955 (1♂, MVM); 30.xii.1954 (1♀, MVM); *Cobar:* 70 W 24.xi.1949 (3♀, 2♂, ANIC); *Dareton:* 29.xi.1993, N.W. Rodd (1♂, AMSA); *Dowsons Springs:* Mt Kaputar, 18.ix.1968, C.W. Frazier (1♀, 1♂, ANIC); 30.x.1967 (3♀, 3♂, ANIC); *Eubalong West:* 16 km, 27.xii.1992, M.S. & B.J. Moulds (1♀, AMSA); *Hankes:* x.1966 (1♀ SAMA); *Grassmere Stn:* ix.1962 (1♂, SAMA); *Nombinnie Nature Reserv.:* 18 air km SSE Mount Hope, 160m, 32.99613°S – 145.94006°E±70m, 3.i.2013, M.V., Oswald, Diehl & Machado, Oswald #626 (1♂, TAMU); *Nyngan:* 21.x.1949, E.F. Riek (3♀, ANIC); *Pilliga Nature Reserve:* 34 km N Coonabarabran, 23.ix.2005, R. Miller & L. Stange (1♂, FSCA); *Trangie:* 13.vi.1968 (1♀, ANIC); *Yanco:* 8.xi.1949 (3♀, 1♂, ANIC); *Yass:* 26.xii.1931 (1♀, ANIC); *Walgett:* 15.x.1957, E.F. Riek (1♀, ANIC); *Wilcannia:* 22.xi.1949, E.F. Riek (1♀, ANIC); **Northern Territory:** *Alice Springs:* 19.x.1966 (1♀, ANIC); 17.ii.1966 (1♂, FSCA); x.1978 (1♀, ANIC); *Austral Downs:* ix.1977 (1♂, 2♀ SAMA); *Bullita HS:* 21.vi.1969 (1♀, ANIC); *Clifton Hills:* 18.ix.1972, M.S. Upton (3♀,

4♂, ANIC); *Coolibah*: 15.34S – 130.54E, 15.ix.1968 (3♀, ANIC); 10.vi.1968 (3♂, ANIC); *Erlunda*: ix.1967 (1♀, MVM); *Hermansberg*: iii.1967 (1♂, SAMA); *Katherine*: viii.1973, (2♀, 2♂, ANIC); *Kings Canyon*: 22.xi.1989, R. Miller (1♂, 1♀, FSCA); *Lake Woods*: x.1977 (2♀, SAMA); *Limbunya*: 2.viii.1969 (1♀, ANIC); *Newcastle Waters*: 4.vi.1929, T.G. Campbell (1♂, ANIC); *Victoria R.*: 18 km W of Timber Creek township, 25.xii.1991, M.S. & B.J. Moulds (1♀, AMSA); ix.1973, (1♀, ANIC); *Yuenduni*: ii.1968 (1♂, SAMA); **Queensland**: *Archer River x-ing*: N of Coen, 7.x.1979, M.S. & B.J. Moulds (1♀, AMSA); *Atherton Tableland*: x.1947, N. Geary (1♀, AMSA); *Barakula State Forest*: 28.5 air km NNW Chinchilla, 26.49661°S 150.52354°E, R Machado, MV light, 19.xii.2015, AustRM#04 (1♂, TAMU); *Bingil Bay*: 30.vi.1992, @ light, DH Habeck (1♂, FSCA); *Bollon*: 35 N, 17.x.1957, E.F. Riek (1♂, 1♀, ANIC); *Bouli*: x.1978 (1♀, ANIC); *Brisbane*: (9?, QLD); 23.x.1926 (1♂, ZMUC; 1♀, QLD); *Camooweal*: 13.vi.1968 (2♀, ANIC); *Carandotta*: ix.1977 (3♂, 1♀ SAMA); *Charleville*: 11.i.1934 (1♀, QLD); 21.x.1957 (5♀, 1♂, ANIC); x.1975 (1♀, ANIC); *Chinchilla*: 20.x.1985 (1♀, QLD); 1.i.1986 (1♀, QLD); *Clermont*: Dr. K.K. Spence (1♂, 1♀, AMSA); *Cunnamulla*: 20.x.1938, N. Geary (1♂, AMSA); x.1941, N. Geary (1♂, AMSA); x.1943, N. Geary (1♀, AMSA); ii.1949, N. Geary (1♀, AMSA); *Durak R. x-ing*: Gibb River road, E. Kimberley, 29.xii.1991, M.S. & B.J. Moulds (1♂, AMSA); *Eidsvold*: (1♀, ANIC); 6.x.1936 (1?, QLD); *Emerald*: 20.ii.1916 (1♀, 1♂, ANIC); *Eromanga*: xi.1967 (1♀, ANIC); *Gregory River*: at Gregory Downs, 20.xii.1986, M.S. & B.J. Moulds (1♀, AMSA); *Julia Creek*: 18.xii.1954, (1♀, QLD); *Kundala*: (1♀, MVM); *Lawn Hill Nat. Pk*: 3.v.1995 (1♀, QLD); *Longreach*:

11.xi.2005, L. Stange (1♀, FSCA); *Magnetic Island*: (1♀, SAMA); *Mitchell*:
 18.x.1957, E.F. Riek (1♀, ANIC); *Mount Isa*: i.1992, (1♀, ANIC); *Muttaburra*:
 22.viii.1966, G. Monteith (1♂, QLDM); *Nappamerry*: 6.xi.1949, E.F. Riek (2♀, ANIC);
Nockatunga: 10.xi.1949, E.F. Riek (1♀, ANIC); *Powela Aramac*: viii.1920, F. Bradshaw
 (1♀, AMSA); *Roma*: 11.xi.1938 (2?, QLDM); *Silver Plains*: 16.xi.1996 (1♀, ANIC);
Sunnybank: 18.x.1926 (1♂, QLDM); *Tambo*: 28 km S.E., 11.ii.1981, M.S. & B.J.
 Moulds (1♀, AMSA); *Thargomindah*: 22.x.1957, E.F. Riek (1♀, ANIC); *Taroom*
District: Boggomoss 21, 25°27'S - 150°03'E, 10.xi.1996, at light, C.J. Burwell & S.
 Evans (1♀, QLDM); *Yulepa*: (1?, QLDM); *Walkers Ck*: 35 km NNE of Normanton,
 2.i.1990, M.S. & B.J. Moulds (1♂, AMSA); *Westwood*: 29.ix.1923 (1♀, MVM);
Windorah: 3.ix.1997 (1♀, QLDM); **South Australia**: *Adelaide*: xii.1886 (1♀, SAMA);
Andamooka HS: x.1975 (1♂, SAMA); *Approddinna Attora Knolls*: ix.1998 (1♀, SAMA);
Arkaba Creek: 26 air km ENNE Hawker, 390m, 31.68717°S – 138.57257°E±70m,
 31.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #623 (1♀, TAMU); *Flinders Rge*:
 iii.1973 (1♀ SAMA); *Arkaroola*: northern Flinders Ranges, 22.i.1976, M.S. & B.J.
 Moulds (1♂, AMSA); xi.1969 (2♂, 1♀, SAMA); *Athelstone*: x.1973 (1♀, SAMA);
Balcanoona Ck: xi.1975 (1♀, SAMA); *Billero Dam*: xi.1975 (3♀, SAMA); *Copley*:
 x.1967 (1♂, 1♀, SAMA); *Coward Springs*: xi.1955 (1♀, SAMA); *Dalhousie Springs*:
 x.1987 (1♀, SAMA); x.1980 (1♂, SAMA); *Finniss Springs HS*: xii.1964 (1♂, SAMA);
Gawler Ranges NP: x.2006 (1♂, SAMA); *Gluepot Res*: xii.2000 (1♂, SAMA); *Goyder*
Lagoon: 18.ix.1972 (4♂, ANIC); *Hesso*: x.1975 (1♂, SAMA); *Indulkana Ck*: ix.2001
 (1♀, SAMA); *Innamincka*: Cooper Ck, 24.i.1976, M.S. & B.J. Moulds (1♀, AMSA);

ix.1996 (1♀, SAMA); *Kalamurina HS*: 17.ix.1972 (1♀, ANIC); *Karoonda*: (1♀, SAMA); *Koonchera*: 2.ix.1997 (2♀, QLDM); *Lake Eyre*: Prescott Point, iii.1965 (2♂, SAMA); *Leigh Creek*: 14.xii.1966 (1♂, ANIC); x.1965 (1♂, ANIC); xii.1965 (2♂, 5♀ SAMA); *Marree*: 1914 (1♀, ANIC); 15.ix.1972, Z. Liepa (4♂, ANIC); xii.1964 (1♀, SAMA); x.1966 (1♂, 1♀, SAMA); *McDonalds Downs*: viii.1930 (2♂, 1♀, SAMA); *Mitchan*: ii.1975 (1♀ SAMA); xii.1978 (1♀ SAMA); *Mount Freeling Stn*: xi.1998 (2♂, SAMA); *Mulloorina HS*: iii.1965 (1♀ SAMA); *Munyaroo CP*: xi.2005 (1♀, SAMA); *Murta*: x.1960 (1♀, SAMA); *Nullarbor NP*: x.2004 (1♀, SAMA); *Oraparinna Ck*: 32°21'S – 138°42'E, 9.x.1997, J & A Skevington, C. Lambkin, S. Winterton (1♀, QLDM); *Reynella*: x.1922 (1♂, SAMA); *Yelpawaralinna*: ix.1993 (2♀, SAMA); *White Bull Yard*: Kalamurina Stn x.1999 (1♂, 1♀, SAMA); *Wirreanda Ck*: xi.1975 (1♂, SAMA); **Victoria**: (1♀, ANIC); *Deddick River Junction*: Snowy River, 14.xii.1976 (1♀, MVM); *Inglewood*: 1902 (1♂, ANIC); *Kewell*: iv.1988 (1♂, ANIC); *Kyabram*: 1947 (1♂, MVM); 25.xi.1945 (1♀, MVM); *Mildura*: 9.xi.1947 (3♀, MVM); *Ouyen*: Mallee District (1♂, MVM); **Western Australia**: (1♀, FSCA); *Carnarvon*: x.1992 (1♂, ANIC); *Cave Hill*: iii.1996 (1♂, SAMA); *Claremont*: i.1914 (1♀, ANIC); *Dampler*: 20.iv.1971 (1♀, ANIC); *Drysdale Riv. Natl. Pk.*: Carson River St., 14°37'S - 126°56'E, 1.viii.1996, Edwards (1♀, MVM); *Halls Creek*: iii.1995 (1♀, ANIC); *Hancock Range*: v.2003 (1♀, ANIC); *Kalgoorlie*: 30.xi.1985, M.S. & B.J. Moulds (2♀, AMSA); 20.i.1989, A.J. Graham (1♂, AMSA); *Karijini Dr.*: 82 km S jct on Great Northern hwy, 694m, 23°07.3'S - 119°05.5'E, Malaise trap in wash with pools, 23.iv – 16.v.2003, M.E. Irwin & F.D. Parker (1♂, FSCA); *Karijini Natl. Pk.*: Kalamina Rd, 648m, 22°25.6'S -

118°23.7'E, Malaise trap across ravine leading to gorge, 23.iv – 4.v.2003, M.E. Irwin & F.D. Parker (3♀, FSCA); *Karonie*: 9.xi.1969 (2♀, ANIC); *Kelmscott*: 19.i.1936, K.R. Norris (1♂, ANIC); *Kunamurra*: ii.1979, (1♀, ANIC); iv.1966 (1♀ SAMA); *Mandorast*: ix.1979 (1♀, ANIC); *Marble Bar*: 18.ii.1977, M.S. & B.J. Moulds (1♀, AMSA); *Mendurah*: 30mi S, 13.i.1971, mv lamp, G.A. Holloway & H. Hughes (1♂, 1♀, AMSA); *Millstream HS*: 2.iv.1971 (1♂, ANIC); 2.xi.1970 (2♀, ANIC); *Nedlands*: iii.1963 (1♂, SAMA); *Norseman*: 17.xi.1969, Key & Upton (3♀, ANIC); *Serpentine Falls*: Darling Ranges, 30.xii.1970, mv lamp, G.A. Holloway & H. Hughes (1♂, AMSA); 20.xi.1978 (1♂, MVM); *Tickalara*: 14.xi.1949 (1♂, ANIC); *Wandoo Nat. Pk.*: Kent Rd, 26 km air SWSW York, 270m; 31.99773°S – 116.52801°E±70m, 17.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #606 (1♀, TAMU); *Weeli Wolli Creek*: Hancock Range, 610m, Malaise trap, 26 km air SWSW York, 270m; 23°1.9'S – 119°10.7', 6-17.v.2003, M.I. Irwin & F.D. Parker (2♀, FSCA); *Widgiemooltha*: 31.14S – 121.28E, 6.xi.1969, Key & Upton (1♀, 1♂, ANIC); *Wyndham*: 15.vii.1969 (1♂, MVM); **no label**: (1♂, ANIC).

Comments – The synonym of *Glenoleon annulicorne* under *G. osmyloides* proposed by Esben-Petersen (1923) and corroborated by New (1985b) is confirmed here once again. The type series of *G. annulicorne* designated by Esben-Petersen (1915) was checked, and it is clear that these specimens belong to *G. osmyloides*.

In the original description of *G. gerstaeckeri* New (1985b) mentioned that it resembles *G. osmyloides* in appearance but differs in abdominal pattern and genitalia. In fact the holotype of *G. gerstaeckeri* is very similar to *G. osmyloides*, the general body

marks, length of legs, shape and wing venation are almost identical. The abdominal pattern mentioned by New (1985b) is certainly not a robust character; actually that is one of the most variable characteristics on the whole group. The holotype is only slightly paler than regular *G. osmyloides* specimens. The genitalia is basically identical to *G. osmyloides* the only difference is that the parameres seems slightly wider, which seems to be a weak character to sustain the species. In this sense *Glenoleon gerstaeckeri* is considered here as a junior synonym of *Glenoleon osmyloides*.

***Glenoleon pulchellus* (Rambur 1842)**

(A4 Figs 100-101)

Myrmeleon pulchellus Rambur 1842:408 (OD); Gerstaecker 1885a:25 (cit); Gerstaecker 1885b:114 (cit).

Glenurus pulchellus (Rambur): Hagen 1866:405 (n. cb.); Froggatt 1902:360 (rd); Banks 1910:40 (cit).

Glenoleon pulchellus (Rambur): Banks 1913:224 (n. cb.); Esben-Petersen 1915:72 (key) [as “*pulchellum*”]; Esben-Petersen 1923:586 (cit); Handschin 1935:690 (cit); Adams 1936:25 (cit); Stange 1976:306 (cat); New 1985b:33 (key, rd, ill); Lambkin 1987:12 (cit); New 1996:83 (cat); Whittington 2002:382 (cit); Stange 2004:105 (cat); Miller & Stange 2012:14 (im); Oswald 2015 (cat).

Diagnosis – Legs elongate [not short]; tibial spurs reaching T2 apex [not absent or shorter]; forewing costal area uniareolate [not biareolate]; hind wing with two broad bands on apical half [not without bands]; wings broad [not narrow]; male gonarcus +

mediuncus complex tubular [not in other shape]; male paramere positioned posteriorly to the gonarcus + mediuncus complex [not below].

Description – Lengths: forewing: 29 – 34 mm; hind wing: 27 – 32 mm.

Head (A4 Figs 100a-b): *Labrum* brown, set with a line of elongate setae. *Clypeus* pale with brown spots in some specimens; set with elongate white setae. *Frons* predominantly black, except for ventrolateral corners pale; beset with white setae. *Gena* pale to light brown. *Vertex* raised; in frontal view pale, with a median black line, usually interrupted centrally; in dorsal view mostly black except for some pale areas around center posteriorly; set with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, > 3x length of pronotum; distance between antennae wider than scape width; all segments dark-brown to black, except by three to five subapical flagellomeres pale in some specimens; torular membrane yellow; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae. *Mandibles* pale to light brown, but darker at tip. *Palpi*, maxillary and labial pale to light brown with distal segments generally darker, apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 100b): *Pronotum* longer than wide; posterior margin wider than anterior; subapical furrow present; mostly pale with a broad black longitudinal band on midline (flanked by thinner pale longitudinal bands), margins generally black; set with short black setae, and long setae at margins. *Mesonotum* mostly black, with two rounded pale spots on prescutum, scutum with two small pale spots near wing bases and two thin pale longitudinal bands on each side, scutellum black with pale spots laterally or

posterolaterally. *Metanotum* usually black with two pale longitudinal bands. *Pterothoracic pleura* black but with few pale areas generally between sclerites; set with elongate white setae; Miller's organ present.

Wings (A4 Fig 100c): Fairly broad with tip acute; anterior Banksian line present in both wings, posterior absent; veins set with short black setae, in general brown, except for some specimens with main longitudinal veins are intercalated by numerous short white regions. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline with brown marks generally concentrated on posterior margin, tip, pterostigma, rhegmal area, and around crossveins; in some specimens the brown areas are darker; cubital fork located between origins of Rs and MA origin; three presectoral crossveins; some subcostal veinlets forked and irregularly linked in some specimens; posterior area narrower than prefork area. *Hind wing* membrane mostly hyaline except for two broad brown subapical bands; medial fork located between origins of Rs and MA origin; subcostal veinlets simple; one presectoral crossvein, with a medial spur.

Legs (A4 Figs 100a-b): *All pairs of legs*, femur elongate ($> 3.5x$ length of coxa); tibia slightly longer than femur but longer than tarsi; tibial spurs surpassing T2 tip; T2, T3 and T4 about same size, T1 about twice as long as T2, T5 about twice as long as T1; claws about half of T5 length; coxa, trochanter, and femur set with short white setae; femur, tibia and tarsi set with short black setae, and scattered long black setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair absent; tibia with antennal cleaning setae ventroapically; coloration varies in intensity among specimens, but in general femur dorsal surface and tip blackish, remaining areas pale, tibia blackish

with two or three pale rings, T1 and base of T2 pale, remaining tarsomeres blackish. *Midleg* with same color pattern of foreleg except for a dorsal subapical yellow spot on femur. *Hindleg* with femur and tibia slightly longer than in other legs; femur, tibia and T5 pale except for their blackish tip; four basal tarsomeres generally pale but darker in some specimens.

Abdomen: Usually entirely black or dark brown, occasionally with irregular pale spots on tergites and sternites.

Male Terminalia (A4 Figs 101a-d): *Ectoproct* rounded in lateral view, set with elongate black setae. *9th sternite* in lateral view with posterior margin longer than anterior; in ventral view posterior margin with a shallow medial concavity; set with elongate black setae. *Gonarcus* and *mediuncus* fused forming a tubular structure. *Paramere* located posteriorly to gonarcus + mediuncus complex; long, curved and with tip acute.

Female Terminalia (A4 Figs 101e-g): *Ectoproct* rounded set with long black setae. *Lateral gonapophyses* rounded, shorter than ectoproct, and set with cavisetae. *7th sternite* with distal margin elongate and covered with long black setae in lateral view. *Pregenital plate* large, squared shaped with dorsolateral margins elongate. *Posterior gonapophyses* broad, elongate, set with very long black setae and, a group of cavisetae apically. *9th tergite* with an elongate membranous digitiform process. *Anterior gonapophyses* a small rounded sclerotized plate, located at base of gonapophyseal plates.

Distribution (A4 Figs 165) – Australia: ACT, NSW, QLD, SA*, and VIC*. * = new record.

Adult activity period – Records for September to April.

Biology – New (1996) mention the larva as terrestrial and predator. Miller and Stange (2012) reared a female from a larva collected in coarse sand at the entrance of a cave in Pilliga Nature Reserve, NSW. They did not describe the larva, but mentioned that it had a complex color pattern and the distinctive Dendroleontinae medial tuft.

Primary type – Holotype (by monotypy), sex unknown (MNHN), not examined. From original description, Rambur (1842): “D'après un individu en assez mauvais état, venant de la Nouvelle-Hollande” (According to an individual in poor condition, from New Holland). New Holland refers to Australia. From New (1985b): “Australia (?Paris, not seen)”. Attempts to obtain information about this type from the MNHN were unsuccessful.

Material examined – (142♂, 211♀, 8?). **AUSTRALIA:** 1917 (1♀, 1♂, SAMA); **ACT:** *Black Mt:* 10.ii.1952, L.J. Chinnick (1♀, ANIC); ii.1967 (1♂, ANIC); 16.i.1950 (1♀, ANIC); *Canberra:* 11.ii.1967, E. Paramonov (1♀, ANIC); 23.xi.1929 (1♂, ANIC); 5.ii.1951 (1♂, ANIC); 2.ii.1960 (2♀, 2♂, ANIC); 5.ii.1960 (4♀, 1♂, ANIC, 1♂, FSCA); 8.ii.1960 (2♀, ANIC); 16.ii.1960 (1♂, ANIC); 20.ii.1960, E.F. Riek (1♀, AMSA); 7.iii.1960 (2♀, 1♂, ANIC); 28.xi.1960, K.G. Sewnson (1♀, OSU); 12.xii.1960, E.F. Riek (1♂, TAMU); 15.xii.1960 (1♀, 2♂, ANIC); 27.xii.1960 (2♀, ANIC); 29.xii.1960 (2♀, ANIC); 9.i.1961 (1♀, 1♂, ANIC); 12.i.1961 (1♂, ANIC); 23.iv.1961 (1♀, ANIC); 1.ii.63 (1♂, AMSA); 14.ii.1963 (1♀, ANIC); *Cotter River Reserve:* 26.xi.1977, G. Daniels (1♀, AMSA); *Mount Majura:* 27.xi.1977, G. Daniels (1♂, 1♀, AMSA); **New South Wales:** no label (1♂, ANIC); 22.xii.12 (1♂, ANIC); *Armidale:* 20.xii.1954 (1♀, 1♂, ANIC); 23.xi.1959 (1♂, ANIC); 11.xii.1959 (1♀, ANIC); xii.1960 (2♀, ANIC);

Asquith: 21.ii.66, A.B. Rose (1♂, AMSA); *Ballina*: x.22, A.N. Burns (1♀, AMSA);
Bankstown: near Sydney, 16.xi.1980, B.J. Day (1♀, AMSA); *Banyabba Nt Rs*: 20.i.1971
(1♀, ANIC); *Bayview*: 29.x.1970, L.C. Haines (1♀, AMSA); *Belmont*: 4.i.1947 (2♂,
1♀, MVM); 30.xii.1946 (1♂, MVM); *Bendalong*: 24.i.1970, G. Daniels (1♂, AMSA);
Berowra: Galston Gorge near Hawkesbury R., ii.1927, T.G. Campbell (1♀, AMSA);
Bilpin: 6 km NE near Nurradjong, 2.ii.1980 N.W. Rodd (1♂, AMSA); *Blue Mountains*:
Clarence, 8.i.1983, N.W. Rodd (1♂, AMSA); *Brindabella Rg*: iii.1984 (1♂, ANIC);
Loqnet Valley School, 6.ii.1984, at light, L.C. Haines (1♀, AMSA); Mt Tomah,
9.i.1984, N.W. Rodd (1♀, AMSA); *Braidwood*: 14.i.1934, Fuller (1♀, 1♂, ANIC);
Bundeena: 12.xi.1960 (1♀, FSCA); *Cabramatta*: 10.i.1961 (1♂, FSCA); *Colo River*:
1.5mi N, 23.x.65, G.L. Bush (1♀, TAMU); *Como*: 7.i.1911, Waterhouse coll. (1♀,
ANIC); 18.i.1933 (1♀, MVM); 5.ii.1922 (1♀, MVM); *Conjola*: 26.xii.1950 (1♂,
MVM); *Coonabarabran*: 2.xii.1974 (1♂, ANIC); *Cuttler's Pass*: William's river,
10.i.1943, A. Musgrave (1♀, AMSA); *Deriah Aboriginal Area*: 23 km E of Narrabri, -
30.345 S – 150.014 E, 10.xi.2009, Ooline, light, D.R. Britton, J. Recsei (1♀, AMSA);
Ebenezer: xii.1996 (1♀, ANIC); Hazelbrook, 1984, M. Dingley (2♂, 1♀, AMSA);
i.1985, light (1♂, AMSA); *Elanora Heights*: xi.1986, T. Robinson (1♀, AMSA);
Elizabeth Bay: 29.i.1940, K.C. McKeown (1♀, AMSA); *Engadine*: near Sydney,
23.xii.1976, R. Eastwood (1♀, AMSA); *Fletcher*: 29.xii.1960 (1♂, ANIC); *Fraser Park*:
2.i.1947 (1♀, MVM); *Glenbrook*: 15.1.1993, M.S. & B.J. Moulds (1♂, 1♀, AMSA);
27.xii.1964 (1♀, ANIC); *Gosford*: (1♂, ANIC); *Greta*: 1951 (1♂, FSCA); *Goose Vale*:
29.x.1988, N.W. Rodd (1♂, AMSA); *Gundamain N. P.*: 14.ii.1926, Mackerras (1♂,

FSCA); *Helensburgh*: 23.i.1979, R. Eastwood (1♀, AMSA); *Hornsby*: 3.i.1916, Tillyard (1♂, ANIC); *Ilford*: 9.3 km S, 29.xii.1977, G. Daniels (1♀, AMSA); *Killara*: 22.xii.1934, M.F. Day (1♀, ANIC); *Killarney Gap*: Kaputar N.P., -30.141 S – 150.066 E, 14.xi.2009, Callitris & sclerophyll scrub / rocky ridge, MV Lamp, D.R. Britton, J. Recsei (1♀, AMSA); *Kyogle*: 6 km NE, Murwillumbah Rd, 9.i, B.J. Day (1♂, AMSA); *Liverpool*: Heathcote Rd., 33°56' S – 150°56' E, 13.xii.1998, light, B.J. & C.J.R. Day (1♂, AMSA); *Loftus*: 27.xii.1978, J. Olive (1♂, AMSA); *Mann River*: 5 km upstream from Old Glen Innes, Grafton Rd x-ing, 27.xi.1977, M.S. & B.J. Moulds (1♀, AMSA); *Mittagong* (1♂, SAMA); *Moonbi*: 7.ii.1968, D.H. Collens (1♀, ANIC); *Mooney Mooney Ck*: near Gosforo, 13.i.1977, D.K. McAlpine (1♀, AMSA); *Mount Kaputar N.P.*: 15.i.1978, G. Daniels (1♀, AMSA); *Mount Victoria*: 4.xii.1946 (1♀, MVM); *Nambucca*: 26.x.1949 (1♀, MVM); *Narrabeen*: 18.ix.1934 (1♀, ANIC); *Narrabri*: 17.xii.1934, M.F. Day (1♀, ANIC); xi.1997 (1♀, ANIC); *Nepean River*: x.1931, A. Musgrave (1♂, AMSA); *Newcastle*: Sugarloaf Mount, 2.i.1947 (1♂, MVM); *Newport*: 2.xii.57, G. Dolezal (1♀, AMSA); *Pilliga Nature Reserve*: 34 km N Coonabarabran, 13.x.2005, L.A. Stange (1♀, FSCA); *Royal N.P.*: Goondera Ridge, 3.xii.1977, G. & A. Daniels (1♀, AMSA); *Singleton*: 23.iii.1957, E.F. Riek (1♂, ANIC); *Sutton*: 19.i.1979 (1♂, QLDM); *Sydney*: C. Gibbons (1♀, AMSA); 28.xii.1961, D.H. Collens (1♂, ANIC); xii.1946 (1♀, MVM); (1♀, SAMA); Waitara, 23.i.1983, M.S. & B.J. Moulds (1♂, AMSA); *Tomerong*: Nowra district, 3mi N, 7.ii.1970, D.K. McAlpine (1♀, AMSA); *Tuggerah*: xii.1904 (1♀, SAMA); *Ulan*: xi.1982 (1♂, ANIC); *Wahroonga*: 12.xii.1970, A.B. Rose (1♀, AMSA); H.J. Carter (1♀, AMSA); *Wapengo*: 12.i.1978 (1♀, MVM); *Warialda*: Adam's Scrub

14.6 km S, -29.667 S – 150.567 E, 18.xi.2009, Callitris/sclerophyll forest, MV lamp, D.R. Britton, J. Recsei (1♂, AMSA); *Waste point*: 8.3 km N Jindabyne, Kosciuszko N.P., -36.347 S – 148.606 E, 8.xii.2007, MV lamp, D.R. Britton, D.J. Smith, P. Hinton (1♂, AMSA); *Watalgan Forrest*: 24.xi.1973 (1♀, ANIC); *Wedderburr*: 3 km E, 34°08' S – 150°49' E, 13.xii.2005, MV light, D. Britton (1♂, AMSA); *Wee Jasper*: 25.xii.56, E. shipp (1♂, AMSA); *Wellington*: 28.ix.1957, E.F. Riek (2♂, ANIC); *West Head*: PiHwater, 2.i.1985, L.C. Haines (1♂, AMSA); *Whiskers*: xii.1992 (1♂, ANIC); **Queensland**: (1♀, ZMHB); (1♀, SAMA); *Archer River x-ing*: 13°25'S – 142°56'E, iv.1989, mv lamp, G. & A. Daniels (6 ?, QLDM); *Barankula St. Ft.*: 26°26'07'' S – 150°49'31'' E, 3-7.iv.2000, malaise, M. Mathieson (1♀, TAMU); *Bardon*: x.1943 (1♀, 1♂, SAMA); *Barrine*: 10.x.1967 (2♂, ANIC); *Blackdown Tableland*: Expedition Rg, 17.i.1987, M.S. & B.J. Moulds (1♂, AMSA); *Bluff Range*: 16.xii.1970 (1♀, 1♂, ANIC); 9.i.1971 (2♀, 1♂, ANIC); *Biggenden*: 22-23.xi.1977 (12♀, 9♂, ANIC); 1.i.1972 (2♀, ANIC); 2.xii.1974 (1♂, ANIC); *Biloela*: 17.i.1947 (1♀, ANIC); *Bin Bin Range*: 4.xii.1974 (1♀, ANIC); 12.i.1972 (1♀, 1♂, ANIC); *Bingera*: 22.xi.1971 (1♀, ANIC); *Bon Accord Falls*: Montville, Blackall Ranges, 22.ix.55, R. Dobson (1♀, AMSA); *Boolaboonda Ra*: 10.xi.1973 (1♀, 1♂, ANIC); *Boompa*: 4.xii.1980, H. Franca (1♂, ANIC); *Bowen*: 1.x.1950, E.F. Riek (1♀, ANIC); *Brisbane*: (6♂, 24♀, QLDM); i.1888 (2♀, SAMA); xi.1965 (2♀, ANIC); 20.x.1900 (1♀, ANIC); 1903 (1♀, ZMUC); x.1911 (1♀, SAMA); 20.ii.27, L. Franzen (2♂, ZMUC); 19.ix.1927 (1♀, QLDM); 30.xii.1927 (1♀, MVM); 19.x.1938 (1♀, ANIC); 9.i.1960 (1♂, 1♀, MVM); 10.i.1960 (1♀, MVM); 24.xii.1955 (1♀, MVM); 27.xii.1959 (1♀, MVM); 2.xii.1922 (2♀, MVM); 29.x.1936

(1♀, MVM); 4.xi.1936 (1♂, MVM); 26.xi.1956 (1♂, MVM); x.1910 (1♂, 2♀, MVM); Moggill Farm, 23.i.1961 (1♂, FSCA); *Bucasia Nth*: i.2003 (1♂, ANIC); *Bundaberg*: 19.xi.1978 (2♀, 3♂, ANIC); 22.xii.1979 (1♀, 2♂, ANIC); *Bunya Mountains*: 17.i.1955 (1♂, MVM); *Burleigh Heads*: 3.i.1956 (1♀, MVM); xi.1942 (1♂, MVM); xii.1942 (1♂, MVM); 10.x.1956 (1♀, MVM); *Byfield St. Ft.*: x.1924, A. Musgrave (1♂, AMSA); 1.i.1976, G. Daniels (1♀, AMSA); *Carnarvon N.P.*: 7.xii.1938, N. Geary (2♀, AMSA); 8.xii.1938 (1♂, AMSA); 12.xii.1938 (1♂, 1♀, AMSA); 5.i.1939 (1♀, AMSA); 8.i.1939 (1♂, AMSA); ii.1944 (1♀, AMSA); 92 air km NNW Injune, 25.06695°S 148.24611°E±30m, R Machado, MV light, 25.xii.2015, AustRM#10 (2♀, TAMU); *Charleville*: 27.xii.1925 (1♀, QLDM); *Cordalba Nt. Ft.*: 30 km S of Bundaberg, 29.xi.1979, H. frauca (1♀, ANIC); *Degilbo*: 9.xii.1978 (2♂, ANIC); *Electra*: 8.ii.1977 (1♂, ANIC); *Fletcher*: 12.i.1967, E. Sutton (1♂, ANIC); *Forty Mile Scrub*: 4.x.1989 (1♂, ANIC); *Hayman Is*: 24.x.1950, R. Dobson (3♀, 1♂, ANIC); *Herberton*: 6.xii.1968, E. Britton & S. Misko (1♂, ANIC); x.1990 (1♀, ANIC); *Injune*: 55 km NNE, 23.xi.1986, M.S. & B.J. Moulds (1♂, AMSA); *Kinbombi falls*: Goomeri, 19.xii.1976, M.S. & B.J. Moulds (1♀, AMSA); *Kingston*: xii.1981 (1♂, QLDM); *Kuranda*: (1♀, SAMA); 19.xi.1951 (1♀, MVM); 5.x.1949 (1♀, MVM); *Mackay*: 1905 (1♀, 1♂, ANIC); *Milmerran*: 14.xi.1945 (1♂, MVM); *Montville*: Bon Accord Falls, 20.ix.1955 (1♂, 1♀, MVM); *Mount Cootha*: x.1942 (1♀, SAMA); 16.xii.1973 (2♀, QLDM); *Mount Garmet*: i.1961 (1♂, ANIC); *Mount Hay*: 24.i.2009 (1♀, QLDM); *Mount Moffat N.P.*: Mahogany Forest, 11-12.xii.1987, M.T. Yeates (1♂, 2♀, QLDM); *Mount Tamborine*: 30.iii.1950 (1♂, MVM); 26.xii.1950 (1♀, MVM); *Mount Tinbeerwah* : 1.i.1979 (1♀,

QLDM); *Murphy's Ck*: 29.xi.1992 (1♀, QLDM); *Noosa Heads*: 1.x.1956 (1♀, MVM); *Ravenshoe*: xi.1998 (1♀, ANIC); *Stanthorpe*: 30.i.1927 (1♀, QLDM); 29.xii.1977 (2♂, QLDM; 1♂, ANIC); 9.ii.1981 (1?, QLDM); *Stradbroke Is*: 21.ix.1954 (1♀, MVM); *Tamborine*: (1♂, QLDM); *Toowoomba*: 11.ii.1960 (1♂, ANIC); *Townsville*: 12.xii.1908 (1♀, MVM); *Wacol*: 16.x.1952 (1♂, QLDM); *West Burleigh*: 1960, A.T. Bandsoma (1♂, AMSA); *Woodridge*: 2.i.1968 (1♂, MVM); **South Australia**: *Aldgate*: 19.iii.1930(1♀, MVM); *Barossa*: (1♀, SAMA); *Blackwood*: ii.1965 (2♀, SAMA); 20.i.1969 (1♀, MVM; 2♀, SAMA); xii.1975 (1♀, SAMA); *Bridgewater*: xii.1967 (1♀, SAMA); *Cara Pook*: i.1973 (1♂, SAMA); *Heywood Pk*: xii.1958 (1♂, SAMA); *Highbury*: i.1969 (1♂, SAMA); *Kangaroo Ck Reserve*: i.1971 (1♂, SAMA); “*Kurlge*” *Blackwood*: xi.1957 (1♀, SAMA); xii.1957 (1♂, SAMA); i.1958 (2♀, SAMA); ii.1958 (1♀, SAMA); *Mount Lofty Rg*: ii.1965 (1♀, SAMA); xii.1973 (1♂, SAMA); *Nairne*: i.1988 (1♂, SAMA); Location not recognized: Saunder's Coll., iii.68 (1♀, BMNH); No label (2♀, 3♂, ANIC); **Victoria**: *Bendigo*: 5.i.1930 (1♀, MVM); *Hurstbridge*: 18.ii.1947 (1♂, MVM); *Monbulk*: 27.i.1929 (1♀, MVM); *Nowa Nowa*: 21.ii.1947 (1♂, MVM); *Moe*: 24.xii.1944 (1♂, MVM); *Oakleigh*: (1♂, MVM); *Research*: ii.1983, (1♀, ANIC); *Warrandyte*: i.1988 (1♀, ANIC); *Wartook*: xii.1935 (1♀, SAMA).

Comments – *Glenoleon pulchellus* is commonly found in eastern Australia. Its color intensity varies considerably among specimens; some are almost completely dark, while others have many pale areas. Despite these differences in coloration the species is easily recognized by two dark bands on tip of hind wing; no other species in “*Perichlystus* genus group” has this character. However, the long legs and pronotum, associated with the

broad wings place *G. pulchellus* close to its congeneric species, as demonstrated by both molecular and morphological phylogeny (A4 Figs 1-3).

***Manselleon* new genus**

Type species: *Manselleon brevipletron* sp. nov., by present designation.

Diagnosis – Male mediuncus broad with tip rounded [not short with tip acute]; male paramere broad and well sclerotized [not thin and weakly sclerotize]; foretibia about as long as foretarsi [not much longer]; tibial spurs present [not absent]; female lateral gonapophyses set with cavisetae [not absent]; female, posterior gonapophyses thin with no cavisetae [not broad or with cavisetae] female, anterior gonapophyses absent [not present].

Description – Head: *Vertex* raised. *Antennae* clubbed and elongate; flagellomeres almost as long as wide at base, but apical ones wider than long. *Palpimacula* oval-shaped, located medially. Thorax: Pronotum slightly wider than long. Miller's organ present. Wings: mostly hyaline with brown marks. *Anterior Banksian* line present in both wings, posterior absent. *Forewing* prefork area slightly wider than posterior area. *Hind wing* with one presectoral crossvein; with rhegmal infuscations. *Male pilula axillaris* present. Legs: *Forefemur* > 2x length of forecoxa. *Foretibia* about same size of foretarsi. *Sense hair* absent. *Tarsus*, T5 < 2x length of T1. *Tibial spurs* generally short. Male Terminalia: *Ectoproct* rounded in lateral view; *gonarcus* arched, with anterior margin broader than posterior, in lateral view; *paramere* sclerotized and broad; mediuncus long, broad with tip rounded. Female Terminalia: *Ectoproct* rounded; *lateral*

gonapophyses set with cavisetae; *posterior gonapophyses* thin and long, set with long black setae but no cavisetae; *Anterior gonapophyses* absent; *pregenital plate* usually large.

Distribution (A4 Fig 167) – Australia: NSW, NT, QLD, SA, VIC, and WA.

Comments – This new genus is formed by three new species and *M. tillyardi*, previously placed in *Glenoleon*. All these new species share with *M. tillyardi* the long and broad mediuncus in the male terminalia, the main characteristic of the genus. The genus is closely associated with *Aurantoleon* and *Aplectrinia* as demonstrated by both morphological and molecular phylogeny, where these three genera form a monophyletic group. The relative broad wing, the absence of cavisetae in the female posterior gonapophyses united these genera. Among these monophyletic clade, *Aplectrinia* and *Manselleon* are more closely associated, (A4 Figs 1-3), but they can be easily separated by the overall shape of the male terminalia and the presence of the tibial spurs.

Biology – Unknown.

Etymology – Mansell, from the surname of Dr. Mervyn W. Mansell, South African entomologist. In recognition of his extensive work in the Neuroptera faunas of southern Africa and other areas.

Key to species of *Manselleon*

- 1 Female (A4 Fig 109e): ectoproct without cavisetae, female lateral gonapophyses smaller than ectoproct, digitiform membranous process very long; wings relatively broad, ventral margin strongly convex medially (A4 Fig 108c).....2

- 1' Female (A4 Fig 103e): ectoproct with cavisetae, lateral gonapophyses about the same size of ectoproct, digitiform membranous process absent; wings relatively narrow, ventral margin weakly convex medially (A4 Fig 102c).....3
- 2 Body mostly pale; wings hyaline (A4 Fig 108c); female pregenital plate small and semi elliptic (A4 Fig 109f); male paramere with anterior region broad (ventral view) (A4 Fig 109d).....*M. tillyardi*
- 2' Body mostly dark; wings with brown marks on distal half (A4 Fig 104c); female pregenital plate large and kite shaped (A4 Fig 105f); male paramere with anterior region thin (ventral view) (A4 Fig 105c).....*M. longidigitus*
- 3 Tibial spurs short (reaching half of T1 length); forewing heavily marked (A4 Fig 102c), most crossveins brown shaded; male paramere apex acute (posterior view) (A4 Fig 103c); female pregenital plate small, thin, with medial region acute (A4 Fig 103f).....*M. brevipletron*
- 3' Tibial spurs long (reaching T1 apex); forewing not heavily marked, with small marks in the mediocubital area and gradate crossveins (A4 Fig 106c); male paramere apex rounded (posterior view) (A4 Fig 107c); female pregenital plate large and rhomboid (A4 Fig 107e).....*M. rebellis*

***Manselleon brevipletron*, new species**

(A4 Figs 102-103)

Diagnosis – Forewing, full of brown marks [not hyaline or with few marks]; tibial spurs short, about half of T1 length [not reaching T1 apex]; male, paramere with tip acute in

posterior view [not rounded]; female, ectoproct with few cavisetae [not absent]; female, lateral gonapophyses about as large as ectoproct [not smaller]; female, membranous digitiform process absent [not present].

Description – Lengths: forewing: 16 – 23 mm; hind wing: 15 – 21 mm.

Head (A4 Figs 102a-b): *Labrum* pale, set with a line of elongate setae. *Clypeus* pale, set with some short black setae. *Frons* almost entirely black, except for ventral area pale; set with some short white setae. *Gena* pale. *Vertex* raised; in frontal view pale, with five small rounded black spots on central area; (two lateral spots at each side connected in darker specimens); in dorsal view mostly pale except for a central longitudinal black line, a central transversal sinuous line and two black spots posterolaterally; set with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; very long, about five times longer than pronotum; distance between antennae wider than scape width; all segments dark brown except for few pale marks on scape and ventral margin of few subapical flagellomeres; torular membrane pale; flagellomeres wider than long specially apical ones; all segments set with short black setae. *Mandibles* pale, with tip black. *Maxillary palpi*, dark brown except for apical segment pale. *Labial palpi* pale except for apical segment dark brown; apical palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 102b): *Pronotum* slightly wider than long; posterior margin wider than anterior; subapical furrow present; mostly black, but with some pale areas as follows: two lateral rounded spots on posterior margin and two on anterior margin, two curved longitudinal lines laterally; covered with black setae, and few white setae on anterior

corners. *Mesonotum* mostly black except for small pale areas as follows: two rounded spots on prescutum, two rounded lateral spots and two central longitudinal lines on mesoscutum, and posterior margin of scutellum; all segments set with short black setae. *Metanotum* entirely black except for a central pale area in some specimens, set with short black setae. *Pterothoracic pleura* entirely black, except for some pale area between sclerites in some specimens; covered with short white setae; Miller's organ present.

Wings (A4 Fig 102c): Rather narrow with tip acute; anterior Banksian line present in both wings, posterior absent. Longitudinal veins black and white; crossveins mostly black but some white; beset with short black setae. *Forewing* membrane mostly hyaline but full of brown marks around crossveins, subcostal and apical areas, and beneath pterostigma; pterostigma apex white; cubital fork located between origins of Rs and MA; three presectoral crossveins, with a veinlet connecting last one and Rs in some specimens; subcostal veinlets simple; prefork area slightly wider than posterior area at cubital fork level. *Hind wing* membrane mostly hyaline, except for large, rounded, brown stigmal and rhegmal spots, and small brown marks on apex; medial fork located between origins of Rs and MA; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Fig 102a): *All pairs of legs*, femur long (about two times longer than coxa); femur, tibia and tarsi about same size; tibial spurs short, about half of T1 length; T2, T3 and T4 about same size, T1 about twice longer than T2, and T5 slightly longer than T1; claws as long as half of T5 length; coxa, trochanter and femur (mainly forefemur) set with short white setae; femur, tibia and tarsi set with short black setae, and scattered long setae on tibia. *Foreleg* sense hair absent; tibia with antennal cleaning setae

ventroapically; coxa predominantly black with internal surface pale; trochanter pale; femur mostly brown except for a subapical ring and ventral surface pale; tibia pale with three brown rings, but ventral surface entirely pale in some specimens; tarsi pale with tarsomere tips darker. *Midleg* with same color pattern of foreleg, except for ventral surface of femur entirely brown. *Hindleg* with femur and tibia slightly longer than other legs; color pattern similar to other legs, except for tibia entirely pale with tip darker.

Abdomen: Entirely black but with scattered pale marks on tergites of some specimens; covered with short white setae, mainly four basal segments, and short black setae on apical segments.

Male Terminalia (A4 Figs 103a-d): *Ectoproct* rounded; set with elongate black setae. *9th sternite* short, with posterior margin curved as “U” in posterior view; covered with elongate black setae. *Gonarcus* arched in posterior view; in lateral view broad, with anterior margin larger; in dorsal view with central area less sclerotized. *Mediuncus* broad with the posterior margin rounded with a short medial concavity. *Paramere* elongate, in lateral view with anterior area broad and posterior area curving upwards; in posterior view with tip acute.

Female Terminalia (A4 Figs 103e-f): *Ectoproct* rounded and set with thin elongate setae and some elongate cavisetae ventrally. *Lateral gonapophyses* rounded, about same size of ectoproct, beset with elongate cavisetae. *7th sternite* long with distal margin elongate medially; covered with short black setae. *Pregenital plate* in ventral view thin with medial region acute. *Posterior gonapophyses* elongate and thin, covered with long black

setae. 9th tergite ventral margin without membranous digitiform process. *Anterior gonapophyses* absent. *Ventral membrane* gonapophyseal plates absent.

Distribution (A4 Figs 167) – Australia: NSW, NT, SA, VIC, and WA.

Adult activity period – Records for December to April and September.

Biology – Unknown, larva unknown.

Etymology – The specific name is derived from the combination of two Latin words, *brevis* (= short) and *plectrum* (= spur), and refer to the short tibial spurs very characteristic of the species.

Primary type – Holotype (by present designation), male, (ANIC). **AUSTRALIA: New South Wales: Lake Mungo:** 33°44'S - 143°59'E, 22.feb.1998, C. Reid, pine woodland, at light. Condition: pinned; good; but left midleg missing.

Paratype: AUSTRALIA: New South Wales: Lake Mungo: 33°44'S - 143°59'E, 22.feb.1998, C. Reid, pine woodland, at light (1♂, ANIC, pinned); *Nombinnie Nature Reserv.:* 18 air km SSE Mount Hope, 160m, 32.99613°S – 145.94006°E±70m, 3.i.2013, M.V., Oswald, Diehl & Machado, Oswald #626 (1♂, TAMU, in ETOH); **Victoria: Hattah:** 44 km E, 76m, 34°45.3'S – 142°40.9'E, 3.ii.2004, M. Moulds & S. Cowan (1♀, AMSA, pinned); *Ouyen:* 1 mi S, 14.mar.1966, M.S. Upton & J.A. Grant (1♀, ANIC, pinned); **Western Australia: Goldfields hwy:** 85 km SSE Wiluna, 27.32886°S - 120.50593°E±70m, 560m, 26.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #617 (2♂, 3♀, TAMU, 1 female pinned, rest in ETOH); *Kalgoorlie:* 21.ii.1988, A.J. Graham (1♂, AMSA, pinned); *Leinster:* 18 km SE, 28:05S – 120:51E, 16.i.1989, M.S. & B.J.

Moulds (2♀, AMSA, pinned); *Norseman*: 7 km NNE, 32.09S – 121.49E, 23.Mar.1971, Upton & Mitchell (2♀, ANIC; pinned);

Extra material examined – (19♂, 25♀). **AUSTRALIA: New South Wales:** *Barellan*: 25 km NNW, 1.iii.1974, E.D. Edwards (1♀, ANIC); *Lake Mungo*: 33°44'S - 143°59'E, 22.ii.1998, C. Reid (3♂, ANIC); **Northern Territory:** *Illamurta Spring*: iii.1993 (1♀, SAMA); **Southern Australia:** *Billa Kalina Stn*: iv.2006 (1♂, SAMA); *Cortina Stn*: via Kingston ii.1968 (1♀, SAMA); *Danggali*: Tomahawk Dam, ix.1996 (1♂, SAMA); *Emu Junction*: iv.1994 (2♀, SAMA); *Gluepot Res*: ii.2002 (1♂, SAMA); *Iron Knob*: 6 mi W, 16.iii.1968, I.F.B. Common & M.S. Upton (1♀, ANIC); *Karie*: iii.1971 (1♂, SAMA); *Koonamore Stn*: ii.1956 (1♀, SAMA); *Oolarinna*: iii.1996 (1♂, 2♀, SAMA); *Pinkawillinia*: late.x.1989, A. Sundholm & J. Bugeja (1♀, AMSA); *Serpentine Lakes*: iv.1994 (4♂, 1♀, SAMA); *Vokes Hill*: iv.1994 (1♂, 1♀, SAMA); *Yeelanna*: (1♀, SAMA); *Yungo*: ii.1956 (1♂, 1♀, SAMA); **Victoria:** *Hattah*: iii.1971 (2♀, SAMA); **Western Australia:** *Carnarvon*: Wanberry Station, 22.iv.1955 (1♂, 2♀, MVM); *Cunderdin*: ii.1914 (1♂, ANIC); *Lake Douglas*: 12 km SW of Kalgoorlie, 13.i.1989, M.S. & B.J. Moulds (2♀, AMSA); *Lake Johnston*: iii.1996 (2♀, SAMA); *Lake Marmion*: iii.1996 (2♂, 1♀, SAMA); *Norseman*: 7 km NNE, 32.09S – 121.49E, 23.iii.1971, Upton & Mitchell (1♀, ANIC); *Nyabing*: 8 mi NNW, 2.ii.1953, McIntosh & Calaby (1♀, ANIC).

Comments – *Manselleon brevipletron* is closely associated with *M. rebellis*. Both species share many similarities, particularly on female terminalia. Besides it, their

general body color patterns are also very similar, but the wings marks and the size of the tibial spurs can easily separate them. For phylogenetic relationship see (A4 Figs 1-3).

***Manselleon longidigitus*, new species**

(A4 Figs 104-105)

Diagnosis – Forewing, with few apical brown marks [not hyaline or full of marks]; tibial spurs short, about half of T1 length [not reaching T1 apex]; male, paramere with anterior margin thin in ventral view [not broad]; female, ectoproct without cavisetae [not present]; female, lateral gonapophyses smaller than ectoproct [not about the same size]; female, membranous digitiform process long [not absent].

Description – Lengths: forewing: 22 – 24 mm; hind wing: 20 – 21 mm.

Head (A4 Figs 104a-b): *Labrum* pale; set with a line of elongate setae. *Clypeus* pale with some elongate pale or black setae. *Frons* pale but area surrounding antennae dark brown, set with short white setae. *Gena* pale. *Vertex* raised; in frontal view pale, with two short transversal dark brown marks laterally and a rounded central dark spot; in dorsal view mostly pale with two central perpendicular dark brown lines and two black marks posterolaterally; covered with short black setae, and some white ones on lateral margins. *Ocular rim* setae absent. *Antennae* clubbed; elongate, about three times longer than pronotum; distance between antennae wider than scape width; mostly dark brown, but anterior surface of pedicel and few subapical flagellomeres pale; torular membrane pale; flagellomeres almost as long as wide at base, but apical ones much wider than long; scape and pedicel covered with short white setae, flagellum set with short black setae.

Mandibles mostly pale, with tip black. *Palpi*, maxillary and labial pale with dark brown marks on the basal segments; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 104b): *Pronotum* slightly wider than long; posterior margin as wide as anterior; subapical furrow present; mostly pale except by a dark brown sagittal band that encircles a pale mark on anterior area and two sinuous lateral bands encircling a pale line on posterior half; beset with short white setae. *Mesonotum* mostly dark brown except for two pale marks on prescutum, two longitudinal pale bands encircling a small dark area at scutum, and pale lateral and posterior margins of scutellum; covered with short white setae. *Metanotum* dark brown except by small pale areas as follows: central line of prescutum, two longitudinal bands on scutum, posterior border of scutellum; covered with short white setae. *Pterothoracic pleura* dark brown with some pale areas on segments border in some specimens; covered with white setae; Miller's organ present.

Wings (A4 Fig 104c): Rather broad with tip acute; anterior Banksian line present in both wings, but posterior absent; veins mostly dark brown, but with some veins intercalated with white spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline, but with few of brown marks as follows: two longitudinal lines surrounding gradate veins, and three marks, one at tip of subcostal area, other on mediocubital area, and other at base of hypostigmatic cell; tip of pterostigma white but base brown; cubital fork located at level of Rs origin or slightly basal in some specimens; three presectoral crossveins; subcostal veinlets simple; posterior area narrower than prefork area at level of cubital fork. *Hind wing* membrane mostly hyaline

except for a small brown mark at base of hypostigmatic cell, and a large rhegmal spot; pterostigma with tip white but base brown; medial fork located at same level of Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 104a-b): *All pairs of legs*, femur elongate (> 2x length of coxa); tibia and femur about same size, and slightly longer than tarsi; tibial spurs slightly shorter than half of T1 length; T2, T3 and T4 about same size, T1 slightly longer than T2, but shorter than T5; claws slightly longer than half of T5 length; coxa, trochanter and most femur set with short white setae; femur apex, tibia and tarsi set with short black setae, and scattered long black setae; T5 ventrally with two rows of thick, long, black setae.

Foreleg sense hair absent; tibia with antennal cleaning setae ventroapically; coxa dark brown, trochanter pale, femur pale with apex dark brown, but in some specimens pale area slightly darker on external surface, tibia intercalated with three pale and three dark brown rings; tarsi pale, except for T5 tip, dark brown. *Midleg* with same color pattern to foreleg, except for some irregular pale marks on coxa. *Hindleg* with femur, tibia and T1 slightly longer than in other legs; color pattern similar to midlegs, except for tibia entirely pale with tip dark brown.

Abdomen: Tergites dark brown with longitudinal pale areas laterally. Sternites entirely dark brown or with central pale marks in some specimens. All segments covered with short white setae.

Male Terminalia (A4 Figs 105a-d): *Ectoproct* rounded in lateral view, set with elongate black setae. *9th sternite* short, with posterior margin straight and set with elongate black setae in ventral view. *Gonarcus* broad with anterior margin straight in lateral view;

medially arched and laterally curved in posterior view. *Mediuncus* extending downwards in lateral view; broad and rounded in posterior view. *Paramere* in lateral view curved, with anterior margin acute and posterior rounded; in posterior view broad with ventral margin curved; in ventral view, with inner region rounded and exterior region thin and curved.

Female Terminalia (A4 Figs 105e-f): *Ectoproct* rounded and covered with thin elongate setae. *Lateral gonapophyses* rounded, smaller than ectoproct, set with few cavisetae and elongate black setae. *7th sternite* distal margin straight and covered with short black setae in ventral view. *Pregenital plate* in ventral view large and “kite” shaped, with anterior region larger than posterior; anterior and posterior corners curved but lateral corners acute; posterior area with a medial rounded concave region. *Posterior gonapophyses* elongate, with tip rounded and covered with long black setae. *9th tergite* with a long membranous digitiform process. *Anterior gonapophyses* absent. *Ventral membrane gonapophyseal plates* present.

Distribution (A4 Fig 167) – Australia: WA.

Adult activity period – Records for August, October and November.

Biology – Unknown, larva unknown.

Etymology – The specific name is derived from the combination of two Latin words, *longus* (= long) and *digitus* (= finger), and refer to the extremely elongate membranous digitiform process in the female terminalia.

Primary type – Holotype (by present designation), male, (ANIC). **AUSTRALIA:**
Western Australia: *Millstream HS*: ½ km SSW, 21.35S – 117.04E, 4.xi.1970, Upton &

Feehan. Condition: pinned, good, right antenna missing and left hindleg last two tarsomeres missing; terminalia dissected.

Paratype: AUSTRALIA: Western Australia: *Fortescue River*: 29.viii.1964 (1♂, ANIC, pinned); *Millstream HS*: ½ km SSW, 21.35S – 117.04E, 27.x.1970, Upton & Feehan (1♀, ANIC, pinned); 3.xi.1970, MS Upton (2♂, 1♀, ANIC, pinned).

Comments – *Manselleon longidigitus* is closely associated with *M. tillyardi*. Both species share many similarities, particularly the extremely elongate digitiform process in the female terminalia, and smaller lateral gonapophyses. Actually these two characteristics not only distinguish them from the other *Manselleon* species but also from the other two closely related genera, *Aplectrinia* and *Aurantileon*. However the overall shape of the male terminalia and both morphological and molecular data justify its placement in this clade (A4 Figs 1-3). These two species also share the short tibial spurs, but the body and wings color and the male paramere shape can easily separate them.

***Manselleon rebellis*, new species**

(A4 Figs 106-107)

Diagnosis – Forewing, with few brown marks [not full of marks]; tibial spurs long, reaching T1 apex [not reaching half of T1]; male, paramere with tip rounded in posterior view [not acute]; female, ectoproct with few cavisetae [not absent]; female, lateral gonapophyses about as large as ectoproct [not smaller]; female, membranous digitiform process absent [not present].

Description – Lengths: forewing: 21 – 25 mm; hind wing: 19 – 22 mm.

Head (A4 Figs 106a-b): *Labrum* pale, set with a line of elongate setae. *Clypeus* pale, with few short black setae. *Frons* almost entirely black, except for ventral margin pale; covered with short white setae. *Gena* pale. *Vertex* raised; in frontal view pale, with a central rounded dark brown spot and two small transverse lines laterally; in dorsal view mostly pale except for a central longitudinal black line, a central transversal sinuous line and two black spots posterolaterally; set with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, about three times longer than pronotum; distance between antennae wider than scape width; all segments brown except by pale marks on basal segments in some specimens; torular membrane pale; flagellomeres wider than long specially apical ones; all segments set with short black setae. *Mandibles* pale, with tip dark. *Palpi* maxillary and labial pale with scattered dark brown marks. Apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 106b): *Pronotum* slightly wider than long; posterior margin wider than anterior; subapical furrow present; mostly pale, with black lines as follows: a broad central line enclosing a thin pale medial line, two curved lateral lines wider on posterior region and enclosing a small pale area; covered with black setae, and few white setae on margins. *Mesonotum* mostly black except for a pale medial line on each side, enclosing a small dark area on scutum, and two small rounded pale spots near wings base; all segments set with short black setae. *Metanotum* mostly black except for a central pale area on prescutum and internal margin of scutum; set with short black setae.

Pterothoracic pleura entirely black, except for some pale areas between sclerites in some specimens; covered with short white setae; Miller's organ present.

Wings (A4 Fig 106c): Rather narrow with tip acute; anterior Banksian line present in both wings, posterior absent; longitudinal veins mostly black but with small white marks in some veins; crossveins mostly black but few white; beset with short black setae.

Forewing membrane mostly hyaline with small brown marks around crossveins on mediocubital area, apical margin, surrounding gradate veins, and at subcostal area; pterostigma cream; cubital fork located between origins of Rs and MA origin; three presectoral crossveins; subcostal veinlets simple; prefork area slightly wider than posterior area. *Hind wing* membrane mostly hyaline, except for small rhegmal brown infuscation and a small brown mark at subcostal area apex; medial fork located between origins of Rs and MA; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Fig 106b): *All pairs of legs*, femur long ($> 2x$ length of coxa); femur, tibia and tarsi about same size; tibial spurs as long as T1 length; T2, T3 and T4 about same size, T1 longer than T2; and T5 slightly longer than T1; claws as long as half of T5 length; coxa, trochanter and femur set with short white setae; femur, tibia and tarsi set with short black setae, and scattered long setae on femur and tibia. *Foreleg* sense hair absent; tibia with antennal cleaning setae ventroapically; coxa predominantly black but internal surface pale; trochanter pale; femur mostly brown except for a subapical ring and ventral surface pale; tibia pale with three brown rings, but ventral surface entirely pale in some specimens; tarsi pale with tip dark. *Midleg* with same color pattern of foreleg, except for ventral surface of femur brown with one subbasal and a subapical pale ring. *Hindleg* with

femur and tibia slightly longer than in other legs; color pattern similar to midleg, except for tibia, entirely pale with tip and a subbasal ring dark.

Abdomen: Entirely black but with scattered pale marks on tergites of some specimens; covered with short white setae, but with some black setae on apical segments.

Male Terminalia (A4 Figs 107a-c): *Ectoproct* rounded in lateral view and set with elongate black setae. *9th sternite* short, with posterior margin curved in ventral view; covered with elongate black setae. *Gonarcus* broad in lateral view; arched with margins curved in posterior view. *Mediuncus* elongate in lateral view; broad and rounded in posterior view. *Paramere* broad in lateral view, curved with apex very sclerotized in posterior view.

Female Terminalia (A4 Figs 107d-e): *Ectoproct* rounded, set with thin elongate setae and some cavisetae ventrally. *Lateral gonapophyses* rounded, slightly shorter than ectoproct, beset with cavisetae. *7th sternite* long with distal margin rounded with a central small concavity in ventral view; covered with short black setae. *Pregenital plate* in ventral view rhomboid, with anterior margin acute. *Posterior gonapophyses* elongate and thin, covered with long black setae. *9th tergite* with ventral margin without membranous digitiform process. *Anterior gonapophyses* absent. *Ventral membrane* gonapophyseal plates present.

Distribution (A4 Figs 167) – Australia: NT, QLD, SA, and WA.

Adult activity period – Records for February to April.

Biology – Unknown, larva unknown.

Etymology – The specific name is derived from the Latin word *rebellio* (= rebel, rebellion) and refers to the shape of the male genitalia in posterodorsal view, which remembers the symbol of the Rebel Alliance from the Star Wars movie series.

Primary type – Holotype (by present designation), male, (SAMA). **AUSTRALIA: Northern Territory:** *Illamurta Spr CP*: 24°18'50''S – 132°41'10''E, at light, 25.March.1993, J.A. Forrest & D. Hirst // 24-000123. Condition: pinned; good, anterior part of abdomen broken, but glued in a white card and pinned below the specimen.

Paratype: AUSTRALIA: Northern Territory: *Andado Stn*: 25 km S. Rodinga Range, 24°34'S – 135°16'E, 18.iii.1993, JA Forrest & D Hirst // 24-000122 (1♀, SAMA, pinned); *Emily Gap*: 6 m SE of Alice Springs, 17.ii.1966, Britton, Upton & McInnes (1♂, ANIC, pinned); *Illamurta Spr CP*: 24°18'50''S – 132°41'10''E, at light, 24.March.1993, J.A. Forrest & D. Hirst // 24-000122 (1♀, SAMA, pinned); *Ruby Gap NP*: 23°28'50''S – 134°59'00''E, 21.iii.1993, IA Forrest, D Hirst, at light (// 24-000124 1♂; // 24-000126 1♀, SAMA, pinned); **Queensland:** *Miles*: 15.iii.1990, T.A. Lambkin (1♀, QLDM, pinned); **South Australia:** *Leigh Ck*: x.1964 – iii.1965, G.C. Gregory (1♀, ANIC, pinned); *Maryinna Hill Pitfalls*: 27°01'S – 131°17'E, 14-18.iii.1995, Pitjantjatjara Lands Survey // 24-000125 (1♂, SAMA, pinned); **Western Australia:** *Carnegie Station*: 20 km N, 25°47.8'S – 122°58.8'E, 7.iii.2005, D. Brzoska (1♀, FSCA, pinned); *Meekatharra*: 20 km N, 26°25'22.7''S – 118°35'25.6''E, 5.iii.1994, R. Miller & L. Stange (2♂, 2♀, FSCA, pinned)

Extra material examined – (13♂, 9♀). **AUSTRALIA: Northern Territory:** *Areyonga*: 1958 (1♂, SAMA); *Illamurta Spr CP*: 24°18'50''S – 132°41'10''E,

23.iii.1993, JA Forrest & D Hirst (1♀, SAMA); 25.iii.1993 (1♀, SAMA); *Ruby Gap NP*: 23°28'50''S – 134°59'00''E, 21.iii.1993, IA Forrest, D Hirst, at light (1♀, SAMA); 20.iii.1993 (1♀, SAMA); **Queensland**: *Eulo*: 30.iii.1941 (1♀, QLDM); *Thargomindah*: 3.iv.1941 (1♂, 2♀, QLDM); **South Australia**: *Boolcoomatta Stn Res*: 8.4 km ENE, 31°55'28''S – 140°36'27''E, 6-9.iv.2007, pit trap, Boolcoomatta Svy, R. Hutchinson (1♂, SAMA); *Junction Watercress and Moralana Ck*: Valley of a thousand Hills, 27.iii.1970, G. Gross (1♀, SAMA); *Mount Chambers Gorge*: iii.1973 (1♂, SAMA); *Mount Painter*: Flinders Rg, H.G. Stokes (4♂, SAMA); **Western Australia**: *Carnegie Station*: 20 km N, 25°47.8'S – 122°58.8'E, 7.iii.2005, D. Brzoska (2♂, 2♀, FSCA); *Coolgardie*: 19 km W, 7.ii.1994, R. Miller & L. Stange (1♂, FSCA); *Meekatharra*: 20 km N, 26°25'22.7''S – 118°35'25.6''E, 5.iii.1994, R. Miller & L. Stange (2♂ FSCA).

Comments – See comments for *M. brevipletron*.

***Manselleon tillyardi* (New 1985), new combination**

(A4 Figs 108-109)

Glenoleon tillyardi New 1985b:54 (OD); New 1996:84 (cat); Stange 2004:106 (cat); Oswald 2015 (cat).

Diagnosis – Forewing, hyaline [not with large brown marks]; tibial spurs short, about half of T1 length [not reaching T1 apex]; male, paramere with anterior margin broad in ventral view [not thin]; female, ectoproct without cavisetae [not present]; female, lateral gonapophyses smaller than ectoproct [not about the same size]; female, membranous digitiform process long [not absent].

Description – Lengths: forewing: 18 – 20 mm; hind wing: 16 – 19 mm.

Head (A4 Figs 108a-b): *Labrum* pale; with a line of elongate setae. *Clypeus* pale; with few elongate setae. *Frons* predominantly pale, except by a transversal black band located around antennae (some specimens with band reduced to just a dark area near antennal base); set with few black setae. *Gena* pale. *Vertex* raised; in frontal view mostly pale with two small transversal dark brown bands medially and a central medial dark brown spot; in dorsal view mostly pale with scattered dark brown marks, mainly on posterior margin; set with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, > 3x length of pronotum; distance between antennae wider than scape width; mostly light brown to pale, in some specimens few subapical segments entirely pale, and apical ones dark brown; torular membrane and scape pale; flagellomeres almost as long as wide at base, but apical ones much wider than long; all segments set with short black setae. *Mandibles* mostly pale, with tip black. *Palpi*, maxillary and labial pale; in some specimens apical labial segment light brown; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 108b): *Pronotum* slightly wider than long; posterior margin as wide as anterior; subapical furrow present; mostly pale except for few dark brown marks as follows: a central large one (in some specimens only on posterior half), two curved and thin surrounding the central one, two small located laterally on posterior half of some specimens; beset with short black setae and some long setae, some specimens with long pale setae on anterior corners. *Mesonotum* mostly pale, with some small dark brown spots distributed on segments as follows: two rounded on prescutum, two small

longitudinal on each side of scutum, anterior margin of scutellum; covered with short black setae. *Metanotum* pale, with few small dark brown marks, mainly near wings base; and scutellum medially. *Pterothoracic pleura* mostly pale with some dark brown areas mainly on segments border; covered with white setae; Miller's organ present.

Wings (A4 Fig 108c): Fairly broad; anterior Banksian line present in both wings, posterior absent; veins mostly pale, but some veins intercalated with light brown spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane hyaline with pterostigma white (few darker specimens area surrounding crossveins brown shaded); cubital fork located between origins of Rs and MA origin; three presectoral crossveins; most of subcostal veinlets simple but few distal ones forked; posterior area narrower than prefork area. *Hind wing* membrane hyaline with pterostigma white; medial fork located between origins of Rs and the MA origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 108a-b): *All pairs of legs*, femur elongate ($> 2.5x$ length of coxa); tibia and femur with same size, but slightly longer than tarsi; tibial spurs very smaller than T1 half; T2, T3 and T4 about same size, T1 slightly longer than T2, T5 slightly longer than T1; claws about half of T5 length; coxa set with many short white setae, remaining set whit short black setae and scattered long black setae (some specimens with short white setae); T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair absent; tibia with antennal cleaning setae ventroapically; all segments pale except for tips of femur and T5, dark brown, and three rings on tibia. *Midleg* with same color of foreleg.

Hindleg with femur, tibia and T1 slightly longer than in other legs; color same of other legs except for tibia entirely pale with tip dark brown.

Abdomen: Segments mostly pale with dark brown marks on posterior border (some darker specimens with distal segments mostly dark brown). Beset with short black setae.

Male Terminalia (A4 Figs 109a-d): *Ectoproct* rounded in lateral view; set with elongate black setae. *9th sternite* posterior margin rounded in ventral view; set with elongate black setae. *Gonarcus* broad in lateral view and arched in posterior view. *Mediuncus* elongate in lateral; broad and rounded in posterior view. *Paramere* in lateral view with apex thin, curved and rounded but anterior area broad and elongate; curved in posterior view; in ventral view broad and curved but apical inner corner elongate.

Female Terminalia (A4 Figs 109e-f): *Ectoproct* rounded and covered with thin elongate setae. *Lateral gonapophyses* rounded, smaller than ectoproct, set with few cavisetae. *7th sternite* distal margin straight in ventral view; covered with short black setae. *Pregenital plate* small, semi elliptical, with a small medial extension in ventral view. *Posterior gonapophyses* thin, elongate, covered with long black setae. *9th tergite* with a very long membranous digitiform process. *Anterior gonapophyses* absent. *Ventral membrane gonapophyseal plates* present.

Distribution (A4 Fig 167)– Australia: NSW, NT*, QLD*, SA*, and WA. * = new record.

Adult activity period – Records for February to December.

Biology – Unknwon, larva unknown.

Primary type – Holotype (by original designation), female (ANIC), examined. From original description, New (1985b): “Holotype, ♀, Western Australia, Deeba Rock Hole, 34 km NE, by N. Laverton, 28°22’S., 122°37’E., 12.xi.1977, M. S. Upton (ANIC)”. Condition: good; terminalia dissected.

Material examined – (73♂, 56♀). **AUSTRALIA: Northern Territory:** *Alice Springs:* 3 mi N, 21.x.1966, A. & R. Mesa (1♂, ANIC); *Barrel Ck:* 2 miles S, 13.ii.1966, Britton, Upton & McInnes (1♂, ANIC); *Devil’s Marbles:* 350m, 27.x.1962, E.S. Ross & D.Q. Cavagnaro (1♂, 1♀, FSCA); *Elkedra:* x.1977 (1♂, SAMA); *Kings Creek Campground:* nr. Kings Canyon Nat. Park (A22), 22.xi.1989, R.B. Miller (1♂, 1♀, FSCA); *Mount Gilruth:* Gorge NE, 13.02S – 133.05E, 10-13.vii.1979, G. Monteith & D. Cook (1♀, QLD); *Palm Valley:* 26.xi.1954 (1♀, MVM); *SA White:* (1♀, SAMA); *Standley Chasm:* 42 km W of Alice Springs, 11.x.1972, M.S. Upton (1♂, ANIC); *Tenant Creek:* xi.1978 (1♀, QLD); *Tickalara:* 14.xi.1949, E.F. Riek (7♂, 4♀, ANIC, 1♂, FSCA); **Queensland:** *Tickalara:* xi.1949, Riek (1♂, FSCA); **South Australia:** *Mount Lindsay:* 18.x.1996 (1♂, SAMA); *Mulga Pk:* x.1960 (1♂, SAMA); *Musgrave Rg:* x.1994 (2♂, 3♀, SAMA); *Petermann Range:* 30.x.1963, at light, P. Aitken & N.B. Tindale (1♀, 1♂, SAMA); *Victory Well Everard Pk Station:* 31.x.1970; G. Gross & E. Mattheus, 24-000101 (1♀, SAMA); *Wantary Campsite:* x.1998 (1♂, SAMA); **Western Australia:** *Blackstone:* x.2006 (2♂, SAMA); *Cane River HS:* 17 km NbyE, 21.56S – 115.39E, 27.iv.1971, Upton & Mitchell (2♀, ANIC); 8 km SWbyW, 22.07S – 115.33E, 31.iii.1971, E.F. Riek (21♂, 10♀, ANIC); *Carnarvon:* 107 miles SSE, 21.iv.1968, I.F.B. Common & M.S. Upton (6♂, 5♀, ANIC); *Dampier:* 20.iv.1971, Upton (1♀, ANIC);

Deeba Rock Hole: 34 km NE, by N. Laverton, 28°22'S., 122°37'E., 12.xi.1977, M. S. Upton (1♂ PT, 3♀ PT, ANIC); *Giles*: ii.1962 (1♂, 1♀, MVM); *Goldfields hwy*: 85 km SSE Wiluna, 27.32886°S - 120.50593°E±70m, 560m, 26.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #617 (2♂, 3♀, TAMU); *Halls Ck*: x.1953 (1♂, SAMA); *Hamelin Pool*: 13.iv.1970 (1♂, MVM); *Learmonth*: 6.vi.1957 (2♂, MVM); *Logues Springs*: 102 km SEbyE Broome, 18.25S – 123.05E, 18.viii.1976, I.F.B. Common (2♂, 2♀, ANIC); *Meekatharra*: 20 km N, 26°25'22.7''S - 118°35'25.6''E, 5.iii.1994, R. Miller & L. Stange (2♂, 1♀, FSCA); *Millstream HS*: 1 km NE, 21.35S – 117.04E, 23.iv.1971, Upton & Mitchell (1♀, ANIC); *Mount Keith HS*: 6 km S, 27.20S – 120.30E, 14.xi.1970, Upton & Feehan (2♂, 5♀, ANIC); *Pilgangoora*: v.1953 (1♂, SAMA); *Pungkulpirri Waterhole*: 0.5 km E, Walter James Rg, 24°39'15''S – 128°45'18''E, 26.ix.2006, at light, Central Ranges Sur. Camp 1 (4♂, 3♀, SAMA); *Roebourne*: iv.1914 (1♂, 1♀, ANIC); *Yardie Creek*: iv.1953 (1♂, 1♀, MVM); *Warroora*: iv.1978 (1♂, QLDM); *Wittenoom*: 4.iii.1994, L. Stange & R. Miller (1♀, FSCA); *Wolfe Ck Crater*: Kimberly Div. ix.1953 (1♀, SAMA); *Wylo*: iv.1978 (1♂, QLDM).

Comments – See comments for *M. longidigitus*.

***Minyleon* new genus**

Type species: *Austrogymnocnemia pygmaea* New 1985, by current designation.

Diagnosis – Legs femur length > 3.5x length of coxa [not shorter than this]; tibial spurs absent [not present]; foreleg with T1 longer than T5 [not shorter or same size]; pronotum much longer than wide [not as long as wide]; head, mandibles reduced, hidden behind

labrum [not visible]; head, gena extending over labrum ventral margin [not until clypeus ventral margin].

Description – Head: *Mandibles* reduced, hidden behind clypeus. *Gena* extending over labrum ventral margin. *Ocular rim* setae absent. *Antennae* clubbed and elongate; flagellomeres almost as long as wide at base, apical ones slightly wider than long, all segments set with short black setae. *Palpimacula* oval-shaped, located medially. Thorax: *Pronotum* much longer than wide; posterior margin wider than anterior. Miller's Organ present. Wings: anterior Banksian line present, posterior absent. *Forewing* cubital fork located after Rs origin; subcostal veinlets simple; three presectoral crossveins; posterior area narrower than prefork area. *Hind wing* medial fork located after Rs origin; one presectoral crossvein. *Male pilula axillaris* present. Legs: *Femur* > 3.5x length of coxa. *Tibial spurs* absent. *Foreleg*, T1 longer than T5. *Foretibia*, antennal cleaning setae absent. Male Terminalia: *Gonarcus* broad and arched; short and well sclerotized. Female Terminalia: *Ectoproct* rounded, without cavisetae; *lateral gonapophyses* smaller than ectoproct, set with few cavisetae; *posterior gonapophyses* elongate, broad and set with few cavisetae apically; *9th tergite* with a long membranous digitiform process; *anterior gonapophyses* absent.

Distribution (A4 Fig 167) – Australia: SA, VIC, and WA.

Comments – The genus contains only one species, *Minyleon pygmaeus*, which was originally described in *Austrogymnocnemia*. However, *M. pygmaeus* is very different from all other species previously classified in *Austrogymnocnemia* by New (1985b). In fact, the only shared character was the absence of tibial spurs. This minute species

presents some unusual characters, like the reduced mandibles and extended gena, which are considered here as generic distinctive, based on their uniqueness within the “*Periclystus* genus group”.

The results obtained in both molecular and morphological phylogenies clearly demonstrated that *Austrogymnocnemia* had to be split, as discussed before. All species previously placed in this genus were divided in a couple of smaller new genera or transferred to other existing ones, with the exception of *M. pygmaeus*. This unique species is not closely associated with any of these new genera; it was actually placed basal to the clade (*Glenoleon* (*Periclystus* (*Fossorioleon*, *Riekoleon*))) in the morphological phylogeny (A4 Fig 3). In this sense, because of the uniqueness of *M. pygmaeus*, and its isolated placement recovered in the morphological phylogeny, the species is here classified in his own genus.

Etymology – The genus name is derived from the Greek word *minys* (= little, small, short) and refers to the particular small size of the type species.

***Minyleon pygmaeus* (New 1985), new combination**

(A4 Figs 110-111)

Austrogymnocnemia pygmaea New 1985:24 (OD); New 1996:68 (cat); Stange 2004:100 (cat); Oswald 2015 (cat).

Diagnosis – Mandibles reduced, hidden behind labrum [not large and visible]; pronotum longer than wide [not wider than long]; pronotum posterior margin wider than anterior [not with same width]; foreleg T1 longer than T5 [not T5 longer or same size]; foretibia

antennal cleaning setae absent [not present]; male genitalia elongate [not short]; Female, forewing no longer than 15 mm [not longer than 15 mm].

Description – Lengths: forewing: 12 – 20 mm; hind wing: 11 – 19 mm.

Head (A4 Figs 110a-b): *Labrum* light brown, set with a line of elongate setae. *Clypeus* mostly pale but dark brown laterally and dorsally, set with few elongate pale setae. *Frons* shiny black with irregular pale marks ventrally; set with white setae. *Gena* pale, extending to labrum ventral margin. *Vertex* raised; in general dark brown with anterior and posterior margin pale; covered with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, about twice longer than pronotum; distance between antennae wider than scape width; scape, pedicel and most flagellomeres dark brown with a pale ring at distal margin, apical flagellomeres entirely dark brown; torular membrane pale; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae. *Mandibles* reduced, hidden behind labrum. *Palpi*, maxillary and labial pale; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 110b): *Pronotum* much longer than wide; posterior margin wider than anterior; subapical furrow present; mostly light brown with black areas as follows: a broad medial line “Y” shaped, two sinuous longitudinal lines around midline, lateral margins; beset with black setae and few long white setae on borders. *Mesonotum* coloration mostly black with few pale areas as follows: two rounded marks on prescutum, two longitudinal lines near midline on scutum, and posterior margin of scutellum; covered with short black setae. *Metanotum* black with irregular pale marks

near midline, covered with few short black setae. *Pterothoracic pleura* black; covered with white setae; Miller's organ present.

Wings (A4 Fig 110c): Rather narrow with tip acute (wings broader in male); anterior Banksian line present in both wings, posterior absent; veins mostly dark brown, but some intercalated with white spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline but full of irregular brown marks mainly around crossveins, apex, and posterior margin (marks reduced in males); pterostigma white but brown basally; cubital fork located between origins of Rs and MA, three presectoral crossveins; subcostal veinlets simple; posterior area slightly narrower than prefork area. *Hind wing* membrane mostly hyaline except for some irregular brown marks apically and a large brown spot on rhegmal area (marks reduced in males); pterostigma white; medial fork located between origins of Rs the MA origin; veinlets simple; one or two presectoral crossvein.

Legs: *All pairs of legs*, femur elongate ($> 3.5x$ length of coxa); tibia and femur about same size but longer than tarsi; tibial spurs absent; T3 and T4 about same size, T2 slightly longer than T3, T1 longer than T5 and about twice longer than T2; claws about as half of T5 length; coxa, trochanter, and femur set with short white setae; femur, tibia and tarsi set with short black setae, and scattered long black setae. *Foreleg* sense hair absent; tibia without antennal cleaning setae; coxa dark brown, trochanter brown, femur mostly brown with internal surface pale, tibia mostly pale with three brown marks on external surface; all tarsomeres pale basally but brown apically. *Midleg* with color pattern similar to foreleg, except for femur pale with apex dark brown, and tibia dark

brown with three pale rings. *Hindleg* with femur and tibia slightly longer than in other legs; color pattern similar to midleg, except for tibia pale with tip dark brown, and tarsi with pale areas larger.

Abdomen: Mostly dark brown with distal margin pale. Beset with short black setae.

Male Terminalia (A4 Figs 111a-c): *Ectoproct* rounded in lateral view, set with elongate black setae. *9th sternite* short, with posterior margin rounded and set with long black setae, in ventral view. *Gonarcus* broad and arched; anterior margin thinner and rounded in lateral view; in dorsal view with a medial invagination on anterior margin. *Mediuncus* absent. *Paramere* in lateral view short with posterior margin longer than anterior, and with a rounded medial prolongation; prolongations with apex dark and very sclerotized.

Female Terminalia (A4 Figs 111d-e): *Ectoproct* rounded covered with thin elongate setae. *Lateral gonapophyses* rounded, smaller than ectoproct, set with few cavisetae. *7th sternite* small, with distal margin straight in ventral view; beset with long black setae. *Pregenital plate* in ventral view a transversal line with a medial knob on posterior margin. *Posterior gonapophyses* broad, elongate, with tip rounded; covered with long black setae and few cavisetae apically. *9th tergite* with a long membranous digitiform process. *Anterior gonapophyses* absent. *Ventral membrane* gonapophyseal plates present.

Distribution (A4 Figs 167) – Australia: SA, VIC, and WA.

Adult activity period – Records for January, February and November.

Biology – Unknown, larva unknown.

Primary type – Holotype (by original designation), female (SAMA), examined. From original description, New (1985b): “Holotype, ♀, South Australia, Jimmy's Well, 15 miles E. Tintinara, 3.ii.1965, P. Aitken and Tindale (SAM)”. Condition: good, with terminalia dissected.

Material examined – (1♂, 9♀). **South Australia:** *Jimmy's Well*: 15 miles E. Tintinara, 3.ii.1965, P. Aitken & Tindale (5♀ PT, SAMA); *Salt Ck*: tourist road, xi.1967 (1♀, SAMA); *Taratap Stn*: 23.i.1965, P. Aitken & Tindale, MV light (1♀, SAMA); **Victoria:** *Kiata*: 12.i.1952, CMC, A.N. Burns (1♂, MVM); *Little Desert*: 5 mls S of Kiata, 12.ii.1956, I.F.B. Common (2♀PT, ANIC; SAMA).

Comments – Until now *M. pygmaeus* was known only by females, but one male was discovered during this study. This male specimen is larger than females and marks on the wings are reduced. The male forewing has 20 mm while all females studied here have the forewing measuring between 12 and 14 mm. However, despite these differences, it is clear that the male belongs to *M. pygmaeus*. The specimen presents all the distinctive and odd characteristics of the species, like: the reduced mandible, the extended gena, the long T1, foretibia without the antennal cleaning setae, and the overall body color pattern. For phylogenetic relationships see (A4 Fig 3).

Because the species was originally described in *Austrogymnocnemia*, a female word, the specific name also had to be female, “*pygmaea*”. However with the transference of this species to *Minyleon*, a male word, the specific name has to change in order to match the genus gender, therefore it must be called now *Minyleon pygmaeus*.

***Normanleon* new genus**

Type species: *Myrmeleon dissolutus* Gerstaecker 1885, by present designation.

Diagnosis – Hind wing with a large sub apical mark [not hyaline]; femoral sense hair longer than femur width [not absent or longer than half of femur length]; female ectoproct cavisetae absent [not present]; lateral gonapophyses long, broad, with cavisetae present [not thin, short or cavisetae absent]; male, gonarcus in lateral view with anterior margin thinner than posterior [not equal or larger]; male, mediuncus short and rounded [not absent or long and acute]; male, paramere broad [not longitudinally narrow].

Description – Head: *Vertex* raised and set with short setae. *Frons*, mostly black. *Ocular rim* setae absent. *Antennae* clubbed; elongate, distance between antennae wider than scape width, flagellomeres almost as long as wide at base, apical ones much wider than long, all segments set with short black setae. *Palpimacula* oval and located medially. Thorax: *Pronotum* about as long as wide. Miller's organ present. Wings: *Anterior Banksian* line present in both wings, posterior absent in hind wing, but distinguishable in the forewing. *Forewing* with cubital fork located near Rs origin; costal crossveins mostly simple; posterior area narrower than prefork area. *Hind wing* medial fork located near Rs origin; one presectoral crossvein with a medial spur. *Male pilula axillaris* present. Legs: *Forefemur* length > 2.5x length of forecoxa. Femoral sense hair longer than femur width. *Tibial spurs* usually reaching T1 apex. *Pretarsal claws* longer than half of T5 length. *Tibia* with antennal cleaning setae ventroapically. Male Terminalia: *Ectoproct* rounded in lateral view; gonarcus arched, with anterior margin thinner than posterior in lateral

view; *paramere* broad, and well sclerotized; *mediuncus* short with tip rounded. Female Terminalia: *Ectoproct* rounded with no cavisetae; *lateral gonapophyses* set with cavisetae; *posterior gonapophyses* broad and long; *anterior gonapophyses* absent or a small plate.

Distribution (A4 Figs 168-169) – Australia: all states. Solomon Island*. * = new record.

Comments – This new genus arises from the division of *Glenoleon* (see discussion under this genus), and is represented by five species previously placed in *Glenoleon* and one new species. The species transferred to the new genus differ from *Glenoleon* because of the relative length of forelegs, the presence of femoral sense hair, and overall shape of the male and female terminalia. The distinctive position of *Normanleon* in relation to *Glenoleon* was confirmed by both morphological and molecular phylogeny (A4 Figs 1-3). In fact, both phylogenies place *Normanleon* in a monophyletic clade together with *Austrogymnocnemia*, *Ceratoleon* and *Paraustrogymnocnemia*.

However, despite the congruence between the two phylogenies, the internal relationship of the clade is quite confusing in the molecular phylogeny. *Normanleon* was not recovered monophyletic as in the morphological phylogeny. However this specific part of the tree seems particularly problematic. The support values are relatively low (mainly in ASTRAL); the taxon sample is quite reduced (except *Austrogymnocnemia*); and the distance between the branches are extremely short, almost indistinguishable in many branches. These results clearly infer that these four genera are very closely associated, but the internal classification seems a little confusing based only the molecular analysis. By this sense we prefer the morphological analysis, which recovered

a more defined tree. It is possible that a future molecular study based on a larger taxon sample might change the classification adopted here, but until there this classification is the most appropriated.

Etymology – Norman, from the fore name of Norman D. Pale [1946-2016], American entomologist. In recognition of carrer-long contributions to the study of Neuropterology.

Key to species of *Normanleon*

- 1 Male 9th sternite apex strongly emarginated (A4 Fig 123d); female posterior gonapophyses without cavisetae (A4 Fig 123e).....2
- 1' Male 9th sternite apex not emarginated; female posterior gonapophyses with some cavisetae apically (A4 Fig 117e).....3
- 2 Forewing mediocubital area with a long longitudinal dark line (A4 Fig 112c); female pregenital plate rounded (A4 Fig 113e).....*N. berthoudi*
- 2' Forewing mediocubital area without a longitudinal dark line (A4 Fig 122c); female pregenital plate shaped like a “goblet” (A4 Fig 123f).....*N. meteoricus*
- 3 Forewing relatively broad, posterior margin strongly convex apically (A4 Fig 118c).....4
- 3' Forewing rather narrow, inferior margin straight (A4 Fig 120c).....5
- 4 Hind wing with a large apical mark at anterior margin (A4 Fig 116c); foretibia longer than foretarsi (A4 Fig 116a); frons black except the pale ventral corners (A4 Fig 116a); male mediuncus short, tip broader than base (A4 Fig 117c); female pregenital plate with a short ventral extension medially (A4 Fig 117c)*N. conspersum*

- 4' Hind wing without a large apical mark at anterior margin (A4 Fig 118c); foretibia as long foretarsi (A4 Fig 118a); frons mostly, except the pale ventral margin (A4 Fig 118a); male mediuncus long, apex narrower than base (A4 Fig 119d); female pregenital plate without a ventral extension (A4 Fig 119f).....*N. dissolutus*
- 5 Pronotum entirely black (A4 Fig 120b); hind wing with a broad transversal brown band at rhegmal area (A4 Fig 120c); tibial spurs long (reaching T1 apex); female anterior gonapophyses as a small rounded plate (A4 Fig 121d)....*N. falsus*
- 5' Pronotum mostly black, but full of pale areas (A4 Fig 114b); hind wing with a rhegmal spot, not a band (A4 Fig 114c); tibial spurs short (reaching half of T1 length); female, anterior gonapophyses absent (A4 Fig 115d).....*N. ceciliae*

***Normanleon berthoudi* (Tillyard 1916), new combination**

(A4 Figs 112-113)

Glenoleon berthoudi Tillyard 1916:55 (OD); Esben-Petersen 1923:578 (cit); Stange 1976:305 (cat); New 1985b:39 (key, rd, ill); New 1996:81 (cat); Stange 2004:103 (cat); Oswald 2015 (cat).

Diagnosis – Forewing thin [not broad]; forewing, with a long longitudinal brown line [not without line]; pronotum mostly black with pale marks [not entirely black]; tibial spurs long [not short]; female posterior gonapophyses with cavisetae absent [not present]; male, 9th sternite emarginated with sides elongate [not with margin straight].

Description – Lengths: forewing: 30 – 32 mm; hind wing: 24 – 28 mm.

Head (A4 Figs 112a-b): *Labrum* pale and set with a line of elongate setae. *Clypeus* pale; with few elongate setae. *Frons* predominantly black, except for ventral margin pale; set with few black setae. *Gena* pale. *Vertex* raised; in frontal view pale, with a median black line interrupted centrally; in dorsal view mostly black except for pale areas on anterior and posterior margins; covered with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, about three times longer than pronotum; distance between antennae wider than scape width; all segments mostly dark brown except for a pale dorsal ring on most flagellomeres; torular membrane black; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae. *Mandibles* mostly pale, with tip black. *Palpi*, maxillary and labial mostly light brown, except for segments distal margin pale; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 112b): *Pronotum* as long as wide; posterior margin as wide as anterior; subapical furrow present; pale except by a large central black mark “X” shaped, and margins also black; beset with many short black setae and some long set at margins. *Mesonotum* coloration mostly black, but with some pale marks: two rounded marks on prescutum and scutellum, and two longitudinal lines on each side of scutum; covered with short black setae. *Metanotum* black, with a large pale mark on each side of scutum; set with few short black setae. *Pterothoracic pleura* mostly black with some pale areas near sclerites borders; covered with white setae; Miller’s organ present.

Wings (A4 Fig 112c): Rather narrow with tip acute; anterior Banksian line present in both wings, posterior absent on hind wing; veins mostly dark brown, but some veins

intercalated with white spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline but with a longitudinal brown line on mediocubital area, which extends over gradate veins, and many small brown marks concentrated in forks of apical area, posterior margin, beneath pterostigma and subcostal area; cubital fork located near Rs origin; three presectoral crossveins; subcostal veinlets simple; posterior area narrower than prefork area at the cubital fork level. *Hind wing* membrane mostly hyaline except for a small brown mark at hypostigmatic cell base, and a large brown rhegmal spot; medial fork located between origins of Rs and MA; subcostal crossveins simple; one presectoral crossvein, with a medial spur.

Legs (A4 Figs 112a-b): *All pairs of legs*, femur elongate ($> 2.5x$ length of coxa); tibia and femur about same size, but longer than tarsi; tibial spurs surpassing T1 apex; T2, T3 and T4 about same size but slightly shorter than T1, which is shorter than T5; claws about half of T5 length; coxa, trochanter and femur set with short white setae; femur apically, tibia and tarsi set with short black setae, and scattered long black setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair shorter than half of femur length; tibia with antennal cleaning setae ventroapically; coxa dark brown with some pale areas on anterior surface, trochanter light brown, femur dark brown with some lighter areas basally, tibia mostly dark brown with three pale rings; tarsi dark brown, except for T1, pale. *Midleg* with same color pattern of foreleg, except for some areas on internal surface of femur and tibia, light brown. *Hindleg* with femur and tibia slightly longer than in other legs; color pattern similar to midleg, except for tibia pale with tip dark brown.

Abdomen: Tergites mostly black with scattered pale marks; beset with short black setae and few short white setae on basal segments. Sternites mostly black with a large medial pale longitudinal band; basal segments mostly set with short white setae and few black setae; distal segments covered with short black setae.

Male Terminalia (A4 Figs 113a-c): *Ectoproct* rounded in lateral view; set with elongate black setae. *9th sternite* in posterior view with distal margin emarginated, with a short medial lobe and with sides elongate; set with elongate black setae. *Gonarcus* broad with lateral margins acute in posterior view; and anterior margin thinner in lateral view. *Mediuncus* short with tip acute in lateral and posterior view. *Paramere* large, with tip curved and sclerotized in posterior and lateral view; elongate with anterior margin thinner in lateral view.

Female Terminalia (A4 Figs 113d-e): *Ectoproct* rounded, covered with thin elongate setae. *Lateral gonapophyses* rounded, about same size of ectoproct, set with thickened setae. *7th sternite* distal margin straight in ventral view and covered with long black setae. *Pregenital plate* in ventral view rounded, but anterior margin curved and acute medially. *Posterior gonapophyses* broad, elongate, with tip rounded; covered with long black setae. *9th tergite* with a short membranous digitiform process. *Anterior gonapophyses* absent. *Ventral membrane* gonapophyseal plates present.

Distribution (A4 Fig 168) – Australia: NT*, QLD, SA*, and WA. * = new record.

Adult activity period – Records for February, March and November.

Biology – Unkwnon, larva unknown.

Primary type – Holotype (by original designation), female (BMNH), high-resolution image examined. From original description, Tillyard (1916): “Hab. Waroona, W.A. Taken by Mr. G. F. Berthoud, to whom I dedicate the species, on February 23rd, 1911. Unique. Type in Coll. Tillyard”. From New 1985: “Type / Holotype, ♀, Western Australia, Waroona, 23.ii.1911, G. F. Berthoud (BMNH) (seen)”. Condition: good; left antenna missing; terminalia dissected.

Material examined – (7♂, 5♀). **AUSTRALIA: Northern Territory:** *Alice Springs:* Emily Gap 6mi SE, 17.ii.1966, Britton, Upton & McInnes (1♀, ANIC); **Queensland:** *Clermont:* 26.iii.1914 (1♂, QLDM); **South Australia:** *Nullarbor:* 40mi E, 18.iii.1968, I.F.B. Common & M.S. Upton (1♀, ANIC); *Pinkawillinia CP:* 20.iii.1996 (1♂, SAMA); ix.1995 (2♂, SAMA); *Tintinara:* Jimmy’s Well, ii.1965 (1♀, SAMA); *Yumberra CP:* Inila Rock Waters, iii.1995 (1♂, SAMA); **Western Australia:** *Balladonia:* iii.1996 (1♀, SAMA); *Coolgardie:* 53mi SSW, 31.39S – 120.46E, 5.xi.1960 (1♂, ANIC); *Karonie:* 13mi EbyS, 9.xi.1969, Key & Upton, Key’s field notes, trip 163, stop 19422.7 (1♀, ANIC); *Lake Austin:* 27°36.5’S – 117°53.3’E, 24.iii.2005, D Brzoska (1♂, FSCA).

Comments – *Normanleon berthoudi* is closely associated with *N. meteoricus*, these are the only two species of “*Periclystus* genus group” with largely emarginated male 9th sternite. However, *N. berthoudi* is easily recognized by the long longitudinal line on the forewing. For phylogenetic relationships see (A4 Figs 1-3).

***Normanleon ceciliae*, new species**

(A4 Figs 114-115)

Diagnosis – Forewing thin [not broad]; forewing, without a longitudinal brown line [not with a line]; pronotum mostly black with pale marks [not entirely black]; tibial spurs short [not long]; female posterior gonapophyses set with cavisetae [not absent]; male 9th sternite straight [not emarginated].

Description – Lengths: forewing: 25 – 28 mm; hind wing: 21 – 26 mm.

Head (A4 Figs 114a-b): *Labrum* pale and set with a line of elongate setae. *Clypeus* pale; with some elongate black setae. *Frons* predominantly shiny black, except for ventral margin pale; set with few short black setae. *Gena* pale (with small black marks in some specimens). *Vertex* raised; in frontal view pale, with a median black line (interrupted centrally in some specimens); in dorsal view mostly black except for pale marks on anterior and posterior margins; covered with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, > 2x length of pronotum; distance between antennae wider than scape width; all segments dark brown except for a pale dorsal ring on most flagellomeres; torular membrane pale; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae. *Mandibles* mostly pale, with tip black. *Palpi*, maxillary and labial mostly dark brown, except for distal margins pale; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 114b): *Pronotum* about as long as wide; posterior margin as wide as anterior; subapical furrow present; mostly pale except for some black areas as follows: two large medial longitudinal lines, margins, scattered rounded spots; beset with short black setae. *Mesonotum* mostly black or grey, with some longitudinal yellow bands on

central region of segments; covered with short black setae. *Metanotum* black or grey, with a thin medial pale line; covered with short black setae and few white setae on scutum in some specimens. *Pterothoracic pleura* black or grey with small pale areas on borders of sclerites; covered with white setae; Miller's organ present.

Wings (A4 Fig 114c): Rather narrow with tip acute; anterior Banksian line present in both wings, posterior absent; veins mostly dark brown, but some veins intercalated with white spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline with brown marks concentrated at tip, posterior margin, gradate veins, pterostigma, subcostal area, and parts of mediocubital area; cubital fork located between origins of Rs and MA, but very close to Rs origin; three presectoral crossveins; subcostal veinlets simple; posterior area narrower than prefork area at level of cubital fork. *Hind wing* membrane mostly hyaline except for a small brown mark at base of hypostigmatic cell, and a large brown rhegmal spot; medial fork located between origins of Rs and MA origin; subcostal veinlets simple; one presectoral crossvein, with a medial spur.

Legs (A4 Figs 114a-b): *All pairs of legs*, femur elongate ($> 2.5x$ length of coxa); tibia and femur about same size, but longer than tarsi; tibial spurs no longer than half of T1; T3 and T4 about same size but little shorter than T2, which is slightly shorter than T1; T5 about twice longer than T1; claws about half of T5 length; coxa, trochanter, femur, and tibia set with short white setae; femur, tibia and tarsi set with short black setae, and scattered longer black setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair elongate, about half of femur length; tibia with antennal cleaning

setae ventroapically; coxa dark brown with some pale areas on the anterior surface, trochanter light brown, femur dark brown with some lighter areas basally, tibia mostly dark brown with three pale rings; tarsi dark brown, except for T1 base, pale. *Midleg* with same color pattern of foreleg, except for some areas on internal surface of femur and tibia, light brown. *Hindleg* with femur and tibia slightly longer than in other legs; color pattern similar to anterior legs, except for tibia pale with tip dark brown tip and T1 almost entirely pale.

Abdomen: Tergites mostly black with scattered pale marks; beset with short black setae, and some white setae on basal segments. Sternites mostly black with a large medial pale longitudinal band; basal segments set with short white setae, and short black setae on distal segments.

Male Terminalia (A4 Figs 115a-c): *Ectoproct* rounded in lateral view, set with elongate black setae. *9th sternite* posterior margin straight in ventral view; set with elongate black setae. *Gonarcus* very broad in posterior view; with anterior margin thinner in lateral view. *Mediuncus* short with tip acute in lateral and posterior view. *Paramere* large and with tip acute and sclerotized in posterior view; elongate with anterior margin large and apex with a small concavity in lateral view.

Female Terminalia (A4 Figs 115d-e): *Ectoproct* rounded, covered with thin elongate setae. *Lateral gonapophyses* rounded, smaller than ectoproct, set with cavisetae. *7th sternite* distal margin bending upwards in lateral view; in ventral view with posterior margin concave medially, and covered with long black setae. *Pregenital plate* divided into two parts, anterior part a thin, curved transversal line with lateral extremities

expanded and rounded; posterior part a small transversal sclerotized bar with an acute medial projection on anterior margin. *Posterior gonapophyses* broad, elongate, with tip enlarged; covered with long black setae, and many cavisetae on posteroventral corner. *9th tergite* with a short membranous digitiform process. *Anterior gonapophyses* absent. *Ventral membrane* gonapophyseal plates present.

Distribution (A4 Fig 168) – Australia: NSW, SA, VIC, and WA.

Adult activity period – Records for September and November to January.

Biology – Unknown, larva unknown.

Etymology – The species is named after Dr. Cecilia G. Simões, who was extremely helpful and essential during the development of every step of this study.

Primary type – Holotype (by present designation), female, (AMSA). **AUSTRALIA: South Australia:** 13 km S of *Alawoona*: 6.jan.1996, M.S. & B.J. Moulds & K.A. Kopestonsky. Condition: pinned; good, left midleg and tip of right antenna missing.

Paratypes: AUSTRALIA: New South Wales: *Nombinnie Nature Reserv.:* 18 air km SSE Mount Hope, 160m, 32.99613°S – 145.94006°E±70m, Oswald, Diehl & Machado, 3.i.2013, M.V., Oswald #626 // TAMU – ENTO X0911133 (1♂, TAMU); **South Australia:** same data of holotype (1♀, AMSA, pinned); **Western Australia:** N of Cave Rock Camp, 28.6 km S of *Burra Rock*, 31.640S – 121.209E, 17.nov.2007, 380m, D.R. Britton, D.J. Bickell, BRITTON 2007013 [at light] (1♂, AMSA, pinned); *Karonie:* 13mi EbyS, 9.nov.1969, Key & Upton // Key's field notes, trip 163, stop 19422.7 (1♀, ANIC, pinned); *Norseman:* 35mi SWbyS, 32.38S – 121.29E, 17.xi.1969, Key & Upton // Key's field notes, trip 163, stop 20206.8 (1♂, ANIC, pinned); track S off hwy1, 79 km EENE

of Norseman, 32.08056°S – 122.60297°E±90m, Oswald, Diehl & Machado, 290m, 28.xii.2012, M.V., Oswald #619 // TAMU – ENTO X0911234 (1♀, TAMU, pinned); same data as anterior, // TAMU – ENTO X0911017 (1♂, TAMU, pinned).

Extra material examined – (6♂, 3♀). **AUSTRALIA: South Australia:** *Alawoona*: 13 km S, 6.i.1996, M.S. & B.J. Moulds & K.A. Kopestonsky (2♀, AMSA); *Gluepot Res.*: ix.2000 (1♂, SAMA); xi.2000 (1♀, SAMA); xii.2000 (2♂, SAMA); *Munyaroo CP*: xi.2005 (1♀, SAMA); *Whyalla Munyaroo CP*: xi.2005 (1♂, SAMA); **Victoria:** *Murray-Sunset Nat. Pk*: Millewa South Bore Track, 34°33'35'' – 141°03'40'', 17-23.xi.2002, C. Lambkin, D. Yeates, N. Starick, J. Recsei (1♀, CSCA); **Western Australia:** track S off hwy1, 79 km EENE of Norseman, 290m, 32.08056°S – 122.60297°E±90m, 28.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #619 (1♂, TAMU).

Comments – The placement of *N. ceciliae* in *Normanleon* is justified by the morphological phylogeny, which recovered the species within this monophyletic group (A4 Fig 3). However, the species was recovered closer to *Paraustrogymnocnemia* in the molecular analysis (A4 Figs 1-2). This particular part of the tree seems quite problematic, as mentioned under the genus discussion. The overall shape of the male terminalia between *N. ceciliae* and *Paraustrogymnocnemia* is very different, like: the presence of the mediuncus, gonarcus not acute anteriorly, and paramere anteriorly broader. All these characters clearly separate it from *Paraustrogymnocnemia* and approximate the species with *Normanleon*.

Within the genus, *N. ceciliae* is closely associated with *N. falsus*, the male and female terminalia of both species are very similar. However they can be easily separated by the length of the tibial spurs and the general body color pattern.

***Normanleon conspersum* (Banks 1918), new combination**

(A4 Figs 116-117)

Glenoleon conspersum Banks 1918:11 (OD); New 1985b:34 (key, rd, ill); New 1996:81 (cat); Stange 2004:103 (cat); Oswald 2015 (cat).

Glenoleon franzeni Esben-Petersen 1926:72 (OD); Stange 1976:305 (cat); New 1985b:34 (syn); New 1996:81 (cat); Stange 2004:103 (cat); Oswald 2015 (cat).

Diagnosis – Forewing broad [not thin]; forewing, without a longitudinal brown line [not with a line]; hind wing with an apical spot on dorsal margin [spot not absent]; foretibia longer than foretarsi [not same length]; pronotum mostly black with pale marks [not entirely black]; tibial spurs long [not short]; female posterior gonapophyses set with cavisetae [not absent]; male, 9th sternite straight [not emarginated].

Description – Lengths: forewing: 28 – 33 mm; hind wing: 26 – 30 mm.

Head (A4 Figs 116a-b): *Labrum* pale; with a line of elongate setae. *Clypeus* pale; with few elongate black setae. *Frons* predominantly black, except for ventrolateral corners pale; beset with short black setae. *Gena* pale. *Vertex* raised; in frontal view pale, with two lateral short transverse black lines and a medial dark spot; in dorsal view pale except for two black perpendicular central lines and two large rounded lateral marks on posterior border, covered with short black setae. *Ocular rim* setae absent. *Antennae*

clubbed; elongate, about three times longer than pronotum; distance between antennae wider than scape width; all segments dark-brown to black, but in some specimens basal flagellomeres with a distal pale ring; torular membrane pale; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae. *Mandibles* pale, with tip black. *Palpi*, maxillary and labial mostly pale but with few dark brown marks, mainly at basal and apical segments, apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 116b): *Pronotum* about as long as wide; posterior margin as wide as anterior; subapical furrow present; mostly black with some pale areas: a thin longitudinal line medially (sometimes present only on anterior area), two broader longitudinal lines near center and other two shorter longitudinal lines laterally; covered with short black setae and some long black setae on margins and medially. *Mesonotum* coloration mostly black, with some pale areas: two rounded spots on prescutum, two longitudinal lines on each side of scutum, and two lateral marks on scutellum, in some specimens there is a thin longitudinal line medially; covered with short black setae, and some elongate setae on prescutum. *Metanotum* usually black with two longitudinal pale lines near central area, in some specimens there is a thin longitudinal pale line medially; set with few short black setae. *Pterothoracic pleura* black covered with white setae; Miller's organ present.

Wings (A4 Fig 116c): Fairly broad; anterior Banksian line present in both wings, posterior weakly distinguishable in forewing but absent in hind wing; veins brown, but many intercalated with pale spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane hyaline but with many brown marks generally as follows:

apex, posterior margin, around crossveins, and some larger brown marks at mediocubital and subcostal areas, around gradate crossveins and pterostigma; cubital fork located near Rs origin; three presectoral crossveins, connected by veinlets in some specimens; subcostal veinlets mostly simple, but few distal ones are forked; posterior area smaller than prefork area. *Hind wing* membrane mostly hyaline except for a subapical broad longitudinal brown line and a dorsal brown spot on apex; medial fork located between origins of Rs and MA; subcostal veinlets simple; one presectoral crossvein with a medial spur.

Legs (A4 Figs 116a-b): *All pairs of legs*, femur elongate ($> 2.5x$ length of coxa); femur slightly longer than tibia; tibia longer than tarsi; tibial spurs reaching T1 apex; T2, T3 and T4 about same size, T1 about twice as long as T2, T5 longer than T1; claws longer than half of T5 length; coxa, trochanter, and femur set with short white setae; femur, tibia and tarsi set with short black setae, and scattered long black setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair present, about twice longer than femur width; tibia with antennal cleaning setae ventroapically; coxa black with internal margin pale, trochanter pale, femur dark brown (internal margin lighter in some specimens); tibia dark brown with three pale rings; tarsi dark brown, except for T1 pale. *Midleg* similar to foreleg except for femur base, pale. *Hindleg* with femur and tibia slightly longer than in other legs; color pattern similar to anterior legs, except for tibia pale tip dark brown, and T2 pale.

Abdomen: Sternites with medial area pale with scattered brown lines, but lateral areas brown. Tergites mostly dark brown with four pale marks near center (some specimens

with pale areas reduced and segments almost entirely dark brown). Basal segments beset with short white setae, distal ones covered with short black setae.

Male Terminalia (A4 Figs 117a-d): *Ectoproct* rounded in lateral view, set with elongate black setae. 9th sternite short, with posterior margin corners and medial area rounded in ventral view; covered with elongate black setae. *Gonarcus* arched with posterior area broad and anterior margin acute in lateral view. *Mediuncus* short with tip more sclerotized and broader than base. *Paramere* broad, with ventral and anterior margin curved in lateral view, in posterior view with internal margin more sclerotized.

Female Terminalia (A4 Figs 117e-f): *Ectoproct* rounded covered with thin elongate setae. *Lateral gonapophyses* small, rounded, beset with cavisetae. 7th sternite distal margin straight, covered with long black setae. *Pregenital plate* large, in ventral view with posterior margin straight and long, with two lateral expansions medially, and with a medial acute extension on anterior half; set with few short setae. *Posterior gonapophyses* elongate, with tip slightly enlarged, covered with many long black setae, and some elongate cavisetae on apex. 9th tergite with ventral margin covered with long setae, and with a long membranous digitiform process distally. *Anterior gonapophyses* reduced to a small rounded plate covered with short setae. *Ventral membrane* gonapophyseal plates present.

Distribution (A4 Figs 169) – Australia: NSW*, NT, QLD, and WA. * = new record.

Adult activity period – Records for October to March and June.

Biology – Unknwon, larva unknown.

Primary type – *Glenoleon conspersum*: Holotype (by monotypy), female (ANIC), examined. From original description, Banks (1918): “Type – M. C. Z. 10,067. Queensland: Herberton, 11 February. F. P. Dodd. One specimen”. From New (1985b): “Holotype, ♀, of *Glenoleon conspersum* Banks, Queensland, Herberton, 11 Feb., F. P. Dodd (MCZ 10067 now ANIC)”. Condition: good; terminalia dissected.

Glenoleon franzeni: Syntypes (by original designation), male and female (ZMUC), examined. From original description, Esben-Petersen (1926): “Brisbane, 1926 (L. Franzen leg.). (Type one male and one female in Coll. Franzen one female in the author's collection.)”. From New (1985b): “ ‘Cotype’, ♀, of *Glenoleon franzeni* Esben-Petersen, Queensland, Brisbane 1926, L. Franzen (Copenhagen)”.

Material examined – (17♂, 34♀). **AUSTRALIA: New South Wales:** *Banyabba Nat. Reserve*: Nr Cooldale, 8.i.1971, R. Hardie (3♀, ANIC); **Queensland:** *Archer Ck*: rest area nr Ravenshoe, 17°38'53''S – 145°20'46''E, 13.i.2004, M.S. Moulds & S. Cowan (1♂, AMSA); *Biggenden*: iii.1931 (1♀, ANIC); *Bluff Range*: i.1972 (1♀, ANIC); *Brisbane*: (4♂, 8♀, QLDM); 24.x.1926, L.F./ *Glenoleon franzeni* Esben-Petersen, Coll. M.L. Franzen (1♂, AMSA); 12.xi.1926, L.F. (1♀, AMSA); 8.i.1927 (1♀, QLDM); 26.ii.1927 / *Glenoleon conspersum* det. Esben-Petersen (2♀, ZMUC); ii.1931 (1♂, ANIC); *Bucasia*: i.2003 (1♂, ANIC); *Cape York: Damel* / *Glenoleon falsus* (1♀, ZMHB); *Clermont*: 7.ii.1981, M.S. Moulds & B.J. Moulds / *Glenoleon conspersum* det. T.R. New 1982 (2♂, 2♀, AMSA); *Edungalba*: nr Duaringa, 22.i.1982, M.S. Moulds & B.J. Moulds (1♂, AMSA); *Eungella*: 6.xi.1992 (1♀, QLDM); *Ma Ma Creek*: i.1965, A. Macqueen / *Glenoleon conspersum* det. TR New (1♀, QLDM); *Mareeba*: 25.i.1960 (1♀,

QLDM); *Mount Carbine*: i.1993 (1♂, ANIC); *Mount Isa*: 13 km NW, 357m, 20°34'9''S – 139°29'1''E, 16.i.2004, M.S. Moulds & S. Cowan (1♀, AMSA); *Mount Petrie*: ii.1918, A.E. Show (1♀, ANIC); *Normanby R. x-ing*: 15:17S – 144:50E, 2.i.1994, M.S. Moulds & B.J. Moulds (3♀, AMSA); *Normanby River*: 5 km E, on Battle Camp Rd NW of Cooktown, 15°17'S – 144°52'E, 6.vi.1997, J & A Skevington (1♀, QLDM); *Townsville*: xii.1967 (1♂, ANIC); 12.ii.1948 (1♂, MVM); *Yeppoon*: 29.xi.1965 (1♂, ANIC); **Western Australia**: *Millstream*: Pilbara, 7.ii.1991, D.A.L. Davies (1♀, BMNH); *Tom Price Rd.*: 15 km North along, 150m East of Tom Price Rd., -22.6736S – 117.7725E, 17.ii.2005, 710m, light trap on slope of small hill above dry creek bed dominated by Acacia, M. Bulbert & S.G. Ginn (1♀, AMSA); *Wittenoom*: 4.iii.1994, L. Stange (2♂, 2♀, FSCA). One specimen with label New Holland (1♀, ZMHB).

Comments – The synonym of *Glenoleon franzeni* under *N. conspersum*, proposed by New (1985b), was confirmed here. Both syntypes of *G. franzeni* were seen in this study, and as mentioned by New (1985b) they are almost identical to *N. conspersum* holotype. The similarity between these two species was also noticed by Esben-Petersen, who actually added identification labels of *G. conspersum* in some of his specimens previously identified as *G. franzeni*.

Within *Normanleon*, *N. conspersum* is clearly associated with *N. dissolutus*. Both species are very similar but separated by a few constant characters, all mentioned in the key. New (1985b) mentioned that the species was similar to other large northern species, *A. radialis* and *A. stigmatus*. Indeed in the overall body shape and color of these tree

species are similar, but both male and female terminalia, clearly separate them. For phylogenetic relationships see (A4 Figs 1-3).

***Normanleon dissolutus* (Gerstaecker 1885), new combination**

(A4 Figs 118-119)

Myrmeleon dissolutus Gerstaecker 1885:26 (OD); Gerstaecker 1885b:114 (cit)

Glenurus dissolutus (Gerstaecker): Banks 1910:40 (n. cb.)

Glenoleon dissolutus (Gerstaecker): Banks 1913:224 (n. cb., key); Esben-Petersen 1915:72 (key, ill) [as “*dissolutum*”]; Esben-Petersen 1923:586 (cit); Handschin 1935:690 (cit); Stange 1976:305 (cat); New 1985b:36 (key, rd, ill); New 1996:82 (cat); Whittington 2002:382 (cit); Stange 2004:103 (cat); Oswald 2015 (cat).

Glenoleon mcalpinei New 1985 **New Synonym**. *Glenoleon mcalpinei* New 1985b:35 (OD); New 1996:82 (cat); Stange 2004:104 (cat); Oswald 2015 (cat).

Diagnosis – Forewing broad [not thin]; forewing, without a longitudinal brown line [not with a line]; hind wing without a apical spot on dorsal margin [not with spot]; foretibia as long as foretarsi [not longer]; pronotum mostly black with pale marks [not entirely black]; tibial spurs long [not short]; female posterior gonapophyses set with cavisetae [not absent]; male, 9th sternite straight [not emarginated].

Description – Lengths: forewing: 22 – 34 mm; hind wing: 21 – 32 mm.

Head (A4 Figs 118a-b): *Labrum* pale; set with a line of elongate setae. *Clypeus* pale; with few elongate pale setae, some larger specimens with few long black setae. *Frons* predominantly black, except for ventral area pale; beset with short black setae. *Gena*

pale. *Vertex* raised; in frontal view pale, with five black rounded spots on median line, (some specimens two lateral spots connected forming a short transverse black line); in dorsal view pale except for two black perpendicular central lines and two large rounded lateral marks on posterior border, in some specimens central longitudinal line interrupted near the transversal line, covered with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, > 2.5x length of pronotum; distance between antennae wider than scape width; scape and pedicel black, apical flagellomeres black, subapical segments pale, remaining of flagellomeres dark brown, with a pale distal ring in some specimens; torular membrane pale; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae. *Mandibles* pale, with tip black. *Palpi*, maxillary and labial pale, except for few black spots on basal maxillary segment; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 118b): *Pronotum* about as long as broad; posterior margin as wide as anterior; subapical furrow present; mostly pale with some black marks as follows: two large spots around midline on anterior margin before furrow, a broad longitudinal medial line after furrow (sometimes connected with the two anterior marks), two thin longitudinal curved lines near center of each side (lines medially interrupted in some specimens), a large lateral mark extending from posterior margin until furrow; covered with short black setae and some long black setae on margins. *Mesonotum* mostly black, with some pale areas as follows: two rounded spots on prescutum, a large mark enclosing a thin black line at each side of scutum, a small rounded mark near wing base, two lateral marks on scutellum; covered with short black setae, and some elongate setae

on prescutum. *Metanotum* usually black with two longitudinal broad pale lines near central area, some specimens with a small medial pale triangle on anterior border; covered with few short black setae. *Pterothoracic pleura* black (sometimes with scattered pale marks on borders of few sclerites); set with white setae; Miller's organ present.

Wings (A4 Fig 118c): Fairly broad; anterior Banksian line present in both wings, posterior only distinguishable in forewing of some specimens; veins brown, but some intercalated with pale spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane hyaline but with many brown marks distributed through the whole wing but slightly darker at tip, mediocubital and subcostal areas, gradate veins, and pterostigma (specimens from NT and WA with membrane mostly amber, brown marks reduced); tip of pterostigma white; cubital fork located between origins of Rs and MA; three to four presectoral crossveins, connected by veinlets in some specimens; costal area large, subcostal veinlets mostly simple, but few distal ones forked; posterior area narrower than prefork area. *Hind wing* membrane mostly hyaline except for a large rhegmal spot, (some specimens with rhegmal brown mark larger and connected to pterostigma); medial fork located between origins of Rs and MA; subcostal veinlets simple; one presectoral crossvein, with a medial spur in most specimens.

Legs (A4 Figs 118a-b): *All pairs of legs*, femur long ($> 2.5x$ length of coxa); femur slightly longer than tibia; tibia slightly shorter or about as long as tarsi; tibial spurs reaching T1 apex (few specimens from WA without spurs); T2, T3 and T4 about same size, T1 about twice as long as T2, T5 slightly longer than T1; claws slightly shorter than

T5 length; coxa, trochanter, and femur set with short white setae; femur, tibia and tarsi set with short black setae, and scattered long black setae, femur and tibia with some elongate white setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair slightly shorter than half femur length; tibia with antennal cleaning setae ventroapically; coxa pale with scattered black marks on external margin, trochanter pale, femur mostly pale but apex dark brown (part or whole dorsal surface brown in some specimens); tibia mostly pale, but apex dark brown; T3, T4 and apex of T2 and T5 dark brown, remaining tarsi areas pale. *Midleg* similar to foreleg except for coxa entirely pale, and sense hair slightly shorter. *Hindleg* with femur and tibia slightly longer than in other legs; color pattern similar to midlegs, except for femur and tarsi slightly paler, tibia pale with tip dark brown.

Abdomen: Mostly dark brown, with scattered pale marks in central area, in some specimens sternites (mainly basal ones) mostly pale. Segments beset with elongate white setae, and some short black setae.

Male Terminalia (A4 Figs 119a-d): *Ectoproct* rounded in lateral view, set with elongate black setae. *9th sternite* with posterior margin elongate and rounded medially in ventral view; covered with elongate black setae. *Gonarcus* arched, with posterior area broad, anterior margin acute in lateral view; central area less sclerotized in posterior view. *Mediuncus* with base wide, apical half thin and located between parameres. *Paramere* broad, in lateral view with posteroventral region more sclerotized; in posteroventral view with internal margin rounded with tip straight.

Female Terminalia (A4 Figs 119e-f): *Ectoproct* rounded covered with thin elongate setae. *Lateral gonapophyses* small, rounded, beset with cavisetae. 7th *sternite* distal margin curved, covered with long black setae. *Pregenital plate* large, in ventral view with anterior margin rounded, and with a small acute extension in posterior margin. *Posterior gonapophyses* elongate, with tip curved and slightly enlarged, covered with many long black setae, and some elongate cavisetae at apex. *Anterior gonapophyses* a small rounded plate covered with black setae. 9th *tergite* with ventral margin covered with long setae, and with a long membranous digitiform process distally. *Ventral membrane* gonapophyseal plates present.

Distribution (A4 Fig 169) – Australia: NSW, NT, QLD, and WA. The records presented by New (1985b) do not belong to this species but to *Aurantoleon stigmatus*, see comments below.

Adult activity period – Records for November to May.

Biology – Unknown, larva unknown.

Primary type – *Myrmeleon dissolutus*: Holotype (by implicit monotypy), female (ZIMG), high-resolution image examined. From original description, Gerstaecker (1885a): "Patria: Australia". From New (1985b): "Holotype (?) 'Australia' (Greifswald, not seen) (diagnosis based on specimen det. Esben-Petersen, in ANIC). From New (1996): "Type data: holotype EMAG adult sex indet.*. / Type locality: Australia". From Stange (2004): "Holotype, Australia (EMAU)". Condition: excellent, no parts missing.

Glenoleon mcalpinei: Holotype (by original designation), female (AMSA), high-resolution images examined. From original description, New (1985b): "Holotype, ♀,

Queensland, Claudie R., 1 mile W. Mt Lamond, 16.xii.1971, D. K. McAlpine, G. A. Holloway (AM)”. Condition: good; antennae and left fore and midleg missing.

Material examined – (61♂, 108♀, 6?). **AUSTRALIA: New South Wales:** *Banyabba Nat. Reserve*: i.1971 (1♀, ANIC); *Deriah Aboriginal Area*: 23 km E of Narrabri, - 30.345S - 150.014E, 10.xi.2009, 460m, Ooline, D.R. Britton & J. Recsei (1♂, AMSA); **Northern Territory:** *Alexandria*: 18.iii.1954 (1♀, SAMA); *Andado Stn*: Rodinga Rg, iii.1993 (2♂, 2♀, SAMA); *Borrooloola*: 37 km E, 21.xii.1991, M.S. Moulds & B.J. Moulds (1♂, 2♀, AMSA); 65 km W, 13.xi.2011, D. Marshall (2♀, TAMU); *Burrell’s Ck*: x.1972 (1♀, ANIC); *Cahill Crossing*: xi.1972 (1♂, ANIC); *Cullen R. x-ing*: S of Pine Ck, 3.i.1992, M.S. Moulds & B.J. Moulds (2♀, AMSA); *Daly Arborig. Res.:* x.1974 (1♀, ANIC); *Darwin*: (1♀, ANIC); *Jabiluka Lagoon*: xi.1972 (1♂, ANIC); *Katherine*: xii.2004 (1♀, ANIC); *Keep River x-ing*: Victoria Highway, 7.i.1986, M.S. Moulds & B.J. Moulds (1♀, AMSA); *Keep River Nat. Park*: 15°52’S – 129°03’E, 3.i.1993 (1♀, QLD); *Kununarra*: 110 km E, Victoria Hwy, 26.xii.1991, M.S. Moulds & B.J. Moulds (1♂, 1♀, AMSA); *Larrimah*: (3?, QLD); *Mount Cahill*: xi.1972 (1♀, ANIC); *The Three Ways*: 70 km E, nr Tennant Creek township, 21.i.1984, M.S. Moulds & B.J. Moulds (2♂, 2♀, AMSA); *Victoria R.:* 18 km W of Timber Creek Township, 25.xii.1991, M.S. Moulds & B.J. Moulds (1♀, AMSA); *Victoria Hwy (Hwy 1)*: 30 km W of Katherine, 14°40.776’S - 132°05.142’E, 125m, 30.xi.2011, K. Hill & D. Marshall (1♂, 1♀, AMSA); *Waterhouse River*: Mataranka Hsd, 23.xii.1986, M.S. Moulds & B.J. Moulds (1♂, AMSA); **Queensland:** *Almaden*: Chillagoe Dist., 1931, W.D. Campbell / *Glenoleon conspersus* det. by T.R. New (1♀, AMSA); *Alpha*: 37 km W, 23:37.4S –

146:16.2E, 12.i.2002, Cooley, Cowan, Hill, Marshall & Moulds (1♂, 1♀, AMSA); *Archer River x-ing*: 60 km N of Coen, 29.xii.1983, M.S. Moulds & B.J. Moulds (1♂, 1♀, AMSA); *Bald Hills Stn*: nr turnoff to Laura, N. of Cooktown, 3.i.1981, rainforest, M.S. Moulds & B.J. Moulds (3♂, AMSA); *Biggenden*: xii.1971 (1♀, ANIC); *Biloela*: 14.i.1947 (1♀, QLDM); *Bin Bin Range*: xii.1974 (2♂, ANIC); *Bluff Rg*: xii.1970 (1♂, ANIC); i.1972 (1♀, ANIC); *Brisbane*: (2♀, QLDM); 29.x.1936 (2♂, 1♀, MVM); *Camp Milo*: Cooloola, 3-13.iii.1970, E. Dahms, Open forest, To light (1♂, QLDM); *Campsie River x-ing*: WSW of Charters Towers, 17.i.1984, M.S. Moulds & B.J. Moulds (1♀, AMSA); *Cape York*: 1907, H. Elgret / *Glenoleon conspersus* Banks = *G. franzeni* Esb.-Pet. det by Franzen (1♀, AMSA); *Carnarvon Gorge NP*: at Peter's house, Information Centre Camp, 30.xi.1993, G. Cassis (1♀, AMSA); *Carnarvon Ra*: xii.1938, N. Geary (1♀, AMSA); ii.1944 (1♀, AMSA); *Chillagoe*: 20.i.1988, M.S. Moulds & B.J. Moulds (1♀, AMSA); *Chinchilla*: 12.xi.1990 (3?, QLDM); *Claudie R.*: 4 miles W. Mt. Lamond, 16.xii.1971, mv light, D.K. McAlpinei & G.A. Holloway (1♂, 1♀, AMSA); 11.ii.1914 (1♀, MVM); *Clermont*: (1♂, 2♀, QLDM); 7.ii.1981, M.S. Moulds & B.J. Moulds (1♀, AMSA); x.1922 (1♂, ANIC); xi.1928 (1♀, ANIC); *Coen*: 6.i.1988, M.S. Moulds & B.J. Moulds (2♀, AMSA); *Coleman Riv x-ing*: W of Musgrave, 14°47'55''S – 143°21'34''E, 31.ix.1993 (1♂, QLDM); *Dawson R.*: N of Injune, 25:23:02S – 148:38:44E, 11.i.1999, M.S. Moulds & B.J. Moulds (3♂, 7♀, AMSA); *Degilbo*: xii.1978 (1♂, ANIC); *Hughenden*: 4.ii.1981, M.S. Moulds & B.J. Moulds (3♀, AMSA); *Injune*: 12.ii.1939, N. Geary (1♀, AMSA); 55 km NNE, 23.xi.1986, M.S. Moulds & B.J. Moulds (1♂, AMSA); *Issacs R. x-ing*: Dingo/Mt Flora road, 24.i.1982, M.S. Moulds & B.J. Moulds

(3♀, AMSA); *Leyburn*: 5 km N, 27°58'S – 151°38'E, 3.iv.1993, 450 m, G & A Daniels, CJ Burwell (1♂, QLDM); *Lynd jct.*: 30 km S, Kennedy Dev. Rd, 19:06S – 144:28E, 6.i.2004, Cooley, Hill, Marshall & Moulds (1♀, AMSA); *Mareeba*: 21.i.1951, J.G. Brooks / det. T.R. New *Glenoleon conspersum* (1♂, 1♀, AMSA); 14.xii.1952, J.G. Brooks (1♂, AMSA); 30.xi.1952 (1♂, 3♀, MVM); *McLeod R.*: 9¼mi N Mt Carbini, 9.xii.1965, G.L. Bush, 65133, at UV light (2♀, TAMU); *Miles*: 10.xi.1986 (1♂, 4♀, QLDM); *Monto*: 28 km W, xi.1960 (1♂, 1♀, FSCA); *Mount Garmet*: i.1961 (1♀, ANIC); xii.1970 (3♂, 3♀, ANIC); Archers ck, xii.1964 (1♀, ANIC); *Mount Moffat*: 25°01'22''S – 147°56'59''E, 19.i.1998, J & A Skevington, S Winterton (1♀, QLDM); *Nine Mile Ck*: 14 km NNW of Miles, 24.i.1990, M.S. Moulds & B.J. Moulds (2♀, AMSA); *Noonbah Stn*: SW of Longreach, 24:05.2S – 143:08.7E, 14.i.2002, Cooley, Hill, Marshall & Moulds (1♀, AMSA); *Rocky Creek*: Atherton Tableland, 14.iv.1944, M.C. Nott (1♂, SAMA); *Rolleston*: 43 km S, 24.xi.1986, M.S. Moulds & B.J. Moulds (1♀, AMSA); *Roma*: 30.xi.1930, Franzen, Coll. Esben-Petersen (1♀, ZMUC; 1♂, 1♀, QLDM); ii.1930 (1♀, ANIC); *Sandy Ck*: 29.xi.1997 (1♂, QLDM); *Silver Plains*: Homestead, xii.1959 (1♂, ANIC); i.1962 (1♀, ANIC); i.1963 (1♂, ANIC); ii.1964 (1♀, ANIC); *Stradbroke Is*: xii.1912 (1♂, 1♀, ANIC); *Taroom*: 25°36'S – 149°46'E, xi.1992 (1♂, QLDM); *Thursday Is*: (1♀, ANIC); *Tinnanbar*: 2.5 km S 25°47'S – 152°58'E, 8.xii.2002, C. Burwell (1♂, CSCA); *Townsville*: 10-17.xii.1987, T. Goertemiller (1♂, TAMU; 2♂, FSCA); *Yeppoon*: i.1995 (1♀, ANIC); *York Downs*: 50 km E of weipa, 28.xii.1983, M.S. Moulds & B.J. Moulds (2♀, AMSA); *Weir River*: S of Moonie, 22.xii.1989, M.S. Moulds & B.J. Moulds (2♀, AMSA); **Western Australia**: *Barradale*:

23 km WSW, 22.56S – 114.45E, 30.iii.1971, E.F. Riek (1♀, ANIC); *Dunham River*: 100 km S of Wyndham, 3.i.1986, M.S. Moulds & B.J. Moulds (1♀, AMSA); *Durak R. x-ing*: Gibb River road E. Kimberley, 29.xii.1991, M.S. Moulds & B.J. Moulds (1♂, 1♀, AMSA); *Karonie*: 13mi EbyS, 9.xi.1969, Key & Upton / Key's Field notes. Trip 63, Stop 19422.7 (1♂, ANIC); *Kununurra*: 6.i.1986, M.S. Moulds & B.J. Moulds (2♂, 4♀, AMSA); *Pingagoora*: 14.v.1953 (1♀, SAMA); *Sandfire Flat*: 50 km SW, between Broome and Port Hedland, 15.ii.1977, M.S. Moulds & B.J. Moulds (4♀, AMSA); *Townsville*: 1-9.xi.1987, I. Goertemiller (5♂, 2♀, FSCA); *Wamberry Stn*: Carnarvon, 22.iv.1955, A. Snell (1♀, MVM); *West Strelley River*: 70 km SE Port Hedland, 16.ii.1977, Moulds & B.J. Moulds (1♂, AMSA).

Comments – *Normanleon dissolutus* has been consistently misidentified for the past 100 years based on a significant early misidentification by Esben-Petersen (1915). Gerstaecker (1885a) established the species as *Myrmeleon dissolutus* in a short treatment containing a brief German description, but no illustration. Banks (1910) transferred *dissolutus* to *Glenurus*, commenting that it was similar to his new Australian species *Glenurus stigmatus*. Esben-Petersen (1915), basing his treatment on the descriptions of *dissolutus* Gerstaecker and *stigmatus* Banks (but apparently not having seen the types of either species), transferred *dissolutus* to *Glenoleon* and published a photograph under that name. All subsequent authors, including New (1985a) who last taxonomically reviewed the species (but was not able to examine its type), have apparently interpreted *dissolutus* based on Esben-Petersen's figure. Unfortunately, Esben-Petersen misidentified the specimen in his photograph. Work for this revision, including the

examination of *stigmatus* holotype and *dissolutus* holotype high-resolution photographs, has revealed that the specimen photographed by Esben-Petersen is a dark specimen of *stigmatus* Banks, not *dissolutus* Gerstaecker. Thus, all information published by New, and other authors since Esben-Petersen (1915), under the name *dissolutus* should be interpreted as *stigmatus*. Furthermore, due to the longstanding misinterpretation of the true *dissolutus*, New (1985a) redescribed *dissolutus* under the name *Gleonoleon mcalpinei*, which falls here as a junior synonym. Within *Normanleon* the species is clearly associated with *N. conspersum*, as mentioned in the comments of the later species (A4 Figs 1-3).

***Normanleon falsus* (Walker 1853), new combination**

(A4 Figs 120-121)

Myrmeleon falsus Walker 1853:393 (OD); Gerstaecker 1885b:114 (cit)

Glenurus falsus (Walker): Hagen 1866:405 (n. cb.); Froggatt 1902:361 (rd)

Gleonoleon falsus (Walker): Banks 1913:224 (n. cb.) [mentioned as equal to *G. meteoricus*]; Navás 1914:470 (cit); Esben-Petersen 1915:73 (key) [as “*falsum*”]; Esben-Petersen 1923:586 (cit); Tillyard 1926:323 (cit., im); Handschin 1935:690 (cit); Stange 1976:305 (cat); New 1985b:34 (key, rd, ill); New 1992:44 (cit., ill); New 1996:82 (cat); Stange 2004:104 (cat); Oswald 2015 (cat).

Diagnosis – Forewing thin [not broad]; forewing, without a longitudinal brown line [not with a line]; hind wing with a broad transversal brown band [not with a small spot]; pronotum entirely black [not with pale marks]; tibial spurs long [not short]; female

posterior gonapophyses set with cavisetae [not absent]; male, 9th sternite straight [not emarginated].

Description – Lengths: forewing: 27 – 35 mm; hind wing: 25 – 31 mm.

Head (A4 Figs 120a-b): *Labrum* pale; set with a line of elongate setae. *Clypeus* pale; with elongate white setae. *Frons* black, except for ventrolateral corners; beset with small white setae. *Gena* pale. *Vertex* raised; in frontal view with a pale transversal line, some specimens with a small black spot medially; in dorsal view black; set with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, > 2x length of pronotum; distance between antennae wider than scape width; black, except for a small apical yellow ring on basal flagellomeres; torular membrane yellow; flagellomeres almost as long as wide at base, but apical ones much wider than long; all segments set with short black setae. *Mandibles* pale to light brown, darker at tip. *Palpi*, maxillary and labial pale to light brown with dorsal surface and distal segments generally darker, apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 120b): *Pronotum* about as long as wide; posterior margin as wide as anterior; subapical furrow present in some specimens; black; set with short black setae and long setae located medially and on margins; ventrally with some elongate white setae. *Pterothorax* black; with many short and long black setae, mostly located on mesoprescutum. *Pterothoracic pleura* black, set with elongate white and black setae, Miller's organ present.

Wings (A4 Fig 120c): Rather narrow with tip acute; anterior Banksian line present in both wings, but posterior only distinguishable in forewing of some specimens; veins set

with short black setae, in general brown, except for some specimens with main longitudinal veins intercalated by numerous short white regions. *Male pilula axillaris* present. *Forewing* membrane almost hyaline (slightly darker than hind wing) with brown marks generally concentrated on posterior margin, tip, pterostigma, subcostal area, and mediocubital cells; mediocubital area with cells much longer than wide; cubital fork located near Rs origin Rs; three to five presectoral crossveins (irregularly forked and linked in some specimens); subcostal veinlets simple, but a few forked in some specimens; posterior area narrower than prefork area. *Hind wing* membrane mostly hyaline except for a large brown subapical band; medial fork located near Rs origin; subcostal veinlets simple; one presectoral crossvein, with a medial spur.

Legs: *All pairs of legs*, femur elongate ($> 2.5x$ length of coxa); tibia about same size of femur but slightly longer than tarsi; tibial spurs long, reaching T1 apex; T2, T3 and T4 about same size, T1 about twice as long as T2, T5 little longer than T1; claws about half of T5 length; coxa, trochanter, and femur set with short and few long white setae; femur, tibia and tarsi set with short black setae, and scattered long black setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* femur generally slightly thicker than in other legs; sense hair longer than femur width; tibia with antennal cleaning setae ventroapically; all segments black, except for trochanter and femur ventral surface, pale. *Midleg* with same color pattern of foreleg, but femur ventral pale area generally larger. *Hindleg* with femur, tibia and T1 slightly longer than in other legs; color pattern similar to midleg, except for T1 basally and most part of tibia, pale.

Abdomen: Usually entirely black, but some specimens present irregular pale spots on sternites.

Male Terminalia (A4 Figs 121a-c): *Ectoproct* rounded in lateral view, set with elongate black setae. *9th sternite* in ventral view, with posterior margin with a shallow medial concavity; set with elongate black setae. *Gonarcus* broad posteriorly but with anterior margin acute in lateral view. *Mediuncus* small, with tip rounded in posterior view. *Paramere* elongate with tip sclerotized and partially folded in posterior view.

Female Terminalia (A4 Figs 121d-e): *Ectoproct* rounded set with long black setae. *Lateral gonapophyses* rounded, shorter than ectoproct; set with some cavisetae. *7th sternite* with distal margin straight and covered with elongate black setae in ventral view. *Pregenital plate* elliptic with a medial sclerotized triangle on posterior margin. *Posterior gonapophyses* broad, elongate, set with long black setae and elongate cavisetae apically. *9th tergite* with a short membranous digitiform process. *Anterior gonapophyses* reduced to a small rounded plate covered with black setae. *Ventral membrane gonapophyseal plates* present.

Distribution (A4 Fig 168) – Australia: NSW, QLD, TAS, VIC, and WA. Solomon Islands (new record). The Solomon Island record seems a little doubtful, but the specimen was collected and identified by W. Froggatt who had collected many insects during that time on this country. Interestingly *G. falsus* is one of the few Dendroleontini species with records out of mainland Australia (Tasmania), although the Solomon Islands are much farther and this distribution seems to be unnatural. Only further collecting efforts in those island will be need to solve this question.

Adult activity period – Records for August to May.

Biology – Unknwon, larva unknown.

Primary type – Lectotype (by subsequent designation), male (BMNH), high-resolution images examined. From original description, Walker (1853): “a. New South Wales. Presented by J. W. Evans, Esq. / b. Port Stephen, New Holland. Presented by the Earl of Derby”. From New (1985b): “Holotype ♂, paratype ♀, of *Myrmeleon falsus* Walker (BMNH) (seen)”. From New (1996): “Type data: holotype BMNH ♂, paratype BMNH ♀. / Type locality: unknown”. From Stange (2004): “Male, female, syntypes, no data (BMNH)”. The original description Walker (1853) did not fix holotype, but specified two syntypes. However the statement made by New (1985b), where he pointed out the male specimens as the holotype and the female as the paratype, is considered here as an explicit differentiation among the type series, what according to the nomenclatural code (article 74.5) should be considered as a lectotype designation. By this reason the male specimen (“a” from the original description) is considered here as the lectotype, and the female (“b” from the original description) as the paralectotype. Condition: good; left antennae and foreleg missing.

Material examined – (38 ♂, 61 ♀): **AUSTRALIA: ACT:** *Black Mt.*: 6.ii.1930, J.W. Evans (1♀, ANIC); *Campbell*: 18.xii.1987, JB & Ginward (1♂, 1♀, BMNH); ii-iii.1967, light trap (1♀, ANIC); *Canberra*: ii.1910 (2♀, ANIC); xii.1928 (1♀, ANIC); 30.iii.1931 (1♀, ANIC); 15.ii.1944 (1♀, ANIC); 21.iii.1948 (1♂, ANIC); 5.xii.1949 (2♀, ANIC); 4.ii.1957 (5♀, 1♂, ANIC); 5.ii.1960 (1♂, ANIC); 7.iii.1960, E. F. Riek (1♂, ANIC); 12.i.1961 (1♀, ANIC); 13.ii.1962 (2♀, ANIC); 30.i.1970 (1♂, ANIC); 19.iii.1970 (1♀,

ANIC); 20.i.1961, Ex – Acacia, K.G. Swenson (1♀, OSU); 25.xii.1962, E. shipp (1♀, AMSA); 12.ii.1980 (1♂, ANIC); 5.i.81, D. Ferguson (1♀, BMNH); 30.xii.1964 (1♀, MVM); *Yass*: 6.ii.1930, K. English (1♂, ANIC); **New South Wales**: *Armidale*: 30.ix.1966 (1♀, ANIC); 8.ii.1960 (1♂, ANIC); 26.i.1967 (1♀, ANIC); 28.xi.1960 (1♀, ANIC); *Blackheath*: 6.xii.1946 (1♀, MVM); *Blue Mountains*: Hazelbrook, i.1985, light, M. Dingley (1♂, 1♀, AMSA); ii.1985 (1♂, AMSA); 20.viii.1901, Froggatt (1♂, ANIC); *Bombala*: ii.30, Rev.A.J. Barrett (2♀, AMSA); *Enfield*: 31.xii.1908 (1♀, AMSA); *Goulburn*: 20.ii.1970 (1♀, ANIC); *Hornsby*: ii.10 (1♀, AMSA); 4.i.1917 (1♀, ANIC); *Jervis Bay*: 1.ii.1936 (1♀, ANIC); *Leura*: 27.iii.1917 (1♀, ANIC); *Merimbula*: 21.i.1960, K.R. Norris (1♂, ANIC); *Mt Kosciusko*: 25.i.1914 (1♂, ANIC); *Nimmitabel*: 12.ii.1963, D. McMichael (1♂, AMSA); *Richmond*: 24.ii.1980, N.W. Rodd (1♂, AMSA); *Roseville*: 16.i.04 (1♂, AMSA); 25.i.04 (1♂, AMSA); *Sydney*: (1♂, AMSA); 10.ii.1912 (1♂, ANIC); xii.1946 (1♀, MVM); Museum grounds, 13.ix.07 (1♂, AMSA); Burwood, ii.1928, Miss Sanders (1♂, AMSA); **Queensland**: *Brisbane*: (1♂, 2♀, QLDM); *Clermont*: 29.ii.20, E.J.D. (1♀, QLDM); *Northgate*: 13.i.38, J.A. Beck (1♀, QLDM); *Stanthorpe*: 19..1926 (1♂, QLDM); **South Australia**: *Adelaide*: (1♀, SAMA); 8.i.1910 (1♂, SAMA); iii.1936 (1♀, SAMA); *Belair*: 5.iii.1982 (1♀, SAMA); *Blakis Stn*: 25.i.1892 (1♀, SAMA); *Blackwood*: ii.1966 (1♂, SAMA); *Brookfield Con. Pk*: 34.21S – 139.29E, iii-iv.1992 (1♀, ANIC); *Georgetown*: (1♂, SAMA); *Kangaroo Island*: Birchmore Lagoon 15m from Kingscote, E. Troughton (1♀, AMSA); **Tasmania**: *Launceston*: iii.1943, S. Bowring (1♀, AMSA); (2♂, SAMA); **Victoria**: 20.xii.1902 (1♀, ANIC); *Balwyn*: 17.ii.1912 (1♀, MVM); *Giffard*: i.1951 (1♀, MVM);

Greensborough: 3.i.1949 (1♂, MVM); *Kew*: Peel stn, 14.ii.1911 (1♀, MVM); *Kinglake*: 2.xii.1945 (1♂, MVM); *Melbourne*: 28.ii.1909 (1♀, MVM); 21.ii.1929 (2♂, MVM); ii.1933 (1♀, MVM); (1♂, SAMA); *Murrumbreena*: 19.ii.1901 (1♀, MVM); *Ringwood*: 4.xii.1927 (1♀, MVM); *Seaford*: 22.ii.1953 (1♀, MVM); *Stawell*: 19.v.1895 (1♂, MVM); **SOLOMON ISLANDS**: iv.1913, Coll & Det. W.W. Froggatt (1♀, ANIC); **Location not recognized**: Saunder's Coll., iii.68 (1♀, BMNH); **No label**: (1♂, ANIC; 1♂, SAMA; 2♀, MVM).

Comments – *Normanleon falsus* is relatively common in eastern Australia. Its dark coloration and singular brown band on the hind wing easily distinguish the species. For phylogenetic relationships see (A4 Figs 1-3).

***Normanleon meteoricus* (Gerstaecker 1885), new combination**

(A4 Figs 122-123)

Myrmeleon meteoricus Gerstaecker 1885a:25 (OD); Gerstaecker 1885b:114 (cit).

Glenoleon meteoricus (Gerstaecker): Banks 1913:224 (n. cb.) [= *G. falsus*]; Esben-Petersen 1915:72 (key, ill) [as “meteoricum”]; Esben-Petersen 1923:586 (cit); Esben-Petersen 1926:12 (cit); Stange 1976:305 (cat); New 1985b:40 (key, rd, ill); New 1996:82 (cat); Stange 2004:104 (cat); Oswald 2015 (cat).

Diagnosis – Forewing thin [not broad]; forewing, without a long longitudinal brown line [line not present]; pronotum mostly black with pale marks [not entirely black]; tibial spurs long [not short]; female posterior gonapophyses with cavisetae absent [not present]; male, 9th sternite emarginated with sides elongate [not with margin straight].

Description – Lengths: forewing: 24 – 33 mm; hind wing: 21 – 30 mm.

Head (A4 Figs 122a-b): *Labrum* pale with a line of elongate setae. *Clypeus* pale; set with some elongate pale setae. *Frons* predominantly shiny black, except for ventrolateral corner, pale; set with short black setae. *Gena* pale. *Vertex* raised; in frontal view pale, with a median black line (interrupted centrally); in dorsal view mostly pale with a transversal black central line and three posterior marks; covered with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, > 2x length of pronotum; distance between antennae wider than scape width; scape and pedicel dark brown, flagellum brown with a pale dorsal ring on basal flagellomeres, apical ones generally darker; torular membrane dark brown; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae. *Mandibles* mostly pale, with tip black. *Palpi*, maxillary and labial mostly pale, except for dark spots on basal segments, and distal segments entirely brown; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 122b): *Pronotum* about as long as wide; posterior margin as wide as anterior; subapical furrow present; mostly dark brown except for some pale lines: two small medial longitudinal, two small curved on anterior area, and two sinuous on posterior area; beset with short black setae and few elongate near margins. *Mesonotum* mostly dark brown, with some pale marks as follows: two small spots on prescutum, two longitudinal lines on scutum, posterior margin of scutellum; covered with short black setae (setae on prescutum longer). *Metanotum* dark brown, with some irregular pale areas, mainly on scutum medial area; set with few short black setae. *Pterothoracic*

pleura mostly dark brown with irregular pale areas on sclerites margins; covered with short white setae, except for anterior segments with black setae; Miller's organ present.

Wings (A4 Fig 122c): Rather narrow with tip acute; anterior Banksian line present in both wings, posterior distinguishable only in the forewing; veins mostly dark brown, but some veins intercalated with white spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline with brown marks concentrated on tip, posterior margin, gradate veins, pterostigma, subcostal area, and parts of mediocubital area; cubital fork located near Rs origin; three or four presectoral crossveins; costal area large with most veinlets simple, but few forked; posterior area narrower than prefork area. *Hind wing* membrane mostly hyaline except for a small brown mark beneath pterostigma, and a large brown spot on rhegmal area; medial fork located between origins of Rs and MA; subcostal veinlets simple; one presectoral crossvein, with medial spur.

Legs: *All pairs of legs*, femur elongate ($> 2.5x$ length of coxa); tibia and femur about same size, but longer than tarsi; tibial spurs surpassing T1 apex; T3 and T4 about same size, T2 slightly longer than T3, T1 slightly longer than T2, T5 twice longer than T1; claws about half of T5 length; coxa, trochanter and femur set with short white setae; femur, tibia and tarsi set with short black setae, and scattered long black setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair about half of femur length; tibia with antennal cleaning setae ventroapically; coxa dark brown with some pale areas on anterior surface, trochanter light brown, femur dark brown with pale areas on anterior surface in some specimens, tibia mostly dark brown with three pale

rings (some specimens anterior surface pale); tarsi dark brown, except for T1 mostly pale with tip dark. *Midleg* with same color pattern of foreleg. *Hindleg* with femur, tibia and T1 slightly longer than in other legs; color pattern similar to anterior legs, except for tibia pale with tip dark brown, and T1 and base of T2 pale.

Abdomen: Segments mostly dark brown with scattered pale marks mainly in central areas; beset with short white setae on basal segments and short black setae on distal segments.

Male Terminalia (A4 Figs 123a-d): *Ectoproct* rounded in lateral view, set with elongate black setae. *9th sternite* posterior margin emarginated with sides elongate in ventral view; set with long black setae. *Gonarcus* broad and arched; anterior margin thinner than posterior in lateral view. *Mediuncus* short with tip rounded. *Paramere* large with tip sclerotized, curved and medially fused in ventral view.

Female Terminalia (A4 Figs 123e-f): *Ectoproct* rounded, covered with thin elongate setae. *Lateral gonapophyses* rounded, about same size as ectoproct, set with cavisetae. *7th sternite* distal margin straight in ventral view; covered with long black setae. *Pregenital plate* shaped like a “goblet”. *Posterior gonapophyses* broad, elongate, with tip curved; covered with long black setae. *9th tergite* with a short membranous digitiform process. *Anterior gonapophyses* absent. *Ventral membrane* gonapophyseal plates present.

Distribution (A4 Figs 169) – Australia: NSW, NT, QLD, SA, VIC, and WA.

Adult activity period – Records for November to May.

Biology – Unknwon, larva unknown.

Primary type – Syntypes (by original designation), male & female (ZIMG), high-resolution images examined. From original description, Gerstaecker (1885a): “(mas, fem.) -- Patria: Peak Downs Australiae”. From New 1985: “Holotype: ‘Australia’ (Greifswald, not seen) (diagnosis based on specimens det. by Esben-Petersen and Tillyard, ANIC)”. From Stange (2004): “Holotype, Australia (EMAU)”. The holotype statements of New (1985b) and Stange (2004) are incorrect; in the original description Gerstaecker explicit mentions at least two specimens and did not fix a holotype. The holotype statements made by subsequent authors do not explicitly select a single specimen from the type series to be the true primary type, so do not qualify as lectotypes designations under Art. 74.5. Syntypes: condition: both very good.

Material examined – (104♂, 146♀). **AUSTRALIA: ACT:** *Black Mountain:* ii.1947 (1♀, ANIC); *Canberra:* 2.iii.1960, E.F. Riek (2♂, 1♀, FSCA); iii.1929 (1♀, ANIC); ii.1931 (1♀, ANIC); iii.1946 (1♀, ANIC); i.1960 (1♂, 1♀, ANIC); ii.1960 (2♂, 2♀, ANIC); 7.iii.1960 (1♂, ANIC); 10.iii.1961 (1♂, ANIC); iii.1957 (3♀, ANIC); iii.1963 (1♂, ANIC); **New South Wales:** *Bogan R.:* (1♂, ANIC); *Callubri Nyngan:* iii.1936, J. Armstrong (1♀, AMSA); *Dunedoo:* 3.ii.1966, C.N. Smithers (1♀, AMSA); *Cowan Stn:* iii.1953 (1♀, ANIC); *Goonoo State Forest:* 5mi S. of Mendooran, 22.iii.1971, D.K. McAlpine (1♂, AMSA); 23.iii.1971 (1♂, 1♀, AMSA); 25.iii.1971 (1♀, AMSA); *Enfield:* 5.iii.1904 (1♀, AMSA); *Ingleburn:* ii.1915 (2♀, ANIC); *Lightning Ridge:* 30 km S, 27.xii.1988, M.S. & B.J. Moulds (1♀, AMSA); *Mendooran:* 5mi S., 19.ii.1972, mv lamp, G. Daniels (1♀, AMSA); *Nombinnie Nature Reserv.:* 18 air km SSE Mount Hope, 160m, 32.99613°S – 145.94006°E±70m, 3.i.2013, M.V., Oswald, Diehl &

Machado, Oswald #626 (1♀, TAMU); *Sydney*: (2♀, ANIC); *Temora*: 2.iii.1974 (1♀, ANIC); *Tuross*: 17-22.i.1936, K.C. McKeown (1♂, AMSA); *Ulan*: xii.1982 (1♀, ANIC); *Wagga area*: ii.1964 (1♀, ANIC); *Warrubungle N.P.*: Buckley's Creek, 31°16.083S – 149°00.344E, 13.iii-8.iv.2008, S. Winterton (1♂, CSCA); *Wheogo*: near Dunedoo, xii.1927, A. Musgrave (1♂, 1♀, AMSA); *Wingabutta Creek*: 23mi N. of Mendooran, 27.iii.1971, D.K. McAlpine (1♀, AMSA); **Northern Territory**: *Ayer's Rock*: 16 km E, 18.v.1983, at light, G.A. Holloway (1♂, AMSA); *Center of Australia Marker*: iii.1993 (1♂, SAMA); **Queensland**: *Amby*: W of Roma, 12.ii.1981, M.S. & B.J. Moulds (1♀, AMSA); *Barcaldine*: 10.ii.1981, M.S. & B.J. Moulds (1♂, AMSA); *Bluff Range*: 21.xii.1970 (1♂, ANIC); *Brisbane*: i.1926 (1♀, ANIC); 10.iii.1926 (1♂, ZMUC); 11.iv.1926 (1♂, ZMUC); 13.xi.1926 (1♀, ZMUC); 13.ii.1927 (1♂, AMSA); *Carnarvon Rge*: 12.xii.1938, N. Geary (1♀, AMSA); 17.xii.1938 (1♀, AMSA); iii.1944 (1♀, AMSA); *Chinchilla*: 9.i.1986, light, Grace Lithgow (1♂, QLDM); 27.ii.1986 (1♀, QLDM); *Clermont*: 8 km S, 18.iii.1982, M.S. & B.J. Moulds (5♀, AMSA); iii.1920 (1♂, ANIC); *Injune*: 55 km NNE, 23.x.1986, M.S. & B.J. Moulds (1♀, AMSA); *Lake Broadwater*: nr Dalby, 27°21'S – 151°06'E, 2.v.1987, G & A Daniels (1♀, QLDM); *Millmerram*: iv.1957 (1♂, ANIC); *Rock Poll*: ridge, Carnarvon Gorge NP, 25°3'51.7''S - 148°14'38.3''E, 405m, 27.iv.2006, MV lamp, D.R. Britton & J.R. Weiner (1♂, AMSA); *Stanthorpe*: ii.1923 (1♂, QLDM); **South Australia**: *Adelaide*: (1♂, SAMA); *Anna Ck Stn*: iv.2004 (1♀, SAMA); *Billiatt CP*: S Alawoona, iii.2000 (2♀, SAMA); *Blackwood*: ii.1965 (1♀, SAMA); iii.1965 (1♀, SAMA); ii.1966 (1♀, SAMA); iv.1966 (1♂, SAMA); iii.1967 (1♀, SAMA); ii.1969 (2♀, SAMA); i.1960 (1♀, SAMA);

Ceduna: iii.1963 (1♀, ANIC); *Danggali CP*: iii.2001 (7♂, 7♀, SAMA); *Emu Junction*:
 iv.1994 (6♂, 6♀, SAMA); *Eyre Pen.*: Colona, iv.2008 (2♀, SAMA); *Iron Knob*: iii.1963
 (2♀, 1♂, ANIC); 16.iii.1968 (1♀, ANIC); 28.iii.1964, G.L. Bush (1♂, FSCA);
Kangaroo Is: i.1986 (1♂, SAMA); *Kurlge*: Blackwood, iv.1957 (1♂, SAMA); .iii.1962
 (2♂, 2♀, SAMA); *Malinong*: iv.2010 (1♂, SAMA); *Moorundie*: iii.1973, G. Hall (1♀,
 ANIC); *Mount Chambers Gorge*: iii.1973 (1♀, SAMA); *Murat Bay*: (1♀, SAMA);
Narrina Stn: iii.1999 (1♀, SAMA); *Nullarbor*: 40 miles E, 18.iii.1968, I.F.B. Common
 & M.S. Upton (1♂, ANIC); *Oak Valley*: v.2002 (1♂, 1♀, SAMA); *Pantaltjara*: iii.1996
 (1♂, 1♀, SAMA); *Pinkawillinia*: iii.1996 (2♂, 1♀, SAMA); *Portee Stn*: iii.1973 (1♀,
 SAMA); *Reedy Ck*: ii.1962 (2♀, SAMA); *Serpentine Lakes*: iv.1994 (3♂, 10♀, SAMA);
Tintinara: ii.1985 (2♂, 6♀, SAMA); *Venus Bay*: ii.1994 (1♀, SAMA); *Vokes Hill*:
 iv.1994 (1♂, 2♀, SAMA); *Yalata Mission*: 21.iii.1971, Upton & Mitchell (5♀, ANIC);
Yalata Mission: 14 km NNW, 31.22S – 131.47E, 9.iv.1983, E.S. Nielsen & E.D.
 Edwards (1♂, ANIC); *Yeelanna*: (1♂, 1♀, SAMA); *Yunta*: i.1943 (1♂, 2♀, MVM);
Willmington: i.1943 (1♀, SAMA); **Victoria**: *Bendigo*: 5.i.1930 (1♀, MVM);
Broadmeadows: 25.ii.1931 (1♀, MVM); *Cobram*: 13.i.1944 (1♂, 2♀, MVM); *Kiata*:
 i.1979 (1♂, SAMA); *Lake Hattah*: 15.ii.1969 (1♂, MVM); *Lake Meran*: 7.iii.1948 (1♀,
 MVM); *Mallee*: 19.ii.1914 (1♂, 1♀, MVM); *Ouyen*: 1mi S, 14.iii.1966, M.S. Upton &
 J.A. Grant (3♀, ANIC); *Taratap Stn*: i.1965 (1♀, SAMA); *Tatura*: ii.1893 (1♂, 1♀,
 MVM); *Warook*: v.1935 (1♂, SAMA); *Wedderburn*: 26 km SE, 12.xi.1989, R.B. Miller
 (1♂, FSCA); **Western Australia**: *Austin*: 27°36.51'S - 117°53.3'E, 24.iii.2005, 410m,
 D. Brzoska (1♂, AMSA); *Balledonia*: iii.1996 (2♂, 3♀, SAMA); *Beverley*: (1♀,

SAMA); *Binneringie*: (2♂, 1♀, SAMA); *Cave Hill*: iii.1995 (1♂, 1♀, SAMA); iii.1996 (2♀, SAMA); *Coolgardie*: iii.1996 (5♀, 3♂, ANIC); *Grass Patch*: iii.1996 (1♂, 1♀, SAMA); *Kambalda*: iii.1996 (1♂, 1♀, SAMA); *Lake Johnston*: iii.1996 (2♀, SAMA); *Lake Marmion*: iii.1996 (3♂, 2♀, SAMA); *Madura*: iii.1968 (1♀, 1♂ ANIC); iv.1968 (1♀, ANIC); *Murchison*: 27.iii.1971 (2♂, ANIC); *New Eucla*: 22.iii.1971, Upton & Mitchell (3♀, 2♂, ANIC); *Norseman*: xi.1958 (1♀, ANIC); *Northampton*: iv.1968 (2♀, 1♂, ANIC); *Northam*: iii.1959 (2♂, 2♀, MVM); *Old Pinjin*: near Lake Rebecca, iii.1996 (1♀, SAMA); *Perth*: 19mi ENE, 30.i.1967, M.S. Upton (1♀, ANIC); **NO LABEL**: (1♂, MVM; 1♂, SAMA).

Comments – See comments for *N. berthoudi* and *N. falsus*.

***Paraustrogymnocnemia* new genus**

Type species: *Gymnocnemia interrupta* Esben-Petersen 1915, by present designation.

Diagnosis – Ocular setae absent [not present]; tibial spurs absent [not present]; male gonarcus anterior margin acute [not rounded]; male paramere with apical hook absent [not present]; male paramere anterior margin acute [not present] anterior gonapophyses absent [not present as plate or digitiform]; posterior gonapophyses with tip enlarged and rounded [not absent or present and recurved].

Description – Head: *Vertex* strongly raised. *Ocular rim* setae absent. *Antennae* clubbed and elongate; flagellomeres almost as long as wide at base, apical ones slightly wider than long. *Palpimacula* oval-shaped, located medially. Thorax: *Pronotum* almost as long as wide. Miller's organ present. Wings: rather narrow and acute. *Anterior Banksian* line

present in both wings, posterior present in the forewing. *Forewing* prefork area wider than posterior area and with few of longitudinal crossveins. *Hind wing* with one presectoral crossvein. *Male pilula axillaris* present. Legs: *Forefemur* > 2x length of forecoxa length. *Foretibia* and foretarsi about same size. *Sense hair* absent or slightly longer than forefemur width. Male Terminalia: *Ectoproct* rounded; *gonarcus* anterior margin acute; *paramere* with anterior margin acute, and posterior rounded. Female Terminalia: *Ectoproct* rounded; *lateral gonapophyses* small and set with few thickened setae; *posterior gonapophyses* long with tip rounded and enlarged, set with few cavisetae on apex; *anterior gonapophyses* absent; 9th *tergite* with a membranous digitiform process; *pregenital plate* with anterior margin curved, with medial distal margin enlarged.

Distribution (A4 Fig 170) – Australia: NSW, NT, QLD, SA, and WA.

Comments – Following the discussion presented in *Austrogymnocnemia*, this new genus originated from the division of the original genus. *Paraustrogymnocnemia* is a small genus containing three species, the new species *P. diehli* and *P. interrupta* and *P. lineata*, both previously placed in *Austrogymnocnemia* (New 1985b). This new genera is closely associated with *Austrogymnocnemia*, as indicate by both molecular and morphological phylogeny (A4 Figs 1-3). Both genera share many characters but are easily separated based on the male and female terminalia.

Biology – Unknown.

Etymology – The genus name is derived from the Greek prefix *para* (= beside, near) and refers to the closeness between the new genus and *Austrogymnocnemia*.

Key to species of *Paraustrogymnocnemia*

- 1 Body mostly dark; clypeus with two rounded dark marks (A4 Fig 126a); forewing with at least basal half of mediocubital area dark (A4 Fig 126c).....2
- 1' Body mostly gray; clypeus entirely pale (A4 Fig 124a); forewing mediocubital area hyaline (A4 Fig 124c).....*P. diehli*
- 2 Forewing mediocubital streak interrupted medially (A4 Fig 126c)....*P. interrupta*
- 2' Forewing mediocubital streak not interrupted (A4 Fig 128c).....*P. lineata*

***Paraustrogymnocnemia diehli*, new species**

(A4 Figs 124-125)

Diagnosis – tibial spurs absent [not present]; male gonarcus anterior margin acute [not rounded]; male paramere with apical hook absent [not present]; male paramere anterior margin acute [not rounded]; posterior gonapophyses with tip enlarged and rounded [not absent or present and recurved]; body color mostly grey [not dark]; forewing mediocubital area hyaline [not with a longitudinal dark line].

Description – Lengths: forewing: 18 – 23 mm; hind wing: 16 – 21 mm.

Head (A4 Figs 124a-b): *Labrum* pale, set with a line of elongate setae. *Clypeus* pale, with few elongate black setae. *Frons* mostly shiny brown with ventral margin pale, in some specimens there is a small central brown mark; covered with few short black setae. *Gena* pale. *Vertex* raised; in frontal view grey, with two short transversal dark marks laterally and a rounded central dark spot; in dorsal view mostly grey with two central perpendicular dark lines and two dark marks posterolaterally (some specimens posterior

margin and a small area near ocular rim pale); covered with short black setae anteriorly, and white posteriorly, in some specimens the white setae cover the whole head. *Ocular rim* setae absent. *Antennae* clubbed; elongate, about three times longer than pronotum; distance between antennae wider than scape width; mostly brown with distal margin of segments pale, and anterior surface of four to five subapical flagellomeres pale, in some specimens posterior surface of these subapical flagellomeres also with pale areas; torular membrane pale; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae. *Mandibles* pale, with tip black. *Palpi*, maxillary and labial pale with area enclosing palpimacula brown; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 124b): *Pronotum* about as long as wide; posterior margin as wide as anterior; subapical furrow present; mostly greyish with darker longitudinal lines: two around midline and two lateral (some specimens with two spots at furrow and two on posterior margin); beset with short white setae, few black setae, and some long white setae on borders. *Mesonotum* grey with a sagittal dark brown band and four narrower lateral bands on each side of scutum; covered with short white setae. *Metanotum* grey with irregular dark marks mainly at scutum; with short white setae. *Pterothoracic pleura* grey; covered with white setae; Miller's organ present.

Wings (A4 Fig 124c): Rather narrow with tip acute; anterior Banksian line present in both wings, but posterior present only in the forewing. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline with two apical longitudinal brown marks, one around anterior Banksian line and other near inferior margin, veins mostly white,

Subcosta intercalated with brown spots, cubital crossveins, veins near border, and at anterior Banksian line black; in some specimens area around the black cubital crossveins brown infuscated, cubital fork located about the same place of Rs origin; three presectoral crossveins; subcostal veinlets simple; posterior area narrower than prefork area. *Hind wing* membrane mostly hyaline except for a brown longitudinal mark at rhegmal area; veins mostly white, except for some dark crossveins at anterior Banksian line and at the brown mark; medial fork located near Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 124a-b): *All pairs of legs*, femur elongate ($> 2x$ length of coxa); tibia and tarsi about same size, but slightly shorter than femur; tibial spurs absent; T3 and T4 about same size, T2 slightly longer than T3, T1 slightly longer than T2 and T5 about twice longer than T1; claws slightly longer than half of T5 length; coxa, trochanter, femur and tibia set with short white setae; trochanter, femur, tibia and tarsi set with short black setae, and scattered long setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair slightly longer than femur width; tibia with antennal cleaning setae ventroapically; coxa grey with internal surface pale, trochanter pale, femur internal surface pale, external brown, tibia pale with three irregular brown marks, tarsi pale. *Midleg* with color pattern similar to foreleg, except for femur with anterior surface brown, and posterior pale. *Hindleg* with femur, tibia and T1 slightly longer than in other legs; color pattern similar to midleg, except for tibia pale.

Abdomen: Mostly grey except for distal margin of segments, pleura, and apical segments pale; covered with short white setae.

Male Terminalia (A4 Figs 125a-c): *Ectoproct* rounded in lateral view set with elongate black setae. 9th sternite short, with posterior margin straight in ventral view; set with elongate black setae. *Gonarcus* broad, arched, with anterior margin thin and elongate in lateral view; with medial area less sclerotized in posterior view. *Mediuncus* absent. *Paramere* broad, with anterior margin acute, and with tip and ventral margin more sclerotized in lateral view.

Female Terminalia (A4 Figs 125d-e): *Ectoproct* rounded, covered with thin elongate setae. *Lateral gonapophyses* rounded, much smaller than ectoproct, set with few thickened setae. 7th sternite long, with distal margin straight, covered with black setae. *Pregenital plate* with anterior margin elongate, and distal medial region enlarged with a central line more sclerotized. *Posterior gonapophyses* wide, elongate, with tip rounded and large; covered with long black setae, and with few cavisetae apically. 9th tergite with an elongate membranous digitiform process. *Anterior gonapophyses* absent. *Ventral membrane* gonapophyseal plates present.

Distribution (A4 Fig 170) – Australia: NT, QLD, and WA.

Adult activity period – Records for October to December.

Biology – Unknwon, larva unknown.

Etymology – The species is named after the entomologist Ben Diehl, who collected most of the type series, and helped during the development of this study and the species identification.

Primary type – Holotype (by present designation), female, (WAM). **AUSTRALIA:**
Western Australia: hwy 138, 9 air km EENE, Newman, 520m, 23.34699°S –

119.82137°E±80m, Oswald, Diehl & Machado, 25.xii.2012, M V, Oswald #616 // TAMU – ENTO X0909441. Condition: pinned; good; terminalia dissected.

Paratype: AUSTRALIA: Western Australia: All with same data as holotype: TAMU – ENTO X0909143 (1♂, WAM, pinned); TAMU – ENTO X0910644 (1♀, AMSA, pinned); TAMU – ENTO X0909415 (1♂, AMSA, pinned); TAMU – ENTO X0910290 (1♀, ANIC, pinned); TAMU – ENTO X0910665 (1♂, ANIC, pinned); TAMU – ENTO X0909832 (1♀, TAMU, pinned); TAMU – ENTO X0909401 (1♀, TAMU, pinned); TAMU – ENTO X0909822 (1♀, TAMU, pinned); TAMU – ENTO X0909780 (1♀, TAMU, pinned); TAMU – ENTO X0911267 (1♂, TAMU, pinned); TAMU – ENTO X0909086 (1♂, TAMU, pinned); TAMU – ENTO X0910251 (1♂, TAMU, pinned); TAMU – ENTO X0910716 (1♂, TAMU, pinned).

Extra material examined – (164♂, 179♀). **AUSTRALIA: Northern Territory:** *Devil's Marbles*: x.1961 (1♂, 1♀, FSCA); *Tennant Creek*: xi.1966 (2♀, ANIC); **Queensland:** *Mount Isa*: 110 km NW, 27.xi.1990, at light, W.F. Chamberlain (1♀, TAMU); *Mount Isa*: Lake Moondarra, 21.xi.1978 (1♀, QLDM); Selwyn Mine, 29.xii.1991, T. Woodger (2♀, ANIC); **Western Australia:** *Millstream Chichester National Park*: Python Pool, 21.33309°S – 117.23930°E±130m, 180m, 23.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #615 (4♂, 2♀, TAMU); *Millstream*: x.1970 (1♂, 3♀, ANIC); 1 km NE, 21.35S – 117.04E, 6.xi.1970, Upton & Feehan (1♀, ANIC); *Nanutarra Roadhouse*: hwy 136, 13 air km NENE, 22.47124°S – 115.60040°E±70m, 22.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #614 (31♂, 59♀, TAMU); *Newman*: hwy 138, 9 air km EENE, 520m, 23.34699°S – 119.82137°E±80m,

25.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #616 (125♂, 107♀, TAMU);
Wittenoorn: x.1970 (2♂, ANIC).

Comments – *Paraustrogymnocnemia diehli* can be easily distinguished from the other two species in the genus, mainly because of the body and wings color pattern. However this new species should be grouped in this genus based on the shape of the female and male terminalia, which are almost identical in all three species. For phylogenetic relationships see (A4 Figs 1-3).

***Paraustrogymnocnemia interrupta* (Esben-Petersen 1915), new combination**

(A4 Figs 126-127)

Gymnocnemia interrupta Esben-Petersen 1915:64 (OD).

Austrogymnocnemia interrupta (Esben-Petersen): Esben-Petersen 1917:206 (n. cb.); Esben-Petersen 1923:587 (cit); Stange 1976:302 (cat); New 1985b:20 (key, rd, ill); New 1996:67 (cat); Stange 2004:99 (cat); Oswald 2015 (cat).

Diagnosis – Tibial spurs absent [not present]; male gonarcus anterior margin acute [not rounded]; male paramere with apical hook absent [not present]; male paramere anterior margin acute [not rounded]; posterior gonapophyses with tip enlarged and rounded [not absent or present and recurved]; body color mostly dark [not grey]; forewing mediocubital area with an interrupted dark line [not hyaline or with a continuous line].

Description – Lengths: forewing: 17 – 21 mm; hind wing: 16 – 19 mm.

Head (A4 Figs 126a-b): *Labrum* brown; set with a line of elongate setae. *Clypeus* pale with two lateral rounded brown marks dorsally; set with some elongate black setae.

Frons shiny black, covered with few short black setae. *Gena* pale. *Vertex* raised; in frontal view pale, with two short transversal dark brown marks laterally and a rounded central dark spot; in dorsal view mostly pale with two central perpendicular dark brown lines and two black marks posterolaterally; covered with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, more $> 3x$ length of pronotum; distance between antennae wider than scape width; in general completely dark brown, but distal margin of flagellomeres pale in some specimens; torular membrane pale; flagellomeres almost as long as wide at base, apical ones much wider than long; set with short black setae. *Mandibles* mostly brown, with tip black. *Palpi*, maxillary and labial mostly pale with dark brown marks, but entirely dark brown in some specimens; apical labial palpomere fusiform, palpmacula oval-shaped, located medially.

Thorax (A4 Fig 126b): *Pronotum* about as long as wide; posterior as wide as anterior; subapical furrow present; mostly dark brown except for four pale longitudinal thin streaks laterally; medial line usually darker; beset with long white setae and short black setae. *Mesonotum* mostly dark brown to grey (in general medial area darker) with two longitudinal yellow bands around central area; covered with short black setae. *Metanotum* in general dark brown with mid line grey in some specimens; set with few short white setae. *Pterothoracic pleura* dark brown with some pale areas in sclerites' borders in some specimens; covered with white setae, and some short black setae on anterior sclerites; Miller's organ present.

Wings (A4 Fig 126c): Rather narrow with tip acute; anterior Banksian line present in both wings, posterior present only in the forewing. Veins mostly dark brown, but some

veins intercalated with white spots, most crossveins white with brown punctuations on setal base. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline with some brown marks on pterostigma, around banksian lines, posterior margin, and subcostal area; mediocubital area is totally brown in basal area and part of distal area; cubital fork located about same level Rs origin; three presectoral crossveins; subcostal veinlets simple; posterior area narrower than prefork area. Prefork area with few longitudinal crossveins. *Hind wing* membrane mostly hyaline except for a small brown mark on rhegmal area; medial fork located near Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 126a-b): *All pairs of legs*, femur elongate ($> 2x$ length of coxa); tibia, femur and tarsi about same size; tibial spurs absent; T2, T3 and T4 about same size, T1 about twice longer than T2, but shorter than T5; claws slightly longer than half of T5 length; all segments set with short white setae, but some long setae at femur base; femur, tibia and tarsi set with short black setae, and scattered long black setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair absent; tibia with antennal cleaning setae ventroapically; coxa dark brown, trochanter light brown, femur dark brown with internal surface pale, tibia dark brown with three pale rings; tarsi dark brown. *Midleg* with the same color pattern of foreleg. *Hindleg* femur, tibia and T1 slightly longer than in other legs; color pattern similar to anterior legs, except for tibia with most part of anterior surface pale.

Abdomen: Dark brown set with short black setae, and some short white setae on basal sternites.

Male Terminalia (A4 Figs 127a-d): *Ectoproct* rounded in lateral view, set with elongate black setae. 9th sternite very short, with anterior margin concave and posterior straight in ventral view; set with elongate black setae, longer than sternite. *Gonarcus* very broad, arched, with anterior margin thin and elongate in lateral view. *Mediuncus* absent. *Paramere* broad with tip sclerotized in posterior view, and with anterior margin thin and elongate.

Female Terminalia (A4 Figs 127e-f): *Ectoproct* rounded covered with thin elongate setae. *Lateral gonapophyses* rounded, much smaller than ectoproct, set with few thickened setae. 7th sternite elongate with distal margin curved in ventral view, covered with long black setae. *Pregenital plate* rounded with an anterior transversal arched bar and with an acute extension on ventral surface. *Posterior gonapophyses* broad, elongate, with tip dorsally enlarged and rounded; covered with long black setae, and few elongate cavisetae apically. 9th tergite with an elongate membranous digitiform process. *Anterior gonapophyses* absent. *Ventral membrane* gonapophyseal plates present.

Distribution (A4 Fig 170) – Australia: NSW, NT, QLD, SA, and WA.

Adult activity period – Records for November to March, with one isolated record for June.

Biology – Unknown, larva unknown.

Primary type – Holotype (by implicit monotypy), female (ANIC), examined. From original description, Esben-Petersen (1915): “Coolebah, N. S. W.; one specimen, 16.ii.1907 (W. W. Froggatt leg.). Type in Coll. Froggatt”. From New (1985b): “Holotype of *Gymnocnemia interrupta*, ♀, New South Wales, Coolibah, 16.ii.1907, W.

W. Froggatt leg. (ANIC) (antennae missing, body very mouldy: many markings indistinct)". Condition: bad; body very mouldy.

Material examined – (31♂, 34♀). **AUSTRALIA: New South Wales:** *Barrier Range:* 10.i.1986, R.H. Mulder collection (2♂, 2♀, AMSA); *Broken Hill:* nr. race track, 31.96445°S - 141.41817°E±70m, 280m, 2.i.2013, M.V., Oswald, Diehl & Machado, Oswald #625 (1♂, TAMU); i.1964 (1♂, 1♀, ANIC); *Cobar:* 65 km W, 28.i.1976, M.S. & B.J. Moulds (1♂, AMSA); *Talyealye Hsd:* 29°05'28''S - 144°27'59''E, 17.i.1999, M.S. & B.J. Moulds (1♀, AMSA); *Tintinallongy Stn:* -31.99947° - 143.01706°, 15.i.2010, S. Winterton (2♂, 3♀, CSCA); **Northern Territory:** *Alice Springs:* 48 miles WSW, 10.ii.1966, Britton, Upton & McInnes (1♂, ANIC); **South Australia:** *Arkaba Creek:* 26 air km ENNE Hawker, 390m, 31.68717°S - 138.57257°E±70m, 31.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #623 (2♂, 3♀, TAMU); *El Alamein:* ii.1964 (1♀, SAMA); *Eringa:* iii.1993 (1♂, SAMA); *Flinders Range:* (4♀, SAMA); *Gammon Ranges:* Flinders, iii.1973 (1♀, SAMA); *Leigh Ck:* 20.i.1966, G.C. Gregory (7♂, 1♀, ANIC); i.1955 (1♂, 2♀, SAMA); i.1965 (2♂, 2♀, SAMA); ii.1965 (1♂, SAMA); xii.1965 (2♂, 1♀, SAMA); *Mount Serle:* i.1965 (1♂, SAMA); *Muloorina HS:* iii.1965 (1♂, SAMA); *Witjira:* xi.1995 (1♀, SAMA); **Queensland:** *Noccundra:* 2 miles NE, 28.i.1965, L.J. Chinnick (2♂, 3♀, ANIC); **Western Australia:** *Coolgardie:* 19 km W, 7.ii.1994, L. Stange & R. Miller (3♀, FSCA; 1♀, TAMU); *Cobar:* 65 km W, 28.i.1976, M.S. & B.J. Moulds (1♂, AMSA); *Dedari Pump Stn:* 14.i.1992, J Bugeja (1♀, ANIC); *Gascoyne Junction:* 70 air km WNW, 24.87559°S - 114.55150°E±90m, 21.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #613 (7♂, 9♀, TAMU); *Goldfields hwy:* 85

km SSE Wiluna, 27.32886°S - 120.50593°E±70m, 560m, 26.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #617 (1♂, TAMU); *Lake Raeside*: 29°44.3'S - 122°31.5'E, 8.iv.2005, D. Brzoska (♀, FSCA); *Kalgoorlie*: 18.vi.1986, A.J. Graham (1♀, AMSA); *Mount Magnet*: 55 km ESE, 18.i.1989, M.S. & B.J. Moulds (1♀, AMSA); 19.i.1989 (1♂, AMSA).

Comments – *Paraustrogymnocnemia interrupta* is closely associated with *P. lineata*, based on body and wing color pattern, what differentiate them from *P. diehli*. These two close species, are very similar, and are separated based on mediocubital longitudinal line, which is interrupted medially in *P. interrupta* but continuous in *P. lineata*. In fact, this difference in the longitudinal line, might be only an intraspecific variation, and these two species might be synonymized in the future. *P. lineata* is know only by few specimens, including only one male, but more specimens are needed to confirm the status of these two species. For phylogenetic relationships see (A4 Figs 1-3).

***Paraustrogymnocnemia lineata* (New 1985), new combination**

(A4 Figs 128-129)

Austrogymnocnemia lineata New 1985:21 (OD); New 1996:67 (cat); Stange 2004:99 (cat); Oswald 2015 (cat).

Diagnosis – tibial spurs absent [not present]; male gonarcus anterior margin acute [not rounded]; male paramere with apical hook absent [not present]; male paramere anterior margin acute [not rounded]; posterior gonapophyses with tip enlarged and rounded [not

absent or present and recurved]; body color mostly dark [not grey]; forewing mediocubital area with continuous dark line [not hyaline or with an interrupted line].

Description – Lengths: forewing: 20 – 21 mm; hind wing: 17 – 18 mm.

Head (A4 Figs 128a-b): *Labrum* pale; set with a line of elongate setae. *Clypeus* pale with two lateral brown spot dorsally; set with some elongate black setae. *Frons* shiny black, except for ventral corners pale, covered with few short black setae. *Gena* pale. *Vertex* raised; in frontal view pale, with five central dark brown spots; in dorsal view mostly pale with two central perpendicular dark brown lines and two black marks posterolaterally; covered with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, about twice longer than pronotum; distance between antennae wider than scape width; in general anterior surface pale and posterior surface dark brown, but on basal segments part of posterior surface pale and in some subapical segments anterior surface has dark brown areas; torular membrane pale; flagellomeres almost as long as wide at base, but apical ones much wider than long; set with short black setae. *Mandibles* mostly brown, with tip black. *Palpi*, maxillary and labial mostly pale with dark brown marks on basal segments; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 128b): *Pronotum* about as long as wide; posterior margin about as wide as anterior; subapical furrow present; dark brown except for two pale longitudinal lines laterally; beset with short black setae, some long black setae on borders, and some long white setae on anterior margin. *Mesonotum* mostly dark brown with two longitudinal pale lines around central area; covered with short black setae. *Metanotum* dark brown

with irregular pale spots around midline; set with few short black setae. *Pterothoracic pleura* dark brown with some pale areas on borders of sclerites; covered with white setae; Miller's organ present.

Wings (A4 Fig 128c): Rather narrow with tip acute; anterior Banksian line present in both wings, posterior present only in the forewing; veins mostly dark brown, but some veins intercalated with white areas, most of the crossveins white with brown punctuations on the base of the setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline with some brown marks on base of hypostigmatic cell, subcostal area, and posterior margin; mediocubital area totally brown and extending over anterior banksian line; area surrounding mediocubital area brown infuscated, mainly at cubital area; cubital fork located about same level of Rs origin; three presectoral crossveins; subcostal veinlets simple; posterior area narrower than prefork area; prefork area with few longitudinal crossveins. *Hind wing* membrane mostly hyaline except for a small brown mark around anterior banksian line and another on rhegmal area; medial fork located near Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 128a-b): *All pairs of legs*, femur elongate ($> 2x$ length of coxa); femur slightly longer than tibia, tarsi and tibia about same size; tibial spurs absent; T2, T3 and T4 about same size, T1 and T5 about same size but near twice longer than T2; claws about half of T5 length; all segments set with short white setae, and some long setae at femur base; femur, tibia and tarsi set with short black setae, and scattered long black setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair absent; tibia with antennal cleaning setae ventroapically; coxa dark brown with pale spots on

external surface, trochanter light brown, femur dark brown with basal internal surface pale, tibia dark brown with three pale rings; tarsi dark brown, except for T1 base pale. *Midleg* with same color pattern of foreleg. *Hindleg* with femur, tibia and T1 slightly longer than in other legs; color pattern similar to anterior legs, except for femur and tarsi entirely dark brown, and tibia with internal surface dark brown and external pale except for base and tip dark brown.

Abdomen: Dark brown. Tergites set with short black setae and sternites covered with white setae.

Male Terminalia (A4 Figs 129a-d): *Ectoproct* rounded in lateral view, set with elongate black setae. *9th sternite* very short, with anterior margin concave and posterior straight in ventral view; set with elongate black setae, longer than the sternite. *Gonarcus* very broad, arched, with anterior margin thin and elongate in lateral view. *Mediuncus* absent. *Paramere* broad with tip sclerotized in posterior view, with anterior margin thin and elongate, but semi triangular in posteroventral view.

Female Terminalia (A4 Figs 129e-f): *Ectoproct* rounded covered with thin elongate setae. *Lateral gonapophyses* rounded, much smaller than ectoproct, set with few thickened setae. *7th sternite* elongate with distal margin straight in ventral view, covered with long black setae. *Pregenital plate* rounded with a proximal transversal arched bar and an acute extension on ventral surface. *Posterior gonapophyses* broad, elongate, with tip dorsally enlarged and rounded; covered with long black setae and with few elongate cavisetae apically. *9th tergite* with an elongate membranous digitiform process. *Anterior gonapophyses* absent. *Ventral membrane* gonapophyseal plates present.

Distribution (A4 Fig 170) – Australia: WA.

Adult activity period – Records for January to March, and May.

Biology – Unknwon, larva unknown.

Primary type – Holotype (by original designation), male (WAM), high-resolution images examined. From original description, New (1985b): “Holotype, ♂, Western Australia, 7.5 km SE. Banjiwarn HS. (27°42'S., 121°37'E.), 24.iii.1979, T. F. Houston *et al.* 260-1 (WAM)”. Condition: relatively good; abdomen dissected and tips of right wings damaged.

Material examined – (2♀). **AUSTRALIA: Western Australia: Kalgoorlie:** 23.i.1986, A.J. Graham (1♀, AMSA); *Laverton:* v.1997 (1♀, SAMA).

Comments – See comments for *P. interrupta*.

***Periclystus* Gerstaecker 1888**

Peryclystus; Stange 1976:307 (mistyping).

Type species: *Periclystus laceratus* Gerstaecker 1888, by subsequent designation (Esben-Petersen 1915). Banks (1941) incorrectly designated *P. callipeplus* as the type species.

Diagnosis – Thorax lustrous [not dull]; wings broad [not narrow], with tip falcate [not straight] and full of dark marks [not hyaline or with few marks]; forewing with posterior area almost twice wider than prefork area [not equal or thinner]; male paramere with tip furcated [not simple]; posterior gonapophyses long, broad, and with many cavisetae at apex [not short or thin, not with cavisetae absent].

Description – Head: *Vertex* strongly raised. *Ocular rim* setae absent. *Antennae* clubbed and elongate; flagellomeres almost as long as wide at base, apical ones slightly wider than long, all segments set with short black setae. *Palpimacula* oval-shaped, located medially. Thorax: lustrous, not covered with microtrichia. Miller’s Organ absent. Wings: broad, with tip falcate. *Membrane* hyaline but full of dark marks, mainly at tip. *Anterior Banksian* line present in both wings, posterior absent. *Forewing* with four or five presectoral crossveins; subcostal veinlets simple; posterior area almost twice wider than prefork area. *Hind wing* medial fork located near Rs origin; one presectoral crossvein. *Male pilula axillaris* present. Legs: *Femur* elongate, > 2.5x length of coxa. *Tibial spurs* extending to T2 apex. *Pretarsal claws* slightly shorter than half of T5 length. *Sense hair* absent. Male Terminalia: *Gonarcus* broad and arched; *mediuncus* large and fused with gonarcus; *paramere* broad with tip acute and furcated. Female Terminalia: *Ectoproct* and *lateral gonapophyses* without cavisetae; *posterior gonapophyses* broad, long with many cavisetae at apex; *anterior gonapophyses* as a small lobe covered with long setae; 9th *tergite* with a broad membranous digitiform process; *pregenital plate* small.

Distribution (A4 Fig 171) – Australia: NSW, NT, QLD, SA, VIC, and WA. Papua New Guinea: Port Moresby.

Comments – The genus contains four species, *P. aureolatus*, *P. circuiter*, *P. laceratus* and *P. vicinus* that are easily distinguished from the other antlions in Australia, mainly by their lustrous body, and their long, colorful and falcate wings. For phylogenetic relationships see (A4 Figs 1-3).

Biology – Unknown.

Key to species of *Periclystus* (modified from New 1985b)

- 1 Hind wing apex mostly brown (A4 Fig 136b).....2
- 1' Hind wing apex mostly hyaline (few brown marks) (A4 Fig 134c).....3
- 2 Wings strongly falcate apically (A4 Fig 132c); hind wing with two large brown bands separated by a broad hyaline area (A4 Fig 132c); male ectoproct rounded (lateral view) (A4 Fig 133a); Australia.....*P. circuiter*
- 2' Wings weakly falcate apically (A4 Fig 136b); hind wing with two large brown bands separated by a narrow hyaline area (A4 Fig 136b); male ectoproct with ventral margin straight and longer than dorsal margin (lateral view) (A4 Fig 137a); Papua New Guinea.....*P. vicinus*
- 3 Body mostly pale; wings apex weakly falcate (A4 Fig 130d); wings marks mostly golden (A4 Fig 130d); thorax with tufts of elongate setae, mainly at the scutellum.....*P. aureolatus*
- 3' Body mostly dark; wings apex strongly falcate (A4 Fig 134c); wings marks mostly brown (A4 Fig 134c); thorax setae not forming tufts.....*P. laceratus*

***Periclystus aureolatus* Tillyard 1916**

(A4 Figs 130-131)

Periclystus aureolatus Tillyard 1916:50 (OD); Esben-Petersen 1918:6 (cit); Esben-Petersen 1923:586 (cit); Stange 1976:307 (cat); New 1985b:4 (key, rd, ill); New 1996:91 (cat); Stange 2004:107 (cat)

Diagnosis – Thorax lustrous [not dull]; body mostly pale [not mostly dark]; wings broad [not thin], with tip weakly falcate [not strongly falcate]; hind wing tip hyaline with some golden marks [not with brown marks, or transversal stripes].

Description – Lengths: forewing: 24 – 33 mm; hind wing: 22 – 30 mm.

Head (A4 Figs 130a-c): *Labrum* pale, set with a line of elongate setae. *Clypeus* reddish brown to brown; with some elongate black setae. *Frons* reddish brown to dark brown, generally darker than clypeus; covered by short black setae. *Gena* reddish brown. *Vertex* strongly raised, pale to orange, with some short black setae located medially on each side. *Ocular rim* setae absent. *Antennae* clubbed; short, slightly longer than pronotum; distance between antennae wider than scape width; scape and pedicel reddish brown, flagellum mostly brown but apex slightly paler; torular membrane pale; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae. *Mandible* reddish brown, with internal margin darker. *Palpi*, maxillary and labial pale to reddish brown; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Figs 130b-c): *Pronotum* about as long as wide; posterior margin about as wide as anterior; subapical furrow present; in general pale to orange, with lateral margins and some central marks darker in some specimens; covered with short black setae and long setae at margins and medially. *Mesonotum* mostly brown, except for irregular pale marks: two rounded spots at prescutum and scutellum, and small longitudinal lines medially at scutum; with tufts of very long black setae: at prescutum anterior margin and medial line; a longitudinal medial line on each side of scutum, and

two tufts at posterior margin of scutellum; posterior margin of scutellum elevate in lateral view. *Metanotum* mostly dark brown except for some irregular marks at scutum and scutellum; with two tufts of elongate black setae at posterior margin of scutellum; posterior margin of scutellum elevate in lateral view. *Pterothoracic pleura* dark brown with irregular pale marks mainly on ventral margin and anterior sclerites; covered with few black setae, with ones at anterior sclerites longer; Miller's organ absent.

Wings (A4 Fig 130d): Broad with tip weakly falcate, mainly forewing. Anterior Banksian line present in both wings, posterior absent. Veins mostly white, but with brown marks along membrane spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline but full of irregular rounded golden to brown marks, mainly at tip, posterior margin, apex of mediocubital and prefork areas, pterostigma, around some crossveins in mediocubital and radial areas; cubital fork located near Rs origin; five to six presectoral crossveins, with distal ones connected by longitudinal crossveins in some specimens; subcostal veinlets simple; posterior area much wider than prefork area. *Hind wing* membrane mostly hyaline except for few irregular golden to brown marks at tip, one at pterostigma, one at hypostigmatic cell base, a large one on rhegmal area, and a small one on radial area medially; medial fork located near Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 130a-c): *All pairs of legs*, femur elongate ($> 2.5x$ length of coxa); tibia and femur about same size but slightly longer than tarsi; tibial spurs extending over T2 apex; T2, T3 and T4 about same size, T1 slightly longer than T2, and T5 about twice longer than T1; claws about half of T5 length; all segments set with short black setae,

and scattered long setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair absent; tibia without antennal cleaning setae; coxa and trochanter brown but dark brown in some specimens, femur brown except for internal surface and a subapical mark pale; tibia mostly pale with three light brown rings; tarsi pale. *Midleg* with color pattern similar to foreleg, except for coxa and trochanter dark brown; femur and tibia brown areas darker than foreleg. *Hindleg* with femur and tibia much longer than in other legs; with color similar to anterior legs, except for femur and tibia pale to white with apex dark brown.

Abdomen: Tergite 1 pale to white; tergites 2, 3 and 4 mostly pale to white with a large irregular dark medial mark, remaining tergites mostly dark brown with distal margin pale to white. Sternite 1 pale to white; remaining sternites pale basally and dark brown distally, (basal segments pale areas larger and distal segments dark brown areas larger). There are some darker specimens with pale areas reduced. Beset with black setae.

Male Terminalia (A4 Figs 131a-d): *Ectoproct* large, with ventral margin slightly longer than dorsal in lateral view; set with elongate black setae. *9th sternite* short, with posterior margin straight, in ventral view; covered with long black setae. *Gonarcus* broad, with posterior margin straight but anterior narrower and rounded in lateral view; arched in posterior view. *Mediuncus* curved with tip acute in lateral view; in posterior view elongate with apex enlarged and acute. *Paramere* broad, elongate, with posterior margin rounded and anterior thinner; in posterior view curved and tip acute; in ventral view with two lobes: external lobe broad and rounded but internal lobe narrow, with tip acute.

Female Terminalia (A4 Figs 131e-f): *Ectoproct* rounded covered with thin elongate setae. *Lateral gonapophyses* rounded, smaller than ectoproct, covered with elongate setae. *7th sternite* long, with distal margin straight in ventral view; covered with long black setae. *Pregenital plate* small, semi triangular, with apex rounded and ventral margin concave in ventral view. *Posterior gonapophyses* broad, long, with apex wider and rounded, covered with many long black setae and many long cavisetae apically. *9th tergite* with a broad membranous digitiform process. *Anterior gonapophyses* as a plate covered with long setae. *Ventral membrane* gonapophyseal plates present.

Distribution (A4 Fig 171) – Australia: NT, QLD, SA, VIC*, and WA. * = new record.

Adult activity period – Records for January to May and October.

Biology – Unknown, larva unknown.

Primary type – *Holotype* (by original designation), female [not male], (WAM), high-resolution images examined. From original description, Tillyard (1916): “A unique specimen, apparently a male, but the abdomen is somewhat shrivelled. Type in Coll. West Australian Museum, Perth. Museum label No.6972; no date”. From New (1985): “Holotype, ♀, Western Australia, Cunderdin, No. 6972 (WAM) (seen). Tillyard supposed this to be a male, and it is labelled as such in his writing. A female from the same locality in BMNH is also labelled as 'Type' but this is presumed an error”. From Stange (2004): “Holotype, female, Cunderlin, Western Australia (WAMP!)”. The statement of New (1985b) about the holotype is confirmed here. The holotype is a female and the specimen labeled as type in the BMNH is apparently an error. The

holotype is in the WAM, and perfectly matches the image given in the original description. Condition: good; with right forewing broken, and left forewing tip damaged.

Material examined – (17♂, 42♀). **AUSTRALIA: Northern Territory:** *Carpentaria H/way*: 4.8 km E of Hi-Way Inn, 2.iv.2008, at light, ex woodland, G. Williams & W. Pullawski (1♀, AMSA); *Mataranka*: 12 km S, 15.02S – 130.05E, 31.iii.1995, E.D. Edwards & M. Matthews (2♀, ANIC); *Mt Cahil*: 16 km NE, 12°50'S – 132°51'E, 29.x.1972, M.S. Upton & R.S. McInnes (1♀, ANIC); **Queensland:** *Archer River x-ing*: 13°25'S – 142°56'E, 5.iv.1989, mv lamp, G. & A. Daniels (2♂, QLDM); 6.iv.1989 (1♂, QLDM); 7.iv.1989 (1♂, 4♀, QLDM); 10.iv.1989 (1♂, QLDM); 13.iv.1989 (1♂, QLDM); *Camooweal*: 4 km E, 19°56'S – 138°09'E, 12.v.1973, M.S. Upton (1♀, ANIC); *Musgrave*: 13 km W, 14°48'S – 143°23'E, 26.iv.1989, G & A Daniels (1♂, QLDM); *Musselbrook Resource Centre*: Lawn Hill Nat. Pk, 160 m, 18°35'54''S – 138°07'44''E, 18.iv.1995, A Daniels & MA Schneider (1♀, QLDM); *White Mts*: Warang Camp, 10 km S, 20.31S – 144.51E, 29.iii.2000, E.D. Edwards (1♀, ANIC); **South Australia:** (1♀, SAMA); *Aroona Dam*: iii.1958 (1♀, SAMA); *Mindarie*: (1♂, SAMA); **Victoria:** *Lake Hattah*: 31.i.1967 (1♀, MVM); **Western Australia:** *Broome*: Rocbuck Roadhouse, 33 km E, 1.iii.1994, R. Miller & L. Stange (3♂, 6♀, FSCA); *Bridgetown*: 5.iii.1957 (1♂, MVM); *Camboon Park*: 22.i.1951 (1♂, MVM); 28.i.1957 (1♂, MVM); 11.ii.1957 (1♂, 7♀, MVM); *Cane River HS*: 17 km NE, 21°56'S – 115°39'E, 27.iv.1971, Upton & Mitchell (1♀, ANIC); *Cape York*: 20.x.1900 (1♀, ANIC); *Chichester Ra NP*: Black Hill Pool, 21.20S – 117.15E, 1.v.2003, E.D. Edwards, F. FitzGibbon (1♂, ANIC); *Giles*: ii.1962 (1♀, MVM); *Kimberley Research Stn*: via Wyndham, 1.iii.1955, E.C.B.

Langfield (1♀, ANIC); *Millstream HS*: 1 km NE, 21°35'S – 117°04'E, 23.iv.1971, Upton & Mitchell (1♂, 5♀, ANIC); 5 km SE, 21°37'S – 117°06'E, 12.iv.1971 (1♀, ANIC); *Pilgangoora*: Pilbara, v.1953 (3♀, SAMA); *Roebuck Roadhouse*: 33 km E Broome, 1.iii.1994, L. Stange (1♀, TAMU); *Yokine*: Mount Yokine, 6.i.1957 (1♂, 1♀, MVM).

Comments – *Perichlystus aureolatus* is closer related to *P. laceratus* because of dark marks in the hind wing apex, different from the remaining two species that have the hind wing apex mostly brown. *P. aureolatus* is the smallest species in the genus, but some specimens can get as big as the other species, presenting longer wings with more of the golden marks. For phylogenetic relationship see (A4 Figs 1-3).

***Perichlystus circuiter* (Walker 1853)**

(A4 Figs 132-133)

Myrmeleon circuiter Walker 1853:400 (OD); Gerstaecker 1885b:114 (cit); Gerstaecker 1888:105 (cit)

Glenurus circuiter (Walker): Hagen 1866:405 (n. cb.); Froggatt 1902:362 (cit); Handschin 1935:690 (cit)

Perichlystus circuiter (Walker): Esben-Petersen 1915:68 (n. cb., ill); Esben-Petersen 1918:6 (cit); Esben-Petersen 1923:586 (cit); Tillyard 1926:323 (cit., ill); Adams 1936:25 (cit., ill); Stange 1976:307 (cat); New 1985b:5 (key, rd, ill); New 1996:91 (cat); Stange 2004:107 (cat); Oswald 2015 (cat).

Periclystus callipeplus Gerstaecker 1888:107 (OD); Navás 1914:470 (cit); Esben-Petersen 1915:68 (syn); Stange 1976:307 (cat); New 1985b:5 (cit); New 1996:67 (cat); Stange 2004:98 (cat); Oswald 2015 (cat).

Diagnosis – Thorax lustrous [not dull]; body mostly dark [not mostly pale]; wings broad [not thin], with tip strongly falcate [not weakly falcate]; hind wing with two large brown bands separated by a broad hyaline area [not hyaline with scattered dark marks].

Description – Lengths: forewing: 35 – 45 mm; hind wing: 31 – 42 mm.

Head (A4 Figs 132a-b): *Labrum* pale, set with a line of elongate setae. *Clypeus* reddish brown with ventral margin pale; set with some elongate black setae. *Frons* mostly reddish brown, but slightly darker around antennae in some specimens, and dorsal area pale in most specimens; covered with short black setae. *Gena* reddish brown. *Vertex* strongly raised; pale to reddish brown with some small irregular dark marks medially; darker areas covered with short black setae. *Ocular rim* setae absent. *Antennae* filiform; elongate, > 2x length of pronotum; distance between antennae wider than scape width; scape and pedicel reddish brown except for distal margin pale; flagellomeres entirely pale, except for brown marks on dorsal surface of apical flagellomeres; torular membrane entirely pale; flagellomeres almost as long as wide at base, but apical ones slightly wider than long; all segments set with short black setae. *Mandible* reddish brown, with internal margin darker. *Palpi*, maxillary and labial reddish brown but maxillary generally darker; apical labial palpomere fusiform, palpmacula oval-shaped, located medially.

Thorax (A4 Fig 132b): *Pronotum* about as long as wide; posterior margin about as wide as anterior; subapical furrow present; brown to dark brown except for some darker central marks and area anterior to furrow paler in some specimens; covered with short black setae and very long setae at margins and medial area. *Mesonotum* black, except for small rounded pale marks in some specimens, mainly at prescutum; set with short black setae, and few elongate black ones, generally at prescutum, two longitudinal lines at scutum, and distal margin of scutellum. *Metanotum* black with a thin medial longitudinal pale line, set with long black setae, mainly at prescutum and distal margin of scutellum. *Pterothoracic pleura* black; covered with long black setae; Miller's organ absent.

Wings (A4 Fig 132c): Broad with tip strongly falcate; anterior Banksian line present in both wings, posterior absent; veins mostly dark brown, but some veins intercalated with white spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline with two irregular dark brown lines (one around tip of prefork area, and other near pterostigma), and irregular brown areas, mainly at tip, base, posterior margin, and around some crossveins, mainly at mediocubital, subcostal, and radial areas; cubital fork located between origins of Rs and MA; four to five presectoral crossveins; subcostal veinlets mostly simple, but few distal ones forked; posterior area much wider than prefork area. *Hind wing* veins mostly white; membrane mostly hyaline except for two broad brown lines, an apical and a subapical near rhegmal area, and some small marks around radial crossveins; medial fork located near Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 132a-b): *All pairs of legs*, femur elongate (> 3.5x length of coxa); tibia slightly longer than femur but about twice longer than tarsi; tibial spurs surpassing T2 apex; T3 and T4 about same size, T2 slightly longer than T3, T1 twice longer than T2, and T5 twice longer than T1; claws about half of T5 length; all segments set with short black setae, and scattered long setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair absent; tibia with antennal cleaning setae ventroapically; coxa and trochanter black, femur basally dark brown but remaining pale, tibia and tarsi pale (some darker specimens with femur mostly dark brown and tibia with three brown marks). *Midleg* with color pattern similar to foreleg (darker specimens femur dark brown, except for pale apex, and tibia is mostly dark brown with three pale marks). *Hindleg* with femur and tibia slightly longer than in other legs; coxa and trochanter black but remaining segments pale (darker specimens with irregular brown marks on femur and tibia apex).

Abdomen: Mostly dark brown except for pale basal half of tergite 3 and 4 and basal half of sternites 2 and 3 (entirely dark brown in darker specimens). Beset with black setae.

Male Terminalia (A4 Figs 133a-d): *Ectoproct* rounded, in lateral view, set with elongate black setae. *9th sternite* short, with posterior margin straight in ventral view; covered with black setae. *Gonarcus* broad with anterior margin large and almost straight in lateral view; in posterior view very broad and curved. *Mediuncus* large, curved, with tip acute in lateral view; in posterior view with apex enlarged and acute. *Paramere* in lateral view elongate with anterior margin curved and apex divided into two lobes: dorsal lobe larger with tip rounded, ventral lobe shorter with tip acute; in posterior view with dorsal

margin curved and ventral margin split into two acute lobes; in ventral view with anterior margin rounded and posterior with two acute expansions (external larger).

Female Terminalia (A4 Figs 133e-f): *Ectoproct* rounded covered with thin elongate setae. *Lateral gonapophyses* rounded, smaller than ectoproct, covered with elongate setae, and few short thickened setae ventrally. *7th sternite* long, with distal margin straight in ventral view, and distal area smaller in lateral view; covered with long black setae. *Pregenital plate* small, semi triangular with apex rounded in ventral view. *Posterior gonapophyses* broad, long, with apex curved and rounded, covered with many long black setae and many cavisetae apically. *9th tergite* with a broad membranous digitiform process. *Anterior gonapophyses* a large plate covered with long setae. *Ventral membrane* gonapophyseal plates present.

Distribution (A4 Figs 171) – Australia: ACT, NSW, NT*, QLD, VIC*. * = new record.

Adult activity period – Records for October to May.

Biology – Unknown, larva unknown.

Primary type – *Myrmeleon circuitei*: Syntypes, one male and one female (BMNH), high-resolution images examined. From original description, Walker (1853): “a, b. Australia. From Mr. Strange's collection”. From Esben-Petersen (1915): “...agrees very well with the type-series of Walker”. From New (1985b): “Holotype, 'Australia' (BMNH) (seen)”. From Stange (2004): “Holotype, Australia (BMNH!)”. Despite the latest statements from New (1985b) and Stange (2004) mentioning a holotype, the species description was clearly based in two specimens as mentioned by the author (Walker 1853), and are both deposited at BMNH. The holotype mention by New

(1985b) is not considered here as clear differentiation of that specimen among the type series; it is not possible to distinguish which of the two specimens is the one indicated as the holotype. In this sense, this mention did not consist a lectotype designation according to the nomenclatural code (article 74.5). Syntypes, condition: both very good.

Periclystus callipeplus: Holotype (by implicit monotypy), female (ZIMG), high-resolution images examined. From original description, Gerstaecker (1888): “(fem.). – Patria: Australia”. From New (1996): “Type data: holotype ZMH ♀ (?destroyed)*. / Type locality: Australia”. From Stange (2004): “Holotype, Australia (EMAU)”. New (1996) noted incorrectly that the type was destroyed; it is present in ZIMG. Condition: good; right antenna missing, terminalia dissected.

Material examined – (25♂, 50♀). **AUSTRALIA: ACT:** *Black Mountain*: ii-iii.1967, Light Trap (1♀, ANIC); 18.i.1965, light trap (1♀, ANIC); *Canberra*: 22.i.1960, E.F. Riek (1♀, ANIC); 13.ii.1962 (1♂, ANIC); 1.iii.1957 (1♀, ANIC); 18.iii.1953 (1♀, FSCA); 26.iii.1963 (1♀, FSCA); *Cotter Dam*: xii.1930, G. Jeffries (1♂, ANIC); **New South Wales:** (1♀, MVM); *Bathurst*: Coll. Froggatt (1♂, ANIC); Glen Innes, Prison farm, 1969-70 (1♀, ANIC); *Grafton*: 30 km W, Danahara Creek, 16iii.1969, J. Frazier (1♀, ANIC); *Mount Kaputar*: 11.ii.1997, M.S. & B.J. Moulds (1♀, AMSA); *Narrabeen*: 26.xi.1961, Missd. Walsh. (1♂, AMSA); 10.ii.1922 (1♀, MVM); *Sydney*: Loftus, 26.i.1980, M.S. & B.J. Moulds (1♀, AMSA); *Three Ways*: 0.8 km E, 32°46’S – 150°33’E, 31.xii.1977, G. Daniels (1♀, AMSA); *Woodford*: 11.x.1909, G.A. Waterhouse (1♂, ANIC); **Northern Territory:** *Batchelor*: iv.1966 (1♀, SAMA); **Queensland:** (3♀, QLD); *Agnes Water*: 40 km E Miriam Vale, 4.xi.1984, N.W. Rodd (1♀, AMSA);

Armstrong Ck x-ing: 13 km NNW of Guthalungra, 26.i.1986, M.S. & B.J. Moulds (1♀, AMSA); *Bluff Range*: 25°36'S – 152°03'E, 15.xii.1970, H. Frauca (1♀, ANIC); 8.i.1971 (1♂, ANIC); *Brisbane*: (2♂, 10♀, QLDM); Coll. Froggatt (1♂, ANIC); 5.xii.1924 (1♂, 1♀, QLDM); 5.i.1928 (1♂, MVM); 11.v.1936 (1♂, MVM); 29.x.1936 (1♀, MVM); 25.ii.1940, JA Beck (1♀, QLDM); Highvale 14mls NW, 30.i.1960, R. Strantman (1♂, ANIC); -27.50° – 153.0167°, 1.xi.1999, S. Winterton (1♂, CSCA); *Bunya Mountains*: 14.ii.1957 (1♂, MVM); *Cape R.*: 100 km S of Charters Towers, 21.xii.1983, M.S. & B.J. Moulds (1♂, AMSA); *Chillagoe*: 20.i.1988, M.S. & B.J. Moulds (1♂, AMSA); *Coast Range*: 12 km SE of Biggenden, 22-23.xi.1977, H. Frauca (1♀, ANIC); *Dunwich*: 7-10.i.1992 (1♀, QLDM); *Gayndah*: Masters (1♀, AMSA); *Herberton*: (1♀, ANIC); *Kuranda*: (1♀, 1♂, SAMA); *Linnaroo Ck. Rd.*: 20 miles near Mareeba, at MVL, 30.xii.1972, M.S. & B.J. Moulds (1♀, AMSA); *Little Crystal Creek*: Mt Spec, 1000ft, 3.i.1968, R. Dobson (1♀, ANIC); *Mount Louisa*: 27.xii.1984 (1♂, QLDM); *Ring's Rock*: Bluewater Rg, S end of Paluma Rg, 4.i.1992, L. Ring (1♂, QLDM); *Rollingstone*: 5 km NW, 19.01S – 146.22E, 18.iii.1995, E.D. Edwards & M. Matthews (1♀, ANIC); *Station Ck*: 4.xii.1988, J. Olive (1♂, AMSA); *Toowoomba*: scrub bellow escarpment 18.xii.1976, M.S. & B.J. Moulds (1♀, AMSA); xii.1919 (2♀, SAMA); *Virginia*: 4.ii.1926, J.A. Beck (1♀, QLDM). No Label (1♂, 1♀, ANIC); *Woodford*: 12.ii.1928 (1♀, QLDM); 1.ii.1940 (1♀, QLDM); **Victoria**: (1♂, 2♀, MVM); *Fernshaw*: (1♂, MVM); *Noorinbee*: 13.ii.1959 (1♂, MVM).

Comments – *Perichystus circuiter* seems to be largest and most common species in the genus. It is clearly closer to *P. vicinus* from New Guinea than the other two Australian

Periclystus, based on shape and color pattern of the wings. High-resolution images from the holotype of *Periclystus callipeplus* were analyzed in this study, and it is clear a synonym of *P. circuiter* as proposed by Esben-Petersen (1915) and supported by all subsequent authors. For phylogenetic relationships see (A4 Figs 1-3).

***Periclystus laceratus* Gerstaecker 1888**

(A4 Figs 134a-b)

Periclystus laceratus Gerstaecker 1888:105 (OD); Esben-Petersen 1915:68 (cit, ill); Esben-Petersen 1918:6 (cit); Esben-Petersen 1923:586 (cit); Stange 1976:307 (cat); New 1985b:3 (key, rd, ill); New 1996:91 (cat); Stange 2004:107 (cat); Oswald 2015 (cat).

Diagnosis – Thorax lustrous [not dull]; body mostly dark [not mostly pale]; wings broad [not thin], with tip strongly falcate [not weakly falcate]; hind wing tip hyaline with some brown marks [not mostly brown].

Description – Lengths: forewing: 33 – 40 mm; hind wing: 30 – 36 mm.

Head (A4 Figs 134a-b): *Labrum* brown with margins pale, mainly between labrum and clypeus, set with a line of elongate setae. *Clypeus* reddish brown to black; set with some elongate black setae. *Frons* reddish brown to black, except for a rounded pale mark, medially beneath antennae; with some short black setae. *Gena* reddish brown to black. *Vertex* strongly raised, pale, and covered with short black. *Ocular rim* setae absent. *Antennae* clubbed; short, about twice longer than pronotum; distance between antennae wider than scape width; scape, pedicel, and two basal flagellomeres reddish brown to black except for pale distal margin of pedicel, nine to ten apical flagellomeres pale to

white, remaining flagellomeres brown; torular membrane entirely pale; flagellomeres almost as long as wide at base, apical ones slightly wider than long; all segments set with short black setae. *Mandible* reddish brown, with internal margin darker (some darker specimens base also black). *Palpi*, maxillary and labial reddish brown to black with apical labial segment paler; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 134b): *Pronotum* about as long as wide; posterior margin about as wide as anterior; subapical furrow present; mostly brown with three longitudinal dark brown lines before furrow (darker specimens with pronotum almost entirely dark brown with paler marks at anterior area); covered with short black setae and long setae at margins and medial area. *Mesonotum* mostly dark brown to black, except for irregular pale marks around midline of each segment; set with some short black setae, and some elongate black setae, generally at prescutum, two longitudinal lines at scutum, and posterior margin of scutellum; posterior margin of scutellum elevate in lateral view. *Metanotum* dark brown to black with irregular pale marks at scutellum in some specimens, set with few short black setae, posterior margin of scutellum elevate in lateral view. *Pterothoracic pleura* black, in some specimens anterior sclerites with some irregular pale marks; covered with long black setae; Miller's organ absent.

Wings (A4 Fig 134c): Broad with tip strongly falcate; anterior Banksian line present in both wings, posterior absent; veins mostly white, but some veins intercalated with brown marks, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline but full of irregular brown areas, mainly at tip, inferior margin,

pterostigma, tip of prefork area, around some crossveins, mainly at mediocubital, subcostal, and radial areas; cubital fork located near Rs origin; five presectoral crossveins; subcostal veinlets simple; posterior area much wider than prefork area. *Hind wing* veins mostly white; membrane mostly hyaline except for some irregular brown marks at tip, one at pterostigma, two at radial area, and a large one at rhegmal area; medial fork located near Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs: *All pairs of legs*, femur elongate ($> 3.5x$ length of coxa); tibia slightly longer than femur and about twice longer than tarsi; tibial spurs surpassing T2 apex; T3 and T4 about same size, T2 slightly longer than T3, T1 longer than T2, and T5 about twice longer than T1; claws about half of T5 length; all segments set with short black setae, and scattered long setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair absent; tibia with antennal cleaning setae ventroapically; coxa and trochanter black, femur dark brown to black except for internal surface pale; tibia brown with two pale rings; tarsi pale, but T3 and tip of T2 sometimes brown. *Midleg* with color pattern similar to foreleg, except for femur dark brown with two pale marks, one at base and other at apex. *Hindleg* with femur and tibia slightly longer than in other legs; with color similar to midleg, except for femur and tibia pale to white with apex dark brown.

Abdomen: Mostly dark brown except for pale to white tergites basal halves; distal margin of sternites pale; in some specimens sternite 1 entirely pale to white. Beset with black setae.

Male Terminalia (A4 Figs 135a-d): *Ectoproct* rounded in lateral view; set with elongate black setae. *9th sternite* short, with posterior margin rounded in ventral view; covered

with long black setae. *Gonarcus* broad, with anterior margin curved in lateral view; in posterior view broad and rounded. *Mediuncus* curved and acute in lateral view; apex rounded in posterior view. *Paramere* broad, elongate with apex rounded in lateral view; in posterior view with two acute lobes in ventral margin (external larger); in ventral view with apex divided into two acute expansions (external larger).

Female Terminalia (A4 Figs 135e-f): *Ectoproct* rounded, covered with thin elongate setae. *Lateral gonapophyses* rounded, smaller than ectoproct, covered with elongate setae. *7th sternite* long, with distal margin straight, in ventral view; covered with long black setae. *Pregenital plate* small, semi triangular with apex rounded and ventral margin concave in ventral view. *Posterior gonapophyses* broad, long, and apex wider and rounded, covered with many long black setae and many cavisetae apically. *9th tergite* with a broad membranous digitiform process. *Anterior gonapophyses* a plate covered with long setae. *Ventral membrane* gonapophyseal plates present.

Distribution (A4 Fig 171) – Australia: NSW, QLD, SA, VIC*, and WA. * = new record.

Adult activity period – Records for October to February.

Biology – Unknown, larva unknown.

Primary type – *Holotype* (by implicit monotypy), male (ZIMG), high-resolution images examined. From original description, Gerstaecker (1888): “(mas.) – Patria: Australia”. From New (1985): “Types (Greifswald) (not seen)”. From Stange (2004): “Types, Australia (EMAU)”. Condition: good; right antenna and midleg missing.

Material examined – (4♂, 14♀). **AUSTRALIA: New South Wales:** *Bourke*: 80mi W, 31.x.1967, R. McInnes (1♀, ANIC); *Lake Mungo*: 33.44S – 141.59E, 22.ii.1998, C. Reid (1♀, ANIC); *Nombinnie Nature Reserv.*: 18 air km SSE Mount Hope, 160m, 32.99613°S – 145.94006°E±70m, 3.i.2013, M.V., Oswald, Diehl & Machado, Oswald #626 (2♀, TAMU); **South Australia:** *Kimba*: hwy 1 pulloff, 1.6 air km ENNE, 220m, 33.12763°S – 136.43115°E±80m, 12.xii.2012, M.V., Oswald, Diehl & Machado, Oswald #600 (1♀, TAMU); *Orroroo*: 20.xii.1943, Gray (1♀, SAMA); *Pinkawillinie*: xi.1995 (1♂, SAMA); *Weetaratank*: 27 km E Wirrulla, xi.1995 (2♀, SAMA); **Queensland:** *Carnarvor Rge*: 20.xii.1938, N.Geary (1♂, AMSA); *Clermont*: 15.ii.1924, E.J.D. (1♂, ANIC); *Emerald*: 66mi W, 29.xi.1965, A. Mesa & R. Sandulski (1♀, ANIC); *Gilruth Plains*: 15.xii.1963, A.L. Dyce (1♀, ANIC); *Injune*: 55 km NNE, 23.xi.1986, M.S. & B.J. Moulds (1♂, AMSA); *Selwyn Mine*: 160 km SE of Mt Isa, 2.i.1992, T. Woodger (1♀, ANIC); *Stonehenge*: 16.x.1968, G. Monteith (2♀, QLDM); **Victoria:** *Murray-Sunset Nat. Pk*: -34.63207° – 141.97935°, 10.i.2010, S. Winterton (1♀, CSCA).

Comments – *Periclystus laceratus* is closely related to *P. aureolatus* based on the color pattern of the wings. Some specimens of *P. laceratus* can get as big as some *P. circuiter*, but they can be easily separated by the hind wing pattern. These two species are mostly distributed in the eastern side of the country, however they seem to occur in different environments, *P. circuiter* records are always very close to the costal area, whereas *P. laceratus* are commonly found more inland. For phylogenetic relationships see (A4 Figs 1-3).

***Periclystus vicinus* New 1985**

(A4 Figs 136-137)

Periclystus vicinus New 1985d:229 (OD); Stange 2004:107 (cat); Oswald 2015 (cat).

Diagnosis – Thorax lustrous [not dull]; body mostly dark [not mostly pale]; wings broad [not thin], with tip weakly falcate [not strongly falcate]; hind wing with two large brown bands separated by a thin hyaline area [not hyaline with scattered dark marks].

Description – Lengths: forewing: 46 mm; hind wing: 41 mm.

Head (A4 Fig 136a): *Labrum* reddish brown, set with a line of elongate setae. *Clypeus* reddish brown, set with some elongate black setae. *Frons* mostly reddish brown, but slightly darker in border; set with short black setae. *Gena* slightly darker than frons. *Vertex* strongly raised; pale to reddish brown with some small irregular dark marks medially; darker areas covered with short black setae. *Ocular rim* setae absent. *Antennae* filiform; elongate (tip broken); distance between antennae wider than scape width; scape and pedicel reddish brown; flagellomeres entirely pale; torular membrane reddish brown; flagellomeres almost as long as wide; all segments set with short black setae. *Mandible* reddish brown, with internal margin darker. *Palpi*, maxillary and labial dark reddish brown; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 136a): *Pronotum* about as long as wide; posterior margin about as wide as anterior; subapical furrow present; reddish brown but with a medial longitudinal black line; covered with some short black setae and some long setae at margins and medial area. *Mesonotum* black, except for scattered small pale marks; set with short black setae,

and some long setae at prescutum, *Metanotum* black, set with short black setae. *Pterothoracic pleura* black; covered with long black setae; Miller's organ absent.

Wings (A4 Fig 136b): Broad with tip weakly falcate; anterior Banksian line present in both wings, posterior absent; veins mostly dark brown, but some veins intercalated with white spots, and basal veins mostly white; beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane hyaline, with tip mostly brown, but enclosing some small transparent areas, with a transversal curved brown streak located on apex of CuA₂; and with scattered brown marks, mainly at base, posterior margin, around crossveins, of mediocubital, subcostal, and radial areas; cubital fork located between origins of Rs and MA; five presectoral crossveins; subcostal veinlets mostly simple, with few distal ones forked; posterior area much wider than prefork area. *Hind wing* veins mostly white; membrane mostly hyaline except for tip, mostly brown with a subapical transversal hyaline stripe; medial fork located between origins of Rs and MA; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Fig 136a): *All pairs of legs*, femur elongate (> 3.5x length of coxa); tibia slightly longer than femur but about twice longer than tarsi; tibial spurs extending over T2 apex; T3 and T4 about same size, T2 slightly longer than T3, T1 twice longer than T2, and T5 twice longer than T1; claws about half of T5 length; all segments set with short black setae, and scattered long setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair absent; tibia with antennal cleaning setae ventroapically; coxa and trochanter black, femur basal half dark brown but remaining areas pale, tibia and tarsi pale. *Midleg* with color pattern similar to foreleg, except for femur with only

basal extremity dark brown, remaining areas pale. *Hindleg* with femur and tibia slightly longer than in other legs; with same color pattern of midleg.

Abdomen: Mostly black except for pale basal halves of tergite 3 and 4 and basal halves of sternites 2 and 3. Beset with black setae.

Male Terminalia (A4 Fig 137a-c): *Ectoproct* with ventral margin straight and slightly longer than dorsal margin in lateral view; covered elongate black setae. 9th sternite short, with posterior margin rounded in ventral view; covered with long black setae mainly medially. *Gonarcus* broad, arched, with anterior margin rounded in lateral view. *Mediuncus* large, broad, with tip acute. *Paramere* broad, in ventral view with anterior margin rounded, posterior with two acute expansions (external much larger); in lateral view apex of external expansion rounded.

Female Terminalia: *Unknown*

Distribution (A4 Fig 171) – Known only by the holotype from Port Moresby, Papua New Guinea.

Adult activity period – Only record for March.

Biology – Unknown, larva unknown.

Primary type – Holotype (by original designation), male (ANIC), examined. From original description, New (1985d): “*Type* – Papua New Guinea: Holotype ♂, Central Province, ca 20 km SE of Port Moresby, 20.iii.1982. J.W. Ismay (swept from trees) (to be deposited in Australian National Insect Collection, CSIRO, Canberra)”. Condition: good; with antennae tip missing, terminalia dissected.

Comments – *Periclystus vicinus* is the only species of the genus located out of Australia, and until this study it was the only record of the former Periclystina outside of the country. Despite been located in the neighboring country *P. vicinus* is clearly close associated with *P. circuiter* as mentioned by New (1985d) on its original description. For phylogenetic relationships see (A4 Fig 3)

***Riekoleon* New 1985**

Type species: *Riekoleon convergens* New 1985, by original designation.

Diagnosis – Ocular setae absent [not present]; wings narrow and acute [not broad], wing membrane most hyaline but full of brown marks [not completely hyaline]; legs elongate [not short], male ectoproct elongate ventrally [not rounded]; posterior gonapophyses long, [not short] broad [not thin], and with many cavisetae at apex [not cavisetae absent].

Description – Head: *Vertex* weakly raised. *Ocular rim* setae absent. *Antennae* clubbed and elongate; flagellomeres almost as long as wide at base, apical ones slightly wider than long. *Palpimacula* oval-shaped, located medially. Thorax: Pronotum longer than wide. Miller's Organ present. Wings: rather narrow and acute. *Membrane* mostly hyaline but full of dark marks. *Anterior Banksian* line present in both wings, posterior absent. *Forewing* with subcostal veinlets simple; prefork area slightly wider than posterior area. *Hind wing* with one presectoral crossvein. *Male pilula axillaris* present. Legs: *Femur* elongate, > 3.5x length of coxa. *Tibia* about twice longer than tarsi. *Pretarsal claws* slightly shorter than half of T5 length. *Sense hair* absent or reduced. Male Terminalia: *Ectoproct* elongate ventrally; *mediuncus* absent; *paramere* elongate with tip acute.

Female Terminalia: *ectoproct* rounded; *lateral gonapophyses* set with short cavisetae; *posterior gonapophyses* broad, long with many cavisetae at apex; *anterior gonapophyses* a plate covered with long setae; 9th *tergite* with a broad membranous digitiform process; *pregenital plate* very reduced, almost imperceptible.

Distribution (A4 Fig 172) – Australia: NSW and QLD. There is one specimen held in ANIC, which is in a bad shape but seems to belong to *Riekoleon*. This specimen was collected in the southwestern corner of WA, at Ravensthorpe in January 1993, indicating that the genus distribution might be much larger.

Comments – The genus contains four species, the two original ones (New 1985b), *R. convergens* and *R. furcatus*, the new species *R. squamosus* and the newly transferred from *Austrogymnocnemia*, *R. proctus* (A4 Figs 1-3). These delicate species are very characteristic because of their elongate legs and pronotum, and by their wings full of brown marks, but their main character is the distinctive elongate ventral margin of the male ectoproct. Elongate ectoprocts can also be found in another Dendroleontini genus from Australia, the monospecific *Chrysoleon*. However these two genera can be easily separated by the biareolate costal area in the forewing of *Chrysoleon*, and also by its elongate female anterior gonapophyses.

New (1985b) on the genus original description included the tibial spurs extending to T2 apex, as a main character for *Riekoleon*, but with the inclusion of *R. proctus* in the genus, this character can no longer be used to distinguish it. The author also mentioned that the female anterior gonapophyses is absent in *Riekoleon*, however this structure is actually present, it is reduced to a small plate, but can be easily noticeable. The

specimen, mentioned in the previous section from WA (ANIC), probably belongs *Riekoleon*, but because of its very bad shape we decided to not include it in this study, avoiding possible future confusions.

Biology – Unknown.

Key to species of *Riekoleon* (modified from New 1985b)

- 1 Pterothorax and abdomen covered with regular setae (long).....2
- 1' Pterothorax pleuron and abdomen covered with scale like setae (short and flatt) (A4 Fig 144b).....*R. squamosus*
- 2 Tibial spurs present (reaching T2 apex).....3
- 2' Tibial spurs absent.....*R. proctus*
- 3 Body dark (vertex, mesonotum and legs mostly brown) (A4 Fig 140b); pronotum setae black and short; hind wing with a large rhegmal spot (A4 Fig 140c)*R. furcatus*
- 3' Body pale (vertex, mesonotum and legs mostly pale) (A4 Fig 138b); pronotum setae mostly white and long; hind wing with a small rhegmal spot (A4 Fig 138b)*R. convergens*

***Riekoleon convergens* New 1985**

(A4 Figs 138-139)

Riekoleon convergens New 1985:75 (OD); New 1996:93 (cat); Stange 2004:108 (cat); Oswald 2015 (cat).

Diagnosis – Legs elongate [not short]; wings narrow [not broad] and full of brown marks [not hyaline]; tibial spurs reaching apex of T2 [not absent or longer or shorter]; body mostly pale [not mostly dark]; pronotum with some long white setae [not short or black]; male ectoproct ventrally elongate [not rounded].

Description – Lengths: forewing: 19 – 21 mm; hind wing: 18 – 19 mm.

Head (A4 Figs 138a-b): *Labrum* pale, set with a line of elongate setae. *Clypeus* pale with a thin central longitudinal dark brown line, margin between clypeus and frons dark brown; set with some elongate white setae. *Frons* ventral margin pale with a thin central longitudinal dark brown line, but remaining areas dark brown; covered with short white setae. *Gena* pale. *Vertex* entirely pale with some small irregular brown marks posteriorly in some specimens; covered with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, about twice longer than pronotum; distance between antennae wider than scape width; scape and pedicel mostly dark brown, most flagellomeres brown basally and pale distally, apex entirely dark brown; torular membrane pale; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae, except for scape and pedicel with short white setae. *Mandible* pale, with tip darker. *Palpi*, maxillary and labial pale with distal segments brown, and some irregular brown marks in some specimens; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 138b): *Pronotum* longer than wide; posterior margin wider than anterior; subapical furrow present; mostly pale except for lateral margins up to furrow dark brown, and a thin longitudinal dark brown line medially in some specimens; set with few

short black setae and some long white setae. *Mesonotum* coloration mostly pale with brown areas as follows: two rounded marks on posterior margin of prescutum, and two large rounded lateral marks at scutum; covered with short black setae, and few long white setae. *Metanotum* dark brown laterally with a broad longitudinal pale line medially, covered with few short black setae. *Pterothoracic pleura* mostly dark brown with irregular pale marks ventrally in some specimens; covered with long white setae; Miller's organ present.

Wings (A4 Fig 138c): Rather narrow with tip acute; anterior Banksian line present in both wings, posterior absent; veins mostly dark brown, but some veins intercalated with white spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline with irregular brown marks, mainly near pterostigma (apex white), posterior margin, and around basal crossveins; cubital fork located near Rs origin; three presectoral crossveins; subcostal veinlets simple; posterior area narrower than prefork area. *Hind wing* membrane mostly hyaline except for a small brown mark on rhegmal area and other two brown marks around pterostigma (white); medial fork located between origin, of Rs and MA, subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 138a-b): *All pairs of legs*, femur elongate ($> 3.5x$ length of coxa); tibia slightly longer than femur and more than twice longer than tarsi; tibial spurs surpassing T2 apex; T2, T3 and T4 about same size, T1 longer than T2, and T5 twice longer than T1; claws about half of T5 length; coxa, trochanter, and femur set with short white setae; femur, tibia and tarsi set with black setae, and scattered long ones. *Foreleg* sense hair

absent; tibia with antennal cleaning setae ventroapically; coxa and trochanter pale, femur mostly pale but apex and anterior surface dark brown, tibia pale with scattered dark brown areas; tarsi dark brown. *Midleg* with color pattern similar to foreleg, except for femur pale with apex and two thin lines on dorsal surface dark brown. *Hindleg* with femur and tibia slightly longer than anterior legs; color pattern similar to midleg, except for tibia paler.

Abdomen: Mostly pale with scattered dark brown marks, mainly on distal margin, but mostly dark brown in some specimens. Beset with short black setae.

Male Terminalia (A4 Figs 139a-c): *Ectoproct* with posteroventral margin extended in lateral view; set with elongate black setae. *9th sternite* short, with posterior margin elongate medially in ventral view; covered with elongate black setae. *Gonarcus* large, thin and “C” shaped in lateral view; in posterior view with medial region broader. *Mediuncus* membranous. *Paramere* elongate longitudinally, with tip acute, base divided into two lobes and curving upwards in lateral and posterior view. Dorsal region of paramere and gonarcus connected by a membrane.

Female Terminalia (A4 Figs 139d-e): *Ectoproct* rounded covered with thin elongate setae. *Lateral gonapophyses* rounded, much smaller than ectoproct, set with some elongate setae, and few short thickened setae ventrally. *7th sternite* small, with distal margin rounded in ventral view; covered with long black setae. *Pregenital plate* weakly sclerotized, small, a transverse bar with anterior margin straight, posterior margin with a medial rounded expansion in ventral view. *Posterior gonapophyses* broad, long, covered with many long black setae and many cavisetae dorsoapically. *9th tergite* with a broad

membranous digitiform process. *Anterior gonapophyses* as a large plate covered with long setae. *Ventral membrane* gonapophyseal plates absent.

Distribution (A4 Fig 172) – Australia: QLD.

Adult activity period – Records for November to February.

Biology – Unknown, larva unknown.

Primary type – Holotype (by original designation), female (ANIC), examined. From original description, New (1985b): “Holotype, ♀, Queensland, Mission Beach, near Tully, 5-23.xi.1967, R. Dobson (ANIC)”. Condition: good; terminalia dissected.

Material examined – (3♂, 8♀). **AUSTRALIA: Queensland:** *Bald Hills Stn:* 30 km N of Cooktown, 11.ii.1982, M.S. & B.J. Moulds (1♀, AMSA); *Cape York:* Silver Plains HS, 28.i.1962, J.L. Wassell (1♀ PT, ANIC); *Crystal Creek:* 22 miles SSE Ingham, 18°58’S - 146°16’E, 9.xii.1968, Britton & Misko (1♀ PT, ANIC); *Etty Bay:* nr innisfail, 23.ii.1982, M.S. & B.J. Moulds (1♀, AMSA); *Half Tide:* nr McKay, xi.1965 (1♀, QLDM); *Isabela Falls:* NW Cooktown, 15°18’02’’S – 145°00’13’’E, 11.i.2004, Moulds & Cowan (1♀, AMSA); *Kuranda:* 5 miles S, Speewah Rd, 11.i.1967, D. K. McAlpine and G. Holloway (1♂, PT, AMSA); *McIlwraith Rg:* NE of Coen, 13°43.247’S – 143°19.458’E, 508m, 7.i.2007, K. Hill, D. Marshall & M. Moulds (1♂, AMSA); *Meringa:* 27.ii.1926 (1♀, QLDM); *Station CK:* 15 km NW of Mount Molloy, 26.xii.1987, M.S. & B.J. Moulds (1♂, FSCA, 1♀, AMSA).

Comments – See comments for *R. furcatus*.

***Riekoleon furcatus* New 1985**

(A4 Figs 140-141)

Riekoleon furcatus New 1985:76 (OD); New 1996:93 (cat); Stange 2004:108 (cat); Oswald 2015 (cat).

Diagnosis – Legs elongate [not short]; wings narrow [not broad] and full of brown marks [not hyaline]; tibial spurs reaching apex of T2 [not absent or longer or shorter than T2]; body mostly brown [not pale]; pronotum with short black setae [not long and white]; male ectoproct ventrally elongate [not rounded].

Description – Lengths: forewing: 21 – 24 mm; hind wing: 19 – 22 mm.

Head (A4 Figs 140a-b): *Labrum* pale with central area dark in most specimens, set with a line of elongate setae. *Clypeus* pale with a narrow central longitudinal dark brown line, margin between clypeus and frons dark brown in some specimens; set with some elongate white setae. *Frons* ventral margin pale with a thin central longitudinal dark brown line, remaining areas dark brown; covered with short white setae. *Gena* pale. *Vertex* anteriorly pale to yellow posteriorly dark brown; covered with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, about twice longer than pronotum; distance between antennae wider than scape width; scape mostly pale, pedicel and most flagellomeres brown with a pale ring at distal margin, three to four subapical flagellomeres pale, but apex entirely dark brown; torular membrane pale; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae, except for scape and pedicel with short white setae. *Mandible* pale, with tip darker. *Palpi*, maxillary and labial pale with distal segments brown, with some

irregular brown marks in some specimens; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 140b): *Pronotum* longer than wide; posterior margin wider than anterior; subapical furrow present; mostly pale except for some dark brown areas as follows: lateral margins up to furrow, a narrow sagittal line (in most specimens extending up to furrow but reaching anterior margin in some specimens), small rounded spots at setal base; beset with short black setae, few long black, and pale setae on borders. *Mesonotum* mostly dark brown with pale areas as follows: two square marks on prescutum (fused, forming large rectangle in some specimens), two large pale marks, enclosing a longitudinal dark line, near midline and a rounded spot at wings base at scutum, two posterior triangular marks at scutellum; covered with short black setae. *Metanotum* mostly dark brown with lateral pale marks, set with few short black setae. *Pterothoracic pleura* dark brown dorsally and covered with short black setae; ventrally pale and covered with white setae; Miller's organ present.

Wings (A4 Fig 140c): Rather narrow with tip acute; anterior Banksian line present in both wings, posterior absent; veins mostly dark brown, but some veins intercalated with white spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline but full of irregular brown marks as follows: larger marks at end of prefork area, near pterostigma (with apex white), and gradate crossveins; and many small marks at posterior margin, base of costal and subcostal area, apex, radial, presectoral, and mediocubital crossveins; cubital fork located between origins of Rs and MA; three presectoral crossveins with distal ones connected by longitudinal crossveins

in some specimens; subcostal veinlets mostly simple but few forked; posterior area thinner than prefork area. *Hind wing* membrane mostly hyaline except for two large brown marks, one at rhegmal area and other at hypostigmatic cell, and some small brown marks distal to pterostigma, and inferior margin apically; pterostigma white; medial fork located near Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 140a-b): *All pairs of legs*, femur elongate (> 3.5x length of coxa); tibia slightly longer than femur but more than twice longer than tarsi; tibial spurs extending to T2 apex; T2, T3 and T4 about same size, T1 slightly longer than T2, and T5 twice longer than T1; claws about half of T5 length; coxa, trochanter, and femur set with short white setae; femur, tibia and tarsi set with black setae, and scattered long ones. *Foreleg* sense hair absent; tibia with antennal cleaning setae ventroapically; coxa pale with irregular dark brown marks externally, trochanter pale, femur mostly dark brown with a pale line at ventral surface (restricted to basal region for most specimens but longer in some specimens), tibia dark brown with a basal pale ring; tarsi dark brown. *Midleg* with color pattern similar to foreleg, except for femur generally paler. *Hindleg* with femur and tibia slightly longer than in midleg; color pattern similar to midleg, except for tibia pale with tip dark brown, and femur paler.

Abdomen: Mostly black with scattered pale marks, mainly on medial and lateral areas, but entirely black in some specimens. Beset with short black setae.

Male Terminalia (A4 Figs 141a-c): *Ectoproct* with posteroventral margin extended, in lateral view; set with elongate black setae. *9th sternite* short, with posterior margin elongate medially in ventral view; covered with elongate black setae. *Gonarcus* large,

thin, and “C” shaped in lateral view, with dorsal region narrower. *Mediuncus* absent. *Paramere* elongate longitudinally, with tip acute, base divided into two lobes and curving upwards in lateral and posterior view. Dorsal region of paramere and gonarcus connected by a membrane.

Female Terminalia (A4 Figs 141d-e): *Ectoproct* rounded covered with thin elongate setae. *Lateral gonapophyses* rounded, much smaller than ectoproct, set with some elongate setae, and few short thickened setae ventrally. *7th sternite* small, with distal margin rounded in ventral view; covered with long black setae. *Pregenital plate* weakly sclerotized almost indistinguishable but small and rectangular in ventral view. *Posterior gonapophyses* broad, long, covered with many long black setae and many cavisetae apically. *9th tergite* with a broad membranous digitiform process. *Anterior gonapophyses* a large plate covered with long setae. *Ventral membrane gonapophyseal plates* absent.

Distribution (A4 Fig 172) – Australia: NSW* and QLD. * = new record.

Adult activity period – Records for October to February and April.

Biology – Unknown, larva unknown.

Primary type – Holotype (by original designation), male (ANIC), examined. From original description, New (1985b): “Holotype, ♂, Queensland, Electra S.F., c. 25 km S. Bundaberg, November 1976, H. Frauca (ANIC)”. Condition: good; terminalia dissected.

Material examined – (9♂, 15♀). **AUSTRALIA: New South Wales:** *Deriah State Forest:* 30.22S – 149.59E, 21.xi.1997, E.D. Edwards (1♀, ANIC, 1♀, FSCA); *Ebenezer:* 33°50.706’S – 151°10.857’E, 19.xii.1998, J.C. Keast (1♀, ANIC); *Wedderburn:* 3 km E, 34°08’S – 150°49’E, 2.ii.2006, at MV light, Coll D. Britton (1♀, AMSA); **Queensland:**

Blackbutt Rg foot: 13 km E of Blackbutt, 26:53.3S – 152:12.8E, 9.i.2002, Moulds, Hill et al. (2♂, 3♀, AMSA); *Blackdown Tableland*: Expedition Rg, 17.i.1987, M.S. & B.J. Moulds (1♀, AMSA); *Brisbane*: xi.1943 (1♂, QLDM); xi.1990 (1♂, QLDM); *Bunya Mt*: i.1940 (1♂, QLDM); *Canungra*: Curtis Property, 8 km SW, 9.i.1979, at light, K.J. & C.L. Lambkin (1♀, QLDM); *Carnarvon Nt Pk*: Mount Moffat, 25°01'22''S – 147°56'59''E, 2.xii.1997, J Skevington, C Lambkin, S Evans (1♀, QLDM); *Eidsvold*: 25°19'S – 150°27'E, 16.i.1991, G & A Daniels, mv lamp (1♀, QLDM); *Forty Mile Scrub*: 65 km NW of Mt Garnet, 19.i.1977, M.S. & B.J. Moulds (1♂, PT *R. convergens*, AMSA); *Injune*: 55 km NNE, 23.xi.1986, M.S. & B.J. Moulds (1♀, AMSA); *Mount Abbott*: iv.1997 (1♂, QLDM); *Nine Mile Ck*: 14 km NNW of Miles, 24.i.1990, M.S. & B.J. Moulds (1♂, AMSA); *Tamborine Mt*: xii.1992 (1♂, QLDM); *Toowoomba*: 9.xi.1983, I.F.B. Common & B. Hacobian (1♀, AMSA); 23.i.1993, S Winterton (1♀, QLDM); *Yeppon*: x.1924 (1♀, QLDM).

Comments – One of the *R. convergens* paratypes (male from Forty Mile Scrub, AMSA) actually belongs to *R. furcatus*. Both species are very similar including male and female terminalia, but can be distinguished by some external characters: *R. furcatus* is darker than *R. convergens*, mainly at vertex, pterothorax and legs, besides the large rhegmal mark in *R. furcatus* hind wing, which is absent in *R. convergens*. Both species can be separated from the other two by the tibial spurs reaching apex of T2. For phylogenetic relationships see (A4 Figs 1-3).

***Riekoleon proctus* (New 1985), new combination**

(A4 Figs 142-143)

Austrogymnocnemia procta New 1985:16 (OD); New 1996:68 (cat); Stange 2004:100 (cat); Oswald 2015 (cat).

Diagnosis –Legs elongate [not short]; wings narrow [not broad] and full of brown marks [not hyaline]; tibial spurs absent [not present]; pronotum with short black setae [not long and white]; male ectoproct ventrally elongate [not rounded].

Description – Lengths: forewing: 20 – 22 mm; hind wing: 18 – 21 mm.

Head (A4 Figs 142a-b): *Labrum* pale with central area dark in most specimens, set with a line of elongate setae. *Clypeus* pale with a thin central longitudinal dark brown line, and margin between clypeus and frons dark brown; set with few elongate pale setae. *Frons* with ventral margin pale, remaining areas dark brown (dorsal margin curved and ventral medially excavated); covered with short white setae. *Gena* pale. *Vertex* entirely dark brown except for a transversal pale line in frontal view; covered with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, about twice longer than pronotum; distance between antennae wider than scape width; scape mostly pale, pedicel and most of flagellomeres brown with a pale ring at distal margin, three to four subapical flagellomeres pale, and apex entirely dark brown; torular membrane pale; flagellomeres almost as long as wide at base, but apical ones much wider than long; all segments set with short black setae. *Mandibles* pale, with tip dark. *Palpi*, maxillary and labial pale with distal segments brown; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 142b): *Pronotum* longer than wide; posterior margin wider than anterior; subapical furrow present; mostly pale except for some dark brown areas: lateral margins, two small marks on posterior half, and thin longitudinal line medially; beset with short black setae and few long black setae on borders. *Mesonotum* mostly dark brown with pale areas as follows: two lateral rounded spots on prescutum and two large marks around central area, in some specimens medial area of scutellum pale; covered with short black setae. *Metanotum* mostly dark brown, except for irregular pale areas mostly around midline, covered with few short black setae. *Pterothoracic pleura* mostly dark brown with some irregular pale marks, mainly at ventral sclerites; covered with white setae but some black setae at dorsal sclerites; Miller's organ present.

Wings (A4 Fig 142c): Rather narrow with tip acute; anterior Banksian line present in both wings, posterior absent; veins mostly dark brown, but some veins intercalated with white spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline but full of irregular brown marks at end of prefork area and near pterostigma, which is white; cubital fork located near Rs origin; four to five presectoral crossveins with the distal ones connected by irregular longitudinal crossveins; subcostal veinlets simple; posterior area thinner than prefork area. *Hind wing* membrane mostly hyaline except for a wide subapical brown line, some irregular brown marks distal to pterostigma, and posterior margin brown infuscated apically; medial fork located near Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 142a-b): *All pairs of legs*, femur elongate ($> 3.5x$ length of coxa); tibia slightly longer than femur but twice longer than tarsi; tibial spurs absent; T3 and T4

about same size, T2 slightly longer than T3, T1 slightly longer than T2, and T5 about twice longer than T1; claws shorter than half of T5 length; coxa, trochanter, and femur set with short white setae, with scattered long setae; femur, tibia and tarsi set with black setae, and scattered long black setae. *Foreleg* sense hair absent; tibia with antennal cleaning setae ventroapically; coxa externally dark brown but internally pale, trochanter brown, femur mostly brown, with internal pale marks specially at base, tibia brown with two pale rings, both on basal half; tarsi dark brown. *Midleg* with color pattern similar to foreleg, except for femur mostly pale with apex and part of dorsal surface brown. *Hindleg* with femur and tibia slightly longer than in other legs; color pattern similar to midleg, except for tibia pale with tip and internal surface midline dark brown.

Abdomen: Mostly black with scattered pale marks, mainly on sternites medial and lateral areas, and tergites proximal halves. Beset with short black setae.

Male Terminalia (A4 Figs 143a-d): *Ectoproct* with posteroventral margin extended, in lateral view; set with elongate black setae. *9th sternite* short, with posterior margin elongate medially in ventral view; covered with elongate black setae. *Gonarcus* broad in lateral view and circular in posterior view. *Mediuncus* absent. *Paramere* elongate longitudinally, fused basally and with tip acute and curving upwards.

Female Terminalia (A4 Figs 143e-f): *Ectoproct* rounded covered with thin elongate setae. *Lateral gonapophyses* rounded, much smaller than ectoproct, with few elongate setae, and few short thickened setae ventrally. *7th sternite* small, with distal margin rounded in ventral view; covered with long black setae. *Pregenital plate* trapezoid, with anterior margin narrow and distal broad in ventral view; hidden beneath *7th sternite* in

ventral view. *Posterior gonapophyses* broad, long, covered with many long black setae and with many cavisetae apically. *9th tergite* with a broad membranous digitiform process. *Anterior gonapophyses* a small plate covered with long setae. *Ventral membrane* gonapophyseal plates present.

Distribution (A4 Fig 172) – Australia: NSW* and QLD. * = new record.

Adult activity period – Records for February and December.

Biology – Unknown, larva unknown.

Primary type – Holotype (by original designation), male (QLDM), examined. From original description, New (1985b): “Holotype, ♂, Queensland, Brisbane, 15.xii.1928 (QM)”. Condition: good; terminalia dissected.

Material examined – (4♂, 2♀). **AUSTRALIA: New South Wales:** *Pillaga Scrub:* 30:56S – 149:23E, 10.ii.1997, M.S. & B.J. Moulds (1♂, AMSA); **Queensland:** *Brisbane:* 2.xii.1928, Coll. Esben-Petersen (1♀, ZMUC); *Mt Moffat N. P.:* Top Moffat Camp, 13-15.xii.1987, M.V., Monteith Thompson Yeates (3♂, 1♀, QLDM).

Comments – *Riekoleon proctus* was initially described in *Austrogymnocnemia* by New (1985b), who mentioned that the male genitalia was unusual to this genus, and that the ectoproct form implied that it could be generically distinct. However, the author decided to keep it in *Austrogymnocnemia*, pending on the discovery of the female. With the description of the females here, it is clear that the species belongs to *Riekoleon*. The female and male terminalia are almost identical to the other species, including the elongate male ectoproct, the most distinctive character in the genus. The external characters such as the shape of wings, pronotum and legs also corroborate with the

transference of this species to *Riekoleon*. The major difference from *R. proctus* to the remaining species is the absence of the tibial spurs, which justified the placement in *Austrogymnocnemia* at that time. However this character is historically known to be very plastic and was confirmed as very problematic during this study. The elongation of the male ectoproct seems to be a much more robust character, what justifies the new combination proposed here. For phylogenetic relationships see (A4 Fig 3).

Because the species was originally described in *Austrogymnocnemia*, a female word, the specific name also had to be female, “*procta*”. However with the transference of this species to *Riekoleon*, a male word, the specific name has to change in order to match the genus gender, therefore it must be called now *Riekoleon proctus*.

***Riekoleon squamosus*, new species**

(A4 Figs 144-145)

Diagnosis – Legs elongate [not short]; wings narrow [not broad] and full of brown marks [not hyaline]; tibial spurs reaching apex of T1 [not absent or longer or shorter than T1]; body mostly brown [not pale]; pterothorax pleura and abdomen covered short flattened setae, remembering scales [not regular long setae].

Description – Lengths: forewing: 18 – 19 mm; hind wing: 17 – 18 mm.

Head (A4 Figs 144a, c): *Labrum* pale but brown in some darker specimens, set with a line of elongate setae. *Clypeus* pale with a thin central longitudinal dark brown line, and margin between clypeus and frons dark brown in some specimens; set with few elongate black setae and some short pale setae. *Frons* ventral margin pale with a thin central

longitudinal dark brown line, remaining areas dark brown; covered with short white setae. *Gena* pale with irregular dark brown marks, and some short black setae. *Vertex* anteriorly pale but posteriorly dark brown; covered with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, about twice longer than pronotum; distance between antennae wider than scape width; most segments brown with a pale ring at distal margin, three subapical flagellomeres pale, but apex entirely dark brown; torular membrane pale; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae. *Mandible* pale, with tip darker. *Palpi*, maxillary and labial pale with distal segments brown (some specimens with irregular brown marks); apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 144c): *Pronotum* longer than wide; posterior margin wider than anterior; subapical furrow present; mostly pale except for some dark brown areas: a longitudinal medial line (broad before furrow but thin after it), two sinuous lines and lateral margins extending to furrow, two marks after furrow, and small rounded spots at setal base; beset with short thickened black setae and few long thickened setae. *Mesonotum* mostly dark brown, with some pale areas as follows: a longitudinal medial line on posterior half of prescutum, two large pale marks, enclosing a longitudinal dark line, near midline and a rounded spot at wings base on scutum, and posterior margin of scutellum; covered with short thickened black setae. *Metanotum* dark brown with irregular small pale marks in some specimens, with three small groups of setae: one at prescutum and two at posterior margin of scutum, those setae are short, thickened, and with apex rounded and enlarged.

Pterothoracic pleura dark brown and totally covered with short thickened black setae with tip enlarged; Miller's organ present.

Wings (A4 Fig 144d): Rather narrow with tip acute; anterior Banksian line present in both wings, posterior absent; veins mostly dark brown, but some veins intercalated with white spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane mostly hyaline but full of irregular brown marks at costal area base, subcostal area basal half, before pterostigma, posterior margin, apex, and some crossveins; pterostigma white; cubital fork near Rs origin; four to five presectoral crossveins with distal ones connected by irregular longitudinal crossveins in some specimens; subcostal veinlets simple; posterior area narrower than prefork area. *Hind wing* membrane mostly hyaline except for two large brown marks around pterostigma, a large brown mark at rhegmal area and small brown marks around prefork crossveins and tip; pterostigma white; medial fork located near Rs origin; subcostal veinlets simple; one presectoral crossvein, except for one specimen with two on left wing.

Legs (A4 Figs 144a, c): *All pairs of legs*, femur elongate ($> 3.5x$ length of coxa); tibia slightly longer than femur but longer than tarsi; tibial spurs extending to T1 apex; T1 to T4 about same size, T5 more than twice longer than T1; femur and tibia broad, specially femur apically; claws shorter than half of T5 length. *Foreleg* sense hair absent; tibia with antennal cleaning setae ventroapically; all segments dark brown except for coxa internally and base of tibia pale; all segments covered with short black setae, coxa external margin covered with short thickened setae, femur and tibia with long thickened setae. *Midleg* similar to foreleg, except for femur without long thickened setae. *Hindleg*

with femur and tibia slightly longer than in midleg; color pattern similar to midleg, except for femur and tibia pale with tip dark brown; femur covered only by short thickened setae, and tibia with short black setae ventrally, almost glabrous dorsally.

Abdomen (A4 Fig 144b): Mostly dark brown with scattered pale marks, mainly on medial area of sternites and distal margin of tergites. Four basal tergites and three basal sternites entirely covered by short black thickened setae with apex enlarged, remaining segments with thickened setae.

Male Terminalia: *Unknown*

Female Terminalia (A4 Figs 145a-b): *Ectoproct* rounded covered with thin elongate setae. *Lateral gonapophyses* rounded, much smaller than ectoproct, set with some elongate setae, and few short thickened setae ventrally. *7th sternite* small, with distal margin rounded in ventral view; covered with long black setae. *Pregenital plate* weakly sclerotized, small, and rectangular in ventral view. *Posterior gonapophyses* broad, long, covered with many long black setae and with many cavisetae apically. *9th tergite* with a long membranous digitiform process. *Anterior gonapophyses* a large plate covered with long setae. *Ventral membrane* gonapophyseal plates absent.

Distribution (A4 Fig 172) – Australia: NSW and QLD.

Adult activity period – Records for November to January.

Biology – Unknown, larva unknown.

Etymology – The specific name is derived from the Latin word *squamosus* (= scaly) and refers to the scale like setae that cover most parts of thorax and abdomen.

Primary type – Holotype (by present designation), female, (AMSA). **AUSTRALIA:**

Queensland: foot of Blackbutt Rg, 13 km E of Blackbutt, 26:53.3S – 152:12.8E, 9.jan.2002, Moulds, Hill et al. Condition: pinned; good; no parts missing.

Paratypes: **AUSTRALIA: New South Wales:** *Canowindra:* i.1956 (1♀, MVM, pinned); *Deriah Aboriginal Area:* 23 km E of Narrabri, -30.345S – 150.014E, 10.xi.2009, 460m, Ooline, D.R. Britton & J. Recsei, SEVT2009012, [at light] (1♀, AMSA, pinned); *Moema NP:* 36.5 km NE of Narrabri, -30.064S – 149.965E, 13.xi.2009, 355m, Semi evergreen vine thicket, D.R. Britton & J. Recsei, SEVT2009029, [black light bucket] (1♀, AMSA, pinned); *Temora:* 18 km N; 26.xii.1992, M.S. & B.J. Moulds (2♀, AMSA, pinned); **Queensland:** *Barakula State Forest:* 28.5 air km NNW Chinchilla, 26.49661°S - 150.52354°E, R Machado, MV light, 19.xii.2015, AustRM#04 (2♀, TAMU, 100% ETOH).

Comments – The males of *R. squamosus* are still unknown, preventing the study of their ectoproct, which is one of the most important characters in the genus. However the study of the eight females presented here clearly place this species in *Riekoleon*. The female terminalia is almost identical to the other three species, and the shape of the legs, pronotum and wings also approximate *R. squamosus* with the remaining species. The scale like setae covering parts of the body of this species, is unique among the Australian species, and easily separate it from the other antlions. For phylogenetic relationship see (A4 Figs 1-3).

***Tanyleon*, new genus**

Type species: *Glenoleon cahillensis* New 1985, by present designation.

Diagnosis – Pronotum longer than wide [not same size or wider]; femur > 3.5x length of coxa [not shorter]; forewing fairly broad [not thin]; tibial spurs present [not absent]; female lateral gonapophyses about same size of ectoproct [not smaller]; female, posterior gonapophyses, long, thin and without cavisetae [not broad or with cavisetae]; male, gonarcus with anterior area curved in lateral view [not straight].

Description – Head: *Vertex* raised and set with short setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, distance between antennae longer than scape width, flagellomeres almost as long as wide at base, apical ones much wider than long, all segments set with short black setae. *Palpimacula* rounded, located medially. Thorax: *Pronotum* longer than wide. Miller's organ absent. *Wings*: fairly broad. *Anterior Banksian* line present in both wings, posterior absent. *Forewing* with cubital fork located near Rs origin; three presectoral crossveins; posterior area narrower than prefork area. *Hind wing* medial fork located near Rs origin; one presectoral crossvein. *Male pilula axillaris* present. Legs: *Femur* > 3.5x length of coxa. *Tibial spurs* long, extending to T1 apex. *Pretarsal claws* slightly shorter than half of T5 length. *Sense hair* absent. *Tibia* with antennal cleaning setae ventroapically. Male Terminalia: *Ectoproct* rounded in lateral view; *gonarcus* with anterior area curved in lateral view; *mediuncus* broad; *paramere* with a rounded and an elongate region. Female Terminalia: *Ectoproct* and *lateral gonapophyses* about same size; *lateral gonapophyses* set with cavisetae; *posterior gonapophyses* long, thin and without cavisetae; *anterior gonapophyses* absent;

9th tergite membranous digitiform process short; ventral membrane gonapophyseal plates present

Distribution (A4 Figs 173) – Australia: NT, QLD, SA, and WA.

Comments – *Tanyleon* is another genus originated from the division of *Glenoleon* (see discussion there), and contains three species: two previously classified in *Glenoleon* and a new species. This small genus seems to be placed in an intermediary position between the clade containing the species left in *Glenoleon* and the clade with *Aurantoleon* (entirely composed by species also previously classified in *Glenoleon*). The long legs and pronotum of *Tanyleon*, indicates an association with *Glenoleon*, while the overall shape of the female terminalia place it close to *Aurantoleon*. However the general form of the male terminalia can distinguish *Tanyleon* from both. According to the morphological phylogeny the genus seems to closer to the *Aurantoleon* clade (A4 Fig 3), but unfortunately the genus was not present in the molecular phylogeny.

Etymology – The specific name is derived from the Greek word *tany* (= long, stretch out) and refers to the specimens' elongate legs.

Key to species of *Tanyleon*

- 1 Hind wing apex without a longitudinal band at posterior margin (A4 Fig 146c); pronotum posterior margin as wide as anterior margin.....2
- 1' Hind wing apex with a longitudinal brown band at posterior margin (A4 Fig 148c); pronotum posterior margin much wider than anterior margin (A4 Fig 148b).....*T. lesouefi*

- 2 Frons mostly black, but ventral margin pale (A4 Fig 146a); hind wing with a large rhegmal infuscation (A4 Fig 146c); female ectoproct without cavisetae (A4 Fig 147d); male paramere apex strongly bent (ventral view) (A4 Fig 147c)
*T. cahillensis*
- 2' Frons mostly pale, but area between antennae black (A4 Fig 150a); hind wing with a small rhegmal infuscation (A4 Fig 150d); female ectoproct with cavisetae (A4 Fig 151e); male paramere apex evenly curved (ventral view) (A4 Fig 151d)
*T. newi*

***Tanyleon cahillensis* (New 1985), new combination**

(A4 Figs 146-147)

Glenoleon cahillensis New 1985b:55 (OD); New 1996:81 (cat); Stange 2004:103 (cat); Oswald 2015 (cat).

Diagnosis – Head, frons mostly black [not mostly pale]; hind wing with a large rhegmal infuscation [not small]; pronotum, posterior margin as wide as anterior margin [not wider]; female, ectoproct, cavisetae absent [not present]; male, paramere, apex strongly bent in ventral view [not evenly curved].

Description – Lengths: forewing: 27 – 31 mm; hind wing: 24 – 29 mm.

Head (A4 Figs 146a-b): *Labrum* and *clypeus* pale; set with a line of elongate pale setae. *Frons* black, except for ventral margin pale; set with short pale setae. *Gena* pale. *Vertex* raised; in frontal view mostly pale with two small transversal dark brown marks laterally, and a small medial line; in dorsal view mostly pale with a central longitudinal

dark brown line and three rounded marks on posterior border; set with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, > 2x length of pronotum; distance between antennae wider than scape width; all segments brown, except for four subapical pale segments; torular membrane pale; flagellomeres almost as long as wide at base, apical ones wider than long; scape and pedicel covered with short white setae, flagellomeres set with short black setae. *Mandibles* mostly pale, with tip black. *Palpi*, maxillary and labial pale with dark brown marks on each basal segment and around palpimacula; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 146b): *Pronotum* longer than wide; posterior margin as wide as anterior; subapical furrow present; mostly pale with black areas as follows: a broad dark mark anterior to furrow, three longitudinal lines posterior to furrow, lateral lines enclosing a pale line medially; beset with short black setae and few long white setae at margins. *Mesonotum* mostly black, with some pale longitudinal marks specially at scutum; covered with short black setae. *Metanotum* mostly black, except for two large pale marks on prescutum. *Pterothoracic pleura* mostly black with scattered pale marks on ventral sclerites; covered with white setae; Miller's organ present.

Wings (A4 Fig 146c): Fairly broad; anterior Banksian line present in both wings, posterior absent. Veins mostly brown, but some veins intercalated with pale spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane hyaline with small infuscations on rhegmal area, around some crossveins particularly at radial area, and at forks in posterior and apical margins; pterostigma light brown; cubital fork

located near Rs origin; three presectoral crossveins; subcostal veinlets simple, few distal ones forked; posterior area narrower than prefork area. *Hind wing* membrane hyaline, with a large rhegmal infuscation and small marks at hypostigmatic cell; medial fork located near Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Fig 146a): *All pairs of legs*, femur elongate (> 3.5x length of coxa); tibia and femur about same size, but almost twice longer than tarsi; tibial spurs surpassing T1 apex; T2, T3 and T4 about same size, T1 longer than T2, T5 twice longer than T1; claws about half of T5 length; coxa, trochanter and femur set with many short white setae, femur, tibia and tarsi set with short black setae and scattered long black setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair absent; tibia with antennal cleaning setae ventroapically; coxa pale with some dark brown marks, trochanter pale, femur pale but tip and a medial mark on dorsal surface dark brown, tibia pale with three dark brown rings, one at apex, and two at basal half, T1 and T2 pale remaining tarsi areas dark brown. *Midleg* with same color pattern of foreleg. *Hindleg* with femur and tibia slightly longer than in other legs; all segments pale except for apex of femur, tibia and t5, dark brown

Abdomen: Tergites mostly dark brown with two squared pale marks at base. Sternites mostly pale but with dark brown marks on distal segments. Beset with short white setae.

Male Terminalia (A4 Figs 147a-c): *Ectoproct* rounded in lateral view; set with elongate black setae. *9th sternite* posterior margin with tip rounded and elongate; set with elongate black setae. *Gonarcus*, arched, thin and “C” shaped in lateral view thin. *Mediuncus* long and broad in posterior view, with apex curved in lateral view. *Paramere* in ventral view

with ventral area wide, rounded and covered with short black setae; dorsal area thinner with apex strongly bent and acute; in lateral view with anterior area large and rounded.

Female Terminalia (A4 Figs 147d-e): *Ectoproct* rounded, set with thin elongate setae and few thickened setae ventrally. *Lateral gonapophyses* rounded, about same size of ectoproct, beset with elongate cavisetae. *9th tergite* in lateral view with dorsal margin narrow, and set with thickened setae on ventral area. *7th sternite* long with distal margin straight, in ventral view; covered with black setae. *Pregenital plate* large and transversal, with anterior margin rounded and posterior curved medially in ventral view. *Posterior gonapophyses* thin, elongate, covered with black setae. *9th tergite* with a short membranous digitiform process. *Anterior gonapophyses* absent. *Ventral membrane gonapophyseal plates* present.

Distribution (A4 Fig 173) – Australia: NT and QLD*. * = new record.

Adult activity period – Records for March and May.

Biology – Unknown, larva unknown.

Primary type – Holotype (by original designation), female (ANIC), examined. From original description, New (1985b): “Holotype, ♀, Northern Territory, 12°51’S., 132°47’E., 10 km E. by N. Mt Cahill, 22.v.1973, M. S. Upton and R. S. McInnes (ANIC)”. Condition: good, right hindleg missing, terminalia dissected. The two paratypes were also seen in this study, but different from the original statement they are two male and not one male and one female.

Material examined – (3♂, 6♀). **AUSTRALIA: Northern Territory: Koongarra:** 15 km E of Mt Cahill, 12.52S – 132.50E, 24.iii.1973, M.S. Upton (1♀, ANIC); *Kununurra*

(WA): 70 mi ESE, UV light, 17.iv.1966, N. McFarland (1♀, SAMA); *Mount Cahill*: 10 km E 12°51'S., 132°47'E., 22.v.1973, M.S. Upton and R.S. McInnes (2♂PT, ANIC, 1♂, FSCA); *Oenpelli*: 6 km SW by S, 12.22S – 133.01E, 30.iii.1973, M.S. Upton & R.S. McInnes (3♀, ANIC); **Queensland**: *Emerald*: 20 km S, 24.iv.1994, M.S. Moulds (1♀, AMSA).

Comments – *Tanyleon cahillensis* is closely associated with *T. newi*. Despite the differences in the body color pattern, the overall shape of the male terminalia is very similar, particularly the gonarcus. For phylogenetic relationships see (A4 Fig 3).

***Tanyleon lesouefi* (New 1985), new combination**

(A4 Figs 148-149)

Glenoleon lesouefi New 1985b:41 (OD); New 1996:82 (cat); Stange 2004:104 (cat); Oswald 2015 (cat).

Diagnosis – Hind wing apex with a large longitudinal line at inferior margin [not without a line]; pronotum, posterior margin wider than anterior margin [not same width]; female, ectoproct, cavisetae present [not absent]; male, gonarcus with ventral area wide in lateral view [not thin].

Description – Lengths: forewing: 27 – 29 mm; hind wing: 25 – 27 mm.

Head (A4 Figs 148a-b): *Labrum* pale with small reddish brown marks; set with a line of elongate setae. *Clypeus* pale with two large longitudinal reddish brown bands laterally; set with few elongate pale setae. *Frons* predominantly pale, except for reddish brown marks beneath antennae, a small central longitudinal black line on ventral half, and a

curved black band behind antennae; set with few black setae. *Gena* pale. *Vertex* raised; in frontal view pale, with a median reddish brown mark, and two small lateral transversal reddish brown marks; in dorsal view mostly pale with two central perpendicular reddish brown bands; covered with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, > 2x length of pronotum; distance between antennae as wide as scape; mostly reddish brown except for scape and pedicel light brown; torular membrane reddish brown; flagellomeres almost as long as wide at base, apical ones much wider than long; all segments set with short black setae. *Mandibles* mostly pale, with tip black. *Palpi*, maxillary and labial mostly pale, except for labial distal segment, reddish brown; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 148b): *Pronotum* much longer than wide; posterior margin wider than anterior; subapical furrow present; mostly pale except for three longitudinal reddish brown bands: a large one at midline, and two thinner and shorter laterally (extending from posterior margin to subapical furrow); beset with many short pale setae and few long setae on anterior margin. *Mesonotum* mostly reddish brown, with two longitudinal pale bands around midline; covered with short pale setae. *Metanotum* very similar to mesonotum. *Pterothoracic pleura* mostly reddish brown with some pale areas mainly on sclerites ventral areas; covered with pale setae; Miller's organ present.

Wings (A4 Fig 148c): Fairly broad with tip acute; anterior Banksian line present in both wings, posterior absent; veins mostly light brown, but some veins intercalated with white spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane

mostly hyaline with brown marks concentrated on apical margins and pterostigma; cubital fork located near Rs origin; three presectoral crossveins; subcostal veinlets simple; posterior area narrower than prefork area. *Hind wing* membrane mostly hyaline except for a large brown band at apical ventral margin and brown marks at anterior margin; pterostigma apex white; medial fork located near Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 148a-b): *All pairs of legs*, femur elongate ($> 3.5x$ length of coxa); tibia slightly longer than femur, but about twice longer than tarsi; tibial spurs surpassing T1 apex; T2, T3 and T4 about same size, T1 about twice longer than T2, and T5 about twice longer than T1; claws about half of T5 length; all segments beset with short black setae, and scattered long black setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense absent; tibia with antennal cleaning setae ventroapically; coxa reddish brown with some pale areas on anterior surface, trochanter light brown, femur reddish brown but internal surface pale, tibia mostly reddish brown with three pale rings; tarsi mostly reddish brown, except for base of T1, T2 and T5 pale. *Midleg* with same color pattern of foreleg, except for a subapical pale spot at femur dorsal surface. *Hindleg* with femur, tibia and T1 slightly longer than in other legs; color pattern similar to midleg, except for tibia with internal surface reddish brown but external pale, and T2 entirely reddish brown.

Abdomen: Reddish brown but basal segments slightly lighter; set with white setae.

Male Terminalia (A4 Figs 149a-c): *Ectoproct* rounded in lateral view; set with elongate black setae. *9th sternite* posterior margin rounded in ventral view; set with very long

black setae. *Gonarcus* broad and arched in posterior view; with anterior margin bending downwards in lateral view, ventral area much wider than dorsal area in lateral view. *Mediuncus* large, broad, with apex straight in posterior view but curved in lateral view. *Paramere* large and very sclerotized, dorsal region rounded and ventral region curving laterally in posterior view; in lateral view with a medial posterior lobe.

Female Terminalia (A4 Figs 149d-e): *Ectoproct* rounded set with thin elongate setae and some cavisetae ventrally. *Lateral gonapophyses* rounded, same size as ectoproct, beset with cavisetae. *9th tergite* with few thickened setae ventrally in lateral view. *7th sternite* distal border with a small concavity to fit the pregenital plate in ventral view; covered with black setae. *Pregenital plate* as large concave transversal bar in ventral view. *Posterior gonapophyses* thin, elongate, covered with short black setae. *9th tergite* with a short membranous digitiform process. *Anterior gonapophyses* absent. *Ventral membrane* gonapophyseal plates present.

Distribution (A4 Fig 173) – Australia: QLD.

Adult activity period – May – July.

Biology – Unknown, larva unknown.

Primary type – Holotype (by original designation), female (MVM), examined. From original description, New (1985b): “Holotype, ♀, Queensland, Hann R. 10 miles N. Coen, 27.vi.1970, J. C. Le Souëf (MVM)”. Condition: good, left antenna, fore and midleg missing; terminalia dissected.

Material examined – (5♂, 2♀). **AUSTRALIA: Queensland: Laura:** 6 km NW [new], 15°31'12''S - 144°25'25''E, 30.v.1998, MV, JD Oswald (1♂, TAMU); *Coen:* 15 km S.

Yarraden, 27-28.vi.1975, S.R. Monteith (3♂, 2♀ PT; ANIC); *Telegraph Crossing*: Cape York Peninsula, Dulhunty R., 2-4.vii.1973, S. R. Monteith (1♂ PT; ANIC).

Comments – *Tanyleon lesouefi* seems to be restricted to the forested areas of northern QLD, and can be easily distinguished from the other “*Periclystus* genus group” species, particularly by the elongate pronotum and the marks on hind wing. However, overall shape of both male and female terminalia, indicate a close relationship with the other two species of *Tanyleon*, as indicated by the morphological phylogeny (A4 Fig 3).

***Tanyleon newi*, new species**

(A4 Figs 150-151)

Diagnosis – Head, frons mostly pale [not mostly black]; hind wing with small rhegmal spot [not large infuscation]; pronotum, posterior margin as wide as anterior margin [not wider]; female, ectoproct, cavisetae present [not absent]; male, paramere, apex evenly curved in ventral view [not strongly bent].

Description – Lengths: forewing: 21 – 24 mm; hind wing: 20 – 22 mm.

Head (A4 Figs 150a-b): *Labrum* pale; set with a line of elongate setae. *Clypeus* pale; set with few elongate black setae. *Frons* predominantly pale with two dark brown small curved marks around antennal base; set with short pale setae. *Gena* pale. *Vertex* raised; in frontal view mostly pale with two small transversal dark brown marks laterally, and a small medial line; in dorsal view mostly pale with a central longitudinal dark brown line, three marks on posterior border, and some irregular brown marks on central region; set with short black setae. *Ocular rim* setae absent. *Antennae* clubbed; elongate, about twice

longer than pronotum; distance between antennae wider than scape width; all segments with anterior surface pale but posterior brown (some specimens distal flagellomeres entirely brown); torular membrane pale; flagellomeres almost as long as wide at base, apical ones much wider than long; scape and pedicel covered with short white setae, flagellomere set with short black setae. *Mandibles* mostly pale, with tip black. *Palpi*, maxillary and labial pale with dark brown marks on each basal segment and around palpimacula; apical labial palpomere fusiform, palpimacula oval-shaped, located medially.

Thorax (A4 Fig 150b): *Pronotum* longer than wide; posterior margin as wide as anterior; subapical furrow present; mostly pale except for some dark brown marks, a central longitudinal on posterior half, two small marks at midline in anterior area, two curved longitudinal lines near center (separated medially in some specimens), and small dark spots on setal bases; beset with short black setae and some long black and white setae. *Mesonotum* mostly pale, with some dark brown areas distributed on segments as follows: prescutum with two longitudinal lines around center, scutum with a medial line and three thin longitudinal lines on each side (lines closer to the center line generally connected to the prescutum lines), border between scutum and scutellum, and scutellum with a thin medial line and two rounded spot posteriorly; covered with short black setae, except for few long black setae on prescutum. *Metanotum* pale, with some dark brown areas as follows: two curved marks around medial area on prescutum, a large rectangular mark at the center of metathorax, a large longitudinal lateral line on each side of scutum, anterior border and midline of scutellum. *Pterothoracic pleura* mostly pale with scattered dark

brown areas around margins of sclerites; covered with white setae; Miller's organ present.

Wings (A4 Fig 150d): Fairly broad, anterior Banksian line present in both wings, posterior absent. Veins mostly pale, but some veins intercalated with brown spots, beset with short black setae. *Male pilula axillaris* present. *Forewing* membrane hyaline with small amber marks (almost indistinguishable in some specimens) on rhegmal area, surrounding some crossveins, and tip of prefork area; pterostigma light brown with apex white; cubital fork located between origins of Rs and MA; three presectoral crossveins; subcostal veinlets simple; posterior area about as wide as prefork area. *Hind wing* membrane color hyaline, with only a very small rhegmal amber mark present in some specimens; medial fork located near Rs origin; subcostal veinlets simple; one presectoral crossvein.

Legs (A4 Figs 150a-b): *All pairs of legs*, femur elongate ($> 3.5x$ length of coxa); tibia and femur about same size, but longer than tarsi; tibial spurs extending over T1 apex; T2, T3 and T4 about same size, T1 slightly longer than T2, T5 twice longer than T1; claws about half of T5 length; coxa, trochanter and femur set with many short white setae, femur, tibia and tarsi set with short black setae and scattered long black setae; T5 ventrally with two rows of thick, long, black setae. *Foreleg* sense hair absent; tibia with antennal cleaning setae ventroapically; coxa pale with some dark brown marks, trochanter pale, femur pale with tip and a subapical ring dark brown, tibia pale with three dark brown rings, tarsi pale with tip of T5 dark brown. *Midleg* with same color of

foreleg. *Hindleg* with femur and tibia slightly longer than in other legs; color same of other legs except for tibia tip dark brown.

Abdomen (A4 Fig 150c): Tergites 1 and 2 mostly pale, tergite 3 mostly dark brown with two pale rounded marks at base, remaining tergites with basal thirds pale but rest dark brown with scattered irregular pale marks mainly at central area. Sternites entirely pale, except for some dark brown marks, mainly at sternite 4 and 5, which are completely dark brown in few darker specimens. Beset with short white setae.

Male Terminalia (A4 Figs 150c, 151a-d): *Ectoproct* rounded in lateral view; set with elongate black setae. *9th sternite* posterior margin with tip rounded and elongate, extending between ventral half of ectoprocts in posterior view; set with elongate black setae. *Gonarcus* simple, arched in posterior view, but “C” shaped in lateral view. *Mediuncus* in posterior view very broad with tip more sclerotized and rounded medially, in lateral view curved with tip slightly broader. *Paramere* in lateral view curved and covered with short black setae; in ventral view with external part rounded but internal thin, evenly curved, and apex acute.

Female Terminalia (A4 Figs 151e-f): *Ectoproct* rounded set with thin elongate setae and some elongate cavisetae ventrally. *Lateral gonapophyses* with distal margin rounded, about same size of ectoproct, beset with elongate cavisetae. *9th tergite* in lateral view, with dorsal margin narrow, and set with some thickened setae on ventral area. *7th sternite* very long with distal margin straight, in ventral view; covered with black setae. *Pregenital plate* small and longitudinally elongate in ventral view, curved with a central acute extension in lateral view. *Posterior gonapophyses* thin, elongate, covered with

black setae. 9th tergite with a short membranous digitiform process. *Anterior gonapophyses* absent. *Ventral membrane* gonapophyseal plates present.

Distribution (A4 Fig 173) – Australia: NT, QLD, SA, and WA.

Adult activity period – Records for March to May and August to December.

Biology – Unknown, larva unknown.

Etymology – The species is named after the great neuropterist Timothy R. New, who immensely contributed to the knowledge of the Australian Myrmeleontidae.

Primary type – Holotype (by present designation), male, (AMSA). **AUSTRALIA: Western Australia:** Broome: 5.Nov.1978, M.S. & B.J. Moulds // Australian Museum, K427356. Condition: pinned; good; antennae missing.

Paratypes: AUSTRALIA: Northern Territory: *Devil's Marbles:* 7mi N. of Wauchope, UV light, 22nd. Apr. 1966, N. McFarland // SAMA Database, No. 24-000055 (1♀, SAMA, pinned); *Dingo Hole Dam:* 30 km N Ammaroo Stn, at light, 8.Oct.1977, G.F. Gross, J.A. Forrest // SAMA Database, No. 24-000099 (1♂, SAMA, pinned); **Queensland:** *Clermont:* Dr. K.K. Spence // Australian Museum, K427360 (1♂, AMSA, pinned); *Clermont:* Dr. K.K. Spence // Australian Museum, K427361 (1♂, AMSA, pinned); 8 kmS of *Clermont*, 18.Mar.1982, M.S. & B.J. Moulds // Australian Museum, K427357 (1♀, AMSA, pinned); *Fox Creek:* 27.9.1949, Black & Bearup // Australian Museum, K427362 (1♂, AMSA, pinned); *Fox Creek:* 27.9.1949, Black & Bearup // Australian Museum, K427363 (1♂, AMSA, pinned); *Lawn Hill Ck:* Adels Grove, W of Gregory Downs, 19.dec.1986, M.S. & B.J. Moulds // Australian Museum, K427359 (1♂, AMSA, pinned); **Western Australia:** 18.53S - 123.43E, 186 km SE by E *Broome*,

10.august.1976, I.F.B. Common (1♂, 1♀, ANIC, pinned); 50 km SW *Sandfire flat*, between Broome and Port Hedland, 29.Oct.1978, M.S. & B.J. Moulds // Australian Museum, K427358 (1♀, AMSA).

Material examined – (16♂, 25♀). **AUSTRALIA: Northern Territory:** *Alice Springs:* x.1977 (2♀, QLDM); *Barrow Ck:* 21 km SW, 21.40S – 133.45E, 12.x.1972, M.S. Upton (1♀, ANIC); *Barry Caves:* ix.1967 (1♂, MVM); *Devil's Marbles:* 7mi N. of Wauchope, 22.iv.1966, UV light, N. McFarland (1♀, SAMA); ix.1967 (1♀, MVM); *Dingo Hole Dam:* 30 km N Ammaroo Stn, 8.x.1977, at light, G.F. Gross, J.A. Forrest (1♂, SAMA); *Elliott:* 8 km NWbyN, 17.29S – 133.30E, 14.x.1972, M.S. Upton (2♀, ANIC); *Renner Springs:* 2.8 mi S, 8.iv.1966 (1♀, SAMA); *Smoke Hills Sanctuary:* Tanami Desert, iv.1965, H Logger (1♀, SAMA); *Tennant Creek:* 6 mi N, 9.xi.1966, A. & R. Mesa (1♂, ANIC); *Stuart H'way,* 296 km S, 29.xi.1976, D.H. Colles (1♂, ANIC); *Victoria River Downs:* 4 mi WSW, 15.viii.1973, L.P. Kelsey (1♀, ANIC); *Wauchope:* 30 km N, 20.22S – 134.14E, 13.x.1972, M.S. Upton (1♂, ANIC); **Queensland:** *Gloucester District:* (2♀, MVM); *Charleville:* 16 km SSW, 26.35S – 146.11E, 14.iii.1990, E.D. Edwards & J.H. Fisk (1♀, ANIC); *Darr River:* 31 km NWbyN of Longreach, 23.13S – 144.04E, 22.x.1975, J.C. Cardale (1♀, ANIC); *Mica Creek:* 16.iii.2001 (1♂, 1♀, QLDM); *Musselbrook Resource Center:* Lawn Hill Nat. Pk, 18°35'54''S – 138°07'44''E, 18.iv.1995, G Daniels & MA Schneider (1♀, QLDM); *Ridgepole Waterhole:* 24 km ESE of Musselbrook Resource Center, Lawn Hill Nat. Pk, 18°40'15''S – 138°22'15''E, 8.v.1995, G Daniels & MA Schneider (1♂, QLDM); *Riversleigh Hs:* Gregory River, 29.iv.1986 (1♀, SAMA); **South Australia:** *Marree:*

22.x.1972 (1♂, SAMA); *Marree Picinic Gd*: xi.1955 (1♂, SAMA); **Western Australia:**
Broome: 186 km SE by E, 18.53S - 123.43E, 10.viii.1976, I.F.B. Common (3♂, 4♀,
ANIC, 1♀, FSCA); *Cane River HS*: 17 km NbyE, 21.56S – 115.39E, 27.iv.1971, Upton
& Mitchell (1♀, ANIC); *Daby*: 28.viii.1953, Tindale (1♀, SAMA); *Elvire Stn*: Halls Ck,
1968 (1♂, SAMA); *Karijini National Park*: Dale George Rd, 668m, 22°35.1'S –
118°27.2'E, 21.iv.2003, F.D. Parker & M.E. Irwin (1♂, FSCA); *Liveringa*: 1.ix.1953,
Tindale (1♀, SAMA); *Millstream HS*: ½ km W, 21.38S – 117.04E, 21.iv.1971, Upton
& Mitchell (1♂, ANIC); 21.35S – 117.04E, 28.x.1970, Upton & Feehan (1♂, ANIC).

Comments – *Tanyleon newi* is closely associated with *T. cahillensis*, as discussed
before. Many specimens of this new species studied here were misidentified as *G.*
aurora. In fact, in a quick look of the external morphology, these two species are very
similar, but both male and female terminalia are completely different, which can easily
separate them. For phylogenetic relationships see (A4 Fig 3).

CHAPTER IV

GENERAL CONCLUSIONS

This study presents the largest phylogenetic data set on the Myrmeleontidae analyzed to date. It was the first genomic phylogenetic study for the family and the results obtained are broadly consistent with previous phylogenetic analyses that recovered Myrmeleontidae paraphyletic in relation to Ascalaphidae. In this sense, a new Myrmeleontidae classification, consistent with the results obtained here, was proposed. This new classification synonymizes Ascalaphidae under Myrmeleontidae and divides the family into four subfamilies and 18 tribes (A1 Table 3).

The revision of the former subtribe Periclystina, confirmed some previous ideas (New 1985; Stange 2004), that the two largest genera of the group were paraphyletic. The taxonomic review presented here is very important to a better understanding of the Australian antlion fauna: 16 new species described, 6 new synonyms, historical misidentifications were corrected, and many new distributional records were recorded.

In general the results obtained in this dissertation provided a better understanding of the Myrmeleontidae evolutionary history and will serve as a starting point for all future systematic works related to family.

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APPENDIX I

Table A1.1. Taxa used in the molecular phylogeny. Myrmeleontidae species follow the traditional classification (Stange 2004)

Family	Subfamily	Tribe	Subtribe	Species	Code	Country
Chrysopidae	Chrysopinae	Belonopterygini		<i>Italochrysa impar</i> (Navás 1912)	ITIMPAR	South Africa
Chrysopidae	Chrysopinae	Chrysopini		<i>Chrysoperla savioi</i> (Navás 1933)	YSA	China
Chrysopidae	Chrysopinae	Leucochrycini		<i>Gonzaga nigriceps</i> (McLachlan 1867)	GONZNI	Costa Rica
Chrysopidae	Notochrysinæ			<i>Nothochrysa californica</i> Banks 1892	NOTCHA	USA
Hemerobiidae	Drepanacrinae			<i>Drepanacra binocula</i> (Newman 1838)	DREPABI	Australia
Hemerobiidae	Hemerobiinae			<i>Hemerobius incurtus</i> Banks 1931	HEIN	Malaysia
Hemerobiidae	Psychobiellinae			<i>Psychobiella sordida</i> Banks 1909	PSYCOS	Australia
Hemerobiidae	Symphorobinae			<i>Symphorobius beameri</i> Gurney 1948	RM 260	USA
Ithonidae				<i>Oliarces clara</i> Banks 1908	LIAG	USA
Ithonidae				<i>Platystoechotes lineatus</i> Carpenter 1940	PLALI	USA
Ithonidae				<i>Polystoechotes sp.</i>	POL	USA
Ithonidae				<i>Rapisma sp.</i>	RAP	Thailand
Ascalaphidae	Albardiinae			<i>Albardia furcata</i> van der Weele 1903	RM 69	Brazil
Ascalaphidae	Ascalaphinae	Ascalaphini		<i>Ascalaphus bilineatus</i> (Kolbe 1897)	ASCAB	South Africa
Ascalaphidae	Ascalaphinae	Ascalaphini		<i>Libelloides coccajus</i> (Denis & Schiffermüller 1775)	RM 102	France
Ascalaphidae	Ascalaphinae	Ascalaphini		<i>Encyopsidius apicalis</i> Tjeder & Hansson 1992	ENAP	South Africa

Table A1.1. Continued

Family	Subfamily	Tribe	Subtribe	Species	Code	Country
Ascalaphidae	Ascalaphinae	Suhalacsini		<i>Megacmonotus magnus</i> (McLachlan 1871)	RM 190	Australia
Ascalaphidae	Ascalaphinae	Suhalacsini		<i>Parasuphalomitus macinnesi</i> New 1984	RM 192	Australia
Ascalaphidae	Ascalaphinae	Suhalacsini		<i>Suhalacsa dietrichiae</i> (Brauer 1869)	RM 66	Australia
Ascalaphidae	Ascalaphinae	Suhalacsini		<i>Suphalomitus difformis</i> (McLachlan 1871)	RM 170	Australia
Ascalaphidae	Ascalaphinae	Ululodini		<i>Ameropterus mexicanus</i> (Weele 1909)	RM 57	Mexico
Ascalaphidae	Ascalaphinae	Ululodini		<i>Ameropterus sp.</i>	RM 229	Brazil
Ascalaphidae	Ascalaphinae	Ululodini		<i>Ascalorphne sp.</i>	RM 230	Brazil
Ascalaphidae	Ascalaphinae	Ululodini		<i>Cordulecerus sp.</i>	RM 100	Brazil
Ascalaphidae	Ascalaphinae	Ululodini		<i>Ululodes arizonensis</i> Banks 1907	RM 108	USA
Ascalaphidae	Ascalaphinae	Ululodini		<i>Ululodes bicolor</i> (Banks 1895)	RM 109	USA
Ascalaphidae	Haplogleniinae	Haplogleniini		<i>Ascalobyas microcerus</i> (Rambur 1842)	RM 216	Brazil
Ascalaphidae	Haplogleniinae	Melambrotini		<i>Balanopteryx locuples</i> (Rambur 1842)	RM 219	Madagascar
Ascalaphidae	Haplogleniinae	Melambrotini		<i>Melambrotus pseudosimia</i> Kimmins 1992	MELAM	South Africa
Ascalaphidae	Haplogleniinae	Verticillecerini		<i>Ascaloptynx appendiculatus</i> (Fabricius 1793)	RM 177	USA
Nemopteridae	Crocinae	Crocini		<i>Austrocroce attenuata</i> (Froggatt 1905)	RM 235	Australia
Nemopteridae	Crocinae	Crocini		<i>Austrocroce occidens</i> Mansell 1983	OCC	Australia

Table A1.1. Continued

Family	Subfamily	Tribe	Subtribe	Species	Code	Country
Nemopteridae	Crocinae	Crocini		<i>Concroce capensis</i> Tjeder 1967	CONCA	South Africa
Nemopteridae	Crocinae	Necrophylini		<i>Pterocroce capillaris</i> (Klug 1838)	PTECAP	South Africa
Nemopteridae	Crocinae	Pastranaiini		<i>Pastranaia riojana</i> Orfila 1955	ARIO	Argentina
Nemopteridae	Nemopterinae			<i>Chasmoptera huttii</i> (Westwood 1848)	RM 99	Australia
Nemopteridae	Nemopterinae			<i>Lertha barbara</i> (Klug 1838)	LEBA	Tunisia
Nemopteridae	Nemopterinae			<i>Nemoptera bipennis</i> (Illiger 1812)	RM 105	Portugal
Nymphidae	Myiodactylinae			<i>Myiodactylus osmyloides</i> Brauer 1866	MYOS	Australia
Nymphidae	Myiodactylinae			<i>Norfolius howensis</i> (Tillyard 1917)	RM 63	Australia
Nymphidae	Myiodactylinae			<i>Osmylops sejunctus</i> (Walker 1853)	RM 98	Australia
Nymphidae	Nymphinae			<i>Nymphes myrmeleonoides</i> Leach 1814	RM 64	Australia
Psychopsidae	Psychopsinae			<i>Psychopsis barnardi</i> Tillyard 1925	BAR	Australia
Psychopsidae	Psychopsinae			<i>Psychopsis insolens</i> McLachlan 1863	RM 194	Australia
Psychopsidae	Zygophlebiinae			<i>Zygophlebius leoninus</i> Navás 1910	ABRA	South Africa
Myrmeleontidae	Myrmeleontinae	Acanthaclisini		<i>Centroclisis brachygaster</i> (Rambur 1842)	RM 197	South Africa
Myrmeleontidae	Myrmeleontinae	Acanthaclisini		<i>Centroclisis distincta</i> (Rambur 1842)	RM 198	South Africa
Myrmeleontidae	Myrmeleontinae	Acanthaclisini		<i>Centroclisis maligna</i> (Navás 1912)	RM 199	South Africa

Table A1.1. Continued

Family	Subfamily	Tribe	Subtribe	Species	Code	Country
Myrmeleontidae	Myrmeleontinae	Acanthaclisini		<i>Centroclisis sp.</i>	RM 180	Vietnam
Myrmeleontidae	Myrmeleontinae	Acanthaclisini		<i>Cosina annulata</i> (E. P. 1915)	RM 101	Australia
Myrmeleontidae	Myrmeleontinae	Acanthaclisini		<i>Cosina mclachlani</i> (Weele 1904)	RM 11	Australia
Myrmeleontidae	Myrmeleontinae	Acanthaclisini		<i>Heoclisia fundata</i> (Walker 1853)	RM 94	Australia
Myrmeleontidae	Myrmeleontinae	Acanthaclisini		<i>Heoclisia sp.</i>	RM 187	Vietnam
Myrmeleontidae	Myrmeleontinae	Acanthaclisini		<i>Jaya dasymalla</i> (Gerstaecker 1863)	RM 207	South Africa
Myrmeleontidae	Myrmeleontinae	Acanthaclisini		<i>Paranthaclisis hageni</i> (Banks 1899)	RM 86	USA
Myrmeleontidae	Myrmeleontinae	Acanthaclisini		<i>Paranthaclisis nevadensis</i> Banks 1939	RM 87	USA
Myrmeleontidae	Myrmeleontinae	Acanthaclisini		<i>Vella fallax</i> (Rambur 1846)	RM 110	USA
Myrmeleontidae	Myrmeleontinae	Brachynemurini		<i>Ameromyia sp.</i>	RM 70	Brazil
Myrmeleontidae	Myrmeleontinae	Brachynemurini		<i>Argentoleon irrigatus</i> (Gerstaecker 1893)	RM 33	Brazil
Myrmeleontidae	Myrmeleontinae	Brachynemurini		<i>Austroleon immitus</i> (Walker 1853)	RM 35	Brazil
Myrmeleontidae	Myrmeleontinae	Brachynemurini		<i>Brachynemurus abdominalis</i> (Say 1823)	RM 236	USA
Myrmeleontidae	Myrmeleontinae	Brachynemurini		<i>Brachynemurus californicus</i> Banks 1895	RM 45	USA
Myrmeleontidae	Myrmeleontinae	Brachynemurini		<i>Brachynemurus carolinus</i> Banks 1911	RM 46	USA
Myrmeleontidae	Myrmeleontinae	Brachynemurini		<i>Brachynemurus hubbardii</i> Currie 1898	RM 47	USA

Table A1.1. Continued

Family	Subfamily	Tribe	Subtribe	Species	Code	Country
Myrmeleontidae	Myrmeleontinae	Brachynemurini		<i>Brachynemurus longicaudus</i> (Burmeister 1839)	RM 238	USA
Myrmeleontidae	Myrmeleontinae	Brachynemurini		<i>Brachynemurus mexicanus</i> Banks 1895	RM 239	USA
Myrmeleontidae	Myrmeleontinae	Brachynemurini		<i>Brachynemurus nebulosus</i> (Olivier 1811)	RM 48	USA
Myrmeleontidae	Myrmeleontinae	Brachynemurini		<i>Brachynemurus sackeni</i> Hagen 1888	RM 12	USA
Myrmeleontidae	Myrmeleontinae	Brachynemurini		<i>Chaetoleon pusillus</i> (Currie 1899)	RM 220	USA
Myrmeleontidae	Myrmeleontinae	Brachynemurini		<i>Clathroneuria coquilletti</i> (Currie 1898)	RM 09	USA
Myrmeleontidae	Myrmeleontinae	Brachynemurini		<i>Clathroneuria schwarzi</i> (Currie 1903)	RM 181	USA
Myrmeleontidae	Myrmeleontinae	Brachynemurini		<i>Mexoleon papago</i> (Currie 1899)	RM 26	USA
Myrmeleontidae	Myrmeleontinae	Brachynemurini		<i>Peruveleon dorsalis</i> (Banks 1903)	RM 88	USA
Myrmeleontidae	Myrmeleontinae	Brachynemurini		<i>Scotoleon carrizonus</i> (Hagen 1888)	RM 41	USA
Myrmeleontidae	Myrmeleontinae	Brachynemurini		<i>Scotoleon dissimilis</i> (Banks 1903)	RM 90	USA
Myrmeleontidae	Myrmeleontinae	Brachynemurini		<i>Scotoleon eiseni</i> (Banks 1908)	RM 67	USA
Myrmeleontidae	Myrmeleontinae	Brachynemurini		<i>Scotoleon expansus</i> (Navás 1913)	RM 91	USA
Myrmeleontidae	Myrmeleontinae	Brachynemurini		<i>Scotoleon minusculus</i> (Banks 1898)	RM 15	USA
Myrmeleontidae	Myrmeleontinae	Brachynemurini		<i>Scotoleon niger</i> (Currie 1898)	RM 92	USA
Myrmeleontidae	Myrmeleontinae	Brachynemurini		<i>Scotoleon pallidus</i> (Banks 1899)	RM 106	USA

Table A1.1. Continued

Family	Subfamily	Tribe	Subtribe	Species	Code	Country
Myrmeleontidae	Myrmeleontinae	Brachynemurini		<i>Scotoleon quadripunctatus</i> (Currie 1898)	RM 107	USA
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Acanthoplectrina	<i>Acanthoplectron tenellum</i> E.P. 1918	RM 176	Australia
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Dendroleontina	<i>Dendroleon longipennis</i> E.P. 1915	RM 94	Australia
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Dendroleontina	<i>Dendroleon pantherinus</i> (Fabricius 1787)	RM 182	Italy
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Dendroleontina	<i>Dendroleon speciosus</i> Banks 1905	RM 183	USA
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Dendroleontina	<i>Froggattisca anicis</i> New 1985	RM 113	Australia
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Dendroleontina	<i>Froggattisca tipularia</i> (Gerstaecker 1885)	RM 96	Australia
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Dendroleontina	<i>Layahima elegans</i> (Banks 1937)	RM 189	Vietnam
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Dendroleontina	<i>Tricholeon hirtellus</i> E.P. 1925	RM 227	South Africa
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Periclystina	<i>Anomaloplectron lineatipenne</i> E.P. 1918	RM 159	Australia
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Periclystina	<i>Austrogymnocnemia bipunctata</i> (E.P. 1915)	RM 58	Australia
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Periclystina	<i>Austrogymnocnemia interrupta</i> (E.P. 1915)	RM 174	Australia
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Periclystina	<i>Austrogymnocnemia nigrescens</i> New 1985	RM 148	Australia
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Periclystina	<i>Austrogymnocnemia n sp TAMU</i>	RM 05	Australia
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Periclystina	<i>Austrogymnocnemia n sp near procta</i>	RM 20	Australia
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Periclystina	<i>Austrogymnocnemia n sp WAM</i>	RM 218	Australia

Table A1.1. Continued

Family	Subfamily	Tribe	Subtribe	Species	Code	Country
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Periclystina	<i>Ceratoleon brevicornis</i> E.P. 1917	RM 10	Australia
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Periclystina	<i>Ceratoleon mjobergi</i> E.P.1923	RM 150	Australia
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Periclystina	<i>Csiroleon tumidipalpus</i> New 1985	RM 151	Australia
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Periclystina	<i>Franzenia irrorata</i> E.P. 1929	RM 152	Australia
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Periclystina	<i>Fusoleon stigmatus</i> New 1985	RM 153	Australia
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Periclystina	<i>Fusoleon n sp WA</i>	RM 162	Australia
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Periclystina	<i>Glenoleon brevigonarcus</i> New 1985	RM 114	Australia
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Periclystina	<i>Glenoleon dissolutus</i> (Gerstaecker 1885)	RM 137	Australia
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Periclystina	<i>Glenoleon meteoricus</i> (Gerstaecker 1885)	RM 138	Australia
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Periclystina	<i>Glenoleon minutillus</i> New 1985	RM 154	Australia
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Periclystina	<i>Glenoleon osmyloides</i> (Gerstaecker 1885)	RM 61	Australia
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Periclystina	<i>Glenoleon pulchellus</i> (Rambur 1842)	RM 97	Australia
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Periclystina	<i>Glenoleon secula</i> New 1985	RM 157	Australia
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Periclystina	<i>Glenoleon stigmatus</i> (Banks 1910)	RM 116	Australia
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Periclystina	<i>Glenoleon tillyardi</i> New 1985	RM 158	Australia
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Periclystina	<i>Glenoleon n sp near berthoudi</i>	RM 163	Australia

Table A1.1. Continued

Family	Subfamily	Tribe	Subtribe	Species	Code	Country
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Periclystina	<i>Glenoleon n sp near maculatus</i>	RM 21	Australia
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Periclystina	<i>Glenoleon n sp near roseipennis</i>	RM 221	Australia
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Periclystina	<i>Periclystus laceratus</i> Gerstaecker 1888	RM 145	Australia
Myrmeleontidae	Myrmeleontinae	Dendroleontini	Periclystina	<i>Riekoleon n sp</i>	RM 122	Australia
Myrmeleontidae	Myrmeleontinae	Gnopholeontini		<i>Gnopholeon delicatulus</i> (Currie 1903)	RM 117	USA
Myrmeleontidae	Myrmeleontinae	Maulini		<i>Isonemurus n sp "kobee"</i>	RM 188	South Africa
Myrmeleontidae	Myrmeleontinae	Maulini		<i>Maula stigmata</i> Navás 1912	MAUL	South Africa
Myrmeleontidae	Myrmeleontinae	Myrmecaelurini		<i>Myrmecaelurus punctulatus</i> (Steven 1822)	RM 140	Russia
Myrmeleontidae	Myrmeleontinae	Myrmecaelurini		<i>Myrmecaelurus trigrammus</i> (Pallas 1771)	RM 141	Russia
Myrmeleontidae	Myrmeleontinae	Myrmeleontini	Myrmeleontina	<i>Baliga sp1</i>	RM 123	Thailand
Myrmeleontidae	Myrmeleontinae	Myrmeleontini	Myrmeleontina	<i>Baliga sp2</i>	RM 124	Thailand
Myrmeleontidae	Myrmeleontinae	Myrmeleontini	Myrmeleontina	<i>Callistoleon erythrocephalus</i> (Leach 1815)	RM 125	Australia
Myrmeleontidae	Myrmeleontinae	Myrmeleontini	Myrmeleontina	<i>Euroleon nostras</i> (Geoffroy 1785)	RM 136	Russia
Myrmeleontidae	Myrmeleontinae	Myrmeleontini	Myrmeleontina	<i>Hagenomyia lethifer</i> (Walker 1853)	RM 164	South Africa
Myrmeleontidae	Myrmeleontinae	Myrmeleontini	Myrmeleontina	<i>Hagenomyia tristis</i> (Walker 1853)	RM 165	South Africa
Myrmeleontidae	Myrmeleontinae	Myrmeleontini	Myrmeleontina	<i>Myrmeleon acer</i> Walker 1853	RM 247	Australia

Table A1.1. Continued

Family	Subfamily	Tribe	Subtribe	Species	Code	Country
Myrmeleontidae	Myrmeleontinae	Myrmeleontini	Myrmeleontina	<i>Myrmeleon alcestris</i> Banks 1911	RM 167	South Africa
Myrmeleontidae	Myrmeleontinae	Myrmeleontini	Myrmeleontina	<i>Myrmeleon californicus</i> Banks 1943	RM 240	USA
Myrmeleontidae	Myrmeleontinae	Myrmeleontini	Myrmeleontina	<i>Myrmeleon croceicollis</i> Gerstaecker 1885	RM 128	Australia
Myrmeleontidae	Myrmeleontinae	Myrmeleontini	Myrmeleontina	<i>Myrmeleon diminutus</i> (E.P. 1915)	RM 248	Australia
Myrmeleontidae	Myrmeleontinae	Myrmeleontini	Myrmeleontina	<i>Myrmeleon exitialis</i> Walker 1853	RM 53	USA
Myrmeleontidae	Myrmeleontinae	Myrmeleontini	Myrmeleontina	<i>Myrmeleon houstoni</i> New 1985	RM 82	Australia
Myrmeleontidae	Myrmeleontinae	Myrmeleontini	Myrmeleontina	<i>Myrmeleon hyalinus</i> Olivier 1811	RM 129	Cyprus
Myrmeleontidae	Myrmeleontinae	Myrmeleontini	Myrmeleontina	<i>Myrmeleon immanis</i> Walker 1853	RM 130	Russia
Myrmeleontidae	Myrmeleontinae	Myrmeleontini	Myrmeleontina	<i>Myrmeleon inconspicuus</i> Rambur 1842	RM 142	Russia
Myrmeleontidae	Myrmeleontinae	Myrmeleontini	Myrmeleontina	<i>Myrmeleon lanceolatus</i> Rambur 1842	RM 209	South Africa
Myrmeleontidae	Myrmeleontinae	Myrmeleontini	Myrmeleontina	<i>Myrmeleon mexicanus</i> Banks 1903	RM 83	USA
Myrmeleontidae	Myrmeleontinae	Myrmeleontini	Myrmeleontina	<i>Myrmeleon obscurus</i> Rambur 1842	RM 76	South Africa
Myrmeleontidae	Myrmeleontinae	Myrmeleontini	Myrmeleontina	<i>Myrmeleon pallidus</i> (E.P. 1918)	RM 241	Australia
Myrmeleontidae	Myrmeleontinae	Myrmeleontini	Myrmeleontina	<i>Myrmeleon quinquemaculatus</i> (Hagen 1853)	RM 166	South Africa
Myrmeleontidae	Myrmeleontinae	Myrmeleontini	Myrmeleontina	<i>Myrmeleon regularis</i> (E.P. 1918)	RM 249	Australia
Myrmeleontidae	Myrmeleontinae	Myrmeleontini	Myrmeleontina	<i>Myrmeleon rusticus</i> Hagen 1861	RM 85	USA

Table A1.1. Continued

Family	Subfamily	Tribe	Subtribe	Species	Code	Country
Myrmeleontidae	Myrmeleontinae	Myrmeleontini	Myrmeleontina	<i>Myrmeleon wangi</i> Miller & Stange 2000	RM 104	Taiwan
Myrmeleontidae	Myrmeleontinae	Myrmeleontini	Myrmeleontina	<i>Myrmeleon sp.</i>	RM 233	Brazil
Myrmeleontidae	Myrmeleontinae	Myrmeleontini	Myrmeleontina	<i>Myrmeleon sp.</i>	RM 133	Thailand
Myrmeleontidae	Myrmeleontinae	Myrmeleontini	Myrmeleontina	<i>Myrmeleon n sp "draco"</i>	RM 210	South Africa
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Dimarellina	<i>Brasileon sp.</i>	RM 71	Brazil
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Dimarellina	<i>Dimarella (Dimarella) effera</i> Walker 1853	RM 43	Brazil
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Dimarellina	<i>Dimarella (Dimarella) praedator</i> (Walker 1853)	RM 06	Brazil
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Dimarellina	<i>Dimarella (Dimarella) riparia</i> (Navás 1918)	RM 246	Brazil
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Dimarellina	<i>Dimarella (Pachyleon) alvarengai</i> (Stange 1970)	RM 23	Brazil
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Nemoleontina	<i>Mjobergia fulviguttata</i> E. P. 1918	RM 120	Australia
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Nemoleontina	<i>Nemoleon quadrimaculatus</i> Banks 1911	RM 234	Mozambique
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Nemoleontina	<i>Protoplectron longitudinalis</i> Tillyard 1916	RM 13	Australia
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Nemoleontina	<i>Protoplectron pallidum</i> Banks 1910	RM 39	Australia
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Nemoleontina	<i>Protoplectron striatellum</i> E. P. 1917	RM 40	Australia
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Nemoleontina	<i>Protoplectron venustum</i> Gerstaecker 1885	RM 65	Australia
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Bandidus brevisculus</i> (Gerstaecker 1885)	RM 178	Australia

Table A1.1. Continued

Family	Subfamily	Tribe	Subtribe	Species	Code	Country
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Bandidus canifrons</i> (Navás 1914)	RM 179	Australia
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Bandidus furcatus</i> New 1985	RM 44	Australia
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Banyutus lethalis</i> (Walker 1853)	RM 160	South Africa
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Creoleon africanus</i> (Rambur 1842)	RM 73	Madagascar
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Creoleon mortifer</i> (Walker 1853)	RM 201	South Africa
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Creoleon plumbeus</i> (Olivier 1811)	RM 126	Russia
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Distoleon bistrigatus</i> (Rambur 1842)	RM 36	Australia
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Distoleon pulverulentus</i> (Rambur 1842)	RM 161	South Africa
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Distoleon somnolentus</i> (Gerstaecker 1885)	RM 37	Australia
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Distoleon tetragrammicus</i> (Fabricius 1798)	RM 112	Italy
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Distoplectron sp.</i>	RM 49	Australia
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Eremoleon capitatus</i> (Navás 1913)	RM 75	Brazil
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Eremoleon nigribasis</i> Banks 1920	RM 184	USA
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Escura nigrosignata</i> (Tillyard 1916)	RM 185	Australia
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Escura notostriata</i> New 1985	RM 95	Australia
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Escura sp.</i>	RM 52	Australia

Table A1.1. Continued

Family	Subfamily	Tribe	Subtribe	Species	Code	Country
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Euptilon arizonense</i> (Banks 1935)	RM 186	USA
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Euptilon ornatum</i> (Drury 1773)	RM 50	USA
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Euptilon sinuatum</i> (Currie 1903)	RM 51	USA
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Euptilon</i> sp.	RM 231	Brazil
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Glenurus luniger</i> (Gerstaecker 1893)	RM 55	USA
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Glenurus snowii</i> Banks 1907	RM 81	USA
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Macronemurus bilineatus</i> Brauer 1868	RM 118	Russia
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Macronemurus perlatus</i> (Gerstaecker 1885)	RM 208	South Africa
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Megistopus flavicornis</i> (Rossi 1790)	RM 119	Russia
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Neuroleon chloranthe</i> (Banks 1911)	RM 211	South Africa
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Neuroleon lukhtanovi</i> Krivokhatsky 1996	RM 134	Russia
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Neuroleon nemausiensis</i> (Borkhausen 1791)	RM 143	Russia
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Purenleon connexus</i> (Banks 1920)	RM 89	USA
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Purenleon inscriptus</i> (Hagen 1861)	RM 193	USA
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Stenoleon copleyensis</i> New 1985	RM 195	Australia
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Stenoleon</i> sp.	RM 146	Australia

Table A1.1. Continued

Family	Subfamily	Tribe	Subtribe	Species	Code	Country
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Neuroleontina	<i>Xantholeon montanus</i> New 1985	RM 228	Australia
Myrmeleontidae	Myrmeleontinae	Nemoleontini	Obina	<i>Obus sp.</i>	RM 169	South Africa
Myrmeleontidae	Myrmeleontinae	Nesoleontini		<i>Cueta anomala</i> Navás 1915	RM 135	Russia
Myrmeleontidae	Myrmeleontinae	Nesoleontini		<i>Cueta pallens</i> (Klug 1834)	RM 72	Madagascar
Myrmeleontidae	Myrmeleontinae	Nesoleontini		<i>Cueta trivirgata</i> (Gerstaecker 1885)	RM 202	South Africa
Myrmeleontidae	Myrmeleontinae	Nesoleontini		<i>Cueta n sp "kalahari"</i>	RM 203	South Africa
Myrmeleontidae	Myrmeleontinae	Nesoleontini		<i>Cueta n sp "longicauda"</i>	RM 204	South Africa
Myrmeleontidae	Myrmeleontinae	Nesoleontini		<i>Nesoleon boschimanus</i> (Péringuey 1910)	RM 168	South Africa
Myrmeleontidae	Palparinae	Dimarini		<i>Dimares elegans</i> (Perty 1833)	RM 54	Brazil
Myrmeleontidae	Palparinae	Palparidiini		<i>Palparidius capicola</i> (Péringuey 1910)	RM 224	South Africa
Myrmeleontidae	Palparinae	Palparini		<i>Crambomorphus sp.</i>	RM 200	South Africa
Myrmeleontidae	Palparinae	Palparini		<i>Palparellus nyassanus</i> (Navás 1911)	RM 212	South Africa
Myrmeleontidae	Palparinae	Palparini		<i>Palpares amitinus</i> Kolbe 1906	RM 79	Madagascar
Myrmeleontidae	Palparinae	Palparini		<i>Palpares caffer</i> (Burmeister 1839)	RM 191	South Africa
Myrmeleontidae	Palparinae	Palparini		<i>Palpares cataractae</i> Péringuey 1910	RM 213	South Africa
Myrmeleontidae	Palparinae	Palparini		<i>Palpares kalahariensis</i> Stitz 1912	RM 214	South Africa

Table A1.1. Continued

Family	Subfamily	Tribe	Subtribe	Species	Code	Country
Myrmeleontidae	Palparinae	Palparini		<i>Palpares lentus</i> Navás 1912	RM 215	South Africa
Myrmeleontidae	Palparinae	Palparini		<i>Palpares libelluloides</i> (Linnaeus 1764)	RM 121	Russia
Myrmeleontidae	Palparinae	Palparini		<i>Palpares pardaloides</i> Weele 1907	RM 80	Madagascar
Myrmeleontidae	Palparinae	Palparini		<i>Pamexis karoo</i> Mansell 1992	RM 225	South Africa
Myrmeleontidae	Stilbopteryginae			<i>Aeropteryx monstrosa</i> Riek 1968	RM 93	Australia
Myrmeleontidae	Stilbopteryginae			<i>Stilbopteryx auricornis</i> Kimmins 1940	RM 226	Australia
Myrmeleontidae	Stilbopteryginae			<i>Stilbopteryx walkeri</i> Kimmins 1940	RM 68	Australia

Table A1.2. Neuropterida species used for Anchored Hybrid Enchiment probe design.

Order	Family	Species	Sample Code
Megaloptera	Corydalidae	<i>Neochauliodes koreanus</i>	CORY5614
Raphidioptera	Inocellidae	<i>Negha inflata</i>	NEGHA3609
Neuroptera	Berothidae	<i>Lomamyia sp.</i>	BERO210615
Neuroptera	Nymphidae	<i>Nymphes myrmeleonoides</i>	NYMP6233
Neuroptera	Osmylidae	<i>Thaumatosmylus delicatus</i>	OSMY212511
Neuroptera	Myrmeleontidae	<i>Palpares sp.</i>	MYRM231114
Neuroptera	Chrysopidae	<i>Nothancyla verreauxi</i>	CHRY451898
Neuroptera	Sisyridae	<i>Sisyra sp.</i>	SISY061814
Neuroptera	Coniopterygidae	<i>Coniopteryx sp.</i>	CONY7514
Neuroptera	Nevrorthidae	<i>Nevrorthus apatelios</i>	Peters et al. 2014

Table A1.3. A comparison of the traditional classification (Oswald 2015) and the newly proposed classification for Myrmeleontidae.

Traditional Classification	Proposed Classification
Family: Ascalaphidae Lefèbvre, 1842	Family: Myrmeleontidae Latreille, 1802
Subfamily: Albardiinae Weele, 1909	Subfamily: Ascalaphinae Lefèbvre, 1842
Subfamily: Ascalaphinae Lefèbvre, 1842	Tribe: Dimarini Navás, 1914
Subfamily: Haplogeniinae Newman, 1853	Tribe: Palparini Banks, 1911
Family: Myrmeleontidae Latreille, 1802	Tribe: Ululodini Weele, 1909
Subfamily: Myrmeleontinae Latreille, 1802	Tribe: Stilbopterygini Newman, 1853
Tribe: Acanthaclisini Navás, 1912	Tribe: Melambrotini Tjeder, 1992
Tribe: Brachynemurini Banks, 1927	Tribe: Haplogleniini Newman, 1853
Tribe: Dendroleontini Banks, 1899	Tribe: Ascalaphini Lefèbvre, 1842
Tribe: Gnopholeontini Stange, 1994	Subfamily: Myrmeleontinae Latreille, 1802
Tribe: Lemolemini Stange, 1994	Tribe: Brachynemurini Banks, 1927
Tribe: Maulini Markl, 1954	Tribe: Myrmeleontini Latreille, 1802
Tribe: Myrmeleontini Latreille, 1802	Tribe: Acanthaclisini Navás, 1912
Tribe: Myrmecaelurini Esben-Petersen, 1919	Tribe: Myrmecaelurini Esben-Petersen, 1919
Tribe: Nemoleontini Banks, 1911	Tribe: Nesoleontini Markl, 1954
Tribe: Nesoleontini Markl, 1954	Subfamily: Dendroleontinae Banks, 1899
Subfamily: Palparinae Banks, 1911	Tribe: Acanthoplectrini Markl, 1954
Tribe: Dimarini Navás, 1914	Tribe: Dendroleontini Banks, 1899
Tribe: Palparidiini Markl, 1954	Subfamily: Nemoleontinae Banks, 1911
Tribe: Palparini Banks, 1911	Tribe: Nemoleontini Banks, 1911
Tribe: Pseudimarini Markl, 1954	Tribe: Megistopini Navás, 1912
Subfamily: Stilbopteryginae Newman, 1853	Tribe: Protoplectrini Tillyard, 1916
	Tribe: Glenurini Banks, 1927

APPENDIX II



Figure A2.1. Root outgroups and Myrmeleontiformia (traditional classification), maximum likelihood tree. Clades with bootstrap values < 95% are marked. CHR = Chrysopidae; HEM = Hemerobiidae; ITH = Ithonidae; PSY = Psychopsidae; NEM = Nemopteridae; NYM = Nymphidae; ASC = Ascalaphidae, MYR = Myrmeleontidae.

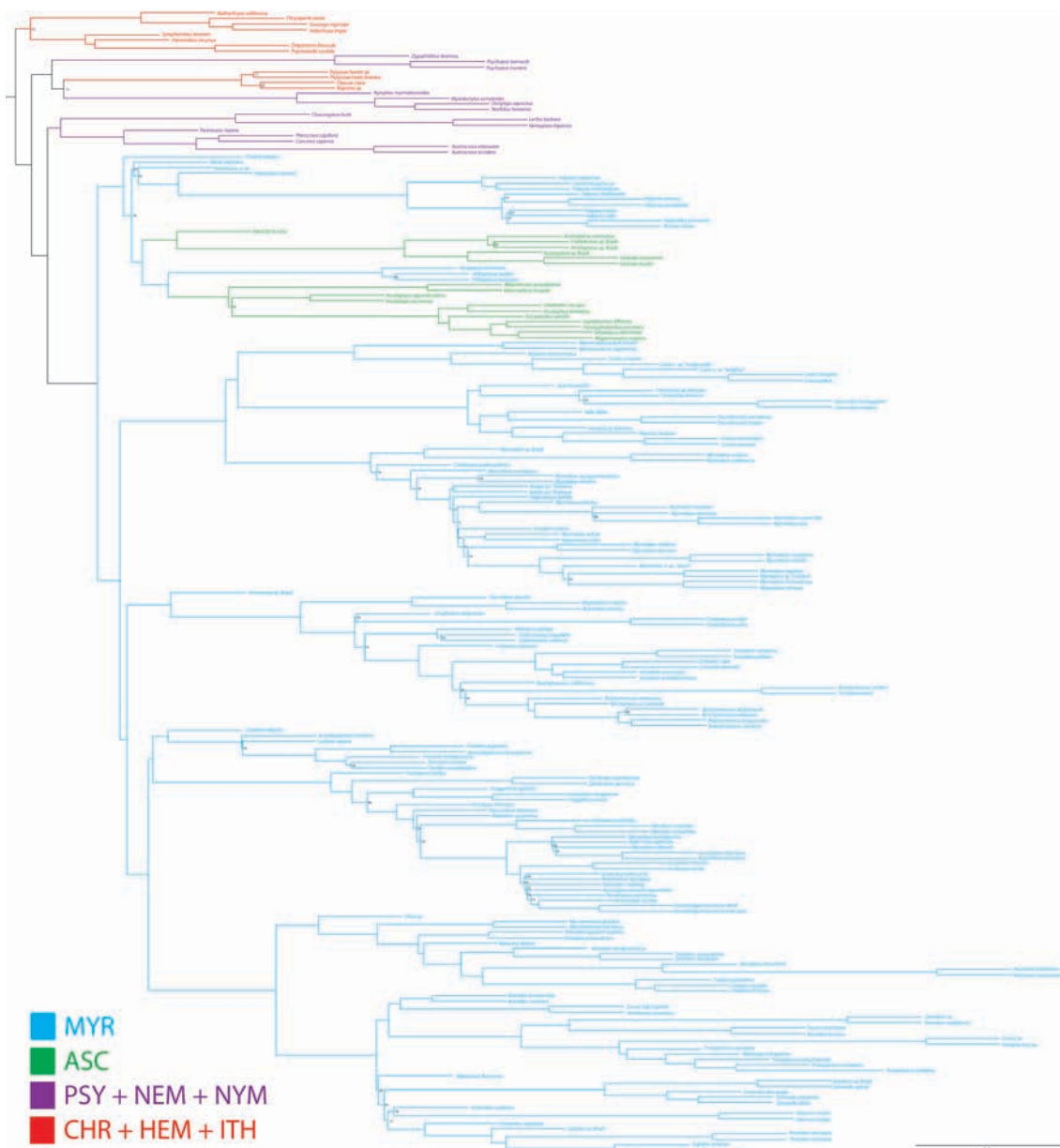


Figure A2.2. Root outgroups and Myrmeleontiformia (traditional classification), ASTRAL tree. Clades with bootstrap values < 95% are marked. CHR = Chrysopidae; HEM = Hemerobiidae; ITH = Ithonidae; PSY = Psychopsidae; NEM = Nemopteridae; NYM = Nymphidae; ASC = Ascalaphidae, MYR = Myrmeleontidae.

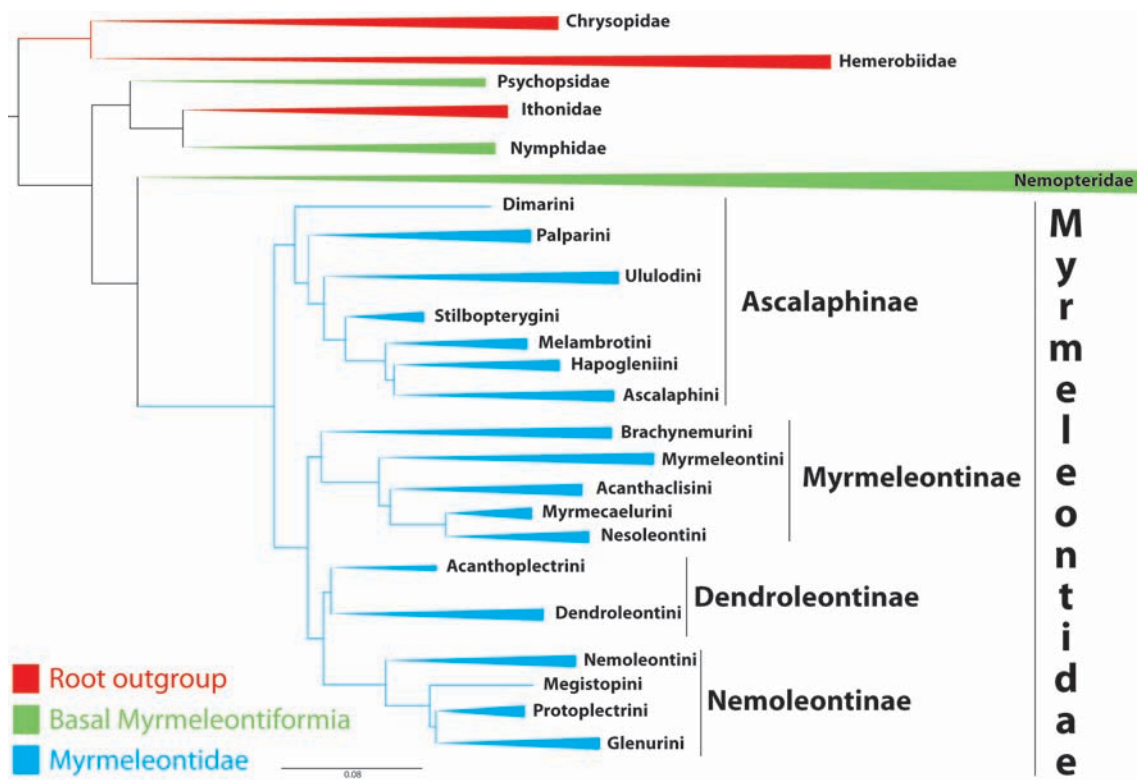


Figure A2.3. Myrmeleontiformia (new classification), maximum likelihood summary tree.

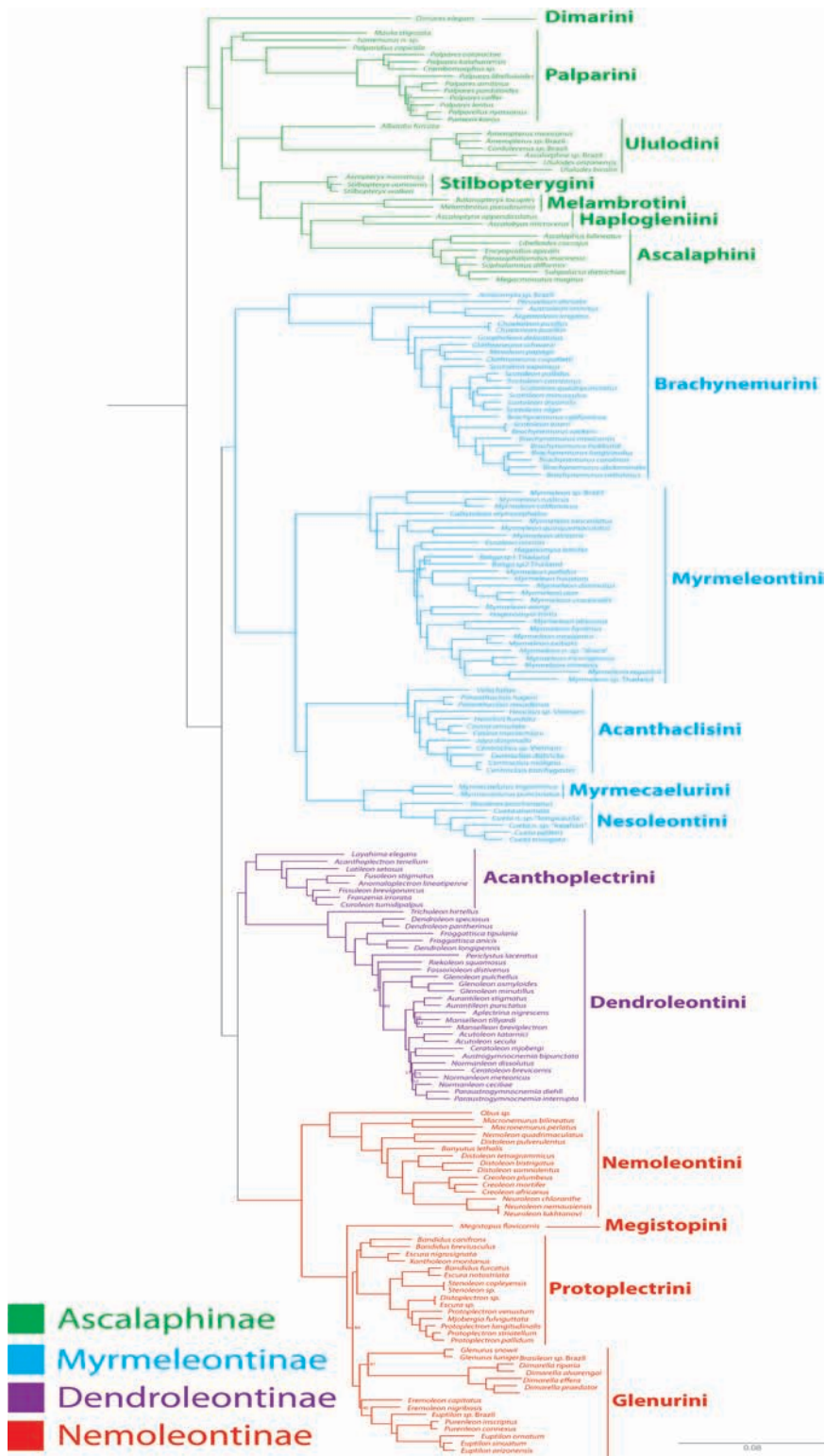


Figure A2.4. Myrmeleontidae (new classification), maximum likelihood tree. Clades with bootstrap values < 95% are marked.

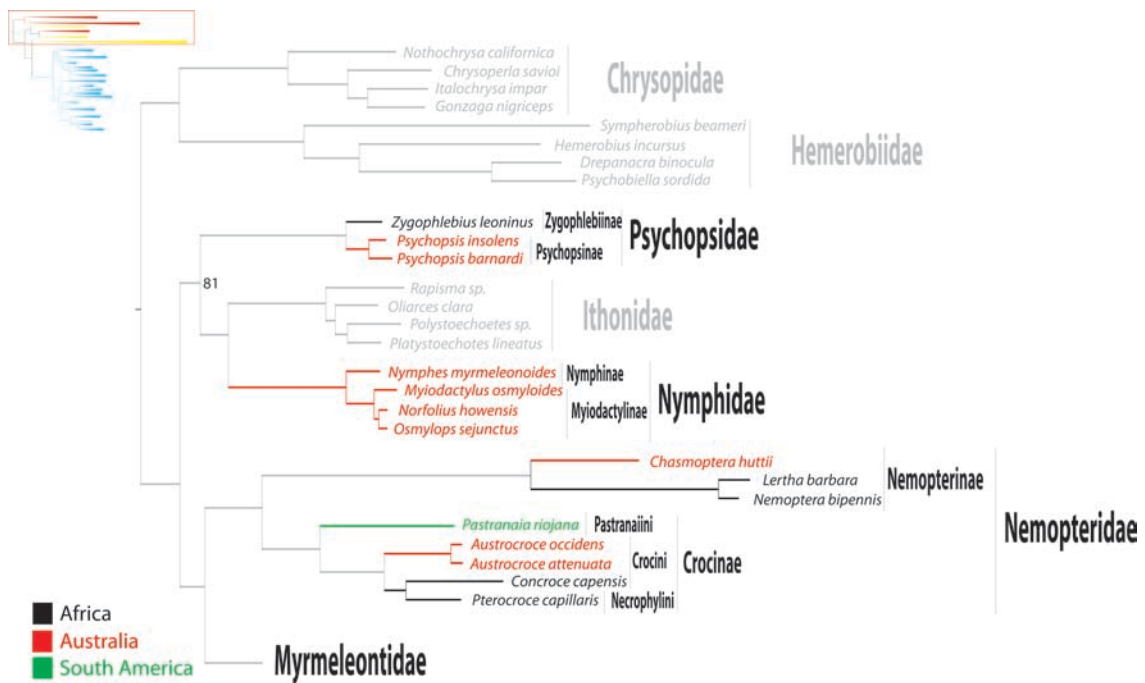


Figure A2.5. Root outgroup and basal Myrmeleontiformia (traditional classification), maximum likelihood. Clades with bootstrap values < 95% are marked.

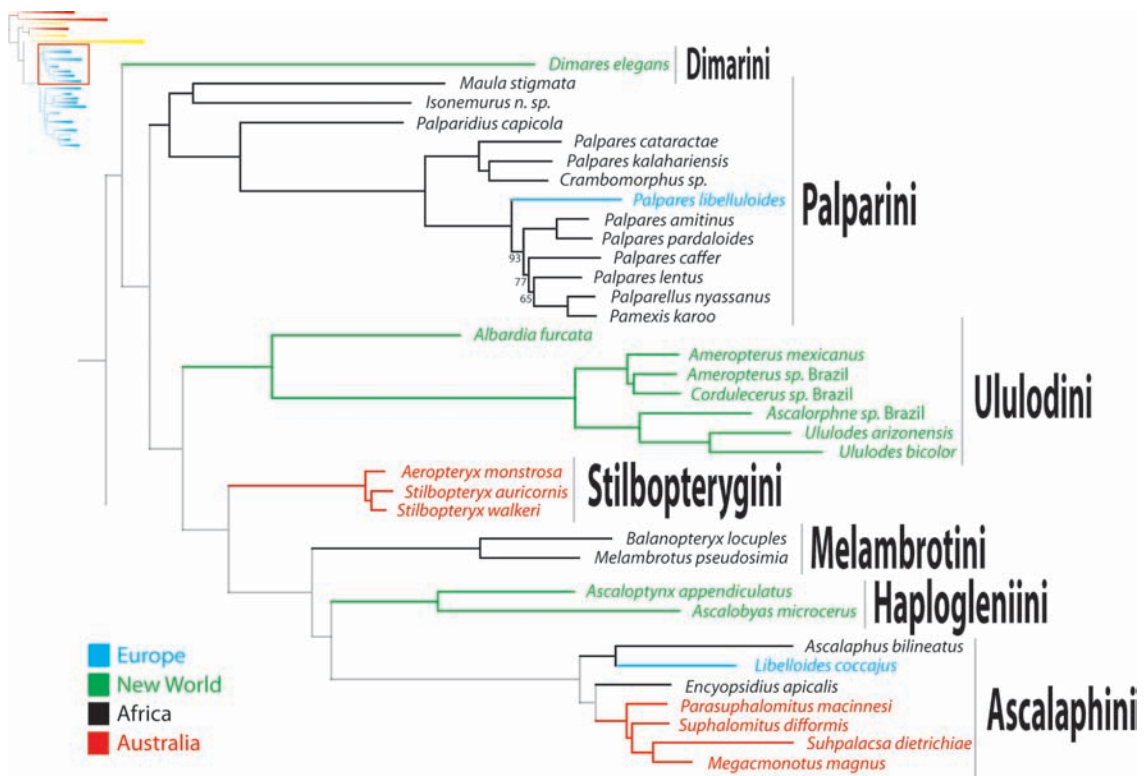


Figure A2.6. Myrmeleontidae: Ascalaphinae (new classification), maximum likelihood tree. Clades with bootstrap values < 95% are marked.

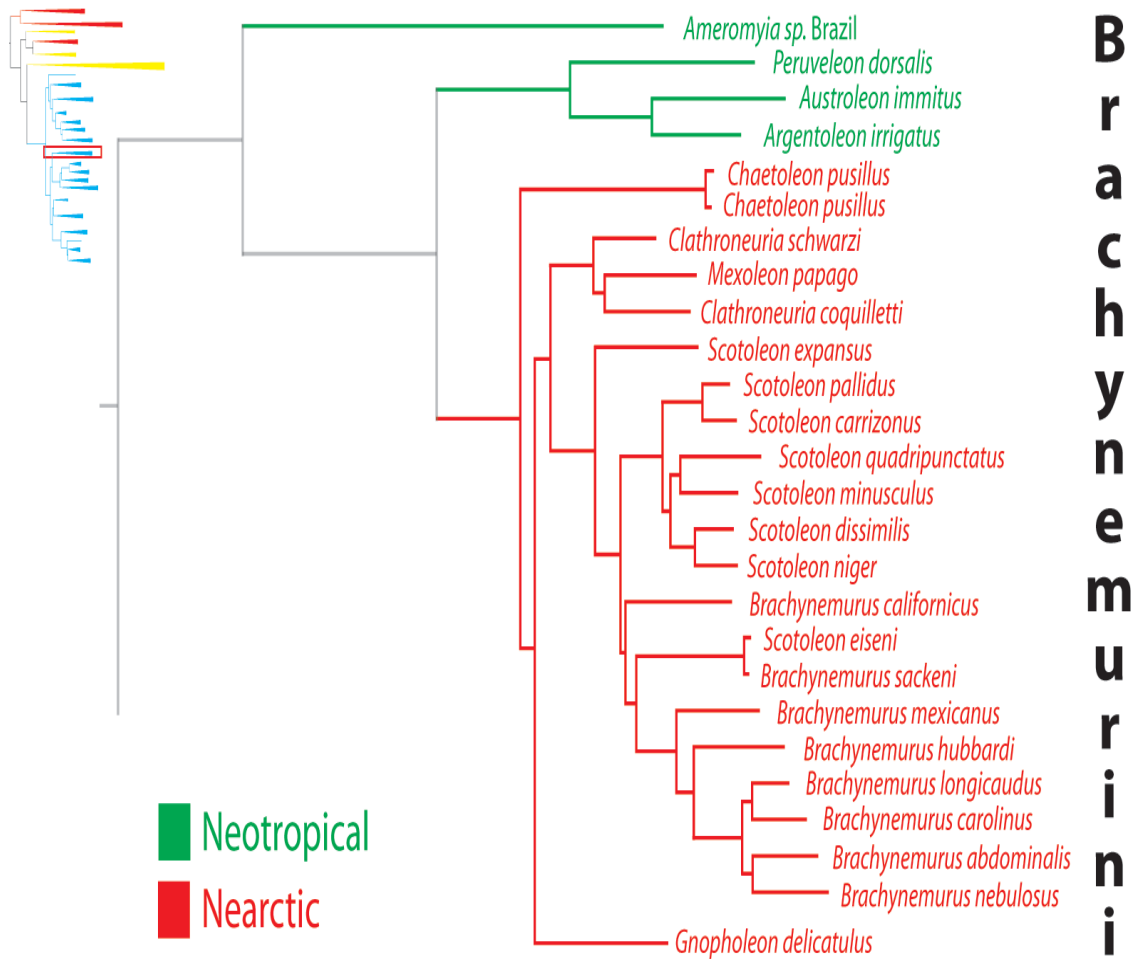


Figure A2.7. Myrmeleontidae: Myrmeleontinae: Brachynemurini (new classification), maximum likelihood tree. All clades with bootstrap values > 95%.

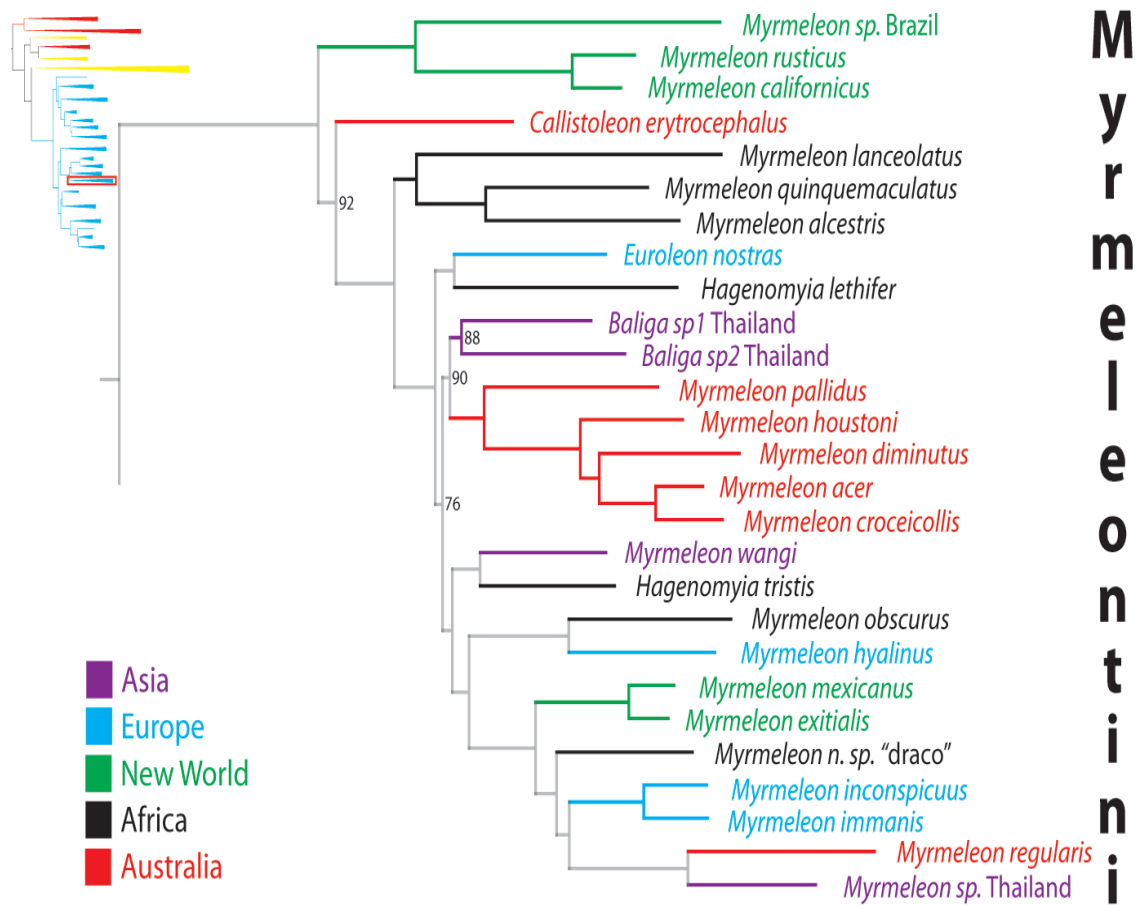


Figure A2.8. Myrmeleontidae: Myrmeleontinae: Myrmeleontini (new classification). maximum likelihood tree. Clades with bootstrap values < 95% are marked.

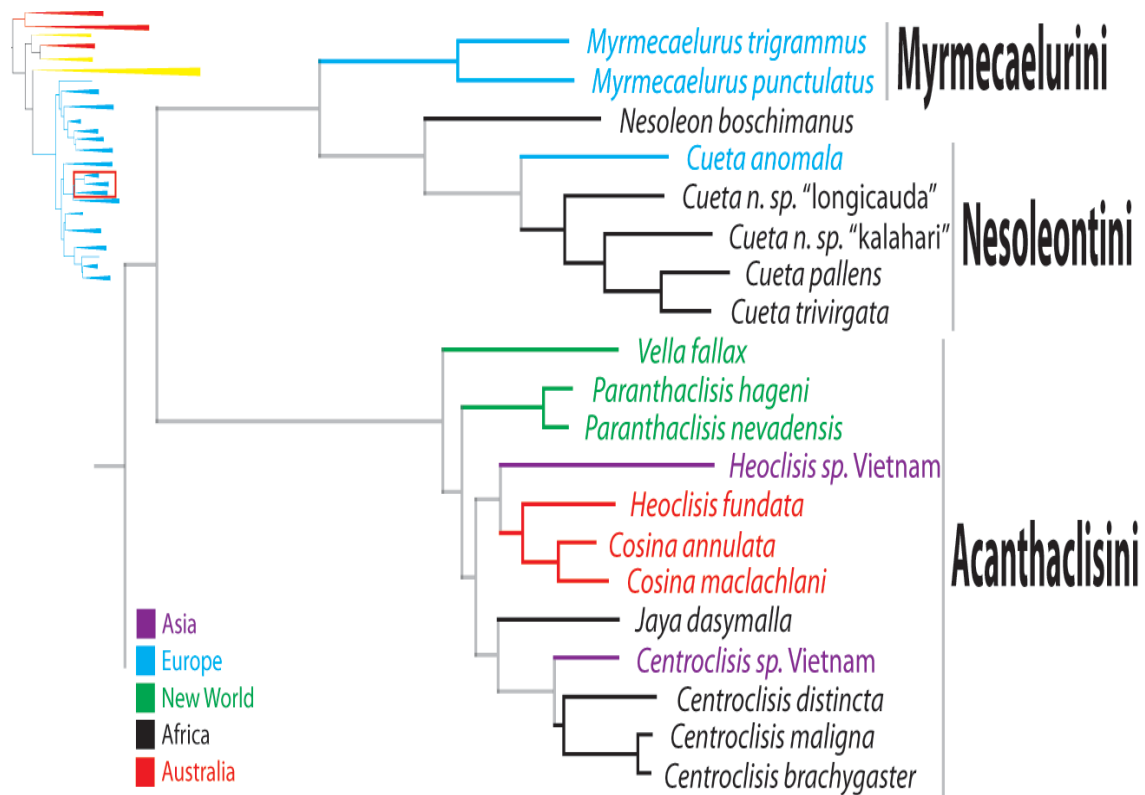


Figure A2.9. Myrmeleontidae: Myrmeleontinae: Acanthaclisini, Nesoleontini, Myrmecaelurini (new classification), maximum likelihood tree. All clades with bootstrap values > 95%.

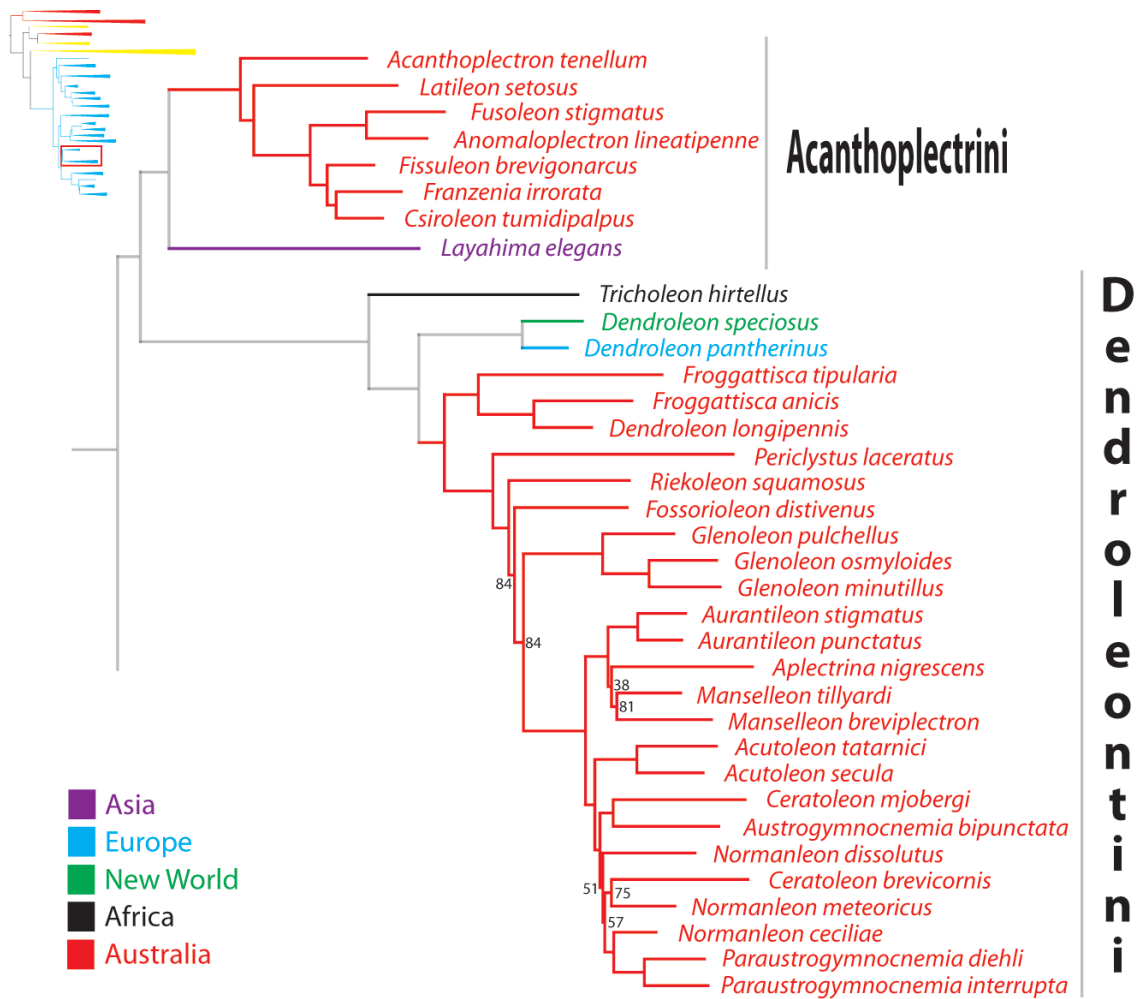


Figure A2.10. Myrmeleontidae: Dendroleontinae (new classification), maximum likelihood tree. Clades with bootstrap values < 95% are marked.

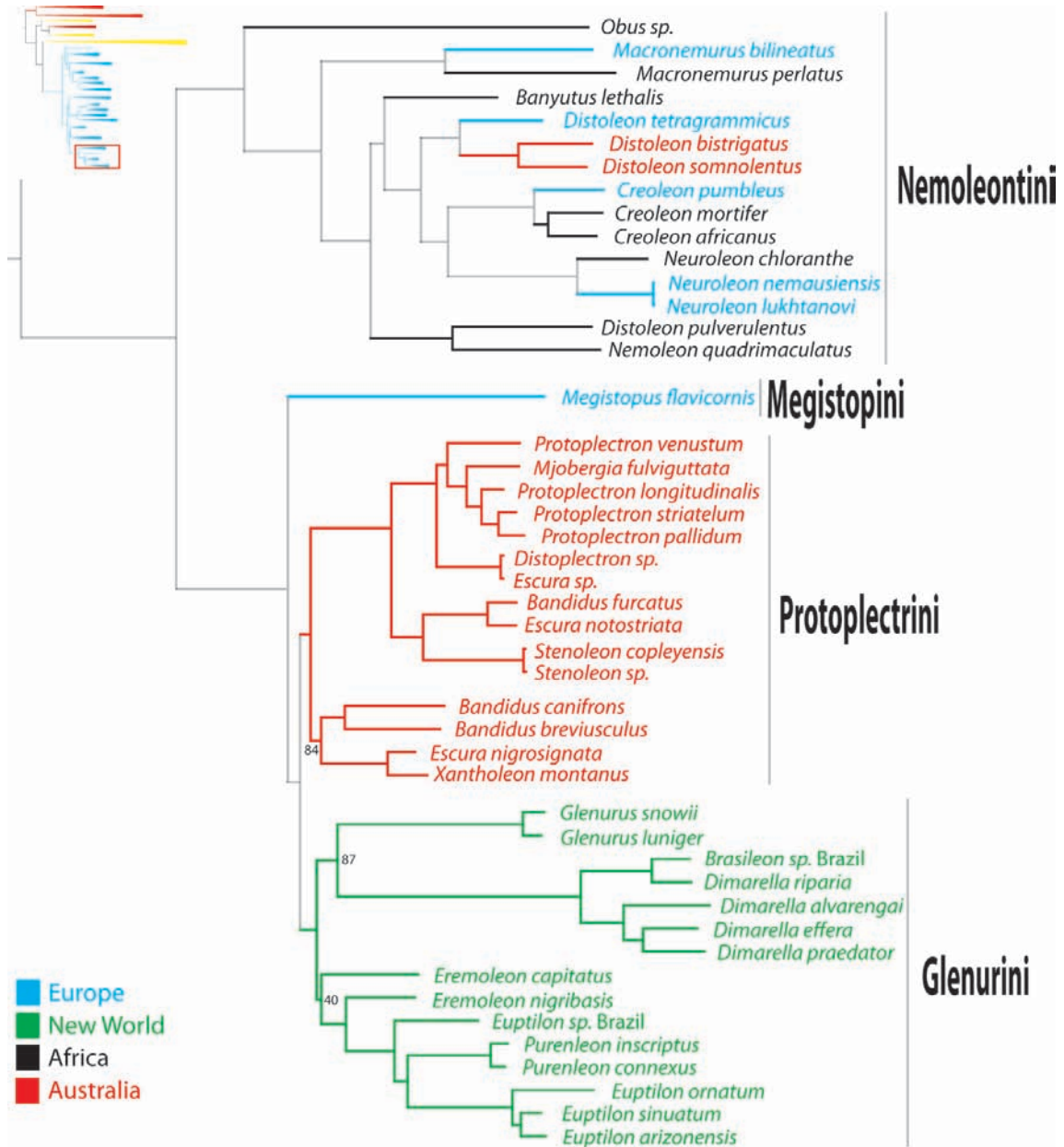


Figure A2.11. Myrmeleontidae: Nemoleontinae (new classification), maximum likelihood tree. Clades with bootstrap values < 95% are marked.

APPENDIX III

Table A3.1. Australian Myrmeleontidae species used in the molecular phylogeny.

Tribe	Species	Code
Acanthoplectrini	<i>Acanthoplectron tenellum</i> Esben-Petersen 1918	RM 176
Acanthoplectrini	<i>Anomaloplectron lineatipenne</i> Esben-Petersen 1918	RM 159
Acanthoplectrini	<i>Csiroleon tumidipalpus</i> New 1985	RM 151
Acanthoplectrini	<i>Fissuleon brevigonarcus</i> (New 1985)	RM 114
Acanthoplectrini	<i>Fissuleon mouldsorum</i> (New 1985)	RM 155
Acanthoplectrini	<i>Fissuleon nigristriatus</i> (New 1985)	RM 22
Acanthoplectrini	<i>Franzenia irrorata</i> Esben-Petersen 1929	RM 152
Acanthoplectrini	<i>Fusoleon stigmatus</i> New 1985	RM 153
Acanthoplectrini	<i>Latileon setosus n. sp.</i>	RM 162
Dendroleontini	<i>Acutoleon mulesi</i> (New 1985)	RM 139
Dendroleontini	<i>Acutoleon oombulgurriensis n. sp.</i>	RM 218
Dendroleontini	<i>Acutoleon secula</i> (New 1985)	RM 157
Dendroleontini	<i>Aplectrinia nigrescens</i> (New 1985)	RM 148
Dendroleontini	<i>Aplectrinia pentagramma</i> (Gerstaecker 1885)	RM 19
Dendroleontini	<i>Aurantoleon punctatus n. sp.</i>	RM 221
Dendroleontini	<i>Aurantoleon stigmatus</i> (Banks 1910)	RM 116
Dendroleontini	<i>Austrogymnocnemia arcuata</i> New 1985	RM 147
Dendroleontini	<i>Austrogymnocnemia bipunctata</i> (Esben-Petersen 1915)	RM 58
Dendroleontini	<i>Austrogymnocnemia maculata</i> (Tillyard 1916)	RM 17
Dendroleontini	<i>Austrogymnocnemia pallida</i> New 1985	RM 149
Dendroleontini	<i>Austrogymnocnemia pseudomaculata n. sp.</i>	RM 59

Table A3.1. Continued.

Tribe	Species	Code
Dendroleontini	<i>Ceratoleon brevicornis</i> Esben-Petersen 1917	RM 10
Dendroleontini	<i>Ceratoleon mjobergi</i> Esben-Petersen 1923	RM 150
Dendroleontini	<i>Dendroleon longipennis</i> Esben-Petersen 1915	RM 94
Dendroleontini	<i>Glenoleon minutillus</i> New 1985	RM 154
Dendroleontini	<i>Glenoleon osmyloides</i> (Gerstaecker 1885)	RM 61
Dendroleontini	<i>Glenoleon pulchellus</i> (Rambur 1842)	RM 97
Dendroleontini	<i>Fossorioleon distivenus</i> n. sp.	RM 20
Dendroleontini	<i>Fossorioleon rudda</i> (New 1985)	RM 156
Dendroleontini	<i>Froggattisca anicis</i> New 1985	RM 113
Dendroleontini	<i>Froggattisca tipularia</i> (Gerstaecker 1885)	RM 96
Dendroleontini	<i>Manselleon breviplectron</i> n. sp.	RM 21
Dendroleontini	<i>Manselleon tillyardi</i> (New 1985)	RM 158
Dendroleontini	<i>Normanleon ceciliae</i> n. sp.	RM 163
Dendroleontini	<i>Normanleon dissolutus</i> (Gerstaecker 1885)	RM 137
Dendroleontini	<i>Normanleon meteoricus</i> (Gerstaecker 1885)	RM 138
Dendroleontini	<i>Paraustrogymnocnemia diehli</i> n. sp.	RM 05
Dendroleontini	<i>Paraustrogymnocnemia interrupta</i> (Esben-Petersen 1915)	RM 174
Dendroleontini	<i>Periclystus laceratus</i> Gerstaecker 1888	RM 145
Dendroleontini	<i>Riekoleon squamosus</i> n. sp.	RM 122
Protoplectrini	<i>Protoplectron longitudinalis</i> Tillyard 1916	RM 13

Table A3.2. Matrix for the morphological phylogenetic analysis of the former Periclystina.

taxon	Characters																											
	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2
	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8
<i>Myrmeleon houstoni</i>	0	0	1	0	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	2	1	0	0	0	0	0	0	0
<i>Protoplectron longitudinalis</i>	0	0	1	0	1	0	1	0	0	1	0	0	1	0	0	0	2	2	0	1	2	0	0	1	1	0	0	1
<i>Acanthoplectron umbratus</i>	0	0	1	1	0	1	1	0	0	1	0	0	1	0	0	1	2	2	1	1	3	3	0	0	0	0	0	0
<i>Anomaloplectron lineatipenne</i>	1	0	1	0	0	0	1	0	0	0	0	0	0	0	1	2	0	0	1	3	3	1	0	0	0	0	0	0
<i>Csiroleon tumidipalpus</i>	0	1	0	1	1	1	1	1	0	1	1	0	1	0	0	0	2	2	0	1	2	1	1	0	2	1	1	0
<i>Cs. fasciatus</i>	0	1	0	1	1	1	1	1	0	1	0	0	1	0	0	0	2	1	0	1	2	1	1	0	2	1	1	0
<i>Franzenia irrorata</i>	0	0	1	0	1	1	0	1	0	2	1	0	1	0	0	0	1	2	0	1	0	1	0	0	0	0	1	0
<i>Fusoleon stigmatus</i>	1	0	1	0	0	1	0	1	0	0	0	0	0	0	0	1	2	0	1	1	3	3	1	0	0	0	0	0
<i>Latileon hyalinus</i>	0	0	1	0	0	0	0	0	0	2	0	0	0	0	0	1	2	1	1	1	3	3	1	0	0	0	1	0
<i>L. setosus</i>	0	0	1	0	0	1	0	0	0	2	0	0	0	0	0	1	2	1	1	1	3	3	1	0	0	0	1	0
<i>Fissuleon brevigonarcus</i>	0	0	1	1	0	1	1	1	0	0	0	0	0	0	1	0	1	0	1	1	2	2	1	0	1	0	0	0
<i>Fi. mouldsorum</i>	0	0	1	1	0	1	1	1	0	0	0	0	0	0	1	0	1	0	1	1	2	2	1	0	1	0	0	0
<i>Fi. nigristriatus</i>	0	0	1	1	0	1	1	1	0	1	0	0	1	0	1	0	1	2	1	1	2	2	1	0	1	0	0	0
<i>Austrogymnocnemia arcuata</i>	0	0	1	0	0	0	1	1	0	2	0	0	1	1	1	0	1	2	0	1	0	1	1	0	1	0	0	0
<i>Aus. bipunctata</i>	0	0	1	0	0	0	1	1	0	2	0	0	1	1	1	0	1	2	0	1	0	1	1	0	1	0	0	0
<i>Aus. forcipata</i>	0	0	1	0	0	0	1	1	0	2	0	0	1	1	1	0	1	1	0	1	0	1	1	0	1	0	0	0
<i>Aus. maculata</i>	0	0	1	0	0	0	1	1	0	2	0	0	1	1	1	0	1	2	0	1	0	1	1	0	1	0	0	0
<i>Aus. pseudomaculata</i>	0	0	1	0	1	0	1	0	0	2	0	0	1	1	1	0	1	2	0	1	0	1	1	0	1	0	0	0
<i>Aus. pallida</i>	0	0	1	0	0	0	1	1	0	2	0	0	1	1	1	0	1	2	0	1	0	1	1	0	1	0	0	0
<i>Aplectrinia cardaleae</i>	0	0	1	0	1	0	1	1	0	1	0	0	1	1	1	0	0	0	1	1	0	1	1	0	1	0	0	0
<i>Ap. lulinguensis</i>	0	0	1	0	0	0	1	1	0	1	0	0	1	1	1	0	0	0	0	1	0	0	1	0	1	0	0	0
<i>Ap. nigrescens</i>	0	0	1	0	1	0	1	1	0	1	0	0	1	1	1	0	0	0	1	1	0	0	1	0	1	0	0	0
<i>Ap. pentagramma</i>	0	0	1	0	1	0	1	0	0	1	0	0	1	1	1	0	0	0	0	1	0	0	1	0	1	0	0	0
<i>Ap. sarahae</i>	0	0	1	0	0	0	1	1	0	1	0	0	1	1	1	0	0	0	0	1	0	1	1	0	1	0	0	0

Table A3.2. Continued.

taxon	Characters																											
	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	
	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8
<i>Ap. tindalei</i>	0	0	1	0	1	0	1	1	0	1	0	0	1	1	1	0	0	0	0	1	0	0	1	0	1	0	0	0
<i>Ap. oombulgurrinesis</i>	0	0	1	0	0	0	1	1	0	1	0	0	1	1	2	0	0	1	0	1	0	1	1	0	1	0	0	0
<i>Pa. interrupta</i>	0	0	1	0	0	0	1	1	0	1	0	0	0	1	1	0	0	0	0	1	0	1	1	0	1	0	0	0
<i>Pa. lineata</i>	0	0	1	0	0	0	1	1	0	1	0	0	0	1	1	0	0	0	0	1	0	1	1	0	1	0	0	0
<i>Pa. diehli</i>	0	0	1	0	0	0	1	1	0	1	0	0	0	1	1	0	1	0	0	1	0	1	1	0	1	0	0	0
<i>Ceratoleon brevicornis</i>	0	0	1	0	0	1	1	1	0	1	1	0	1	1	0	0	1	2	1	1	0	2	0	0	0	0	0	1
<i>Ce. mjobergi</i>	0	0	1	0	1	1	1	1	0	1	0	0	1	1	1	0	1	1	1	1	0	0	1	0	1	0	0	1
<i>Minyleon pygmaeus</i>	1	0	1	0	1	0	1	2	1	1	0	0	1	1	3	0	0	1	1	0	0	1	1	0	1	0	0	0
<i>Tanyleon cahillensis</i>	1	0	1	0	1	0	1	2	0	1	0	0	1	1	3	0	0	1	2	1	2	2	1	0	1	0	1	0
<i>T. newi</i>	1	0	1	0	1	0	1	2	0	1	0	0	1	1	3	0	0	1	2	1	2	2	1	0	1	0	0	1
<i>T. lesouefi</i>	1	0	1	0	0	0	1	2	1	1	0	0	1	1	3	0	0	1	2	1	2	1	1	0	1	0	0	0
<i>Glenoleon aurora</i>	1	0	1	0	0	0	1	2	0	1	0	0	1	1	3	0	0	1	2	1	2	2	1	0	1	0	1	0
<i>G. maculatus</i>	1	0	1	0	1	0	1	2	1	1	0	0	1	1	3	0	0	1	2	1	1	1	1	0	1	0	1	0
<i>G. minutillus</i>	1	0	1	0	0	0	1	2	1	1	0	0	1	1	3	0	0	1	2	1	2	2	1	0	1	0	0	0
<i>G. osmyloides</i>	1	0	1	0	0	0	1	2	1	1	0	0	1	1	3	0	0	1	2	1	2	2	1	0	1	0	1	0
<i>G. pulchellus</i>	1	0	1	0	1	0	1	2	1	1	0	0	1	1	3	0	0	1	2	1	2	1	1	0	1	0	1	0
<i>G. froggatti</i>	1	0	1	0	0	0	0	2	1	1	0	0	1	1	3	0	1	0	2	0	2	2	0	0	1	0	1	1
<i>Fossorioleon edwardsi</i>	0	0	1	0	0	0	1	2	1	0	0	0	0	1	2	0	0	0	2	1	0	2	1	0	0	0	0	0
<i>Fo. distivenus</i>	1	0	1	0	0	0	1	2	1	1	0	0	1	1	2	0	0	0	2	1	0	1	1	0	0	0	0	0
<i>Fo. striatus</i>	0	0	1	0	0	1	1	0	1	1	0	0	1	1	2	0	0	1	2	0	0	1	1	0	0	0	0	0
<i>Fo. longitudinalis</i>	0	0	1	0	0	0	1	1	0	0	0	0	0	1	2	0	0	1	2	1	2	1	1	0	0	0	0	1
<i>Fo. rudda</i>	1	0	1	0	0	0	1	2	0	1	0	0	0	1	2	0	0	1	2	1	2	1	1	0	0	0	0	1
<i>Aurantoleon annulatus</i>	0	0	1	0	1	0	1	0	0	2	0	0	1	1	2	0	1	2	1	1	2	1	1	0	1	0	0	0
<i>Aur. banksi</i>	0	0	1	0	1	0	1	0	0	2	0	0	1	1	2	0	1	1	1	1	2	1	1	0	1	0	0	1

Table A3.2. Continued.

taxon	Characters																											
	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2
	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8
<i>Aur. drysdalensis</i>	0	0	1	0	0	0	1	0	0	1	0	0	1	1	2	0	1	1	1	1	0	1	1	0	1	0	01	0
<i>Aur. pingrupensis</i>	0	0	1	0	1	0	1	0	0	2	0	0	1	1	2	0	1	1	1	1	2	1	1	0	1	0	0	0
<i>Aur. radialis</i>	0	0	1	0	1	0	1	1	0	1	0	0	1	1	2	0	1	1	1	1	2	1	1	0	1	0	0	0
<i>Aur. roseipennis</i>	0	0	1	0	1	0	1	0	0	1	0	0	1	1	2	0	1	1	1	1	2	1	1	0	1	0	0	0
<i>Aur. punctatus</i>	0	0	1	0	1	0	1	0	0	1	0	0	1	1	2	0	1	1	1	1	2	1	1	0	1	0	0	0
<i>Aur. stigmatus</i>	0	0	1	0	1	0	1	1	0	1	0	0	1	1	2	0	1	1	1	1	2	1	1	0	1	0	1	0
<i>Normanleon berthoudi</i>	0	0	1	0	0	0	1	1	0	1	0	0	1	1	2	0	1	1	1	1	2	1	1	0	1	0	0	0
<i>N. ceciliae</i>	0	0	1	0	0	0	1	1	0	1	0	0	1	1	2	0	1	1	1	1	1	1	1	0	1	0	0	0
<i>N. conspersum</i>	0	0	1	0	0	0	1	1	0	1	0	0	1	1	2	0	1	1	1	1	2	1	1	0	1	0	01	0
<i>N. dissolutus</i>	0	0	1	0	0	0	1	1	0	1	0	0	1	1	2	0	1	1	1	1	2	1	1	0	1	0	01	0
<i>N. falsus</i>	0	0	1	0	0	0	1	1	0	1	0	0	1	1	2	0	1	1	1	1	2	1	1	0	1	0	0	0
<i>N. meteoricus</i>	0	0	1	0	0	0	1	1	0	1	0	0	1	1	2	0	1	1	1	1	2	1	1	0	1	0	0	0
<i>Acutoleon tatarnici</i>	0	0	1	0	0	0	1	1	0	1	0	0	0	1	2	0	0	0	1	1	0	1	1	0	1	0	0	0
<i>Ac. mulesi</i>	0	0	1	0	0	0	1	1	0	1	0	0	0	1	2	0	0	0	1	1	2	1	1	0	1	0	0	0
<i>Ac. parviproctus</i>	0	0	1	0	0	0	1	1	0	1	0	0	0	1	2	0	0	0	1	1	2	1	1	0	1	0	0	0
<i>Ac. secula</i>	0	0	1	0	0	0	1	1	0	1	0	0	0	1	2	0	0	0	1	1	2	1	1	0	1	0	0	0
<i>Manselleon rebellis</i>	0	0	1	0	0	0	1	0	0	1	0	0	1	1	2	0	0	1	0	1	2	1	1	0	1	0	0	0
<i>Ma. breviplectron</i>	0	0	1	0	0	0	1	0	0	1	0	0	1	1	2	0	0	1	0	1	1	1	1	0	1	0	0	0
<i>Ma. tillyardi</i>	0	0	1	0	0	0	1	0	0	1	0	0	1	1	2	0	0	1	0	1	1	1	1	0	1	0	0	0
<i>Ma. longidigitus</i>	0	0	1	0	0	0	1	0	0	1	0	0	1	1	2	0	0	1	0	1	1	1	1	0	1	0	0	0
<i>Periclystus aureolatus</i>	1	0	1	0	0	0	1	1	0	2	0	1	0	0	2	0	0	1	1	0	2	2	1	0	1	0	0	0
<i>Pe. circuiter</i>	1	0	1	0	0	0	1	1	0	2	0	1	1	0	3	0	0	1	2	1	2	2	1	0	1	0	1	0
<i>Pe. laceratus</i>	1	0	1	0	0	0	1	1	0	1	0	1	0	0	3	0	0	1	2	1	2	2	1	0	1	0	0	0
<i>Pe. vicinus</i>	1	0	1	0	0	0	1	1	0	1	0	1	1	0	2	0	0	1	2	1	2	2	1	0	1	0	1	0

Table A3.2. Continued.

taxon	Characters																											
	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	
	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8
<i>Riekoleon proctus</i>	0	0	1	0	0	0	0	2	1	1	0	0	0	1	3	0	0	1	2	1	0	2	0	0	0	0	0	0
<i>R. convergens</i>	0	0	1	0	0	0	0	2	1	2	0	0	0	1	3	0	0	1	2	1	2	2	0	0	0	0	0	0
<i>R. furcatus</i>	0	0	1	0	0	0	0	2	1	1	0	0	0	1	3	0	0	0	2	1	2	2	0	0	0	0	0	0
<i>R. squamosus</i>	0	0	1	0	0	0	0	2	1	1	0	0	0	1	3	0	0	0	2	1	2	2	0	0	0	0	0	0
<i>Compsoleon bembicidis</i>	0	0	1	0	0	0	0	2	1	1	0	0	1	1	3	0	0	2	1	1	1	1	1	0	2	1	0	0
<i>Chrysoleon punctatum</i>	0	0	1	0	1	0	1	2	1	2	0	0	1	0	3	0	0	2	1	0	0	1	1	0	0	0	1	0
<i>Dendroleon dumigani</i>	0	0	1	0	0	0	1	2	1	1	0	0	1	1	3	0	0	1	1	1	2	1	1	0	0	0	0	0
<i>Froggattisca tipularia</i>	0	0	1	0	0	0	0	2	1	1	1	0	1	0	3	0	0	1	1	1	1	1	1	0	2	1	0	0
<i>Fr. gemma</i>	0	0	1	0	0	0	0	2	1	2	0	0	1	0	3	0	0	1	1	1	0	1	1	0	2	1	0	0
<i>Mossega indecisa</i>	0	0	1	0	1	0	0	2	1	2	0	0	1	0	3	0	0	1	1	1	2	1	1	0	0	0	1	0

Table A3.2. Continued.

taxon	Characters																											
	2	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5
<i>Myrmeleon houstoni</i>	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	2	4	6	1	1	0	0	1	2	5
<i>Protoplectron longitudinalis</i>	0	1	0	1	0	0	0	0	1	0	1	0	0	0	2	0	0	0	2	0	6	1	1	0	0	1	0	5
<i>Acanthoplectron umbratus</i>	0	0	0	0	0	0	0	0	0	0	1	0	0	0	2	1	0	0	2	1	4	1	1	0	0	0	0	5
<i>Anomaloplectron lineatipenne</i>	0	0	1	0	0	0	1	1	1	0	1	0	0	0	2	1	0	0	2	1	4	1	1	0	0	1	0	5
<i>Csiroleon tumidipalpus</i>	1	0	1	0	0	0	0	1	0	0	0	0	0	0	1	0	0	2	1	4	1	1	0	0	1	0	1	
<i>Cs. fasciatus</i>	1	0	1	0	0	0	0	0	0	0	0	0	0	0	?	?	?	?	?	?	1	1	0	0	1	0	1	
<i>Franzenia irrorata</i>	0	0	1	0	0	0	0	1	0	0	1	0	0	0	2	1	0	0	2	1	4	1	1	0	0	1	0	1
<i>Fusoleon stigmatus</i>	0	0	1	0	0	0	0	1	0	0	1	0	0	0	1	0	0	2	1	4	1	1	0	0	1	0	1	
<i>Latileon hyalinus</i>	0	0	1	0	0	0	0	0	0	0	0	0	0	0	?	?	?	?	?	?	1	1	0	0	1	0	5	
<i>L. setosus</i>	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	1	4	1	1	0	0	1	0	5	
<i>Fissuleon brevigonarcus</i>	0	0	1	0	0	0	0	1	0	0	1	0	0	0	1	0	0	2	1	4	1	0	0	0	1	0	1	
<i>Fi. mouldsorum</i>	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0	0	2	1	4	1	0	0	0	1	0	1	
<i>Fi. nigristriatus</i>	0	0	1	0	0	0	0	1	0	0	1	0	0	0	1	0	0	2	1	4	1	0	0	0	1	0	1	
<i>Austrogymnocnemia arcuata</i>	0	0	0	1	1	1	0	0	0	0	1	1	0	0	3	1	0	0	7	0	9	0	1	2	0	0	7	
<i>Aus. bipunctata</i>	1	0	0	1	1	1	0	0	0	0	1	1	0	0	2	1	0	0	7	0	9	0	1	2	0	0	7	
<i>Aus. forcipata</i>	0	0	0	0	1	1	0	0	0	0	1	1	0	0	2	1	0	0	7	0	9	?	?	?	?	?	?	
<i>Aus. maculata</i>	0	0	0	1	1	1	0	0	0	0	1	1	0	0	2	1	0	0	7	0	9	0	1	2	0	0	7	
<i>Aus. pseudomaculata</i>	0	0	0	1	1	1	0	0	0	0	1	0	0	0	2	1	0	0	7	5	9	0	1	2	0	0	7	
<i>Aus. pallida</i>	0	0	0	1	1	1	0	0	0	0	1	1	0	0	2	1	0	0	7	0	9	0	1	2	0	0	7	
<i>Aplectrinia cardaleae</i>	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	4	2	6	1	0	0	1	1	0	2
<i>Ap. lulinguensis</i>	0	0	0	0	1	0	0	0	1	0	1	0	0	0	1	1	0	0	4	2	8	0	1	1	1	1	0	2
<i>Ap. nigrescens</i>	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2	1	0	0	4	2	8	1	0	1	0	1	0	2
<i>Ap. pentagramma</i>	0	0	0	0	1	0	0	0	0	0	1	0	0	0	2	1	0	0	4	2	8	1	0	1	1	1	0	2
<i>Ap. sarahae</i>	0	0	0	0	1	0	0	0	0	0	0	1	0	0	1	1	0	0	4	2	8	1	0	0	1	1	0	2

Table A3.2. Continued.

taxon	Characters																											
	2	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5
<i>Ap. tindalei</i>	0	0	0	0	1	0	0	0	0	0	1	0	0	0	1	1	0	0	4	2	8	1	0	1	0	1	0	2
<i>Ap. oombulgurrinesis</i>	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	0	4	4	6	0	0	0	0	1	1	2
<i>Pa. interrupta</i>	0	0	0	1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	6	0	5	0	1	2	0	0	0	6
<i>Pa. lineata</i>	0	0	0	1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	6	0	5	0	1	2	0	0	0	6
<i>Pa. diehli</i>	0	0	0	1	1	1	0	0	0	0	0	0	0	0	1	1	0	0	6	0	5	0	1	2	0	0	0	6
<i>Ceratoleon brevicornis</i>	0	0	0	1	1	1	0	1	0	0	1	0	0	0	2	1	0	0	5	3	5	0	1	2	0	0	0	6
<i>Ce. mjobergi</i>	0	0	0	1	1	1	0	1	0	0	1	0	0	0	3	1	0	0	5	3	5	0	1	2	0	0	0	6
<i>Minyleon pygmaeus</i>	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	1	0	0	5	0	2	0	1	1	0	0	0	6
<i>Tanyleon cahillensis</i>	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	1	0	0	3	4	2	1	1	1	1	0	0	2
<i>T. newi</i>	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	3	4	2	1	1	1	1	1	0	2
<i>T. lesouefi</i>	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	1	0	0	4	4	2	0	1	1	1	1	0	2
<i>Glenoleon aurora</i>	0	0	0	0	1	0	0	0	0	0	0	0	0	1	2	1	0	1	1	6	2	1	1	1	0	0	1	6
<i>G. maculatus</i>	0	0	1	0	1	0	0	0	0	0	0	0	0	1	3	?	?	?	?	?	?	0	1	1	0	0	0	6
<i>G. minutillus</i>	1	0	0	0	1	0	0	0	0	0	1	0	0	1	2	1	0	1	5	3	2	0	1	1	0	0	1	6
<i>G. osmyloides</i>	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	2	1	0	1	4	3	2	0	1	2	0	0	6
<i>G. pulchellus</i>	1	0	0	0	1	0	0	1	0	0	0	0	0	1	3	1	0	1	0	4	2	0	1	2	0	0	1	6
<i>G. froggatti</i>	1	0	0	0	1	0	0	0	0	0	0	0	0	0	2	1	0	0	0	6	2	0	1	1	0	0	1	6
<i>Fossorioleon edwardsi</i>	0	0	0	1	1	0	1	1	1	0	1	0	0	0	3	1	1	0	5	0	7	0	1	1	0	0	1	3
<i>Fo. distivenus</i>	0	0	0	0	1	0	1	1	0	0	1	1	0	0	3	1	1	0	5	0	7	0	1	1	0	0	0	3
<i>Fo. striatus</i>	0	0	0	1	1	0	1	0	1	0	1	0	0	0	2	1	1	0	6	0	5	0	1	1	0	0	1	3
<i>Fo. longitudinalis</i>	1	0	0	0	1	0	1	1	1	0	1	0	0	0	3	?	?	0	?	?	?	0	1	1	0	0	1	4
<i>Fo. rudda</i>	1	0	0	1	1	0	1	0	1	0	1	1	0	0	2	1	1	0	5	0	7	0	1	1	0	0	1	4
<i>Aurantoleon annulatus</i>	0	0	1	0	1	0	0	0	0	0	0	0	0	0	2	1	0	0	1	6	1	1	0	0	1	1	0	0
<i>Aur. banksi</i>	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	6	1	1	0	0	1	1	0	0

Table A3.2. Continued.

taxon	Characters																											
	2	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5	5
<i>Aur. drysdalensis</i>	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	3	1	1	0	0	1	1	0	2
<i>Aur. pingrupensis</i>	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	6	1	1	0	0	1	1	0	1
<i>Aur. radialis</i>	0	0	0	0	1	1	0	1	0	0	0	0	0	0	2	1	0	0	1	3	1	1	0	1	1	1	0	2
<i>Aur. roseipennis</i>	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	1	6	1	1	0	0	0	1	0	0
<i>Aur. punctatus</i>	0	0	1	0	1	0	0	0	0	0	0	0	0	0	2	1	0	0	1	6	0	1	1	0	0	1	0	0
<i>Aur. stigmatus</i>	0	0	0	0	1	0	0	01	0	0	0	0	0	0	2	1	0	0	1	3	1	1	0	1	1	1	0	2
<i>Normanleon berthoudi</i>	0	0	0	01	1	01	0	1	1	0	1	1	0	1	3	1	0	2	6	3	6	0	1	1	0	0	0	6
<i>N. ceciliae</i>	0	0	0	1	1	01	0	1	1	0	1	1	0	1	3	1	0	0	6	3	2	0	1	1	0	0	0	6
<i>N. conspersum</i>	0	0	0	1	1	01	0	1	0	0	0	0	0	1	3	1	0	0	6	3	6	0	1	2	0	0	1	6
<i>N. dissolutus</i>	0	0	0	01	1	01	0	1	0	0	0	0	0	1	3	1	0	0	6	5	6	1	1	2	0	0	1	6
<i>N. falsus</i>	0	0	0	1	1	1	0	1	1	0	1	1	0	01	3	1	0	0	6	3	6	1	1	1	0	0	1	6
<i>N. meteoricus</i>	1	0	0	1	1	01	0	1	1	0	1	1	0	1	3	1	0	2	6	3	6	0	1	1	0	0	0	6
<i>Acutoleon tatarnici</i>	0	0	0	0	1	0	0	0	0	0	1	1	0	0	1	1	0	0	5	5	1	?	?	?	?	?	?	?
<i>Ac. mulesi</i>	0	0	0	0	1	0	0	1	1	0	1	1	0	0	2	1	0	0	5	5	01	1	1	2	0	0	0	5
<i>Ac. parviproctus</i>	0	0	0	0	1	0	0	1	1	0	1	1	0	0	2	1	0	0	5	5	01	0	1	2	0	0	0	5
<i>Ac. secula</i>	0	0	0	1	1	0	0	1	1	0	1	1	0	0	3	1	0	0	5	5	01	0	1	2	0	0	1	5
<i>Manselleon rebellis</i>	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	1	0	0	5	4	6	0	0	0	0	1	0	2
<i>Ma. brevipletron</i>	0	0	0	0	1	0	0	0	0	0	1	1	0	0	2	1	0	0	4	4	6	0	0	0	0	1	0	2
<i>Ma. tillyardi</i>	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	1	0	0	4	4	6	0	0	2	0	0	0	2
<i>Ma. longidigitus</i>	0	0	0	0	1	0	0	0	0	0	0	0	0	0	2	1	0	0	4	4	6	0	0	2	0	0	0	2
<i>Periclystus aureolatus</i>	0	0	1	0	1	0	0	0	0	1	1	0	0	0	3	1	1	0	5	3	3	0	1	1	0	0	1	4
<i>Pe. circuiter</i>	0	0	1	0	1	0	0	0	0	1	0	0	0	0	3	1	1	0	5	3	3	0	1	1	0	0	1	4
<i>Pe. laceratus</i>	0	0	1	0	1	0	0	0	0	1	0	0	0	0	3	1	1	0	5	3	3	0	1	1	0	0	1	4
<i>Pe. vicinus</i>	0	0	1	0	1	0	0	0	0	1	0	0	0	0	3	1	1	0	5	3	3	?	?	?	?	?	?	?

Table A3.2. Continued.

taxon	Characters																											
	2	3	3	3	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	5	5	5	5	5	5
<i>Riekoleon proctus</i>	0	0	0	0	1	0	1	1	0	0	1	0	0	0	3	1	2	0	0	0	2	0	1	1	0	0	1	4
<i>R. convergens</i>	0	0	0	0	1	0	1	0	0	0	1	0	0	0	3	1	2	0	0	0	2	0	1	1	0	0	1	4
<i>R. furcatus</i>	0	0	0	0	1	0	1	1	0	0	1	0	0	0	3	1	2	0	0	0	2	0	1	1	0	0	1	4
<i>R. squamosus</i>	0	0	0	0	1	0	1	1	0	0	1	0	0	0	3	?	?	?	?	?	?	0	1	1	0	0	1	4
<i>Compsoleon bembicidis</i>	0	0	0	0	1	0	0	0	0	0	1	0	0	0	2	1	0	0	2	4	2	1	1	0	0	0	2	5
<i>Chrysoleon punctatum</i>	1	0	1	0	1	0	0	0	0	0	0	0	0	0	2	1	2	0	2	4	6	1	1	0	0	0	2	5
<i>Dendroleon dumigani</i>	0	0	0	0	1	0	0	0	0	0	1	0	0	0	2	1	0	0	2	4	6	1	1	0	0	0	2	5
<i>Froggattisca tipularia</i>	0	0	0	0	1	0	0	0	0	0	1	0	0	0	2	1	0	0	2	4	6	1	1	0	0	0	2	5
<i>Fr. gemma</i>	0	0	0	0	1	0	0	0	0	0	1	0	0	0	2	1	0	0	2	4	6	1	1	2	0	0	2	5
<i>Mossega indecisa</i>	1	0	0	0	1	0	0	0	0	0	0	0	0	0	2	1	0	0	2	4	6	1	1	0	0	0	2	5

Table A3.2. Continued.

taxon	Character					
	5 7	5 8	5 9	6 0	6 1	6 2
<i>Myrmeleon houstoni</i>	0	0	2	0	0	0
<i>Protoplectron longitudinalis</i>	0	0	2	0	0	0
<i>Acanthoplectron umbratus</i>	0	0	2	0	0	0
<i>Anomaloplectron lineatipenne</i>	0	0	2	0	0	0
<i>Csiroleon tumidipalpus</i>	0	0	2	0	0	1
<i>Cs. fasciatus</i>	0	0	2	0	0	1
<i>Franzenia irrorata</i>	0	0	2	0	0	1
<i>Fusoleon stigmatus</i>	0	0	2	0	0	1
<i>Latoleon hyalinus</i>	0	0	2	0	0	0
<i>L. setosus</i>	0	0	2	0	0	0
<i>Fissuleon brevigonarcus</i>	0	0	2	0	0	1
<i>Fi. mouldsorum</i>	0	0	2	0	0	1
<i>Fi. nigristriatus</i>	0	0	2	0	0	1
<i>Austrogymnocnemis arcuata</i>	1	0	1	1	0	0
<i>Aus. bipunctata</i>	1	0	1	1	0	0
<i>Aus. forcipata</i>	?	?	?	?	?	?
<i>Aus. maculata</i>	1	0	1	1	0	0
<i>Aus. pseudomaculata</i>	1	0	1	0	0	0
<i>Aus. pallida</i>	1	0	1	0	0	0
<i>Aplectrinia cardaleae</i>	0	1	2	1	1	0
<i>Ap. lulinguensis</i>	0	1	2	0	0	0
<i>Ap. nigrescens</i>	0	1	2	0	0	0
<i>Ap. pentagramma</i>	0	1	2	0	0	0
<i>Ap. sarahae</i>	0	1	2	1	0	0
<i>Ap. tindalei</i>	0	1	2	1	0	0
<i>Ap. oombulgurrinesis</i>	0	1	2	1	0	0
<i>Pa. interrupta</i>	1	0	1	1	0	0
<i>Pa. lineata</i>	1	0	1	1	0	0
<i>Pa. diehli</i>	1	0	1	1	0	0
<i>Ceratoleon brevicornis</i>	1	0	2	0	0	0
<i>Ce. mjobergi</i>	2	0	2	1	0	0
<i>Minyleon pygmaeus</i>	1	0	2	1	0	0
<i>Tanyleon cahillensis</i>	0	1	2	1	0	0
<i>T. newi</i>	0	1	2	0	0	0
<i>T. lesouefi</i>	0	1	2	1	0	0

Table A3.2. Continued.

taxon	Character					
	5 7	5 8	5 9	6 0	6 1	6 2
<i>Glenoleon aurora</i>	2	0	2	0	0	0
<i>G. maculatus</i>	2	0	0	1	0	0
<i>G. minutillus</i>	2	0	2	0	0	0
<i>G. osmyloides</i>	2	0	2	0	0	0
<i>G. pulchellus</i>	2	0	2	1	1	0
<i>G. froggatti</i>	2	0	2	1	1	0
<i>Fossorioleon edwardsi</i>	2	0	0	0	0	0
<i>Fo. distivenus</i>	2	0	0	0	0	0
<i>Fo. striatus</i>	2	0	0	0	0	0
<i>Fo. longitudinalis</i>	2	0	0	0	0	0
<i>Fo. rudda</i>	2	0	0	0	0	0
<i>Aurantoleon annulatus</i>	0	1	2	1	1	0
<i>Aur. banksi</i>	-	1	2	1	1	0
<i>Aur. drysdalensis</i>	0	1	2	1	0	0
<i>Aur. pingrupensis</i>	0	1	2	1	1	0
<i>Aur. radialis</i>	0	1	2	1	1	0
<i>Aur. roseipennis</i>	-	1	2	1	1	0
<i>Aur. punctatus</i>	-	1	2	1	1	0
<i>Aur. stigmatus</i>	0	1	2	1	1	0
<i>Normanleon berthoudi</i>	0	1	2	1	0	0
<i>N. ceciliae</i>	2	0	2	1	0	0
<i>N. conspersum</i>	2	0	2	1	0	0
<i>N. dissolutus</i>	2	0	2	1	0	0
<i>N. falsus</i>	2	0	2	1	0	0
<i>N. meteoricus</i>	0	1	2	1	0	0
<i>Acutoleon tatarnici</i>	?	?	?	?	?	?
<i>Ac. mulesi</i>	0	0	2	0	0	0
<i>Ac. parviproctus</i>	0	0	2	0	0	0
<i>Ac. secula</i>	1	0	2	0	0	0
<i>Manselleon rebellis</i>	0	1	2	1	0	0
<i>Ma. brevipletron</i>	0	1	2	0	0	0
<i>Ma. tillyardi</i>	0	0	2	1	0	0
<i>Ma. longidigitus</i>	0	0	2	1	0	0
<i>Periclystus aureolatus</i>	2	0	0	0	0	0
<i>Pe. circuiter</i>	2	0	0	0	0	0

Table A3.2. Continued.

taxon	Character					
	5	5	5	6	6	6
	7	8	9	0	1	2
<i>Pe. laceratus</i>	2	0	0	0	0	0
<i>Pe. vicinus</i>	?	?	?	?	?	?
<i>Riekoleon proctus</i>	2	0	1	0	0	0
<i>R. convergens</i>	2	0	1	0	0	0
<i>R. furcatus</i>	2	0	1	0	0	0
<i>R. squamosus</i>	2	0	1	0	0	0
<i>Compsoleon bembicidis</i>	0	0	2	0	0	0
<i>Chrysoleon punctatum</i>	0	0	2	1	0	0
<i>Dendroleon dumigani</i>	0	0	0	0	0	0
<i>Froggattisca tipularia</i>	0	0	2	0	0	0
<i>Fr. gemma</i>	0	0	2	0	0	0
<i>Mossega indecisa</i>	1	0	2	0	0	0

APPENDIX IV

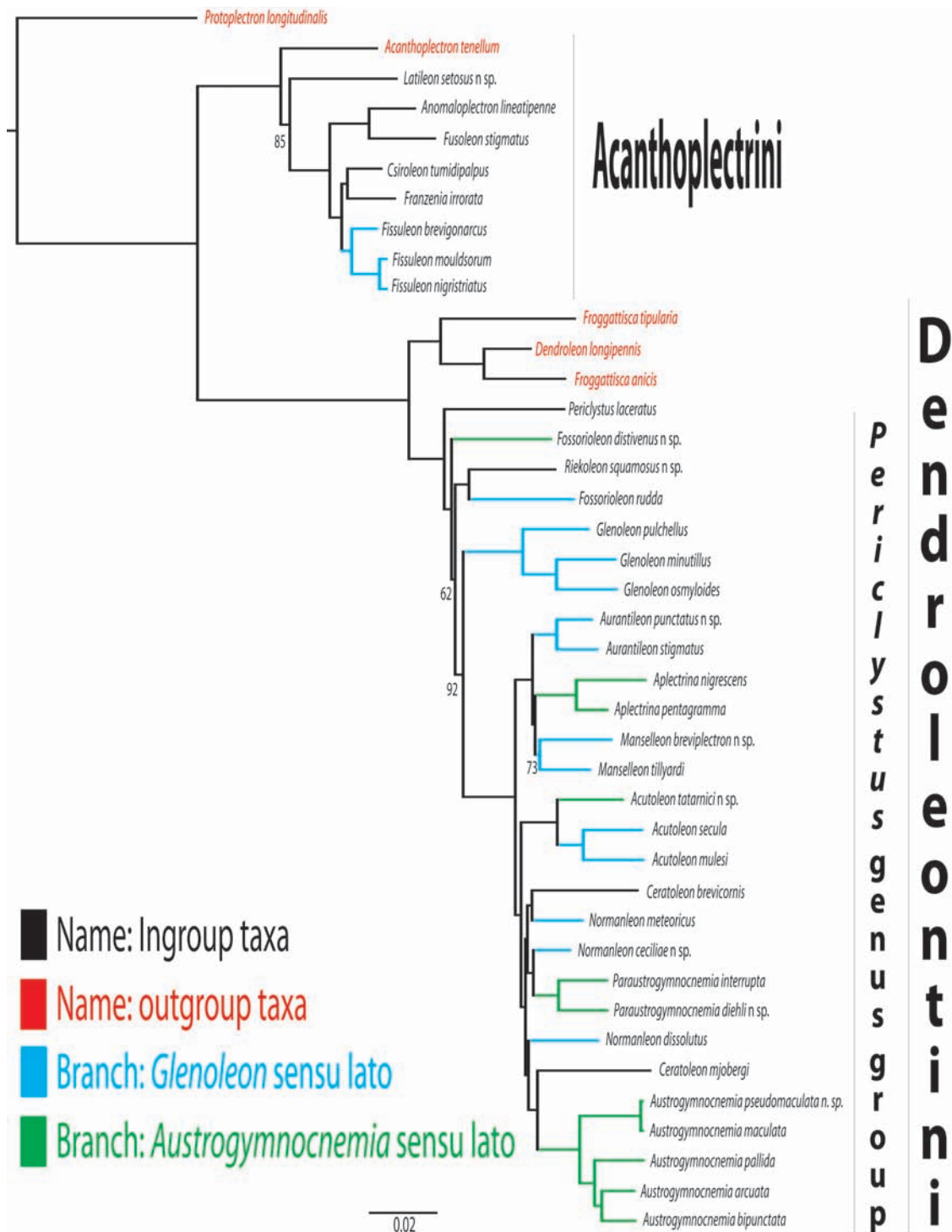


Figure A4.1. Myrmeleontidae: Dendroleontinae (new classification), maximum likelihood tree. Only bootstrap values < 95% are marked.

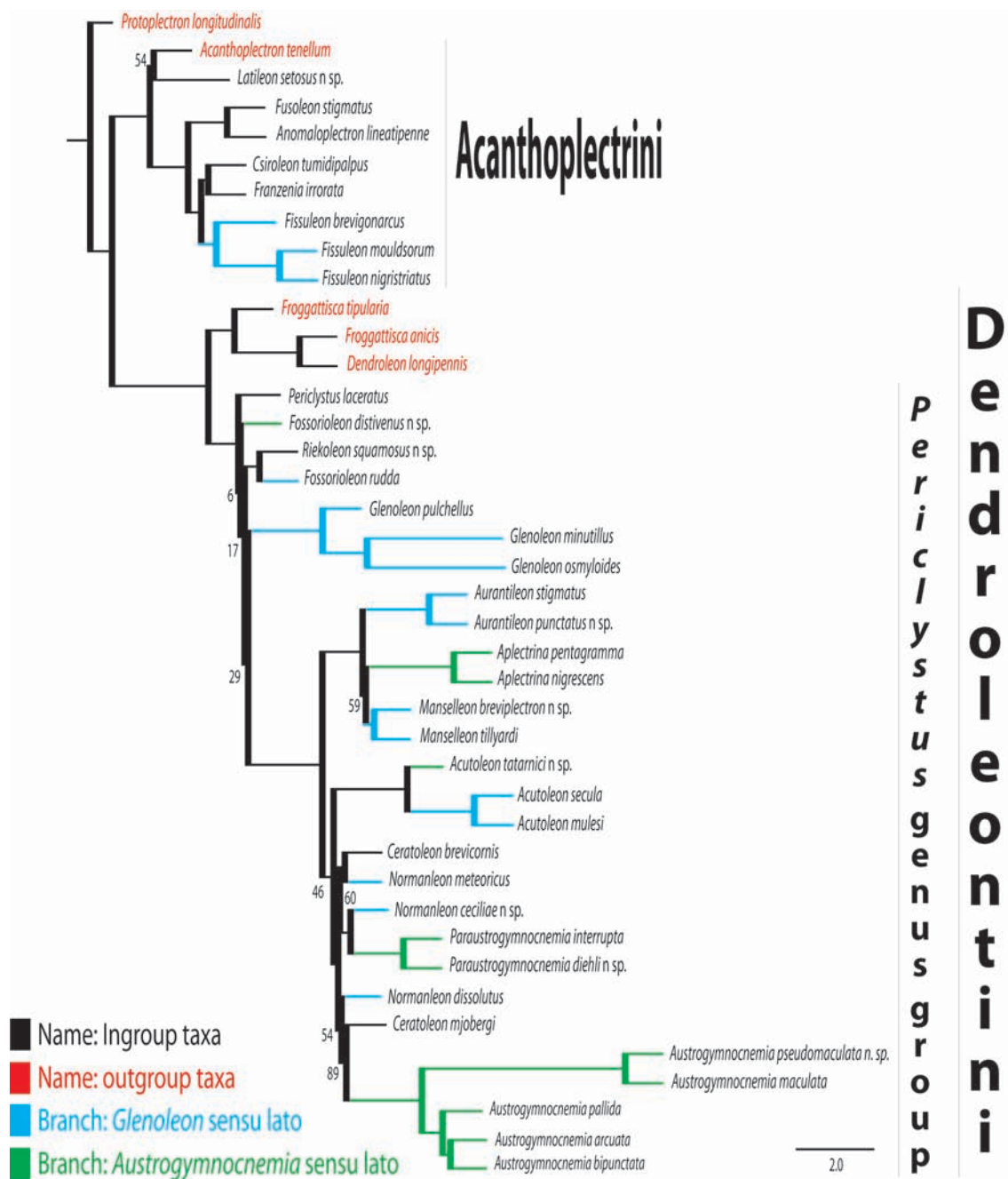


Figure A4.2. Myrmeleontidae: Dendroleontinae (new classification), ASTRAL tree. Only bootstrap values < 95% are marked.

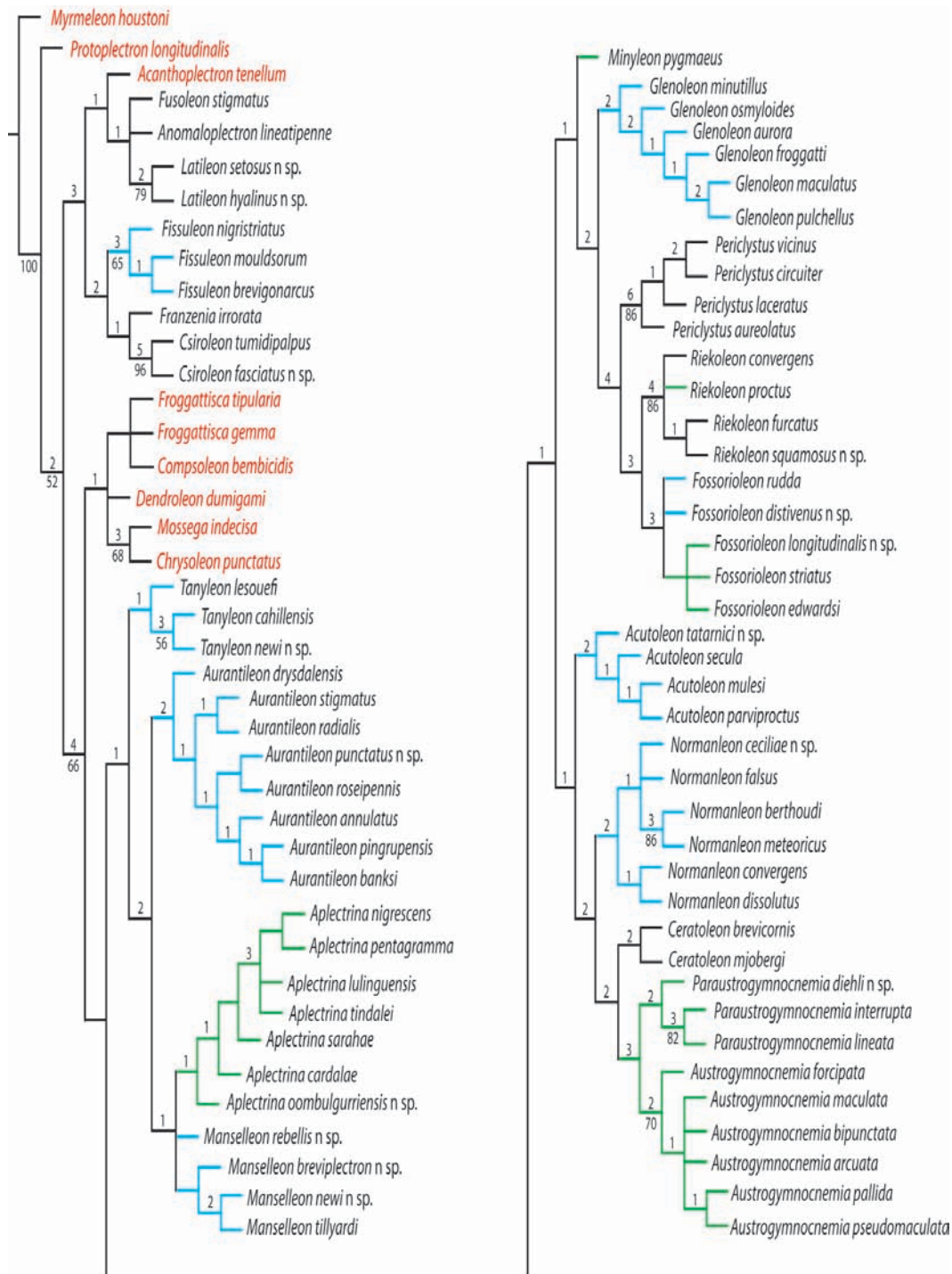


Figure A4.3. Parsimony morphology, strict consensus tree. Bremer support values are above the branches; bootstrap values are below the branches (only values over 50% are shown). Names in black are ingroup taxa (former Periclystina); red are outgroup taxa. Blue branches are *Glenoleon sensu lato*; green branches are *Austrogymnocnemina sensu lato*.

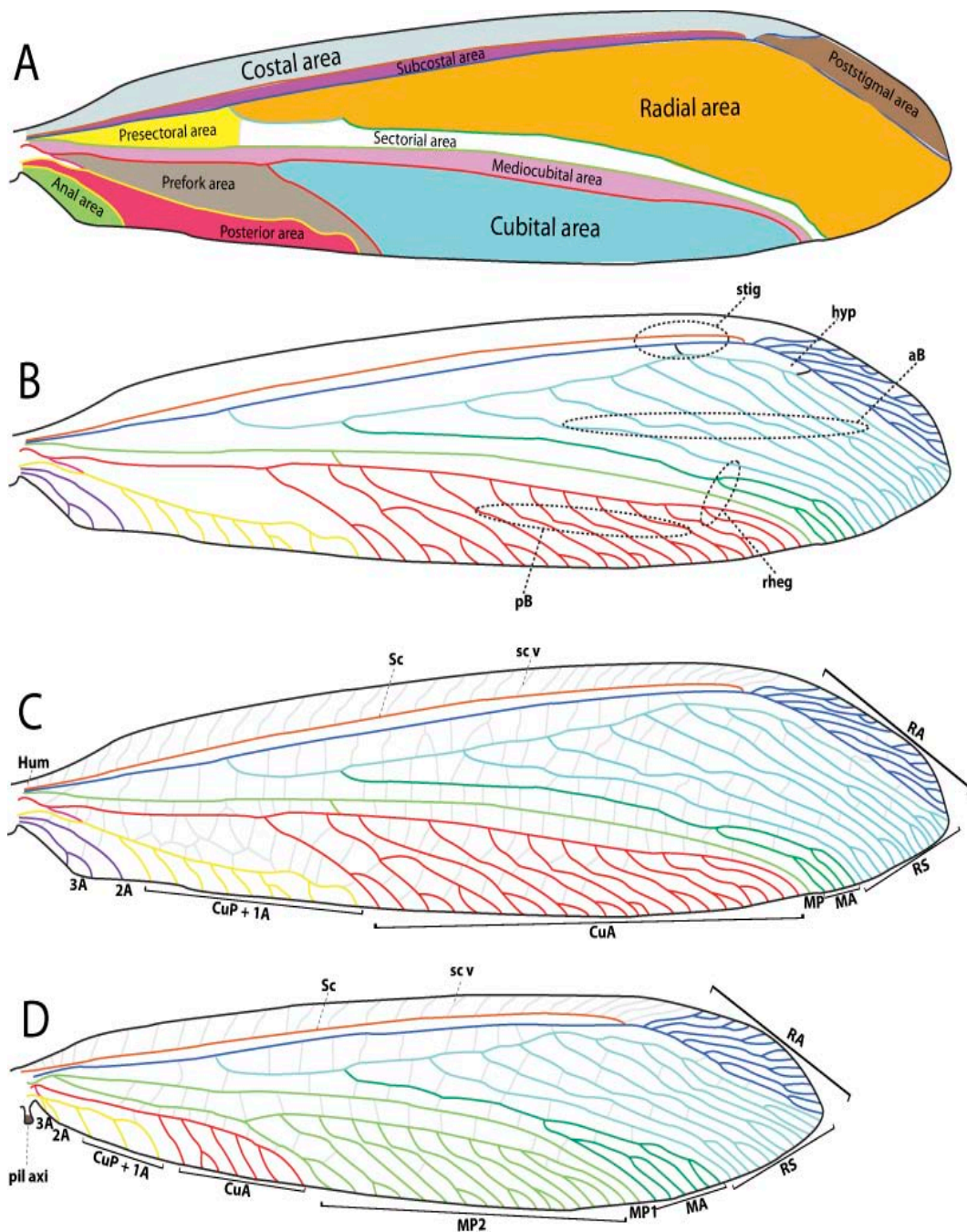


Figure A4.4. Antlion wing terminology: A) forewing showing main wing areas. B) forewing special wing areas. C) forewing main wing veins. D) hind wing main wing veins. A = Anal; a B = anterior Banksian line; Cu A = Cubital Anterior; Cu P = Cubital Posterior; Hum = humeral; hyp = hypostigmatic cell; Medial Anterior; MA = Medial Anterior; MP = Medial posterior; p B = posterior Banksian line; pil axi = pilula axilaris; RA = Radial Anterior; RA = Radial Sector; rheg = rhegmal area; Sc = Subcosta; sc V = subcostal veinlets; stig = stigmatal area.

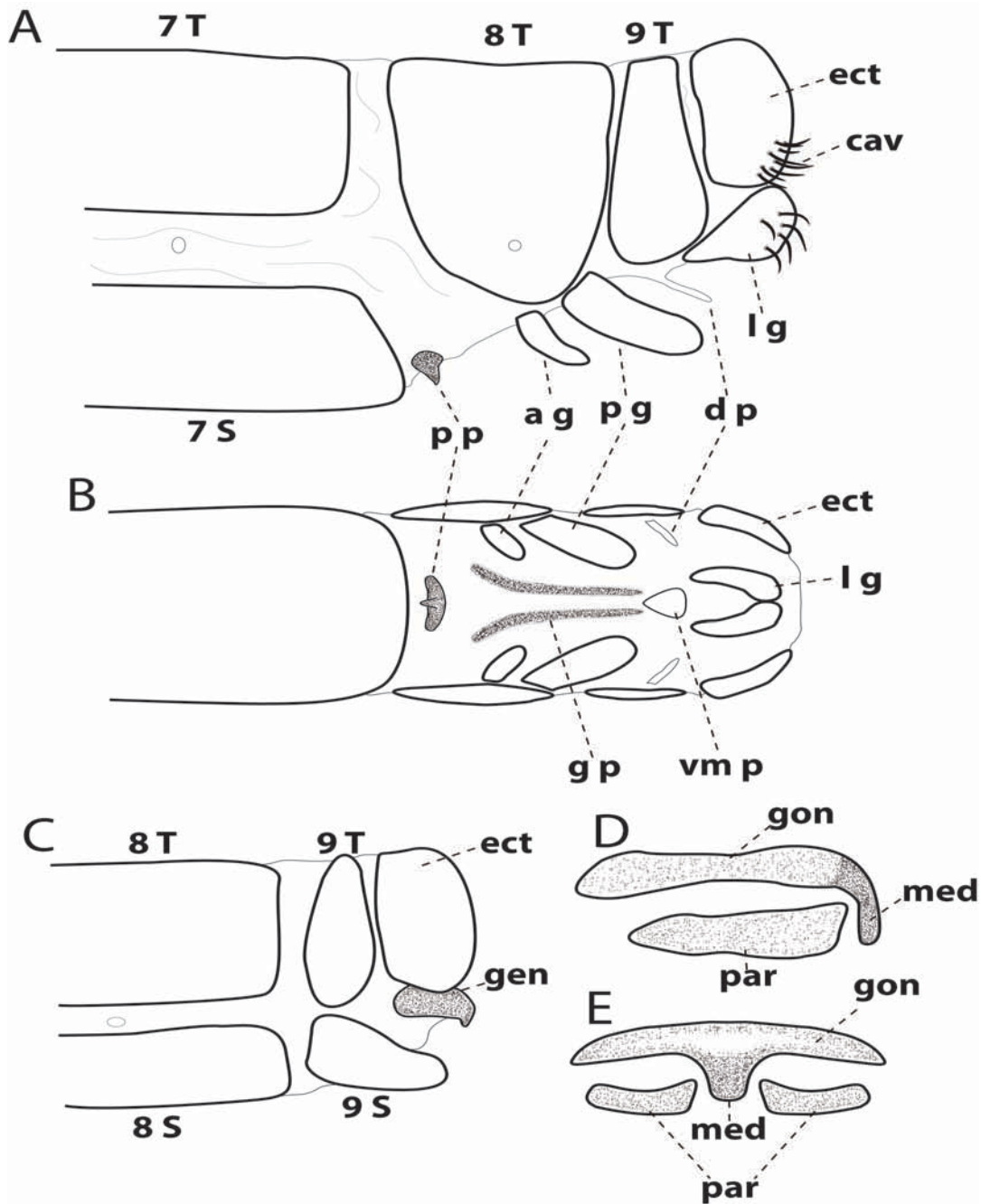


Figure A4.5. Generalized Dendroleontinae female and male terminalia: A) Female terminalia lateral. B) Female terminalia ventral. C) Male terminalia lateral. D) Male genitalia lateral. E) Male genitalia posterior. ag = anterior gonapophyses; cav = cavisetae; dp = digitiform process; ect = ectoproct; gen = genitalia; gon = gonarcus; gp = genitalia; lg = lateral gonapophyses; med = mediuncus; par = paramere; pg = posterior gonapophyses; pp = pregenital plate; S = sternite; T = tergite; v mp = ventromedial plate.

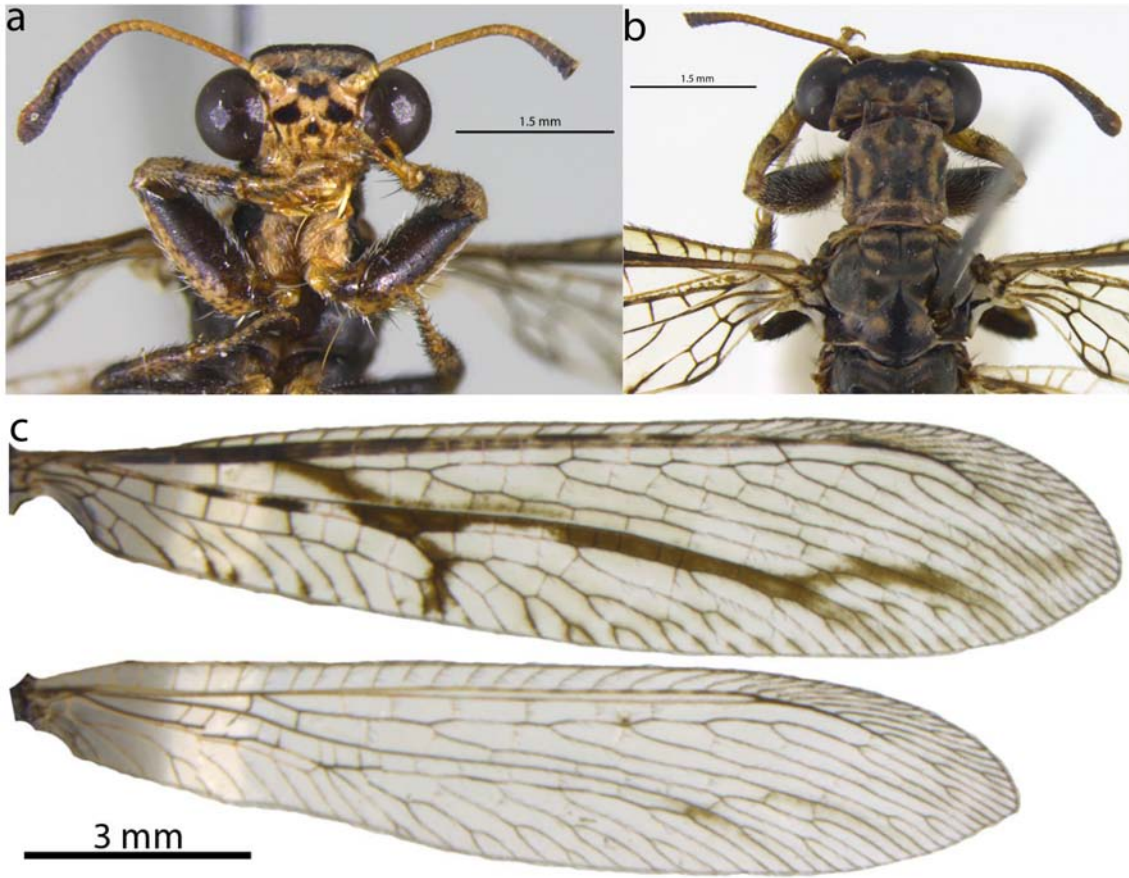


Figure A4.6: *Anomaloplectron lineatipenne*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

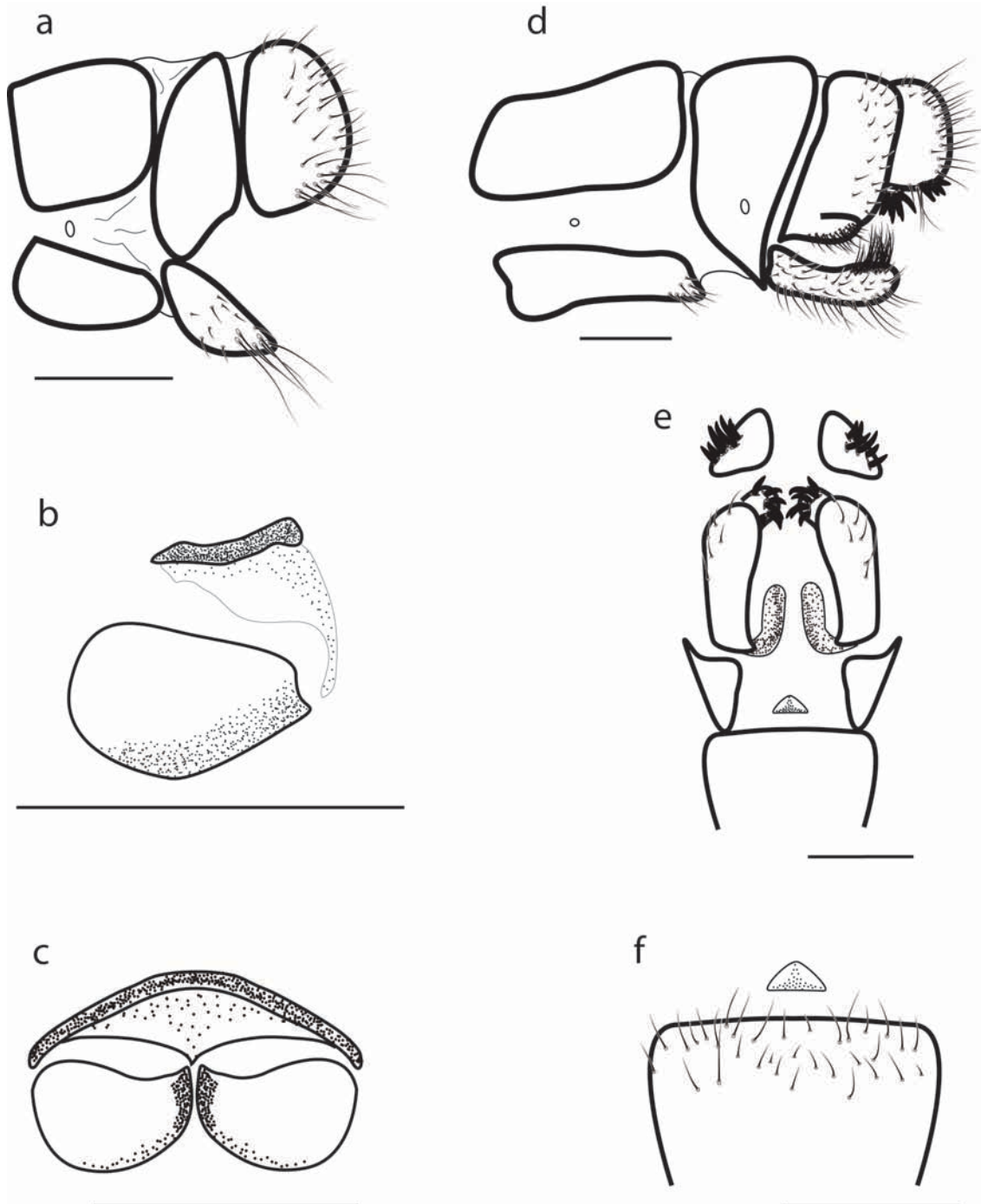


Figure A4.7: *Anomaloplectron lineatipenne*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; female: d) terminalia, lateral; e) terminalia, ventral; f) 7th sternite and pregenital plate, ventral. Scale bars = 500 μ m.

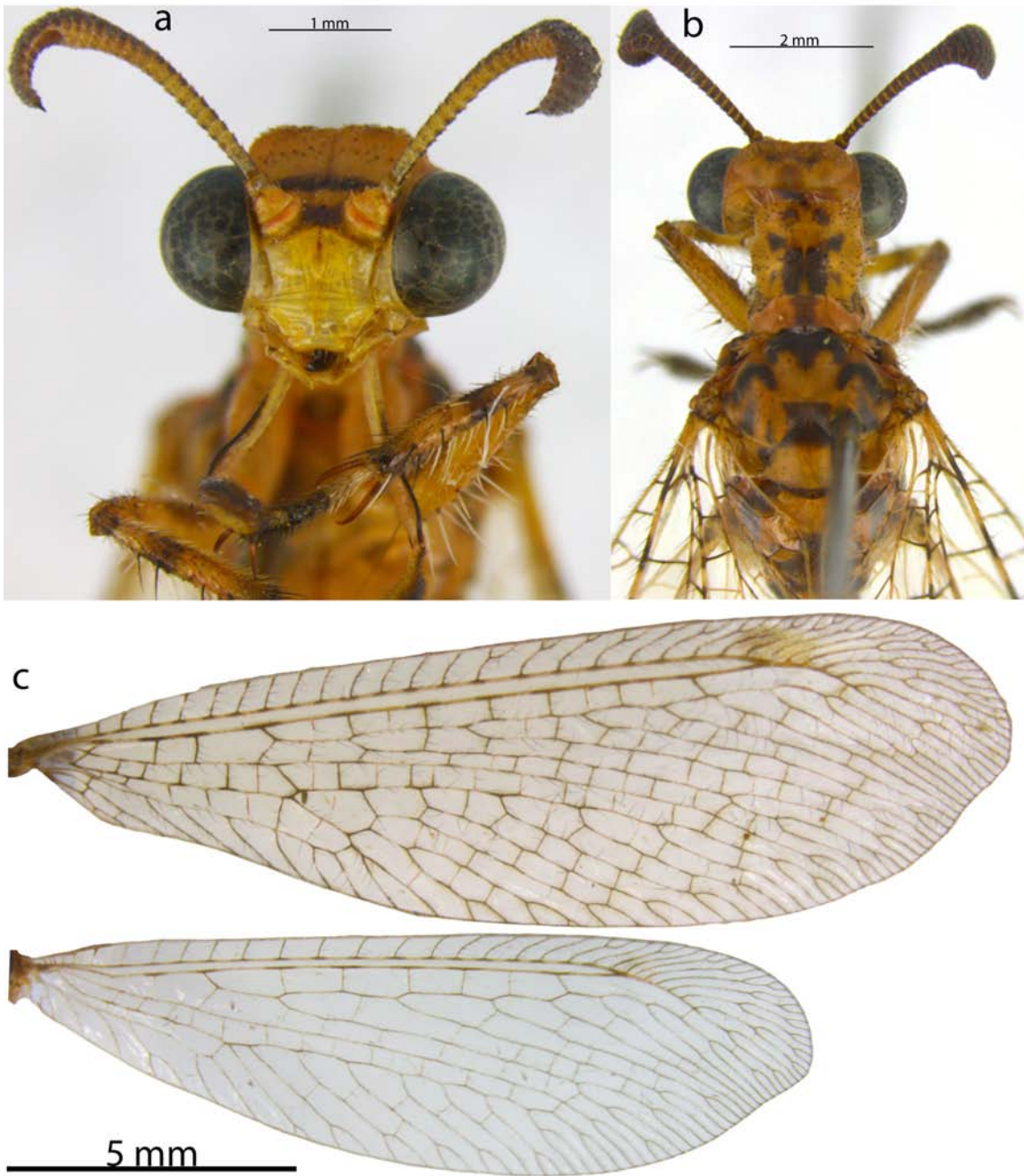


Figure A4.8: *Csiroleon fasciatus* n. sp.: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

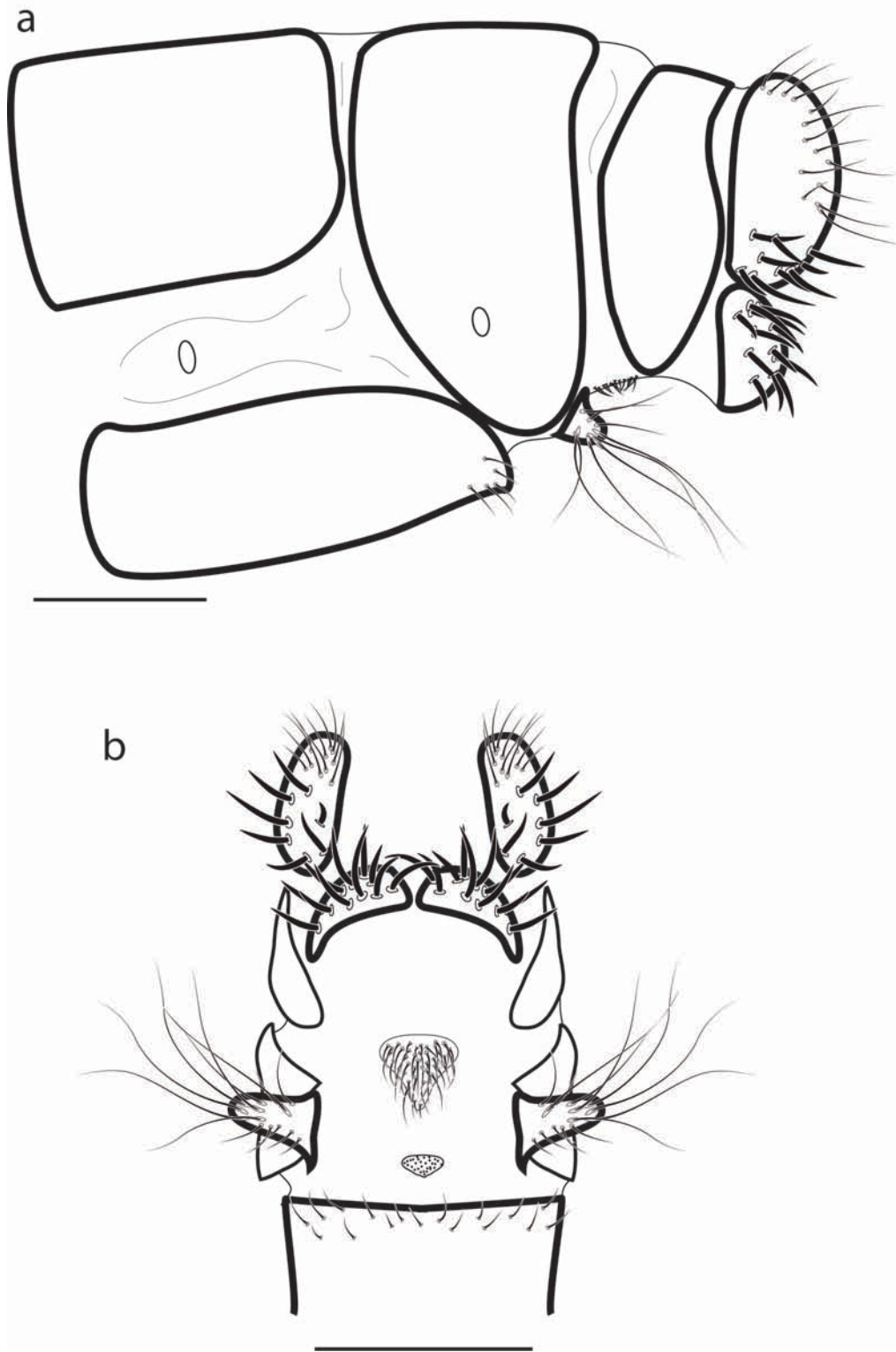


Figure A4.9: *Csiroleon fasciatus* n. sp.: female: a) terminalia, lateral; b) terminalia, ventral. Scale bars = 500 μ m.



Figure A4.10: *Csiroleon tumidipalpis*: a) head, frontal; b) head and thorax, lateral; c) head and thorax, dorsal; d) fore and hind wing, dorsal.

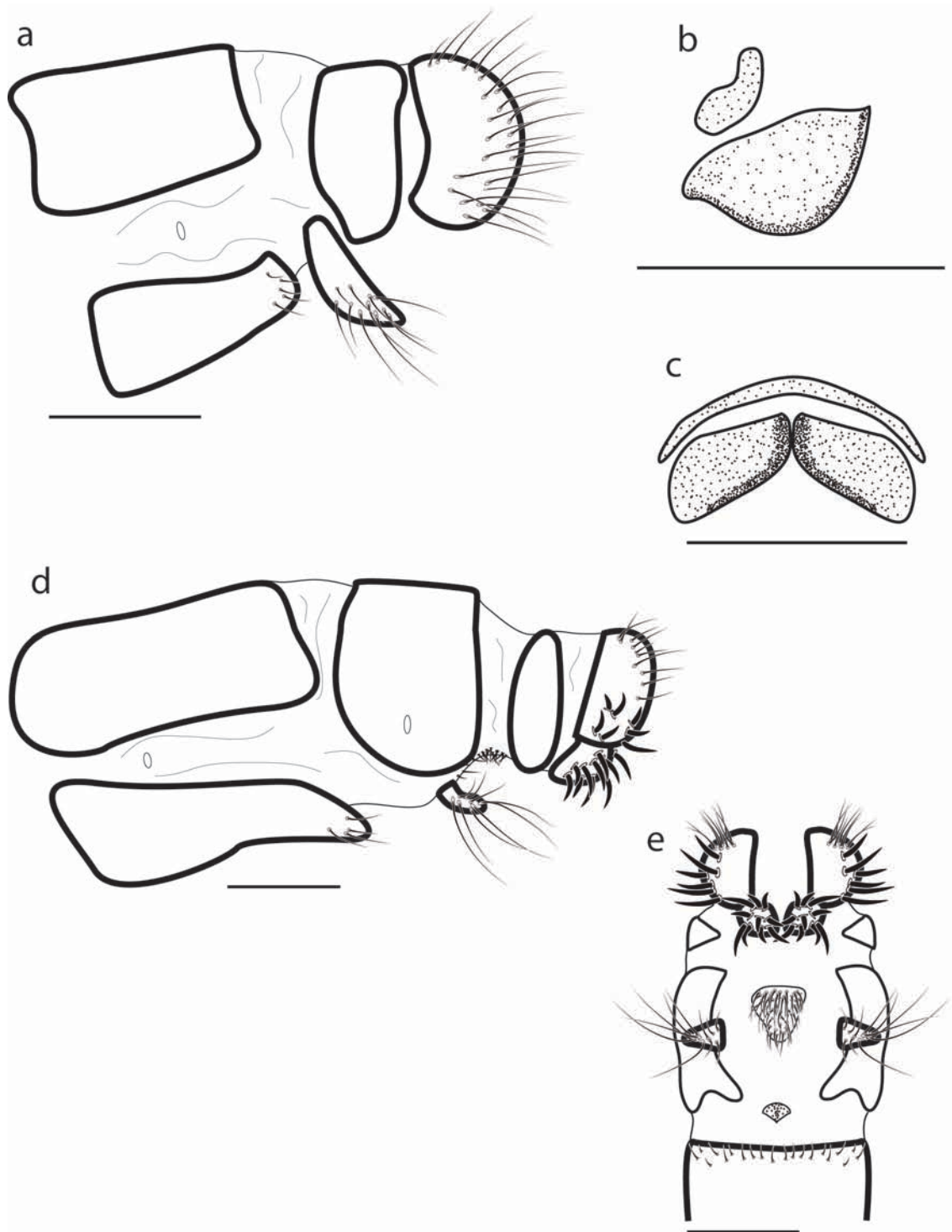


Figure A4.11: *Csiroleon tumidipalpis*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; female: d) terminalia, lateral; e) terminalia, ventral. Scale bars = 500 μ m.

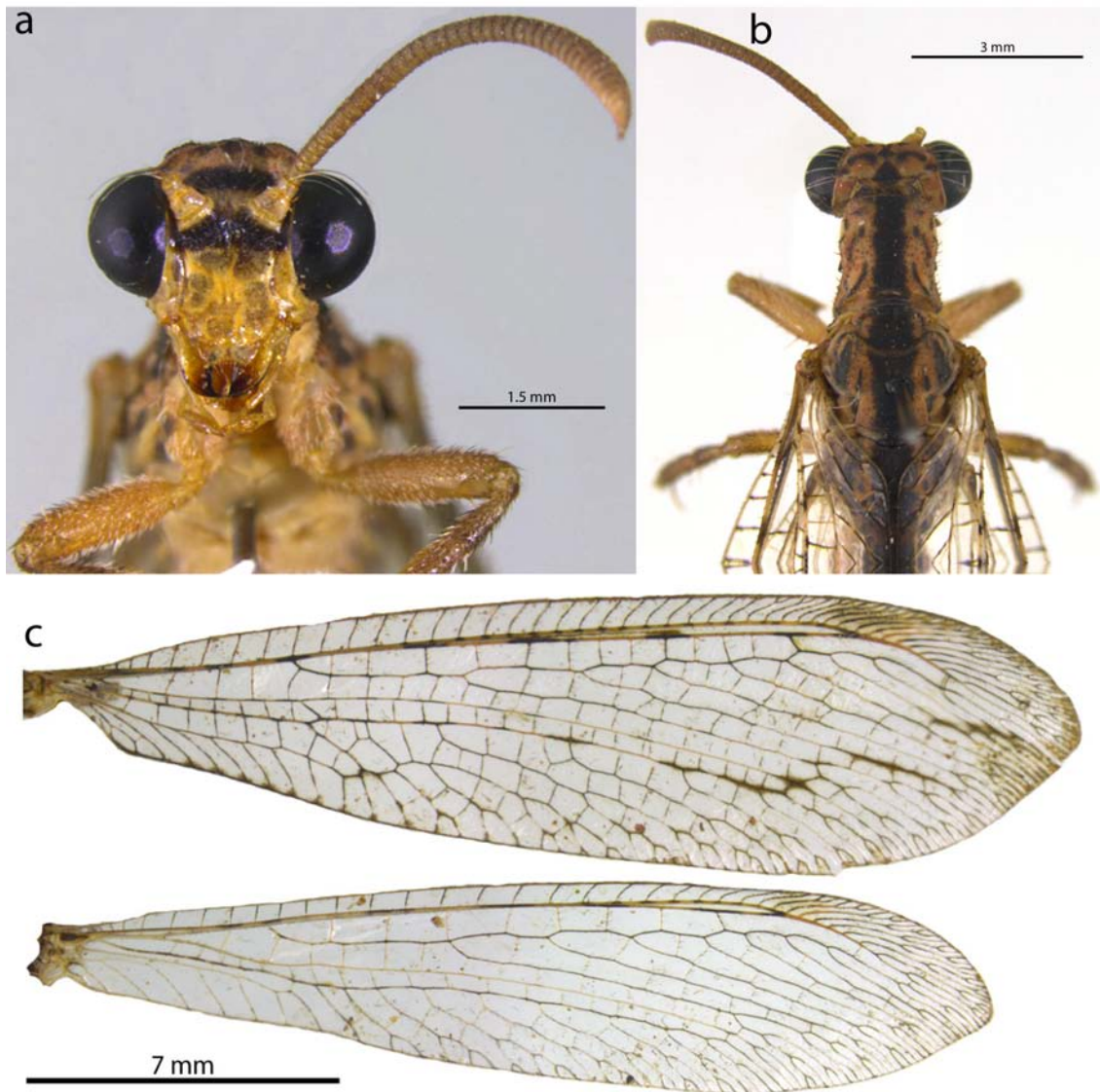


Figure A4.12: *Fissuleon brevigonarcus*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal

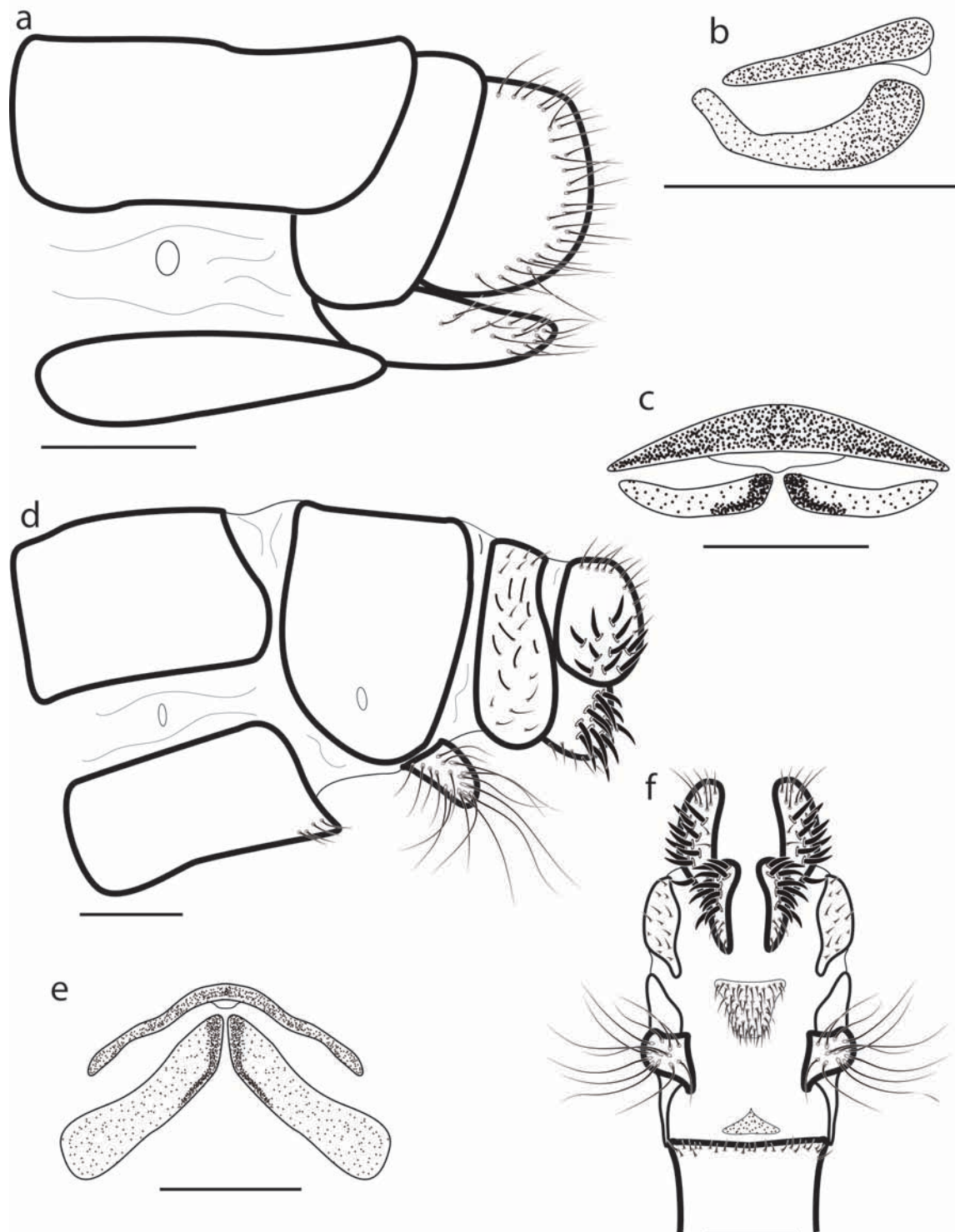


Figure A4.13: *Fissuleon brevigonarcus*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; e) genitalia, posteroventral; female: d) terminalia, lateral; f) terminalia, ventral. Scale bars = 500 μ m.

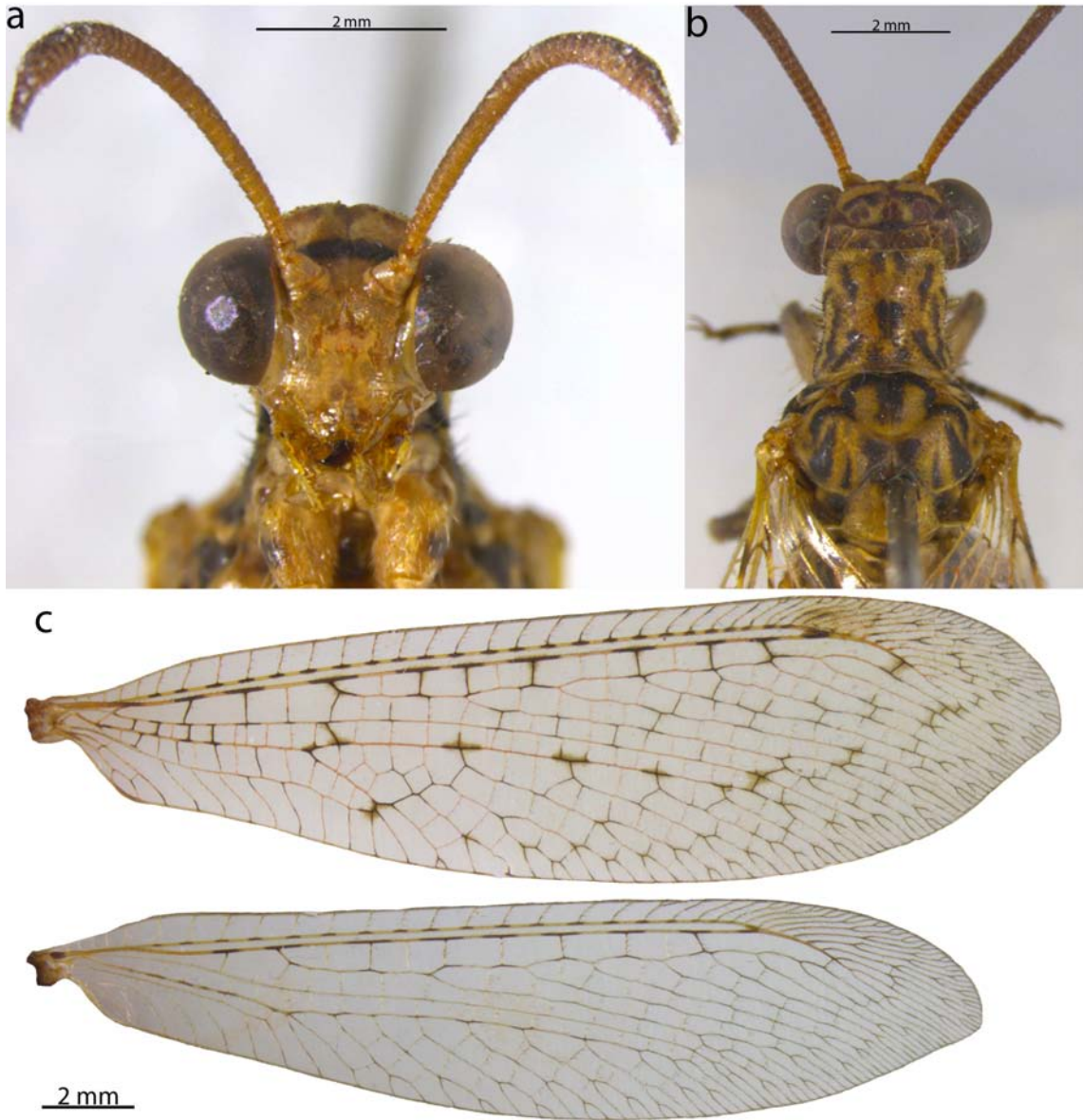


Figure A4.14: *Fissuleon mouldsorum*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

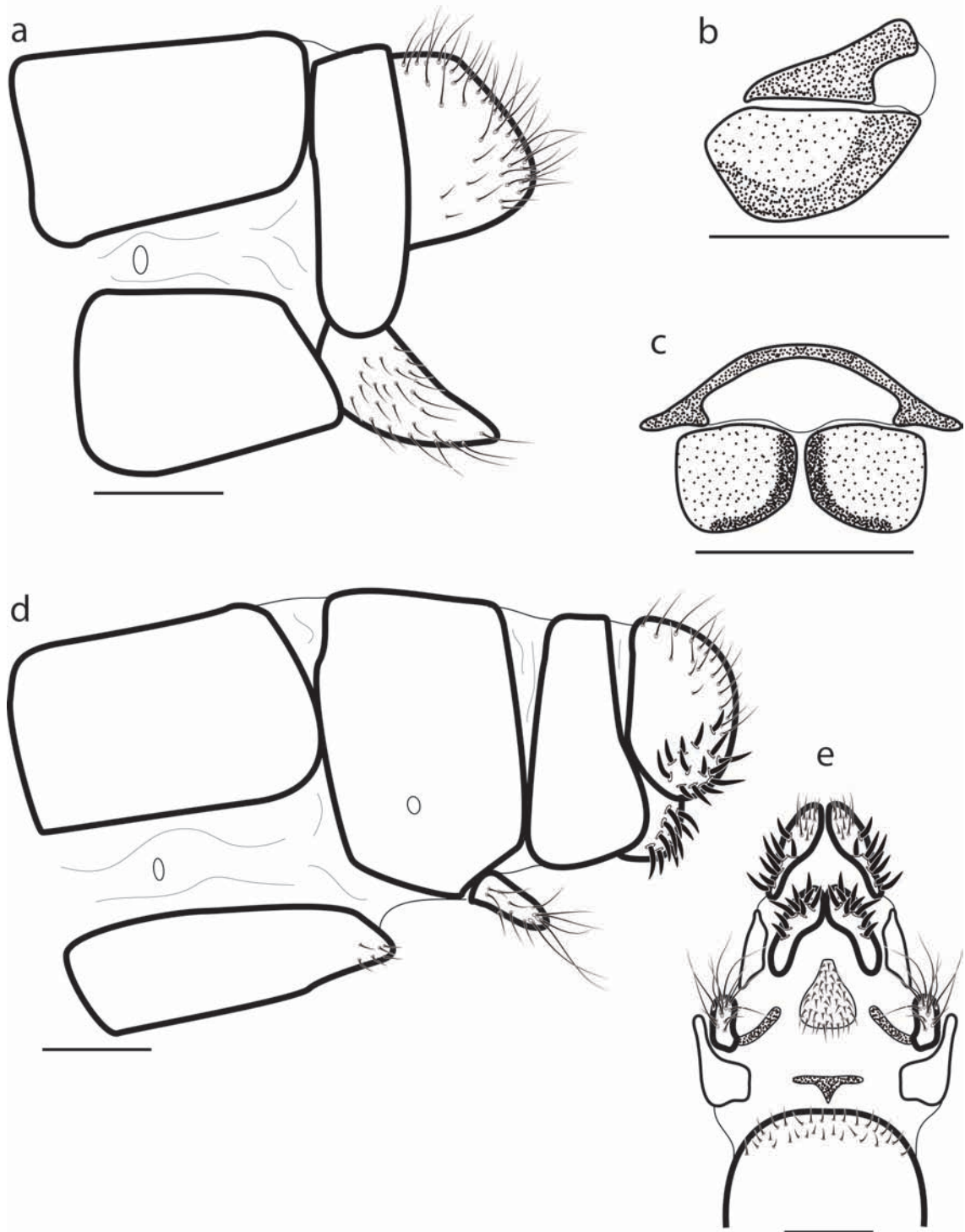


Figure A4.15: *Fissuleon mouldsorum*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; female: d) terminalia, lateral; e) terminalia, ventral. Scale bars = 500 μ m.

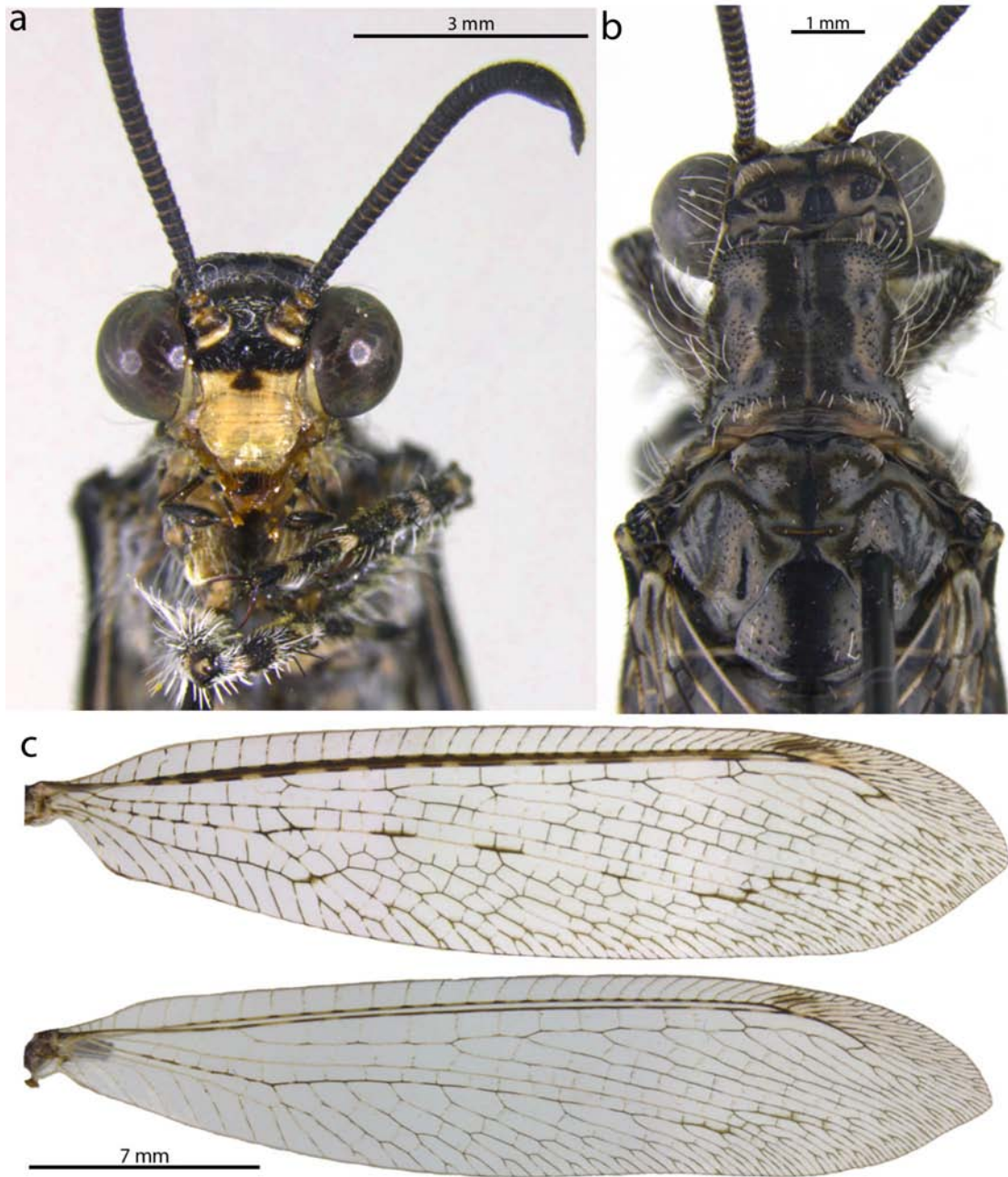


Figure A4.16: *Fissuleon nigristriatus*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

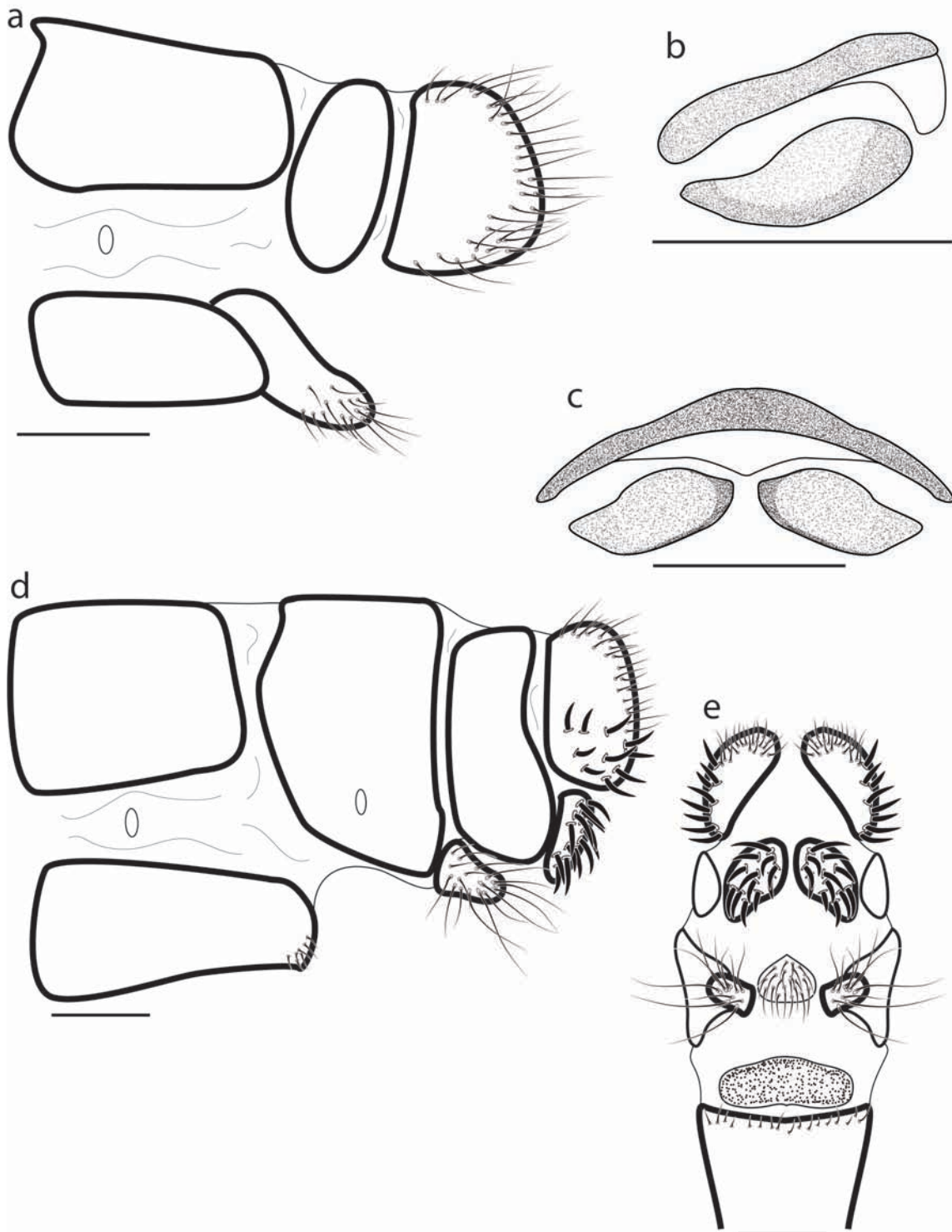


Figure A4.17: *Fissuleon nigristriatus*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; female: d) terminalia, lateral; e) terminalia, ventral. Scale bars = 500 μ m.

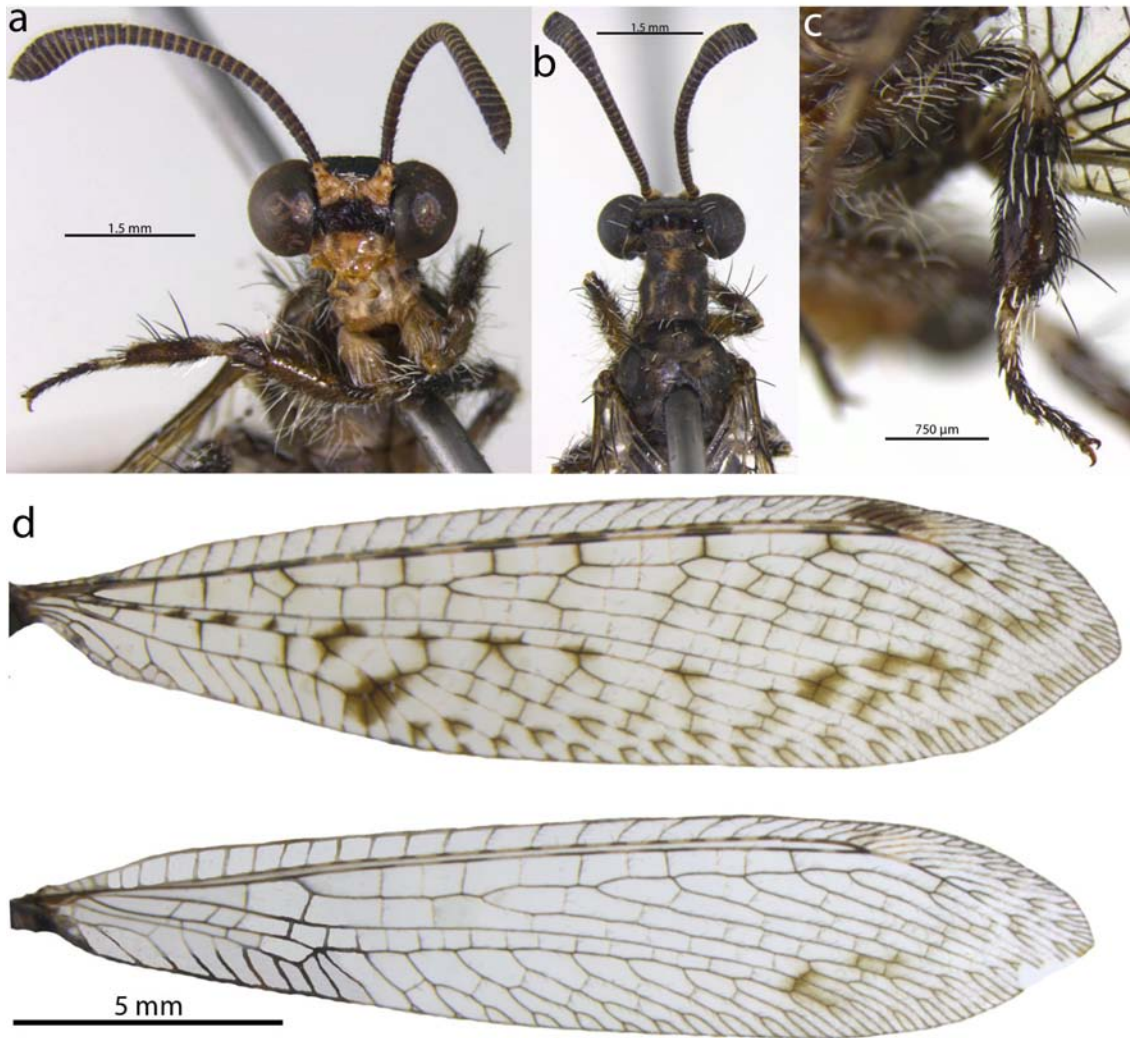


Figure A4.18: *Franzenia irrorata*: a) head, frontal; b) head and thorax, dorsal; c) left mid leg, anterior; d) fore and hind wing, dorsal.

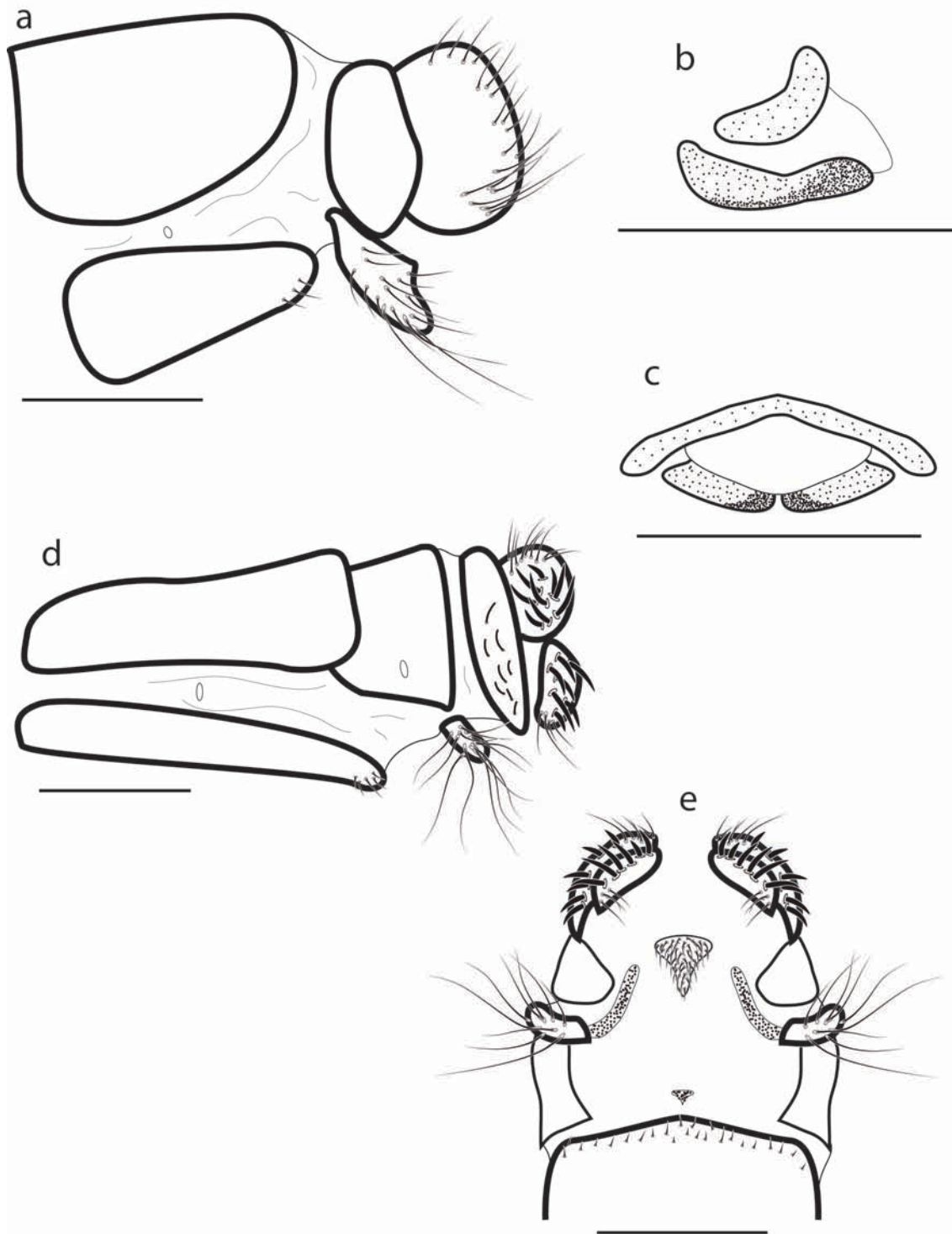


Figure A4.19: *Franzenia irrorata*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; female: d) terminalia, lateral; e) terminalia, ventral. Scale bars = 500 μ m.

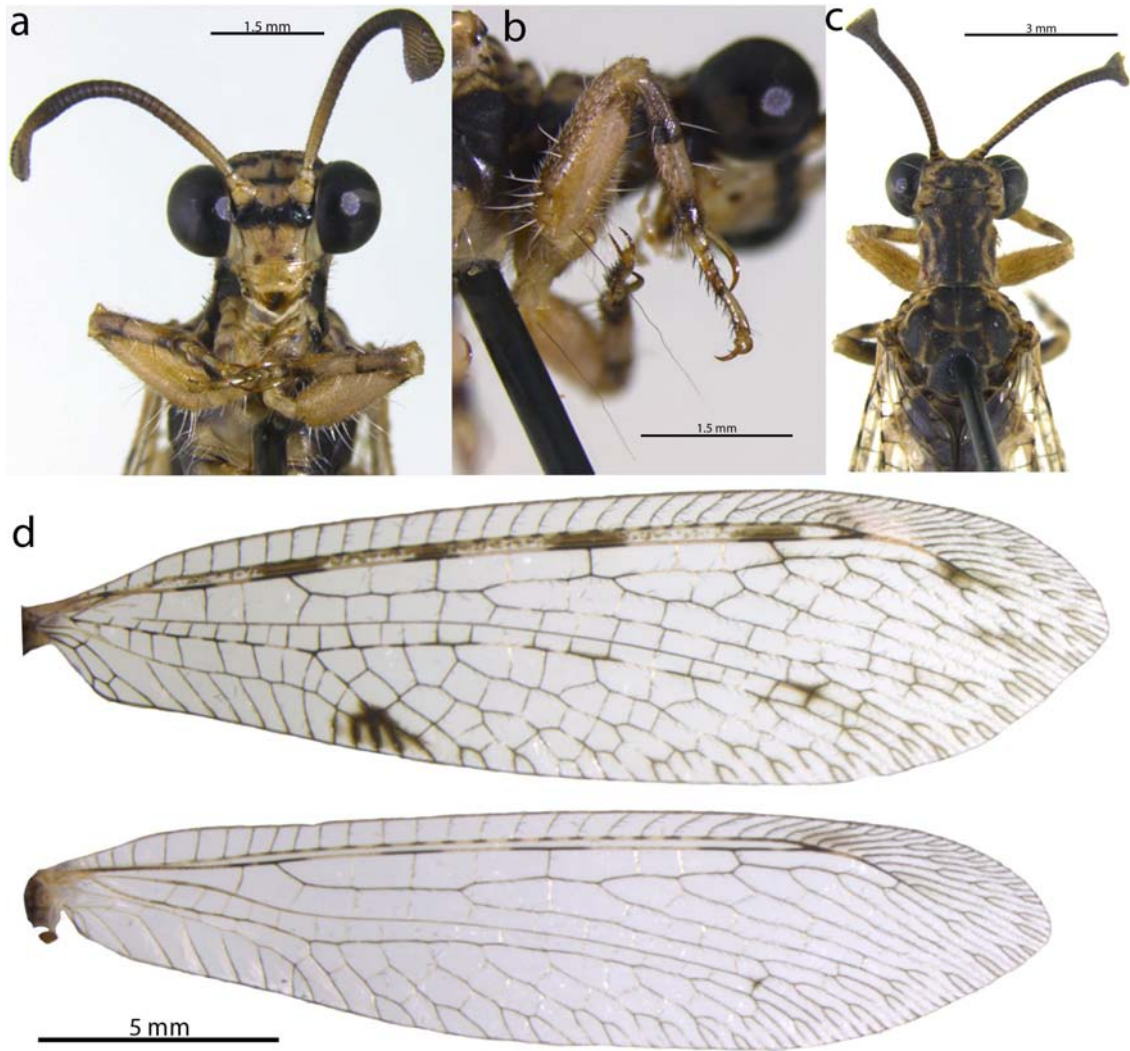


Figure A4.20: *Fusoleon stigmatus*: a) head, frontal; b) right foreleg, ventrolateral; c) head and thorax, dorsal; d) fore and hind wing, dorsal.

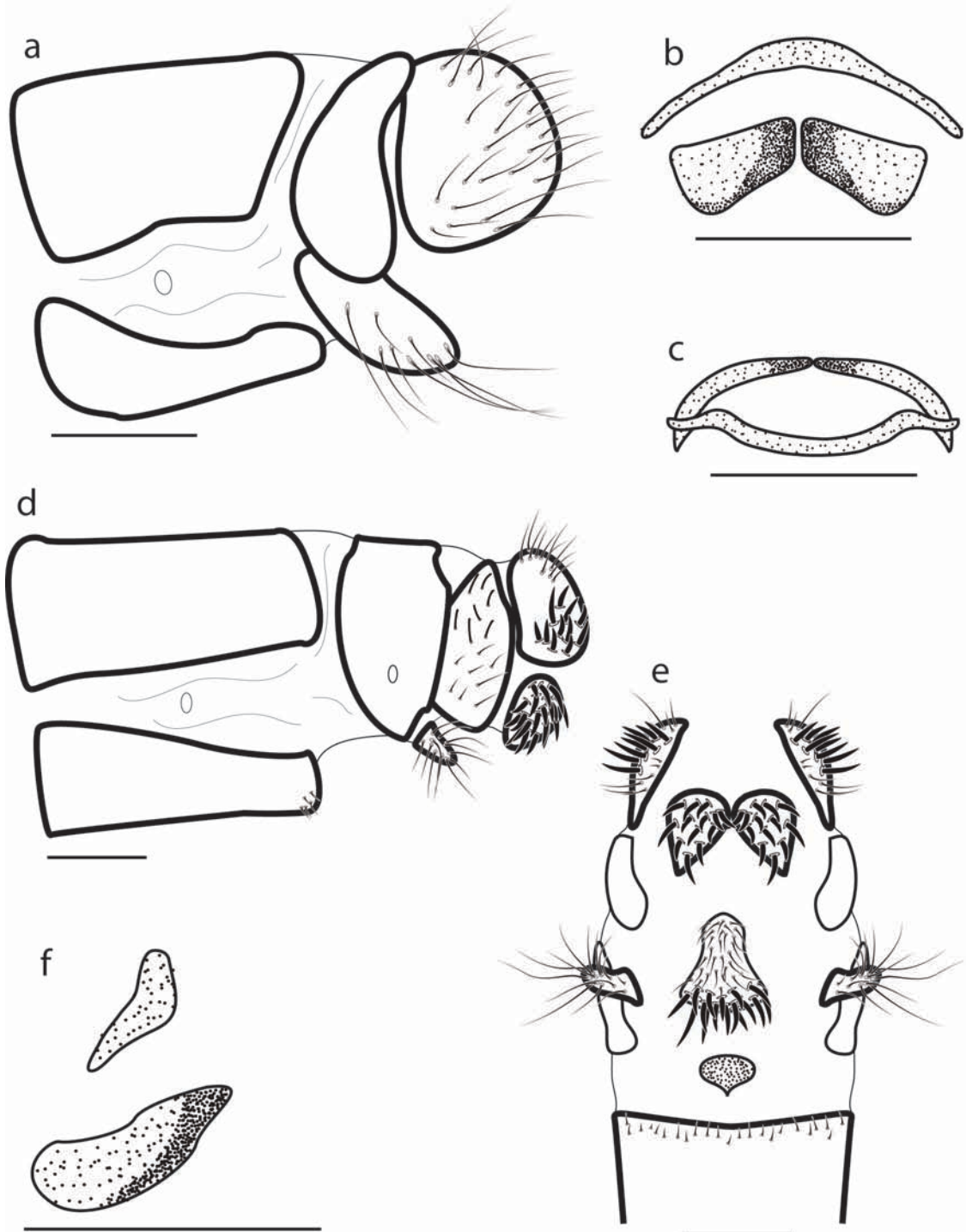


Figure A4.21: *Fusoleon stigmatus*: male: a) terminalia, lateral; b) genitalia, posterior; c) genitalia, dorsal; f) genitalia, lateral; female: d) terminalia, lateral; e) terminalia, ventral. Scale bars = 500 μ m.

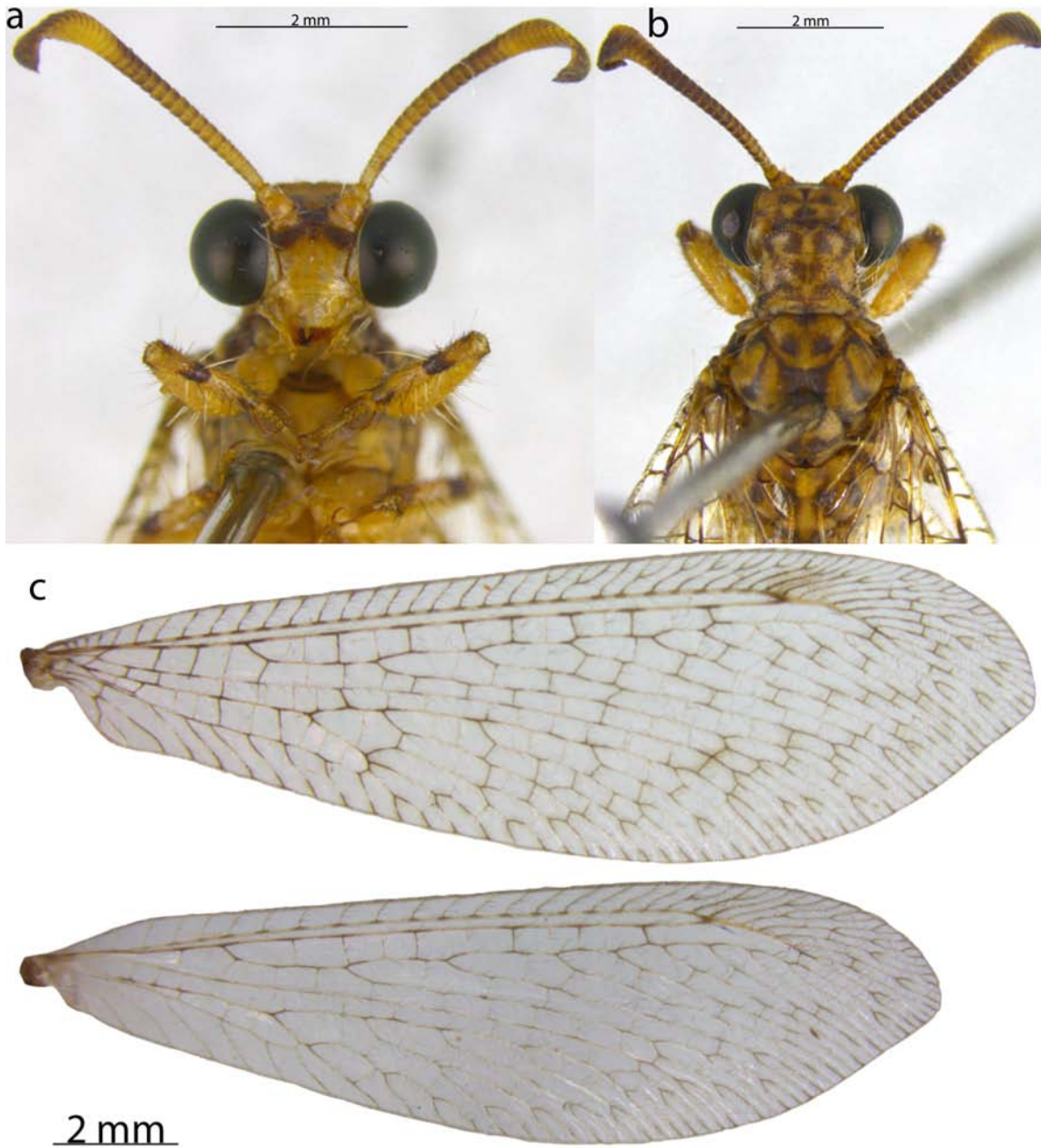


Figure A4.22: *Latileon hyalinus* n. sp.: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

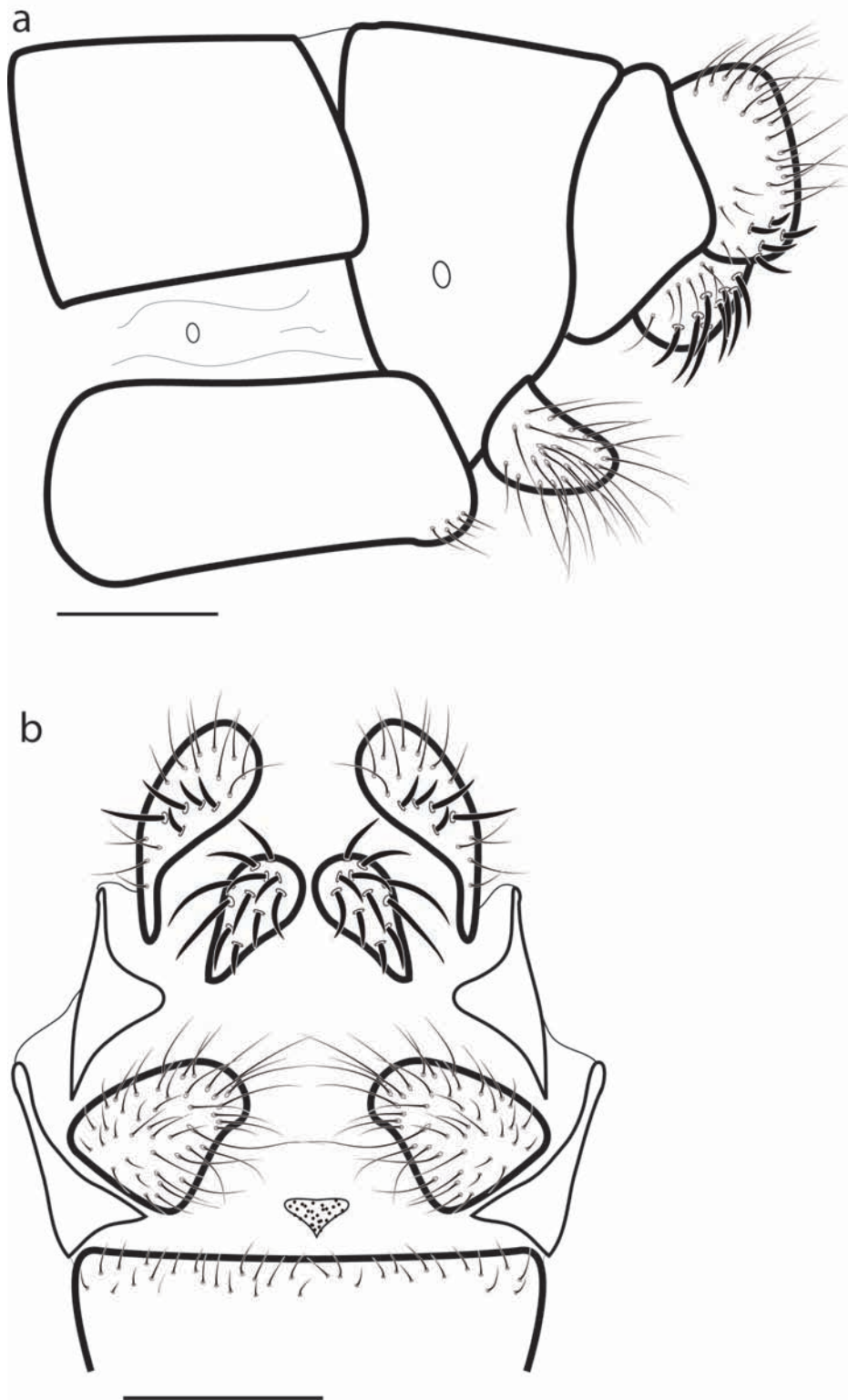


Figure A4.23: *Latileon hyalinus* n. sp.: female: a) terminalia, lateral; b) terminalia, ventral. Scale bars = 500 μ m.



Figure A4.24: *Latileon setosus* n. sp.: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

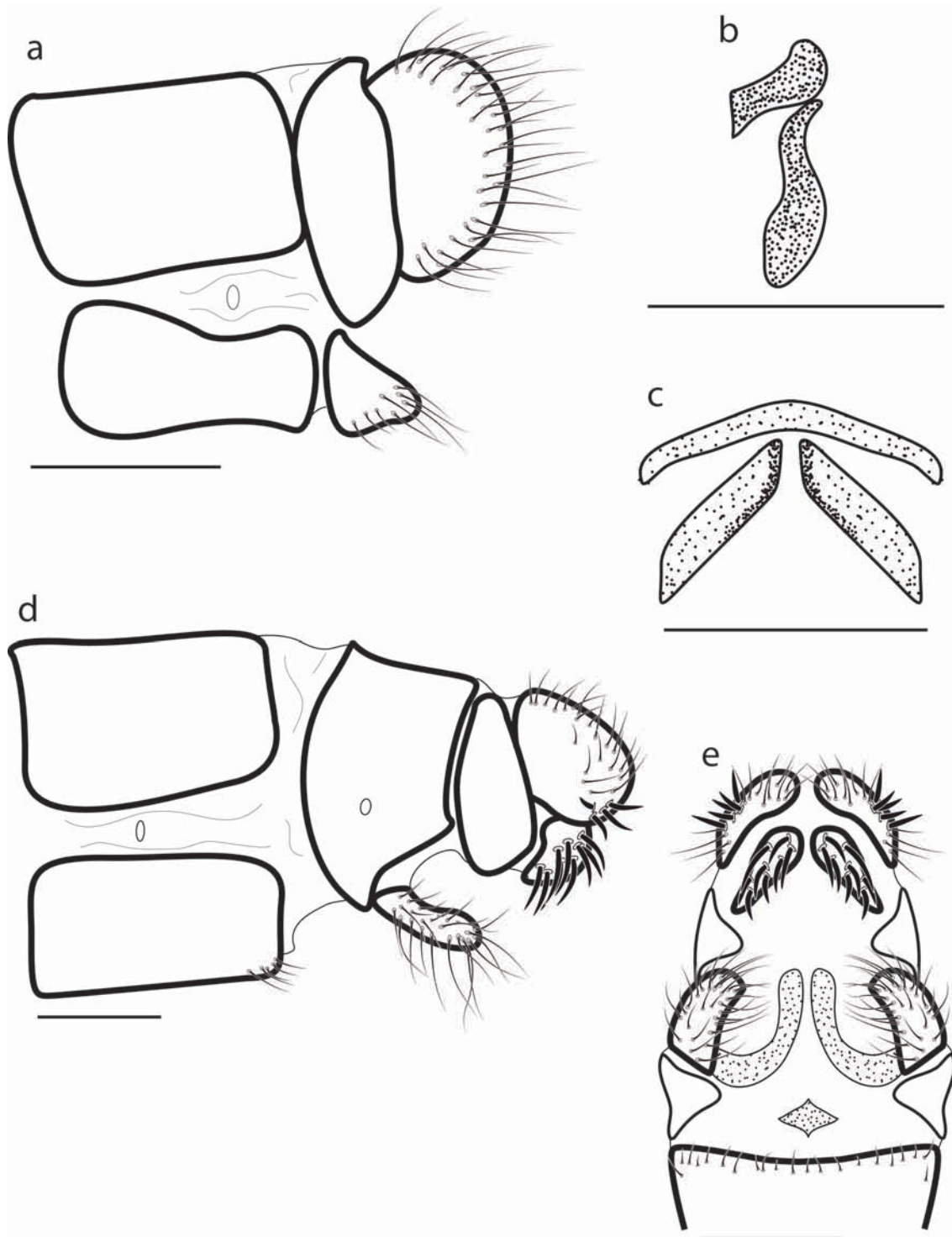


Figure A4.25: *Latileon setosus n. sp.*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posteroventral; female: d) terminalia, lateral; e) terminalia, ventral. Scale bars = 500 μ m.

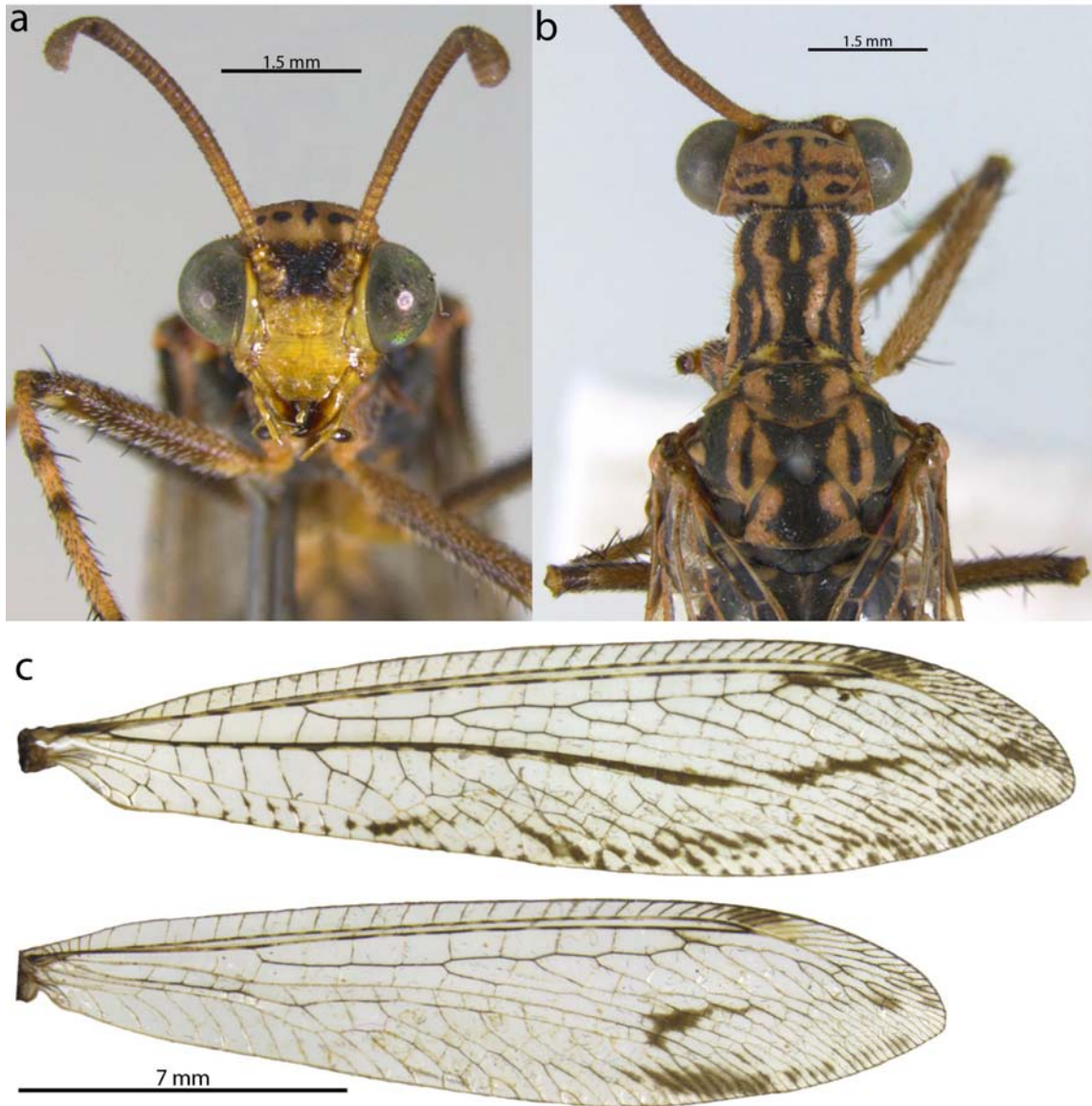


Figure A4.26: *Acutoleon mulesi*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

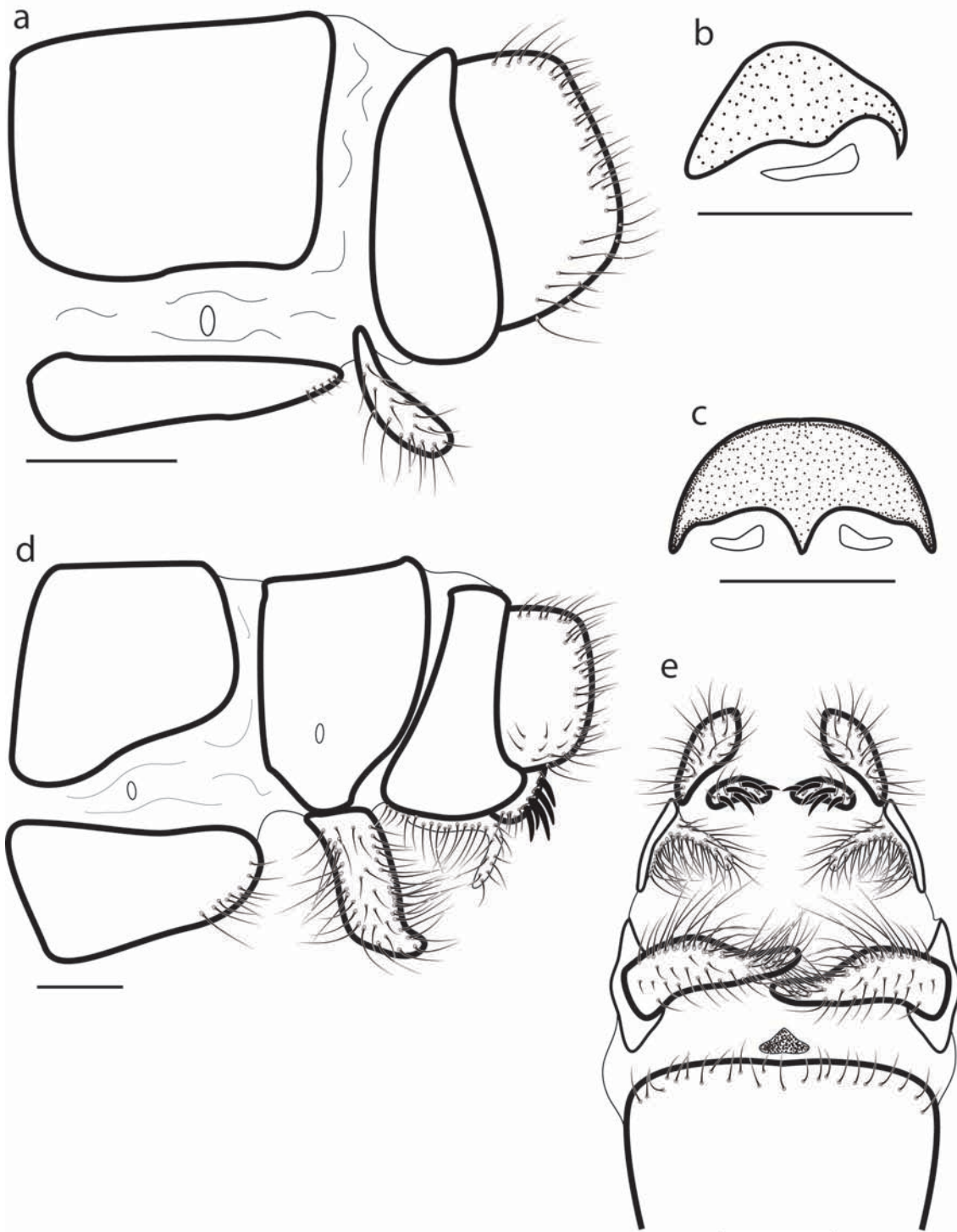


Figure A4.27: *Acutoleon mulesi*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; female: d) terminalia, lateral; e) terminalia, ventral. Scale bars = 500 μ m.

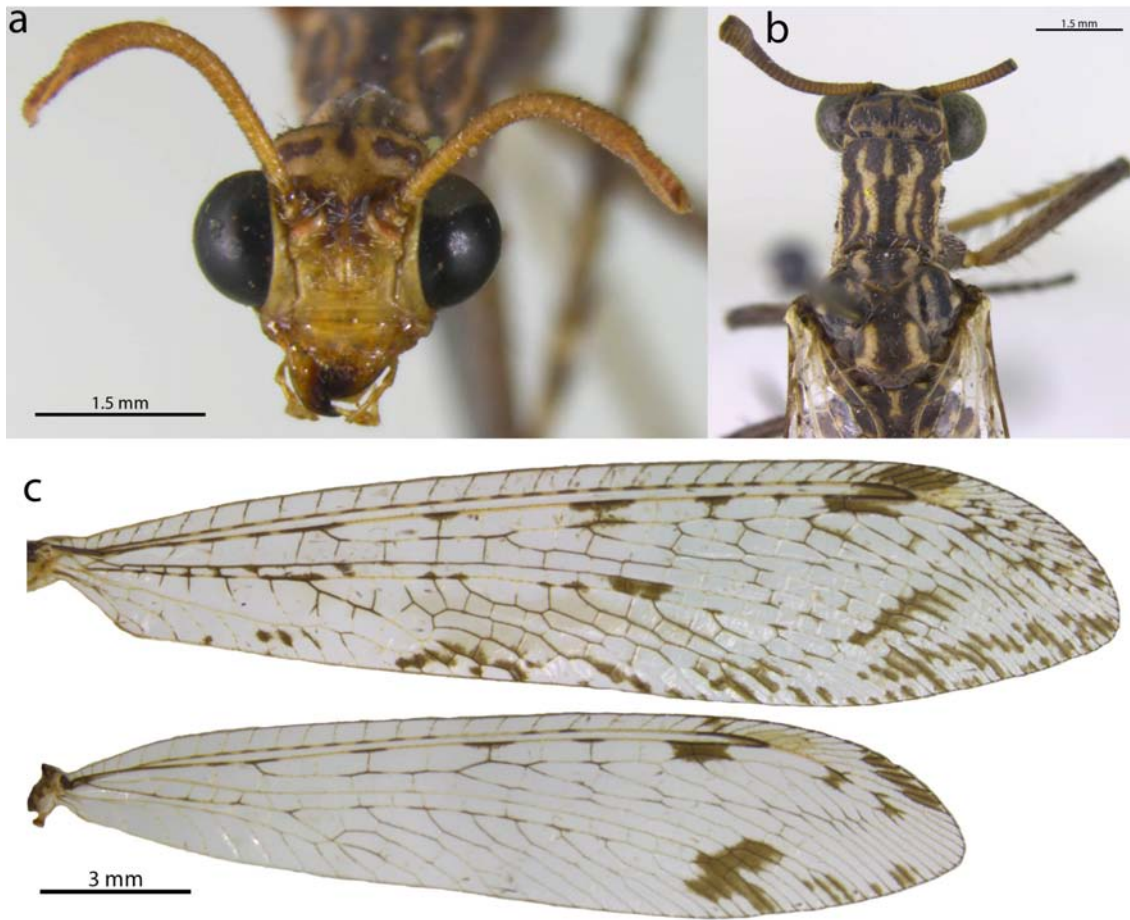


Figure A4.28: *Acutoleon parviproctus*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

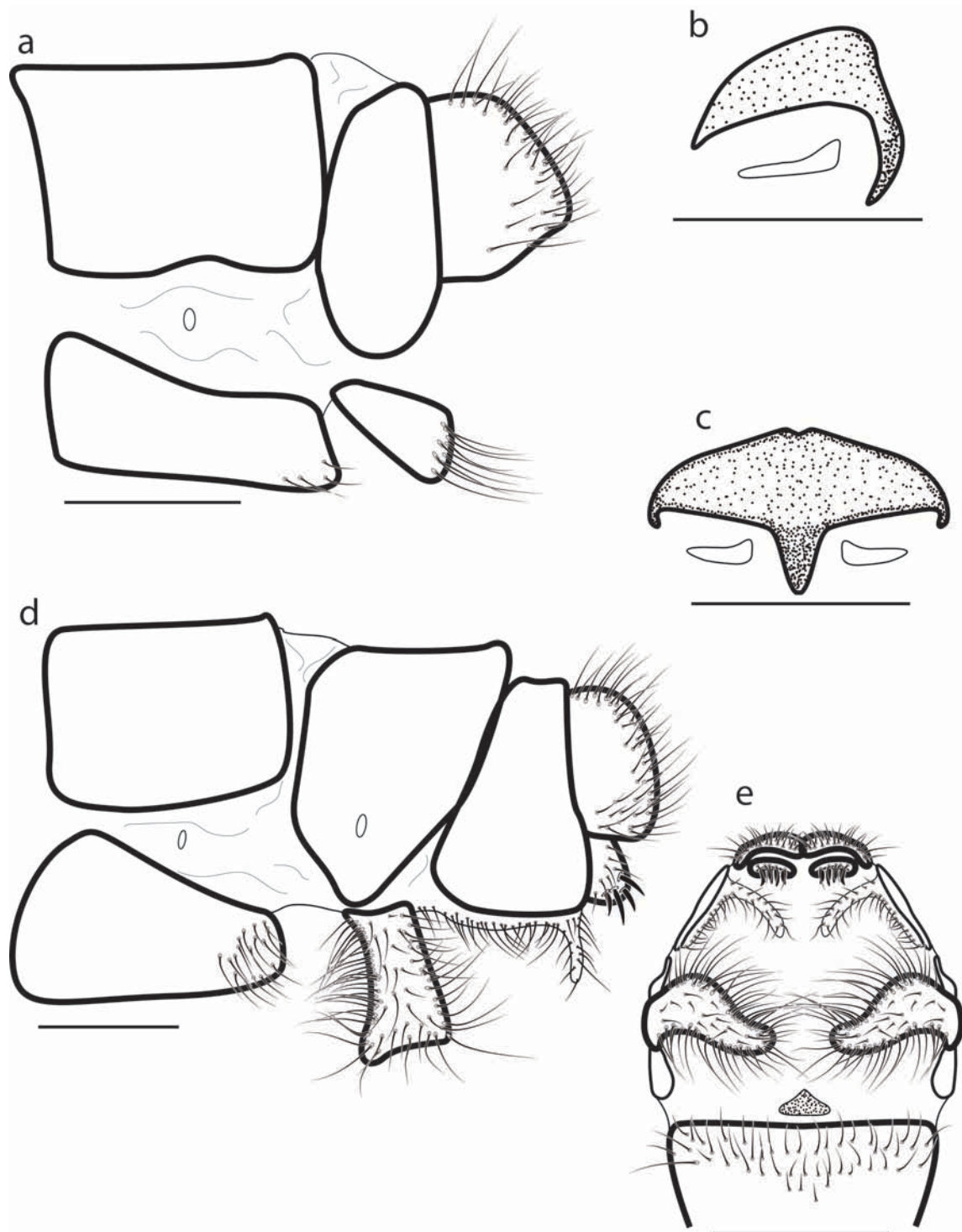


Figure A4.29: *Acutoleon parviproctus*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; female: d) terminalia, lateral; e) terminalia, ventral. Scale bars = 500 μ m.

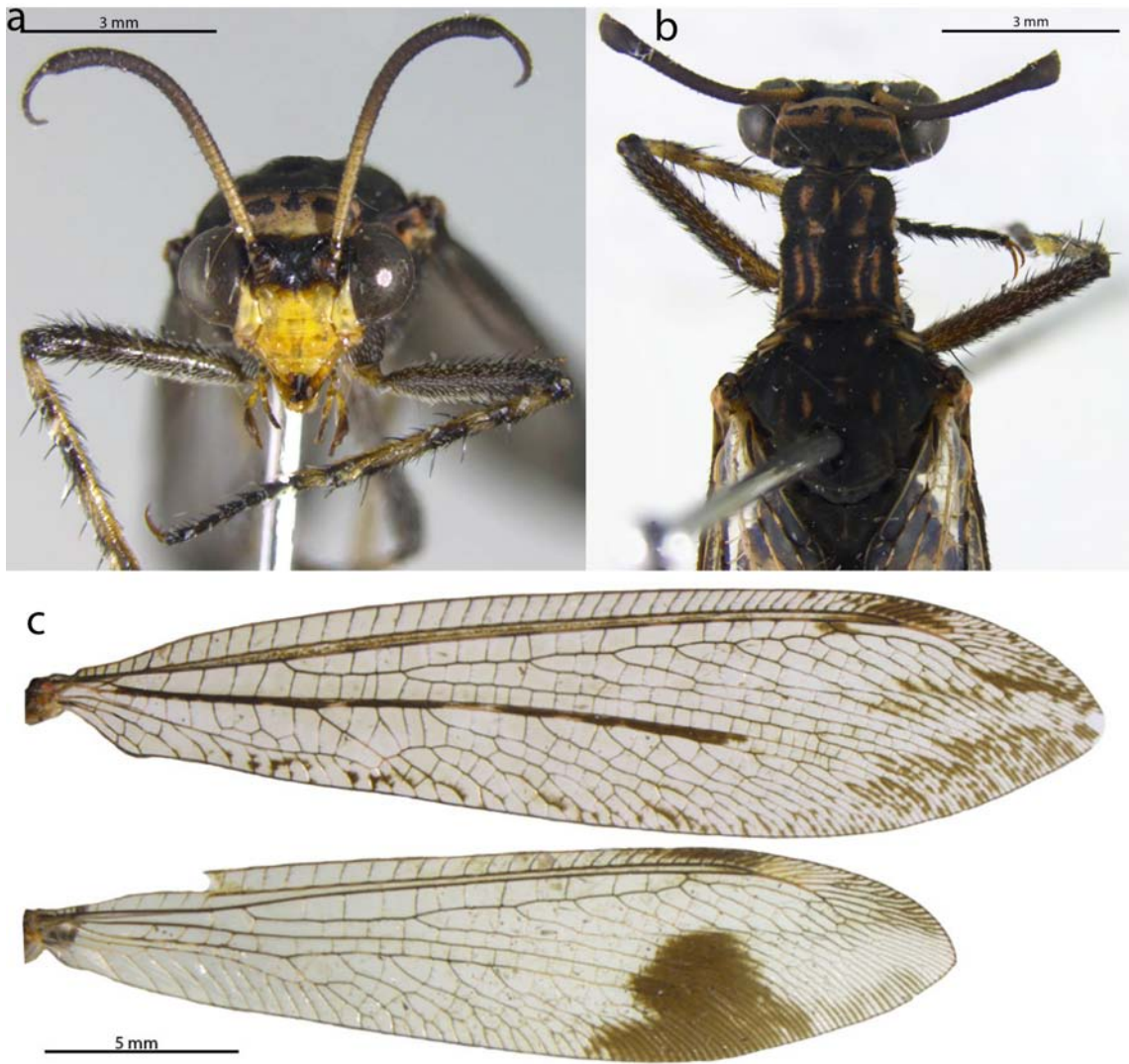


Figure A4.30: *Acutoleon secula*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

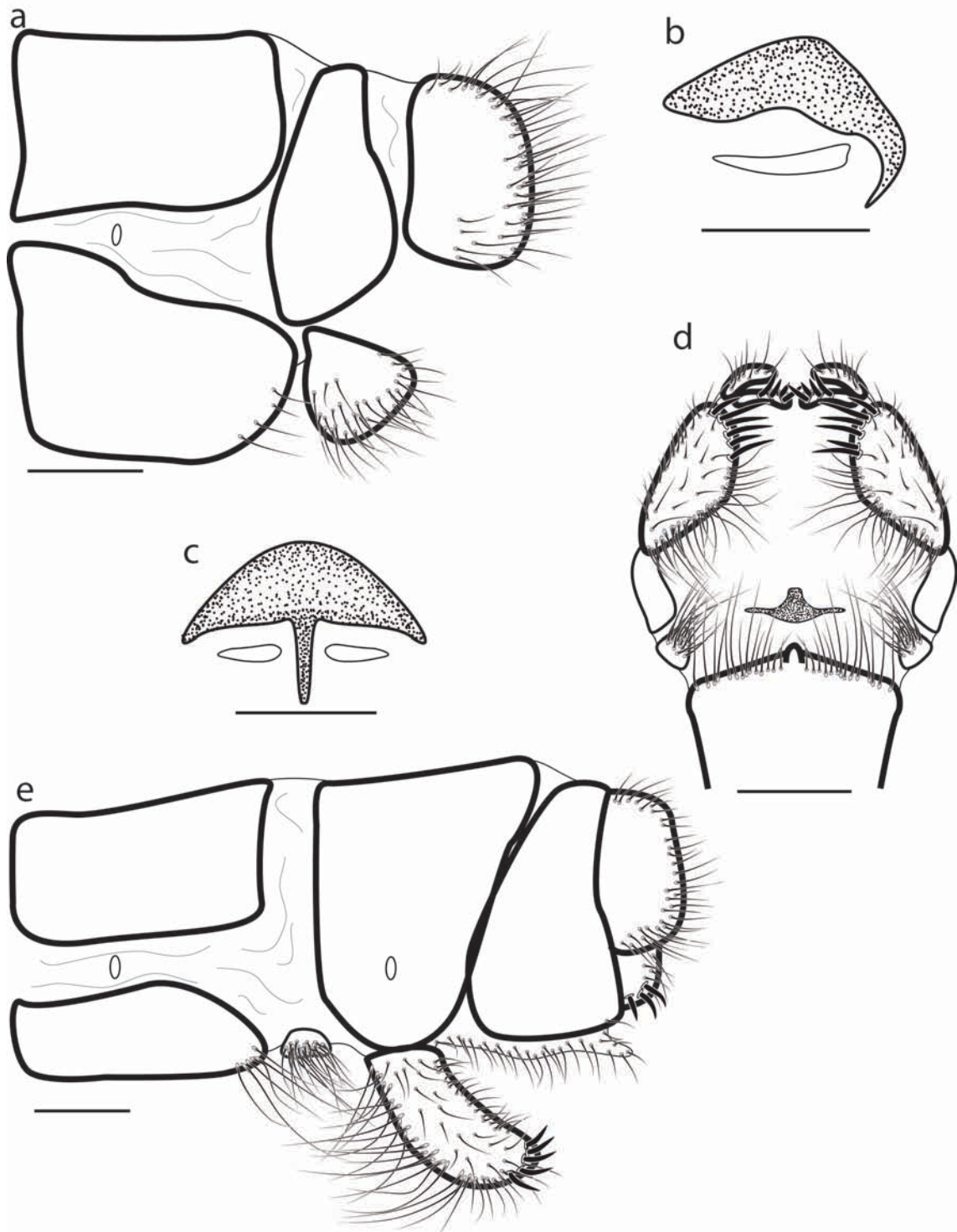


Figure A4.31: *Acutoleon secula*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; female: d) terminalia, ventral; e) terminalia, lateral. Scale bars = 500 μ m.



Figure A4.32: *Acutoleon tatarnici* n. sp.: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

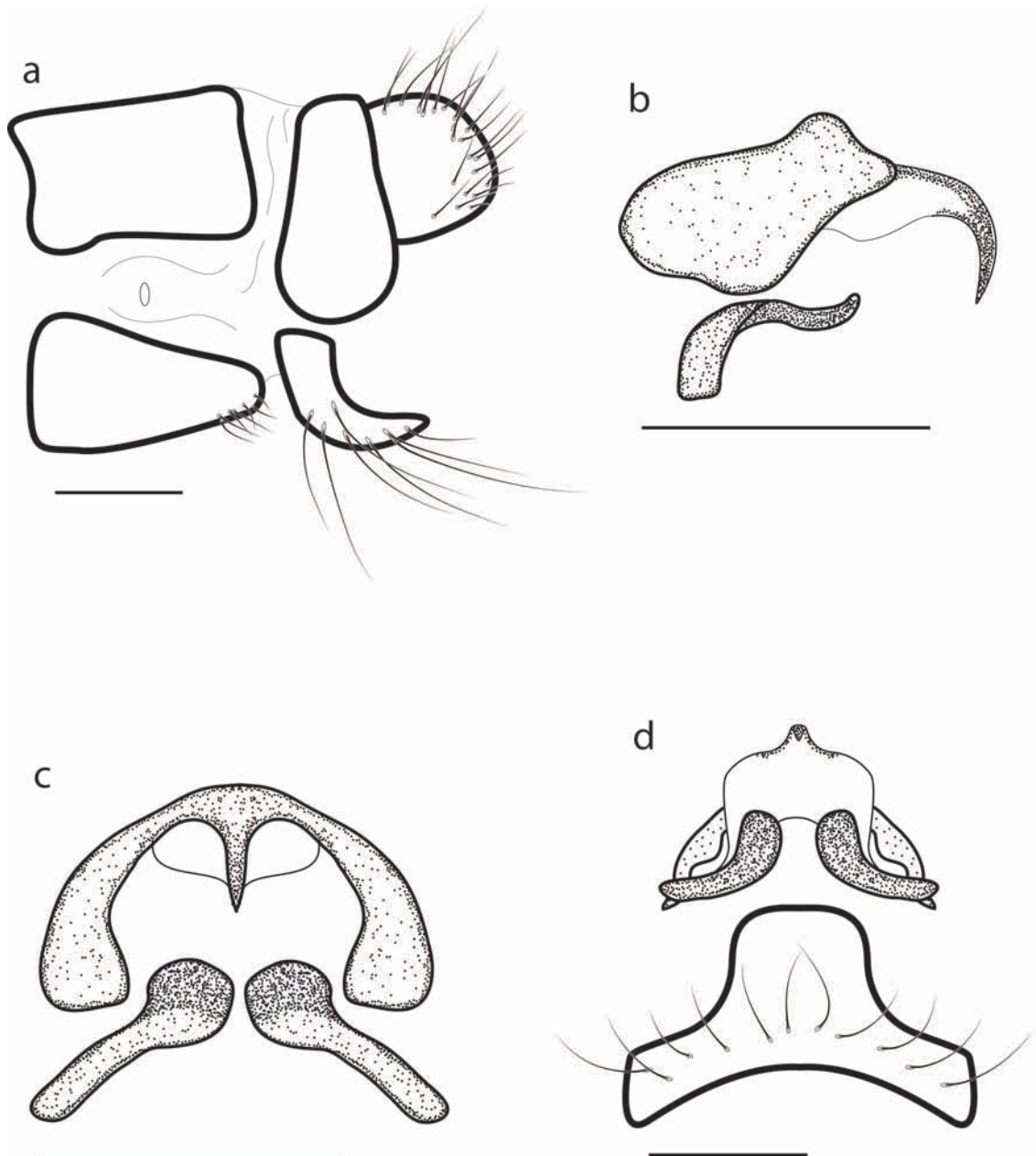


Figure A4.33: *Acutoleon tatarnici* n. sp.: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posteroventral; d) 9th sternite and genitalia, ventral. Scale bars = 500 μ m.



Figure A4.34: *Alectrinia cardaleae*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

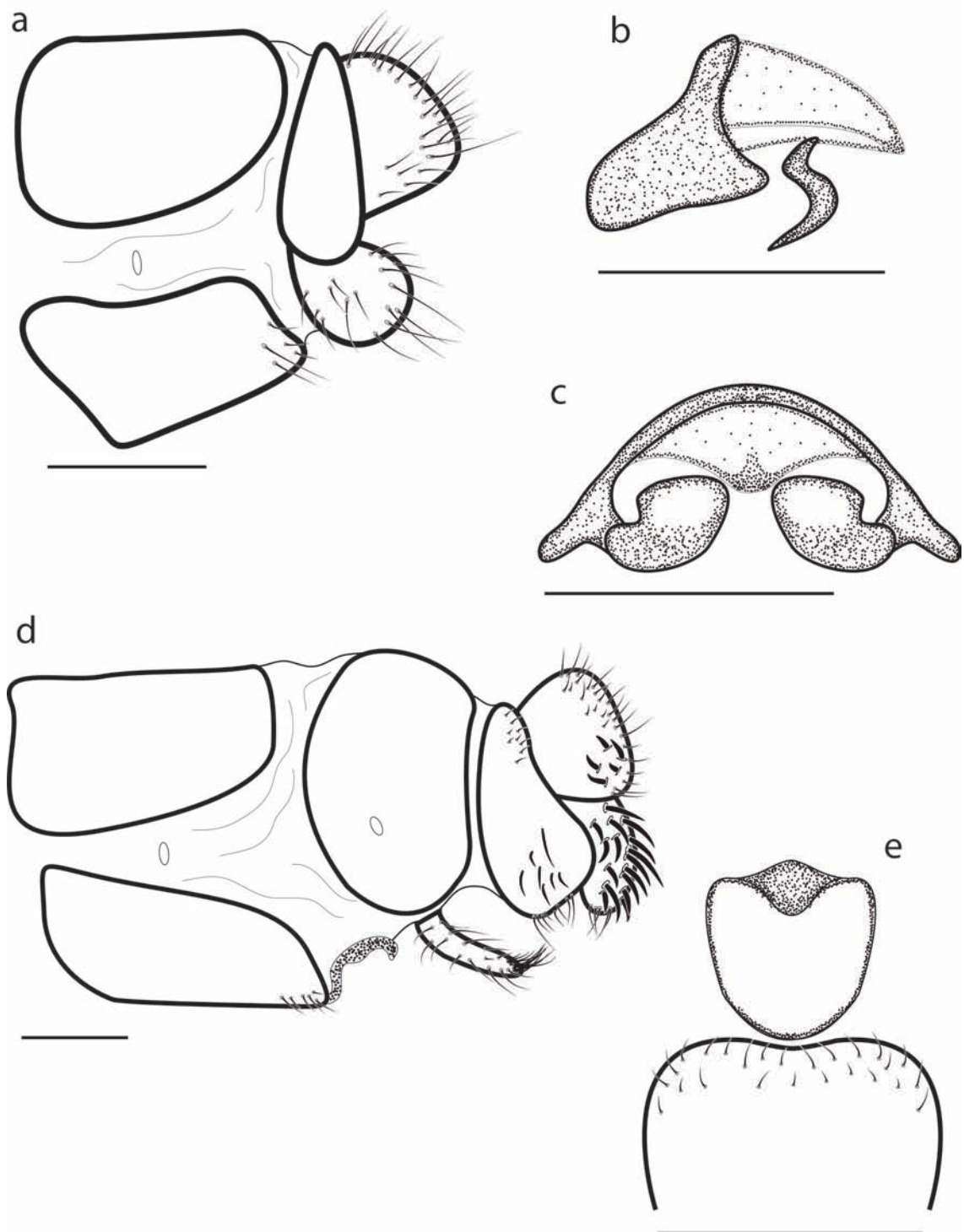


Figure A4.35: *Alectrinia cardaleae*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; female: d) terminalia, lateral; e) 7th sternite and pregenital plate, ventral. Scale bars = 500 μ m.

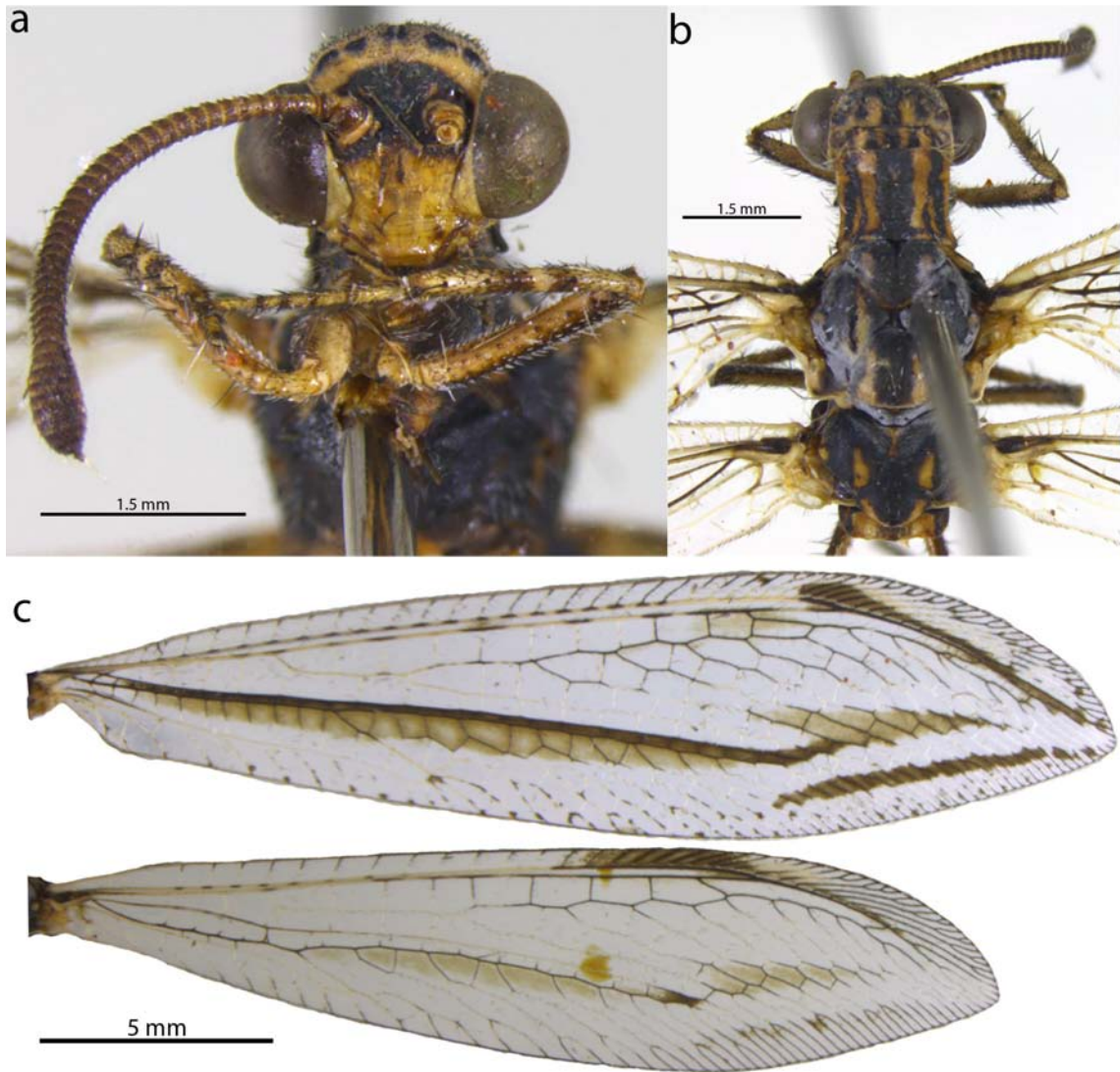


Figure A4.36: *Alectrinia lulinguensis*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

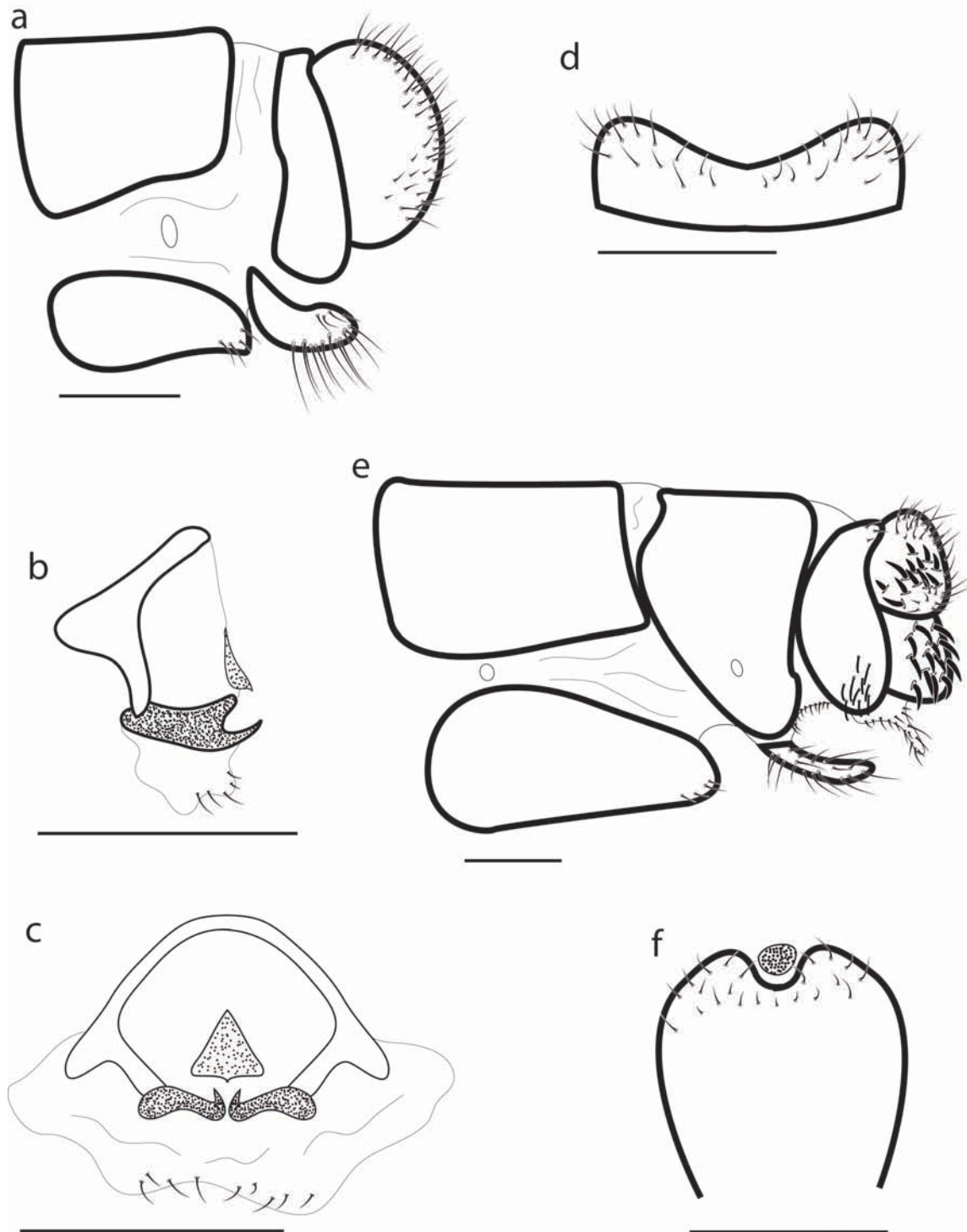


Figure A4.37: *Alectrinia lulinguensis*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; d) 9th sternite, ventral; female: e) terminalia, lateral; f) 7th sternite and pregenital plate, ventral. Scale bars = 500 μ m.

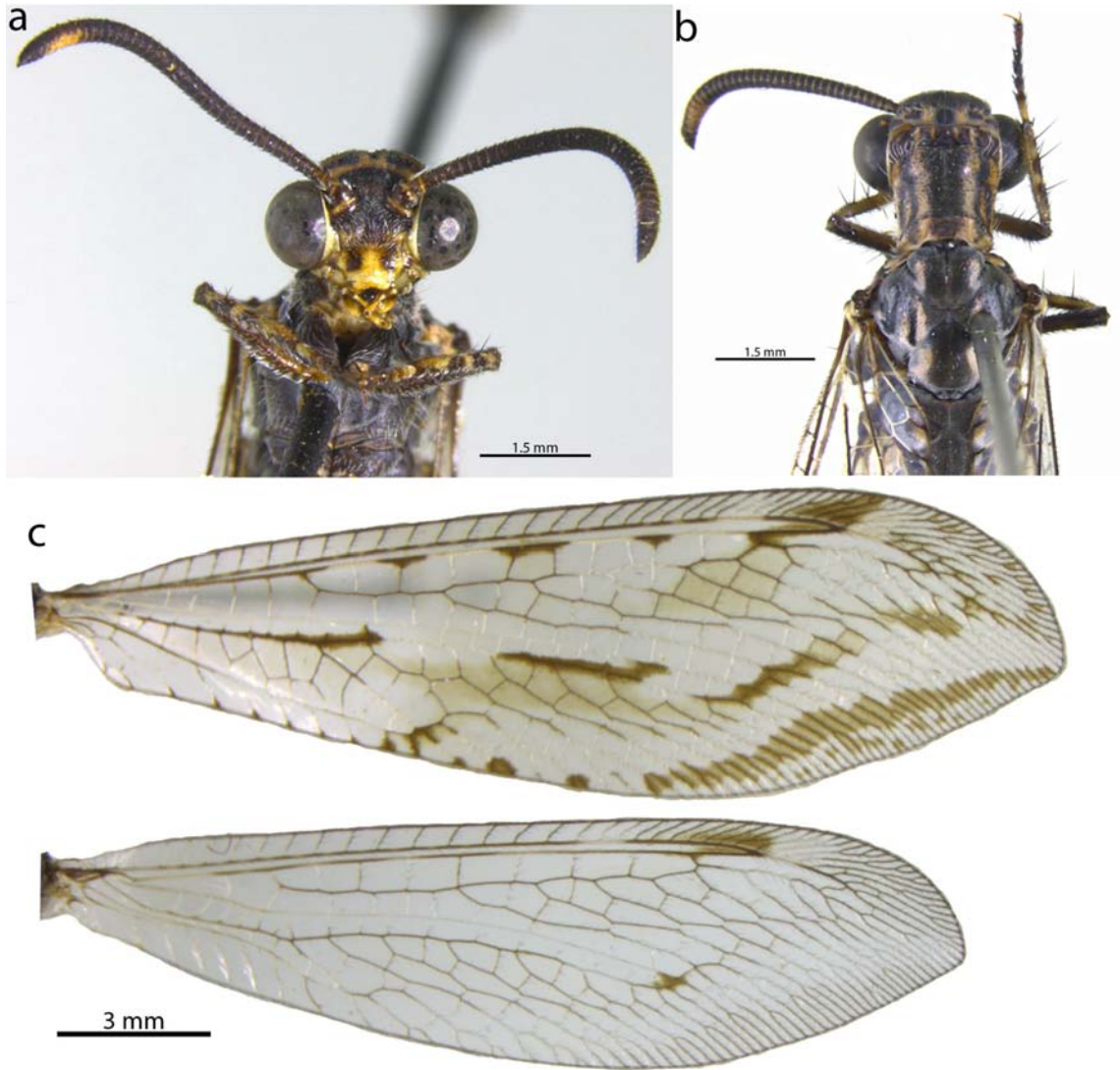


Figure A4.38: *Alectrinia nigrescens*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

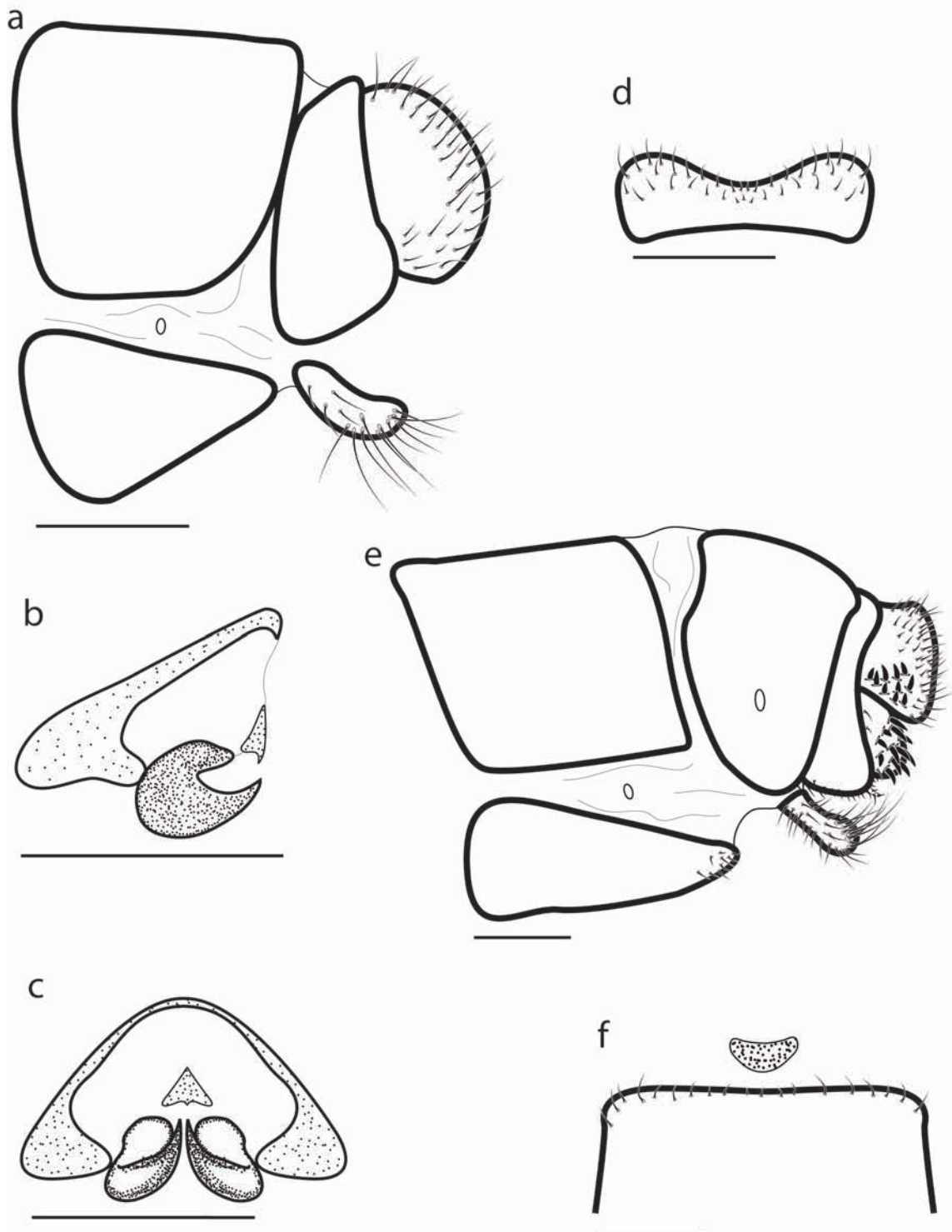


Figure A4.39: *Alectrinia nigrescens*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; d) 9th sternite, ventral; female: e) terminalia, lateral; f) 7th sternite and pregenital plate, ventral. Scale bars = 500 μ m.

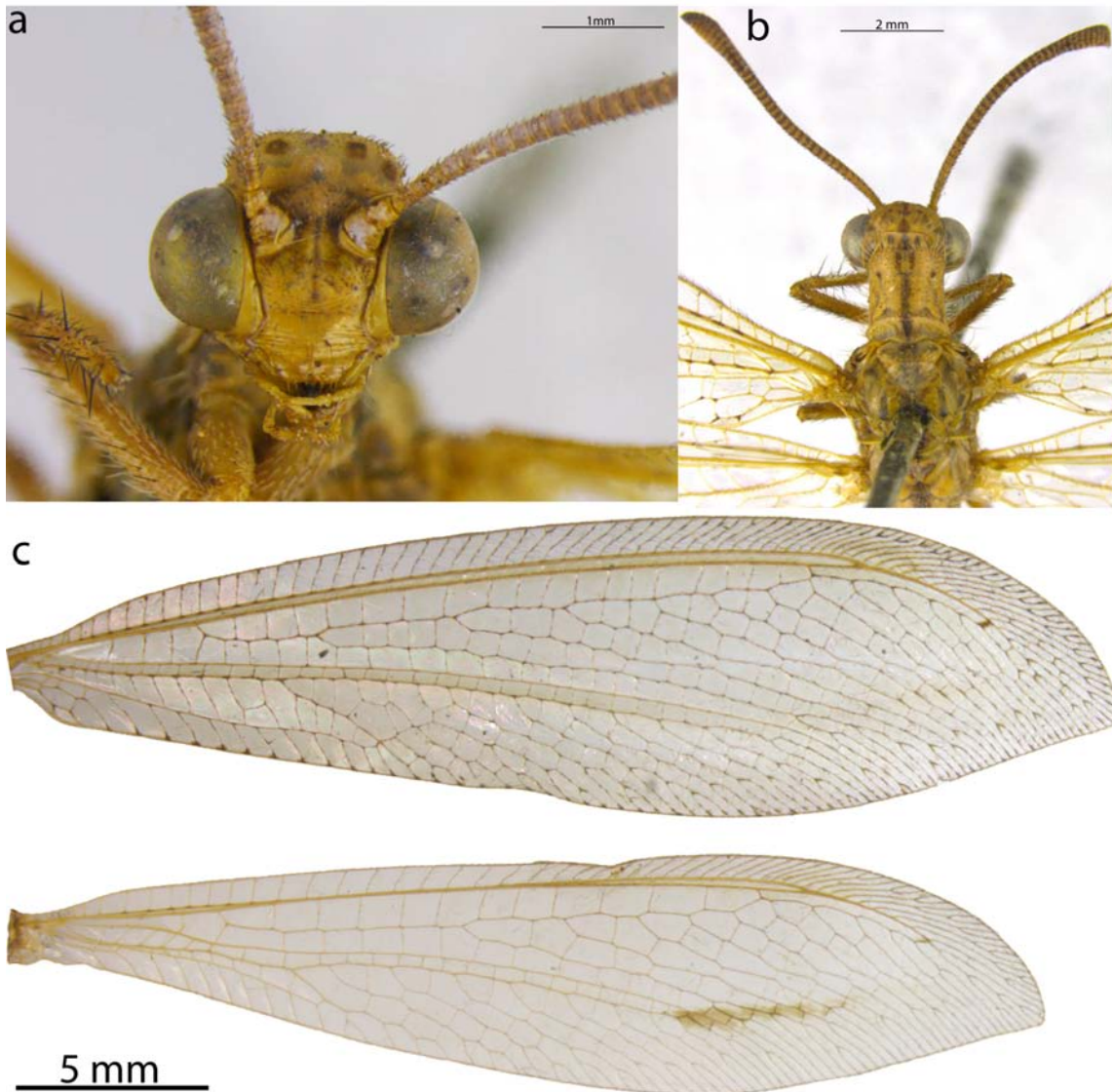


Figure A4.40: *Alectrinia oombulgurriensis* n. sp.: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

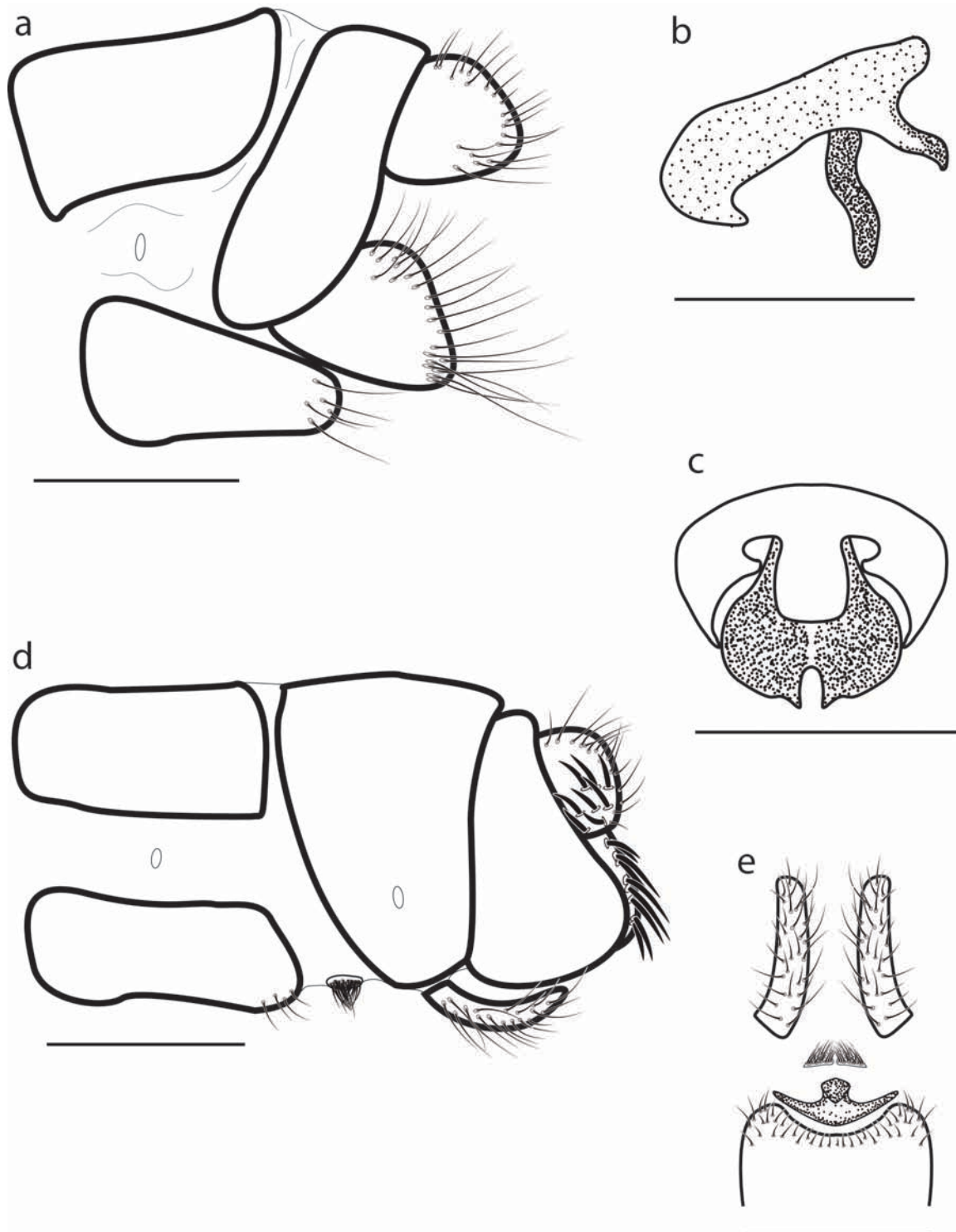


Figure A4.36: *Alectrinia oombulgurriensis* n. sp.: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; female: d) terminalia, lateral; e) terminalia, ventral. Scale bars = 1mm.

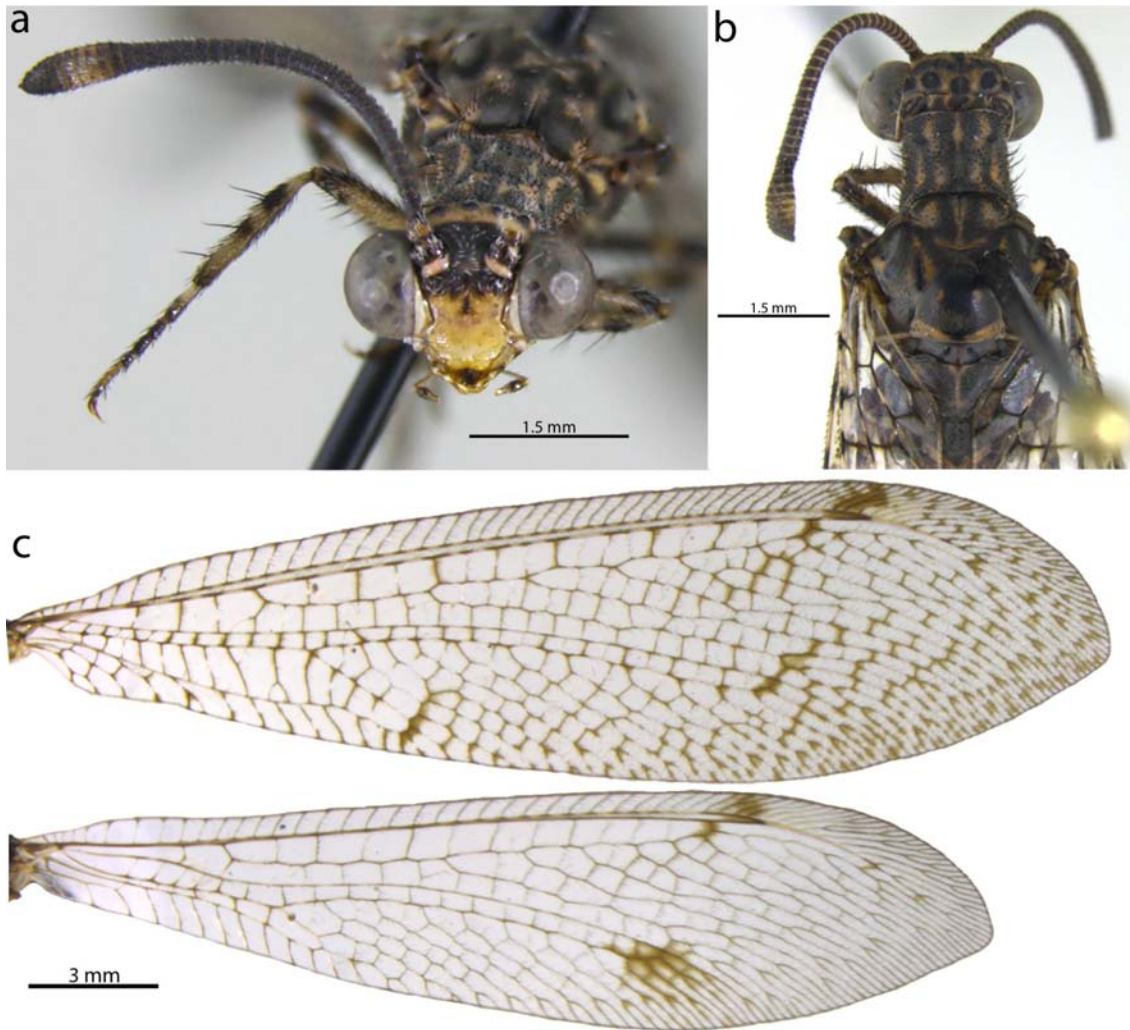


Figure A4.42: *Alectrinia pentagramma*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

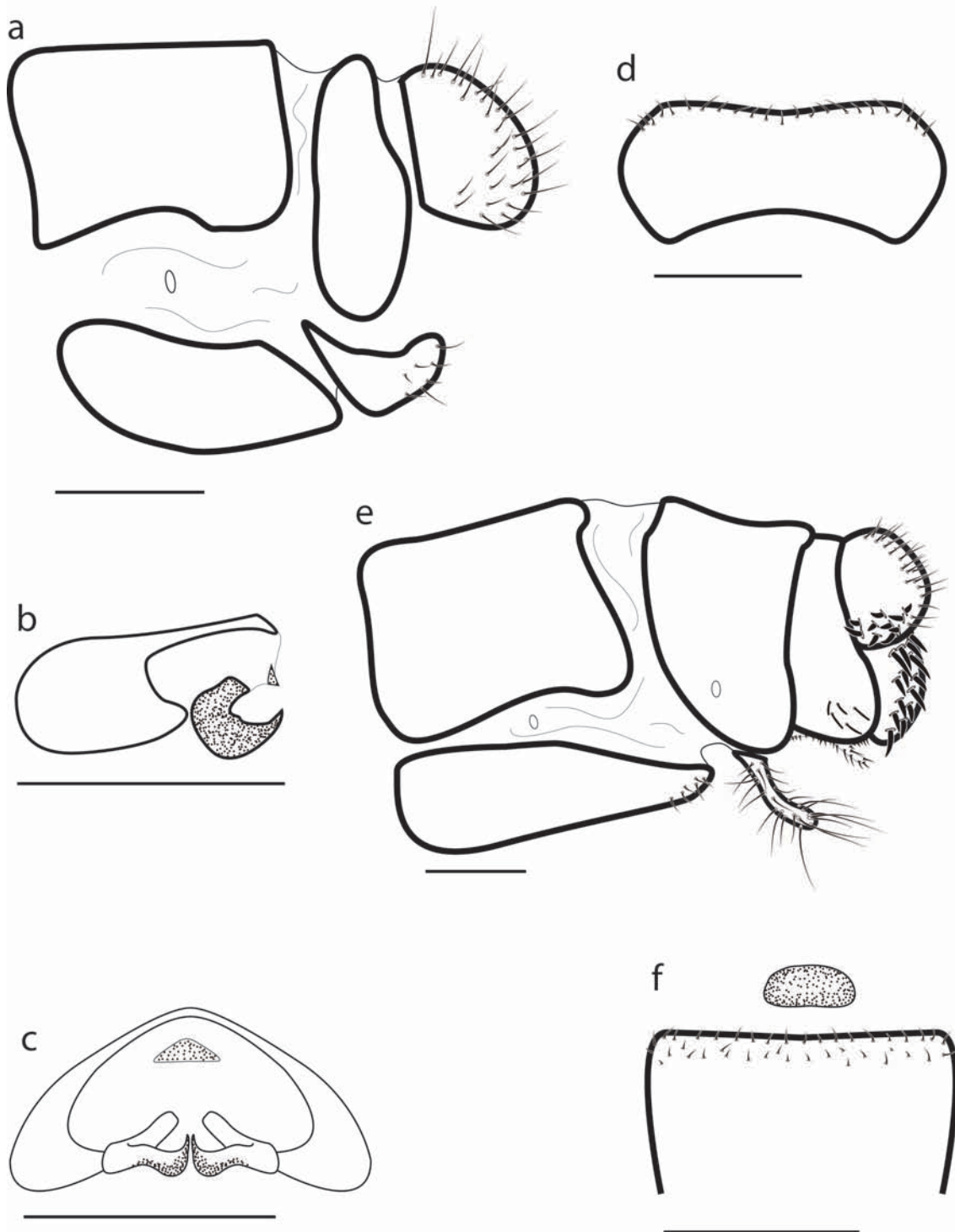


Figure A4.43: *Alectrinia pentagramma*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; d) 9th sternite, ventral; female: e) terminalia, lateral; f) 7th sternite and pregenital plate, ventral. Scale bars = 500 μ m.

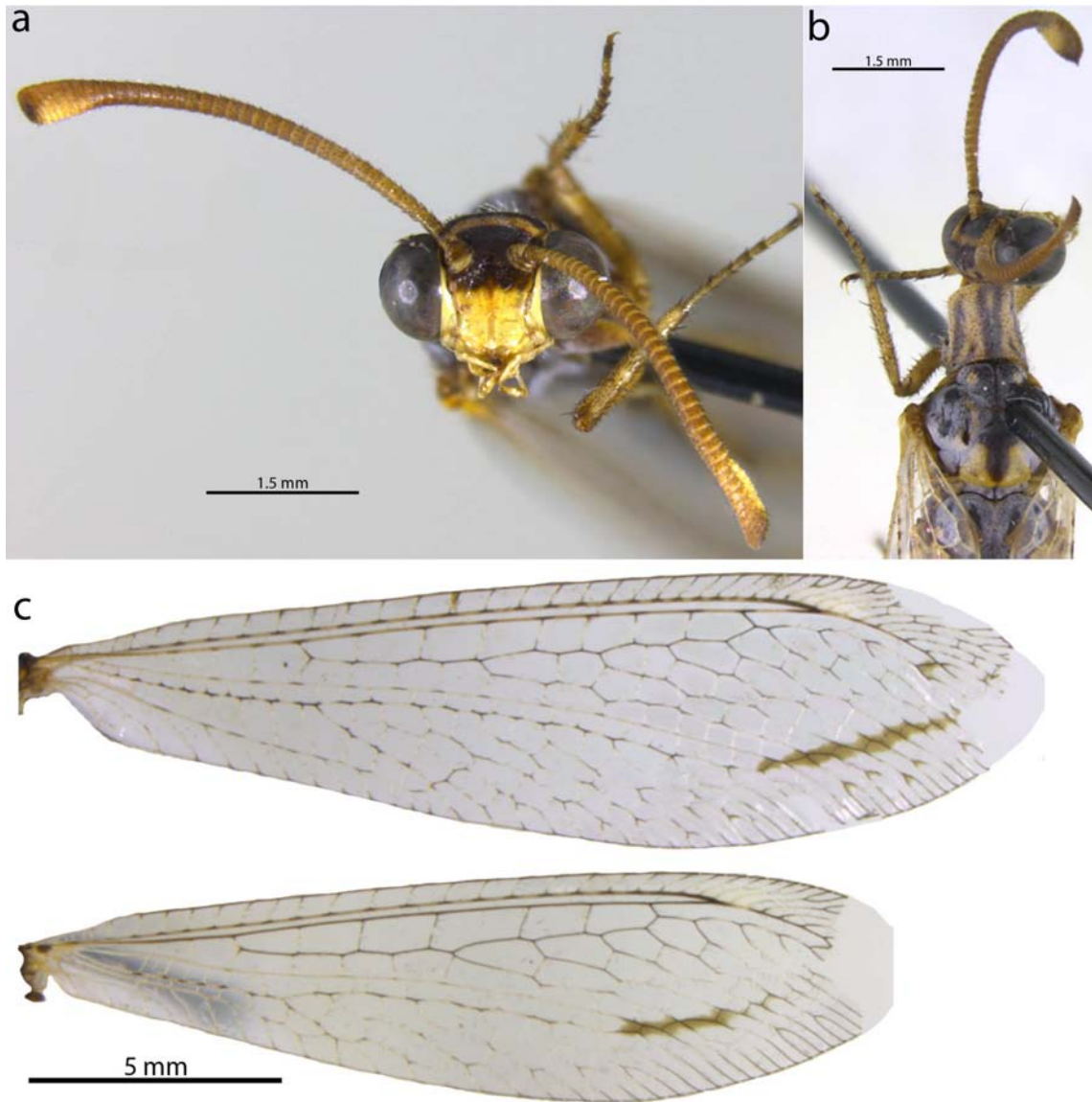


Figure A4.44: *Alectrinia sarahae*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

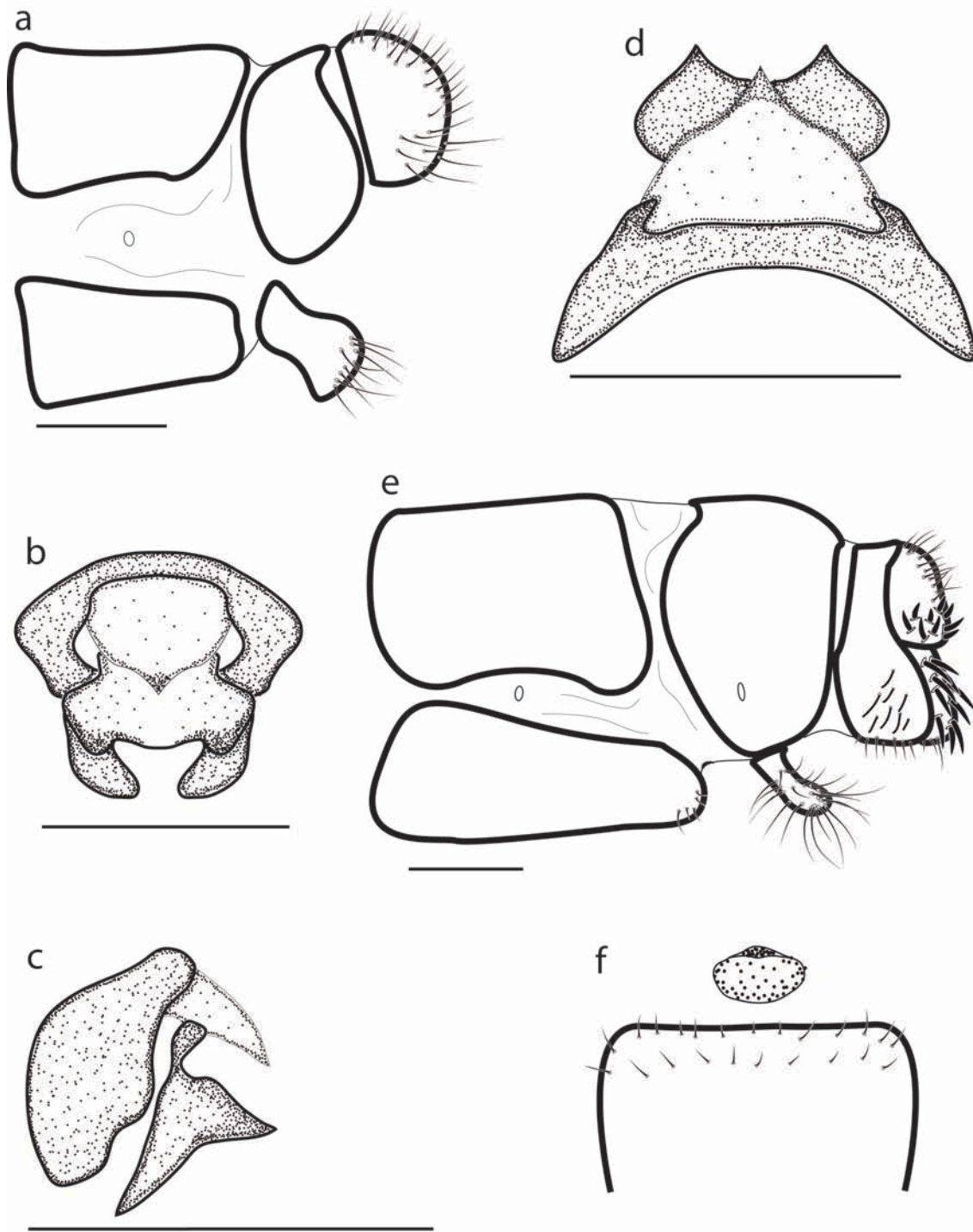


Figure A4.45: *Alectrinia sarahae*: male: a) terminalia, lateral; b) genitalia, posterior; c) genitalia, lateral; d) genitalia, dorsal; female: e) terminalia, lateral; f) 7th sternite and pregenital plate, ventral. Scale bars = 500 μ m.

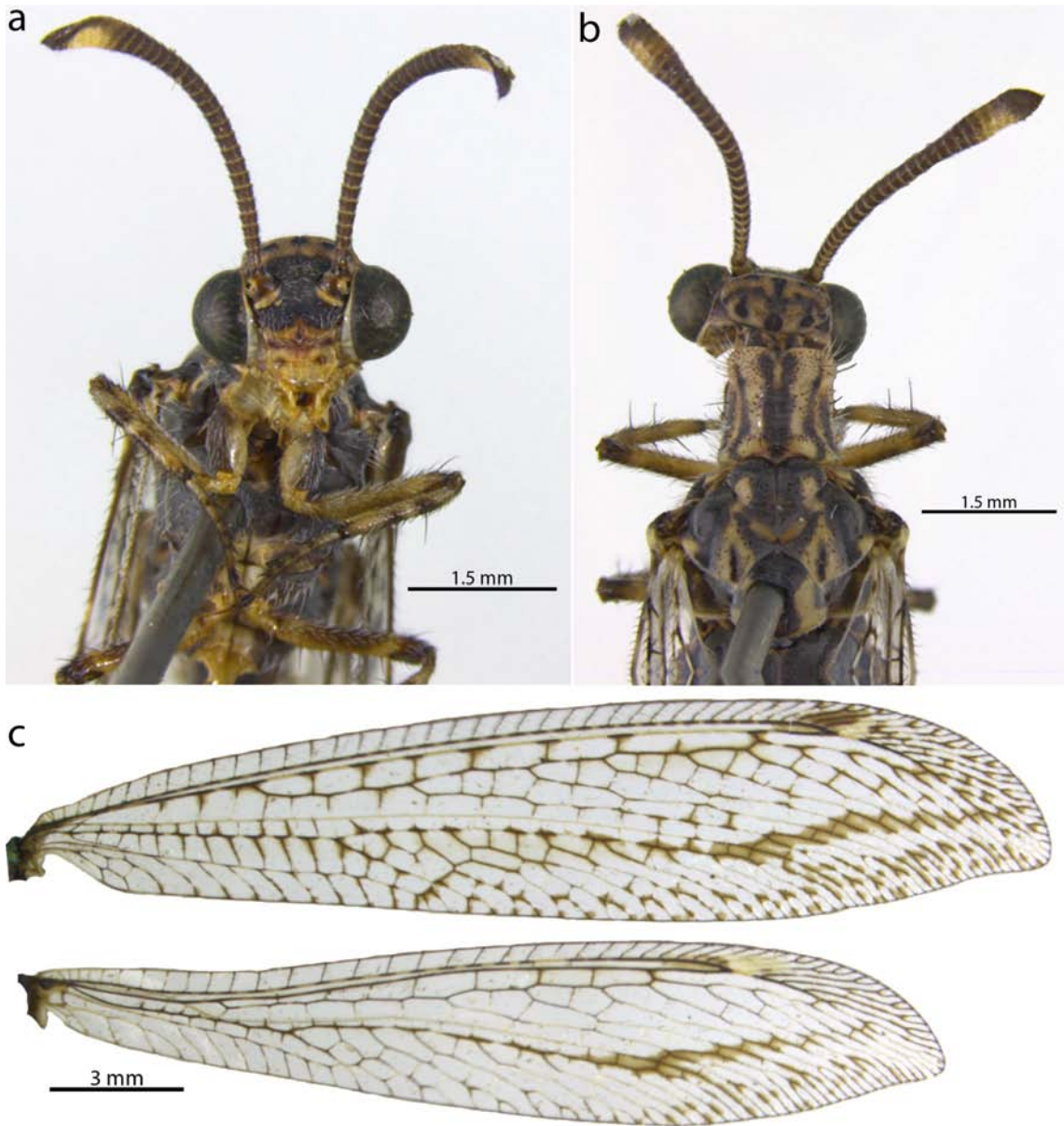


Figure A4.46: *Alectrinia tindalei*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

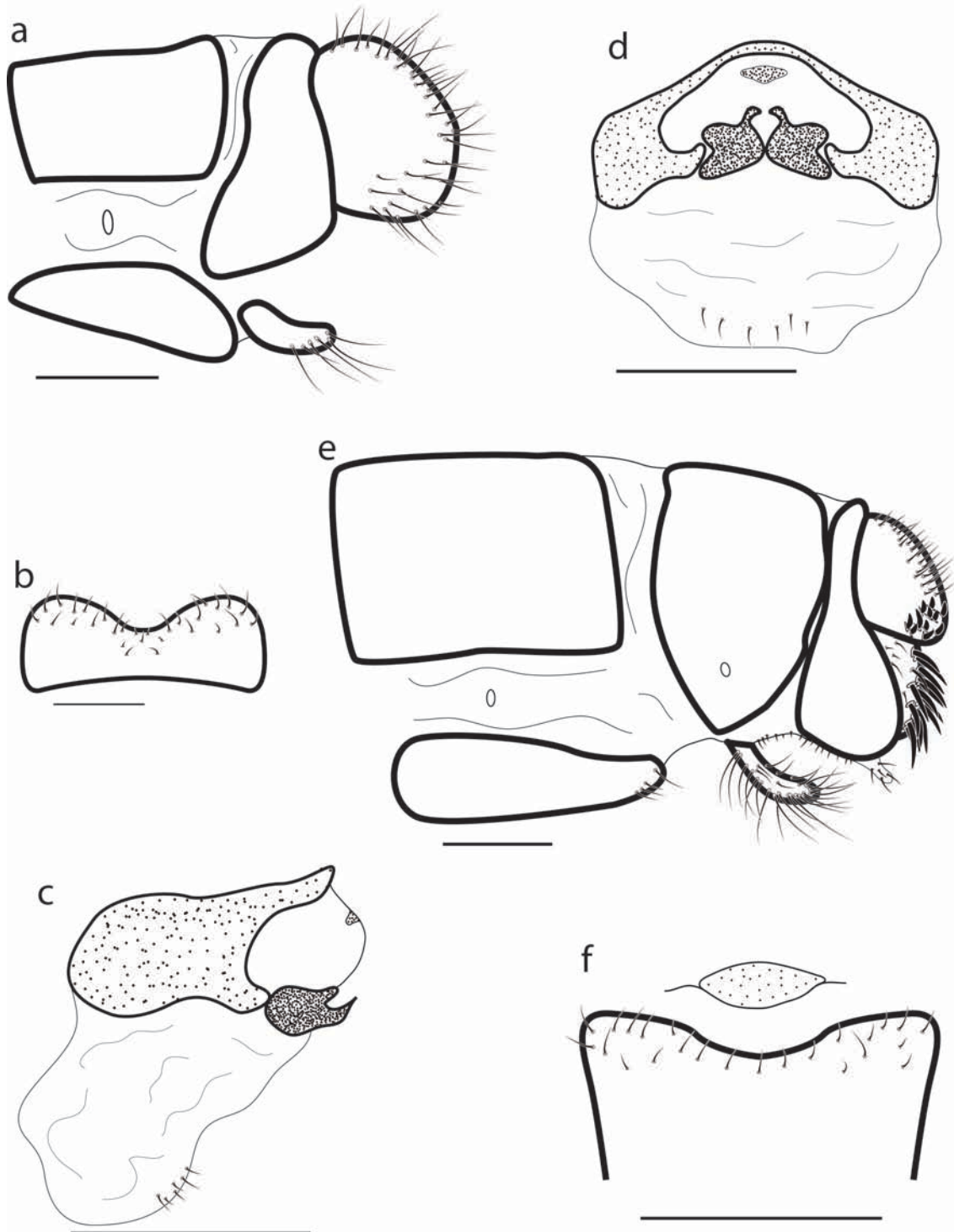


Figure A4.47: *Alectrinia tindalei*: male: a) terminalia, lateral; b) 9th sternite, ventral; c) genitalia, lateral; d) genitalia, posterior; female: e) terminalia, lateral; f) 7th sternite and pregenital plate, ventral. Scale bars = 500 μ m.

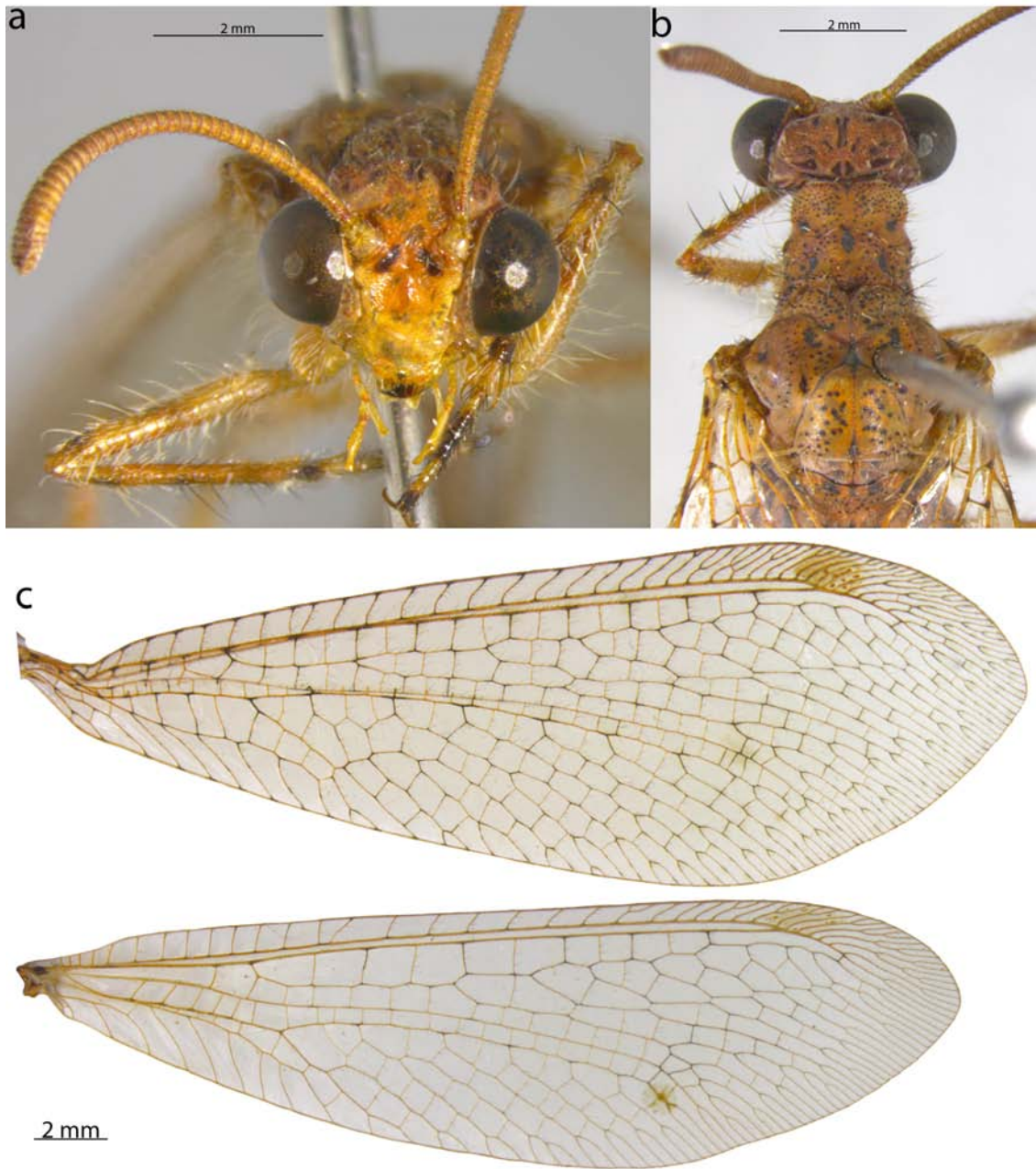


Figure A4.48: *Aurantileon annulatus*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

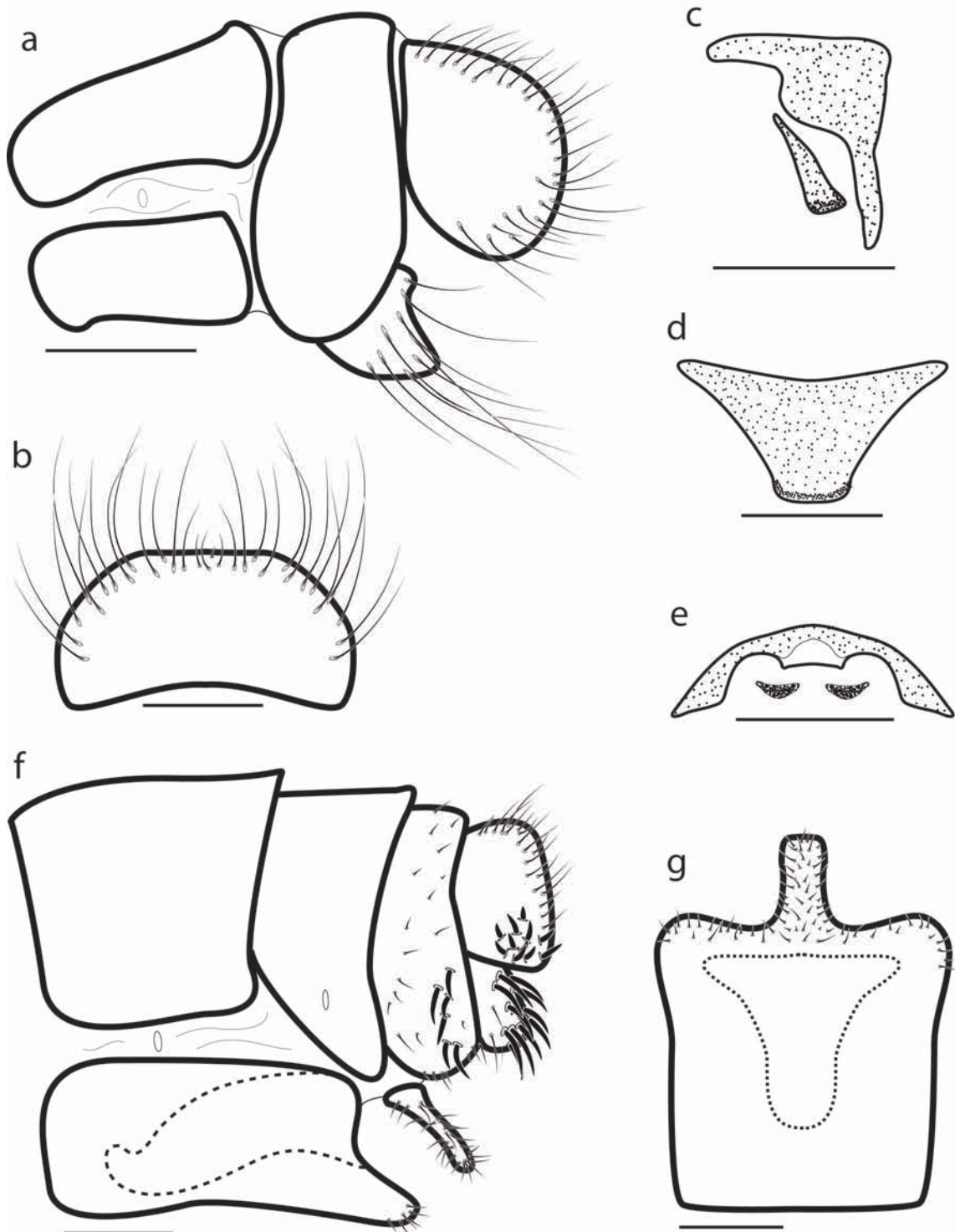


Figure A4.49: *Aurantileon annulatus*: male: a) terminalia, lateral; b) 9th sternite, ventral; c) genitalia, lateral; d) genitalia, posterior; e) genitalia, ventral; female: f) terminalia, lateral; g) 7th sternite and pregenital plate, ventral. Scale bars = 500 μ m.

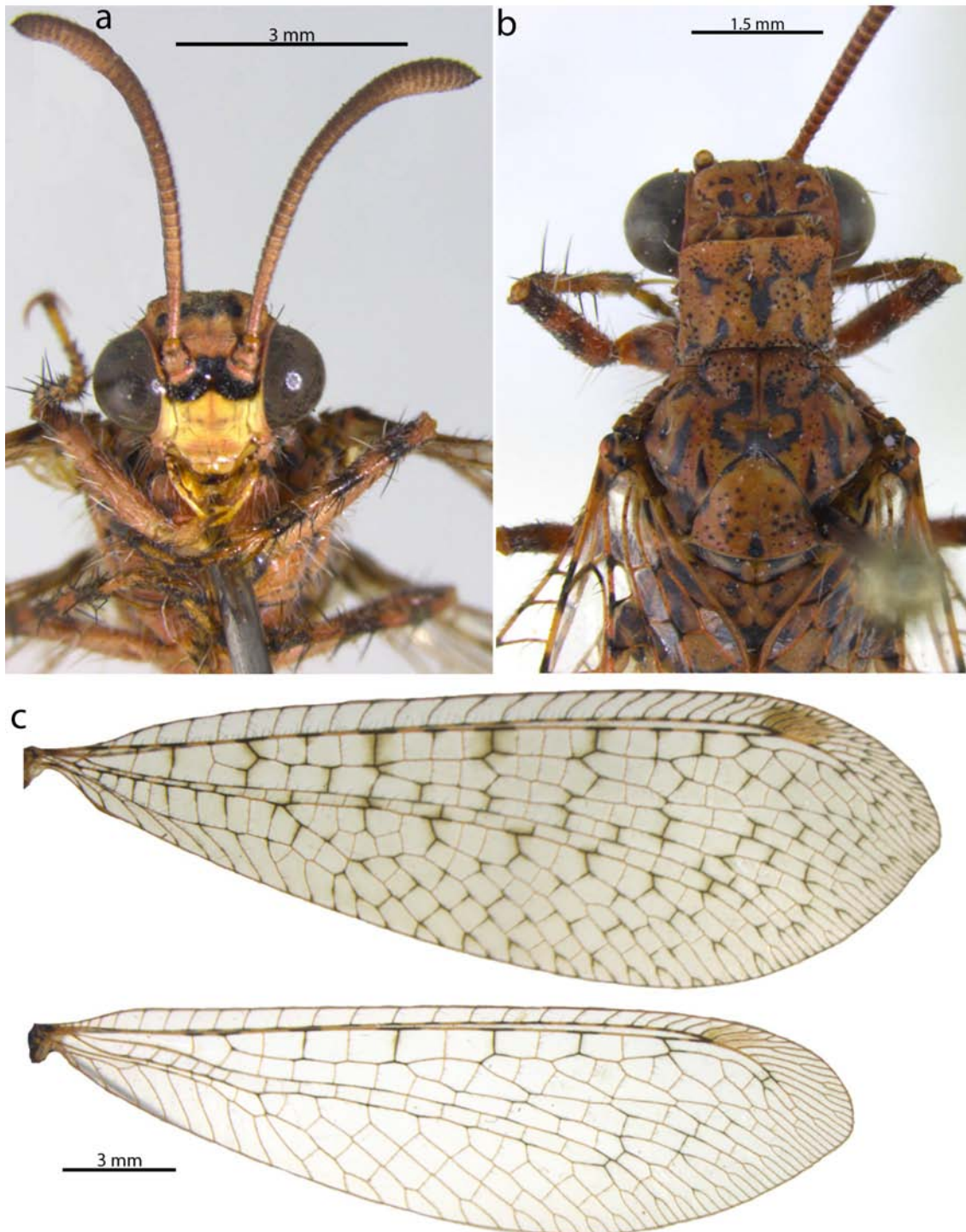


Figure A4.50: *Aurantileon banksi*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

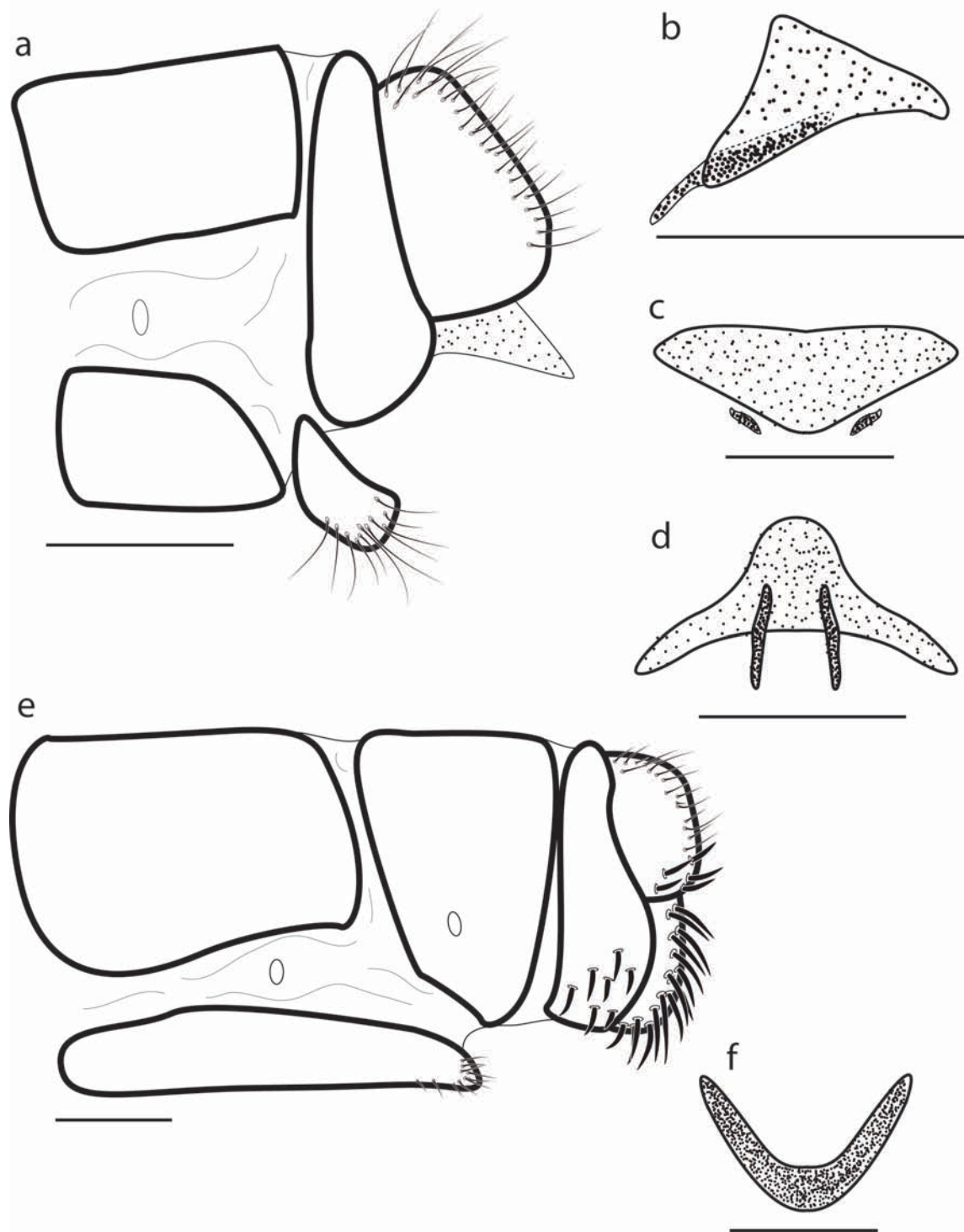


Figure A4.51: *Aurantileon banksi*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; d) genitalia, ventral; female: e) terminalia, lateral; f) pregenital plate, posterior. Scale bars = 500 μ m.



Figure A4.52: *Aurantileon drysdalensis*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

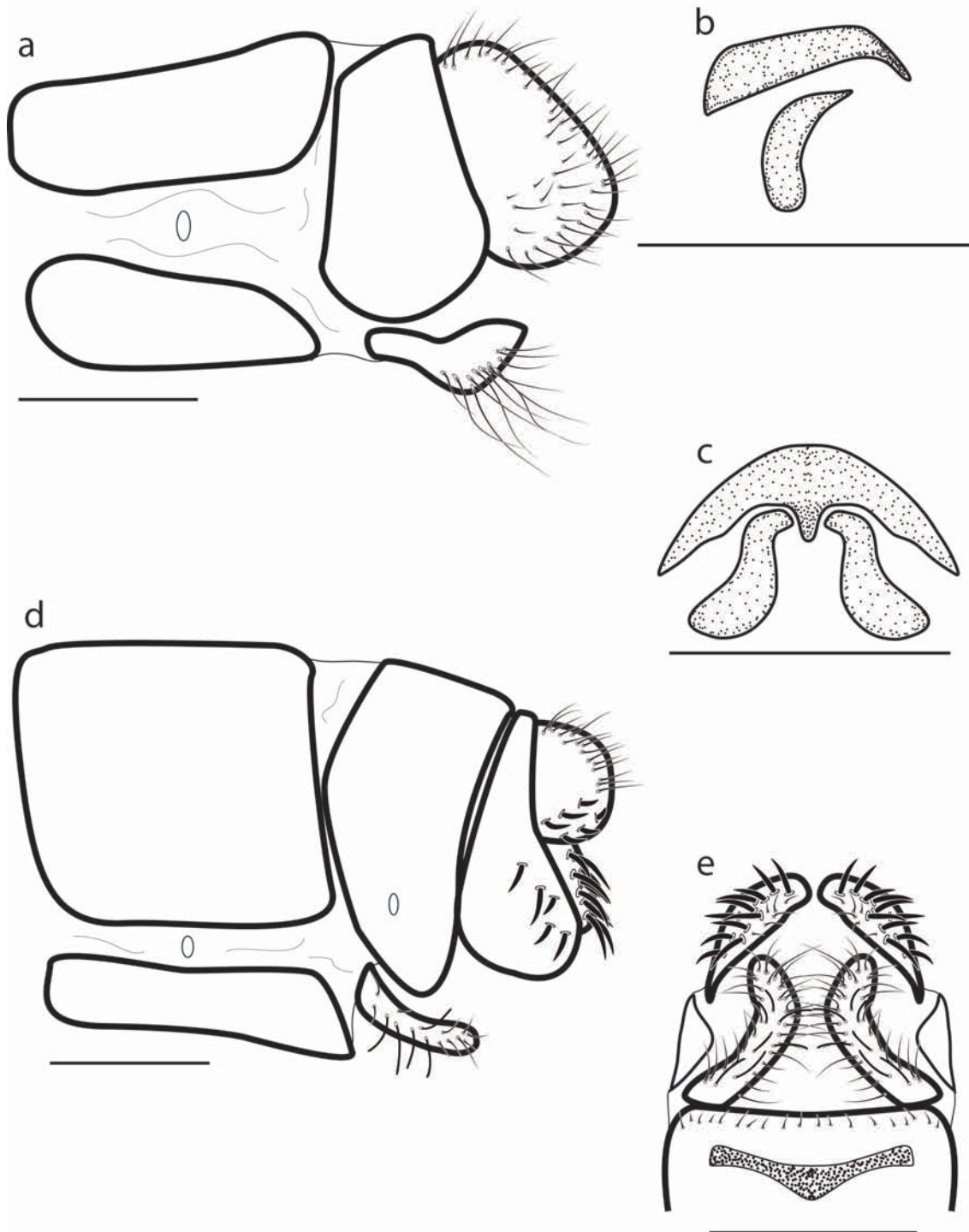


Figure A4.53: *Aurantileon drysdalensis*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; female: d) terminalia, lateral; e) terminalia, ventral, showing pregenital plate hidden beneath the sternite. Scale bars = 500 μ m.

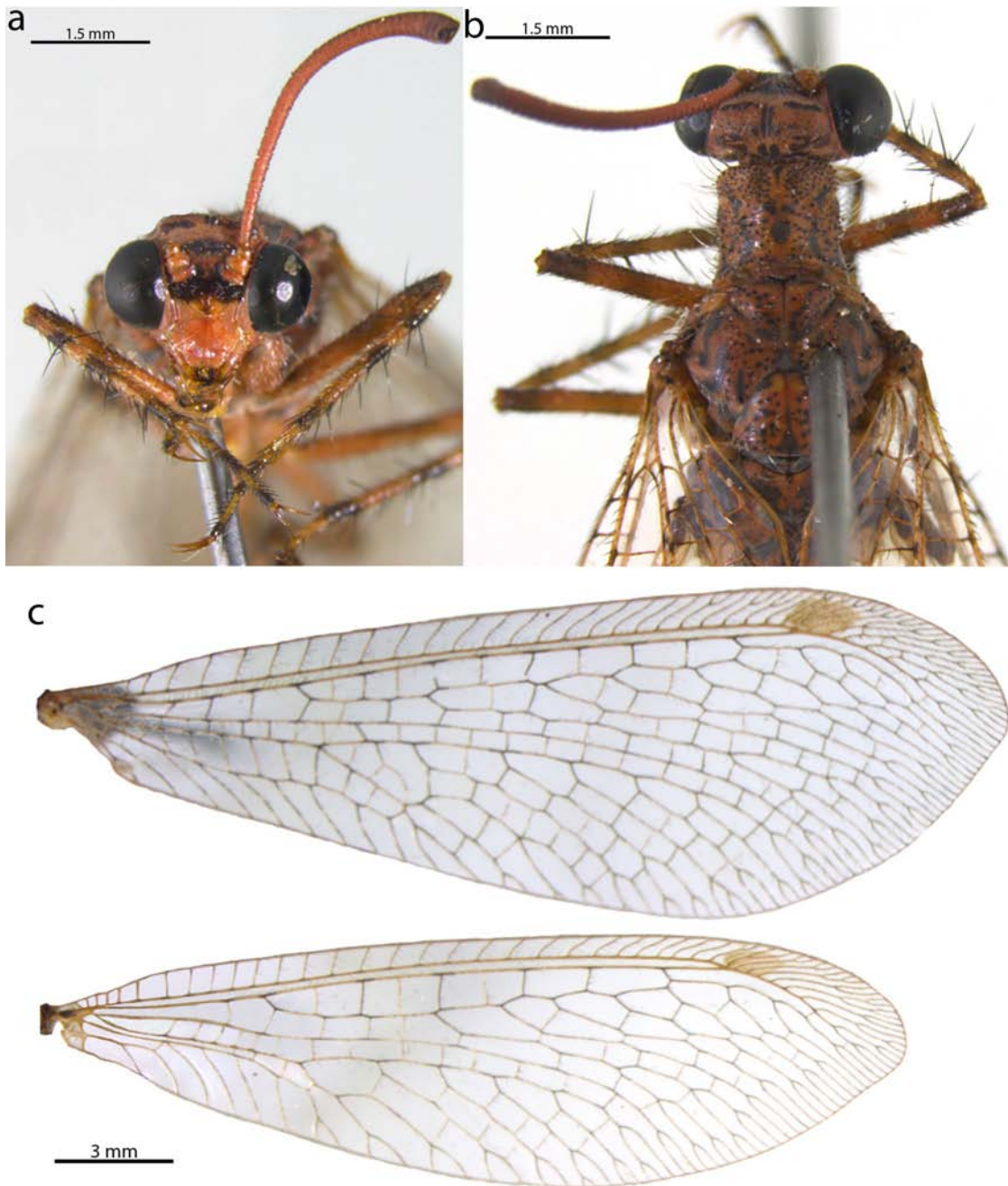


Figure A4.54: *Aurantileon pingrupensis*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

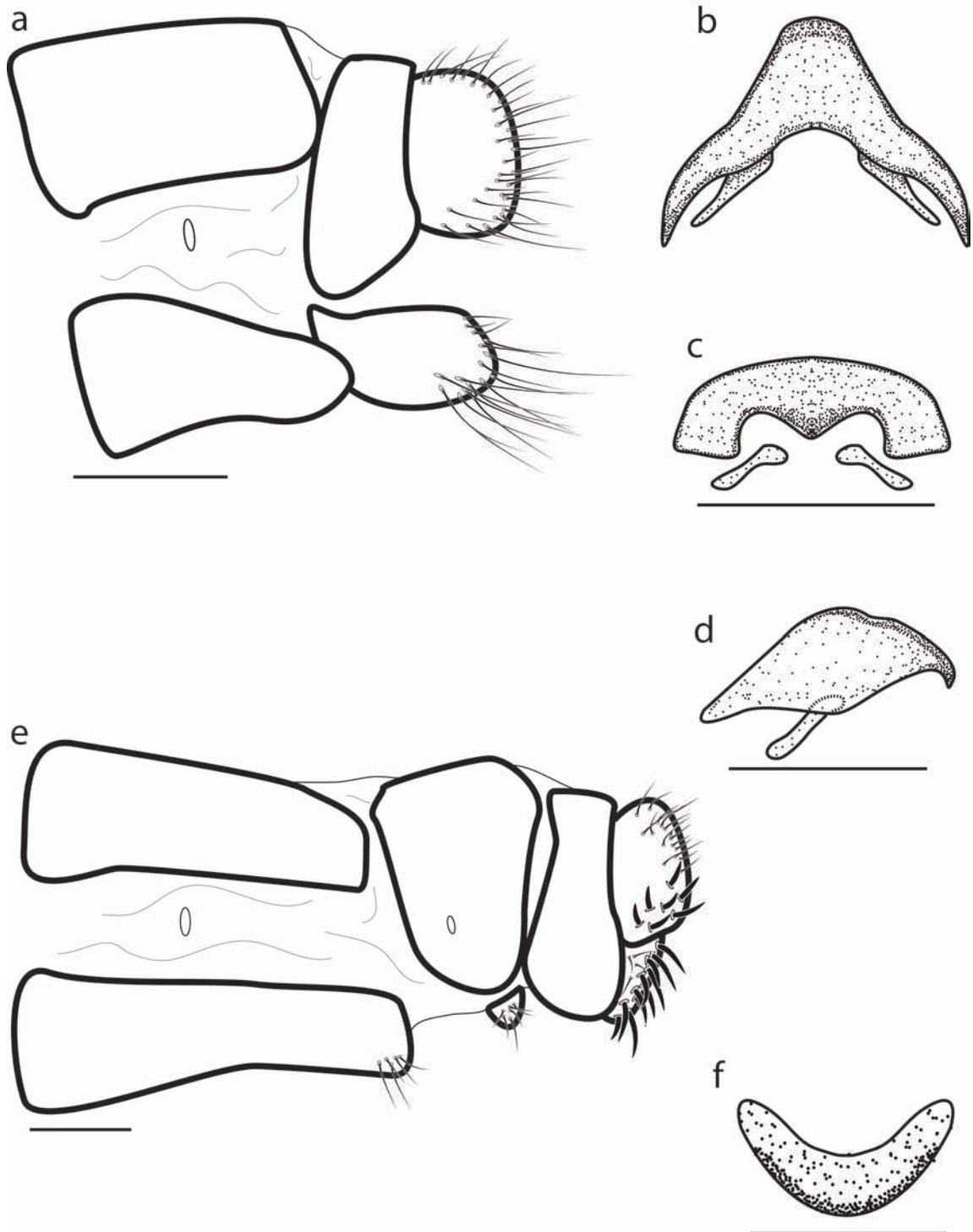


Figure A4.55: *Aurantileon pingrupensis*: male: a) terminalia, lateral; b) genitalia, dorsal; c) genitalia, posterior; d) genitalia, lateral; female: e) terminalia, lateral; f) pregenital plate, posterior. Scale bars = 500 μ m.

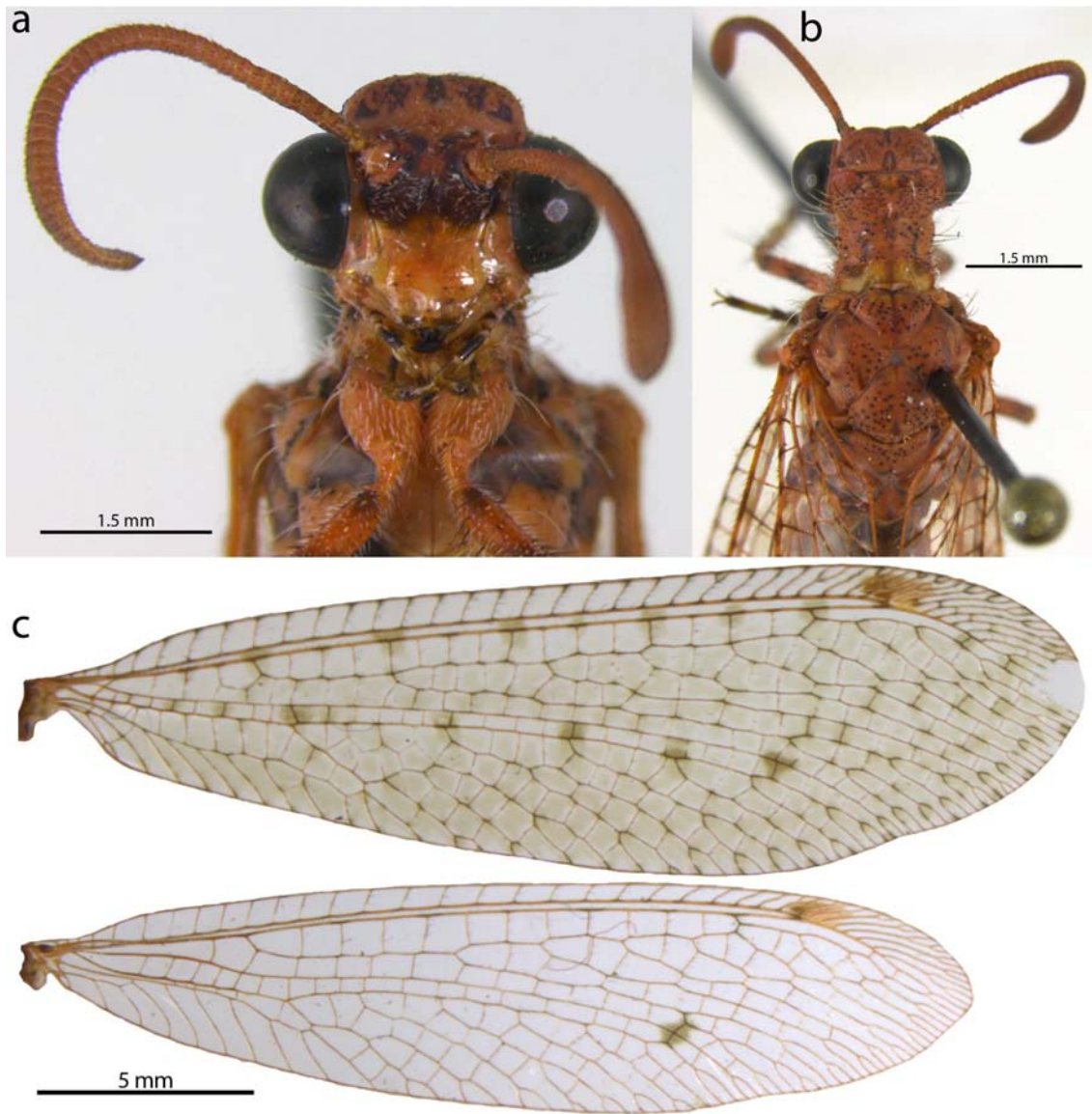


Figure A4.56: *Aurantileon punctatus* n. sp.: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

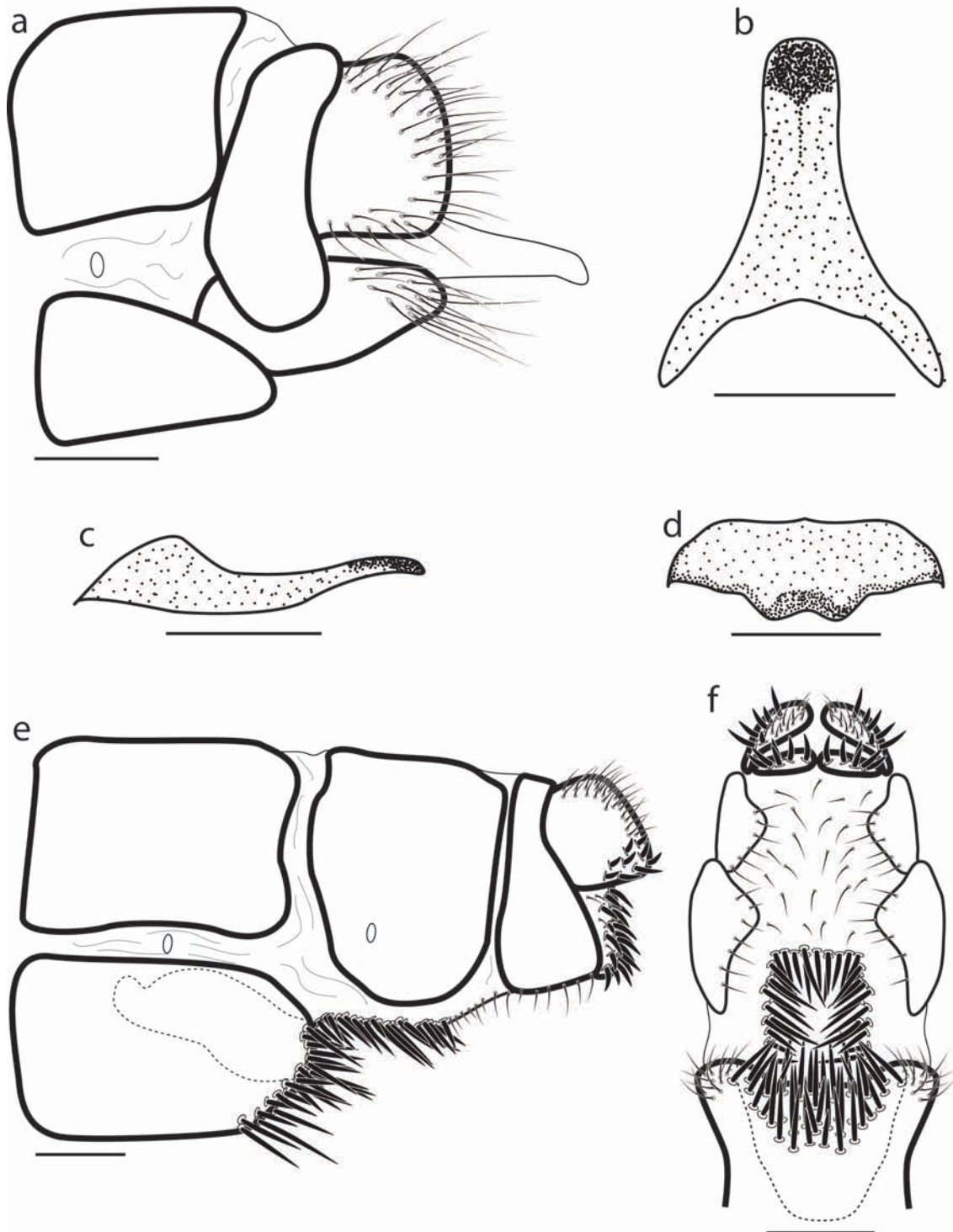


Figure A4.57: *Aurantileon punctatus* n. sp.: male: a) terminalia, lateral; b) genitalia, dorsal; c) genitalia, lateral; d) genitalia, posterior; female: e) terminalia, lateral; f) terminalia, ventral. Scale bars = 500 μ m.

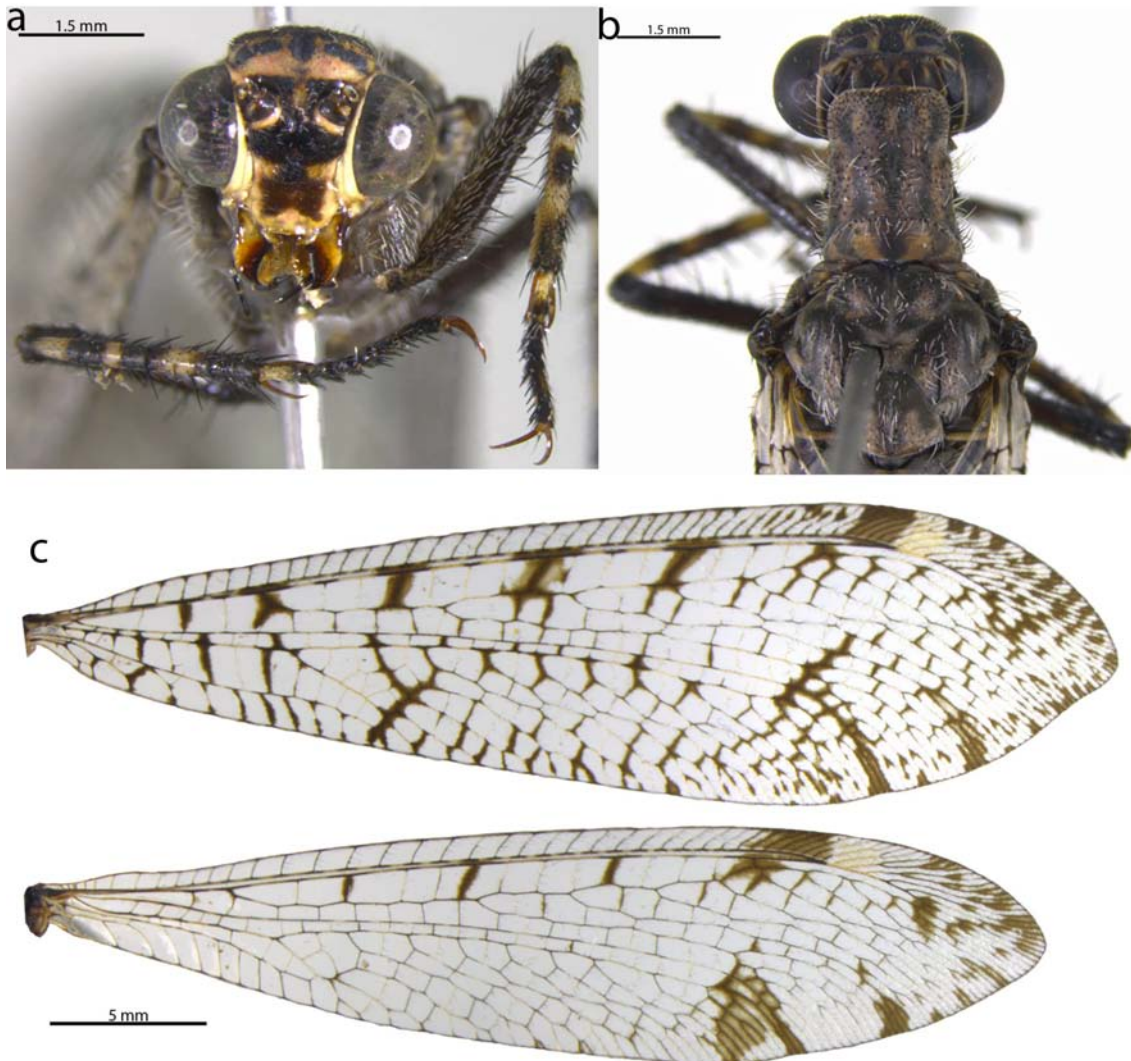


Figure A4.58: *Aurantileon radialis*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

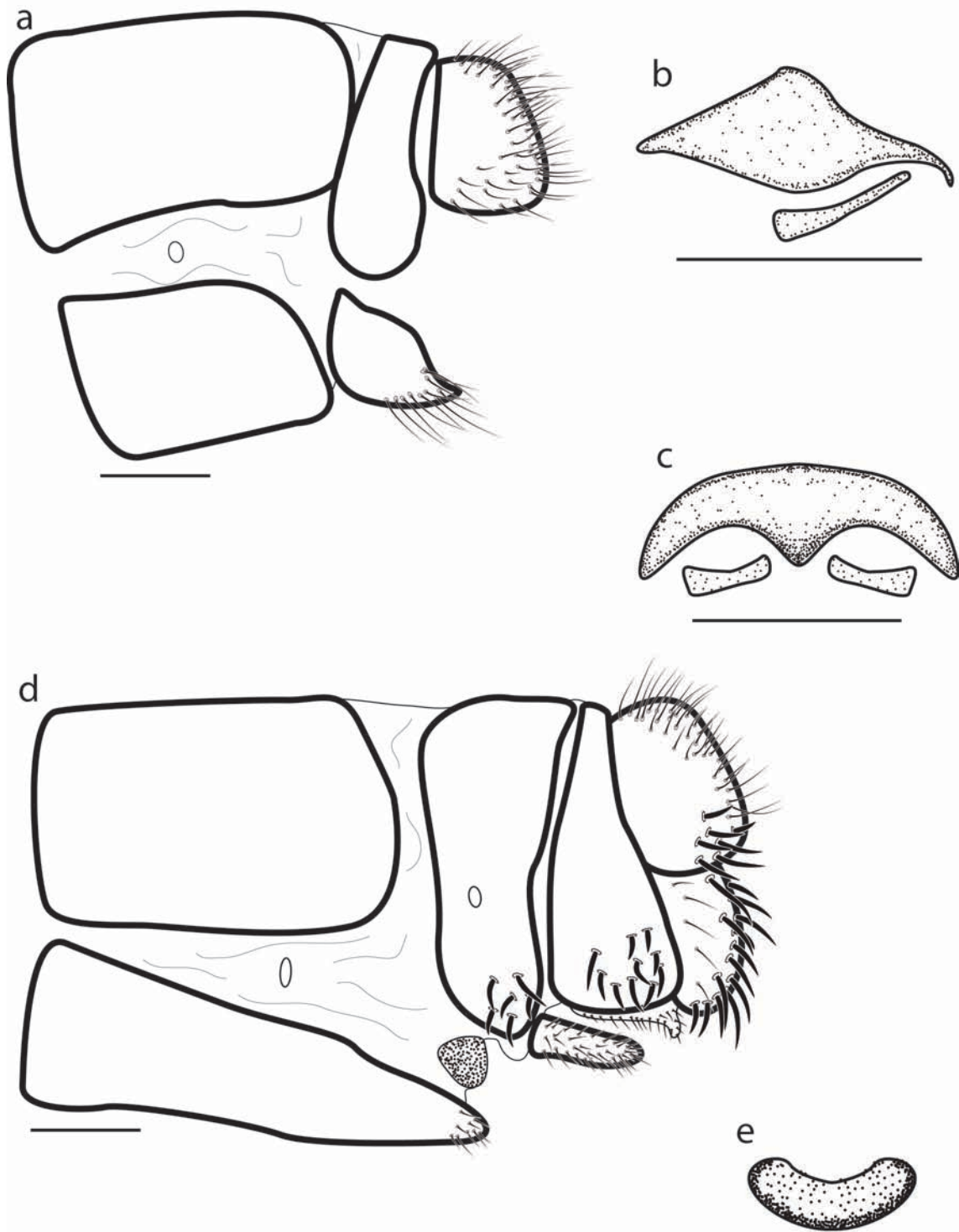


Figure A4.59: *Aurantileon radialis*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; female: d) terminalia, lateral; e) pregenital plate, posterior. Scale bars = 500 μ m.



Figure A4.60: *Aurantileon roseipennis*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

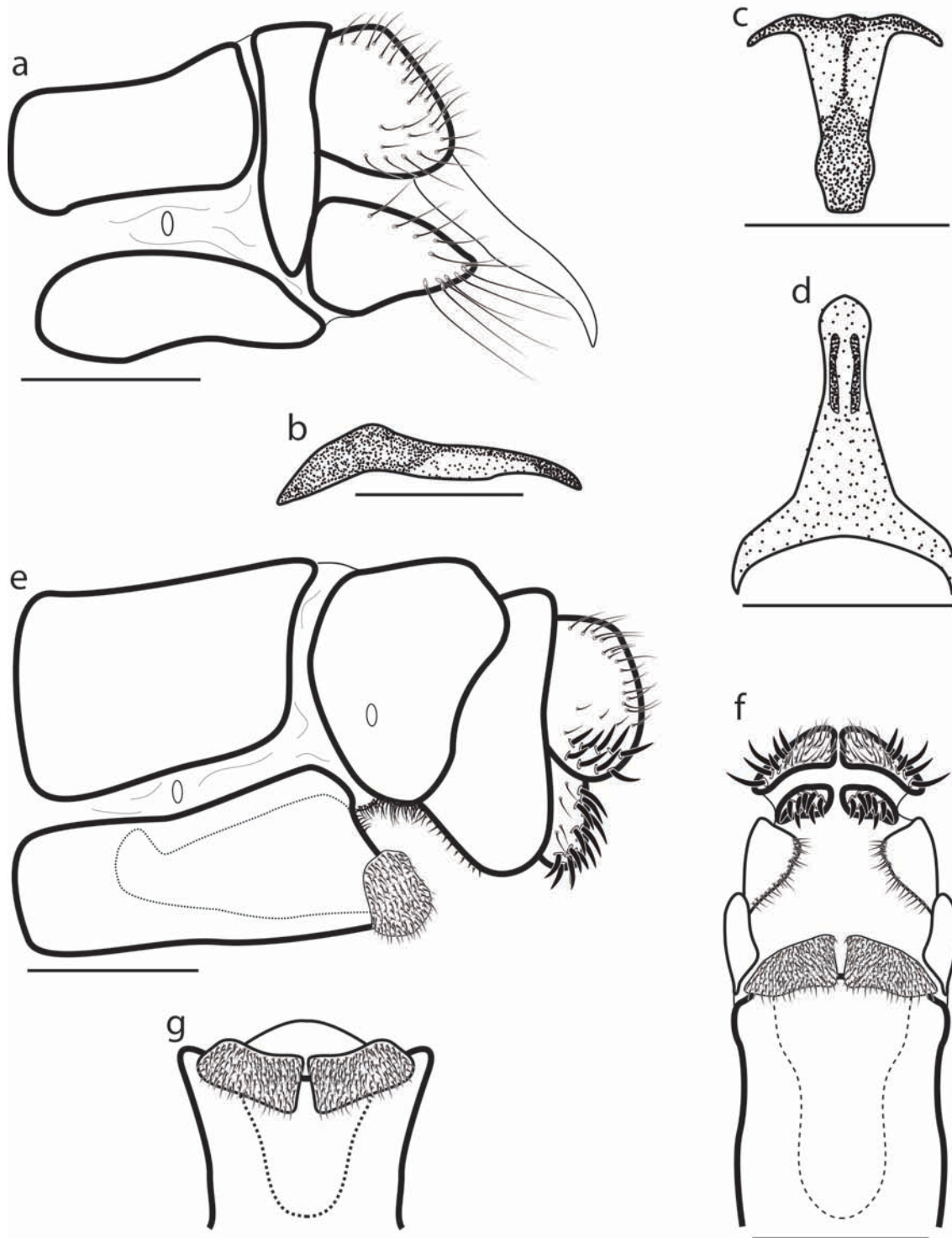


Figure A4.61: *Aurantileon roseipennis*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterodorsal; d) genitalia, ventral; female: e) terminalia, lateral; f) terminalia, ventral; g) 7th sternite and pregenital plate, posteroventral. Scale bars = 1mm.



Figure A4.62: *Aurantileon stigmatus*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

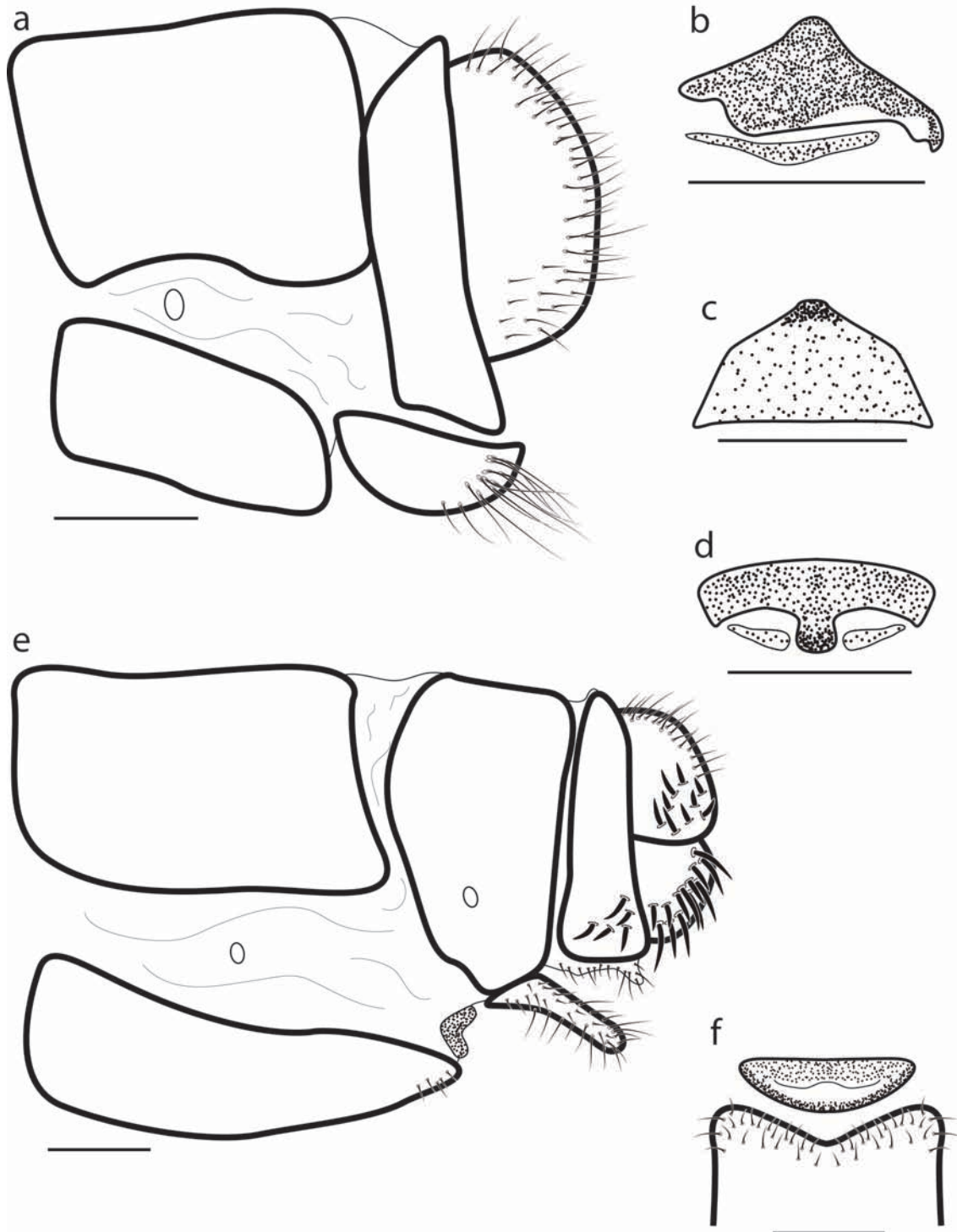


Figure A4.63: *Aurantileon stigmatus*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, dorsal; d) genitalia, posterior; female: e) terminalia, lateral; f) 7th sternite and pregenital plate, ventral. Scale bars = 500 μ m.

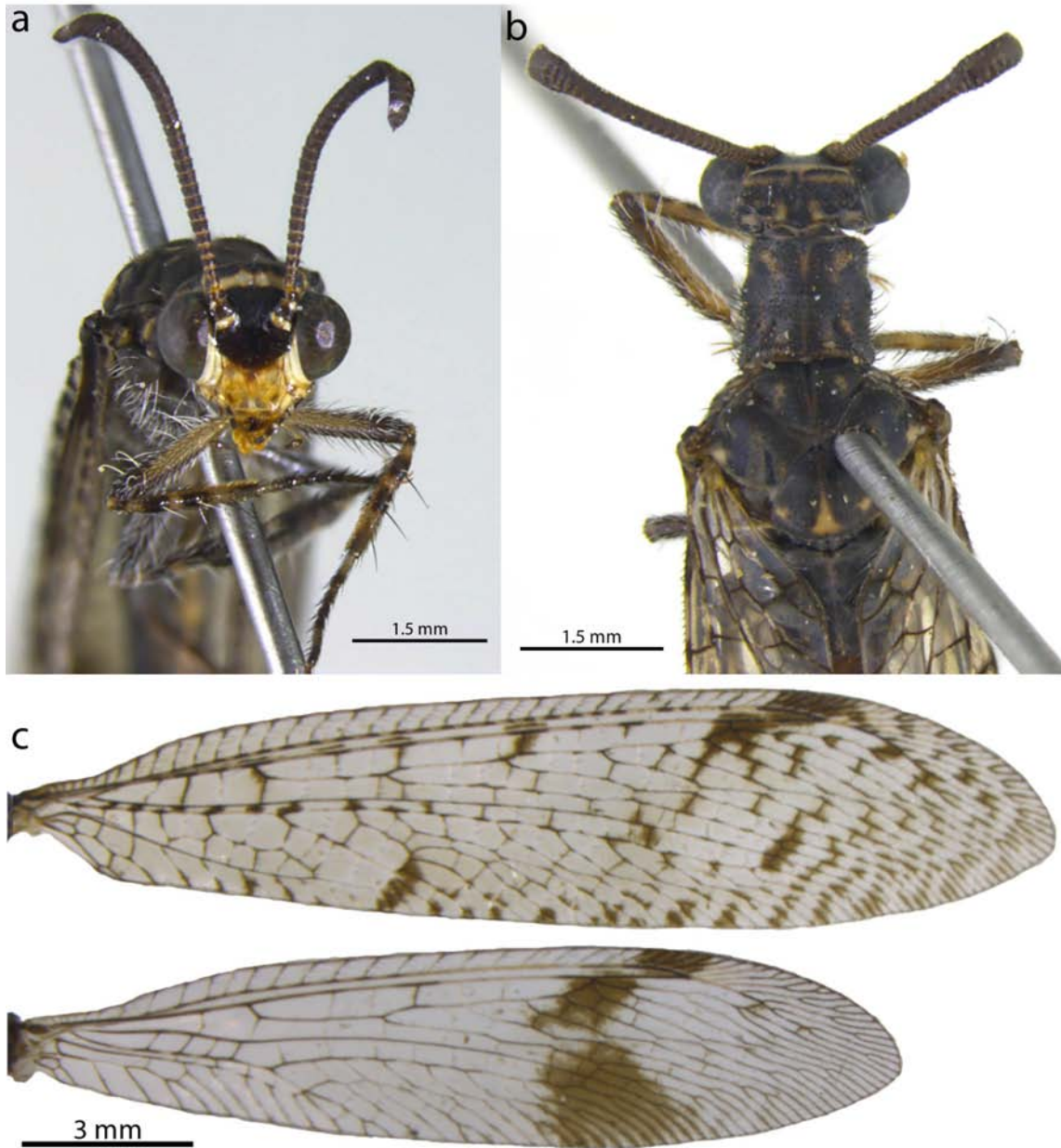


Figure A4.64: *Austrogymnocrania arcuata*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

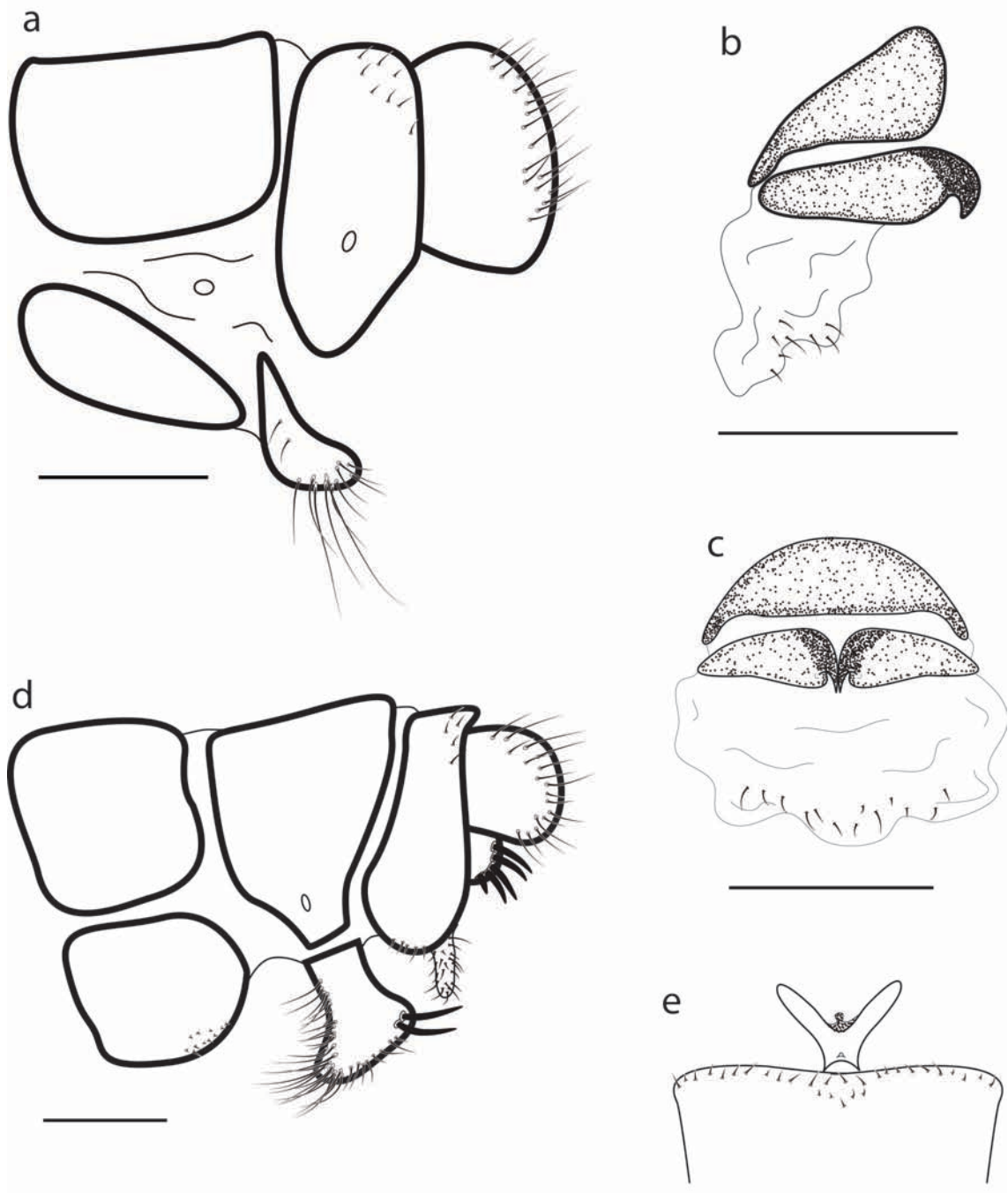


Figure A4.65: *Austrogymnocnemia arcuata*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; female: d) terminalia, lateral; e) 7th sternite and pregenital plate, ventral. Scale bars = 500 μ m.

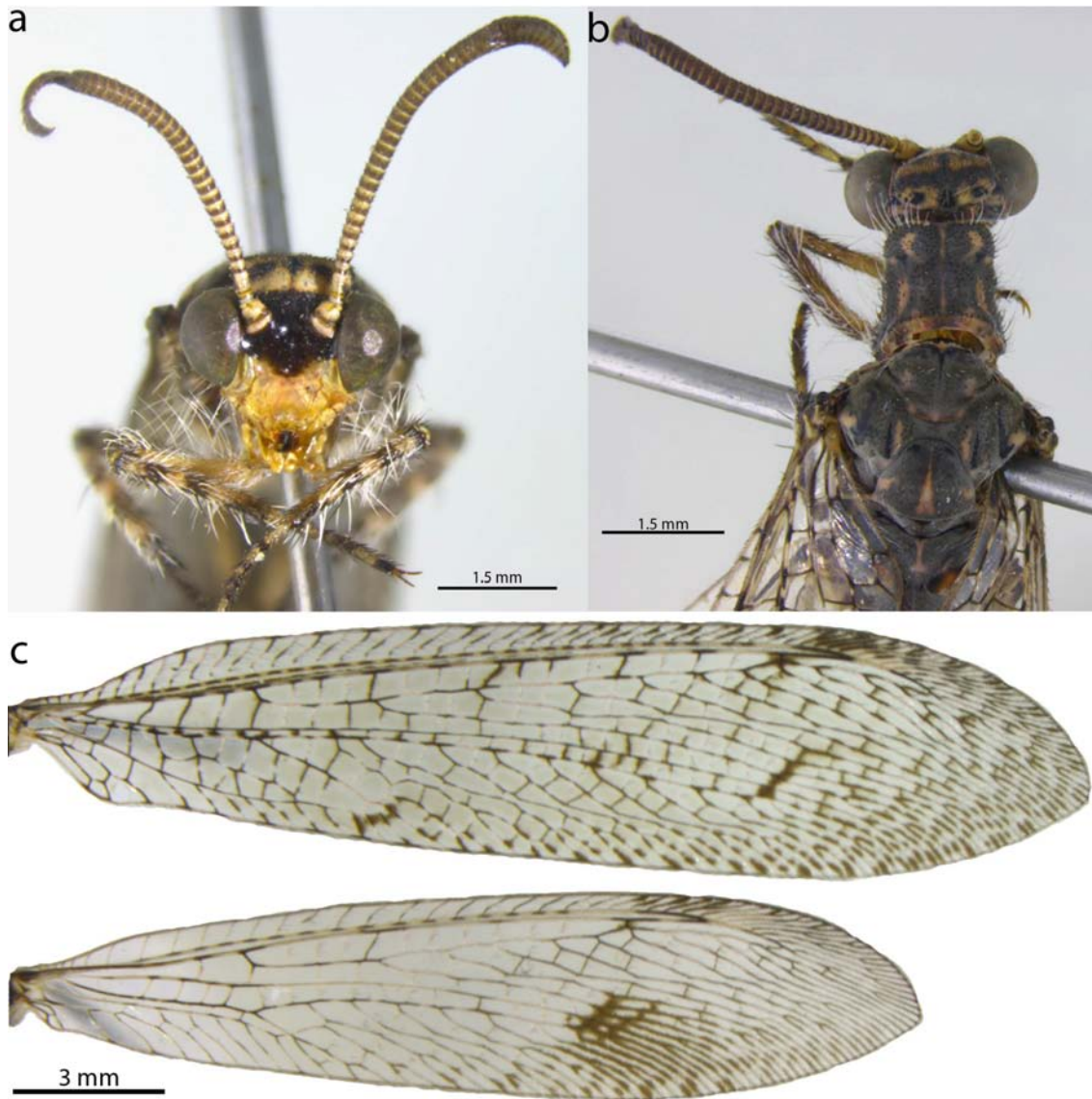


Figure A4.66: *Austrogymnocrania bipunctata*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

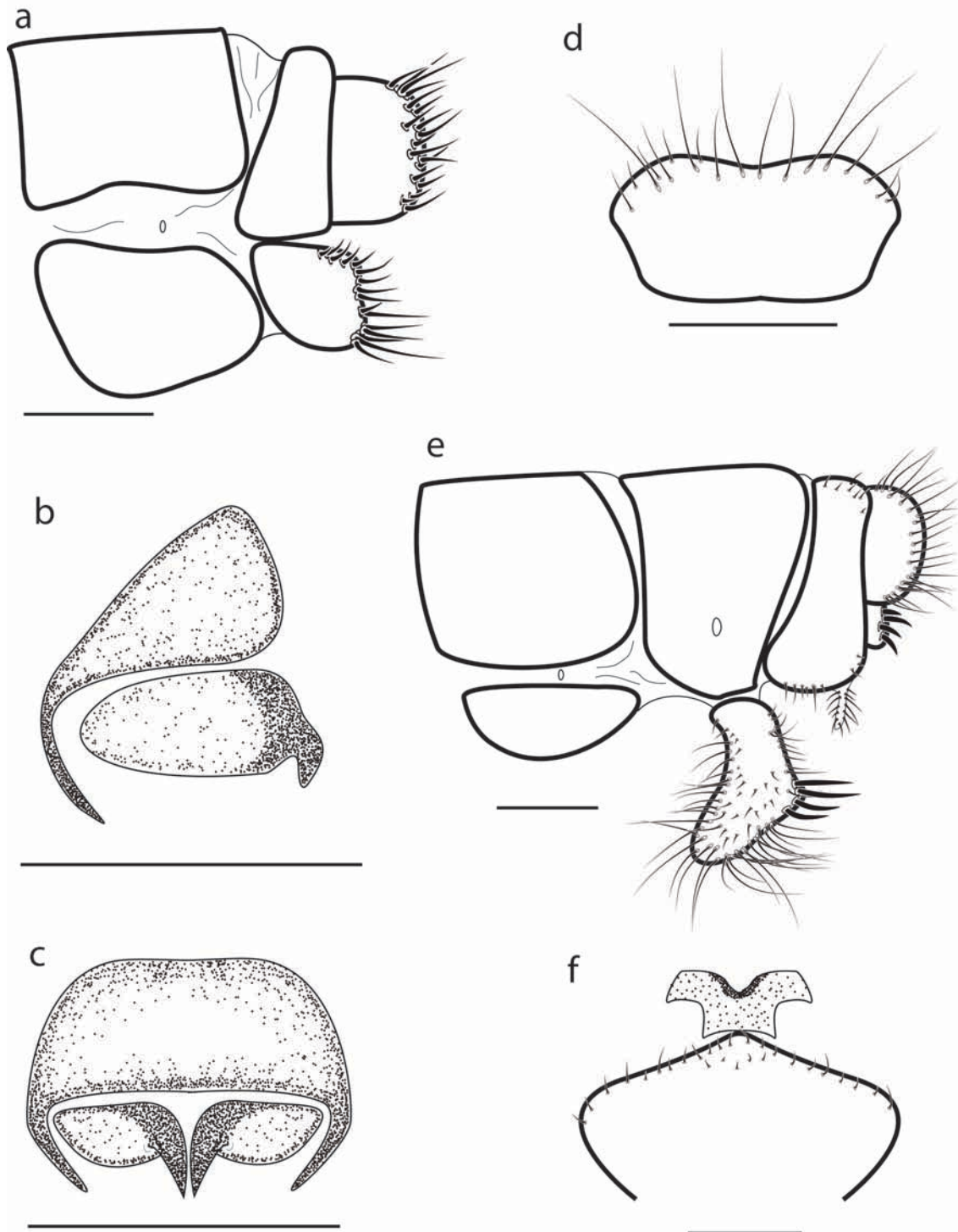


Figure A4.67: *Austrogymnocnemia bipunctata*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; d) 9th sternite, ventral; female: e) terminalia, lateral; f) 7th sternite and pregenital plate, ventral. Scale bars = 500 μ m.



Figure A4.68: *Austrogymnocrania forcipata*: a) specimen, dorsal; b) fore and hind wing, dorsal (white areas on wings' bases are part of the foam where the specimen is pinned).

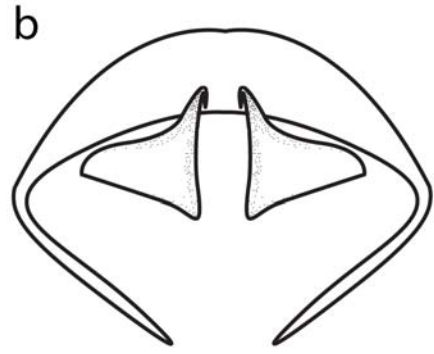
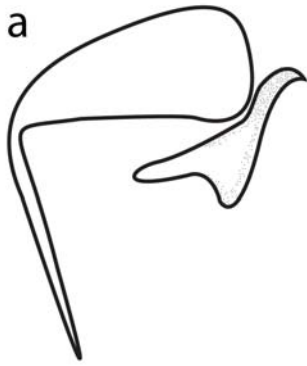


Figure A4.69: *Austrogymnocnemia forcipata*: male: a) genitalia, lateral; b) genitalia, posterior. Scale bars = 500 μ m.

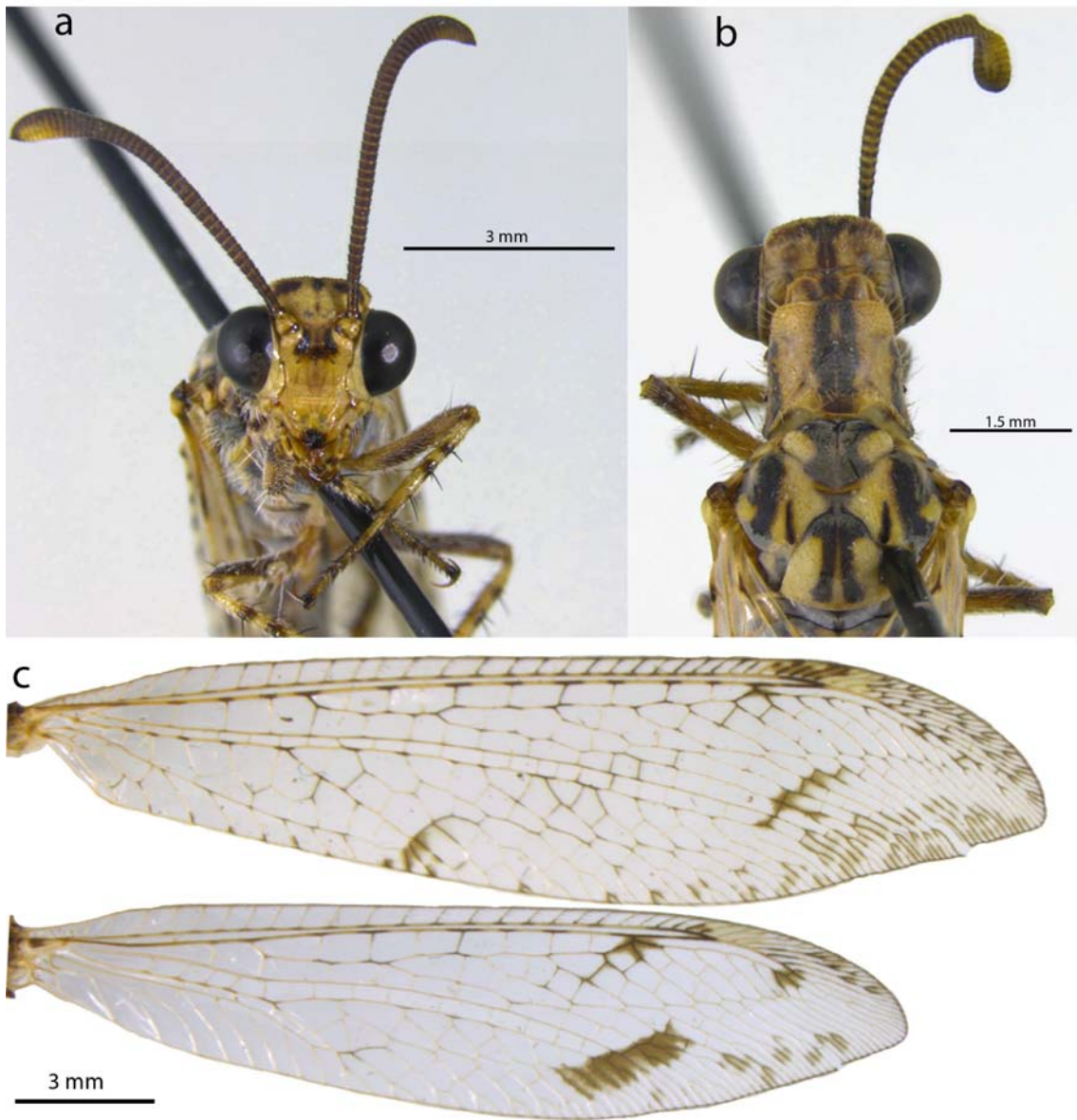


Figure A4.70: *Austrogymnocnemia maculata*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

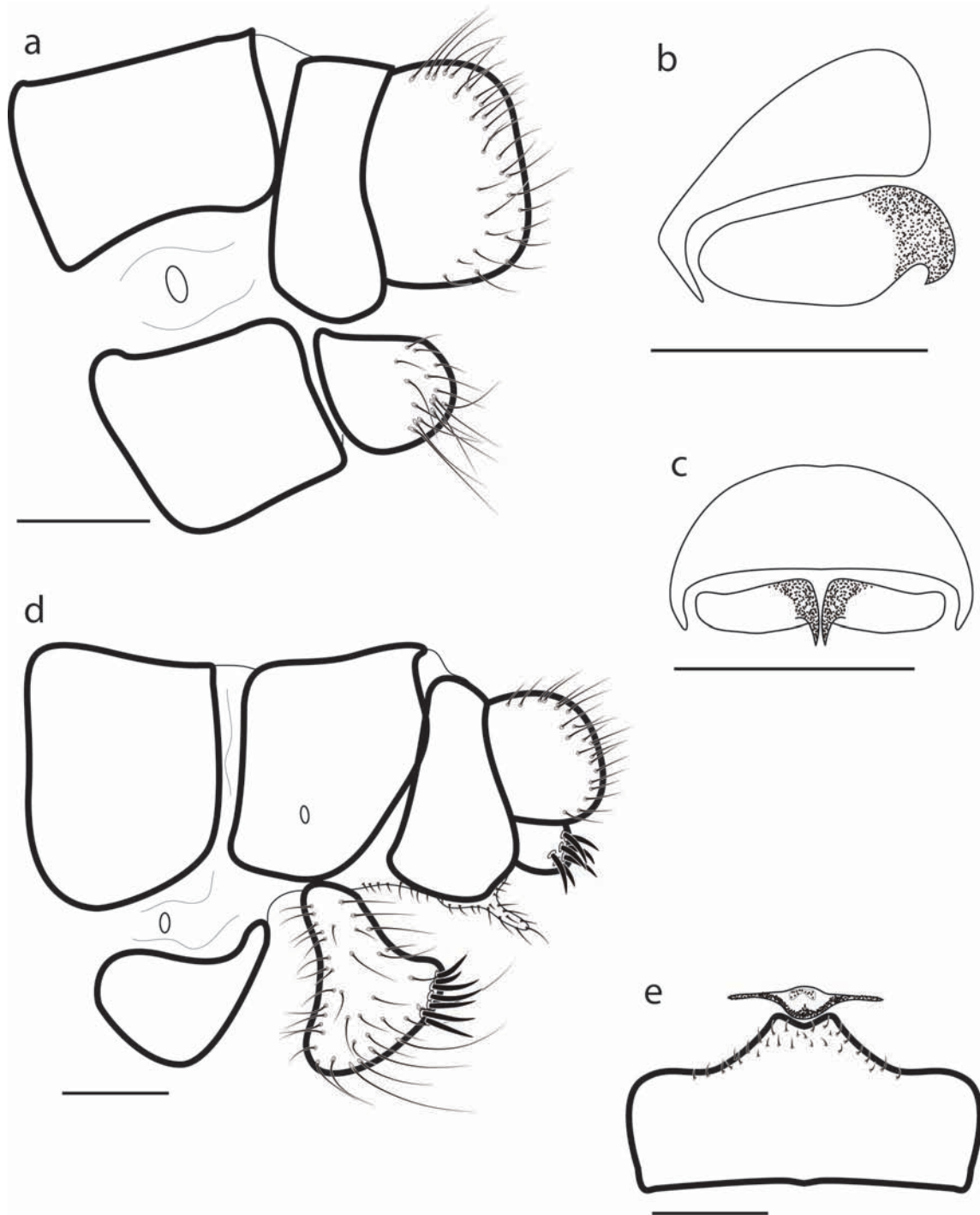


Figure A4.71: *Austrogymnocnemia maculata*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; female: d) terminalia, lateral; e) 7th sternite and pregenital plate, ventral. Scale bars = 500 μ m.

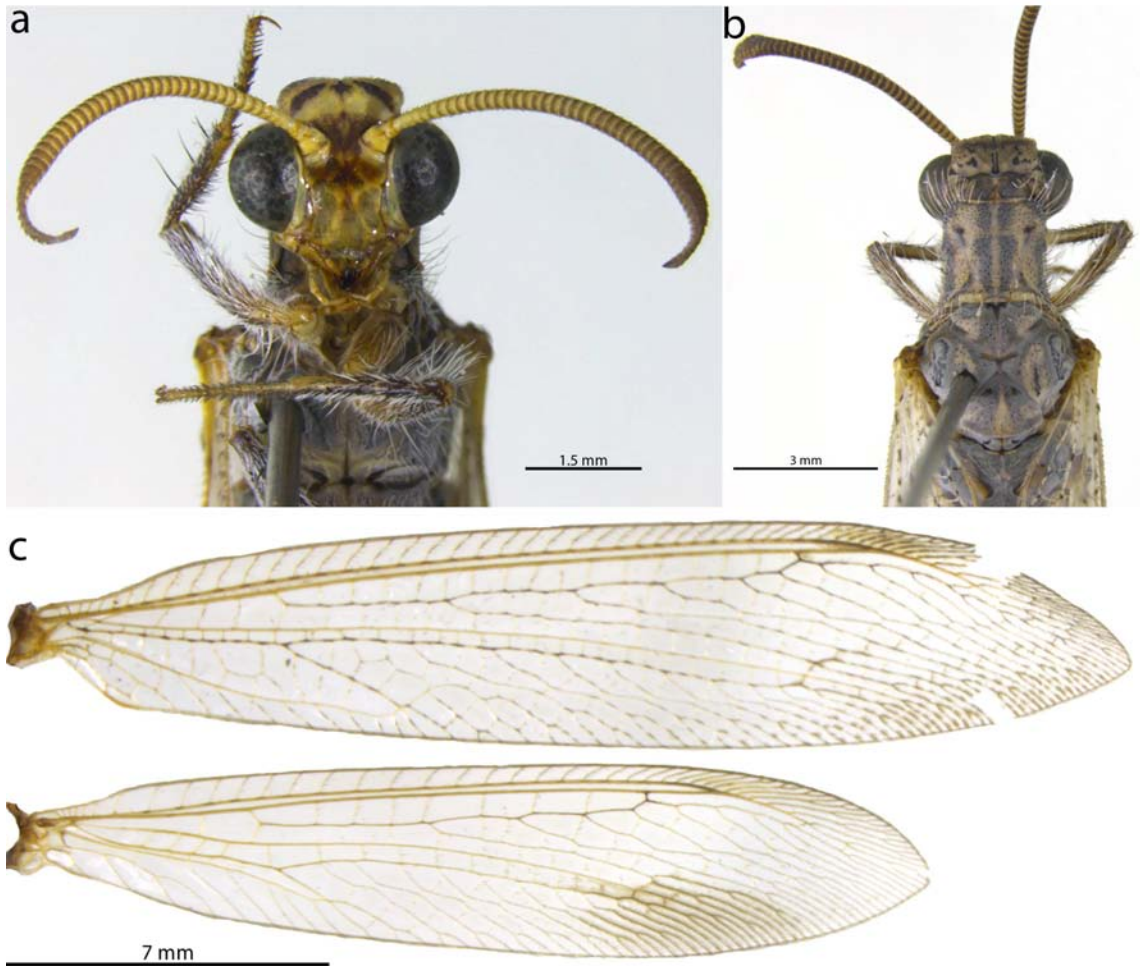


Figure A4.72: *Austrogymnocrania pallida*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

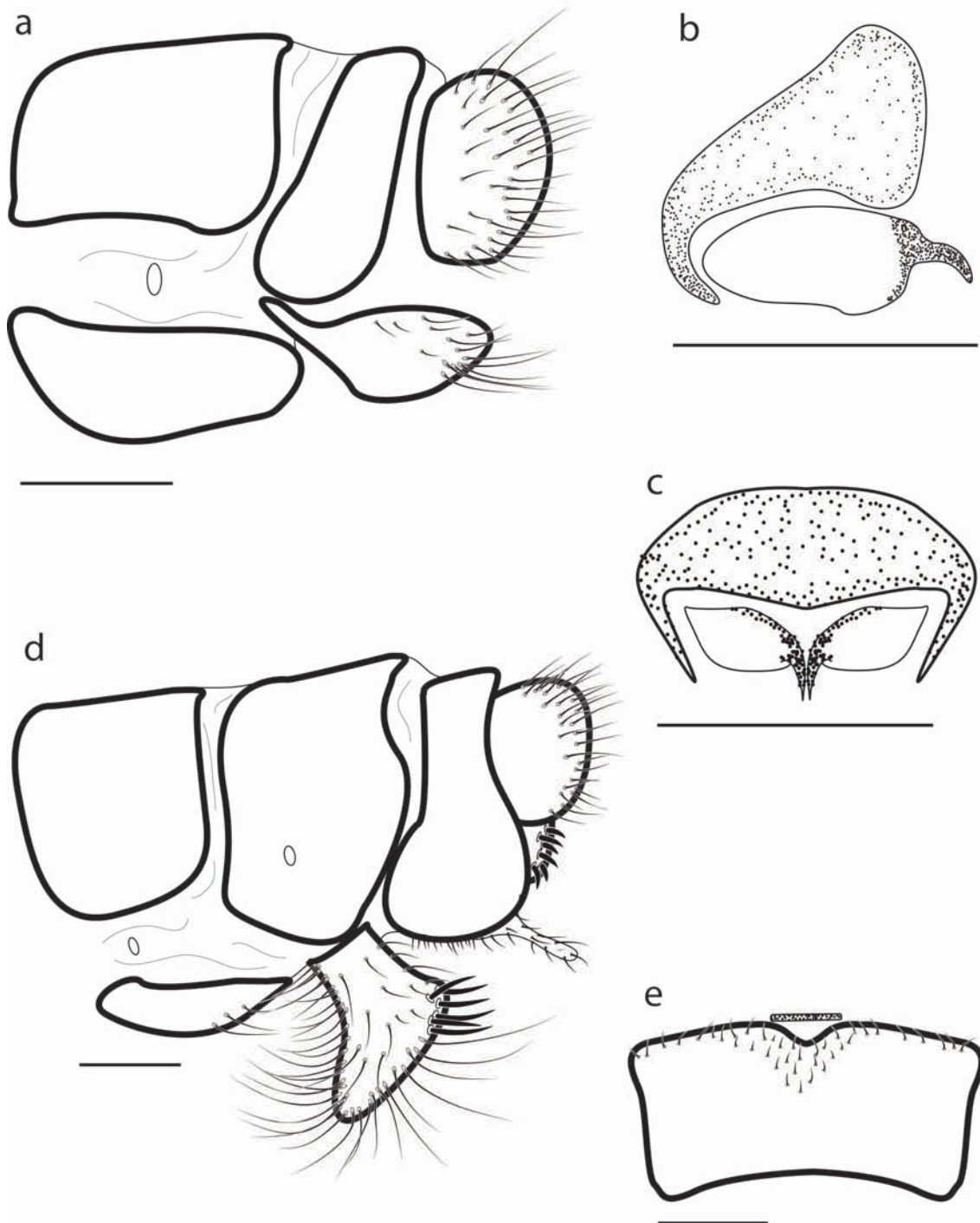


Figure A4.73: *Austrogymnocnemia pallida*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; female: d) terminalia, lateral; e) 7th sternite and pregenital plate, ventral. Scale bars = 500 μ m.



Figure A4.74: *Austrogymnocnemia pseudomaculata* n. sp.: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

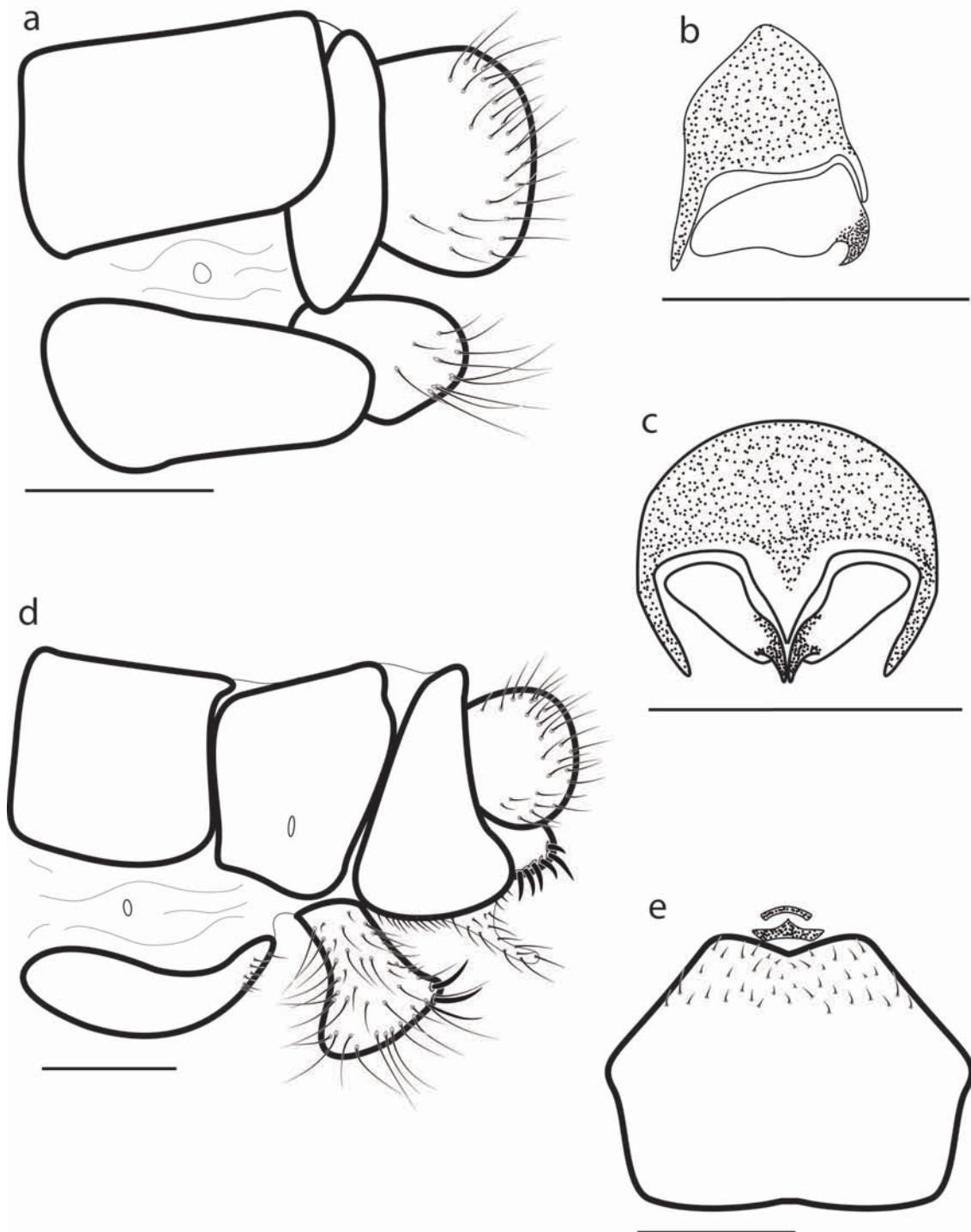


Figure A4.75: *Austrogymnocnemia pseudomaculata* n. sp.: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; female: d) terminalia, lateral; e) 7th sternite and pregenital plate, ventral. Scale bars = 500 μ m.



Figure A4.76: *Ceratoleon brevicornis*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

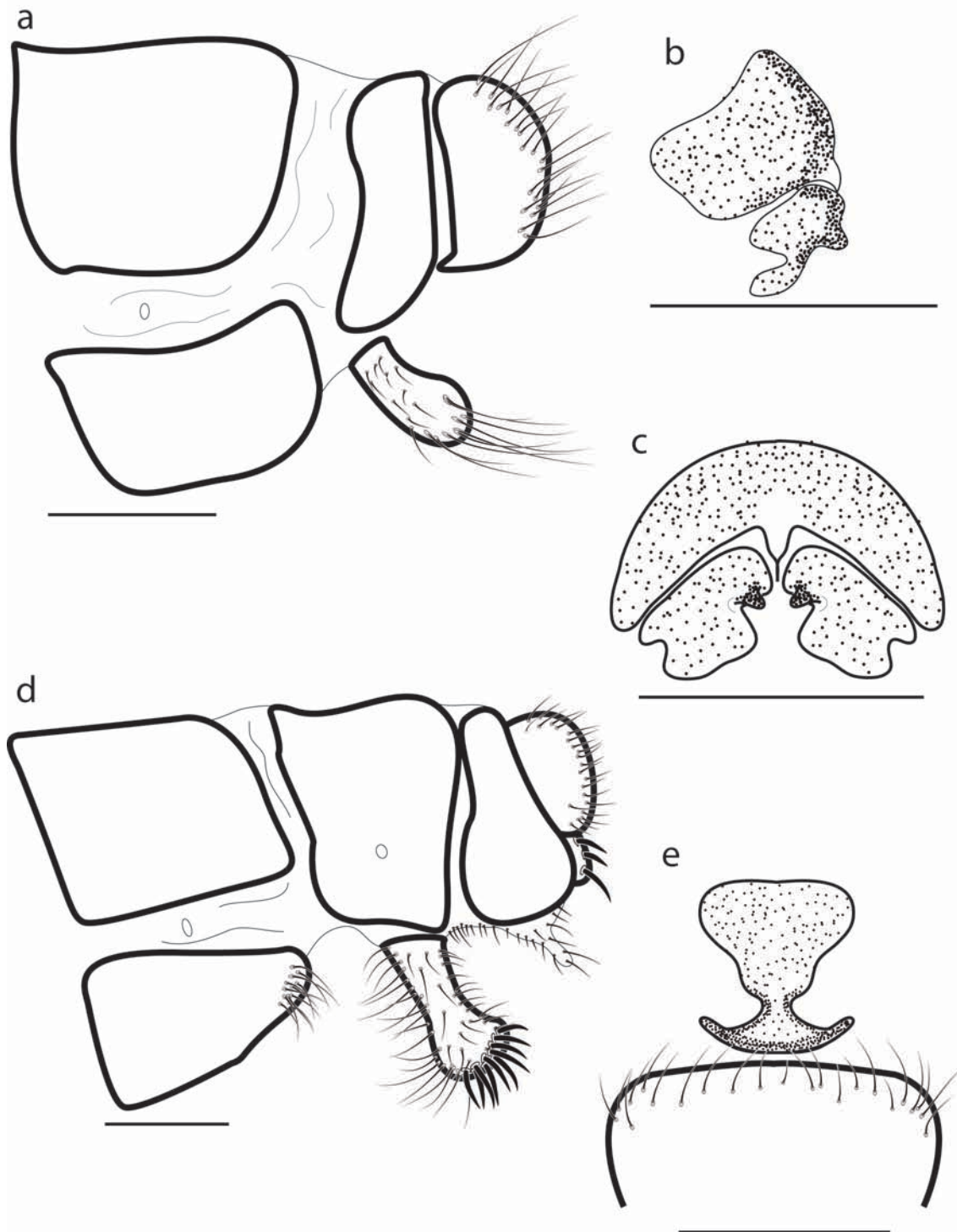


Figure A4.77: *Ceratoleon brevicornis*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; female: d) terminalia, lateral; e) 7th sternite and pregenital plate, ventral. Scale bars = 500 μ m.

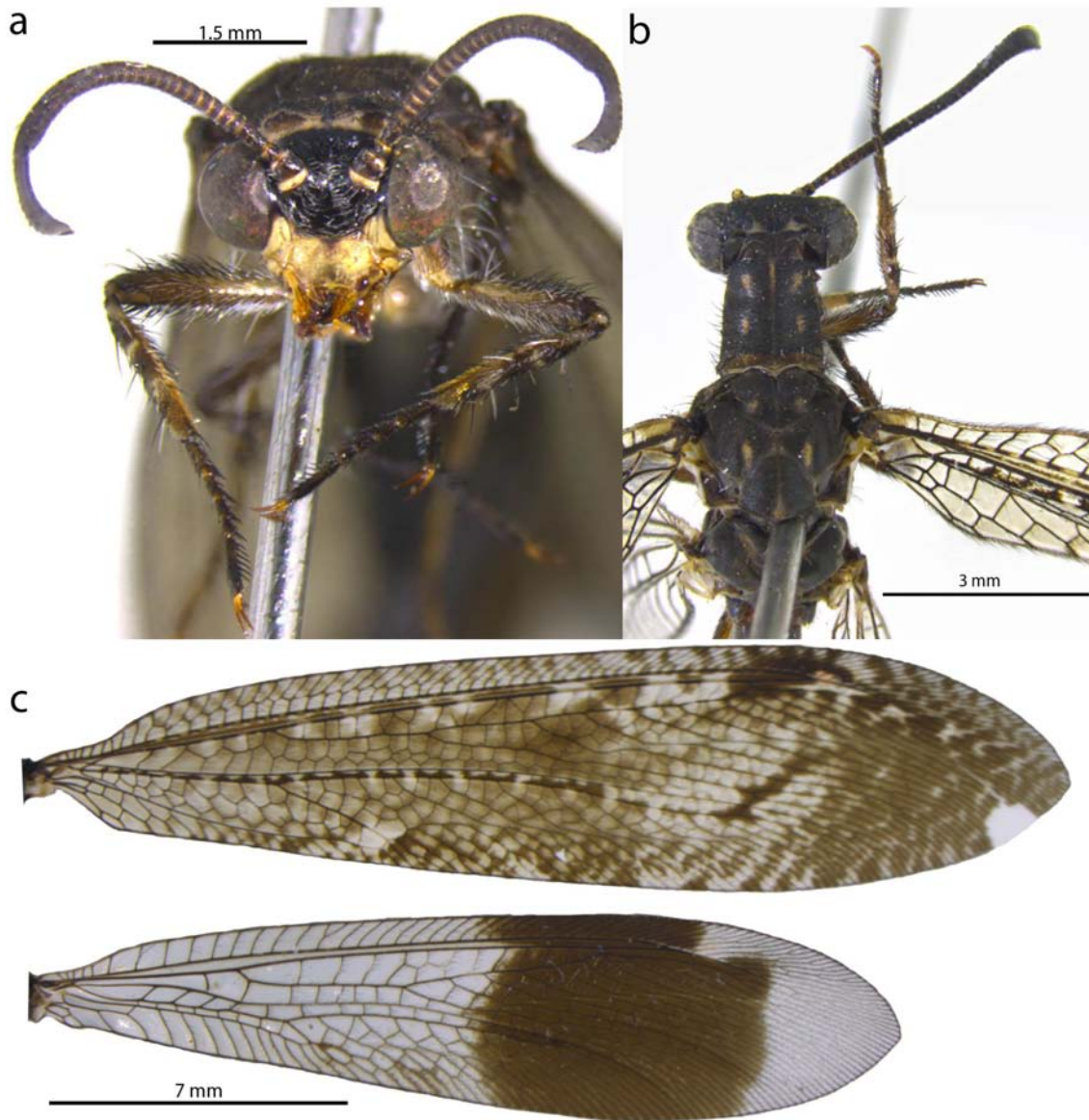


Figure A4.78: *Ceratoleon mjobergi*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

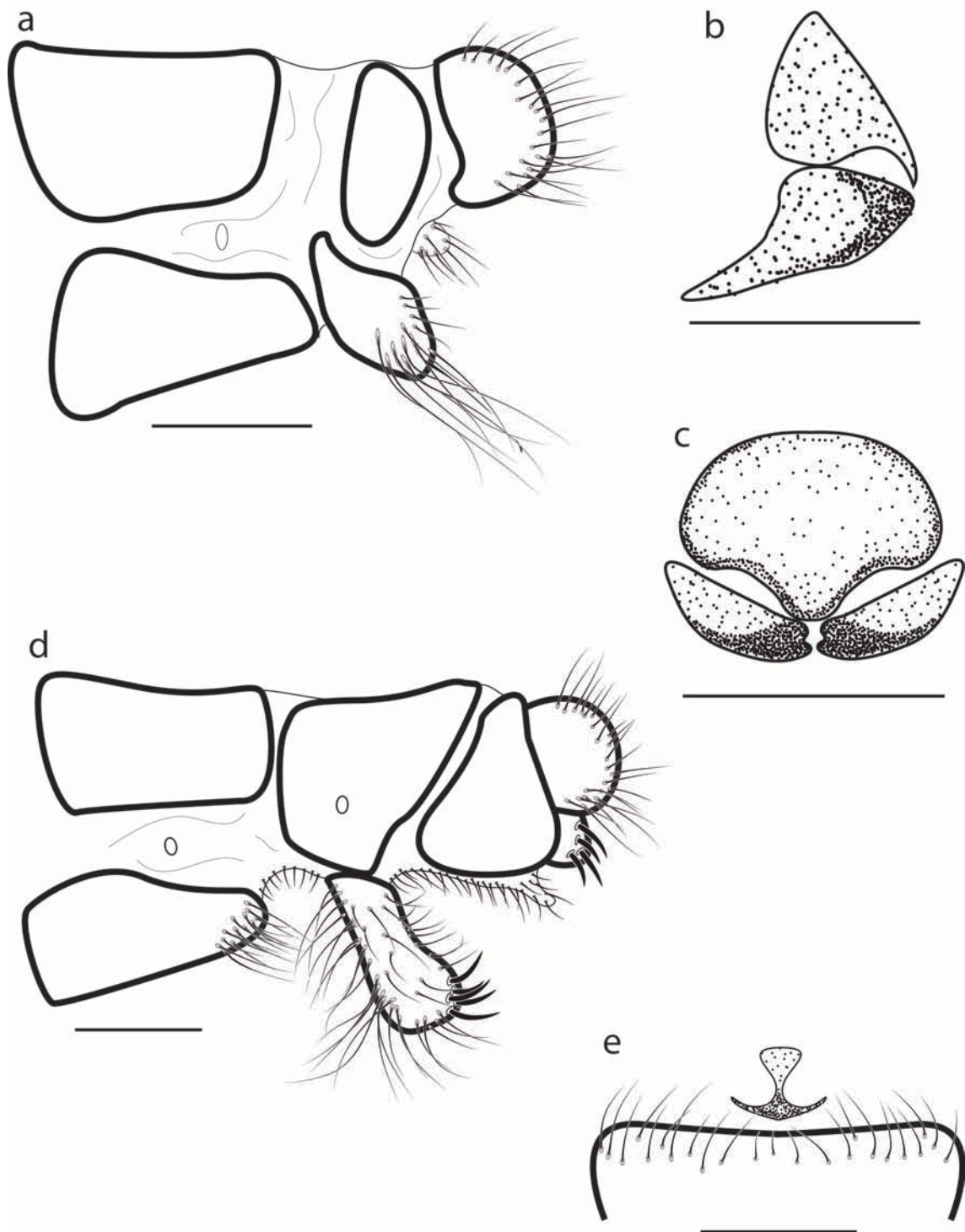


Figure A4.79: *Ceratoleon mjobergi*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; female: d) terminalia, lateral; e) 7th sternite and pregenital plate, ventral. Scale bars = 500 μ m.

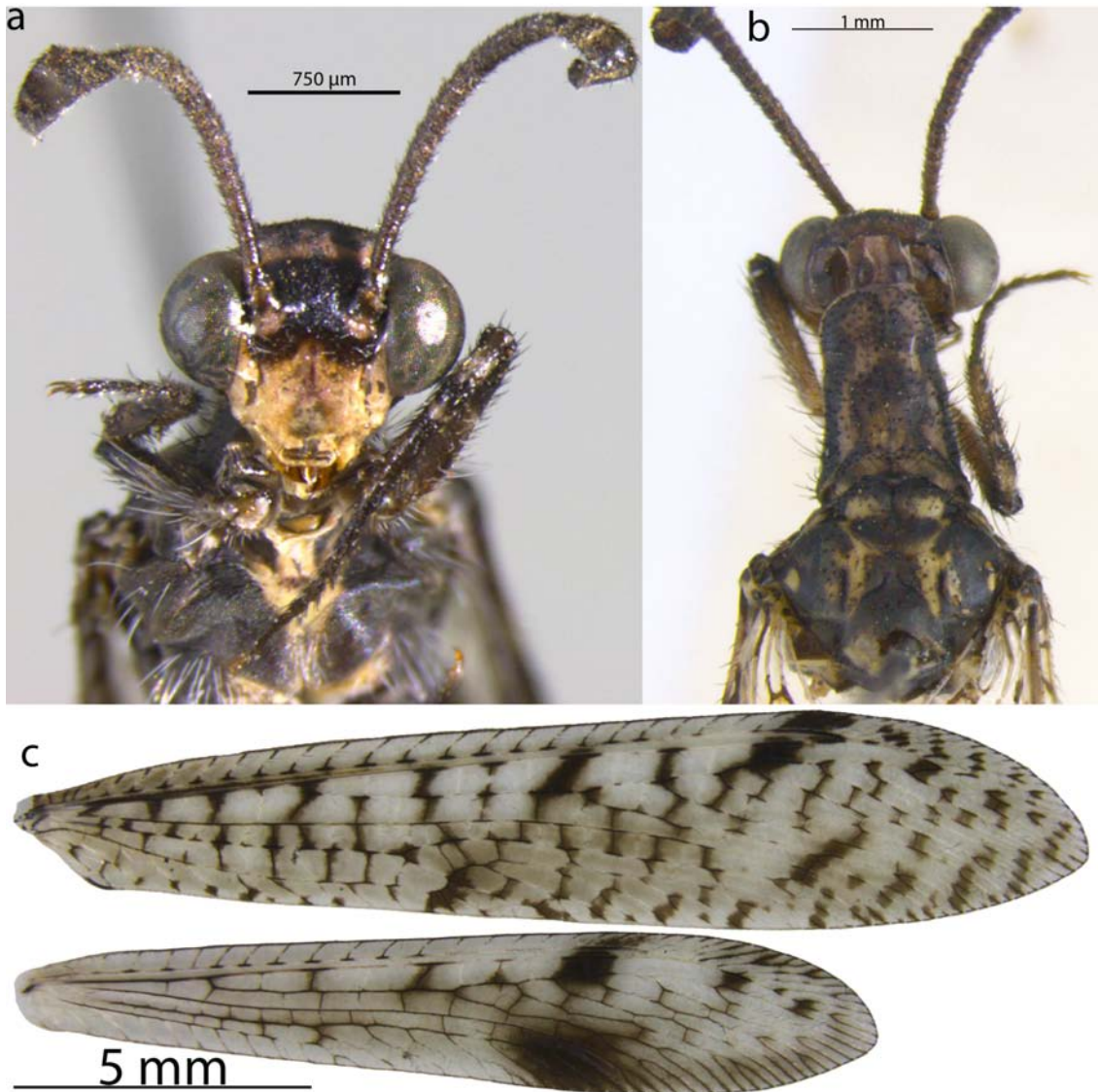


Figure A4.80: *Fossorioleon distivenus* n. sp.: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

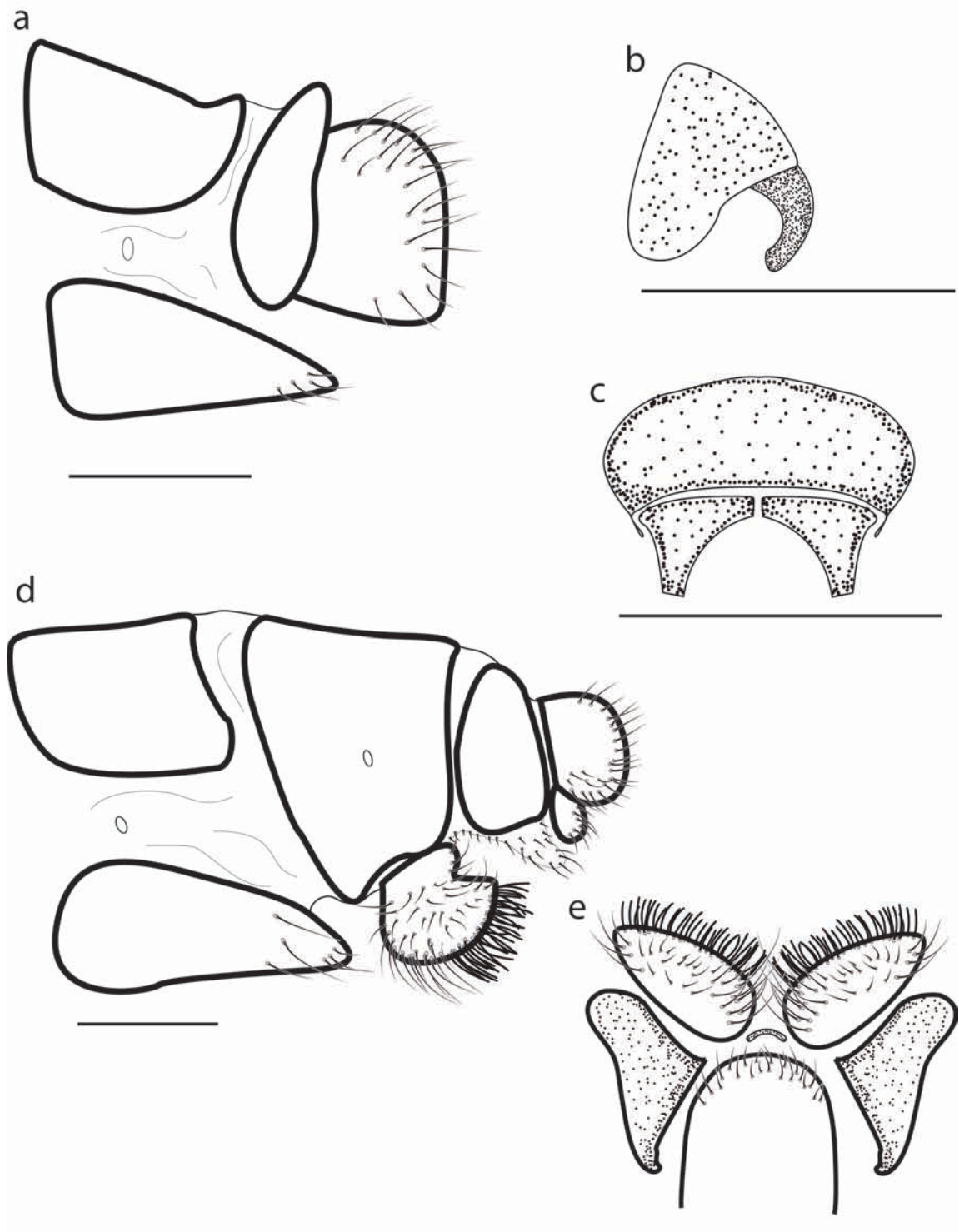


Figure A4.81: *Fossorioleon distivenus* n. sp.: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; female: d) terminalia, lateral; e) terminalia, ventral. Scale bars = 500µm.

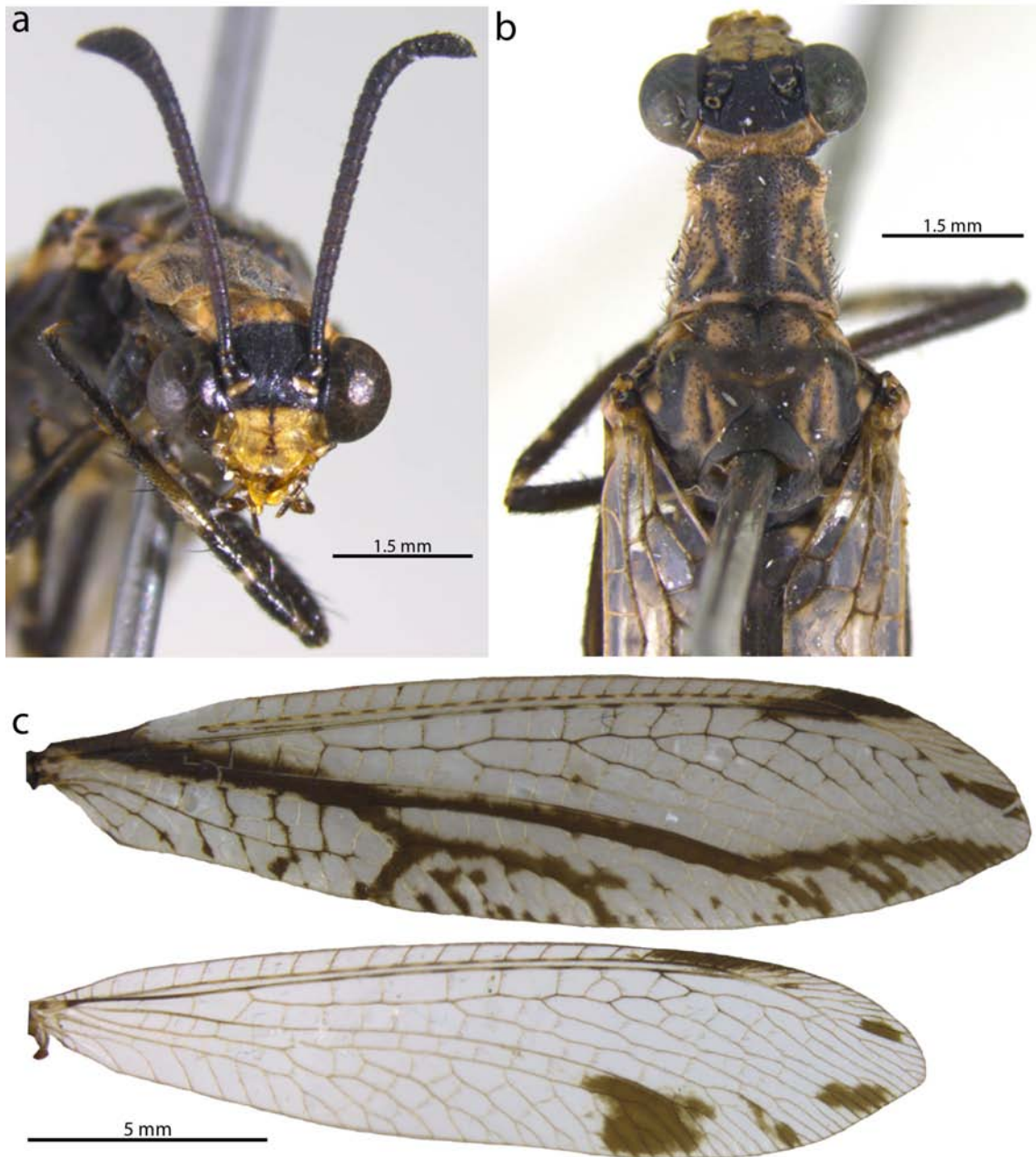


Figure A4.82: *Fossorioleon edwardsi*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

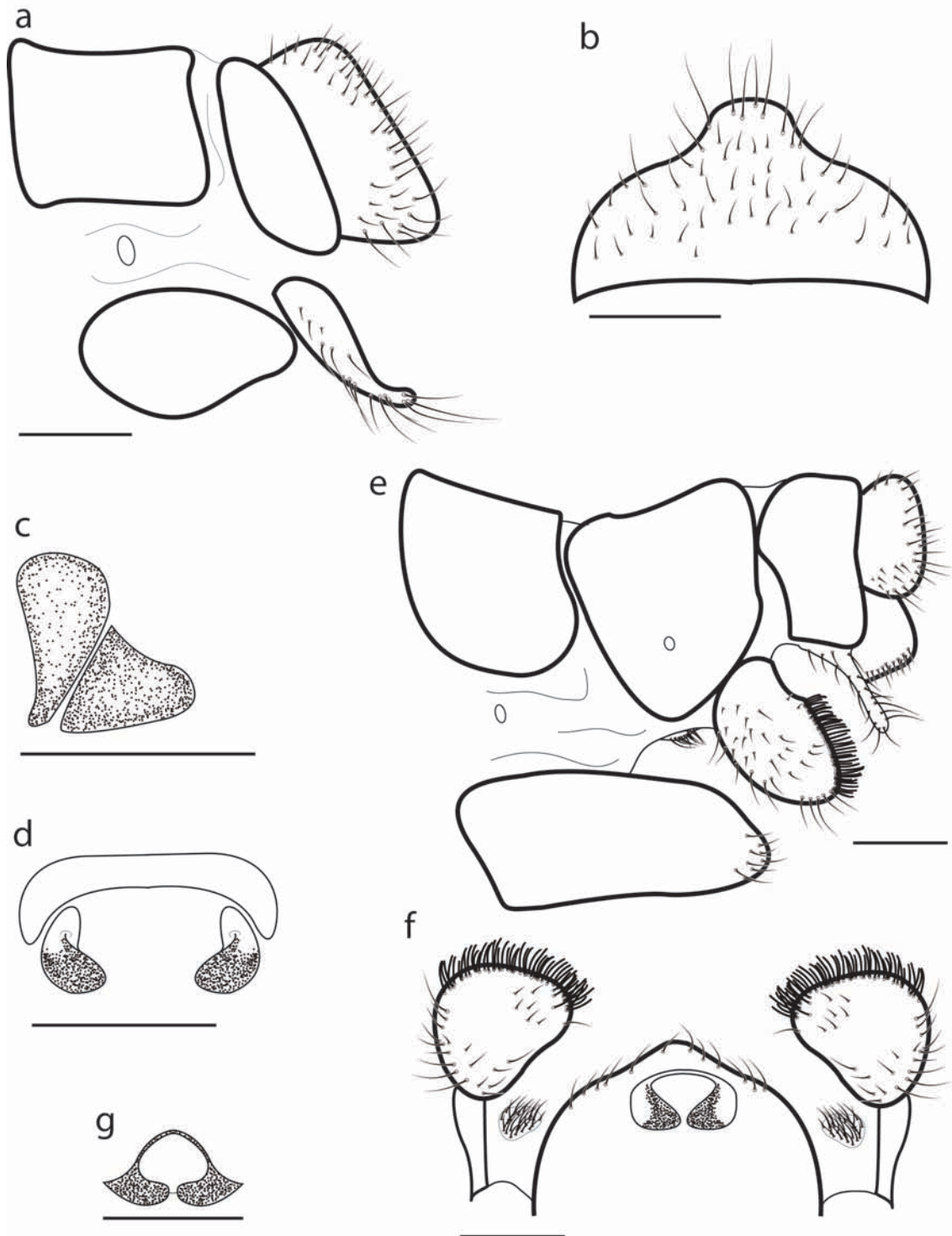


Figure A4.83: *Fossorioleon edwardsi*: male: a) terminalia, lateral; b) 9th sternite, ventral; c) genitalia, lateral; d) genitalia, posterior; female: e) terminalia, lateral; f) terminalia, ventral, showing the pregenital plate hidden beneath the sternite; g) pregenital plate, posterior. Scale bars = 500 μ m.

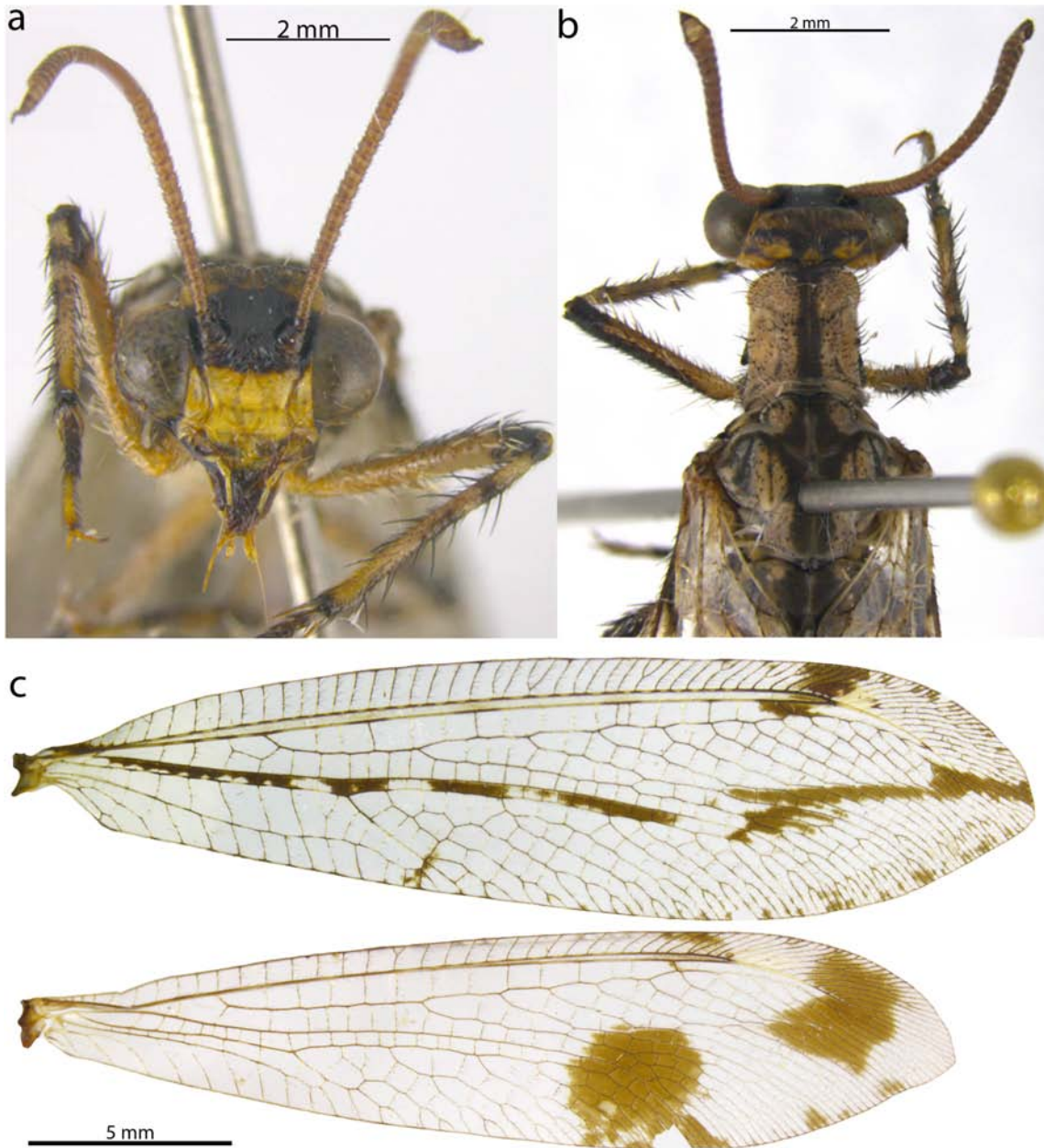


Figure A4.84: *Fossorioleon longitudinalis* n. sp.: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

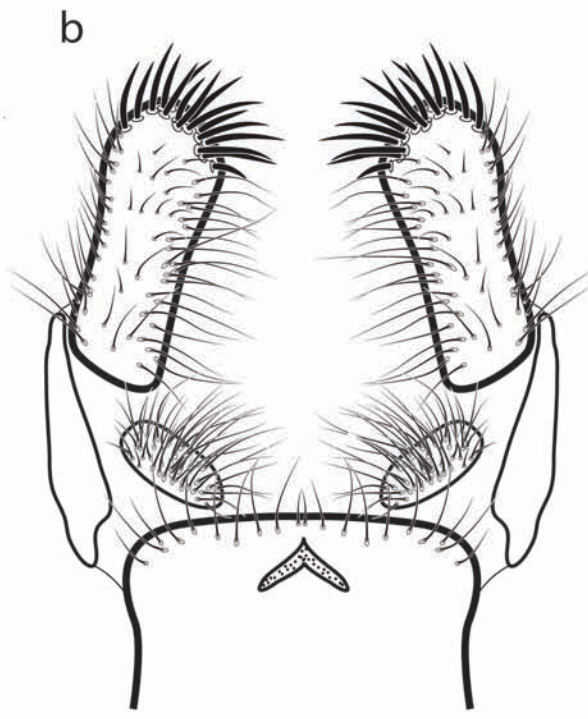
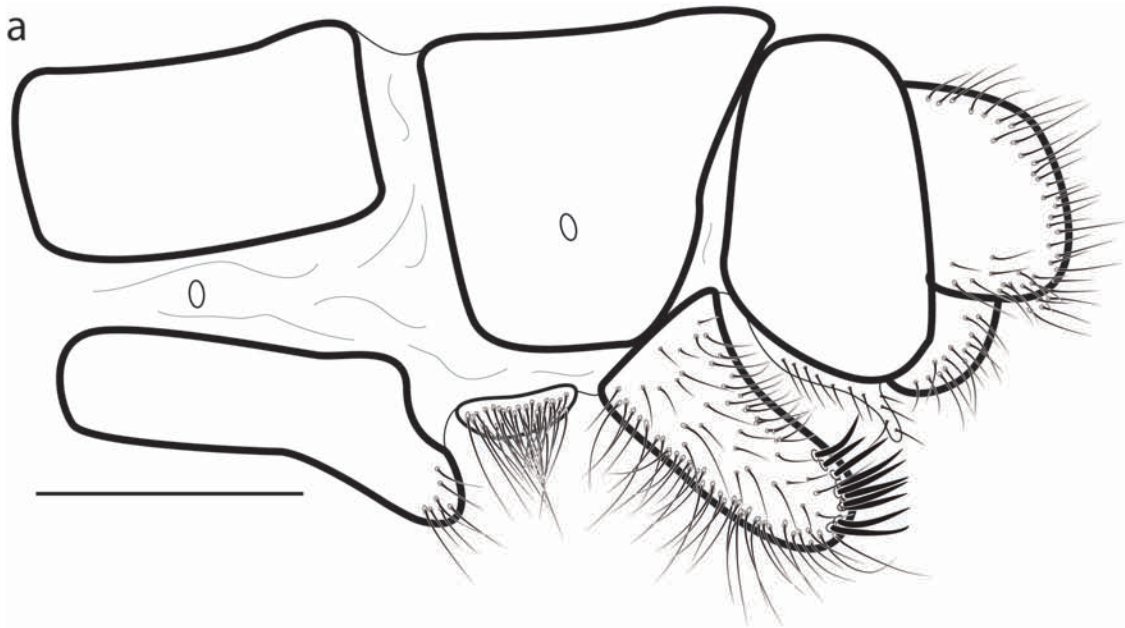


Figure A4.85: *Fossorioleon longitudinalis* n. sp.: female: a) terminalia, lateral; b) terminalia, ventral, showing the pregenital plate hidden beneath the sternite. Scale bars = 1mm.

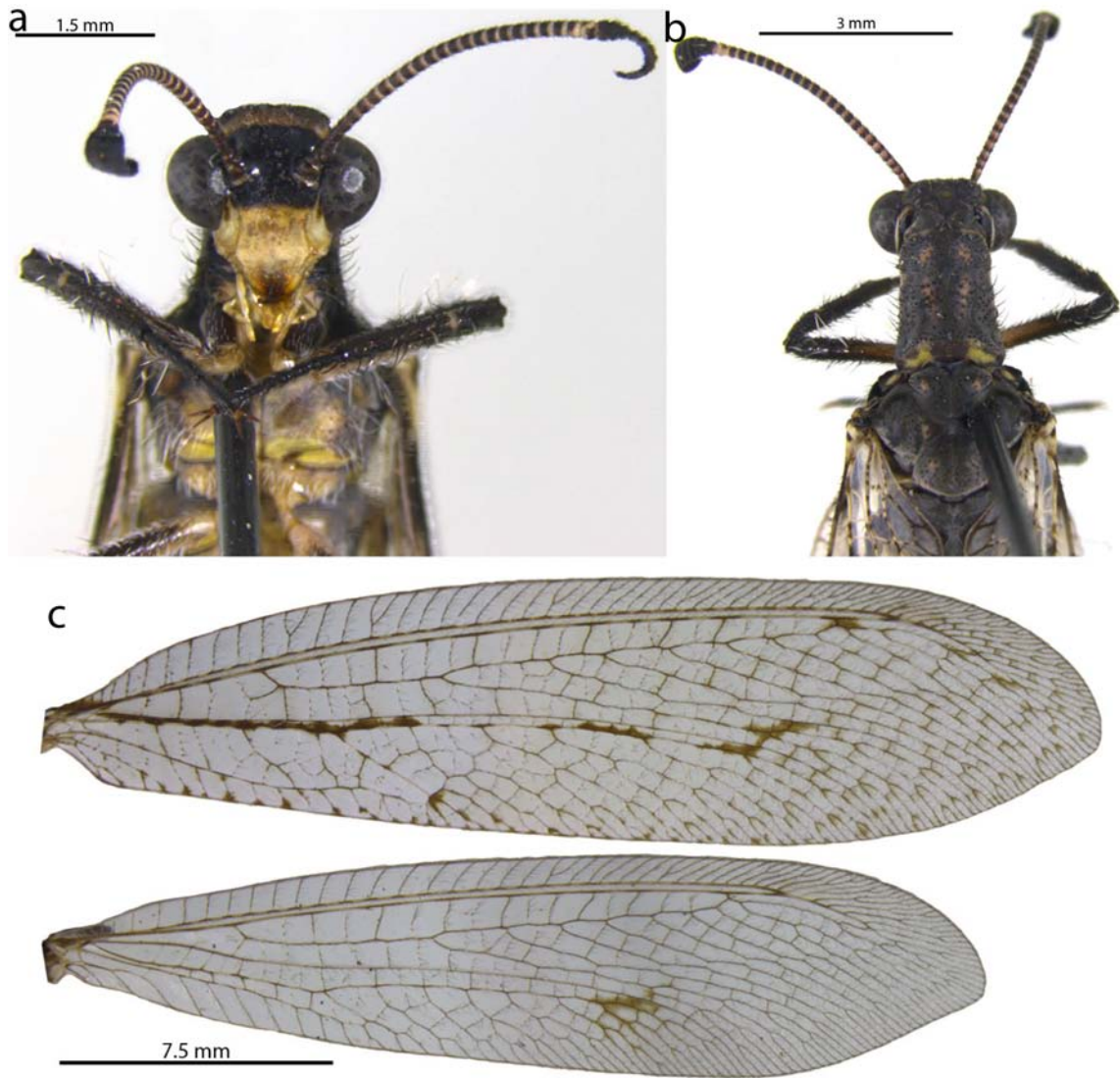


Figure A4.86: *Fossorioleon rudda*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

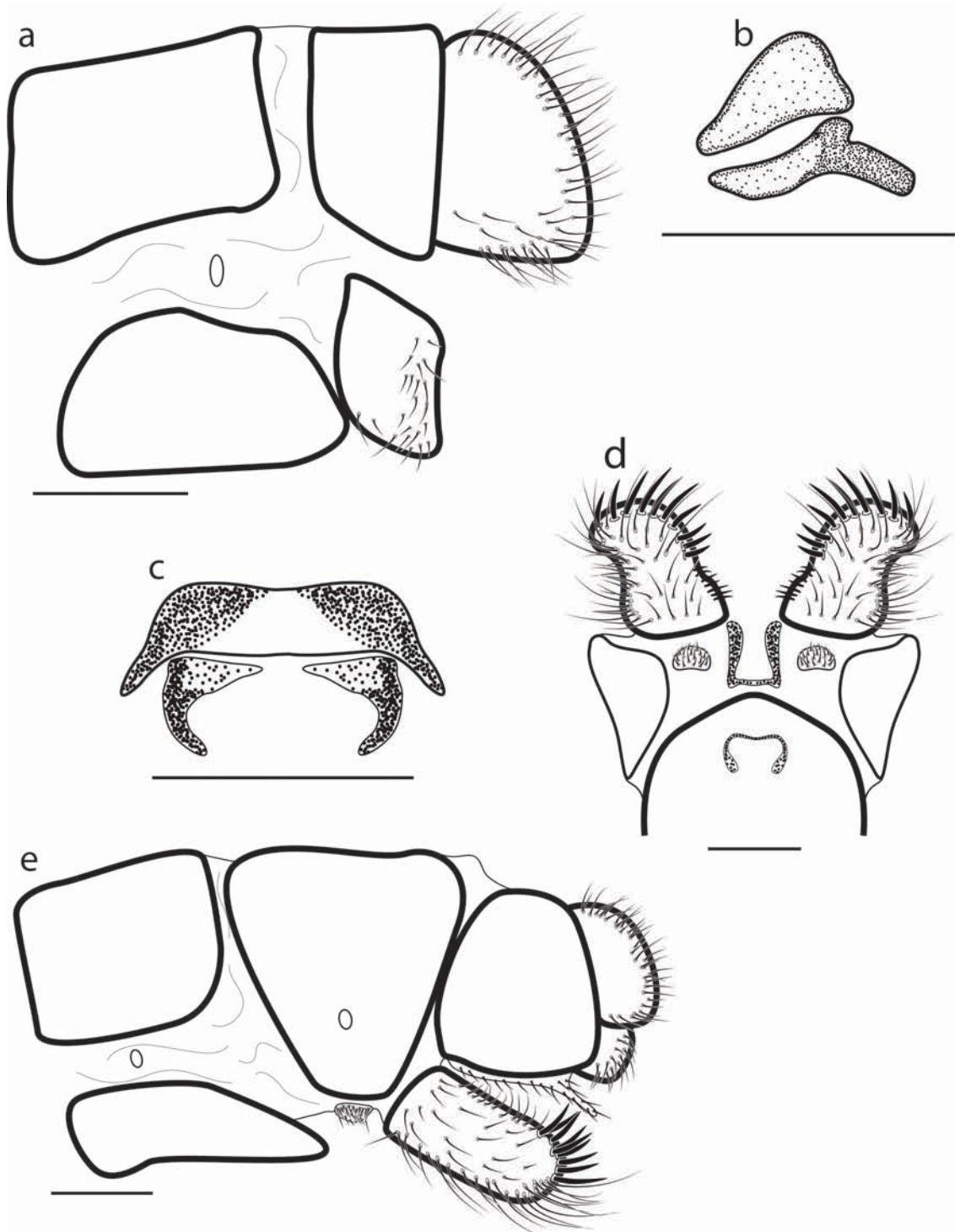


Figure A4.87: *Fossorioleon rudda*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; female: d) terminalia, ventral, showing the pregenital plate hidden beneath the sternite; e) terminalia, lateral. Scale bars = 500 μ m.

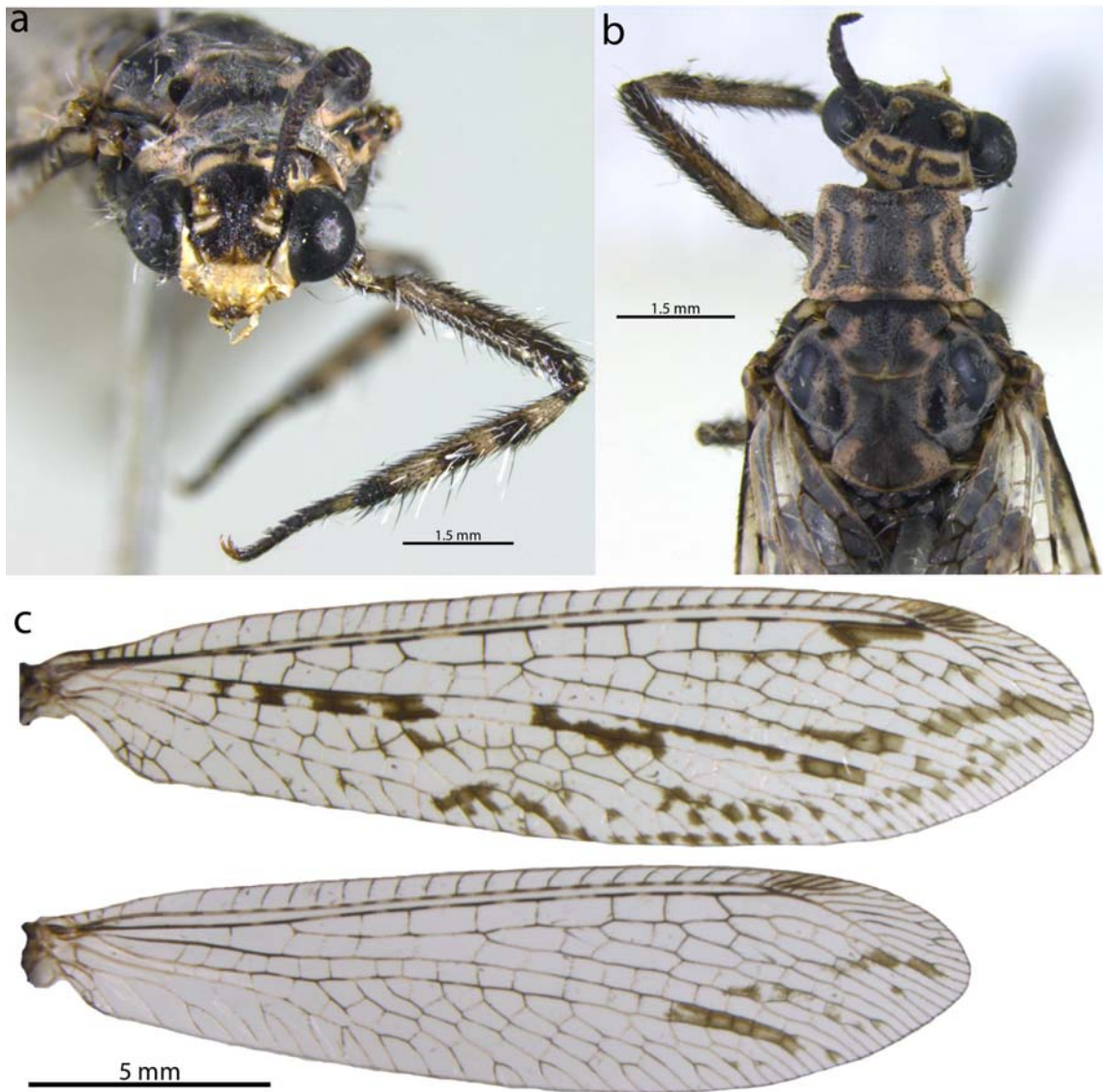


Figure A4.88: *Fossorioleon striatus*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

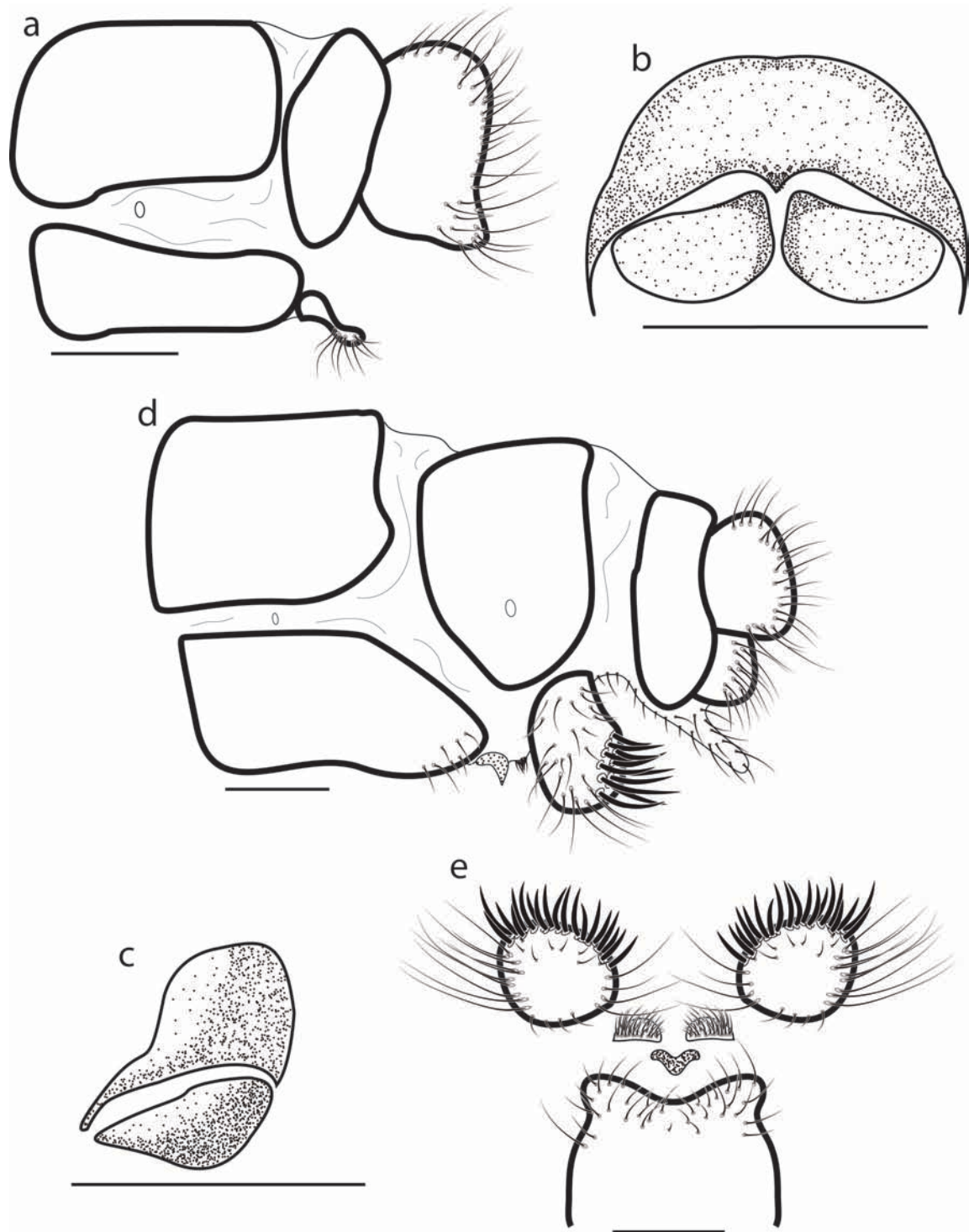


Figure A4.89: *Fossorioleon striatus*: male: a) terminalia, lateral; b) genitalia, posterior; c) genitalia, lateral; female: d) terminalia, lateral; e) terminalia, ventral. Scale bars = 500 μ m.

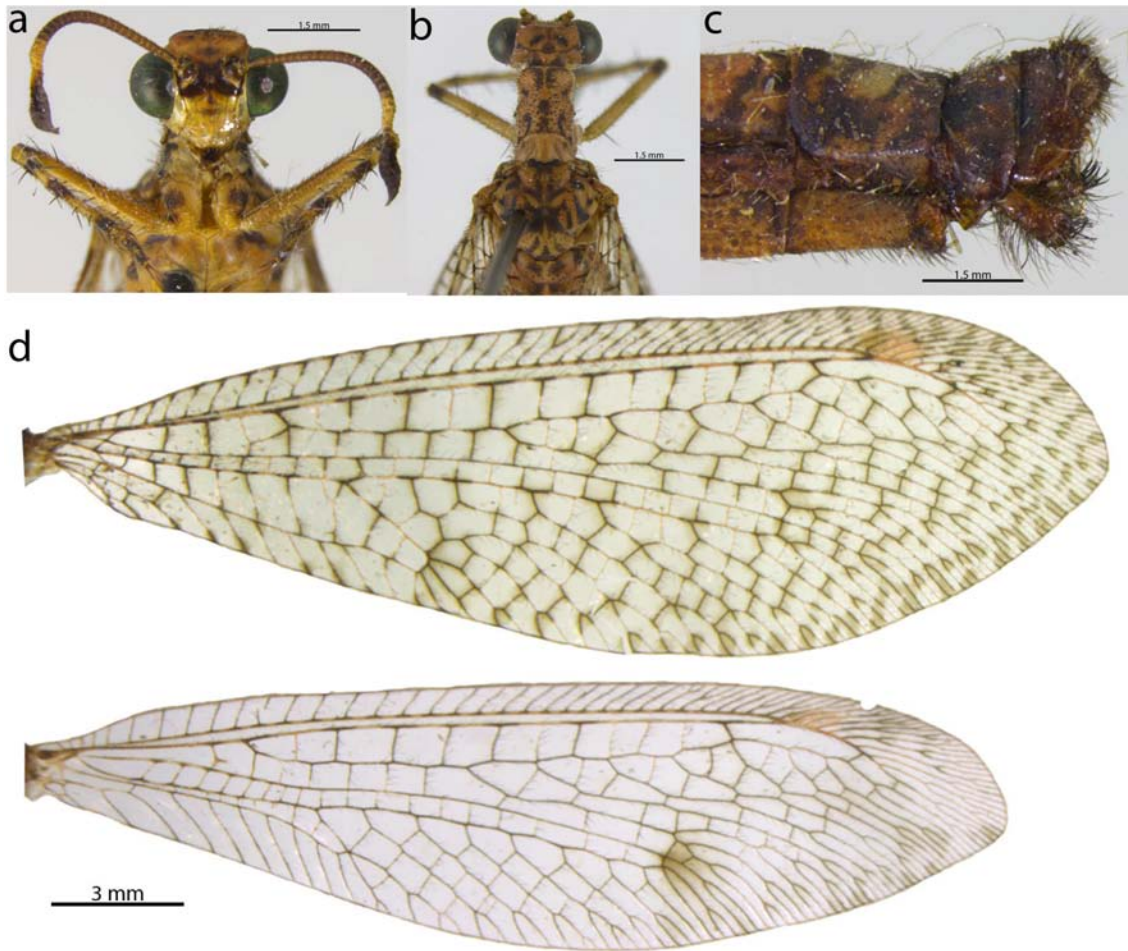


Figure A4.90: *Glenoleon aurora*: a) head, frontal; b) head and thorax, dorsal; c) female abdomen apex, lateral; d) fore and hind wing, dorsal.

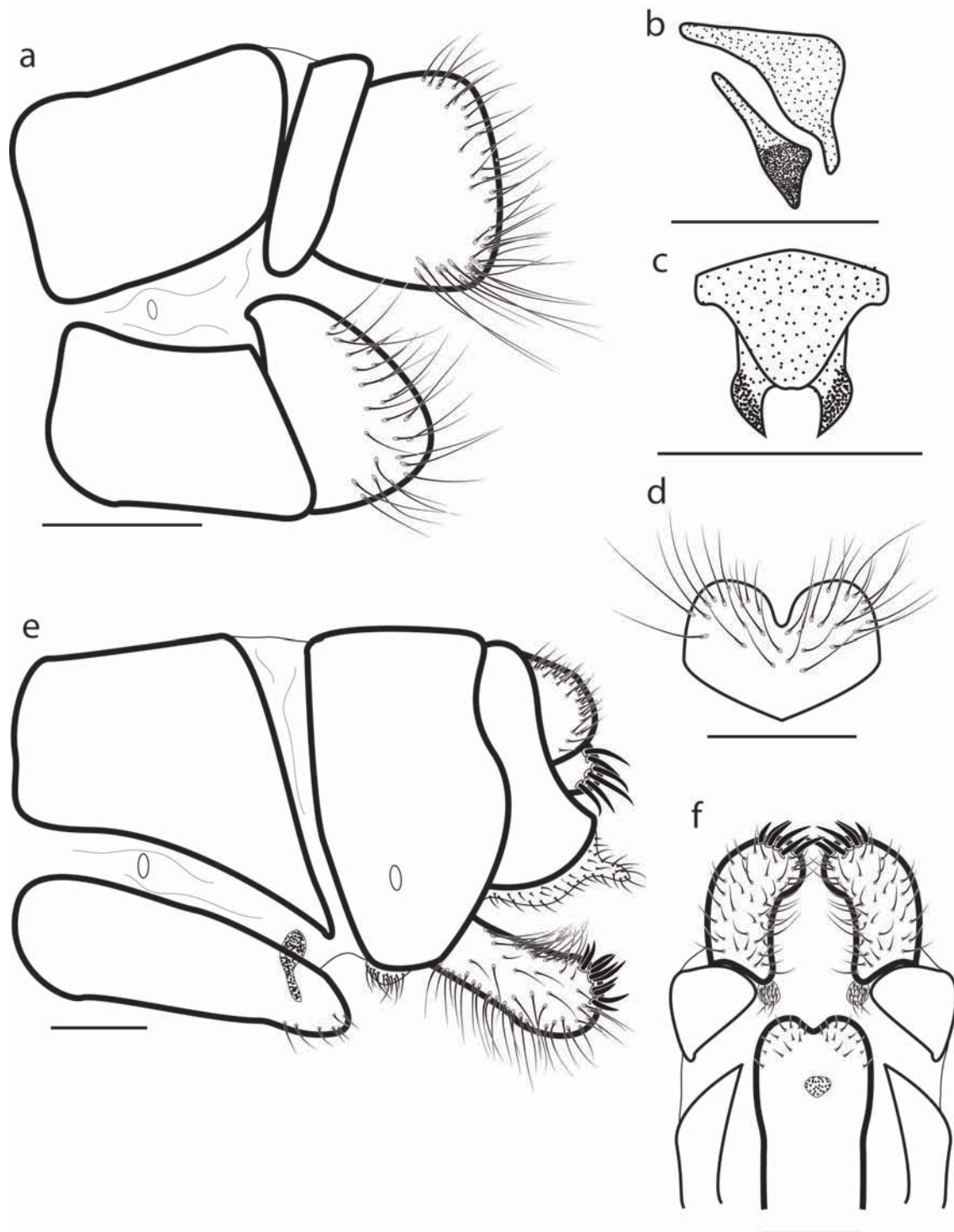


Figure A4.91: *Glenoleon aurora*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; d) 9th sternite, ventral; female: e) terminalia, lateral; f) Terminalia, ventral, showing the pregenital plate hidden beneath the sternite. Scale bars = 500µm.

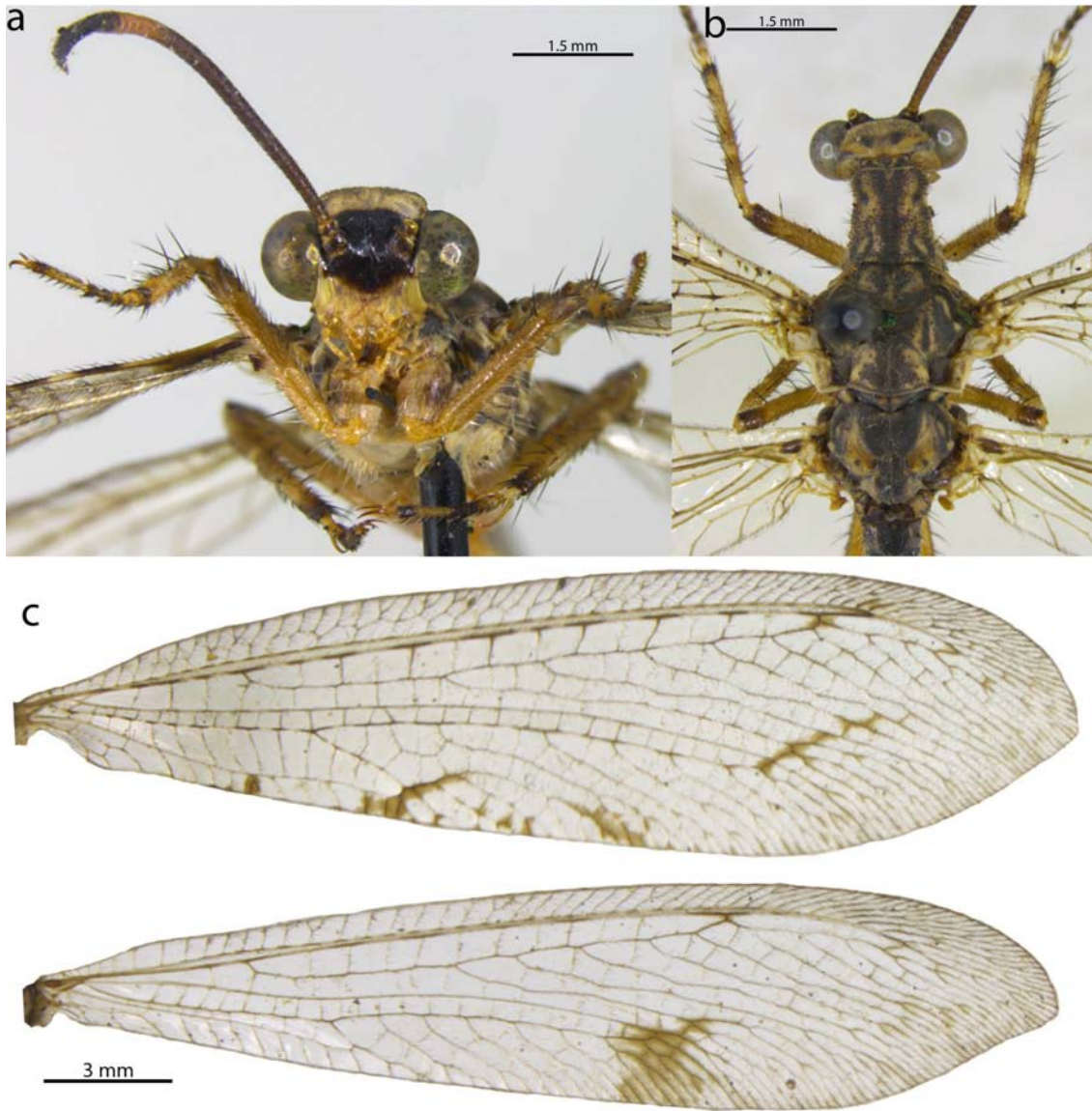


Figure A4.92: *Glenoleon froggatti*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

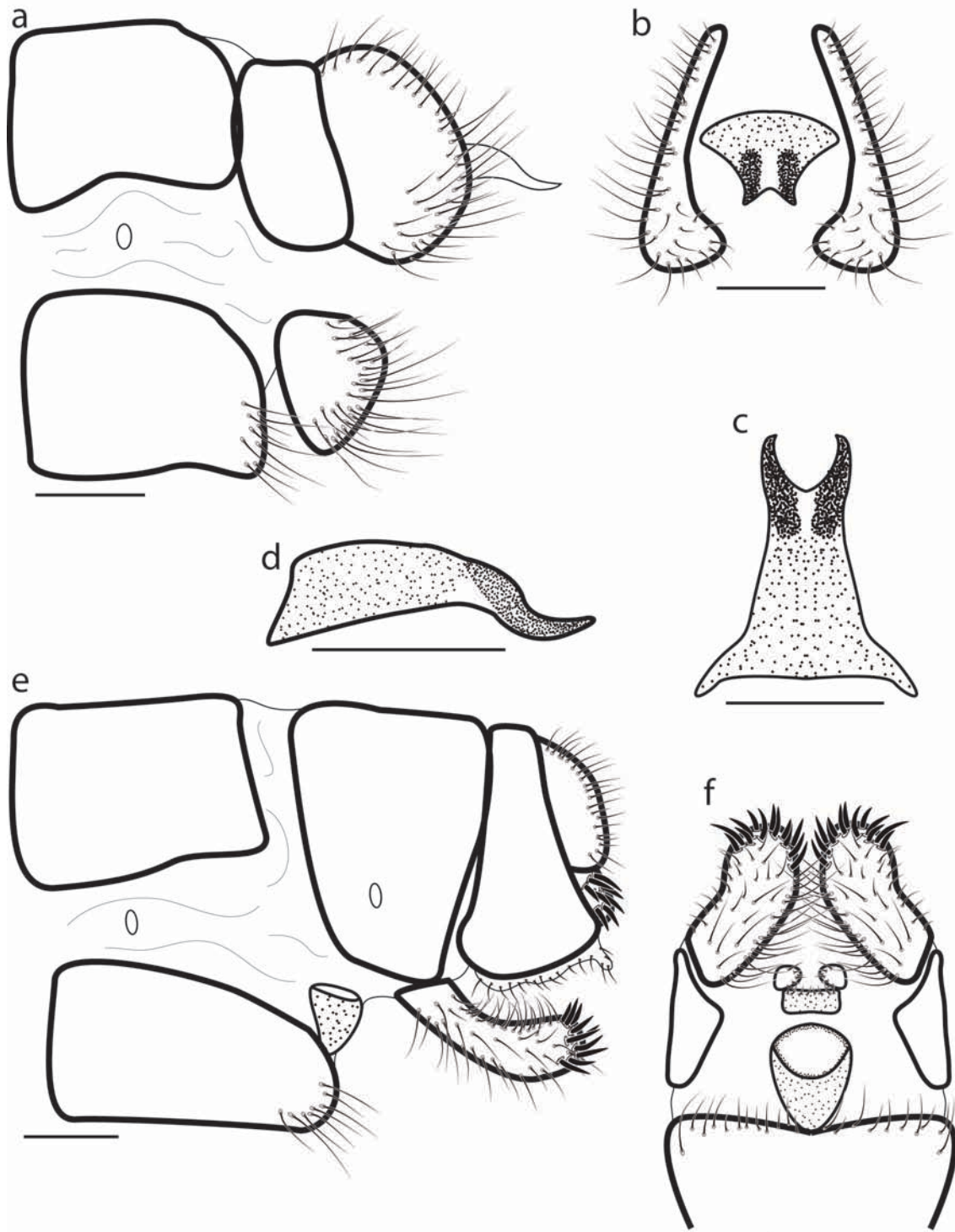
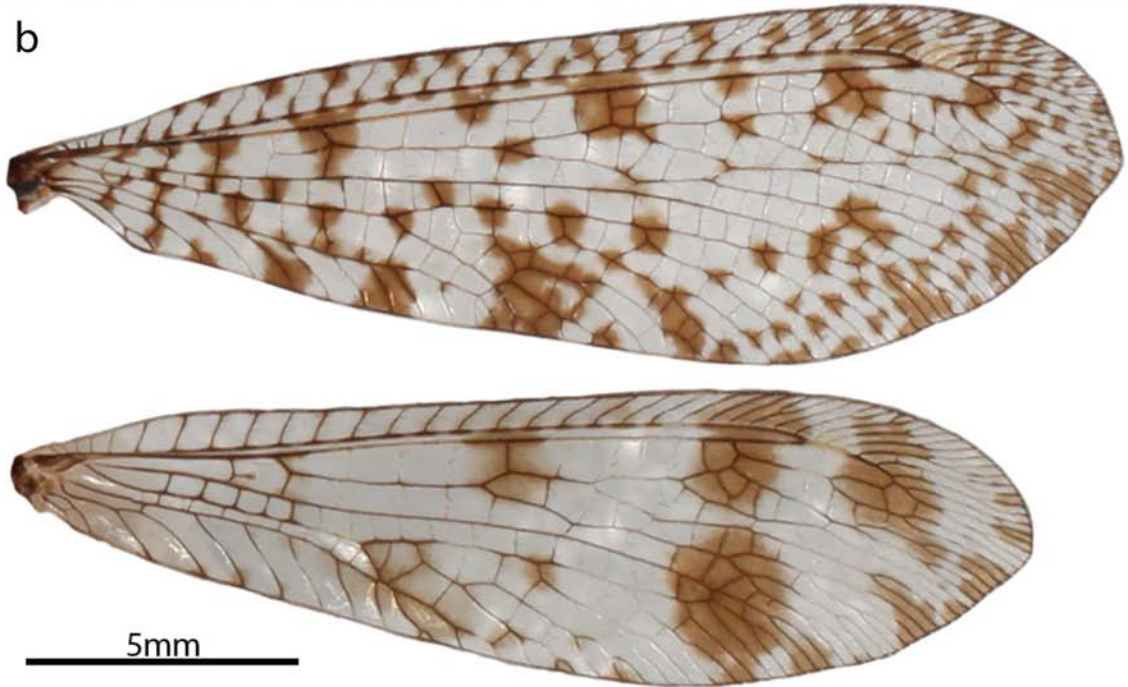


Figure A4.93: *Glenoleon froggatti*: male: a) terminalia, lateral; b) genitalia and ectoproct, posterior; c) genitalia, dorsal; d) genitalia, lateral; female: e) terminalia, lateral; f) terminalia, ventral. Scale bars = 500 μ m.



A4.: *Glenoleon maculatus*: a) specimen, dorsal; b) fore and hind wing, dorsal.

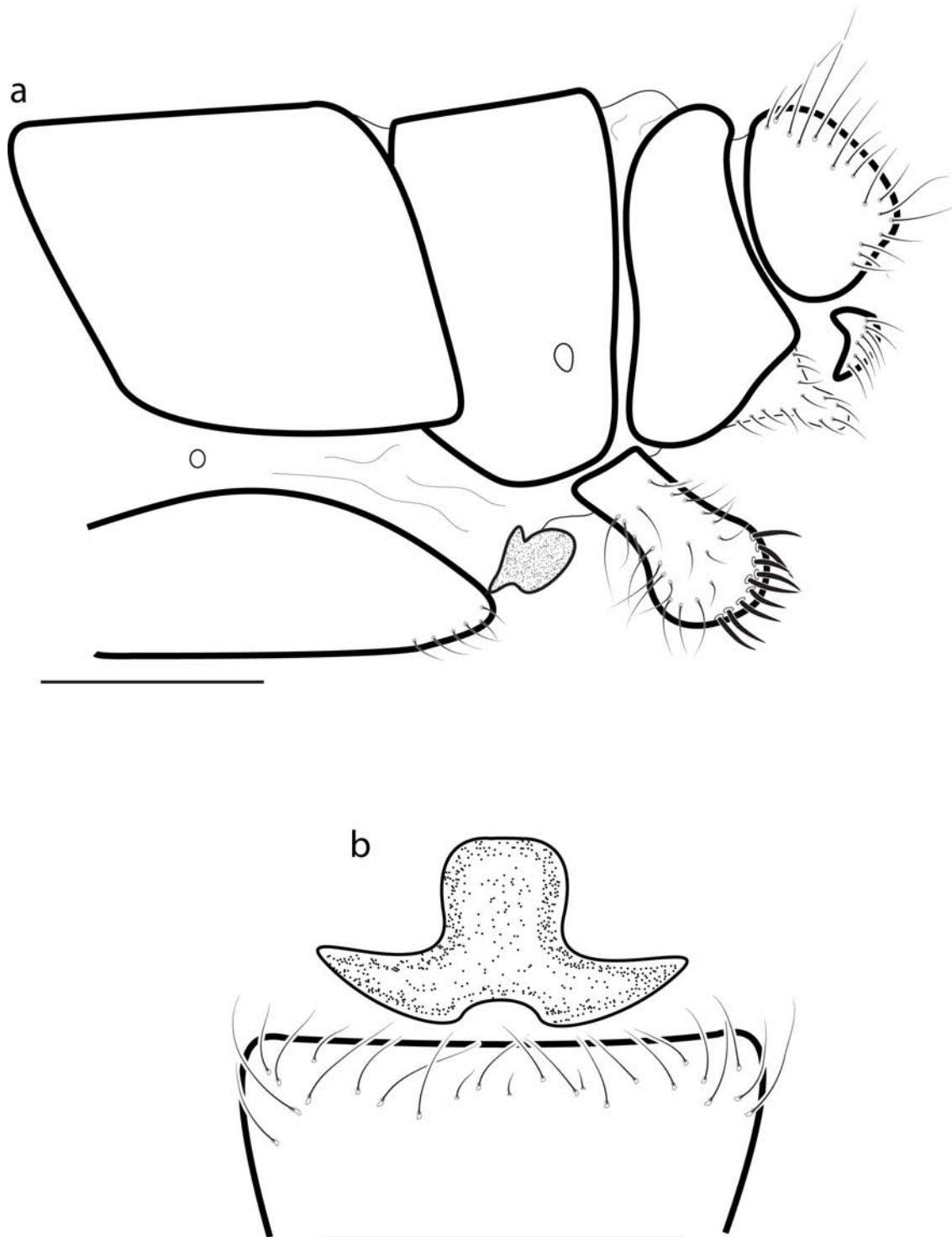


Figure A4.95: *Glenoleon maculatus*: female: a) terminalia, lateral; b) 7th sternite and pregenital plate, ventral. Scale bars = 500 μ m.

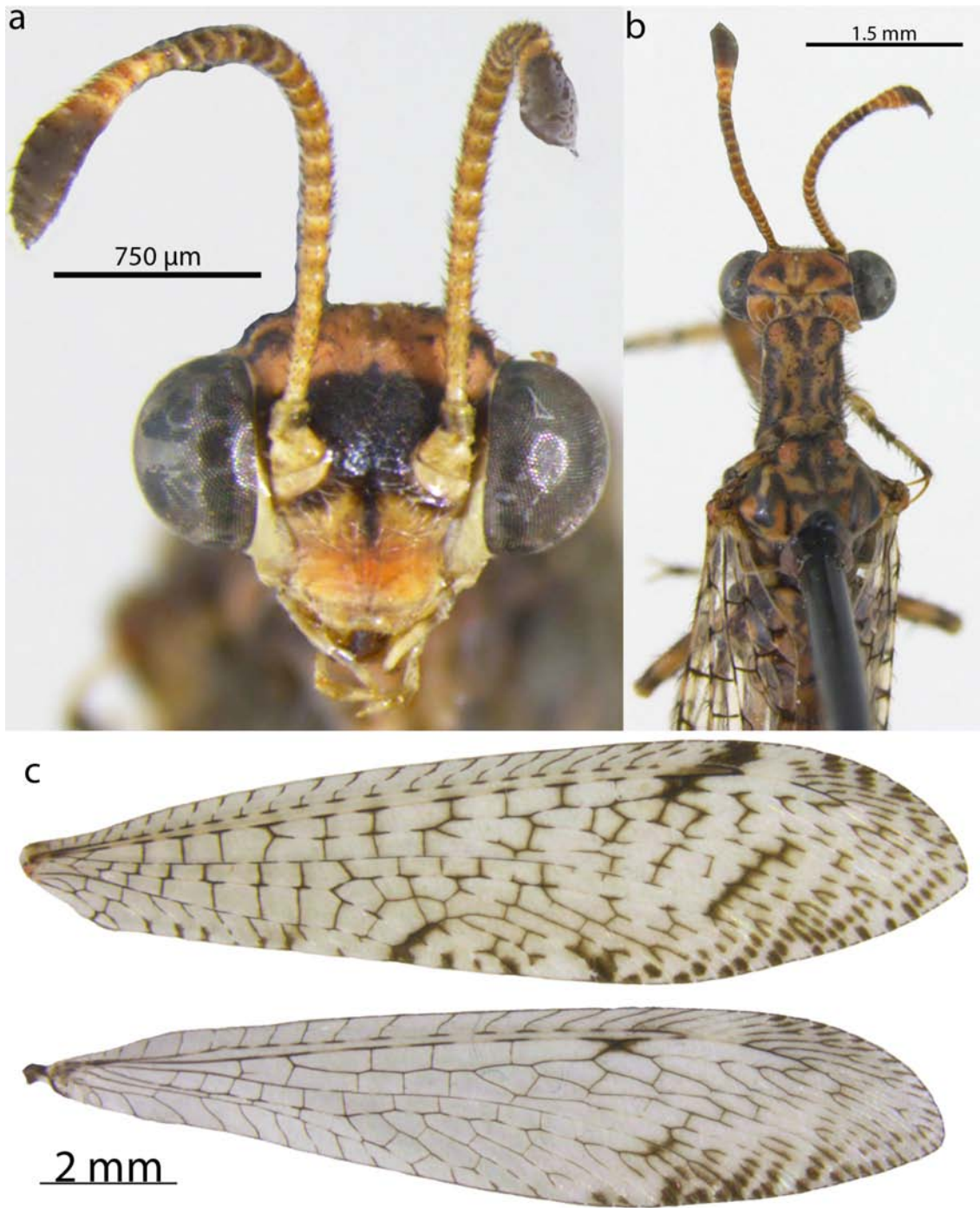


Figure A4.96: *Glenoleon minutillus*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

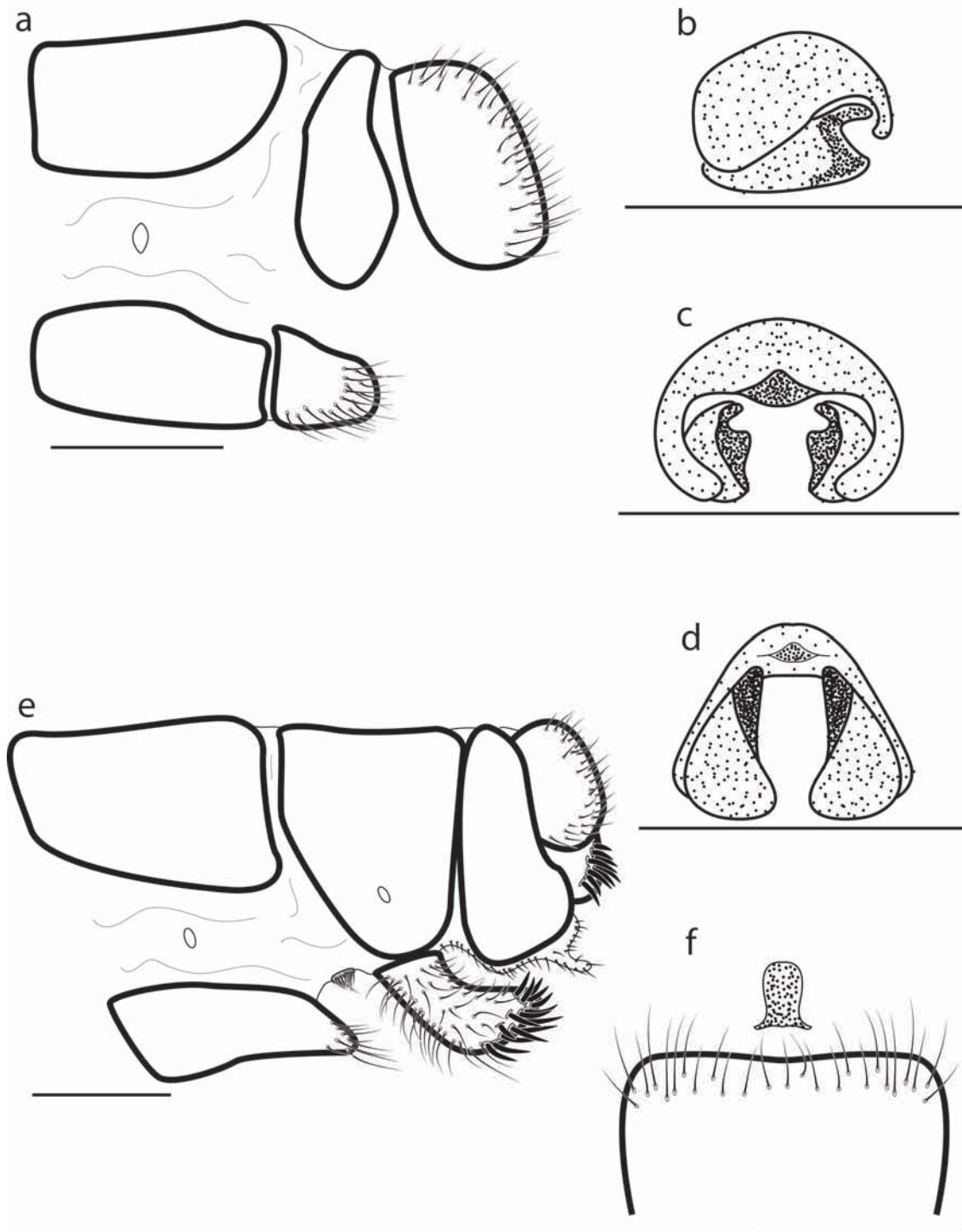


Figure A4.97: *Glenoleon minutillus*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; d) genitalia, ventral; female: e) terminalia, lateral; f) 7th sternite and pregenital plate, ventral. Scale bars = 500 μ m.

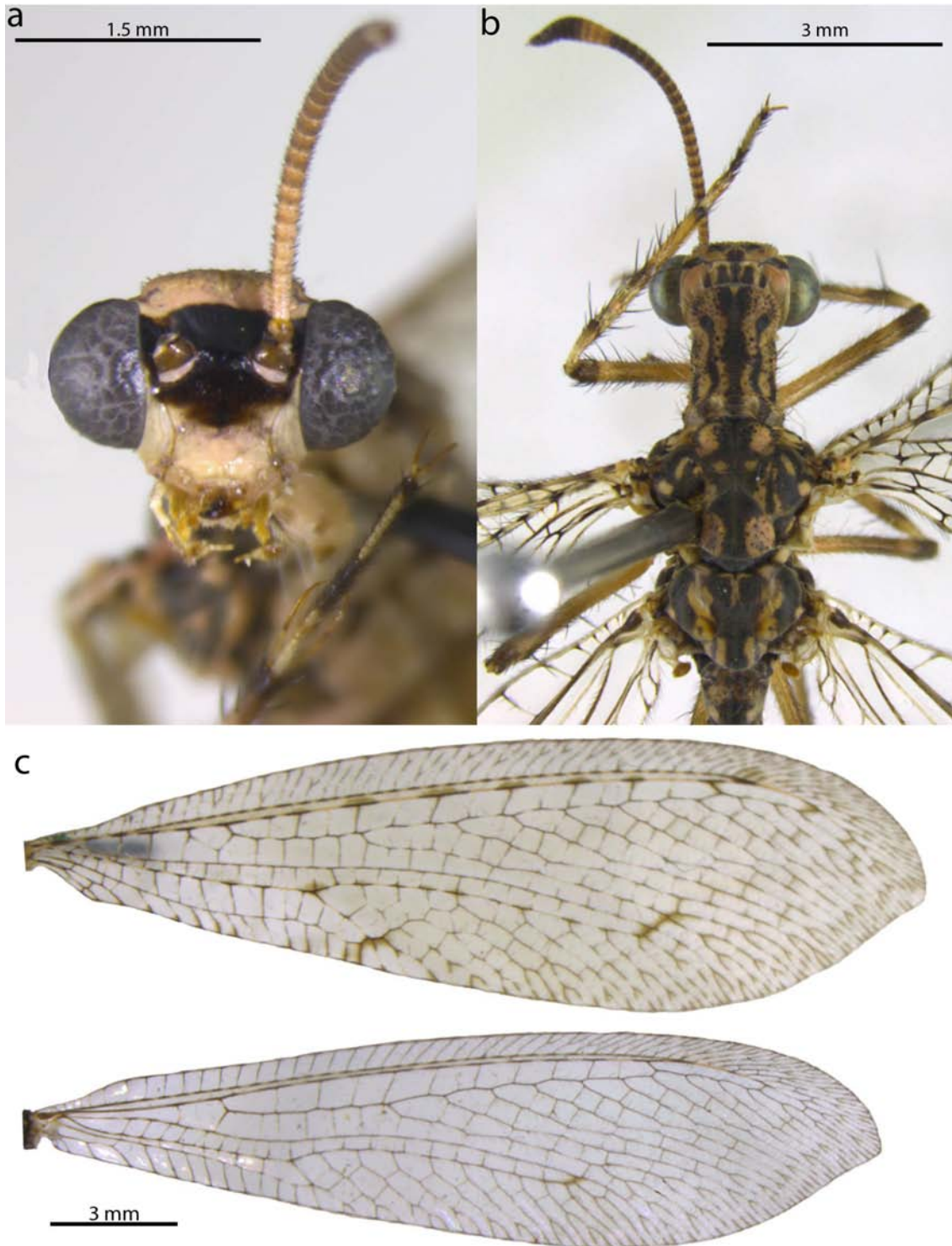


Figure A4.98: *Glenoleon osmyloides*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

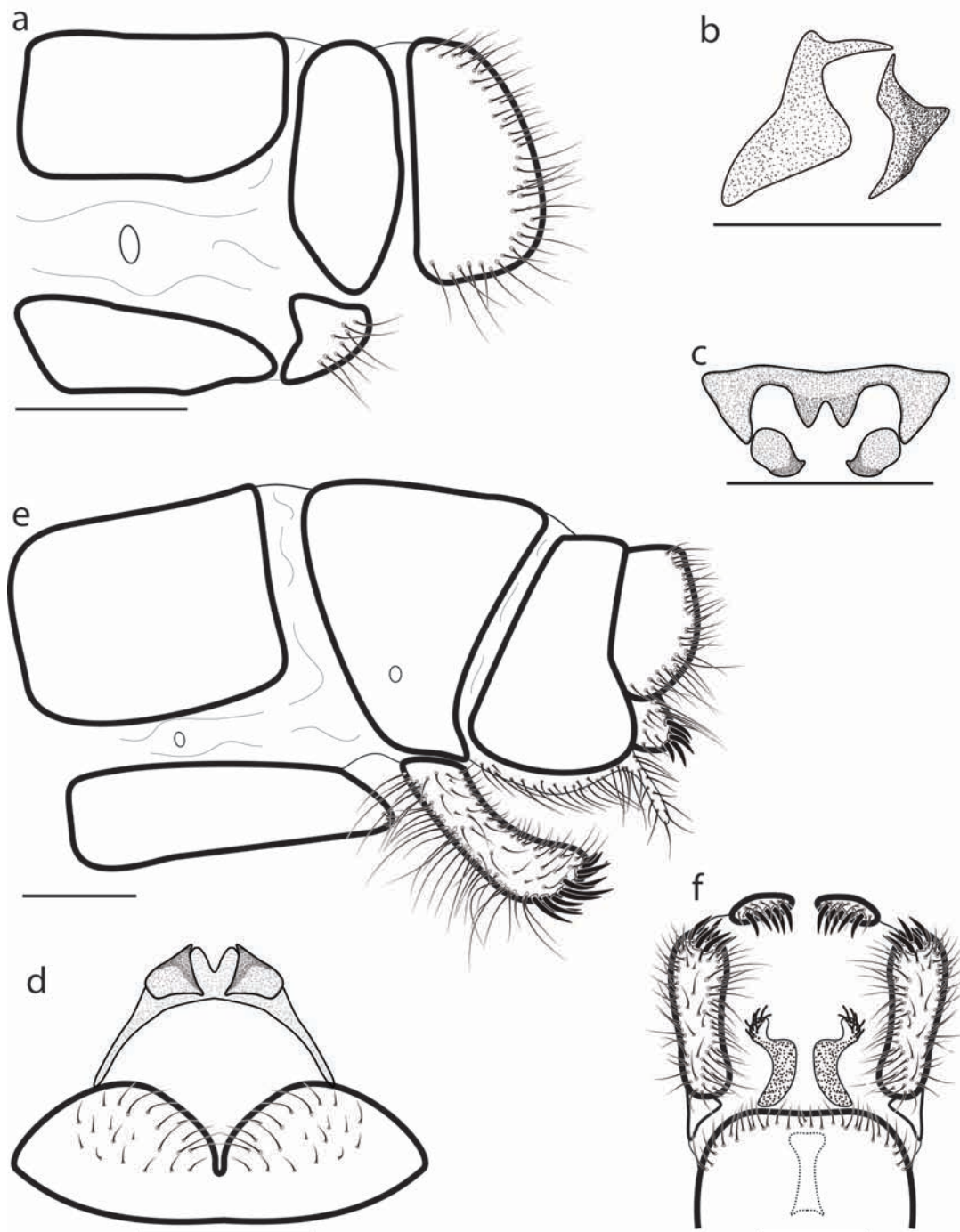


Figure A4.99: *Glenoleon osmyloides*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterodorsal; d) genitalia and 9th sternite, ventral; female: e) terminalia, lateral; f) terminalia, ventral, showing the pregenital plate hidden beneath the sternite. Scale bars = 500 μ m.

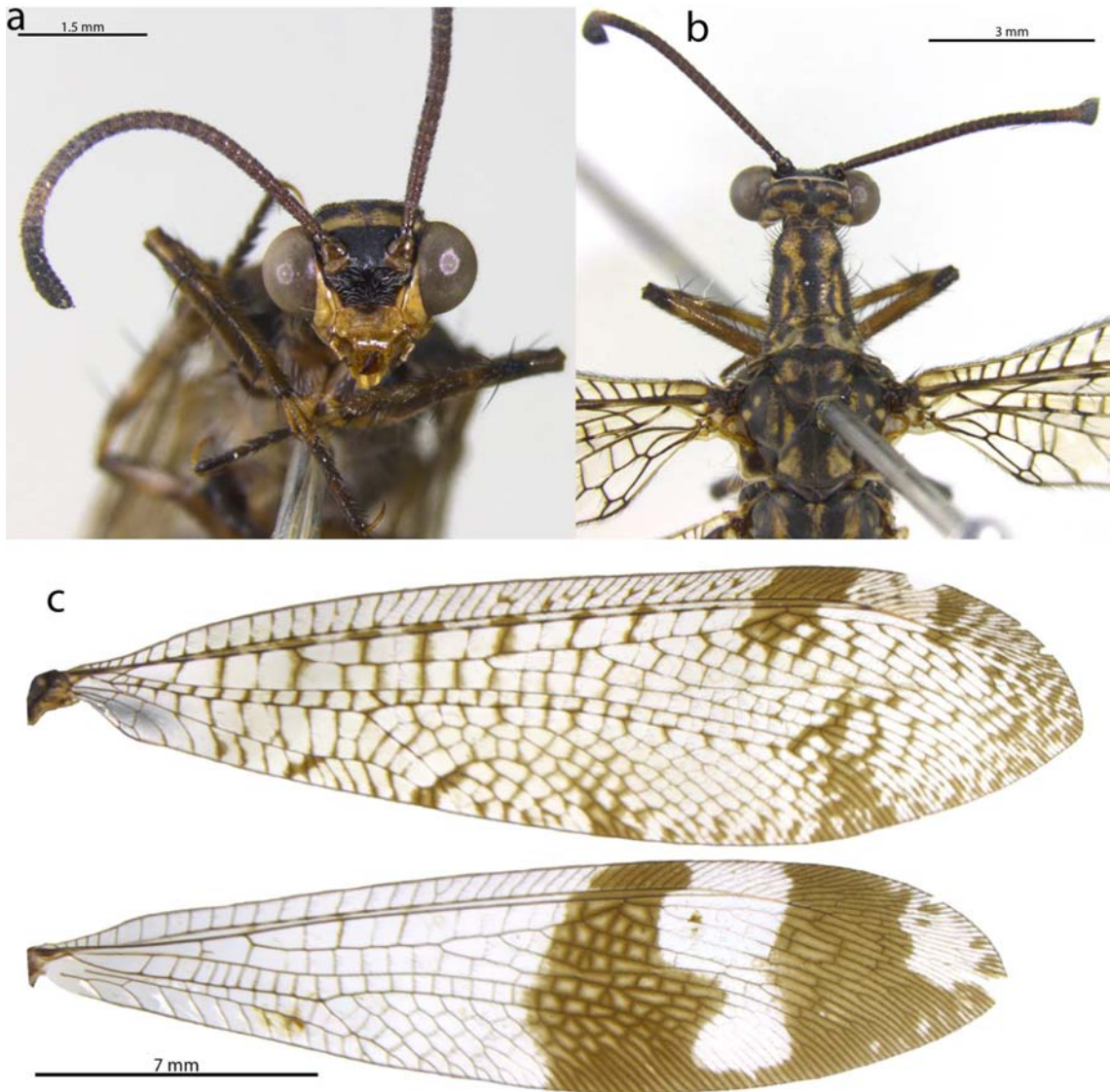


Figure A4.100: *Glenoleon pulchellus*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

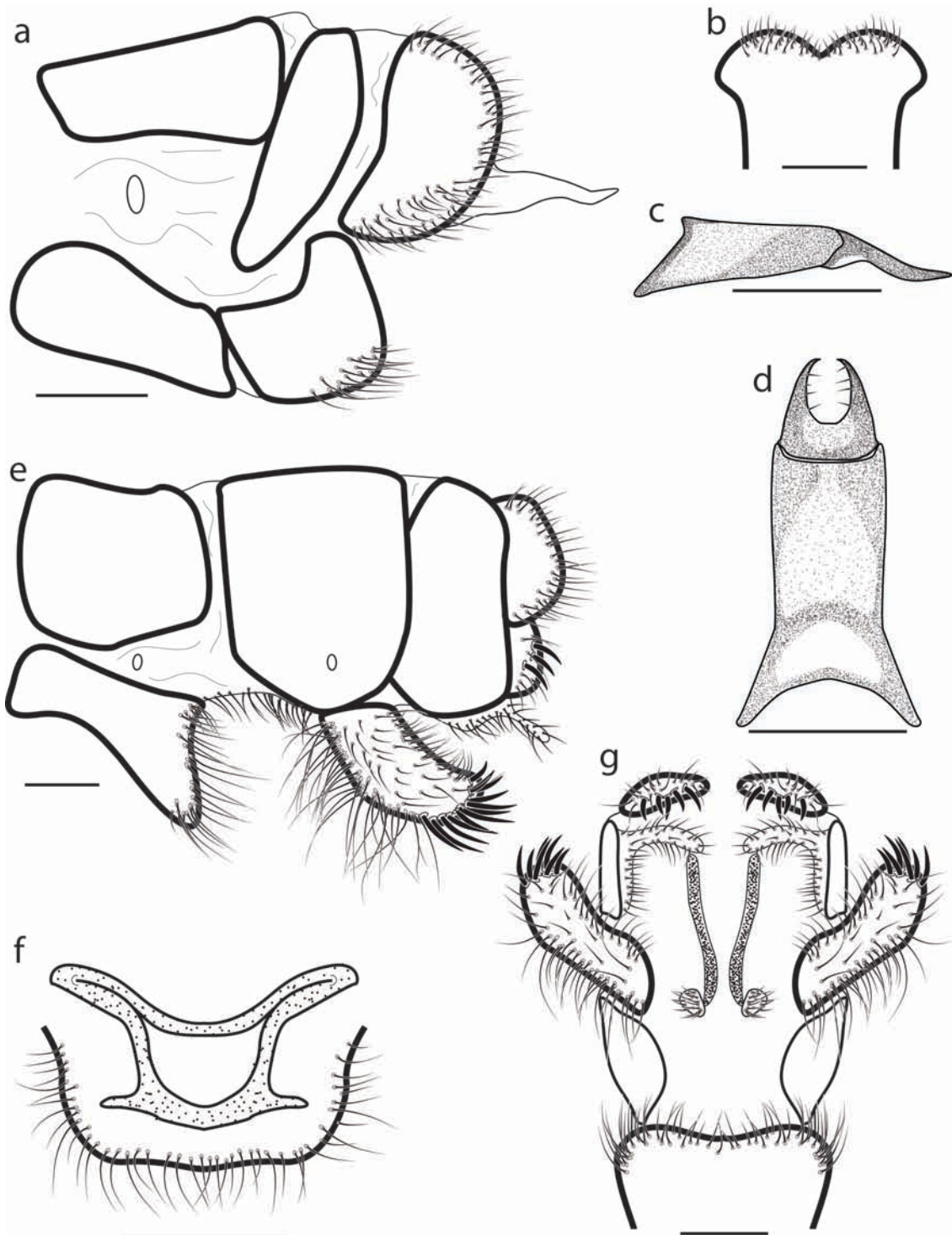


Figure A4.101: *Glenoleon pulchellus*: male: a) terminalia, lateral; b) 9th sternite, ventral; c) genitalia, lateral; d) genitalia, dorsal; female: e) terminalia, lateral; f) pregenital plate and ventral margin of 7th sternite, posterior; g) terminalia, ventral. Scale bars = 500µm.



Figure A4.102: *Manselleon breviplectron* n. sp.: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

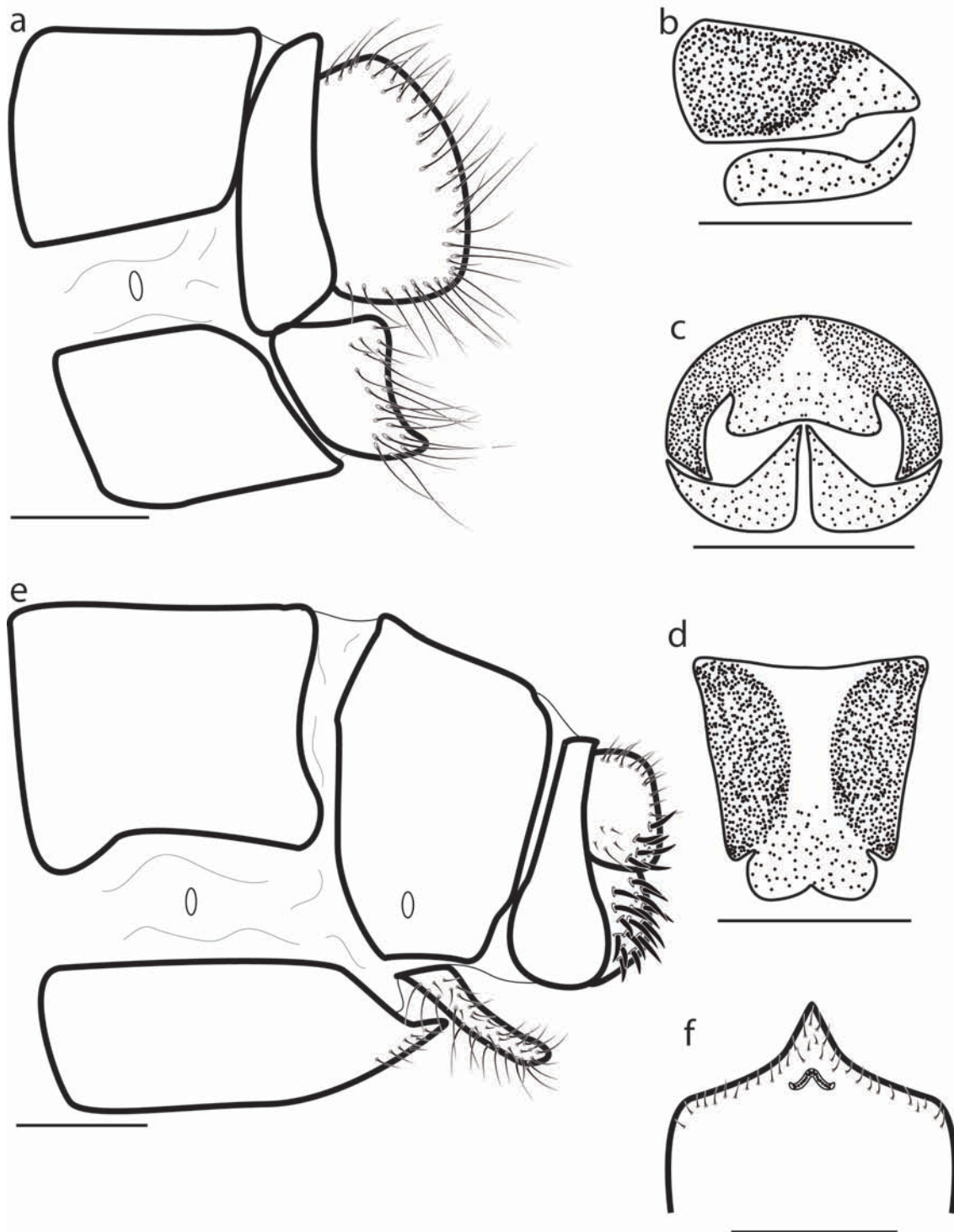


Figure A4.103: *Manselleon breviplectron* n. sp.: male: a) terminalia, lateral; b) genitalia lateral; c) genitalia, posterior; d) genitalia, dorsal; female: e) terminalia, lateral; f) pregenital plate and 7th sternite, ventral, (pregenital plate hidden beneath the sternite). Scale bars = 500 μ m.

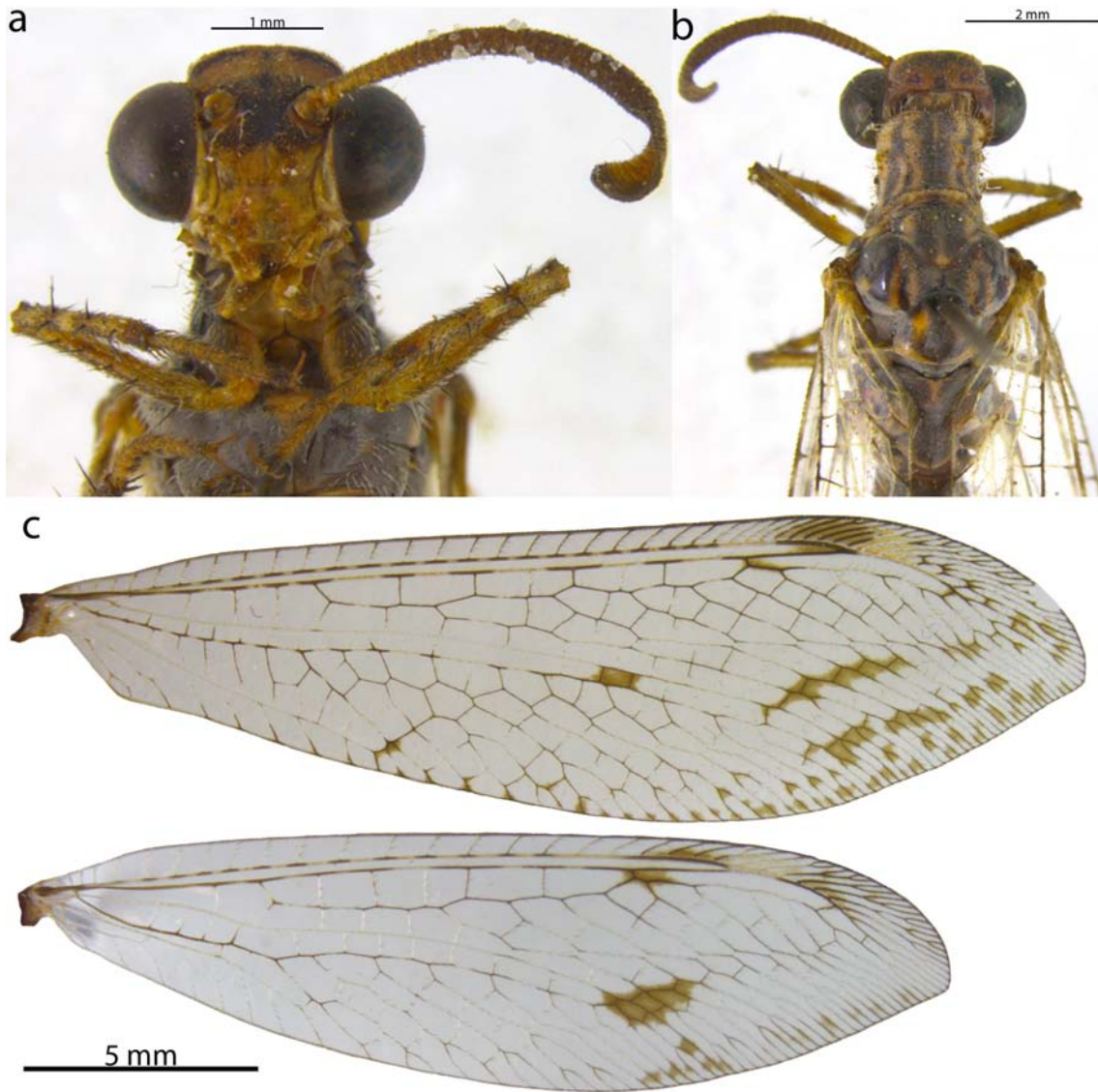


Figure A4.104: *Manselleon longidigitus* n. sp.: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

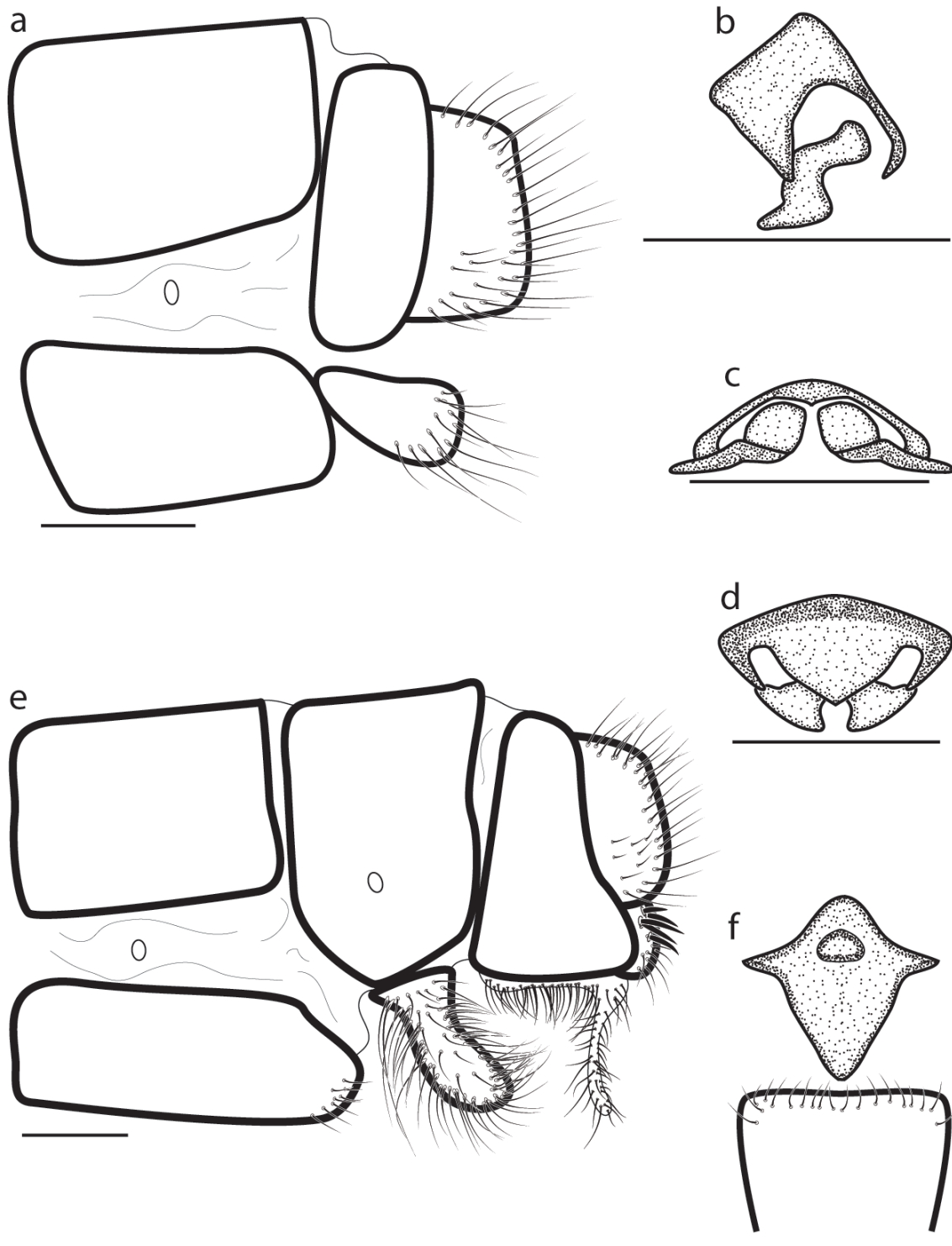


Figure A4.105: *Manselleon longidigitus* n. sp.: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, ventral; d) genitalia, posterior; female: e) terminalia, lateral; f) pregenital plate and 7th sternite, ventral. Scale bars = 500 μ m.

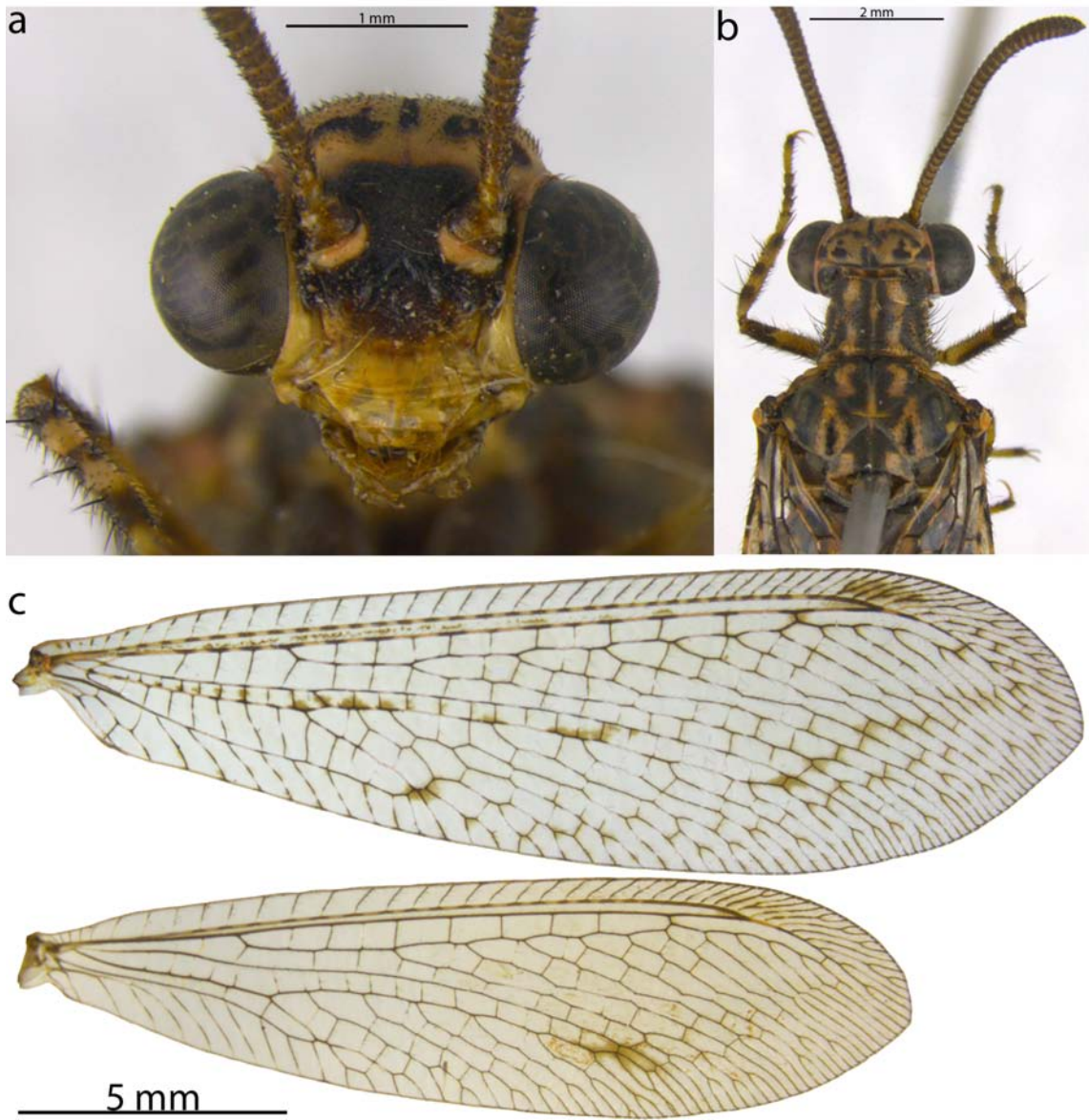


Figure A4.106: *Manselleon rebellis* n. sp.: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

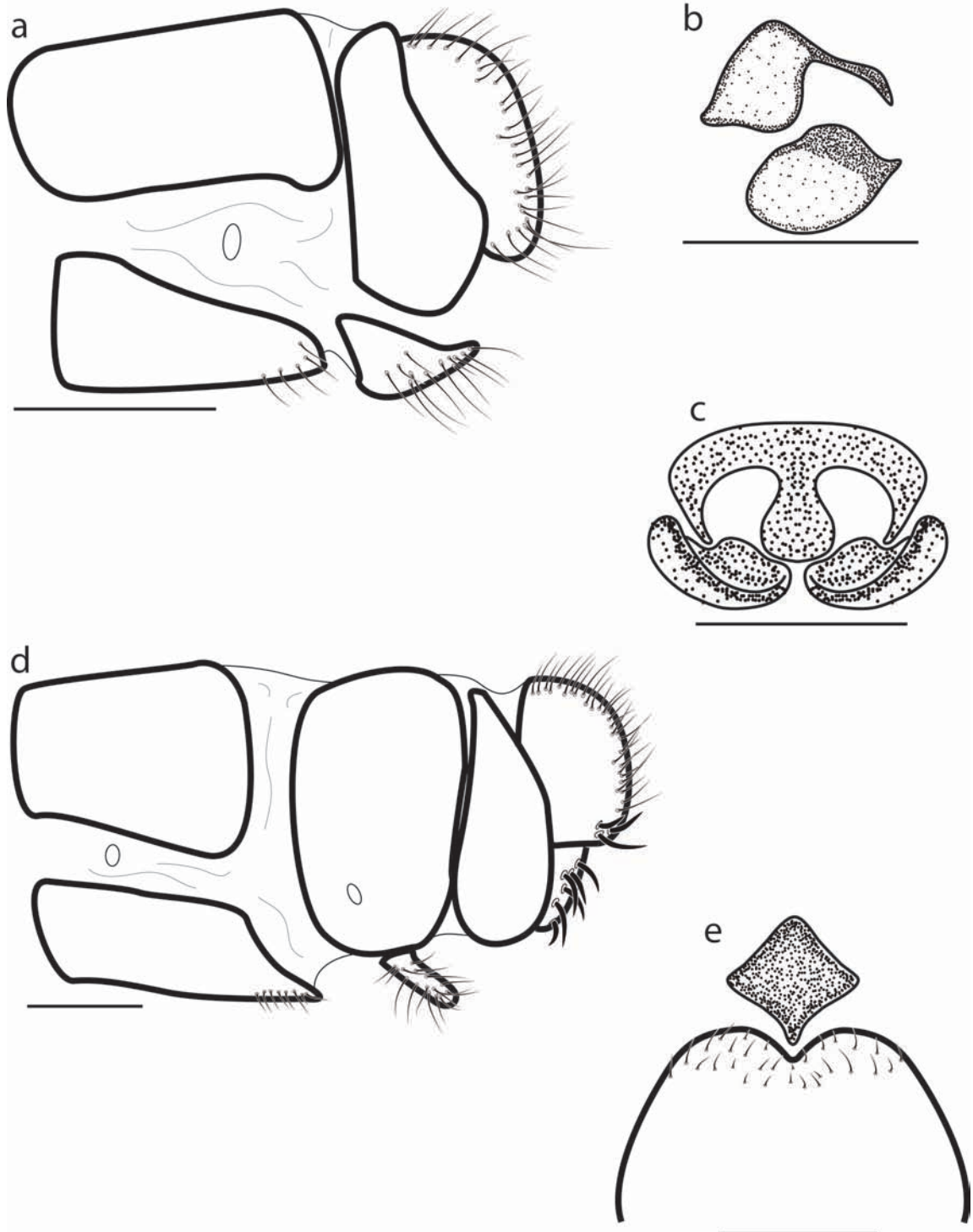


Figure A4.102: *Manselleon rebellis* n. sp.: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; female: d) terminalia, lateral; e) pregenital plate and 7th sternite, ventral. Scale bars = 500µm.

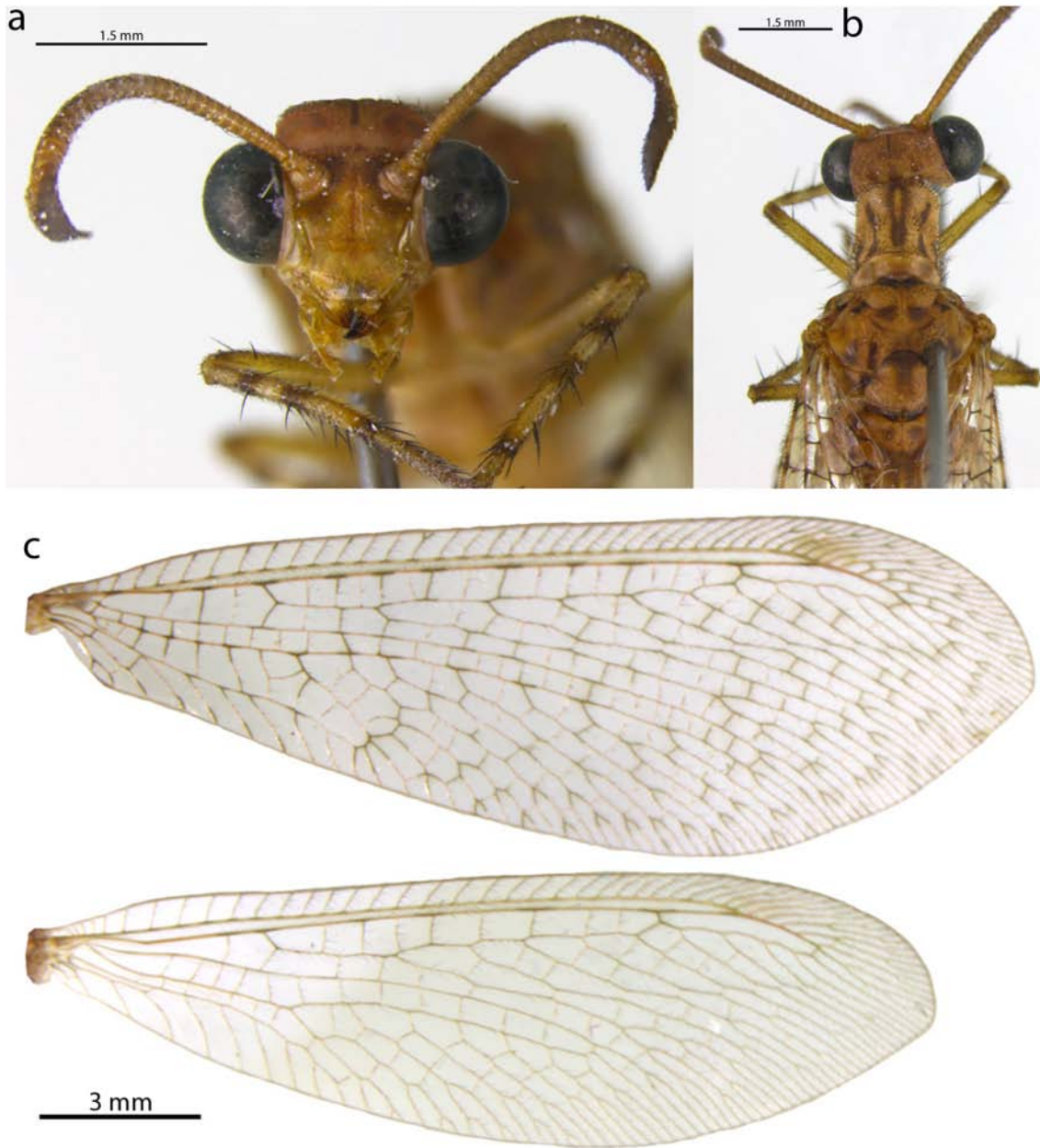


Figure A4.108: *Manselleon tillyardi*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

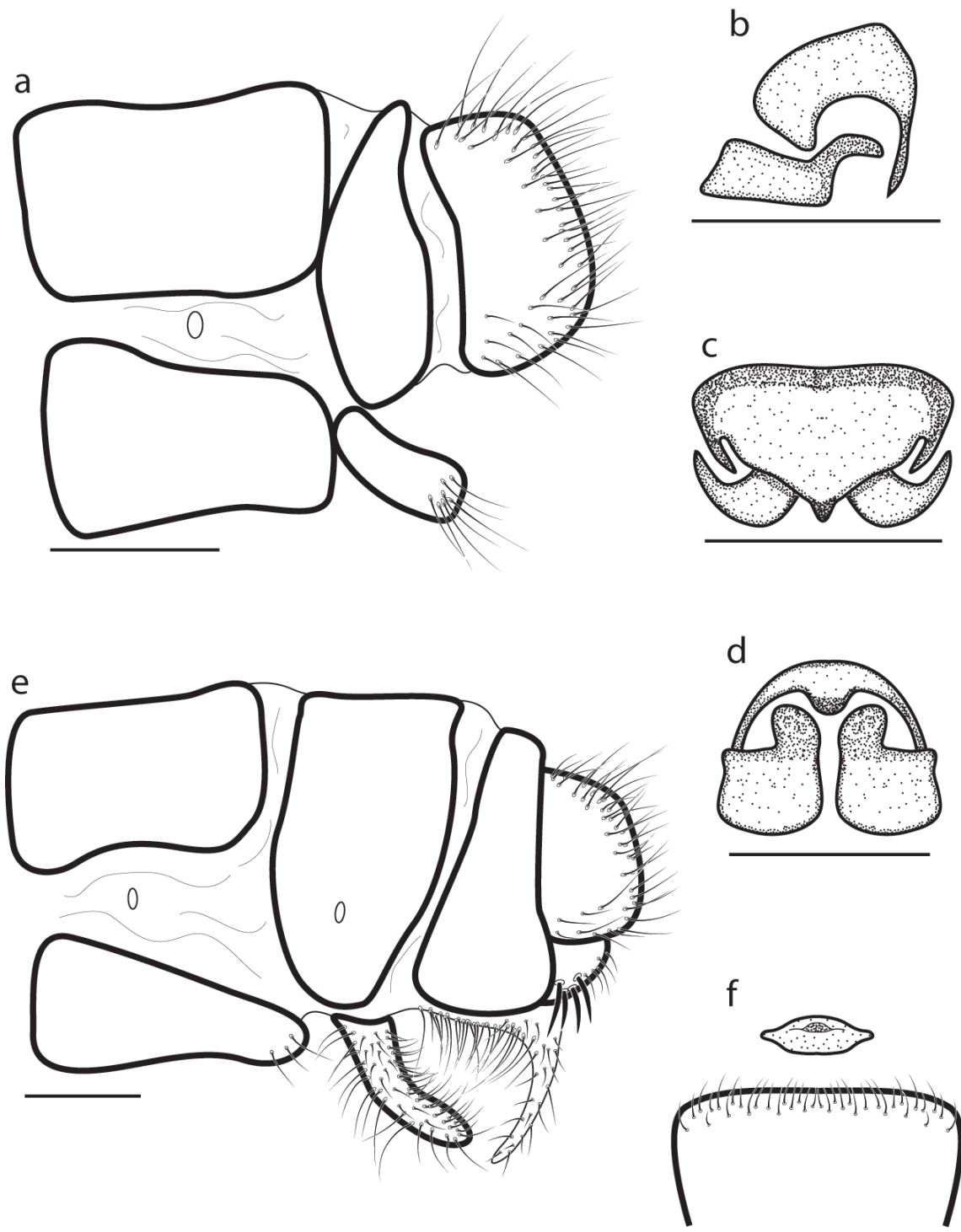


Figure A4.109: *Manselleon tillyardi*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; d) genitalia, ventral; female: e) terminalia, lateral; f) pregenital plate and 7th sternite, ventral. Scale bars = 500 μ m.

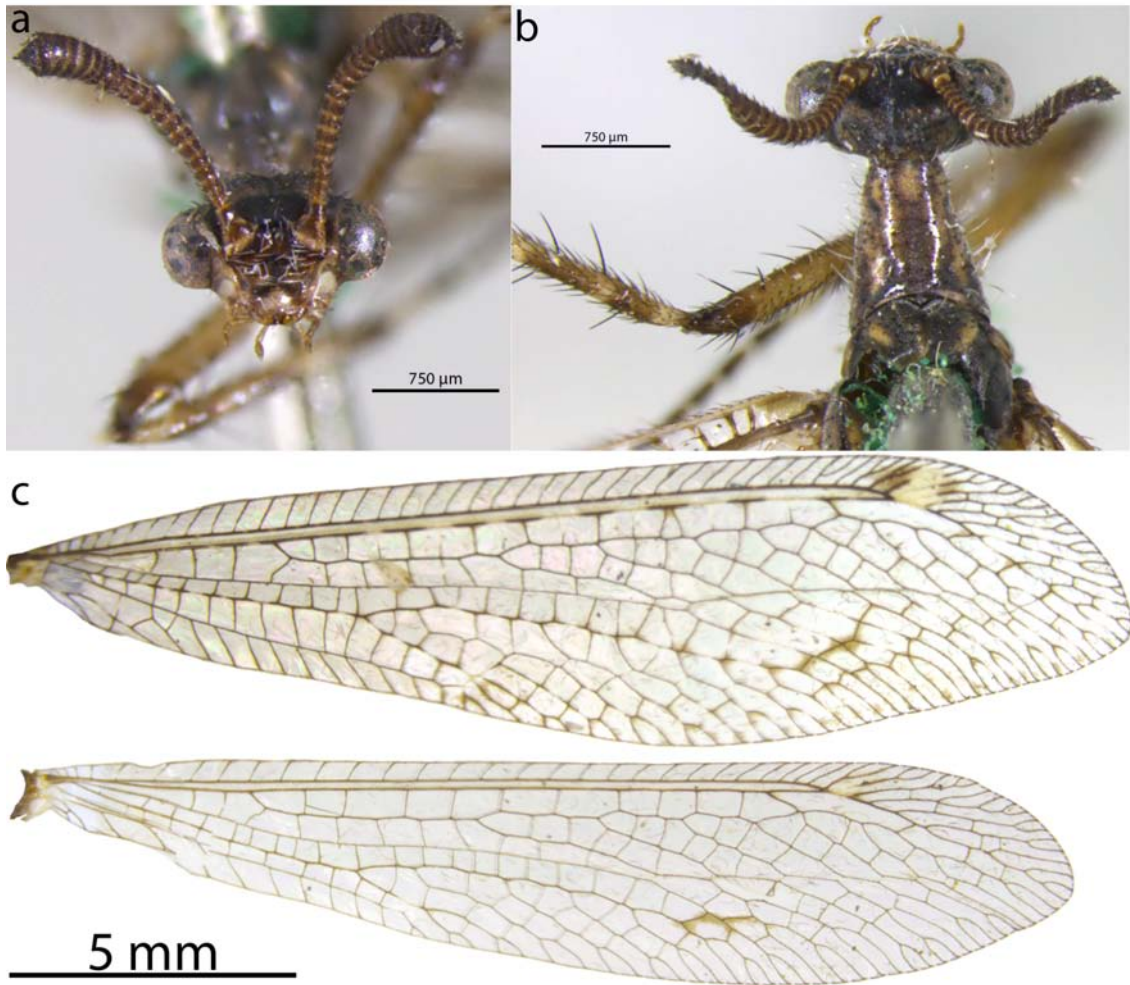


Figure A4.110: *Minyleon pygmaeus*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

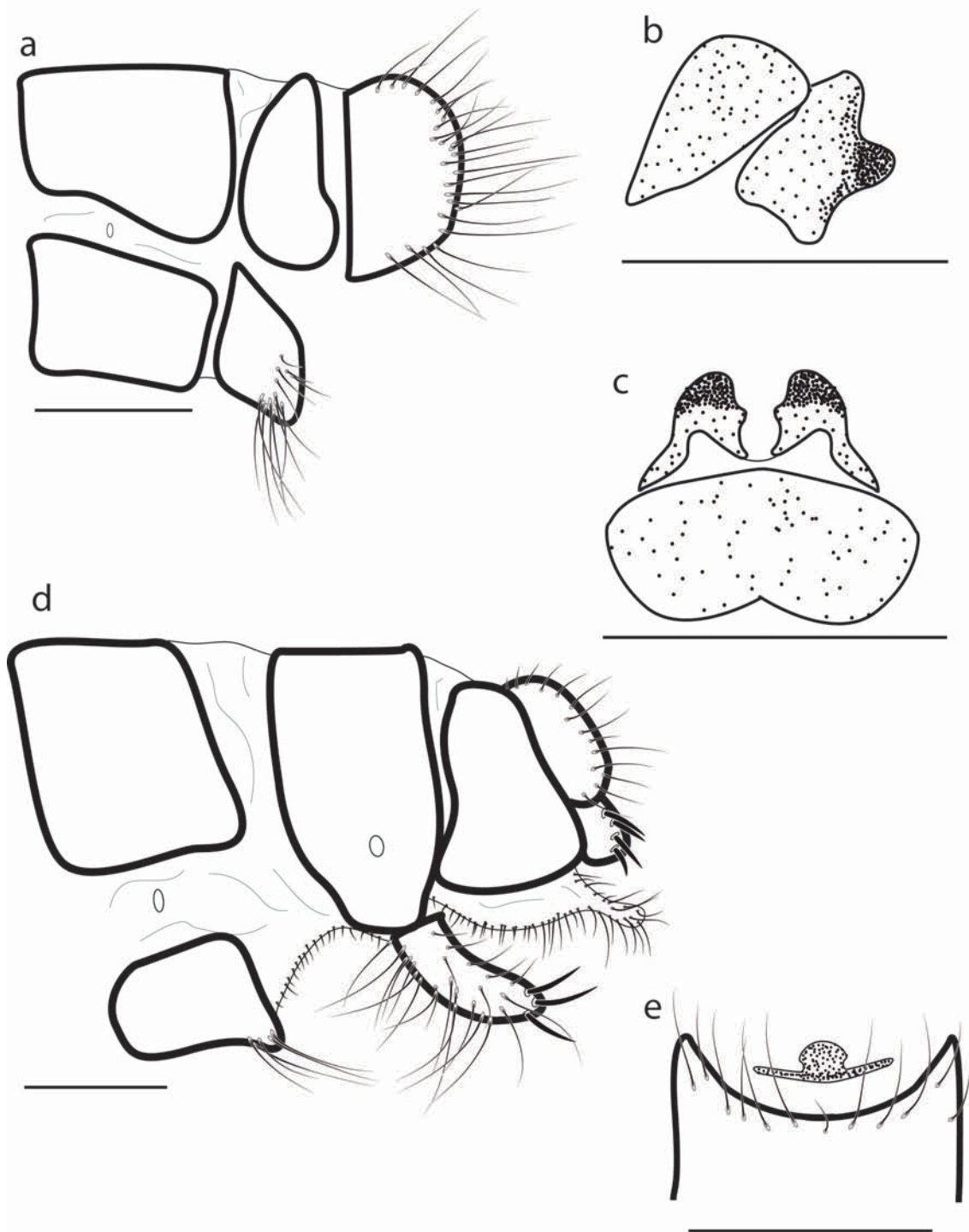


Figure A4.111: *Minyleon pygmaeus*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, dorsal; female: d) terminalia, lateral; e) pregenital plate and 7th sternite, posteroventral. Scale bars = 500 μ m.

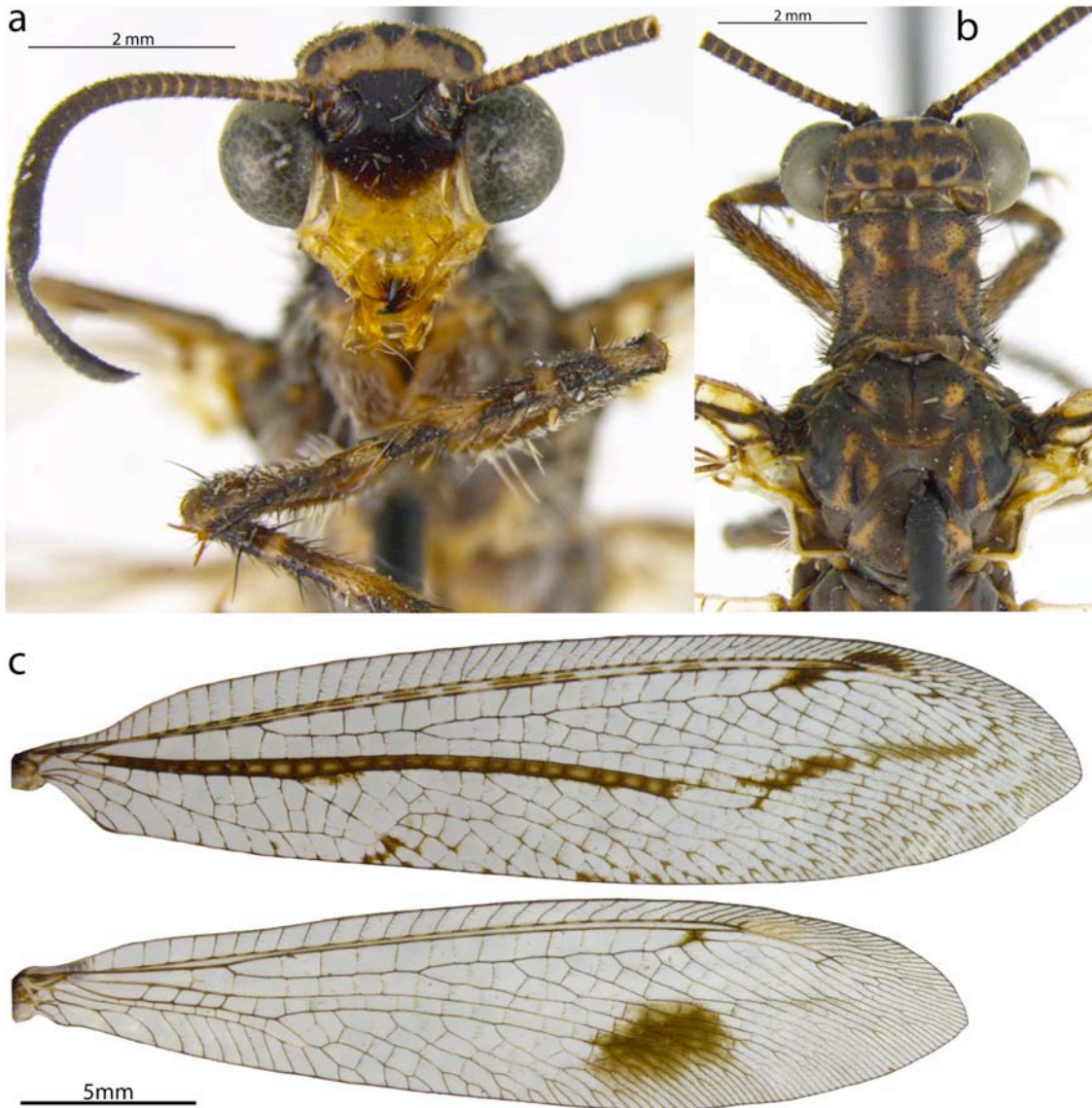


Figure A4.112: *Normanleon berthoudi*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

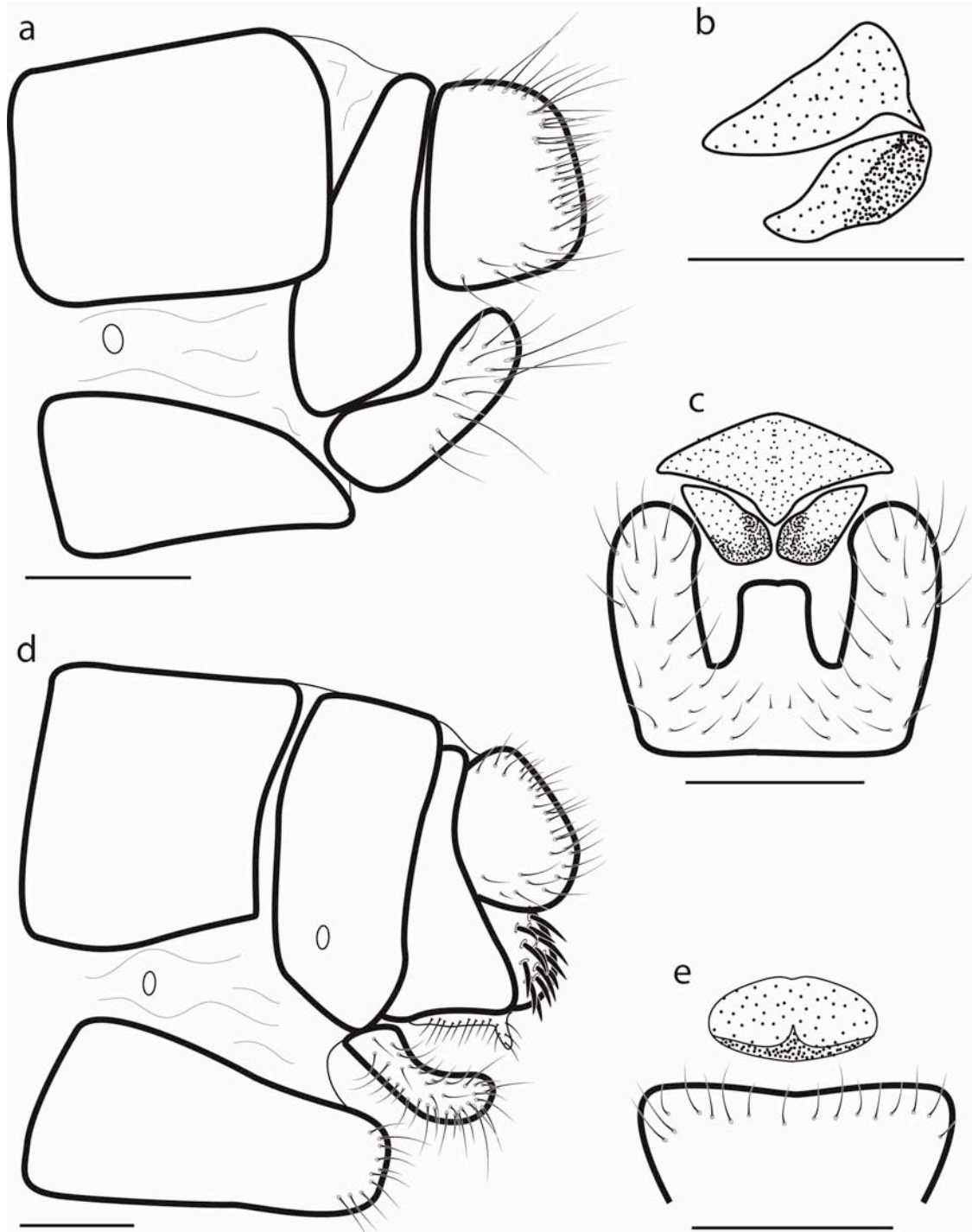


Figure A4.113: *Normanleon berthoudi*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia and 9th sternite, posterior; female: d) terminalia, lateral; e) pregenital plate and 7th sternite, ventral. Scale bars = 500µm.

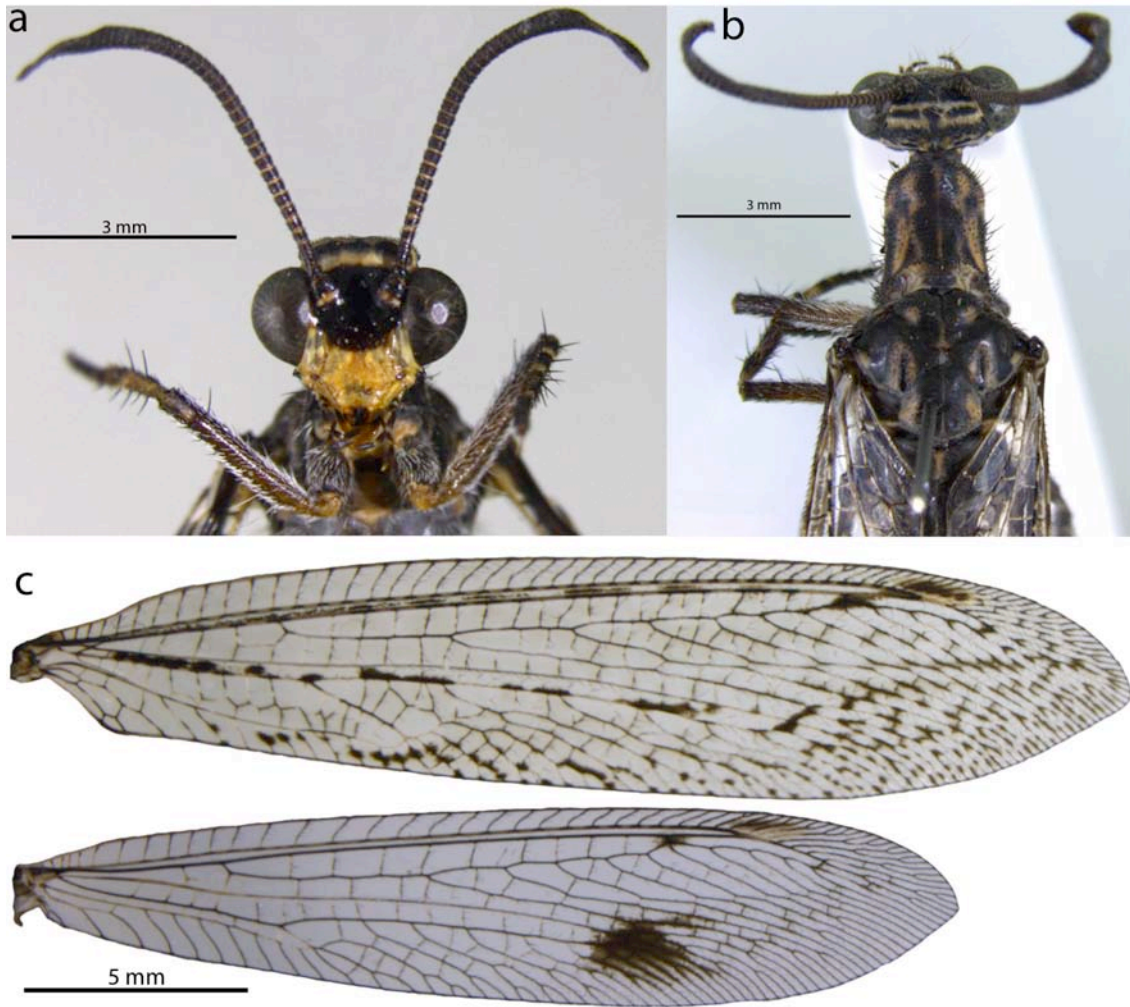


Figure A4.114: *Normanleon ceciliae* n. sp.: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

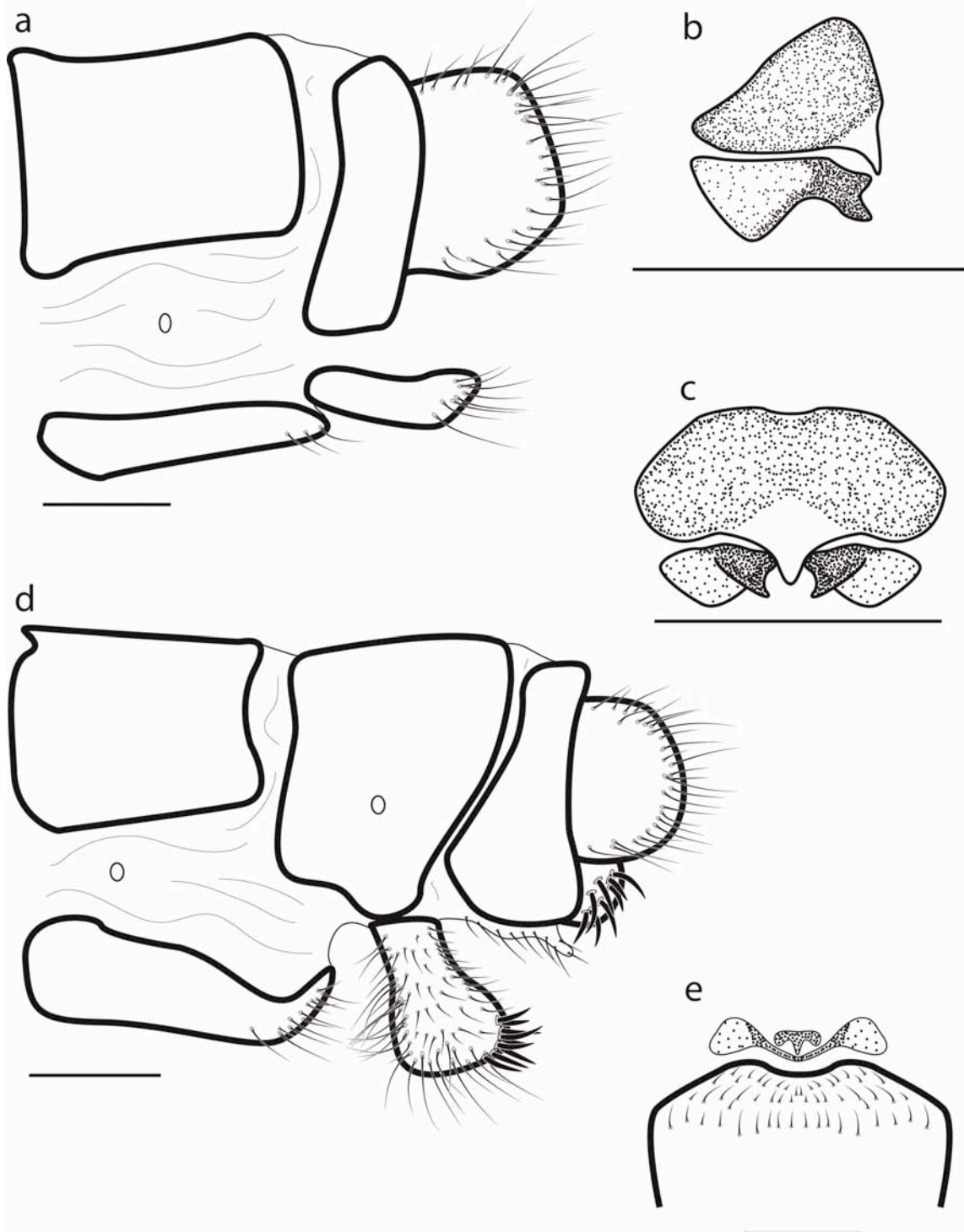


Figure A4.115: *Normanleon ceciliae* n. sp.: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; female: d) terminalia, lateral; e) pregenital plate and 7th sternite, ventral. Scale bars = 500µm.

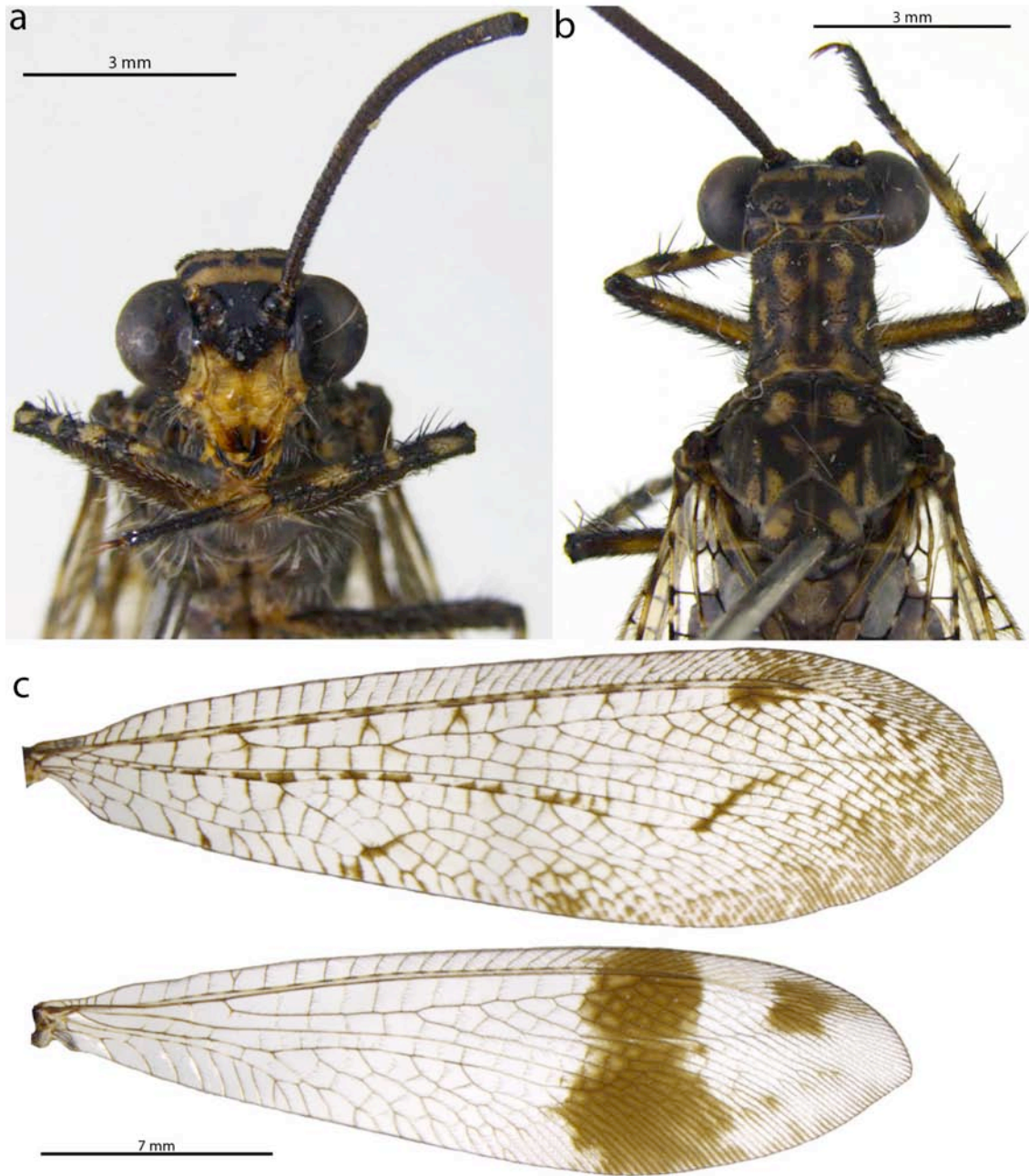


Figure A4.116: *Normanleon conspersum*: a a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

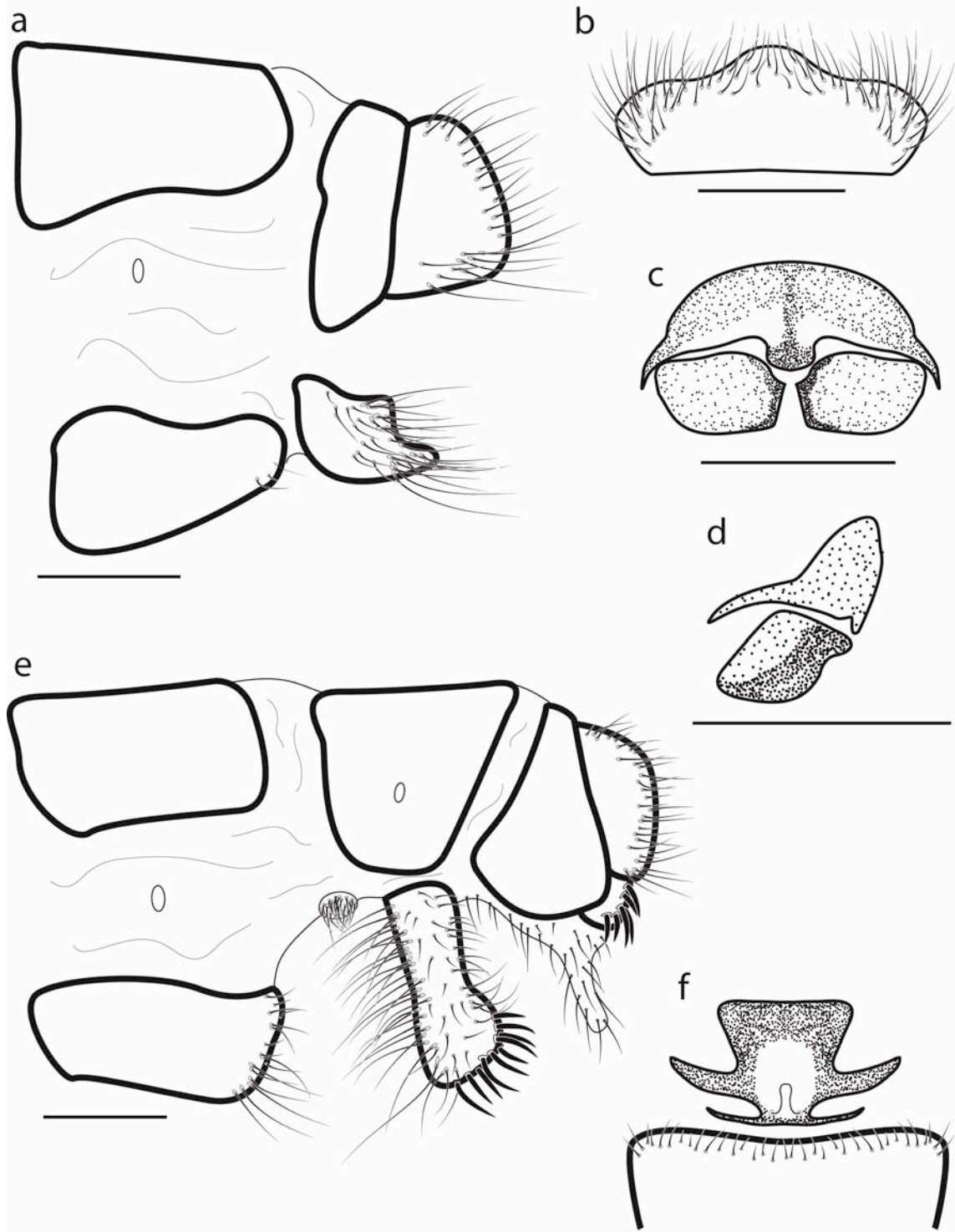


Figure A4.117: *Normanleon conspersum*: male: a) terminalia, lateral; b) 9th sternite, ventral; c) genitalia, posterior; d) genitalia, lateral; female: e) terminalia, lateral; f) pregenital plate and 7th sternite, ventral. Scale bars = 500 μ m.

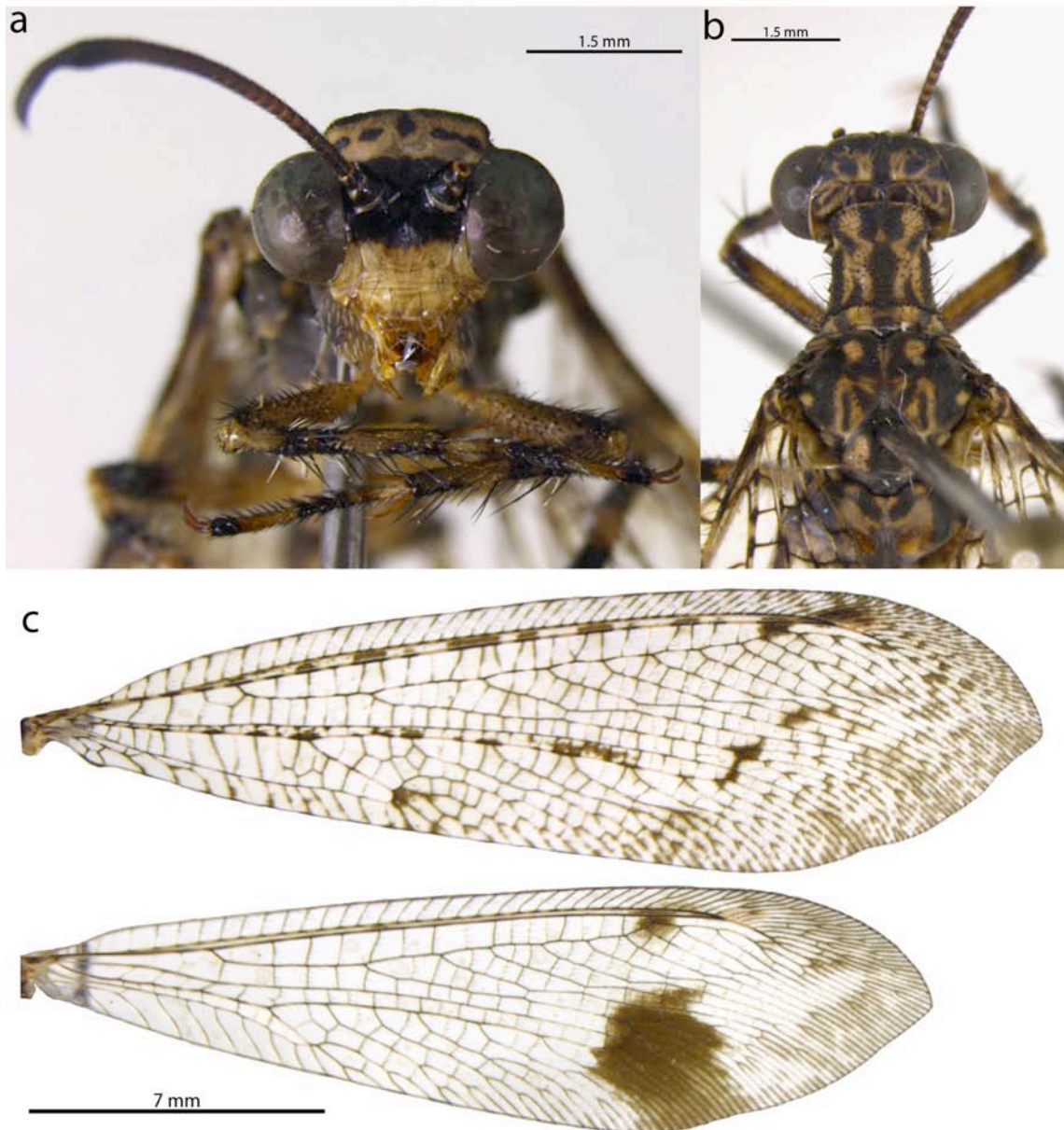


Figure A4.118: *Normanleon dissolutus*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

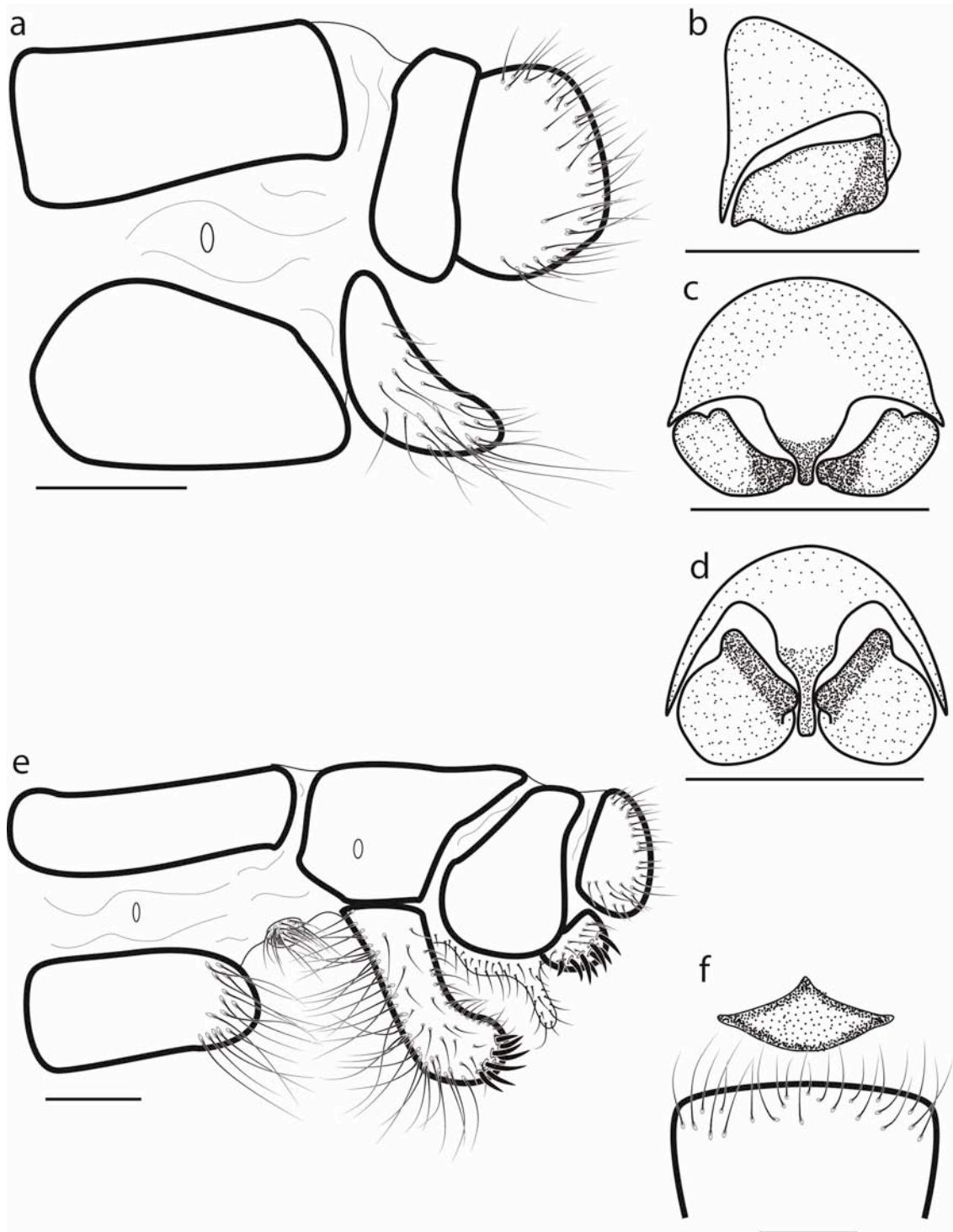


Figure A4.119: *Normanleon dissolutus*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; d) genitalia, posteroventral; female: e) terminalia, lateral; f) pregenital plate and 7th sternite, ventral. Scale bars = 500µm.

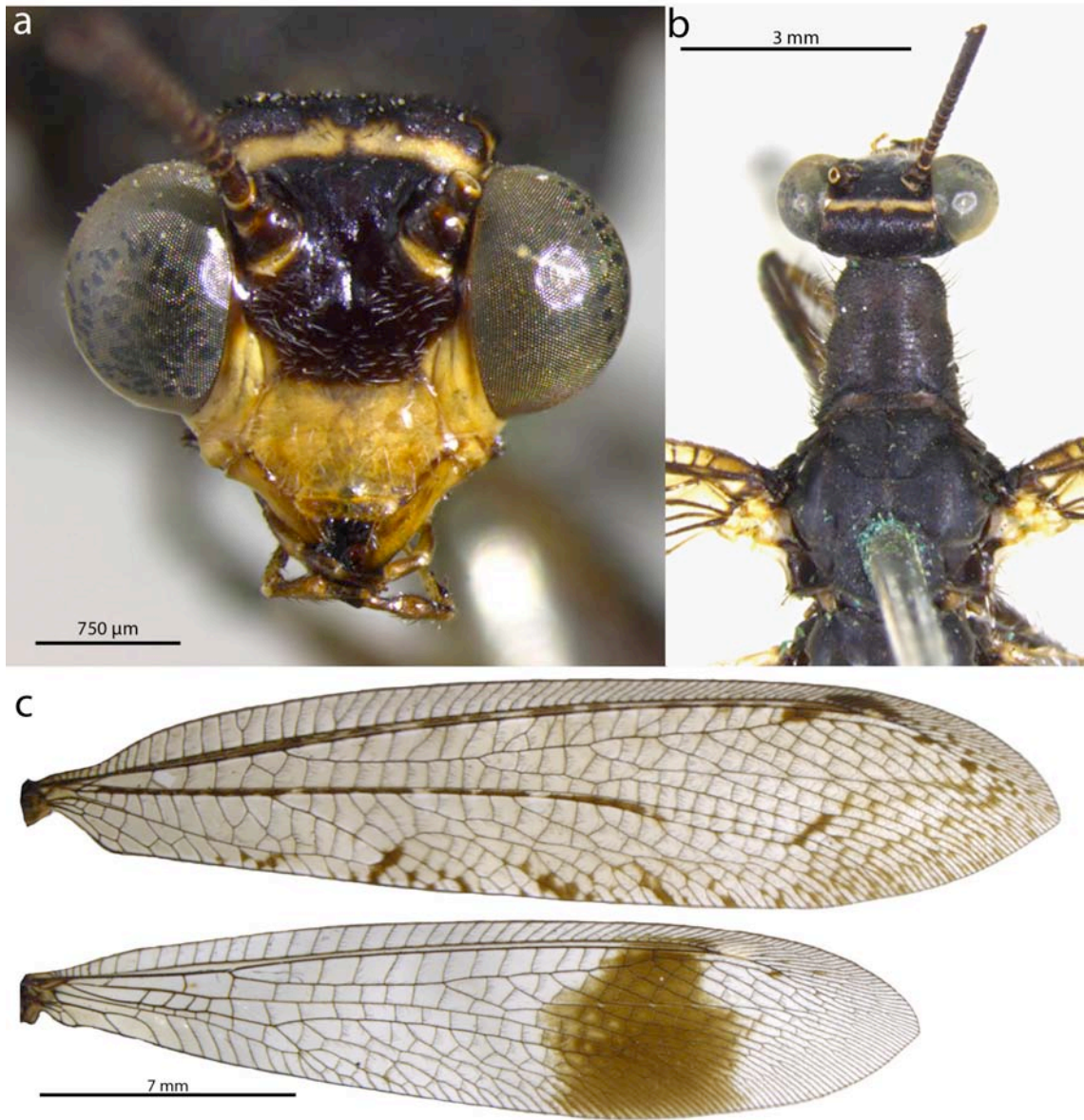


Figure A4.120: *Normanleon falsus*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

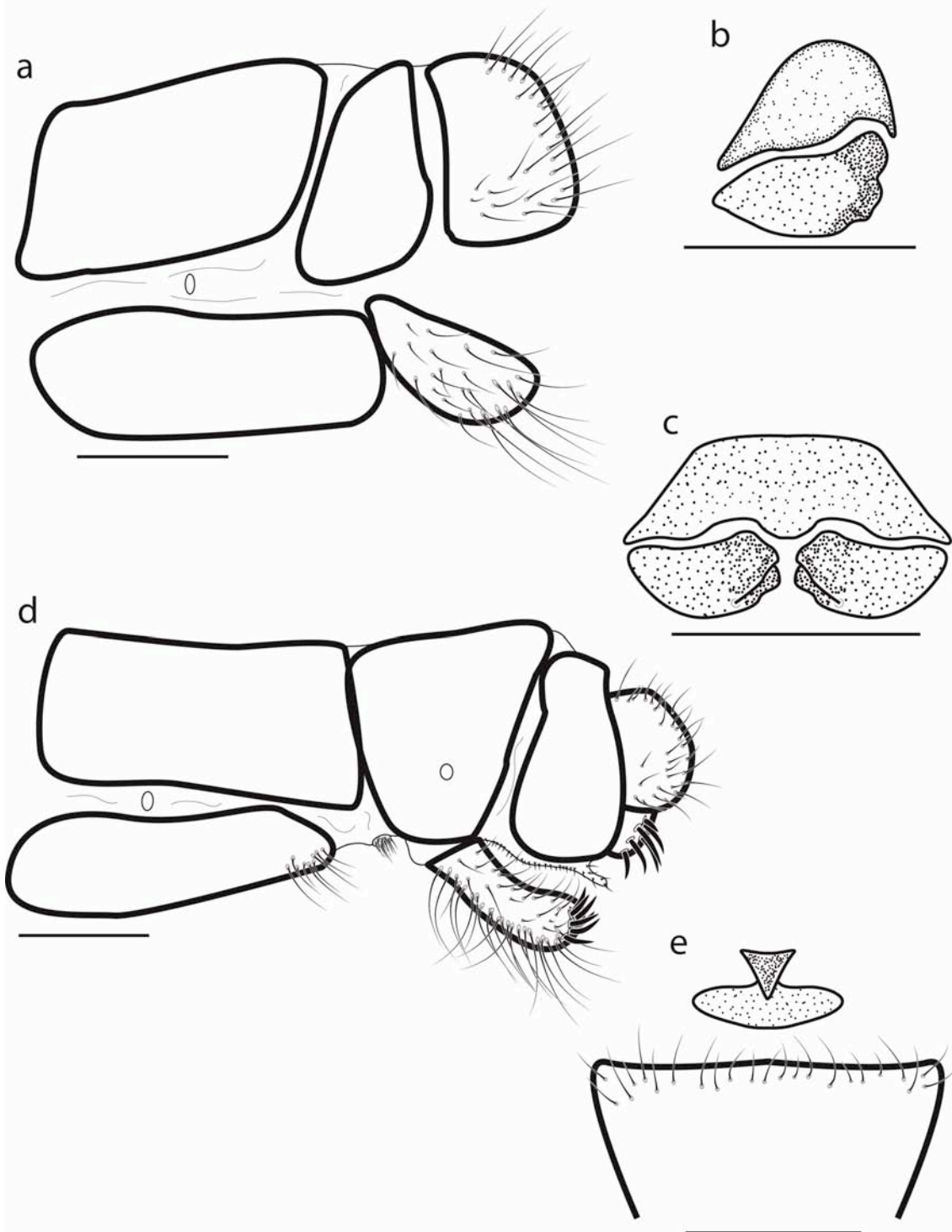


Figure A4.121: *Normanleon falsus*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; female: d) terminalia, lateral; e) pregenital plate and 7th sternite, ventral. Scale bars = 500 μ m.

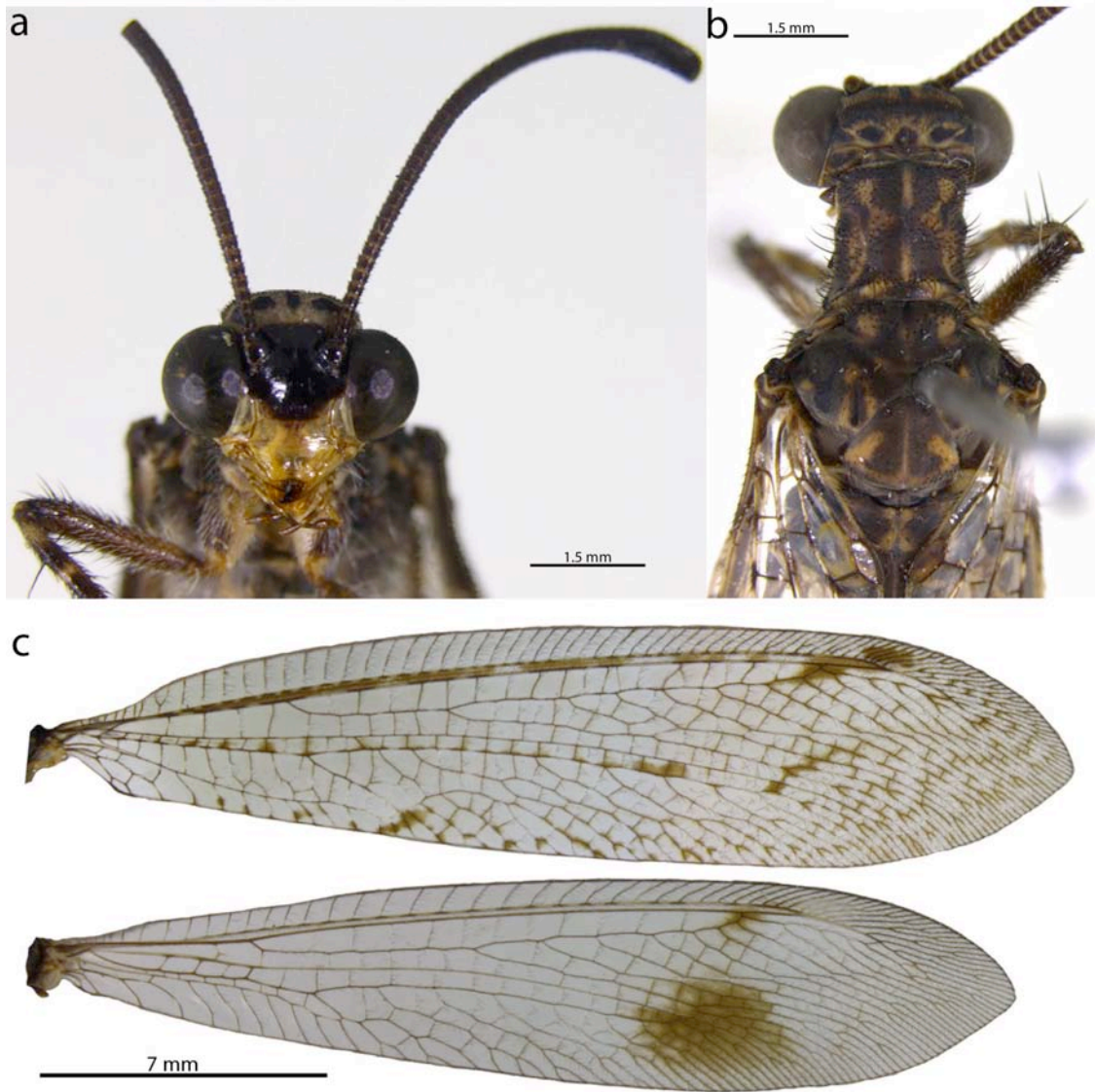


Figure A4.122: *Normanleon meteoricus*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

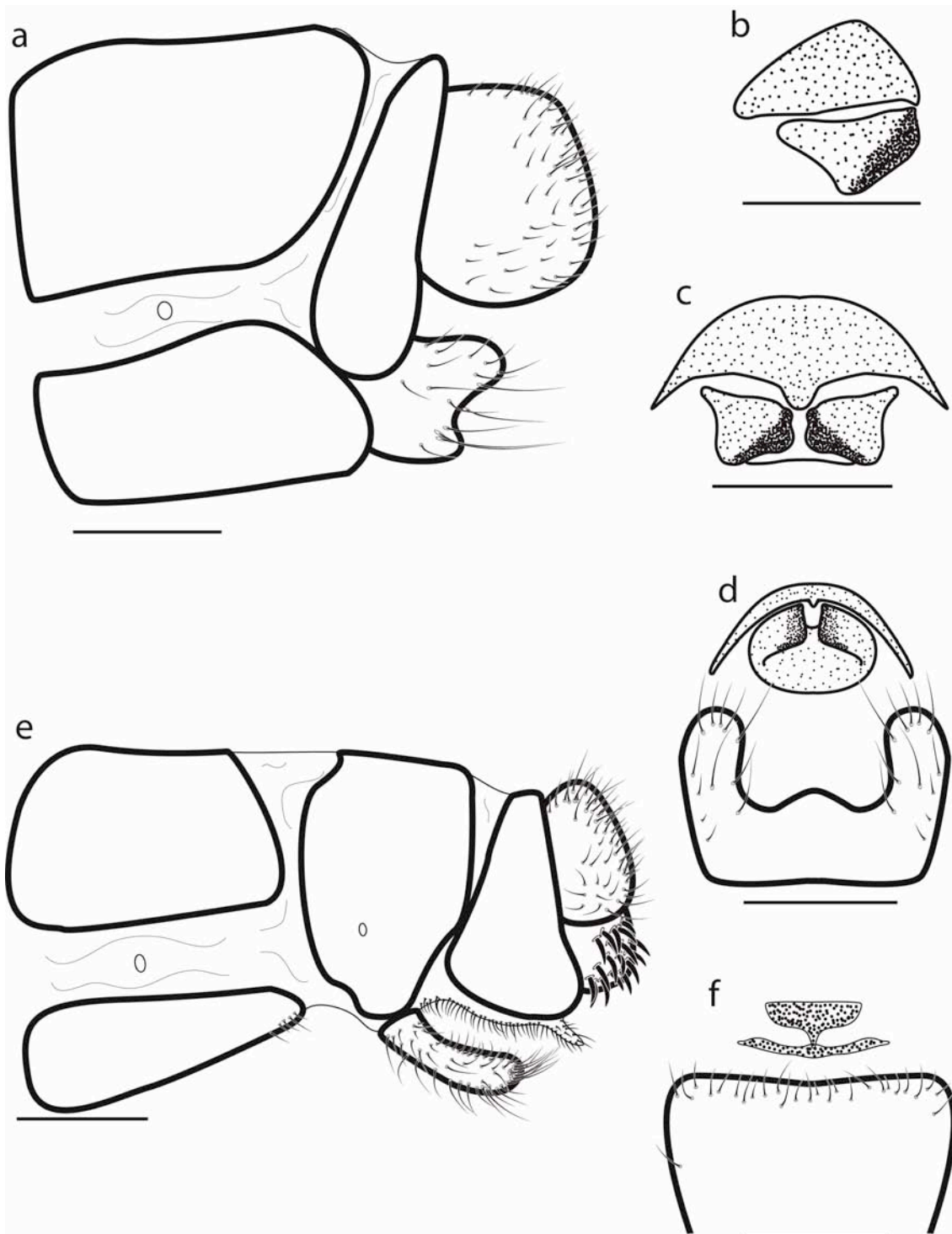


Figure A4.123: *Normanleon meteoricus*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; d) genitalia and 9th sternite, posteroventral; female: e) terminalia, lateral; f) pregenital plate and 7th sternite, ventral. Scale bars = 500µm.

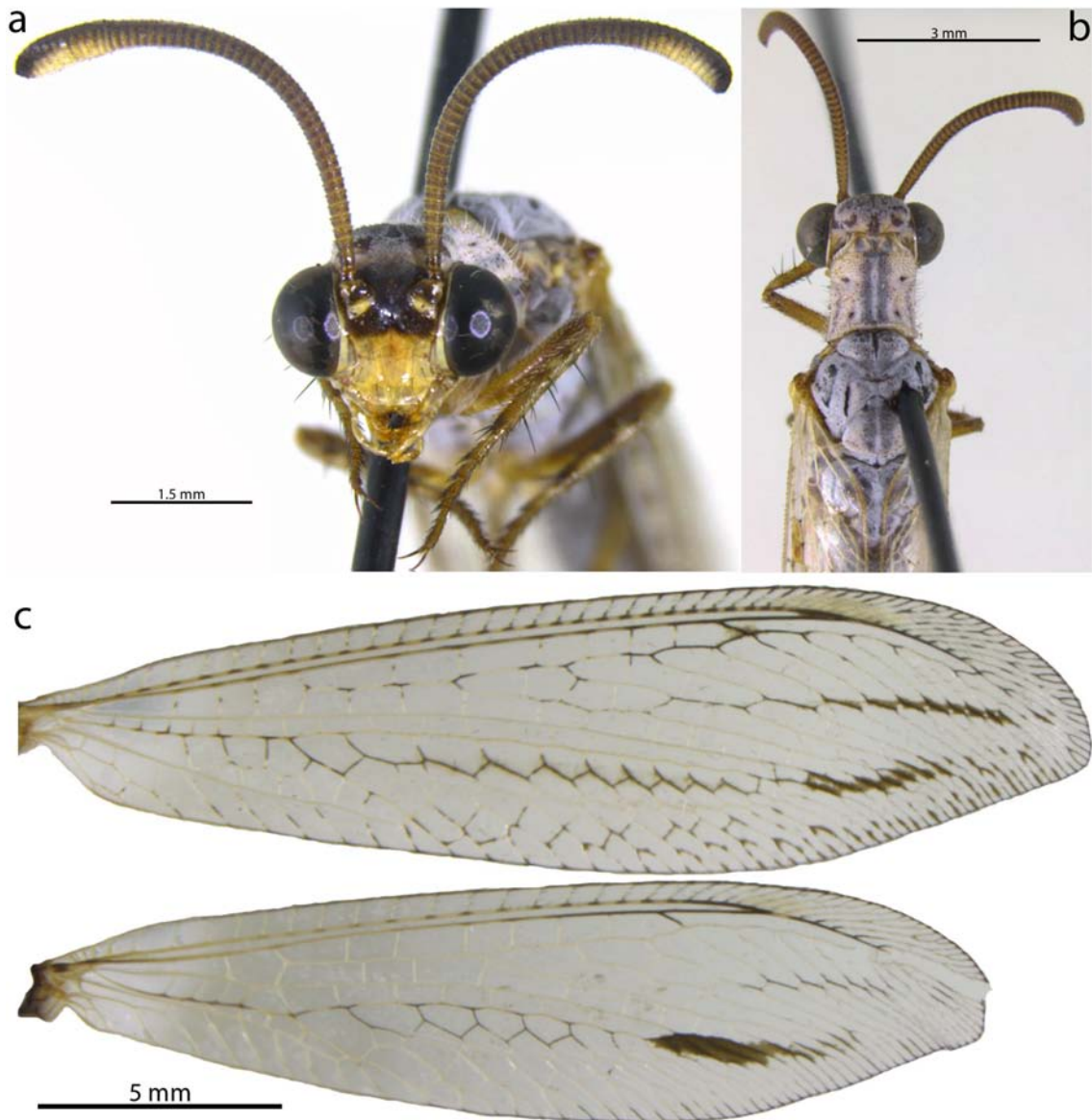


Figure A4.124: *Paraustrogymnocnemia diehli* n. sp.: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

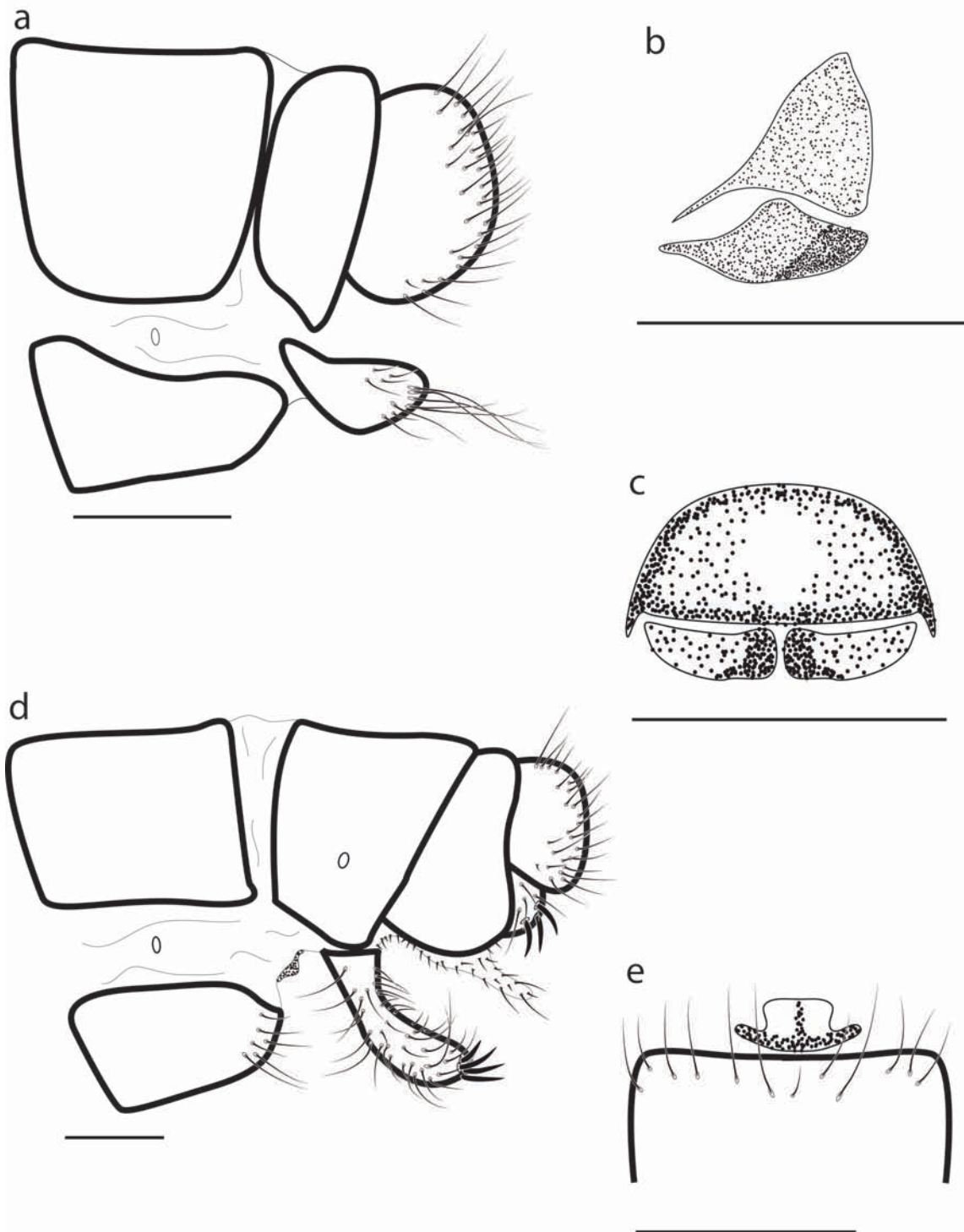


Figure A4.125: *Paraustrogymnocnemia diehli* n. sp.: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; female: d) terminalia, lateral; e) pregenital plate and 7th sternite, ventral. Scale bars = 500 μ m.

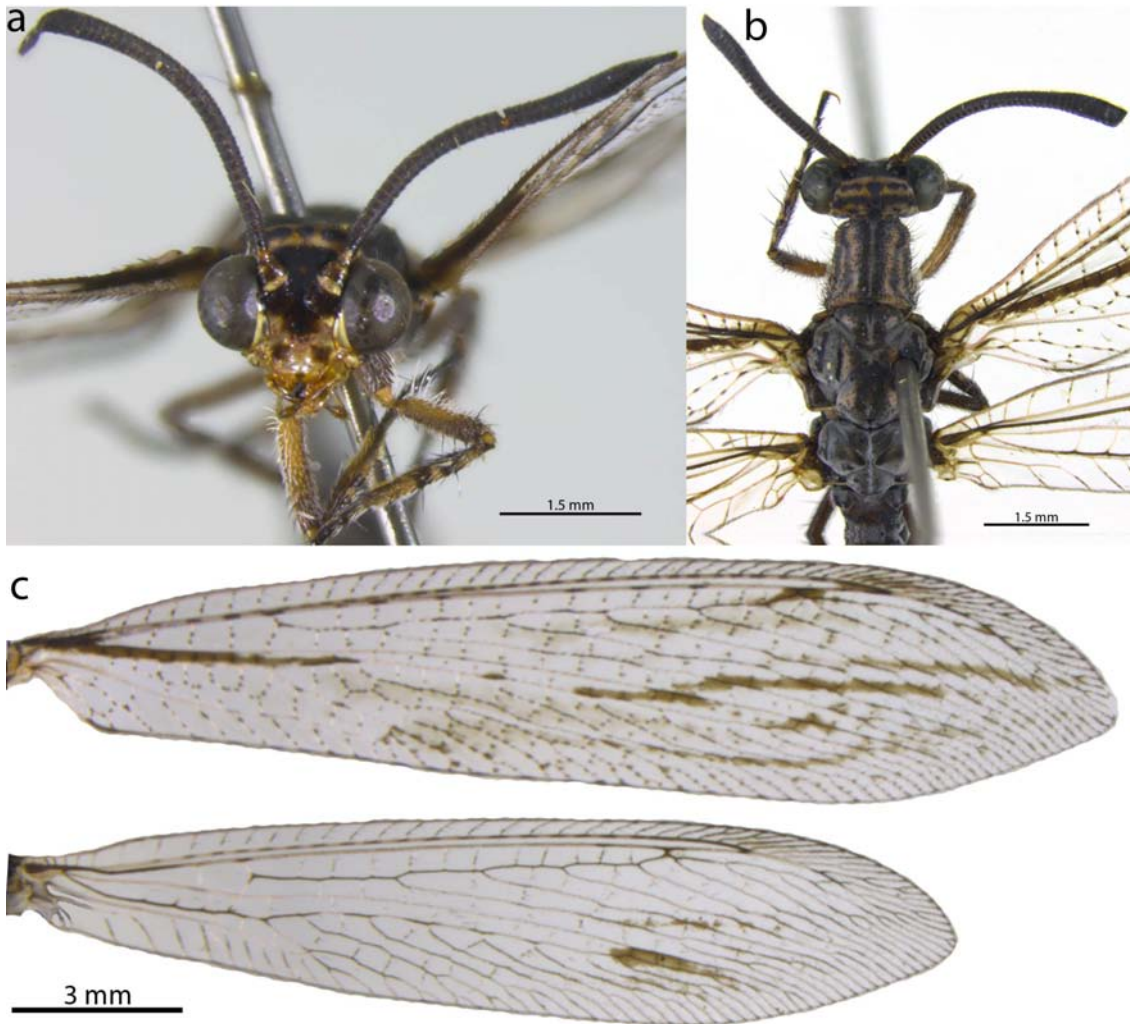


Figure A4.126: *Paraustrogymnocnemia interrupta*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

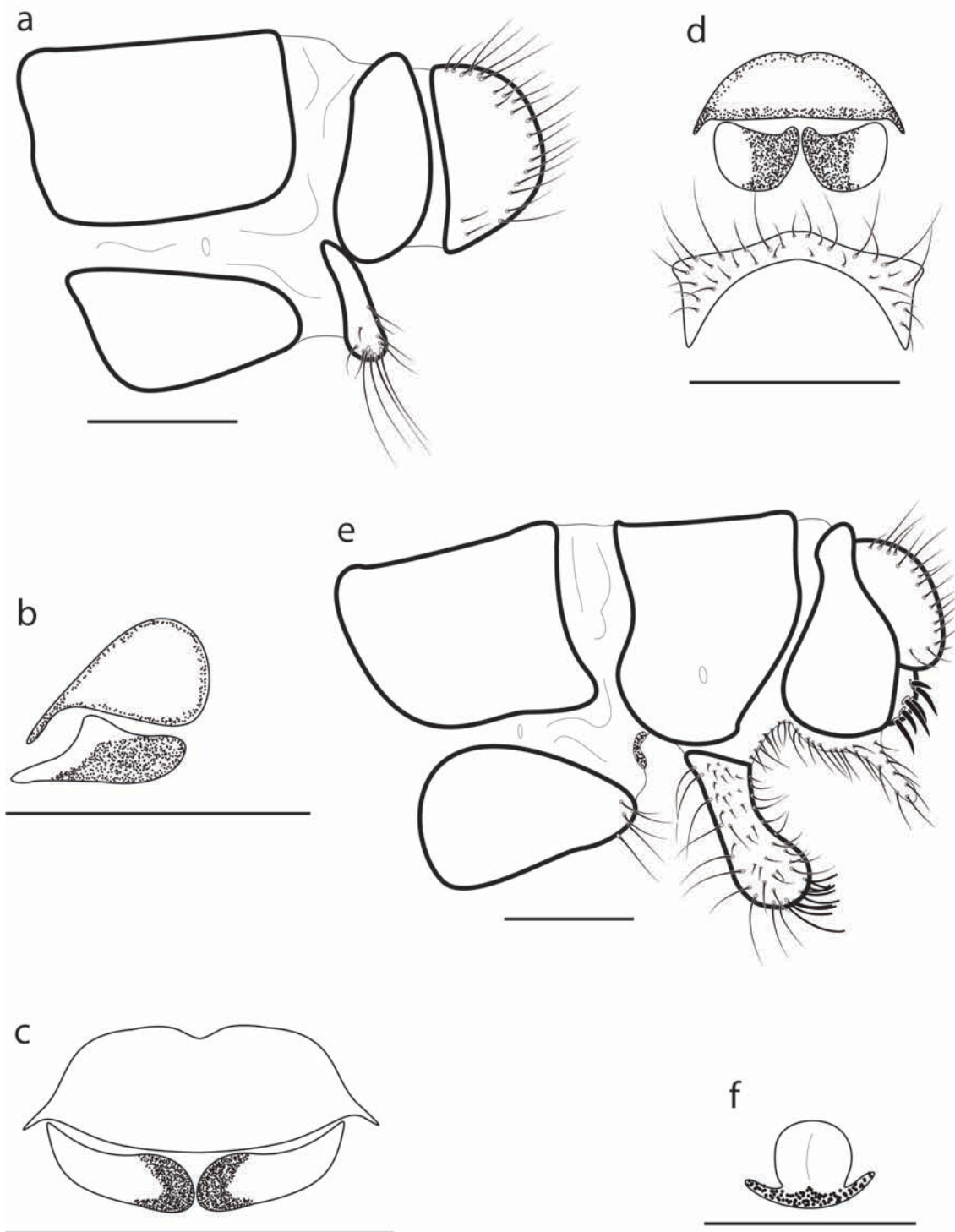


Figure A4.127: *Paraustrogymnocnemia interrupta*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; d) genitalia and 9th sternite, posteroventral; female: e) terminalia, lateral; f) pregenital plate, ventral. Scale bars = 500 μ m.

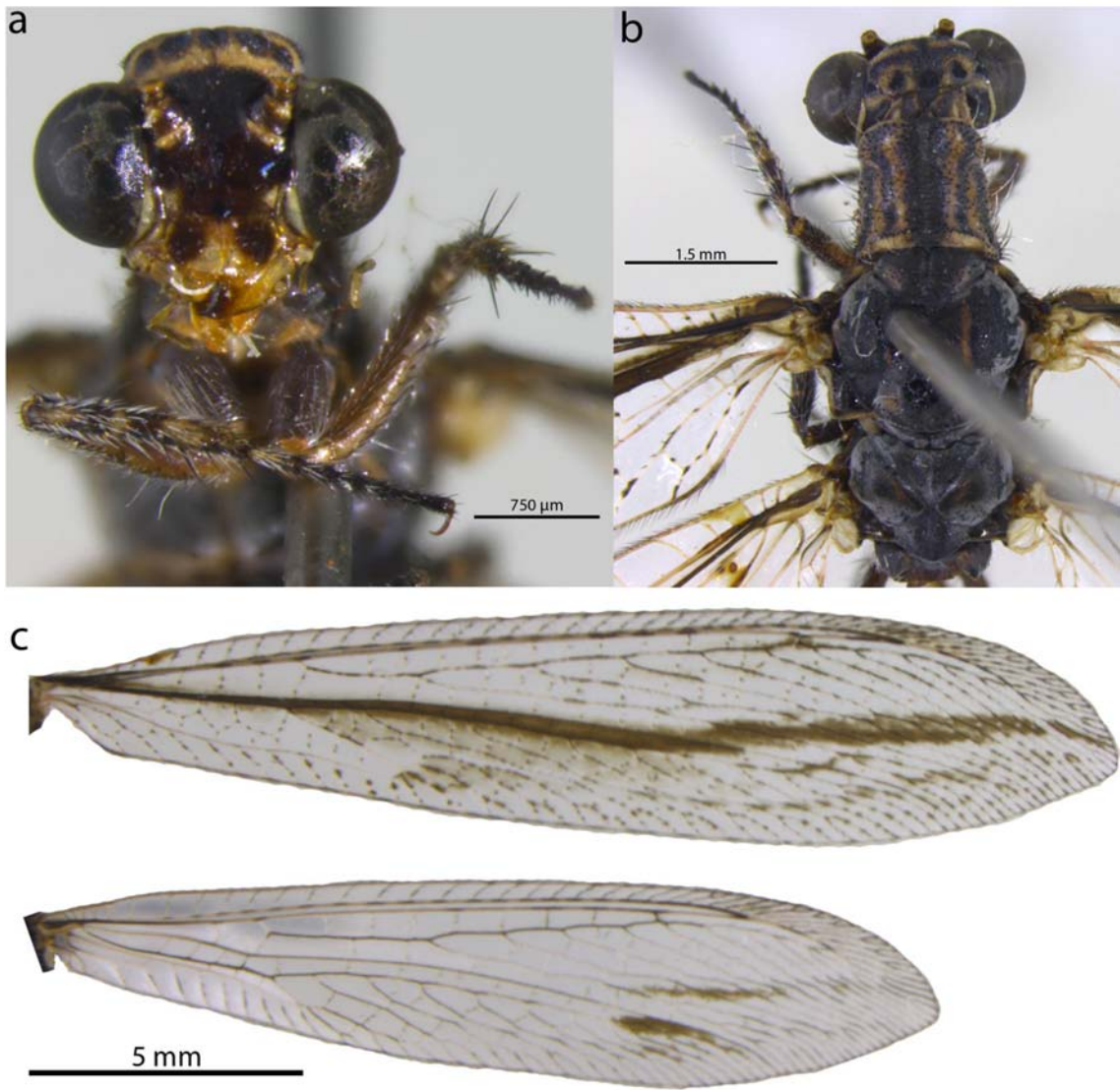


Figure A4.128: *Paraustrogymnocnemia lineata*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

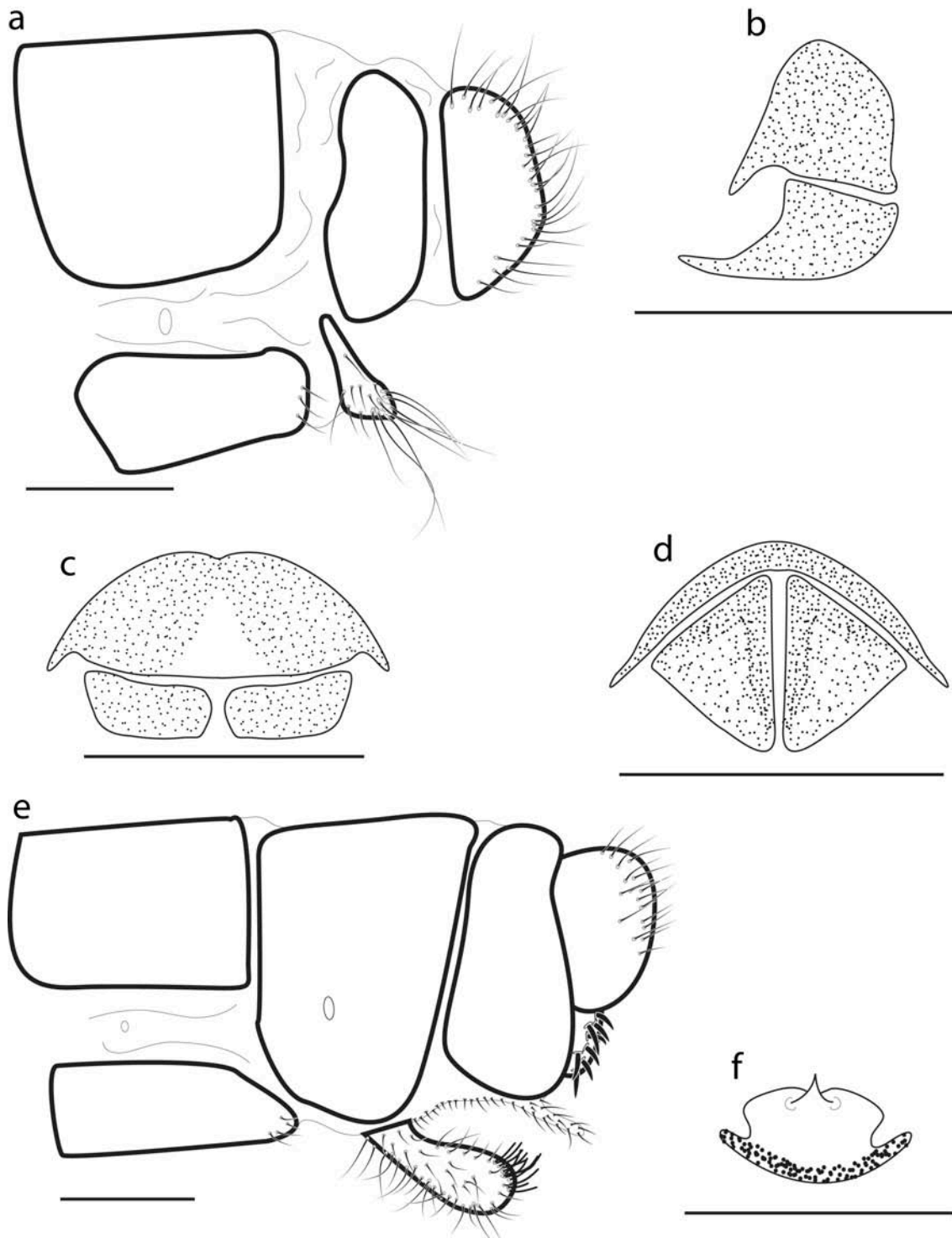


Figure A4.129: *Paraustrogymnocnemia lineata*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; d) genitalia, posteroventral; female: e) terminalia, lateral; f) pregenital plate, ventral. Scale bars = 500 μ m.



Figure A4.130: *Periclystus aureolatus*: a) head, frontal; b) head and thorax, lateral; c) head and thorax, dorsal; d) fore and hind wing, dorsal.

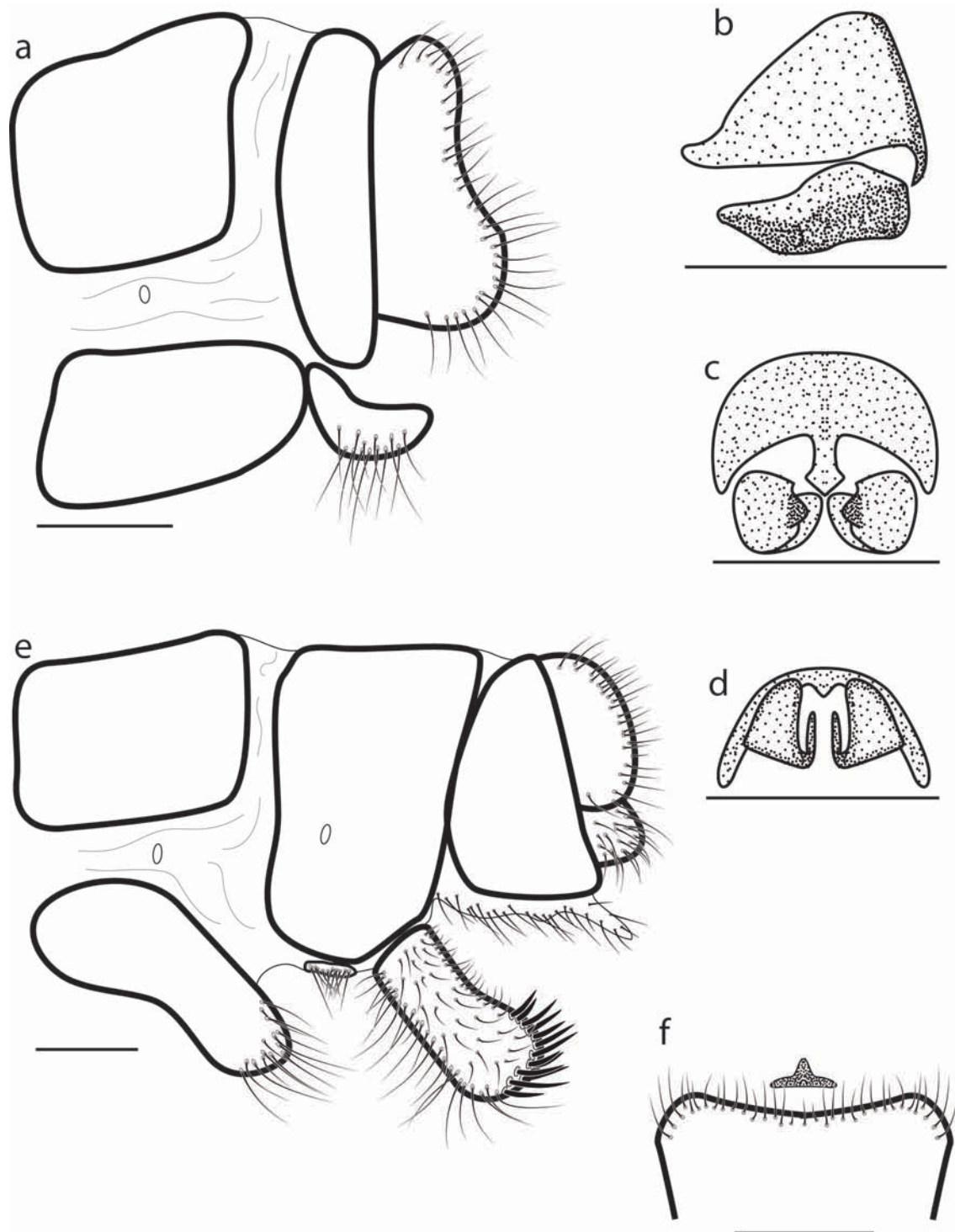


Figure A4.131: *Periclystus aureolatus*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; d) genitalia, ventral; female: e) terminalia, lateral; f) 7th sternite and pregenital plate, ventral. Scale bars = 500 μ m.

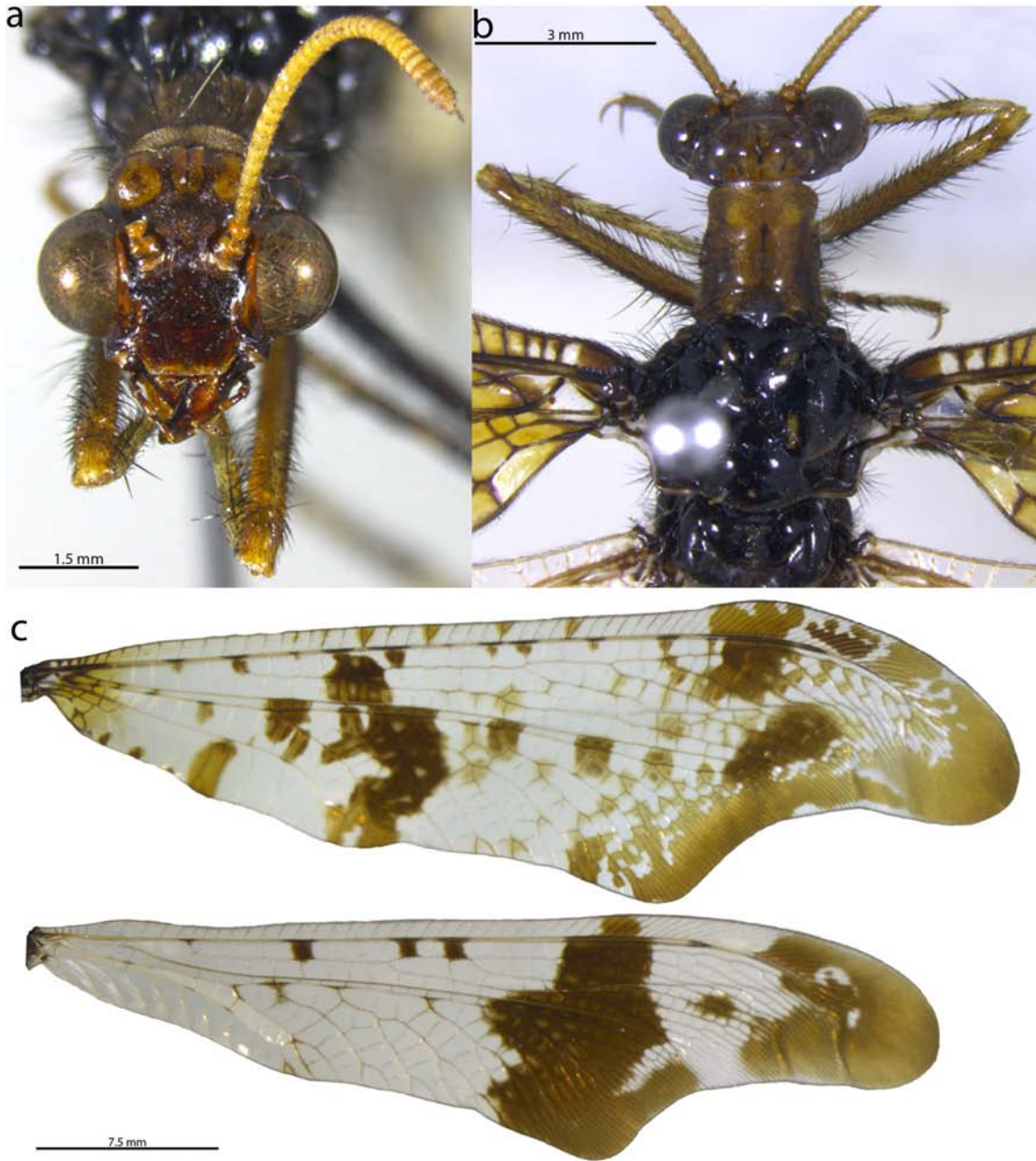


Figure A4.132: *Periclystus circuiter*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

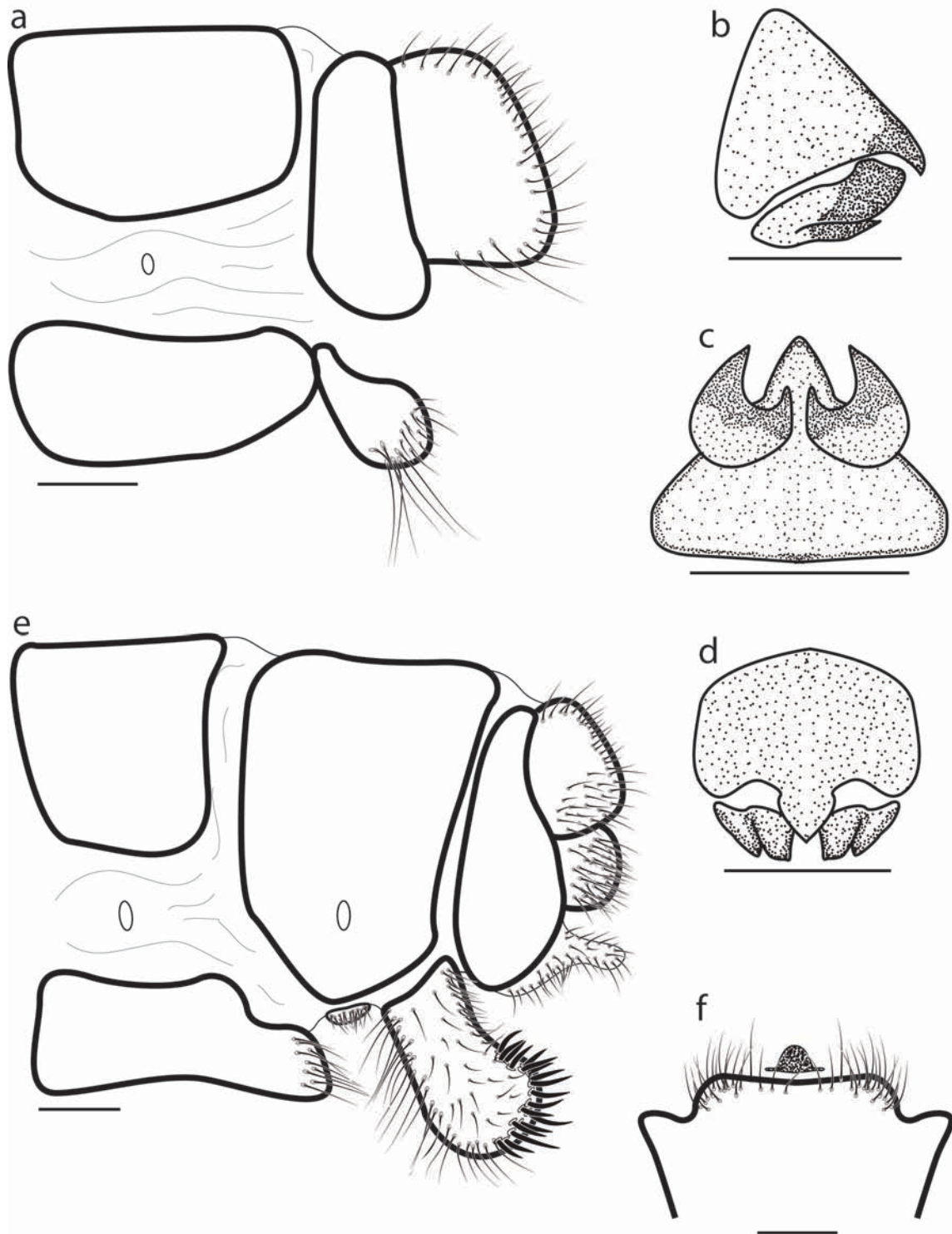


Figure A4.133: *Perichlystus circuiter*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, ventral; d) genitalia, posterior; female: e) terminalia, lateral; f) 7th sternite and pregenital plate, ventral. Scale bars = 500µm.

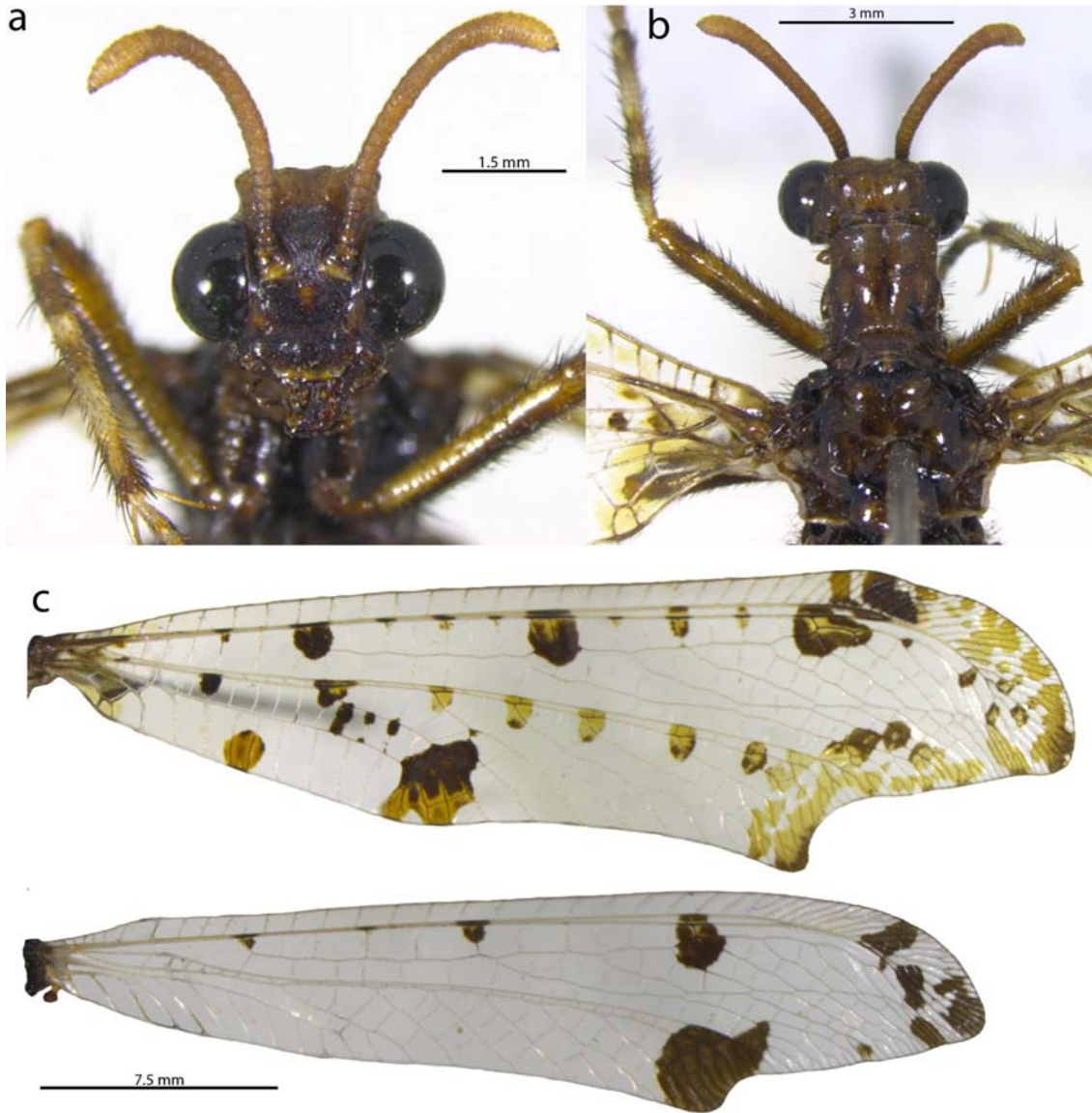


Figure A4.134: *Perichlystus laceratus*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

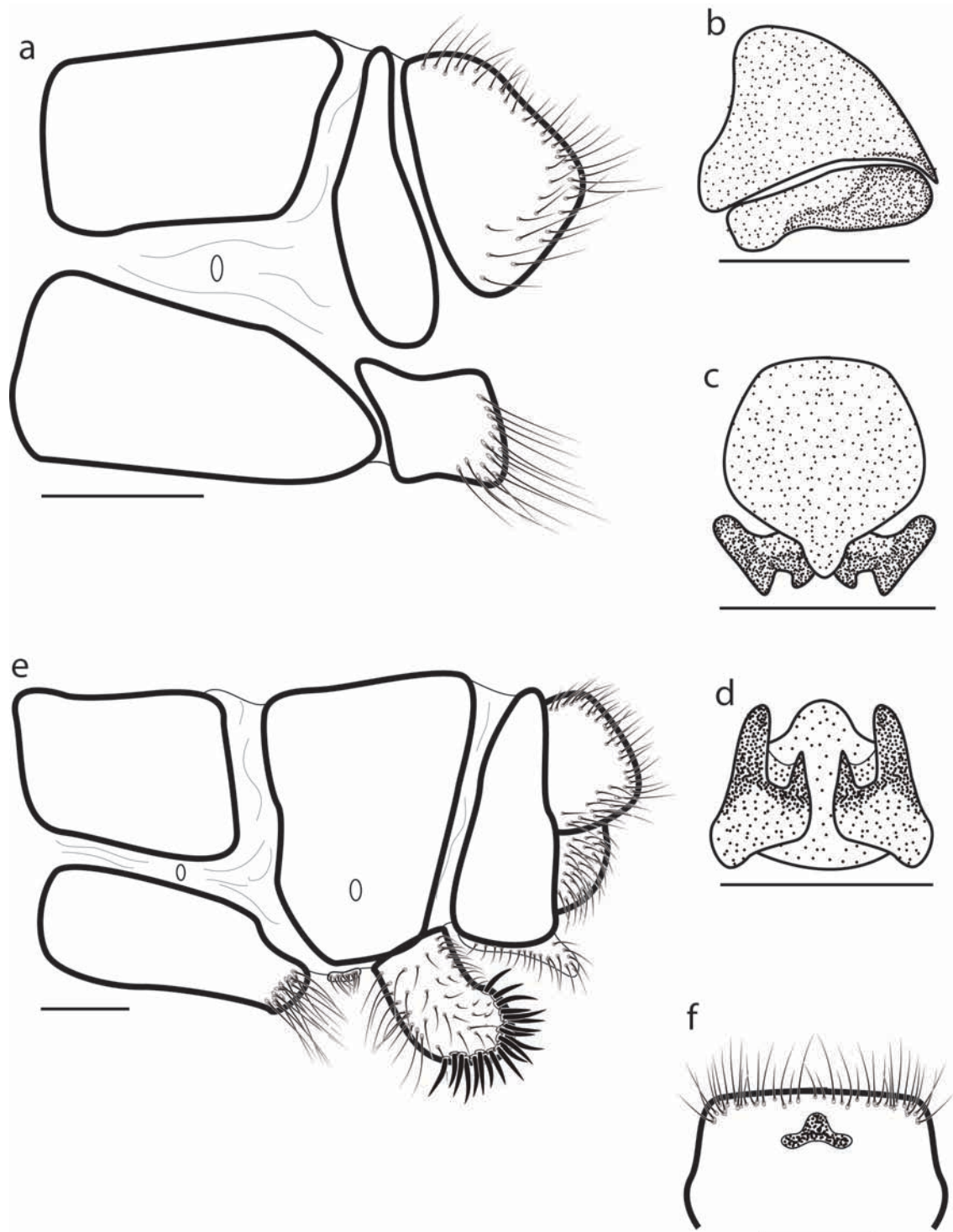


Figure A4.135: *Periclystus laceratus*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; d) genitalia, ventral; female: e) terminalia, lateral; f) 7th sternite and pregenital plate, ventral, showing the pregenital plate hidden beneath the sternite. Scale bars = 500 μ m.



Figure A4.136: *Periclystus vicinus*: a) specimen, lateral; b) fore and hind wing, dorsal.

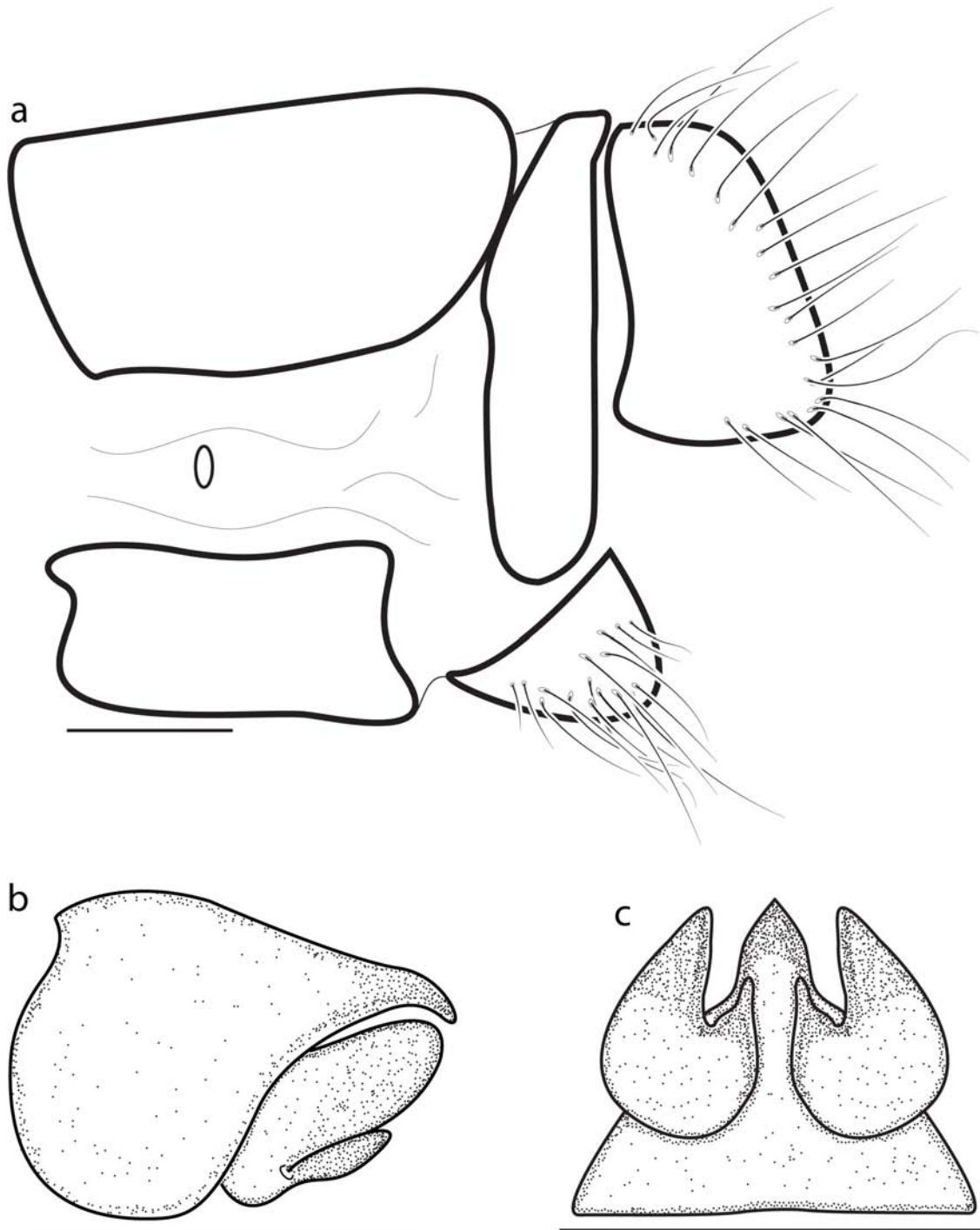


Figure A4.137: *Periclystus vicinus*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, ventral. Scale bars = 500 μ m.

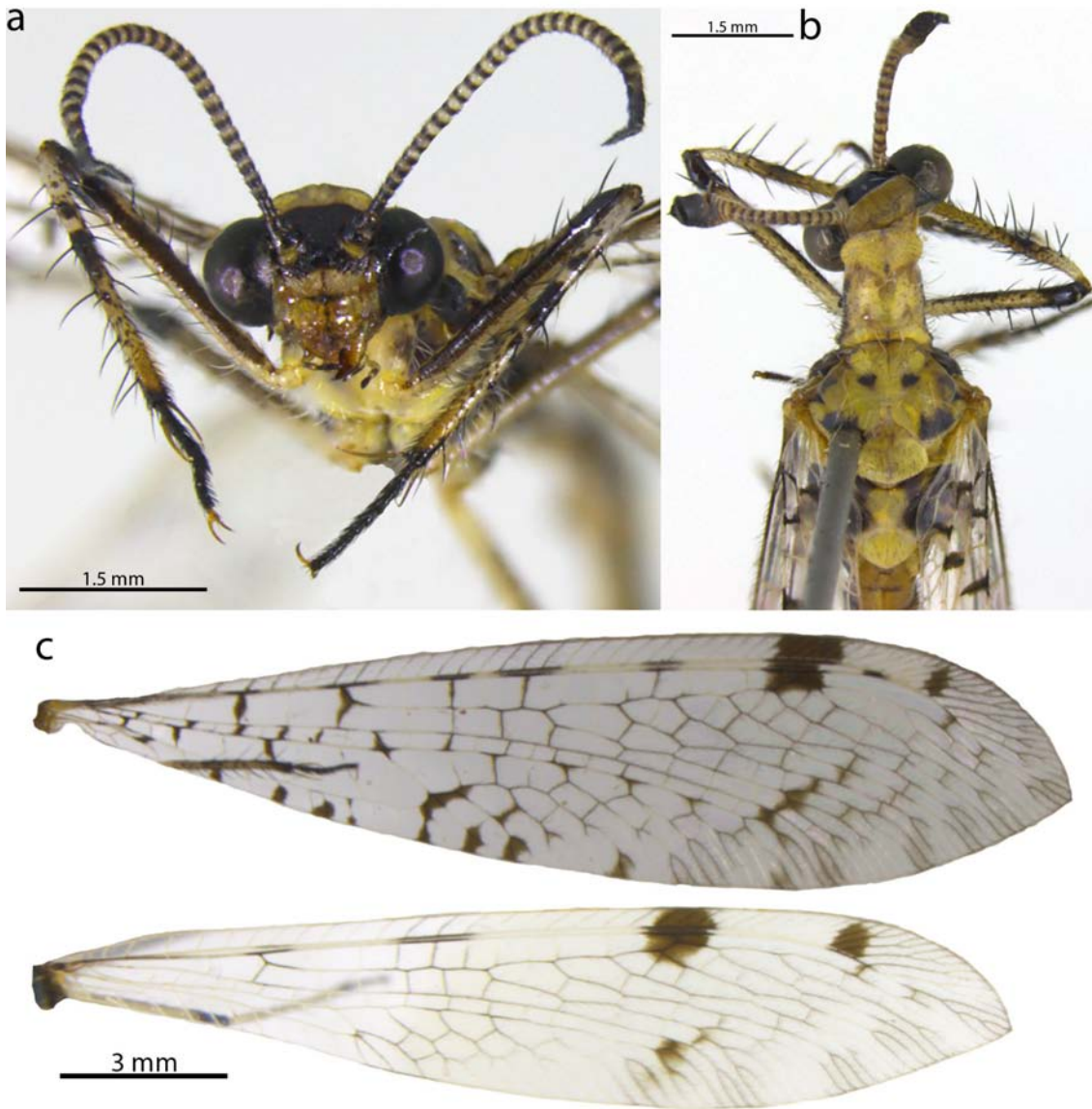


Figure A4.138: *Riekoleon convergens*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal (tip of legs shoeing on the base of the wings).

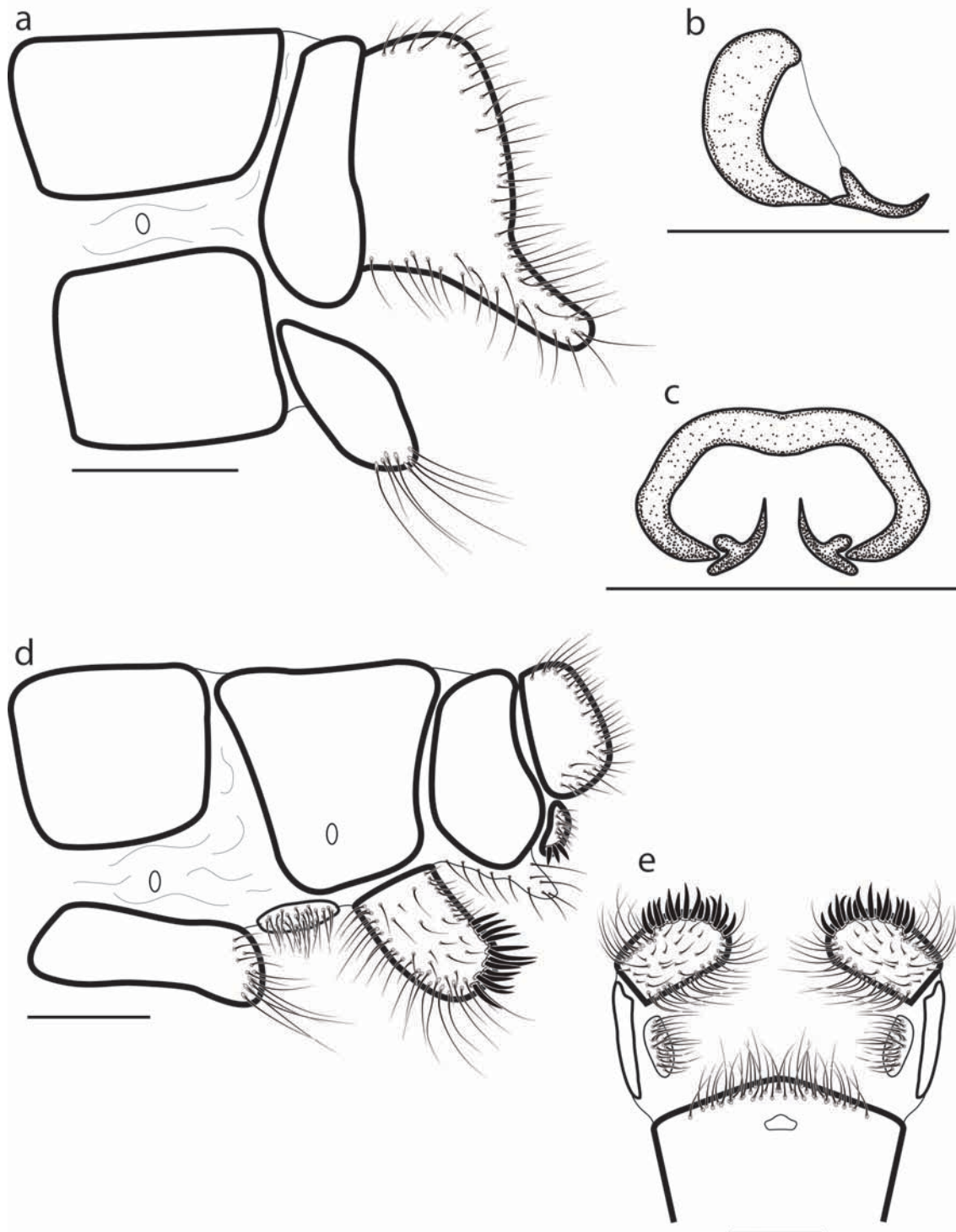


Figure A4.139: *Riekoleon convergens*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; female: d) terminalia, lateral; e) terminalia, posteroventral, showing the pregenital plate hidden beneath the sternite. Scale bars = 500 μ m.

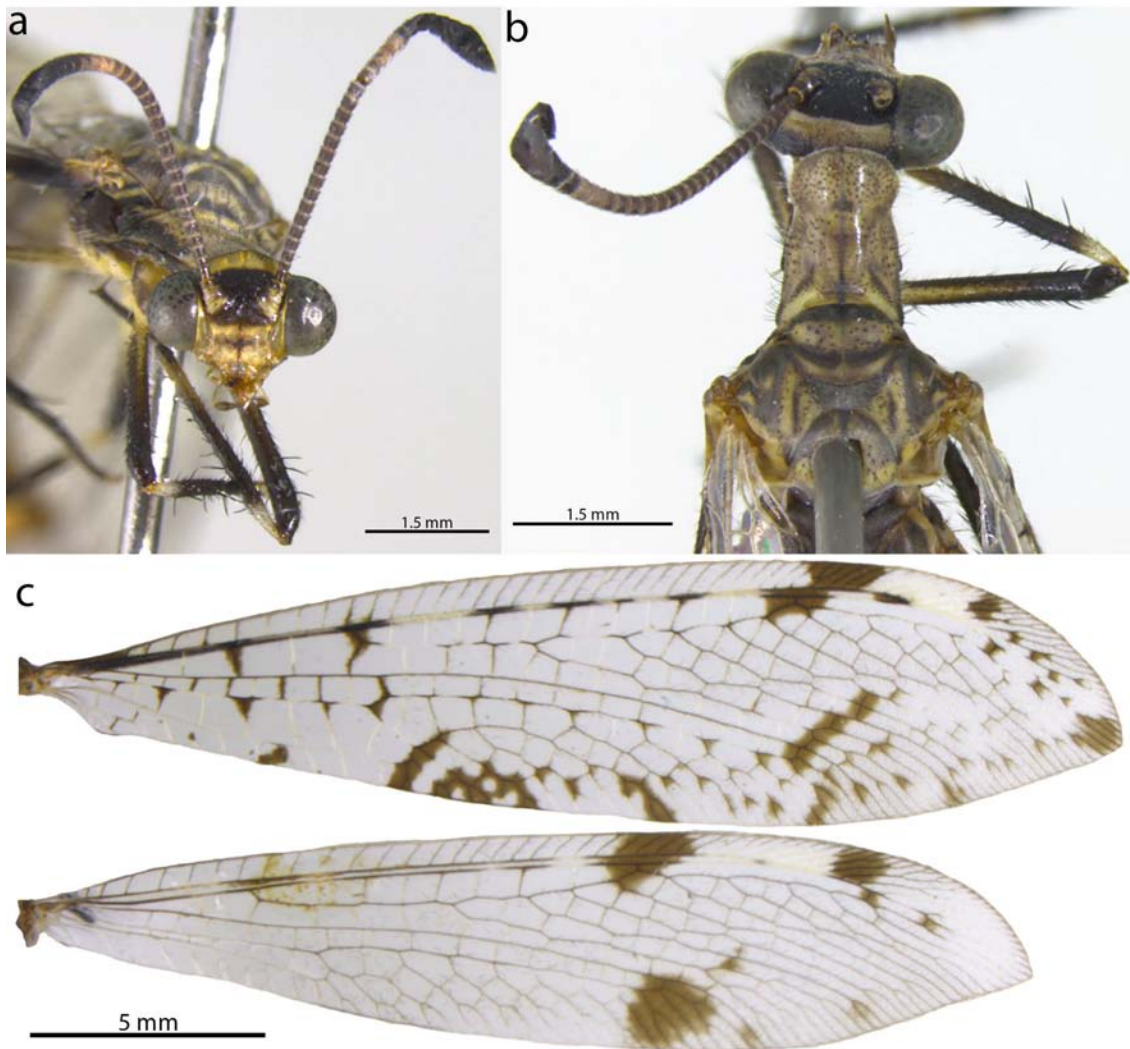


Figure A4.140: *Riekoleon furcatus*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

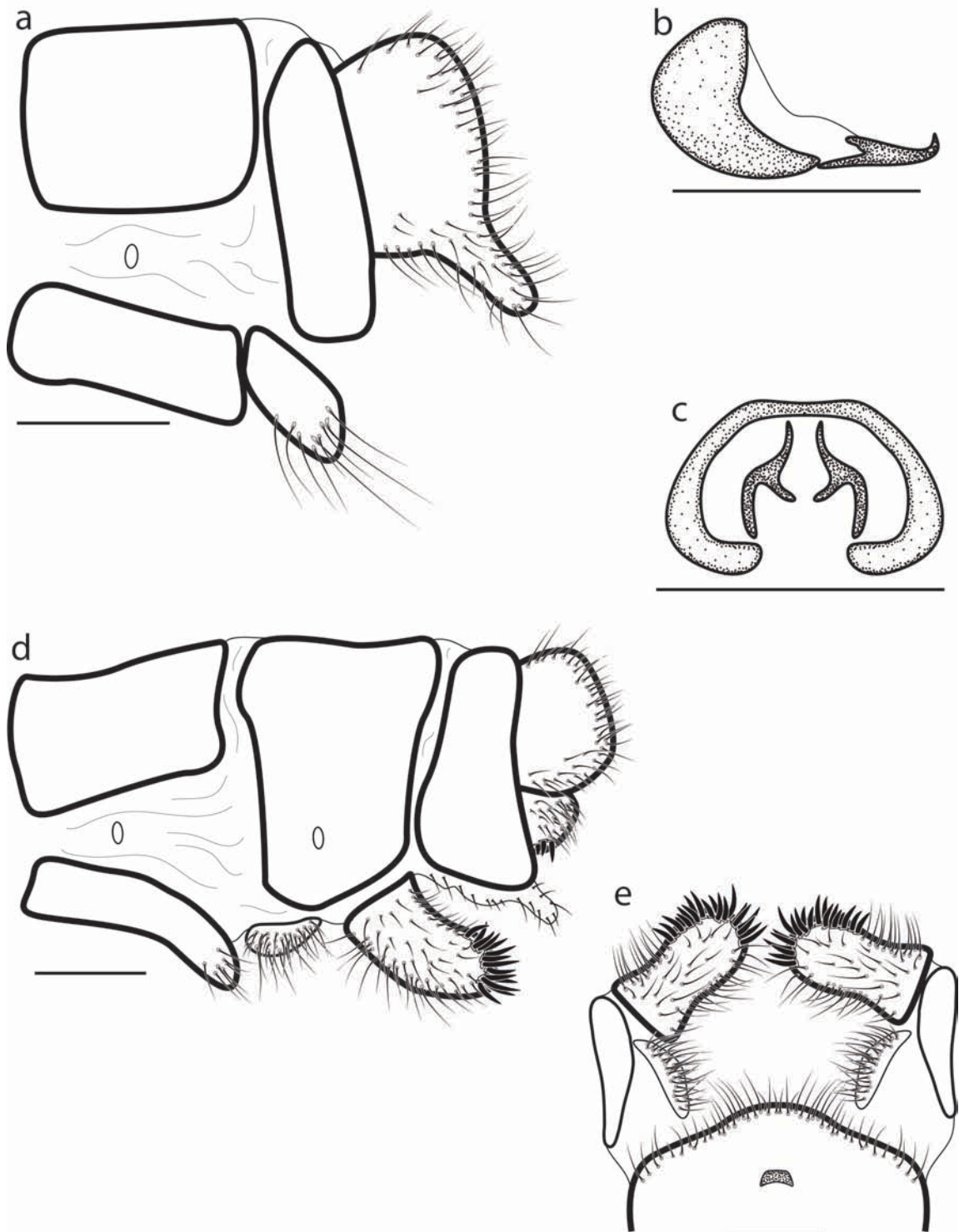


Figure A4.141: *Riekoleon furcatus*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; female: d) terminalia, lateral; e) terminalia, posteroventral, showing the pregenital plate hidden beneath the sternite. Scale bars = 500 μ m.

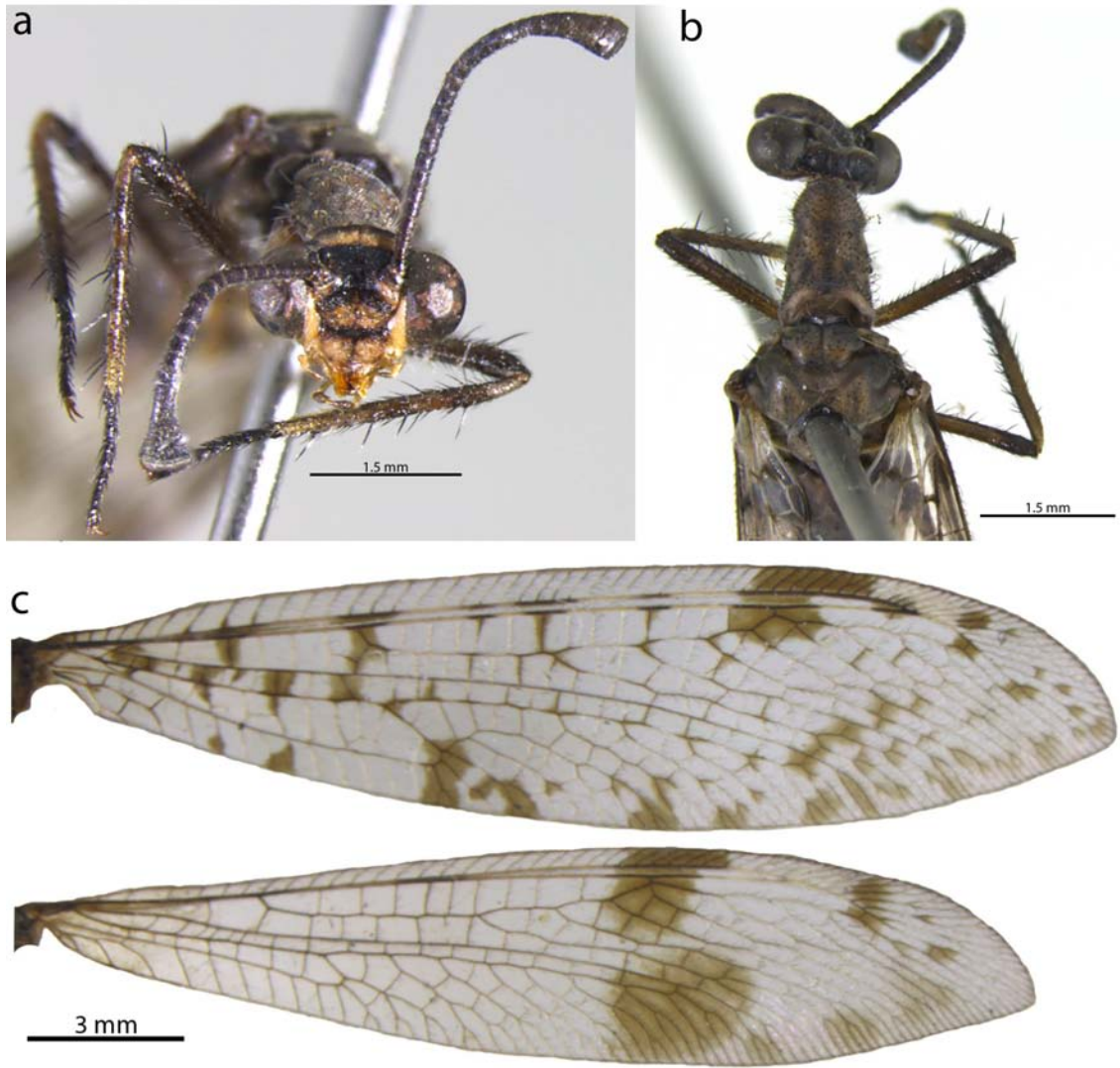


Figure A4.142: *Riekoleon proctus*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

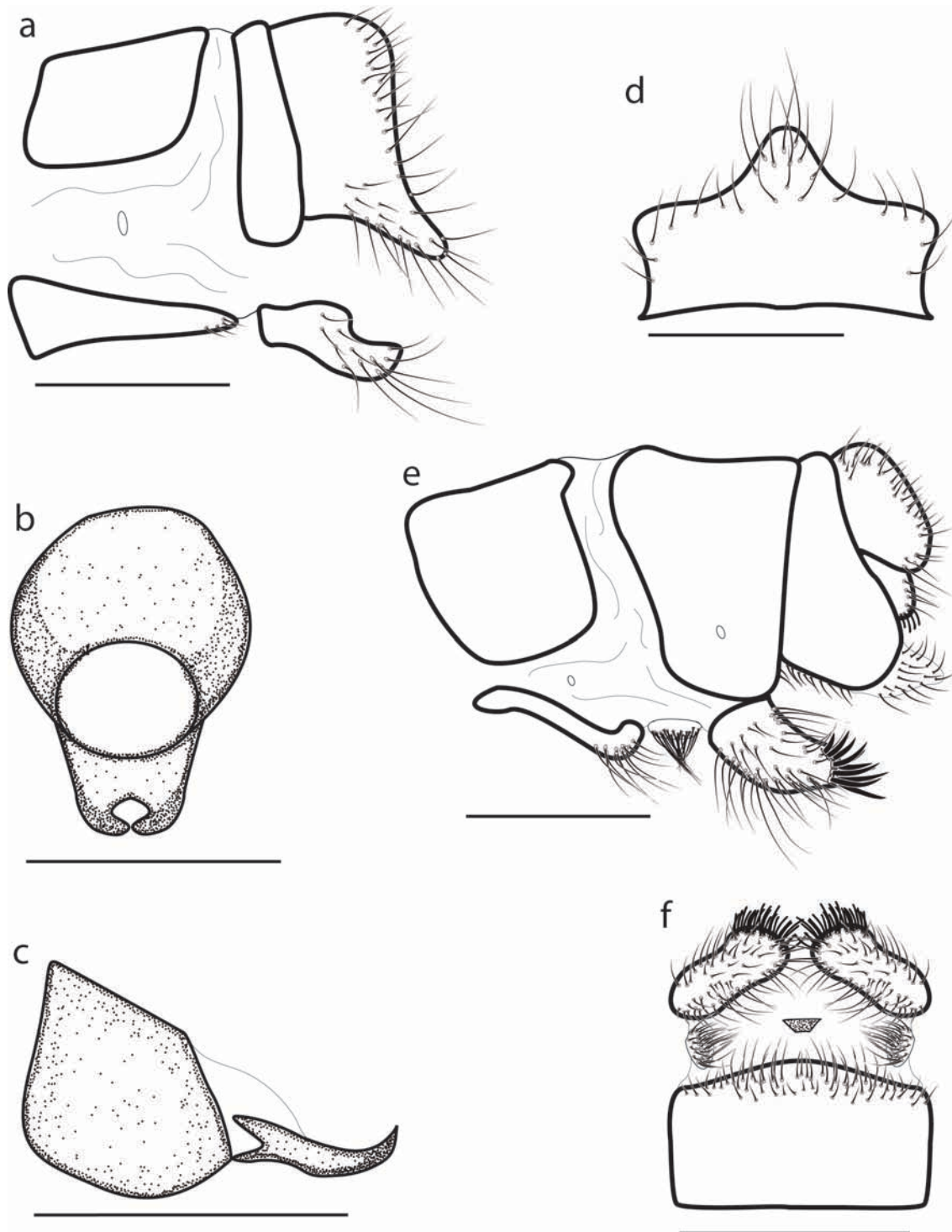


Figure A4.143: *Riekoleon proctus*: male: a) terminalia, lateral; b) genitalia, posterodorsal; c) genitalia, lateral; d) 9th sternite, ventral; female: e) terminalia, lateral; f) terminalia, ventral. Scale bars = 500 μ m.

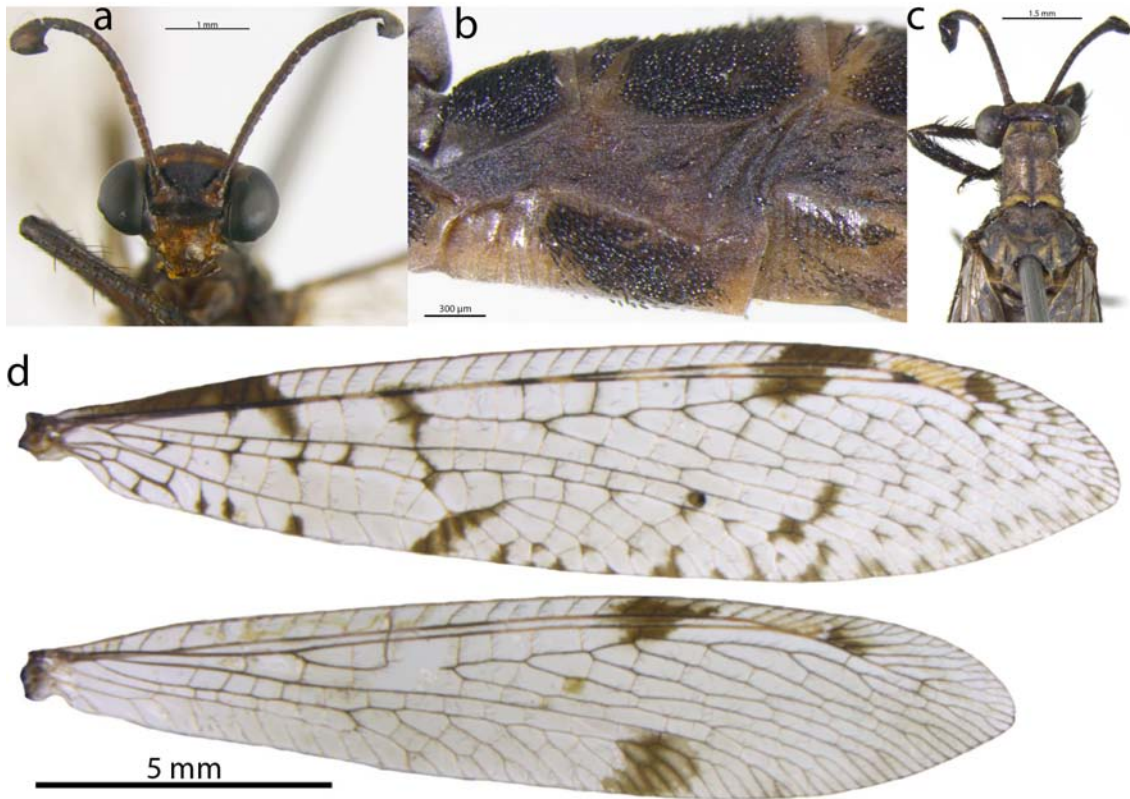


Figure A4.144: *Riekoleon squamosus* n. sp.: a) head, frontal; b) abdomen base, lateral; c) head and thorax, dorsal; d) fore and hind wing, dorsal.

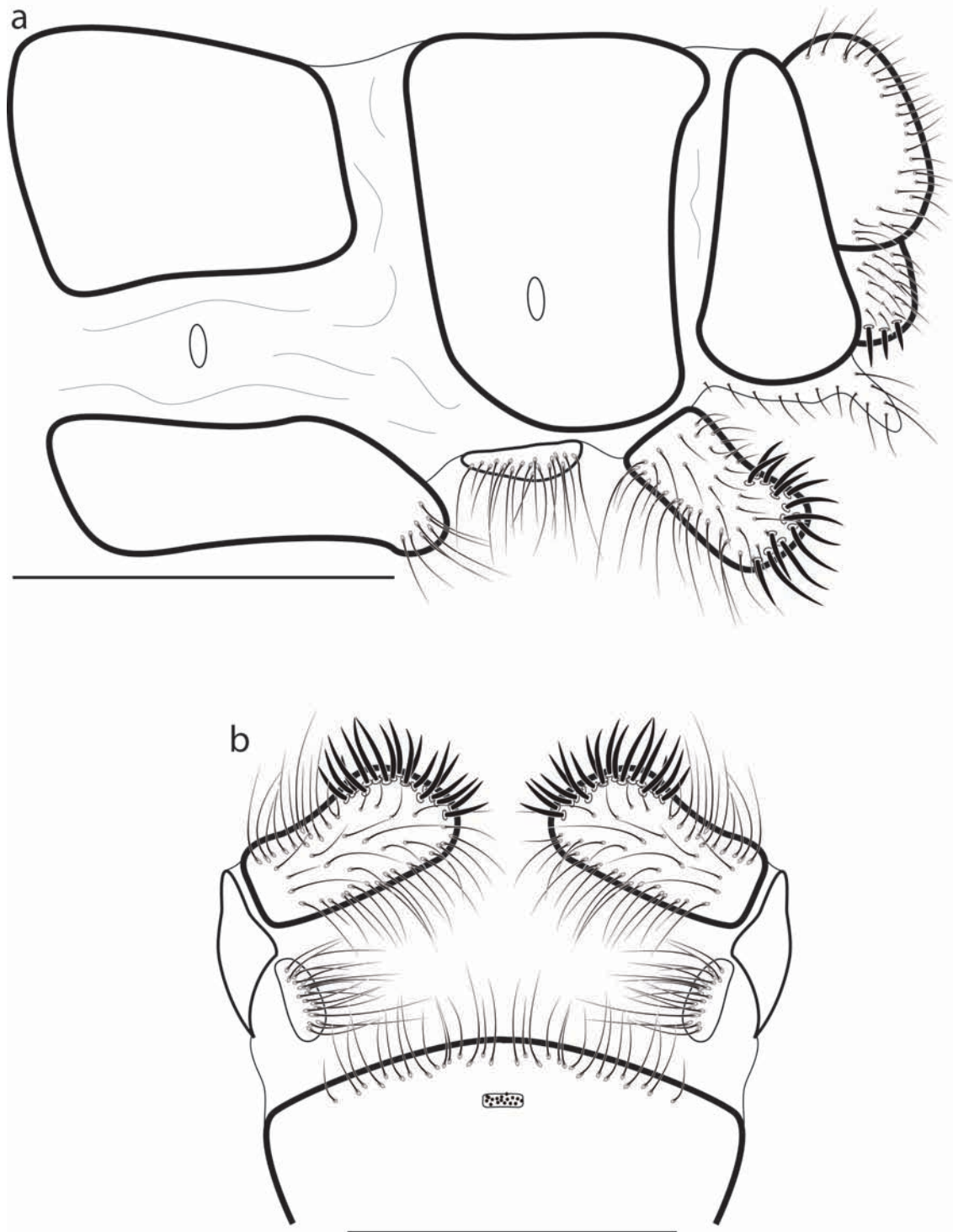


Figure A4.145: *Riekoleon squamosus* n. sp.: female: a) terminalia, lateral; b) terminalia, ventral, showing the pregenital plate hidden beneath the sternite. Scale bars = 1mm.

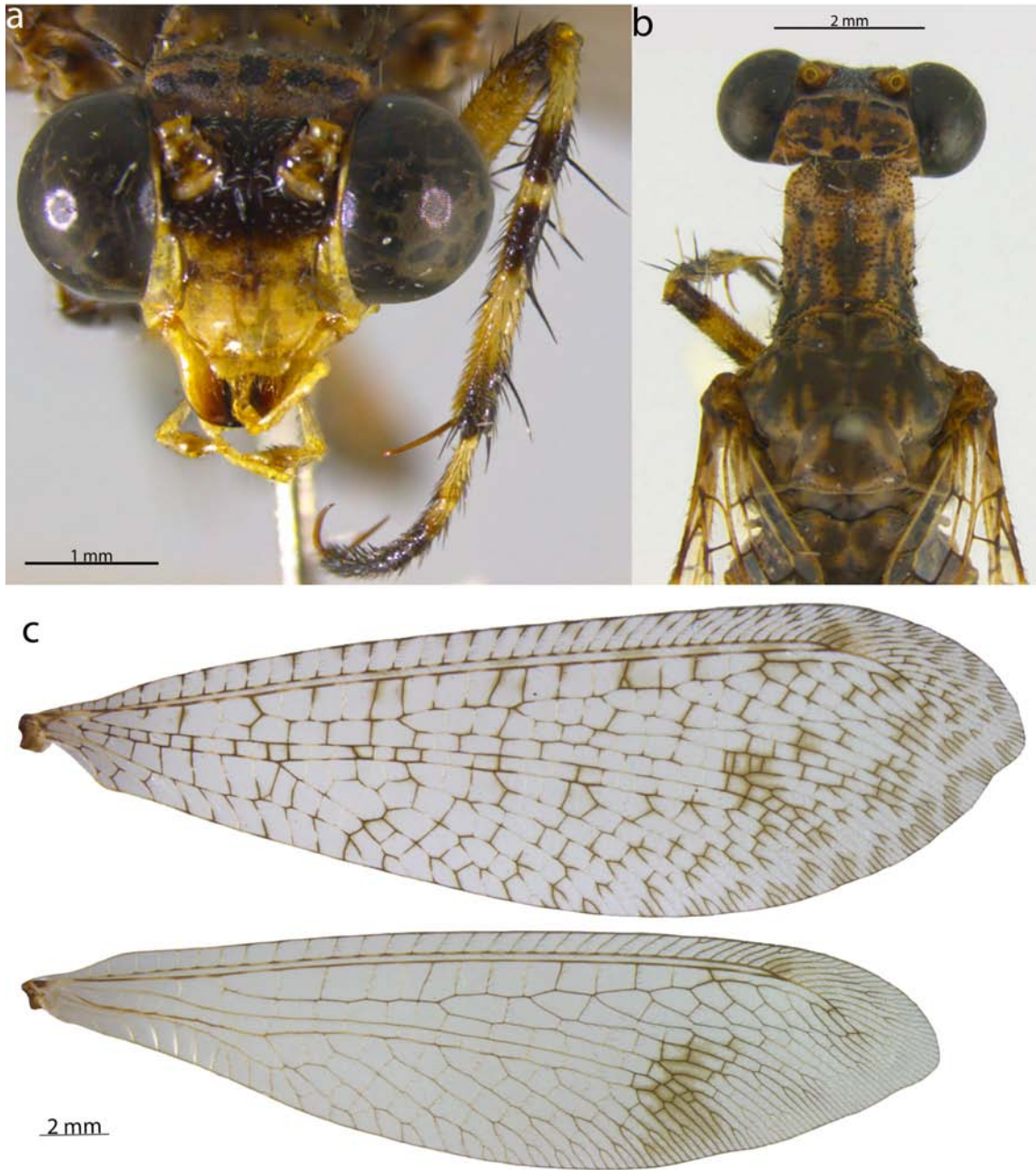


Figure A4.146: *Tanyleon cahilensis*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

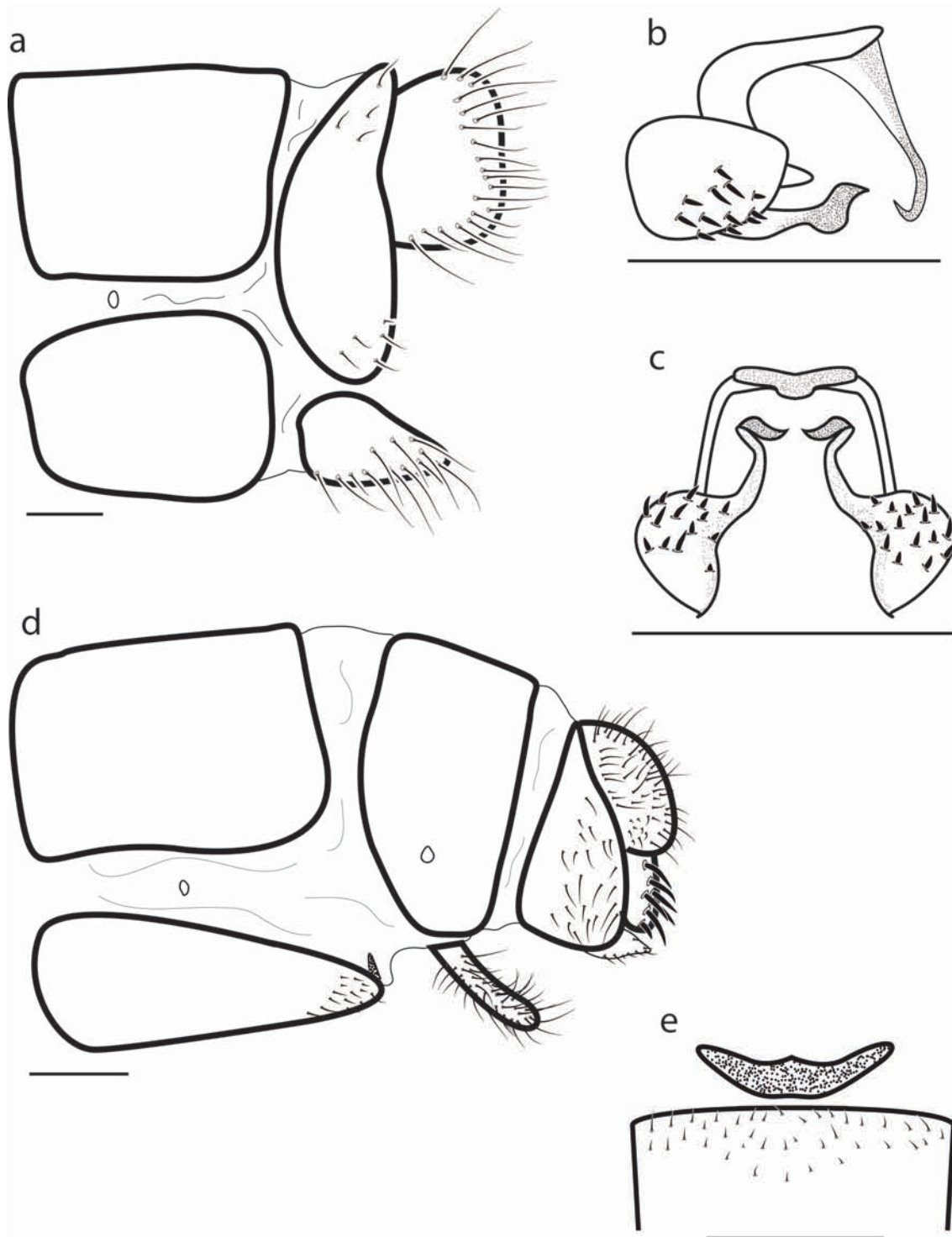


Figure A4.147: *Tanyleon cahilensis*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posteroventral; female: d) terminalia, lateral; e) 7th sternite and pregenital plate, ventral. Scale bars = 500 μ m.



Figure A4.148: *Tanyleon lesouefi*: a) head, frontal; b) head and thorax, dorsal; c) fore and hind wing, dorsal.

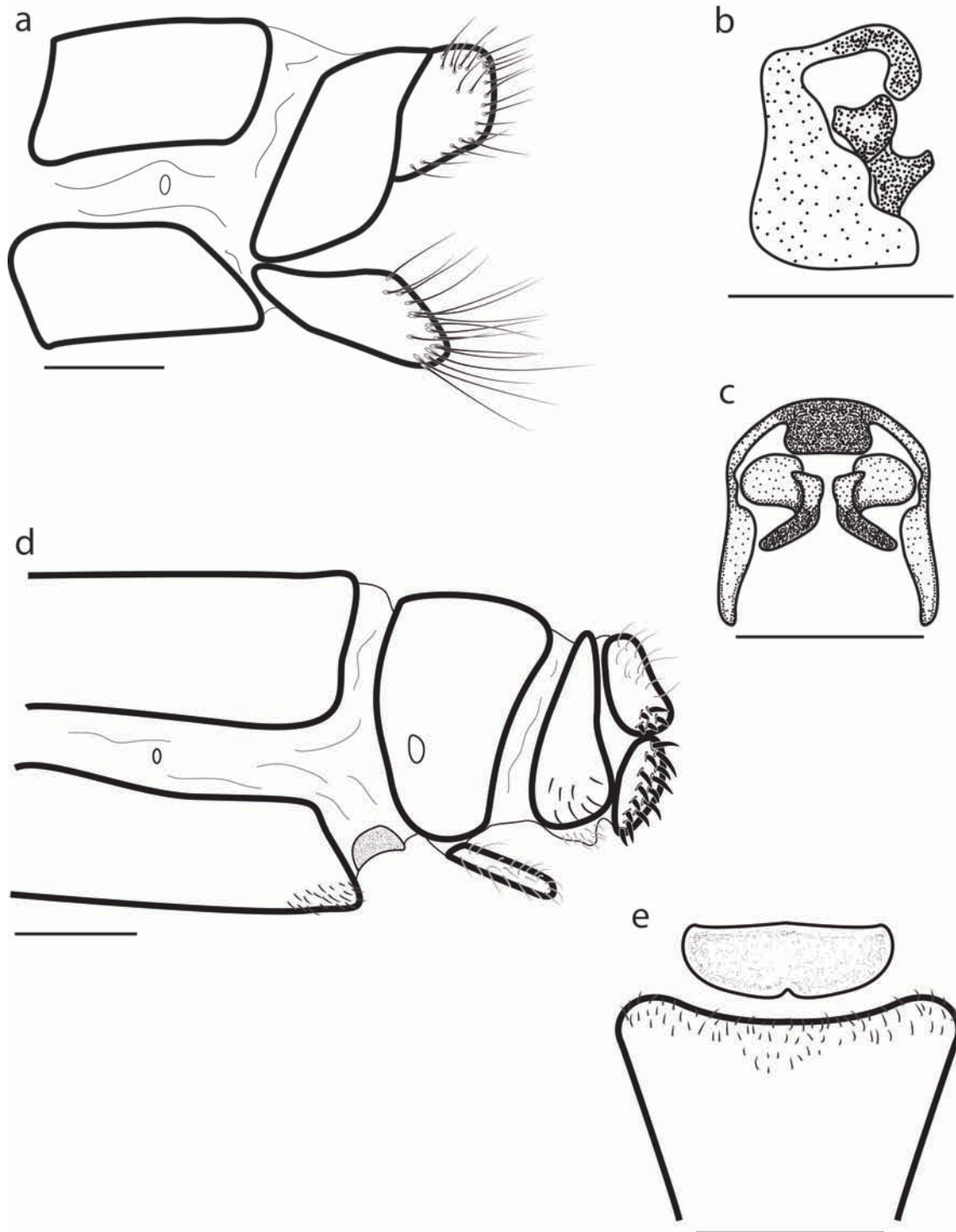


Figure A4.149: *Tanyleon lesouefi*: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, ventral; female: d) terminalia, lateral; e) 7th sternite and pregenital plate, ventral. Scale bars = 500 μ m.

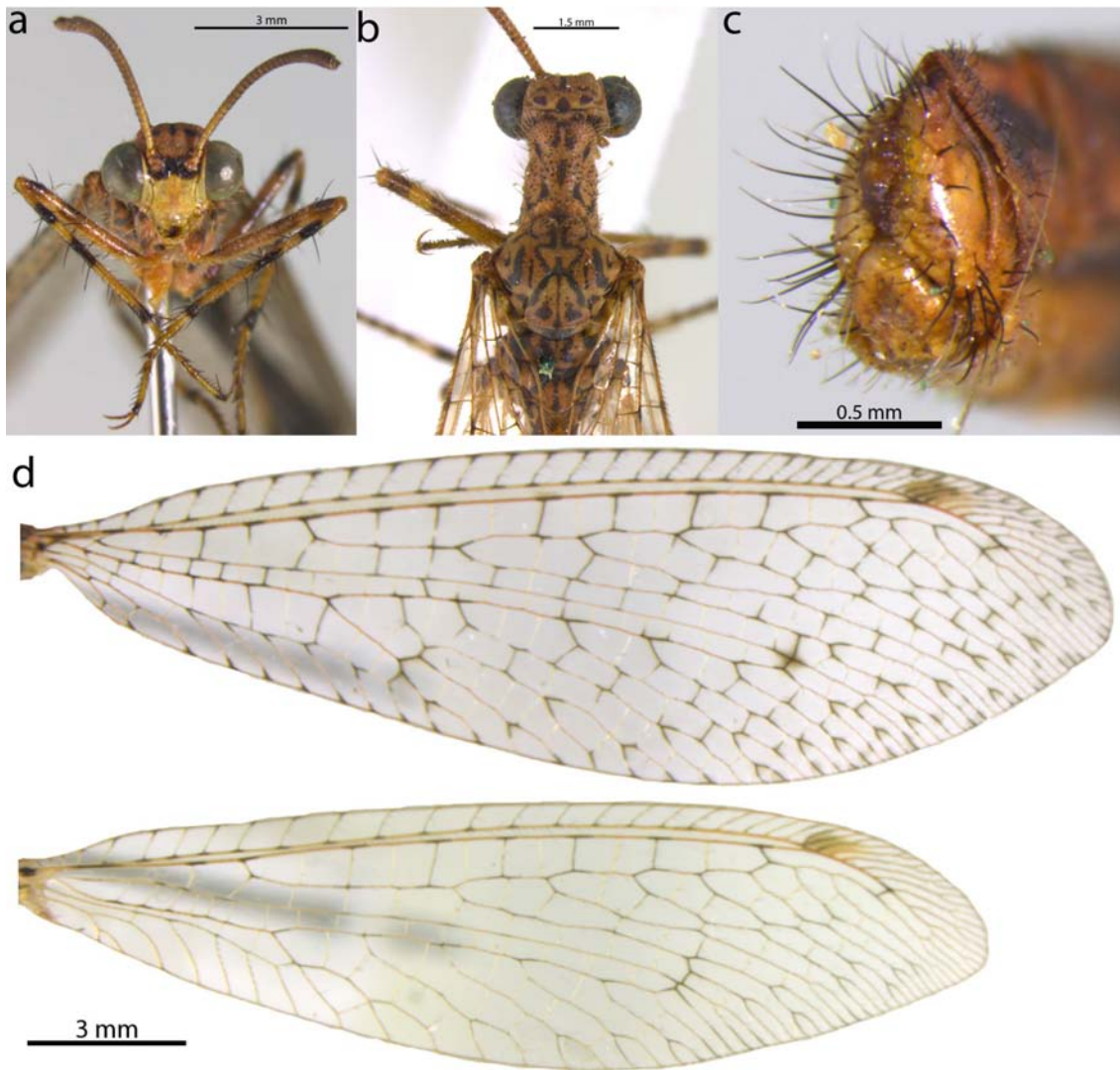


Figure A4.150: *Tanyleon newi* n. sp.: a) head, frontal; b) head and thorax, dorsal; c) male abdomen apex, posterior; d) fore and hind wing, dorsal.

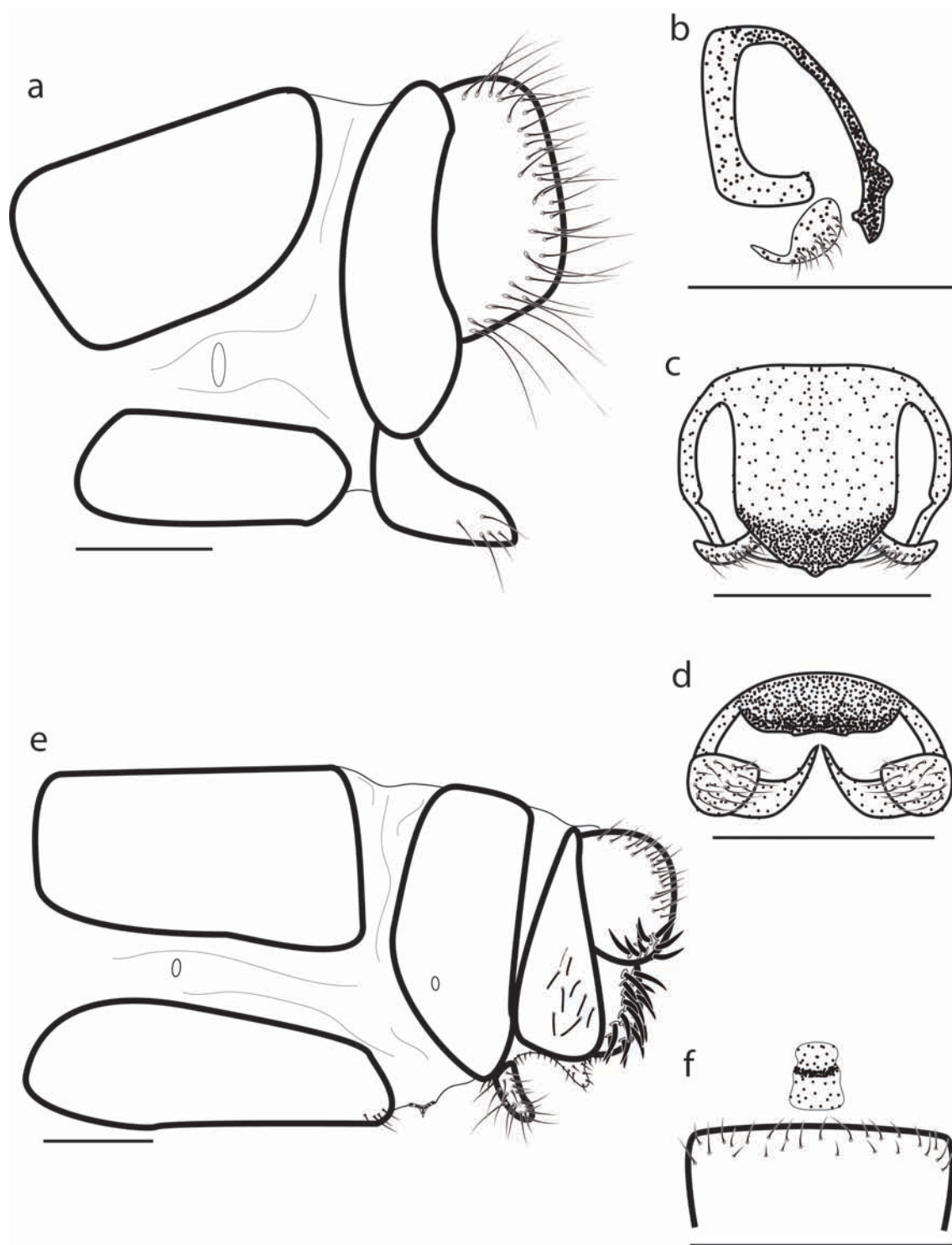


Figure A4.151: *Tanyleon newi* n. sp.: male: a) terminalia, lateral; b) genitalia, lateral; c) genitalia, posterior; d) genitalia, ventral; female: e) terminalia, lateral; f) 7th sternite and pregenital plate, ventral. Scale bars = 500 μ m.

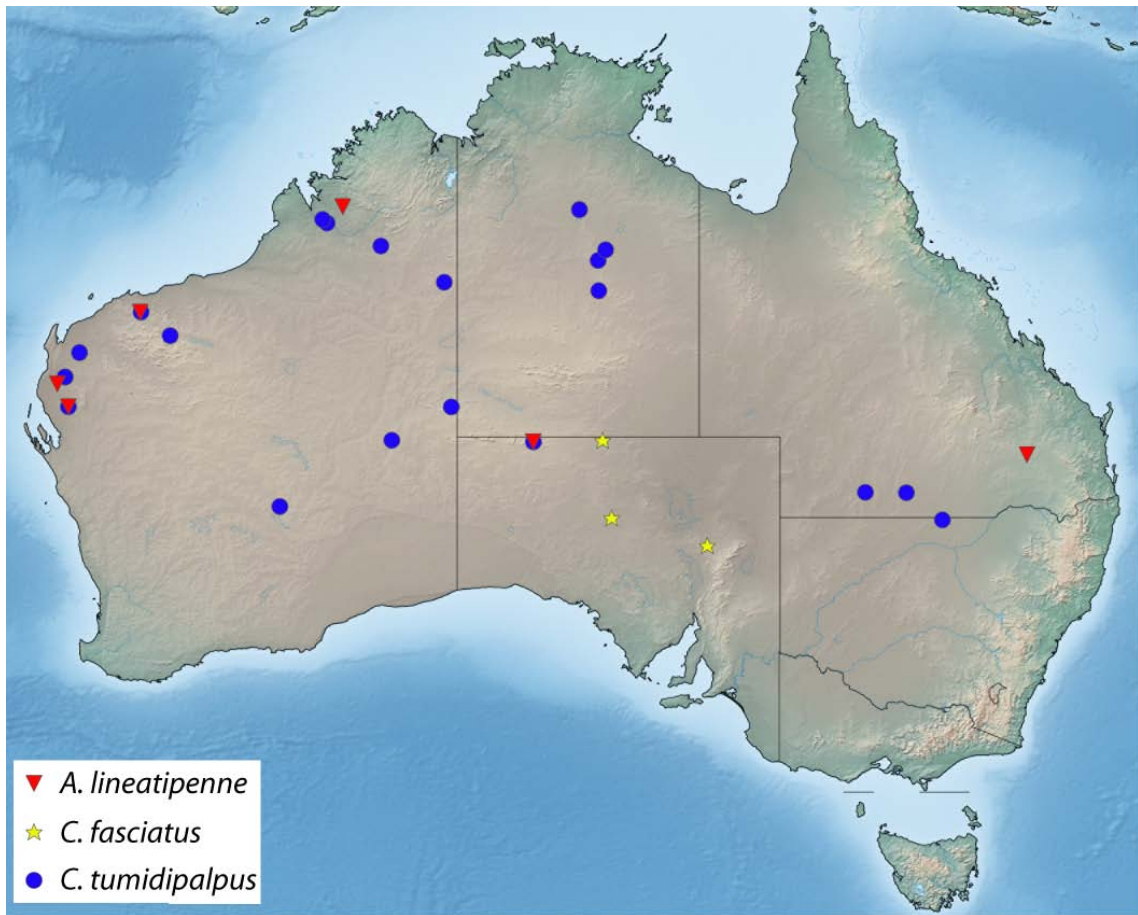


Figure A4.152: Distribution map of *Anomaloplectron* and *Csiroleon*.

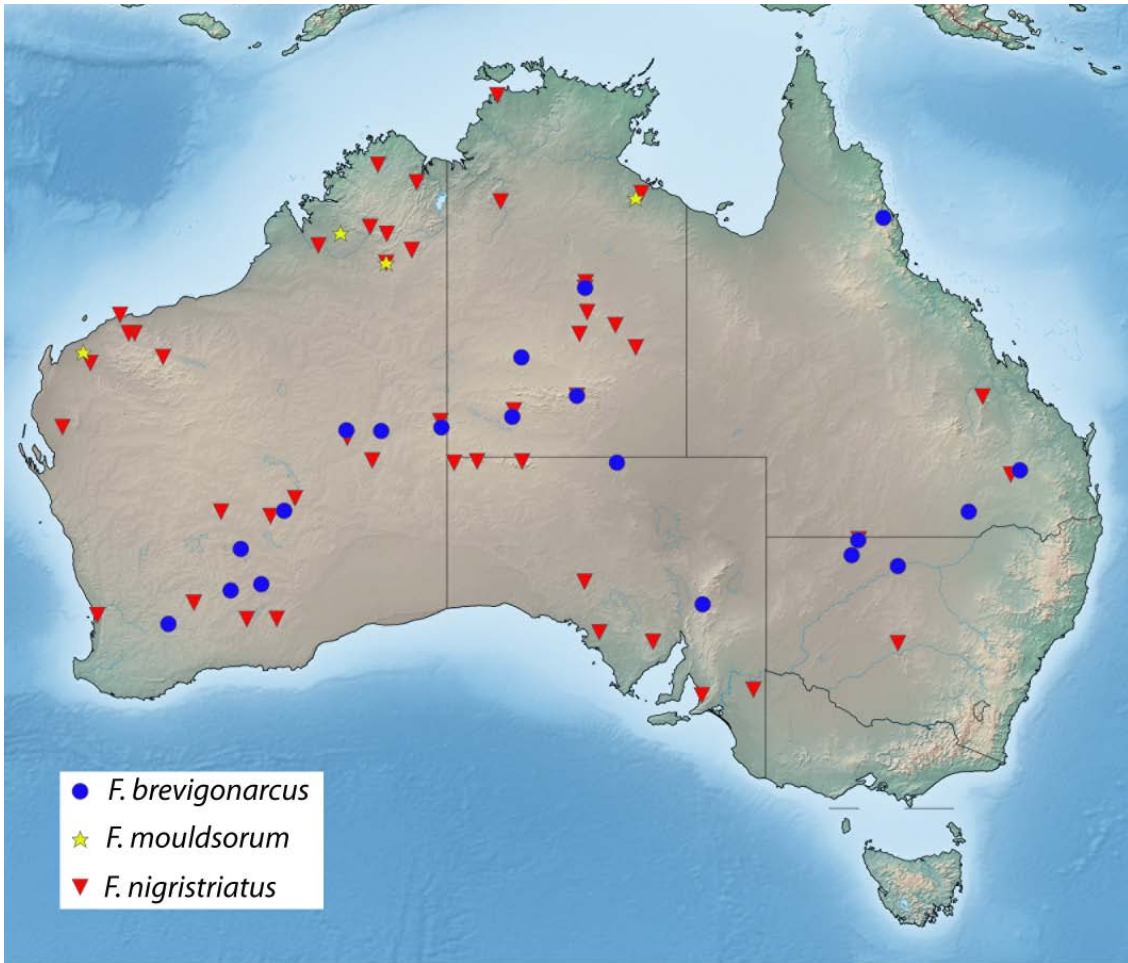


Figure A4.153: Distribution map of *Fissuleon*.

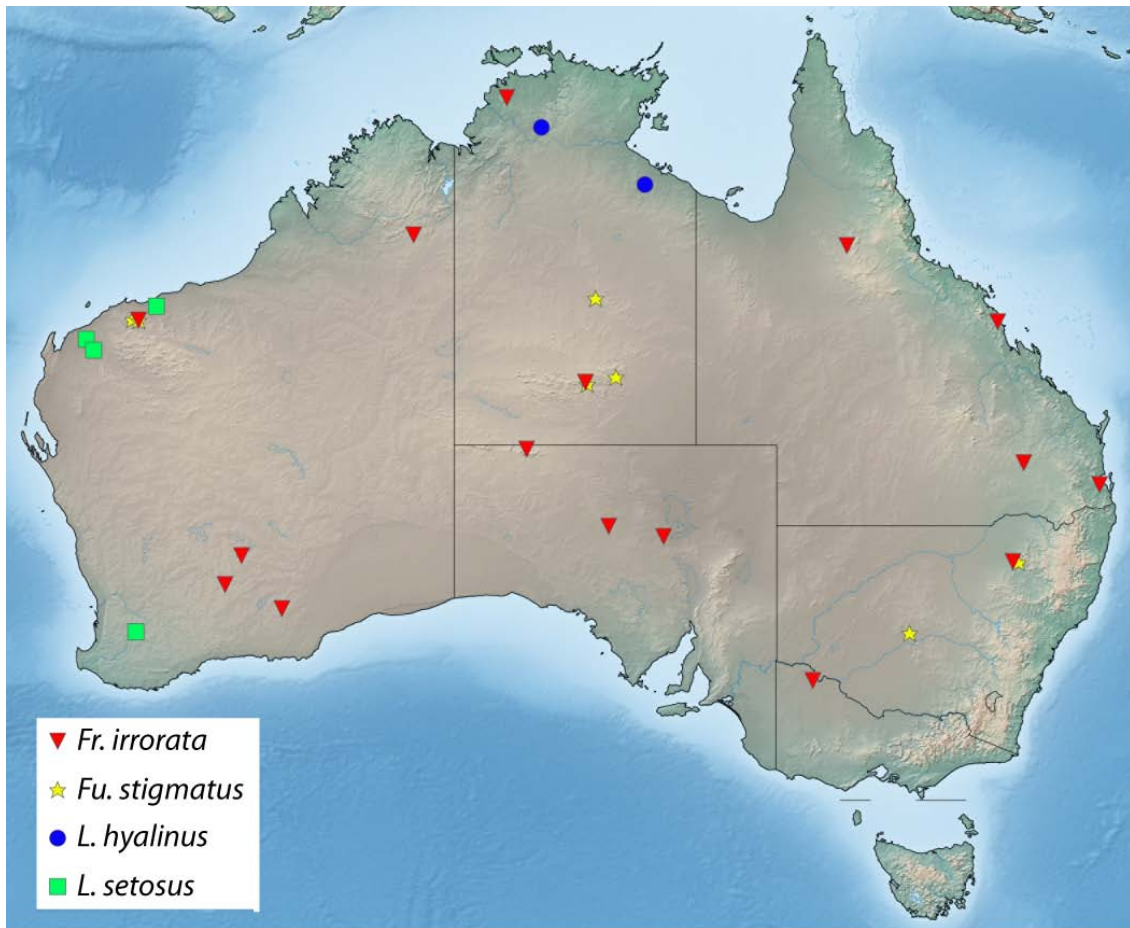


Figure A4.154: Distribution map of *Franzenia*, *Fusoleon* and *Latileon*.

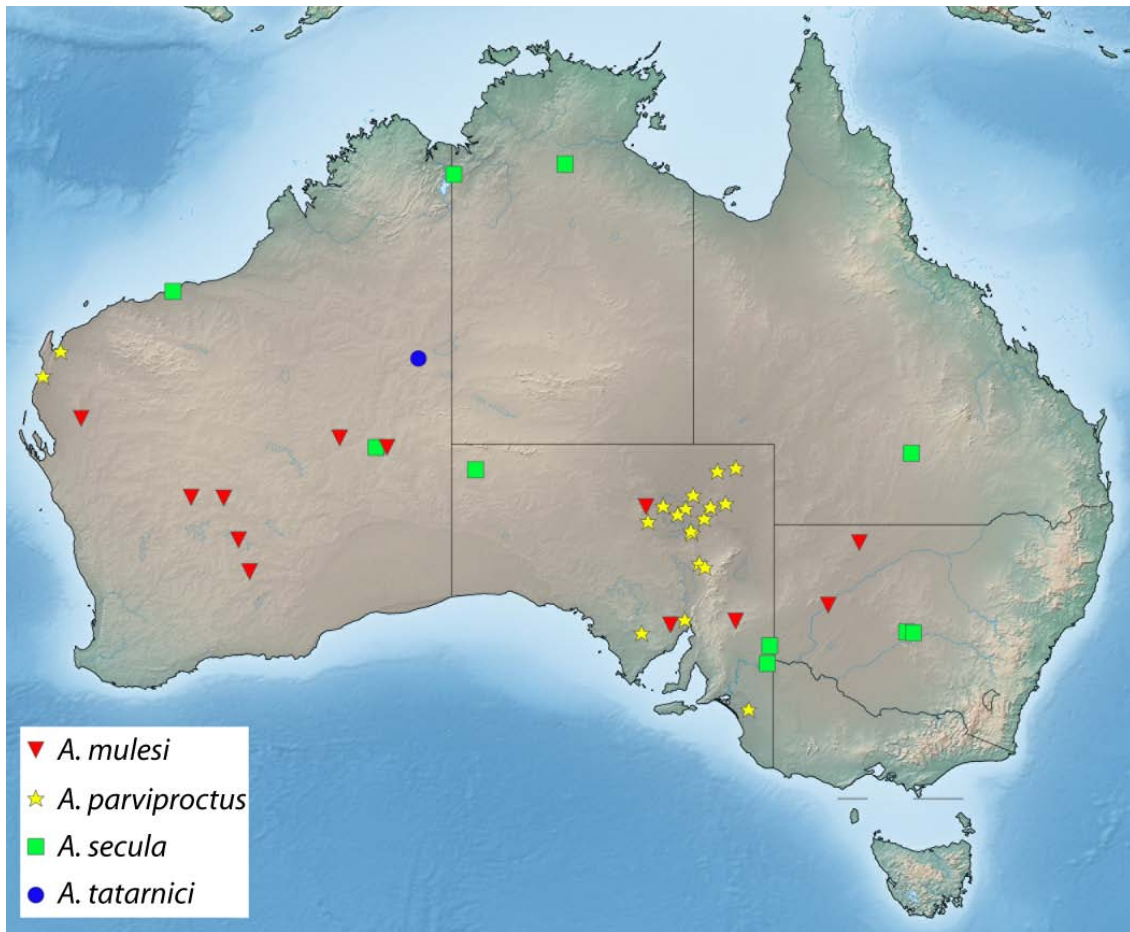


Figure A4.155: Distribution map of *Acutoleon*.

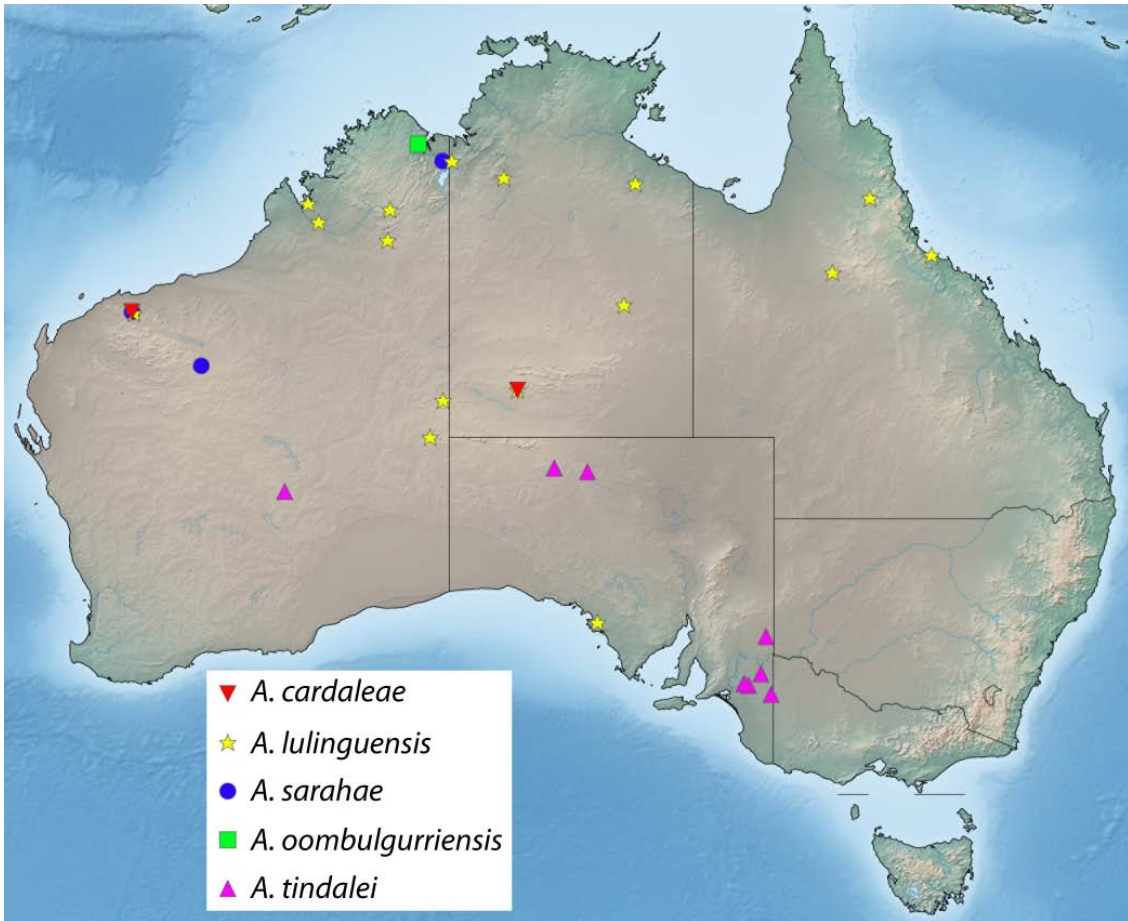


Figure A4.156: Distribution map of part of *Aplectrinia*.

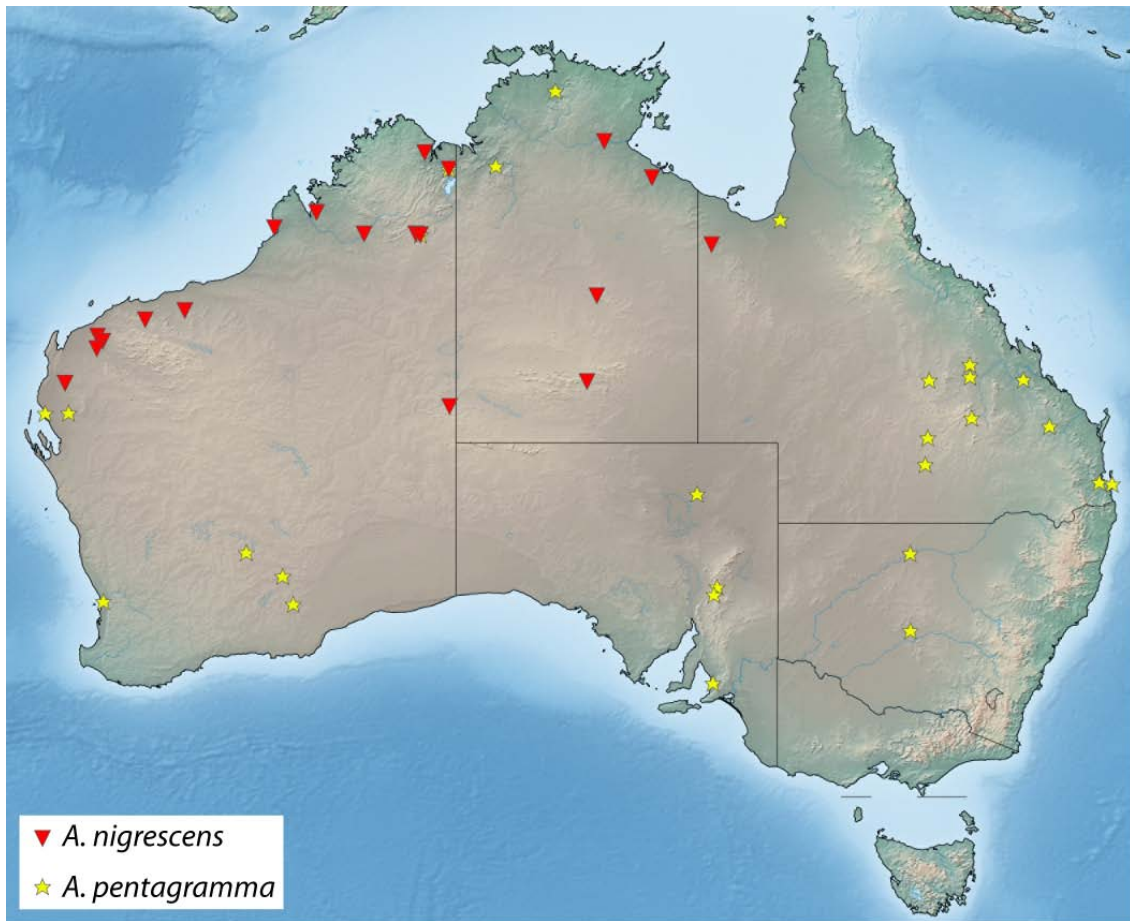


Figure A4.157: Distribution map of part of *Aplectrinia*.

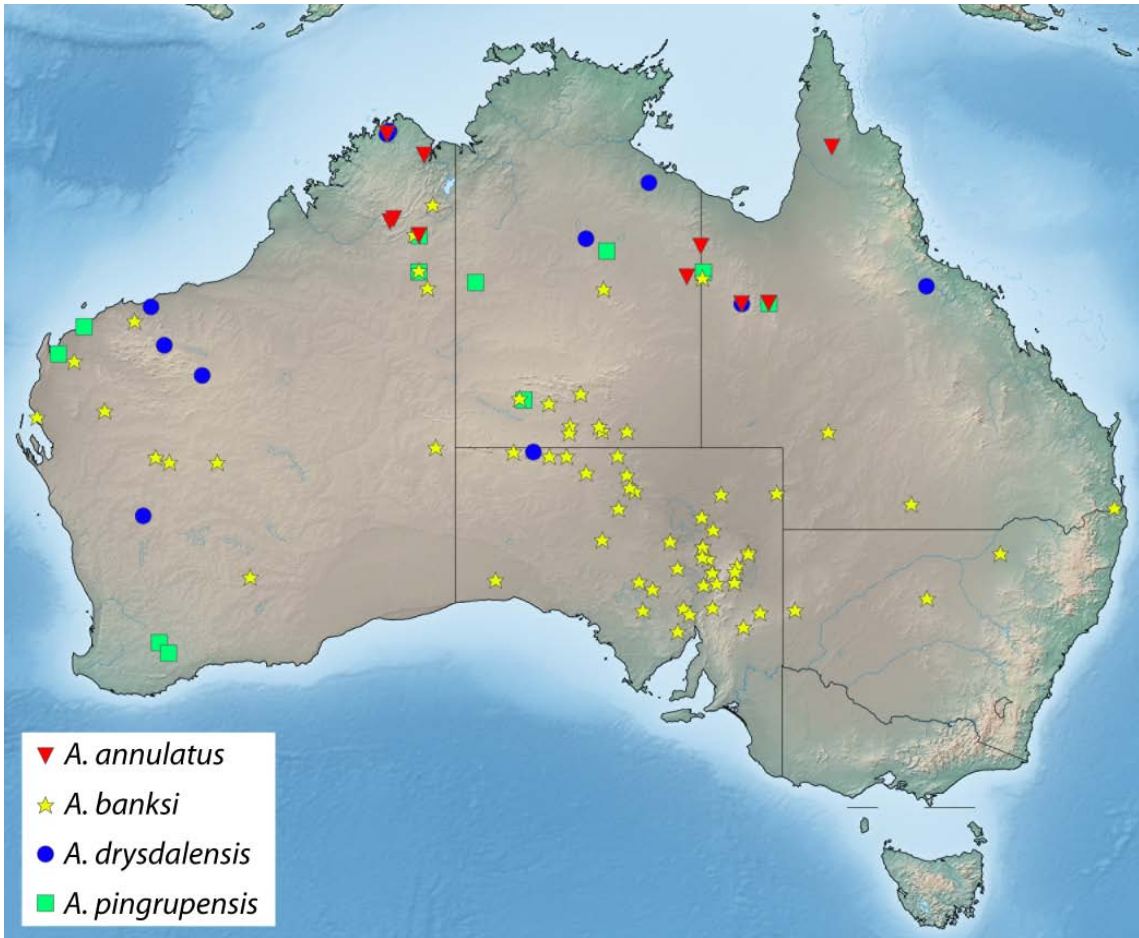


Figure A4.158: Distribution map of part of *Aurantileon*.

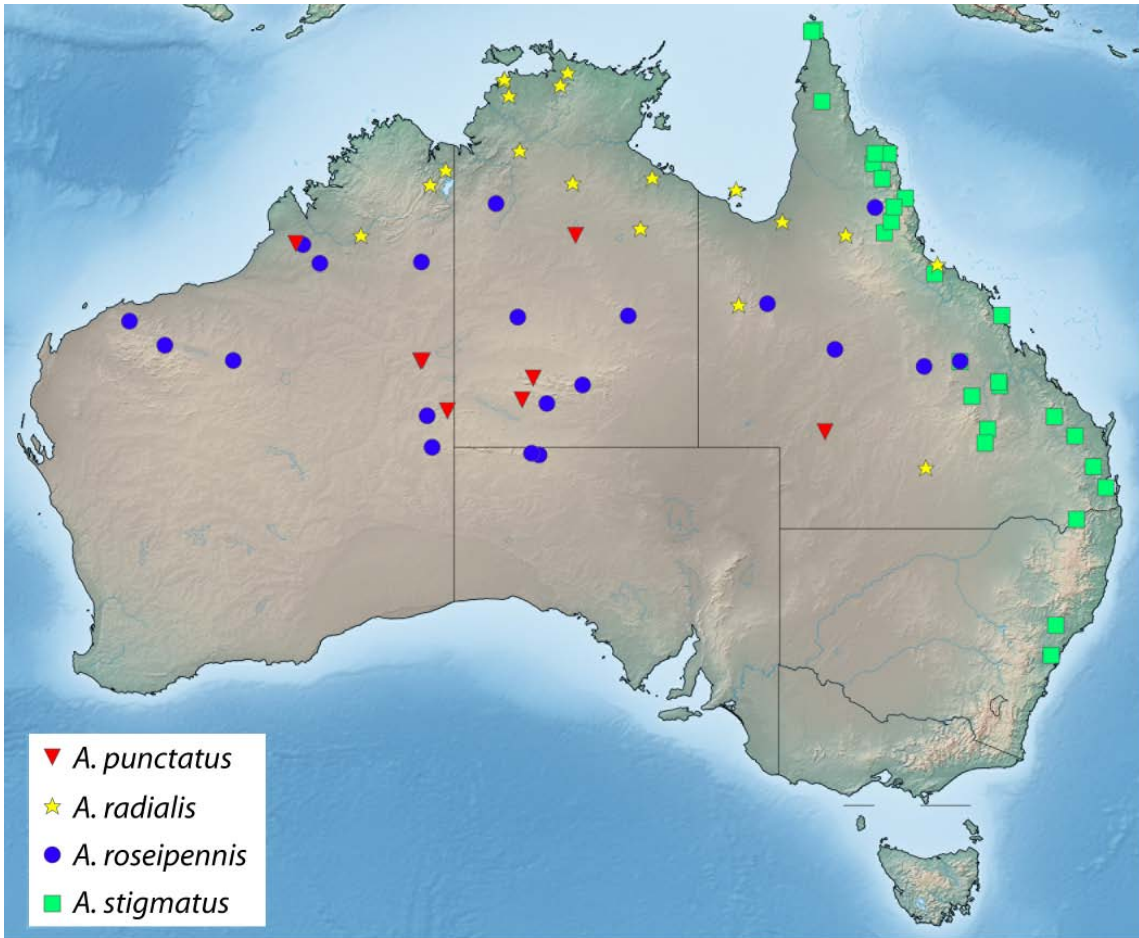


Figure A4.159: Distribution map of part of *Aurantileon*.

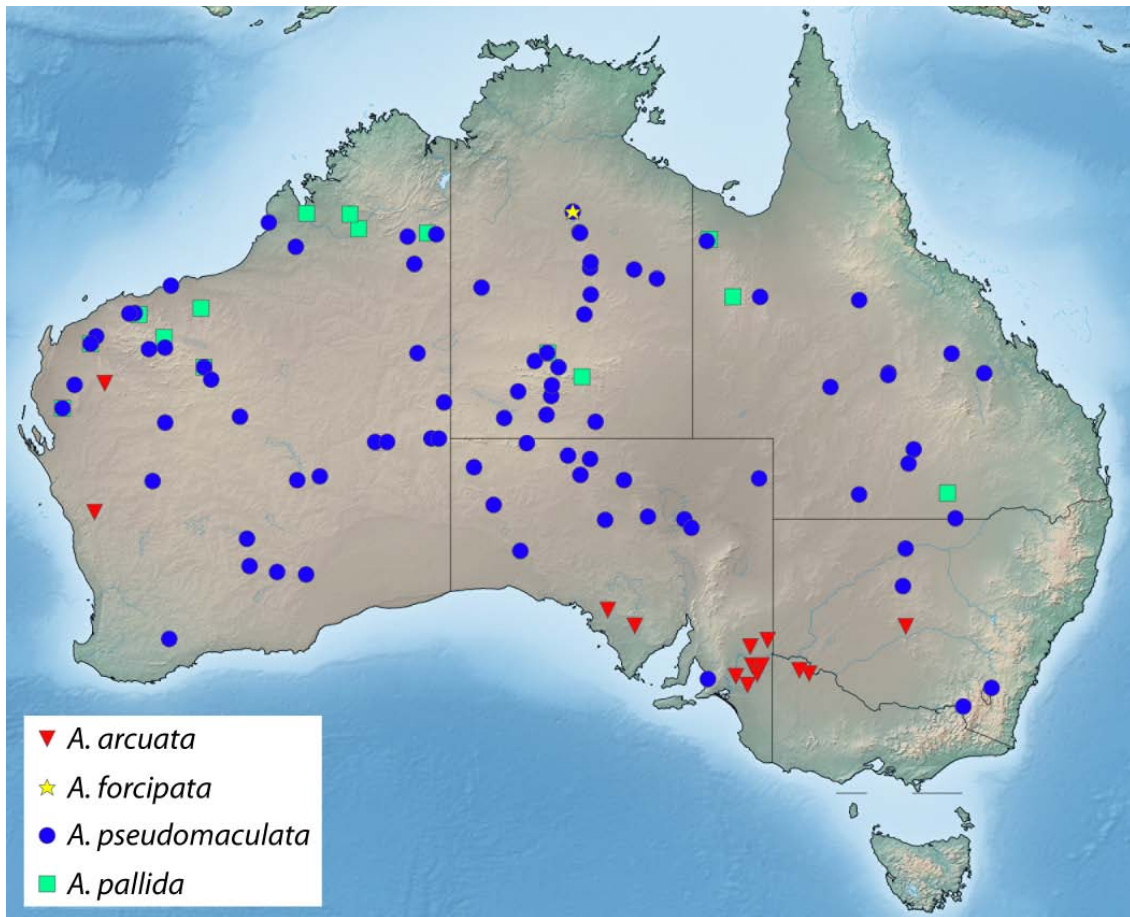


Figure A4.160: Distribution map of part of *Austrogymnochnemia*.

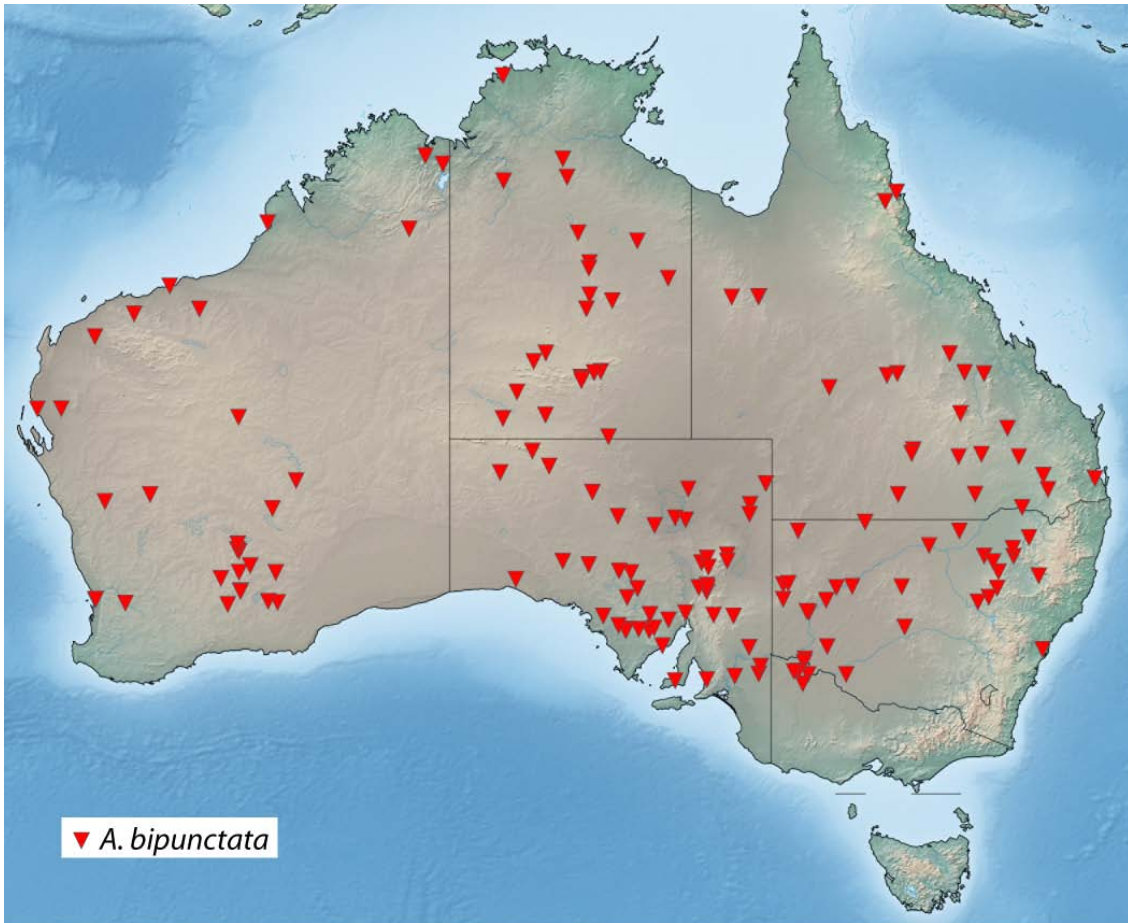


Figure A4.161: Distribution map of part of *Austrogymnocnemia*.

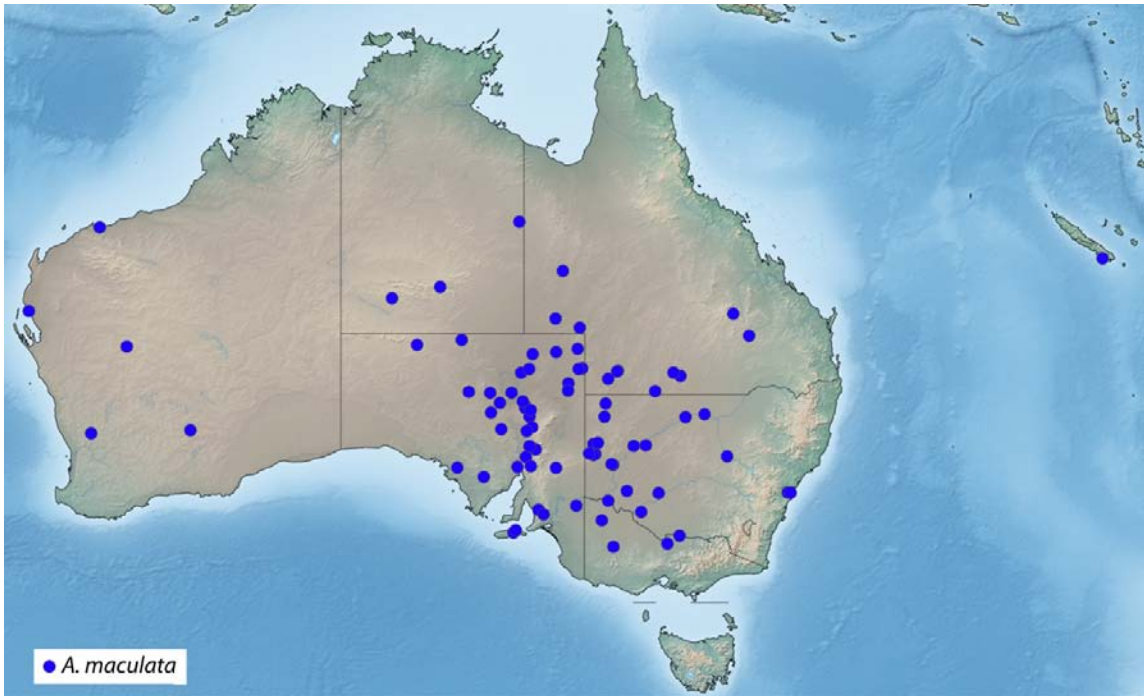


Figure A4.162: Distribution map of part of *Austrogymnocrania*, showing the first record for New Caledonia.

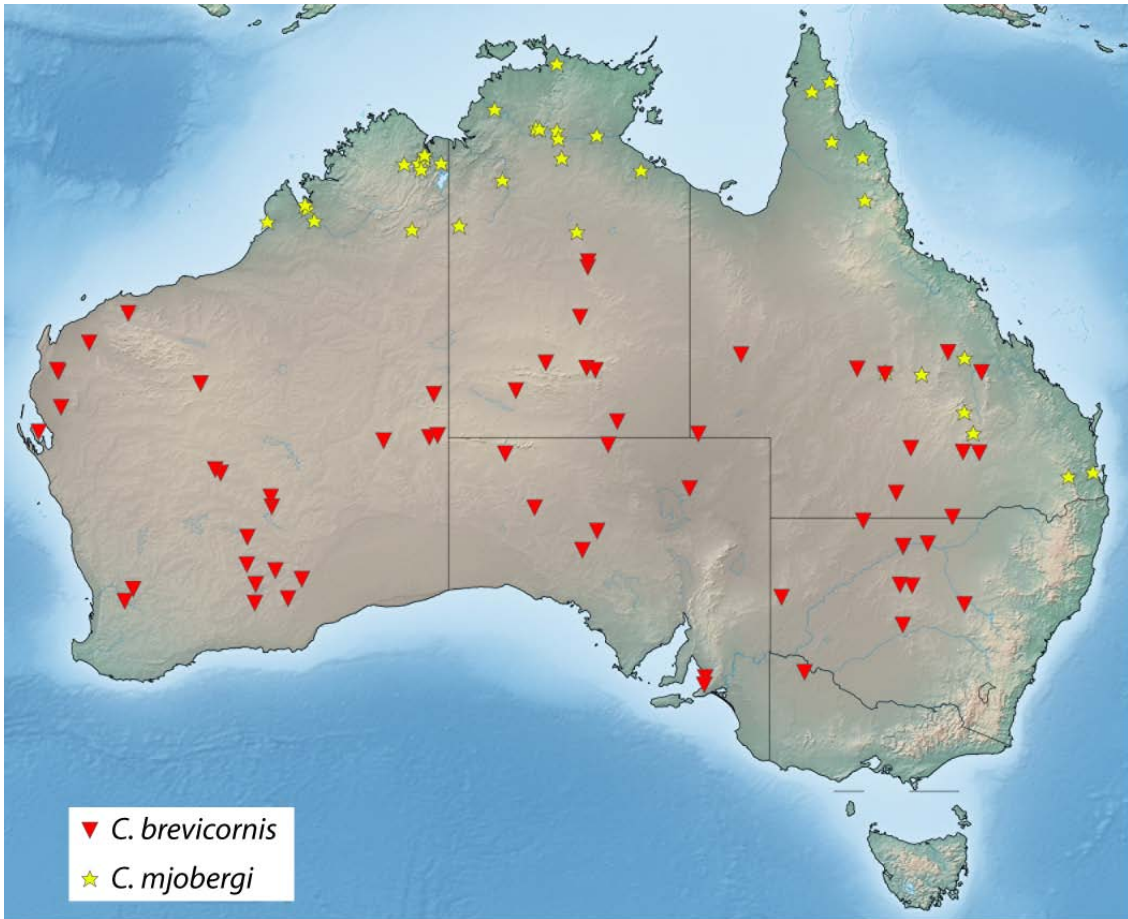


Figure A4.163: Distribution map of *Ceratoleon*.

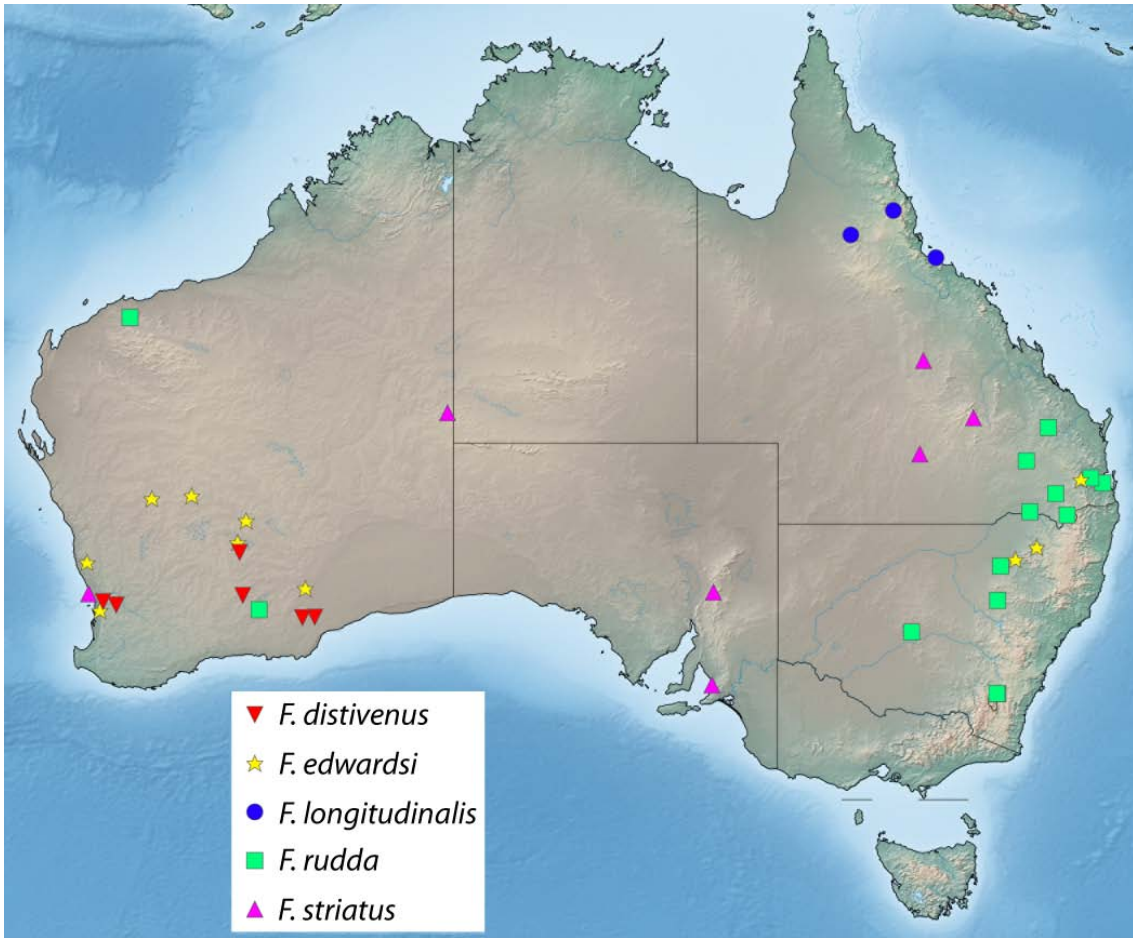


Figure A4.164: Distribution map of *Fossorioleon*.

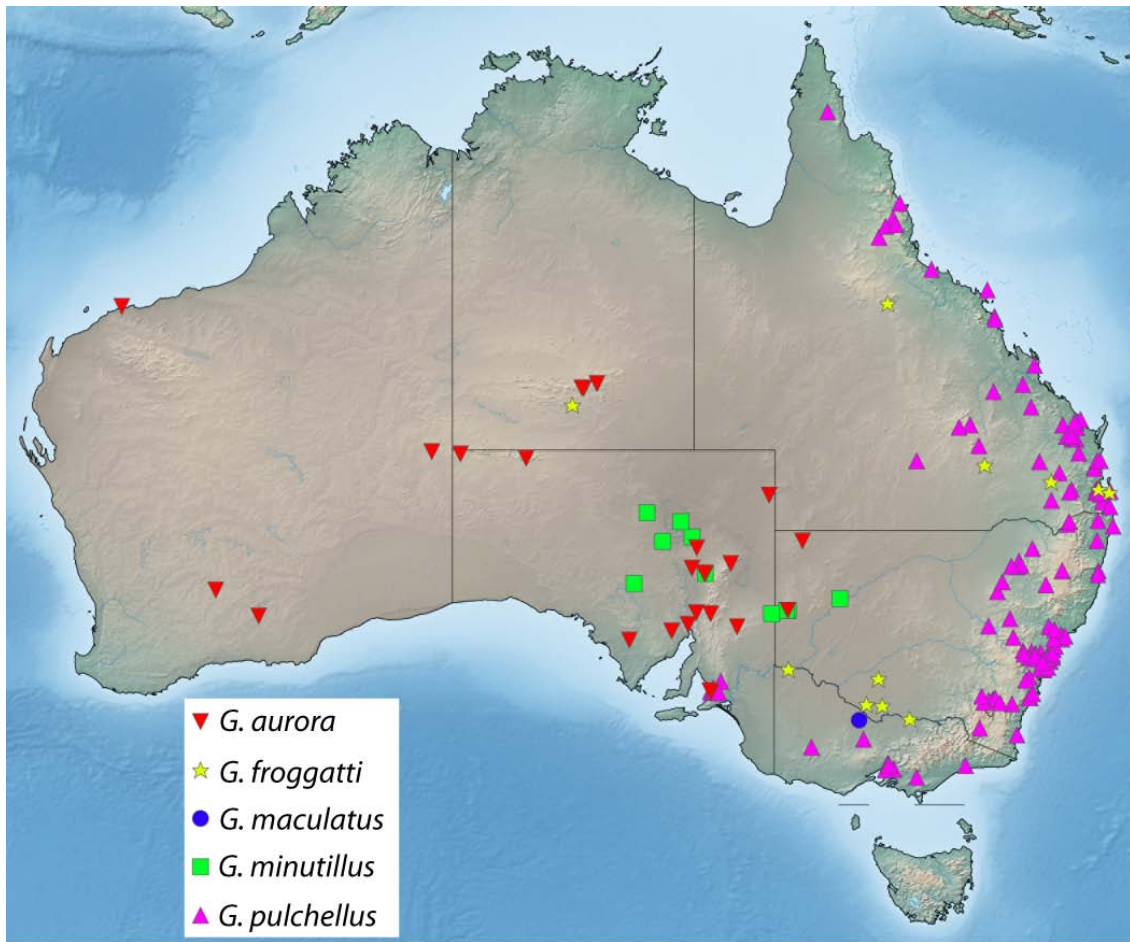


Figure A4.165: Distribution map of part of *Glenoleon*.

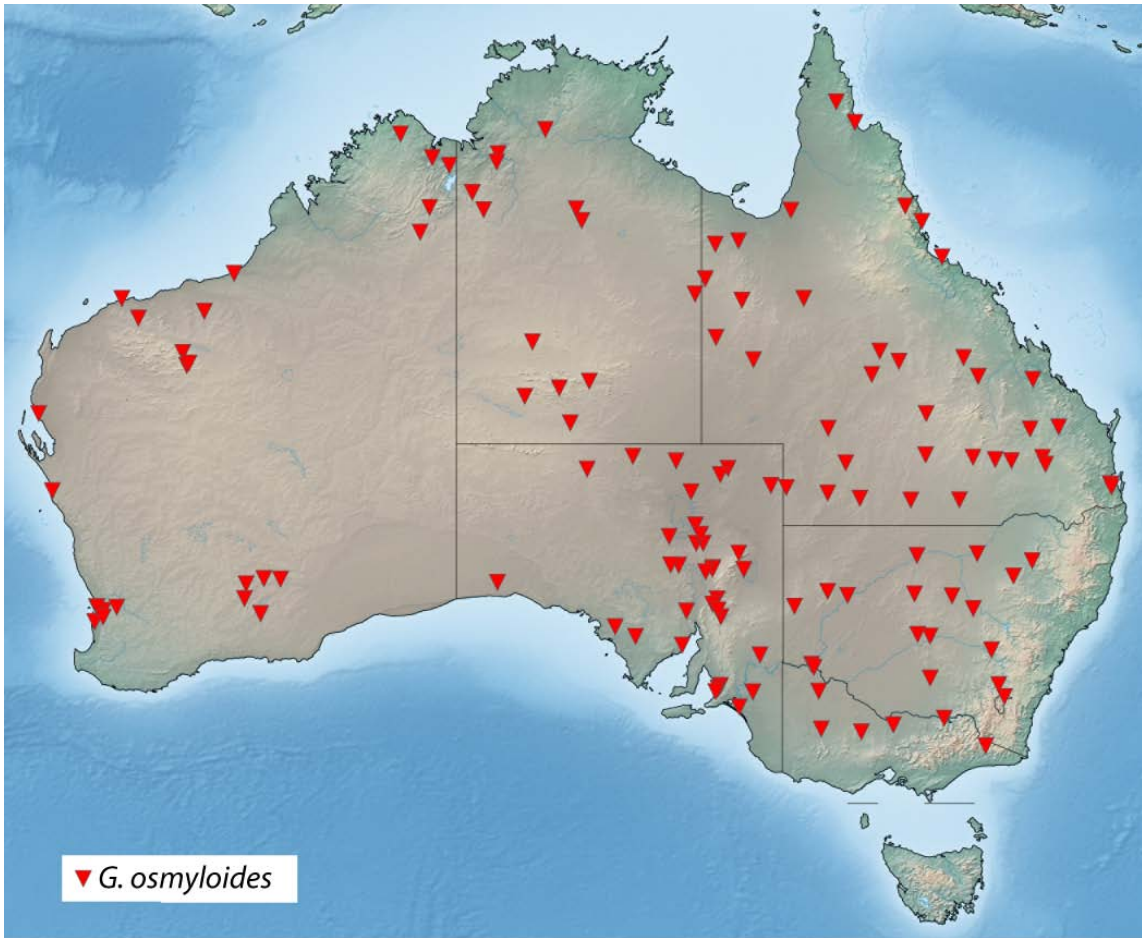


Figure A4.166: Distribution map of part of *Glenoleon*.

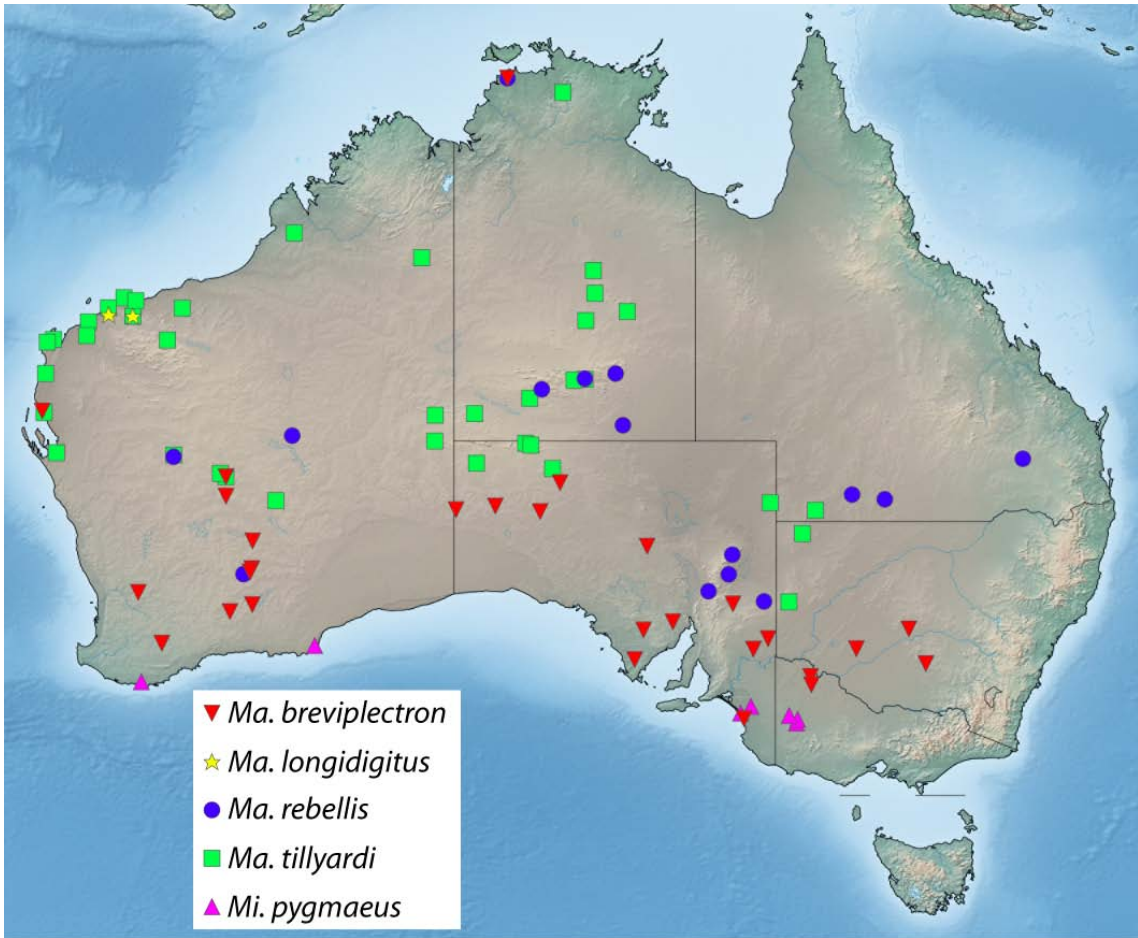


Figure A4.167: Distribution map of *Manselleon* and *Minyleon*.

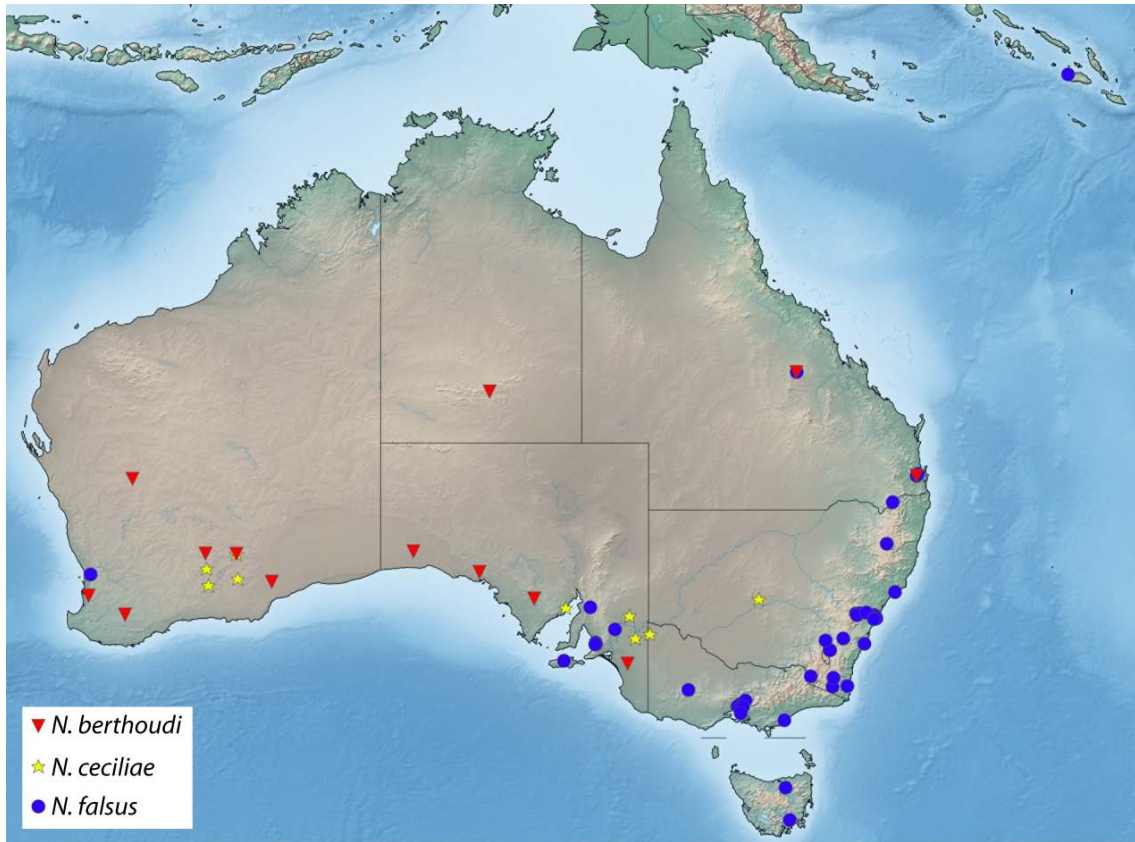


Figure A4.168: Distribution map of part of *Normanleon*, showing the first record for the Solomon Islands.

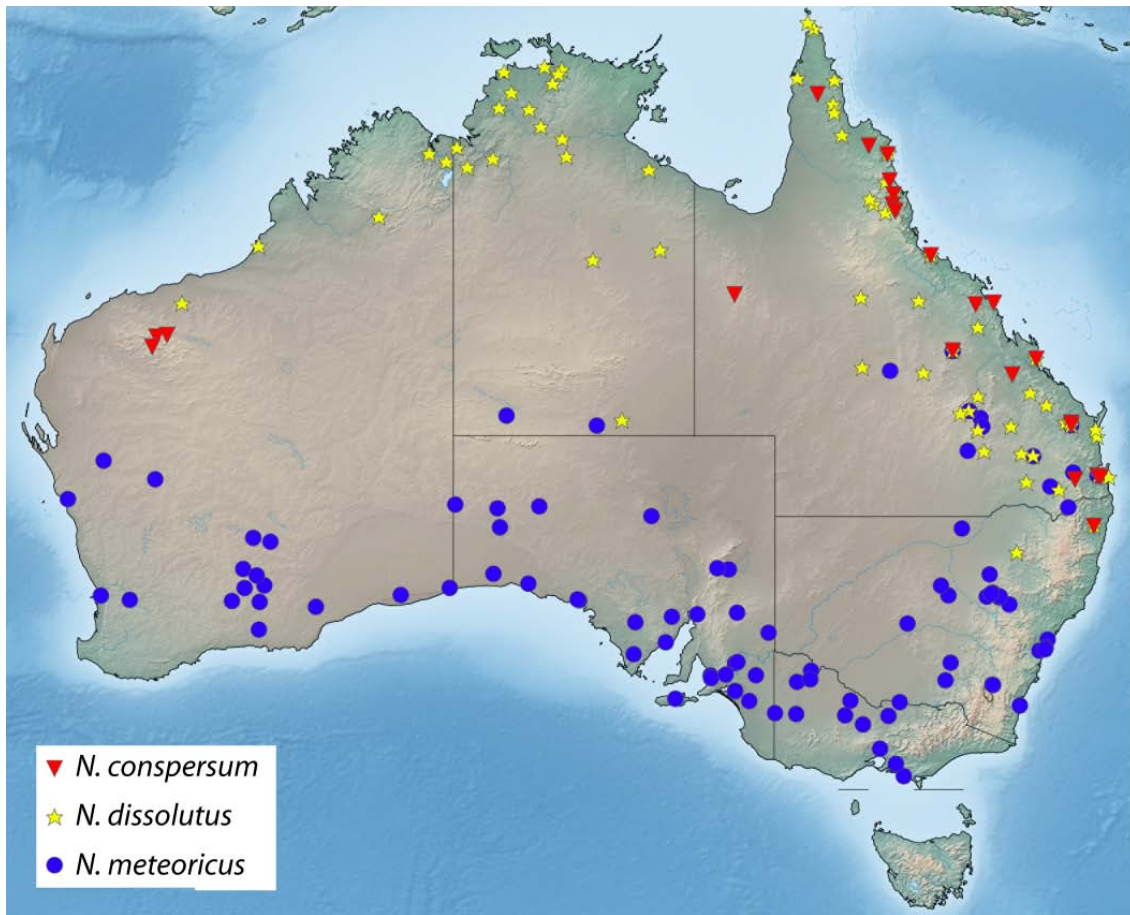


Figure A4.169: Distribution map of part of *Normanleon*.

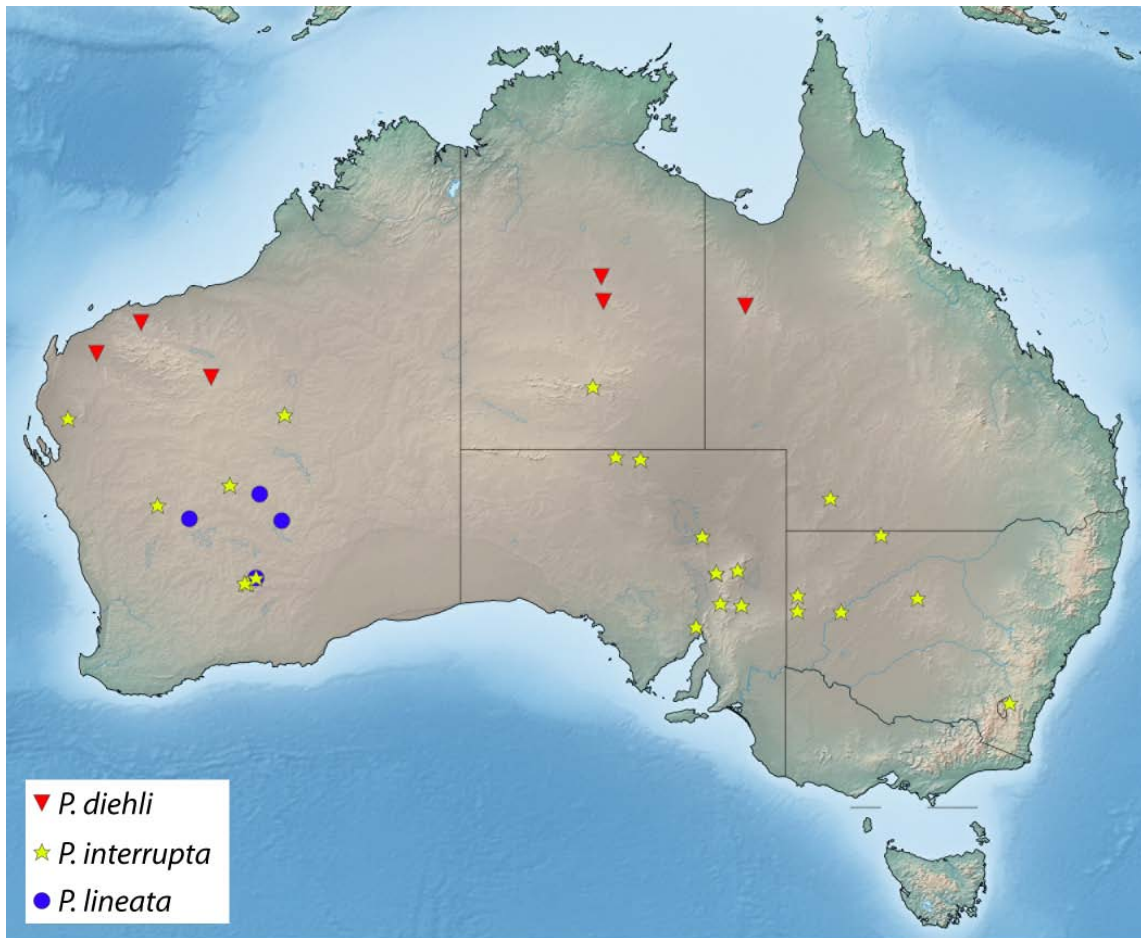


Figure A4.170: Distribution map of *Paraustrogymnocnemia*.

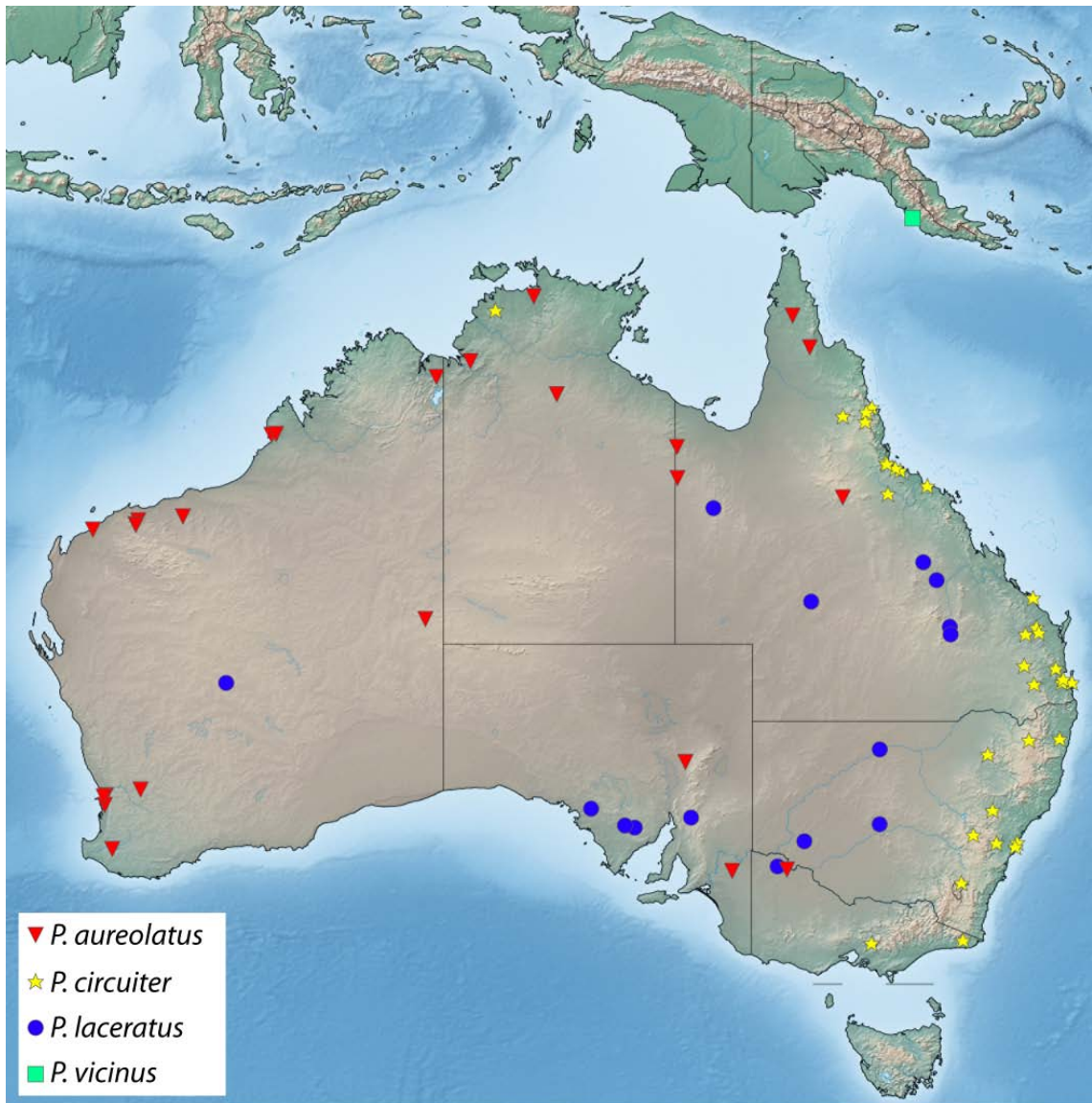


Figure A4.171: Distribution map of *Perichystus*, showing the record for Papua New Guinea.

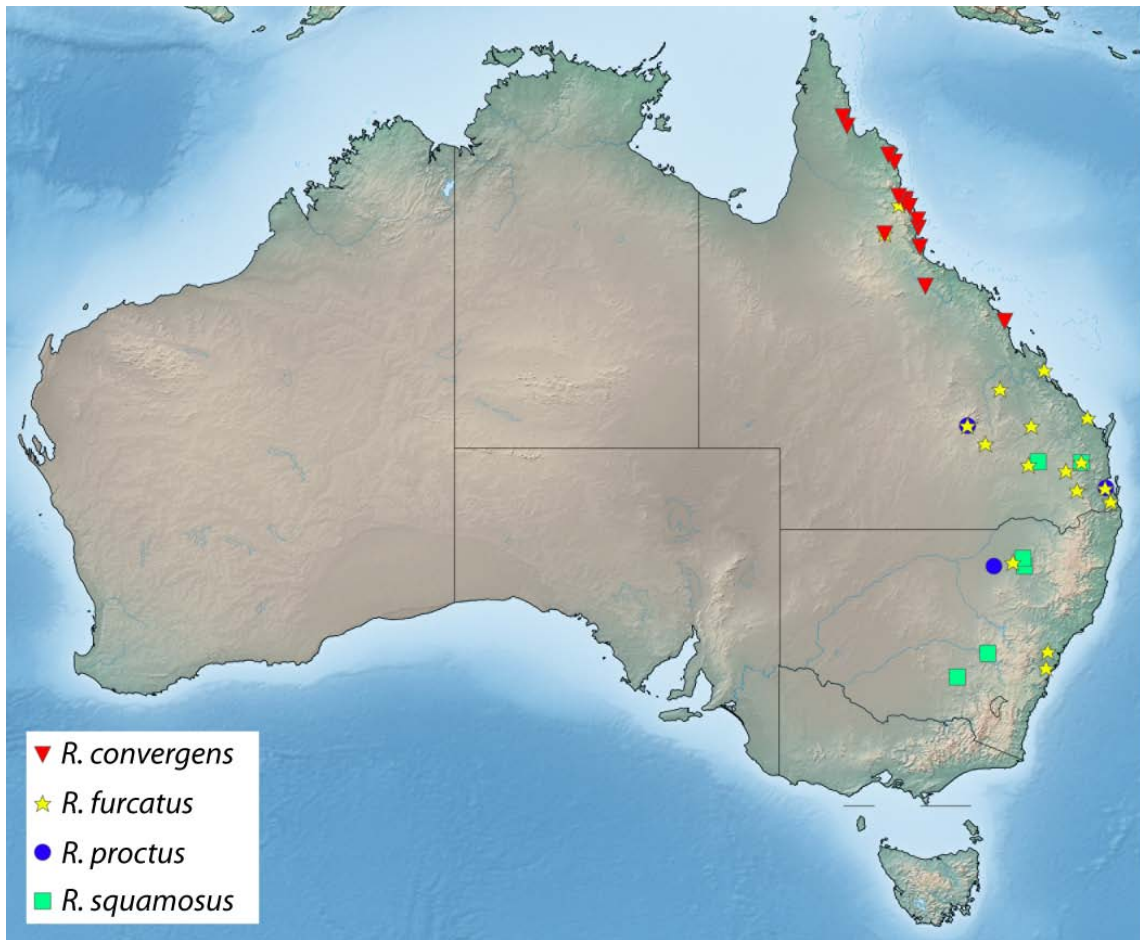


Figure A4.172: Distribution map of *Riekoleon*.

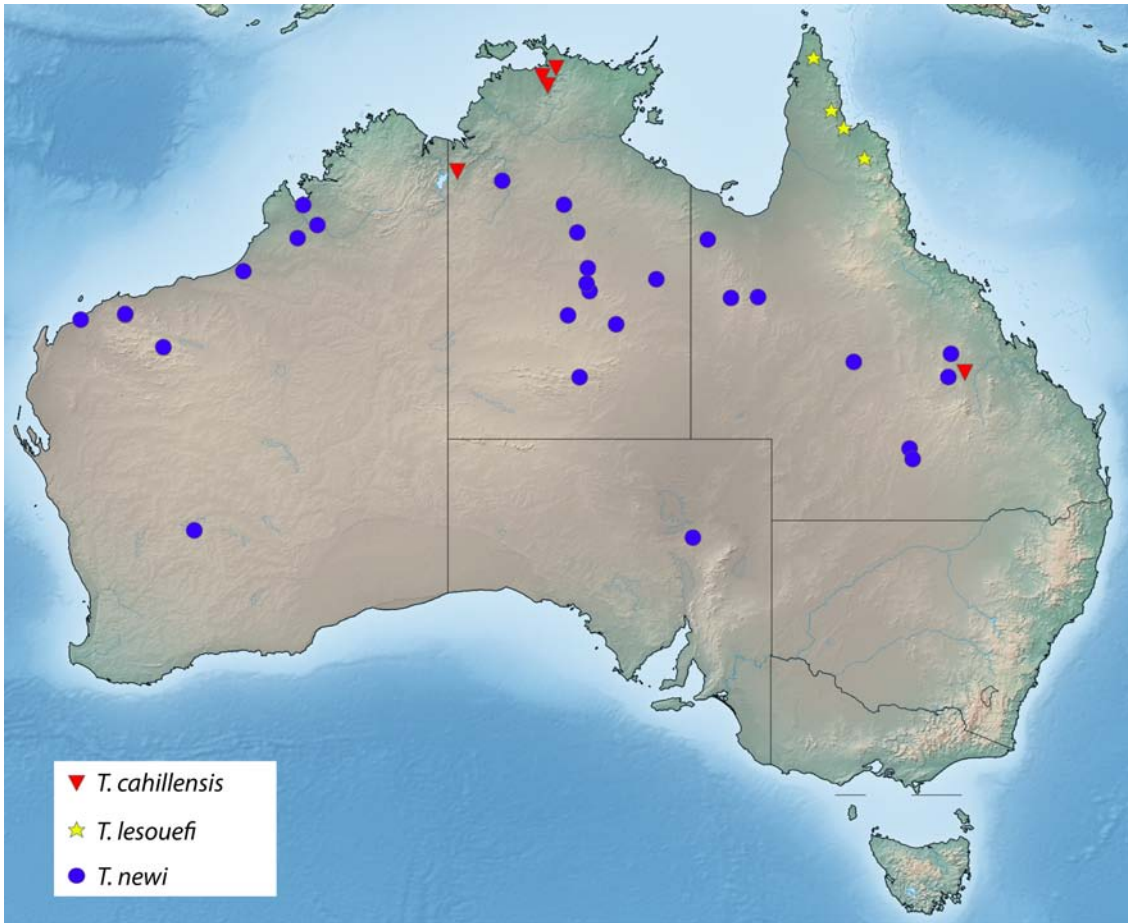


Figure A4.173: Distribution map of *Tanyleon*.