Systematics and Analysis of the Radiation of Orthotylini Plant Bugs Associated with Callitroid Conifers in Australia

Description of Five New Genera and 32 New Species

(Heteroptera: Miridae: Orthotylinae)

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CONTENTS

ABSTRACT

Orthotyline plant bugs inhabiting the southern conifer genus *Callitris* in Australia are investigated and classified systemically for the first time, with the description of 5 new genera and 32 new species from Australia. The five new callitroid-inhabiting Orthotylini genera proposed are *Avititerra, Blattakeraia, Callitricola, Erysivena,* and *Ngullamiris*. The 32 new species accommodated by these genera are: *Avititerra lepidothrix, A. xerophila, Blattakeraia actinostrobi, B. hochuli, Callitricola ballina, C. boorabbin, C. cordylina, C. finke, C. finlayae, C. gammonensis, C. graciliphila, C. parawirra, C. pullabooka, C. silveirae, C. tatarnici, C. wiradjuri, C. wollemi, Erysivena apta, E. bundjalung, E. drepanomorpha, E. emeraldensis, E. endlicheriphila, E. kalbarri, E. majori, E. mareeba, E. molloy, E. notodytika, E. paluma, E. schuhi, E. schwartzi, E. sydneyensis,* and *Ngullamiris whadjuk*. A key to the newly described Australian taxa, habitus photographs of all species, illustrations of male and female genitalia, and scanning electron micrographs of representative species are given. A phylogenetic analysis of these callitroid-inhabiting Orthotylini was undertaken, incorporating described *Orthotylus* Fieber species extralimital to Australia and other recently described Australian Orthotylini. *Callitris* host plants are mapped to the implied-weights phylogenetic analysis, and their associations are discussed. Associations between related species of Orthotylini and related species of *Callitris* were detected, as were three independent colonisations by a paraphyletic assemblage of callitroid-inhabiting Orthotylini. Generic concepts within Orthotylini are discussed, with reference to *Orthotylus* species extralimital to Australia and includes a comparison of key character systems. It is demonstrated that the endosomal spicule characters are primary determinants of generic limits in the Orthotylini, which are supported by other characters of the male and female genitalia and external characters.

Keywords: Insecta, Heteroptera, Miridae, Orthotylinae, Orthotylini, *Orthotylus*, systematics, taxonomy, phylogeny, new species, host plants, Cupressaceae, *Callitris*, Australia

INTRODUCTION

The plant bug family Miridae (Insecta: Hemiptera: Heteroptera) is a hyperdiverse family of mostly phytophagous insects, with 11,000+ described species globally (Schuh, 2002–2013). The family is poorly documented in the Southern Hemisphere (Cassis et al., 2007), no more so than in Australia, where the Plant Bug Inventory (Cassis and Schuh, 2012; Schuh, 2012) and Bush Blitz (Preece et al., 2015) programs have resulted in the discovery of a largely unknown mirid fauna, and facilitated descriptive works that are improving this situation (Weirauch, 2007; Cassis, 2008; Soto and Weirauch, 2009; Tatarnic, 2009; Cassis et al., 2010; Schuh and Pedraza, 2010; Schuh and Weirauch, 2010; Menard and Schuh, 2011; Namyatova et al., 2011; Schuh and Menard, 2011; Cheng et al., 2012a; Cassis and Symonds, 2014a; 2014b; Cassis and Symonds, 2016; Schuh and Schwartz, 2016; Chin and Cassis, in press). Of the eight mirid subfamilies, most of these recent works on Australian mirids have focused on the Orthotylinae and Phylinae, which are commonly associated with woody perennial shrubs (Cassis and Schuh, 2012). This is particularly so for taxa of the nominotypical orthotyline tribe, Orthotylini, which has significantly radiated in Australia and where the taxonomic impediment is imposing.

Foremost in classifying these new species is genus-group placement, an ongoing issue in Australian plant bugs, where there is undoubted generic endemism on the one hand and historical misapplication of Northern Hemisphere genus-group concepts on the other. Of the 220+ described genera of Orthotylini worldwide (Schuh, 2002–2013), just 13 have been recorded from Australia thus far, seven in just the past 10 years (Cassis et al., 2012). In Australia and elsewhere the systematics of the Orthotylini is challenging because of the lack of a workable diagnosis for the genotype, *Orthotylus* Fieber. It is by far the most species-rich genus in the tribe, with nearly 400 described species, and has a cosmopolitan distribution (Schuh 2002–2013). *Orthotylus* is regarded as a convenience group and new species continue to be assigned to it albeit on a provisional basis (Linnavuori, 1994; Kerzhner and Schuh, 1995; Yasunaga, 1999; Polhemus, 2002, 2004, 2011, 2013; Forero, 2009), and no more so than in Hawaii (90+ species described; Polhemus 2002, 2004, 2011, 2013). There has been no attempt as yet to address the diagnosis of the genus across its range.

Orthotylus species are saliently often green plant bugs that have exaggerated male genitalia, with elongate serrate endosomal spicules (Southwood, 1953; Wagner, 1973; Yasunaga, 1999; Forero, 2009). In this work we focus on a large complex of orthotyline species that are mostly green and possess elaborate endosomal spicules, and are associated with callitroid conifers in Australia. We provisionally assigned these taxa to *Orthotylus*, but rejected this generic assignment in comparison with the European type species, *O. marginalis* Reuter, and other Northern Hemisphere representatives of the genus. More generally within the Orthotylini, we found body color to be misleading and the presence of serrate endosomal spicules to be widespread (also see Schuh, 1974). For example, in the Australian genus *Naranjakotta* Cassis and Symonds dorsal coloration is highly variable and the presence of endosomal spicules alone is not genus defining, although their fine details are (Cassis and Symonds, 2016). Further, a largely undescribed southern Orthotylini fauna presents an opportunity to reassess generic concepts and review historical northern hemisphere generic application to Australian fauna.

In this work we describe five new genera and 32 new species of Australian orthotylines, in the context of a broader assessment of *Orthotylus* and in reference to previously described Australian orthotyline genera. In so doing, we also assess their relationships, distribution and host associations, with the purpose of understanding their diversification on the Australian continent. These orthotylines exclusively inhabit cupressaceous conifers, of the genus *Callitris* Vent., belonging to the subfamily Callitroideae. Callitroids are primarily a Southern Hemisphere group that includes the iconic Australian and New Caledonian genus *Callitris*, the New Caledonia genus *Neocallitropsis* Florin, the Chilean genus *Fitzroya* Hook. f. ex Lindl., and the South African genus *Widdringtonia* Endl. (Gadek et al., 2000). In Australia, callitroids are represented primarily by the genus *Callitris*, commonly known as native cypress pines, and are considered a Gondwanan relict. They have diversified across much of Australia, including the tropics and subtropics, cool temperate mesic areas, and particularly in semiarid and arid regions, with the latter an outcome of the aridification of the Australian continent during the Palaeocene (Bowman and Harris, 1995; Farjon, 2005).

In summary, this work has the following aims:

(1) To establish a generic framework for the assignment of the above callitroid-inhabiting Orthotylini species, using phylogenetic methods;

(2) To assess genus-group diagnoses of the Orthotylini, focusing on *Orthotylus* and allied genera, as well as other Australian orthotyline genera;

(3) To determine the in-group relationships of callitroid-inhabiting orthotylines;

(4) To analyze the host-plant associations of callitroid-inhabiting orthotylines; and

(5) To describe new Australian orthotyline taxa associated with callitroid Cupressaceae.

Materials and Methods

Specimens examined: Over 500 specimens were examined in this study, mostly comprising material collected in fieldwork throughout Australia from 1995 to 2006 by one of us (G.C.) and Randall T. Schuh of the American Museum of Natural History, and funded in part by the U.S. National Science Foundation program. In addition, significant collections were obtained from an investigation of insects on *Callitris glaucophylla* in a habitat-fragmentation study of the wheatbelt of western New South Wales (Major et al., 2003). One of us (C.L.S.) collected additional material in 2005, targeting previously unsampled species of *Callitris* in eastern Australia and *Actinostrobus* in Western Australia. After 2008, additional specimens were collected during Bush Blitz surveys (Preece et al., 2015; Cassis and Symonds, 2016). All but one of the 20 species of *Callitris* have been sampled (see below for *Actinostrobus*), and in many cases sampled in multiple locations across their ranges, including morphologically variant populations of some *Callitris* species in northeastern Queensland.

Abbreviations of the depositories of materials examined in this work are as follows: **AM,** Australian Museum (Sydney); **AMNH,** American Museum of Natural History; **MAGNT,** Museum and Art Gallery of the Northern Territory (Darwin); **MVMA,** Museum of Victoria (Melbourne); **QM,** Queensland Museum (Brisbane); **SAMA,** South Australian Museum (Adelaide); **UNSW,** University of New South Wales (Sydney); and **WAMP,** Western Australian Museum (Perth).

Specimens were also assigned a unique specimen identifier (USI) and matrix code labels were attached to each specimen. The USI codes comprise an institution and project code (e.g., AMNH_PBI) and an eight-digit number (e.g., 00001234), which together form a unique code (e.g., AMNH_PBI 00001234). The majority of specimens databased in this study have USIs beginning with AMNH_PBI. For the paratype and specimens examined listings the AMNH_PBI institution and project code prefix has been omitted from series of specimen entries for greater clarity. Specimen information and collection event data (including locality, host plant, collector, and collection date) were databased using the online Plant Bug Inventory (PBI) locality database, currently named the Arthropod Easy Capture Specimen Database (http://research.amnh.org/pbi/locality/). These data can be publicly viewed by querying the PBI Heteroptera Species Pages search tool (http://research.amnh.org/pbi/heteropteraspeciespage/), part of the PBI website.

Locality coordinates were given on the labels accompanying most specimens, but where not provided, they were obtained using the Geoscience Australia online gazetteer (http://www.ga.gov.au/map/names). These locality data were used to generate all species distribution maps provided in this work. Maps were prepared using the PBI Mapping Tool (http://research.amnh.org/pbi/maps/) based on the online tool SimpleMappr (Shorthouse, 2010).

The male and female genitalia of most populations of each species were examined with light microscopy, and representative samples with scanning electron microscopy. About 80 male and over 50 female genitalic dissections were made over the course of this study. Type material was mostly limited to populations verified by examination of internal male genitalia.

Four extralimital species of *Orthotylus* and one Australian species previously assigned to *Orthotylus* (Cassis and Gross, 1995; Cassis and Symonds, 2016) were also examined.

Identification of females: Females generally have a smaller body, which is more ovoid in shape, and shorter hemelytra. In the case of *Ngullamiris*, n. gen., females are significantly shorter than males. Most females are best identified by association with colocated males from the same collecting event. This is confounded where only females have been collected at a locality or multiple species of the same genus are found in the same collection event. In such circumstances, identification to species is limited to a comparison of minor external characters and internal female genitalia. In some circumstances, females can only be narrowed to a group of species in the genus, particularly for *Erysivena*, n. gen., species, which possess a distinctive red color patterning on the hemelytra. Where more than one species in a genus has been collected sympatrically, and cannot be differentiated externally by nongenitalic characters, the females are not identifiable to species without dissection.

Measurements: Measurements were made using either a digital micrometer or microscope camera mounted on a Leica MZ16 stereomicroscope with LAS V4.3 software (Leica Microsystems, 2003–2013). A minimum of five males and five females were measured for each species where numbers permitted; otherwise all available specimens were measured. The measurements in millimeters, were taken for the following characters: total body length, clypeus to cuneus length, head length and width, pronotum length and width, scutellum length and width, cuneus length, interocular distance, and lengths of antennal segments I through IV.

Imaging: Habitus photographs are provided for the males of each species (females were not photographed, due to limited sexual dimorphism) using a Nikon D1X camera and Microptics or Visionary Digital (Dun Inc., U.S.) imaging system. A series of shots were taken due to shallow depth of field and compiled using Helicon Focus software (Kozub et al., 2008), to render a fully focused image.

Illustrations of the full male genitalia and female interramal lobes are provided for each species, with the internal female genitalia provided in full for representatives of each genus. Illustrations were prepared using a Leica DMB compound microscope and camera lucida at 40× magnification. Illustrations of each of the male genitalic structures are given in the same view where possible, supplemented with alternative views to demonstrate fine details and canting of complex structures. For the female genitalia, the dorsal labiate plate was removed to clearly view and illustrate the ventral labiate plate. Orientation of genitalic structures is indicated in figure legends. Scanning electron micrographs (SEM) are provided for males of at least one species of each genus showing characters of the head, pronotum, thoracic pleura, scent gland, tarsus, and male genitalia. SEMs of the external male genitalia in situ (including+ pygophore, parameres, and aedeagus) and endosoma were produced. SEMs for one species of the female genitalia demonstrate fine details of the bursa copulatrix. Male and female genitalic dissections were prepared for SEM as follows: glycerol washed off with ethanol, critical point dried, mounted on a carbon stub, and gold sputter coated. SEM examination and imaging was undertaken using a LEO 435VP with Robinson Backscatter detector.

Abbreviations used for morphological structures in illustrations and SEMs are given in appendix 1.

Character Homology and Terminology

Homology and terminology for character systems used in this study mostly follow those summarized in Cassis and Schuh (2012) unless stated otherwise.

Diagnosis for genera and species includes a summary of the important characters characters used to define each taxon, in combination. The Remarks sections include a discriminatory or differential diagnosis, distinguishing the treated taxon from similar genera or species. The following characters were used in the classification of the callitroid-inhabiting Orthotylini: color, dorsal vestiture, head shape, eye shape and size, male genitalia, pygophore, paramere, phallotheca, endomsomal spicules, and female genitalia.

Color: Although color is typically a poor species determinant in orthotylines, in callitroid-inhabiting taxa, color provides supporting information. In general these taxa are green, but do show minor variation in the shade of green and contrasting markings are discriminatory. In some species the tip of the cuneus, hemelytral membrane, and membrane veins are red and a clear spot is present distal to the cuneus (figs. 12–14). Preservation (dry and wet) can result in color fading and yellowing. Live specimens (fig. 4) are mostly bright green, with the head and pronotum yellowish green, and the antennal segments AII–IV and tarsi yellowish brown. In dried specimens the green commonly fades, and is either patchily or completely faded, with the pronotum, head, scutellum, mesoscutum, and appendages yellow to yellowish green.

Dorsal vestiture: The type of setae varies from pale to dark simple erect setae that are sometimes intermixed with white or black flattened, scalelike setae.

Head shape: The shape of the anterior portion of the head is useful in discriminating species in callitroid-inhabiting orthotylines. The head is either strongly expanded anteriorly (> half length of eye; e.g., fig. 57B) or weakly expanded anteriorly (< half length of eye; e.g., fig. 63B).

Eye shape and size: The eyes are moderate to large in size and rounded to subovate in lateral view, and are more elongate and narrower in lateral view in a few species. The eyes do not or only weakly extend beyond the anterior angles of the pronotum and the posterior margins of the eyes are in line with the posterior margin of the head (e.g., figs. 57A, C, 43A, C).

Male genitalia: As primary phylogenetic and taxonomic characters at both genus and species level, the male genitalia of the callitroid-inhabiting Orthotylini taxa are described and discussed in detail, and summarized in table 5 and figure 11. The terminology and homology used in this work also includes comparison with representative species of extralimital *Orthotylus* species (figs. 7, 8, 9). The key characters of the pygophore, parameres, phallotheca, and endosoma that are of taxonomic and/or phylogenetic significance are as follows.

Pygophore: The pygophore exhibits a great deal of variability in the callitroid-inhabiting Orthotylini, with numerous characters having classificatory significance. These characters include: size of genital opening, number and shape of tergal processes, shape and size of the ventral phalloguide (ventrad to right paramere insertion), and presence of short, dark, spinelike setae on the ventral surface.

Elaborate tergal processes are present on the dorsal margin of the genital opening of the pygophore in three of the callitroid Orthotylini genera. In comparison, tergal processes are commonly absent in many Orthotylini taxa, or are small and singular as in the type species of *Orthotylus* (figs. 7, 8A) and *Naranjakotta* Cassis and Symonds. However, there are Orthotylini genera with large and complicated tergal processes that are characteristic of the genus, e.g., *Pseudopsallus* Van Duzee (Stonedahl and Schwartz, 1986).

Parameres: The structure, size, and position of the parameres in repose exhibit phylogenetic and taxonomic characters at the genus and species-group levels. The left paramere follows the terminology of Cassis (2008) (e.g., fig. 15B, C). In particular, the apophysis shape, angle, and apex structure appear to conform and are diagnostic for the genera. In this work, we devise terminology for areas of the right paramere that vary (e.g., figs. 36C, 49C, 50C). We found that the terminology of Stonedahl and Schwartz (1986), who homologized paramere structures, could not be adopted satisfactorily for the callitroid-inhabiting orthortylines because of their differing morphology.

The extent of variation in paramere morphology varies between genera. In *Callitricola*, n. gen., the left paramere is virtually indistinguishable between congeners (e.g., figs. 28B, 29B). In *Erysivena* the left paramere is more variable (e.g., figs. 49B, 50B), although they are similar in closely related species (e.g., figs. 56B, 70B, 73B). In these genera the left paramere is mostly L-shaped, often with a tapering apophysis, hooked apex, and expanded sensory lobe. The left paramere sensory lobe may also have serrations on the outer margin (e.g., figs. 15B, 18B) and may be setose (e.g., fig. 65B). In the abovementioned two genera the right parameres are clubshaped and expanded distally (e.g., figs. 28C, 34D), C-shaped and expanded medially (e.g., figs. 49C, 53C), or a combination thereof (e.g., figs. 50C, 62C).

Phallotheca: The shape and degree of sclerotization of the phallotheca are taxon defining, with two main types observed: (1) phallotheca heavily sclerotized and boat shaped, opening dorsally with margins enclosing; in this type the phallotheca is large and protrudes from the genital opening of the pygophore (e.g., figs. 21C, 22D, 31B, 32D, 52A, 53E). (2) phallotheca lightly sclerotized and smaller, with reduced sides, more withdrawn within the pygophore and enclosed by the parameres at rest (e.g., figs, 17C, 18E, 76C, 77E). There is interspecific variation in the type 1 phallotheca, including the shape of the opening, where the dorsal surface is opened fully (e.g., fig. 49D) or just distally (e.g., fig. 50D), and there are sometimes prominent lobes on the dorsal margin (e.g., fig. 47A) and tumescences on the ventral, right lateral, right basal, and left lateral surfaces (e.g., fig. 32D, E). These were named and labelled to allow comparison throughout this work.

Endosomal spicules: Modern works on the Australian Orthotylinae focus on fine details of the endosomal spicules (Cassis, 2008; Cassis et al., 2010; Cheng et al., 2012a; Cassis and Symonds, 2014a, 2014b, 2016). Taxa have been found to have either two (*Acaciacapsus* Cassis and Symonds, *Granitohyoidea* Cassis and Symonds, *Lattinova* Cassis complex of Austromirini) or three (*Harveycapsus* Cassis, Symonds, and Tatarnic, *Myrtlemiris* Cheng, Mututantri, and Cassis, *Naranjakotta*) endosomal spicules. In those taxa with two spicules, Cassis (2008) named the dorsally positioned spicule as the dorsal endosomal spicule (DES), which was also defined by the possession of a basal keel (DESk), which hooks dorsomesially into the sclerotized midregion of the phallotheca. This is observed in the austromirine genera *Metopocoris* Cassis and *Sinistropa* Cassis. In these taxa the second spicule is mostly ventral in position and was termed the ventral endosomal spicule (VES). Cassis (2008) made an exception for *Latitnova jacki* Cassis, with DES the innermost spicule based on possession of a basal keel. He recognized that this was conjectural and this is pertinent to the callitroid Orthotylini of this work (see below).

Cassis et al. (2010) adapted this above terminology for the Western Australia orthotyline *Harveycapsus dimorpha* Cassis, Symonds, and Tatarnic, which has three endosomal spicules. In this species two of the endosomal spicules are dorsal in position and referred to as the first and second dorsal endosomal spicules (DES1 and DES2 respectively), with DES1 possessing a basal keel (note: in that work reference to DES2 as the outermost spicule is a lapsus; DES1 is the outermost). The third endosomal spicule in this species is ventral in position. *Myrtlemiris* has three spicules that are all dorsal in position. Cheng et al. (2012a) referred to the innermost as the VES, under the assumption that it has rotated to the dorsal position. The VES was renamed as the proximal endosomal spicule (PES) as it is closest to the secondary gonopore (Cheng et al., 2012b). This was done in order to better reflect the patterns observed in further investigations across the Australian Orthotylini. We applied the latter terminology to the Australian orthotyline genera *Acaciacapsus* (Cassis and Symonds, 2014a), *Granitohyoidea* (Cassis and Symonds, 2014b), and *Naranjakotta* (Cassis and Symonds, 2016).

In *Acaciacapsus* the aedeagus has two endosomal spicules, both dorsally positioned, with the DES possessing a well-defined keel (DESk). In *Naranjakotta* there are three endosomal spicules, which are also all dorsal in position, with PES and DES2 being near coplanar, and DES1 outermost but with no obvious basal keel. Schwartz (2011) highlighted the importance of the basal keel on the dorsal endosomal spicule as a common feature of North American orthotylines. He reported that most North American orthotyline species have one or two endosomal spicules, with one in a right dorsal position (equivalent to our DES) and the second in the ventral to left lateral position (equivalent to our PES). Southwood (1953) identified two spicules in British species of *Orthotylus*, which he described as right and left appendages. He described the number and position of the spicules, their structure and position relative to the secondary gonopore and ductus seminis. His terminology can also be aligned with our terminology for Australian orthotylines, with PES most often to the left side and DES most often to the right side of the secondary gonopore.

Asquith (1991) proposed a mosaic evolutionary model for transformation of the endosomal spicules of the North American Orthotylini, highlighting their reduction (also see Schwartz, 2011). Asquith (1994) proposed a sister-group relationship between the Hawaiian genus *Sarona* Kirkaldy and the North American genera *Slaterocoris* Wagner and *Scalponotatus* Kelton and defined the *Slaterocoris* group based on a single branched endosomal spicule, among other characters. Schwartz (2011) supported the monophyly of this group based on this character. Further, Asquith (1994) homologized this single spicule with the dorsal right spicule of North American genera such as *Pseudopsallus* and *Lopidea* Uhler, using position and structure of this single spicule in *Sarona* to make this association (namely, the right dorsal position of the base in relation to the secondary gonopore and the ventral and dorsal portions of this spicule, referred to as ventral and dorsal lobes [Schwartz, 2011, after Stonedahl and Schwartz, 1986]). Asquith (1994) also equated this spicule with Southwood's (1953) right dorsal (sic, ventral) vesical appendage in the British *Orthotylus*, and Schwartz supports this analysis and goes further, considering the single endosomal spicule in another six Mexican orthotyline genera (Schaffner and Schwartz, 2008) as homologous with those described by Southwood (1953) and Cassis (2008). This dorsal endosomal spicule in *Orthotylus* sensu stricto, *Sarona*, *Scalponotatus*, and *Lopidea* also has a prominent sclerotized basal keel (Asquith, 1994; Schwartz, 2011; Southwood, 1953).

In Australian Orthotylini described to date, the endosomal spicules are most often dorsal in position (aside from *Harveycapsus*) and are clearly differentiated, arising from a basal endosomal membranous skirt. Schwartz (2011) disputed the possibility of more than two endosomal spicules in orthotylines, and referred to folds of a connective sclerotized band. This is not the case in the Australian Orthotylini, where such folds do not exist and the spicules are basally distinct and separated by membrane. In callitroid-inhabiting orthotylines the dorsal endosomal spicules can be flattened and adjacent at the base, and although their attachment can be basally obscure, they can be teased apart. This is the case for *Avititerra*, n. gen., and *Blattakeraia*, n. gen. In *Callitricola* and *Erysivena* the DES keel is sometimes separated by membrane from DES1, and in the latter genus connects to the phallobase dorsad to the second dorsal endosomal spicule (DES2). The keel in the Australian Orthotylini is nearly always in the right dorsal position regardless of the number of spicules, which also appears to conform with that found in North American and European orthotylines.

We hypothesize that the left endosomal spicule of British *Orthotylus* species to be synonymous with the proximal endosomal spicule (PES) in Australian Orthotylini. In general, PES is positioned to the left of the secondary gonopore, but is not uniformly ventral in position, and can also be dorsal or sheathing the secondary gonopore. In *Orthotylus marginalis* PES is mostly left dorsolateral (figs. 7, 8D, E), although the basal section extends to the ventral surface of the secondary gonopore (fig. 8D).

The characters of the endosomal spicules that we consider significant taxonomically for each genus of the callitroid-inhabiting Orthotylini are given in table 5.

Female genitalia: The female genitalia in many callitroid Orthotylini species are strongly sclerotized and possess phylogenetically significant and diagnostic substructure at generic and species levels. The characters of importance include:

(1) *Vestibulum*: the opening has asymmetrical structures at the base of gonapophyses 8 (= first gonapophyses) (e.g., figs. 19B, 46A, 55A) and are often heavily sclerotized in orthotyline genera (Schwartz, 2011). Schwartz (2011) and Cassis and Symonds (2016) found that their characters are diagnostic at the species-group and species levels in orthotylines. These sclerotized structures have also been documented in New Zealand orthotylines (Eyles, 2005).

(2) *Dorsal labiate plate*: the broad membranous region possesses or lacks mediolateral lobes. These are found lateral of and proximate to gonapophyses 8, and posterior to the sclerotized rings. They are positioned mesially within the

genital chamber and can generally be recognized by a uniform distribution of spinules (e.g., figs. 19A, 27A, 29A, 55A, 60B). The sclerotized rings vary in size and shape between the genera.

(3) *Ventral labiate plate*: this is usually spiniferous (e.g., fig. 19A) and in some callitroid-inhabiting orthotyline genera there are lateral lobes, which vary in size and shape, that are diagnostic (e.g., figs. 23A, 27A, 46A, 60C, 61A). These lateral lobes, when present, sit medial to the sclerotized rings and just anterior to the mediolateral lobes of the dorsal labiate plate, and also arise proximate to gonapophyses 8.

(4) *Posterior wall of the bursa copulatrix* (e.g., figs. 19C, 27C, 29B, 55B, 60D): as pointed out by Slater (1950) and Davis (1955) this structure is of classificatory significance in mirids, including the Orthotylini. In particular, the interramal sclerite is often spiniferous and sometimes medially divided. The interramal sclerite(s) bears interramal lobes (= K-structures of Slater, 1950) that are the most important diagnostic characters of the posterior wall, particularly their shape, size, and connection to the interramal sclerite(s). In *Callitricola* and *Erysivena*, these lobes are complex, and we have termed them the *lateral* and *medial interramal lobes* (figs. 48, 74). We have found characters of the posterior wall to be diagnostic as to genus and species among these taxa.

In our work on the Australian orthotyline genus *Naranjakotta* (Cassis and Symonds, 2016), we provide detailed illustrations of the position and homologies of female genitalic structures. In the main, terminology is based on Davis (1955) and Schwartz (2011).

Callitris Identification and Alternative Classifications

Callitroid-inhabiting Orthotylini are a paraphyletic assemblage found exclusively on *Callitris*. The most speciose and widely distributed genus of the Southern Hemisphere Cupressaceae (Farjon, 2005), *Callitris* is endemic to Australia and New Caledonia (Hill, 1998; Pye et al., 2003), with a relictual Gondwanan distribution (Hill and Brodribb, 1999). In addition, *Callitris* is allied with the monotypic New Caledonian genus *Neocallitropsis* (Gadek et al., 2000), and recent molecular phylogenetic analysis suggests that the latter genus and *Actinostrobus* are nested within *Callitris* (Pye et al., 2003).

In this study *Callitris* host plants were identified by botanists at the Western Australian (WA) Herbarium, Perth, and the Royal Botanic Gardens (RBG), Sydney. Correct identification of *Callitris* species can be difficult because their taxonomy is unresolved and species readily hybridize. There are two alternative classifications in contemporary use, which are variously applied in the databases of Australian state herbaria, with all names currently listed as valid scientific names, aside from *Callitris tuberculata* (CHAH).

Hill (1998) recognized 17 species in his *Flora of Australia* treatment. Farjon (2005) in his monograph of the Cupressaceae implemented a broader species concept, recognizing 13 *Callitris* species. Farjon (2005) synonymized *Callitris intratropica* with *C. glaucophylla* and *C. columellaris*, an action not universally followed, whereas his synonymy of *C. gracilis* and *C. tuberculata* with *C. preissii* is widely accepted. *Callitris verrucosa* and *C. tuberculata* have been treated as either subspecies of *Callitris preissii* (Harden and Thompson, 1990) or as a distinct species (Hill, 1998).

We largely follow Hill's treatment (1998) (see appendix 2) in our discussion and analysis of host-plant associations, and in the host-plant discussions within the species descriptions. However, host records in the type and specimens examined listings are all given as per the herbarium identifications and host-plant labels.

We do not follow the substantial nomenclatorial changes proposed by Farjon (2005), in part because the majority of identifications of our host-plant voucher specimens predate his work. In contrast, we recognize the synonymy of *Actinostrobus* with *Callitris*, based on molecular and morphological analyses (Pye et al., 2003; Piggin and Bruhl, 2010), and the identity of species previously assigned to *Actinostrobus* is not confounded by their transfer to *Callitris*. We follow the treatment of Pye et al. (2003) in part, who recognized morphologically variable populations of *Callitris* at Emerald Creek Falls and Paluma (northeastern Queensland) as *C. intratropica* and *C. endlicheri* respectively.

The monophyly of *Callitris columellaris*, *Callitris intratropica*, and *Callitris glaucophylla* is strongly supported (Piggin and Bruhl, 2011). External characters differentiating *C. columellaris*, *C. intratropica*, and *C. glaucophylla* sometimes overlap, although they are readily distinguished by wood-tracheid anatomy and leaf-chemical differences (Piggin and Bruhl, 2011) and each has for the most part distinct distributions. Although molecular data was incomplete (Pye, et al., 2003), morphological analysis by Piggin and Bruhl (2011) does not support the monophyly of these three species: *Callitris gracilis, Callitris tuberculata*, and *Callitris preissii*.

For the purposes of discussion and analysis, host-plant identifications after 2005 in the Western Australian Herbarium database of *Callitris columellaris* were recognized as *Callitris glaucophylla* and records of *Callitris preissii* outside the Perth region were recognized as *Callitris tuberculata* in accordance with the above information.

Hill (1998) restricted *Callitris preissii* to coastal limestone plains and offshore islands in the Perth region and distinguished it from the following species that have warty fruits: *C. tuberculata* is more broadly distributed in Western Australia and *C. verrucosa* is restricted to eastern Australia. We regard the records of *C. roei* from South Australia as misidentifications, as this species is restricted to the Southwest Interzone phytogeographical subregion of Western Australia (records from Hill, 1998).

Identification of *Callitris* species is also confounded by known hybridization in the genus. For example, some of our host-plant vouchers of *Callitris* species could not be identified, and one specimen may represent a hybrid between *C. gracilis* or *C. glaucophylla*. Hybrid populations of these latter two species are known to occur across the mallee country and Flinders Ranges of South Australia, Victoria, and New South Wales (Thompson and Johnson, 1986; Harden and Thompson, 1990). *Callitris glaucophylla*, *C. gracilis*, and *C. verrucosa* all are also known to hybridize with each other and *C. glaucophylla* with *C. tuberculata* (Hill, 1998).

Host-plant records and cooccurrence of callitroid orthotylines are summarized in table 3. For a list of *Callitris* species and synonymy, see appendix 2.

Callitris floristics: *Callitris* species are either shrubs or trees that occur in tropical rainforest, coastal forest, and woodland, tropical savannah, semiarid to arid woodlands and shrublands, and temperate heathlands and shrublands (Hill and Brodribb, 1999). In eastern Australia they often occur as codominant or in a mosaic pattern in mixed eucalypt forests or dense pure stands, which is in part due to changing land use and altered fire regimes (Noble, 1997; Farjon, 2005). The majority of species occur in eastern Australia, with numerous species broadly distributed (*C. endlicheri, C. gracilis, C. rhomboidea*, and *C. verrucosa*). *Callitris rhomboidea* and *C. oblonga* are also found in Tasmania. Eight *Callitris* species occur in Western Australia with over half these species restricted to the Southwest Botanical Province (*C. drummondii, C. preissii, C. acuminata, C. arenaria*, and *C. pyramidalis*). Only *Callitris intratropica* is a solely tropical species distributed across northern Australia, from the Kimberley to the wet tropics. *Callitris glaucophylla* is a well-known element in Australian xeric regions and occurs in all states and territories of the mainland.

PHYLOGENETIC ANALYSIS

A total of 88 morphological characters (see page 215) were used to construct the phylogenetic data matrix (table 1), for 32 callitroid Orthotylini and 12 outgroup taxa. Outgroup taxa comprised three Austromirini species: *Fronsetta geraldtoni* Cassis, *Metopocoris asquithi* Cassis, and *Sinistropa northami* Cassis from the *Lattinova* complex; four *Orthotylus* species including the North American species *Orthotylus cuneatus* Van Duzee, the Hawaiian species *Orthotylus clermontiella* Polhemus and *Orthotylus tantali* (Perkins), and the European type species *Orthotylus marginalis* Reuter; *Morobea spectabilis* Wall (Orthotylini) from Papua New Guinea; and three Australian Orthotylini taxa: *Naranjakotta sidnica* (Stål) and two undescribed Orthotylini species, from Scorpion Springs, South Australia, and Eneabba, southwestern Western Australia respectively. All trees were rooted with *Morobea spectabilis* which has the most simple male endosoma of all the taxa sampled. For the matrix the hyphen ("-") was used to code for inapplicable characters and the question mark ("?") for unknown data.

Maximum parsimony analysis was undertaken with TNT (Goloboff et al., 2003a), using the New Technology option, with default settings for sectorial search (RSS and CSS), drift and tree fusing, and 1000 iterations for the ratchet routine. Characters were unordered and analyses were undertaken with equal and implied weighting. The data was run using implied weights at concavity values of k = 1–10 and 100, to allow for self-consistency in the data and down weighting of homoplasy, as recommended by Goloboff et al. (2008).

Symmetric resampling values (Goloboff et al., 2003b) were calculated in TNT to assess nodal support and were calculated for the dataset with unweighted characters and weighted characters with the concavity value k = 4. Unambiguous characters were optimized onto the k = 4 tree in Winclada (Nixon, 1999–2002).

Phylogenetic relationships: The analyses resulted in the recognition of four monophyletic genera of callitroid-inhabiting Orthotylini: *Erysivena, Callitricola, Blattakeraia*, and *Avititerra*, and the monotypic genus *Ngullamiris*. These five genera do not collectively form a monophyletic group, and represent at least three independent associations with *Callitris*.

The equal-weights analysis resulted in six most parsimonious trees (tree length = 263, CI = 42, RI = 77). The strict consensus of these six trees is shown in figure 1. Three monophyletic callitroid-inhabiting genera (*Blattakeraia*, *Callitricola*, and *Erysivena*) form a clade with significant symmetric resampling support (87%), and within this clade, two genera (*Callitricola*, n. gen., and *Erysivena*, n. gen.) have >70% resampling support, indicating a strong sister-genus relationship (see phylogeny discussion below and *Callitricola* and *Erysivena* generic remarks). Resampling values for *Callitricola* in this analysis are not significant (<50%); however, the classification is based on the implied-weights analysis wherein *Callitricola* has >50% resampling support (see phylogeny discussion below). The European species *Orthotylus marginalis* is sister to this clade, supported by color characters (6, 7) and the presence of mediolateral lobes in the female genitalia (78), although without resampling support. The ingroup relationships of *Callitricola* and *Erysivena* are only partly resolved, and the most-resolved relationships are within *Erysivena*, with six of the 10 nodes with >50% resampling support (versus only three of eight nodes with >50% resampling support within *Callitricola*). In addition, the genus *Avititerra* has 77% resampling support.

The consensus tree shows placement of *Ngullamiris*, *Avititerra*, *Naranjakotta*, and the two undescribed Australian Orthotylini with the Hawaiian *Orthotylus* species and of *Orthotylus marginalis* basal to *Blattakeraia*. When common synapomorphies are mapped on this unweighted topology, characters 23, 57, and 82 group these species together. These characters relate to the shape of the apophysis of the left paramere, structure of the distal margins of the first dorsal endosomal spicule (DES1), and medial region of the posterior wall (in females), and are highly homoplasious across the Orthotylini; thus, there is no support for this grouping.

The implied-weights analyses at different k values were largely congruent. For higher weighting (k = 1 & 2) an identical tree was obtained, which was similar to that reconstructed for lower weighting values (k = 4–10). The k = 1 & 2 tree differed in the placement of *Erysivena paluma*

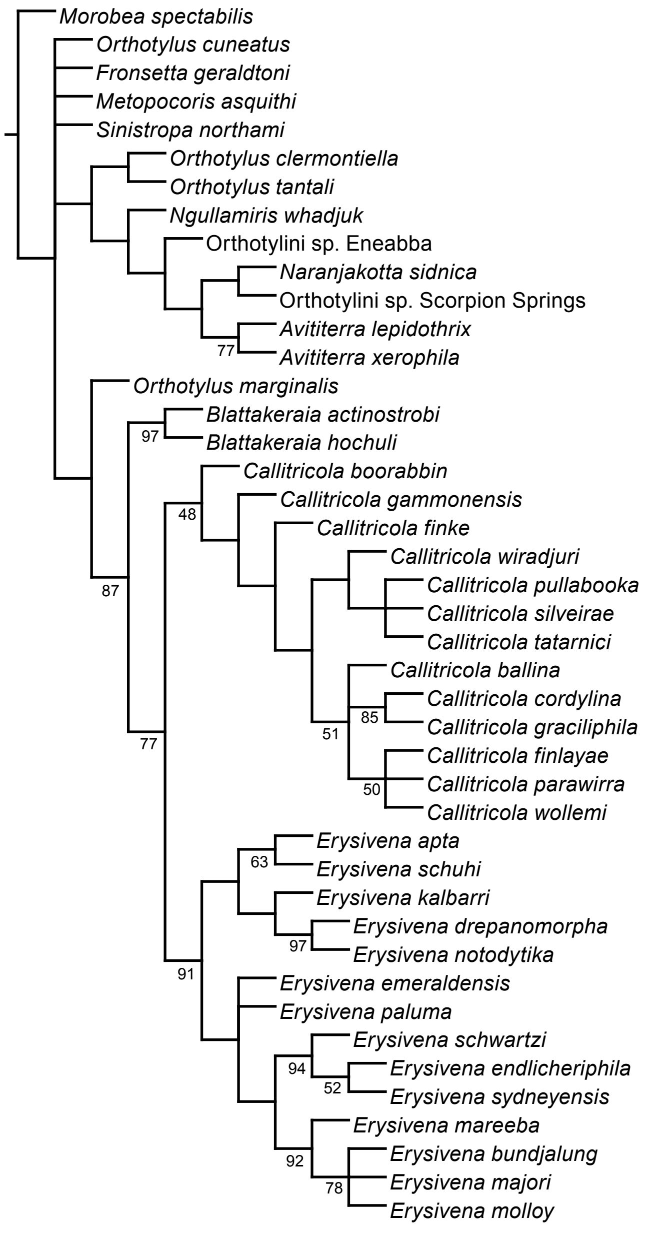


FIG. 1. Strict consensus of six most parsimonious trees (TL = 263, CI = 42, RI = 77) from unweighted New Technology search, with symmetric resampling values (1000 replicates) from the unweighted analysis (numbers at nodes).

TABLE 1

CHARACTER MATRIX

Taxon / Character No.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Callitroid Orthotylini																							
Avititerra lepidothrix	1	0	0	0	0	0	0	0	1	0	–	–	–	0	–	0	–	–	0	0	0	2	–
Avititerra xerophila	1	0	0	0	0	0	0	0	1	1	0	–	1	0	–	0	–	–	0	0	0	0	–
Blattakeraia actinostrobi	0	1	0	0	1	1	1	1	1	0	–	–	–	0	–	0	–	–	0	1	0	2	–
Blattakeraia hochuli	0	1	0	0	1	1	1	1	1	0	–	–	–	0	–	0	–	–	0	1	0	2	–
Callitricola ballina	0	0	0	0	1	1	1	1	0	1	0	–	2	0	–	0	–	–	0	1	0	2	–
Callitricola boorabbin	0	0	0	0	1	1	1	1	0	1	0	–	2	0	–	0	–	–	0	1	0	2	–
Callitricola cordylina	0	0	0	0	1	1	0	1	0	0	–	–	–	1	0	0	–	–	0	1	0	2	–
Callitricola finke	0	0	0	0	1	1	1	1	0	1	0	–	0	0	–	0	–	–	0	1	0	2	–
Callitricola finlayae	0	0	0	0	1	1	0	1	0	1	0	–	2	0	–	0	–	–	0	1	0	2	–
Callitricola gammonensis	0	0	0	0	1	1	1	1	0	1	0	–	2	0	–	0	–	–	0	1	0	2	–
Callitricola graciliphila	0	0	0	0	1	1	0	1	0	1	0	–	2	1	0	0	–	–	0	1	0	2	–
Callitricola parawirra	0	0	0	0	1	1	1	1	0	1	0	–	2	0	–	0	–	–	0	1	0	2	–
Callitricola pullabooka	0	0	0	0	1	1	1	1	0	1	0	–	0	0	–	0	–	–	0	1	0	2	–
Callitricola silveirae	0	0	0	0	1	1	1	1	0	1	0	–	0	0	–	0	–	–	0	1	0	2	–
Callitricola tatarnici	0	0	0	0	1	1	1	1	0	1	0	–	0	0	–	0	–	–	0	1	0	2	–
Callitricola wiradjuri	0	0	0	0	1	1	1	1	1	1	0	–	2	0	–	1	0	–	0	1	0	2	–
Callitricola wollemi	0	0	0	0	1	1	0	1	0	?	–	–	–	?	–	?	–	–	0	1	0	?	–
Erysivena apta	0	0	0	1	1	1	2	0	1	1	1	0	–	1	0	1	1	0	0	1	0	2	–
Erysivena bundjalung	0	0	0	1	1	1	2	0	1	1	1	0	–	0	–	1	1	1	0	1	0	2	–
Erysivena drepanomorpha	0	0	0	0	1	1	2	0	1	1	1	1	–	1	0	0	–	–	0	1	0	2	–
Erysivena emeraldensis	0	0	0	1	1	1	2	0	1	1	1	0	–	1	0	1	1	0	0	1	0	3	1
Erysivena endlicheriphila	0	0	0	1	1	1	2	0	1	1	1	0	–	1	1	1	1	0	1	1	0	3	0
Erysivena kalbarri	0	0	0	0/1	1	1	2	0	1	1	1	0	–	0	–	1	1	0	0	1	0	2	–
Erysivena majori	0	0	0	1	1	1	2	0	1	1	1	0	–	0	–	1	1	1	0	1	0	2	–
Erysivena mareeba	0	0	0	1	1	1	2	0	1	1	1	0	–	1	0	1	1	0	0	1	0	2	–

Taxon / Character No.	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
Callitroid Orthotylini																						
Avititerra lepidothrix	0	1	2	1	2	0	3	0	0	1	–	0	0	0	–	0	0	–	0	0	0	0
Avititerra xerophila	0	1	2	1	2	0	3	0	0	1	–	0	0	0	–	0	0	–	0	0	0	0
Blattakeraia actinostrobi	0	4	1	0	0	0	0	1	0	1	–	0	0	1	0	1	0	–	0	0	0	1
Blattakeraia hochuli	0	4	2	1	3	0	0	1	0	1	–	0	0	1	0	1	0	–	0	0	0	1
Callitricola ballina	1	1	0	0	0	0	0	1	1	1	–	1	0	1	1	1	0	–	1	1	1	1
Callitricola boorabbin	1	1	0	0	0	0	0	1	1	1	–	0	0	1	0	1	0	–	1	0	0	1
Callitricola cordylina	1	1	0	0	0	0	0	1	1	1	–	1	0	1	1	1	1	1	1	1	1	1
Callitricola finke	1	1	0	0	0	0	0	1	1	1	–	0	0	1	1	1	0	–	1	1	1	1
Callitricola finlayae	1	1	0	0	0	0	0	1	1	1	–	1	0	1	2	0	1	1	0	1	0	1
Callitricola gammonensis	1	1	0	0	0	0	0	1	1	1	–	0	0	1	0	1	0	–	1	1	0	1
Callitricola graciliphila	1	1	0	0	0	0	0	1	1	1	–	1	0	1	1	1	1	1	1	1	1	1
Callitricola parawirra	1	0/1	0	0	0	0	0	1	1	1	–	1	0	1	2	0	1	1	0	1	1	1
Callitricola pullabooka	1	1	0	0	0	0	0	1	1	1	–	0	0	1	1	0	0	–	1	1	1	1
Callitricola silveirae	1	1	0	0	0	0	0	1	1	1	–	0	0	1	1	0	0	–	1	1	1	1
Callitricola tatarnici	1	1	0	0	0	0	0	1	1	1	–	0	0	1	1	0	0	–	1	1	1	1
Callitricola wiradjuri	1	1	0	0	0	0	0	1	1	1	–	0	0	1	1	1	0	–	1	1	0	1
Callitricola wollemi	1	1	0	0	0	0	0	1	1	1	–	1	0	1	2	0	1	1	0	1	1	1
Erysivena apta	1	0	1	0	0	0	2	1	1	1	–	0	0	1	0	0	1	0	0	1	1	1
Erysivena bundjalung	1	1	2	0	0	1	1	1	1	0	0	0	0	1	0	0	1	0	0	0	0	1
Erysivena drepanomorpha	1	0	1	0	0	0	2	1	1	1	–	0	1	1	0	0	0	–	0	0	0	1
Erysivena emeraldensis	1	1	2	0	0	0	2	1	1	1	–	0	0	1	0	0	0	–	0	0	0	1
Erysivena endlicheriphila	1	1	2	0	0	0	2	1	1	0	1	0	0	1	0	0	0	–	0	0	0	1
Erysivena kalbarri	1	0	1	0	0	0	2	1	1	1	–	0	0	1	0	0	0	–	0	0	0	1
Erysivena majori	1	1	2	0	0	1	1	1	1	0	0	0	0	1	0	0	1	0	0	0	0	1
Erysivena mareeba	1	1	2	0	0	1	1	1	1	0	0	0	0	1	0	0	1	0	0	0	0	1

TABLE 1
(*Continued*)

Taxon / Character No.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44
Erysivena molloy	0	0	0	1	1	1	2	0	1	1	1	0	–	0	–	1	1	1	0	1	0	2	–	0	1	2	0	0	1	1	1	1	0	0	0	0	1	0	0	1	0	0	0	0	1
Erysivena notodytika	0	0	0	0	1	1	2	0	1	1	1	1	–	0	–	0	–	–	0	1	0	2	–	1	0	1	0	0	0	2	1	1	1	–	0	1	1	0	0	0	–	0	0	0	1
Erysivena paluma	0	0	0	1	1	1	2	0	1	1	1	0	–	1	0	0	–	–	0	1	0	3	1	1	0	2	0	0	0	2	1	1	0	0	0	0	1	0	0	0	–	0	0	0	1
Erysivena schuhi	0	0	0	1	1	1	2	0	1	1	1	0	–	0	–	1	1	0	0	1	0	2	0	1	0	1	0	0	0	2	1	1	1	–	0	0	0	–	0	1	0	0	1	1	1
Erysivena schwartzi	0	0	0	1	1	1	2	0	1	1	1	0	–	1	1	1	1	0	0	1	0	3	0	1	1	2	0	0	0	2	1	1	0	1	0	0	1	0	0	0	–	0	0	0	1
Erysivena sydneyensis	0	0	0	0/1	1	1	2	0	1	1	1	0	–	1	1	1	1	0	1	1	0	3	0	1	1	2	0	0	0	2	1	1	0	1	0	0	1	0	0	0	–	0	0	0	1
Ngullamiris whadjuk	0	0	0	0	0	0	4	0	1	0	–	–	–	0	–	0	–	–	0	1	1	0	–	0	3	0	0	0	0	0	0	0	1	–	0	0	0	–	0	0	–	0	0	0	0
Orthotylini outgroup taxa																																													
Naranjakotta sidnica	1	0	0	0	0	0	3	0	1	1	0	–	1	0	–	0	–	–	0	0	0	1	–	1	1	2	1	3	0	4	0	0	1	–	0	0	0	–	0	0	–	0	0	0	1
Orthotylini sp. Eneabba	1	0	0	0	0	0	0	0	1	1	0	–	1	0	–	0	–	–	0	0	0	1	–	0	2	2	0	0	0	3	0	0	1	–	0	0	0	–	0	0	–	0	0	0	0
Orthotylini sp. Scorpion Springs	0	0	0	0	0	0	0	0	0	1	0	–	1	0	–	0	–	–	0	0	0	0	–	1	0	2	1	1	0	3	1	0	1	–	0	0	0	–	1	1	0	0	0	0	1
Orthotylus clermontiella	0	0	0	0	0	0	1	0	0	0	–	–	–	0	–	0	–	–	0	0	0	0	–	0	1	0	0	0	0	0	0	0	1	–	0	0	0	–	0	0	–	0	0	0	0
Orthotylus cuneatus	1	0	0	0	0	0	3	0	1	0	–	–	–	0	–	0	–	–	0	0	1	0	–	1	0	0	0	0	0	0	0	0	1	–	0	0	0	–	0	0	–	0	0	0	0
Orthotylus marginalis	0	0	0	0	0	0	1	1	1	1	0	–	1	0	–	0	–	–	0	0	1	0	–	1	1	3	0	0	0	2	0	0	1	–	0	0	0	–	0	0	–	0	0	0	0
Orthotylus tantali	0	0	0	0	0	1	3	0	1	0	–	–	–	0	–	0	–	–	0	0	0	0	–	0	2	0	0	0	0	2	0	0	1	–	0	0	0	–	0	0	–	0	0	0	0
Austromirini outgroup taxa																																													
Fronsetta geraldtoni	0	0	1	0	0	0	3	0	0	0	–	–	–	0	–	0	–	–	0	0	0	0	–	1	1	3	0	0	0	2	1	0	1	–	0	0	0	–	0	0	–	0	0	0	0
Metopocoris asquithi	0	0	1	0	0	0	3	0	0	0	–	–	–	0	–	0	–	–	0	0	0	0	–	1	1	2	0	0	0	2	1	0	1	–	0	0	0	–	0	0	–	0	0	0	0
Morobea spectabilis	0	0	1	0	0	0	2	0	0	0	–	–	–	0	–	0	–	–	0	0	0	3	1	1	0	0	0	0	0	1	0	0	1	–	0	0	0	–	0	0	–	0	0	0	0
Sinistropa northami	0	0	1	0	0	0	3	0	1	0	–	–	–	0	–	0	–	–	0	0	0	0	–	1	1	3	0	0	0	2	1	0	1	–	0	0	0	–	0	0	–	0	0	0	0

TABLE 1
(*Continued*)

Taxon / Character No.	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87
Callitroid Orthotylini																																											
Avititerra lepidothrix	1	2	2	1	2	0	0	0	0	1	1	0	0/1	–	0	0	–	–	0	1	0	0	0	–	–	0	1	0	0	0	0	1	0	0	1	0	1	0	1	1	1	0	–
Avititerra xerophila	1	2	2	1	2	0	0	0	0	1	1	0	0/1	–	0	1	1	0	0	1	0	1	0	0	1	0	0/1	–	0	0	0	1	0	0	1	0	1	0	1	1	1	0	–
Blattakeraia actinostrobi	0	2	2	0	1	1	0	0	0	1	0	1	0	1	0	0	–	–	0	0	0	1	0	0	0	0	0/1	–	1	1	–	1	0	1	1	0	0	1	1	0	1	0	–
Blattakeraia hochuli	1	2	2	0	1	1	0	0	0	1	0	1	1	1	0	0	–	–	0	0	0	1	0	1	0	0	1	?	1	1	–	1	0	1	1	0	0	1	1	0	1	0	–
Callitricola ballina	1	2	1	1	1	0	0	0	0	1	1	0	1	–	0	1	1	1	1	1	0	0	0	–	–	0	1	0	1	0	1	1	1	1	1	0	0	2	1	1	0	1	0
Callitricola boorabbin	1	2	1	0	0	1	0	0	0	1	1	0	1	–	0	1	1	0	0	0	0	0	0	–	–	0	1	0	1	0	1	1	1	1	1	0	0	2	1	1	0	1	0
Callitricola cordylina	1	2	1	0	1	0	0	0	0	1	1	0	1	–	0	1	1	0	0	1	0	1	0	1	0	0	1	?	1	0	1	1	1	1	1	0	0	2	1	1	0	1	0
Callitricola finke	1	2	1	0	0	1	0	0	0	1	1	1	1	0	0	1	0	1	2	0	0	0	0	–	–	0	1	0	1	0	1	1	1	1	1	0	0	2	1	1	0	1	0
Callitricola finlayae	1	2	1	0	1	0	0	0	0	1	1	0	1	–	0	0	–	–	1	1	0	0	0	–	–	0	1	0	1	0	0	1	1	1	1	0	0	2	1	1	0	1	0
Callitricola gammonensis	1	2	1	0	0	1	0	0	0	1	1	0	1	–	0	0	–	–	0	0	0	0	0	–	–	1	1	0	1	0	1	1	1	1	1	0	0	2	1	1	0	1	0
Callitricola graciliphila	1	2	1	0	1	0	0	0	0	1	1	0	1	–	0	1	1	1	0	1	0	1	0	1	0	0	1	?	1	0	1	1	1	1	1	0	0	2	1	1	0	1	0
Callitricola parawirra	1	2	1	0	0	0	0	0	0	1	1	0	1	–	0	0	–	–	2	1	0	0	0	–	–	0	1	0	1	0	1	?	?	?	?	?	?	?	?	?	?	?	?
Callitricola pullabooka	1	2	1	0	0	1	1	0	0	1	1	0	1	–	0	0	–	–	0	1	0	1	0	1	0	0	1	?	1	0	0	1	1	1	1	0	0	2	1	1	0	1	0
Callitricola silveirae	1	2	1	0	0	1	1	0	0	1	1	0	1	–	0	0	–	–	0	1	0	1	0	1	0	0	1	?	1	0	0	1	1	1	1	0	0	2	1	1	0	1	0
Callitricola tatarnici	1	2	1	0	0	1	1	0	0	1	1	0	0	–	0	0	–	–	0	1	0	1	0	1	1	0	1	?	1	0	0	1	1	1	1	0	0	2	1	1	0	1	0
Callitricola wiradjuri	1	2	1	0	0	1	1	0	0	1	1	0	0	–	0	0	–	–	0	1	0	0	0	–	–	0	1	0	1	0	0	1	1	1	1	0	0	2	1	1	0	1	0
Callitricola wollemi	1	2	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	1	1	1	1	0	0	2	1	1	0	1	0
Erysivena apta	1	2	1	0	1	1	0	1	0	0	–	0	1	–	1	0	–	–	0	1	1	0	0	–	–	0	1	0	1	1	1	1	1	1	1	0	0	2	1	1	0	1	1
Erysivena bundjalung	1	2	1	0	0	1	0	0	0	0	–	1	1	0	0	1	0	1	0	1	1	0	0	–	–	1	1	0	1	1	1	1	1	1	1	0	0	2	1	1	0	1	1
Erysivena drepanomorpha	1	2	1	0	0	1	0	1	1	0	–	0	0	–	1	0	–	–	0	1	1	1	1	1	1	0	1	?	1	1	1	1	1	1	1	0	0	2	1	1	0	1	1
Erysivena emeraldensis	1	2	1	0	0	1	0	0	0	0	–	0	1	–	0	1	1	1	0	1	1	0	0	–	–	0	1	0	1	1	1	1	1	1	1	0	0	2	1	1	0	1	1
Erysivena endlicheriphila	1	2	1	0	0	1	0	0	0	0	–	1	0	0	0	0	–	–	0	1	1	0	0	–	–	0	0	1	1	1	1	1	1	1	1	0	0	2	1	1	0	1	1
Erysivena kalbarri	1	2	1	0	1	1	0	1	1	0	–	0	0	–	1	0	–	–	1	1	1	0	0	–	–	0	0	0	1	1	1	1	1	1	1	0	0	2	1	1	0	1	1
Erysivena majori	1	2	1	0	0	1	0	0	0	0	–	1	1	–	0	1	1	1	0	1	1	0	0	–	–	1	1	0	1	1	1	1	1	1	1	0	0	2	1	1	0	1	1

TABLE 1
(*Continued*)

Taxon / Character No.	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87
Erysivena mareeba	1	2	1	0	0	1	0	0	0	0	–	1	1	0	0	1	1	1	0	1	1	0	0	–	–	1	1	0	1	1	1	1	1	1	1	0	0	2	1	1	0	1	1
Erysivena molloy	1	2	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	1	1	1	1	0	0	2	1	1	0	1	1
Erysivena notodytika	1	2	1	0	0	1	0	1	1	0	–	0	0	–	1	0	–	–	0	1	1	1	1	1	1	0	1	?	1	1	1	1	1	1	1	0	0	2	1	1	0	1	1
Erysivena paluma	1	2	1	0	1	1	0	0	0	0	–	0	1	–	0	1	1	1	0	1	1	0	0	–	–	0	1	0	1	1	1	1	1	1	1	0	0	2	1	1	0	1	1
Erysivena schuhi	1	2	1	0	1	1	0	1	0	0	–	0	1	–	0	0	–	–	1	1	1	0	0	–	–	0	1	0	1	1	1	1	1	1	1	0	0	2	1	1	0	1	1
Erysivena schwartzi	1	2	1	0	0	1	0	0	0	0	–	1	0	0	0	0	–	–	1	1	1	0	0	–	–	0	0	0	1	1	1	1	1	1	1	0	0	2	1	1	0	1	1
Erysivena sydneyensis	1	2	1	0	0	1	0	0	0	0	–	1	0	0	0	0	–	–	1	1	1	0	0	–	–	0	0	1	1	1	1	1	1	1	1	0	0	2	1	1	0	1	1
Ngullamiris whadjuk	0	2	2	1	1	1	0	0	0	0	–	0	0	–	0	1	0	0	0	0	1	1	0	0	0	0	0/1	–	0	0	0	0	–	0	0	0	0	0	1	0	1	0	–
Orthotylini outgroup taxa																																											
Naranjakotta sidnica	1	2	2	1	1	0	0	0	1	0	–	0	1	–	0	1	1	1	0	1	0	1	0	0	0	0	0/1	–	–	0	–	1	0	1	0	1	0	0	1	0	1	0	–
Orthotylini sp. Eneabba	0	1	2	1	–	0	0	0	0	0	0	1	0	0	0	–	–	–	–	–	–	0	0	–	–	0	1	1	–	–	–	?	?	?	?	?	?	?	?	?	?	?	?
Orthotylini sp. Scorpion Springs	1	2	2	1	1	0	0	0	0	0	–	0	0	–	0	0	–	–	0	1	0	1	0	1	0	0	1	–	0	0	1	?	?	?	?	?	?	?	?	?	?	?	?
Orthotylus clermontiella	0	1	1	0	–	0	0	0	0	1	0	0	0	–	0	–	–	–	–	–	–	0	0	–	–	0	0	0	0	–	0	?	?	?	?	?	?	?	?	?	?	?	?
Orthotylus cuneatus	0	0	2	–	–	1	0	0	0	1	0	0	1	–	0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	1	0	?	0	0	0	2	1	0	0	0	–
Orthotylus marginalis	0	1	2	1	–	1	0	0	0	1	0	0	1	–	0	–	–	–	–	–	–	1	0	1	0	0	1	–	0	–	0	1	0	1	0	1	0	1	1	0	0	0	–
Orthotylus tantali	0	1	1	0	–	0	0	0	0	1	0	0	0	–	0	–	–	–	–	–	–	1	1	1	0	0	0	–	0	–	0	1	0	2	0	?	0	0	0	0	0	0	–
Austromirini outgroup taxa																																											
Fronsetta geraldtoni	1	1	0	0	–	1	0	0	0	1	1	0	1	–	0	–	–	–	–	–	–	1	0	0	1	0	0	–	0	–	0	1	0	0	0	0	0	2	1	0	0	0	–
Metopocoris asquithi	1	1	0/1	0	–	1	0	0	0	1	1	0	1	–	0	–	–	–	–	–	–	1	0	0	1	0	0	–	0	–	0	1	1	0	0	0	0	2	1	0	0	0	–
Morobea spectabilis	1	–	–	–	–	–	–	–	–	–	?	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	?	?	?	?	?	?	?	?	?	?	?	?
Sinistropa northami	1	1	2	0	–	1	0	0	0	1	1	0	1	–	0	–	–	–	–	–	–	0	0	0	–	0	1	0	–	–	–	1	1	0	0	0	0	2	1	0	0	0	–

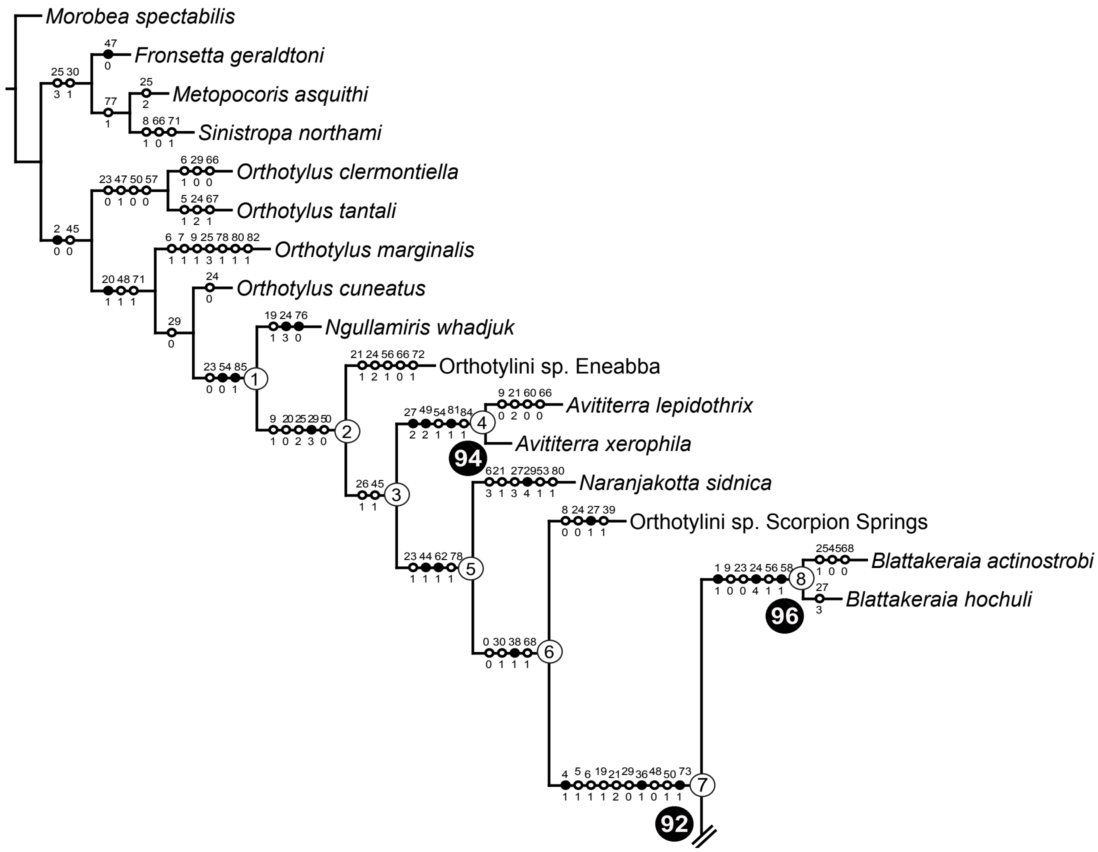
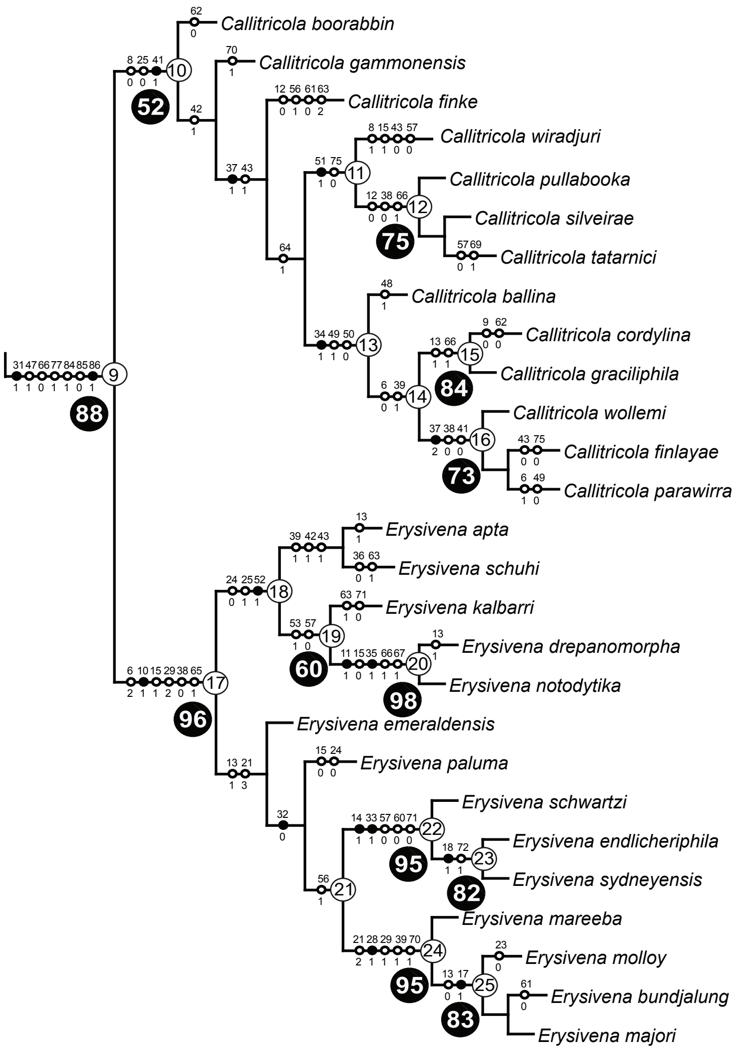


FIG. 2. Implied weights tree (*above, and continued on opposite page*) for callitroid Orthotylini and outgroups (TL = 21), with unambiguous character state changes mapped. Weighting function k = 4. Symmetric resampling values (1000 replicates) are in black circles below nodes. Filled circles = nonhomoplasious characters; open circles = homoplasious characters. Numbers above circles indicate character number and below circles the character state.

and *E. emeraldensis*, which were more basally positioned in the genus. The k = 4–10 tree varied in the placement of *Ngullamiris*, which was basal to "Orthotylini Eneabba" sp., and the Hawaiian *Orthotylus* species (*O. clermontiella* and *O. tantali*) were more basal to *Orthotylus marginalis* and *Orthotylus cuneatus*. At k = 3 the basal topology was congruent with the k = 1 & 2, and for *Erysivena* species topology was congruent with the k = 4–10 tree. As expected the k = 100 was largely congruent with the equal-weights consensus tree. Unambiguous synapomorphic and contradicted apomorphic characters were optimized to the k = 4 tree based on the stability of the topology across the above four concavity values, and are shown in figure 2.

Discussion by node: Relationships and character supports at the nodes for the resulting phylogeny (fig. 2) are as follows:

Node 1. All the Australian Orthotylini included in the analysis group together in the phylogeny. *Ngullamiris whadjuk* is the basal callitroid-inhabiting taxon and is distinguished by a combination of characters, including: the short spinelike setae on the ventral surface of the pygophore (19-1), the large, curved subapi-



cal hook on the left paramere (24-3), and the lack of any sclerotized structures around the vestibulum (76-0). Although placed basal in the phylogeny due to atypical genitalic characters, *N. whadjuk* shares some other homoplasious characters, such as the lack of scalelike setae on the dorsum (0-0), and a club-shaped right paramere (29-0), with the higher groups but not with in-between taxa.

Node 2. This clade includes all species of node 1 aside from *Ngullamiris whadjuk*, and is supported by a number of characters including: presence of a left tergal process on the pygophore (9-1), straight ventral margin of the pygophore (20-0), strongly expanded left paramere sensory lobe (25-2), and an expanded and or serrate medial margin on the right paramere (29-3).

Node 3. Australian taxa excluding *N. whadjuk* and Orthotylini sp. Eneabba all have a relatively large aedeagus and phallotheca in relation to the pygophore size (45-1). Orthotylini sp. Eneabba is the only Australian Orthotylini with two endosomal spicules (46-1) included in this analysis.

Node 4. Avititerra is supported in the phylogeny as a monophyletic group by a number of genitalic characters including: the shape of the left paramere with an expanded, round, and serrate sensory lobe (27-2), the position of DES1 right dorsolateral to DES2 (49-2), and the distinctive female interramal sclerites with a round ridge on the inner margins (81-1). In this genus scalelike setae are present on the dorsum (0-1). Additionally, this species group, although sharing the branched character state of the female interramal lobe (85-1) with the other basal clades, has a serrate lobe at the base of the interramal lobe (84-1), as found in other higher clades of callitroid Orthotylini.

Nodes 5–6. This analysis has also placed *Naranjakotta sidnica* and the undescribed Orthotylini sp. "Scorpion Springs" among the callitroid taxa, based on their possession of characters such as a more everted and externally visible phallotheca (44-1), rather than inverted and not visible as in the basal clades; and a more complex and sculpted phallotheca (30-1), which is incidentally also characteristic of the Austromirine outgroup species.

Node 7. The relationship between *Blattakeraia*, *Callitricola*, and *Erysivena* is supported by 10 unambiguous characters including: a clear spot in the forewing membrane just below the base of the cuneus (4-1), a patchy coloration on the forewing membrane veins (5-1), the presence of short, spinelike setae on the ventral surface of the pygophore proximate to the genital opening (19-1; also shared with *N. whadjuk*), and a sclerotized, sometimes serrate right ventral process on the pygophore (21-2/3), a subapical ventral tumescence on the phallotheca (36-1), the PES spicule wrapped sheathlike around the secondary gonopore (50-1), and the membranous base of the DES1 basal keel (DESk) (73-1).

The presence of short, dark spinelike setae on the ventral surface of the pygophore proximate to the genital opening (19-1) is a character present in a range of Australian Orthotylini and among Orthotylini fauna worldwide including *Orthotylus* (e.g., *O. cuneatus*).

Node 8. The genus *Blattakeraia* has six unambiguous character supports in this phylogeny, including a red first antennal segment (1-1), no left tergal process in the pygophore dorsal margin (9-0), the shape of the left paramere with a broad apophysis (23-0) and weak apical hook somewhat inset from the round apex (24-4), a club-shaped right paramere (30-0), and the PES spicule having a submedial process (56-1) with serrate distal margins (58-1).

Node 9. A sister relationship between *Callitricola* and *Erysivena* is supported by equal numbers of characters from the male and female genitalia including: the presence of an extra medial interramal lobe (82-1), heavily sclerotized structures around the vestibulum of females (76-1) and for males a dark and heavily sclerotized phallotheca (31-1), and the positioning of the spicules in relation to the secondary gonopore from ventral round to left lateral and left dorsolateral (47-1). No other callitroid Orthotylini have the PES ventrally sheathing the secondary gonopore as found in these two genera.

The extra medial interramal lobe (82-1) found in the female genitalia—a character not documented in any other orthotyline to date—appears to strongly support the relatedness of these two genera, along with the spicule arrangement with PES ventral. The extra medial interramal lobe (mIRL) is subequal but generally shorter than the lateral interramal lobe (laIRL).

Node 10. *Callitricola* has only just >50% resampling support and this relatively low significance is possibly due to greater morphological heterogeneity within the genus compared with the others. It is supported unambiguously in this phylogeny by three characters: the weakly concave to straight pygophore dorsal margin (8-0), a narrow, curved left paramere with only a weakly expanded sensory lobe (25-0), and a right lateral basal tumescence on the pygophore dorsal margin (41-1) not found in other callitroid Orthotylini but secondarily lost in one higher clade of this group.

C. boorabbin, *C. gammonensis*, and *C. finke* place basally in the genus and vary to other *Callitricola* species in the structure of the endosomal spicules. All *Callitricola* except *C. boorabbin* possess a lobe on the right dorsal margin (42-1), which is reduced in size in *C. gammonensis* and again in *C. finlayae* (43-0). The grouping of *C. finke* with the rest of the genus is also supported by the enlarged size of the subapical ventral tumescence of the phallotheca (37-1).

Node 11. The PES spicule in *C. pullabooka*, *C. silveirae*, *C. tatarnici*, and *C. wiradjuri* is entirely wrapped around the secondary gonopore at the base with only the apex of the gonopore exposed (51-1). These species also appear to have a shorter basal keel on DES1 than other *Callitricola* (75-0).

Node 12. The characters supporting this clade of species—*C. pullabooka*, *C. silveirae*, and *C. tatarnici*—include: the left tergal process of the pygophore shaped like a serrate comb and extending from the dorsal margin (12-0) (also found in *C. finke*), and a bifurcate DES1 spicule (66-1). *C. wiradjuri* is morphologically distinctive and is sister to this clade, with the pygophore having a concave dorsal margin (8-1) and a right tergal process (15-1), both of which are unique characters within this genus.

Node 13. The remaining six species are grouped by a synapomorphy of the phallotheca the apex of which is twisted to a point (34-1). Also, within the aedeagus of these species the PES spicule is slightly removed from and not sheathlike around the secondary gonopore (50-0) and the DES1 spicule is positioned dorsal to DES2 (49-1).

Node 14. The clade includes the *Callitricola* species with yellow/orange forewing membrane veins (6-0), with the exception of *C. finlayae*. The phallotheca again is found to be an informative character at the higher levels in this group and possesses a right lateral tumescence (39-1), a synapomorphic character for this clade within the genus. The relationship of *C. ballina* to the two species groups within this clade is unresolved and, as such, there is not a strong branch support for this clade. In *C. ballina* the DES2 position varies being right dorsolateral to PES (48-1).

Node 15. There is also strong support for this sister-species relationship (84% symmetric resampling) of *C. graciliphila* and *C. cordylina* with the following male genitalic characters: a tergal lobe on the right dorsal margin of the pygophore (13-1; exclusive within this genus), and a bifurcate DES1 spicule (66-1; not present in the sister clade).

Node 16. Although significant (73% symmetric resampling), the branch support for this clade is lower than the sister clade above, as the male aedeagal characters for *Calliticola wollemi* are unknown. The pygophore characters supporting this clade are: the synapomorphic doubled or grooved subapical ventral tumescence (37-2), and homoplasious apomorphies in the lack of both a left lateral tumescence (38-0), or right lateral basal tumescence (41-0; present in all other *Callitricola* species).

Node 17. The genus *Erysivena* is strongly supported (96% symmetric resampling) by six unambiguous characters: red forewing membrane veins (6-2, unique among the callitroid Orthotylini); an elongate left tergal process (10-1, synapomorphy) and a right tergal process (15-1) on the dorsal margin of the pygophore; the right paramere shape with an expanded or serrate medial margin, without a bulbous apex (29-2, with the exception of one higher clade); lack of left lateral tumescence on the phallotheca (38-0); and the DES2 spicule with serrations along the medial margin (65-1, shared only with *N. whadjuk*).

Node 18. This clade of five *Erysivena* species is supported by three unambiguous characters: the PES structure, with a broad base, then constricted (weakly or strongly), narrow to the apex (52-1); the left paramere has only a moderately expanded sensory lobe (25-1) and an unhooked apex (24-0). With the exception of *E. schuhi*, this clade is also typified by the presence of a right lateral membrane join from PES to DES2 adjacent to the secondary gonopore (59-1).

Node 19. Further characters of PES support this clade of species, with the presence of a perpendicular or downward-directed straplike process near the base above the constriction point (53-1), and smooth distal margins (57-0); compared to *E. apta* and *E. schuhi*, which both have slight distal serrations.

Node 20. The sister-species relationship between *E. drepanomorpha* and *E. notodytika* is supported by five unambiguous characters, including two synapomorphies: a distinctive large,

TABLE 2

Host Plants of Callitroid-inhabiting Orthotylini Species and Cooccurring Taxa

Bug species	Plant species[1]	Cooccurring bug species[2]
Avititerra		
Avititerra lepidothrix	*Callitris pyramidalis* (20; 2L)	*B. actinostrobi* (1)
	Callitris roei (9; 1L)	
Avititerra xerophila	*Callitris canescens* (1; 1L)	*C. cordylina* (1)
	Callitris glaucophylla (29; 5L)	*C. gammonensis* (1)
		C. pullabooka (1)
		C. wiradjuri (1)
		E. drepanomorpha (1)
		E. majori (1)
Blattakeraia		
Blattakeraia actinostrobi	*Callitris arenaria* (6; 1L)	*A. lepidothrix* (1)
	Callitris pyramidalis (5; 2L)	
	Callitris sp. (8; 1L)	
Blattakeraia hochuli	*Callitris glaucophylla* (54; 10L)	*C. cordylina* (2)
		E. apta (4)
		E. schuhi (4)
		N. whadjuk (3)
Callitricola		
Callitricola ballina	*Callitris columellaris* (4; 2L)	*E. bundjalung* (2)
Callitricola boorabbin	*Callitris tuberculata* (3; 1L)	*E. drepanomorpha* (1)
Callitricola cordylina	*Callitris glaucophylla* (14; 7L)	*A. xerophila* (1)
		B. hochuli (2)
		C. pullabooka (2)
		C. wiradjuri (1)
		E. apta (1)
		E. schuhi (1)
Callitricola finke	*Callitris glaucophylla* (30; 2L)	-
Callitricola finlayae	*Callitris intratropica* (32; 2L)	*E. mareeba* (2)
Callitricola gammonensis	*Callitris glaucophylla* (8; 1L)	*A. xerophila* (1)
Callitricola graciliphila	*Callitris glaucophylla* or *gracilis* (4; 1L)	*C. parawirra* (3)
	Callitris gracilis (13; 1L)	*C. silveirae* (2)
	Callitris sp. (5; 1L)	*E. drepanomorpha* (2)
	Callitris sp. (12; 1L)	*E. schuhi* (2)
	Callitris verrucosa (8; 2L)	*E. schwartzi* (4)
Callitricola parawirra	*Callitris gracilis* (1; 1L)	*C. graciliphila* (3)
	Callitris sp. (9; 1L)	*E. drepanomorpha* (1)
	Callitris sp. (2; 1L)	*E. schuhi* (1)
	Callitris verrucosa (1; 1L)	*E. schwartzi* (3)
Callitricola pullabooka	*Callitris glaucophylla* (17; 7L)	*A. xerophila* (1)
		C. cordylina (2)
		C. wiradjuri (2)
		E. schuhi (1)
Callitricola silveirae	*Callitris verrucosa* (9; 2L)	*C. graciliphila* (2)
		E. drepanomorpha (2)
		E. schuhi (2)
Callitricola tatarnici	*Callitris tuberculata* (5; 1L)	–
Callitricola wiradjuri	*Callitris glaucophylla* (36; 4L)	*A. xerophila* (1)
		C. cordylina (1)
		C. pullabooka (2)
		E. majori (2)
		E. schuhi (1)

TABLE 2
(*Continued*)

Bug species	Plant species[1]	Cooccurring bug species[2]
Callitricola wollemi	*Callitris rhomboidea* (3; 1L)	*E. sydneyensis* (1)
Erysivena		
Erysivena apta	*Callitris glaucophylla* (30; 5L)	*B. hochuli* (4) *C. cordylina* (1) *E. schuhi* (2)
Erysivena bundjalung	*Callitris columellaris* (36; 3L)	*C. ballina* (2)
Erysivena drepanomorpha	*Callitris canescens* (7; 1L) *Callitris drummondii* (3; 1L) *Callitris gracilis* (3; 2L) *Callitris* sp. (3; 1L) *Callitris tuberculata* (49; 3L) *Callitris verrucosa* (35; 5L)	*A. xerophila* (1) *C. boorabbin* (1) *C. graciliphila* (2) *C. parawirra* (1) *C. silveirae* (2) *E. schuhi* (2) *E. schwartzi* (1)
Erysivena emeraldensis	*Callitris intratropica* (Emerald Creek) (14; 1L)	–
Erysivena endlicheriphila	*Callitris endlicheri* (4; 1L)	–
Erysivena kalbarri	*Callitris arenaria* (72; 1L)	–
Erysivena majori	*Callitris glaucophylla* (24; 4L)	*A. xerophila* (1) *C. wiradjuri* (2)
Erysivena mareeba	*Callitris intratropica* (147; 9L)	*C. finlayae* (2)
Erysivena molloy	*Callitris intratropica* (5; 1L)	–
Erysivena notodytika	*Callitris preissii* (19; 2L) *Callitris tuberculata* (72; 1L)	*N. whadjuk* (1)
Erysivena paluma	*Callitris endlicheri* (Paluma) (42; 1L)	–
Erysivena schuhi	*Callitris glaucophylla* (87; 6L) *Callitris* sp. (2; 1L) *Callitris verrucosa* (7; 2L)	*B. hochuli* (4) *C. cordylina* (1) *C. graciliphila* (2) *C. parawirra* (1) *C. silveirae* (2) *E. drepanomorpha* (2) *E. apta* (2) *E. schwartzi* (1)
Erysivena schwartzi	*Callitris glaucophylla* (11; 1L) *Callitris glaucophylla* or *gracilis* (6; 1L) *Callitris gracilis* (50; 1L) *Callitris* sp. (8; 1L) *Callitris* sp. (12; 1L)	*C. graciliphila* (4) *C. parawirra* (3) *E. drepanomorpha* (1) *E. schuhi* (1)
Erysivena sydneyensis	*Callitris baileyi* (34; 1L) *Callitris endlicheri* (10; 2L) *Callitris rhomboidea* (144; 5L) *Callitris* sp. (2; 1L)_	*C. wollemi* (1)
Ngullamiris		
Ngullamiris whadjuk	*Callitris glaucophylla* (23; 3L) *Callitris preissii* (3; 1L)	*B. hochuli* (3) *E. notodytika* (1)

[1] The number of specimens and localities recorded for each host is indicated in parentheses in the format (no. of species; number of localities, L).
[2] Collected simultaneously or from the same locality. The number in parentheses after the species name indicates the number of localities of cooccurrence.

broad left tergal process on the pygophore (11-1), and the compressed apex of the phallotheca, which forms a crest (35-1). Homoplasious supporting characters are: the lack or loss of a right tergal process on the pygophore (15-0); the complex structure of the DES1 spicule, bifurcate (66-1) with two small subbasal processes (67-1).

Node 21. The presence of a submedial process (56-1) on PES distinguishes this clade from the rest of *Erysivena* (where a process is more basal on PES when present).

Node 22. The two synapomorphic characters supporting this clade are an elongate, medially projected right tergal lobe on the dorsal margin of the pygophore (14-1) and the distal opening of the phallotheca with a lobe on the anterior margin (33-1; a more derived state of character 32).

Node 23. The *E. sydneyensis* and *E. endlicheriphila* sister-species relationship is supported by two characters: a third medial tergal process on the pygophore (18-1), and a forked apex on the simple and unbranched DES1 spicule (72-1).

Node 24. A distinctive "hammer shaped" right paramere (29-1), and short, dark bristles on the sensory lobe of the left paramere (28-1) are synapomorphic characters for these four species. The size of the right ventral lobe of the phalloguide is reduced in these species (21-2) and a serrate medial margin on the DES1 spicule also distinguish these species from other *Erysivena* (70-1). These four species are all significantly smaller than other *Erysivena* and have large, bulbous eyes.

Node 25. The presence of a lobe at the base of the right tergal process (17-1) provides synapomorphic support in this analysis for the clade of *E. bundjalung, E. molloy*, and *E. majori*.

The placement of *E. emeraldensis* and *E. paluma* in this phylogeny is unresolved. A small dorsal opening of the phallotheca (32-0) groups *E. paluma* with half of the genus (node 21). Both *E. paluma* and *E. emeraldensis* have a more derived form of the right ventral process of the phalloguide, which is elongate (21-3) and possesses a dorsal spine (22-1). *E. paluma* lacks a right tergal process on the pygophore that all the other species possess (15-0).

HOST-PLANT ASSOCIATIONS

Host plants were mapped onto the above implied-weights tree. Hosts used in this analysis are based largely on those digitized in the Plant Bug Inventory database (Schuh, 2002–2013; https://research.amnh.org/pbi/locality/) and as outlined in the methods above. The two alternative classifications of *Callitris* (Hill, 1998; Farjon, 2005) were both mapped as independent visualizations of the host associations. See appendix 2 for the alternative classifications. The alternative host-plant mappings are given in figure 3. Three of the callitroid Orthotylini genera (*Blattakeraia*, *Callitricola* and *Erysivena*) form a clade and are associated with 12 species of *Callitris* (fig. 3A). *Callitricola* and *Erysivena* are the most speciose genera (13 and 14 species respectively) and have both radiated on *Callitris*. *Avititerra* and *Ngullamiris* represent independent lineages of callitroid-inhabiting taxa (fig. 2).

Host-plant mapping also suggests that related species of callitroid Orthotylini may have diversified on related or the same species of *Callitris* (depending on researchers' classification of the taxa). For example, the clade comprising *Erysivena mareeba, E. molloy, E. bundjalung*, and *E. majori* are associated with *Callitris intratropica, Callitris columellaris*, and *Callitris glaucophylla*. These plants are considered either closely related (Pye et al., 2003) or a single species (after Farjon, 2005; fig. 3B). Disjunct populations of these *Callitris* species also harbor different species of the above *Erysivena* clade. Conversely, *Erysivena mareeba* and *E. molloy* are recorded from proximate populations of *Callitris intratropica*, with the latter thought to be undergoing ecological speciation (Paul Gadek, personal commun.). Also, host switching to geographically proximate *Callitris* species is evident; *Erysivena paluma* and *E. emeraldensis* are found on unrelated *Callitris* species.

The Callitroid-inhabiting Orthotylini are found on the branchlets and pollen cones of their *Callitris* hosts (fig. 4). About 40% of localities sampled had multiple orthotyline species cooccurring on the same *Callitris* species (table

2; figs. 5, 6). The 32 callitroid Orthotylini species described in this work were found in association with 15 *Callitris* species (table 2). We sampled all but one (*C. monticola*) of the 20 *Callitris* species-group taxa in Australia. We found no orthotylines on *Callitris muelleri* or two of the three subspecies of *C. oblonga*. Sampling on *Callitris macleayana* was limited and only an unidentified adult and a handful of nymphal specimens of *Callitricola* were collected. Collecting on northern New South Wales species *Callitris macleayana*, a tall forest tree, was hindered by lack of access to the canopy and, consequently, sampling was limited.

The most widespread species of *Callitris*, *C. glaucophylla*, hosted the greatest number of callitroid Orthotylini, totalling 12 species from all five genera. Five species were recorded from *C. verrucosa*; four from *C. intratropica*, *C. gracilis*, and *C. tuberculata*; three from *C. endlicheri*; two from *C. arenaria*, C. *pyramidalis*, *C. canescens*, *C. preissii*, and *C. rhomboidea;* and one species from *C. baileyi, C. roei*, and *C. drummondii* (see table 2). Following Farjon's (2005) callitroid classification, nine of 13 harbor callitroid Orthotylini, with the majority of species found on *Callitris columellaris* (18), then *Callitris preissii* (8) (fig. 3B, appendix 2).

Callitris glaucophylla was the most intensively sampled species of the genus, with material primarily collected in the Australian Museum's woodland remnants survey in southeastern Australia (Major et al., 2003). *Callitris intratropica* is widespread across northern Australia but was sampled only on the Atherton Tablelands in northeastern Queensland, where four callitroid-inhabiting Orthotylini species were collected. The discrete populations of *Callitris endlicheri* "Paluma" and *Callitris intratropica* "Emerald Creek" (see Methods above) both harbored host-plant specific species of callitroid Orthotylini. This discrete population of *Callitris intratropica* at Emerald Creek, located in the Lamb Range on the Atherton Tablelands, hosts unrelated callitroid-inhabiting orthotyline species in comparison with other *C. intratropica* populations (ca. 10 km apart). This segregation in orthotyline species aligns with the hypothesis of Pye et al. (2003) that geographic barriers have led to divergence in *Callitris intratropica* populations. This is also the case for a genetically distinct *Callitris intratropica* population near Mt. Molloy, which exclusively harbors *Erysivena molloy*.

The majority of callitroid-inhabiting Orthotylini (20 species) are known from only one *Callitris* species, while other species are have multiple hosts, such as *Erysivena drepanomorpha,* found on five species of *Callitris*. Over half the species are known from at least three localities, nine species from just one locality, and four species from two localities (table 2). There are a number of widely distributed callitroid Orthotylini, with some species known from up to 13 localities. These widespread species appear to be either host-plant specific or occur on different *Callitris* species across their range. For example, *Erysivena drepanomorpha* has a broader distributional range in southern Australia than any of its *Callitris* host plants. In contrast, the widely distributed *Avititerra xerophila* (Western Australia, South Australia, New South Wales and Queensland), *Erysivena majori* and *Callitricola wiradjuri* (both New South Wales and Queensland), have been recorded only on *Callitris glaucophylla*.

Some species with multiple-host records have been found on closely related *Callitris* species. For example, *Blattakeraia actinostrobi* was collected on two related *Callitris* species that were formerly placed in *Actinostrobus*. *Erysivena notodytika* was collected on *Callitris tuberculata* and *C. preissii*, which are considered as either two very closely related species (Hill, 1998) or synonyms (Farjon, 2005; also CHAH). *Erysivena drepanomorpha* was collected primarily on *C. tuberculata* and *C. verrucosa*, two closely related species that are distributed in western and eastern Australia respectively.

Twenty-five of the 32 species of callitroid-inhabiting Orthotylini were found cooccurring with their congeners (table 2), with multiple species collected (mostly) from a single *Callitris* species at 29 of 74 sampling sites, including species from either the

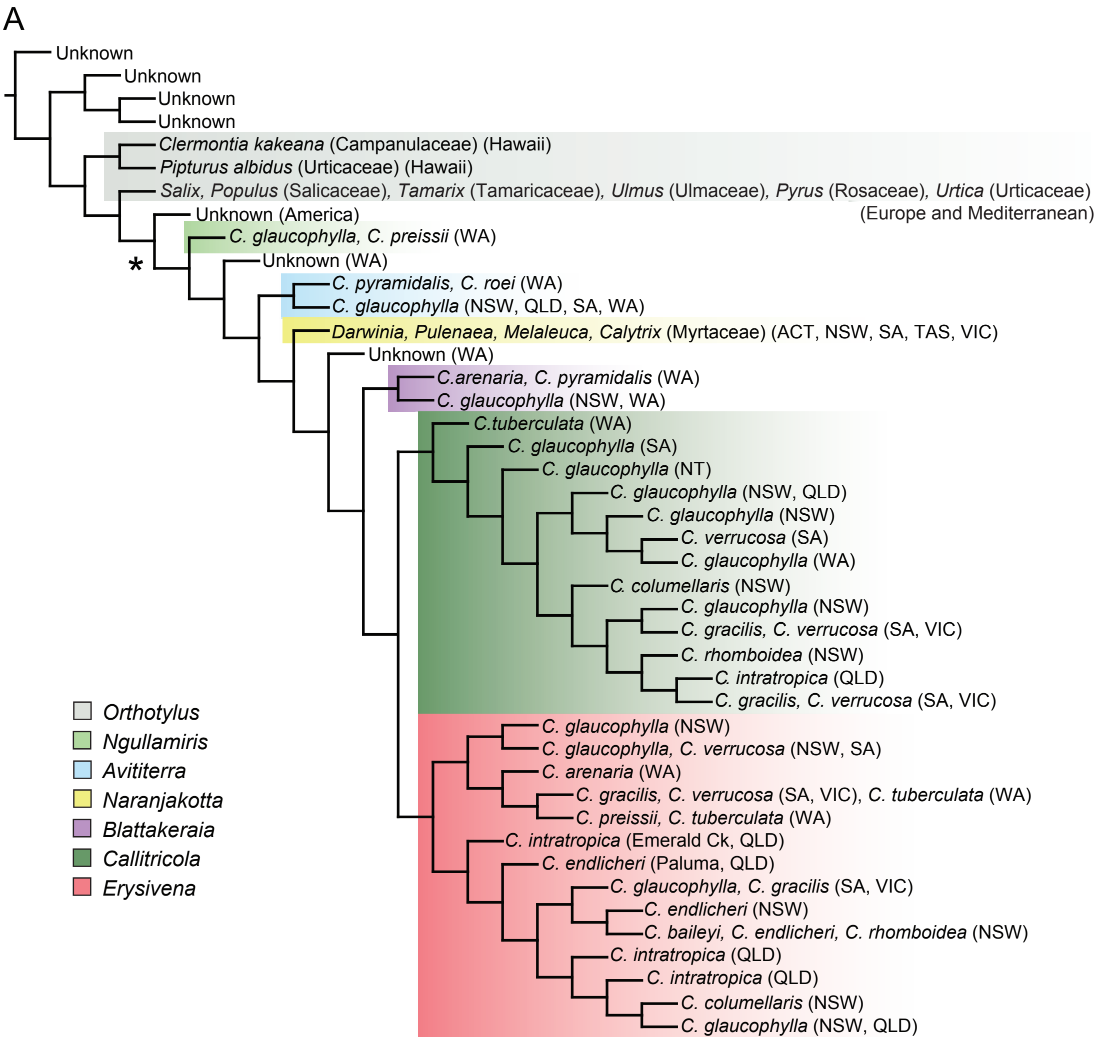
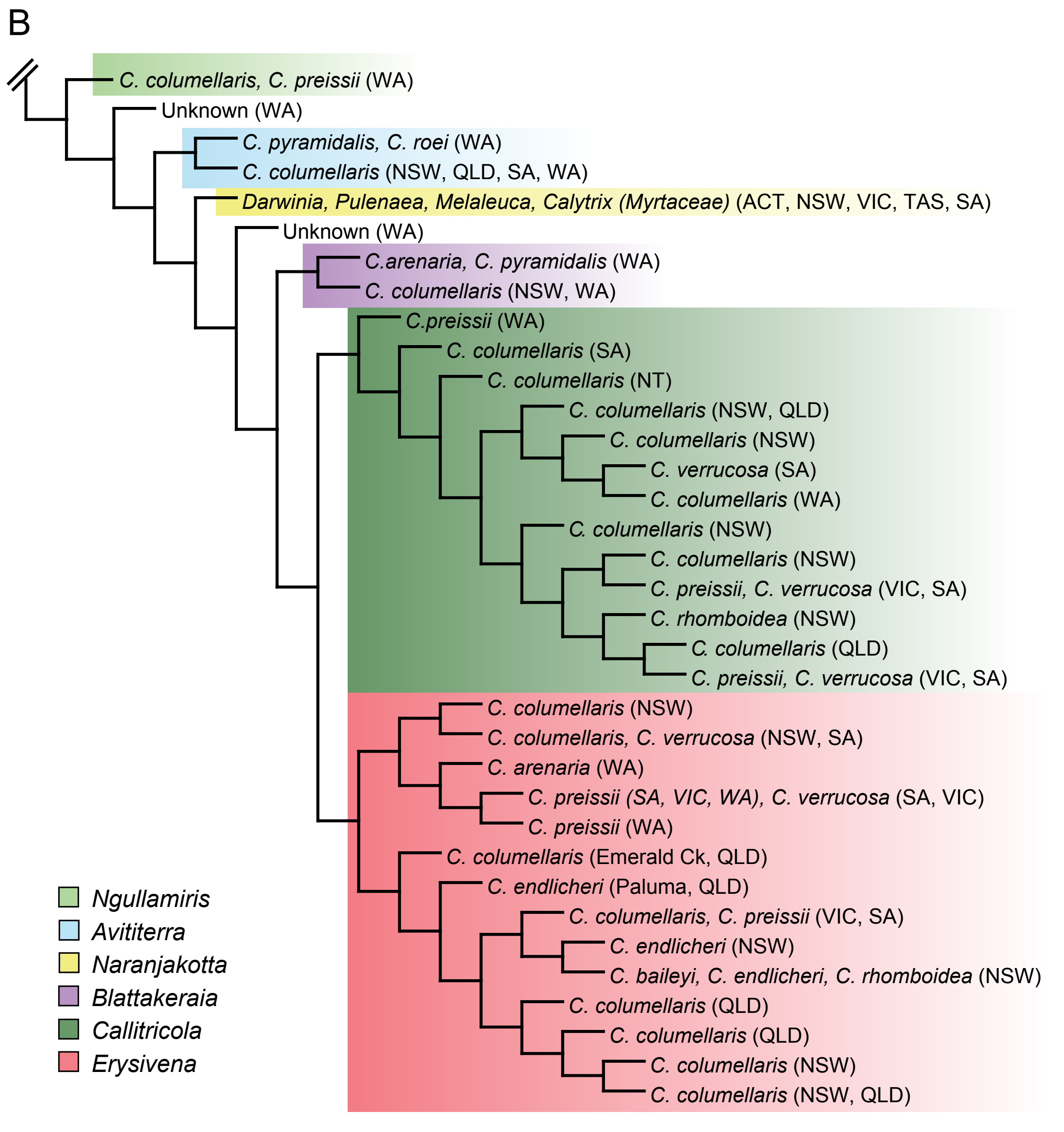


FIG. 3. Host optimization tree with host plants and distribution information of callitroid Orthotylini and outgroups. Callitroid Orthotylini genera and their *Callitris* (Cupressaceae) hosts in bold (limited to hosts recorded for type series only). **A.** *Callitris* species names as used in this work based on Hill (1998). See also table 2. **B.** (*opposite page*) *Callitris* species based on broader concept of Farjon (2005). Asterisk indicates the common root for both trees.

same genus or multiple genera, and with different species at different localities across their ranges. At most, five callitroid orthotyline species were collected on *Callitris glaucophylla* in Murda State Forest in New South Wales and four species on *C. verrucosa* at Scorpion Springs Conservation Park in South Australia. Three species were commonly cooccurring on *C. glaucophylla*, including at Euglo South, Gunningbland and Pullabooka State Forests in New South Wales, and east of Mitchell in Queensland. A number of species were consistently collected together on the same *Callitris* species (table 2), including *Callitricola silveirae*, *Erysivena schuhi*, and *E. drepanomorpha* at two sites in Scorpion Springs Conservation Park on *Callitris verrucosa*. *Blattakeraia hochuli, Erysivena apta*, and *E.*



schuhi were sympatric at up to four localities. The species pairs *Blattakeraia hochuli* and *Ngullamiris whadjuk* and *Callitricola graciliphila* and *Erysivena schwartzi* were also commonly collected together. Within Wyperfeld National Park in western Victoria, *Avititerra lepidothrix, Callitricola graciliphila, C. parawirra*, and *Erysivena schwartzi* were collected on *Callitris gracilis*, two of which were collected on *Callitris verrucosa*. High diversity within a genus at single localities on the same host plant is a pattern that has also been observed for other mirid and also tingid genera in Southeast Asia and Australia (Cassis and Symonds, 2008; Tatarnic and Cassis, 2008).

Miridae Associations with the Cupressaceae

In comparison to the Northern Hemisphere, few Miridae have been recorded from southern

FIG. 4. **A.** *Erysivena sydneyensis*, male, ex. Terrey Hills, New South Wales. **B.**, **C.**, **D.**, *Erysivena notodytika*, ex. Mosman Park, Perth, Western Australia: **B, C.** Adult male. **D.** Nymph. Scale bars = 1 mm.

conifers. In southern Africa the cupressaceous species *Widdringtonia nodiflora* (L.) E. Powrie harbors the isometopine species *Myiomma milleri* (Hoberlandt) and the phyline species *Widdringtoniola kirstenboschiana* Schuh (Schuh, 1974, 2002–2013). In contrast, seven orthotyline genera have been recorded from Cupressaceae in the Northern Hemisphere, most notably *Orthotylus* in Europe and North Africa and *Dichaetocoris* Knight in western North America. Nine species of European *Orthotylus* (Schuh, 2002–2013) have been recorded on *Cupressus* L., *Juniperus* L., and *Tetraclinis* Mast. The two *Orthotylus* species (*O. callitris* Lindberg and *O. carinatus* Wagner) recorded from *Tetraclinis articulata* (Vahl) Mast. do not appear to be closely related based on male genitalic illustrations and Wagner (1973) placed them in different subgenera.

Dichaetocoris comprises 16 species, which are all associated with conifers, in genera belonging to the Cupressaceae and Pinaceae (Asquith and Lattin, 1993; Schuh, 2002–2013). Some species bear a striking resemblance to *Callitricola*, with body green, yellow on the wing membrane veins, and slight yellowing of the middle of the cuneus (fig. 13). Endosomal spicule and paramere morphology are also not dissimilar between these two disjunctly distributed genera and a more detailed comparison would be of interest. We note however that the male genitalic descriptions and illustrations of two *Dichaetocoris* species are different enough (see Asquith and Lattin, 1993; Schwartz and Scudder, 2003) to warrant an investigation of the monophyly of the genus. In the nominotypical tribe of the Mirinae, *Dichrooscytus* Fieber species are mostly associated with the cupressaceous genus *Juniperus*, as well as *Pinus* L. species. In contrast, the megadiverse genus *Phytocoris* Fallén has a more diverse host-plant range, but also has species associated with *Juniperus* and *Pinus* (Schuh, 1995, 2002–2013).

In Australia, phylines and mirines are commonly collected on *Callitris*, but they are largely undescribed, aside from the leucophoroptorine species *Arafuramiris queenslandensis* Menard and Schuh, which was recorded from *Callitris intratropica* (Menard and Schuh, 2011). However, this record is likely incidental (Katrina Menard, personal commun.).

Body Color and Host-Plant Associations in Miridae Classification

Body color is used in the classification of the Miridae, particularly in differentiating species, but its classificatory value is confounded by convergence of this cryptic coloration. For example, many Orthotylini, including the callitroid-inhabiting species described in this work, are primarily green, some of which are undoubtedly distantly related. There are also independent orthotyline lineages that possess red markings against a green background color. For example, the callitroid-inhabiting genus *Erysivena* and the myrtaceous-inhabiting genus *Myrtlemiris* are primarily green with red markings on the hemelytron. However, many features of the male genitalia of these two groups are indicative of a distant relationship.

Where orthotylines are associated with flowers, their body color is similarly camouflaged, as in the Australian genus *Acaciacapsus*, which are mostly yellow, in accord with the flowers of their *Acacia* host plants, to which they are restricted (Cassis and Symonds, 2014a). In this example, body color and male genitalic characters are corroborated and genus defining. Conversely, body color is of no use in the diagnosis of *Naranjakotta*, whose host-plant range is remarkably broad, encompassing 12 different families, while characters of the male genitalia are paramount for defining the genus (Cassis and Symonds, 2016).

Similar patterns are found in the subfamily Phylinae in Australia. For example, many taxa of the subtribe Cremnorrhinina are often closely matched in color with the leaves of the Australian endemic genus *Eremophila* R. Br., both mostly pale green (Schuh and Schwartz, 2016). Conversely, where phyline genera have a wider host range (e.g., *Wallabicoris* Schuh and Pedraza), across multiple plant families (Schuh and Pedraza, 2010), the external morphology and coloration of the species is diverse.

DISTRIBUTION PATTERNS

The callitroid-inhabiting Orthotylini have been found in all states except Tasmania and all major habitat types except rainforest, although both have not been adequately sampled. Northern Australia, central Australia, northeastern New South Wales, and southern Queensland are also areas where little sampling has been undertaken.

All genera except for the monotypic genus *Ngullamiris* are found in both eastern and western Australia, and there are narrowly distributed and widespread species, including three transcontinental species. In the southern half of the continent, these distribution patterns mirror those of many other organisms (Rix et al., 2014), including monophyletic taxa of the Miridae and Tingidae (Cassis and Symonds, 2011, 2016; Schuh and Schwartz, 2016). The center of diversity of callitroid-inhabiting Orthotylini is in eastern Australia (New South Wales plus


A
B
C
D
E
F

Queensland) and is akin to other miroid clades, such as *Epimixia* Kirkaldy (Cassis et al., in prep.). There are 13 callitroid-inhabiting Orthotylini from New South Wales, 10 from Western Australia, eight from Queensland, seven from South Australia, four from Victoria and one from the Northern Territory. Victoria is the only state without endemic species. We acknowledge that the diversity in New South Wales may be biased because of an intensive ecological study of insects of *Callitris glaucophylla* in the central western part of that state (Major et al., 2003). There are differing patterns of diversity by genus group. Western Australia is the center of diversity for the less diverse genera of callitroid-inhabiting genera (*Avititerra, Blattakeraia*, and *Ngullamiris*), with all five species occurring in the southwest of that state, including three endemic species. In contrast, *Callitricola* and *Erysivena* are most diverse in eastern Australia with 18 of the 27 species found in either or both New South Wales (11) and Queensland (7), followed by the Adelaide and Eyre Peninsula biogeographic regions of southern Australia with seven species in South Australia and/or Victoria, and then by five species in Western Australia . For both *Callitricola* and *Erysivena*, species with a southwestern distribution are found in related clades and are often sister to species from eastern Australia (South Australia, Victoria, and southern New South Wales) (see fig. 3A). The single species (*C. finke*) from central Australia is nested phylogenetically between species from South Australia and Queensland + New South Wales, all from *Callitris glaucophylla* (fig. 3A). *Callitricola* and *Erysivena* species from New South Wales show three distributional patterns: those restricted to New South Wales with a short range (central, southeast, or northeast), those with a northeast range extending into Queensland, and those with a southern range extending to South Australia (fig. 3). All *Callitricola* and *Erysivena* species found on *Callitris intratropica* are restricted to northeastern Queensland.

High endemism for the callitroid Orthotylini occurs in the Northern Territory in central Australia (1/1, 100%), southwestern Western Australia (7/10, 70%) and then Queensland (5/8, 63%), and New South Wales (8/13, 62%), and moderate endemism in South Australia (2/7, 27%) and Victoria low (0/4, no endemism).

Over half the callitroid-inhabiting species were collected at one or two localities, and there has been limited sampling across the range of *Callitris* in Australia. Although, there are undoubtedly new species that remain to be discovered in this complex, we regard the above distribution patterns to be informative when considering the continental scale of our collections. We have demonstrated that widespread host species, particularly *C. glaucophylla* and *C. intratropica*, harbor multiple orthotyline species, some of which, in all likelihood, are truly narrow-range endemics.

OVERVIEW OF *ORTHOTYLUS* FIEBER AND ALLIED TAXA

Review of the taxonomy of *Orthotylus*: Generic concepts in the tribe Orthotylini are a work in progress. There are currently 222 orthotyline genera, with *Orthotylus* Fieber the nominotypical and most speciose genus of the tribe (Cassis and Schuh, 2012). *Orthotylus* comprises 392 described species (Schuh, 2002–2013; Polhemus, 2013) and is found in all major biogeographical regions of the world. The centers of

FIG. 5. **A, B.** Hosts of *Erysivena sydneyensis*: **A.** *Callitris bayleyi,* nr Tabulam, northern tablelands of New South Wales (NSW) [28°54′7.7″S 152°41′37.2″E]. **B.** *Callitris rhomboidea,* Wollemi National Park, NSW [33°15′36.8″S 150°13′5.2″E]. **C, D.** Host of *Erysivena bundjalung* and *Callitricola ballina, Callitris columellaris*, Bundjalung National Park, northeastern NSW [29°10′34.2″S 153°23′26.7″E]: **C.** Habitat in coastal eucalypt forest. **D.** Foliage and mature fruit. **E, F.** Host of *Erysivena paluma*, *Callitris endlicheri* “Paluma,” northern Queensland [18°59′18.5″S 146°3′2.4″E]: **E.** Habitat in dry tropical eucalypt woodland. **F.** Foliage and pollen cones.


A
B
Termite
C

Orthotylus diversity are the Western Palearctic and Hawai'i (distribution summarized in table 3). Polhemus (2002; 2004; 2011; 2013) described nearly 100 new species of *Orthotylus* from Hawai'i, and found no basis for erecting a separate genus for their inclusion.

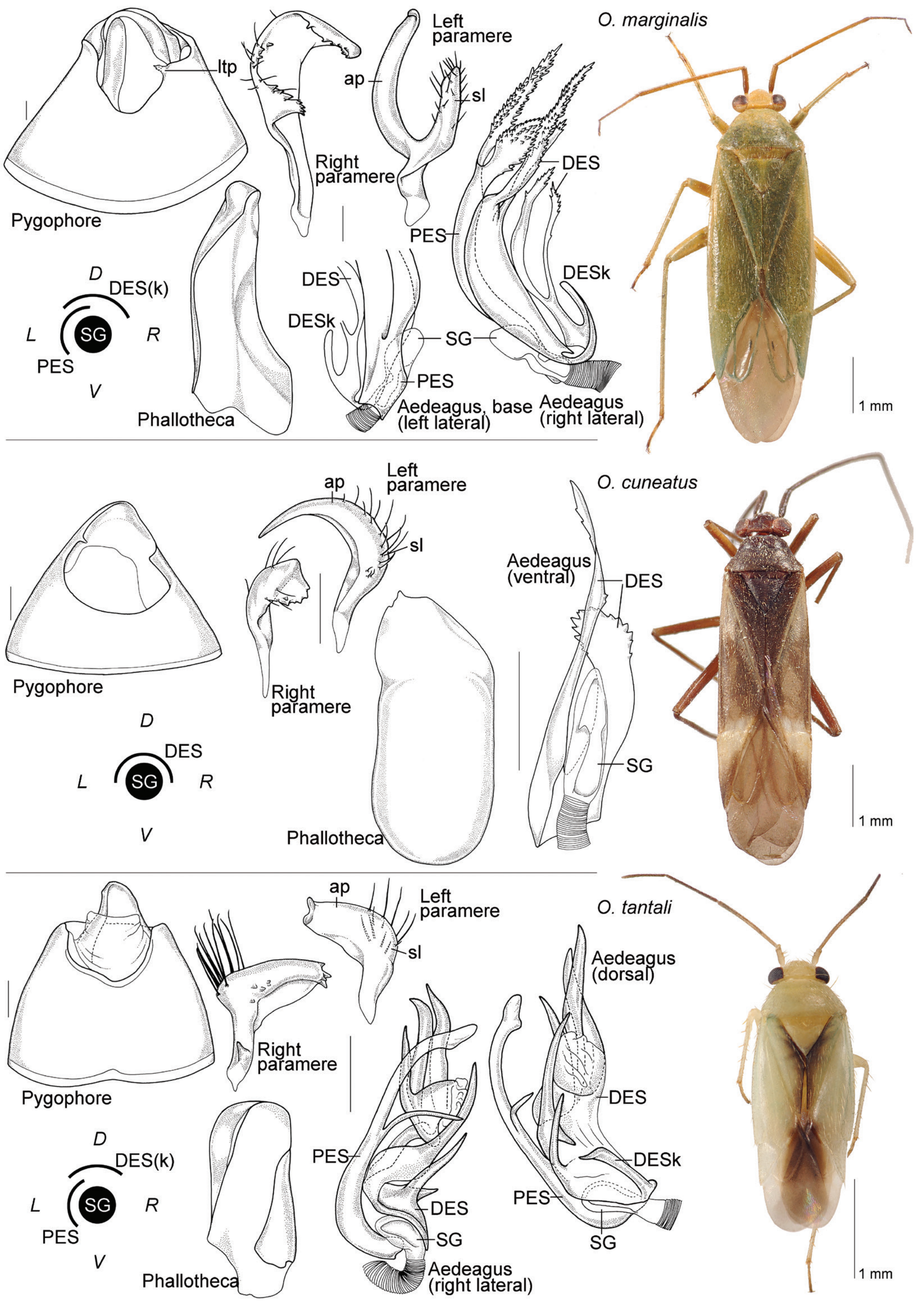
There are currently 16 junior synonyms of *Orthotylus*, with all but one described from the Palearctic region (Schuh, 2002–2013). Fieber (1858) first described *Orthotylus*, with *O. marginalis* designated as the type species. Reuter (1875) relegated *Melanotrichus* Reuter to a subgenus of *Orthotylus* and he was the first to adopt a subgeneric classification. In his study of British *Orthotylus*, Southwood (1953) recognized four subgenera based primarily on the morphology of the endosomal (as vesical) spicules and parameres. Wagner (1973), in an overview of Mediterranean *Orthotylus* species, recognized six subgenera, including those of Southwood (1953). More recently, Yasunaga (1999) erected *Orthotylus* (*Yamatorthotylus*) Yasunaga from the eastern Palearctic, Ehanno and Matocq (1990) described the subgenus *Orthotylus* (*Parapachylops*) Ehanno and Matocq from the western Palearctic, and Linnavuori (1994) described *Orthotylus* (*Ericinellus*) Linnavuori from the Afrotropical region (see table 4). Chinese authors have also followed this subgeneric approach (Liu and Zheng, 2014).

Elsewhere in the world, subgenera have not been used in the classification of *Orthotylus* species. The Nearctic, Neotropical, and Australasian (including Hawaiian) species of *Orthotylus* have not been assigned to subgenera and often assigned to *Orthotylus* on a provisional basis (Carvalho and Fontes, 1973; Carvalho and Schaffner, 1973; Carvalho, 1985; Kerzhner and Schuh, 1995; Schuh, 1995; 2002–2013; Polhemus, 2002; 2004; Forero, 2009; Polhemus, 2011; 2013). Van Duzee (1916) and Knight (1968) described most *Orthotylus* species from North America. The South African species are few, scarcely documented, and mentioned only in general terms by Schuh (1974).

American workers recognized *Melanotrichus* as a valid genus (Henry and Wheeler, 1988; Henry, 1991; Schwartz and Scudder, 2003). In contrast, Palearctic workers have traditionally treated it as a subgenus of *Orthotylus* (Southwood, 1953; Wagner, 1973; Ehanno and Matocq, 1990; Linnavuori, 1994; Yasunaga, 1999). Knight (1927, 1968) described the majority of North American *Melanotrichus* species. Schuh (1995, 2002–2013) treated *Melanotrichus* as a junior synonym of *Orthotylus* on a worldwide basis pending revision. Kelton (1979a) also found the North American species assigned to *Melanotrichus* (Knight, 1927, 1968) to be paraphyletic, and transferred 15 species to a new genus *Brooksetta* Kelton (1979b), after comparison with the Palearctic type of *Melanotrichus*, *Orthotylus flavosparsus* (Sahlberg). Carvalho (1985) described South American species of *Melanotrichus*, however, these taxa are very different morphologically from the Palearctic taxa. Kerzhner and Schuh (1995) transferred these species to *Orthotylus*. Recently, Yasunaga and Duwal (2017) recognized 11 Asian species with Oriental and Palearctic distributions as congeners of *Melanotrichus* (after Henry and Wheeler, 1988), including one new species and 10 species transferred from *Orthotylus*, while also recognizing the need for a revision of *Melanotrichus* worldwide. In this case, the recognition of *Melanotrichus* as a valid genus represents an alternative classification that requires a much broader study than we present in this work.

Schuh (1974) listed nearly 40 genera as part of his suprageneric *Orthotylus* group, including *Blephardiopterus* Kolenati, *Hadronema* Uhler, *Lopidea*, *Heterotoma* Le Peletier and Serville, *Pseudoloxops* Kirkaldy, and *Pseudopsallus*. The above condition of the endosomal spicules applies to many orthotyline taxa worldwide, including the Neotropical genera *Biobiocoris*

FIG. 6. **A.** *Callitris glaucophylla,* Kings Canyon in Watarrka National Park, central Australia [24°15′25.9″S 131°34′7.7″E], host of *Callitricola finke*. *Callitris* on the Atherton Tablelands, far north Queensland: **B.** *Callitris intratropica* near Mareeba [16°59′19.9″S 145°30′30.1″E], host of *Erysivena mareeba*. **C.** *Callitris intratropica* "Emerald Creek," northern Queensland [17°3′10.2″S 145°32′28.9″E], host of *Erysivena emeraldensis*.


O. marginalis
Pygophore
ltp
Right paramere
Left paramere
ap
sl
DES
PES
DESk
SG
D
DES(k)
L
R
PES
V
Phallotheca
Aedeagus, base (left lateral)
Aedeagus (right lateral)
1 mm
O. cuneatus
Pygophore
ap
Left paramere
sl
Right paramere
Aedeagus (ventral)
DES
SG
D
DES
L
R
V
Phallotheca
1 mm
O. tantali
Pygophore
ap
Left paramere
sl
Right paramere
Aedeagus (dorsal)
DES
DESk
PES
SG
D
DES(k)
L
R
PES
V
Phallotheca
Aedeagus (right lateral)
1 mm

Carvalho and *Chileria* Carvalho (Forero, 2009) as well as species of the recently described Australian genera *Acaciacapsus*, *Granitohyoidea*, *Harveycapsus*, *Myrtlemiris*, and *Naranjakotta* (Cassis et al., 2010; Cheng et al., 2012a; Cassis and Symonds, 2014a, 2014b, 2016).

Taxonomic characters within *Orthotylus*: To assign the callitroid-inhabiting species to genus, we investigated the characters used by previous authors in establishing genera of Orthotylini, including *Orthotylus* and its infrageneric groups, as well as making novel observations of exemplar taxa from regions extralimital to Australia. Our approach was first to gain a detailed understanding of the key characters of *Orthotylus*. The genus is hyperdiverse, the only cosmopolitan genus in the tribe, and likely a convenience group; as such, numerous genus groups are likely to overlap. *Orthotylus* is a highly heterogeneous genus morphologically, based on the species currently placed within it. The characters that have been used in the infrageneric classification of *Orthotylus* include: (1) relative lengths of the antennae; (2) eye to vertex ratio; (3) body color (yellow-green to dark brown, sometimes with patterning); (4) dorsal vestiture type (simple setae or a mix of simple and scalelike setae) and color; (5) pronotum shape; (6) pygophore (genital opening, presence of absence of tergal processes); (7) paramere shape; (8) aedeagus (positioning, shape, branching, and substructure of the endosomal spicules); and (9) female interramal lobes (= K structures sensu Slater, 1950).

The key characters differentiating *Orthotylus* subgenera are summarized in table 4. The paramere and endosomal spicule structure is described in detail in a homologous approach to our characterization of the Australian Orthotylini. The following discussion gives a summary of key characters by subgenus in the Palearctic region, and *Orthotylus* sensu lato in other biogeographic regions as well as the Hawaiian Islands, and highlights examples of some inconsistencies within the subgeneric groups.

We examined in detail the genitalic characters of the type species of *Orthotylus*, *O. marginalis* Reuter, and putatively related Palearctic species. These species possess pale hairlike simple setae, large and projecting parameres, the left paramere has a rounded and elongate sensory lobe and elongate and angulate apophysis with a small, recurved apical hook, and the right paramere is roughly C-shaped. They also possess two endosomal spicules, with the PES and DES arcuate and subequal in length, with a basal branch on DES and a basal keel attached to the basal branch (fig. 7, 8C–E). Also, the genital opening of the pygophore is large and there is a small, spinelike left tergal process (figs. 7, 8A) and the ventral margin of the pygophore is straight. The number, form, and position of the endosomal spicules in relation to the secondary gonopore vary in infrageneric groups of *Orthotylus* (table 4). In *Orthotylus marginalis* and related Palearctic species, the endosomal spicules are often branched and usually serrate on the distal margins. PES is left dorsolateral to the secondary gonopore but also extends to the ventral surface, at the base of this spicule, sheathing the secondary gonopore, whereas DES is dorsad to the secondary gonopore and extends to the right dorsal side of the secondary gonopore (fig. 8C–E). A key characteristic for *Orthotylus* is that the basal branch on DES is connected by a small bridge and the small, sclerotized basal hook is connected to that basal branch (fig. 7; Southwood, 1953). The female genitalia of *O. marginalis* has a divided interramal sclerite, which are individually spiniferous basally and at the medial angle, with the medial region extending in a triangular shape beyond the margin of the interramal sclerites (fig. 10C). The interramal lobes are divided at the apex and attached narrowly at the base, laterally on the interramal sclerites, and are strongly spinose (fig. 10C). The ventral labiate plate is broadly spinose (fig. 10A) and the ves-

FIG. 7. Male genitalia and habitus of *Orthotylus* spp. Views dorsal unless otherwise stated. Scale bars = 0.1 mm, unless otherwise marked.

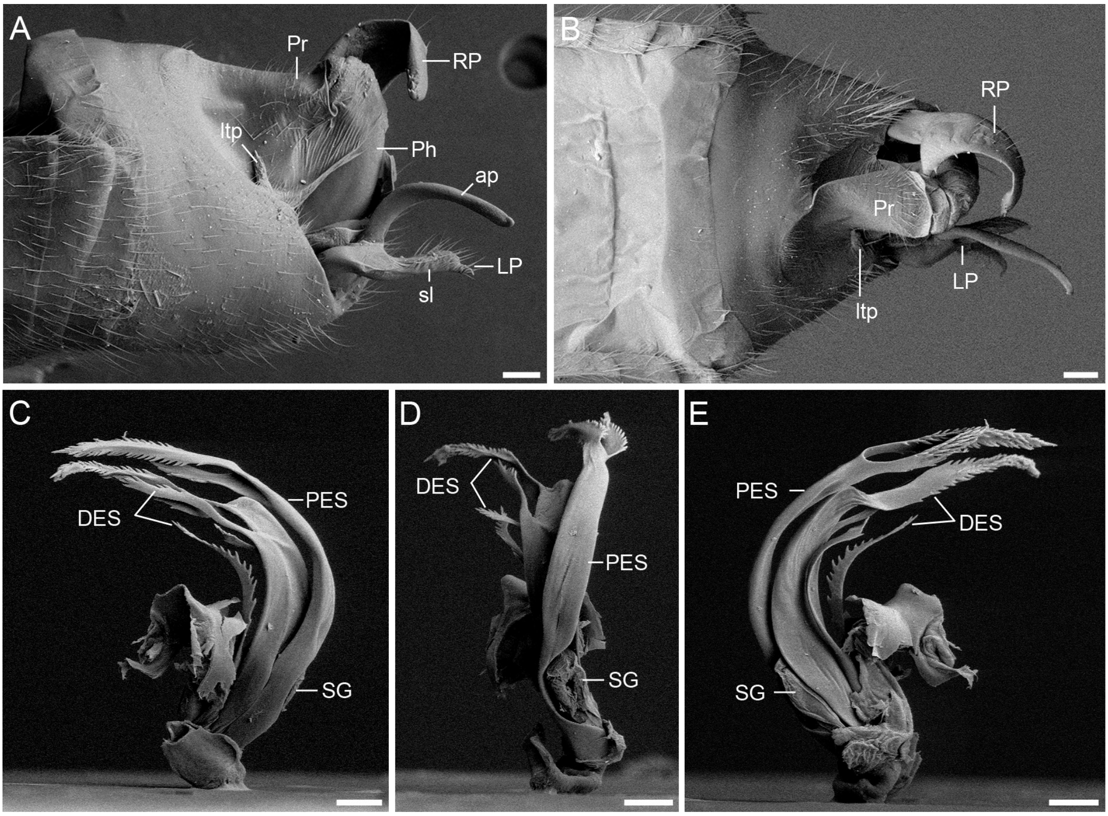


FIG. 8. *Orthotylus marginalis* male genitalic morphology. **A.** Pygophore, left lateral view. **B.** Pygophore, dorsal view. **C.** Aedeagus, left lateral view. **D.** Aedeagus, ventral view. **E.** Aedeagus, right lateral view. Scale bars = 100 μm.

tibulum is strongly sclerotized (fig. 10B), and subquadrate mediolateral lobes are present mesially on the dorsal labiate plate (fig. 10B).

Although there are repeated paramere and endosomal spicule patterns within *Orthotylus*, they are not defining for the described subgenera as presented. Within the nominotypical subgenus of *Orthotylus* there is considerable variation in the structure of the two endosomal spicules, which corresponds in part to differences in paramere structure as well (Southwood 1953). Most species assigned to the nominotypical subgenus have branched and serrate endosomal spicules, some differing from *Orthotylus marginalis* (table 4), which Southwood (1953) recognized in his subgeneric species groups. In some species, such as *Orthotylus virescens* (Douglas and Scott), *O. adenocarpi* (Perris), *O. viridinervis* (Kirschbaum), and *O. boreellus* (Zetterstedt), the endosoma has a slender unbranched ventral spicule (= PES) and a similar bifurcate, basally branched dorsal spicule (= DES) (see Southwood, 1953: figs. 97–110). Wagner (1973) also noticed this and transferred species to other *Orthotylus* subgenera.

Wagner (1973) provided a redescription of *Orthotylus* in his study of western Palearctic species, but in the main most of his characters are general to the subfamily Orthotylinae, except for the presence of endosomal spicules (as two chitin bands) and the presence of interramal lobes (as K structures). He then used external characters to define subgenera, including dorsal vestiture and secondarily supported by the structure of the endosomal spicules.

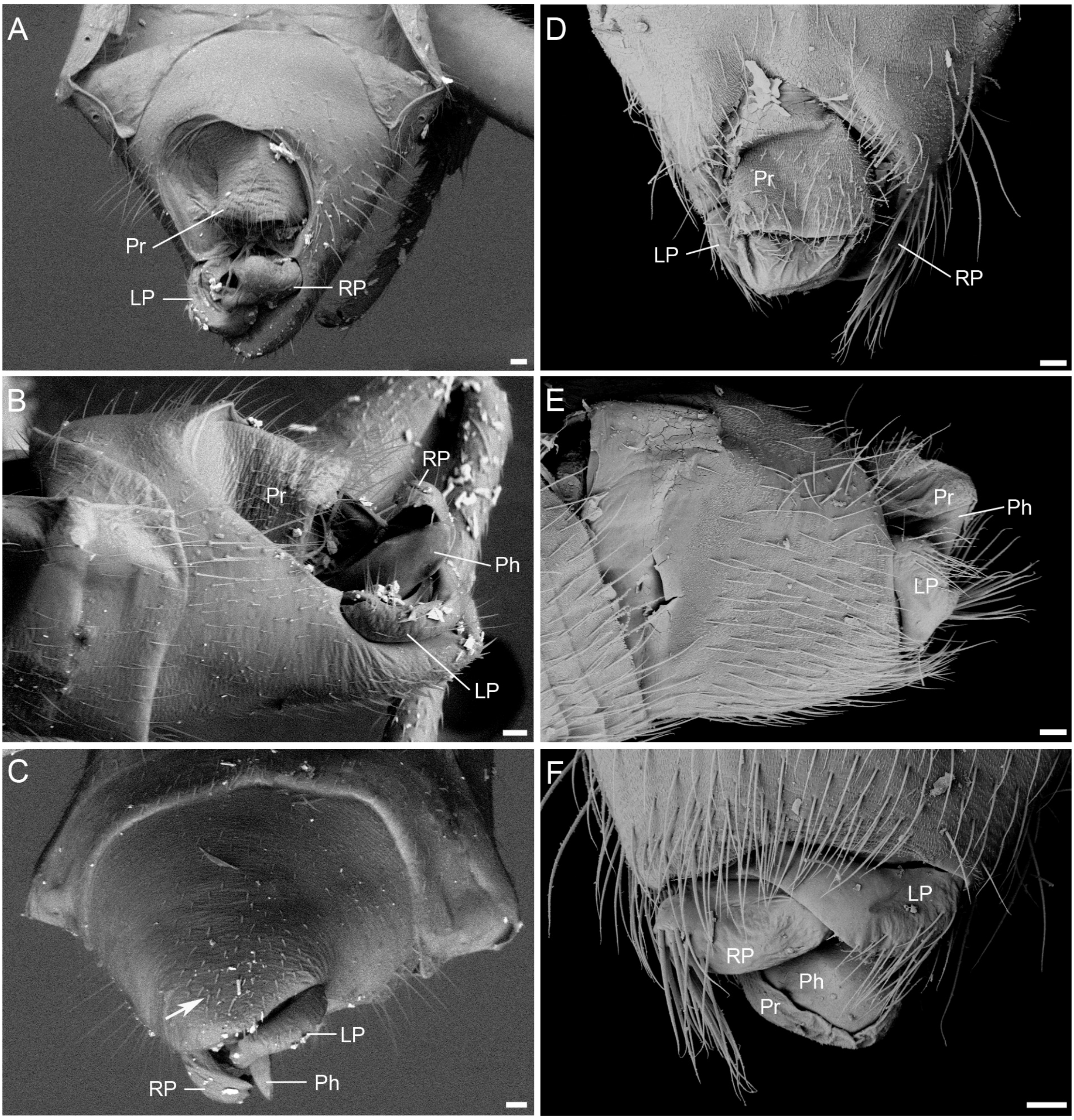


FIG. 9. Structure of the pygophore and male genitalia of *Orthotylus cuneatus* (**A–C.**) and *Orthotylus tantali* (**D–F.**): **A, D.** Pygophore, dorsal. **B, E.** Pygophore, left lateral. **C.** Pygophore, posteroventral; arrow indicates short spinelike setae. **F.** Pygophore, ventral. Scale bars = 30 μm.

Yasunaga (1999: figs. 7–25) reported that Japanese species of *Orthotylus* (*Orthotylus*) have three endosomal spicules, although it is likely there are two spicules in some species (based on illustrations, the two dorsal spicules appear to be connected by a basal branch), which allies them with *O. marginalis*. In contrast, the male genitalia of *Orthotylus japonicus* Yasunaga are significantly different and putatively do not belong to the nominotypical subgenus, possessing three discrete endosomal spicules and differently configured parameres (Yasunaga, 1999: figs. 26–30). *Orthotylus* (*Orthotylus*) *nassatus* Fabricius appears to be related to *Orthotylus* (*Kiiorthoty-*

lus) *gotchi* Yasunaga (Yasunaga, 1999: figs. 46–49), which has a distinctive left paramere hook and dorsal subbasal lobe, a similar flattened and distally serrate right paramere, and a greatly divided ventral spicule (PES); in addition, the dorsal spicule (DES) of both these species is without a basal branch or obvious basal keel (see Wagner, 1973: figs. 482A, E, 483A). Illustrations of African *Orthotylus* (*Orthotylus*) species (Linnavuori, 1975; 1994) also suggest that they are distantly related to *Orthotylus marginalis*.

Numerous Palearctic species assigned to *Orthotylus* (*Melanotrichus*) are robust, possess hairlike and scalelike setae, and the parameres and two simple endosomal spicules define the group . Wagner (1973; fig. 503G) described one or more tergal processes on the genital capsule of the pygophore of these taxa, which are typically elongate and fingerlike, and project medially from right of centre. This is similar to the Palearctic species *Orthotylus ericetorum* (Fallén). The African species assigned by Linnavuori (1994) to *Orthotylus* (*Melanotrichus*) have in common the vestiture and parameres typical of western Palearctic species (including the type species of the subgenus, *O. flavosparsus* Reuter). They also have distinct differences, including a small phallotheca with a spiniferous patch distally, no endosomal spicules, a greatly elongate secondary gonopore, the pygophore without any tergal processes (also noted in North American species by Kelton, 1979a), and a distinctive pattern of scalelike setae on the pygophore (Linnavuori, 1975; 1994). Asian species with Oriental and Palearctic distributions now treated as *Melanotrichus* possess a distinct character set including: a small body size and eyes, both dark simple setae and scalelike setae, small parameres, and a simple endosoma, without endosomal spicules (Yasunaga and Duwal, 2017). On the basis of our observations and review of the literature, the absence or presence of endosomal spicules among these taxa brings into question the monophyly of *Melanotrichus*, regardless of its ranking, and the transfer of all the species by Yasunaga and Duwal (2017). We have considered character systems for only some of the species previously assigned to *Melanotrichus* at generic and subgeneric levels here, but not exhaustively, which is beyond the scope of this work. We are in agreement that the definition of *Melanotrichus* requires a comprehensive review.

The subgenus *Orthotylus* (*Neopachylops*) Wagner comprises species with complex serrate endosomal spicules and a combination of setal types, and at least two natural groups, not necessarily related, for the species included by Wagner (1973). Species such as *Orthotylus adenocarpi* bear little resemblance in paramere and endosomal spicule structure to those of the type *Orthotylus concolor* (Kirschbaum). The male genitalia of *Orthotylus ericetorum*, the type of the junior synonym *Litocoris* Fieber appear to be similar to *Orthotylus* (*Neopachylops*) Wagner, but there are differences in the pygophore and parameres between these subgenera. Linnavuori (1994) erected the subgenus *Orthotylus* (*Ericinellus*) for two species, both of which occur in Africa, and these also resemble *Orthotylus ericetorum*, differing in the ecarinate vertex and simple aedeagus, which is without spicules.

Southwood (1953) erected the monotypic subgenus *Orthotylus* (*Pinocapsus*) Southwood (type: *Orthotylus fuscescens* (Kirschbaum)) based on two elongate, unbranched and smooth endosomal spicules and characteristic parameres. Subsequently, Wagner (1973) placed another two species in this subgenus, both of which have two similar endosomal spicules, but the parameres of only one resemble those of the type species (Wagner, 1973: fig. 472). Southwood (1953) also erected the subgenus *Orthotylus* (*Neomecomma*), for the Palearctic species, *Orthotylus bilineatus* (Fallén). Its genitalia are undoubtedly distinct, and it is unlikely to be closely related to *Orthotylus* sensu stricto.

The type species of the monotypic subgenus *Orthotylus* (*Yamatorthotylus*) Yasunaga, *Orthotylus xanthopoda* Yasunaga, has large parameres that project beyond the genital opening of the pygophore (as in *Orthotylus marginalis*) and there is a bifid left tergal process on the genital opening of the pygophore. The ventral margin of the genital opening is weakly convex and there are short, dark spinelike setae proximate to the opening. Yasunaga (1999: figs. 54–56) reported that the two endosomal spicules are bifurcate, but their configuration is difficult to discern from his illustration. *Orthotylus* is the most diverse group of true bugs in the Hawaiian Islands, and are thought to represent multiple insular radiations that putatively track different plant families (Polhemus, 2011). Polhemus (2002) mentions that the paramere shapes are homologous among species found on host plants in the same genus or family. There is much congruence in the shapes of the parameres across the 100 or so species, as in the structure of the phallotheca and endosomal spicules. Key characters of these Hawaiian species are: (1) relatively small, elongate ovoid shape, mixed green-brown to black species, often bicolored (e.g., *Orthotylus tantali*, fig. 7); (2) simple setae on the dorsum; (3) short head in front of the eyes; (4) robust tibial spines on the legs; (5) simple transverse pygophore, without tergal processes; (6) simple parameres, with the left paramere L-shaped, with a weakly to moderately expanded and rounded sensory lobe, and the right paramere club shaped or L-shaped, with both parameres, particularly the right, with a clump of elongate setae on the outer distal lobe (e.g., figs. 7, 9F); (7) endosomal spicules mostly with smooth margins, divided into many branches, often with connecting membrane, and when serrate confined to the apices; and (8) phallotheca usually simple and open (fig. 7). Polhemus (2002; 2004; 2011; 2013) did not homologize the endosomal spicules nor provide detailed description of their substructure.

We examined in detail the male genitalia of the Hawaiian species, *Orthotylus tantali* Polhemus, and its L-shaped left and right parameres, pygophore, and phallotheca are relatively simple (fig. 7). The ventral margin of the genital opening of the pygophore is almost straight and the parameres are folded over each other and are situated just inside the ventral margin, beneath the aedeagus and phallotheca, both of which protrude only slightly (fig. 9D–F). Two distinctive endosomal spicules are present, which we interpret as a simplified PES and complex DES (fig. 7). PES is positioned in the left lateral position and DES is right dorsal, with PES relatively narrow and bifurcate, with short and elongate branches. DES is large and broad, with five branches emanating from a membranous midsection, and possesses a distinctive basal keel. Both spicules have smooth margins and are interspersed with membrane, as seen in the Australian orthotyline genus *Myrtlemiris*, although in the latter genus there are three distinct endosomal spicules (Cheng et al., 2012a). The female of *O. tantali* has a lightly sclerotized opening of the vestibulum, in comparison with *Orthotylus marginalis*, and a spiniferous ridge or mediolateral band (mlb) along the posterior margin of the dorsal labiate plate (fig. 10E). The interramal sclerites appear to be an undivided plate across the posterior wall, obscured and covered by the interramal lobes, which are quadrate, uniformly spiniferous, and broadly fused across the sclerite base (fig. 10F).

The North American *Orthotylus* species are most commonly found on willows and poplars and, with the South African species (which feed on *Acacia* spp.), are the least described morphologically within the genus. Van Duzee (1916) described taxa of three main body forms—small, green, and moderately elongate; medium sized, pale, and ovoid; and larger, dark, and elongate species. He also was the first author to use the morphology of the parameres in the classification of *Orthotylus*. The Nearctic species of *Orthotylus* possess one or two spicules (Asquith and Lattin, 1993). We examined one of these species, *Orthotylus cuneatus* Van Duzee, which is distinctly different from the Palearctic and Hawaiian congeners. They possess a single endosomal spicule, which we interpret as DES (also see Asquith, 1991; Schwartz, 2011), that sheaths the secondary gonopore dorsally, is divided toward the base with two serrate branches, and does not possess a keel (fig.

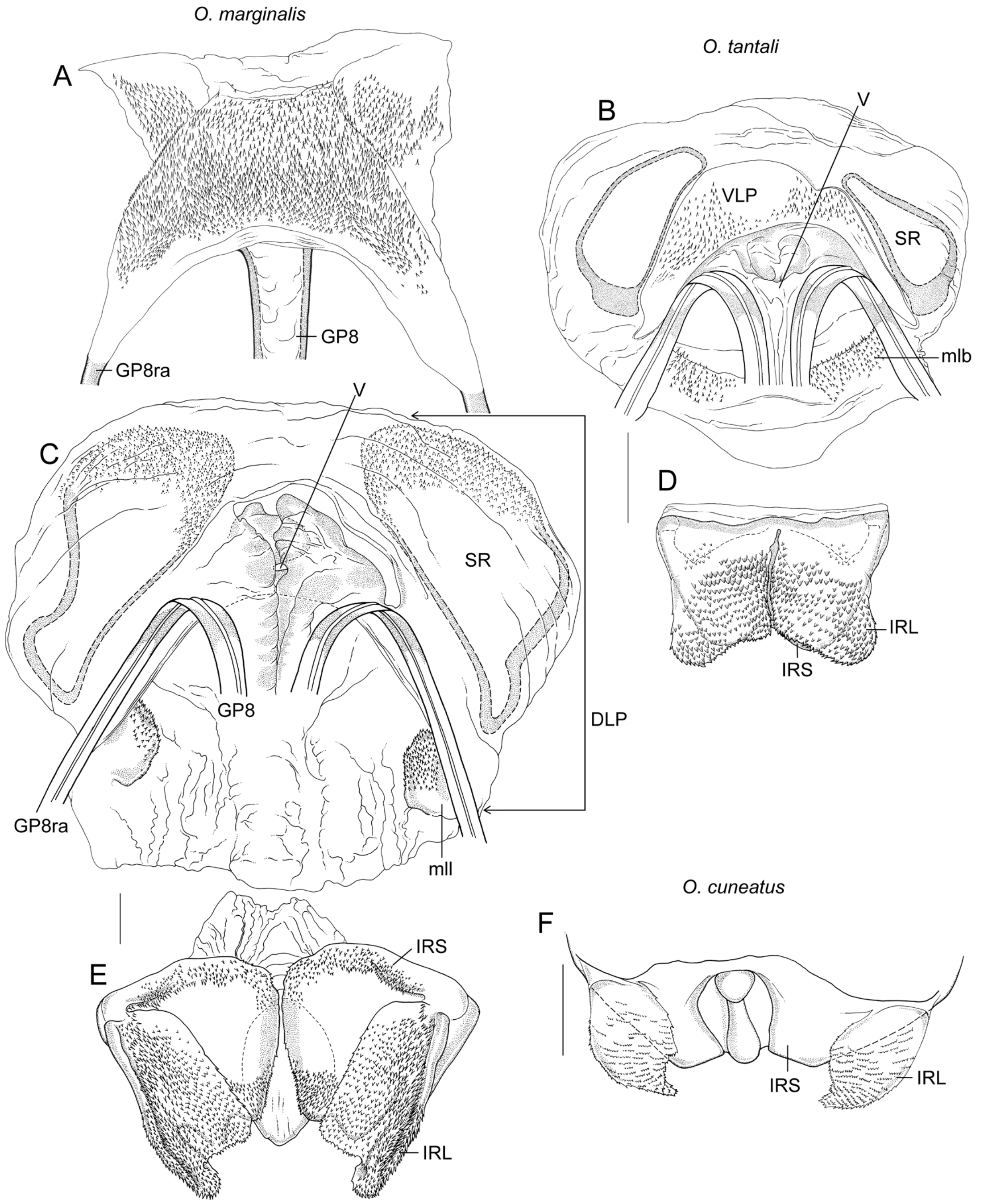


FIG. 10. Female genitalia of *Orthotylus* spp. **A.** Ventral labiate plate, dorsal. **C**, **B.** Bursa copulatrix, ventral. **D**, **E**, **F.** Posterior wall, dorsal. Scale bars = 0.1 mm.

7). The phallotheca is very simple and opens broadly, without enclosing margins (fig. 7). While this species is large and elongate, with large eyes (fig. 7), the abdomen is short and the male genitalia are small overall (fig. 7). This combination of characters is also seen in some Australian Orthotylini, for example, *Ngullamiris whadjuk*, described in this work, has a cup-shaped ventral margin of the pygophore (figs. 7, 9A–C), parameres that sit inside the ventral margin of the genital opening of the pygophore (fig. 9A, B), and the ventral surface of the pygophore has small spines (fig. 9C). In addition to the characters above, the male genitalia of *O. cuneatus* differs from *Orthotylus marginalis* in the possession of a simple opening of the phallotheca and simpler parameres (fig. 7). The left paramere is a curved L-shape with a rounded and unexpanded sensory lobe, tapering apophysis, and acuminate apex. The right paramere is club shaped with a small apical flange, which is also seen in species of callitroid-inhabiting Orthotylini. The female genitalia of *Orthotylus cuneatus* is also small in comparison with its body size, and the vestibulum opening is largely membranous, and at most very lightly sclerotized. On the posterior wall (fig. 10D), the interramal sclerites are joined at the base and without any spines, the medial region has a bulbous process rounded distally and does not extend beyond the margins of the interramal sclerites. The interramal lobes are small with pointed and medially curved apices, and fine spines uniformly distributed across the lobes (fig. 10D).

Kelton (1959) illustrated and described two species of American *Orthotylus*, *O. notabilis* Knight and *O. ornatus* Van Duzee. Both these species have similar paramere and endosomal spicule morphology, which is significantly different from *O. cuneatus*. He described four endosomal spicules, however, from the illustrations it appears these are two that are basally branched.

Neotropical *Orthotylus* species, like the Afrotropical species, have very complex and ornate endosomal spicules (Carvalho and Fontes, 1973; Carvalho, 1985), and Forero (2009) described natural groupings within the genus. Characteristics of these species include the presence of two endosomal spicules, which are dorsal to the secondary gonopore. PES is simple and slender, with an apical branch, with smooth margins, and is positioned at the left dorsolateral to the secondary gonopore. DES is subequal in length to PES, with medial branching and at least two small subbranches, the margins are smooth, and it is positioned right dorsolateral to the secondary gonopore (see Forero, 2009: fig. 14A–D). Other supporting characters include the structures of the parameres, pygophore and pinched phallotheca (Forero, 2009: figs. 14, 15). The South African *Orthotylus* species have been little documented and are highly variable, although natural groupings are apparent (Schuh, 1974).

Many of the above characters in *Orthotylus* are also found in other Orthotylini genera. For example, *Orthotylus marginalis* has many characters that are also found in the callitroid-inhabiting Orthotylini such as: (1) the simple setae; (2) overall green body color; (3) the elongate ovoid body (fig. 7); (4) the left paramere roughly L-shaped, with an expanded sensory lobe, and elongate apophysis with a hooked apex (fig. 7); (5) the right paramere C-shaped (fig. 7); (8) the parameres large and everted from the pygophore in repose; (9) the genital opening of the pygophore having a straight ventral margin (fig. 8A, B), with a left lateral tergal process (figs. 7, 8A); and (10) phallotheca simple and large (fig. 7) extending beyond the genital opening of the pygophore in repose (fig. 8A). Similarly, the Australian species, *Naranjakotta sidnica*, which was previously placed in *Orthotylus,* shares many of these characters.

The above discussion focuses on genitalic characters, where considerable variation exists. It is also important to evaluate previous use of vestiture characters in the diagnoses of subgenera of *Orthotylus* (e.g., Southwood, 1953; Wagner, 1973; Linnavuori, 1994). There is little doubt that setal types are homoplasious in *Orthotylus* (Polhemus, 2002), but have not been consistently applied across the genus. For example, *Orthotylus* (*Orthotylus*) is generally diagnosed as having only simple hairlike setae, yet some species with scalelike setae have also been placed in the nominotypical subgenus (e.g., *Orthotylus repandus* Linnavuori and related Afrotropical species; Linnavuori, 1994). Also, the *Orthotylus* (*Orthotylus*) *compactus* species group contains species with and without scalelike setae, as well as simple setae of differing color (Linnavuori, 1994). The presence or absence of mixed vestiture has been found to be genus defining in Australian orthotyline genera, such as *Acaciacapsus* and *Naranjakotta*, both of which have intermixed hairlike and scalelike setae, whereas *Myrtlemiris* has only hairlike simple setae (Cheng et al., 2012a; Cassis and Symonds, 2014a, 2016). In Australian Orthotylini the color of scalelike setae can vary between species within a genus and in some cases even within a species, e.g., *Naranjakotta myrtlephila* Cassis and Symonds (2016). Stonedahl and Schwartz (1986) also reported that different scalelike setae in the Orthotylini are important taxonomically.

As with most character systems in the Miridae, many are subject to convergence, particularly in the case of the male genitalic characters in *Orthotylus* and other genera of the Orthotylini, where there appears to be repeated evolution of paramere and endosomal spicule types. This is confounded by the largely regional studies of the tribe and nominotypical genus. However, this does not infer that they are of limited taxonomic value. On the contrary, the degree of diversification, particularly of the endosomal spicules, necessitates their use, but we argue for in-depth evaluation of their number, position, canting, and substructure.

Australian species previously assigned to *Orthotylus*: Four Australian species have been historically placed in *Orthotylus* (Cassis and Gross, 1995). These include: (1) *Leptidolon australianus* (Carvalho, 1965), which was originally in *Orthotylus* (*Melanotrichus*). Subsequently it was transferred to the subfamily Phylinae based on illustrations of the male genitalia (Schuh, 1995; Schuh et al., 2015). (2) *Orthotylus eurynome* Kirkaldy, 1902, was described from New South Wales and Reuter (1900) incorrectly synonymized it with the European species *Orthotylus ericetorum* (Fallén). We compared a female cotype of *O. eurynome* with *O. ericetorum* specimens and confirm them as separate species, the former being larger in size and more uniformly pale green color (cf. bright green), with translucent wing membrane (cf. dark gray) and larger eyes. We also examined unpublished male genitalic illustrations of Jose Carvalho of *O. eurynome*, which resembles Orthotylini sp. Scorpion Springs, which we used as an outgroup taxon in our phylogenetic analysis. (3) *Orthotylus roseipennis* Reuter was described from a female specimen (Cassis and Gross, 1995) with the holotype housed in the Naturhistoriska Riksmuseet, Stockholm, Sweden (Gustafsson, 2006; Cassis et al., 2012). Examination of the type photograph suggests that this species is allied to the Australian genus *Myrtlemiris* by the red coloration of the first antennal segment, orange head, and largely red cuneus (Cheng et al., 2012a). It resembles *Myrtlemiris astartephila* Cheng, Mututantri, and Cassis, with the latter known from southwestern Western Australia, whereas *O. roseipennis* was recorded from northern Australia (no precise locality). This species needs further investigation to confirm whether it should be transferred to *Myrtlemiris*. Nonetheless *O. roseipennis* does not belong to the new callitroid-inhabiting genera, and is retained within *Orthotylus* as incertae sedis. (4) Reuter (1905) placed *Capsus sidnica* Stål in *Orthotylus*; the type is located at the University Museum (Zoology), Helsinki, Finland. It is a female in poor condition with the abdomen missing and the locality recorded as "Sydney." Cassis and Symonds (2016) transferred this species to their new Australian genus *Naranjakotta*, based on the unique structure of the proximal endosomal spicule (PES) (see fig. 11, table 5).

Global perspective on *Orthotylus* and generic concepts in the Orthotylini: *Orthotylus* is a diverse genus but is ill defined, and we regard it as a convenience group that is likely intermixed taxonomically with putatively

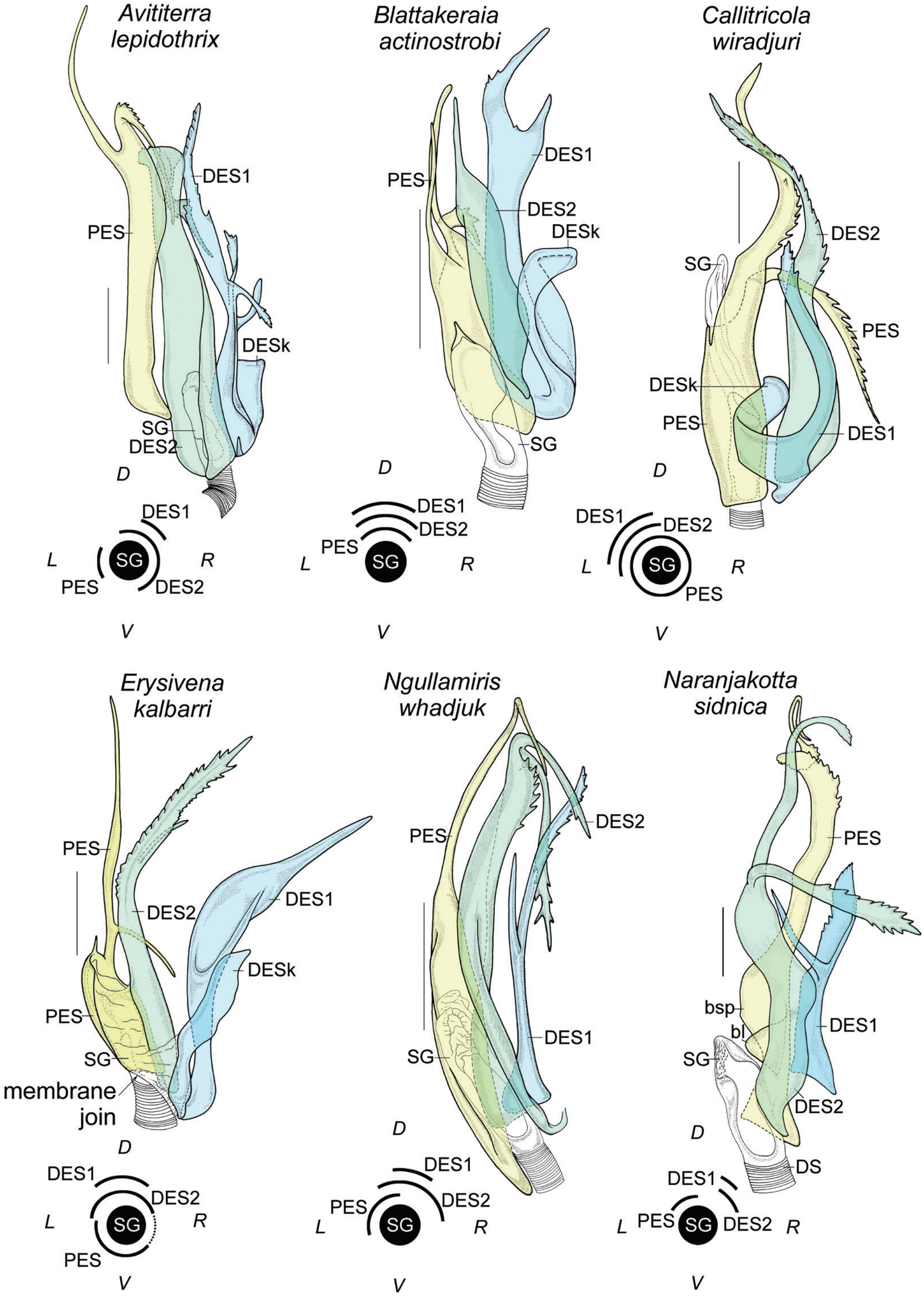


FIG. 11. Callitroid Orthotylini + *Naranjakotta sidnica*. Generic overview of aedeagus and arrangement of endosomal spicules. Scale bars = 0.1 mm.

related orthotyline genera. Furthermore, almost all studies on the genus and tribe have been regional in scope, and there are few case studies that test the monophyly of supraspecific taxa. Our study began with the discovery of numerous new species of callitroid-inhabiting orthotylines in Australia, collected during a continentwide survey program in Australia (Cassis et al., 2007). We provisionally assigned these species to *Orthotylus*, based on their green coloration, complex elongate endosomal spicules, simple setae, and an L-shaped left paramere. On closer inspection, we found the male genitalia to be significantly different from those of *Orthotylus marginalis*, the type of the genus, and allied western Palearctic species (Southwood, 1953; Wagner, 1973). In addition, we examined the literature on species assigned to *Orthotylus* from the Afrotropical (Linnavuouri, 1994), Oriental (Yasunaga, 1999) and Neotropical (Forero, 2009) regions, as well as Hawai'i (Polhemus, 2002, 2004, 2011, 2013), and again found the genitalic characters to be fundamentally different.

Southwood's (1953) British *Orthotylus* work is the early benchmark for studies on the genus and allied taxa. He explicitly recognized the importance of endosomal spicules (as vesical appendages), parameres, and female genitalic interramal lobes, in differentiating subgenera within *Orthotylus*. However, he was hesitant to raise these subgenera to generic rank based on internal characters, although he maintained the approach of classifying species into defined subgenera based in part on vesical types. As a result, he did not provide an overarching diagnosis for the genus.

Subsequently, Kelton (1959) in his comparative study of male genitalia of the Miridae, recognized the primary importance of the "vesica" in defining species and genera, in particular the secondary gonopore, ductus seminis, and associated sclerotized processes. His work was deliberately descriptive and a limited synthesis, and in the case of the Orthotylinae, he observed that the Orthotylini and Halticini shared the horseshoe-shaped secondary gonopore. Within the Orthotylini, he recognized the presence or absence of sclerotized processes (spiculi or sclerites) associated with the "vesica" as distinctive at the species level and thus helpful for determining natural groupings of species. He also appreciated the value of the phallotheca in defining species. He examined 19 genera of which only two were *Orthotylus* species, and although he described fine details of the spicules he did not find any major trends in the morphology of the "vesica" among these taxa.

In recent decades mirid workers have examined in more detail the positioning and structure of the endosomal spicules in the Orthotylini. As part of this effort, authors have proposed hypotheses on the homology of the endosomal spicules (Schwartz and Stonedahl, 1986; Stonedahl and Schuh, 1986; Stonedahl and Schwartz, 1986; Schwartz and Stonedahl, 1987; Asquith, 1991; Schwartz, 2004, 2011; Cassis, 2008; Forero, 2009; Cassis et al., 2010; Cheng et al., 2012a; Cassis and Symonds, 2014a, 2016).

In defining genera of Australian Orthotylini, we have focused primarily on endosomal spicule morphology (Cassis, 2008; Cheng et al., 2012a; Cassis and Symonds, 2014a, 2016). As a result we have diagnosed new genera on the number, structure, and arrangement of the endosomal spicules, as well as features of the phallotheca, pygophore, and parameres (Cassis et al., 2010; Cheng et al., 2012a; Cassis and Symonds, 2014b, 2014a, 2016).

We found that the substructure of PES is critical in defining genera (see also table 5 and fig. 11). Fine details of PES serve as nonhomoplasious synapomorphies in the following Australian genera: (1) *Naranjakotta* (PES has a curved whiplike apex); (2) *Myrtlemiris* (PES has a medial membranous region; Cheng et al., 2012a); (3) *Acaciacapsus* (PES has a downturned medial process; Cassis and Symonds, 2014a); and (4) *Blattakeraia* (PES has a distally serrate submedial process; this work).

There are also important characters associated with the second dorsal endosomal spicules—

TABLE 3

Geographic Distribution of *Orthotylus* Species (after Schuh, 2002–2013; Polhemus, 2013; Yasunaga and Duwal, 2017)

Zoogeographical region	Number of *Orthotylus* spp.
Afrotropical	28
Australian	2
Indomalayan	2
Nearctic	76
Neotropical	55
Oceania (Pacific)	96
Palearctic	134

DES2. *Erysivena* is defined in part by serrations on the medial margin of DES2. This is also the case in the North American genus *Lopidea*, which is separated from its sister genus, *Ilnacora* Reuter, by the absence of a ventral branch on the dorsal spicule (= DES), whereas the ventral spicule (= PES) exhibits intrageneric variation and is either branched or unbranched, although always slender (Asquith, 1991).

There are numerous other recent examples analogous to ours that lend support to examining the substructure of the endosomal spicules. For example, in most genera of the *Hadronema* group (Western Hemisphere) the "major spicule" is elongate, and apically bifurcate and downturned (Forero, 2008). Also, a cursory glance at a number of the described South American *Orthotylus* species (Forero, 2009) indicates a possible relationship with *Lopidea*, based on the shared presence of a uniformly narrow and distally bifid spicule in the left ventrolateral position that arises near the base of the secondary gonopore and that we would thus homologize with PES.

Schwartz (2011) also noted that where genera and groups of genera are defined on endosomal spicule number and morphology, there are often supporting external characters. In the case of the *Slaterocoris* group he found the included species shared a similar structure of the head and left paramere. Furthermore, Schwartz (2011) highlighted convergence of external characters in *Slaterocoris* group and externally similar and undescribed Australian taxa; he claimed that the latter differed significantly in male genitalic morphology. For example, he argued that the endosomal spicules of the Australian taxa resemble those of the *Lattinova* group and the parameres are unlike North American orthotylines.

Forero (2008) also described a distinctive bridge across the dorsal margin of the genital opening of the pygophore supporting the *Hadronema* group of genera. Stonedahl and Schwartz (1986) found that *Pseudopsallus* has uniquely structured tergal processes on the dorsal margin of the pygophore.

The parameres have been shown to be effective as supporting characters in the definition of supraspecific taxa in the Orthotylini. The size and position of the parameres in the pygophore at rest (illustrated but not discussed by Yasunaga, 1999) and shape, position, and size of the phallotheca extend the original conclusions of Southwood (1953). With respect to females, we found that it is not only the shape of the interramal lobes that were of importance, but the means by which they attach to the interramal sclerite; any subdivision of the latter or sclerotization associated with labiate plates is informative.

TABLE 4

Comparison of vestiture and genital characters of *Orthotylus* subgenera based on type species
(See appendix 1 for abbreviations)

Subgenus (other references)	Bioregion	Type species	Dorsal vestiture	Parameres	Structure of endosomal spicules	Interramal lobes
Ericinellus Linnavuori, 1994	Afro-tropical	*O. ericinellae* Poppius, 1910 Ex. Ericaceae East Africa	One setal type: erect, long, brown or black, hairlike simple setae	LP: L-shaped, sicklelike; sensory lobe rounded; apophysis elongate, tapering; apex weakly recurved RP: club-shaped with prominent beak shaped process at apex; small distal serrations	No endosomal spicules	Unknown
Kiiorthotylus Yasunaga, 1993 (Yasunaga, 1999)	Palearctic	*O. gotchi* Yasunaga, 1993 Ex. Ericaceae Japan	One setal type: semierect, pale brown, hairlike simple setae	LP: club-shaped, or modified L-shape; sensory lobe not expanded, with small dorsal lobe; apophysis short; strong recurved subapical hook RP: elongate ovate to subrectangular, flattened, serrate along long distal margin	Two elongate endosomal spicules PES (Ventral/left spicule): narrow, broader at base, sheathing SG, trifurcate with two branches divided apically, mostly smooth, weakly serrate apically DES (Dorsal/right spicule): slender, small, with submedial branch or process, very weakly serrate apically, without basal branch or obvious keel	Bilobed
Litocoris Fieber, 1860 (Wagner, 1973)	Palearctic	*O. ericetorum* (Fallen, 1807) Europe Ex. Ericaceae See Wagner, 1973: fig. 513	One setal type: semierect, dark, hairlike simple setae Sometimes pale on head	LP: L-shaped; sensory lobe weakly to moderately expanded, rounded, partly serrate; apophysis short, strongly curved; apex acuminate, weakly hooked RP: triangular or hammer shaped, with serrations on dorsal margin	Two elongate endosomal spicules PES: moderately broad, trifurcate distally, branches splayed with antler-like, margins DES: moderately broad, bifurcate in distal half, margins serrate, subequal in length to PES, with short basal branch, distally serrate, small basal keel	Bilobed

TABLE 4
(*Continued*)

Subgenus (other references)	Bioregion	Type species	Dorsal vestiture	Parameres	Structure of endosomal spicules	Interramal lobes
Melanotrichus Reuter, 1875 (Southwood, 1953) (Wagner, 1973) (Linnavuori, 1994) (Yasunaga, 1999) (Knight, 1968) (Yasunaga and Duwal, 2017)	Palearctic Afrotropical Nearctic	*O. flavosparsus* (Sahlberg, 1842) Ex. Chenopodiaceae Europe	Two setal types: (1) semierect, pale, brown or black hairlike simple setae; (2) white, adpressed scalelike setae Species with black scalelike setae (Knight, 1927; 1968) not congeneric with type based on genitalia (see Kelton, 1979a	LP: L-shaped; sensory lobe strongly expanded, often with serrations or fingerlike process; apophysis short or moderately long, tapering, arcuate; apex acuminate; prominent setae on sensory lobe and apophysis RP: club-shaped, weakly constricted preapically, often with pointed apical projection or spines, prominent setae distally	Two elongate strongly sclerotized spicules PES and DES: slender, unbranched, margins smooth, subequal in length DES without keel See Southwood (1953) and Wagner (1973)	Small, simple, round, unilobed
Orthotylus Fieber, 1858 (Southwood, 1953) (Wagner, 1973) (Yasunaga, 1999) (Linnavuori: 1975, 1994: African species not congeneric with this type)	Palearctic	*O. marginalis* Reuter, 1883 (see figs. 7, 8, 10) Ex. Salicaceae, Ulmaceae Europe	One setal type: long, semierect, pale hairlike simple setae	LP: L-shaped; sensory lobe strongly expanded, elongate, with hairlike setae apically; apophysis 45° to sensory lobe, narrow; small apical hook (figs. 8A & B) RP: C-shaped; dorsal margin sometimes expanded subdistally or medially; with few serrations; apex arcuate (figs. 7, 8B) Parameres large, projecting posteriorly beyond genital opening (figs. 8A & B). See Wagner (1973: fig. 477)	Two elongate, curved spicules, often strongly serrate (e.g., *O. marginalis*, figs. 7, 8C–E) PES: moderately slender, sheathing SG at base, left lateral to SG, often bifurcate distally, branches splayed and densely serrate DES: broad, dorsal to SG, often distally bifurcate, branches slender, margins serrate, with a basal branch (dorsal portion), moderately elongate and bifurcate, keel off basal branch, basal branch ca. 2/3rd length of ventral portion of DES; subequal in length to PES See Wagner (1973: fig. 478) and Southwood (1953: figs. 103, 107, 110)	Bilobed, or with divided apex (fig. 10C) Interramal sclerites divided (fig. 10C)

TABLE 4
(*Continued*)

Subgenus (other references)	Bioregion	Type species	Dorsal vestiture	Parameres	Structure of endosomal spicules	Interramal lobes
Neopachylops Wagner, 1956 (Wagner, 1973)	Palearctic Europe	*O. concolor* (Kirschbaum, 1856) Ex. Fabaceae Europe	Two setal types: (1) semierect, black (mostly) hairlike simple setae; (2) silvery white, adpressed scalelike setae	LP: L-shaped; sensory lobe expanded, rounded, curved towards apophysis; apophysis long, tapered, curved, ca. 90° to sensory lobe, apex acuminate RP: subrectangular, divided apically See Wagner (1973: fig. 493)	Two short endosomal spicules, margins serrate, subequal in length	Small, unilobed, apically acuminate
Parapachylops Ehanno and Matocq, 1990 See Ehanno and Matocq (1990: figs. 8–14).	Palearctic Europe	*O. armoricanus* Ehanno and Matocq, 1990 Host unknown Europe	One setal type: semierect, brown or dark brown, hairlike simple setae	LP: L-shaped; sensory lobe weakly expanded; short, rounded apophysis, moderately broad; strongly recurved subapical hook RP: club-shaped, weakly serrate distally, medial process on ventral surface Robust setae on both parameres	Two elongate endosomal spicules PES: moderate width at base, apically very divided, margins serrate DES: moderate width at base, apically very divided, margins serrate, with basal keel; possibly bifurcate closer to base but without basal branch	Bilobed, plus separate basal lobe
Pinocapsis Southwood, 1953 See Wagner (1973: fig. 472).	Palearctic Europe	*O. fuscescens* (Kirschbaum, 1856) Ex. Pinaceae Europe	Two setal type: (1) erect, brown or yellowish hairlike simple setae; (2) white adpressed fine simple setae (not scalelike)	LP: T-shaped, two distal arms, small subbasal lobe on dorsal margin, with few serrations RP: C- or T-shaped, expanded medially, with one or two spines, apex spiniferous or serrate	Two elongate strongly sclerotized endosomal spicules PES and DES: slender, unbranched, margins smooth, subequal in length DES without keel	Bilobed
Pseudorthotylus Poppius, 1914 (synonym: *Neomecomma* Southwood, 1953) (Wagner, 1973)	Palearctic, Afrotropical North America?	*O. bilineatus* (Fallen, 1807) Ex. Salicaceae (*Populus*) Europe	One setal type: semierect, pale, hairlike simple setae	LP: reverse C-shape (modified L-shape); small, rounded sensory lobe; apophysis elongate, arcuate to angulate, uniformly narrow, apex broad RP: club shaped, curved apically, with small subapical acuminate process	Two endosomal spicules, simple, unbranched PES: elongate, broad with medial wedge-shaped knob, before tapering to acuminate apex DES: short, slender, apex acuminate See Wagner (1973: fig 473)	Small, unilobed, triangular, slender, pointed apically

Subgenus (other references)	Bioregion	Type species	Dorsal vestiture	Parameres	Structure of endosomal spicules	Interramal lobes
Yamatorthotylus Yasunaga 1999 See Yasunaga (1999: figs. 54–57)	Palearctic	*O. xanthopoda* Yasunaga, 1999 Ex.Hydrangeaceae (*Deutzia*), Oleaceae (*Fraxinus*) Japan	One setal type: semierect, brown, hairlike simple setae	LP: L-shaped; sensory lobe strongly expanded, subquadrate, with two acuminate processes; apophysis short, tapering, apex acuminate, weakly curved RP: modified club-shaped, with elongate dorsomedial process; weakly curved, apex with prominent spine	Two elongate endosomal spicules PES: bifurcate DES: bifurcate, with basal keel, apices unexpanded with serrate margins	Unilobed, elongate, slender, apically acuminate, widely separated IRS divided

These examples above illustrate the primary importance of examining the male genitalia from gross (e.g., number of spicules) to fine (e.g., position, presence of serrations) detail, in the defining of genera. As a result, we have demonstrated that the fine details of the endosomal spicules are informative at the genus level for Australian orthotylines, extending the original observations of Southwood (1953) and Kelton (1959) for the Orthotylinae. Further, genus groups can be supported by other male genitalic characters and female genitalic characters, as well as nongenitalic characters, following on from Schwartz (2011).

Placement of the callitroid-inhabiting Orthotylini within the tribe: The callitroid-inhabiting Orthotylini genera described in this work differ from the type species of *Orthotylus* and allied taxa in the following characters: (1) the number, structure, arrangement, and degree of basal fusion of the endosomal spicules; (2) shape, orientation, and sclerotization of the phallotheca; (3) the structure and arrangement of tergal processes on the dorsal margin of the genital opening of the pygophore; and (4) paramere shape and position.

Close to Australia, the New Zealand genus *Tridiplous* Eyles possesses characters displayed in the callitroid-inhabiting taxa herein and Australian Orthotylini generally, such as a spinelike tergal process, a hooked left paramere with an expanded sensory lobe and three branched endosomal spicules in the males; and asymmetrical sclerotized structure around the vestibulum opening (Eyles, 2005). *Tridiplous* may be related to the callitroid-inhabiting Orthotylini based on such characters, however, the homology of the spicules in particular would need to be established. These taxa should be considered in relation to the Australian Orthotylini more broadly.

Four of the callitroid-inhabiting genera are supported by significant resampling support and at least one nonhomoplasious synapomorphy as well as numerous homoplasious apomorphic characters (fig. 2: nodes 4, 8, 10, 17). *Ngullamiris* is a monotypic genus. The five callitroid-inhabiting genera together do not form a monophyletic group, and three independent lineages are hypothesized. The clade *Blattakeraia* (*Callitricola* + *Erysivena*) has significant symmetric resampling and character support (fig. 2: node 7), whereas *Avititerra* and *Ngullarmiris* are nested elsewhere within our orthotyline analysis.

Increased sampling of Australian orthotylines is needed to confirm their placement within, and sampling more broadly is also required to understand their position relative to the world orthotyline fauna. These results will also need to be tested with the inclusion of molecular data.

TAXONOMY

In order to understand systematically the morphological differences and similarities of these callitroid-inhabiting Orthotylini in comparison with *Orthotylus* sensu stricto and sensu lato, a number of detailed genitalic characters were considered above what has been conventionally and historically described across the *Orthotylus* complex.

Detailed characterization of the male genitalia in particular and the primary importance of the endosomal spicules has enabled us to elucidate, diagnose, and define genera by monophyly, and this approach has been adopted in modern taxonomic studies of the Australian Orthotylini, e.g., *Myrtlemiris*, *Acaciacapsus*, and *Naranjakotta*. It is therefore possible that with these sets of genitalic characters in combination, the Australian callitroid-inhabiting Orthotylini can be differentiated from *Orthotylus* and from other Orthotylini, both in Australia and worldwide, and cogent genera created. The defining genitalic characters for the five callitroid-inhabiting Orthotylini genera described herein have been summarized in table 5 and figure 11 for comparative purposes and to demonstrate the characterization of the structures that define these genera. Also included in figure 11 is another Australian Orthotylini genus *Naranjakotta* for comparison.

KEY TO MALES OF CALLITROID-INHABITING ORTHOTYLINI

As much as possible external characters have been used in the key. Locality and host information may also be used in some cases to correctly identify a species. Where taxa from the same genus overlap in distribution and also occur on the same host, the pygophore and parameres can positively identify a species in most cases. Where external male genitalic characters are very similar, particularly in *Erysivena* and *Callitricola*, dissection of the male and examination of the aedeagus is required to make a positive identification.

1. Forewing membrane without subcuneal clear spot (fig. 12A), coloration uniform; dorsum with or without adpressed scalelike setae intermixed with semierect simple setae......2
– Forewing membrane with subcuneal clear spot (fig. 12B), coloration patchy or rarely uniform; dorsum with simple setae only.........6
2. Dorsum with adpressed scalelike setae and semierect simple setae; body slender, parallel sided (fig. 12); females only slightly shorter, with same body shape as males; pygophore with straight or slightly sinuous ventral margin, parameres large and meeting roughly medially, situated posterior to ventral margin, left paramere L-shaped with expanded sensory lobe, right paramere with expanded mediodorsal margin (figs. 17A–C, 18B–C); phallotheca and aedeagus small, extending externally, but cupped inside parameres and covered by large proctiger (fig. 17A, C); ventral surface of pygophore with simple hairlike setae (fig. 17B) ....*Avititerra*: 3
– Dorsum with semierect simple setae only; body broad, parallel sided (fig. 12); females significantly shorter and more ovate than males; pygophore with convex, cup-shaped ventral margin, parameres small and meeting roughly medially just inside rim of ventral margin, left paramere linear, modified L-shape with unexpanded sensory lobe and short apophysis, right paramere club shaped (figs. 76A–C, 78A–D); phallotheca and aedeagus very small, not extending beyond ventral pygophore margin or capped by proctiger, apex visible (fig. 76A, C); ventral surface of pygophore with short spinelike setae (fig. 76B) ....*Ngullamiris* Pygophore, genital opening small, dorsal margin concave without any tergal processes (fig. 75H); left paramere, sensory lobe

reduced with smooth margin, apex truncate with a large subapical hook (fig. 76B, C); phallotheca with lateral margins reduced, marginally membranous, not enclosing aedeagus (fig. 77E); body midsized, uniformly green, forewing membrane veins green and yellow (fig. 12) (WA)............ ....*N. whadjuk*

3. Dorsum uniformly bright yellowish green, scalelike setae brown or black; cuneus with yellow tip and inner margin; forewing membrane dark gray-brown, veins orange-yellow outer vein, inner vein concolorous with membrane (fig. 12); pygophore dorsal margin concave, without a left tergal process, proctiger membranous (fig. 15A); left paramere, sensory lobe greatly expanded with large spinelike serrations at apex and two large spines subapically, apophysis narrow and abruptly constricted from sensory lobe (fig. 15B); right paramere apex straight (fig. 15) (WA) ....*A. lepidothrix*

– Dorsum uniformly pale green, scalelike setae white, cuneus all green; forewing membrane light brown, veins all yellowish orange (fig. 12); pygophore dorsal margin sinuous, not concave, with a small left lateral spinelike tergal process, sclerotized and spiniferous proctiger (figs. 17A, 18A); left paramere, sensory lobe moderately expanded with small spinelike serrations at apex, apophysis broad and gradually tapering from sensory lobe (fig. 18B); right paramere apex curved inward (fig. 18C) (NSW, SA, QLD, WA) ....*A. xerophila*

4. AI red to red-brown, different to rest of antenna, remainder green to yellowish green (fig. 12); left paramere, apophysis broad, not tapering, flexed anteriorly over ventral margin of pygophore, with broad, rounded apex and weak subapical hook (figs. 21D, 22B, 25A, 26B); pygophore, dorsal margin genital opening without any tergal lobes or processes (figs. 21A, 24H) ....*Blattakeraia*: 5

– AI concolorous with rest of antenna, all green to yellowish green (figs. 13, 14); left paramere, apophysis narrow or tapering, situated along or just inside ventral margin of pygophore (figs. 31A, 64B), occasionally flexed over ventral margin of pygophore (e.g., fig. 52B), with or without a recurved apical hook (figs. 31B, 49B, 50B); pygophore, dorsal margin of genital opening with at least one tergal lobe or process (figs. 30H, 39F, 51H, 57H) 6

5. Left paramere apophysis moderately short, and weakly curved, 45° to base across ventral margin of pygophore, sensory lobe broad and round with a smooth margin (figs. 21B, D, E, 22B) (WA) ....*B. actinostrobi*

– Left paramere apophysis elongate and arcuate, 90° to base across ventral pygophore margin, sensory lobe acuminate with serrate apex (figs. 25A, B, D, 26B) (NSW, WA).....*B. hochuli*

6. Forewing membrane veins green or yellow/orange; cuneus all green to yellowish green (concolorous with rest of wing) (fig. 13); pygophore, dorsal margin of genital opening, mostly weakly concave or straight, with at least a short, serrate, left lateral tergal process (figs. 36A, 39F, 43H) (if absent then with a right tergal lobe (fig. 30H)); left paramere narrow with a broad, round, weakly expanded sensory lobe (fig. 28B); right paramere widest distally, with an apical or subapical flange, not expanded medially (fig. 28C, 47D), situated mostly inside pygophore right ventral to phallotheca and aedeagus (fig. 31B); phallotheca darkly sclerotized and broad apically (fig. 31A, B).......*Callitricola*: 7

– Forewing membrane veins red; cuneus mostly with a red tip (differing from rest of green wing) (fig. 14); pygophore, dorsal margin of genital opening strongly concave and always with an elongate distally serrate, left lateral tergal process (figs. 49A, 51H, 57H, 63H); left paramere with a moderately to greatly expanded and often bulbous sensory lobe (figs. 49B, 50B); right paramere with expanded medial flange/lobe (figs. 49C, 50C, 53C) situated externally and right lateral or dorsal to phallotheca (figs.

51H, 72B), phallotheca moderately to darkly sclerotized tapering to apex, moderately slender (figs. 52A, B, 58A, B) ....*Erysivena*: 19

7. Forewing membrane veins yellow-orange......8
– Forewing membrane veins green, yellow-green..11
8. Medium size (~4 mm); major cell of forewing membrane veins usually without green spot, cuneus short (fig. 13); pygophore, dorsal margin of genital opening with small tergal process just left lateral of midline (fig. 34A); phallotheca, apex round, without a basal lobe on right dorsal margin (fig. 34E); PES bifurcate basally (fig. 34G) (QLD).............. ....*C. finlayae*
– Moderately large size (>4.5 mm); major cell of forewing membrane veins with green spot, cuneus moderate length to elongate (fig. 13); pygophore, dorsal margin of genital opening with or without a small left lateral tergal process (figs. 32A, 36A); phallotheca, apex with a slight to twisted point, with a prominent basal lobe on right dorsal margin (figs. 32E, 36H, 47A); PES bifurcate distally (figs. 32F, 36I), unknown for *C. wollemi*.............9
9. Very large (>5 mm); wing membrane darkened at margins of veins, cuneus greatly elongate (fig. 13); pygophore, dorsal margin of genital opening with short, round, spiniferous left lateral tergal process (fig. 36A) (SA, VIC) ....*C. graciliphila*
– Moderately large (4.5–5 mm), wing membrane not darkened at margins of veins; pygophore, dorsal margin of genital opening without left lateral tergal process (unknown for *C. wollemi*), if so then right paramere with an enlarge dorsal flange and subapical dorsal lobe (fig. 47D)..................................10
10. Right paramere, apical flange small with smooth margin, subapical dorsal margin unexpanded, round, margins not serrate (figs. 31B, 32C) (NSW)..............*C. cordylina*
– Right paramere, apical flange greatly enlarged with very small spinelike serrations on margin, subapical dorsal margin expanded, bulbous, margins serrate (fig. 47D, E) (NSW).... ....*C. wollemi*
11. Pygophore with comblike, serrate tergal process, left lateral along dorsal margin of genital opening (figs. 33A, 38A, 39F, 40A, 41A, 42A) 12
– Pygophore with a small linear or broad round tergal process, left lateral or just left of midline, on dorsal margin of genital opening, tergal process with small spinelike serrations, at least distally (figs. 14A, 35A, 37A, 43H, 44A, 45A) 15
12. Very small (≤3 mm), pale dusty yellow-green, cuneus short, eyes large, bulbous (fig. 13); pygophore, dorsal margin of genital opening flat, without medial lobe (fig. 33A); phallotheca with round but broad and slightly flattened apex, with subapical right lateral tumescence (fig. 33D); right paramere, subapical dorsal margin expanded forming a bulbous, serrate lobe (fig. 33C); aedeagus with PES wrapped partially sheathlike around secondary gonopore, and short submedial process (fig. 33F) (Central Australia, NT) ....*C. finke*
– Moderate size (>3 mm); yellowish green, cuneus moderate length, eyes moderate size; pygophore dorsal margin of genital opening with a medial tumescence (figs. 38A, 39F); phallotheca with round, slightly tapering apex, without subapical right lateral tumescence (fig. 38D, E); right paramere, subapical dorsal margin unexpanded and round with a few small serrations on margin (figs. 38C, 41C, 42C); aedeagus with PES enclosing secondary gonopore, without short submedial process (figs. 38G, 40E, 41F, 42H)............................13
13. Right paramere subovate, apex slightly pointed (fig. 41C); phallotheca, right dorsal margin, without basal lobe; DES1 branches unequal—one very short, smooth branch, one elongate, serrate branch (fig. 41F) (SA). ....*C. silveirae*
– Right paramere ovate, apex round (figs. 38C, 42C); phallotheca, right dorsal margin with basal lobe (figs. 38E, 42F); DES2 branches

subequal, both elongate and serrate (38G, 40C, 42G)..14

14. Phallotheca, right dorsal margin with a small, round basal lobe (fig. 38E); aedeagus, PES tapering to apex in distal half with sparsely serrate margins (figs. 38G, 40D, E); moderately small, males 3.20–3.51 mm (NSW) ....*C. pullabooka*

– Phallotheca, right dorsal margin with very large, broad basal lobe (fig. 42F); aedeagus, PES very fine and threadlike in distal half with smooth margins (fig. 42G, H); male moderately sized, 4.02 mm (WA) ....*C. tatarnici*

15. Pygophore dorsal margin of genital opening with medial tumescence and two, broad, round, lobelike spiniferous tergal processes, positioned left and right lateral (figs. 43H, 44A, 45A); PES enclosing secondary gonopore (figs. 44D, E, 45E) (NSW, QLD) ....*C. wiradjuri*

– Pygophore dorsal margin of genital opening without a medial tumescence and at most one small, linear/round sparsely spiniferous tergal process, positioned just left lateral of midline (figs. 29A, 35A, 37A); PES at most partially wrapped sheathlike around secondary gonopore (figs. 29D, 35E, 37H)....... 16

16. Left paramere apophysis subrectangular, apex truncate with strongly recurved hook (fig. 28B), or without a hook and two small prongs at apex (fig. 37B, C); phallotheca with twisted point at apex, large or doubled subapical ventral tumescence, basal lobe on right dorsal margin (figs. 28D, 37E); PES not wrapped sheathlike, but removed slightly from secondary gonopore (figs. 28F, 37G) 17

– Left paramere apophysis tapering, apex narrow with a small, defined, recurved hook (always hooked) (figs. 29B, 35B); phallotheca with round apex, no basal lobe on right dorsal margin, small subapical ventral tumescence, no basal lobe on right dorsal margin (figs. 29C, 35D); PES wrapped sheathlike around secondary gonopore (figs. 29D, 35E) 18

17. Right paramere, subapical dorsal margin unexpanded, round and sparsely serrate, apex curved inward slightly with small apical ridge (fig. 28C); phallotheca with single large subapical ventral tumescence, left dorsal margin with a large lobe, dorsal opening visible (fig. 28D) (northeastern NSW).......... ....*C. ballina*

– Right paramere, subapical dorsal margin greatly expanded to form a bulbous and serrate lobe, apex not curved, mesial-ventral surface with a large subapical ridge (fig. 37D); phallotheca with doubled subapical ventral tumescence (fig. 37F), left dorsal margin with large lobe covering dorsal opening (fig. 37E) (SA).............*C. parawirra*

18. Cuneus faded yellowish green, color of wing membrane veins diffused onto surrounding membrane (fig. 13); pygophore, left tergal process curved distally serrate or spiniferous (fig. 35A); aedeagus, PES with both branches tapering and distally serrate, DES2 unbranched, DES1 expanded and serrate medially, then constricted and tapering to serrate apex (fig. 35E, F) (SA) ....*C. gammonensis*

– Cuneus faded light green, color of wing membrane veins confined to veins and not diffused onto surrounding membrane (fig. 13); PES with strongly serrate and broad apex and smooth margins on downturned tapering branch, DES2 bifurcate, DES1 not expanded or serrate medially, tapering to serrate apex (fig. 29D) (WA)....*C. boorabbin*

19. Left paramere flexed onto ventral margin of pygophore (fig. 52B)....................................20

– Left paramere situated along ventral pygophore margin (figs. 58B, 64B, 72A) 22

20. Tip of cuneus with or without a red tip, red color confined to with membrane veins (fig. 14); pygophore with sickle-shaped left tergal process with acute posterior end, lobe on right dorsal margin (figs. 51H, 53A); phallotheca with compressed apical crest (figs. 52B, 53F); right paramere with short apex, broad and serrate mediodorsal margin (fig.

53C); left paramere with rounded sensory lobe, tapering apex without a hook (fig. 53B) (SA, VIC, WA) ....*E. drepanomorpha*

– Tip of cuneus dark red, red color extending onto surrounding membrane from wing veins (fig. 14); pygophore with linear left tergal process, short serrate right tergal process (fig. 69A); phallotheca with tapering apex but not compressed (fig. 69D); right paramere with elongate, curved, and greatly expanded apex, small, acutely tapered, and weakly serrate mediodorsal margin and subbasal serrate lobe (not easily visible externally) (fig. 69C); left paramere with slightly angled sensory lobe just basal to apophysis, tapering apex with weak recurved hook (fig. 69B) (NSW, SA)...............................*E. schuhi*

21. Pygophore, genital opening with elongate right ventral lobe (e.g., figs. 72A, B, 73C); left paramere usually subtriangular with greatly expanded sensory lobe (figs. 54B, 72A); cuneus with a red tip; red coloring of wing membrane veins confined to veins, major cell of membrane elongate with major membrane vein straight and parallel to inner margin of cuneus (e.g., *E. emeraldensis, E. sydneyensis*, fig. 14).....................................22

– Pygophore genital opening without elongate right ventral lobe, lobe small and round (e.g., figs. 58B, 59A, 64B, 65A); left paramere subtriangular (fig. 49B, 50B, 64B, 65B) or only moderately rounded on sensory lobe (fig. 58B, 59B); cuneus with or without red tip; red coloring of wing membrane veins often extending at least slightly onto surrounding membrane (e.g., *E. apta*) or confined to veins (e.g., *E. bundjalung*), major cell of membrane moderate length to short and subovate, with vein either straight or slightly rounded and curved in relation to inner cuneal margin (e.g., *E. kalbarri, E. majori*, fig. 14)...26

22. Tip of cuneus with red extending halfway up inner cuneal margin (fig. 14); pygophore, right dorsal margin without any lobes or with at most, a broad lobe along the margin (fig. 54A), with one or two tergal processes (right tergal process very short if present; fig. 54A), elongate right ventral lobe with one or two marginal spines (figs. 54A, 68A); apex of right paramere smooth and unexpanded (fig. 54C, 68C); PES without a medial process (figs. 30E, 68F) 23

– Tip of cuneus only red, at most (fig. 14); pygophore, with acute slender medially projected lobe on far right dorsal margin (fig. 56A, 71H), with two or three tergal processes (if only two, then right tergal process elongate; fig. 70A), elongate right ventral lobe with or without any marginal spines (figs. 56A, 70A, 71H, 72B, 73A); apex of right paramere serrate and somewhat expanded (56C, 70C, 73C); PES medial process (figs. 56F, 70E, 73G)..24

23. Pygophore, left lateral tergal process with straight, sparsely spiniferous apex, with small, serrate tergal process (fig. 54A); left paramere with hooked apex, moderately expanded and angular sensory lobe (fig. 54B); right paramere with short, uncurved apex and square, expanded medial flange (fig. 54C); phallotheca opening large, distal to medial, without medially enclosing membrane (fig. 54D); DES2 unexpanded medially (fig. 54E, F) (northeastern QLD) ....*E. emeraldensis*

– Pygophore, left lateral tergal process with a clavate, densely spiniferous apex, without right tergal process (fig. 68A); left paramere without hooked apex, with strongly expanded subtriangular sensory lobe (fig. 68B); right paramere with curved apex and round, expanded medial flange (fig. 68C); phallotheca opening small, distal only, medially closed with membrane (fig. 68D); DES2 very broad medially (fig. 68F) (northeastern QLD) ....*E. paluma*

24. Pygophore with right lateral spine on elongate right ventral lobe, dorsal margin with two tergal processes, right tergal process elongate (fig. 70A), no medial tergal process; right paramere with strongly

expanded triangular dorsomedial flange with one spine at tip, strongly curved acute apex (fig. 70C); PES with a short medial process, DES2 medially expanded with threadlike medial process (fig. 70E) (SA, VIC) ....*E. schwartzi*

– Pygophore without any spines on elongate right ventral lobe, dorsal margin with short right tergal process and a medial tergal process (figs. 56A, 71H, 73A); right paramere with weakly expanded dorsomedial margin with a few spines at apex, weakly curved rounded apex (figs. 56C, 73C, D); PES with an elongate medial process, DES2 unexpanded medially (figs. 56F, 72E, 73G) 25

25. Pygophore, right lateral and medial tergal processes shorter than left lateral tergal process (fig. 56A); right paramere with an expanded fanlike apex and clump of spines on lateral subapical margin (fig. 56C); DES2 without submedial threadlike process; DES1 with deeply bisected apex (fig. 56E, F) (NSW) ....*E. endlicheriphila*

– Pygophore, all three tergal processes subequal in length (figs. 71H, 73A); right paramere with unexpanded, round serrate apex, without clump of spines on lateral subapical margin (figs. 71H, 72B, 73C, D); DES2 with submedial threadlike process, DES1 with shallow bisected apex (fig. 72C, D, 73G) (NSW) ....*E. sydneyensis*

26. Cuneus without red tip (fig. 14); pygophore with broad sickle-shaped left tergal process, more subrectangular with posterior edge round, no right tergal process (fig. 67A); moderately expanded and acute sensory lobe on left paramere (fig. 67C) (WA) ....*E. notodytika*

– Cuneus with a red tip (rarely without); pygophore with a linear left tergal process, and a right tergal process (figs. 49A, 50A, 59A); moderately or strongly expanded and acute sensory lobe on left paramere (figs. 50B, 62B), if only moderately expanded then without a recurved apical hook (figs. 49B, 59B) 27

27. Tip of cuneus green red, or at most with a hint of red at very tip (fig. 14); head strongly expanded anteriorly and eyes only moderately sized (figs. 14, 57A, B); pygophore with narrow, elongate left and right tergal processes (figs. 57H, 59A), left tergal process situated flat projected posteriorly (fig. 58A); left paramere only moderately expanded medially with sensory lobe broad and round (figs. 58B, 59B); right paramere with curved apex and triangular medial flange (fig. 59C); PES strongly constricted above base, with small subbasal processes, very narrow an smooth apical margins (figs. 58C, 59E) (WA) ....*E. kalbarri*

– Tip of cuneus obviously red; head either strongly expanded anteriorly and eyes only moderately sized (e.g., *E. apta*, fig. 14, similar to *E. kalbarri*) or head weakly expanded anteriorly and eyes large (e.g., *E. mareeba*, figs. 14, 63A, B); pygophore with broad bases on left and right tergal processes (figs. 49A, 50A, 62A, 63H, 65A, 66A); left tergal process bifid (fig. 49A) or unbranched (fig. 50A), situated laterally and projects ventrally (fig. 64A); left paramere moderately or strongly expanded medially (figs. 49B, 50B); right paramere C-shaped or hammer shaped (figs. 49C, 50C), without a strongly expanded medial flange; PES at most only moderately constricted above base, with or without a submedial process (figs. 49E, 50E) 28

28. Cuneus with prominent red tip, red of membrane veins diffusing onto surrounding membrane, eyes midsize, only weakly exerted from outline of head and not extending past anterior pronotal margins (fig. 14); pygophore with left tergal process forked at base (fig. 49A); left paramere subtriangular with straight apophysis and apex (fig. 49B), right paramere C-shaped (fig. 49C); PES weakly constricted and tapering to apex above base, no medial or subbasal processes (fig. 49E, F) (NSW) ....*E. apta*

– Cuneus with red tip, red of veins not diffusing onto surrounding wing membrane, eyes large, extending well beyond anterior pronotal margins, head weakly expanded anteriorly (figs. 14, 63A–D); left paramere strongly expanded medially, subtriangular shape, apex hooked, sensory lobe sometimes bulbous with strong dark bristlelike setae (figs. 50B, 62B, 64B, 65B, 66B); right paramere hammer shaped with expanded, dorsally projected subapical lobe (figs. 50C, 62C, 63H, 65C, 66C); phallotheca dorsal opening small—closed medially (figs. 50D, 62D, 65D, 66D); PES tapering from base to apex, with a medial process (figs. 50F, 62E, 64D, 65) 29

29. Right paramere, subapical dorsal lobe longer than apex (fig. 66C); pygophore with right lateral tergal process much longer than left lateral tergal process (fig. 66A) (northeastern QLD) ....*E. molloy*

– Right paramere, subapical dorsal lobe shorter than apex (figs. 50C, 62C, 65C); pygophore with right and left lateral tergal process subequal in length (figs. 50A, 62A, 63H, 65A)..30

30. Right paramere, subapical dorsal lobe only weakly expanded, with a ridge from subapical lobe to tip of apex (fig. 65C); pygophore, right tergal process with lateral basal lobe (fig. 65A); PES with a short medial process, tapering curved apex (figs. 64C, D, 65E) (northeastern QLD) ....*E. mareeba*

– Right paramere, subapical dorsal lobe moderately expanded, flattened from subapical lobe to tip of apex (figs. 50C, 62C); pygophore, right tergal process with a lobe posterior to the base (figs. 50A, 62A); PES with a threadlike or elongate medial process, apex with a serrate flange (figs. 50E, F, 62E) 31

31. Left paramere with broad sensory lobe, with margin continuous (fig. 62B); PES with a straight apex and elongate medial process, DES2 with medial margin serrations extending to well below bifurcation point (fig. 62E); moderate size, 3.20–3.56 mm (NSW, QLD) ....*E. majori*

– Left paramere with constricted bulbous sensory lobe (fig. 50B); PES with bent apex and short, threadlike medial process, DES1 with serrate medial margin only just below bifurcation point (fig. 50E, F); small size, 2.84–3.08 mm (northeastern NSW) ....
....*E. bundjalung*

GENUS AND SPECIES DESCRIPTIONS

Avititerra, new genus

Type species: *Avititerra lepidothrix*, n. sp., by original designation.

Diagnosis: Defined by the following characters: moderately small, body narrow, elongate (fig. 12); eyes medium to large; labium short, extending only to mesocoxae; dorsum with moderately dense distribution of pale to medium-brown simple setae intermixed with scalelike setae; dorsum bright yellow-green or bright pale green, cuneus entirely concolorous with rest of hemelytra or with yellow inner margin and tip; forewing membrane uniformly light or dark gray-brown, without subcuneal clear spot (fig. 12A), veins orange or yellow, or partly concolorous with membrane, with color confined to vein (fig. 12); pygophore subquadrate, genital opening moderately large, round, dorsal margin weakly to moderately concave, sometimes with very small spinelike left lateral tergal process (fig. 17A–C); parameres both extend externally well beyond genital opening, meeting medially and enclosing phallotheca and aedeagus (fig. 17A–C); left paramere L-shaped, with large, bulbous, and serrate sensory lobe, apophysis elongate, broad, apex truncate and round with small, recurved hook (figs. 15B, C, 18B); right paramere C-shaped, apex moderately elongate, round, with expanded submedial dorsal lobe, apex and dorsal lobe with small spinelike serrations (figs. 15D, 18C); phallotheca simple, lightly sclerotized, lateral/dorsal margins reduced (figs. 15E, 18E); aedeagus with three elongate sclerotized spicules; PES left lateral to secondary gonopore and base tubular and

TABLE 5

Generic Overview of Male Genitalic Characters of the Callitroid-inhabiting Orthotylini[1]

Diagnostic character	*Avititerra*	*Blattakeraia*	*Callitricola*	*Erysivena*	*Ngullamiris*	*Naranjakotta* (outgroup)
Pygophore						
Dorsal margin shape	Moderately concave	Moderately concave	Weakly concave to straight	Strongly concave	Strongly concave	Straight
Phalloguide	Without ventral lobe	Small right ventral lobe, serrate	Small right ventral lobe, serrate	Small or elongate right ventral lobe, smooth	Without right ventral lobe	Without right ventral lobe
Ventral margin shape	Straight	Weakly sinuate	Sinuate	Sinuate	Convex, cup-shaped	Straight
Ventral vestiture	Without spinelike setae	Without spinelike setae	Spinelike setae at genital opening	Spinelike setae at genital opening	Spinelike setae	Without spinelike setae
Endosomal spicule no.	3	3	3	3	3	3
PES						
Position to SG	Left lateral	Dorsal	Ventral or left ventrolateral	Ventral	Left dorsolateral	Left dorsal
Association with SG	Not sheathing	Sheathing	Sheathing or removed	Sheathing	Partially sheathing	Not sheathing
Basal origin	At apex of SG	At base of SG	At base of SG, or slightly distal to SG	At base of SG or slightly distal to SG	At base of SG	At base of SG
Structure	Bifurcate distally	Bifurcate distally	Bifurcate distally	Unbranched	Unbranched	Unbranched
Substructure	Left branch extending distally, narrow, smooth Right branch curving arcuate basally, smooth or serrate Without other processes	Left branch downturned or to at least perpendicular Right branch extended distally Submedial ventral process (or branch), ventrally positioned, extended distally	Left branch curved basally, serrate Right branch extended distally, serrate Distally serrate (both branches) Without other processes	Tapering apically, often acutely, smooth or serrate distal margins Submedial process sometimes present, directed perpendicular or basally directed Sometimes connected by membrane to DES2, right laterally	Tapering apically, to an acute point, downturned, smooth Without other processes	Curved whiplike apex, constricted, with subapical serrate flange Basal straplike process and basal lobe (aside from one species)
DES2						
Position to SG	Right dorsolateral	Dorsal	Left lateral to left dorsolateral	Dorsal to left dorsolateral	Right dorsal	Right dorsal
Basal origin	At base of SG	At midpoint of SG	At base of SG	At base or slightly distal to base of SG	At base or slightly distal to base of SG	At apex of SG
Basal shape	Broad	Broad	Straight, tubular	Narrow, tapering	Broad	Broad, sinuate

TABLE 5
(*Continued*)

Diagnostic character	*Avititerra*	*Blattakeraia*	*Callitricola*	*Erysivena*	*Ngullamiris*	*Naranjakotta* (outgroup)
Substructure	Unbranched Apex divided, downturned Distally, weakly serrate Length subequal to PES	Unbranched Apex, extending distally, narrow Distally smooth Length subequal to PES	Unbranched or bifurcate Branches extended distally Distally serrate or smooth Length subequal to PES	Unbranched or bifurcate Left branch curved basally when bifurcate Medially and distally serrate Length subequal to PES	Bifurcate distally Constricted before apex, branches downturned Subdistally and distally serrate Length subequal to PES	Bifurcate Left branch extending distally, apex slightly downturned, narrow Right branch extending right lateral Distally serrate or smooth Length subequal to PES
DES1						
Position	Dorsal to DES2	Dorsal to DES2	Left lateral or left dorsolateral to DES2	Dorsal or left dorsolateral to DES2	Dorsal to DES2	Dorsal to DES2
Basal position	Adjacent to DES2	Adjacent to DES2	Adjacent to DES2	Adjacent to DES2	Just distal to base of DES2	Adjacent to DES2
Substructure	Unbranched or bifurcate Short keel Serrate or smooth Slightly shorter than DES2 & PES	Bifurcate distally Keel Weakly serrate Subequal to DES2 & PES	Unbranched Keel separated by membrane, sitting dorsad of DES1 Serrate Subequal to DES2 & PES	Unbranched (rarely complex and bifurcate) Keel separated by membrane, sitting dorsad of DES2 Serrate or smooth Subequal to DES2 & PES	Bifurcate Short keel Serrate or smooth Shorter than DES2 & PES	Unbranched or bifurcate Without keel Serrate or smooth Shorter than PES & DES2
Phallotheca						
Position at rest	Everted beyond genital opening; hidden by parameres and proctiger	Extended beyond genital opening, visible	Extended beyond genital opening, visible	Everted, extending or not extending beyond parameres, cupped by LP, visible	Not everted, visible in dorsal view	Everted beyond genital opening, not extending beyond parameres, visible
Sclerotization	Light	Light	Dark	Moderately dark to dark	Light	Light
Margins	Reduced, slender	Enclosing	Enclosing	Enclosing	Reduced, symmetrical, membranous	Reduced, asymmetrical, membranous
Substructure	Without sculpturing	Without sculpturing	Sculpted, with savt, rbt and rdml; some with llt and rlt	Sculpted, with savt or apical ventral crest	Without sculpturing	Slightly sculpted, with rbt
Apex shape	Rounded	Rounded	Rounded or twisted point	Rounded	Rounded	Excavated

TABLE 5
(*Continued*)

Diagnostic character	*Avititerra*	*Blattakeraia*	*Callitricola*	*Erysivena*	*Ngullamiris*	*Naranjakotta* (outgroup)
Parameres						
Position at rest	Subcontiguous medially, cupping phallotheca LP positioned on ventral margin of genital opening, extended almost to RP insertion point RP sits external, right lateral to phallotheca	Overlapping right laterally, not cupping phallotheca LP positioned on ventral margin of genital opening, extended anteriorly onto venter RP sits mostly within pygophore, on ventral lobe of phalloguide	Overlapping right laterally, not cupping phallotheca LP positioned on ventral margin of genital opening and extended to RP insertion point RP sits mostly within pygophore on ventral lobe of phalloguide	Overlapping medially, not cupping phallotheca LP positioned on ventral margin of genital opening, extended to RP insertion point, rarely extended anteriorly onto venter RP sits external, either lateral or dorsal to phallotheca	Overlapping medially, cupping phallotheca LP slightly removed from ventral margin of genital opening, extended to midline RP sits external, right lateral to phallotheca	Subcontiguous medially, cupping phallotheca LP projected posteriorly, slightly removed from ventral margin of genital opening, extended almost to RP insertion point RP sites external, right lateral to phallotheca
Left paramere						
Overall shape	L-shaped	L-shaped	L-shaped	L-shaped	Modified L-shape	L-shaped
Shape of sl	Expanded, with spines	Expanded, with spines	Not expanded, smooth	Expanded moderate to strongly, smooth	Unexpanded, with few spines	Expanded, with spines
Apical shape	ap 90° to sl, broad, small curved hook	ap <45° to sl, broad, weak inset hook	ap <45° to sl, smooth, arc ap tapering, elongate, small recurved hook	ap < 90° to sl, ap tapering, short or elongate, small recurved or weakly curved hook	ap in line with sl, uniformly broad, large recurved subapical hook	ap 90° to sl, narrow or tapering, weakly hooked
Right paramere						
Overall shape	C-shaped	Club shaped	Club shaped, subquadrate	Modified C-shape	Club shaped	Modified C-shape
Medial shape	Expanded, serrate	Not expanded, smooth	Not expanded, smooth	Expanded, serrate, rarely smooth	Not expanded, smooth	Expanded either medially or distally
Distal shape	Not expanded, slightly bulbous, serrate	Expanded, serrate or smooth	Expanded, serrate	Expanded, serrate, rarely smooth	Expanded, serrate	Distally or medially serrate, or both

[1] Character states are given for the majority of cases within the genus, as there are exceptions. However, PES states given are defining and inclusive of all taxa within the genus. See appendix 1 for abbreviations.

distal to that of DES2 and DES1, bifurcate, ventral branch curved and serrate, dorsal branch with smooth margins (figs. 11, 17D, F); DES2 wrapped sheathlike partially around secondary gonopore and dorsad to secondary gonopore, unbranched or branched and only weakly serrate at most (figs. 11, 17E); DES1 unbranched or bifurcate with short basal keel (figs. 11, 17E); DES2 and DES1 closely associated and flattened basally (fig. 17E), right dorsolateral to secondary gonopore (fig. 11); vestibulum of female light to moderately sclerotized (fig. 19B); ventral labiate plate spiniferous, without spiniferous lateral lobes (fig. 19A); spiniferous mediolateral lobes on posterolateral walls of dorsal labiate plate, proximate to gonapophyses 8 (fig. 19A); interramal sclerites not fully divided, with U-shaped junction and inner margins ridged and heavily sclerotized (fig. 19C); one pair of elongate interramal lobes, medially divided, with one or two basal lobes (fig. 19C).

Description: *Male*: Macropterous, small size, body narrowly elongate, lateral margins parallel, curved ventrally (fig. 12); body length 3.03–3.83 mm. COLORATION: Dorsum, overall yellowish green to bright pale green; head, antennae, pronotum, mesoscutum, and scutellum sometimes faded to yellow; antennae sometimes darkening apically; cuneus sometimes with inner margin and tip yellow; forewing membrane translucent, uniform light brown to dark gray, without subcuneal clear spot (fig. 12A); forewing membrane veins yellow or orange, with color confined to vein, major vein sometimes concolorous with membrane; venter faded yellowish green; legs mostly faded to yellow, tarsi darkened (fig. 12). SURFACE AND VESTITURE: Dorsum smooth, weakly polished; mixed vestiture (fig. 16A, C) with moderately dense distribution of pale to medium-brown, semierect simple setae; dorsum also with shorter, white or brown, adpressed, scalelike setae; antennae with dense distribution of short, pale simple setae, AI also with more elongate, bristlelike setae (approx. 5), pale in color; legs with pale simple setae; hind tibiae with several rows of minute dark spinulae; tibial spines pale; pygophore ventral surface proximal to genital opening, without short, spinelike setae (fig. 17B). STRUCTURE: **Head:** Subovate in lateral view (fig. 16D), strongly expanded anteriorly, frons moderately protruding beyond anterior margin of eyes (fig. 16A); mandibular and maxillary plates, and clypeus large (fig. 16B, D); maxillary plate elongate, subquadrate, anterodorsal margin squared and aligned with anterior margin of mandibular plate; clypeus prominent, round to subtriangular in dorsal view (fig. 16A), dorsal edge squared in lateral view (fig. 16D); vertex flat (fig. 16A); eyes medium to large size, two-thirds to three-quarters height of head (fig. 16D), extending beyond anterolateral angle of pronotum (figs. 12, 16C); labium moderately short, extending only to anterior margins of mesocoxae. **Antennae:** Elongate, insertion just dorsad to ventral margin of eye, very slightly removed from anterior margin of eye (fig. 16D); AI short, subequal to vertex width, slightly wider than remaining segments; AII moderate length ca. 1.2× pronotum width; AIII moderate length, less than 2× length of AIV; AIV subequal or slightly long to AI; AIII and AIV slightly thinner than AII. **Pronotum:** Trapezoidal; anterior margin weakly concave to straight; collar reduced to thin lip; callosite region obsolete; lateral margins straight, moderately to strongly angled 30° to 45° to midline; humeral angles round; posterior margin weakly convex to straight (figs. 12, 16C). **Mesoscutum and scutellum:** Slightly raised, mesoscutum narrow, at most one-third length of scutellum, sometimes partially hidden under pronotum. **Metathorax:** Metathoracic spiracle slitlike, more subovate ventrally, with evaporative area spanning anterior margin (fig. 16E); metathoracic scent gland with ostiole subovate, peritreme narrow, relatively small, evaporative area with elongate evaporative bodies (fig. 16E, F). **Hemelytra:** Elongate, abdomen extending only to cuneal fracture; lateral margins parallel and sometimes slightly curved ventrally; cuneus moderately elongate; forewing membrane major cell elongate and narrow, longitudinal vein straight, parallel to inner margin of cuneus (fig. 12). **Legs:** Elongate, femora slightly flattened, hind femur slender. GENITALIA: **Pygophore:** Subquadrate, genital opening large, round (figs. 15A, 17C, 18A); dorsal margin weakly to moderately concave, margin round or rather sinuous, with or without one small spinelike left lateral tergal process; ventral margin of genital opening straight (fig. 17B); phalloguide round and extending just beyond ventral margin of opening (fig. 15A), with or without slightly sclerotized lobe on right lateral margin ventrad to right paramere articulation; left paramere situated just inside ventral margin of pygophore, right paramere mostly visible with only base hidden within pygophore (fig. 17B); phallotheca and aedeagus not visibly protruding beyond genital opening of pygophore, surrounded by parameres and covered with membranous or sclerotized and spiniferous proctiger (fig. 17A–C). **Left paramere:** L-shaped; strongly expanded medially, sensory lobe prominent, greatly expanded and bulbous, with few spinelike serrations on outer margin; apophysis moderately elongate, broad, uniform width or narrowing slightly toward apex, ca. 90° to rest of paramere; apex truncate, round with small, curved hook; simple setae present on outer surface (figs. 15B, C, 18B). **Right paramere:** C-shaped; apex round, sometimes curved inward, forming moderately elongate and sometimes bulbous lobe, with few spinelike serrations on mesiolateral surface; subapical to medial dorsal margin expanded, forming small or more bulbous round lobe, projected dorsally, with few small spinelike serrations on inner surface; mesiolateral surface not excavated; simple setae present on outer lateral surface (figs. 15D, 18C). **Phallotheca:** Simple; lightly sclerotized, golden color; opening large, distal to medial; apex round; lateral dorsal margins reduced, appearing more like a shallow trough (figs. 15E, 18E). **Aedeagus:** Secondary gonopore elongate, cylindrical, membranous, and faint; three elongate sclerotized endosomal spicules; spicule arrangement (fig. 11): PES left lateral to secondary gonopore, DES2 dorsal to right dorsolateral of secondary gonopore, wrapped sheathlike around dorsal half of secondary gonopore, DES1 right dorsolateral to DES2 with base flattened and adjacent to DES2, PES originates near apex of secondary gonopore, base of DES2 and DES1 originating adjacent to base of secondary gonopore; base of DES2 and DES1 flattened, base of PES narrow and tubular; spicules subequal in length; PES bifurcate medially (fig. 18F) or in distal third (fig. 15F), branches subequal in length and tapering to narrow pointed apex, ventral branch with apex curved downward and margins serrate subapically only (fig. 15F) or fully to apex (fig. 18F, G), dorsal branch with margins smooth (figs. 15F, 18F) and sometimes with couple of threadlike processes subapically (figs. 17F, 18F); DES2 curved downward apically (figs. 15F, 17D–F, 18G) unbranched (fig. 15F) or bifurcate (figs. 17D–F, 18F–G) with sparsely serrate margins; DES1 unbranched (fig. 15F) or bifurcate (fig. 18F), sometimes with short medial processes (fig. 15F), with short basal keel (DESk) (figs. 15F, 18F–G).

Female: Only slight sexual dimorphism. As in male except eyes slightly smaller, vertex wider, and hemelytra slightly shorter; only very marginally smaller than male, body length 2.93–3.77 mm. GENITALIA: Vestibulum moderately sclerotized (fig. 19B); ventral labiate plate sclerotized, mesial surface spiniferous, without spiniferous lateral lobes (fig. 19A); dorsal labiate plate with pair of moderately sized mediolateral lobes adjacent to base of rami of gonapophyses 8 (fig. 19A); sclerotized rings moderately sized, narrow, subovate, anteriorly pointed with lightly spiniferous surface, posteriorly broader (fig. 19A, B); posterior wall lightly sclerotized; medial region of posterior wall reduced; interramal sclerites (IRS), not fully divided, with U-shaped junction and heavily sclerotized, ridged inner margins, forming posterior margin of posterior wall, posterior margin slightly convex (fig. 19C), IRS with one pair of interramal lobes (IRL) (fig. 19C); IRL

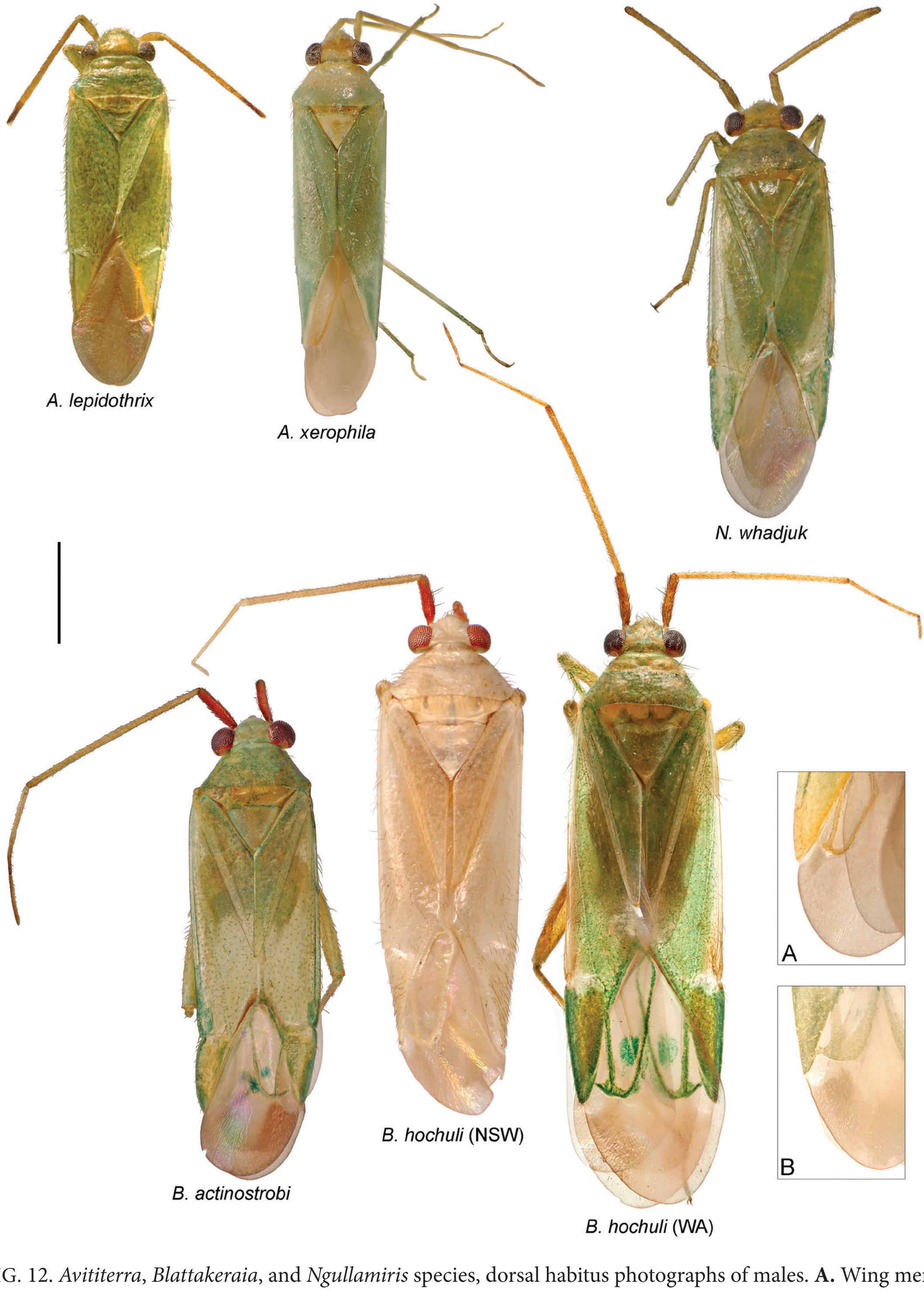


FIG. 12. *Avititerra*, *Blattakeraia*, and *Ngullamiris* species, dorsal habitus photographs of males. **A.** Wing membrane without subcuneal clear spot. **B.** Wing membrane with subcuneal clear spot. Scale bar = 1 mm.

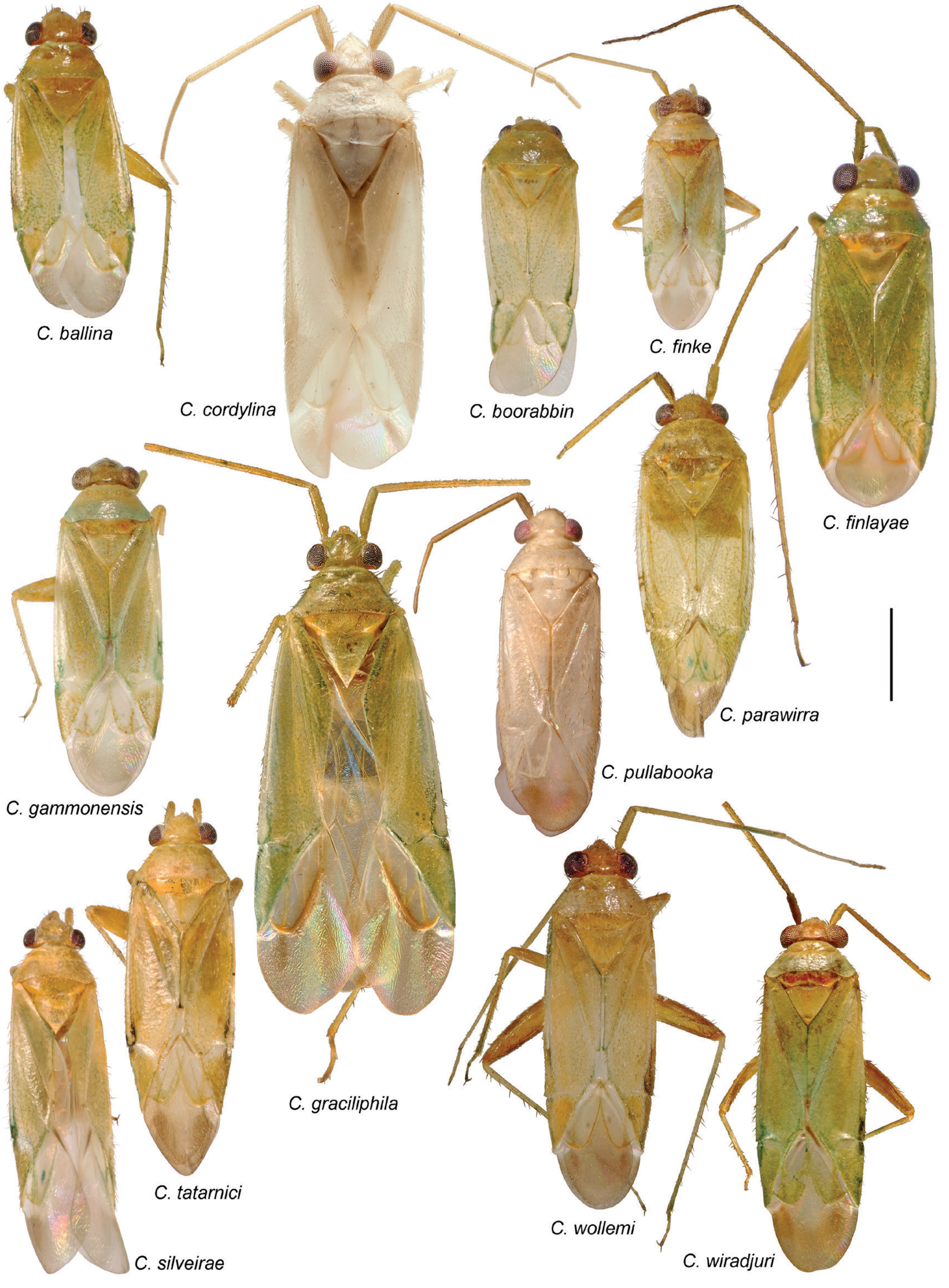


FIG. 13. *Callitricola* species, dorsal habitus photographs of males. Scale bar = 1 mm.

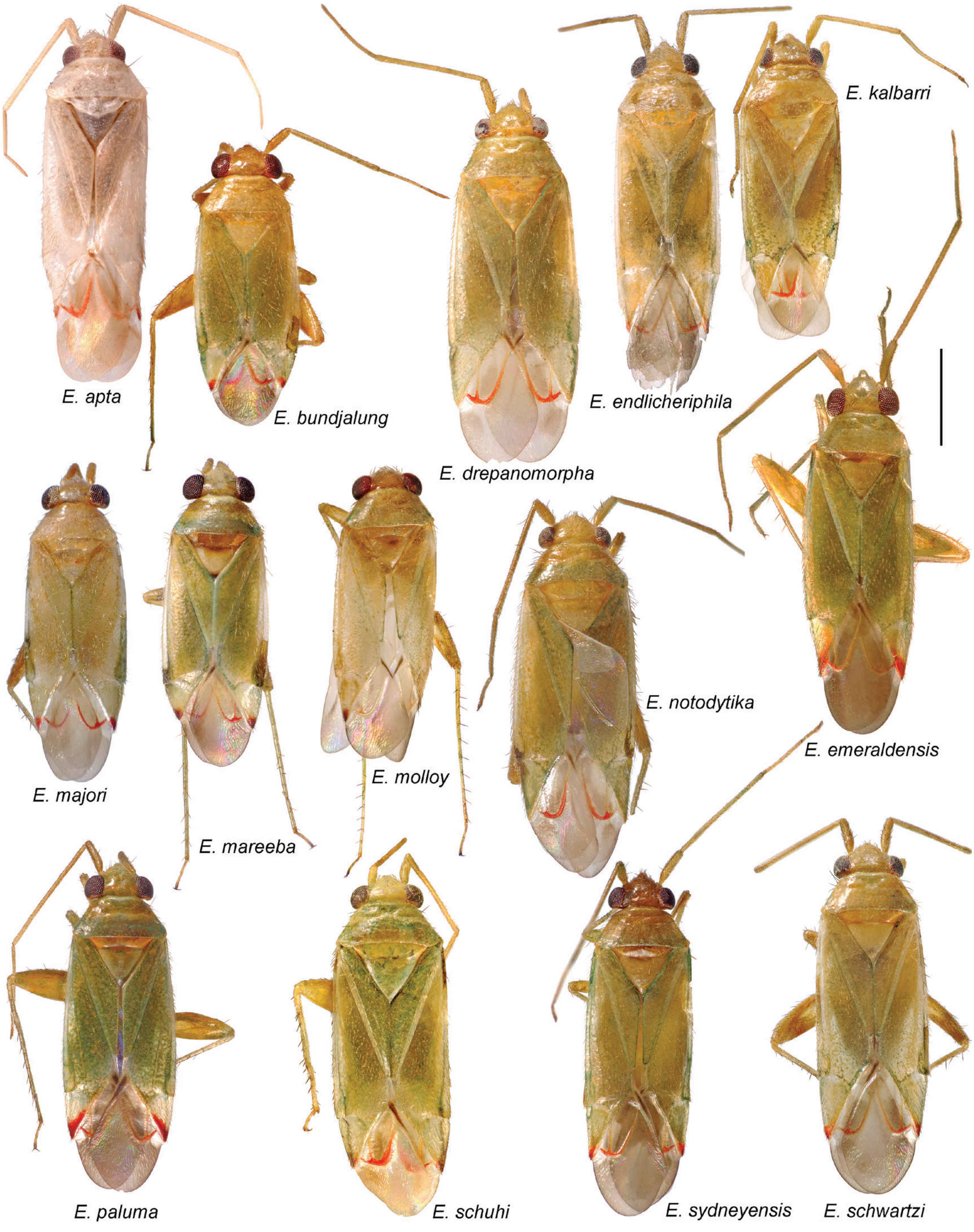


FIG. 14. *Erysivena* species, dorsal habitus photographs of males. Scale bar = 1 mm.

bisected medially, outer branch of moderate length, inner branch either more elongate or shorter than outer branch, margins and surface of IRL covered with minute spinelike serrations (fig. 19C); IRL also with one (fig. 19C) or two spiniferous basal lobes.

Etymology: Named in reference to the age of the varied landscapes of the ancient Australian continent, from a combination of the Latin words *avitus* ("grandfatherly, ancestral, or old") and *terra* ("earth"). The gender is feminine.

Remarks: The endosomal spicule arrangement in *Avititerra* is similar to *Blattakeraia*, where they are largely dorsad to the secondary gonopore, and DES2 and DES1 are closely associated basally and flattened. In *Blattakeraia*, however, PES is dorsad of the secondary gonopore and originates proximal to the base of the secondary gonopore and is more sheathlike at the base, whereas in *Avititerra* PES is more removed from DES2 and DES1, left lateral to the secondary gonopore, originates near the apex of the secondary gonopore and has a narrow tubular base (cf. fig. 11). *Avititerra* has similarities to *Naranjakotta* including the mixed vestiture of both simple and scalelike setae (fig. 16), the meeting of the parameres medially in repose in the pygophore, ventrad to the phallotheca (fig. 17B), there is a single tergal spine (fig. 18A) and the endosomal spicules are dorsolateral in position (figs. 11, 15, 18). *Avititerra* species are relatively small and have a more slender, parallel-sided body in comparison with species in the other callitroid-inhabiting genera. The overall coloration is a relatively uniform green, the wing membrane lacks a subcuneal clear spot (*Ngullamiris* is the only other genus without this), and *Avititerra* is also the only one of these five genera with mixed vestiture.

Avititerra lepidothrix, new species

Figures 11, 12, 15; map 1

Diagnosis: Defined by the following characters: eyes medium; labium extending only to mesocoxae; dorsum bright yellow-green; cuneus with yellow inner margin and tip; forewing membrane uniformly dark gray-brown, veins—major vein concolorous with membrane, inner vein orange-yellow; dorsum with medium- to dark-brown scalelike setae; pygophore dorsal margin moderately concave, without any tergal process, with membranous proctiger covering phallotheca and aedeagus; left paramere, sensory lobe greatly enlarged and bulbous with large spinelike serrations on outer margin, apophysis broad with uniform width to apex; right paramere apex not curved inward, with moderately elongate round apex and small subapical/medial dorsal lobe, both sparsely serrate; phallotheca with fully sclerotized apex; aedeagus with PES bifurcate with both branches smooth at apex and ventral branch curved and subapically serrate, DES2 unbranched with apex downturned, DES1 unbranched with short medial processes; female interramal lobes with elongate and broad inner branch, two basal lobes.

Description: *Male*: Small size, elongate slender body, lateral margins of hemelytra not curved ventrally, body length 3.03–3.45 mm, pronotal width 0.85–0.94 mm. COLORATION: Dorsum, overall bright yellowish green; head, antennae, mesoscutum, and scutellum sometimes faded to yellow; two apical antennal segments darkened; cuneus with inner margin and tip yellow; forewing membrane uniform dark gray-brown; forewing membrane veins, inner vein orange-yellow, major vein mostly concolorous with membrane and dark gray-brown (fig. 12). VESTITURE: Dorsum with light-brown simple setae and medium- to dark-brown scalelike setae (fig. 12). STRUCTURE: **Head:** Eyes midsize, two-thirds height of head, weakly exerted from outline of head and extending just moderately beyond anterolateral angle of pronotum (fig. 12); labium moderately short, extending only to anterior margins of mesocoxae. **Pronotum:** Trapezoidal, narrow; 1.3× wider than head; lateral margins angled ca. 30° to midline. **Mesoscutum and scutellum:** Mesoscutum one-third length of scutellum, sometimes partially hidden under pronotum. GENITALIA: **Pygophore:** Dorsal margin of genital opening moderately concave, margin round, without any tergal processes; phalloguide with lightly sclerotized right lateral margin ventrad to right paramere articulation; phallotheca and aedeagus covered with membranous proctiger (fig. 15A). **Left paramere:** L-shaped; strongly expanded medially, sensory lobe prominent, greatly expanded and bulbous, with few large spinelike serrations on margin; apophysis moderately elongate, moderately broad, uniform width to apex, connected to sensory lobe at 90° angle; apex truncate, round with weakly recurved hook (fig. 15B, C). **Right paramere:** C-shaped; apex not curved inward; apex round, forming moderately elongate lobe, with few large spinelike serrations on mesiolateral surface; subapical to medial dorsal margin expanded, forming small lobe projected dorsally, with few small spinelike serrations on inner surface; mesiolateral surface not excavated (fig. 15D). **Phallotheca:** Apex round, fully sclerotized; lateral/dorsal margins reduced (fig. 15E). **Aedeagus:** Spicule arrangement and orientation as in generic description (fig. 15); PES bifurcate in distal third, branches subequal in length and tapering to narrow pointed apex, ventral branch with apex curved downward and margins serrate after bifurcation and then smooth to apex, dorsal branch margins smooth; DES2 unbranched, apex curved downward and sparsely serrate; DES1 unbranched, apex tapering and serrate, three short medial processes, one smooth and two apically serrate, with short basal keel (DESk) (fig. 15F).

Female: As in generic description, body length 2.93–3.40 mm, pronotal width 0.88–0.92 mm. GENITALIA: Interramal lobes (IRL) bisected medially with inner branch elongate and broad with bulbous round apex, longer than outer branch, margins and surface of IRL covered with minute spinelike serrations; IRL with two moderately large and distantly spaced spiniferous basal lobes, inner lobe only sparsely serrate on margin (not illustrated).

Etymology: Named for the adpressed, scale-like setae present on the dorsum. Noun in apposition.

Host plants: Known from *Callitris pyramidalis* and *C. roei* (table 2).

Holotype: **AUSTRALIA: Western Australia:** 8.6 km S of Ravensthorpe on Hopetoun Road, 33.61625°S 120.1345°E, 500 m, 06 Dec 1997, Schuh, Cassis, Brailovsky, Asquith, *Callitris roei*, det. WA Herbarium PERTH 05055466, 1♂ (AMNH_PBI 00000090) (WAMP).

Paratypes: **AUSTRALIA: Western Australia:** 8.6 km S of Ravensthorpe on Hopetoun Road, 33.61625°S 120.1345°E, 500 m, 06 Dec 1997, Schuh, Cassis, Brailovsky, Asquith, *Callitris roei*, det. WA Herbarium PERTH 05055466, 1♂ (AMNH_PBI 00000087), 3♀ (AMNH_PBI 00000089, 00000091, 00000093) (AM), 1♀ (AMNH_PBI 00003931) (AMNH), 1♂ (AMNH_PBI 00000092) (WAMP). 31 km WNW of Gingin, 31.23067°S 115.6°E, 110 m, 09 Dec 1997, Schuh, Brailovsky, *Actinostrobus pyramidalis*, det. WA Herbarium, 2♂ (AMNH_PBI 00003971, 00003972), 2♀ (AMNH_PBI 00003976, 00003977) (AM), 4♂ (AMNH_PBI 00003967–00003970), 7♀ (AMNH_PBI 00003978-AMNH_PBI 00003984) (AMNH), 1♂ (AMNH_PBI 00003966), 3♀ (AMNH_PBI 00003973–00003975) (WAMP).

Other specimens examined: **AUSTRALIA: Western Australia:** 8.6 km S of Ravensthorpe on Hopetoun Road, 33.61625°S 120.1345°E, 500 m, 06 Dec 1997, Schuh, Cassis, Brailovsky, Asquith, *Callitris roei*, det. WA Herbarium PERTH 05055466, 2♀ (AMNH_PBI 00000094, 00000086) (AM). 10.7 km S of Cataby on Brand Hwy, 31.25855°S 115.82047°E, 57 m, 08 Aug 2005, G. Cassis, *Actinostrobus pyramidalis*, det. WA Herbarium PERTH 07620330, 1♀ (AMNH_PBI 00021802) (AM).

Distribution: Known from three localities in southwesterm Western Australia, around Perth, and on the south coast (map 1). Collected with *B. actinostrobi* (table 2).

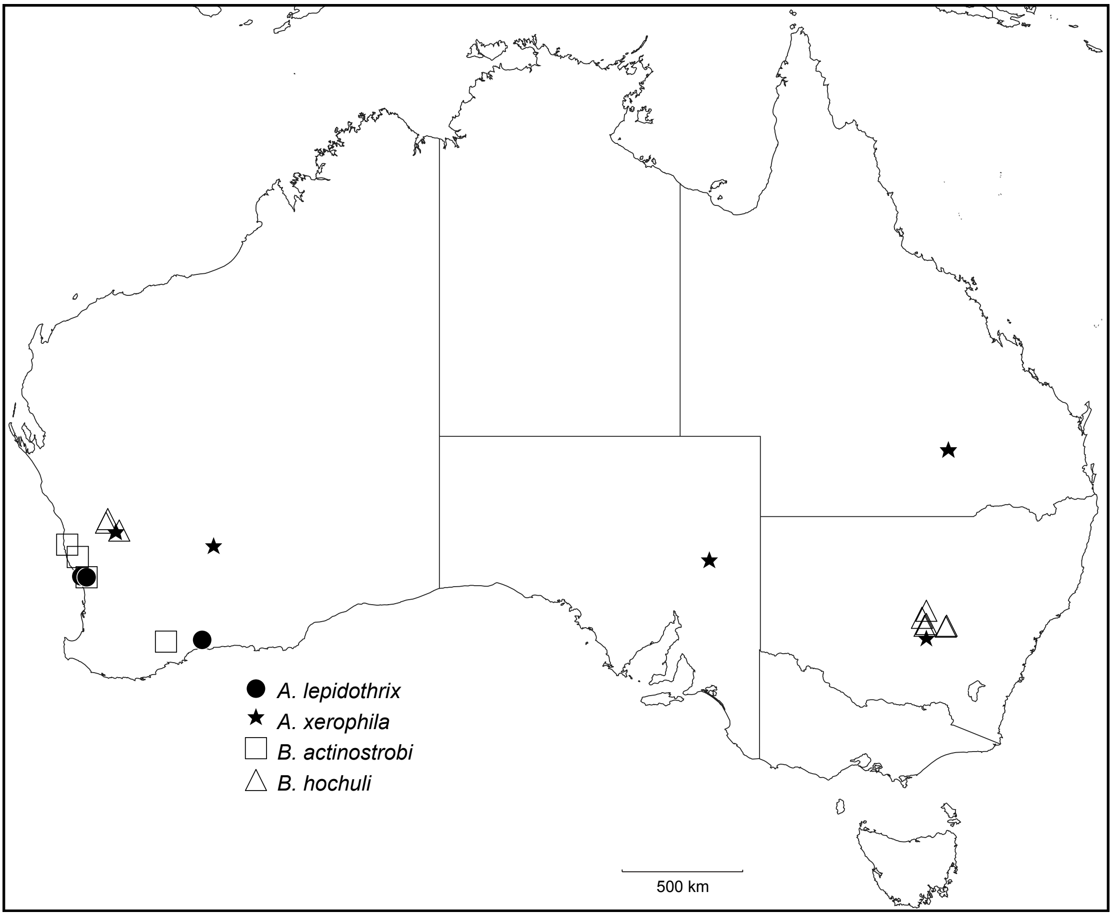
Remarks: *Avititerra lepidothrix* is most easily distinguished externally from *A. xerophila* by the brown scalelike setae on the dorsum, the brighter and more yellowish-green coloration, the cuneus not entirely concolorous with the hemelytron, with a yellow inner margin and tip, the hemelytral membrane darker and more gray brown with the inner vein orange-yellow, the strongly reflexed lateral hemelytral margins, the concave and round dorsal margin of the pygophore, the lack of a tergal spine, and the proctiger membranous without serrations covering the phallotheca and aedeagus. The major male genitalic characters that distinguish this species from *A. xerophila* are the fully sclerotized apex of the phallotheca (fig. 15E), the unbranched DES 1 and DES2 spicules (fig. 15F), PES without small threadlike processes apically on the dorsal branch, and the ventral branch serrate after the point of bifurcation and then smooth to the apex. In females the interramal lobe has an elongate inner branch and two basal lobes (not illustrated). See also remarks below for *A. xerophila*.

Avititerra xerophila, new species

Figures 12, 16–19; map 1

Diagnosis: Defined by the following characters: eyes medium to large, rather bulbous; labium extending only to mesepisternum; dorsum bright pale green, cuneus concolorous with rest of forewing and dorsum; forewing membrane uniformly light brown, veins all yellowish orange; dorsum with white scalelike setae; lateral margins of hemelytra curved ventrally; pygophore dorsal margin weakly concave, irregular shape with very small left lateral tergal spinelike process; sclerotized and serrate proctiger covering phallotheca and aedeagus; left paramere subtriangular, strongly expanded medially, sensory lobe bulbous with few small spinelike serrations on outer margin, apophysis broad and tapering slightly apically; right paramere apex moderately curved inward; with serrate bulbous apex and subapical/medial dorsal lobes; phallotheca apex partially membranous; aedeagus with all three spicules bifurcate, PES ventral branch curved and apically serrate, dorsal branch with smooth margins and small threadlike processes subapically; female dorsal labiate plate with pair of spiniferous pads on posterolateral walls proximate to valvulae; interramal lobes with short inner branch, one small basal lobe.

Description: Male: Moderately small size, very slender, lateral margins of hemelytra curved ventrally, body length 3.49–3.83 mm, pronotal width 0.86–0.99 mm. COLORATION: Dorsum, overall bright pale green; head, antennae, pronotum and scutellum faded to pale yellowish green or very pale green and almost white; mesoscutum orangey yellow; forewing membrane uniform light brown; forewing membrane veins yellowish orange (fig. 12). VESTITURE: Dorsum with pale simple setae and white scalelike setae (fig. 12). STRUCTURE: **Head:** Eyes medium to large size, three-quarters height of head, strongly exerted from outline of head and extending well beyond anterolateral angle of pronotum (figs. 12, 16A–D); labium short in length, extending only to mesepisternum. **Pronotum:** Trapezoidal, 1.3× wider than head, lateral margins strongly angled 45° to midline (fig. 16C). **Mesoscutum and scutellum:** Mesoscutum one-quarter length of scutellum, sometimes partially hidden under pronotum. GENITALIA: **Pygophore:** Dorsal margin of genital opening weakly asymmetrically concave, margin rather sinuous, with one left lateral tergal process; tergal process small, spinelike; phalloguide without (sclerotized or serrate) lobe ventrad to right paramere articulation; aedeagus and phallotheca covered with sclerotized and spiniferous proctiger (figs. 17A, C, 18A). **Left paramere:** L-shaped; strongly expanded medially, subtriangular; sensory lobe prominent, expanded, and bulbous, with few spinelike serrations; apophysis moderately elongate, broad, narrowing slightly apically; apex truncate, round with weakly recurved hook (figs. 17B, 18B). **Right paramere:** C-shaped; apex moderately curved inward dorsally and forming moderately elongate, serrate, bulbous lobe; subapical to medial dorsal margin expanded, forming serrate, bulbous lobe directed inward;



MAP 1. Distribution of *Avititerra* and *Blattakeraia* species.

mesiolateral surface not excavated (figs. 17A, B, 18C). **Phallotheca:** Apex round, partially membranous; lateral/dorsal margins reduced (fig. 18D, E). **Aedeagus:** Spicule arrangement and orientation as in generic description; PES bifurcate medially, branches subequal in length and tapering to narrow pointed apex, ventral branch with apex curved downward and margins serrate, dorsal branch with two threadlike processes and margins smooth; DES2 bifurcate in distal half, right branch short and uniformly narrow, almost threadlike, margins smooth, left branch elongate with bisected apex, apical margins weakly serrate; DES1 bifurcate in distal third, branches subequal, one with serrate apex, other with mostly smooth margins, with short basal keel (DESk) (figs. 17D–F, 18F, G).

Female: As in generic description, body length 3.50–3.77 mm, pronotal width 0.86–0.94 mm. GENITALIA: Interramal lobes (IRL) bisected medially with inner branch short and outer branch elongate, margins and surface of IRL covered with minute spinelike serrations, IRL with single small spiniferous basal lobe (fig. 19C).

ETYMOLOGY: Named in reference to the hot, dry climates of the regions this species inhabits, from the Greek *xēros* (dry) in combination with *phila* (lover).

HOST PLANTS: Known from *Callitris glaucophylla* (after Hill, 1998, see also appendix 2)

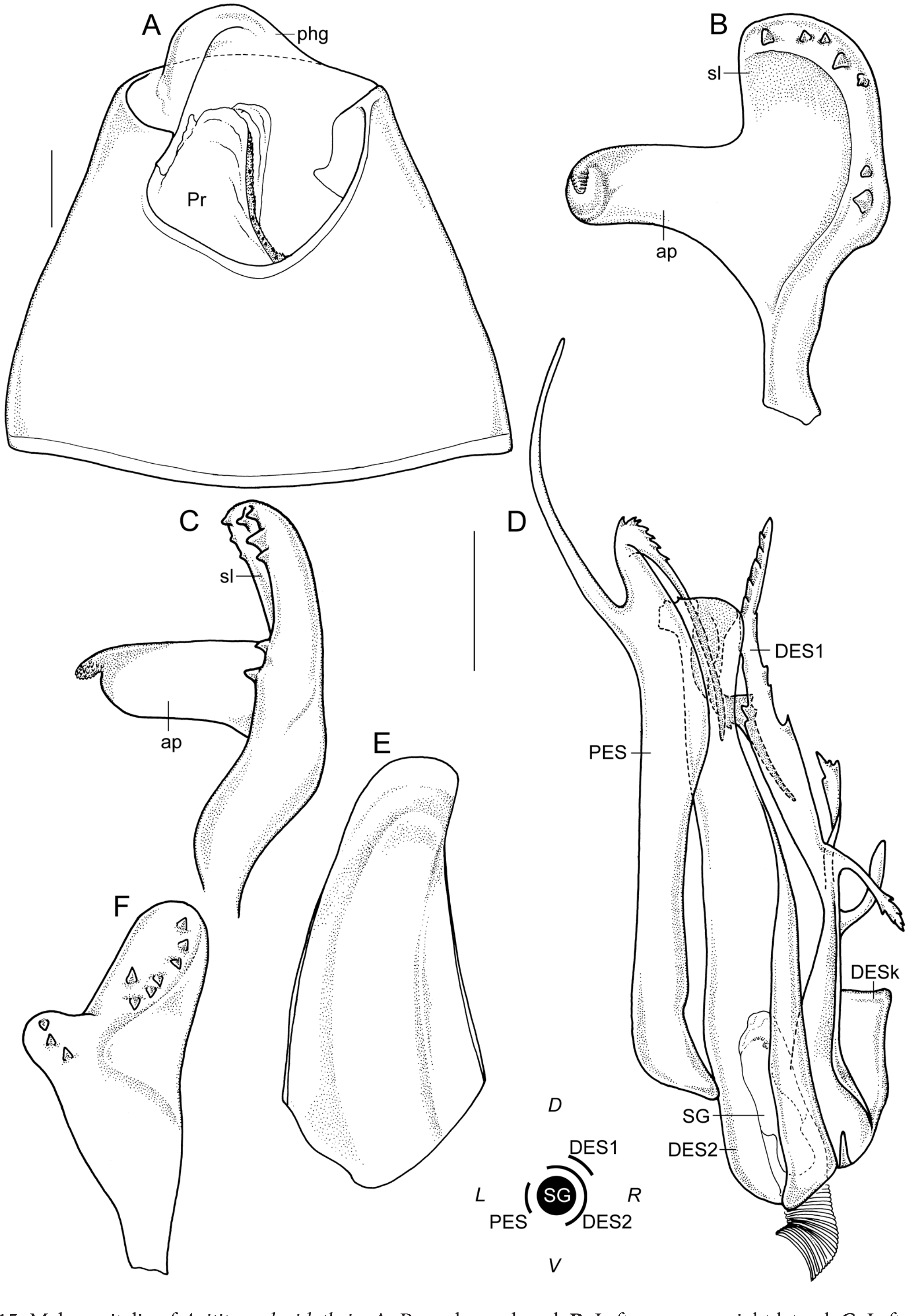


FIG. 15. Male genitalia of *Avititerra lepidothrix*. **A.** Pygophore, dorsal. **B.** Left paramere, right lateral. **C.** Left paramere, dorsal. **D.** Aedeagus, ventral. **E.** Phallotheca, dorsal. **F.** Right paramere, left lateral. Scale bars = 0.1 mm.

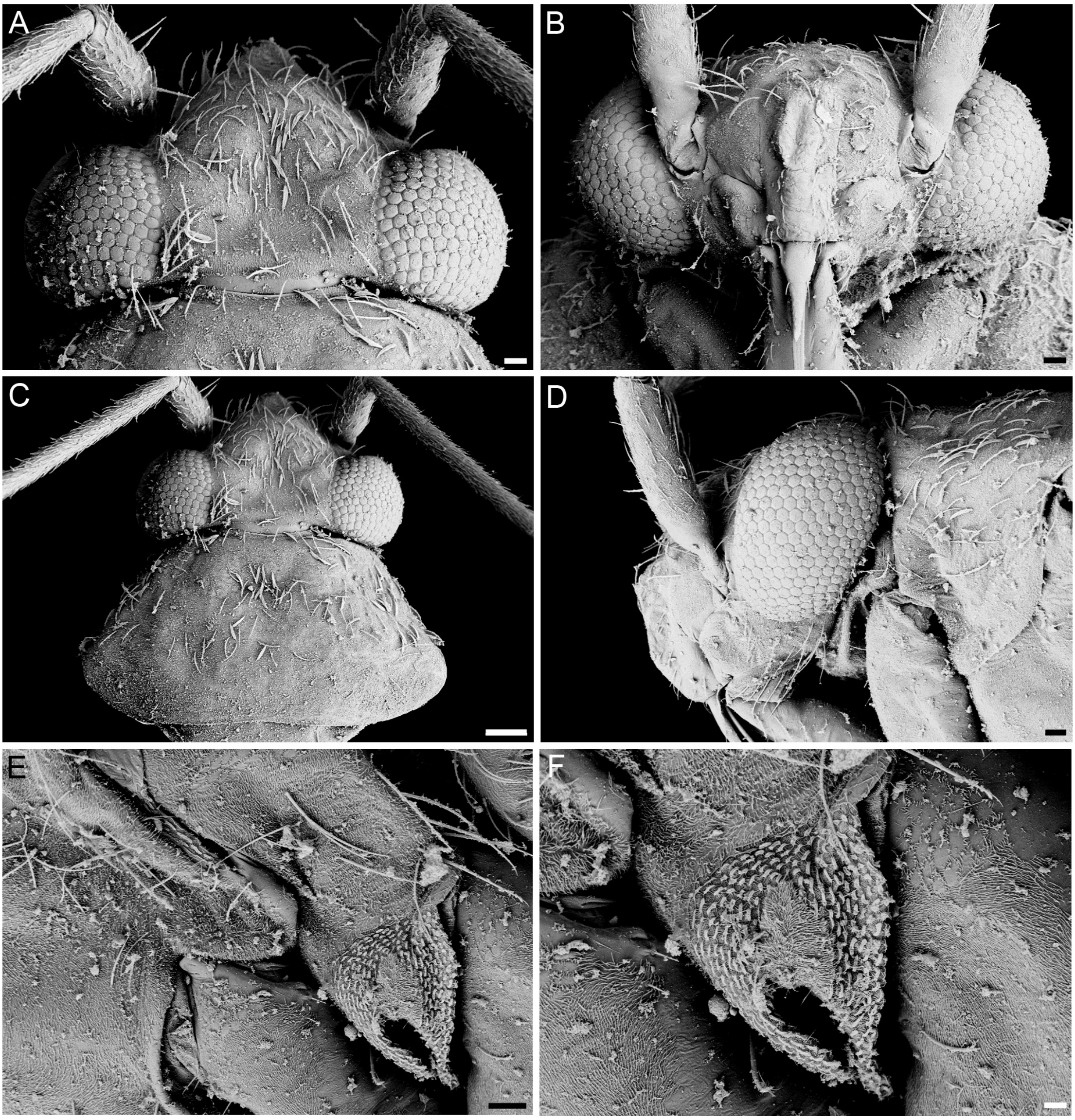


FIG. 16. External morphology of *Avititerra xerophila,* male. **A,** Head, dorsal, scale bar = 30 µm. **B.** Head, ventral, scale bar= 30 µm. **C.** Head and pronotum, dorsal, scale bar = 100 µm. **D.** Head and pronotum, lateral, scale bar = 30 µm. **E.** Meso- and metathorax, scale bar = 30 µm. **F.** Metathoracic scent gland, scale bar = 10 µm.

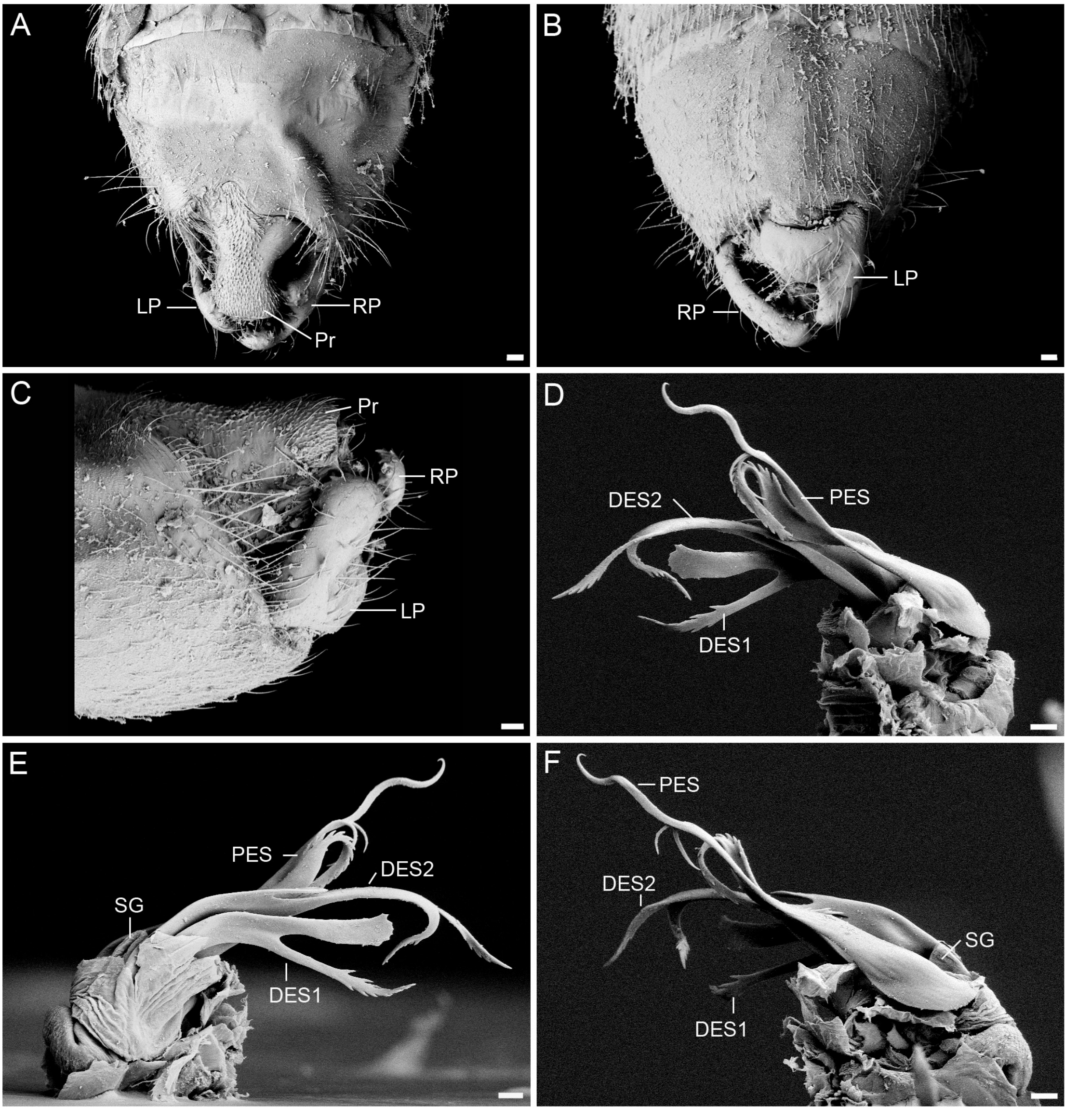
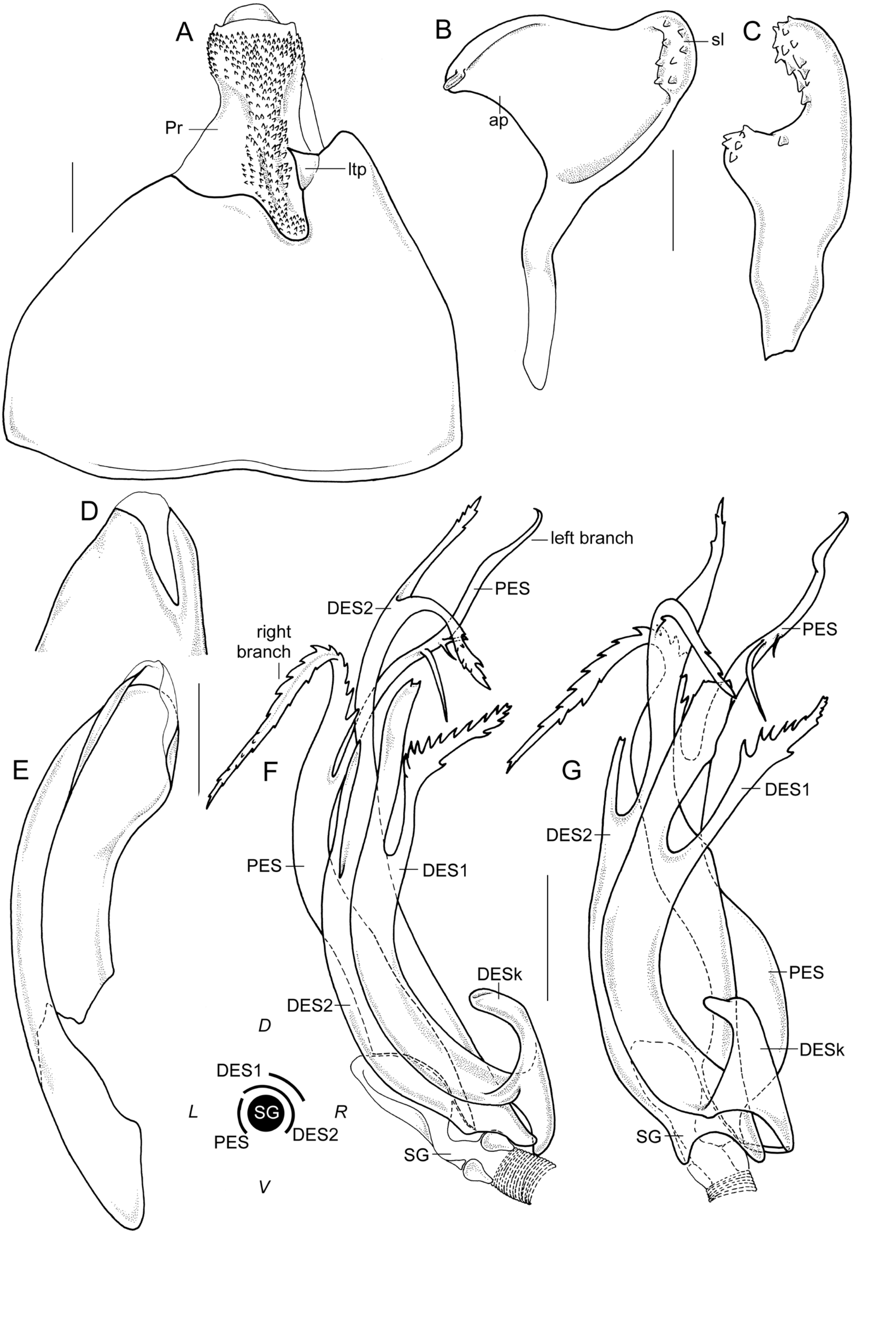


FIG. 17. Male genitalic morphology of *Avititerra xerophila*. **A.** Pygophore, dorsal. **B.** Pygophore, ventral. **C.** Pygophore, left lateral. **D.** Aedeagus, left dorsolateral. **E.** Aedeagus, right lateral. **F.** Aedeagus, left lateral. Scale bars = 30 μm.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across much of this host's range with one specimen collected from *C. canescens* (table 2).

Holotype: **AUSTRALIA: Western Australia:** Charles Darwin Reserve, 4 km N of Wanarra East Rd, track directly N of homestead, 29.54497°S 116.93527°E, 299 m, 06 May 2009, C. Symonds, A. Molan, A. Wheeler, B. Yardley, *Callitris columellaris*, det. T.D. Macfarlane WA Herbarium, 1♂ (AMNH_PBI 00030446) (WAMP).

Paratypes: **AUSTRALIA: New South Wales:** Euglo South State Forest, 33.53305°S 147.20888°E, 11 Dec 1998, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 3♂ (AMNH_PBI 00016255–00016257), 1♀ (AMNH_PBI 00016258) (AM). **Queensland:** 5.9 km E of Mitchell, 26.48726°S 148.0361°E, 380 m, 31 Oct 1998, Schuh, Cassis, Silveira, *Callitris glaucophylla*, det. RBG Sydney NSW427493, 4♂ (AMNH_PBI 00000155, 00000160, 00000166, 00000169), 1♀ (AMNH_PBI 00000156) (AMNH), 1♀ (AMNH_PBI 00000170), 2♂ (AMNH_PBI 00003922, 00003923) (QM). **South Australia:** 12 km E of Nepabunna, Gammon Ranges National Park, 30.60057°S 139.092°E, 440 m, 07 Nov 1998, Schuh, Cassis, Silveira, *Callitris glaucophylla*, det. RBG Sydney NSW427486, 2♂ (AMNH_PBI 00016253, 00016254) (AM), 1♂ (AMNH_PBI 00016252) (SAMA). **Western Australia:** Charles Darwin Reserve, 4 km N of Wanarra East Rd, track directly N of homestead, 29.54497°S 116.93527°E, 299 m, 06 May 2009, C. Symonds, A. Molan, A. Wheeler, B. Yardley, *Callitris columellaris*, det. T.D. Macfarlane WA Herbarium, 2♀ (AMNH_PBI 00404854, 00404855), 1♂ (AMNH_PBI 00404856) (UNSW), 2♂ (AMNH_PBI 00030445, 00030447), 3♀ (AMNH_PBI 00030448–00030450) (WAMP). Charles Darwin Reserve, Wanarra East Rd, NW of Homestead, 29.55577°S 116.90005°E, 04 May 2009, C. Symonds, L. Botten, R. Gilmore, K. Reynolds, K. Woods, *Callitris columellaris*, det. T.D. Macfarlane WA Herbarium, 2♀ (AMNH_PBI 00404857, 00404859), 1♂ (AMNH_PBI 00404858) (UNSW).

Other specimens examined: **AUSTRALIA: Western Australia:** Charles Darwin Reserve, 4 km N of Wanarra East Rd, track directly N of homestead, 29.54497°S 116.93527°E, 299 m, 06 May 2009, C. Symonds, A. Molan, A. Wheeler, B. Yardley, *Callitris columellaris*, det. T.D. Macfarlane WA Herbarium, 1 juv. (UNSW_ENT 00027086) (UNSW), 1 juv. (UNSW_ENT 00027087) (WAMP). Credo Station, 4.8 km along Telstra track off Coolgardie Nth Rd, 30.07069°S 120.57025°E, 503 m, 08 Sep 2011, M. Cheng & C. Symonds, *Callitris canescens*, det. WA Herbarium, 1♀ (UNSW_ENT 00027094) (UNSW).

Distribution: Known from all mainland states and territories, except the Northern Territory, from six semiarid inland localities. It is the most widespread callitroid-inhabiting Orthotylini species (map 1). It cooccurs with six other callitroid-inhabiting Orthotylini across its range (table 2).

Remarks: Some specimens of *Avititerra xerophila* are partly or completely faded to white by alcohol preservation. This species is most easily distinguished externally from *A. lepidothrix* by the white scalelike setae on the dorsum, the lighter and paler green coloration less yellowish, the cuneus concolorous with the hemelytra (all pale green), the hemelytral membrane a lighter brown, and the membrane veins all yellow-orange. *Avititerra xerophila* is also distinguished more subtly by having larger and more bulbous eyes, the labium slightly shorter, the lateral margins of the pronotum projected at slightly less of an angle, the lateral hemelytral margins flexed more downward (fig. 12), the dorsal margin of the pygophore irregular, with a sclerotized and serrate proctiger covering the phallotheca and aedeagus (figs. 17A, 18A). The major internal male genitalic characters that distinguish this species from *A. lepidothrix* are the membranous apex of the phallotheca (fig. 18D), DES1 and DES2 bifurcate distally (figs.

FIG. 18. Male genitalia of *Avititerra xerophila.* **A.** Pygophore, dorsal. **B.** Left paramere, dorsal. **C.** Right paramere, left lateral. **D.** Phallotheca apex, ventral. **E.** Phallotheca, dorsal. **F.** Aedeagus, right lateral. **G.** Aedeagus, dorsal. Scale bars = 0.1 mm.

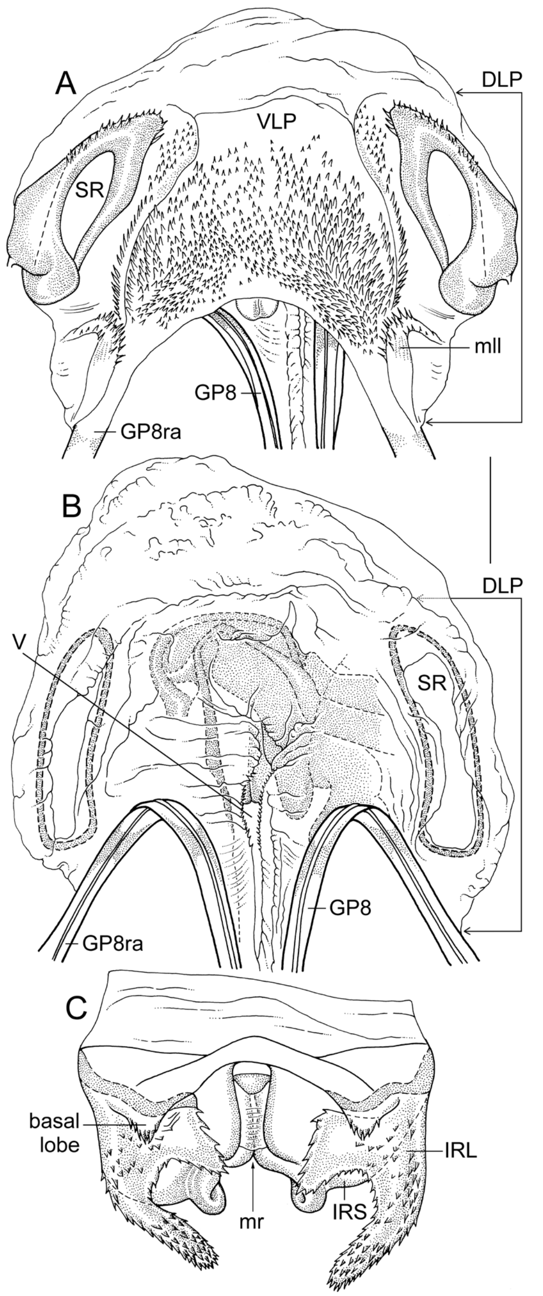


FIG. 19. Female genitalia of *Avititerra xerophila*. **A.** Ventral labiate plate and lateral portions of dorsal labiate plate (sclerotized rings and mediolateral lobes), dorsal. **B.** Bursa copulatrix, ventral. **C.** Posterior wall, dorsal. Scale bar = 0.1 mm.

17D–F, 18F–G), PES with small threadlike processes on the dorsal branch with the ventral branch serrate to the apex (figs. 17D–F, 18F–G), and the female interramal lobes with a short inner branch and just one basal lobe (fig. 19C). See also remarks for *A. lepidothrix*.

Blattakeraia, new genus

Type species: *Blattakeraia actinostrobi*, n. sp., by original designation.

Diagnosis: Defined by the following characters: large, elongate body (fig. 12); large, bulbous eyes; dorsum with moderately dense distribution of pale or dark simple setae; bright green to yellowish-green coloration; AI bright to dark red, reddish brown (fig. 12); forewing membrane light gray-brown, slightly darker laterally, with subcuneal clear spot (fig. 12B); forewing membrane veins green with adjacent green suffusion, major cell with green spot (fig. 12); pygophore genital opening large, round, dorsal margin strongly concave, without any tergal processes, phalloguide with sclerotized and serrate lobe, ventrad to right paramere articulation (figs. 22A, 26A); ventral surface of pygophore proximal to genital opening with short, light-brown, spinelike setae (figs. 21E, 25D); left paramere prominent externally, extending across ventral surface of pygophore with apex directed anteriorly (figs. 21B, 25B), right paramere with only apex visible externally (figs. 21D, E, 25B, D); phallotheca and aedeagus visible externally and extending beyond parameres from genital opening (figs. 21B, C, 25B–D) covered with membranous proctiger (figs. 21A, C, 24H, 25B–D); left paramere L-shaped with broad apophysis, truncate apex with weakly recurved and inset subapical hook (figs. 22B, 26B); right paramere club shaped with apical flange and unexpanded subapical dorsal margin, apical flange and subapical dorsal margin with small spinelike serrations (figs. 22C, 26C); phallotheca lightly sclerotized, dorsal opening large, apex round (figs. 22D, 26D); aedeagus with three sclerotized endosomal spicules, all dorsad to secondary gonopore (fig. 11);

PES partially sheathing secondary gonopore at base, distally bifurcate with serrate or smooth apical margins; PES with ventrally positioned submedial process projecting distally, before bifurcation point (figs. 22E, 26E); DES2 unbranched, with broad base, narrow acuminate apex, margins smooth (figs. 22E, 26E); DES1 bifurcate in distal third, branches unequal in length, with elongate basal keel (figs. 22E, 26E); DES2 and DES1 closely associated at base situated adjacent, originating distad to base of PES; vestibulum of female with lightly sclerotized, asymmetrical structure (fig. 27B); mesial surface of ventral labiate plate spiniferous, with small lateral lobes adpressed at surface (figs. 23A, 27A); small narrow mediolateral lobes on dorsal labiate plate; interramal sclerites with membranous attachment to posterior wall at base (fig. 27C), with one pair of bifurcate, spiniferous interramal lobes (figs. 23B, 27C).

Description. *Male:* Macropterous, large size, body elongate, parallel sided (fig. 12); body length 4.51–5.06 mm. COLORATION: Dorsum uniformly bright green, including head and hemelytra; AI bright to dark red, remainder yellowish orange, darkening apically; cuneus of forewing concolorous, sometimes slightly more yellowish green than rest of hemelytra (fig. 12); forewing membrane translucent, light gray-brown, with slightly darker patches laterally, with subcuneal clear spot (fig. 12B); forewing membrane veins bright green, adjacent membrane suffused with green, major cell with bright green spot (fig. 12); legs mostly pale yellow; tarsi dark brown; abdominal venter pale yellowish green; phallotheca golden. SURFACE AND VESTITURE: Dorsum smooth, weakly polished, with moderately dense distribution of light or dark, semierect simple setae, few setae more elongate and bristlelike on head and lateral margins of dorsum; antennae with dense distribution of short, brown simple setae; AI also with few dark, elongate, erect, spinelike setae (approx. 5); femora with light-brown simple setae, intermixed with few, more elongate, erect, spinelike setae; tibiae and tarsi with light-brown simple setae, on tibiae intermixed with light-brown spines; hind tibiae with rows of minute, dark spinulae; pygophore ventral surface proximal to genital opening with short, light-brown, spinelike setae (figs. 21D, E, 25). STRUCTURE: **Head:** Subovate in lateral view, strongly expanded anteriorly; mandibular and maxillary plates and clypeus large; maxillary plate subovate, anterodorsal margin round, aligned with round anterodorsal margin of mandibular plate; clypeus prominent, round or slightly pointed in dorsal view, dorsal edge round in lateral view; vertex flat; eyes large, strongly exerted beyond outline of head, extending well beyond anterolateral angles of pronotum (figs. 20A–D, 24A–D); labium medium to elongate length. **Antennae:** Elongate, insertion dorsal to ventral margin of eyes, very slightly removed from anterior margin of eyes (figs. 20B, 24B); AI elongate, longer than width of vertex, slightly wider than remaining segments (fig. 12); AII elongate, ca. 1.5× pronotum width; AIII moderately long, ca. 2× length of AIV; AIV subequal or slightly shorter length to AI; AIII and AIV slightly thinner than AII. **Pronotum:** Trapezoidal, broad or narrow; anterior margin weakly concave; collar reduced to thin lip; callosite region weakly defined; lateral margins straight, weakly to strongly angled from 30–45° to midline of body; humeral angles round; posterior margin very weakly sinuous or concave to straight (figs. 20C, 24C). **Mesoscutum:** Slightly raised; mesoscutum wide, exposed, one-third length of scutellum (fig. 12). **Metathorax:** Metathoracic spiracle elongate, subcylindrical, with evaporative area spanning anterior margin and expanded dorsally (figs. 20E, F, 24E, F); metathoracic scent gland with ostiole subcylindrical, peritreme subtriangular extending onto posterior ostiole margin, evaporative area with small subovate to elongate evaporative bodies (figs. 20E, G, 24E, G). **Hemelytra:** Elongate, extending well beyond apex of abdomen, abdomen extends to cuneal fracture; lateral margins parallel; cuneus elongate; forewing membrane major cell elongate, major vein straight, parallel to inner margin of cuneus (fig. 12). **Legs:** Elongate, femora slightly flattened; pretarsus with moderately short claws, pulvilli moderately sized, fleshy parempodia broad, apically convergent (fig. 20H). GENITALIA: **Pygophore:** Transverse to subquadrate, weakly narrowing posteriorly, genital opening large, round (figs. 21A, B, 22A, 24H, 25A); dorsal margin of genital opening strongly concave, lacking tergal processes (figs. 21A, 22A, 24H, 26A); ventral margin of genital opening straight; phalloguide round, extending just beyond ventral margin of opening, with round, strongly sclerotized lobe ventrad to articulation of right paramere, with minute spinelike serrations (figs. 22A, 25B, 26A); left paramere extending across ventral surface of pygophore (figs. 21B, 25A); right paramere mostly nested within pygophore, only apex visible (figs. 21D, E, 25B, D); phallotheca visible externally from pygophore and extending beyond parameres (figs. 21, 25), covered with membranous proctiger (figs. 21A, C, 24H, 25B–D). **Left paramere:** L-shaped; sensory lobe greatly (fig. 26B) or only weakly expanded (fig. 22B); apophysis uniformly broad, either elongate and curved (fig. 26B) or short and relatively straight (fig. 22B), ca. 45° to rest of paramere; apex truncate, round with weak hook, slightly inset from tip of apex (figs. 21D, 22B, 25D, 26B); simple setae on sensory lobe and outer surface. **Right paramere:** Club shaped, subovate in lateral view; apex weakly (figs. 25B, 26C) to moderately curved inward (figs. 21D, 22C), forming small, unexpanded or weakly expanded, sclerotized, flattened flange, with or without small, marginal, spinelike serrations; mesiolateral surface weakly excavate; subapical dorsal margin round, unexpanded, lightly sclerotized, with few small spinelike serrations; simple setae present on outer lateral surface. **Phallotheca:** Lightly sclerotized, dorsal opening large, apex round, with left lateral tumescence, with small subapical ventral tumescence (figs. 22D, 26D), sometimes with left dorsal margin retracted laterally (fig. 26D). **Aedeagus:** Secondary gonopore elongate, cylindrical, membranous; three elongate sclerotized endosomal spicules, subequal in length (fig. 11); PES dorsad to secondary gonopore, originating at base of secondary gonopore, sheathlike, partially bounding gonopore, bifurcate distally, branches unequal in length, branches extending distally, left branch perpendicularly oriented to right branch at base, apical margins smooth or serrate; PES with elongate submedial process, ventrally positioned, slender, elongate, serrate or smooth distally, projected distally (figs. 22E, 26E); DES2 and DES1 originating distad to PES (e.g., fig. 26E); DES2 dorsad to PES, unbranched, tapering to apex or broad and constricted at apex, margins smooth (figs. 22E, 26E); DES1 dorsal (fig. 22) or left dorsolateral (fig. 26) to DES2, bifurcate in distal third, branches unequal in length, apical margins serrate (fig. 26E) or mostly smooth (fig. 22E), left branch very short, narrow, right branch elongate, tapering to arcuate apex, with elongate basal keel (DESk) (e.g., fig. 22E); DESk situated adjacent, ventrad to DES2 and with partial membrane join to base of DES1; base of PES and DES2 broad and flattened, base of DES1 tubular.

Female: As in male except eyes slightly smaller, vertex wider and hemelytra shorter; abdomen extending almost to tip of cuneus; only very marginally shorter than male, occasionally slightly larger, body length 4.34–5.28 mm. GENITALIA: Vestibulum with lightly sclerotized asymmetrical tubular processes (fig. 27B); ventral labiate plate (VLP) sclerotized, mesial surface spiniferous, with small spiniferous lateral lobes arising laterally adjacent to gonapophyses 8, adpressed to VLP (figs. 23A, 27A); dorsal labiate plate with paired mediolateral lobes, lobes small and narrow, surface mostly smooth, marginally spiniferous, positioned posterolateral in genital chamber adjacent to base of rami of gonapophyses 8 (figs. 23A, 27A); sclerotized rings large, subovate, anterior margin round, anterior surface spiniferous (figs. 23A, 27B); posterior wall sclerotized (fig. 27); medial region of posterior wall lightly sclerotized, margin slightly convex, positioned just below anterior margin of interramal sclerites (IRS) (fig. 27); IRS deeply divided, with U-shaped junction, forming posterior margin of posterior wall of bursa copulatrix, posterior margin ill defined, membranous (fig. 27); IRS with one pair of interramal lobes (IRL) (figs. 23B, 27C); IRLs spiniferous, bifurcate basally (fig. 27C) or medially (fig. 23B), outer branch elongate.

Etymology: Named for the distinctive red first antennal segment of the species described in this genus, from Latin *blatta* meaning "blood-clot" and Greek *keraia* "feeler or antenna." The gender is feminine.

Remarks: *Blattakeraia* species are most easily distinguished from other callitroid-inhabiting Orthotylini by their relatively large size, elongate reddish first antennal segment, green wing membrane veins and dorsal vestiture of simple setae. *Blattakeraia* is most closely related to *Callitricola* + *Erysivena*. The most striking differences of *Blattakeraia* (to the other four genera) are the elongate reddish first antennal segment (fig. 12), the very broad apophysis of the left paramere, which has a broad and rounded apex and weak subapical hook (figs. 22B, 26B), as well as the position of the left paramere, which projects over the ventral surface of the pygophore in repose (figs. 21B, 25). Other characters that differentiate *Blattakeraia* from both *Callitricola* and *Erysivena* are the absence of pygophoral tergal processes on the dorsal margin of the pygophore (figs. 21A, 22A, 24H, 26A), a lightly sclerotized and golden colored phallotheca, the three endosomal spicules all positioned dorsad to the secondary gonopore and with differing substructure (cf. fig. 11), and a more cylindrical club-shaped right paramere (figs. 22C, 26C). The female genitalia of *Blattakeraia* is characterized by divided interramal processes but without additional medial or basal lobes (figs. 23B, 27C).

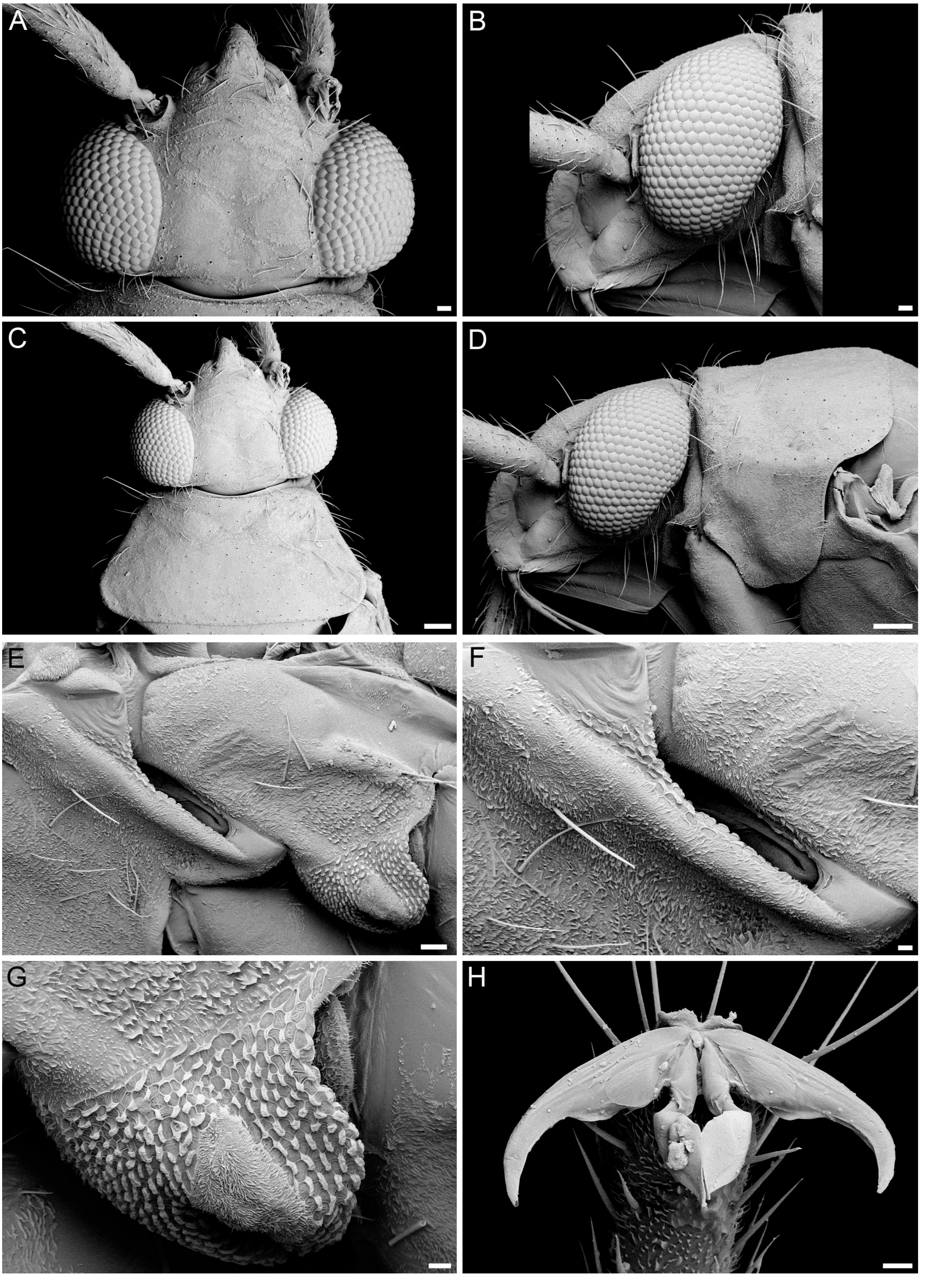
Blattakeraia most closely resembles *Callitricola* externally, with both genera not having red coloration on the hemelytra and the membrane veins are often green (cf. figs. 12, 13), the presence of a subcuneal clear spot on the hemelytral membrane (e.g., fig. 12B), the dorsum has simple setae only, the right paramere is club shaped, and left paramere is relatively long and L-shaped, with a hooked apex. *Blattakeraia* is differentiated from *Callitricola* by the characters above that the latter genus has in common with *Erysivena*, as well as the strongly concave dorsal margin of the pygophore. In addition, the attachment of the basal keel to DES1 is more membranous in *Blattakeraia*. The keel extends adjacent to DES2 in *Blattakeraia* and *Erysivena* and because of its proximity, we first interpreted it to be attached to DES2 rather than DES1. On closer examination its attachment to DES1 was established, although the join is more membranous than observed in other Australian orthotyline genera.

Blattakeraia actinostrobi**,** new species

Figures 11, 12, 20–23; map 1

Diagnosis: Defined by the following characters: elongate labium, extending over abdomen; pronotum narrow, lateral margins angled no more than 30°; dorsum with dark simple setae; left paramere with round and broad sensory lobe, short and broad apophysis; right paramere with moderately arcuate apex and expanded apical flange with serrate margin, subapical dorsal margin with few serrations; PES with smooth, narrow apical margins on submedial process, distally with right branch also smooth and narrow, left branch short and serrate; DES2 constricted subapically with narrow, pointed apex; DES1 distally bifurcate with few marginal serrations, margins mostly smooth, pointed apically; DES1 dorsad to DES2; female interramal lobes medially bifurcate.

Description: *Male*: Large size, elongate, body length 4.78–5.15 mm, pronotal width 1.07–1.14 mm. COLORATION: Dorsum uniformly bright green; AI bright to dark red, remainder of antenna yellowish orange, darker apically; cuneus concolorous with rest of forewing; forewing membrane vein bright green, with adjacent bright green suffusion; major cell of forewing membrane with bright green spot (fig. 12). SURFACE AND VESTITURE: Dorsum with dark, almost black, simple setae; antennae with moderately short, medium-


A
B
C
D
E
F
G
H

brown simple setae; AI simple setae almost black. STRUCTURE: **Head:** Strongly expanded anteriorly, ca. half width of eye; frons moderately protruding beyond anterior margin of eyes (fig. 20A, C); eyes large, four-fifths height of head (fig. 20B, D); labium elongate, extending beyond metacoxae over abdomen. **Pronotum:** Trapezoidal, narrow (figs. 12, 20C, D); 1.3× wider than head; lateral margins weakly angled 30° to midline of body; posterior margin very weakly concave to straight. GENITALIA: **Pygophore:** Left paramere extending slightly over ventral margin of pygophore (fig. 21B, D, E). **Left paramere:** Sensory lobe weakly expanded, round, broad, arcuate (fig. 22B); apophysis short, relatively straight, uniformly broad (fig. 22D). **Right paramere:** Apex moderately curved inward, sclerotized flange with small spinelike marginal serrations, subapical dorsal margin with few small spinelike serrations (figs. 21D, E, 22C). **Phallotheca:** Entire left dorsal margin below lateral tumescence (fig. 22D). **Aedeagus:** PES dorsad to secondary gonopore, DES2 dorsad to PES, DES1 dorsad to DES2 (fig. 22E); PES originating proximate to base of secondary gonopore, DES1 and DES2 originating distad to base of PES and secondary gonopore; PES bifurcate distally, branches unequal in length, right branch narrow, acuminate, margins smooth, left branch short and serrate; submedial process of PES narrow, apically acuminate, margins smooth, base straight; DES2, unbranched, apex constricted and narrow, margins smooth; DES1, bifurcate in distal third, branches unequal in length, apical margins pointed and mostly smooth with few spinelike serrations, with elongate basal keel (DESk).

Female: Large size, elongate, body length 4.51–4.76 mm, pronotal width 1.11–1.21 mm. GENITALIA: VLP with small spiniferous lateral lobes arising adjacent to rami of gonapophyses 8, adpressed to VLP (fig. 23A); posterior wall of bursa copulatrix with posterior margin straight; IRL divided medially with inner branch short, outer branch elongate, surface spiniferous (fig. 23B).

ETYMOLOGY: This species is named after its association with the previously recognized Australian plant genus *Actinostrobus* (now synonymized with *Callitris*).

HOST PLANTS: Known from *Callitris arenaria, C. pyramidalis* and an unidentified *Callitris* species.

HOLOTYPE: **AUSTRALIA: Western Australia:** 10.7 km S of Cataby on Brand Hwy, 31.25855°S 115.82047°E, 57 m, 08 Aug 2005, G. Cassis, *Actinostrobus pyramidalis*, det. WA Herbarium PERTH 07620330, 1♂ (AMNH_PBI 00005731) (WAMP).

PARATYPES: **AUSTRALIA: Western Australia:** 1.3 km E of Brand Hwy on Bibby Rd, 30.49747°S 115.46602°E, 231 m, 08 Aug 2005, G. Cassis, *Actinostrobus pyramidalis*, det. WA Herbarium PERTH 07621825, 1♀ (AMNH_PBI 00005733) (AM). 10.7 km S of Cataby on Brand Hwy, 31.25855°S 115.82047°E, 57 m, 08 Aug 2005, G. Cassis, *Actinostrobus pyramidalis*, det. WA Herbarium PERTH 07620330, 1♂ (AMNH_PBI 00005730) (AM), 1♀ (AMNH_PBI 00005732) (WAMP). 12.9 km E of Green Head on Coorow Green Head Rd, 30.06102°S 115.09913°E, 83 m, 09 Aug 2005, G. Cassis, *Actinostrobus arenarius*, det. WA Herbarium PERTH 07620233, 1♀ (AMNH_PBI 00005740) (AM), 1♂ (AMNH_PBI 00005739), 4♀ (AMNH_PBI 00005741–00005744) (WAMP). Needelup Rd North, 31.3 km N of Gnowangerup-Jerramungup Rds, 33.67855°S 118.79086°E, 290 m, 07 Aug 2005, G. Cassis, *Callitris* sp., 1♂ (AMNH_PBI 00005735), 3♀ (AMNH_PBI 00005736–00005738), 4♀ (AMNH_PBI 00021791–00021794) (AM).

OTHER SPECIMENS EXAMINED: **AUSTRALIA: Western Australia:** 1.3 km E of Brand Hwy on Bibby Rd, 30.49747°S 115.46602°E, 231 m, 08 Aug 2005, G. Cassis, *Actinostrobus pyramidalis*,

FIG. 20. External morphology of *Blattakeraia actinostrobi*, male. **A.** Head, dorsal, scale bar = 30 μm. **B.** Head, lateral, scale bar = 30 μm. **C.** Head and pronotum, dorsal, scale bar = 100 μm. **D.** Head and pronotum, lateral, scale bar = 100 μm. **E.** Meso- and metathorax, scale bar = 30 μm. **F.** Mesothoracic spiracle, scale bar = 10 μm. **G.** Metathoracic scent gland, scale bar = 10 μm. **H.** Tarsal claw, scale bar = 10 μm.

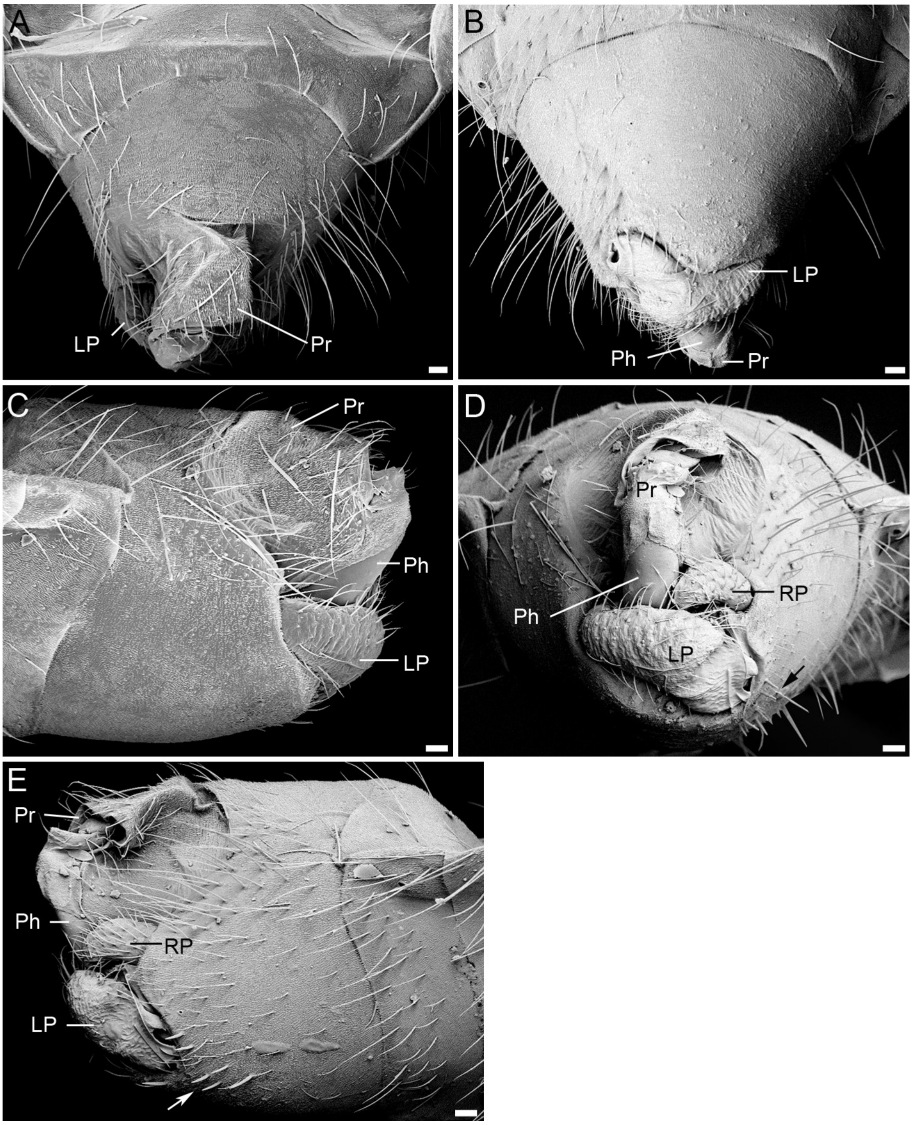


FIG. 21. Male external genitalic morphology of *Blattakeraia actinostrobi*. Pygophore: **A.** Dorsal. **B.** Ventral. **C.** Left lateral. **D.** Posterior. **E.** Right lateral. Arrows indicates spinelike setae. Scale bars = 30 µm.

det. WA Herbarium PERTH 07621825, 1 juv. (AMNH_PBI 00005734) (AM).

Distribution: Known from four localities in the southwest of Western Australia, which is the limit of the range of the two identified *Callitris* host-plant species (map 1). Collected with *Avititerra lepidothrix* (table 2).

Remarks: *Blattakeraia actinostrobi* is distinguished from *B. hochuli* by the following characters: the labium extends to the basal abdominal sternites; the pronotum is relatively narrow, with the lateral margins not strongly divergent posteriorly (fig. 20C); the left paramere is round and has a broad sensory lobe and short apophysis (fig. 22B) (cf. acuminate and apically serrate sensory lobe and elongate apophysis (fig. 26B)), and extends only slightly onto the ventral margin of the pygophore (fig. 21B, D); the right paramere

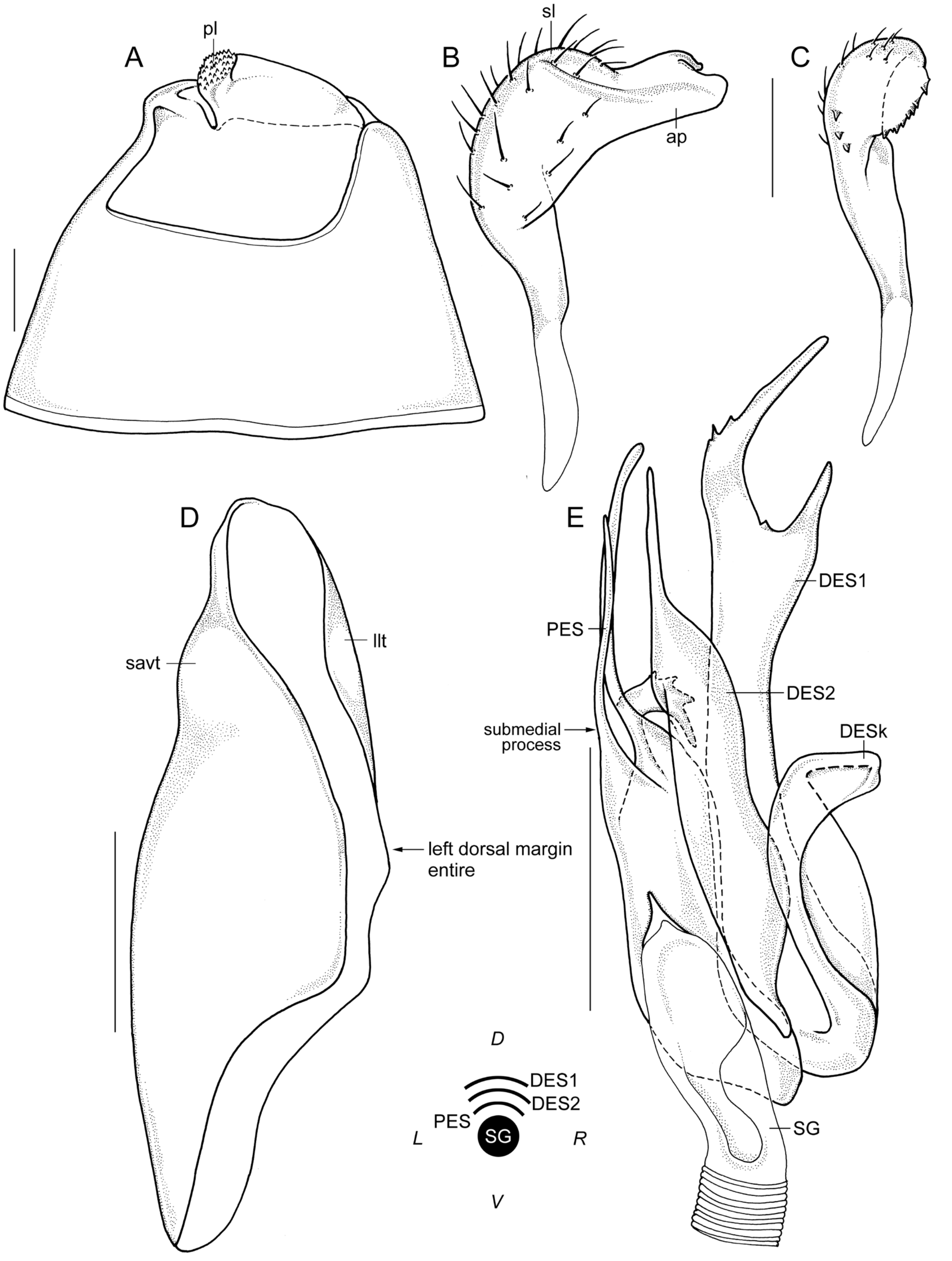


FIG. 22. Male genitalia of *Blattakeraia actinostrobi.* **A.** Pygophore, dorsal. **B.** Left paramere, ventral. **C.** Right paramere, right lateral. **D.** Phallotheca, right lateral. **E.** Aedeagus, right lateral. Scale bars = 0.1 mm.

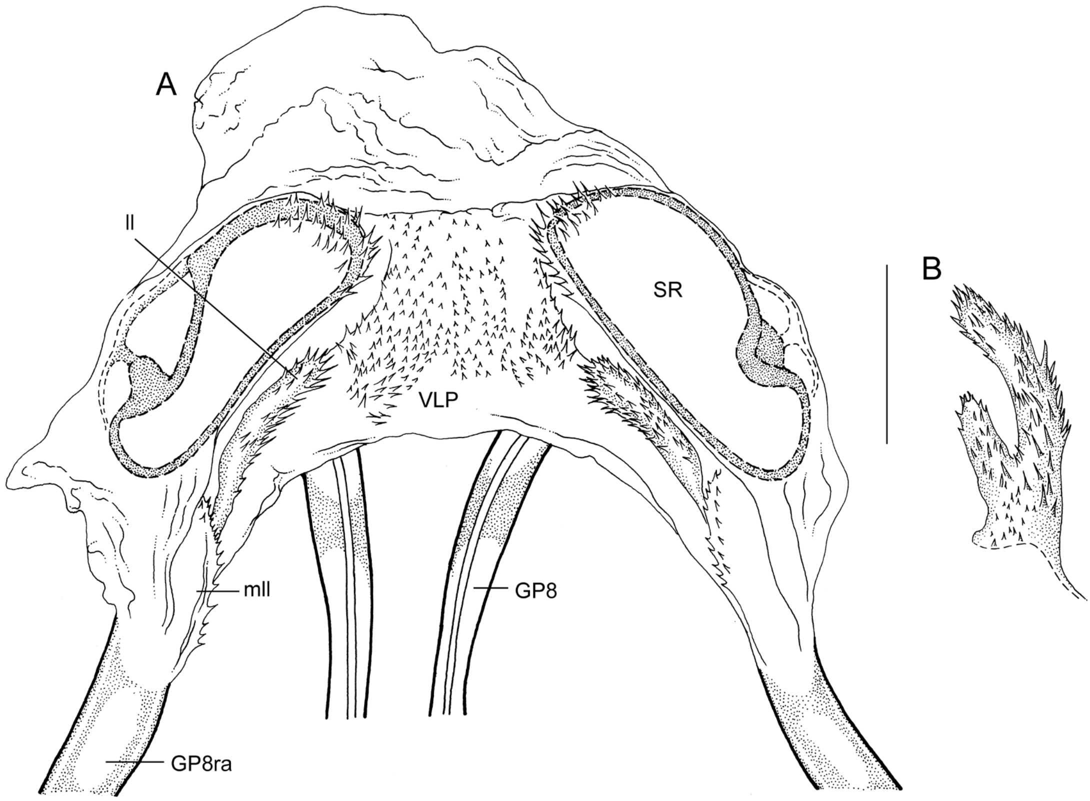


FIG. 23. Female genitalia of *Blattakeraia actinostrobi*. **A.** Ventral labiate plate with lateral lobes and lateral portions of dorsal labiate plate (sclerotized rings and mediolateral lobes), dorsal. **B.** Interramal lobe, right side, dorsal. Scale bar = 0.1 mm.

has a more arcuate apex and enlarged flange (fig. 22C); the submedial process and right distal branch of PES has smooth apical margins, and the base of the submedial process is straight (cf. serrate distal margins and twisted base of submedial process for PES in *B. hochuli*: fig. 26E); DES1 is more dorsal to DES2 (cf. left dorsolateral in *B. hochuli*: fig. 26); and the interramal lobes differ in shape (cf. figs. 23B and 27C).

Blattakeraia hochuli, new species

Figures 12, 24–27; map 1

Diagnosis: Defined by the following characters: moderate length of labium, extending to metacoxae; pronotum broad, lateral margins angled 45°; dorsum with pale simple setae; left paramere with expanded and acuminate sensory lobe, elongate, broad and arcuate apophysis; left paramere situated at rest extending well across ventral surface of pygophore; right paramere with weakly arcuate apex and small apical flange, subapical dorsal margin with numerous serrations; phallotheca left dorsal margin retracted laterally below left lateral tumescence; PES with serrate apical margins on submedial process, distally right and left branches serrate, right branch slightly longer than left branch, submedial process twisted at base; DES2 tapering to apex, round lobe on submedial margin; DES1 bifurcate in distal third, distally serrate and pointed; DES1 left dorsolateral to DES2; female interramal lobes basally bifurcate.

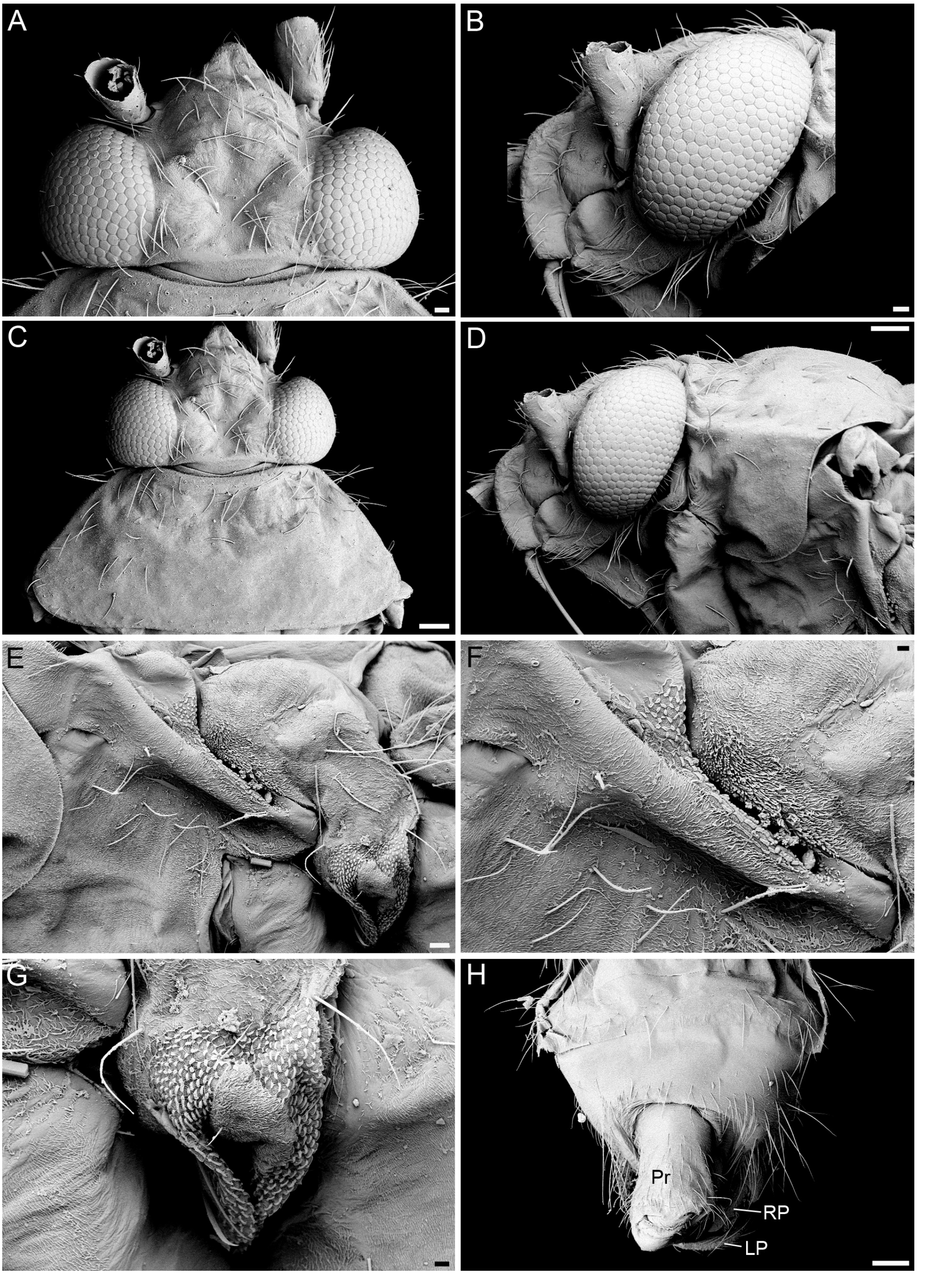


FIG. 24. External morphology of *Blattakeraia hochuli,* male. **A.** Head, dorsal, scale bar = 30 µm. **B.** Head, lateral, scale bar = 30 µm. **C.** Head and pronotum, dorsal, scale bar = 100 µm. **D.** Head and pronotum, lateral, scale bar = 100 µm. **E.** Meso- and metathorax, scale bar = 30 µm. **F.** Mesothoracic spiracle, scale bar = 10 µm. **G.** Metathoracic scent gland, scale bar = 10 µm. **H.** Pygophore, dorsal, scale bar = 100 µm.

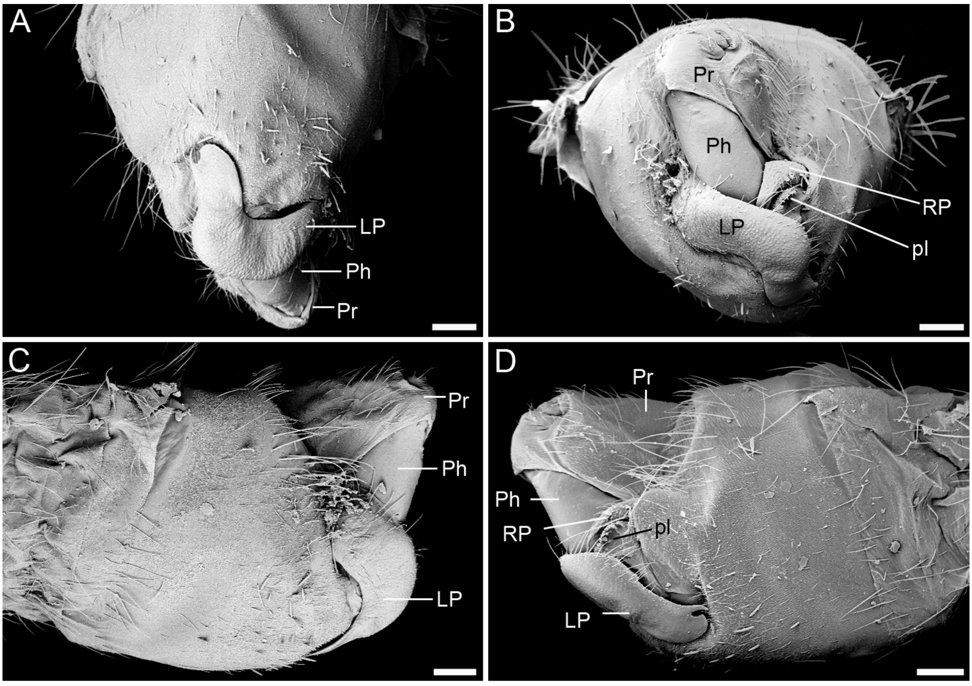


FIG. 25. Male external genitalic morphology of *Blattakeraia hochuli*. Pygophore: **A.** ventral; **B.** posterior; **C.** left lateral; **D.** right lateral. Scale bars = 100 μm.

DESCRIPTION: Male: Large size, elongate, body length 4.72–5.31 mm, pronotal width 1.10–1.30 mm. COLORATION: Dorsum bright green to yellowish green overall; AI faded red, reddish orange-brown, remainder of antenna yellowish green; cuneus concolorous and slightly more yellowish green medially; forewing membrane veins bright green, with adjacent bright green suffusion, major cell with large green spot (fig. 12). SURFACE AND VESTITURE: Dorsum with light-brown simple setae; antennae with dense distribution of short, light-brown simple setae. STRUCTURE: **Head:** Strongly expanded anteriorly, ca. three-quarters width of eye, frons strongly protruding beyond anterior margin of eyes (fig. 24A–C); eyes three-quarters height of head (fig. 24B, D); labium medium length, extending to metacoxae. **Pronotum:** Broad, transverse, at least 1.5× wider than head, lateral margins strongly angled 45° to midline of body, posterior margin very weakly sinuous to straight (fig. 24C, D). GENITALIA: **Pygophore:** Left paramere extending well over ventral surface of pygophore at rest (fig. 24). **Left paramere:** Sensory lobe greatly expanded, subtriangular, with an acuminate apex with few small serrations, apophysis elongate, arcuate, broad (figs. 24, 26B). **Right paramere:** Apex weakly curved inward, with small sclerotized flange, subapical dorsal margin sclerotized, serrate (figs. 25B, 26C). **Phallotheca:** Left dorsal margin retracted laterally below lateral tumescence (fig. 26D). **Aedeagus:** PES dorsad to secondary gonopore, DES2 dorsad to PES, DES1 left dorsolateral to DES2 (fig. 26); PES originating proximate to base of secondary gonopore, bases of DES2 and DES1 originating more distal to base of PES; PES bifurcate distally, branches almost equal in length, left branch slightly shorter than right branch, both branches with serrate splayed apices; submedial process of PES narrow, with serrate apical margins, twisted at base; DES2 tapering to apex, with round lobe on left margin submedially; DES1 with serrate apical margins, left branch very short and narrow, right branch elongate and tapering to arcuate apex, with elongate basal keel (DESk, not illustrated) (fig. 26E).

Female: Large size, elongate, body length 4.34–5.28 mm, pronotal width 1.10–1.27 mm. GENITALIA: VLP with small spiniferous lateral lobes arising adjacent to rami, adpressed to VLP (fig. 27A); posterior wall of bursa copulatrix with posterior margin undefined and membranous (fig. 27C); IRL divided at base, outer branch elongate, spiniferous with round apex, inner branch subrectangular, two-thirds length of outer branch, margins serrate, apex truncate (fig. 27C).

Etymology: Named in honor of invertebrate ecologist Dieter Hochuli in recognition of his support of this project and mentorship of the senior author.

Host plants: Known from *Callitris glaucophylla*.

Holotype: **AUSTRALIA: New South Wales:** Gunningbland State Forest, 33.10111°S 147.945°E, 09 Oct 1998, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 1♂ (AMNH_PBI 00016307) (AM).

Paratypes: **AUSTRALIA: New South Wales:** Bulbodney State Forest, 32.515°S 147.201°E, 25 Sep 1997, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 3♂ (UNSW_ENT 00041770, UNSW_ENT 00041771, UNSW_ENT 00041915), 3♀ (UNSW_ENT 00041772, UNSW_ENT 00041773, UNSW_ENT 00041918) (AM). Gunningbland State Forest, 33.09222°S 147.9675°E, 08 Oct 1998, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 4♀ (AMNH_PBI 00016316, 00016317, 00016319, 00016320), 1♂ (AMNH_PBI 00016318) (AM). Gunningbland State Forest, 33.10111°S 147.945°E, 09 Oct 1998, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 2♂ (AMNH_PBI 00016305, 00016306), 8♀ (AMNH_PBI 00016308–00016315) (AM). Murda State Forest, 33.015°S 147.201°E, 24 Sep 1997, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 3♂ (UNSW_ENT 00041912–UNSW_ENT 00041914), 2♀ (UNSW_ENT 00041916, UNSW_ENT 00041917) (AM). Murda State Forest, Parkes-Condoblin, 33.015°S 147.201°E, 25 Sep 1997, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 1♂ (UNSW_ENT 00041774) (AM). Roadside remnant near Condobolin tip, 33.07505°S 147.14466°E, 25 Sep 1997, Australian Museum, *Callitris glaucophylla*, 5♀ (UNSW_ENT 00041782, UNSW_ENT 00041783, UNSW_ENT 00041785–UNSW_ENT 00041787), 1♂ (UNSW_ENT 00041784) (AM). Taratta State Forest, 32.8°S 147.03333°E, 25 Sep 1997, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 5♀ (UNSW_ENT 00041777–UNSW_ENT 00041781) (AM). **Western Australia:** Charles Darwin Reserve, track to Seven Mile Well, N of Wanarra Rd, 29.52483°S 117.01675°E, 265 m, 24 Sep 2009, C. Symonds, *Callitris columellaris*, det. WA Herbarium, 1♂ (AMNH_PBI 00030456), 1♀ (AMNH_PBI 00030457) (WAMP). Lochada, Kelly Well, 29.08191°S 116.58677°E, 281 m, 17 Sep 2009, C. Symonds, *Callitris columellaris*, det. WA Herbarium, 2♂ (AMNH_PBI 00404860, 00404861), 5♀ (AMNH_PBI 00404862–00404866) (UNSW). Lochada, Steves track, 29.23719°S 116.54694°E, 253 m, 20 Sep 2009, C. Symonds, *Callitris columellaris*, det. WA Herbarium, 2♂ (AMNH_PBI 00030451, 00030452), 3♀ (AMNH_PBI 00030453–00030455) (WAMP).

Other specimens examined: **AUSTRALIA: Western Australia:** Lochada, Steves track, 29.23719°S 116.54694°E, 253 m, 20 Sep 2009, C. Symonds, *Callitris columellaris*, det. WA Herbarium, 1♀ (UNSW_ENT 00401278) (UNSW).

Distribution: Known from 10 localities in southwestern Western Australia and central western New South Wales (map 1). Collected with four other callitroid-inhabiting Orthotylini (table 2).

Remarks: There is large variation in the body length of *Blattakeraia hochuli*, within and between populations. Body lengths (table 6) for New South Wales specimens have a large range from 4.72–5.31 mm in males and 4.34–5.28 mm in females. Western Australian specimens are larger (male body length 5.74–5.91 mm) and have a more elongate and more brownish anten-

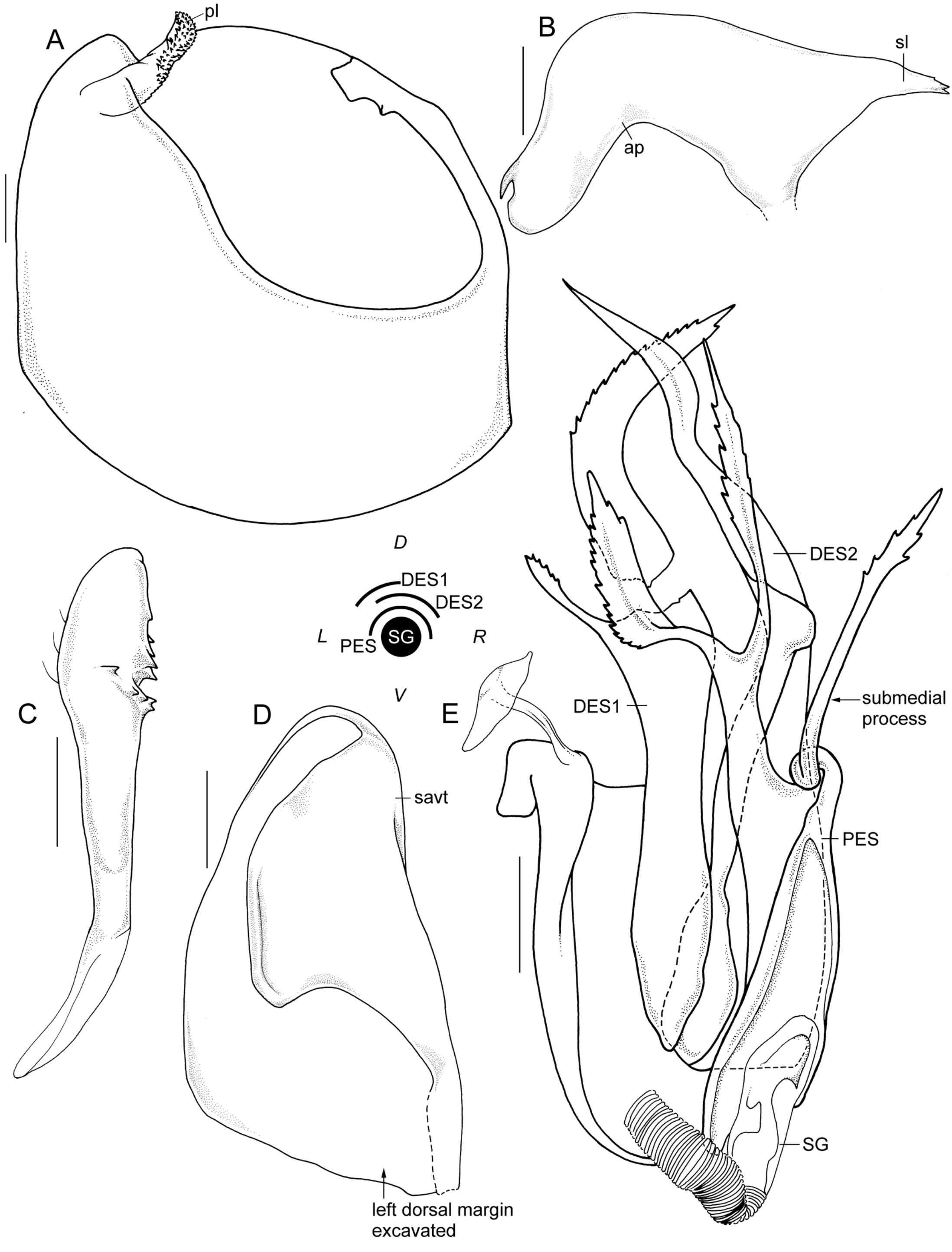


FIG. 26. Male genitalia of *Blattakeraia hochuli* (Species 9): **A.** Pygophore, right dorsolateral. **B.** Left paramere, dorsal. **C.** Right paramere, dorsal. **D.** Phallotheca, left lateral. **E.** Aedeagus, ventral. Scale bars = 0.1 mm.

nal AI (fig. 12). Other than these characters, these disjunct populations cannot be differentiated and the male genitalia are nearly identical. Thus, we regard them as conspecific.

Blattakeraia hochuli and *B. actinostrobi* both have a large and elongate body, large bulbous eyes, distinctive bright to dark red first antennal segment, and lightly sclerotized and exposed phallotheca in repose. This species is most readily distinguishable from *B. actinostrobi* by the shape of the left paramere, with an extended and acuminate sensory lobe (fig. 26B), and enlarged, broad curved apophysis that projects onto the ventral surface of the pygophore in repose (see fig. 25). See also remarks for *B. actinostrobi*. Some specimens are faded to white because of ethanol preservation.

***Callitricola*, new genus**

TYPE SPECIES: *Callitricola wiradjuri*, n. sp., by original designation.

DIAGNOSIS: Defined by the following characters: variable size (fig. 13); subovate to elongate; pale dusty green to yellowish-green coloration; antennae green; cuneus green; forewing membrane with subcuneal clear spot (fig. 12B), light brown, with darker patches laterally; forewing membrane veins either green or orange/yellow, major cell sometimes with green spot (fig. 13); dorsum with moderate distribution of pale simple setae; pygophore with short dark spinelike setae proximate to genital opening on ventral surface (fig. 31A, B); genital opening of pygophore large, round (figs. 29A, 31B); pygophore dorsal margin straight (figs. 30H, 32A), rarely moderately concave (figs.43H, 45A), with one short left lateral tergal process positioned left lateral or just left of midline on dorsal margin of pygophore (figs. 38A, 39F), rarely absent (figs. 30H, 32A), rarely with second right lateral tergal process or lobe (figs. 36A, 43H); phalloguide on pygophore with small, sclerotized, and weakly serrate lobe or very small lobe with serrate margin ventrad to right paramere articulation (figs. 29A, 32A); left paramere L-shaped, only weakly expanded medially, sen-

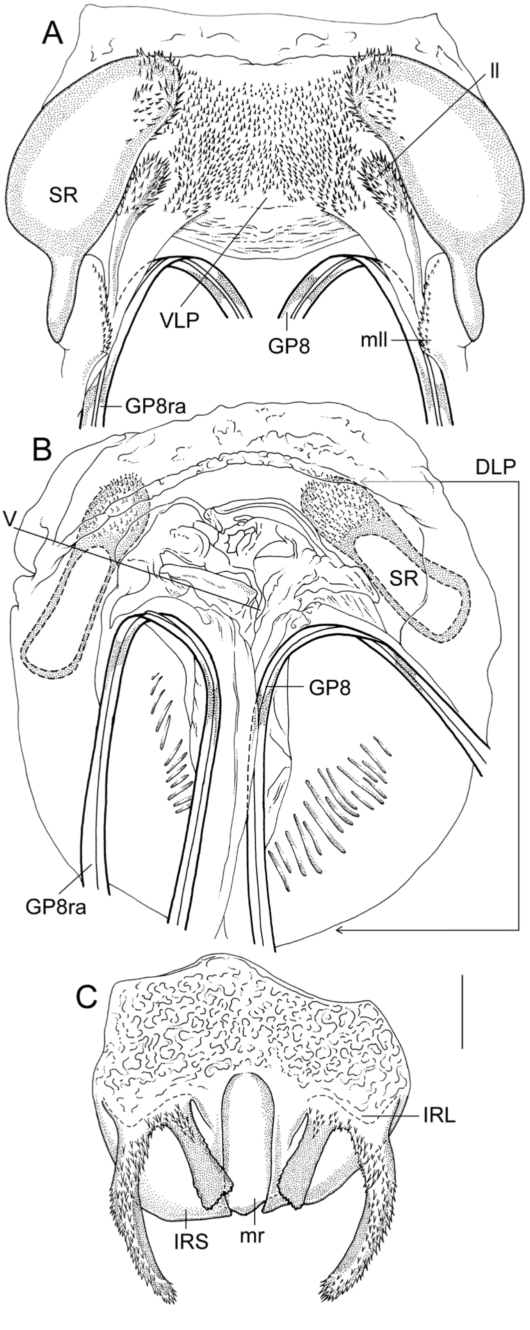


FIG. 27. Female genitalia of *Blattakeraia hochuli*. **A.** Ventral labiate plate with lateral lobes and lateral portions of dorsal labiate plate (sclerotized rings and mediolateral lobes), dorsal. **B.** Bursa copulatrix, ventral. **C.** Posterior wall, dorsal. Scale bar = 0.1 mm.

sory lobe elongate and round, strongly curved, apex mostly hooked (figs. 29B, 32B); left paramere positioned just inside and along entire ventral margin of pygophore (figs. 31A, 43B); right paramere club shaped, widest distally, with an apical or subapical flange on inner ventral surface, shape more variable than left paramere (figs. 28C, 32C, 33C); right paramere nested within pygophore with only expanded apex visible externally (figs. 31B, 44B); phallotheca very dark and heavily sclerotized, visible protruding from genital opening, well beyond parameres, covered with membranous proctiger (figs. 31A, B, 44A, B), with subapical ventral tumescence and right basal lobe and tumescence on dorsal margin; aedeagus with three mostly elongate sclerotized endosomal spicules (figs. 11, 31D–F), proximal endosomal spicule (PES) positioned ventral or left ventrolateral to and sheathing, fully (figs. 38G, 40E), partially (figs. 29D, 33E) or slightly removed from secondary gonopore (figs. 28F, 31F, 32F), second dorsal endosomal spicule (DES2) left lateral to PES (fig. 29) or dorsad to PES and secondary gonopore (fig. 28), first dorsal endosomal spicule (DES1) left lateral (fig. 29) or dorsad to DES2 (fig. 28); PES and DES2 associated with secondary gonopore, while DES1 is removed from secondary gonopore and adjacent to DES2 (fig. 31C); DES1 with basal keel (DESk) (fig. 32F); PES bifurcate distally, left branch downturned or perpendicular, with or without medial process, distally serrate (figs. 31D, E, 33F); DES2 simple, unbranched (fig. 35E, F), or bifurcate in distal half (figs. 36I, J), distally serrate (figs. 28, 31D, 32F) or smooth (figs. 29D, 33F, 35F); DES1 simple, unbranched or bifurcate, distally serrate, with basal keel (figs. 28E, 29D, 32F, 42H); female, vestibulum heavily sclerotized, ventral labiate plate with paired spiniferous lateral lobes (fig. 46A); large spiniferous mediolateral lobes on dorsal labiate plate (fig. 46A); interramal sclerites, deeply divided with V-shaped junction, with two pairs of interramal lobes (figs. 46B, 48), partially joined at base, lateral interramal lobe with basal lobe (fig. 48).

Description: *Male*: Macropterous, small to large size, body subovate to elongate, sides parallel or slightly round; body length 2.84–5.73 mm (fig. 13). COLORATION: Dorsum pale to bright, yellowish green, often faded to yellow as specimens age, with partial color retained on hemelytra and pronotum, or faded yellow all over; when faded, specimens may sometimes have bright green patches of pigmentation retained on hemelytra on inner lateral margin of clavus, lateral margins above and below costal fracture, and lateral margins and tip of cuneus; cuneus concolorous, sometimes slightly more yellow than rest of hemelytra; forewing membrane translucent light silvery gray-brown, sometimes with slightly darker patches laterally; clear spot present below cuneus (fig. 12B); veins orange-yellow with pigmentation confined to vein or yellowish green with adjacent suffusion onto surrounding membrane, middle of inner cell (major cell) sometimes with green spot; venter yellowish green, often faded to yellow; legs mostly yellow with little green and orange pigmentation; tarsi darkened (fig. 13). SURFACE AND VESTITURE: Dorsum smooth, weakly polished, with moderately dense covering of pale to medium-brown, semierect simple setae, sometimes more bristlelike on head and along lateral dorsal margins. **Antennae:** Dense covering of short, pale, soft, simple setae; AI, simple setae medium-brown and more bristlelike, with few long erect spinelike setae (approx. 5). **Legs:** Femora with medium-brown to dark simple setae and some longer, erect, spinelike setae; tibiae and tarsi with pale simple setae; hind tibiae with several rows of minute, dark spinulae; tibial spines light brown. **Male genitalia:** Pygophore, ventral surface proximate to genital opening with short, light or dark brown, spinelike setae (fig. 31A, B). STRUCTURE: **Head:** Subovate in lateral view; moderately expanded anteriorly; frons sloping downward, mandibular and maxillary plates and clypeus not greatly enlarged; clypeus moderately prominent with rounded dorsal margin; eyes moderately large occupying two-thirds to three-quarters of head height, strongly exerted beyond outline of head, extending well past anterolateral angle of pronotum; labium medium length,

TABLE 6

Measurements of Australian callitroid-inhabiting Orthotylini species

		Length						Width							
Species		Total	Clyp-Cun	Head	Pronotum	Scutellum	Cuneus	Head	Pronotum	Scutellum	InterOcDist	AI	AII	AIII	AIV
Avititerra															
A. lepidothrix															
M	**Mean**	**3.24**	**2.04**	**0.25**	**0.40**	**0.31**	**0.62**	**0.68**	**0.89**	**0.43**	**0.34**	**0.28**	**1.14**	**0.54**	**0.35**
n = 5	SD	0.16	0.14	0.03	0.02	0.02	0.07	0.03	0.03	0.05	0.01	0.03	0.08	0.08	0.05
	Range	0.43	0.39	0.07	0.05	0.07	0.18	0.08	0.08	0.16	0.03	0.09	0.20	0.21	0.11
	Min	3.03	1.82	0.21	0.38	0.27	0.54	0.64	0.85	0.35	0.33	0.23	1.05	0.38	0.28
	Max	3.45	2.21	0.28	0.43	0.34	0.72	0.71	0.94	0.51	0.36	0.32	1.25	0.60	0.38
F	**Mean**	**3.13**	**2.04**	**0.28**	**0.38**	**0.28**	**0.58**	**0.70**	**0.91**	**0.44**	**0.39**	**0.27**	**1.10**	**0.57**	**0.36**
n = 5	SD	0.19	0.10	0.05	0.02	0.04	0.06	0.02	0.01	0.07	0.01	0.04	0.05	0.01	0.01
	Range	0.47	0.29	0.11	0.07	0.11	0.15	0.06	0.04	0.19	0.03	0.12	0.14	0.03	0.02
	Min	2.93	1.89	0.21	0.34	0.23	0.52	0.67	0.88	0.35	0.38	0.23	1.04	0.56	0.35
	Max	3.40	2.18	0.32	0.41	0.34	0.68	0.73	0.92	0.54	0.41	0.34	1.18	0.59	0.37
A. xerophila															
M	**Mean**	**3.72**	**2.31**	**0.32**	**0.45**	**0.36**	**0.72**	**0.66**	**0.89**	**0.43**	**0.32**	**0.31**	**1.15**	**0.51**	**0.33**
n = 5	SD	0.14	0.11	0.06	0.03	0.00	0.03	0.01	0.05	0.03	0.02	0.06	0.07	0.09	0.06
	Range	0.33	0.27	0.14	0.08	0.00	0.08	0.02	0.13	0.07	0.06	0.15	0.15	0.22	0.17
	Min	3.49	2.18	0.26	0.42	0.36	0.68	0.65	0.86	0.39	0.30	0.21	1.07	0.37	0.23
	Max	3.83	2.45	0.40	0.50	0.37	0.75	0.67	0.99	0.46	0.36	0.36	1.23	0.58	0.39
F	**Mean**	**3.59**	**2.25**	**0.31**	**0.42**	**0.33**	**0.74**	**0.64**	**0.89**	**0.43**	**0.34**	**0.34**	**1.11**	**0.60**	**0.37**
n = 5	SD	0.09	0.07	0.05	0.01	0.02	0.04	0.01	0.03	0.02	0.02	0.01	0.03	0.05	0.06
	Range	0.27	0.21	0.14	0.04	0.05	0.12	0.03	0.08	0.07	0.06	0.02	0.08	0.13	0.16
	Min	3.50	2.14	0.23	0.40	0.29	0.67	0.62	0.86	0.41	0.31	0.33	1.07	0.52	0.27
	Max	3.77	2.35	0.37	0.44	0.34	0.79	0.65	0.94	0.47	0.37	0.35	1.15	0.64	0.42
Blattakeraia															
B. actinostrobi															
M	**Mean**	**4.91**	**3.20**	**0.35**	**0.47**	**0.49**	**0.86**	**0.84**	**1.11**	**0.58**	**0.34**	**0.54**	**1.98**	**0.87**	**0.45**
n = 5	SD	0.14	0.10	0.09	0.03	0.02	0.04	0.01	0.03	0.04	0.01	0.02	0.07	0.02	0.07
	Range	0.36	0.25	0.24	0.09	0.04	0.09	0.02	0.07	0.10	0.04	0.05	0.18	0.07	0.19
	Min	4.78	3.08	0.27	0.42	0.47	0.80	0.83	1.07	0.53	0.32	0.52	1.87	0.84	0.36
	Max	5.15	3.33	0.51	0.51	0.51	0.89	0.85	1.14	0.62	0.36	0.57	2.05	0.90	0.55
F	**Mean**	**4.63**	**3.15**	**0.42**	**0.47**	**0.48**	**0.76**	**0.81**	**1.14**	**0.61**	**0.45**	**0.54**	**1.81**	**0.80**	**0.51**
n = 5	SD	0.12	0.10	0.03	0.03	0.04	0.04	0.01	0.04	0.02	0.01	0.01	0.04	0.09	0.04
	Range	0.25	0.23	0.08	0.07	0.08	0.07	0.03	0.10	0.06	0.03	0.03	0.11	0.25	0.10
	Min	4.51	3.05	0.38	0.43	0.44	0.73	0.79	1.11	0.58	0.44	0.53	1.74	0.71	0.47

TABLE 6
(*Continued*)

		Length						Width							
Species		Total	Clyp-Cun	Head	Pronotum	Scutellum	Cuneus	Head	Pronotum	Scutellum	InterOcDist	AI	AII	AIII	AIV
	Max	4.76	3.28	0.47	0.50	0.52	0.81	0.82	1.21	0.64	0.46	0.56	1.85	0.96	0.57
B. hochuli															
M	**Mean**	**5.07**	**3.27**	**0.36**	**0.49**	**0.55**	**1.00**	**0.82**	**1.18**	**0.63**	**0.34**	**0.45**	**1.69**	**0.79**	**0.38**
n = 3	SD	0.24	0.10	0.05	0.05	0.03	0.04	0.03	0.08	0.04	0.02	0.02	0.04	0.04	0.04
	Range	0.58	0.23	0.11	0.14	0.08	0.10	0.08	0.20	0.10	0.05	0.04	0.10	0.09	0.07
	Min	4.72	3.11	0.28	0.43	0.51	0.94	0.77	1.10	0.58	0.31	0.44	1.64	0.75	0.34
	Max	5.31	3.34	0.40	0.57	0.59	1.03	0.85	1.30	0.67	0.37	0.48	1.73	0.84	0.42
F	**Mean**	**4.75**	**3.28**	**0.43**	**0.50**	**0.54**	**0.85**	**0.83**	**1.23**	**0.64**	**0.43**	**0.49**	**1.67**	**0.80**	**0.38**
n = 5	SD	0.37	0.28	0.06	0.04	0.04	0.11	0.04	0.07	0.05	0.04	0.09	0.25	0.06	0.09
	Range	0.93	0.75	0.15	0.11	0.09	0.27	0.12	0.17	0.14	0.11	0.22	0.69	0.14	0.22
	Min	4.34	2.85	0.37	0.43	0.50	0.78	0.77	1.10	0.57	0.35	0.41	1.27	0.76	0.27
	Max	5.28	3.60	0.52	0.54	0.59	1.05	0.89	1.27	0.71	0.47	0.63	1.96	0.89	0.49
Callitricola															
C. ballina															
M	**Mean**	**3.31**	**2.36**	**0.33**	**0.40**	**0.40**	**0.48**	**0.78**	**0.94**	**0.50**	**0.37**	**0.40**	**1.14**	**0.63**	**0.35**
n = 2	SD	0.24	0.15	0.02	0.05	0.05	0.05	0.05	0.04	0.02	0.01	0.05	0.08	0.03	0.04
	Range	0.34	0.22	0.03	0.07	0.07	0.07	0.07	0.05	0.03	0.01	0.06	0.11	0.04	0.05
	Min	3.13	2.25	0.32	0.36	0.37	0.44	0.74	0.91	0.48	0.36	0.37	1.09	0.61	0.33
	Max	3.48	2.47	0.35	0.43	0.43	0.51	0.81	0.96	0.51	0.38	0.44	1.20	0.65	0.38
F	**Mean**	**3.25**	**2.28**	**0.37**	**0.37**	**0.35**	**0.47**	**0.73**	**0.93**	**0.46**	**0.43**	**0.43**	**1.09**	**0.61**	**0.32**
n = 2	SD	0.16	0.09	0.07	0.02	0.04	0.05	0.02	0.05	0.03	0.01	0.02	0.01	0.04	0.04
	Range	0.23	0.13	0.10	0.03	0.05	0.06	0.03	0.07	0.05	0.02	0.02	0.02	0.05	0.05
	Min	3.13	2.22	0.32	0.35	0.32	0.44	0.72	0.89	0.44	0.42	0.42	1.08	0.58	0.30
	Max	3.36	2.35	0.41	0.39	0.38	0.50	0.75	0.96	0.49	0.44	0.44	1.09	0.63	0.35
C. boorabbin															
M	**Mean**	**3.27**	**2.19**	**0.35**	**0.35**	**0.35**	**0.55**	**0.71**	**0.95**	**0.44**	**0.37**	**0.36**	**1.10**	**0.43**	**0.27**
n = 2	SD	0.16	0.04	0.04	0.02	0.03	0.08	0.01	0.03	0.01	0.02	0.03	0.06	0.10	0.04
	Range	0.23	0.06	0.06	0.02	0.04	0.11	0.02	0.04	0.02	0.03	0.04	0.08	0.14	0.06
	Min	3.16	2.16	0.32	0.34	0.33	0.49	0.70	0.93	0.43	0.36	0.34	1.06	0.36	0.24
	Max	3.39	2.22	0.38	0.36	0.37	0.60	0.72	0.97	0.45	0.39	0.38	1.14	0.50	0.30
F n = 1		**3.08**	**2.31**	**0.35**	**0.35**	**0.39**	**0.43**	**0.72**	**0.93**	**0.48**	**0.41**	**0.34**	**1.12**		
C. cordylina															
M	**Mean**	**4.56**	**3.15**	**0.40**	**0.46**	**0.52**	**0.73**	**0.86**	**1.15**	**0.61**	**0.34**	**0.49**	**1.72**	**0.82**	**0.43**

TABLE 6
(*Continued*)

		Length						Width							
Species		Total	Clyp-Cun	Head	Pronotum	Scutellum	Cuneus	Head	Pronotum	Scutellum	InterOcDist	AI	AII	AIII	AIV
n = 5	SD	0.08	0.13	0.04	0.01	0.02	0.05	0.03	0.05	0.01	0.02	0.03	0.13	0.04	0.07
	Range	0.16	0.23	0.08	0.02	0.04	0.09	0.06	0.11	0.02	0.04	0.05	0.26	0.08	0.13
	Min	4.49	3.01	0.36	0.45	0.49	0.68	0.84	1.09	0.60	0.32	0.47	1.58	0.78	0.36
	Max	4.65	3.24	0.45	0.47	0.53	0.77	0.90	1.20	0.62	0.36	0.52	1.83	0.86	0.49
F	**Mean**	**4.67**	**3.30**	**0.48**	**0.49**	**0.51**	**0.75**	**0.84**	**1.19**	**0.64**	**0.45**	**0.54**	**1.75**	**0.86**	**0.49**
n = 5	SD	0.16	0.12	0.05	0.04	0.04	0.08	0.02	0.05	0.04	0.03	0.07	0.21	0.11	0.13
	Range	0.43	0.33	0.13	0.10	0.11	0.20	0.06	0.15	0.10	0.07	0.19	0.51	0.30	0.31
	Min	4.43	3.14	0.39	0.45	0.44	0.63	0.80	1.09	0.60	0.41	0.43	1.50	0.73	0.27
	Max	4.85	3.47	0.52	0.56	0.54	0.83	0.86	1.24	0.69	0.48	0.62	2.01	1.03	0.58
C. finke															
M	**Mean**	**2.94**	**1.99**	**0.26**	**0.36**	**0.33**	**0.48**	**0.67**	**0.85**	**0.42**	**0.28**	**0.32**	**1.03**	**0.41**	**0.24**
n = 5	SD	0.11	0.08	0.05	0.02	0.01	0.02	0.01	0.03	0.02	0.01	0.01	0.05	0.06	0.03
	Range	0.26	0.20	0.12	0.07	0.03	0.05	0.03	0.06	0.05	0.02	0.01	0.14	0.14	0.07
	Min	2.84	1.91	0.20	0.33	0.32	0.45	0.66	0.83	0.40	0.27	0.31	0.96	0.32	0.19
	Max	3.11	2.11	0.32	0.39	0.35	0.50	0.69	0.89	0.45	0.29	0.32	1.10	0.47	0.26
F	**Mean**	**3.04**	**2.05**	**0.31**	**0.35**	**0.32**	**0.49**	**0.65**	**0.85**	**0.44**	**0.32**	**0.33**	**1.04**	**0.49**	**0.23**
n = 5	SD	0.18	0.12	0.04	0.01	0.01	0.05	0.02	0.03	0.03	0.02	0.03	0.06	0.03	0.06
	Range	0.40	0.26	0.09	0.04	0.03	0.12	0.05	0.07	0.08	0.04	0.09	0.14	0.10	0.15
	Min	2.81	1.92	0.26	0.34	0.31	0.42	0.62	0.82	0.41	0.30	0.28	0.96	0.45	0.15
	Max	3.22	2.19	0.35	0.38	0.35	0.54	0.68	0.89	0.49	0.34	0.37	1.10	0.55	0.30
C. finlayae															
M	**Mean**	**4.00**	**2.81**	**0.40**	**0.48**	**0.43**	**0.60**	**0.88**	**1.11**	**0.57**	**0.37**	**0.49**	**1.49**	**0.78**	**0.34**
n = 5	SD	0.13	0.12	0.04	0.03	0.05	0.06	0.03	0.06	0.05	0.02	0.04	0.08	0.14	0.10
	Range	0.29	0.29	0.10	0.09	0.13	0.13	0.07	0.16	0.14	0.04	0.10	0.18	0.29	0.23
	Min	3.85	2.73	0.33	0.44	0.36	0.54	0.84	1.02	0.51	0.35	0.45	1.41	0.62	0.23
	Max	4.14	3.02	0.43	0.52	0.49	0.68	0.91	1.18	0.65	0.39	0.55	1.60	0.90	0.46
F	**Mean**	**4.11**	**2.95**	**0.42**	**0.49**	**0.47**	**0.58**	**0.85**	**1.13**	**0.60**	**0.46**	**0.52**	**1.59**	**0.93**	**0.46**
n = 5	SD	0.11	0.07	0.05	0.01	0.01	0.04	0.02	0.04	0.02	0.01	0.03	0.08	0.05	0.04
	Range	0.25	0.16	0.13	0.04	0.03	0.11	0.06	0.09	0.04	0.03	0.08	0.23	0.14	0.11
	Min	4.02	2.87	0.35	0.46	0.45	0.53	0.82	1.09	0.59	0.45	0.50	1.48	0.84	0.40
	Max	4.27	3.04	0.47	0.50	0.49	0.64	0.88	1.18	0.63	0.48	0.58	1.71	0.98	0.51
C. gammonensis															
M	**Mean**	**3.46**	**2.27**	**0.31**	**0.36**	**0.35**	**0.58**	**0.69**	**0.91**	**0.46**	**0.32**	**0.38**	**1.26**	**0.51**	**0.31**
n = 4	SD	0.18	0.09	0.06	0.04	0.04	0.07	0.03	0.08	0.01	0.01	0.03	0.07	0.05	0.03

TABLE 6
(*Continued*)

Species		Length: Total	Length: Clyp-Cun	Length: Head	Length: Pronotum	Length: Scutellum	Length: Cuneus	Width: Head	Width: Pronotum	Width: Scutellum	Width: InterOcDist	AI	AII	AIII	AIV
	Range	0.40	0.20	0.12	0.08	0.09	0.15	0.07	0.17	0.02	0.03	0.07	0.14	0.12	0.05
	Min	3.19	2.15	0.27	0.31	0.30	0.47	0.65	0.80	0.45	0.31	0.35	1.19	0.45	0.28
	Max	3.59	2.35	0.39	0.39	0.39	0.62	0.72	0.97	0.48	0.33	0.41	1.33	0.57	0.33
F	**Mean**	**3.25**	**2.21**	**0.33**	**0.36**	**0.36**	**0.55**	**0.66**	**0.85**	**0.43**	**0.33**	**0.37**	**1.09**	**0.44**	**0.32**
n = 3	SD	0.09	0.01	0.02	0.02	0.01	0.03	0.02	0.01	0.01	0.00	0.01	0.03	0.05	0.01
	Range	0.17	0.01	0.04	0.04	0.02	0.05	0.04	0.03	0.02	0.00	0.01	0.06	0.10	0.02
	Min	3.16	2.21	0.31	0.34	0.35	0.52	0.64	0.83	0.43	0.33	0.37	1.06	0.40	0.31
	Max	3.33	2.22	0.35	0.38	0.37	0.57	0.68	0.86	0.44	0.34	0.38	1.12	0.50	0.33
C. graciliphila															
M	**Mean**	**5.51**	**3.60**	**0.48**	**0.53**	**0.58**	**0.99**	**0.87**	**1.25**	**0.66**	**0.42**	**0.57**	**1.94**	**0.89**	**0.41**
n = 5	SD	0.24	0.14	0.01	0.02	0.05	0.08	0.10	0.08	0.04	0.03	0.07	0.16	0.08	0.04
	Range	0.60	0.34	0.02	0.05	0.13	0.21	0.24	0.21	0.11	0.09	0.18	0.36	0.15	0.07
	Min	5.13	3.40	0.47	0.51	0.50	0.85	0.70	1.14	0.62	0.37	0.46	1.68	0.81	0.36
	Max	5.73	3.74	0.48	0.56	0.63	1.06	0.94	1.35	0.73	0.46	0.64	2.04	0.96	0.43
F	**Mean**	**5.02**	**3.50**	**0.53**	**0.52**	**0.55**	**0.81**	**0.92**	**1.25**	**0.67**	**0.53**	**0.59**	**2.04**	**0.94**	**0.55**
n = 5	SD	0.27	0.18	0.05	0.04	0.03	0.07	0.01	0.06	0.06	0.03	0.08	0.11	0.10	0.04
	Range	0.66	0.46	0.11	0.09	0.07	0.17	0.03	0.14	0.13	0.06	0.18	0.23	0.22	0.08
	Min	4.55	3.21	0.47	0.48	0.50	0.70	0.91	1.17	0.60	0.49	0.50	1.94	0.87	0.52
	Max	5.22	3.68	0.58	0.57	0.57	0.87	0.94	1.31	0.73	0.56	0.69	2.17	1.09	0.60
C. parawirra															
M	**Mean**	**3.88**	**2.66**	**0.37**	**0.46**	**0.44**	**0.64**	**0.81**	**1.12**	**0.57**	**0.41**	**0.44**	**1.18**	**0.53**	**0.31**
n = 5	SD	0.12	0.09	0.03	0.03	0.03	0.04	0.03	0.04	0.02	0.01	0.03	0.13	0.05	0.02
	Range	0.29	0.24	0.06	0.07	0.08	0.12	0.08	0.11	0.04	0.03	0.08	0.36	0.12	0.03
	Min	3.67	2.50	0.35	0.42	0.38	0.58	0.76	1.06	0.55	0.39	0.39	0.97	0.47	0.29
	Max	3.97	2.74	0.41	0.49	0.46	0.70	0.84	1.16	0.60	0.42	0.47	1.32	0.59	0.32
F	**Mean**	**3.31**	**2.34**	**0.40**	**0.40**	**0.32**	**0.61**	**0.72**	**1.07**	**0.49**	**0.42**	**0.39**	**1.20**		
n = 2	SD	0.02	0.00	0.00	0.04	0.01	0.04	0.01	0.00	0.02	0.02	0.01	0.01		
	Range	0.04	0.00	0.01	0.07	0.02	0.09	0.02	0.00	0.04	0.05	0.02	0.02		
	Min	3.29	2.34	0.39	0.36	0.31	0.56	0.71	1.07	0.47	0.40	0.38	1.19		
	Max	3.33	2.34	0.40	0.44	0.33	0.65	0.73	1.07	0.51	0.45	0.40	1.21		
C. pullabooka															
M	**Mean**	**3.38**	**2.18**	**0.28**	**0.35**	**0.38**	**0.62**	**0.70**	**0.92**	**0.51**	**0.33**	**0.33**	**1.12**	**0.47**	**0.32**
n = 5	SD	0.13	0.13	0.03	0.04	0.02	0.04	0.01	0.05	0.04	0.02	0.04	0.06	0.04	0.05
	Range	0.31	0.31	0.08	0.12	0.05	0.08	0.03	0.12	0.11	0.05	0.12	0.14	0.09	0.12

TABLE 6
(*Continued*)

		Length						Width							
Species		Total	Clyp-Cun	Head	Pronotum	Scutellum	Cuneus	Head	Pronotum	Scutellum	InterOcDist	AI	AII	AIII	AIV
	Min	3.20	2.05	0.23	0.29	0.34	0.58	0.69	0.84	0.45	0.30	0.27	1.06	0.42	0.24
	Max	3.51	2.36	0.31	0.41	0.39	0.67	0.72	0.97	0.56	0.35	0.39	1.19	0.51	0.36
C. silveirae															
M	**Mean**	**4.13**	**2.48**	**0.34**	**0.41**	**0.42**	**0.75**	**0.71**	**0.91**	**0.44**	**0.37**	**0.44**	**1.31**	**0.54**	**0.33**
n = 2	SD	0.02	0.08	0.01	0.01	0.01	0.04	0.01	0.07	0.11	0.02	0.01	0.02	0.04	0.08
	Range	0.03	0.11	0.02	0.01	0.01	0.05	0.01	0.09	0.15	0.02	0.02	0.03	0.06	0.12
	Min	4.12	2.43	0.33	0.41	0.41	0.73	0.70	0.86	0.37	0.36	0.43	1.29	0.51	0.28
	Max	4.15	2.53	0.35	0.42	0.42	0.78	0.72	0.96	0.52	0.38	0.45	1.32	0.57	0.39
F	**Mean**	**3.77**	**2.46**	**0.36**	**0.42**	**0.38**	**0.71**	**0.72**	**0.98**	**0.51**	**0.41**	**0.41**	**1.28**	**0.65**	**0.21**
n = 2	SD	0.13	0.09	0.04	0.02	0.02	0.05	0.01	0.02	0.03	0.03				
	Range	0.18	0.12	0.06	0.03	0.02	0.07	0.01	0.03	0.05	0.04				
	Min	3.68	2.40	0.33	0.40	0.37	0.67	0.71	0.97	0.48	0.39				
	Max	3.86	2.53	0.39	0.44	0.40	0.75	0.73	1.00	0.53	0.42				
C. tatarnici															
M	**Mean**	**4.02**	**2.54**	**0.37**	**0.37**	**0.44**	**0.79**	**0.74**	**1.04**	**0.51**	**0.36**	**0.42**	**1.23**	**0.56**	**0.39**
n =1															
F	**Mean**	**3.44**	**2.30**	**0.34**	**0.38**	**0.40**	**0.59**	**0.74**	**1.01**	**0.51**	**0.42**	**0.39**	**1.30**	**0.50**	**0.37**
n = 2	SD	0.16	0.09	0.04	0.04	0.02	0.06	0.08	0.12	0.04	0.06	0.04	0.14	0.01	0.04
	Range	0.22	0.13	0.05	0.05	0.03	0.09	0.11	0.18	0.06	0.09	0.05	0.20	0.02	0.06
	Min	3.33	2.24	0.32	0.36	0.39	0.55	0.68	0.92	0.48	0.38	0.36	1.20	0.49	0.34
	Max	3.55	2.37	0.37	0.41	0.41	0.63	0.79	1.09	0.54	0.47	0.41	1.40	0.51	0.40
C. wiradjuri															
M	**Mean**	**3.56**	**2.29**	**0.29**	**0.38**	**0.39**	**0.66**	**0.74**	**0.95**	**0.49**	**0.31**	**0.35**	**1.24**	**0.55**	**0.25**
n = 5	SD	0.30	0.17	0.06	0.04	0.03	0.10	0.03	0.04	0.04	0.02	0.03	0.07	0.06	0.06
	Range	0.81	0.46	0.16	0.10	0.08	0.27	0.06	0.11	0.09	0.06	0.06	0.17	0.16	0.16
	Min	3.13	2.07	0.20	0.33	0.34	0.50	0.71	0.91	0.43	0.28	0.32	1.12	0.47	0.16
	Max	3.93	2.53	0.36	0.43	0.42	0.77	0.77	1.01	0.53	0.34	0.38	1.29	0.63	0.32
F	**Mean**	**3.41**	**2.31**	**0.35**	**0.37**	**0.37**	**0.57**	**0.68**	**0.89**	**0.46**	**0.37**	**0.39**	**1.26**	**0.54**	**0.28**
n = 5	SD	0.26	0.16	0.05	0.03	0.02	0.05	0.03	0.05	0.04	0.02	0.03	0.07	0.03	0.06
	Range	0.66	0.40	0.12	0.07	0.06	0.12	0.08	0.11	0.08	0.07	0.07	0.17	0.07	0.14
	Min	3.12	2.07	0.30	0.33	0.34	0.52	0.65	0.84	0.43	0.35	0.37	1.15	0.53	0.19
	Max	3.78	2.48	0.42	0.40	0.40	0.64	0.73	0.96	0.51	0.41	0.44	1.32	0.60	0.33
C. wollemi															

TABLE 6
(*Continued*)

Species		Length						Width							
		Total	Clyp-Cun	Head	Pronotum	Scutellum	Cuneus	Head	Pronotum	Scutellum	InterOcDist	AI	AII	AIII	AIV
M		**4.73**	**3.27**	**0.45**	**0.50**	**0.56**	**0.69**	**0.94**	**1.18**	**0.65**	**0.38**	**0.60**	**1.96**	**0.89**	**0.45**
n = 1															
F	**Mean**	**4.22**	**2.96**	**0.43**	**0.50**	**0.47**	**0.63**	**0.83**	**1.08**	**0.54**	**0.43**	**0.52**	**1.59**	**0.77**	**0.32**
n = 2	SD	0.34	0.24	0.09	0.00	0.05	0.08	0.06	0.03	0.01	0.00	0.09	0.30	0.15	0.04
	Range	0.49	0.35	0.13	0.01	0.07	0.12	0.08	0.04	0.02	0.01	0.12	0.42	0.21	0.05
	Min	3.97	2.78	0.37	0.49	0.44	0.57	0.79	1.06	0.53	0.43	0.46	1.38	0.67	0.30
	Max	4.46	3.13	0.50	0.50	0.51	0.69	0.87	1.10	0.55	0.44	0.58	1.80	0.88	0.35
Erysivena															
E. apta															
M	**Mean**	**3.68**	**2.44**	**0.35**	**0.41**	**0.41**	**0.61**	**0.72**	**1.04**	**0.48**	**0.32**	**0.40**	**1.29**	**0.50**	**0.36**
n = 5	SD	0.10	0.10	0.04	0.01	0.05	0.03	0.04	0.06	0.06	0.02	0.03	0.03	0.04	0.04
	Range	0.31	0.30	0.11	0.03	0.15	0.08	0.11	0.18	0.20	0.07	0.07	0.09	0.10	0.12
	Min	3.53	2.30	0.27	0.40	0.33	0.56	0.66	0.99	0.38	0.28	0.36	1.25	0.45	0.29
	Max	3.84	2.60	0.39	0.44	0.48	0.64	0.78	1.17	0.57	0.35	0.44	1.34	0.54	0.41
F	**Mean**	**3.60**	**2.57**	**0.37**	**0.43**	**0.43**	**0.55**	**0.72**	**1.03**	**0.54**	**0.40**	**0.40**	**1.19**	**0.55**	**0.35**
n = 5	SD	0.13	0.10	0.03	0.01	0.03	0.05	0.02	0.02	0.01	0.01	0.04	0.08	0.01	0.03
	Range	0.38	0.26	0.08	0.03	0.09	0.13	0.06	0.05	0.04	0.03	0.10	0.22	0.02	0.07
	Min	3.40	2.50	0.34	0.41	0.40	0.47	0.68	1.01	0.52	0.38	0.35	1.08	0.54	0.30
	Max	3.78	2.76	0.42	0.44	0.49	0.60	0.74	1.06	0.56	0.42	0.45	1.30	0.55	0.37
E. bundjalung															
M	**Mean**	**2.97**	**2.09**	**0.28**	**0.36**	**0.35**	**0.46**	**0.73**	**0.89**	**0.46**	**0.34**	**0.35**	**1.04**	**0.42**	**0.29**
n = 5	SD	0.11	0.09	0.01	0.02	0.01	0.04	0.02	0.01	0.02	0.01	0.02	0.07	0.04	0.02
	Range	0.25	0.21	0.03	0.05	0.03	0.09	0.06	0.03	0.04	0.02	0.05	0.16	0.12	0.05
	Min	2.84	2.00	0.27	0.33	0.33	0.41	0.69	0.88	0.43	0.33	0.33	0.94	0.37	0.26
	Max	3.08	2.21	0.30	0.38	0.36	0.50	0.75	0.91	0.48	0.35	0.38	1.10	0.48	0.31
F	**Mean**	**3.24**	**2.32**	**0.32**	**0.38**	**0.37**	**0.48**	**0.72**	**0.95**	**0.49**	**0.42**	**0.32**	**1.12**	**0.48**	**0.32**
n = 5	SD	0.13	0.10	0.06	0.03	0.03	0.02	0.02	0.05	0.03	0.02	0.04	0.05	0.04	0.03
	Range	0.29	0.23	0.13	0.08	0.08	0.05	0.06	0.13	0.08	0.06	0.10	0.11	0.09	0.07
	Min	3.08	2.19	0.24	0.33	0.32	0.46	0.70	0.89	0.45	0.38	0.26	1.06	0.45	0.28
	Max	3.36	2.42	0.37	0.41	0.40	0.51	0.75	1.02	0.53	0.44	0.36	1.17	0.54	0.35
E. drepanomorpha															
M	**Mean**	**3.51**	**2.40**	**0.32**	**0.43**	**0.38**	**0.56**	**0.75**	**1.02**	**0.52**	**0.42**	**0.37**	**1.12**	**0.52**	**0.33**
n = 5	SD	0.18	0.12	0.03	0.02	0.02	0.07	0.02	0.03	0.02	0.01	0.03	0.06	0.00	0.05
	Range	0.45	0.31	0.06	0.05	0.07	0.16	0.05	0.08	0.05	0.03	0.08	0.14	0.01	0.12

TABLE 6
(*Continued*)

Species		Length: Total	Length: Clyp-Cun	Length: Head	Length: Pronotum	Length: Scutellum	Length: Cuneus	Width: Head	Width: Pronotum	Width: Scutellum	Width: InterOcDist	AI	AII	AIII	AIV
	Min	3.38	2.29	0.29	0.41	0.34	0.49	0.71	0.97	0.49	0.41	0.32	1.08	0.51	0.28
	Max	3.83	2.60	0.35	0.46	0.40	0.65	0.77	1.05	0.53	0.44	0.40	1.22	0.52	0.40
F	**Mean**	**3.52**	**2.51**	**0.35**	**0.40**	**0.39**	**0.52**	**0.77**	**1.04**	**0.56**	**0.47**	**0.37**	**1.11**	**0.54**	**0.37**
n = 5	SD	0.13	0.06	0.06	0.01	0.01	0.04	0.02	0.04	0.02	0.01	0.05	0.07	0.06	0.03
	Range	0.28	0.17	0.15	0.02	0.04	0.11	0.06	0.10	0.05	0.03	0.11	0.16	0.15	0.09
	Min	3.38	2.41	0.27	0.39	0.37	0.46	0.74	0.98	0.53	0.46	0.30	1.05	0.44	0.33
	Max	3.66	2.57	0.43	0.41	0.40	0.57	0.80	1.08	0.58	0.49	0.41	1.21	0.59	0.42
E. emeraldensis															
M	**Mean**	**3.71**	**2.53**	**0.44**	**0.45**	**0.37**	**0.60**	**0.71**	**0.93**	**0.51**	**0.30**	**0.46**	**1.39**	**0.61**	**0.37**
n = 2	SD	0.06	0.01	0.01	0.02	0.02	0.01	0.01	0.04	0.02	0.01	0.01	0.08	0.00	0.00
	Range	0.11	0.02	0.02	0.04	0.04	0.03	0.01	0.07	0.03	0.01	0.03	0.15	0.00	0.00
	Min	3.65	2.52	0.43	0.43	0.35	0.58	0.70	0.89	0.49	0.29	0.44	1.31	0.61	0.37
	Max	3.76	2.54	0.45	0.47	0.40	0.61	0.72	0.96	0.53	0.31	0.47	1.47	0.61	0.37
F	**Mean**	**3.66**	**2.61**	**0.44**	**0.43**	**0.40**	**0.53**	**0.72**	**1.00**	**0.54**	**0.40**	**0.45**	**1.35**	**0.63**	**0.38**
n = 5	SD	0.12	0.10	0.04	0.01	0.03	0.04	0.02	0.04	0.02	0.02	0.03	0.08	0.03	0.02
	Range	0.38	0.27	0.13	0.03	0.07	0.12	0.06	0.10	0.07	0.06	0.09	0.24	0.09	0.06
	Min	3.49	2.46	0.37	0.41	0.35	0.46	0.69	0.95	0.51	0.36	0.42	1.21	0.57	0.33
	Max	3.86	2.73	0.50	0.44	0.42	0.57	0.75	1.06	0.58	0.42	0.51	1.45	0.66	0.40
E. endlicheriphila															
M	**Mean**	**3.89**	**2.53**	**0.31**	**0.41**	**0.43**	**0.71**	**0.74**	**1.01**	**0.51**	**0.36**	**0.43**	**1.27**		
n = 2	SD	0.19	0.12	0.07	0.07	0.01	0.05	0.03	0.03	0.04	0.01	0.00	0.12		
	Range	0.27	0.17	0.10	0.09	0.01	0.07	0.05	0.04	0.06	0.02	0.01	0.17		
	Min	3.76	2.44	0.26	0.36	0.42	0.67	0.71	0.99	0.48	0.35	0.43	1.19		
	Max	4.03	2.61	0.36	0.45	0.44	0.74	0.76	1.03	0.54	0.37	0.44	1.36		
F	**Mean**	**3.55**	**2.53**	**0.36**	**0.40**	**0.42**	**0.57**	**0.72**	**0.97**	**0.49**	**0.42**	**0.45**	**1.02**		
n = 2	SD	0.12	0.01	0.01	0.01	0.02	0.07	0.03	0.03	0.01	0.00				
	Range	0.17	0.01	0.02	0.01	0.02	0.09	0.04	0.05	0.02	0.01				
	Min	3.46	2.53	0.35	0.39	0.41	0.52	0.70	0.94	0.48	0.42				
	Max	3.63	2.54	0.37	0.40	0.43	0.61	0.74	0.99	0.49	0.43				
E. kalbarri															
M	**Mean**	**3.16**	**2.19**	**0.27**	**0.39**	**0.37**	**0.49**	**0.67**	**0.96**	**0.48**	**0.38**	**0.33**	**1.22**	**0.54**	**0.32**
n = 5	SD	0.14	0.12	0.04	0.03	0.01	0.04	0.01	0.02	0.01	0.02	0.05	0.10	0.06	0.01
	Range	0.34	0.33	0.09	0.09	0.04	0.09	0.03	0.05	0.04	0.04	0.13	0.23	0.12	0.01
	Min	2.97	2.01	0.23	0.35	0.34	0.45	0.65	0.94	0.46	0.35	0.26	1.08	0.49	0.31

TABLE 6
(*Continued*)

		Length						Width							
Species		Total	Clyp-Cun	Head	Pronotum	Scutellum	Cuneus	Head	Pronotum	Scutellum	InterOcDist	AI	AII	AIII	AIV
	Max	3.31	2.34	0.33	0.44	0.38	0.55	0.69	0.98	0.50	0.39	0.39	1.32	0.61	0.32
F	**Mean**	**3.35**	**2.38**	**0.31**	**0.40**	**0.37**	**0.49**	**0.70**	**0.97**	**0.48**	**0.41**	**0.38**	**1.28**	**0.57**	**0.32**
n = 5	SD	0.14	0.15	0.04	0.04	0.02	0.03	0.01	0.05	0.04	0.02	0.03	0.07	0.07	0.03
	Range	0.37	0.40	0.09	0.08	0.06	0.07	0.03	0.14	0.09	0.06	0.09	0.19	0.16	0.08
	Min	3.15	2.18	0.28	0.35	0.35	0.46	0.69	0.91	0.42	0.40	0.33	1.19	0.50	0.28
	Max	3.52	2.58	0.37	0.44	0.41	0.52	0.71	1.05	0.51	0.46	0.42	1.38	0.66	0.36
E. majori															
M	**Mean**	**3.33**	**2.27**	**0.28**	**0.38**	**0.39**	**0.51**	**0.75**	**0.96**	**0.48**	**0.33**	**0.34**	**1.16**	**0.51**	**0.31**
n = 5	SD	0.17	0.12	0.02	0.04	0.03	0.04	0.02	0.08	0.05	0.02	0.03	0.03	0.02	0.02
	Range	0.37	0.32	0.04	0.09	0.09	0.10	0.06	0.19	0.13	0.06	0.07	0.09	0.07	0.06
	Min	3.20	2.14	0.26	0.32	0.33	0.46	0.71	0.84	0.42	0.31	0.30	1.10	0.48	0.28
	Max	3.56	2.46	0.30	0.41	0.43	0.56	0.77	1.03	0.55	0.36	0.37	1.19	0.54	0.34
F	**Mean**	**3.27**	**2.30**	**0.32**	**0.39**	**0.37**	**0.48**	**0.72**	**0.95**	**0.48**	**0.41**	**0.37**	**1.13**	**0.52**	**0.29**
n = 5	SD	0.12	0.09	0.02	0.02	0.04	0.02	0.02	0.06	0.03	0.02	0.05	0.03	0.00	0.01
	Range	0.27	0.22	0.05	0.04	0.10	0.05	0.05	0.15	0.09	0.05	0.10	0.09	0.01	0.02
	Min	3.14	2.19	0.29	0.36	0.31	0.46	0.69	0.89	0.45	0.39	0.33	1.07	0.51	0.28
	Max	3.41	2.41	0.33	0.40	0.41	0.51	0.74	1.04	0.54	0.45	0.43	1.16	0.52	0.30
E. mareeba															
M	**Mean**	**3.55**	**2.46**	**0.37**	**0.46**	**0.41**	**0.53**	**0.80**	**1.03**	**0.53**	**0.35**	**0.44**	**1.28**	**0.57**	**0.37**
n = 5	SD	0.09	0.09	0.06	0.02	0.01	0.03	0.03	0.02	0.02	0.01	0.03	0.02	0.02	0.04
	Range	0.25	0.23	0.18	0.05	0.03	0.09	0.07	0.06	0.05	0.03	0.09	0.06	0.05	0.10
	Min	3.42	2.34	0.26	0.43	0.39	0.49	0.75	1.00	0.49	0.33	0.39	1.25	0.55	0.31
	Max	3.66	2.57	0.44	0.48	0.43	0.57	0.82	1.06	0.54	0.36	0.48	1.30	0.59	0.41
F	**Mean**	**3.38**	**2.41**	**0.39**	**0.43**	**0.38**	**0.52**	**0.75**	**1.00**	**0.53**	**0.41**	**0.41**	**1.22**	**0.56**	**0.37**
n = 5	SD	0.11	0.09	0.06	0.03	0.02	0.02	0.02	0.04	0.02	0.02	0.02	0.05	0.07	0.03
	Range	0.29	0.24	0.15	0.06	0.06	0.06	0.05	0.11	0.07	0.06	0.05	0.12	0.18	0.08
	Min	3.23	2.31	0.31	0.40	0.34	0.50	0.72	0.96	0.50	0.39	0.38	1.15	0.45	0.33
	Max	3.52	2.55	0.47	0.46	0.40	0.56	0.77	1.06	0.57	0.45	0.44	1.27	0.63	0.41
E. molloy															
M		**3.28**	**2.36**	**0.30**	**0.44**	**0.40**	**0.56**	**0.78**	**1.02**	**0.47**	**0.36**				
n = 1															
F	**Mean**	**3.38**	**2.36**	**0.34**	**0.43**	**0.37**	**0.51**	**0.76**	**0.96**	**0.50**	**0.42**	**0.45**	**1.37**	**0.58**	**0.43**
n = 2	SD	0.06	0.02	0.08	0.01	0.01	0.00	0.01	0.02	0.02	0.02	0.01	0.02	0.12	
	Range	0.08	0.03	0.11	0.01	0.02	0.00	0.01	0.02	0.03	0.03	0.02	0.03	0.16	

TABLE 6
(*Continued*)

		Length						Width							
Species		Total	Clyp-Cun	Head	Pronotum	Scutellum	Cuneus	Head	Pronotum	Scutellum	InterOcDist	AI	AII	AIII	AIV
	Min	3.34	2.34	0.29	0.42	0.36	0.51	0.75	0.95	0.48	0.41	0.44	1.35	0.50	
	Max	3.42	2.38	0.40	0.43	0.38	0.51	0.76	0.97	0.51	0.43	0.46	1.38	0.66	
E. notodytika															
M	**Mean**	**4.02**	**2.71**	**0.34**	**0.44**	**0.45**	**0.69**	**0.80**	**1.11**	**0.56**	**0.46**	**0.43**	**1.24**	**0.61**	**0.42**
n = 5	SD	0.07	0.05	0.04	0.02	0.04	0.04	0.02	0.03	0.04	0.02	0.05	0.14	0.14	0.07
	Range	0.17	0.11	0.09	0.06	0.07	0.11	0.06	0.08	0.10	0.06	0.14	0.34	0.37	0.16
	Min	3.91	2.67	0.30	0.41	0.41	0.63	0.76	1.08	0.51	0.43	0.35	1.04	0.37	0.35
	Max	4.08	2.78	0.39	0.47	0.48	0.75	0.82	1.16	0.61	0.49	0.49	1.38	0.74	0.51
F	**Mean**	**3.91**	**2.82**	**0.36**	**0.46**	**0.43**	**0.62**	**0.81**	**1.13**	**0.55**	**0.51**	**0.45**	**1.37**	**0.61**	**0.44**
n = 5	SD	0.07	0.07	0.03	0.01	0.02	0.01	0.01	0.04	0.03	0.02	0.04	0.05	0.02	0.03
	Range	0.18	0.19	0.06	0.03	0.05	0.04	0.03	0.12	0.06	0.06	0.10	0.13	0.06	0.08
	Min	3.79	2.71	0.34	0.44	0.41	0.61	0.79	1.08	0.53	0.48	0.40	1.30	0.58	0.40
	Max	3.96	2.89	0.39	0.48	0.46	0.64	0.82	1.20	0.59	0.54	0.50	1.43	0.64	0.48
E. paluma															
M	**Mean**	**3.87**	**2.65**	**0.33**	**0.43**	**0.42**	**0.60**	**0.77**	**1.06**	**0.52**	**0.37**	**0.48**	**1.42**	**0.66**	**0.42**
n = 5	SD	0.06	0.06	0.04	0.02	0.02	0.03	0.02	0.05	0.02	0.02	0.03	0.08	0.07	0.02
	Range	0.16	0.16	0.08	0.06	0.05	0.07	0.05	0.13	0.05	0.04	0.07	0.19	0.18	0.07
	Min	3.79	2.55	0.29	0.41	0.39	0.55	0.74	0.99	0.50	0.35	0.44	1.34	0.54	0.39
	Max	3.95	2.71	0.37	0.47	0.45	0.62	0.79	1.12	0.55	0.38	0.50	1.53	0.72	0.45
F	**Mean**	**3.86**	**2.68**	**0.37**	**0.42**	**0.43**	**0.59**	**0.74**	**1.03**	**0.53**	**0.43**	**0.47**	**1.46**	**0.67**	**0.37**
n = 5	SD	0.11	0.07	0.03	0.03	0.01	0.02	0.02	0.05	0.02	0.01	0.03	0.05	0.11	0.03
	Range	0.28	0.15	0.07	0.07	0.03	0.05	0.05	0.12	0.05	0.02	0.08	0.09	0.26	0.08
	Min	3.73	2.62	0.34	0.38	0.41	0.56	0.72	0.96	0.50	0.42	0.44	1.41	0.48	0.33
	Max	4.01	2.78	0.41	0.45	0.45	0.61	0.77	1.08	0.55	0.44	0.51	1.51	0.75	0.42
E. schuhi															
M	**Mean**	**3.91**	**2.64**	**0.35**	**0.44**	**0.46**	**0.67**	**0.79**	**1.11**	**0.55**	**0.40**	**0.42**	**1.27**	**0.53**	**0.39**
n = 5	SD	0.16	0.16	0.08	0.02	0.03	0.07	0.06	0.08	0.05	0.05	0.04	0.12	0.13	0.04
	Range	0.44	0.43	0.20	0.07	0.07	0.17	0.16	0.20	0.11	0.11	0.10	0.28	0.25	0.05
	Min	3.68	2.43	0.28	0.41	0.42	0.61	0.73	1.06	0.51	0.34	0.38	1.09	0.39	0.37
	Max	4.12	2.86	0.48	0.48	0.49	0.78	0.89	1.26	0.62	0.45	0.48	1.37	0.64	0.42
F	**Mean**	**3.81**	**2.72**	**0.40**	**0.44**	**0.44**	**0.59**	**0.79**	**1.10**	**0.57**	**0.47**	**0.41**	**1.33**	**0.64**	**0.39**
n = 5	SD	0.29	0.16	0.07	0.03	0.02	0.03	0.02	0.03	0.05	0.03	0.03	0.21	0.12	0.06
	Range	0.72	0.40	0.20	0.08	0.05	0.08	0.05	0.07	0.13	0.06	0.07	0.50	0.30	0.13
	Min	3.35	2.47	0.29	0.40	0.42	0.55	0.76	1.06	0.50	0.45	0.38	0.96	0.44	0.33

TABLE 6
(*Continued*)

Species		Length: Total	Length: Clyp-Cun	Length: Head	Length: Pronotum	Length: Scutellum	Length: Cuneus	Width: Head	Width: Pronotum	Width: Scutellum	Width: InterOcDist	AI	AII	AIII	AIV
	Max	4.08	2.87	0.49	0.48	0.46	0.63	0.81	1.13	0.63	0.51	0.45	1.46	0.74	0.46
E. schwartzi															
M	**Mean**	**3.69**	**2.47**	**0.30**	**0.38**	**0.42**	**0.63**	**0.73**	**0.98**	**0.50**	**0.39**	**0.38**	**1.17**	**0.52**	**0.36**
n = 5	SD	0.14	0.10	0.03	0.02	0.02	0.03	0.02	0.03	0.02	0.01	0.03	0.05	0.04	0.05
	Range	0.30	0.26	0.08	0.05	0.06	0.07	0.05	0.07	0.05	0.02	0.06	0.14	0.11	0.10
	Min	3.54	2.36	0.26	0.36	0.38	0.60	0.71	0.95	0.47	0.38	0.36	1.09	0.46	0.33
	Max	3.84	2.62	0.34	0.40	0.44	0.67	0.76	1.02	0.52	0.40	0.41	1.23	0.57	0.43
F	**Mean**	**3.49**	**2.44**	**0.33**	**0.39**	**0.38**	**0.60**	**0.74**	**0.99**	**0.49**	**0.45**	**0.39**	**1.17**	**0.57**	**0.36**
n = 5	SD	0.19	0.12	0.04	0.02	0.02	0.01	0.02	0.03	0.03	0.02	0.04	0.05	0.03	0.03
	Range	0.44	0.28	0.09	0.05	0.05	0.04	0.04	0.08	0.06	0.04	0.10	0.09	0.07	0.08
	Min	3.23	2.28	0.27	0.37	0.35	0.58	0.72	0.93	0.45	0.43	0.34	1.12	0.53	0.32
	Max	3.67	2.56	0.37	0.42	0.41	0.62	0.76	1.02	0.52	0.47	0.44	1.21	0.60	0.40
E. sydneyensis															
M	**Mean**	**3.79**	**2.54**	**0.35**	**0.39**	**0.42**	**0.66**	**0.72**	**0.98**	**0.49**	**0.36**	**0.39**	**1.27**	**0.59**	**0.40**
n = 5	SD	0.29	0.15	0.05	0.03	0.04	0.09	0.05	0.08	0.04	0.02	0.04	0.15	0.04	0.05
	Range	0.67	0.31	0.14	0.09	0.08	0.23	0.12	0.19	0.08	0.06	0.10	0.37	0.09	0.10
	Min	3.51	2.36	0.30	0.35	0.38	0.57	0.67	0.88	0.45	0.34	0.34	1.01	0.54	0.34
	Max	4.19	2.67	0.44	0.43	0.46	0.80	0.79	1.08	0.54	0.40	0.44	1.38	0.63	0.45
F	**Mean**	**3.57**	**2.52**	**0.34**	**0.39**	**0.37**	**0.59**	**0.71**	**0.94**	**0.47**	**0.41**	**0.42**	**1.34**	**0.62**	**0.34**
n = 5	SD	0.38	0.27	0.04	0.04	0.05	0.06	0.05	0.08	0.05	0.02	0.04	0.11	0.06	0.06
	Range	0.88	0.65	0.09	0.09	0.11	0.15	0.10	0.20	0.11	0.05	0.10	0.30	0.14	0.17
	Min	3.13	2.17	0.27	0.33	0.33	0.53	0.66	0.85	0.41	0.39	0.37	1.19	0.56	0.24
	Max	4.01	2.82	0.36	0.43	0.44	0.68	0.76	1.05	0.53	0.44	0.47	1.48	0.70	0.40
Ngullamiris															
N. whadjuk															
M	**Mean**	**4.56**	**2.88**	**0.37**	**0.50**	**0.49**	**0.87**	**0.85**	**1.12**	**0.59**	**0.35**	**0.34**	**1.44**	**0.63**	**0.39**
n = 5	SD	0.24	0.12	0.08	0.02	0.04	0.04	0.02	0.03	0.05	0.06	0.05	0.11	0.11	0.03
	Range	0.57	0.32	0.22	0.06	0.11	0.11	0.04	0.09	0.15	0.13	0.14	0.32	0.22	0.06
	Min	4.22	2.71	0.30	0.47	0.43	0.83	0.83	1.07	0.53	0.27	0.28	1.30	0.52	0.36
	Max	4.79	3.03	0.52	0.53	0.54	0.94	0.87	1.16	0.68	0.40	0.42	1.62	0.74	0.42
F	**Mean**	**3.80**	**2.51**	**0.35**	**0.51**	**0.41**	**0.69**	**0.81**	**1.13**	**0.58**	**0.41**	**0.28**	**1.24**	**0.58**	**0.34**
n = 5	SD	0.06	0.03	0.03	0.02	0.02	0.06	0.01	0.02	0.03	0.01	0.02	0.05	0.03	0.01
	Range	0.17	0.08	0.08	0.04	0.05	0.18	0.02	0.07	0.08	0.02	0.06	0.15	0.08	0.02
	Min	3.69	2.47	0.30	0.49	0.38	0.59	0.80	1.10	0.54	0.40	0.25	1.16	0.55	0.34
	Max	3.85	2.55	0.38	0.53	0.42	0.76	0.82	1.17	0.62	0.42	0.31	1.31	0.62	0.36

extending to mesocoxae or metacoxae, or elongate, extending beyond metacoxae, over abdomen. **Antennae:** Elongate; inserted well above ventral margin of eye, insertion just slightly removed from anterior margin of eye (fig. 30A, B); AI short, subcylindrical, slightly wider than remaining segments, at least subequal to vertex width; AII moderately elongate, 1.2–1.6× pronotum width; AIV subequal length or slightly less than AI, half to two-thirds length of AIII, AIII and AIV slightly thinner than AII. **Pronotum:** Trapezoidal; anterior margin slightly concave; collar reduced to thin lip defined by join to proepisternum; callosite region weakly defined; lateral margins straight, angled 30°–45° to midline of body; humeral angles round extending slightly beyond posterior margin; posterior margin (shallowly and broadly concave medially) straight or slightly sinuous (figs. 30C, 39C, 43C). **Mesoscutum and scutellum:** Moderately raised, mesoscutum one-third length of scutellum (fig. 13). **Metathorax:** Metathoracic spiracle not elongate, narrowly subcylindrical, with evaporative area spanning anterior margin and expanded slightly dorsally (figs. 30E, 39E, 43E); metathoracic scent gland with ostiole subovate to lanceolate, peritreme subovate, extending onto posterior ostiole margin, evaporative area with small subovate to elongate evaporative bodies (figs. 30E, F; 39E, F, 43E, F). **Hemelytra:** Elongate, extending moderately beyond apex of abdomen, abdomen extending to middle of cuneus; lateral margins parallel; cuneus moderately long, at least two-thirds as long as wide; major membrane vein straight and parallel to cuneal margin or slightly curved. **Legs:** Elongate, femora slightly flattened, hind femur incrassate; pretarsus with moderately long claws, pulvilli moderately sized, fleshy parempodia broad, apically convergent (figs. 30G, 43G). GENITALIA: **Pygophore:** Transverse wider than long, or subquadrate, narrowing slightly posteriorly; genital opening large, round (figs. 29A, 31B, 32A, 35A); dorsal margin straight (figs. 30H, 32A) or at most weakly concave (figs. 29A, 37A), usually with one (e.g., figs. 38A, 39F) or rarely two tergal process (figs. 43H, 45A), and occasionally tergal lobe just right lateral of midline (figs. 30H, 36A), rarely without tergal process (figs. 30H, 32A); left tergal process just left lateral of midline, sometimes more far-left lateral, second when present just right lateral of midline; tergal process(es), short, linear (figs. 35A, 36A), or broad (e.g., figs. 38A, 45A), and generally distally serrate; tergal process(es) usually originating from dorsal margin of pygophore, sometimes originating from tergal plate across dorsal margin (e.g., figs. 38A, 41A, 45A); medial tumescence sometimes present on dorsal surface of pygophore proximate to genital opening (figs. 38A, 42A, 43H, 44A, 45A); ventral margin slightly convex medially (figs. 31A, 40B, 44B); phalloguide protruding slightly over ventral margin, round and cup shaped (figs. 29A, 32A), with small, round, sclerotized lobe ventrad to right paramere articulation (figs. 28A, 35A, 37A, 44B), or very slight lobe with sclerotized or serrate margin (figs. 32A, 36A); lobe of phalloguide with serrate margin on right side or more broadly serrate, serrations minute and spinelike; right paramere nested within pygophore with apex only visible, left paramere situated adjacent, just inside ventral margin of pygophore at rest, aedeagus and phallotheca protruding well beyond parameres posteriorly (figs. 29A, 31B), covered by membranous caplike proctiger. **Left paramere:** L-shaped; weakly expanded medially (figs. 28A, 29A, 32A, 40B); strongly curved from sensory lobe to apex; sensory lobe narrow, elongate, with round outer margin; apophysis uniformly narrow or tapering, elongate, ca. <45° to rest of paramere connected by smooth arc; apex acuminate and hooked, hook generally round (figs. 28A, 29A), sometimes slightly blunt (figs. 34B, C, 37B, C); outer margin of sensory lobe with pale simple setae, semierect but soft in appearance (figs. 31A, 32B). **Right paramere:** Club shaped; widest apically; variation in apical structure and amount of serration or spines; with flange or ridge on inner lateral margin at apex, apex curved inward or straight; apical or subapical flange or ridge with or without spinelike serrations; mesiolateral surface usually slightly excavated (e.g., figs. 32C, 33C); subapical dorsal margin round and unexpanded or expanded and bulbous, nearly always with few spinelike serrations; short, pale simple setae usually present on outer lateral surface. **Phallotheca:** Dark and heavily sclerotized; protruding strongly from pygophore and visible externally in repose (figs. 31A, B, 40A, B, 44A, B); overall curved to right side, opening large, distal to medial (figs. 31E, 33D, 35D); apex round (e.g., fig. 35D) or with an acute twisted point (e.g., fig. 36E–H); large subapical ventral tumescence (e.g., figs. 31B, 32D, 38D, 40A), sometimes doubled (e.g., fig. 37F); with various other species-specific tumescences and sculpturing, always with subbasal lobe on right dorsal margin and basal right lateral tumescence, sometimes also with left lateral tumescence, right lateral tumescence (figs. 36G–H, 47A), left dorsal margin sometimes enlarged and folded over dorsal opening (e.g., fig. 37E). **Aedeagus:** Secondary gonopore elongate, cylindrical, membranous, and faint; three elongate, sclerotized endosomal spicules (fig. 11); proximal endosomal spicule (PES) either enclosing secondary gonopore (figs. 38, 41, 42, 45), wrapped sheathlike partially around secondary gonopore (figs. 29, 33, 35, 37) or slightly removed from secondary gonopore (i.e., not wrapped sheathlike around secondary gonopore) (figs. 28, 32, 34, 36), position ventral or left ventrolateral to secondary gonopore (figs. 11, 38G, 40E); second dorsal endosomal spicule (DES2) position variable, either left lateral to PES (figs. 29, 33, 35, 37, 38, 40D, 41, 42), or sometimes dorsad, left dorsolateral of PES and secondary gonopore (figs. 28, 31D, 32, 34, 36, 44D, 45); first dorsal endosomal spicule (DES1) left lateral (e.g., fig. 29) or dorsad (e.g., fig. 28) to DES2, removed from secondary gonopore; bases of spicules often broad then constricted or narrowing either medially or at bifurcation point, base of all spicules originating proximate to base of secondary gonopore (e.g., figs. 38G, 40E), sometimes PES originating more distal to DES1 and DES2 (e.g., figs. 31D, 32F); PES bifurcate, dividing in distal half or third, rarely more basally, apex of left branch turned downward or perpendicular, right branch projected distally, PES distally serrate (figs. 31, 40, 44); PES rarely with submedial process (fig. 33F); DES2 unbranched (figs. 34, 35, 38, 41, 42, 44E, 45), or bifurcate (figs, 28, 29, 31F, 32, 33, 36. 37), distally serrate or margins entirely smooth; DES1 unbranched or bifurcate, distally serrate and sometimes also medially serrate (fig. 35F), elongate, curved basal keel (DESk) present (figs. 28E, 29D, 32F, 40C, 42H).

Female: Almost identical to male, with slight sexual dimorphism in slightly smaller eyes and shorter hemelytra; mostly subequal length to males, sometimes slightly smaller or larger than males in average body length, body length 2.81–5.22 mm. GENITALIA: Vestibulum with heavily sclerotized asymmetrical tubular processes, species specific; ventral labiate plate sclerotized, mesial surface spiniferous, with spiniferous lateral lobes (fig. 46A); dorsal labiate plate with paired spiniferous mediolateral lobes on posterior lateral sides of genital chamber, lobes distally expanded, with broadly acuminate apex directed inward across genital chamber, extending from margin (fig. 46A); sclerotized rings large, anterior surface spiniferous (fig. 46A); posterior wall heavily sclerotized, medial region of posterior wall more lightly sclerotized, margin straight or slightly convex, level with or below anterior margin of interramal sclerites (figs. 46B, 48); interramal sclerites (IRS) deeply divided with V-shaped junction, fused posteriorly below medial region of posterior wall forming posterior margin of posterior wall, posterior margin straight (figs. 46B, 48); IRS with two sets of paired interramal lobes, with species specific differences, partially joined at base (fig. 48); lateral interramal lobes (laIRL) elongate and spiniferous with inner margin smooth and with one (e.g., figs. 46B, 48) or two spiniferous lobes on inner margin at base (e.g., fig. 48); medial interramal lobes (mIRL) ventrad to laIRL, with base partially embedded in socket and partially joined to laIRL at base (outer margin of mIRL to base of inner margin of laIRL); mIRL shorter and broader than laIRL, elongate (only just shorter than laIRL) or short (half-length of laIRL), and sometimes in-between lengths (figs. 46B, 48); mIRL shape variable from subrectangular to subtriangular, apex pointed or round, margins and sometimes also distal surface spiniferous (fig. 48).

Etymology: Named in reference to the callitroid southern conifer host plants of these bugs, in combination with Latin *cola* meaning "dweller or inhabitant." The gender is feminine.

Remarks: *Callitricola* is best recognized by body color, hemelytral membrane color patterning, dorsal vestiture, and shape of the parameres, pygophore, and phallotheca. *Callitricola* is most closely related to *Erysivena* and they share the following characters: the body has hairlike simple setae only; the dorsum is bright to pale, and yellowish green in color; a postcuneal clear spot is present; the hemelytral membrane vein is patchily colored; the phallotheca is heavily sclerotized; the left paramere is simple and L-shaped; the pygophore has a round genital opening and dark bristles on the ventral surface; sclerotized tergal processes are present; PES is ventral in position; the basal keel of DES has a membranous attachment; and the interramal lobes are basally fused with the interramal sclerite.

Callitricola and *Blattakeraia* share similar external characters such as dorsal coloration, a distally broad phallotheca, capped with a membranous proctiger (cf. figs. 25D and 31B), and club-shaped right paramere. *Callitricola* is distinguished externally by uniform antennal coloration and the structure and positioning of the left paramere in repose. See remarks also for *Blattakeraia* for differential diagnosis.

Callitricola is distinguished from *Erysivena* by: the variable wing-membrane coloration (yellow-orange or green) and lack of color variation on the cuneal tip (cf. often red cuneal tip and uniformly red veins in *Erysivena*); the uniform shape of the left paramere, which is always positioned inside and extending the full length of the ventral margin of the genital opening (cf. figs. 31A and 72A) and is strongly curved, weakly expanded medially, with a round sensory lobe, elongate, narrow apophysis, and hooked apex (cf. figs. 28B and 49B); the club-shaped right paramere, which is situated mostly within the pygophore, with only the expanded apex protruding (cf. figs. 31B and 52B), and is widest distally, with an apical or subapical flange (cf. figs. 28B and 49C); the straight to weakly concave dorsal margin of the genital opening of the pygophore, which in most cases has a single short tergal process, positioned on left side to submedially (cf. 39F and 51H); the heavily sclerotized, very dark and prominent phallotheca, which protrudes significantly over the ventral margin of the pygophore and beyond the parameres and is easily visible, distally broad, and much darker than in *Erysivena*, and capped with a membranous proctiger (cf. figs. 31A, B and 52A, B); the caplike membranous proctiger covers the phallotheca (similar to *Blattakeraia*) (cf. figs. 30H, 31B and 51H, 52A); the uniform greenish coloration of the body without any contrasting coloration on head, antennae, or cuneus (cf. figs. 13 and 14); the green or yellow/orange hemelytral membrane veins (cf. figs. 13 and 14); the PES that sometimes sheaths the secondary gonopore and is always bifurcate and serrate distally (cf. narrow, tapering and undivided distally with mostly smooth margins in *Erysivena*) (cf. fig. 11); the lateral lobes of the ventral labiate plate that are more flattened, whereas in *Erysivena* they are more bulbous, three-dimensional, and club shaped; and the mediolateral lobes on the dorsal labiate plate that are more distally expanded and somewhat acuminate (cf. more round or ovate and padlike in *Erysivena*) (cf. figs. 46A, 55A).

Callitricola exhibits greater external variation than *Erysivena*. Accurate identification of species within the genus can be achieved using a combination of external characters, including: body size; hemelytral membrane vein color; and the tergal processes on the dorsal margin of the pygophore. Differentiating closely related species within *Callitricola* requires confirmation with characters of the right paramere, phallotheca, and aedeagus, postdissection. There is also greater morphological variation in the phallotheca within *Callitricola* than in *Erysivena*. Although the left paramere has a very uniform shape across all the species in *Callitricola* there are a few subtle differences in the shape of the apex, either truncate and round or narrow and tapering, and in the shape of the apical hook, which can be strongly or weakly recurved and rarely lacks a hook.

Identifying female species in *Callitricola* based on external characters is problematic, unless they are associated with males by collection event. Identification of females to species level is possible using the structure of the interramal lobes and asymmetrical sclerotization of the vestibulum, which are generally species specific, as they are in other orthotyline groups (e.g., Schwartz, 2011; Cassis and Symonds, 2016).

***Callitricola ballina*, new species**

Figures 5C–D, 13, 28, 48; map 2

Diagnosis: Defined by the following characters: small size; yellow-green forewing membrane veins; pygophore with one tergal process on dorsal margin, just left lateral of midline, tergal process broad round and spiniferous; left paramere with strong apical hook; right paramere base short, apex strongly curved inward and bulbous, subapical dorsal margin round, apical flange and subapical dorsal margins with small spinelike serrations; phallotheca with twisted point at apex, subapical right ventrolateral tumescence, large lobe on right dorsal margin, medially, and retracted left dorsal margin at base; aedeagus with short PES and DES2 originating above base of secondary gonopore, elongate DES1 originating adjacent to base of secondary gonopore; PES left lateral to secondary gonopore, bifurcate distally with left branch weakly downcurved; DES2 bifurcate, branches unequal in length, distally serrate; DES1 unbranched, elongate; female laIRL slightly wider distally, uncurved, base with large spiniferous lobe, margin of lobe sinuous; mIRL moderately elongate, three-quarters length of laIRL, subovate, apex pointed, margin only serrate.

Description: *Male*: Moderately small size, subovate, body length 3.13–3.48 mm, pronotal width 0.91–0.96 mm. COLORATION: Dorsum with patches of bright green pigmentation remaining on hemelytra, creating spotted appearance on faded yellow background; forewing membrane light brown, with slightly darker patches laterally, vein yellow-green with color confined to vein only, major cell with faint green spot (fig. 13). VESTITURE: Dorsum with moderately dense distribution of medium-brown simple setae, slightly bristlelike. STRUCTURE: **Head:** Antennae with AI subequal to vertex width, AII 1.2× pronotal width; labium medium length, extending to mesocoxae. **Hemelytra:** Cuneus and major cell of membrane short, major membrane vein very slightly rounded (fig. 13). GENITALIA: **Pygophore:** Dorsal margin of genital opening straight, with one tergal process medially to just left lateral of midline (not illustrated); left tergal process broad, lobelike, distally round, with spiniferous surface; ventral margin weakly convex medially; phalloguide with small, round, lightly sclerotized, lobe ventrad to right paramere articulation, with minute serrations on right lateral margin of lobe (fig. 28A). **Left paramere:** Apophysis subrectangular; apex truncate with strongly recurved hook (fig. 28B). **Right paramere:** Base short; apex strongly curved inward, bulbous, with slight ridge at edge; subapical dorsal margin weakly expanded and angular, continuous with apical margin; apical margin slightly sclerotized, with minute spinelike serrations on surface; mesiolateral surface weakly excavate (fig. 28C). **Phallotheca:** Dorsal opening large, distal to medial, narrowing distally; apex with twisted point; large subapical right ventrolateral tumescence; small left lateral tumescence; small right lateral basal tumescence; large lobe on right dorsal margin medially; left dorsal margin retracted medially down to base (fig. 28D). **Aedeagus:** Spicule arrangement: PES left lateral to secondary gonopore, not wrapped sheathlike around secondary gonopore, DES2 dorsad to secondary gonopore, DES1 dorsad to DES2 (fig. 28); PES and DES2 short with bases originating near apex of secondary gonopore, DES1 elongate with base originating adjacent to base of secondary gonopore; PES bifurcate distally, branches equal length with serrate margins, left branch only weakly downturned; DES2 bifurcate, branches unequal length, distally serrate; DES1 unbranched, distally serrate, basal keel (DESk) elongate (fig. 28E, F).

Female: Moderately small, subovate, body length 3.13–3.36 mm, pronotal width 0.89–0.96 mm. GENITALIA: Interramal lobes (fig. 48): mIRL partially joined to laIRL at base; laIRL slightly wider distally, uncurved, base with large spiniferous lobe, margin of lobe sinuous; mIRL moderately elongate, three-quarters length of laIRL, subovate, apex pointed, margins serrate.

Etymology: Named after the town of Ballina on the northern coast of New South Wales, near the type locality. Noun in apposition.

Host plants: Known from *Callitris columellaris* (table 2).

Holotype: **AUSTRALIA: New South Wales:** Bundjalung National Park, 10 km from Pacific Hwy on road to Black Rocks, 29.17617°S 153.39075°E, 7 m, 18 Jan 2005, C. Symonds, N. Tatarnic, *Callitris columellaris*, det. Field ID, 1♂ (AMNH_PBI 00005676) (AM).

Paratypes: **AUSTRALIA: New South Wales:** Bundjalung National Park, 10 km from Pacific Hwy on road to Black Rocks, 29.17617°S 153.39075°E, 7 m, 18 Jan 2005, C. Symonds, N. Tatarnic, *Callitris columellaris*, det. Field ID, 2♀ (AMNH_PBI 00005677, 00005678) (AM). Wardell, 16 km S of Ballina on Pacific Hwy, 28.95005°S 153.4658°E, 7 m, 18 Jan 2005, C. Symonds, N. Tatarnic, *Callitris columellaris*, det. Field ID, 1♂ (AMNH_PBI 00005679) (AM).

Distribution: Known from two localities in New South Wales (map 2), where it was collected with *E. bundjalung* (table 2).

Remarks: Although definitively within *Callitricola*, *C. ballina* is distinct, and in the phylogenetic analysis is sister to clade 15, comprising five species (fig. 2). The endosomal spicule structure and the retracted left dorsal margin on the phallotheca are unique within the genus (fig. 28D). It possesses some characters in common with *C. cordylina* and *C. graciliphila*, including the shape of the apex and lobe on the right dorsal margin of the phallotheca (fig. 28D), the shape of the apophysis and apex of the left paramere, and PES not sheathlike around the secondary gonopore (fig. 28E, F).

Callitricola boorabbin, new species

Figures 13, 29, 48; map 2

Diagnosis: Defined by the following characters: small size; yellow-green faded coloration, forewing membrane veins yellow-green; pygophore margin weakly concave with one small spinelike tergal process, just left lateral of midline; left paramere apophysis tapering, apex narrow with weakly recurved hook; right paramere subovate in lateral view, apex strongly curved inward, forming sclerotized and slightly serrate ridge, subapical dorsal margin round with one small spinelike serration; phallotheca simple, round distally, with small subapical ventral tumescence, and left lateral tumescence; aedeagus with PES wrapped sheathlike around secondary gonopore, left ventrolateral, bifurcate distally with twisted, distally serrate apex on right branch, left branch strongly downturned and slender with smooth margins; DES2 bifurcate medially, branches unequal in length; DES1 unbranched, distally serrate; all spicules originate adjacent to base of secondary gonopore, DES2 longer than DES1 and PES; female laIRL uniformly narrow, curved inward distally, base spiniferous with two spiniferous lobes; mIRL short, half height of laIRL, subtriangular, margins and surface serrate.

Description: *Male*: Small size, total length 3.16–3.39 mm, pronotal width 0.93–0.97 mm. COLORATION: Dorsum yellow-green, somewhat faded to yellow with few bright green patches of pigmentation retained on lateral

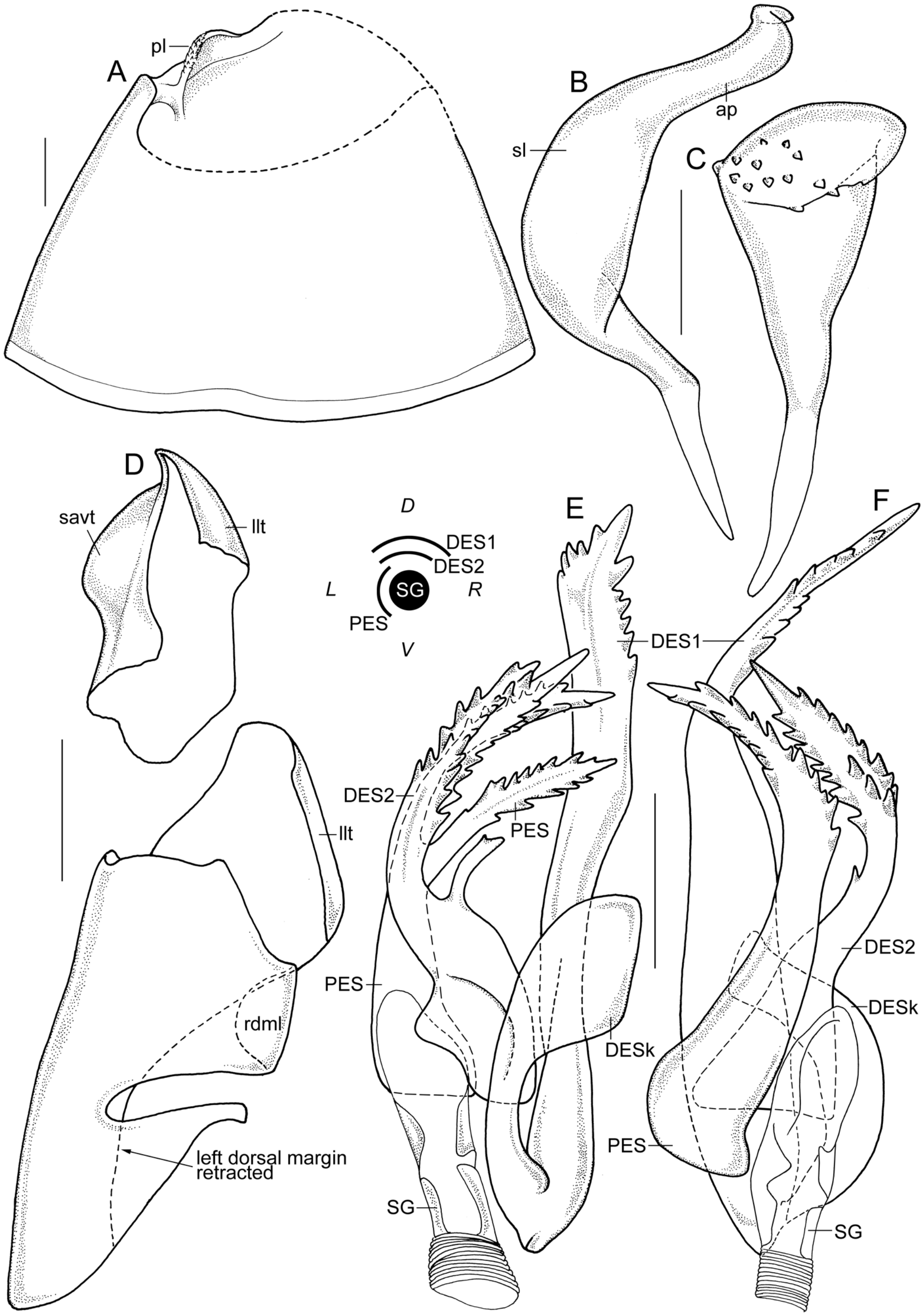


FIG. 28. Male genitalia of *Callitricola ballina.* **A.** Pygophore, dorsal. **B.** Left paramere, ventral. **C.** Right paramere, left lateral. **D.** Phallotheca, right lateral. **E.** Aedeagus, right lateral. F. Aedeagus, ventral. Scale bars = 0.1 mm.

margins of hemelytra; forewing membrane, translucent gray-brown, mostly uniform coloration, with very slightly darker patches laterally, veins yellow-green, with color confined to vein, major cell without colored spot (fig. 13). VESTITURE: Dorsum with moderately dense distribution of pale (light-brown) simple setae, few slightly longer and more bristlelike. STRUCTURE: **Head:** Antennae with AI subequal to vertex width, AII 1.2× pronotal width; labium extending to metacoxae. **Hemelytra:** Cuneus and major cell of membrane moderately short, major membrane vein round (fig. 13). GENITALIA: **Pygophore:** Dorsal margin of genital opening weakly concave, with one tergal process positioned just left lateral of midline; tergal process sclerotized, short, linear, or spinelike, and with jagged distal edge, lacking serration; ventral margin concave medially; phalloguide with small, round lobe ventrad to right paramere articulation; right margin of lobe sclerotized with minute spinelike serrations on margin (fig. 29A). **Left paramere:** Apophysis tapering, apex narrow, with weakly recurved hook (fig. 29B). **Right paramere:** Subovate in lateral view; apex strongly curved inward and flattened into subtriangular ridge, with sclerotized, weakly serrate margin; subapical dorsal margin round, with one small spinelike serration; inner surface not excavated (not illustrated). **Phallotheca:** Dorsal opening large, distal to medial; round distally; small subapical ventral tumescence (fig. 29C); left lateral tumescence; small right lateral basal tumescence. **Aedeagus:** Spicule arrangement: PES left ventrolateral to secondary gonopore, wrapped sheathlike around secondary gonopore, DES2 left ventrolateral to PES and secondary gonopore, DES1 left lateral to DES2 (fig. 29); bases of spicules originating at base of secondary gonopore with base of DES1 slightly more basal to those of PES and DES2 (which are adjacent); bases of PES and DES2 flattened and broad, sheathlike, while base of third more tubular; PES bifurcate in distal third, right branch twisted distally with serrate distal margins, left branch narrow and strongly downturned directed basally with smooth margins; DES2 bifurcate medially, branches unequal in length, acuminate apically with smooth distal margins, ventral branch very short, dorsal branch greatly elongate, longer than PES and DES1, dorsal branch also with submedial row of small spinelike serrations; DES1 unbranched, distally serrate, basal keel elongate (DESk) (fig. 29D).

Female: Small, subovate, body length 3.08 mm, pronotal width 0.93 mm. GENITALIA: Interramal lobes (fig. 48): mIRL partially joined to laIRL at base; laIRL uniformly narrow, curved inward distally, base spiniferous with one large and one small spiniferous lobe; mIRL short, half height of laIRL, subtriangular, margins and surface serrate.

ETYMOLOGY: Named for the type locality, near Boorabbin in southwestern Western Australia. Noun in apposition.

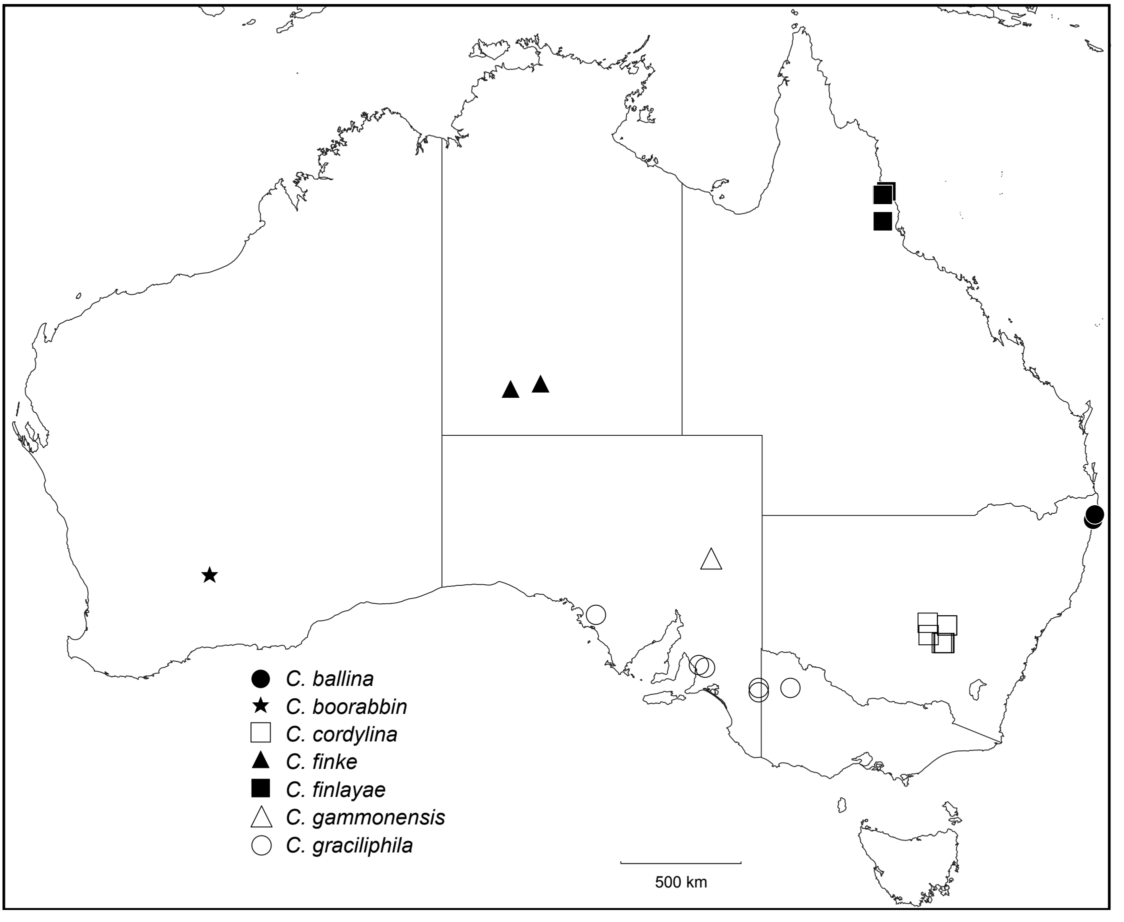
HOST PLANTS: Known from *Callitris tuberculata* (table 2).

HOLOTYPE: **AUSTRALIA: Western Australia:** 92.5 km W of Coolgardie at east side of Boorabbin National Park on Great Eastern Hwy, 31.21233°S 120.31°E, 445 m, 17 Nov 1999, R.T. Schuh, G. Cassis, and R. Silveira, *Callitris tuberculata*, det. WA Herbarium PERTH 05672058, 1♂ (AMNH_PBI 00016550) (WAMP).

PARATYPES: **AUSTRALIA: Western Australia:** 92.5 km W of Coolgardie at east side of Boorabbin National Park on Great Eastern Hwy, 31.21233°S 120.31°E, 445 m, 17 Nov 1999, R.T. Schuh, G. Cassis, and R. Silveira, *Callitris tuberculata*, det. WA Herbarium PERTH 05672058, 1♂ (AMNH_PBI 00016329), 1♀ (AMNH_PBI 00016330) (AM).

DISTRIBUTION: Known from one inland locality in the Southwest Interzone phytogeographic subregion of Western Australia (map 2), and was collected with *E. drepanomorpha* (table 2).

REMARKS: *Callitricola boorabbin* is one of the smallest species of the genus and can be distinguished externally by its small size and the unique left tergal process on the genital opening of the pygophore, which is spinelike and distally



MAP 2. Distribution of *Callitricola* species.

jagged (fig. 29A). These characters separate it from *C. tatarnici*, which is also found in the found in southwestern Western Australia on *Callitris tuberculata*.

Callitricola cordylina, new species

Figures 13, 30–32; map 2

DIAGNOSIS: Defined by the following characters: moderately large size; forewing membrane veins yellow-orange; labium extending over abdomen; pygophore, dorsal margin straight, retracted on left side, with right submedial tergal lobe, lacking tergal processes; left paramere apex truncate with strongly recurved hook; right paramere base elongate, apex twisted, uncurved inward, subapical inner ventral ridge small, without serrations; phallotheca with twisted point at apex, subbasal lobe on right dorsal margin small, subquadrate, with left and right lateral tumescence; aedeagus with PES left ventrolateral and not wrapped sheathlike around secondary gonopore, curving outward away from DES1 and DES2; PES, trifurcate in distal third, with left branch elongate and strongly curved downward; DES2 bifurcate in distal half, branches unequal in length, left branch elongate with an expanded subtriangular apex; DES1 bifurcate in distal half, branches unequal in length, dorsal branch very short, margins serrate, with small lobe below bifurcation point; female laIRL slightly wider at

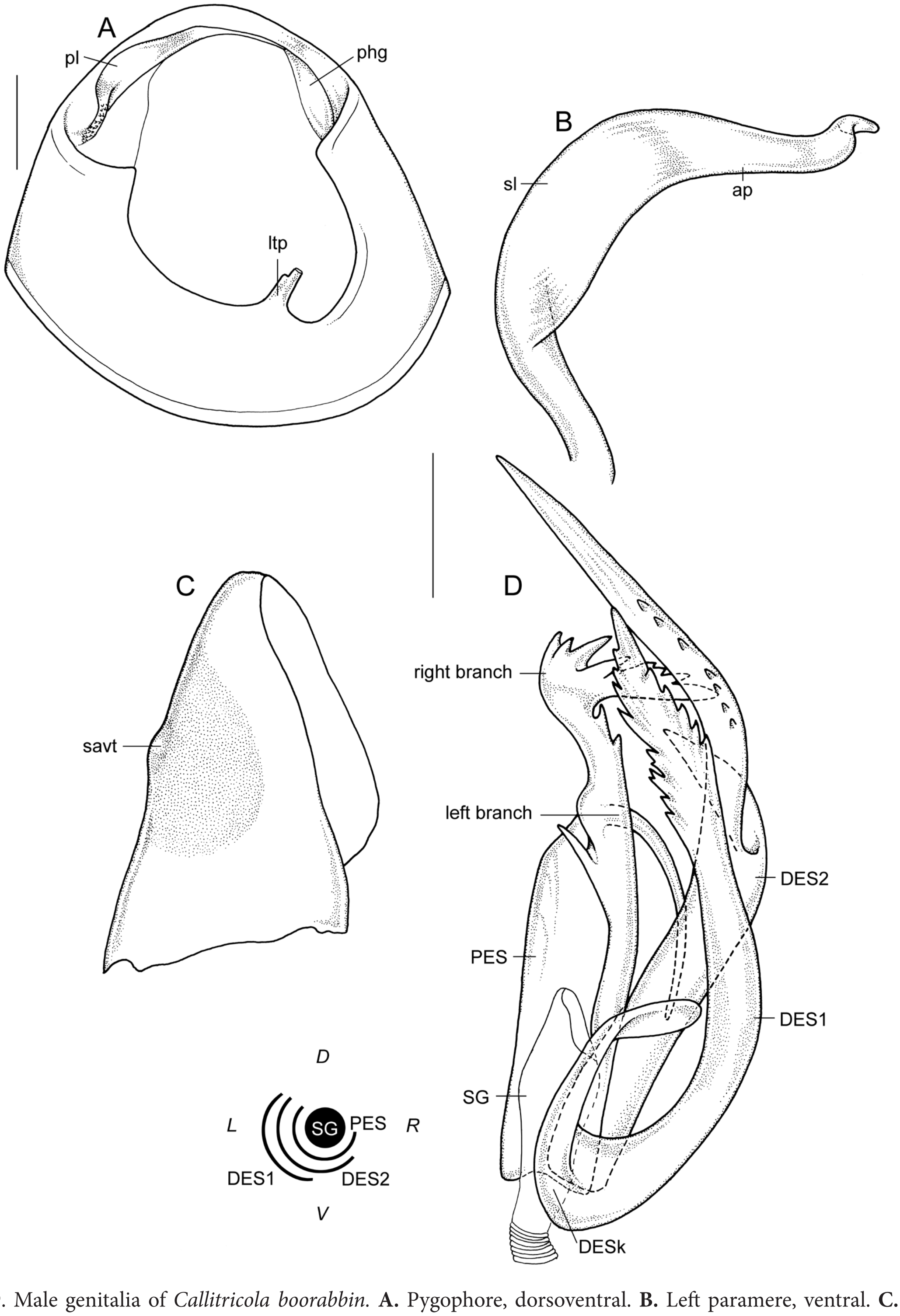


FIG. 29. Male genitalia of *Callitricola boorabbin*. **A.** Pygophore, dorsoventral. **B.** Left paramere, ventral. **C.** Phallotheca, right lateral. **D.** Aedeagus, dorsal. Scale bars = 0.1 mm.

apex and curved inward distally, base with large spiniferous lobe; mIRL elongate, almost as long as laIRL, subtriangular, margins and distal surface (sparsely) serrate.

Description: *Male*: Moderately large size, elongate, body length 4.49–4.65 mm, pronotal width 1.09–1.20 mm. COLORATION: Bleached by ethanol preservation; forewing membrane light brown, veins with slight orange-yellow tint confined to vein only. VESTITURE: Dorsum with moderately dense distribution of pale simple setae. STRUCTURE: **Head:** Antennae with A1 1.5× vertex width, AII 1.5× pronotal width; labium elongate, extending beyond metacoxae over abdomen. **Hemelytra:** Cuneus and major cell of wing membrane elongate, major membrane vein straight. GENITALIA: **Pygophore:** Dorsal margin of genital opening straight, retract on left side, with broad tergal lobe, narrowing apically, positioned just right of midline (figs. 30H, 32A); ventral margin very weakly convex medially (fig. 31A); phalloguide broadly subrectangular, margin ventrad to right paramere articulation with very slight sclerotized lobe with minute spinulae (figs. 31B, 32A). **Left paramere:** Apophysis subrectangular, apex truncate with strongly recurved hook (fig. 32B). **Right paramere:** Base elongate; apex twisted, not curved inward; subapical inner ventral margin constricted slightly to ridge, slightly more sclerotized than rest of paramere; subapical dorsal margin round; apical and subapical margins smooth; mesiolateral surface weakly excavate (figs. 32C, 31B). **Phallotheca:** Dorsal opening large, narrows distally; apex with twisted point (fig. 32E); large subapical ventral tumescence (figs. 32D, 31B); left lateral tumescence; large right lateral tumescence; small right lateral basal tumescence; small subquadrate basal lobe on right dorsal margin, subbasal (fig. 32D, E). **Aedeagus:** Spicule arrangement: with PES left ventrolateral to secondary gonopore, not wrapped sheathlike around secondary gonopore, DES2 dorsad to PES and secondary gonopore, DES1 dorsad to DES2 (fig. 32); base of PES more distal to bases of DES2 and DES1 which are adjacent (figs. 31D, E, 32F); PES bifurcate distally, appearing trifurcate with extra branch on right branch, branches unequal in length, constricted with narrow shaft before dividing point, left branch elongate and strongly curved downward, right branch reduced, all branches distally serrate (figs. 31D–F, 32F); DES2 bifurcate in distal half, branches unequal in length, left branch elongate with an expanded subtriangular apex, right branch short with an expanded diamond-shaped apex, distal margins of branches serrate (figs. 31E, F, 32F); DES1 distal margins serrate, bifurcate in distal half, branches unequal in length, dorsal branch very short, ventral branch elongate, slightly constricted below leaf-shaped apex (figs. 31F, 32F); DES1 with small lobe below bifurcation point, basal keel (DESk) elongate (fig. 32F).

Female: Moderately large, elongate, body length 4.43–4.85 mm, pronotal width 1.09–1.24 mm. GENITALIA: Interramal lobes (fig. 48): mIRL partially joined to laIRL at base; laIRL slightly wider at apex and curved inward distally, base with large spiniferous lobe; mIRL elongate, almost as long as laIRL, subtriangular, margins and distal surface sparsely serrate.

Etymology: This species name is from the Greek *kordylinos* meaning "clublike," after the characteristic shape of the right paramere.

Host plants: Known from *Callitris glaucophylla*, which is a dominant species in semiarid woodland remnants throughout western and central New South Wales (table 2).

Holotype: **AUSTRALIA: New South Wales:** Near Pullabooka State Forest, 33.79083°S 147.73777°E, 06 Nov 1998, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 1♂ (AMNH_PBI 00016275) (AM).

Paratypes: **AUSTRALIA: New South Wales:** Euglo South State Forest, 33.49111°S 147.24777°E, 06 Nov 1998, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 1♀ (AMNH_PBI 00016274) (AM). Gunningbland State Forest, 33.10972°S 147.92944°E, 19 Oct 1997, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 1♂ (AMNH_PBI 00016273) (AM). Gunningbland State Forest, 33.10111°S 147.945°E, 09 Oct 1998, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 1♂ (AMNH_PBI 00016285) (AM). Pullabooka State Forest,

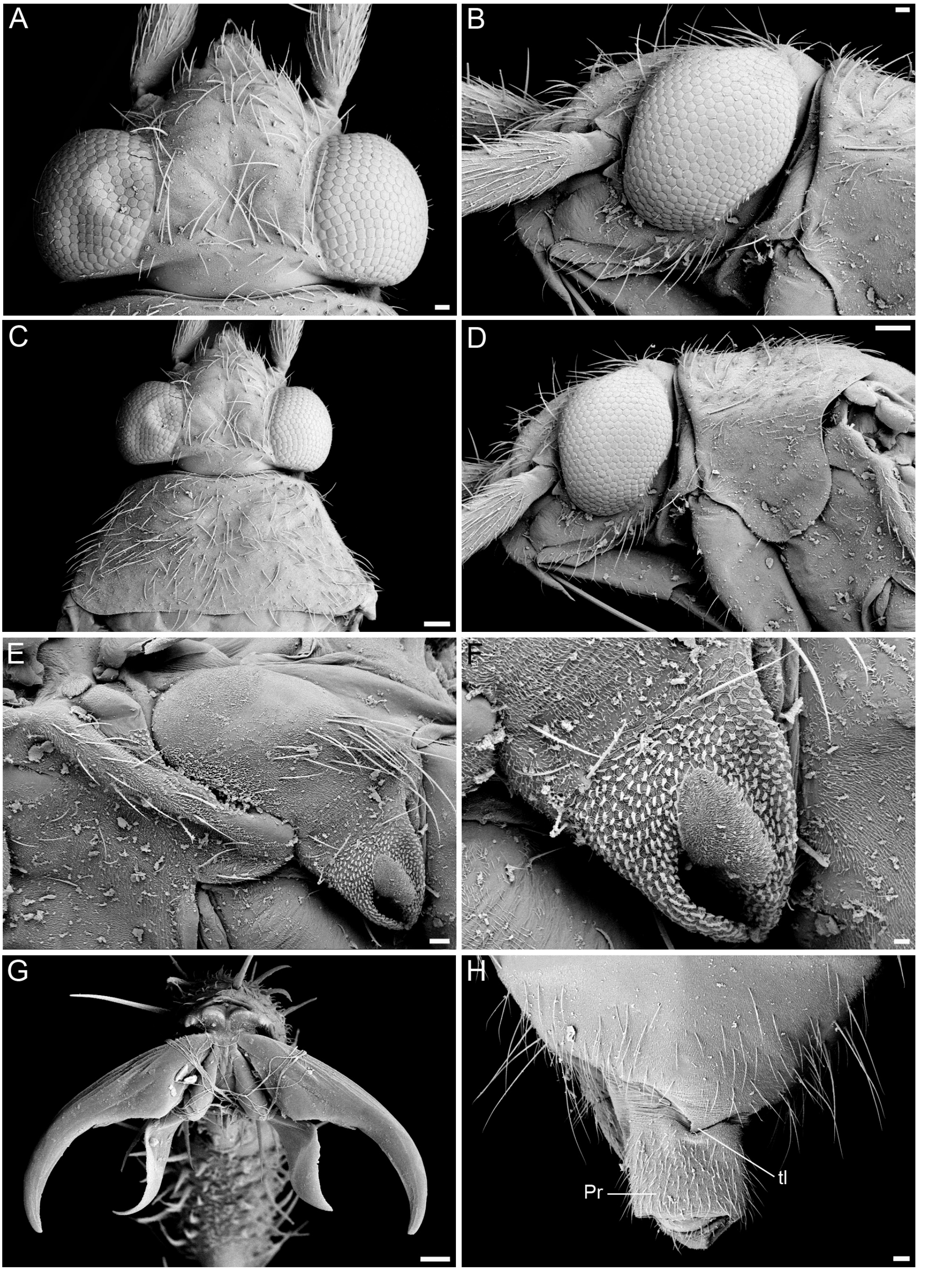


FIG. 30. External morphology of *Callitricola cordylina,* male. **A.** Head, dorsal, scale bar = 30 µm. **B.** Head, lateral, scale bar = 30 µm. **C.** Head and pronotum dorsal, scale bar = 100 µm. **D.** Head and pronotum, lateral, scale bar = 100 µm. **E.** Meso- and metathorax, scale bar = 30 µm. **F.** Metathoracic scent gland, scale bar = 10 µm. **G.** Tarsal claw, scale bar = 10 µm. **H.** Pygophore, dorsal, scale bar = 30 µm.

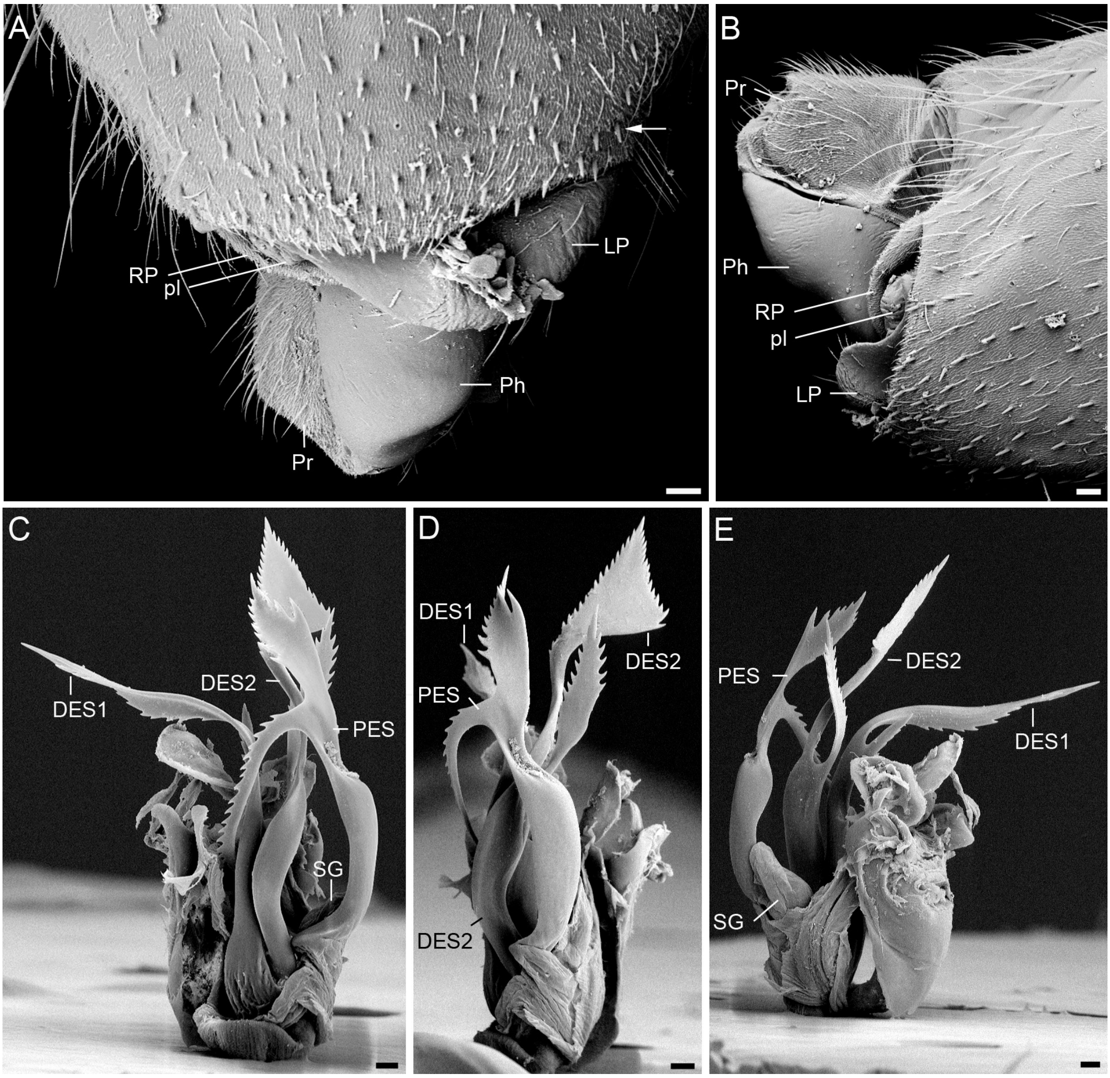


FIG. 31. Male genitalic morphology of *Callitricola cordylina*. **A.** Pygophore, ventral. Arrow indicates short spinelike setae. **B.** Pygophore, right lateral. **C.** Aedeagus left lateral. **D.** Aedeagus, ventral. **E.** Aedeagus, right lateral. Scale bars = 30 μm.

33.77138°S 147.79972°E, 03 Nov 1998, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 1♀ (AMNH_PBI 00016284) (AM). Pullabooka State Forest, 33.76111°S 147.815°E, 06 Nov 1998, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 1♀ (AMNH_PBI 00016282) (AM), 1♂ (AMNH_PBI 00016283) (UNSW). Near Pullabooka State Forest, 33.79083°S 147.73777°E, 06 Nov 1998, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 5♀ (AMNH_PBI 00016277–00016281) (AM), 1♀ (AMNH_PBI 00016276) (UNSW).

Other specimens examined: **AUSTRALIA: New South Wales:** Murda State Forest, 33.015°S 147.201°E, 24 Sep 1997, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 1♂ (UNSW_ENT 00041911) (AM).

Distribution: Known from seven localities in state forests in central western New South

Wales (map 2) and collected with six other species, including *B. hochuli* and *C. pullabooka* at two localities each (table 2).

Remarks: *Callitricola cordylina* is most closely related to *C. graciliphila* but can be differentiated from it by the following characters: smaller size (fig. 13); lack of left tergal process on the dorsal margin of pygophore (cf. figs. 32A and 36A); the right paramere lacking any serrations on the subapical inner ventral and dorsal margins (fig. 32C); the phallotheca with a small subquadrate lobe on the right dorsal margin, subbasally (as opposed to the larger round lobe in *C. graciliphila*) (cf. figs. 32E and 36E, H); PES with an elongate left downturned branch (short in *C. graciliphila*) (cf. figs. 32F and 36J); DES2 branches unequal in length, with the left branch having an expanded splayed apex; DES1 with a short apically serrate and acuminate dorsal branch and lobe proximal to the bifurcation point (cf. figs. 32F and 36J); the female laIRL with only one basal process and base not broadly serrate (cf. two basal processes), apex curved inward and weakly expanded (rather than uniform width and straight), and mIRL subtriangular (rather than subrectangular) (cf. fig. 48). See also remarks for *C. graciliphila* and *C. wollemi*.

Callitricola finke, new species

Figures 6A, 13, 33, 48; map 2

Diagnosis: Defined by the following characters: small size; large, bulbous eyes; pale, dusty green coloration, forewing membrane veins yellow-green; pygophore with comblike, serrate left lateral tergal process; left paramere with tapering apophysis, narrow apex with weakly recurved hook; right paramere base short, apex strongly curved inward with bulbous apical margin; inner ventral margin with small serrate ridge, subapical dorsal margin expanded and bulbous with spinelike serrations; phallotheca with subapical right lateral tumescence and large, broad lobe on right dorsal margin; aedeagus with PES wrapped sheathlike around secondary gonopore, left ventrolateral position, bifurcate distally, both branches serrate, with small medial process, left branch weakly downturned; DES2 bifurcate with right branch twisted above bifurcation point and distally serrate, left branch forked at apex with smooth margins; DES1 unbranched and shorter than PES and DES2; female laIRL uniformly narrow, curved inward at apex, base with small spiniferous lobe; mIRL moderately elongate, three-quarters height of laIRL, subrectangular with an acuminate apex, margin only serrate.

Description: *Male*: Small size, total length 2.84–3.11, pronotal width 0.83–0.89 mm. COLORATION: Dorsum dusty pale green, with some darker bright green pigmentation on hemelytral margins, cuneus faded to yellow; forewing membrane translucent gray-brown, slightly darker patches laterally, veins yellow (perhaps faded from green) with color extending onto membrane around vein, major cell without colored spot (fig. 13). VESTITURE: Dorsum with moderately dense distribution of pale simple setae, intermixed with sparse distribution of more elongate darker, midmedium-brown, bristlelike setae. STRUCTURE: **Head:** Eyes very large, bulbous, greatly exerted from outline of head; antennae with A1 subequal to vertex width, A11 1.2× pronotal width; labium medium length, extending to metacoxae. **Hemelytra:** Cuneus short, major cell subovate, major membrane vein slightly rounded (fig. 13). GENITALIA: **Pygophore:** Dorsal margin of genital opening straight, one left lateral tergal process, only weakly produced from margin; left tergal process sclerotized and serrate, comblike (fig. 33A); ventral margin weakly convex medially; phalloguide with small, slightly sclerotized lobe, at base of right paramere articulation (fig. 33A). **Left paramere:** Apophysis tapering apically, apex narrow with strongly recurved hook (fig. 33B). **Right paramere:** Base short; paramere round in lateral view; apex strongly curved inward, apical margin bulbous; inner ventral margin with small sclerotized ridge, with minute serrations on margin; apical dorsal margin expanded into bulbous lobe, with small spine-

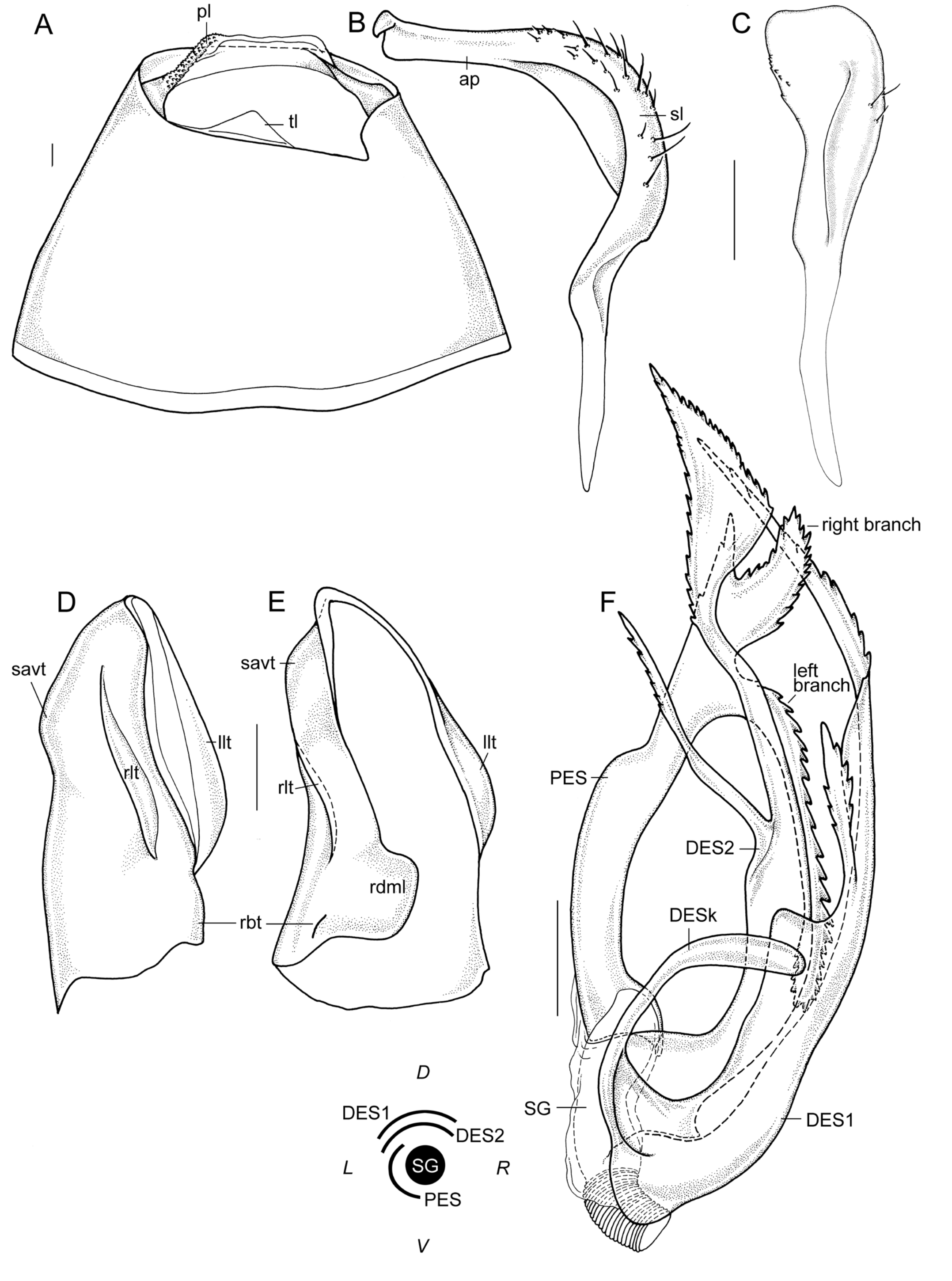


FIG. 32. Male genitalia of *Callitricola cordylina.* **A.** Pygophore, dorsal. **B.** Left paramere, dorsal. **C.** Right paramere, ventral. **D.** Phallotheca, right lateral. **E.** Phallotheca, dorsal. **F.** Aedeagus, dorsal. Scale bars = 0.1 mm.

like serrations; inner surface excavated (fig. 33C). **Phallotheca:** Opening large, distal to medial; strongly curved to right side; apical margin round; apex flattened; large subapical right ventrolateral tumescence; small left lateral tumescence; small right lateral basal tumescence; large medial lobe on right dorsal margin (fig. 33D). **Aedeagus:** Spicule arrangement: PES left ventrolateral to secondary gonopore, base wrapped sheathlike around part of secondary gonopore, DES2 left dorsolateral to PES, DES1 left lateral to DES2 (fig. 33); bases of PES and DES2 spicules flattened and broad, base of DES1 tubular and narrower; bases of all spicules originating adjacently at base of secondary gonopore (fig. 33F); PES bifurcate in distal third, branches subequal in length and both distally serrate, small, hooklike submedial process below bifurcation point, left branch weakly downcurved (fig. 33F); DES2 bifurcate in distal half, left branch bifurcate at apex with smooth distal margins, right branch twisted just above bifurcation point with serrate distal margins, right branch slightly shorter than left branch, left branch slightly longer than PES; DES1 unbranched, distally serrate, significantly shorter than other two spicules, basal keel elongate (DESk) (fig. 33E, F).

Female: Small, subovate, body length 2.81–3.22 mm, pronotal width 0.82–0.89 mm. GENITALIA: Interramal lobes (fig. 48): mIRL partially joined to laIRL at base; laIRL uniformly narrow, curved inward at apex, base with small spiniferous lobe; mIRL moderately elongate, three-quarters height of laIRL, subrectangular with an acuminate apex, margin serrate.

ETYMOLOGY: Named after the type locality in Finke Gorge, central Australia. Noun in apposition.

HOST PLANTS: Known from *Callitris glaucophylla* (table 2).

HOLOTYPE: **AUSTRALIA: Northern Territory:** Finke Gorge National Park, Palm Valley, 24.03333°S 132.7101°E, 586 m, 04 Nov 2001, Cassis, Schuh, Schwartz, Silveira, Wall, *Callitris glaucophylla*, det. RBG Sydney NSW666321, 1♂ (AMNH_PBI 00016207) (MAGNT).

PARATYPES: **AUSTRALIA: Northern Territory:** Finke Gorge National Park, Palm Valley, 24.03333°S 132.7101°E, 586 m, 04 Nov 2001, Cassis, Schuh, Schwartz, Silveira, Wall, *Callitris glaucophylla*, det. RBG Sydney NSW666321, 4♂ (AMNH_PBI 00016203–00016206), 6♀ (AMNH_PBI 00016210–AMNH_PBI 00016215) (AM), 2♂ (AMNH_PBI 00016208, 00016209), 3♀ (AMNH_PBI 00016216–00016218) (MAGNT). Kings Canyon, Watarrka National Park, 24.25001°S 131.5689°E, 633 m, 02 Nov 2001, Cassis, Schuh, Schwartz, Silveira, Wall, *Callitris glaucophylla*, 2♂ (AMNH_PBI 00016220, 00016221), 5♀ (AMNH_PBI 00016224–00016226, 00016230, 00016231) (AM), 2♂ (AMNH_PBI 00016222, 00016223), 3♀ (AMNH_PBI 00016227–00016229) (MAGNT).

OTHER SPECIMENS EXAMINED: **AUSTRALIA: Northern Territory:** Finke Gorge National Park, Palm Valley, 24.03333°S 132.7101°E, 586 m, 04 Nov 2001, Cassis, Schuh, Schwartz, Silveira, Wall, *Callitris glaucophylla*, det. RBG Sydney NSW666321, 1 juv. (AMNH_PBI 00016219) (AM). Kings Canyon, Watarrka National Park, 24.25001°S 131.5689°E, 633 m, 02 Nov 2001, Cassis, Schuh, Schwartz, Silveira, Wall, *Callitris glaucophylla*, 1 juv. (AMNH_PBI 00016232) (AM).

DISTRIBUTION: Known from two localities in central Australia, Kings Canyon and Finke Gorge (map 2). This is the only *Callitricola* species from the Northern Territory.

REMARKS: *Callitricola finke* is the smallest species in the genus and of all other callitroid-inhabiting orthotylines. It is recognized by its pale dusty coloration, large, bulbous eyes (fig. 13), the phallotheca has a flattened and rounded apex as well as a prominent subapical right ventrolateral tumescence (fig. 33D), the shapes of PES and DES2 (fig. 33E, F), and the female interramal lobes with a more slender laIRL, and more slender and apically acuminate mIRL (fig. 48). This is a very distinctive species within *Callitricola* and *C. gammonensis* and *C. wiradjuri* are

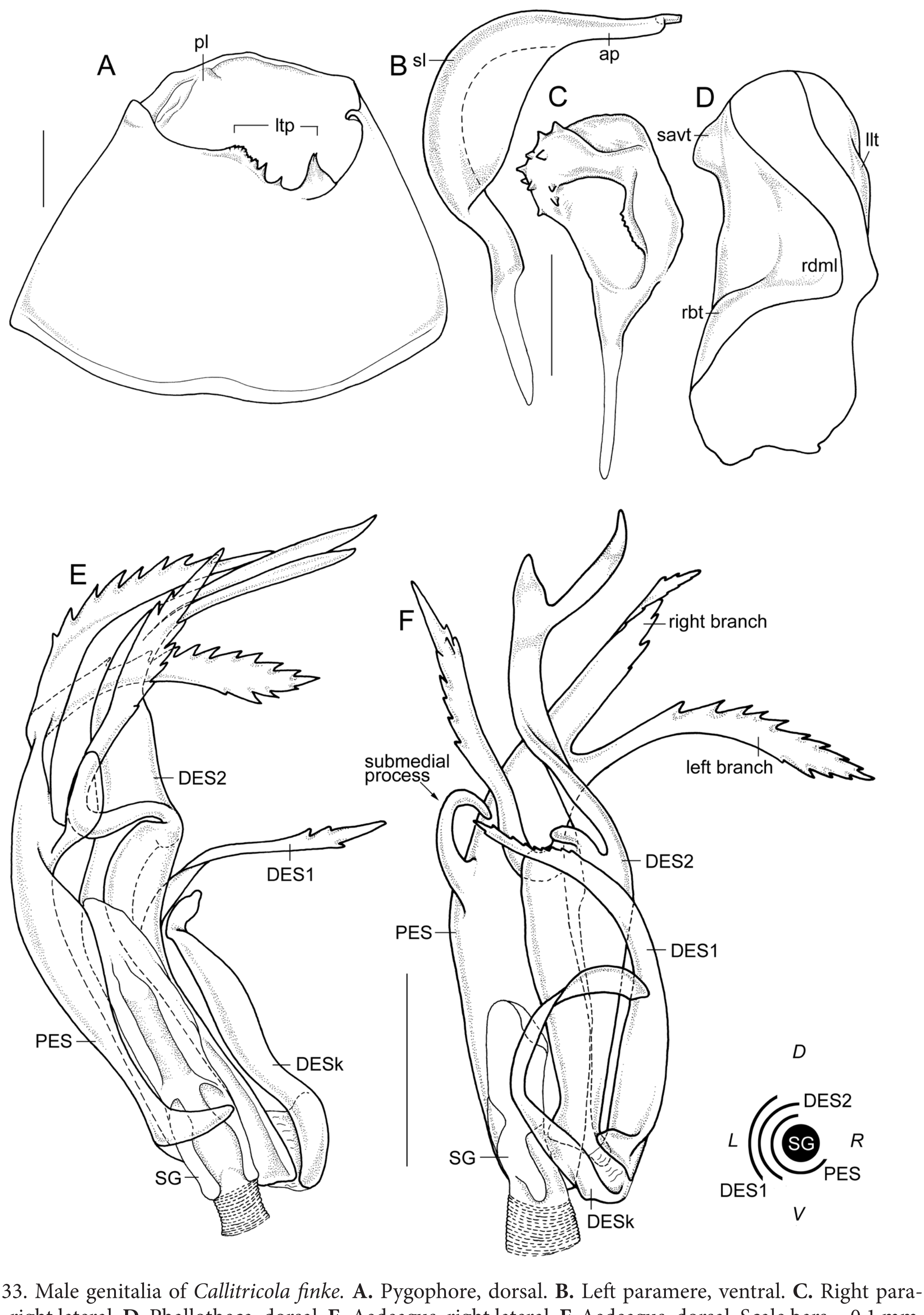


FIG. 33. Male genitalia of *Callitricola finke.* **A.** Pygophore, dorsal. **B.** Left paramere, ventral. **C.** Right paramere, right lateral. **D.** Phallotheca, dorsal. **E.** Aedeagus, right lateral. **F.** Aedeagus, dorsal. Scale bars = 0.1 mm.

also a slighter paler and more dusty yellow-green (cf. to bright yellow-green). *Callitricola finke* is distinguished from both these species by its single serrate comblike left tergal process and the body is smaller than *C. wiradjuri* (fig. 13). See also remarks for *C. gammonensis*.

Callitricola finlayae, new species

Figures 13, 34, 48; map 2

DIAGNOSIS: Defined by the following characters: moderately large size; forewing membrane veins yellow-orange; pygophore dorsal margin weakly concave with one tergal process, just left lateral of midline; left tergal process short with round spiniferous apex; left paramere apex truncate with strongly recurved, reduced hook; right paramere subtriangular in lateral view, apex weakly curved inward forming small ridge on inner ventral margin with minute. spinelike marginal serrations, subapical dorsal margin strongly expanded, bulbous, with strong, spinelike serrations; phallotheca with doubled subapical ventral tumescence, left dorsal margin with large broad lobe folding partially over dorsal opening; aedeagus with PES not wrapped sheathlike around and left ventral to secondary gonopore, bifurcate basally, branches unequal in length, shorter than DES1 and DES2; DES2 unbranched, with submedial smooth threadlike process; DES1 unbranched, with broad base, broad subrectangular and serrate apex; female laIRL apex slightly wider and curved inward, base spiniferous with one small spiniferous lobe; mIRL short, half length of LaIRL, subtriangular, margins and distal surface (sparsely) serrate.

DESCRIPTION: *Male*: Moderately large size, body length 3.85–4.14 mm, pronotal width 1.02–1.18 mm. COLORATION: Dorsum yellow-green, with patches of bright green pigmentation on lateral margins of hemelytra around cuneal fracture and spotted, bright green pigmentation across hemelytra; forewing membrane light brown with slightly darker patches laterally, vein yellow-orange, color confined to vein, major cell without color spot (fig. 13). VESTITURE: Dorsum with moderately dense distribution of medium-brown simple setae. STRUCTURE: **Head:** Eyes very large, bulbous, exerted strongly from outline of head; antennae with AI 1.5× vertex width, AII 1.3× pronotal width; labium medium length, extending to mesocoxae. **Hemelytra:** Cuneus short; major cell of membrane elongate, major membrane vein straight (fig. 13). GENITALIA: **Pygophore:** Dorsal margin of genital opening weakly concave, with one tergal process positioned just left lateral of midline; tergal process sclerotized, short, linear, apex round with minute spinelike serrations (fig. 34A); ventral margin slightly concave medially; phalloguide with small, round lobe ventrad to right paramere articulation; right margin of lobe with minute, spinelike serrations (fig. 34A). **Left paramere:** Apophysis subrectangular; apex truncate with strongly recurved hook (fig. 34B); hook weak, reduced (fig. 34C). **Right paramere:** Base short; subtriangular in lateral view; apex weakly curved inward, forming slightly pointed, sclerotized ridge with minute, spinelike serrations at tip, on inner ventral margin, extended as small flange; subapical dorsal margin enlarged, bulbous, sclerotized, surface covered with large spinelike serrations; mesiolateral surface weakly excavated (fig. 34D). **Phallotheca:** Dorsal opening large, distal to medial; slightly pointed at apex; doubled subapical ventral tumescence; large right lateral tumescence; basal lobe on right dorsal margin, broad, submedial; left dorsal margin with large, broad lobe folding partially over dorsal opening of phallotheca (not shown in illustration) (fig. 34E). **Aedeagus:** Spicule arrangement (fig. 34): PES left ventral to secondary gonopore, removed slightly from and not sheathing secondary gonopore (fig. 34F); DES2 dorsad to PES and left lateral to secondary gonopore, DES1 dorsad to DES2 and left dorsolateral to secondary gonopore; bases of spicules originating above (more distal to) base of secondary gonopore, all adjacent; bases of spicules flattened and broad, sheathlike; PES bifurcate basally, branches unequal in length and distally serrate, left branch broad and leaf shaped, weakly downturned, right branch narrow, tapering to apex, PES shorter than DES2 and DES1, which are subequal (fig. 34G); DES2 unbranched, with submedial smooth threadlike process, narrow medially between expanded base and apex, distally serrate, apex pointed at tip (fig. 34F, G); DES1 unbranched, base very broad, narrows medially, apex subrectangular with serrate margins (fig. 34F), basal keel short (DESk).

Female: Moderately large, subovate, body length 4.02–4.27 mm, pronotal width 1.09–1.18 mm. GENITALIA: Interramal lobes (fig. 48): mIRL and laIRL partially joined at base; laIRL apex slightly wider and curved inward, base spiniferous with one small spiniferous lobe; mIRL short, half length of LaIRL, subtriangular, margins and distal surface sparsely serrate.

Etymology: This species is named in honor of Hannah Mathews (nee Finlay), in recognition of her magnificent taxonomic illustrations of Australian Miridae, including those in this paper.

Host plant: Known from *Callitris intratropica* (table 2).

Holotype: **AUSTRALIA: Queensland:** Kennedy Hwy at Kay Rd, 10 km E of Mareeba, 16.98893°S 145.5084°E, 446 m, 18 Apr 2005, C. Symonds, *Callitris intratropica*, det. Field ID, 1♂ (AMNH_PBI 00005683) (QM).

Paratypes: **AUSTRALIA: Queensland:** 10 km E of Mareeba, jct of Kennedy Hwy & Kay Rd, 17.99041°S 145.5075°E, 450 m, 31 May 2006, Cassis, Barrow, Finlay, and Symonds, *Callitris intratropica*, det. Field ID, 1♂ (AMNH_PBI 00005700), 5♀ (AMNH_PBI 00005704–00005708) (AM), 2♂ (AMNH_PBI 00005698, 00005699), 3♀ (AMNH_PBI 00005701–00005703) (QM). Kennedy Hwy, 8 km E of Mareeba, 16.98458°S 145.4975°E, 454 m, 20 Apr 2005, C. Symonds, *Callitris intratropica*, det. Field ID, 2♀ (AMNH_PBI 00005695, 00005696) (AM), 1♀ (AMNH_PBI 00005697) (QM). Kennedy Hwy, approx. 9 km E of Mareeba, 16.98621°S 145.5031°E, 450 m, 20 Apr 2005, C. Symonds, *Callitris intratropica*, det. Field ID, 1♂ (AMNH_PBI 00005689), 4♀ (AMNH_PBI 00005690–00005693) (AM), 1♀ (AMNH_PBI 00005694) (QM). Kennedy Hwy at Kay Rd, 10 km E of Mareeba, 16.98893°S 145.5084°E, 446 m, 18 Apr 2005, C. Symonds, *Callitris intratropica*, det. Field ID, 1♂ (AMNH_PBI 00005682), 2♀ (AMNH_PBI 00005687, 00005688) (AM), 3♀ (AMNH_PBI 00005684–00005686) (QM). Surprise Creek, 1.5 km along track from Watkins Lookout, 16.84427°S 145.6384°E, 310 m, 19 Apr 2005, C. Symonds, *Callitris intratropica*, det. Field ID; morphologically distinct population, 1♂ (AMNH_PBI 00005711), 2♀ (AMNH_PBI 00005712, 00005713) (AM).

Other specimens examined: **AUSTRALIA: Queensland:** Surprise Creek, 1.5 km along track from Watkins Lookout, 16.84427°S 145.6384°E, 310 m, 19 Apr 2005, C. Symonds, *Callitris intratropica*, det. Field ID; morphologically distinct population, 2 juv. (AMNH_PBI 00005709, 00005710) (AM).

Distribution: Known from two localities in close proximity in the savannah woodlands around Mareeba on the Atherton Tablelands, in northeastern Queensland (map 2). It cooccurs with *E. mareeba* at both localities (table 2).

Remarks: *Callitricola finlayae* is similar to *C. parawirra* from the male genitalia, but can be differentiated as follows: the right paramere has small spinelike serrations on the mesiolateral surface (absent in *C. parawirra*), a more curved apex, and a smaller flange on the inner ventral surface arising from the apex (rather than being large and arising subapically to medially as in *C. parawirra*) (cf. figs. 34D and 37D); the phallotheca has a smaller lobe on the left dorsal margin, only partially covering the dorsal opening (which is more enlarged and fully covering the dorsal opening in *C. parawirra*) (cf. figs. 34E and 37E); and PES is not wrapped sheathlike around the secondary gonopore and branches proximate

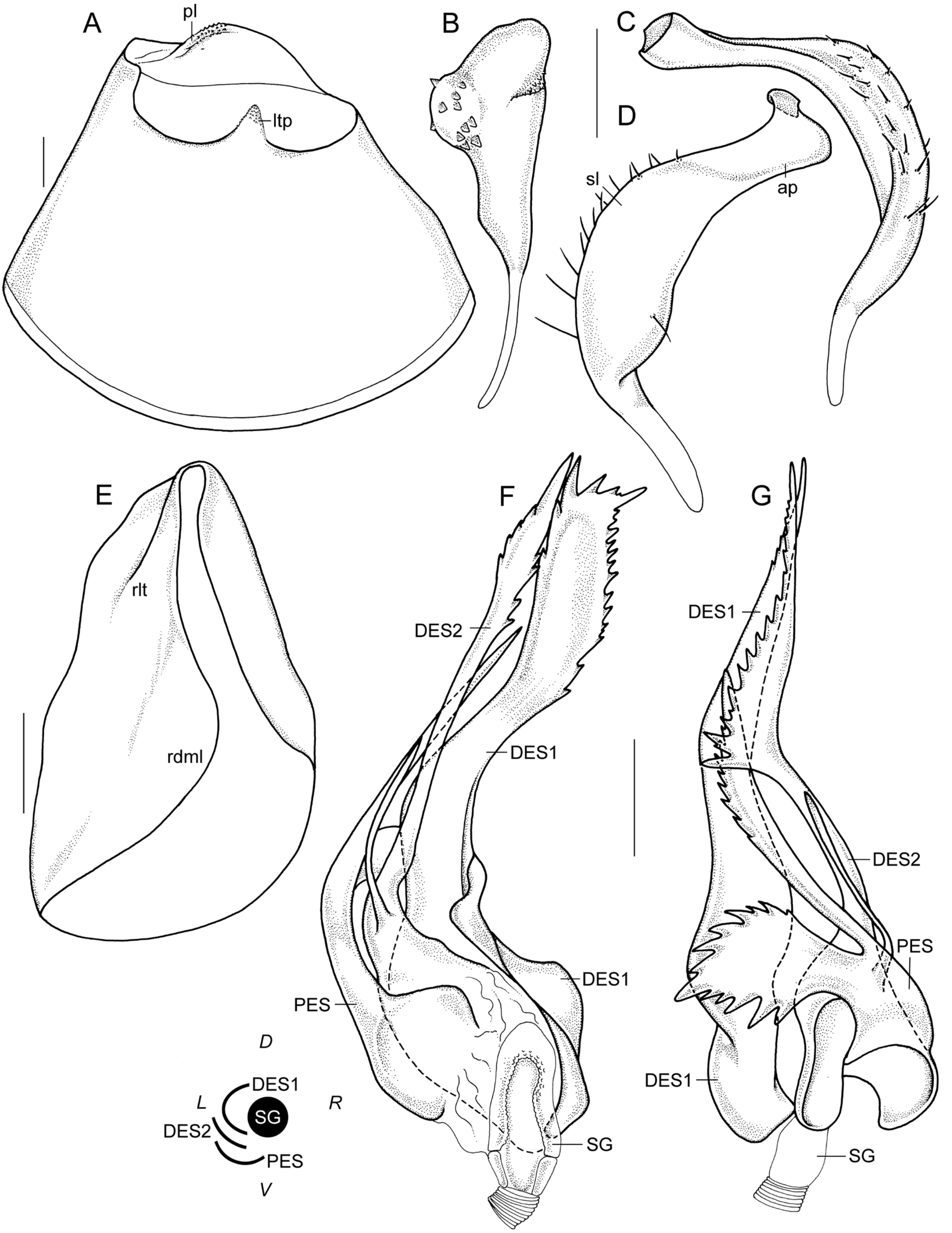


FIG. 34. Male genitalia of *Callitricola finlayae*. **A.** Pygophore, dorsal. **B.** Right paramere, left lateral. **C.** left paramere, dorsal. **D.** Left paramere, ventral. **E.** Phallotheca, dorsal. **F.** Aedeagus, right lateral. **G.** Aedeagus, left lateral. Scale bars = 0.1 mm.

to the base (rather than branching more distally in *C. parawirra*) (cf. figs. 34G and 37G). See also remarks for *C. parawirra*.

Callitricola gammonensis, new species

Figures 13, 35, 48; map 2

Diagnosis: Defined by the following characters: moderately small size; large eyes; pale, dusty yellow-green coloration; forewing membrane veins yellow-green; pygophore dorsal margin with one left lateral tergal process, short digitiform and distally serrate; pygophore, right side lobe on phalloguide with large sclerotized and spiniferous pad; left paramere apophysis tapering, apex narrow with weakly recurved hook; right paramere base short, subquadrate in lateral view, deeply excavated groove on inner ventral margin, apex strongly curved, inward and ventrally forming sclerotized and slightly serrate ridge, subapical dorsal margin round with small spinelike serrations; phallotheca strongly curved to right side, round apex with large left lateral tumescence, large right lateral basal tumescence; aedeagus with PES wrapped sheathlike around secondary gonopore, ventral position, bifurcate distally, both branches distally serrate; DES2 unbranched, apex acuminate with smooth margins; DES1 unbranched, expanded medially, distally and medially serrate; female laIRL uniformly narrow and straight, base with large spiniferous lobe; mIRL subrectangular, moderate length, two-thirds length of laIRL, margin only serrate.

Description: *Male*: Moderately small size, total length 3.19–3.59 mm, pronotal width 0.80–0.97 mm. COLORATION: Dorsum mostly faded to yellow with some dusty/pale green coloration on posterior half of pronotum and lateral margins of hemelytra; forewing membrane translucent, clear medially, light gray-brown laterally, veins yellow (faded) with color suffused slightly onto surrounding membrane, major cell with faint green spot (fig. 13). VESTITURE: Dorsum with moderately dense distribution of light-brown simple setae, intermixed with more sparse distribution of longer, more bristlelike, light-brown simple setae. STRUCTURE: **Head:** Eyes exerted greatly from outline of head; antennae with A1 subequal to vertex width, AII 1.4× pronotal width; labium elongate, extending just beyond metacoxae over abdomen. **Hemelytra:** Cuneus moderately elongate, major cell of membrane elongate, major membrane vein straight (fig. 13). GENITALIA: **Pygophore:** Dorsal margin of genital opening straight, with one tergal process, positioned medially to just left lateral of midline; tergal process short, linear, and distally serrate; ventral margin weakly convex medially; phalloguide with small, round lobe ventrad to right paramere articulation, right margin of lobe enlarged, sclerotized, surface spiniferous (fig. 35A). **Left paramere:** Apophysis tapering; apex narrow with very small, weakly recurved hook (fig. 35B). **Right paramere:** Base short, subquadrate in lateral view; apex strongly curved inward ventrally with small sclerotized ridge, with few small serrations; subapical dorsal margin round, with few small spinelike serrations spread broadly across surface; inner ventral surface with strongly excavated groove (fig. 35C). **Phallotheca:** Opening large, distal to medial; strongly curved to right side; apex round; lobe on right dorsal margin extending from below apex to base, weakly expanded, small subapical ventral tumescence; large left lateral tumescence; large right lateral basal tumescence (fig. 35D). **Aedeagus:** Spicule arrangement (fig. 35): PES ventral to secondary gonopore, base wrapped sheathlike around part of secondary gonopore; DES2 left lateral to PES, DES1 left lateral to DES2; bases of spicules flattened and broad; bases of all spicules originating adjacently at base of secondary gonopore (fig. 35E, F); PES bifurcate in distal third, branches subequal in length, both distally serrate, left branch strongly downcurved (fig. 35E); DES2 unbranched, acuminate apically, margins smooth (fig. 35E, F); DES1 unbranched, expanded medially, tapering apically, distally serrate margins, medially serrate on one side of expanded margin, basal keel elongate (DESk) (fig. 35F).

Female: Relatively small, body length 3.16–3.33 mm, pronotal width 0.83–0.86 mm. GENITALIA: Interramal lobes (fig. 48): mIRL partially joined to laIRL at base; laIRL uniformly narrow, straight, base with large spiniferous lobe; mIRL subrectangular, moderate length, two-thirds length of laIRL, margin serrate.

Etymology: Named after the type locality in the Gammon Ranges, South Australia.

Host plant: Known from *Callitris glaucophylla* (table 2).

Holotype: **AUSTRALIA: South Australia:** 12 km E of Nepabunna, Gammon Ranges National Park, 30.60057°S 139.092°E, 440 m, 07 Nov 1998, Schuh, Cassis, Silveira, *Callitris glaucophylla*, det. RBG Sydney NSW427486, 1♂ (AMNH_PBI 00016259) (SAMA).

Paratypes: **AUSTRALIA: South Australia:** 12 km E of Nepabunna, Gammon Ranges National Park, 30.60057°S 139.092°E, 440 m, 07 Nov 1998, Schuh, Cassis, Silveira, *Callitris glaucophylla*, det. RBG Sydney NSW427486, 2♂ (AMNH_PBI 00016261, 00016265), 1♀ (AMNH_PBI 00016264) (AM), 1♂ (AMNH_PBI 00016260), 2♀ (AMNH_PBI 00016262, 00016263) (SAMA).

Other specimens examined: **AUSTRALIA: South Australia:** 12 km E of Nepabunna, Gammon Ranges National Park, 30.60057°S 139.092°E, 440 m, 07 Nov 1998, Schuh, Cassis, Silveira, *Callitris glaucophylla*, 1♀ (AMNH_PBI 00016562) (AM).

Distribution: Known from one locality in central eastern (outback) South Australia, in the Gammon Ranges (map 2), and collected with *Avititerra xerophila* (table 2).

Remarks: *Callitricola gammonensis* is distinct in comparison to congeners based on characters of the male genitalia. This includes the pygophore having a large sclerotized and spiniferous lobe on the phalloguide ventrad to right paramere articulation (larger than all other species in the group) (fig. 35A), and the right paramere quadrate (fig. 35C), rather than subovate to ovate, which is typical of the genus. This species is similar in external appearance to *C. finke*, which is pale green and small in size, but the latter differs by being more dusty pale green, having larger bulbous eyes, and being smaller in size (cf. fig 13). The parameres of *C. gammonensis* bear some resemblance to those of *C. finke*, in that both have a slender left paramere and more subquadrate to round right paramere. However, the right paramere of *C. gammonensis* differs by being more subquadrate rather than more round as in *C. finke*, oriented more ventrally, with a deeper groove on the mesiolateral surface and a round and unexpanded subapical dorsal margin, which is expanded in *C. finke*. The linear, apically serrate, left submedial tergal process on the ventral margin of the pygophore also differentiates this species from *C. finke*, which has a serrate comblike tergal process. This tergal process type is found in *C. gammonensis* as well as *C. ballina*, *C. boorabbin*, *C. parawirra*, and *C. finlayae*.

***Callitricola graciliphila*, new species**

Figures 13, 36, 48; map 2

Diagnosis: Defined by the following characters: large size: labium extends over abdomen; forewing membrane veins yellow-orange; pygophore dorsal margin weakly concave, with right submedial tergal lobe and left lateral tergal process; left paramere, apophysis subrectangular, apex truncate with strongly recurved hook; right paramere, base elongate, apex twisted but not curved inward, subapical inner ventral ridge small, subapical margins serrate; phallotheca with twisted point at apex, subbasal lobe on right dorsal margin large and round, with left and right lateral tumescence; aedeagus with spicules all compact and situated adjacent, PES not wrapped sheathlike around secondary gonopore, appears trifurcate in distal third, branches short, equal length or left branch slightly longer than divided right branch, left branch strongly curved downward; DES2 bifurcate in distal half, branches equal in length, both narrow and acuminate; DES1 bifurcate in distal half, branches unequal in length, dorsal branch greatly reduced

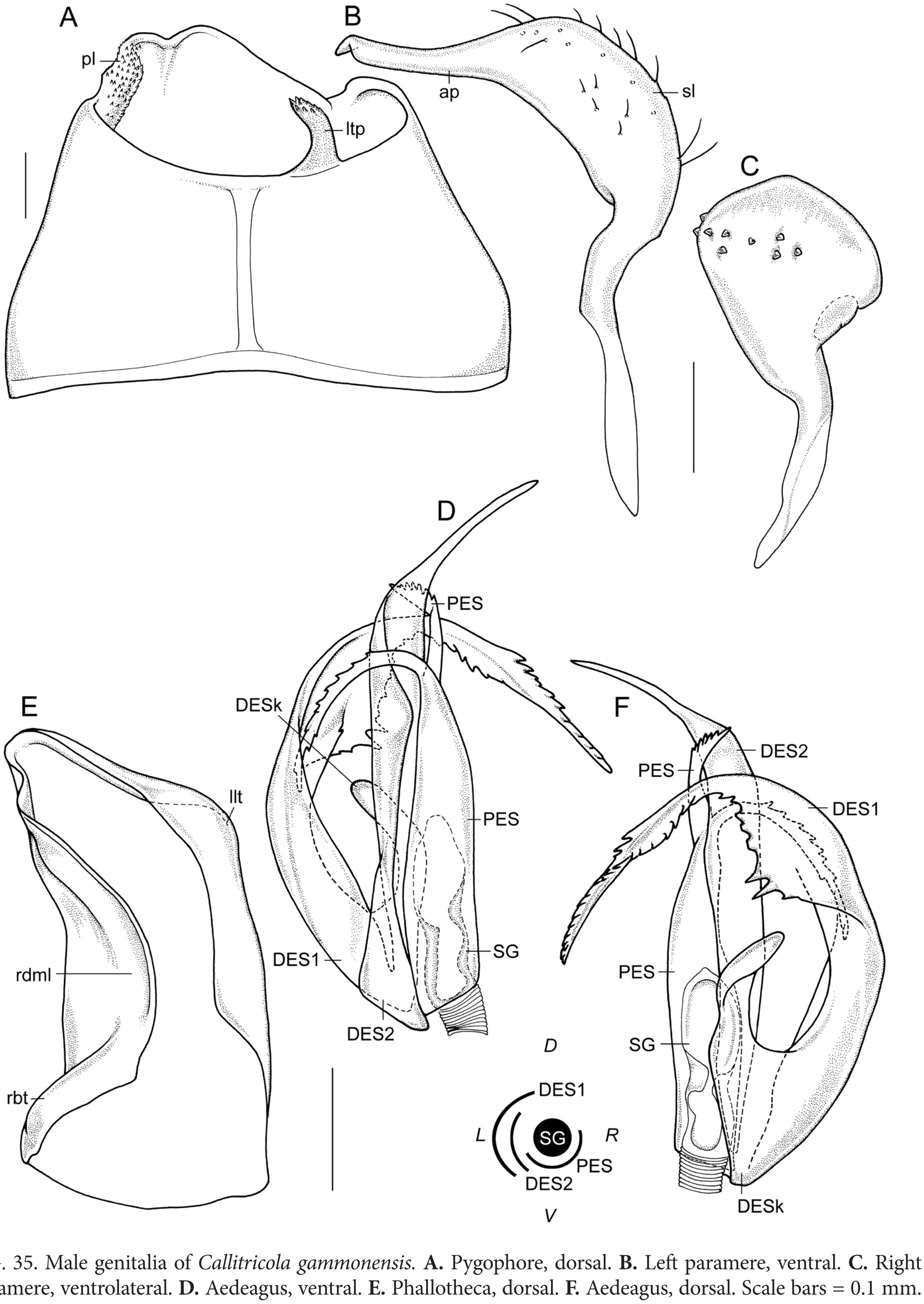


FIG. 35. Male genitalia of *Callitricola gammonensis.* **A.** Pygophore, dorsal. **B.** Left paramere, ventral. **C.** Right paramere, ventrolateral. **D.** Aedeagus, ventral. **E.** Phallotheca, dorsal. **F.** Aedeagus, dorsal. Scale bars = 0.1 mm.

to round lobe with smooth margins; female laIRL uniform width, straight, base spiniferous with two spiniferous lobes; mIRL elongate, almost as long as laIRL, subrectangular, margins and distal surface (sparsely) serrate.

DESCRIPTION: *Male*: Large size, elongate, body length 5.13–5.73 mm, pronotal width 1.14–1.35 mm. COLORATION: Faded yellow-green dorsum, often faded to yellow; forewing membrane light brown, veins yellow-orange with tint confined to vein only, major cell with dark green spot medially that is sometimes faded in dried specimens (fig. 13). VESTITURE: Dorsum with moderately dense distribution of simple setae. STRUCTURE: **Head:** Antennae with AI 1.5× vertex width, AII 2× pronotal width; labium elongate, extending beyond metacoxae over abdomen. **Hemelytra:** Cuneus elongate; major cell of membrane greatly elongate, major membrane vein straight. GENITALIA: **Pygophore:** Dorsal margin of genital opening weakly concave, with one sclerotized left lateral tergal process, and broad tergal lobe, narrowing apically, positioned right of midline; left tergal process, short, digitiform, surface from base to apex with minute spinelike serrations, apex round; ventral margin very weakly convex medially; phalloguide broadly subrectangular, margin ventrad to right paramere articulation with weakly expanded round lobe, sclerotized and with minute spinulae (fig. 36A). **Left paramere:** Apophysis subrectangular, apex truncate with strongly recurved hook (fig. 36B). **Right paramere:** Base elongate; apex twisted, not curved inward; inner subapical ventral margin constricted to form small. well-defined ridge, slightly more sclerotized than rest of paramere, margin with minute spinulae; subapical inner dorsal margin slightly swollen, covered with minute spinulae; mesiolateral surface weakly excavate (fig. 36C, D). **Phallotheca:** Dorsal opening large, pointed distally; apex with twisted point; large subapical ventral tumescence; left lateral tumescence; large right lateral tumescence; small right lateral basal tumescence; large, round lobe on right dorsal margin, subbasal (figs. 36E–H). **Aedeagus:** Spicule arrangement (fig. 36): PES left ventrolateral to secondary gonopore, not wrapped sheathlike around secondary gonopore, DES2 dorsad to PES and secondary gonopore, DES1 dorsad to DES2; base of PES slightly more distal to bases of DES1 and DES2 (which are adjacent) (fig. 36I, J); PES, bifurcate in distal third, branches short, constricted slightly before bifurcation point, left branch short and strongly curved downward, right branch very short, further divided at apex, all branches distally serrate (fig. 36I); DES2 bifurcate in distal half, branches equal in length, both narrow and acuminate, distally serrate (fig. 36J); DES1 bifurcate in distal half, branches unequal in length, dorsal branch greatly reduced to round lobe with smooth margins, ventral branch elongate slightly constricted below leaf-shaped apex, distal margins serrate (fig. 36J); DES1 basal keel (DESk) elongate (fig. 36J).

Female: Large, slightly subovate, body length 4.55–5.22 mm, pronotal width 1.17–1.31 mm. GENITALIA: Interramal lobes (fig. 48): mIRL partially joined to laIRL at base; laIRL uniform width, straight, base spiniferous with two spiniferous lobes, one large and one small; mIRL elongate, almost as long as laIRL, subrectangular, margins and distal surface sparsely serrate.

ETYMOLOGY: The name of this species come from a combination of the host-plant species name *Callitris gracilis* and Greek *phila* meaning "lover."

HOST PLANTS: Known from *Callitris gracilis* in Victoria and *Callitris verrucosa* in South Australia (table 2). Hosts from two other localities in South Australia were unable to be identified to species; this is in a region where a number of *Callitris* species are known to cooccur and hybridize (Hill, 1998).

HOLOTYPE: **AUSTRALIA: South Australia:** 7 km E Para Wirra National Park near Williamstown, 34.70001°S 138.85°E, 250 m, 31 Oct 1995, Schuh, Cassis, and Gross, *Callitris* sp., Field ID, 1♂ (AMNH_PBI 00002453) (SAMA).

PARATYPES: **AUSTRALIA: South Australia:** 7 km E Para Wirra National Park near Williamstown, 34.70001°S 138.85°E, 250 m, 31

Oct 1995, Schuh, Cassis, and Gross, *Callitris* sp., Field ID, 1♂ (AMNH_PBI 00002452), 5♀ (AMNH_PBI 00002455–00002459) (AMNH), 1♂ (AMNH_PBI 00002454), 4♀ (AMNH_PBI 00002460–00002463) (SAMA). 11 km W of Gawler, 34.60001°S 138.6167°E, 100 m, 31 Oct 1995, Schuh, Cassis, and Gross, *Callitris glaucophylla or gracilis*, det. K.D. Hill 1996 NSW 395960, 1♂ (AMNH_PBI 00016328) (AM), 2♀ (AMNH_PBI 00000302, 00000303) (AMNH), 1♀ (AMNH_PBI 00016327) (SAMA). Road to Streaky Bay from Poochera, 32.73441°S 134.7605°E, 100 m, 21 Oct 1996, Schuh and Cassis, *Callitris* sp., det. Field ID, 2♀ (AMNH_PBI 00016323, 00016324) (AM), 1♂ (AMNH_PBI 00000152) (AMNH), 2♀ (AMNH_PBI 00016325, 00016326) (SAMA). **Victoria:** Wyperfeld National Park, Moonah Track, 35.46302°S 142.0464°E, 65 m, 04 Nov 2002, Cassis, Schuh, Schwartz, Silveira, *Callitris gracilis*, det. RBG Sydney NSW658101, 2♀ (AMNH_PBI 00016321, 00016322), 1♂ (AMNH_PBI 00016337) (AM), 7♀ (AMNH_PBI 00003935–00003940, 00003942), 1♂ (AMNH_PBI 00003933) (AMNH), det. RBG Sydney NSW658101, 1♀ (AMNH_PBI 00003941), 1♂ (AMNH_PBI 00003934) (MVMA).

Other specimens examined: **AUSTRALIA: South Australia:** Scorpion Springs Cons. Park, 35.4493°S 140.874°E, 120 m, 10 Nov 1998, Schuh, Cassis, Silveira, *Callitris verrucosa*, det. RBG Sydney NSW427497, 4♀ (AMNH_PBI 00021797-AMNH_PBI 00021800) (AM). Scorpion Springs Cons. Park, 35.62872°S 140.8598°E, 100 m, 09 Nov 1998, Schuh, Cassis, Silveira, *Callitris verrucosa*, det. RBG Sydney NSW427497, 2♀ (AMNH_PBI 00008002, 00008003), 2♀ (AMNH_PBI 00021795, 00021796) (AM).

Distribution: Known from six localities spanning northwestern Victoria to the Eyre Peninsula in South Australia (map 2). It was collected with other *Callitricola* and *Erysivena* species, including at four localities with *E. schwartzi* (table 2).

Remarks: The form of PES and the phallotheca relates *Callitricola graciliphila* to *C. cordylina*. It can be differentiated from *C. cordylina* by the following characters (cf. figs. 13, 32): larger size; presence of a left lateral tergal process on the pygophore; a larger right subbasal lobe on the phallotheca; PES having a shorter and downturned left branch; DES2 more distally bifurcate in the distal third, with the subbranches of equal length and narrow; DES1 having a short dorsal branch reduced to a round lobe with smooth margins; the female laIRL of uniform width and narrow with two basal lobes (as opposed to slightly broader and incurved distally, with only one basal lobe); and the mIRL subrectangular (rather than subtriangular). In *C. cordylina* all endosomal spicules are more elongate and slender and PES curves away from the base and then back toward DES1 and DES2 (figs. 31D, F, 32F); DES2 possesses a distinctive splayed apex on the longer branch (fig. 31D), and DES1 has only a small lobe below the bifurcation point and is then divided with slender serrate branches (figs. 31E, 32F). Due to the large body size and distinctive yellow wing membrane venation, this species is easily distinguished from the other species with which it cooccurs, *C. parawirra* and *C. silveirae*.

Callitricola parawirra, new species

Figures 13, 37; map 3

Diagnosis: Defined by the following characters: moderate size; forewing membrane veins bright green, with bright green spot in major cell; pygophore dorsal margin weakly concave with one tergal process, just left lateral or midline, tergal process short with round spiniferous apex; left paramere apophysis subrectangular; apex truncate with either strongly recurved, reduced hook or without hook, replaced with two small prongs; right paramere subtriangular in lateral view, apex flattened, not curved inward, large ridge on inner subapical ventral margin with small cluster of spinelike serrations, subapical dorsal margin strongly expanded, with strong, spinelike serrations; phallotheca with doubled subapical ventral tumescence, left dorsal margin with large, broad lobe folding completely

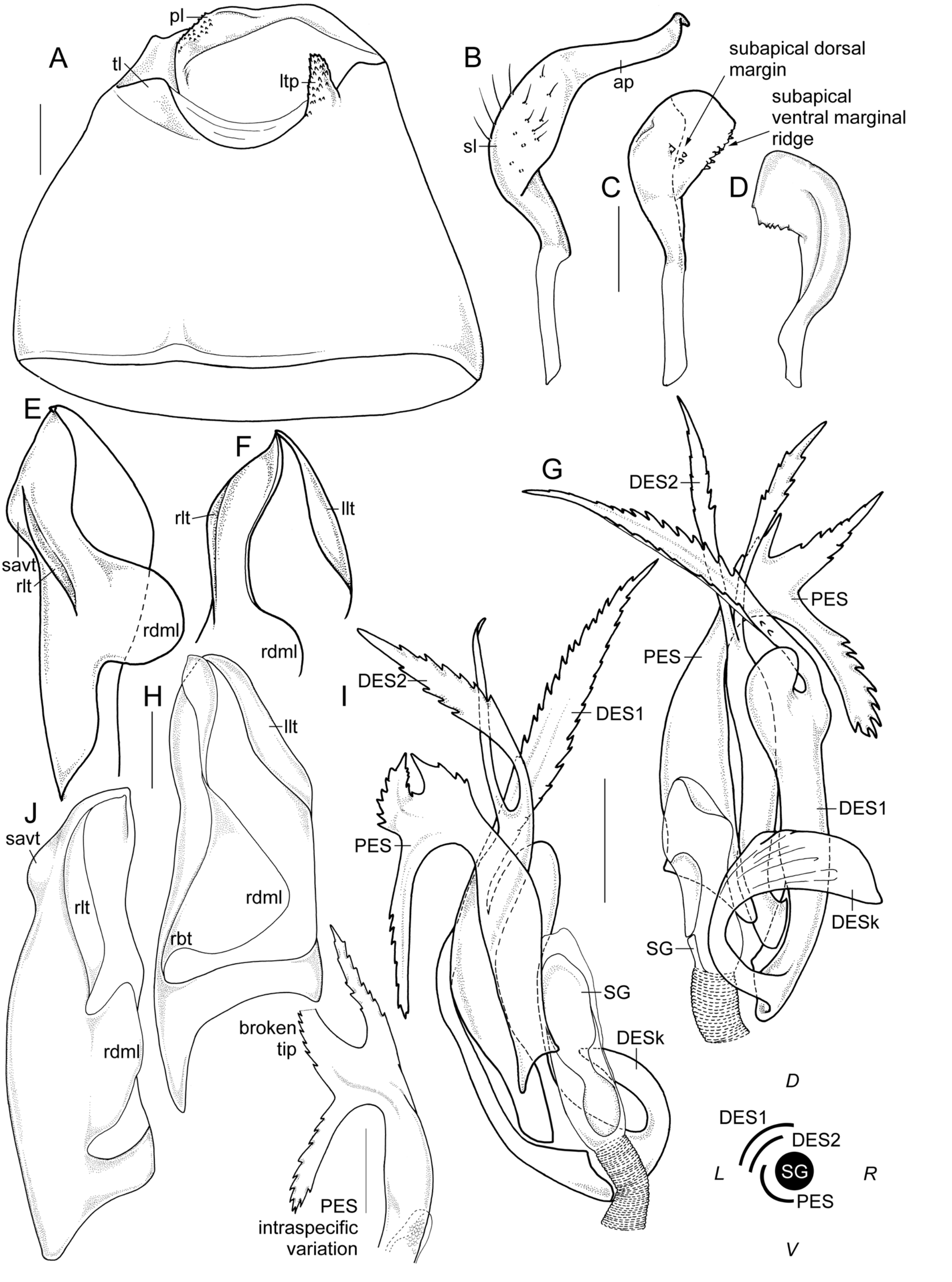


FIG. 36. Male genitalia of *Callitricola graciliphila.* **A.** Pygophore, dorsal. **B.** Left paramere, ventral. **C.** Right paramere, right lateral. **D.** Right paramere, left lateral. **E, J.** Phallotheca, right lateral. **F, H.** Phallotheca, dorsal. **I.** Aedeagus, ventral. **G.** Aedeagus, dorsal. Scale bars = 0.1 mm.

over dorsal opening; aedeagus with PES wrapped sheathlike around secondary gonopore, left ventrolateral position, bifurcate medially, distally serrate, left branch strongly directed downward, right branch broad, small threadlike process below bifurcation; DES2 with broad base, bifurcate in distal third, branches of subequal length, distally serrate; DES1 unbranched, with broad base, serrate apex, shorter than other two spicules.

Description: *Male*: Midsized, total length 3.67–3.97 mm, pronotal length 1.06–1.16 mm. COLORATION: Dorsum mostly yellow-green, often faded to yellow with patches of bright green pigmentation remaining on hemelytra, creating spotted appearance on faded yellow background; forewing membrane light brown, with slightly darker patches laterally, vein bright green with color extending onto surrounding membrane, major cell with bright green spot, sometimes faint due to fading (fig. 13). VESTITURE: Dorsum with moderately dense distribution of medium to dark brown simple setae. STRUCTURE: **Head:** Antennae with AI subequal to vertex width, AII subequal to pronotal width; labium midlength, extending to metacoxae. **Hemelytra:** Cuneus and major cell of membrane moderately elongate, major membrane vein slightly round (fig. 13). GENITALIA: **Pygophore:** Dorsal margin of genital opening weakly concave, with one tergal process positioned just left lateral of midline; tergal process sclerotized, short, linear, apex round and with few minute spinelike serrations at tip; ventral margin slightly concave medially; phalloguide with small, round lobe ventrad to right paramere articulation; right half of lobe sclerotized with minute spinelike serrations on surface (fig. 37A). **Left paramere:** Apophysis subrectangular; apex truncate with either strongly recurved, reduced hook (fig. 37C) or without hook, replaced with two small prongs (fig. 37B); sensory lobe very slightly angular. **Right paramere:** Base short; subtriangular in lateral view; apex uncurved inward, flattened and slightly concave; subapical dorsal margin enlarged, bulbous, sclerotized, surface covered with large spinelike serrations; inner subapical ventral margin expanded into prominent, sclerotized ridge or flange, margin irregular with small cluster of spinelike serrations; inner surface weakly excavated (fig. 37D). **Phallotheca:** Dorsal opening large, distal to medial; slightly pointed at apex; doubled subapical ventral tumescence (fig. 37F); large right lateral tumescence (fig. 37E); broad basal lobe on right dorsal margin (fig. 37E); left dorsal margin with large, broad lobe folding completely over dorsal opening of phallotheca (fig. 37E, F). **Aedeagus:** Spicule arrangement (fig. 37): PES left ventrolateral to secondary gonopore, wrapped sheathlike around secondary gonopore, DES2 left lateral to first spicule and secondary gonopore, DES1 left lateral to DES2; bases of spicules originating at base of secondary gonopore, all adjacent (fig. 37H); bases of spicules flattened and broad, sheathlike; PES bifurcate medially, branches subequal in length and distally serrate, left branch directed basally, strongly downturned and narrow, right branch directed distally and broad with pointed apex; PES also with small submedial threadlike process on dorsal margin, before bifurcations point; DES2 bifurcate medially, branches subequal in length, constricted at bifurcation point and then leaf shaped to apex with distally serrate margins; DES1 unbranched, base very broad, narrowing in distal third, apex serrate, shorter than PES and DES2 spicules, basal keel (DESk) elongate (fig. 37G, H).

Female: Smaller than male, body length 3.29–3.33 mm, pronotal width 1.07 mm. GENITALIA: Unknown. Female specimens not dissected.

Etymology: Named for the type locality, the Para Wirra Conservation Park, in South Australia. Noun in apposition.

Host plants: Known from *Callitris gracilis* and *C. verrucosa* in Victoria and an unidentified *Callitris* species at two localities in South Australia (table 2).

Holotype: **AUSTRALIA: South Australia:** 7 km E Para Wirra National Park near Williamstown,

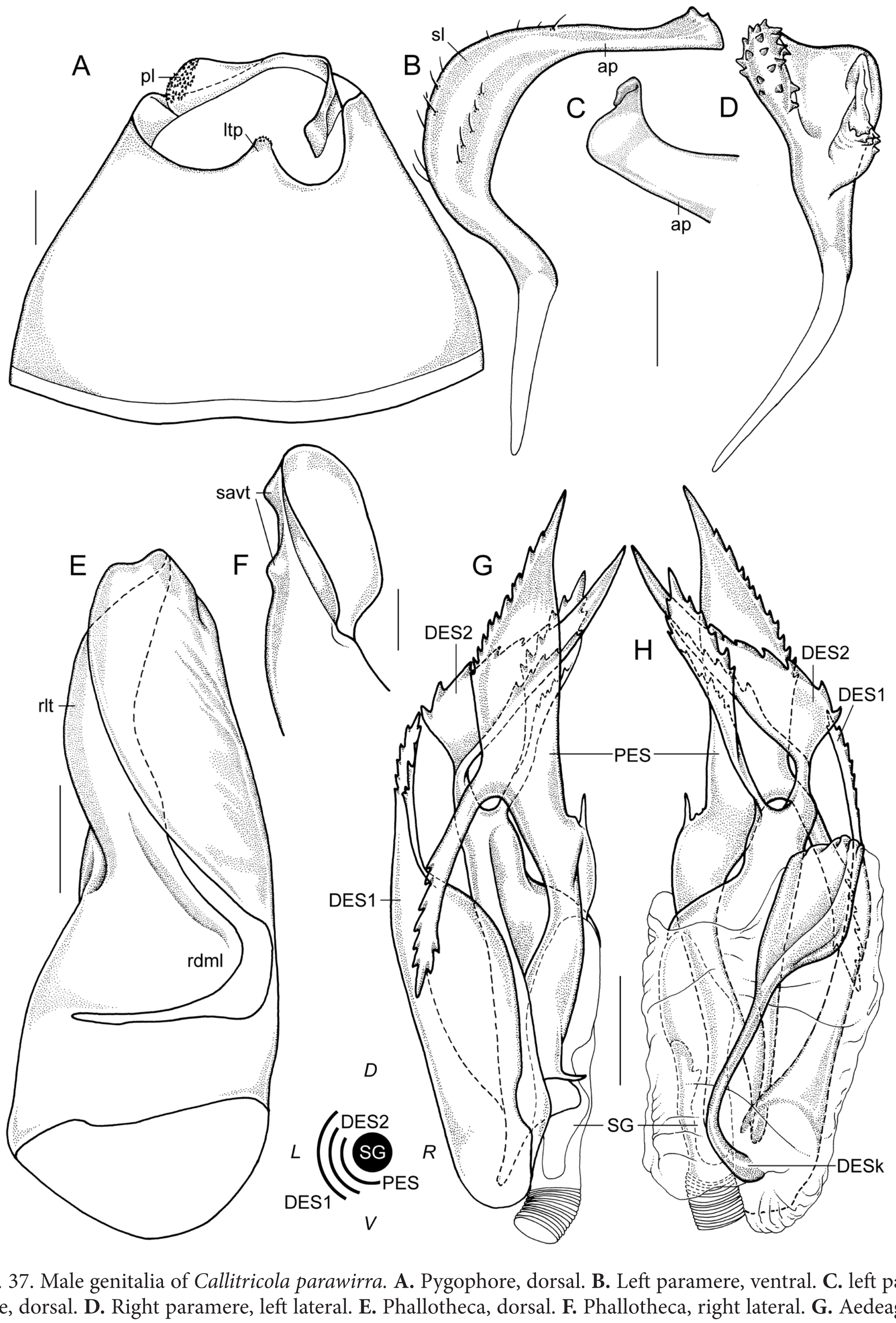
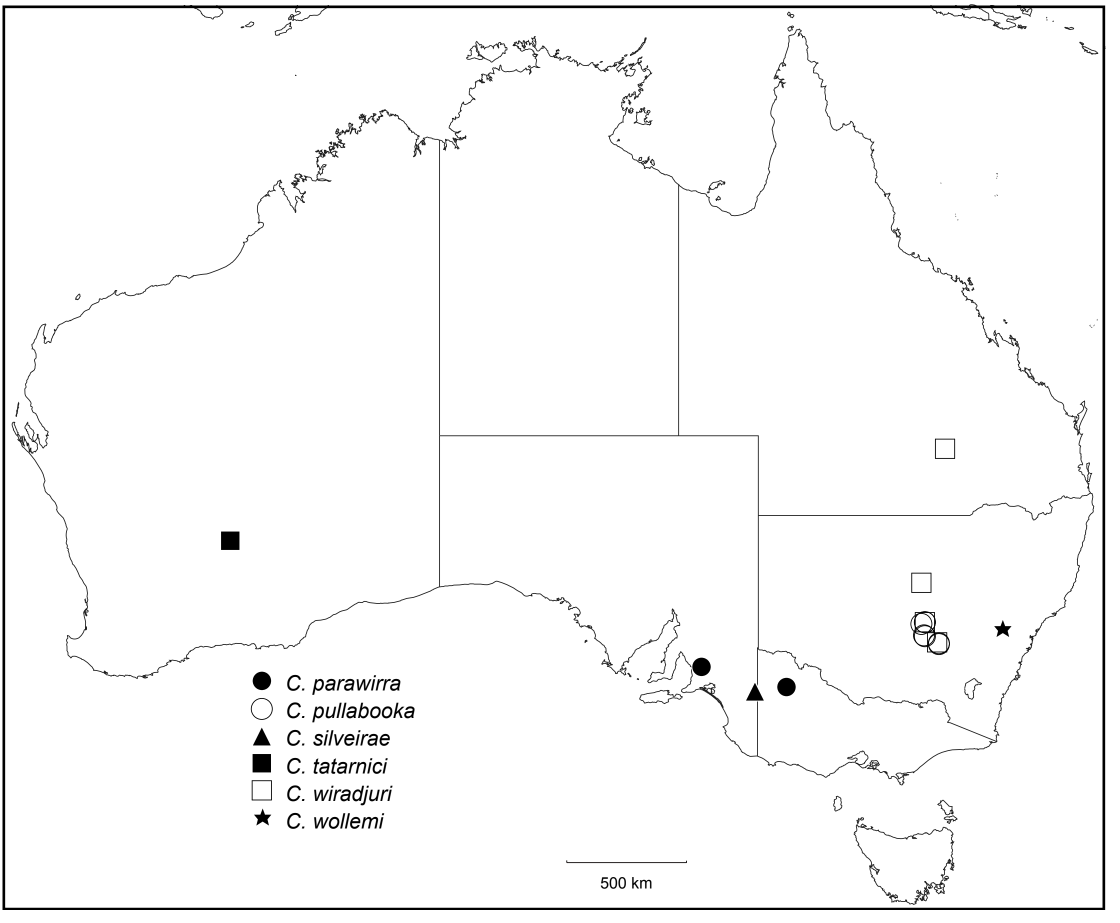


FIG. 37. Male genitalia of *Callitricola parawirra.* **A.** Pygophore, dorsal. **B.** Left paramere, ventral. **C.** left paramere, dorsal. **D.** Right paramere, left lateral. **E.** Phallotheca, dorsal. **F.** Phallotheca, right lateral. **G.** Aedeagus, ventral. **H.** Aedeagus, dorsal. Scale bars = 0.1 mm.



MAP 3. Distribution of *Callitricola* species.

34.70001°S 138.85°E, 250 m, 31 Oct 1995, Schuh, Cassis, and Gross, *Callitris* sp., det. Field ID, 1♂ (AMNH_PBI 00000255) (SAMA).

PARATYPES: **AUSTRALIA: South Australia:** 7 km E Para Wirra National Park near Williamstown, 34.70001°S 138.85°E, 250 m, 31 Oct 1995, Schuh, Cassis, and Gross, *Callitris* sp., det. Field ID, 2♂ (AMNH_PBI 00000256, 00000263) (AM), 4♂ (AMNH_PBI 00000251, 00000252, 00000257, 00000258, AMNH_PBI) (AMNH), 4♂ (AMNH_PBI 00000254, 00000259, 00000260, 00000264) (SAMA). **Victoria:** Wyperfeld National Park, Moonah Track, 35.45218°S 142.066°E, 78 m, 05 Nov 2002, Cassis, Schuh, Schwartz, Silveira, *Callitris verrucosa*, det. RBG Sydney NSW658107, 1♂ (AMNH_PBI 00016561) (AM). Wyperfeld National Park, Moonah Track, 35.46302°S 142.0464°E, 65 m, 04 Nov 2002, Cassis, Schuh, Schwartz, Silveira, *Callitris gracilis*, det. RBG Sydney NSW658101, 1♂ (AMNH_PBI 00016560) (AM).

OTHER SPECIMENS EXAMINED: **AUSTRALIA: South Australia:** road to Streaky Bay from Poochera, 32.73441°S 134.7605°E, 100 m, 21 Oct 1996, Schuh and Cassis, *Callitris* sp. (Cupressaceae), det. Field ID, 2♀ (AMNH_PBI 00000148, 00000150) (AMNH).

DISTRIBUTION: *Callitricola parawirra* is known from semiarid southern Australia, from northwestern Victoria to just northeast of Adelaide (map 3). It was collected with *Callitricola gracil-*

iphila and *Erysivena schwartzi* at two localities, and with *E. schuhi* near Streaky Bay and *E. drepanomorpha* in Victoria (table 2). It has a similar range to *C. graciliphila*, but does not extend as far west (map 2). It similarly has a smaller range than the other cooccurring species (maps 4–5).

Remarks: *Callitricola parawirra* is larger than *C. boorabbin* and *C. gammonensis*, and is of a similar size to *C. finlayae*. It differs from *C. finlayae* by having smaller and less bulbous eyes, green hemelytral membrane veins and a prominent green spot within the major cell (fig. 13). The PES of *C. parawirra* resembles that of *C. boorabbin*, with the small threadlike process proximal to the bifurcation point (cf. figs. 29D, 37G), which does not occur in any other *Callitricola* species. See also remarks for *C. finlayae*.

***Callitricola pullabooka*, new species**

Figures 13, 38–40, 48; map 3

Diagnosis: Defined by the following characters: small size; forewing membrane veins green; pygophore dorsal margin with medial tumescence, one left lateral tergal process arising from tergal plate, tergal process broad serrate comb; left paramere with narrow apex with weakly recurved hook; right paramere base short, apex curved inward forming slightly pointed flange, subapical dorsal margin round, small spinelike serrations on apical flange and subapical dorsal margin; phallotheca with large right basal tumescence and lobe on right dorsal margin; aedeagus with PES fully enclosing secondary gonopore, with perpendicular directed or strongly downturned left branch; DES2 unbranched; DES1 bifurcate, with both branches elongate, subequal; female laIRL wider at apex and curved inward distally, base with two lobes—one round and spiniferous, one with acutely pointed apex and only margins serrate; mIRL moderately elongate, three-quarters length of laIRL, subrectangular, margin only serrate.

Description: *Male*: Small size, body length 3.20–3.51 mm, pronotal width 0.84–0.97 mm. COLORATION: Bleached by ethanol preservation; forewing membrane light brown, veins retaining slight green tint, bleeding to membrane surrounding veins (fig. 13). VESTITURE: Dorsum with moderately dense distribution of pale simple setae. STRUCTURE: **Head:** Antennae, AI subequal to vertex width, AII 1.2× pronotal width; labium medium length, extending to metacoxae. **Hemelytra:** Cuneus and major cell moderately elongate, major membrane vein straight (fig. 13). GENITALIA: **Pygophore:** Dorsal margin of genital opening straight, medial tumescence at margin, one sclerotized tergal process positioned left lateral arising from tergal plate, tergal process, broad, serrate comb shape (figs. 38A, 39F, 40A); ventral margin convex medially, phalloguide with small, slightly sclerotized lobe at base of right paramere articulation (figs. 38A, 40B). **Left paramere:** Apophysis tapering apically, apex narrow with weakly recurved hook (figs. 38B, 40B). **Right paramere:** Base short; paramere round in lateral view; apex curved inward forming small, slightly pointed flange (fig. 40B), margin with small spinelike serrations; subapical dorsal margin round with small spinelike serrations; mesiolateral surface excavated, concave (fig. 38C). **Phallotheca:** Dorsal opening large, distal to medial; round distally; large subapical ventral tumescence; large right lateral basal tumescence (figs. 38A, 40A, B). **Aedeagus:** Spicule arrangement (fig. 38): PES with tubular base entire and wholly sheathing secondary gonopore, opening medially through which apex of secondary gonopore protrudes, distal portion of PES left lateral to secondary gonopore (fig. 38F, G, 40E), DES2 left lateral to PES (fig. 40E), DES1 left dorsolateral to DES2 (fig. 40C, D); bases of all spicules originating adjacently at base of secondary gonopore; DES2 and DES1 flattened at base (rather than tubular); all spicules subequal in length; PES bifurcate medially, branches elongate, distally serrate, left branch either perpendicular (fig. 38F, G) or strongly downturned (fig. 40D); DES2 unbranched, distally serrate (figs. 38G, 40D); DES1, bifurcate in distal half, branches subequal in length and distally serrate, basal keel (DESk) short (figs. 38G, 40C).

Female: GENITALIA: Interramal lobes (fig. 48): mIRL partially joined to laIRL at base; laIRL wider at apex and curved inward distally, base with one spiniferous lobe and one subtriangular lobe with serrate margins only; mIRL moderately elongate, three-quarters length of laIRL, subrectangular, margin serrate.

ETYMOLOGY: Named after the type locality, Pullabooka State Forest, in New South Wales. Noun in apposition.

HOST PLANT: Known from *Callitris glaucophylla* (table 2).

HOLOTYPE: **AUSTRALIA: New South Wales:** Pullabooka State Forest, 33.82444°S 147.81361°E, 05 Nov 1998, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 1♂ (AMNH_PBI 00016294) (AM).

PARATYPES: **AUSTRALIA: New South Wales:** Euglo South State Forest, 33.53°S 147.27861°E, 08 Dec 1998, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 2♂ (AMNH_PBI 00016301, 00016302), 1♀ (AMNH_PBI 00016304) (AM), 1♀ (AMNH_PBI 00005829) (UNSW). Euglo South State Forest, 33.505°S 147.22972°E, 09 Dec 1998, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 1♂ (AMNH_PBI 00016303) (AM). Murda State Forest, 33.06972°S 147.13527°E, 09 Feb 1999, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 1♂ (AMNH_PBI 00016300) (AM). Murda State Forest, 33.01916°S 147.28583°E, 11 Feb 1999, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 4♂ (AMNH_PBI 00016295–00016298) (AM), 1♂ (AMNH_PBI 00016299) (UNSW). Murda State Forest, 33.0175°S 147.26611°E, 11 Feb 1999, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 4♂ (AMNH_PBI 00016286, 00016287, 00016291, 00016292) (AM). Pullabooka State Forest, 33.84111°S 147.81027°E, 05 Nov 1998, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 1♂ (AMNH_PBI 00016293) (AM).

DISTRIBUTION: Known from seven localities in close proximity in central New South Wales on the southwestern slopes of the Great Dividing Range (map 3). Cooccurs with four other species (table 2) including *C. cordylina*, which is also known only from this region (map 2).

REMARKS: *Callitricola pullabooka* is closely related to the Western Australian species *C. tatarnici*, but can be distinguished from it by the smaller size; slightly more bulbous eyes; the basal tumescence on the right dorsal margin of the phallotheca large, and the lobe on the right dorsal margin smaller (cf. figs. 38E and 42F); the right paramere slightly less excavated (cf. figs. 38C and 42C); PES not as narrow having few serrations on the distal half (cf. figs. 38G and 42H); the female laIRL having adjacent basal lobes, of equal size, with one round and spiniferous and the other acute with serrations restricted to the inner only (cf. fig. 48); and the mIRL only three-quarters the length of the laIRL (cf. fig. 48). See alsoremarks for *C. tatarnici* and *C. wiradjuri*.

No females of this species were measured, and dried female specimens cannot be distinguished from the cooccurring species, *C. wiradjuri*.

Callitricola silveirae, new species

Figures 13, 41, 48; map 3

DIAGNOSIS: Defined by the following characters: midsized; forewing membrane veins yellow-green; pygophore dorsal margin with medial tumescence, one left lateral tergal process arising from tergal plate; left tergal process a broad, serrate comb with one prominent spine; left paramere apex narrow with weakly recurved hook; right paramere base short, apex curved inward and slightly pointed, weak ridge on inner subapical ventral surface, subapical dorsal margin round, with few small spinelike serrations on subapical ridge and subapical dorsal margin; phallotheca with small right basal tumescence, large subbasal lobe on right dorsal margin; aedeagus with all three spicules subequal in length; PES fully enclosing secondary gonopore, with strongly downturned left branch; DES2 unbranched; DES1 bifurcate with one branch

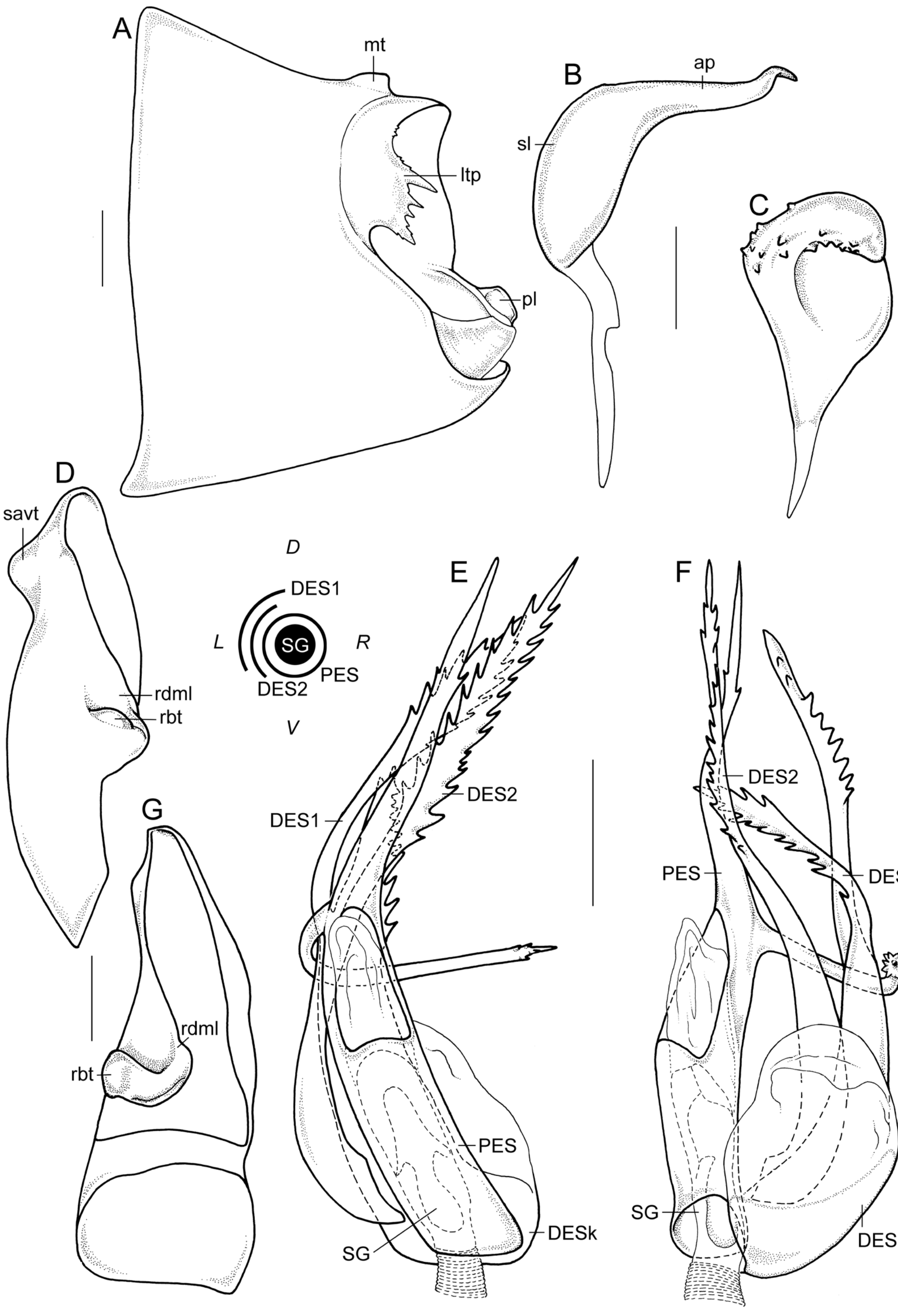


FIG. 38. Male genitalia of *Callitricola pullabooka.* **A.** Pygophore, left lateral. **B.** Left paramere, ventral. **C.** Right paramere, left lateral. **D.** Phallotheca, right lateral. **E.** Aedeagus, right lateral. **F.** Aedeagus, left lateral. **G.** Phallotheca, dorsal. Scale bars = 0.1 mm.

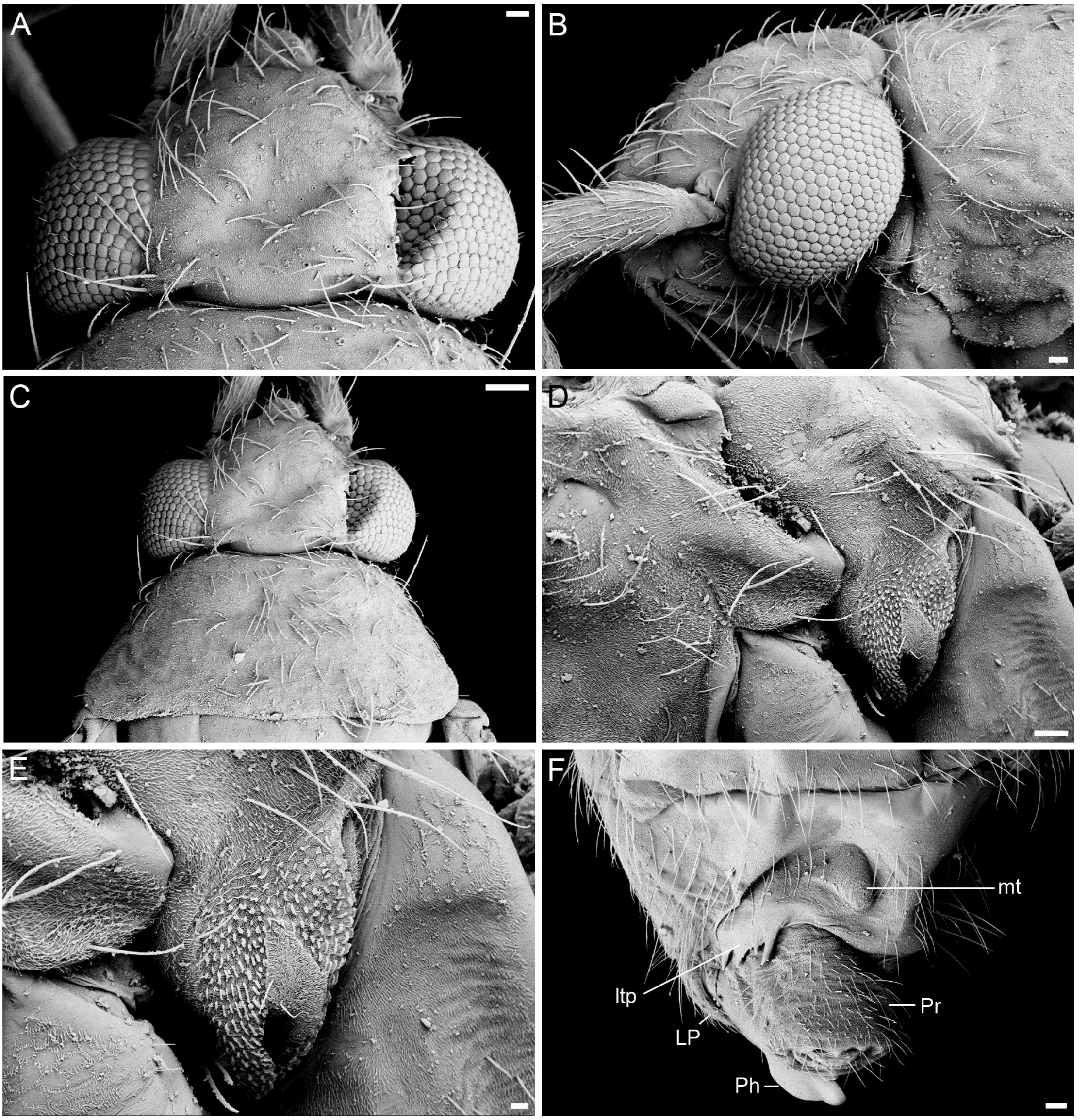


FIG. 39. External morphology of *Callitricola pullabooka,* male. **A.** Head, dorsal, scale bar = 30 μm. **B.** Head, lateral, scale bar = 30 μm. **C.** Head and pronotum, dorsal, scale bar = 100 μm. **D.** Meso- and metathorax, scale bar = 30 μm. **E.** Metathoracic scent gland, scale bar = 10 μm. **F.** Pygophore, dorsal, scale bar = 30 μm.

elongate and one very short; female laIRL slightly wider at apex and weakly curved inward distally, base spiniferous with large spiniferous lobe; mIRL half length of laIRL, subrectangular, margin serrate.

Description: *Male*: Midsized, total length 4.12–4.15 mm, pronotal width 0.86–0.96 mm. COLORATION: Dorsum yellow-green, often faded to yellow, with bright green patches retained on lateral margins of cuneus and embolium and at cuneal fracture; forewing membrane light gray-brown with darker patches laterally, veins yellow-green with pigmentation bleeding onto surrounding membrane, major

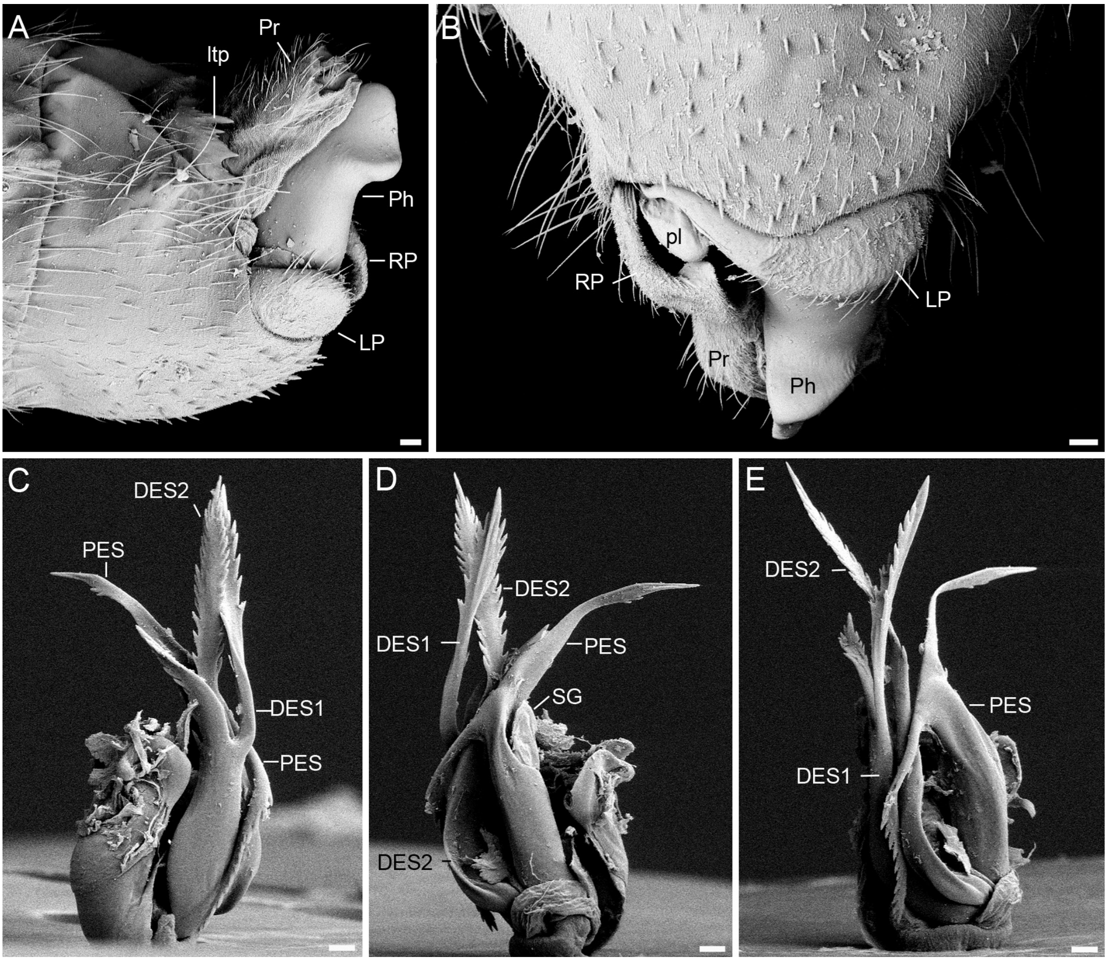


FIG. 40. Male genitalic morphology of *Callitricola pullabooka*. **A.** Pygophore, left lateral. **B.** Pygophore, ventral. **C.** Aedeagus, left dorsolateral. **D.** Aedeagus, ventral. **E.** Aedeagus, left lateral. Scale bars = 30 μm.

cell with bright green spot (fig. 13). VESTITURE: Dorsum with moderately dense distribution of pale simple setae. STRUCTURE: **Head**: Antennae with AI subequal to vertex width, AII 1.4× pronotal width; labium midlength, extending to mesocoxae. **Hemelytra:** Cuneus and major cell of wing membrane moderately elongate, major membrane vein straight (fig. 13). GENITALIA: **Pygophore:** Dorsal margin of genital opening straight, medial tumescence at margin (not illustrated), one sclerotized tergal process positioned left lateral arising from tergal plate; tergal process, broad comblike with one prominent spine; ventral margin convex medially; phalloguide with small, slightly sclerotized lobe at base of right paramere articulation, marginally serrate on right edge (fig. 41A). **Left paramere:** Apophysis tapering, apex narrow with weakly recurved hook (fig. 41B). **Right paramere:** Base short; paramere subovate in lateral view; apex curved inward and slightly pointed to form small lobe, margin forming weak ridge on inner subapical ventral surface, with few small spinelike serrations; subapical dorsal margin round, with few small spinelike serrations; mesiolateral surface excavated (fig. 41C). **Phallotheca:** Dorsal opening large, distal to medial; round distally; mod-

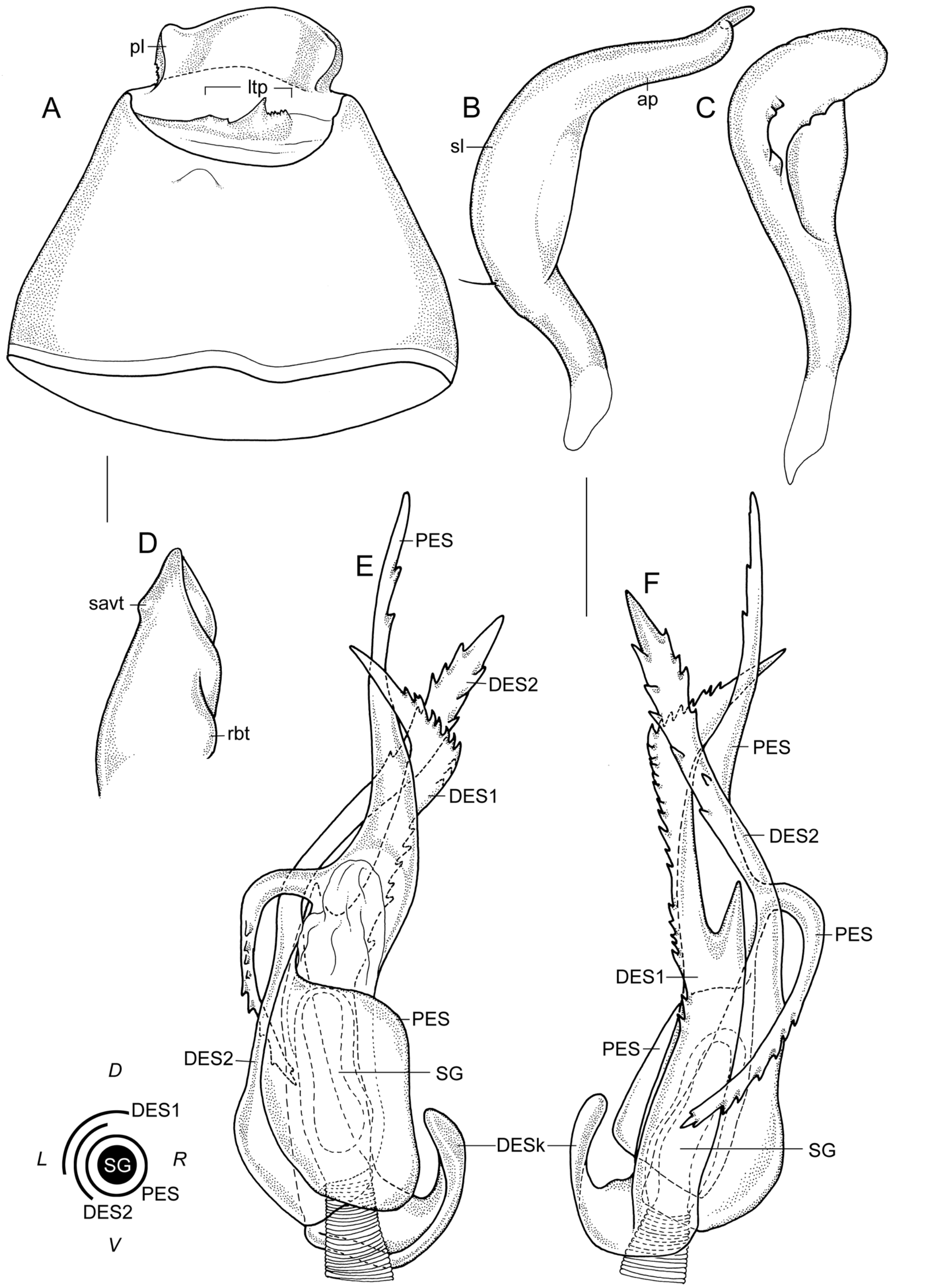


FIG. 41. Male genitalia of *Callitricola silveirae.* **A.** Pygophore, dorsal. **B.** Left paramere, ventral. **C.** Right paramere, dorsal. **D.** Phallotheca, right lateral. **E.** Aedeagus, ventral. **F.** Aedeagus, dorsal. Scale bars = 0.1 mm.

erately large subapical ventral tumescence; small right lateral basal tumescence; large subbasal lobe on right dorsal margin (fig. 41D). **Aedeagus:** Spicule arrangement (fig. 41): PES with tubular base entire and wholly sheathing secondary gonopore, opening medially through which apex of secondary gonopore protrudes, with distal portion of PES left lateral to secondary gonopore, DES2 left lateral to first, DES1 left dorsolateral to second; bases of all spicules originating adjacently at base of secondary gonopore; DES2 and DES1 flattened at base (rather than tubular); PES unbranched, sparsely serrate distally with elongate, distally serrate medial process, projected perpendicular to spicule; DES2 unbranched, distally serrate, subequal length to DES1 and PES; DES1 bifurcate in distal half, branches unequal in length, right branch elongate and serrate distally, left branch very short with smooth margins, basal keel (DESk) short.

Female: Moderately sized, body length 3.68–3.86 mm, pronotal width 0.97–1.00 mm. GENITALIA: Interramal lobes (fig. 48): mIRL partially joined to laIRL at base; laIRL slightly wider at apex and weakly curved inward distally, base spiniferous with large spiniferous lobe, margin of spiniferous lobe sinuous; mIRL half length of laIRL, subrectangular, apex square, margin serrate.

Etymology: Named in honor of Rossana Silveira, in recognition of her contribution to the taxonomy and knowledge of Australian Heteroptera including collecting and curating of collections of Miridae and Heteroptera more broadly across Australia, including this species.

Host plant: Known from *Callitris verrucosa* (table 2).

Holotype: **AUSTRALIA: South Australia:** Scorpion Springs Cons. Park, 35.60421°S 140.8646°E, 125 m, 10 Nov 1998, Schuh, Cassis, Silveira, *Callitris verrucosa*, det. RBG Sydney NSW427497, 1♂ (AMNH_PBI 00000186) (SAMA).

Paratypes: **AUSTRALIA: South Australia:** Scorpion Springs Cons. Park, 35.60421°S 140.8646°E, 125 m, 10 Nov 1998, Schuh, Cassis, Silveira, *Callitris verrucosa*, det. RBG Sydney NSW427497, 2♂ (AMNH_PBI 00016335, 00016336), 1♀ (AMNH_PBI 00016332) (AM), 2♂ (AMNH_PBI 00000185, 00000189) (AMNH), 1♀ (AMNH_PBI 00016331) (SAMA). Scorpion Springs Cons. Park, 35.62872°S 140.8598°E, 100 m, 09 Nov 1998, Schuh, Cassis, Silveira, *Callitris verrucosa*, det. RBG Sydney NSW427497, 1♀ (AMNH_PBI 00016333) (AM).

Other specimens examined: **AUSTRALIA: South Australia:** Scorpion Springs Cons. Park, 35.60421°S 140.8646°E, 125 m, 10 Nov 1998, Schuh, Cassis, Silveira, *Callitris verrucosa*, det. RBG Sydney NSW427497, 1♂ (AMNH_PBI 00016334) (AM).

Distribution: *Callitricola silveirae* is only from sandy open woodlands at two sites in Scorpion Springs Conservation Park, in southeastern South Australia (map 3). It has been collected with *C. graciliphila*, *E. drepanomorpha*, and *E. schuhi* (table 2) at both these sites.

Remarks: *Callitricola silveirae* is differentiated from *C. pullabooka* and *C. tatarnici* by the smaller eyes (in relation to head height); shape of the right paramere more subovate rather than round; unequal lengths and irregular shapes of the branches of DES1 (fig. 41E, F); the broad tergal process on the genital opening of the pygophore with one prominent spine and not a more uniformly serrate comb (fig. 41A); female mIRL short, only half the height of laIRL, and the laIRL has only one (large) basal lobe rather than two (fig. 48). The shape of the right paramere is akin to that of *C. wiradjuri*, with the more subovate shape, slightly pointed apex, and the presence of a ridge on the inner ventral surface (cf. round apex of right paramere in *C. pullabooka* and *C. tatarnici*). The female laIRL of *C. silveirae* is also similar to *C. wiradjuri* in being slender, with only one basal lobe (although much larger than in *C. wiradjuri*), and mIRL is short, only half the height of laIRL (fig. 48). The males of *Callitricola wiradjuri* are distinguished from *C. silveirae* by the lobelike right and left tergal

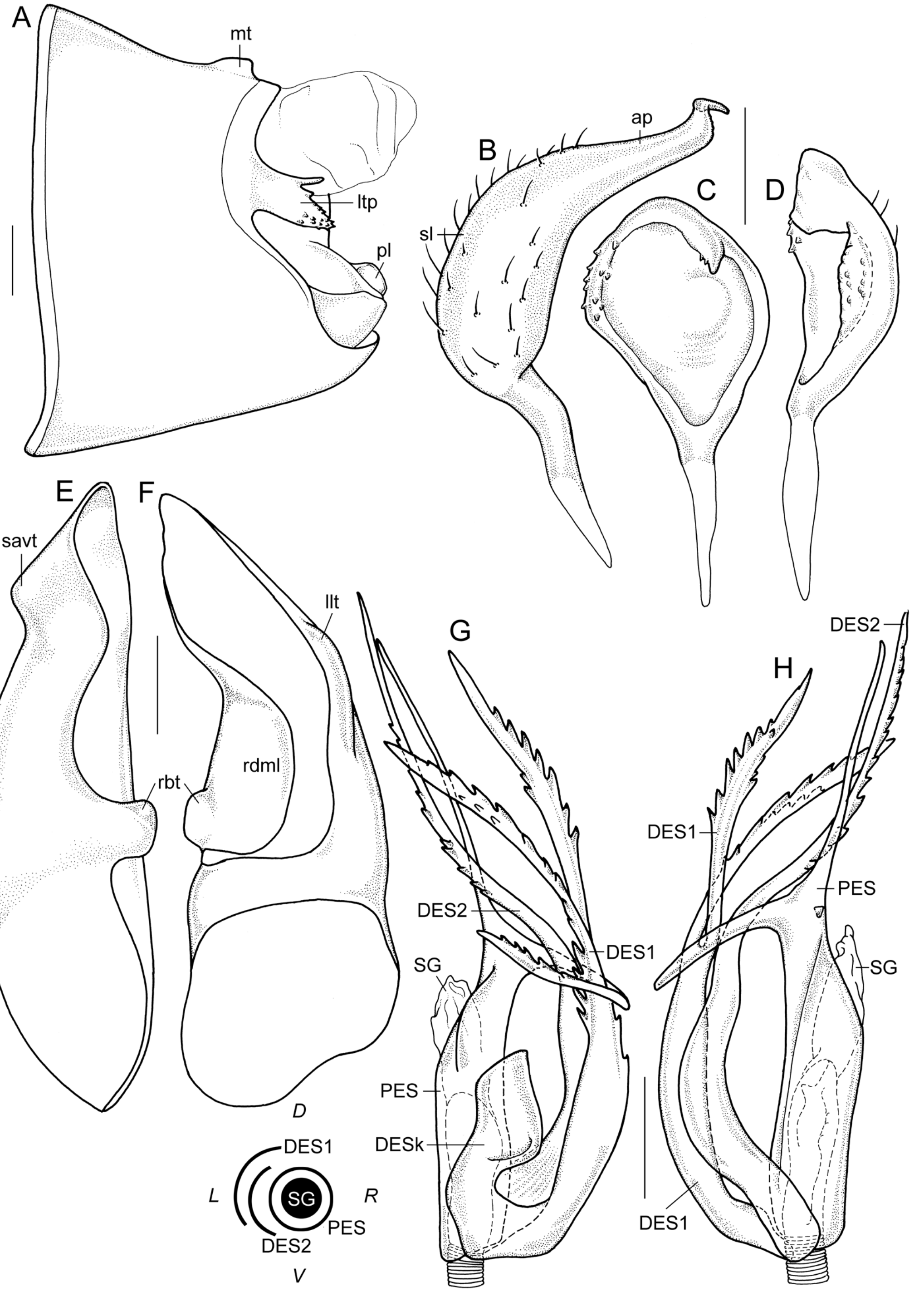


FIG. 42. Male genitalia of *Callitricola tatarnici.* **A.** Pygophore, left lateral. **B.** Left paramere, ventral. **C.** Right paramere, right lateral. **D.** Right paramere, ventral. **E.** Phallotheca, right lateral. **F.** Phallotheca, dorsal. **G.** Aedeagus, dorsal. **H.** Aedeagus, ventral. Scale bars = 0.1 mm.

processes on the dorsal margin of the genital opening of the pygophore (figs. 43H, 45A) and DES1 is much shorter than the other two endosomal spicules, and is also unbranched (figs. 44C–E, 45E).

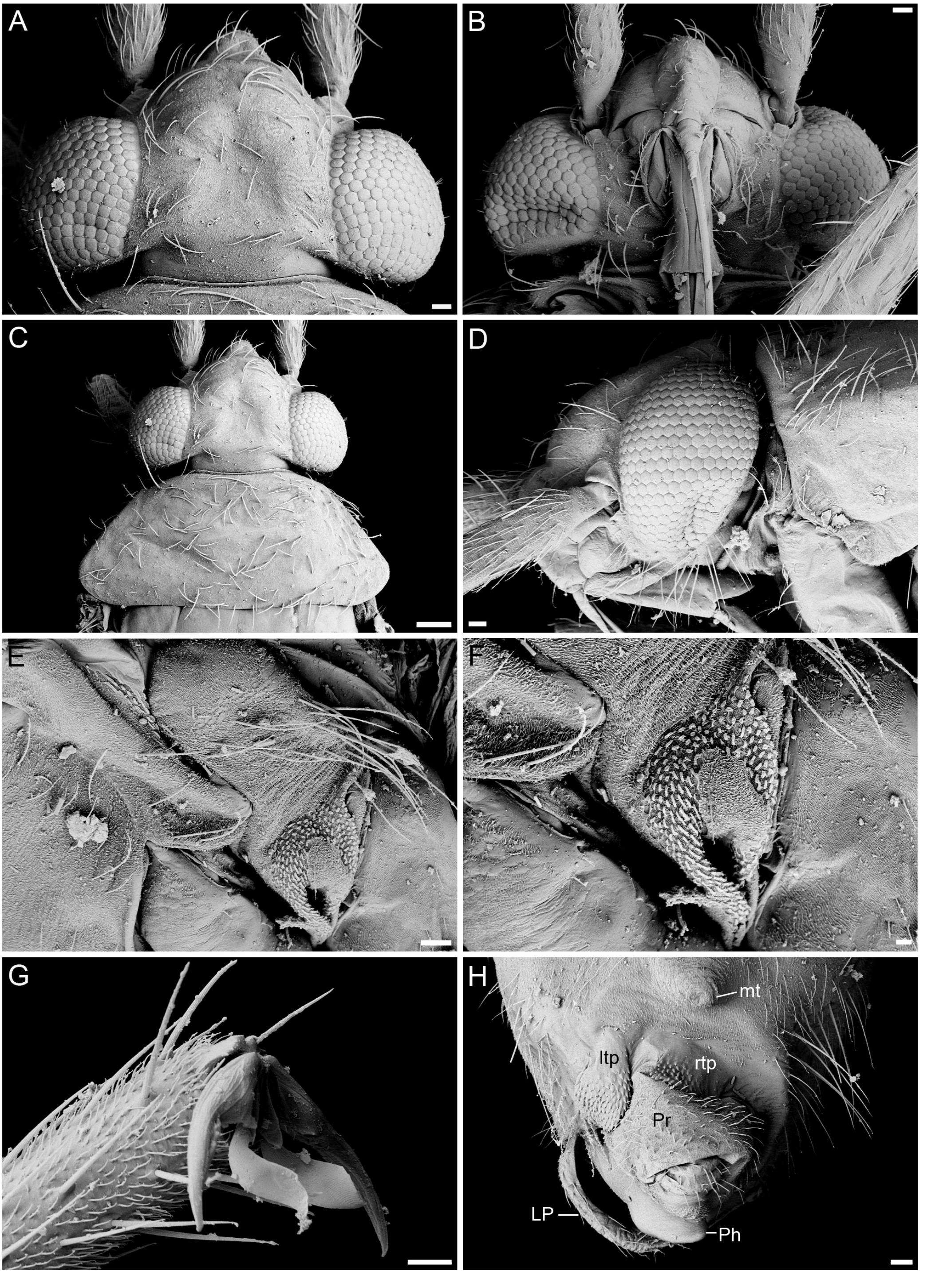
Callitricola tatarnici, new species

Figures 13, 42, 48; map 3

DIAGNOSIS: Defined by the following characters: midsized; forewing membrane veins yellow-green; pygophore dorsal margin with medial tumescence, one left lateral tergal process arising from tergal plate; left tergal process broad serrate comb; left paramere apex narrow with weakly recurved hook; right paramere base short, apex weakly curved inward and forming slightly pointed flange, subapical dorsal margin round, few small spinelike serrations on apical flange and subapical dorsal margin; phallotheca with small basal tumescence and large subbasal lobe, on right dorsal margin; aedeagus with PES fully enclosing secondary gonopore, bifurcate medially with slender smooth right branch and moderately downturned left branch; DES2 unbranched, distally serrate; DES1 bifurcate, branches subequal length, distally serrate; female laIRL uniform width, slightly curved inward at apex, base with two spiniferous lobes—one small (behind), one large (in front); mIRL elongate, almost as long as laIRL, subrectangular, apex round, margins and surface serrate.

DESCRIPTION: *Male*: Midsized, body length 4.02 mm, pronotal width 1.04 mm. COLORATION: Dorsum yellow-green, often faded to yellow, with some bright green patches retained on hemelytra; forewing membrane light gray-brown with darker patches laterally, veins yellow-green with pigmentation bleeding onto surrounding membrane, major cell with bright green spot (fig. 13). VESTITURE: Dorsum with moderately dense distribution of pale simple setae. STRUCTURE: **Head:** Antennae with AI subequal to vertex width, AII 1.2× pronotal width; labium medium length, extending to mesocoxae. **Hemelytra:** Major cell subovate, major membrane vein slightly round (fig. 13). GENITALIA: **Pygophore:** Dorsal margin of genital opening straight, with medial tumescence at margin, with one sclerotized tergal process positioned left lateral arising from tergal plate; left tergal process, broad with one prominent spine; ventral margin convex medially; phalloguide with small, slightly sclerotized lobe at base of right paramere articulation (fig. 42A). **Left paramere:** Apophysis tapering apically, apex narrow with weakly recurved hook (fig. 42B). **Right paramere:** Base short; paramere round in lateral view; apex weakly curved inward, forming small, slightly pointed flange, margin with few small spinelike serrations; subapical dorsal margin with small spinelike serrations; mesiolateral surface excavated (fig. 42C, D). **Phallotheca:** Dorsal opening large, distal to medial; round distally; large subapical ventral tumescence; small right lateral basal tumescence; large right lateral subbasal lobe on dorsal margin; small left lateral tumescence (fig. 42E, F). **Aedeagus:** Spicule arrangement (fig. 42): PES with tubular base entire and wholly sheathing secondary gonopore, with opening medially through which apex of secondary gonopore protrudes, distal portion of PES left lateral to secondary gonopore, DES2 left lateral to PES, DES1 left dorsolateral to DES2; bases of all spicules originating adjacently at base of secondary gonopore; DES2 and DES1 flattened at base, not tubular; PES bifurcate medially, right branch narrow and ribbonlike distally with smooth margins, left branch elongate and distally serrate, projected perpendicular to spicule; DES2 unbranched, distally serrate, subequal length to PES and DES1 spicules; DES1 bifurcate in distal half, branches subequal length and distally serrate, basal keel (DESk) moderately short (fig. 42G, H).

Female: Relatively small, body length 3.33–3.55 mm, pronotal width 0.92–1.09 mm. GENITALIA: Interramal lobes (fig. 48): mIRL partially


A
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joined to laIRL at base; laIRL uniform width, slightly curved inward at apex, base with one small and one large spiniferous lobes; mIRL elongate, almost as long as laIRL, subrectangular, apex round, margins and surface serrate.

Etymology: This species is named after Nikolai Tatarnic, in honor of his contributions to the taxonomy and biology of the Australian Miridae and other Heteroptera, and in gratitude for assistance with fieldwork and supporting this work.

Host plant: Known from *Callitris tuberculata* (table 2). These specimens are labelled as "ex. *Callitris preissii*," but it has been confirmed by the Western Australian Herbarium that the voucher is *Callitris tuberculata* (Sue Carroll, personal commun.).

Holotype: **AUSTRALIA: Western Australia:** ca. 35 km S of Menzies, 29.96214°S 121.1323°E, 600 m, 24 Oct 1996, Schuh and Cassis, *Callitris preissii*, det. WA Herbarium PERTH 05100003, 1♂ (AMNH_PBI 00016338) (WAMP).

Paratypes: **AUSTRALIA: Western Australia:** ca. 35 km S of Menzies, 29.96214°S 121.1323°E, 600 m, 24 Oct 1996, Schuh and Cassis, *Callitris preissii*, det. WA Herbarium PERTH 05100003, 1♂ (AMNH_PBI 00016339), 1♀ (AMNH_PBI 00016340) (AM), 1♀ (AMNH_PBI 00016341) (WAMP).

Other specimens examined: **AUSTRALIA: Western Australia:** ca. 35 km S of Menzies, 29.96214°S 121.1323°E, 600 m, 24 Oct 1996, Schuh and Cassis, *Callitris preissii*, det. WA Herbarium PERTH 05100003, 1♀ (AMNH_PBI 00016342) (AM).

Distribution: Known from a few specimens at one locality in the Goldfields region of south-central Western Australia, where vegetation is predominantly dry open shrublands (map 3). *Avititerra xerophila* and *Erysivena drepanomorpha* were collected nearby but not with *C. tatarnici*. *C. tatarnici* with *E. drepanomorpha* also recorded from *Callitris tuberculata*; the other two orthotyline species have a much very wider range (maps 1, 4).

Remarks: *Callitricola tatarnici* and *C. pullabooka* are very similar, united by the round shape of the right paramere, comblike tergal process on the genital opening of the pygophore, the near identical endosomal spicules, and the female laIRL has two basal lobes and an elongate mIRL. *Callitricola tatarnici* is distinguished from *C. pullabooka* by the slightly larger body; the slightly less bulbous eyes; the phallotheca has a small right basal tumescence and a large lobe on the right dorsal margin; the right paramere is slightly more excavated and cupped; PES is more threadlike distally, lacking serrations on the distally projected right branch (cf. figs. 42 and 38); the shape of the basal lobes on the female laIRL are positioned one in front of the other, with one much larger, and both are round and spiniferous; and the mIRL is almost as long as the laIRL (fig. 48).

Callitricola wiradjuri, new species

Figures 11, 13, 43–46; map 3

Diagnosis: Defined by the following characters: midsized; dusty, pale green coloration; forewing membrane veins pale yellow-green; pygophore dorsal margin with medial tumescence and two sclerotized tergal processes arising from tergal plate; tergal processes round and lobelike with spiniferous surfaces, positioned left lateral and right lateral; left paramere apex narrow with weakly recurved hook; right paramere, base short, apex weakly curved inward and slightly pointed forming flange along inner ventral surface; small bumplike serrations on apical

FIG. 43. External morphology of *Callitricola wiradjuri,* male. **A.** Head, dorsal, scale bar = 30 µm. **B.** Head, ventral, scale bar = 30 µm. **C.** Head and pronotum, dorsal, scale bar = 100 µm. **D.** Head, lateral, scale bar = 30 µm. **E.** Meso and metathorax, scale bar = 30 µm. **F.** Metathoracic scent gland, scale bar = 10 µm. **G.** Tarsal claw, scale bar = 10 µm. **H.** Pygophore, dorsal, scale bar = 30 µm.

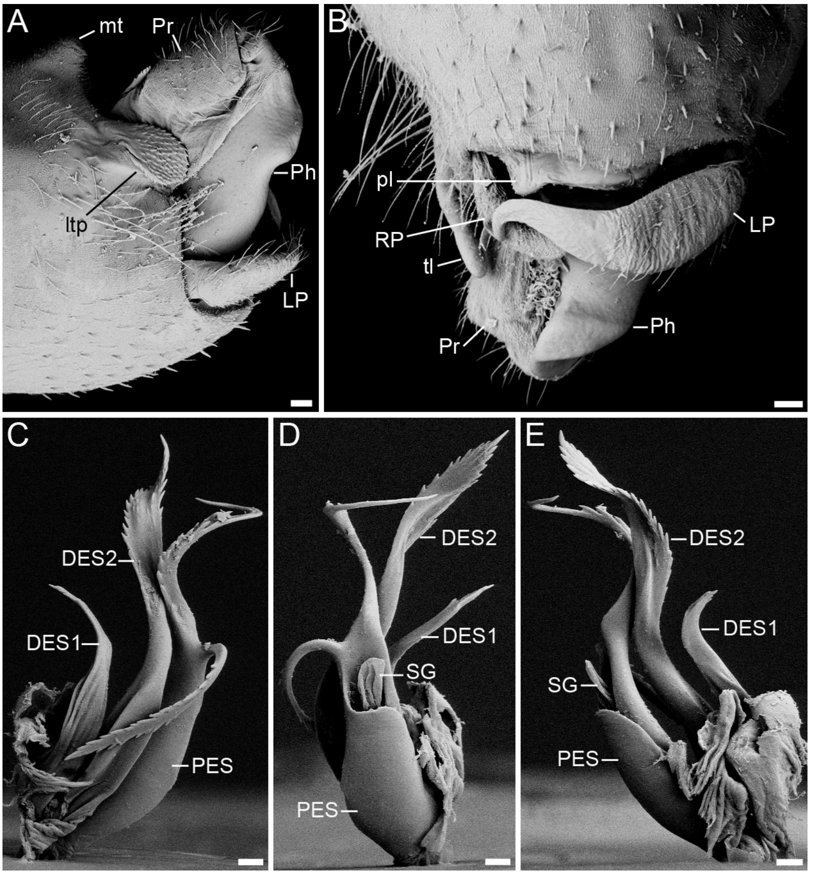


FIG. 44. Male genitalic morphology of *Callitricola wiradjuri*. **A.** Pygophore, left lateral. **B.** Pygophore, ventral. **C.** Aedeagus, left lateral. **D.** Aedeagus, ventral. **E.** Aedeagus, right lateral. Scale bars = 30 μm.

dorsal margin only; phallotheca right dorsal margin with small basal tumescence and weakly expanded lobe; PES fully enclosing secondary gonopore, bifurcate medially, left branch strongly downturned, right branch elongate and subapically serrate, with smooth tip; DES2 unbranched, distally serrate; DES1 unbranched, significantly shorter than other two spicules; female laIRL uniform width, narrow, slightly curved inward distally, base with one small spiniferous lobe; mIRL half height of laIRL, subrectangular, apex slightly pointed, margin only serrate.

Description: *Male*: Midsized, body length 3.13–3.93 mm, pronotal width 0.91–1.01 mm. COLORATION: Dorsum pale dusty green, often faded to pale yellow-green, with some darker bright green patches (retained) on embolium and cuneus; forewing membrane translucent light brown with darker patches laterally, veins dust, pale yellow-green with pigmentation bleeding onto surrounding membrane, major cell without colored spot (fig. 13). VESTITURE: Dorsum with moderately dense distribution of pale simple setae. STRUCTURE: **Head:** Antennae with AI subequal to vertex width, AII 1.3× pronotum width. **Hemelytra:** Cuneus and major cell of wing membrane relatively short, subovate, major membrane vein slightly round (fig. 13). GENITALIA: **Pygophore:** Dorsal margin of genital opening asymmetrically weakly concave, with medial tumescence at margin, two sclerotized tergal process positioned right and left of midline, arising

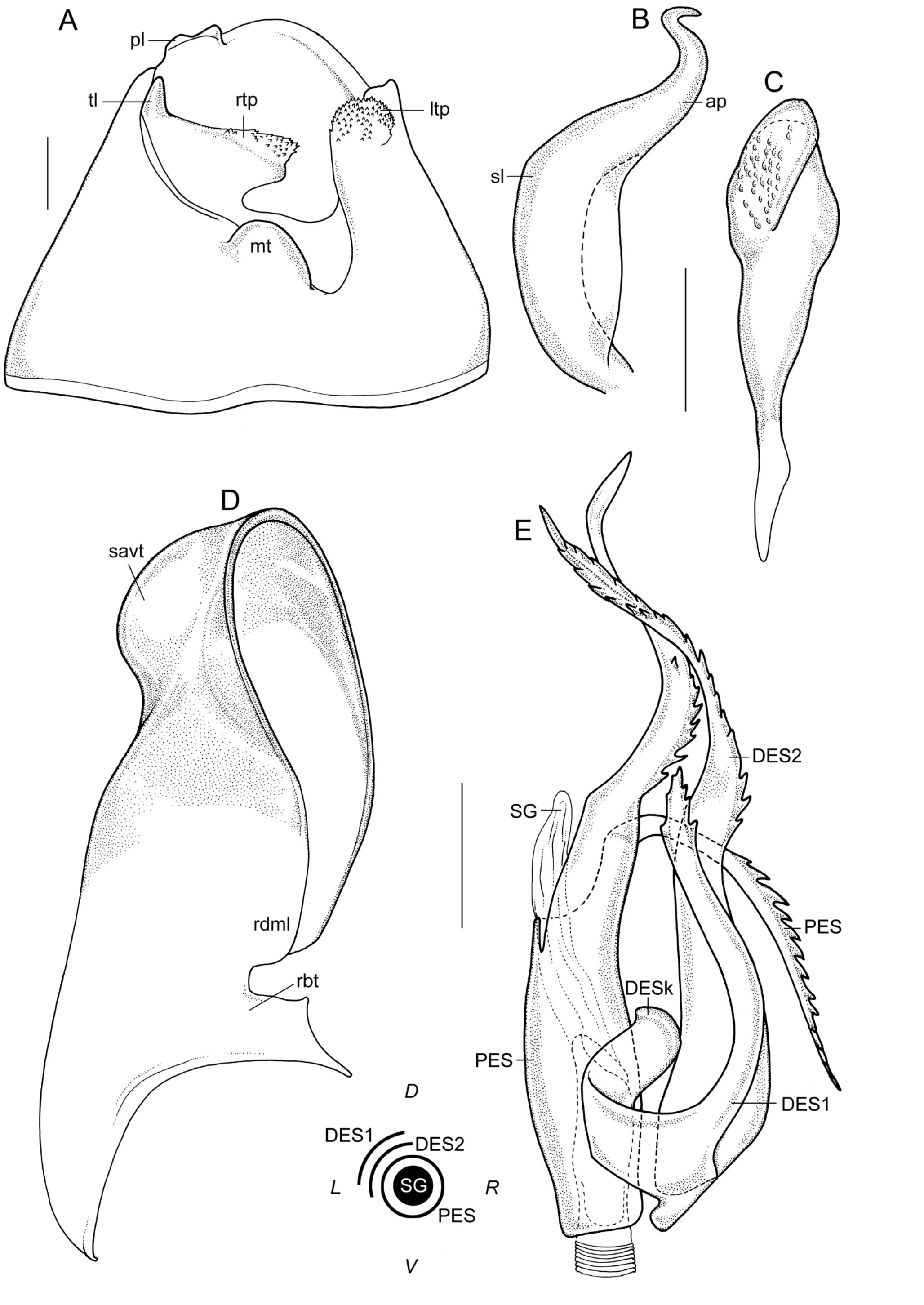


FIG. 45. Male genitalia of *Callitricola wiradjuri*. **A.** Pygophore, dorsal. **B.** Left paramere, ventral. **C.** Right paramere, right lateral. **D.** Phallotheca, right lateral. **E.** Aedeagus, dorsal. Scale bars = 0.1 mm.

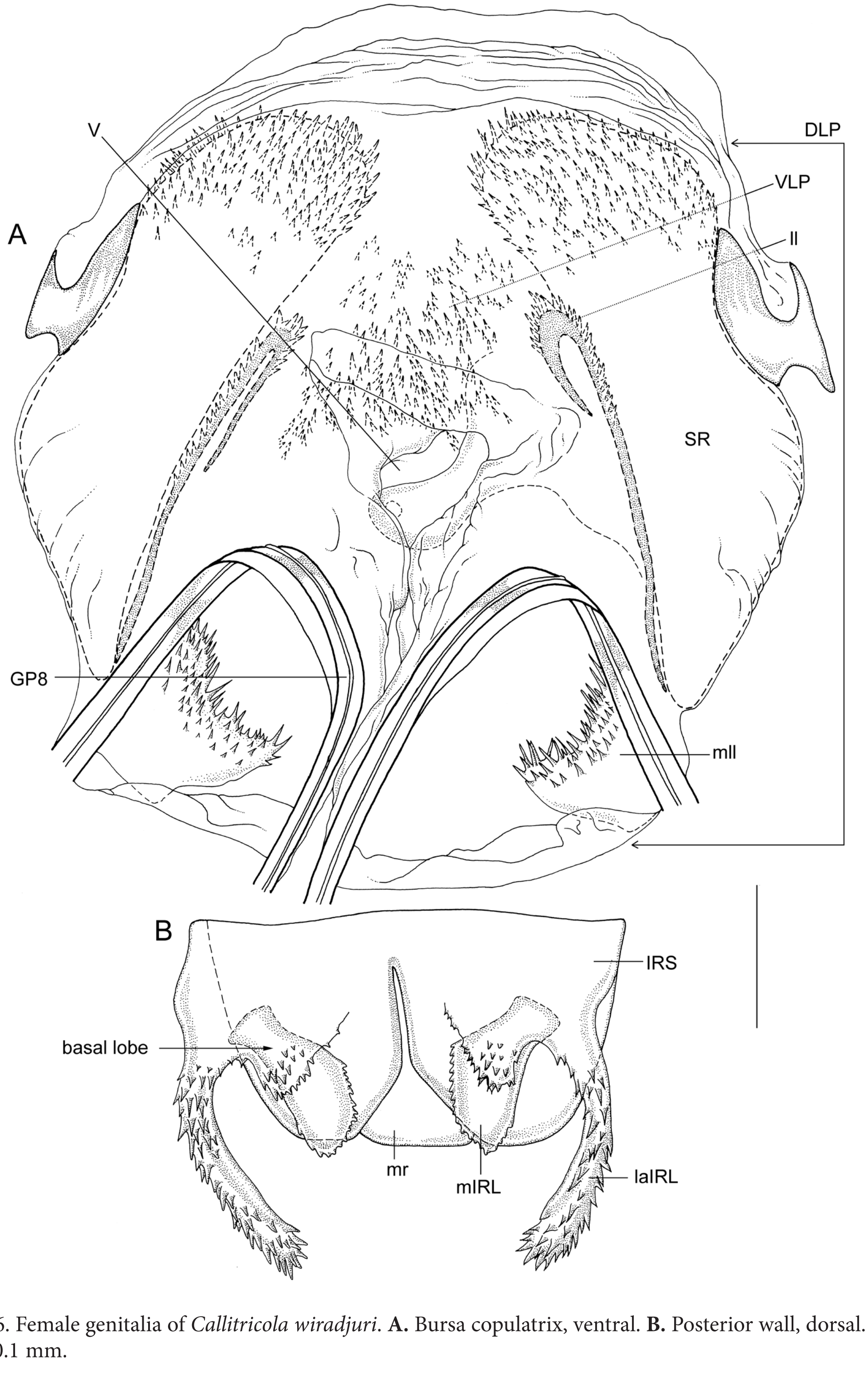


FIG. 46. Female genitalia of *Callitricola wiradjuri*. **A.** Bursa copulatrix, ventral. **B.** Posterior wall, dorsal. Scale bar = 0.1 mm.

from tergal plate (figs. 43H, 44A, 45A); left and right tergal processes broad, lobe shaped with spiniferous surface and round apexes (figs. 43H, 44A, 45A); linear, posteriorly projected tergal lobe on far right margin at base of right tergal process (figs. 44B, 45A); ventral margin slightly convex (fig. 44B); phalloguide with small, lightly sclerotized lobe at base of right paramere articulation, with few serrations on right margin (figs. 44B, 45A). **Left paramere:** Apophysis tapering apically, apex narrow with strongly recurved hook (fig. 45B). **Right paramere:** Base short, paramere subovate in lateral view; apex weakly curved inward, forming flange along inner ventral surface, apex slightly pointed; apical inner dorsal margin with minute raised bumps on surface; mesiolateral surface not excavated (fig. 45C). **Phallotheca:** Dorsal opening large, distal to medial; apex round; large subapical ventral tumescence; small right lateral basal tumescence; weakly expanded lobe on right dorsal margin; small left lateral tumescence (figs. 44A, B, 45D). **Aedeagus:** Spicule arrangement (fig. 45): PES with tubular base entire and wholly sheathing secondary gonopore, with opening medially through which apex of secondary gonopore protrudes (fig. 44D, E); distal portion of PES dorsad to secondary gonopore (fig. 44D), DES2 and DES1 left dorsolateral to PES; bases of all spicules originating adjacently at base of secondary gonopore (fig. 45E); DES2 and DES1 flattened at base, not tubular (fig. 44C); PES bifurcate medially, left branch strongly downcurved and distally serrate, right branch serrate subdistally, with curved acuminate apical tip (figs. 44C, D, 45E); DES2 unbranched, tapering, distally serrate, subequal length to PES (figs. 44C–E, 45C); DES1 short, half length of other two spicules, apex serrate, basal keel (DESk) short (figs. 44C, E, 45E).

Female: Relatively small, subovate, body length 3.12–3.78 mm, pronotal width 0.84–0.96 mm. GENITALIA: Interramal lobes (fig. 46B): mIRL partially joined to laIRL at base; laIRL uniform width, narrow, slightly curved inward distally, base with one small spiniferous lobe; mIRL half height of laIRL, subrectangular, apex slightly pointed, margin serrate.

Etymology: Named for the Wiradjuri people, who are the traditional custodians and original inhabitants of the land in central western New South Wales from where this species is known.

Host plant: Known from *Callitris glaucophylla* (table 2).

Holotype: **AUSTRALIA: New South Wales:** 2.9 km W of Nyngan, 31.55001°S 147.1553°E, 202 m, 18 Oct 2001, Cassis, Silveira, Wall, *Callitris glaucophylla*, det. RBG Sydney NSW658275, 1♂ (AMNH_PBI 00005761) (AM).

Paratypes: **AUSTRALIA: New South Wales:** 2.9 km W of Nyngan, 31.55001°S 147.1553°E, 202 m, 18 Oct 2001, Cassis, Silveira, Wall, *Callitris glaucophylla*, det. RBG Sydney NSW658275, 3♂ (AMNH_PBI 00016527, 00016529, 00016530), 7♀ (AMNH_PBI 00016531–00016537) (AM). Murda State Forest, 33.01916°S 147.28583°E, 11 Feb 1999, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 1♂ (AMNH_PBI 00016549) (AM). Pullabooka State Forest, 33.79166°S 147.735°E, 15 Nov 1997, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 1♂ (AMNH_PBI 00016547) (AM). **Queensland:** 5.9 km E of Mitchell, 26.48726°S 148.0361°E, 380 m, 31 Oct 1998, Schuh, Cassis, Silveira, *Callitris glaucophylla*, det. RBG Sydney NSW427493, 1♂ (AMNH_PBI 00016538), 2♀ (AMNH_PBI 00016541, 00016542), 1♂ (AMNH_PBI 00000175) (AM), 1♂ (AMNH_PBI 00000174), 8♀ (AMNH_PBI 00000153, 00000162, 00000163, 00000167, 00000168, 00000172, 00000173, 00003932) (AMNH), 4♂ (AMNH_PBI 00016539, 00016540, 00000171, 00000161), 4♀ (AMNH_PBI 00016543, 00016544, 00000181, 00000157) (QM).

Other specimens examined: **AUSTRALIA: Queensland:** 5.9 km E of Mitchell, 26.48726°S 148.0361°E, 380 m, 31 Oct 1998, Schuh, Cassis, Silveira, *Callitris glaucophylla*, det. RBG Sydney NSW427493, 2 juv. (AMNH_PBI 00016545, 00016546) (AM).

Distribution: Known from four inland localities, from the south to central western slopes and plains of New South Wales to southern Queensland (map 3), cooccurring with five

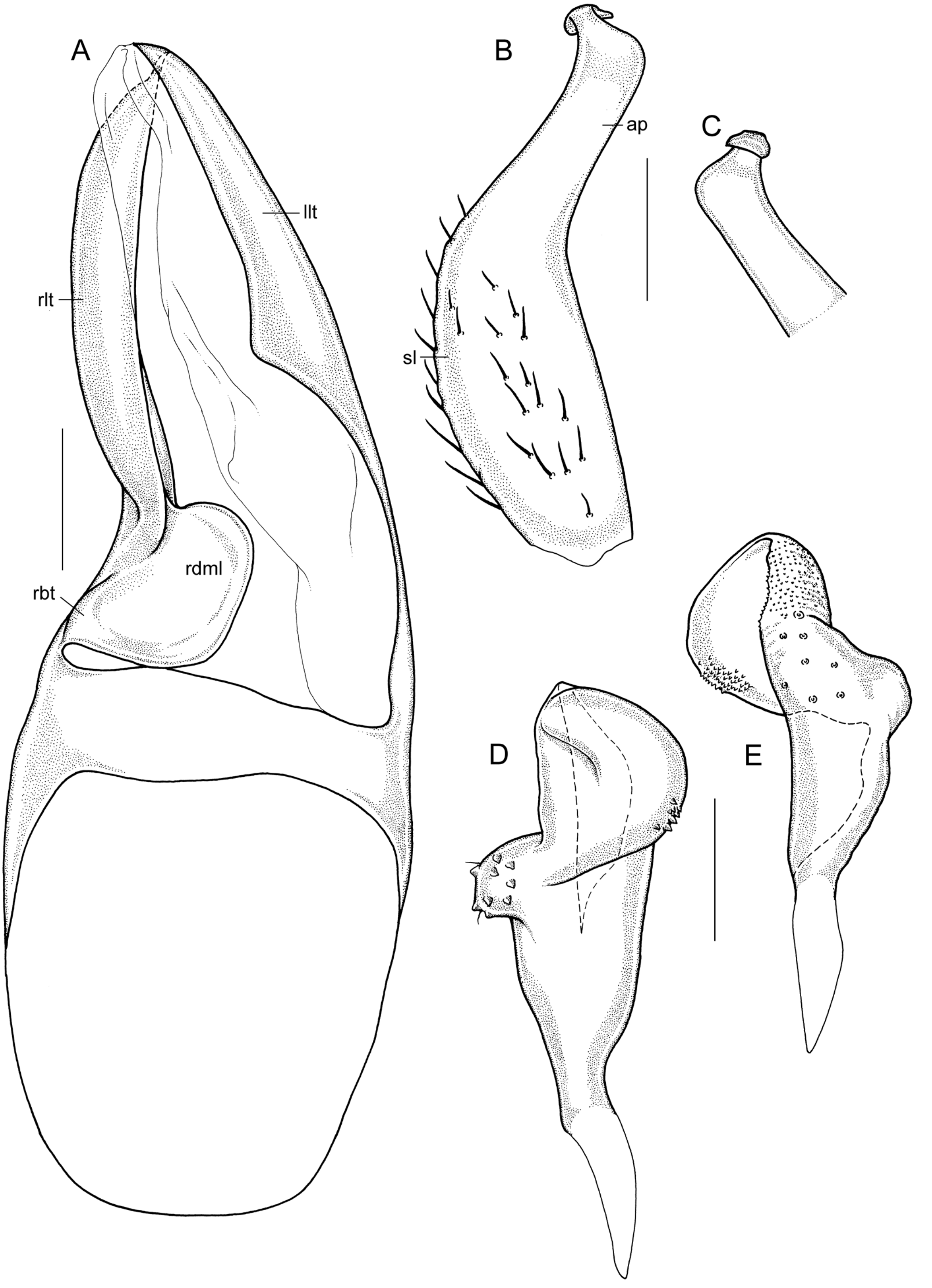


FIG. 47. Male genitalia of *Callitricola wollemi.* **A.** Phallotheca, dorsal. **B.** Left paramere, ventral. **C.** apex of left paramere, dorsal. **D.** Right paramere, left dorsolateral. **E.** Right paramere, right ventrolateral. Scale bars = 0.1 mm.

other species belonging to *Avititerra*, *Callitricola*, and *Erysivena* (table 2).

Remarks: *Callitricola wiradjuri* is most closely related to *C. pullabooka*, C. *silveirae*, and *C. tatarnici* and are united by the distinct PES, which entirely sheaths the secondary gonopore, with an elongate, downturned left branch; a medial tumescence on the dorsal margin of the pygophore; tergal processes arise from a tergal plate on the dorsal margin of the genital opening of the pygophore; and the slender left paramere. *Callitricola wiradjuri* is easily distinguished from the other three species by the paler and more dusty green coloration; very large, bulbous eyes; the male phallotheca simpler with only a small basal tumescence on the right dorsal margin and a weakly expanded lobe on this margin; the genital opening of the pygophore having two lobelike spiniferous tergal processes; DES1 unbranched and significantly shorter than PES and DES2; and the female laIRL narrower with only one small spiniferous basal lobe. See also remarks for *C. silveirae*.

Where *C. pullabooka* and *C. wiradjuri* cooccur, females are indistinguishable externally and require inspection of the posterior wall of the bursa copulatrix.

***Callitricola wollemi*, new species**

Figures 13, 47, 48; map 3

Diagnosis: Defined by the following characters: moderately large size; bright yellow-green coloration; forewing membrane veins yellow-orange with color confined to veins only; left paramere with strongly recurved hook and subrectangular, apically truncate apophysis; right paramere with expanded subapical dorsal lobe with spinelike serrations on surface; right paramere apex enlarged and strongly curved inward to form large flange; phallotheca with twisted point at apex, left and right lateral tumescence, and subquadrate lobe on right dorsal margin near base of margin; female laIRL wider and weakly curved inward distally, base spiniferous with one small lobe; mIRL moderately elongate, three-quarters length of laIRL, subtriangular, margins and distal surface (sparsely) serrate.

Description: *Male*: Moderately large size, body length 4.73 mm, pronotal width 1.18 mm. COLORATION: Dorsum yellow-green, mostly faded to yellow; forewing membrane light brown with slightly darker patches laterally, vein yellow-orange, color confined to vein, major cell with faint green spot (fig. 13). VESTITURE: Dorsum with moderately dense distribution of pale to medium-brown simple setae. STRUCTURE: **Head:** Eyes very large, bulbous, greatly exerted from outline of head (fig. 13); antennae with AI subequal to vertex width, AII 1.5× pronotal width; labium elongate, extending just past metacoxae, over abdomen. **Hemelytra:** Cuneus and major cell of membrane elongate, major membrane vein straight (fig. 13). GENITALIA: **Pygophore:** Not examined, damaged. **Left paramere:** Apophysis subrectangular; apex truncate with strongly recurved hook; hook weak, reduced (fig. 47B, C). **Right paramere:** Base short; subtriangular in lateral view; apex enlarged and strongly curved inward, forming slightly sclerotized ridge along inner subapical ventral margin of paramere; subapical dorsal margin expanded into bulbous lobe, with small spinelike serrations covering surface (fig. 47D, E). **Phallotheca:** Dorsal opening large, narrows distally; apex with twisted point; large subapical ventral tumescence; left lateral tumescence present; large right lateral tumescence; small right lateral basal tumescence; small subquadrate lobe on right dorsal margin, subbasal (fig. 47A). **Aedeagus:** Not examined, teneral.

Female: Midsized, body length 3.97–4.46 mm, pronotal width 1.06–1.10 mm. GENITALIA: Interramal lobes (fig. 48): mIRL and laIRL partially joined at base; laIRL wider and weakly curved inward distally, base spiniferous with one small lobe; mIRL moderately elongate, three-quarters length of laIRL, subtriangular, margins and distal surface (sparsely) serrate.

Etymology: Named after the type locality, Wollemi National Park, northwest of Sydney. Noun in apposition.

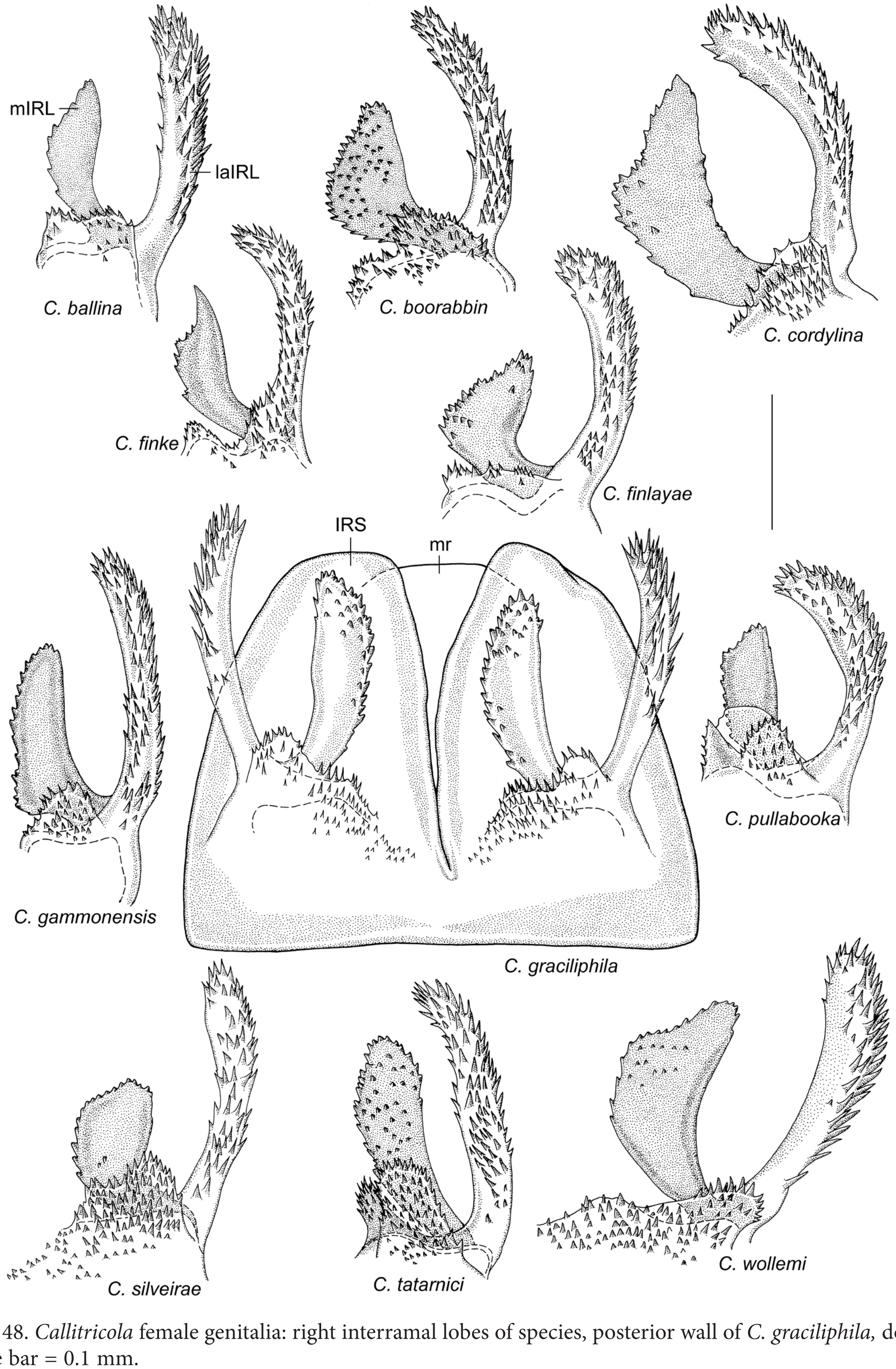


FIG. 48. *Callitricola* female genitalia: right interramal lobes of species, posterior wall of *C. graciliphila,* dorsal. Scale bar = 0.1 mm.

Host plant: From *Callitris rhomboidea* (table 2).

Holotype: **AUSTRALIA: New South Wales:** Wollemi National Park, Glowworm Tunnel Rd, 21 km N of Bungleboori Picnic Area, 33.26031°S 150.2181°E, 942 m, 05 Feb 2005, C. Symonds, *Callitris rhomboidea*, det. RBG Sydney, 1♂ (AMNH_PBI 00005714) (AM).

Paratypes: **AUSTRALIA: New South Wales:** Wollemi National Park, Glowworm Tunnel Rd, 21 km N of Bungleboori Picnic Area, 33.26031°S 150.2181°E, 942 m, 05 Feb 2005, C. Symonds, *Callitris rhomboidea*, det. RBG Sydney, 2♀ (AMNH_PBI 00005715, 00005716) (AM).

Distribution: *Callitricola wollemi* is known only from the type locality, on sandstone plateaus in the Wollemi National Park, near Newnes on the Great Dividing Range (map 3). *Callitris rhomboidea* and *C. endlicheri* grow together in this location, and where *Callitricola wollemi* and *Erysivena sydneyensis* also cooccur (table 2).

Remarks: *Callitricola wollemi* is known only from one male and two female specimens. As the male specimen is teneral and the pygophore was damaged, it was not possible to describe the pygophore and aedeagus. However, from the structure of the right paramere and female genitalia, we were able to determine that this is a distinct species.

It is similar to *Callitricola cordylina, C. graciliphila*, and *C. finlayae* in external appearance; all are large in size, and have orange/yellow hemelytral membrane veins. The male phallotheca is very similar to that of *C. cordylina* with left and right apical tumescences (cf. figs. 47A and 32D, E). In addition, the subbasal lobe or the right dorsal margin of the phallotheca is subquadrate in both species (cf. figs. 32E and 47A). The left paramere of *C. cordylina* also has a subrectangular and truncate apophysis, with a strongly recurved apical hook (cf. figs. 47B, C and 32B). The right paramere of *Callitricola wollemi* differs from *C. cordylina* by having an enlarged apex and an enlarged and bulbous subapical dorsal lobe with spinelike serrations (fig. 47D). This bulbous subapical dorsal lobe is also found in *C. parawirra* (fig. 37D) and *C. finlayae* (fig. 35D), but *C. wollemi* is distinctive, with the lobe slightly smaller, and with a much larger and greatly expanded apical flange (fig. 47D, E), in comparison with *C. parawirra* and *C. finlayae*. The female interramal lobes of *Callitricola wollemi* are most similar to *C. cordylina* (cf. fig. 48), with an elongate subtriangular mIRL. However, in *C. wollemi* the mIRL is slightly less angular and basal lobe and spiniferous base of the laIRL are more expansive. See also remarks for *C. cordylina*.

Erysivena, new genus

Type species: *Erysivena kalbarri*, n. sp., by original designation.

Diagnosis: Defined by the following characters: small to medium size; subovate to elongate; (faded) yellowish-green coloration, cuneus with red tip in most species, forewing membrane with subcuneal clear spot, membrane veins red (fig. 14); pygophore with short dark spinelike setae proximate to genital opening on ventral surface (fig. 58A, B); pygophore dorsal margin moderately to strongly concave, with one, two, or three (elongate) sclerotized tergal processes (figs. 51H, 57H, 63H, 71H); left lateral tergal process always present, elongate and serrate; left paramere L-shaped, moderately (figs. 52B, 53B) to strongly expanded (figs. 72A, 73B) medially, apophysis short or elongate (e.g., figs. 73B, 69B), apex hooked or unhooked (e.g., figs. 50B, 49B); right paramere shape more variable, C-shaped (fig. 49C) or hammer shaped (fig. 50C), widest medially or subapically, mostly with some variation of an expanded medial flange on inner dorsal margin or broad lobe on dorsal margin; right paramere apex short or elongate, curved and mostly serrate; phallotheca dark and heavily sclerotized, often narrow or flattened distally, not always capped by proctiger (figs. 49D, 50D, 51H, 53E, F); in situ, phallotheca projected beyond parameres from genital opening, left paramere situated along majority of (fig. 58B) or over ventral margin of pygophore (fig. 52B), and right paramere situated mostly external and right lateral to phallotheca with curved apex meeting sensory lobe of left paramere (figs. 51H, 52A, B, 57H, 58A, B); aedeagus with three sclerotized, elongate endosomal spicules (fig. 11); proximal endosomal spicule (PES) positioned ventral (or left ventrolateral), second dorsal endosomal spicule (DES2) left dorsolateral to secondary gonopore, and first dorsal endosomal spicule (DES1) left lateral or dorsad to DES2; PES and DES2 associated with secondary gonopore, while DES1 is removed from secondary gonopore and adjacent to DES2; PES unbranched, with or without medial (figs. 56F, 64D, 54E) or subbasal (fig. 53H, 58C, 59E) process(es), constricted above base (figs. 52C, 53G) or more uniformly tapering to apex (fig. 54E, 72C), with smooth or serrate distal margins; DES2 unbranched or bifurcate in distal half, serrate distally and medially (figs. 49F, 50F, 52E); DES1simple and unbranched with smooth or serrate margins (figs. 58E, 59E, 64C, 65C), or complex with serrate bifurcate apex and processes (figs. 52E, 53G), with basal keel situated adjacent to DES2 (fig. 49F); female vestibulum heavily sclerotized (60A, 61A, B); ventral labiate plate with spiniferous lateral lobes (figs. 60C, 61A); large spiniferous mediolateral lobes on dorsal labiate plate (figs. 60B, 61B); interramal sclerites deeply divided with V-shaped junction, with two pairs of interramal lobes, separated at base (figs. 60D, 61C).

Description: *Male*: Macropterous, small to midsized, ovate-elongate, sides parallel or slightly round, body length 2.84–4.19 mm. COLORATION: Dorsal aspect yellowish green, or bright green, often faded to brownish yellow as specimens age, sometimes with bright green patches of pigmentation on lateral margins of pronotum, on hemelytra above and below costal fracture, and on lateral margins and tip of cuneus; pronotum sometimes with anterior half yellow and posterior half bright green, anterior margin sometimes lighter yellow or pale dusty green; mesoscutum and scutellum often faded to yellow; cuneus tip bright red to dark red, sometimes just with slight hint of red; sometimes extending from tip to basal inner half; forewing membrane translucent silvery gray-brown, light with darker patches laterally or dark and more uniform all over, clear spot present below cuneus (fig. 12B), veins bright red; venter yellowish green, often faded to yellow; coxae and adjacent plate structures yellow; legs mostly faded to yellow with little green pigmentation, tarsi darkened; ethanol-preserved specimens faded to white (fig. 14). SURFACE AND VESTITURE: Dorsum smooth, weakly polished; sparse to moderately dense covering of simple setae, mostly pale or sometimes darker medium brown, semierect; setae sometimes more bristlelike on head and along lateral dorsal margins; antennae with dense distribution of short, pale simple setae, antennal segment I also with few elongate erect bristlelike setae (approx. 3 or 5); pygophore, ventral surface proximate to genital opening with short spinelike setae, medium brown or black, adpressed; femora with dark, simple setae and some longer, erect spinelike setae; tibiae with pale simple setae, hind tibiae with several rows of minute dark spinulae, tibial spines light brown. STRUCTURE: **Head:** Subovate in lateral view; weakly or strongly expanded anteriorly. When *weakly expanded anteriorly,* frons sloping downward, mandibular and maxillary plates and clypeus not enlarged (e.g., fig. 63A, B), but when *strongly expanded anteriorly,* frons strongly protruding beyond anterior margin of eyes, mandibular and maxillary plates and clypeus large (e.g., figs. 51A, B, 57A, B, 71A, B). Maxillary plate subovate, anterodorsal margin round and protruding beyond mandibular plate; clypeus prominent, round or slightly pointed in dorsal view, dorsal edge round in lateral view; vertex flat; eyes medium or large. When *eyes medium,* occupying less than three-quarters of head height, weakly exerted beyond outline of head, not or very slightly extending past anterolateral angle of pronotum (e.g., figs. 51A–D, 57A–D), but when *eyes large*, occupying most of head height, exerted moderately or greatly beyond outline of head, extending well past anterolateral angle of pronotum (e.g., figs. 63A–D, 71A–D). Posterior margin of eyes contiguous with posterior margin of head; labium midlength and extending to meso- or metacoxae or elongate and extending beyond metacoxae, over abdomen. **Antennae:** Elongate, inserted just above ventral margin of eye, insertion contiguous with or slightly removed from anterior margin of eye (figs. 51B, 57B); AI short, between 0.9–1.3× vertex width, subcylindrical, slightly wider than remaining segments; AII moderately elongate, on average 1.25× pronotal width; AIII, average 1.5× AIV; AIV, subequal or less than AI; AIII and AIV slightly thinner than AII. **Pronotum:** Trapezoidal, transverse, moderately short, anterior margin weakly concave, collar reduced to thin lip; callosite region undefined; lateral margins straight, angled 30°–45° to midline; humeral angles round; posterior margin very weakly sinuous to straight (figs. 51C, D, 57C, D, 63C, D, 71C, D). **Mesoscutum and scutellum:** Slightly raised; mesoscutum exposed, one-third length of scutellum (fig. 14). **Metathorax:** Metathoracic spiracle moderately elongate, narrowly subcylindrical, with evaporative area narrowly spanning anterior margin and expanded slightly dorsally (figs. 51E, 57E, 63E, 71E); metathoracic scent gland with ostiole subovate to lanceolate, peritreme subovate to subtriangular, extending weakly or strongly onto posterior ostiole margin, evaporative area with small subovate to elongate evaporative bodies (figs. 51E, F; 57E, F; 63E, F, 71E, F). **Hemelytra:** Not greatly elongate, abdomen extending to middle of cuneus; lateral margins parallel to slightly round; cuneal fracture well defined; cuneus short to moderately elongate; forewing membrane major cell mostly elongate, major membrane vein round or straight, curved or parallel to inner margin of cuneus (fig. 14). **Legs:** Elongate, femora slightly flattened, hind femur moderately incrassate; pretarsus with moderately long claws, pulvilli moderately sized, fleshy parempodia broad, apically convergent (figs. 51G, 57G, 63G, 71G). GENITALIA: **Pygophore:** Short, transverse (wider than long), narrowing slightly posteriorly (figs. 51H, 53A); genital opening large, round (figs. 52A, 53A, 5bA); dorsal margin of genital opening strongly concave, sometimes slightly asymmetrically (figs. 51A, 53A); one, two, or three sclerotized, elongate, serrate tergal processes, usually lateral to midline (figs. 51H, 57H, 71H); left lateral tergal process always present, variously shaped (figs. 49A, 53A, 54A); second tergal process positioned right lateral when present, linear shape, sometimes with an expanded, lobed base (figs. 49A, 50A); third tergal process positioned medially, linear, paired with right lateral tergal process, when present (figs. 56A, 71H); far right lateral tergal lobe with smooth margins, sometimes present, either broad posterior facing (figs. 51H, 53A) or elongate and inward facing (figs. 71H, 72B, 73A); ventral margin straight to weakly concave (figs. 58B, 64B), sometimes asymmetrically (e.g., fig. 72A); narrow, round, phalloguide present, extending from ventral margin, modified ventrad to right paramere articulation as sclerotized ridge (figs. 52B, 53A) or an expanded elongate lobe (figs. 72A, 73A); left paramere wrapped along (just inside) ventral pygophore margin at rest (e.g., figs. 58B, 64B, 72A), rarely directed anteriorly across outer ventral surface of pygophore at rest (e.g., fig. 52B); right paramere mostly visible externally at rest, usually situated right lateral to phallotheca and aedeagus and curved round to meet left paramere medially under phallotheca (e.g., figs. 51H, 52B, 57H, 58B, 63H, 64B, 71H, 72B); phallotheca and aedeagus visible externally, extending beyond parameres posteriorly (e.g., figs. 63H, 64A, B); where left paramere is greatly expanded, phallotheca held cupped inside (e.g., figs. 71H, 72A, B); often without capped proctiger over phallotheca (e.g., figs. 51H, 52H, 63H, 64A); proctiger sometimes present covering phallotheca (e.g., figs, 57H, 58A) or present but removed from phallotheca (e.g., figs. 71H, 72B). **Left paramere:** L-shaped; moderately (figs. 52B, 53B) to strongly expanded and subtriangular medially (figs. 72A, 73B); sensory lobe broad and round (e.g., figs. 58B, 59B) or more prominently expanded (figs. 64B, 65B), outer margin sometimes with an angular edge; sensory lobe and outer surface with pale simple setae, sometimes also with short, light to dark brown, bristlelike setae on sensory lobe (figs. 64B, 65B, 66B); apophysis moderately to greatly elongate, narrowing to apex, inner margin sometimes with small spines or serrations (figs. 53B, 54B, 62B, 65B), ca. < 90° to rest of paramere; apex, either round and curved inward but without hook (figs. 49B, 52B, 53B), or hooked (figs. 50B, 54B). **Right paramere:** Shape variable; C-shaped, curved from apex round to medial flange on dorsal inner margin (e.g., figs. 49C, 53C, 56C, 59C, 73C) or "hammer" shaped with expanded subapical lobe on dorsal margin and elongate apex (figs. 50C, 62C, 65C, 66C); medial flange present on dorsal inner margin expanded to differing degrees, from broad, weakly expanded lobe or serrate edge on dorsal margin (figs. 49C, 50C, 53C), or an expanded angular flange (fig. 54D, 68C), often constricted to point (fig. 56C, 59C); medial flange on dorsal margin projected inward or on inner lateral margin projected inward and downward, sometimes greatly reduced; apex generally on inner ventral margin, curved inward, weakly to strongly curved, sometimes greatly expanded/elongate; medial flange and apex mostly with serrate margins or small spines, rarely smooth; with or without simple setae. **Phallotheca:** Darkly sclerotized; protruding moderately from pygophore and visible externally in repose (figs. 52A, 64A), not always extending beyond parameres (figs. 58A, 72B); dorsal opening small (distal only) (e.g., fig. 50D) or large (distal to medial) (e.g., fig. 49D); distally round (fig. 49D) or slightly acuminate (fig. 50D); subapical ventral surface mostly with single tumescence (fig. 54D); distally narrow, without or with slight (e.g., fig. 59D) or full (e.g., fig. 53F) lateral compression (to form flat crest); small opening phallotheca, opening round, drop shaped with small point at apex or subovate sometimes with lobe on basal margin (figs. 50D, 56D); large opening phallotheca, right dorsal margin of genital opening with or without medial (or subbasal) lobe (figs. 49D, 69D). **Aedeagus:** Secondary gonopore elongate, cylindrical, membranous, and faint; three elongate, sclerotized endosomal spicules (fig. 11); proximal endosomal spicule (PES) ventral or left ventrolateral to secondary gonopore; second dorsal endosomal spicule (DES2) dorsad to left lateral of PES and secondary gonopore; PES and DES2 associated with secondary gonopore, but first dorsal endosomal spicule (DES1) is removed from secondary gonopore and adjacent (left lateral or dorsad) to DES2; all spicules originating in line with base of secondary gonopore or slightly distad to it; PES wrapped sheathlike around secondary gonopore, unbranched, with simple or complex forms. With *simple* PES (e.g., figs. 64C, D, 74C, D), tapering evenly from base to apex, with or without medial process, distally smooth or serrate, sometimes medially serrate (e.g., figs. 56F, 50F, 65E), or with *complex* PES (e.g., figs. 52C, 58C), base very broad, then weakly (e.g., fig. 49E) or acutely (e.g., fig. 53G) constricted and narrow and ribbonlike to apex, with or without subbasal straplike process attached just above constriction point (figs. 58C, 59E), expanded base with small, very fine process present on ventral margin proximate to apex of secondary gonopore (figs. 58C, 59E), distally smooth (fig. 67E) or weakly serrate (fig. 49E); complex PES sometimes joined to DES2 by membrane at base on right lateral side of secondary gonopore (figs. 49F, 52E, 53G, 58E, 59E, 67E). DES2 unbranched or bifurcate, sometimes expanded medially, distally serrate, serrations extend from apex to midsection on right side margin (figs. 52E, 64E), rarely with small row of serrations on right side margin more subbasally (fig. 62E), sometimes twisted or curved downward distally (figs. 65E, 68F), unbranched form sometimes with small medial process (figs. 69E, 70E, 72D); DES1 with simple or complex form: with *simple* DES1 (e.g., figs. 58E, 59E, 64C, 69C, 72C, 73G), unbranched, sometimes expanded medially, sometimes

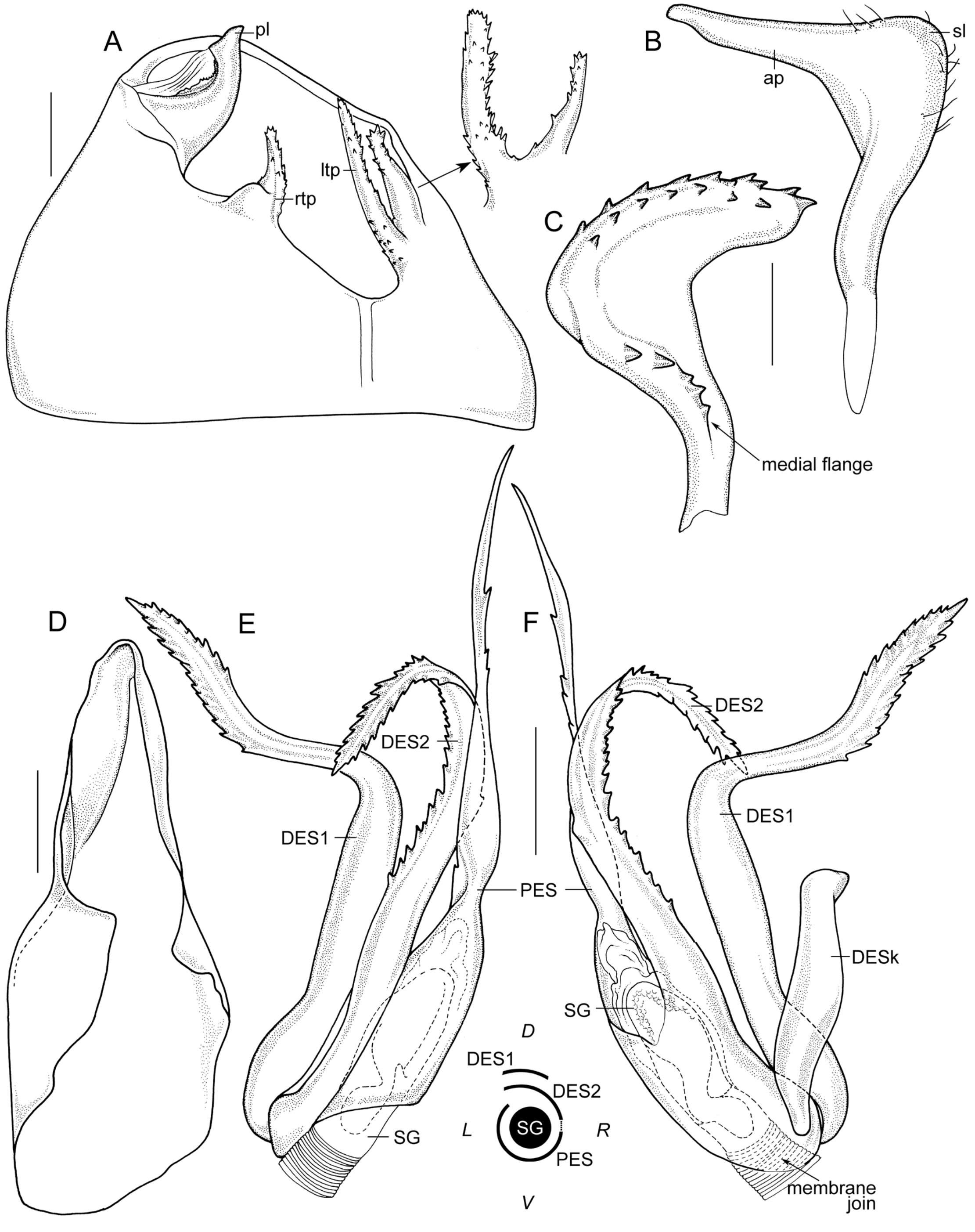


FIG. 49. Male genitalia of *Erysivena apta.* **A.** Pygophore, dorsal, detail of left tergal process in lateral view. **B.** Left paramere, dorsal. **C.** Right paramere, left dorsolateral. **D.** Phallotheca, dorsal. **E.** Aedeagus, left lateral. **F.** Aedeagus, right lateral. Scale bars = 0.1 mm.

medially serrate, distally smooth or serrate; sometimes curved downward distally, apex bisected or whole; with *complex* DES1 (e.g., figs. 52E, 53G), bifurcate with two short serrate basal processes (below bifurcate portion), branches distally serrate; DES1 with elongate basal keel (DESk) present, membranous join at base to DES1, situated more adjacent and dorsal to DES2, with some anchoring membrane (figs. 49F, 50E).

Female: Almost identical to male, with very slight sexual dimorphism in slightly smaller eyes and hemelytral membrane length. On average, subequal size to males and sometimes slightly larger or smaller in body length, body length 2.84–4.08 mm. GENITALIA: Vestibulum with heavily sclerotized asymmetrical tubular processes, species specific (figs. 55A, 60A, 61B); ventral labiate plate sclerotized, mesial surface spiniferous with spiniferous clavate lateral lobes arising adjacent to gonapophyses 8 (figs. 60B, C, 61A); dorsal labiate plate with paired spiniferous mediolateral lobes on posterior lateral sides of genital chamber, lobes round, extending from margin (figs. 30A, 60B, 61B); sclerotized rings large, club shaped anteriorly, anterior surface spiniferous (figs. 55A, 61B); posterior wall heavily sclerotized; medial region of posterior wall more lightly sclerotized, margin straight or slightly convex, level with or slightly raised above anterior margin of interramal sclerites (figs. 55B, 60D, 74); interramal sclerites (IRS) deeply divided with V- or U-shaped junction, fused posteriorly below medial region of posterior wall forming posterior margin of posterior wall, posterior margin straight, broadly convex, broadly concave, or medially convex (figs. 30B, 60D, 61C, 74); IRS with two sets of paired interramal lobes, with species specific differences (fig. 74); lateral interramal lobes (laIRL) elongate and spiniferous with inner margin smooth and with spiniferous area or spiniferous lobe on inner margin at base (figs. 60D, 74); medial interramal lobes (mIRL) ventral to laIRL, with base embedded in socket and separated from laIRL (figs. 60D, 74), although proximate and with attaching membrane at base (e.g., fig. 74, anterolateral view); mIRL shorter and broader than laIRL (figs. 60D, 74); mIRL subquadrate or subrectangular, margins and sometimes also distal surface spiniferous (figs. 60D, 74).

ETYMOLOGY: Named for the distinctive red wing coloration on the hemelytral membrane veins of all species in this genus, from the Greek root *erysi-* ("red") and the Latin word *vena* ("vein"). The gender is feminine.

REMARKS: *Erysivena* is best recognized externally by the red color of the hemelytral membrane veins and the red cuneal tips in the majority of species, yellow-green body, simple hairlike vestiture, small to medium size and elongate ovate body (fig. 14). The red forewing membrane veins are always present in *Erysivena*, but can be reduced within some species. Live specimens are bright green (fig. 4), with the first antennal segment also bright green and the remaining antennomeres lighter yellowish brown, and the lower third of the tibiae and tarsi are light orange-brown, with tarsal claw dark brown.

Erysivena and *Callitricola* are sister taxa and are similar in body size and shape; yellow-green coloration; hairlike setae and lack of scalelike setae on dorsum; sclerotized tergal processes on the dorsal margin of the genital opening of the pygophore; dark bristles on the ventral surface of the pygophore; round genital opening of the pygophore; dark and strongly protruding phallotheca; simple L-shaped left paramere; PES positioned ventrad to the secondary gonopore; DES2 and DES1 left lateral to left dorsolateral of secondary gonopore; female interramal sclerite with two interramal lobes. In both genera, the shape of the left paramere is conserved and there is more interspecific variation in the right paramere.

Erysivena is less variable in size and shape than *Callitricola*. *Erysivena* can be distinguished from *Callitricola* by the red (rather than green) hemelytral coloration on the cuneus (cf. figs. 13, 14); presence of up to three elongate tergal processes on the pygophore, a moderately to greatly expanded left paramere with or without a hooked

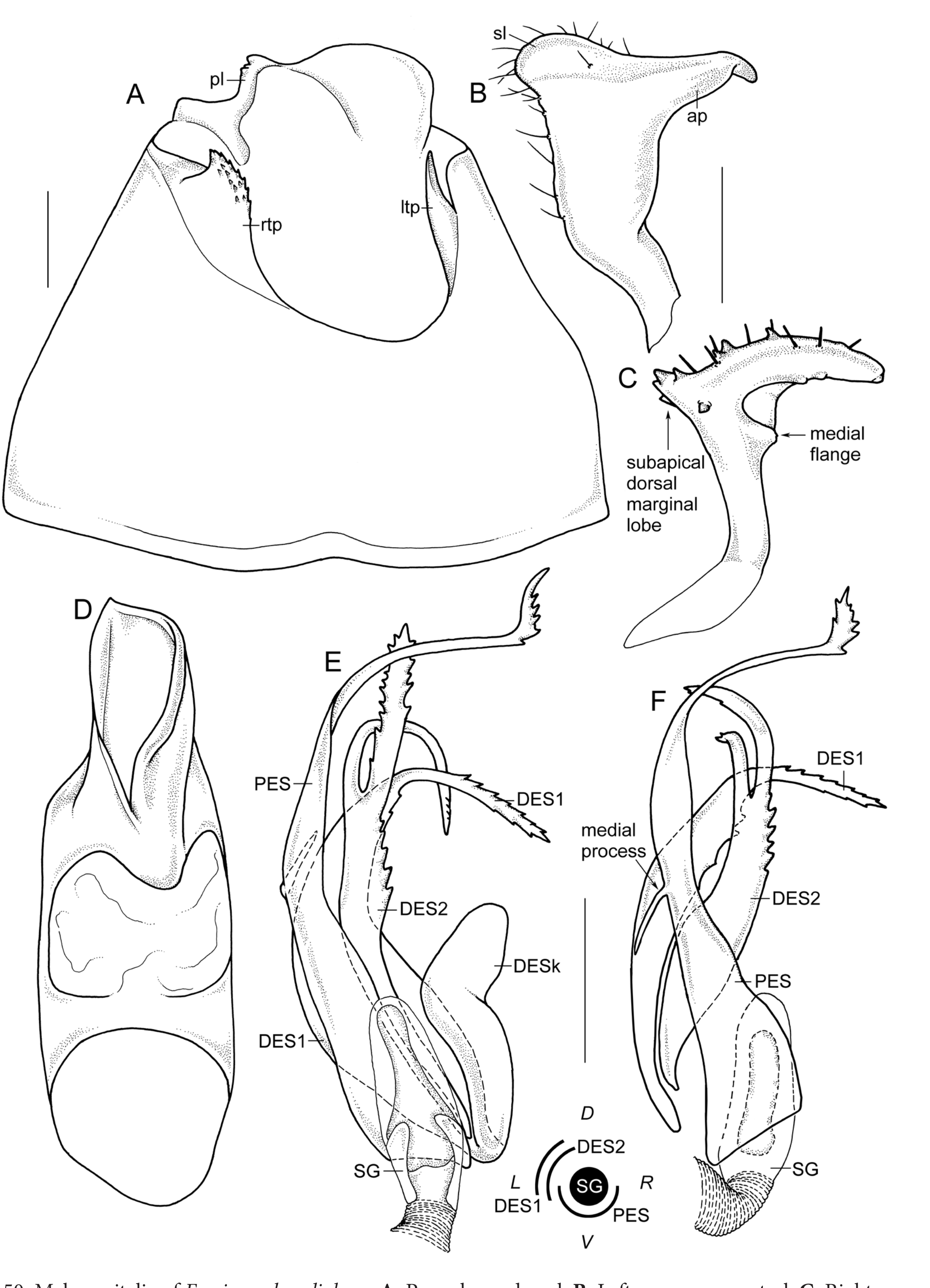


FIG. 50. Male genitalia of *Erysivena bundjalung.* **A.** Pygophore, dorsal. **B.** Left paramere, ventral. **C.** Right paramere, left lateral. **D.** Phallotheca, dorsal. **E.** Aedeagus, right lateral. **F.** Aedeagus, ventral. Scale bars = 0.1 mm.

apex (cf. weakly expanded, strongly curved, and always hooked apex in *Callitricola*); an externally projected and medially expanded right paramere mostly with a serrate apex (cf. club shaped, widest distally and often smooth at apex in *Callitricola*, with only the apex visible externally in repose); the phallotheca is tapered distally and not as strongly projected or as darkly sclerotized as in *Callitricola*; the phallotheca is often not capped by the proctiger in *Erysivena*; PES (cf. fig. 11) is not bifurcate and mostly narrow and smooth distally (cf. distally or medially bifurcate and distally serrate in *Callitricola*); and DES2 is always distally serrate and medially serrate (cf. variable and never medially serrate in *Callitricola*).

There are three main clades of *Erysivena*, with the three Western Australian species (*E. drepanomorpha*, *E. notodytika*, *E. kalbarri*) distinctly different from all other congeners, with complex PES and DES1 endosomal spicules, and PES and DES2 joined by a membrane basally on the right lateral side of the secondary gonopore.

Erysivena apta, new species

Figures 14, 49, 74; map 4

Diagnosis: Defined by the following characters: midsized; head enlarged anteriorly; eyes medium; labium extending over abdomen; tip of cuneus and forewing membrane veins red; pygophore with two tergal processes, left lateral tergal process bifurcate and U-shaped, right tergal process linear with an expanded lobed base; left paramere moderately expanded, sensory lobe angular and broad, apophysis elongate, with straight, unhooked apex; right paramere C-shaped, medial flange unexpanded, strongly curved apex and serrate from apex round to medial flange; aedeagus with all spicules unbranched and without medial processes; PES complex, weakly constricted above broad base, subdistally with few small serrations; DES2, curved downward distally; DES1 unbranched, bent in S-shape medially to apex, distally serrate; PES and DES2 joined right laterally with membrane; female mIRL subquadrate, two-thirds height of laIRL.

Description: *Male*: midsized, elongate, body length 3.53–3.84 mm, pronotal width 0.99–1.17 mm. COLORATION: Cuneus tip red; forewing membrane light gray-brown with darker patches laterally and in major cell, veins red with color extending onto surrounding membrane (fig. 14). VESTITURE: Dorsum with moderately dense distribution of light-brown simple setae. STRUCTURE: **Head:** Strongly expanded anteriorly; eyes midsize, extending slightly beyond anterolateral angle of pronotum; antennae with A1 1.25× vertex width, AII 1.2× pronotal width; labium elongate, extending over abdomen. **Hemelytra:** Cuneus moderately elongate; major cell of membrane ovate-elongate, major membrane vein straight (parallel to inner margin of cuneus) (fig. 14). GENITALIA: **Pygophore:** Dorsal margin strongly concave, slightly asymmetrically, with two tergal processes; left lateral tergal process bifurcate, U-shaped with serrate margins; far right lateral tergal process linear, distally serrate with an expanded bulbous base; ventral margin of genital opening slightly concave with round cup-shaped phalloguide situated just inside and protruding over ventral margin; phalloguide with short, slightly sclerotized lobe ventrad to right paramere articulation (fig. 49A). **Left paramere:** Moderately expanded medially; sensory lobe broad, outer margin angular; apophysis greatly elongate, inner margin smooth; apex straight, not hooked (fig. 49B). **Right paramere:** C-shaped; medial flange on dorsal margin, unexpanded; apex enlarged and strongly curved to medial flange; medial flange unexpanded, with row of toothlike spines; apex with two rows of distinct tooth like spines, separated from medial spines (fig. 49C). **Phallotheca:** Dorsal opening large; round distally; weakly compressed on subapical ventral surface, with small tumescence in lateral view, but not flattened to crest; small lobe on right dorsal margin near base (fig. 49D). **Aedeagus:**

Spicule arrangement (fig. 49): PES ventral to left lateral of and almost fully sheathing secondary gonopore, DES2 dorsal to PES and secondary gonopore, adjoining PES with membrane on right side of secondary gonopore (fig. 49G), DES1 dorsad of DES2, all originating near base of secondary gonopore; PES complex, slightly constricted above base, moderately narrow and tapering to apex; few serrations present on distal margin; without subbasal straplike processes or medial process (fig. 49E, F); DES2 unbranched, flattened, curved downward distally, without medial process (fig. 49E, F); DES1 simple, unbranched, not expanded medially, strong S-shaped bend medially to apex, distally serrate, with elongate basal keel (fig. 49F).

Female: Slightly smaller on average than males, body length 3.40–3.78 mm, pronotal width 1.01–1.06 mm. GENITALIA: IRS posterior margin medially convex. Interramal lobes (fig. 74): mIRL entirely separated from laIRL; laIRL curved inward and slightly tapered distally, base spiniferous with small spiniferous lobe; mIRL two-thirds height of laIRL, subquadrate, distally serrate.

Etymology: Named in reference to the membrane joining PES and DES2, from the Latin *aptus* meaning "joined, bound, or fastened."

Host plant: From *Callitris glaucophylla* (table 2).

Holotype: **AUSTRALIA: New South Wales:** Gunningbland State Forest, 33.09222°S 147.9675°E, 08 Oct 1998, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 1♂ (AMNH_PBI 00016270) (AM).

Paratypes: **AUSTRALIA: New South Wales:** Bulbodney State Forest, 32.515°S 147.201°E, 25 Sep 1997, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 9♂ (UNSW_ENT 00041746, UNSW_ENT 00041748, UNSW_ENT 00041749, UNSW_ENT 00041753–UNSW_ENT 00041758), 9♀ (UNSW_ENT 00041750, UNSW_ENT 00041751, UNSW_ENT 00041759–UNSW_ENT 00041765) (AM), 1♂ (UNSW_ENT 00041747), 1♀ (UNSW_ENT 00041752) (UNSW). Gunningbland State Forest, 33.09694°S 147.95722°E, 18 Oct 1997, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 1♂ (AMNH_PBI 00016268), 1♀ (AMNH_PBI 00016269) (AM); 07 Oct 1998, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 2♂ (AMNH_PBI 00016266, AMNH_PBI 00016267) (AM). Gunningbland State Forest, 33.09222°S 147.9675°E, 08 Oct 1998, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 2♀ (AMNH_PBI 00016271, AMNH_PBI 00016272) (AM). Roadside remnant near Condobolin Tip, 33.07505°S 147.14466°E, 25 Sep 1997, Australian Museum, *Callitris glaucophylla*, 1♂ (UNSW_ENT 00041766) (AM). Taratta State Forest, 32.8°S 147.03333°E, 25 Sep 1997, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 2♂ (UNSW_ENT 00041767, UNSW_ENT 00041768) (AM).

Distribution: *Erysivena apta* is known from five localities in central western New South Wales and is the only member of the genus that is narrowly restricted to this region (map 4). It was collected with *B. hochuli* and *Callitricola cordylina* and *E. schuhi* at four of the above localities (table 2).

Remarks: *Erysivena apta* and *E. schuhi* have similar male genitalia, particularly PES, which is constricted above the base, but without subbasal processes (cf. figs. 49E, F and 69E). Males of *E. apta* are most easily distinguished from those of *E. schuhi* by the distinctive bifid left tergal process of the genital opening (cf. figs. 49A and 69A), the triangular left paramere with straight apophysis that is positioned inside the ventral margin of the pygophore at rest (cf. flexed over pygophore venter at rest in *E. schuhi*) (figs. 49B, 69B), and the unexpanded right paramere (cf. figs. 49C and 69C). Where *E. apta* has been collected sympatrically with *E. schuhi* females are unable to be distinguished without dissection. See also remarks for *E. schuhi*.

Erysivena bundjalung, new species

Figures 5C–D, 14, 50; 74; map 4

Diagnosis: Defined by the following characters: small size; head weakly expanded anteri-

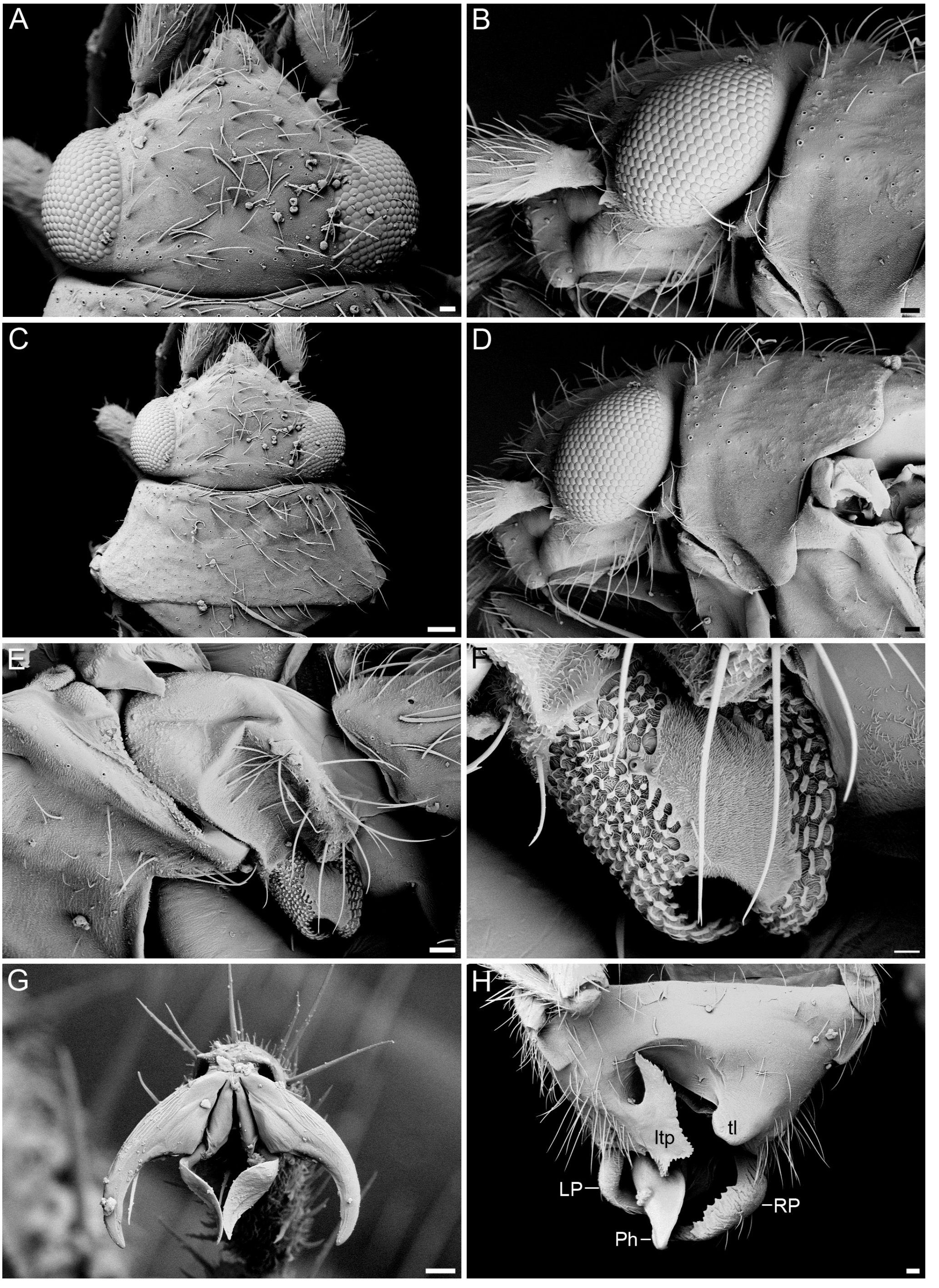


FIG. 51. External morphology of *Erysivena drepanomorpha,* male. **A.** Head, dorsal, scale bar = 30 µm. **B.** Head, lateral, scale bar = 30 µm. **C.** Head and pronotum, dorsal, scale bar = 100 µm. **D.** Head and pronotum, lateral, scale bar = 30 µm. **E.** Meso- and metathorax, scale bar = 30 µm. **F.** Metathoracic scent gland, scale bar = 10 µm. **G.** Tarsal claw, scale bar = 10 µm. **H.** Pygophore, dorsal, scale bar = 30 µm.

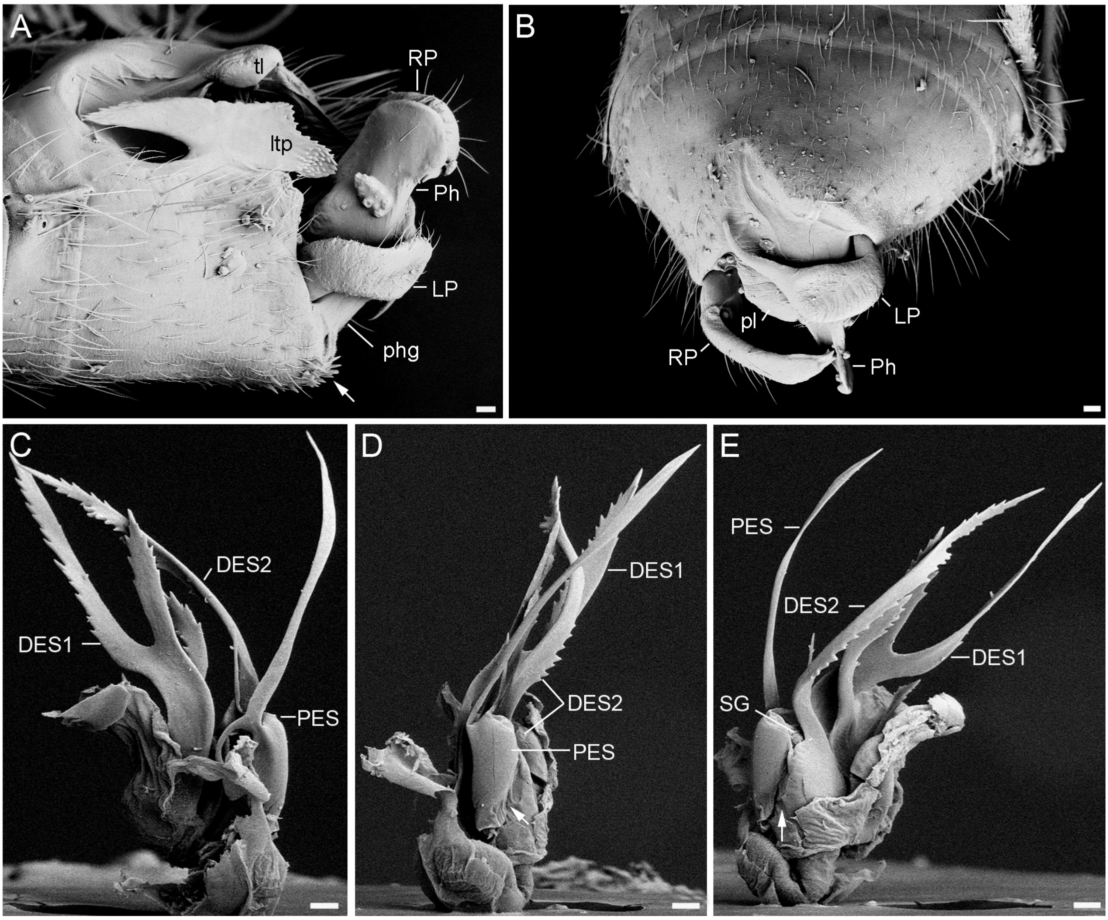
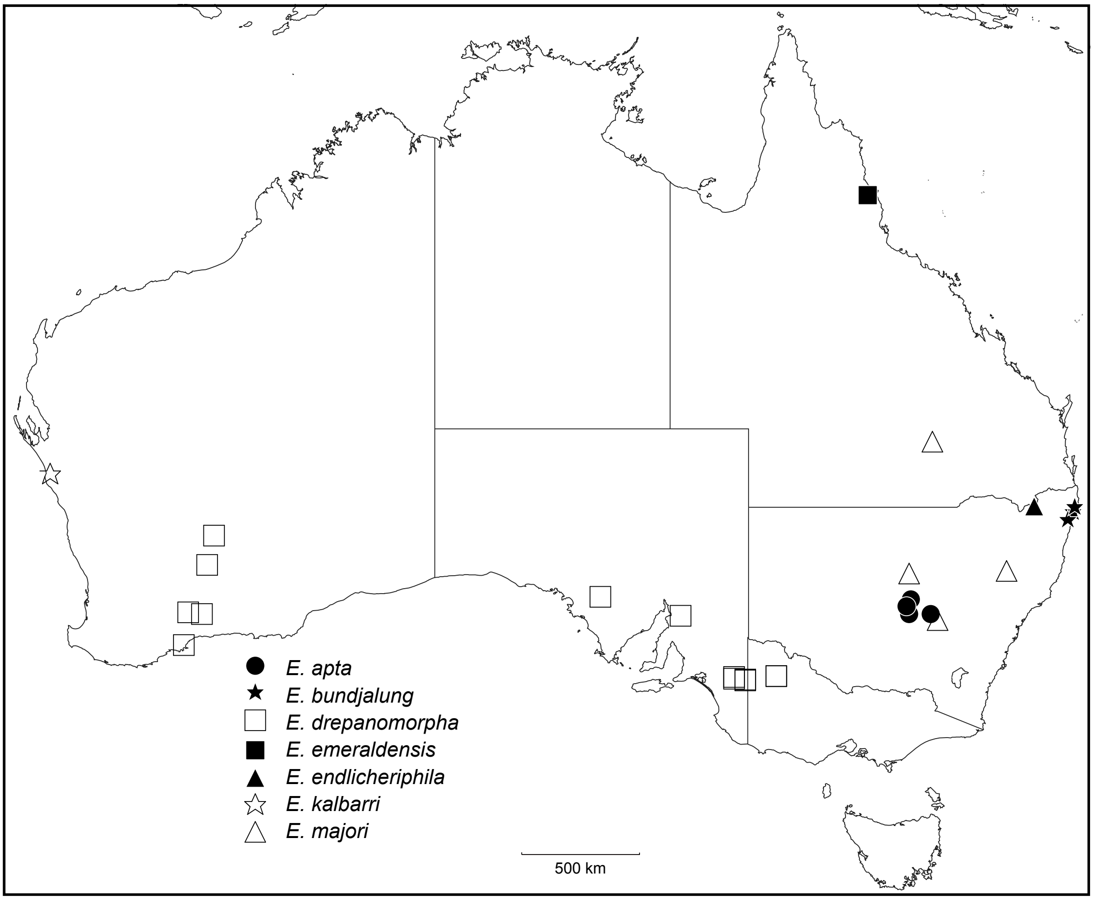


FIG. 52. Male genitalic morphology of *Erysivena drepanomorpha*. **A.** Pygophore, left lateral. Arrow indicates spinelike setae. **B.** Pygophore, ventral **C.** Aedeagus, left lateral. **D.** Aedeagus, ventral. Arrow indicates membrane joining PES and DES2 endosomal spicules. **E.** Aedeagus, right lateral. Arrow indicates same as in D. Scale bars = 30 μm.

orly, eyes large; labium extending to mesocoxae; cuneus short; tip of cuneus and forewing membrane veins red; pygophore with two serrate tergal processes positioned left lateral and far right lateral; far right lateral tergal process short with expanded basal lobe; left lateral tergal process subrectangular, apex squared but not curved downward; left paramere strongly expanded, subtriangular, sensory lobe prominent and swollen with short, light-brown setae, apophysis moderately elongate, apex hooked; right paramere "hammer" shaped, with expanded subapical dorsal lobe, apex elongate, broad and flattened; phallotheca opening small and lanceolate, with small point at apex; PES simple, unbranched with small threadlike medial process, distally serrate with bent apex; DES2 bifurcate in distal third; DES1 unbranched, curved downward distally, medially and distally serrate; female mIRL just over half height of laIRL, round and serrate distally; laIRL straight and uniform width, with large serrate basal lobe.

Description: *Male*: Small size, subovate, body length 2.84–3.08 mm, pronotal width 0.88–0.91 mm. COLORATION: Dorsum yel-



MAP 4. Distribution of *Erysivena* species.

lowish green, faded; cuneus tip red; forewing membrane light gray-brown with darker patches laterally and in major cell, veins red with color confined to veins, subcuneal clear spot large (fig. 14). VESTITURE: Dorsum with moderately dense distribution of pale light-brown simple setae. STRUCTURE: **Head:** Weakly expanded anteriorly; eyes large, extending well beyond anterolateral angle of pronotum; clypeus round in dorsal view; antennae with AI subequal to vertex width, AII 1.2× pronotal width; labium medium length, extending to mesocoxae. **Hemelytra:** Cuneus and wing membrane short, major cell of membrane short, major membrane vein straight, parallel to inner cuneal margin (fig. 14). GENITALIA: **Pygophore:** Dorsal margin of genital opening strongly concave, asymmetrically; two sclerotized tergal processes, positioned left and far right lateral of midline; left tergal process subrectangular, uniform width, apex squared and not curved downward, distally serrate; far right tergal process linear, with expanded lobed base, distally serrate; ventral margin of genital opening slightly convex medially; phalloguide sclerotized and round ventrad to right paramere articulation, serrations on lateral margin (fig. 50A). **Left paramere:** Strongly expanded medially, subtriangular; sensory lobe prominent, expanded, swollen with margins slightly indented; sensory lobe with light-brown, bristlelike setae; apophysis moderately elongate,

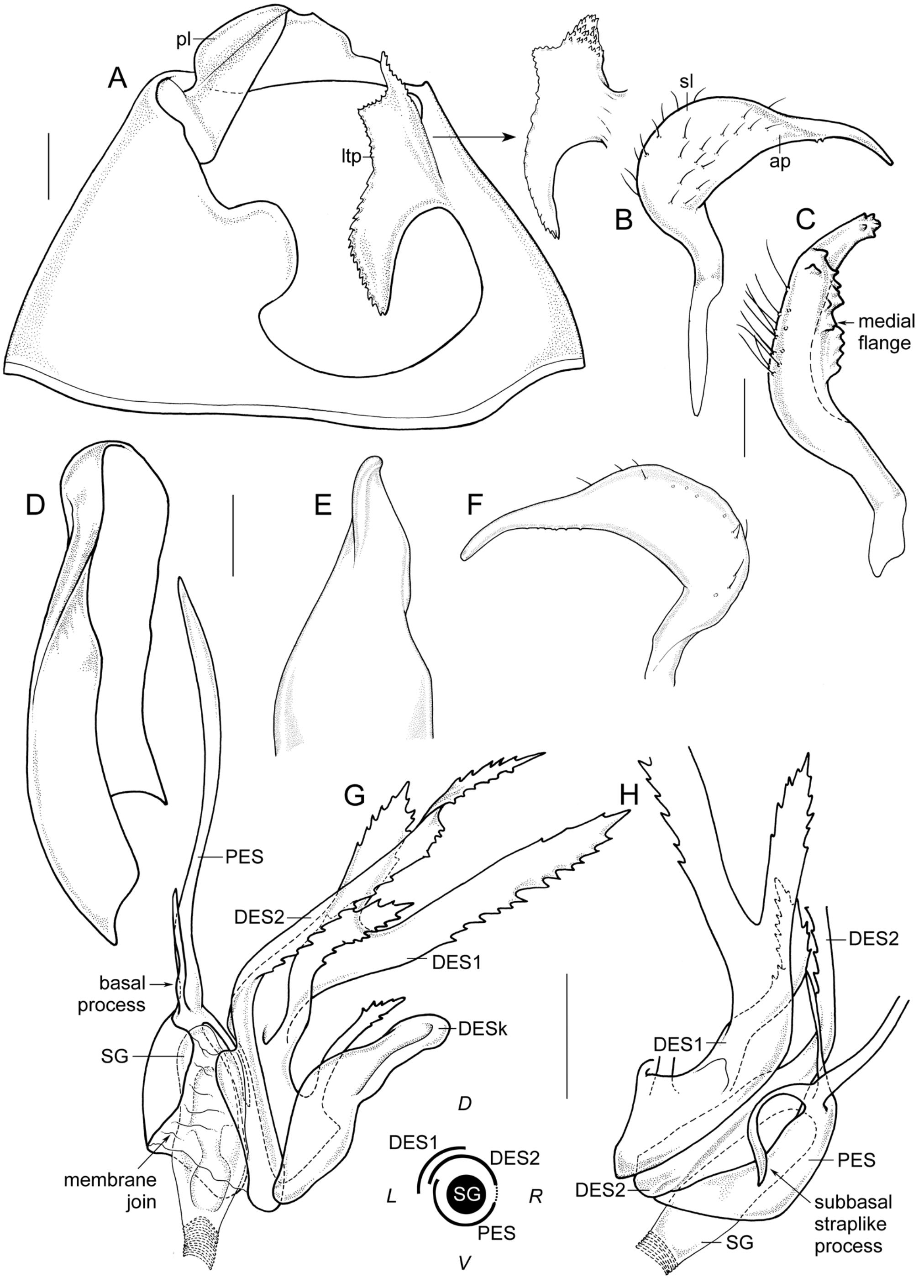


FIG. 53. Male genitalia of *Erysivena drepanomorpha.* **A.** Pygophore, dorsal, detail of left tergal process, lateral. **B.** Left paramere, ventral. **C.** Right paramere, dorsal. **D.** Phallotheca, right lateral. **E.** Phallotheca, ventral. **F.** Left paramere, dorsal. **G.** Aedeagus, right lateral. **H.** Aedeagus, left lateral. Scale bars = 0.1 mm.

inner margin smooth; apex hooked (fig. 50B). **Right paramere:** Hammer shaped; medial flange on inner lateral margin, reduced, directed ventrally; subapical dorsal margin with expanded lobe; apex expanded, strongly curved, with flattened distal edge; toothlike spines present on subapical lobe and in two rows on inner and outer margin along apex; light-brown, short, bristlelike setae on apex (fig. 50C). **Phallotheca:** Dorsal opening small and lanceolate; closed medially; round distally, with small point off center at apex; basal margin of opening V-shaped; small subapical tumescence on ventral surface (fig. 50D). **Aedeagus:** Spicule arrangement (fig. 50): PES ventral to and partially sheathing secondary gonopore, DES2 left dorsolateral to secondary gonopore, DES1 left lateral to DES2; base of spicules originating adjacent secondary gonopore; PES simple with short medial threadlike process projected perpendicular to spicule, apex serrate, diamond shaped and strongly bent; DES2 bifurcate in distal third, branches equal length and narrow, distal margins serrate, left branch curved downward toward base, right branch straight, with row of toothlike serrations submedially just below bifurcation point; DES1 simple, medially expanded and serrate along inner margin, distally curved downward and acuminate, distal margins serrate, basal keel (DESk) elongate (fig. 50E, F).

Female: Slightly larger than male, body length 3.08–3.36 mm, pronotal width 0.89–1.02 mm. GENITALIA: IRS posterior margin convex. Interramal lobes (fig. 74): mIRL entirely separated from laIRL; laIRL straight, linear, uniform width, base with large spiniferous lobe; mIRL just over half height of laIRL, subrectangular, uniformly broad, distally round and serrate.

ETYMOLOGY: Named after the type locality, Bundjalung National Park, on the northeast coast of New South Wales, and in honor of the traditional custodians of that land, the Bundjalung people.

HOST PLANT: From *Callitris columellaris* (table 2). This host plant (sensu Hill, 1998) is restricted to coastal sands around northeastern New South Wales and southeastern Queensland.

HOLOTYPE: **AUSTRALIA: New South Wales:** Bundjalung National Park, 10 km from Pacific Hwy on road to Black Rocks, 29.17617°S 153.39075°E, 7 m, 18 Jan 2005, C. Symonds, N. Tatarnic, *Callitris columellaris*, det. Field ID, 1♂ (AMNH_PBI 00005447) (AM).

PARATYPES: **AUSTRALIA: New South Wales:** Bundjalung National Park, 10 km from Pacific Hwy on road to Black Rocks, 29.17617°S 153.39075°E, 7 m, 18 Jan 2005, C. Symonds, N. Tatarnic, *Callitris columellaris*, det. Field ID, 3♂ (AMNH_PBI 00005445, 00005446, 00005448), 2♀ (AMNH_PBI 00005449, 00005450) (AM). Pacific Hwy, 3 km NE of Maclean, 29.45068°S 153.2206°E, 18 Jan 2005, C. Symonds, N. Tatarnic, *Callitris columellaris*, det. Field ID, 1♂ (AMNH_PBI 00005457), 4♀ (AMNH_PBI 00005458–00005461) (AM). Wardell, 16 km S of Ballina on Pacific Hwy, 28.95005°S 153.4658°E, 7 m, 18 Jan 2005, C. Symonds, N. Tatarnic, *Callitris columellaris*, det. Field ID, 7♂ (AMNH_PBI 00005462–00005466, 00005468, 00005469), 5♀ (AMNH_PBI 00005470–00005474) (AM), 1♂ (AMNH_PBI 00005467), 1♀ (AMNH_PBI 00005475) (UNSW).

OTHER SPECIMENS EXAMINED: **AUSTRALIA: New South Wales:** Bundjalung National Park, 10 km from Pacific Hwy on road to Black Rocks, 29.17617°S 153.39075°E, 7 m, 18 Jan 2005, C. Symonds, N. Tatarnic, *Callitris columellaris*, det. Field ID, 5 juv. (AMNH_PBI 00005440–00005444) (AM). Pacific Hwy, 3 km NE of Maclean, 29.45068°S 153.2206°E, 18 Jan 2005, C. Symonds, N. Tatarnic, *Callitris columellaris*, det. Field ID, 6 juv. (AMNH_PBI 00005451–00005456) (AM).

DISTRIBUTION: Known from three closely associated localities in coastal northeastern New South Wales, from Maclean to just south of Ballina (map 4). This species occurs sympatrically with *E. ballina*, at two of these sites (table 2).

REMARKS: *Erysivena bundjalung* is most closely related to *E. majori, E. mareeba*, and *E. molloy*. This species is differentiated from *E. majori* and *E. mareeba* by the morphology of the endosomal spicules, with the apex of PES bent and marginally serrate, and DES2 distally bifurcate (fig. 50E, F). *Erysivena bundjalung*, *E. mareeba*, and *E. molloy* are similar in size and shape, and all three species are smaller and more subovate than *E. majori* (fig. 14).

Erysivena drepanomorpha, new species

Figures 14, 51–53, 74, map 4

Diagnosis: Defined by the following characters: medium size; head strongly expanded anteriorly; eyes medium size; labium extending to metacoxae; forewing membrane veins red, cuneus tip with only slight hint of red; pygophore with one left lateral tergal process, sickle shaped with angular margins; pygophore with right lateral tergal lobe; left paramere directed anteriorly across outer ventral surface of pygophore at rest; left paramere moderately expanded, with round and broad sensory lobe, elongate apophysis, unhooked apex; right paramere C-shaped, medial flange on dorsal margin weakly expanded, broad and serrate, weakly curved distally, smooth subdistal shaft before serrate apex; phallotheca compressed slightly to right of midline at apex; aedeagus with complex PES and DES1; PES strongly constricted above base, with short, straplike basal process; DES2 unbranched; DES1 not expanded basally, with two basal processes attached parallel, bifurcate medially with branches unequal in length; female laIRL slightly broader distally, curved inward, without spiniferous basal lobe; mIRL half height of laIRL, subrectangular.

Description: *Male*: Midsized, elongate ovoid, body length 3.38–3.83 mm, pronotal width 0.97–1.05 mm. COLORATION: Dorsum yellowish green, faded; cuneus tip with very slight hint of red; forewing membrane light gray-brown with darker patches laterally and in major cell, membrane veins red with color confined to veins (fig. 14). VESTITURE: Dorsum with moderately dense distribution of pale simple setae. STRUCTURE: **Head:** Strongly expanded anteriorly (fig. 51A, B); eyes midsize, extending slightly beyond anterolateral angle of pronotum (fig. 51A, C); antennae with AI 0.9× vertex width, AII 1.1× pronotal width; labium medium length, extending to metacoxae. **Hemelytra:** Cuneus and major cell of membrane moderately elongate, major membrane vein straight (fig. 14). GENITALIA: **Pygophore:** Dorsal margin of genital opening strongly concave (fig. 51H); one left lateral tergal process, sickle shaped, with posterior portion tumescent and serrate (figs. 51H, 52A, 53A); far right lateral tergal lobe present, smooth margins and round to subquadrate in shape (figs. 51H, 53A); ventral margin of genital opening straight with V-shaped incision medially; round cup-shaped phalloguide situated inside and protruding over ventral margin, slightly sclerotized ventrad to right paramere articulation (figs. 52B, 53A); left paramere directed anteriorly across outer ventral surface of pygophore at rest (fig. 52B). **Left paramere:** moderately expanded medially; sensory lobe broad, round; apophysis greatly elongate, inner margin with several small spines; apex curved inward slightly, not hooked (figs. 52B, 53B, D). **Right paramere:** C-shaped, medial flange on dorsal margin, broad weakly expanded edge; apex weakly curved; medial flange and apex serrate, separated by smooth subapical shaft; outer lateral surface with simple setae (figs. 51H, 52B, 53C). **Phallotheca:** dorsal opening large (fig. 53E), round distally (figs. 53E, 52B); compressed at apex, slightly to right side of ventral midline (figs. 51H, 52B, 53F); right dorsal margin without lobe (fig. 53). **Aedeagus:** Spicule arrangement (fig. 53): PES left ventrolateral and almost entirely wrapped sheathlike around secondary gonopore (fig. 52D, E), DES2 dorsal to secondary gonopore and PES (fig. 52E), DES1 left dorsolateral to DES2 (fig. 52E), PES and DES2 joined by membrane sheath on right side of secondary gonopore (figs. 52E, 53G), base of all spicules originating proximal to base of secondary gonopore; PES complex, acutely constricted above base (fig. 53G), with short subbasal straplike process and basal process on broad section of base before bifurcation point, both processes subequal length (figs. 52C, 53H); DES2

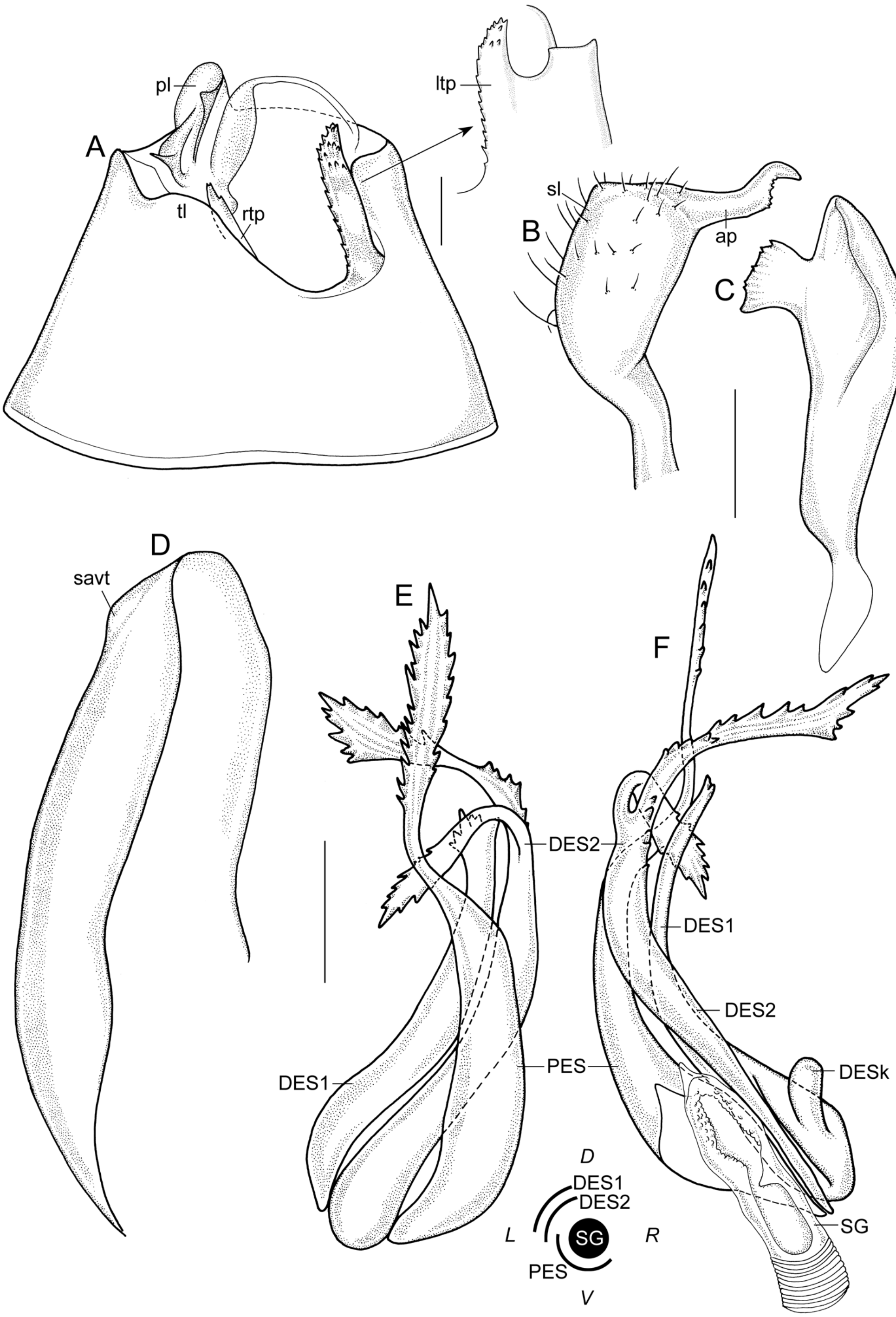


FIG. 54. Male genitalia of *Erysivena emeraldensis.* **A.** Pygophore, dorsal with left lateral detail. **B.** Left paramere, ventral. **C.** Right paramere, ventral. **D.** Phallotheca, right lateral. **E.** Aedeagus, left lateral. **F.** Aedeagus, right lateral. Scale bars = 0.1 mm.

unbranched, twisted distally, medial threadlike process absent (figs. 52E, 53G); DES1 complex, base not expanded, basal processes attached parallel (one behind other), unequal lengths, bifurcate medially with branches differing in length, basal keel (DESk) elongate (figs. 52C, E, 53G).

Female: Subequal size to male, body length 3.38–3.66 mm, pronotal with 0.98–1.08 mm. GENITALIA: IRS posterior margin medially convex. Interramal lobes (fig. 74): mIRL entirely separated from laIRL; laIRL curved inward and slightly broader distally, base spiniferous but without lobe; mIRL half height of laIRL, subrectangular, distally round and serrate.

Etymology: Species name derived from a combination of the Greek words *drepanon* ("sickle") and *morphē* ("shape") after the distinctive left tergal process on the dorsal margin of the genital opening of the pygophore.

Host plants: Known from five identified *Callitris* species: *C. canescens, C. drummondii* and *C. tuberculata* in Western Australia, *C. verrucosa* and *C. gracilis* in Victoria and South Australia (table 2). *Callitris verrucosa*, *C. tuberculata*, *and C. gracilis* are closely related species. Specimens collected near Varley in Western Australia were labelled ex. *Callitris preissii*. The Western Australia Herbarium has confirmed that this plant voucher is *Callitris tuberculata* (Sue Carroll, personal commun.; note that these two latter species are sometimes considered synonyms).

Holotype: **AUSTRALIA: Western Australia:** 1 km S of Lillian Stoke Rock, 33.07681°S 120.0982°E, 380 m, 21 Nov 1999, R.T. Schuh, G. Cassis, and R. Silveira, *Callitris tuberculata*, det. WA Herbarium PERTH 05670799, 1♂ (AMNH_PBI 00016373) (WAMP).

Paratypes: **AUSTRALIA: South Australia:** 15 km S of Bews, 35.48474°S 140.4332°E, 130 m, 08 Nov 1998, Schuh, Cassis, Silveira, *Callitris verrucosa*, det. RBG Sydney NSW427485, 1♂ (AMNH_PBI 00016369) (AM). 18 km S of Bews, Ngarkat Cons. Park, 35.55197°S 140.4332°E, 60 m, 09 Nov 1998, Schuh, Cassis, Silveira, *Callitris verrucosa*, det. RBG Sydney NSW427485, 1♀ (AMNH_PBI 00016370) (AM). Scorpion Springs Cons. Park, 35.60421°S 140.8646°E, 125 m, 10 Nov 1998, Schuh, Cassis, Silveira, *Callitris verrucosa*, det. RBG Sydney NSW427497, 1♂ (AMNH_PBI 00016351), 4♀ (AMNH_PBI 00016355–00016358) (AM), 2♂ (AMNH_PBI 00000187, 00000194), 2♀ (AMNH_PBI 00000192, 00000193) (AMNH), 3♀ (AMNH_PBI 00000191, 00000196, 00000198), 3♂ (AMNH_PBI 00016352–00016354) (SAMA). Scorpion Springs Cons. Park, 35.62872°S 140.8598°E, 100 m, 09 Nov 1998, Schuh, Cassis, Silveira, *Callitris verrucosa*, det. RBG Sydney NSW427497, 4♂ (AMNH_PBI 00016359–00016362), 2♀ (AMNH_PBI 00016363, 00016364) (AM), 4♀ (AMNH_PBI 00016365–00016368) (SAMA). **Victoria:** Wyperfeld National Park, Moonah Track, 35.45218°S 142.066°E, 78 m, 05 Nov 2002, Cassis, Schuh, Schwartz, Silveira, *Callitris verrucosa*, det. RBG Sydney NSW658107, 1♂ (AMNH_PBI 00005285), 5♀ (AMNH_PBI 00005287–00005291) (AM). Wyperfeld National Park, Moonah Track, 35.46302°S 142.0464°E, 65 m, 04 Nov 2002, Cassis, Schuh, Schwartz, Silveira, *Callitris gracilis*, det. RBG Sydney NSW658101, 2♂ (AMNH_PBI 00003953, 00003954) (AMNH). **Western Australia:** 1 km S of Lillian Stoke Rock, 33.07681°S 120.0982°E, 380 m, 21 Nov 1999, R.T. Schuh, G. Cassis, and R. Silveira, *Callitris tuberculata*, det. WA Herbarium PERTH 05670799, 2♂ (AMNH_PBI 00016371, 00016372), 10♀ (AMNH_PBI 00016377–00016386) (AM), 2♂ (AMNH_PBI 00016374, 00016375), 5♀ (AMNH_PBI 00016387–00016390, 00016394) (WAMP). 27.8 km S of Varley, 33.00504°S 119.5856°E, 500 m, 05 Dec 1997, Schuh, Cassis, Brailovsky, Asquith, *Callitris preissii*, det. WA Herbarium PERTH 05055520, 3♂ (AMNH_PBI 00016343-AMNH_PBI 00016345), 3♀ (AMNH_PBI 00016348–00016350) (AM), 3♂ (AMNH_PBI 00000095, 00000099, 00000103), 4♀ (AMNH_PBI 00000096, 00000100, 00000102, 00000109) (AMNH), 3♂ (AMNH_PBI 00016346, 00000097, 00000098), 5♀ (AMNH_PBI 00016347, 00000101, 00000105, 00000107, 00000108)

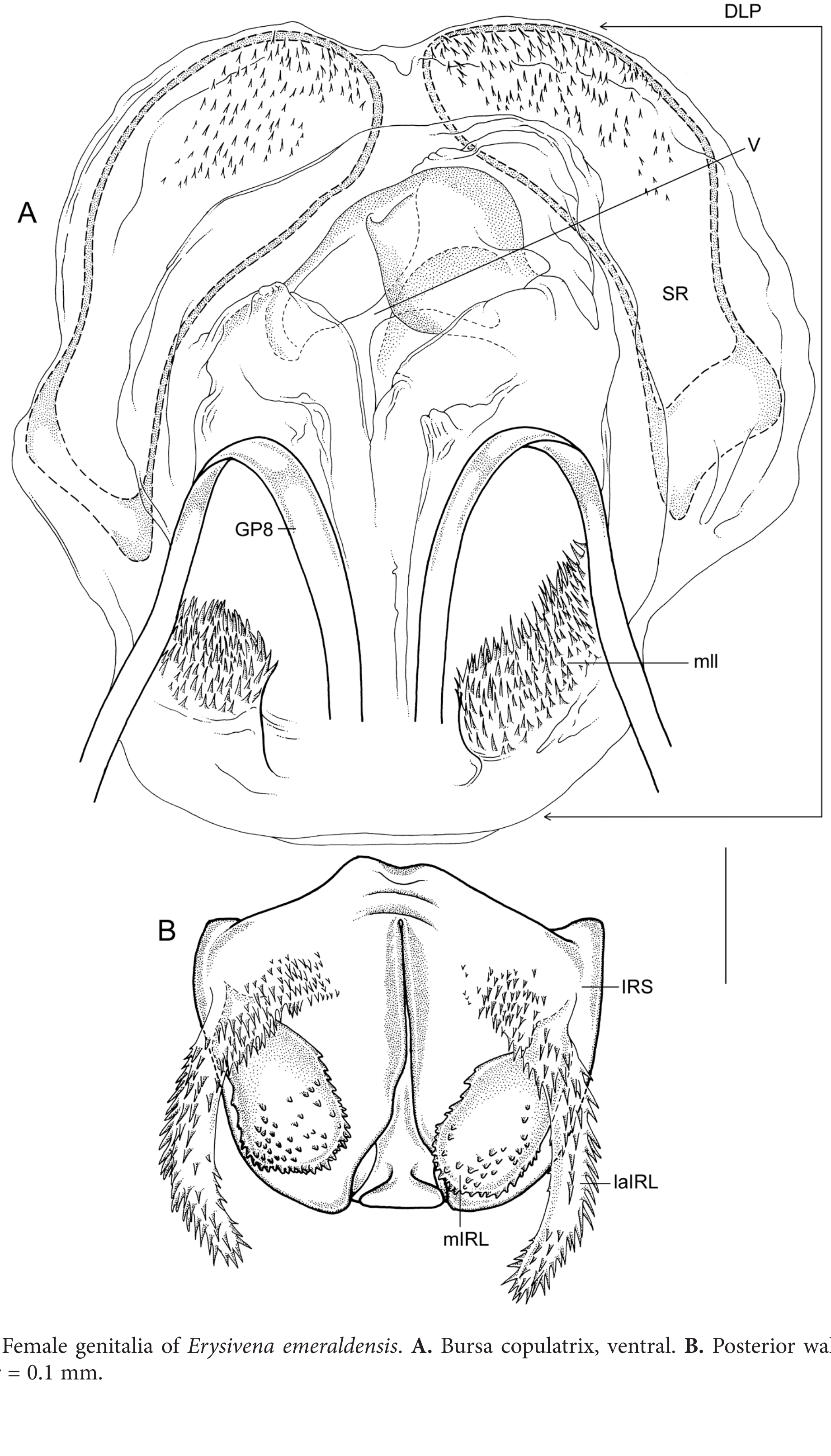


FIG. 55. Female genitalia of *Erysivena emeraldensis*. **A.** Bursa copulatrix, ventral. **B.** Posterior wall, dorsal. Scale bar = 0.1 mm.

(WAMP). 92.5 km W of Coolgardie at east side of Boorabbin National Park on Great Eastern Hwy, 31.21233°S 120.31°E, 445 m, 17 Nov 1999, R.T. Schuh, G. Cassis, and R. Silveira, *Callitris tuberculata*, det. WA Herbarium PERTH 05672058, 3♂ (AMNH_PBI 00016395–00016397), 2♀ (AMNH_PBI 00016398, 00016399) (AM).

Other specimens examined: **AUSTRALIA: South Australia:** 27 km toward Kimba from Lincoln Hwy, 33.15792°S 138.4123°E, 100 m, 21 Oct 1996, Schuh and Cassis, *Callitris* sp., 2♂ (AMNH_PBI 00016552, AMNH_PBI 00016553), 1 juv. (AMNH_PBI 00016554) (AM). Gawler Ranges National Park: ca. 13 km S of Pine Well, 32.43294°S 135.32338°E, 200 m, 16 Nov 2012, M. Cheng, G.S. Taylor & D. McLaughlin, *Callitris gracilis*, det. SA Herbarium BS838–922, 1♀ (AMNH_PBI 00400958) (UNSW). Scorpion Springs Cons. Park, 35.60421°S 140.8646°E, 125 m, 10 Nov 1998, Schuh, Cassis, Silveira, *Callitris verrucosa*, det. RBG Sydney NSW427497, 1♂ (AMNH_PBI 00000188) (AMNH). **Victoria:** Wyperfeld National Park, Moonah Track, 35.45218°S 142.066°E, 78 m, 05 Nov 2002, Cassis, Schuh, Schwartz, Silveira, *Callitris verrucosa*, det. RBG Sydney NSW658107, 1 juv. (AMNH_PBI 00005286) (AM). **Western Australia:** 1 km S of Lillian Stoke Rock, 33.07681°S 120.0982°E, 380 m, 21 Nov 1999, R.T. Schuh, G. Cassis, and R. Silveira, *Callitris tuberculata*, det. WA Herbarium PERTH 05670799, 1♀ (AMNH_PBI 00016391), 2 juv. (AMNH_PBI 00016392, AMNH_PBI 00016393) (AM). Credo Station, 4.8 km along Telstra track off Coolgardie Nth Rd, 30.07069°S 120.57025°E, 503 m, 08 Sep 2011, M. Cheng & C. Symonds, *Callitris canescens*, det. WA Herbarium, 3♂ (AMNH_PBI 00400977, UNSW_ENT 00027088, UNSW_ENT 00027089), 1♀ (UNSW_ENT 00027093) (UNSW), 3♂ (UNSW_ENT 00027090–UNSW_ENT 00027092) (WAMP). Quaalup Homestead, 34.27038°S 119.40955°E, 22 m, 07 Aug 2005, G. Cassis, *Callitris drummondii*, det. WA Herbarium PERTH 07619995, 1♂ (AMNH_PBI 00005292), 2♀ (AMNH_PBI 00005293, AMNH_PBI 00005294) (AM).

Distribution: Known from 13 localities across southern Australia in semiarid sandplain shrubland and woodland. The western populations extend from the Goldfields region to the south coast of Western Australia and eastern populations extend from western Victoria to Adelaide and the Eyre Peninsula regions (map 4). Collected with seven other callitroid-inhabiting Orthotylini across its range (table 2), including four *Callitricola* species and two other *Erysivena* species.

Remarks: Although *Erysivena drepanomorpha* is disjunctly distributed on either side of the Nullarbor Plain, we consider all materials examined as conspecific. There are only minor differences in the male genitalia, for example, DES1 of western populations has the longer half of the bifurcation with a spine medially, proximal to the serrate distal portion (absent in the eastern populations) and the inner margin of this longer half is sometimes more serrate (cf. to the eastern populations that have minor serrations near the apex with the proximal region smooth).

Erysivena drepanomorpha is most closely related to *E. notodytika*, recognized by the complex bifurcate DES1, with basal processes (cf. figs. 53G and 67E), and the apically compressed phallotheca (cf. figs. 53E–F and 67D). Externally *E. drepanomorpha* is slightly smaller and more subovate than *E. notodytika*. The membrane sheath connecting PES and DES2 on the right side of the secondary gonopore (figs. 52E, 53G) is also found in the related species *E. notodytika*, *E. kalbarri*, and *E. apta*.

Erysivena drepanomorpha and *E. schuhi*, which cooccur in South Australia, are the only species in the genus where the left paramere rests over the ventral margin of pygophore (vs. typical position on inside of margin). The males of these two species can be differentiated by the different shapes of the tergal processes of the pygophore and the right paramere, with the latter larger and curved distally in *E. schuhi* (fig.

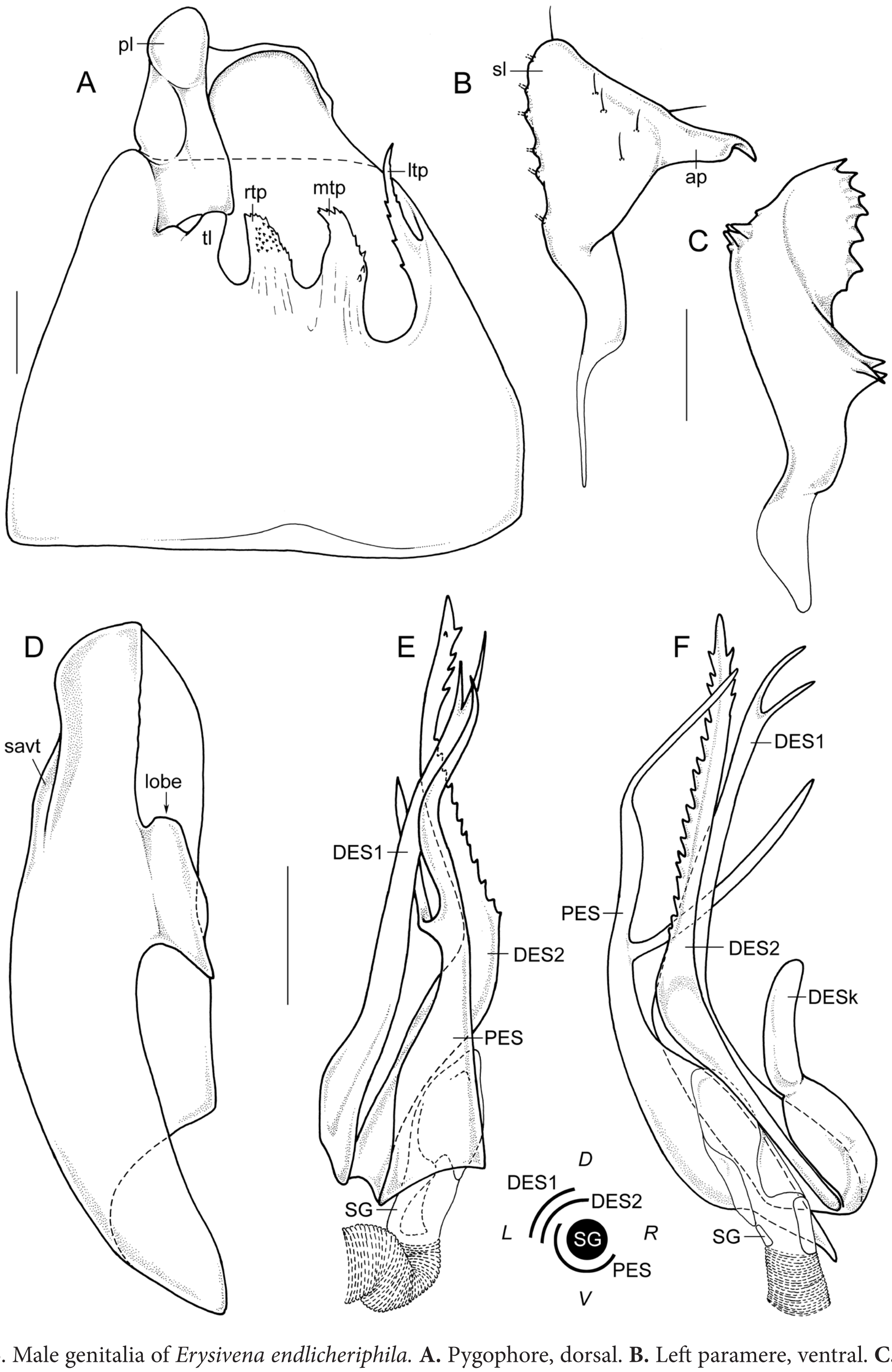


FIG. 56. Male genitalia of *Erysivena endlicheriphila.* **A.** Pygophore, dorsal. **B.** Left paramere, ventral. **C.** Right paramere, dorsal. **D.** Phallotheca, right lateral. **E.** Aedeagus, ventral. **F.** Aedeagus, dorsal. Scale bars = 0.1 mm.

69C). *Erysivena drepanomorpha* is also distinguished from *E. schuhi* by the uniformly green cuneus without or with only a hint of a red tip (cf. fig. 14), which is true in both sexes. *Erysivena drepanomorpha* also cooccurs with *E. schwartzi*, and differs from it by the lack of a prominent red cuneal tip (cf. red tip in *E. schwartzi*, fig. 14) and its males possess a reflexed left paramere (fig. 52B) and large sickle-shaped left tergal process of the pygophore (fig. 53A) (cf. *E. schwartzi* with left paramere more subtriangular [fig. 70B] and situated inside ventral margin of pygophore, and digitiform left tergal process, as well as the presence of a linear and narrow right tergal lobe [fig. 70A]).

Erysivena emeraldensis, new species

Figures 6C, 14, 54, 55; map 4

Diagnosis: Defined by the following characters: medium size; head strongly expanded anteriorly; eyes large; labium extending to metacoxae; tip and inner half of cuneus red, forewing membrane veins red; pygophore with two tergal processes, and broad far right lateral tergal lobe; elongate right lateral lobe or process on phalloguide with two spines on margin; left lateral tergal process linear, elongate, margins serrate; right tergal process, short, arising under tergal lobe; left paramere moderately expanded, sensory lobe broad and angular, apophysis moderately elongate, hooked apex; right paramere C-shaped, medial flange more subapical on inner dorsal margin, subquadrate with slightly serrate margin, apex very weakly curved with smooth margins; aedeagus with PES simple, unbranched, distally sparsely serrate; DES2 bifurcate, not expanded medially; DES1 simple, short, distally serrate only; female laIRL uniform width without spiniferous basal lobe; mIRL two-thirds height of laIRL, subrectangular.

Description: *Male*: Midsized, body length 3.65–3.76, pronotal with 0.89–0.96 mm. COLORATION: Dorsum yellowish green; cuneus tip and inner half dark red, remainder pale green-yellow; forewing membrane dark gray-brown with slightly darker patches laterally and in major cell, membrane veins red with color confined to veins (fig. 14). VESTITURE: Dorsum with moderately dense distribution of light-brown simple setae. STRUCTURE: **Head:** Strongly expanded anteriorly; eyes large, extending well beyond anterolateral angle of pronotum; antennae with AI 1.3× vertex width, AII 1.4× pronotal width; labium medium length, extending to metacoxae. **Hemelytra:** Cuneus and major cell of membrane elongate, major membrane vein straight, parallel to cuneus (fig. 14). GENITALIA: **Pygophore:** Dorsal margin strongly concave, asymmetrically; two sclerotized tergal processes, positioned left lateral and right lateral; left tergal process, linear, elongate, margins and apex serrate, apex not expanded; right tergal process, short, narrowing apically, apex pointed with few small serrations, base concealed behind tergal lobe; far right lateral tergal lobe present, broad; ventral margin of genital opening sinuous, slightly concave on left side; phalloguide with elongate process on right side ventrad to right paramere articulation, lobe flattened and curved, with two spines, one on dorsal margin and one on right lateral margin (fig. 54A). **Left paramere:** Moderately expanded medially; sensory lobe broad, outer margin angular; apophysis moderately elongate, inner margin serrate subapically; apex hooked (fig. 54B). **Right paramere:** C-shaped; medial flange on inner dorsal margin directed inward, in more subapical position, expanded and subquadrate in shape; apex short and very weakly curved; medial flange with lightly serrate margin, apex smooth; setae absent (fig. 54C). **Phallotheca:** Dorsal opening large, distal to medial; round distally; not compressed; slight subapical tumescence on ventral surface; lobes on dorsal margin absent (fig. 54D). **Aedeagus:** Spicule arrangement (fig. 54): PES left ventrolateral to and partially sheathing secondary gonopore, DES2 dorsal to secondary gonopore and PES, DES1 left lateral to DES2, base of PES originating slightly distad to base of secondary gonopore, DES2 and DES1 originating proximal to base of secondary gonopore (fig. 54F);

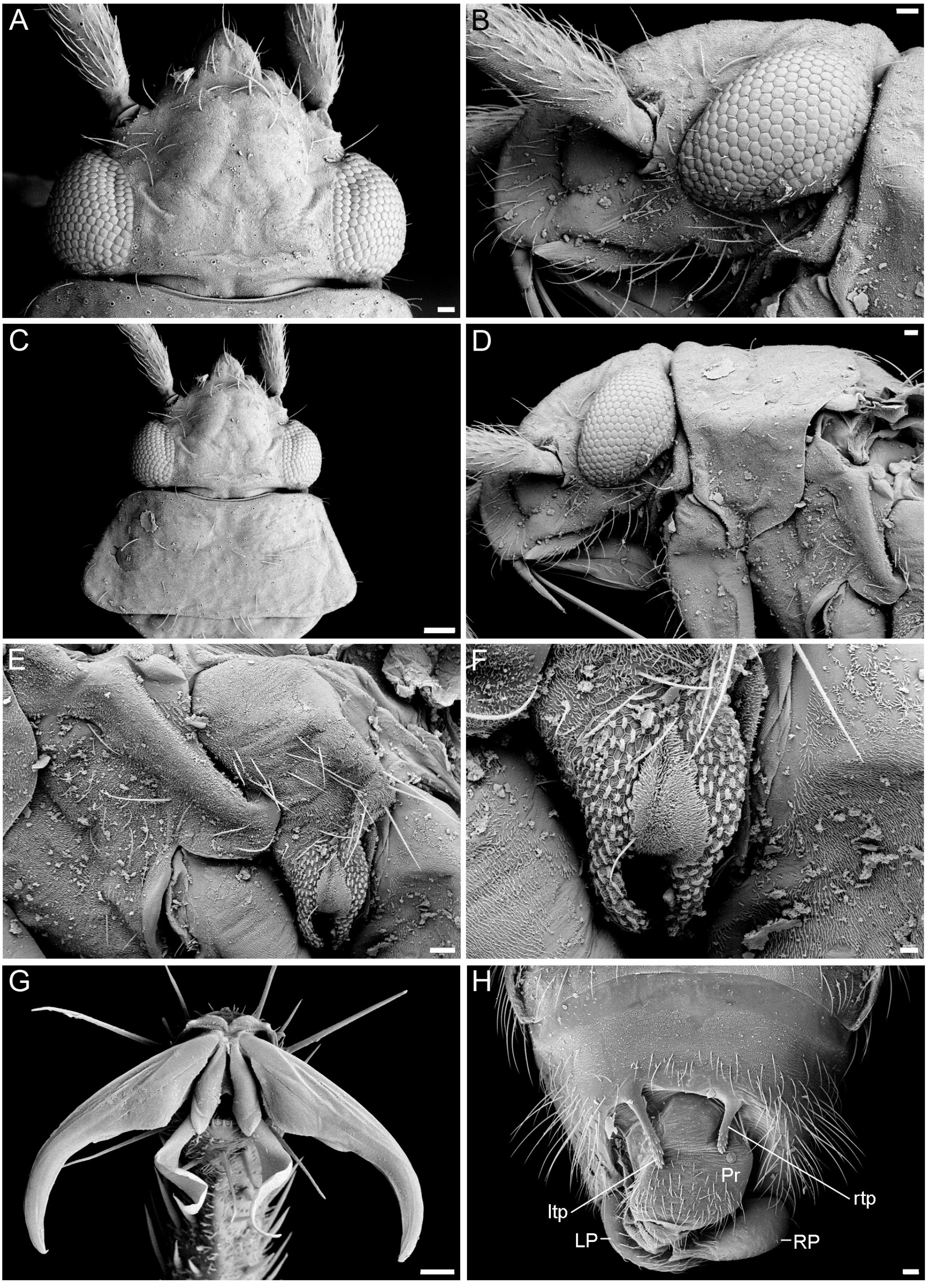


FIG. 57. Scanning electron micrograph images of *Erysivena kalbarri*, male. **A.** Head, dorsal, scale bar = 30 µm. **B.** Head, lateral, scale bar = 30 µm. **C.** Head and pronotum, dorsal, scale bar = 100 µm. **D.** Head and pronotum, lateral, scale bar = 30 µm. **E.** Meso- and metathorax, scale bar = 30 µm. **F.** Metathoracic scent gland, scale bar = 10 µm. **G.** Tarsal claw, scale bar = 10 µm. **H.** Pygophore, dorsal, scale bar = 30 µm.

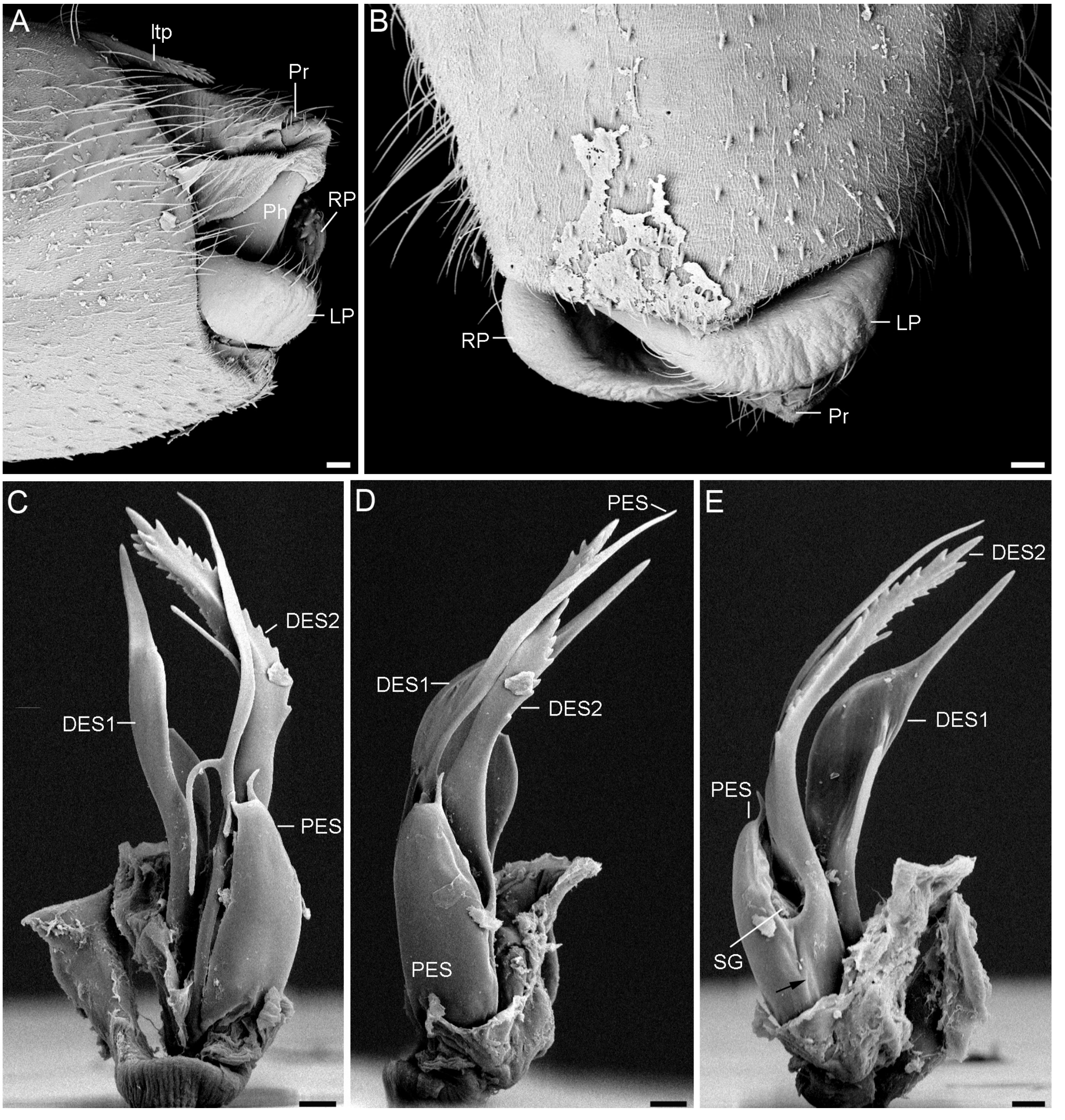


FIG. 58. Male genitalic morphology of *Erysivena kalbarri*. **A.** Pygophore, left lateral. **B.** Pygophore, ventral. **C.** Aedeagus, left lateral. **D.** Aedeagus, ventral. **E.** Aedeagus, right lateral. Arrow indicates membrane join between PES and DES2 endosomal spicules. Scale bars = 30 μm.

PES simple, unbranched, apex acuminate, sparsely serrate in distal third, medial process absent (fig. 54); DES2 bifurcate in distal third, branches subequal, left branch bent downward, distally serrate, medially serrate before bifurcation point on right margin (fig. 54F), not expanded medially; DES1 simple, unbranched, apex blunt and serrate, significantly shorter than first and second spicules, basal keel (DESk) moderately short (fig. 54E, F).

Female: Subequal in size to males, on average slightly smaller, body length 3.49–3.86 mm, pronotal width 0.95–1.06 mm. GENITALIA: IRS posterior margin medially convex (fig. 55B). Interramal lobes (fig. 55B): laIRL curved inward,

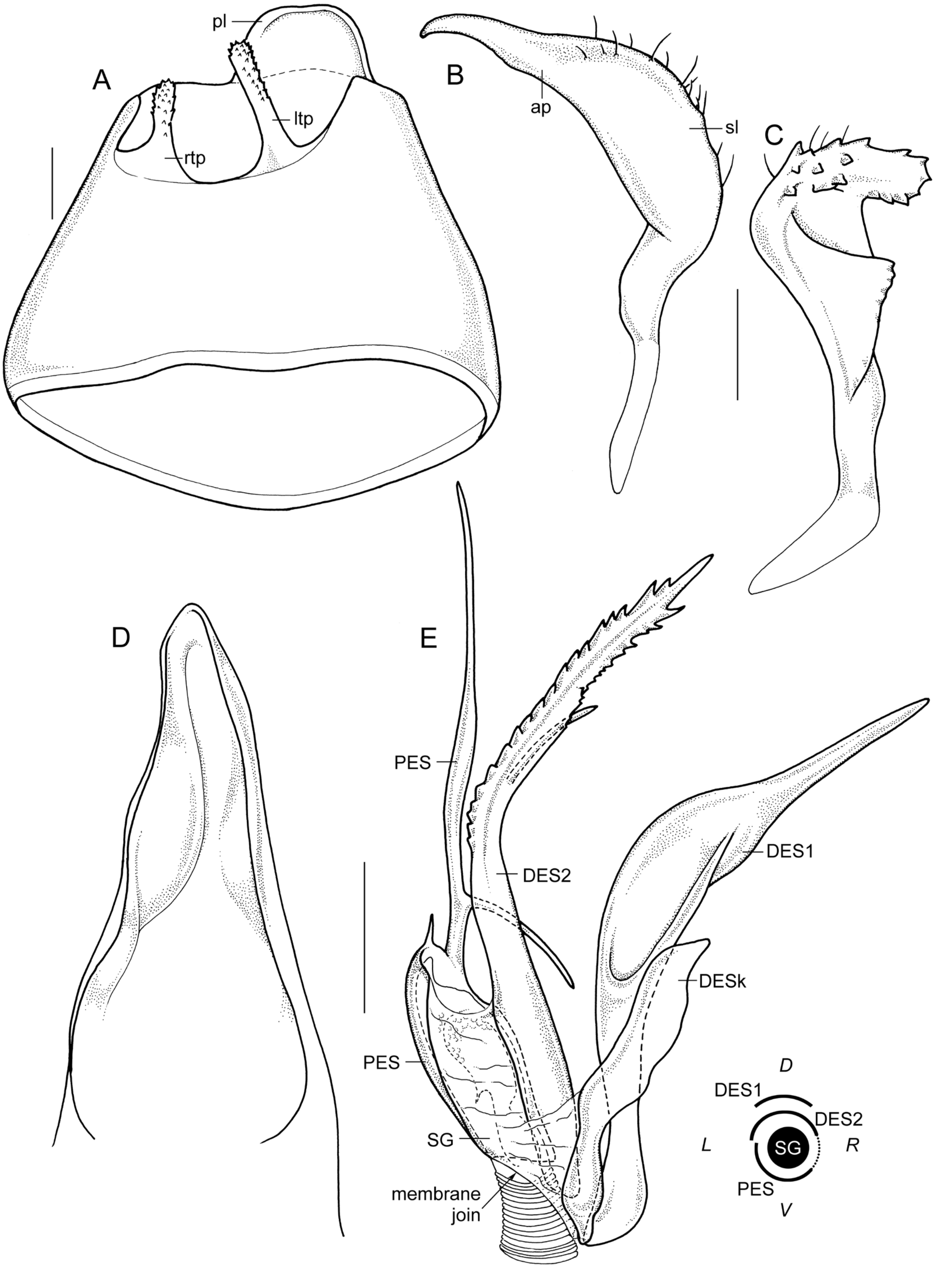


FIG. 59. Male genitalia of *Erysivena kalbarri.* **A.** Pygophore, dorsal. **B.** Left paramere, dorsal. **C.** Right paramere, dorsal. **D.** Phallotheca, dorsal. **E.** Aedeagus, right lateral. Scale bars = 0.1 mm.

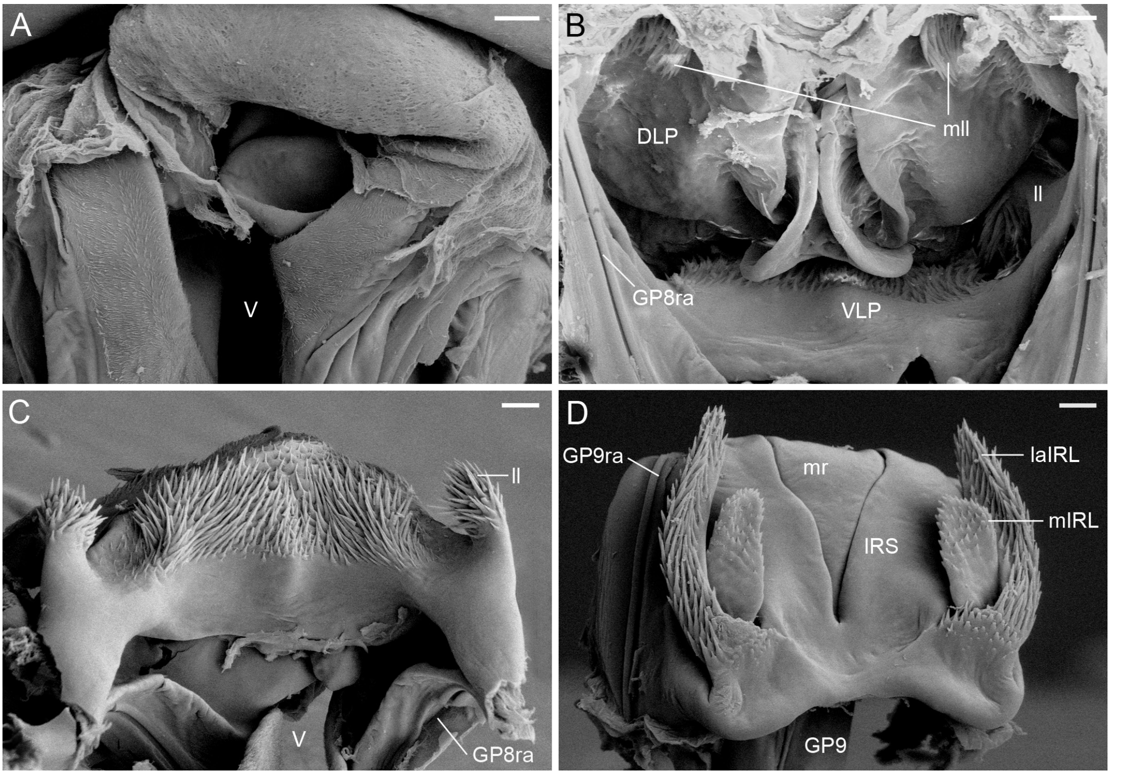


FIG. 60. Scanning electron micrograph images of female genitalic structures of *Erysivena kalbarri*. **A.** Asymmetrical sclerotized vestibulum, ventral. **B.** Genital chamber, posterior. **C.** Sclerotized, densely spinose ventral labiate plate with lateral lobes, dorsal. **D.** Posterior wall, dorsal. Scale bars = 30 µm.

uniform width, base spiniferous without lobe; mIRL two-thirds height of laIRL, subrectangular, distally round and serrate.

Etymology: Named after the type locality, Emerald Creek, on the Atherton Tablelands in northeastern Queensland.

Host plant: Known from a morphologically distinct population, with the phrase name *Callitris intratropica* "Emerald Creek" (fig. 6C). This *Callitris intratropica* population is known only from this locality, where it grows on the banks of a large creek, and may represent a new species (Paul Gadek, personal commun.) (Pye et al., 2003).

Holotype: **AUSTRALIA: Queensland:** Emerald Creek Falls State Forest, falls carpark, 17.05369°S 145.53947°E, 512 m, 31 May 2006, Cassis, Barrow, Finlay, and Symonds, *Callitris intratropica* (Emerald Creek), det. RBG Sydney (see Pye et al., 2003), 1♂ (AMNH_PBI 00005723) (QM).

Paratypes: **AUSTRALIA: Queensland:** Emerald Creek Falls State Forest, falls carpark, 17.05369°S 145.53947°E, 512 m, 31 May 2006, Cassis, Barrow, Finlay, and Symonds, *Callitris intratropica* (Emerald Creek), det. RBG Sydney (see Pye et al., 2003), 4♀ (AMNH_PBI 00005724–00005727) (AM), 2♀ (AMNH_PBI 00005728, 00005729) (QM). Emerald Creek at Emerald Creek Falls car park, 17.05286°S 145.5414°E, 488 m, 19 Apr 2005, C. Symonds, *Callitris intratropica* (Emerald Creek), det. Field ID (ref. Pye et al., 2003), 1♂ (AMNH_PBI 00016551) (AM).

Other specimens examined: **AUSTRALIA: Queensland:** Emerald Creek Falls State Forest, falls carpark, 17.05369°S 145.53947°E,

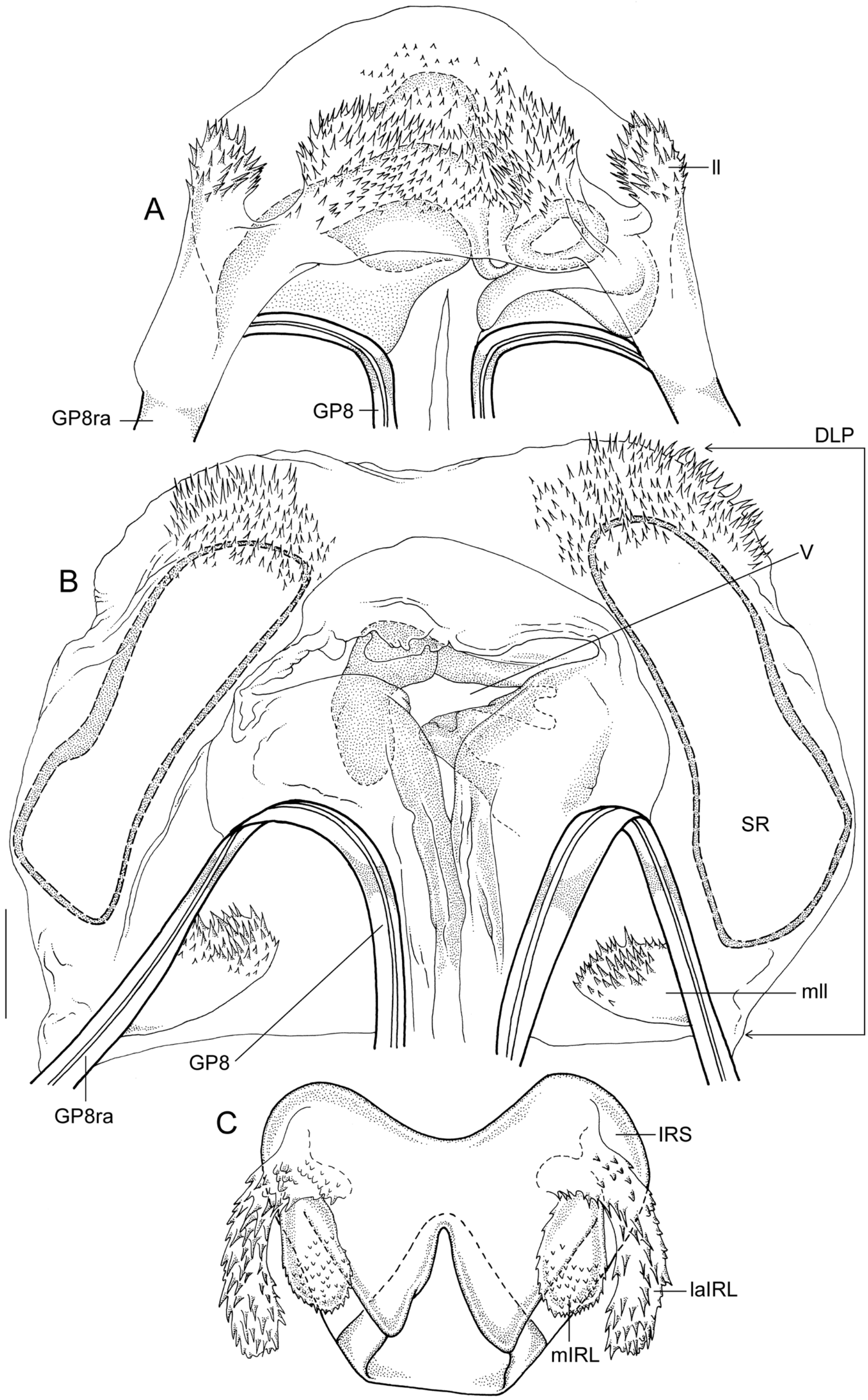


FIG. 61. Female genitalia of *Erysivena kalbarri*. **A.** Ventral labiate plate, dorsal. **B.** Bursa copulatrix, ventral. **C.** Posterior wall, dorsal. Scale bar = 0.1 mm.

512 m, 31 May 2006, Cassis, Barrow, Finlay, and Symonds, *Callitris intratropica* (Emerald Creek), det. RBG Sydney (see Pye et al., 2003), 4 juv. (AMNH_PBI 00005719–00005722) (AM), 2 juv. (AMNH_PBI 00005717, 00005718) (QM).

Distribution: From one locality only at Emerald Creek, on the western side of the Lamb Range, within Dinden National Park on the Atherton tablelands in northeasterm Queensland (map 4). This area has small rocky gorges surrounded by dry savannah forest and creeks.

Remarks: *Erysivena emeraldensis* is most closely related to *E. paluma* and is distinguished from it by two dorsal tergal processes on the pygophore (cf. figs. 54 and 68); the left lateral tergal process is downturned distally and linear in shape (cf. clubbed distally and projected outward); the left paramere is only moderately expanded medially, with an angular sensory lobe and hooked apex (cf. strongly expanded, with rounded sensory lobe and unhooked apex); the right paramere has a medial flange positioned more subapical and is quadrate in shape (cf. medial flange more medial and rounded in shape); right paramere apex is very short and barely curved; the phallotheca has a large (cf. small) dorsal opening; and DES2 is not expanded medially. See also *E. paluma* for further remarks.

***Erysivena endlicheriphila*, new species**

Figures 14, 56, 74; map 4

Diagnosis: Defined by the following: medium size; head strongly expanded anteriorly; eyes midsized; labium extending to mesocoxae; tip of cuneus and wing membrane veins red; pygophore with three tergal processes, far right lateral tergal lobe, elongate phalloguide; left tergal process longer than right processes; left paramere strongly expanded, subtriangular, sensory lobe prominent, apophysis moderately elongate, apex hooked; right paramere C-shaped, expanded medial flange in inner margin with spiniferous tip, apex expanded and flattened with scalloped, serrate margin; aedeagus with PES, simple, acuminate apically, with smooth margins and elongate medial process; DES2 unbranched, without subdistal threadlike process; DES1 unbranched, margins smooth, bifurcate at apex forming large fork, basal keel (DESk) elongate; female mIRL half height of laIRL, subquadrate, margin serrate; laIRL slightly curved inward at apex, uniform width, with spiniferous base and large spiniferous basal lobe.

Description: *Male*: Midsized, elongate, body length 3.76–4.03 mm, pronotal width 0.99–1.03 mm. COLORATION: Dorsum yellowish green, faded; cuneus tip red; forewing membrane uniform gray-brown, membrane veins red with color confined to vein (fig. 14). VESTITURE: Dorsum with moderately dense distribution of light-brown simple setae. STRUCTURE: **Head:** Strongly expanded anteriorly; eyes midsize, extending slightly beyond anterolateral angle of pronotum; antennae with AI 1.2× vertex width, AII 1.3× vertex width; labium medium length, extending to metacoxae. **Hemelytra:** Cuneus and major cell of membrane moderately elongate, major membrane vein straight (fig. 14). GENITALIA: **Pygophore:** Dorsal margin of genital opening strongly concave, asymmetrically; three sclerotized, linear tergal processes, positioned left lateral, right lateral, and right medial; left tergal process longer than two right processes; left tergal process slightly curved downward, apex acuminate with smooth margins, small serrations on margin at base; right and right medial tergal processes adjoined at base, margins serrate; far right lateral tergal lobe present, elongate, weakly narrowing distally, apex round; ventral margin convex on left side; phalloguide with elongate process ventrad to right paramere articulation, apex bulbous, without any spines on margin of process (fig. 56A). **Left paramere:** Strongly expanded medially, subtriangular; sensory lobe prominent, expanded, margins straight, so lobe does not appear swollen; apophysis moderately elongate, inner margin smooth; apex hooked (fig. 56B).

Right paramere: C-shaped; medial flange on inner margin directed downward, expanded and constricted to point; subapical dorsal margin with few spines; apex, short, weakly curved, laterally flattened into fan shape; tip of medial flange and margin of apex with large spines (fig. 56C). **Phallotheca:** Dorsal opening small, elongate, subovate, closed medially; round distally; lobe present on basal end of dorsal opening; weak lateral bicompression subapically on ventral surface, but not flattened (fig. 56D). **Aedeagus:** Spicule arrangement (fig. 56): PES left ventrolateral to and partially sheathing secondary gonopore, DES2 left dorsolateral to secondary gonopore, DES1 left lateral to DES2, base of all spicules originate proximal with base of secondary gonopore (fig. 56E, F); PES simple, unbranched, with elongate medial process projected distally, distally acuminate, margins smooth (fig. 56F); DES2 unbranched, without subdistal threadlike process (fig. 56F); DES1 simple, unbranched, margins smooth, apex evenly bisected, basal keel (DESk) elongate (fig. 56E, F).

Female: Slightly smaller than male, body length 3.46–3.63 mm, pronotal width 0.94–0.99 mm. GENITALIA: IRS, posterior margin medially convex. Interramal lobes (fig.74): mIRL entirely separated from laIRL; laIRL uniform width, straight, base spiniferous with large spiniferous lobe; mIRL half height of laIRL, subquadrate, margin serrate.

Etymology: Named after the host plant, *Callitris endlicheri* in combination with Greek *phila* meaning lover.

Host plant: From *Callitris endlicheri* (table 2).

Holotype: **AUSTRALIA: New South Wales:** 4 km S of Jennings, on New England Hwy, 28.96911°S 151.93263°E, 854 m, 11 Jan 2005, G. Cassis & A. Cassis, *Callitris endlicheri*, det. RBG Sydney, 1♂ (AMNH_PBI 00016523) (AM).

Paratypes: **AUSTRALIA: New South Wales:** 4 km S of Jennings, on New England Hwy, 28.96911°S 151.93263°E, 854 m, 11 Jan 2005, G. Cassis & A. Cassis, *Callitris endlicheri*, det. RBG Sydney, 1♂ (AMNH_PBI 00016522), 2♀ (AMNH_PBI 00016524, 00016525) (AM).

Distribution: Known from one locality in New South Wales, near Jennings, on the Great Dividing Range, just south of the Queensland border (map 4).

Remarks: *Erysivena endlicheriphila* is very closely related to *E. sydneyensis*, but can be differentiated by the medial and right pygophore tergal processes shorter than the left lateral process (cf. figs. 56 and 73); the lack of a medial threadlike process on DES2; the presence of a large fork at the apex of the DES1 spicule; and an expanded fanlike apex on the right paramere. See also *E. sydneyensis* for further remarks.

Erysivena kalbarri, new species

Figures 11, 14, 57–61; map 4

Diagnosis: Defined by the following characters: moderately small size; head strongly expanded anteriorly; eyes midsize; labium extending to metacoxae; forewing membrane veins red, cuneal tip rarely with hint of red; pygophore with two tergal processes positioned right and left of midline, linear shape, distally serrate; left paramere moderately expanded, with broad, round sensory lobe, apophysis elongate, apex unhooked; right paramere C-shaped, with expanded triangular medial flange, distally strongly curved and serrate; phallotheca not compressed at apex; aedeagus with PES complex, DES1 simple; PES strongly constricted above base, with elongate basal straplike process; DES2 unbranched, with medial threadlike process; DES1 unbranched with smooth margins; female laIRL curved inward and broader distally, without basal lobe; mIRL half height of laIRL, subrectangular.

Description: *Male*: Moderately small size, elongate ovoid, body length 2.97–3.31 mm, pronotal width 0.94–0.98 mm. COLORATION: Dorsum yellowish green, faded; cuneus tip concolorous with rest or with very slight tip of red; forewing membrane light gray-brown with darker patches laterally and in major cell, membrane veins red with color confined to veins (fig.

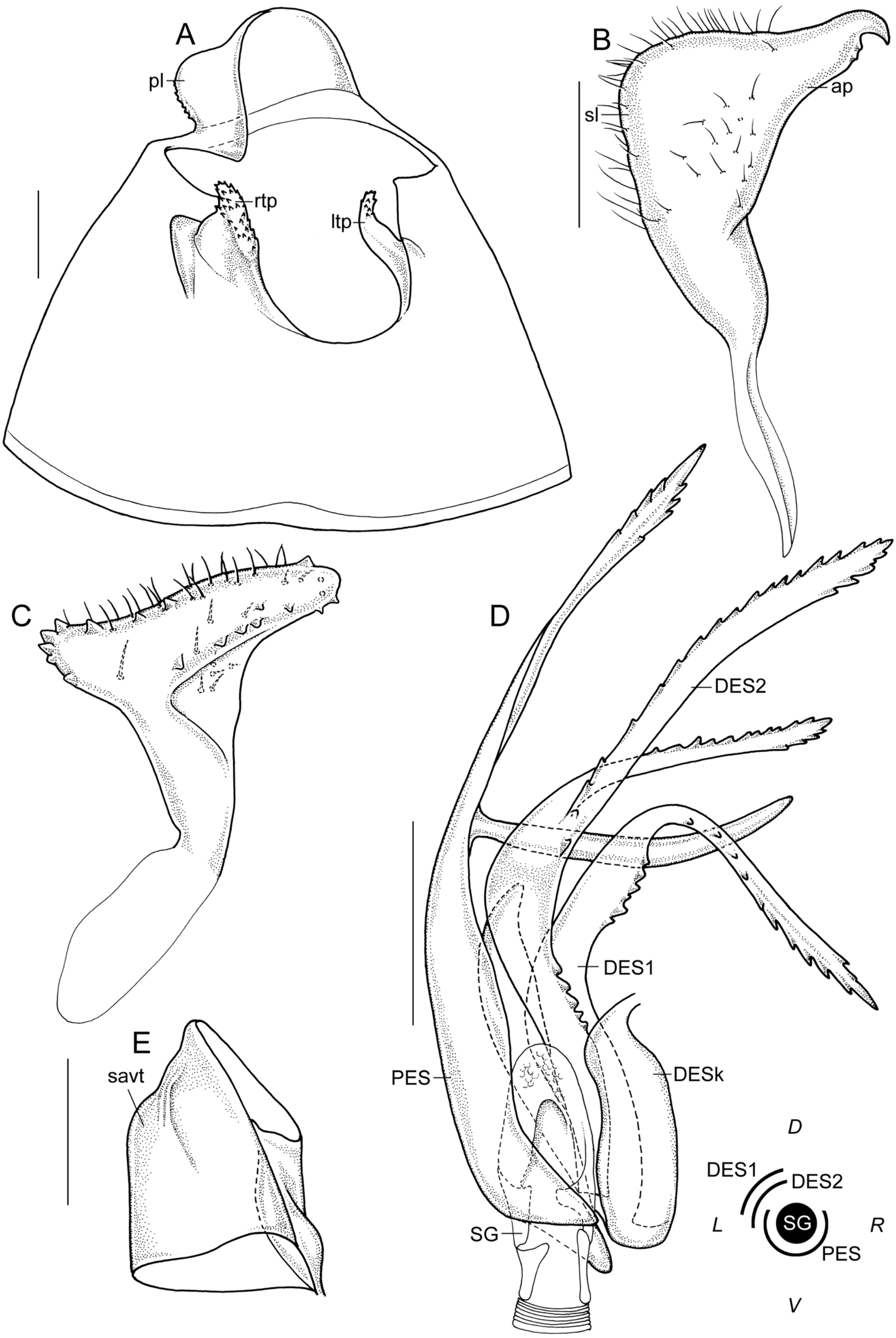


FIG. 62. Male genitalia of *Erysivena majori.* **A.** Pygophore, dorsal. **B.** Left paramere, ventral. **C.** Right paramere, left lateral. **E.** Phallotheca, right lateral. **D.** Aedeagus, right lateral. Scale bars = 0.1 mm.

14). VESTITURE: Dorsum with moderately dense distribution of light-brown simple setae. STRUCTURE: **Head:** Strongly expanded anteriorly (fig. 57A, B); eyes midsize, extending slightly beyond anterolateral angle of pronotum (fig. 57A–C); antennae with AI 0.9× vertex width, AII 1.3× pronotal width; labium medium length, extending to metacoxae. **Hemelytra:** Cuneus and major cell of membrane short, major membrane vein rounded (fig. 14). GENITALIA: **Pygophore:** Dorsal margin of genital opening strongly concave, with two tergal processes, bases expanded, positioned left and right of midline, elongate, left process longer than right process, both distally serrate (figs. 57H, 59A); far right lateral tergal lobe absent; ventral margin of genital opening slightly convex (fig. 58B); round phalloguide present, positioned just inside ventral margin and protruding slightly, phalloguide not sclerotized ventrad to right paramere articulation (fig. 59A). **Left paramere:** Moderately expanded medially; sensory lobe broad, round; apophysis greatly elongate, inner margin smooth; apex curved inward slightly, not hooked (figs. 57H, 58A, B, 59B). **Right paramere:** C-shaped; medial flange on dorsal margin expanded, subtriangular, directed inward; apex strongly curved; medial flange with smooth margin, slightly rough proximate to point but not serrate; apex serrate with two rows of small spines (figs. 57H, 58B, 59C). **Phallotheca:** Dorsal opening large; round distally; ventral surface not compressed at apex; RHS dorsal margin without lobe, capped with proctiger in situ (figs. 58A, 59D). **Aedeagus:** Spicule arrangement (fig. 59): PES left ventrolateral and almost entirely wrapped sheathlike around secondary gonopore (figs. 58C–E), DES2 dorsal to secondary gonopore and PES (fig. 58E), DES1 left dorsolateral to DES2 (figs. 58E), PES and DES2 joined by membrane sheath on right side of secondary gonopore (figs. 58E, 59E), base of all spicules originating proximal to base of secondary gonopore (fig. 58C); PES complex, acutely constricted above base, subbasal straplike process present, moderately elongate, small basal process on base before constriction point, shorter than subbasal process (figs. 58C, 59E); DES2 unbranched, not twisted distally or expanded medially, medial threadlike process present (figs. 58C, E, 59E); DES1 simple, unbranched, margins smooth, medially expanded, acuminate distally (figs. 58C, E, 59E), basal keel (DESk) elongate (fig. 59E).

Female: Slightly longer than male on average, body length 3.15–3.52 mm, pronotal width 0.91–1.05 mm. GENITALIA: IRS, posterior margin concave (figs. 60D, 61C). Interramal lobes (figs. 60D, 61C): mIRL entirely separated from laIRL; laIRL curved inward and slightly broader distally, base spiniferous but without lobe; mIRL half height of laIRL, subrectangular, distally round and serrate.

Etymology: Named after the type locality and only known locality for this species in Kalbarri National Park, Western Australia, an area with a high level of biological diversity and endemism.

Host plant: Known from *Callitris arenaria* (table 2).

Holotype: **AUSTRALIA: Western Australia:** Kalbarri National Park, 12.6 km E Kalbarri, 27.69313°S 114.291°E, 500 m, 29 Oct 1996, Schuh and Cassis, *Actinostrobus arenarius*, det. WA Herbarium PERTH 05120411, 1♂ (AMNH_PBI 00016472) (WAMP).

Paratypes: **AUSTRALIA: Western Australia:** Kalbarri National Park, 12.6 km E Kalbarri, 27.69313°S 114.291°E, 500 m, 29 Oct 1996, Schuh and Cassis, *Actinostrobus arenarius*, det. WA Herbarium PERTH 05120411, 18♂ (AMNH_PBI 00016465, 00016473–00016478, 00016480–00016490), 24♀ (AMNH_PBI 00016491, 00016492, 00016499–00016505, 00016507–00016521) (AM), 1♂ (AMNH_PBI 00016479), 1♀ (AMNH_PBI 00016506) (UNSW), 6♂ (AMNH_PBI 00016466–00016471), 6♀ (AMNH_PBI 00016493–00016498) (WAMP).

Other specimens examined: **AUSTRALIA: Western Australia:** Kalbarri National Park, 12.6 km E Kalbarri, 27.69313°S 114.291°E, 500 m, 29 Oct 1996, Schuh and Cassis, *Actinostrobus arenarius*, det. WA Herbarium PERTH 05120411, 10 juv. (AMNH_PBI 00016450–00016459)

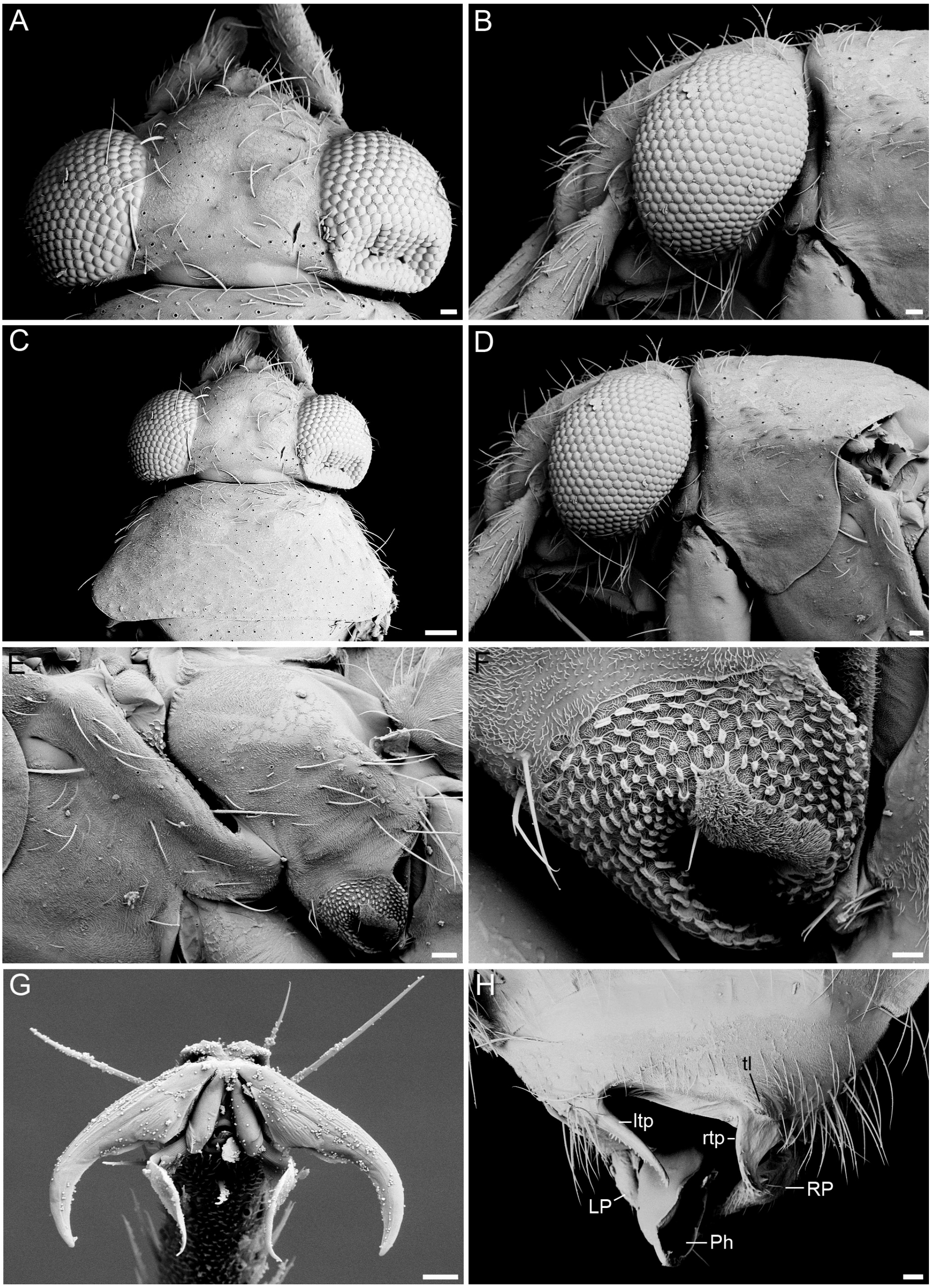


FIG. 63. External morphology of *Erysivena mareeba,* male. **A.** Head, dorsal, scale bar = 30 µm. **B.** Head, lateral, scale bar = 30 µm. **C.** Head and pronotum, dorsal, scale bar = 100 µm. **D.** Head and pronotum, lateral, scale bar = 30 µm. **E.** Meso- and metathorax, scale bar = 30 µm. **F.** Metathoracic scent gland, scale bar = 10 µm. **G.** Tarsal claw, scale bar = 10 µm. **H.** Pygophore, dorsal, scale bar = 30 µm.

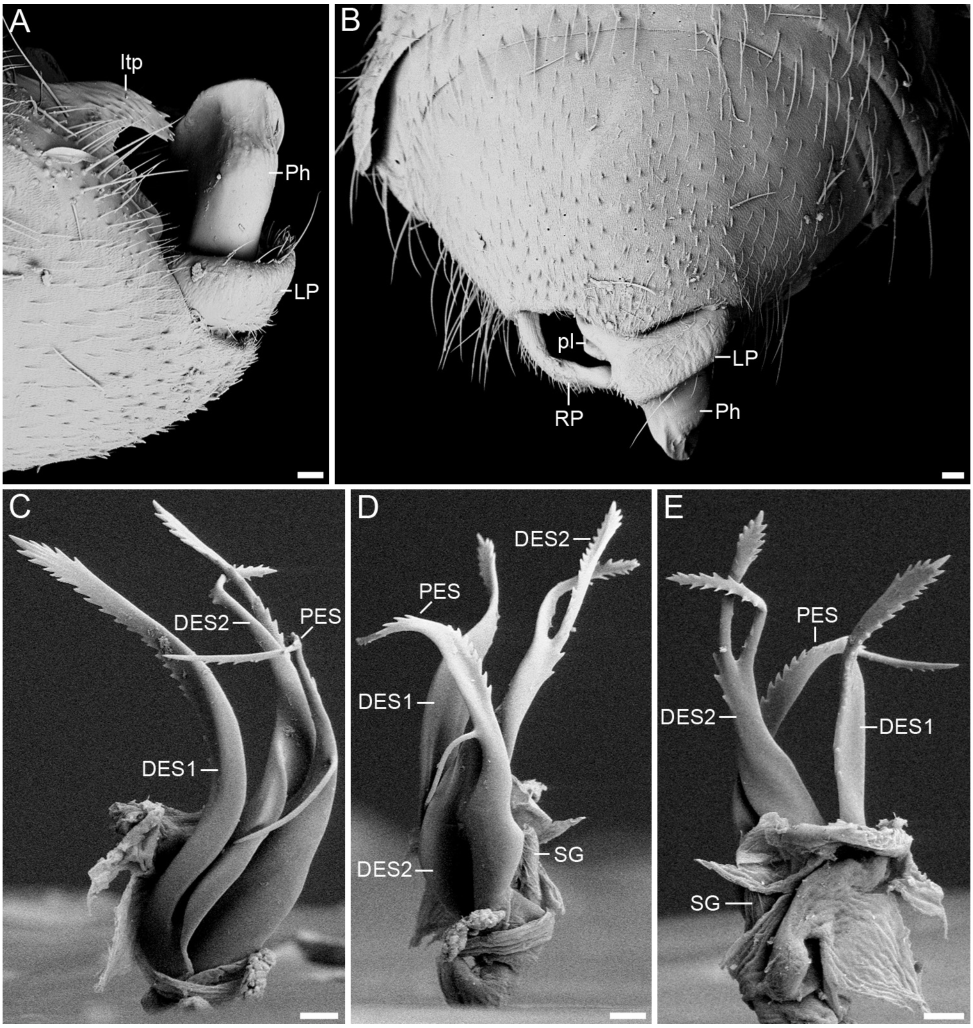


FIG. 64. Male genitalic morphology of *Erysivena mareeba*: **A.** Pygophore, left lateral. **B.** Pygophore, ventral **C.** Aedeagus, left lateral. **D.** Aedeagus, ventral. E. Aedeagus, dorsal. Scale bars = 30 µm.

(AM), 5 juv. (AMNH_PBI 00016460–00016464) (WAMP).

Distribution: Known from one locality in Kalbarri National Park, Western Australia, an area with high endemism in the northern end of the Southwest Botanical Zone (map 4).

Remarks: *Erysivena kalbarri* is most closely related to two Western Australian species, *E. drepanomorpha* and *E. notodytika* by the unique structure of PES (cf. figs. 59E, 53G, 67E). It is best differentiated from the other two species by the smaller body size; more strongly expanded head anteriorly; slightly smaller eyes (figs. 14, 57A–D); presence of two linear tergal processes on the dorsal margin of the genital opening of the pygophore (fig. 57H) (cf. one large, broad tergal process); the expanded and triangular medial flange on the inner dorsal margin of the right paramere (fig. 59C) (cf. weakly expanded dorsal edge of the other two species); and the unbranched and distally smooth DES1 (fig. 58E) (cf. complex DES1 of the other two species). It is noteworthy that the head in *E. kalbarri* is more strongly expanded anteriorly than any other species in the genus.

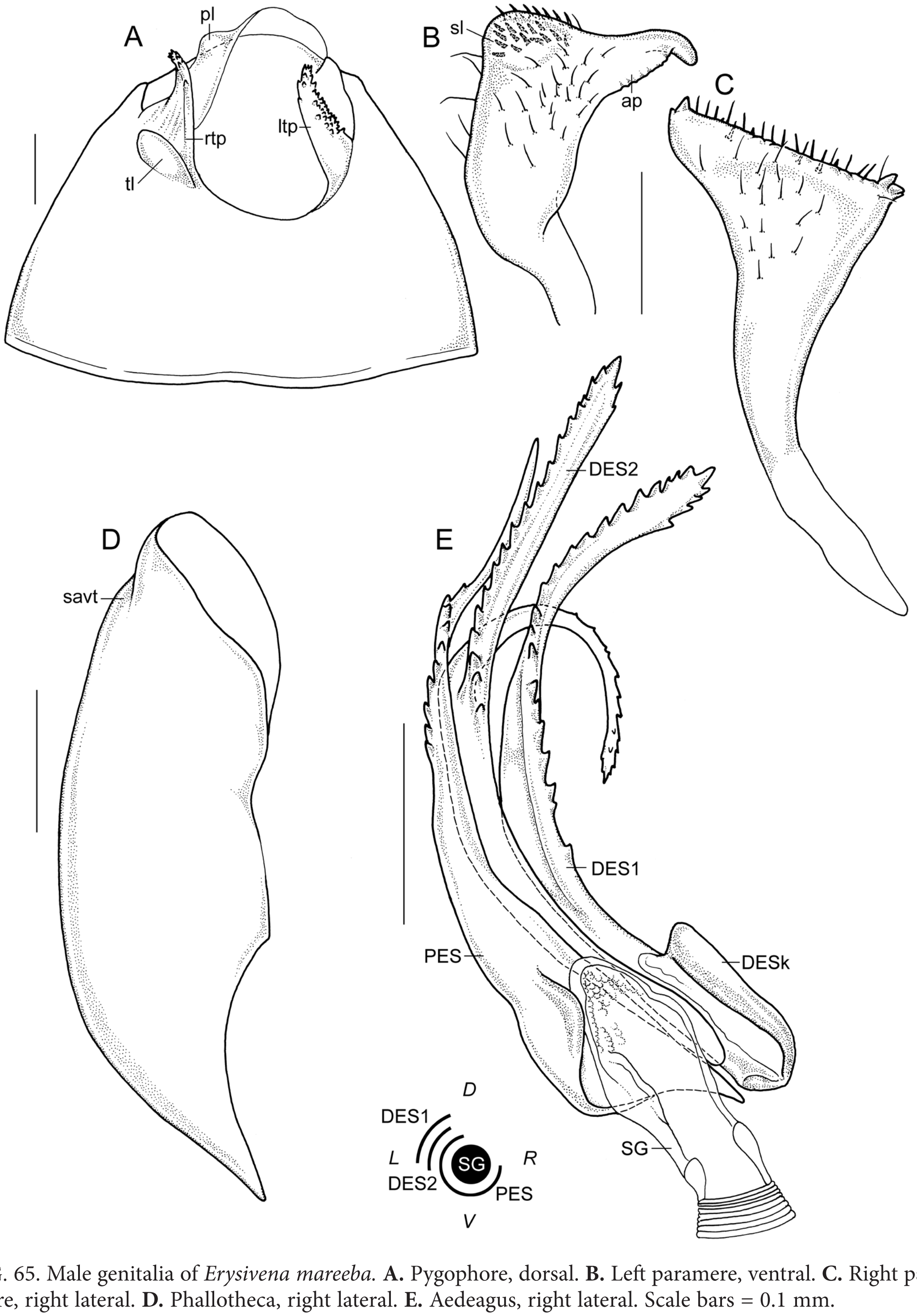


FIG. 65. Male genitalia of *Erysivena mareeba.* **A.** Pygophore, dorsal. **B.** Left paramere, ventral. **C.** Right paramere, right lateral. **D.** Phallotheca, right lateral. **E.** Aedeagus, right lateral. Scale bars = 0.1 mm.

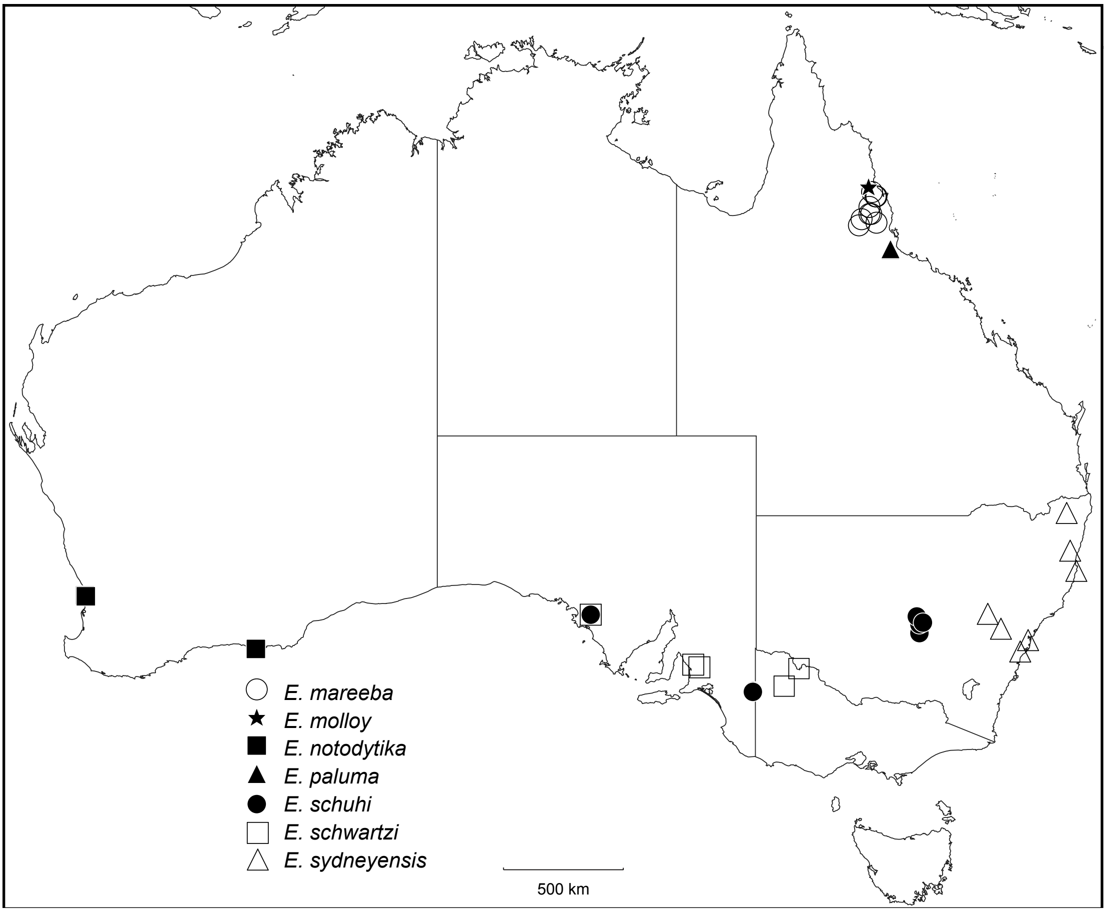
***Erysivena majori*, new species**

Figures 14, 62, 74; map 4

Diagnosis: Defined by the following characters: moderately small size; head weakly enlarged anteriorly; eyes large; labium extends to mesocoxae; cuneus tip and forewing membrane veins red; pygophore with two serrate tergal processes positioned left lateral and far right lateral; far right lateral tergal process linear, with expanded basal lobe; left lateral tergal process subrectangular, curved downward and pointed distally; left paramere strongly expanded, subtriangular, sensory lobe broad with short light-brown setae, apophysis moderately elongate, apex hooked; right paramere hammer shaped, with expanded subapical dorsal lobe, apex elongate, broad, and flattened; phallotheca opening small and round; aedeagus with PES simple, with elongate medial process, distally serrate with straight apex; DES2 bifurcate medially; DES1 simple, unbranched, curved downward distally, medially and distally serrate; female mIRL two-thirds height of laIRL, expanded and serrate distally; laIRL straight and uniform width, with large spiniferous basal lobe.

Description: *Male*: Relatively small to midsized, elongate, body length 3.20–3.56 mm, pronotal with 0.84–1.03 mm. COLORATION: Dorsum yellowish green, faded; cuneus tip red; forewing membrane light gray-brown with darker patches laterally and in major cell, membrane veins red with color confined to vein, subcuneal clear spot large (fig. 14). VESTITURE: Dorsum with moderately dense distribution of pale (cream) simple setae. STRUCTURE: **Head:** Weakly expanded anteriorly; eyes large, extending well beyond anterolateral angle of pronotum; antennae with AI subequal to vertex width, AII 1.2× pronotal width; labium medium length, extending to mesocoxae. **Hemelytra:** Cuneus and major cell of membrane moderately elongate, major membrane vein slightly rounded, membrane elongate (fig. 14). GENITALIA: **Pygophore:** Dorsal margin of genital opening strongly concave, asymmetrically; two sclerotized tergal processes, positioned left and far right lateral of midline; left tergal process subrectangular, apex pointed and acutely curved downward, distally serrate; far right tergal process linear, with expanded lobed base, distally serrate; ventral margin of genital opening slightly convex on left side; phalloguide sclerotized and round ventrad to right paramere articulation, with serrate lateral margin (fig. 62A). **Left paramere:** Strongly expanded medially, subtriangular; sensory lobe broad, round; sensory lobe with light-brown, bristlelike setae; apophysis moderately elongate, inner margin with two small spines subapically; apex hooked (fig. 62B). **Right paramere:** Hammer shaped; medial flange on inner lateral margin, greatly reduced, directed downward; subapical dorsal margin with expanded lobe; apex expanded, strongly curved, with flattened distal edge; toothlike spines present on subapical lobe and in two rows on inner and outer margin along apex; light-brown, short, bristlelike setae on apex (fig. 62C). **Phallotheca:** Dorsal opening small, closed medially; round distally, without small point at apex; basal margin of opening round; small subapical tumescence on ventral surface (fig. 62). **Aedeagus:** Spicule arrangement (fig. 62): PES ventral to and partially sheathing secondary gonopore, DES2 left dorsolateral to PES, DES1 lateral to DES2, base of PES distad to base of secondary gonopore (fig. 62E); PES simple, with elongate medial process which is sometimes distally serrate and projected perpendicular to spicule or downward, apex serrate, acuminate, and straight; DES2 bifurcate medially, branches equal length and narrow, distally serrate, left branch bent perpendicular to base, right branch distally projected, with row of subbasal serrations on right side; DES1 simple, medially weakly expanded and serrate along inner margin, distally strongly curved downward and acuminate, distal margins serrate, basal keel (DESk) elongate (fig. 62E).

Female: Subequal size to male, body length 3.14–3.41 mm, 0.89–1.04 mm. GENITALIA: IRS posterior margin convex. Interramal lobes (fig. 74): mIRL entirely separated from laIRL; laIRL straight, linear, uniform width, base with large spiniferous lobe; mIRL two-thirds height of



MAP 5. Distribution of *Erysivena* species.

laIRL, subrectangular, distally expanded, and serrate.

Etymology: Named after ecologist Richard Major in recognition of his work at the Australian Museum, on the insect assemblages found on *Callitris glaucophylla* in fragmented woodlands of southeastern Australia, from which seven callitroid-inhabiting Orthotylini species (including this species) were found.

Host plant: Known from *Callitris glaucophylla* (table 2).

Holotype: **AUSTRALIA: New South Wales:** 2.9 km W of Nyngan, 31.55001°S 147.1553°E, 202 m, 18 Oct 2001, Cassis, Silveira, Wall, *Callitris glaucophylla*, det. RBG Sydney NSW658275, 1♂ (AMNH_PBI 00016233) (AM).

Paratypes: **AUSTRALIA: New South Wales:** 2.9 km W of Nyngan, 31.55001°S 147.1553°E, 202 m, 18 Oct 2001, Cassis, Silveira, Wall, *Callitris glaucophylla*, det. RBG Sydney NSW658275, 2♂ (AMNH_PBI 00016234, 00016235), 1♀ (AMNH_PBI 00016237) (AM). 43.5 km S of Tamworth, on New England Hwy, 31.44702°S 150.87102°E, 674 m, 10 Jan 2005, G. Cassis, *Callitris glaucophylla*, 1♂ (AMNH_PBI 00016246), 4♀ (AMNH_PBI 00016248–00016251) (AM), 1♂ (AMNH_PBI 00016245), 1♀ (AMNH_PBI 00016247) (UNSW). Near Backyamma State Forest, 33.30638°S 148.21611°E, 10 Apr 1999, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 1♂ (AMNH_PBI 00016242), 2♀ (AMNH_PBI 00016243, 00016244)

(AM). **Queensland:** 5.9 km E of Mitchell, 26.48726°S 148.0361°E, 380 m, 31 Oct 1998, Schuh, Cassis, Silveira, *Callitris glaucophylla*, det. RBG Sydney NSW427493, 4♀ (AMNH_PBI 00016238–00016241) (AM), 3♂ (AMNH_PBI 00000154, 00000159, 00000165), 2♀ (AMNH_PBI 00000177, 00000182) (AMNH).

Other specimens examined: **AUSTRALIA: New South Wales:** 2.9 km W of Nyngan, 31.55001°S 147.1553°E, 202 m, 18 Oct 2001, Cassis, Silveira, Wall, *Callitris glaucophylla*, det. RBG Sydney NSW658275, 1♀ (AMNH_PBI 00016236) (AM).

Distribution: Moderately broad inland distribution from four localities, from southern Queensland to central New South Wales, on the western slopes of the Great Dividing Range and on the Great Dividing Range in northern New South Wales (map 4). Collected with *Avititerra xerophila* and *Callitricola wiradjuri* (table 2).

Remarks: *Erysivena majori* is closely related to *E. bundjalung, E. mareeba*, and *E. molloy*. It is distinguished from *E. bundjalung* and *E. mareeba* by the following characters (cf. figs. 62, 50, 65): the sensory lobe of the left paramere broad and rounded (cf. swollen); PES with an elongate medial process (cf. PES with a short threadlike process in *E. bundjalung* and *E. mareeba*); and dorsal opening of the phallotheca round (cf. elongate and constricted distally and basally acute. see fig. 50D). DES2 of *E. majori* is similar to *E. mareeba*, but differs from that in *E. bundjalung* by being bifurcate medially, rather than more distally bifurcate, and by the absence of a distinct row of toothlike serrations on the inner margin, proximal to bifurcation point (fig. 50E, F), and presence instead of more subbasal marginal serrations (62E). The DES1 spicule is more strongly down curved in *E. majori* than in *E. mareeba* (cf. figs. 62E and 64E, 65E).

Erysivena mareeba, new species

Figures 6B, 14, 63–65; map 5

Diagnosis: Defined by the following characters: midsized; head weakly expanded anteriorly; eyes large; labium extending to mesocoxae; tip of cuneus and forewing membrane veins red; pygophore with two serrate tergal processes positioned left lateral and far right lateral; far right lateral tergal process linear, elongate, separate but arising from broad tergal lobe; left tergal process subrectangular, apex slightly pointed and curved downward; left paramere strongly expanded, subtriangular, prominent sensory lobe with swollen appearance, with dark bristlelike setae, apophysis moderately elongate, apex hooked; right paramere hammer shaped, with small subapical dorsal lobe, apex elongate, narrow edge; phallotheca opening small and subovate; aedeagus with PES simple, with small threadlike medial process, distally acuminate and ribbonlike, apex smooth or with single row of marginal serration; DES2 bifurcate medially; DES1 simple, unbranched, curved distally, serrate continuously from medial to distal margins; female mIRL half height of laIRL, round and serrate distally; laIRL straight and slightly narrowing distally with small spiniferous basal lobe.

Description: *Male*: Midsize, elongate ovoid, body length 3.44–3.66 mm, pronotal width 1.00–1.06 mm. COLORATION: Dorsum yellowish green, faded; cuneus tip dark red; forewing membrane mostly uniform dark gray-brown with slightly darker patches laterally, membrane veins red with color confined to veins, subcuneal clear spot not enlarged. VESTITURE: Dorsum with moderately dense distribution of pale (cream) simple setae. STRUCTURE: **Head:** Weakly expanded anteriorly, eyes large, extending well beyond anterolateral angle of pronotum (figs. 63A–D); antennae with AI 1.3× vertex width, AII 1.2× pronotal width; labium medium length, extending to mesocoxae. **Hemelytra:** Cuneus and major cell of membrane short, major membrane vein straight; forewing membrane slightly truncated (fig. 14). GENITALIA: **Pygophore:** Dorsal margin of genital opening strongly concave, asymmetrically, two sclerotized tergal processes positioned left and far right of midline (figs. 63H, 65A); left tergal process subrectangular, broad, narrows distally with apex curved downward, dis-

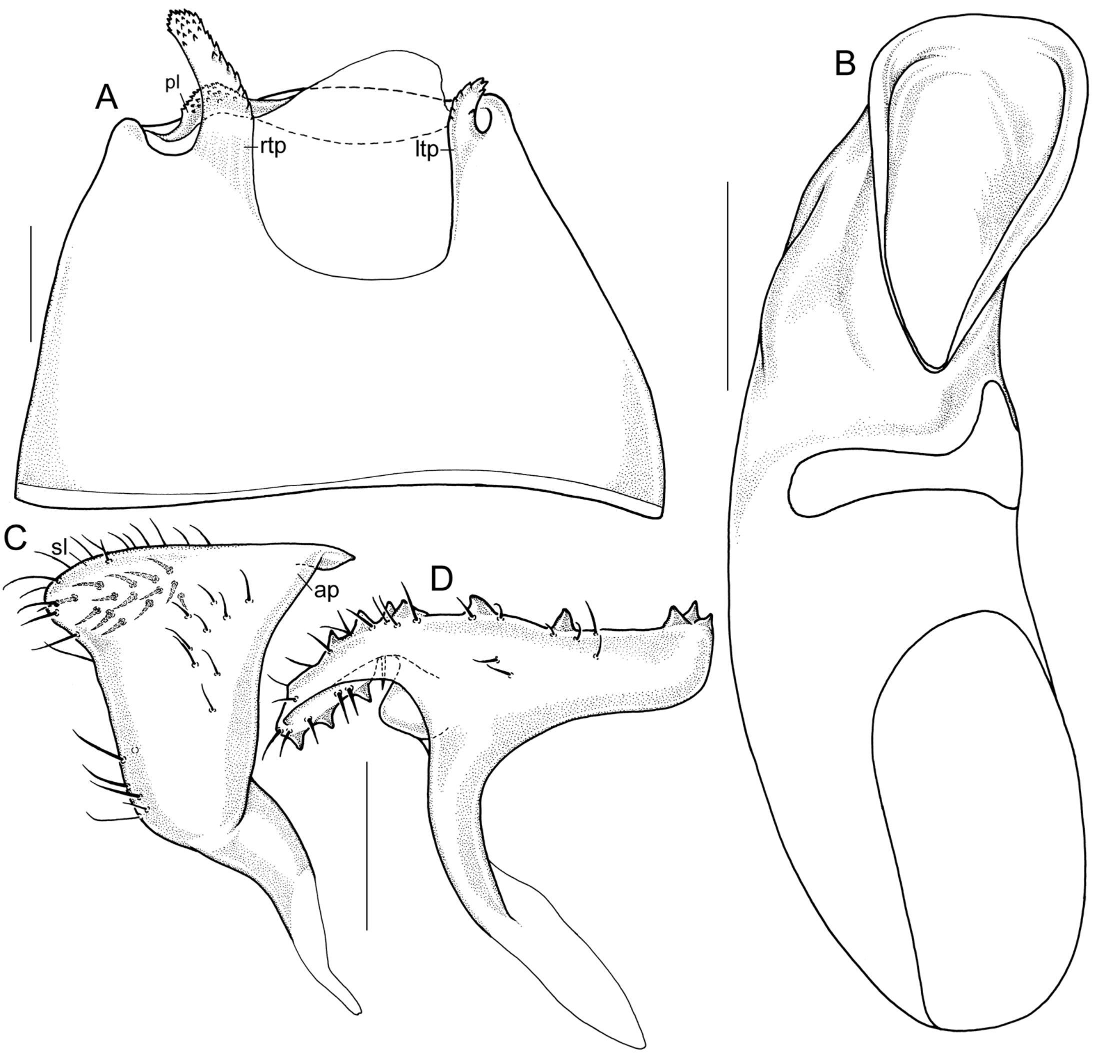


FIG. 66. Male genitalia of *Erysivena molloy.* **A.** Pygophore, dorsal. **B.** Phallotheca, dorsal. **C.** Left paramere, ventral. **D.** Right paramere, right lateral. Scale bars = 0.1 mm.

tally serrate (figs. 64A, 65A); right tergal process elongate, narrow, distally serrate, without an expanded base, but arising from broad tergal lobe (figs. 63H, 65A); ventral margin of genital opening slightly convex on left side (fig. 64B); phalloguide round, sclerotized, and with small, round lobe ventrad to right paramere articulation (fig. 65A). **Left paramere:** Strongly expanded medially, subtriangular; sensory lobe prominent, expanded, margins slightly indented, so lobe appears swollen; sensory lobe with dark brown, bristlelike setae; apophysis moderately elongate, inner margin with serrations subapically; apex hooked (figs. 64A, B, 65B). **Right paramere:** Hammer shaped; medial flange on inner lateral margin, absent; subapical dorsal margin expanded with small lobe; apex expanded, weakly curved, with narrow distal edge; very small toothlike spines present on subapical lobe and along narrow edge of apex; light-brown, short, bristlelike setae on apex (figs. 64B, 65C). **Phallotheca:** Dorsal opening small, subovate; closed medially; round distally; without small point at apex; basal margin of opening V-shaped; small subapical tumescence on ventral surface (fig. 65D). **Aedeagus:** Spicule arrangement (fig. 65): PES ventral to left dorsolateral to and wrapped sheathlike around secondary gonopore (fig. 64C, D), DES2 left lateral to PES (fig. 64D), DES1 left dorsolateral to DES2 (fig. 64C, D), base of PES slightly distad to base of secondary gonopore; PES simple with moderately short, very fine medial threadlike process (fig. 64C) (not illustrated), medially serrate on right margin, apex acuminate and ribbonlike, sometimes curved and either smooth (fig. 65E) or with few marginal serrations (fig. 64C–E); DES2 bifurcate medially, branches equal length and narrow, distal margins serrate, left branch curved downward toward base or perpendicular, right branch not bent, without submedial or subbasal serrations (figs. 64D, E, 65E); DES1 simple, medially weakly expanded, distally weakly curved, serrate continuously from medial to distal margins, basal keel (DESk) moderately elongate (figs. 64C, E, 65E).

Female: Slightly shorter on average than male, body length 3.23–3.52 mm, pronotal width 0.96–1.06 mm. GENITALIA: IRS posterior margin convex. Interramal lobes (fig.74): mIRL entirely separated from laIRL; laIRL straight, linear, narrowing slightly at apex, base spiniferous with small spiniferous lobe; mIRL half height of laIRL, subrectangular, distally round and serrate.

Etymology: Named after Mareeba, near the type locality, on the Atherton Tablelands in northeastern Queensland. Noun in apposition.

Host plant: Known from *Callitris intratropica* (table 2).

Holotype: **AUSTRALIA: Queensland:** 10 km E of Mareeba, jct of Kennedy Hwy & Kay Rd, 17.99041°S 145.5075°E, 450 m, 31 May 2006, Cassis, Barrow, Finlay, and Symonds, *Callitris intratropica*, det. RBG Sydney, 1♂ (AMNH_PBI 00005634) (QM).

Paratypes: **AUSTRALIA: Queensland:** 10 km E of Mareeba, jct of Kennedy Hwy & Kay Rd, 17.99041°S 145.5075°E, 450 m, 31 May 2006, Cassis, Barrow, Finlay, and Symonds, *Callitris intratropica*, det. RBG Sydney, 2♂ (AMNH_PBI 00005630, 00005631), 25♀ (AMNH_PBI 00005635–00005653, 00005657–00005662) (AM), 2♂ (AMNH_PBI 00005632, 00005633), 3♀ (AMNH_PBI 00005654–00005656) (QM). 17 km E of Mt. Garnet, on Kennedy Hwy, 17.659°S 145.24669°E, 678 m, 21 May 2006, Cassis, Barrow, Finlay, and Symonds, *Callitris intratropica*, det. RBG Sydney, 7♂ (AMNH_PBI 00005555–00005561), 6♀ (AMNH_PBI 00005566–00005569, 00005572, 00005573) (AM), 4♂ (AMNH_PBI 00005562–00005565), 2♀ (AMNH_PBI 00005570, 00005571) (QM). 26.1 km W of Mt. Garnet, 17.83677°S 144.94902°E, 673 m, 22 May 2006, Cassis, Barrow, Finlay, and Symonds, *Callitris intratropica*, det. RBG Sydney, 3♂ (AMNH_PBI 00005530, 00005543, 00005596), 14♀ (AMNH_PBI 00005531–00005542, 00005599, 00005600) (AM), 1♂ (AMNH_PBI 00005597), 1♀ (AMNH_PBI 00005601) (AMNH), 1♂ (AMNH_PBI 00005598) (QM). 58 km W of Mt. Garnet, Forty Mile Scrub National Park, 18.08155°S 144.85902°E, 758 m, 23 May 2006, Cassis, Barrow, Finlay, and Symonds, *Callitris intratropica*, det. RBG Sydney, 1♂ (AMNH_PBI 00005664), 3♀ (AMNH_PBI 00005667–00005669) (AM), 1♂ (AMNH_PBI 00005666) (QM), 1♂ (AMNH_PBI 00005665), 1♀ (AMNH_PBI 00005670) (UNSW). Jct of Baillie Rd & Kennedy Hwy, 25 km E of Mt. Garnet, 17.65236°S 145.31588°E, 681 m, 21 May 2006, Cassis, Barrow, Finlay, and Symonds, *Callitris intratropica*, det. C. Symonds, 8♂ (AMNH_PBI 00005607–00005613, 00005615), 10♀ (AMNH_PBI 00005617–00005626) (AM), 2♂ (AMNH_PBI 00005614, 00005616), 3♀ (AMNH_PBI 00005627–00005629) (QM). Kennedy Hwy, 8 km E of Mareeba, 16.98458°S 145.4975°E, 454 m, 20 Apr 2005, C. Symonds, *Callitris intratropica*, det. Field ID, 1♂ (AMNH_PBI 00005675) (AM). Kennedy Hwy at Kay Rd, 10 km E of Mareeba, 16.98893°S 145.5084°E, 446 m, 18 Apr 2005, C. Symonds, *Callitris intratropica*, det. Field ID, 2♂

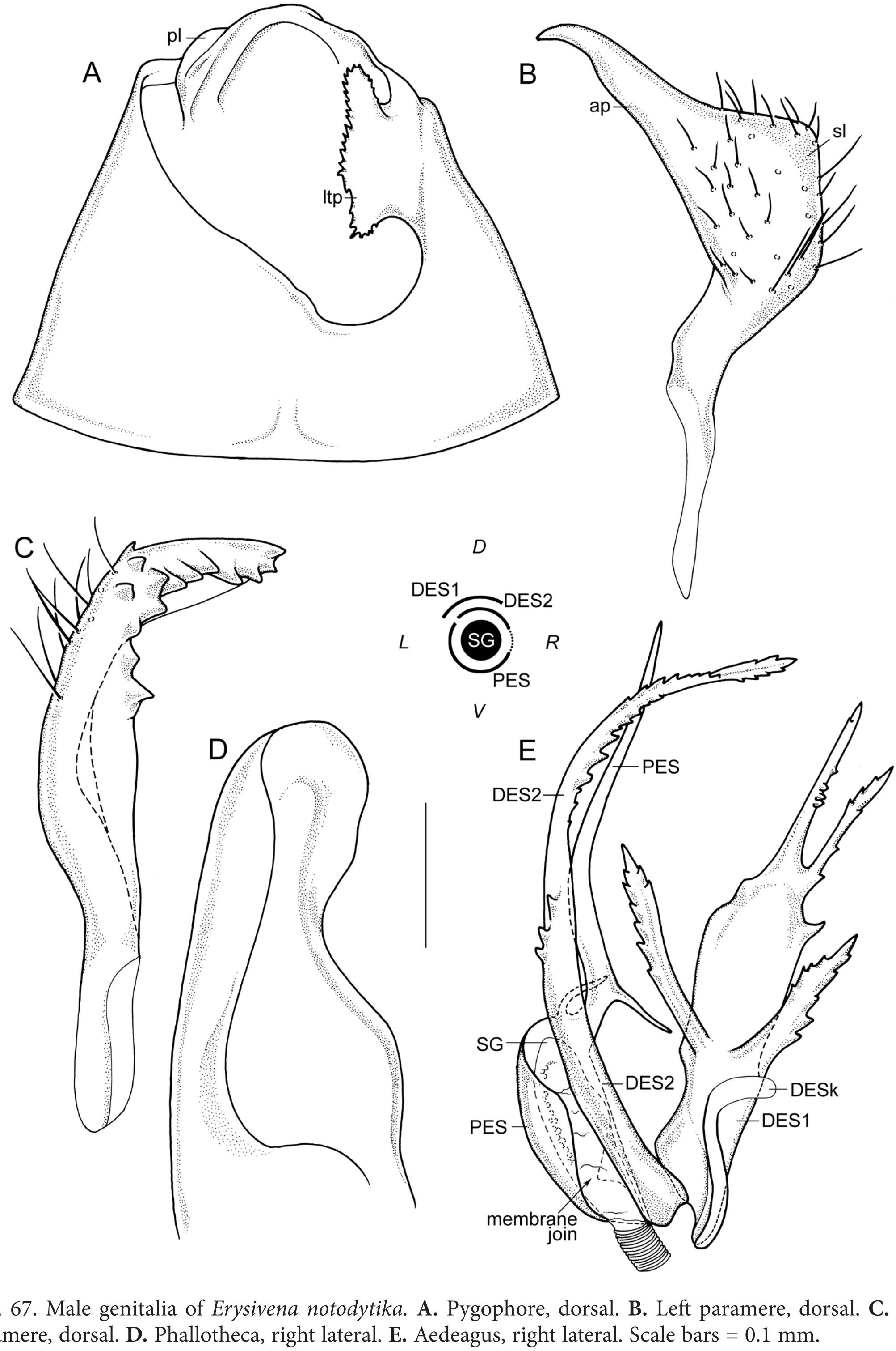


FIG. 67. Male genitalia of *Erysivena notodytika*. **A.** Pygophore, dorsal. **B.** Left paramere, dorsal. **C.** Right paramere, dorsal. **D.** Phallotheca, right lateral. **E.** Aedeagus, right lateral. Scale bars = 0.1 mm.

(AMNH_PBI 00005672, 00005673), 1♀ (AMNH_PBI 00005674) (AM). ca. 11.3 km W of Herberton, on Herberton-Petford Rd, 17.38413°S 145.27125°E, 792 m, 01 Jun 2006, Cassis, Barrow, Finlay, and Symonds, *Callitris intratropica*, det. RBG Sydney, 2♂ (AMNH_PBI 00005577, 00005583), 12♀ (AMNH_PBI 00005578–00005580, 00005584–00005592) (AM), 2♀ (AMNH_PBI 00005581, 00005582) (QM).

Other specimens examined: **AUSTRALIA: Queensland:** 17 km E of Mt. Garnet, on Kennedy Hwy, 17.659°S 145.24669°E, 678 m, 21 May 2006, Cassis, Barrow, Finlay, and Symonds, *Callitris intratropica*, det. RBG Sydney, 9 juv. (AMNH_PBI 00005544–00005547, AMNH_PBI 00005550–00005554) (AM), 2 juv. (AMNH_PBI 00005548, 00005549) (QM). 19.5 km N of Mareeba, 16.81938°S 145.36766°E, 406 m, 24 May 2006, Cassis, Barrow, Finlay, and Symonds, *Callitris intratropica*, det. RBG Sydney, 1♂ (UNSW_ENT 00046038) (AM). 26.1 km W of Mt. Garnet, 17.83677°S 144.94902°E, 673 m, 22 May 2006, Cassis, Barrow, Finlay, and Symonds, *Callitris intratropica*, det. RBG Sydney, 3 juv. (AMNH_PBI 00005593–00005595) (AM). 58 km W of Mt. Garnet, Forty Mile Scrub National Park, 18.08155°S 144.85902°E, 758 m, 23 May 2006, Cassis, Barrow, Finlay, and Symonds, *Callitris intratropica*, det. RBG Sydney, 1 juv. (AMNH_PBI 00005663) (AM). Jct of Baillie Rd & Kennedy Hwy, 25 km E of Mt. Garnet, 17.65236°S 145.31588°E, 681 m, 21 May 2006, Cassis, Barrow, Finlay, and Symonds, *Callitris intratropica*, det. C. Symonds, 3 juv. (AMNH_PBI 00005602–00005604) (AM), 2 juv. (AMNH_PBI 00005605, 00005606) (QM). Kennedy Hwy at Kay Rd, 10 km E of Mareeba, 16.98893°S 145.5084°E, 446 m, 18 Apr 2005, C. Symonds, *Callitris intratropica*, det. Field ID, 1 juv. (AMNH_PBI 00005671) (AM). ca. 11.3 km W of Herberton, on Herberton-Petford Rd, 17.38413°S 145.27125°E, 792 m, 01 Jun 2006, Cassis, Barrow, Finlay, and Symonds, *Callitris intratropica*, det. RBG Sydney, 3 juv. (AMNH_PBI 00005574–00005576) (AM).

Distribution: Known from nine closely located sites near Mareeba, in savannah woodland (map 5). Collected at two sites with *C. finlayae* (table 2). It was also collected close to *E. molloy* (map 5).

Remarks: *Erysivena mareeba* is closely related to *E. majori, E. bundjalung* and *E. molloy*. It is readily differentiated from *E. majori* and *E. bundjalung* by the following characters (cf. figs. 65, 62, 50): the right paramere is narrower apically and the subapical dorsal lobe is very small (cf. the right paramere is flattened and apically broad, and the subapical dorsal lobe is larger in the other two species); the left paramere has dark rather than light-brown, bristlelike setae on the sensory lobe; the left tergal process of the genital opening of the pygophore is slightly larger, and the right tergal process is very narrow and more elongate with a less expanded base; a far right tergal lobe is present (not fused to the tergal process as in the other two species); PES is medially serrate, and has a very short, threadlike medial process (similar in *E. bundjalung*), is very narrow and ribbonlike distally, having a smooth apex or weakly serrate margin and is shorter than the other two endosomal spicules. It is noteworthy that PES varies subtly within all three species. See also remarks below for *E. molloy*.

Erysivena molloy, new species

Figures 14, 66, 74; map 5

Diagnosis: Defined by the following characters: moderately small size; head weakly expanded anteriorly; eyes large; labium extending over abdomen; tip of cuneus and forewing membrane veins red; pygophore with two serrate tergal processes positioned left lateral and far right lateral; far right lateral tergal process elongate, linear, with expanded lobed base; left lateral tergal process subrectangular, curved downward and pointed distally; left paramere strongly expanded, subtriangular, prominent sensory lobe with tumescencelike appearance and with short dark bristlelike setae, apophysis moderately elongate, apex with blunt hook; right paramere hammer shaped, with greatly expanded subapical dorsal lobe longer than apex, apex broad and flattened; phallotheca opening small and drop shaped; female mIRL half height of laIRL, round and serrate distally; laIRL slightly curved inward at apex and uniform width, with small spiniferous basal lobe.

Description: *Male*: Moderately small size, elongate ovoid, body length 3.28 mm, pronotal width 1.02 mm. COLORATION: Dorsum yellowish green, faded; cuneus tip red; forewing membrane uniformly light gray-brown, veins red posteriorly with color confined to veins, subcuneal clear spot enlarged. VESTITURE: Dorsum with moderately dense distribution of light-brown simple setae. STRUCTURE: **Head:** Weakly expanded anteriorly; eyes large, extending well beyond anterolateral angle of pronotum; labium elongate, extending to abdomen; cuneus round in dorsal view. **Hemelytra:** Cuneus and major cell of membrane moderately short, major membrane vein straight (fig. 14). GENITALIA: **Pygophore:** Dorsal margin of genital opening strongly concave, two sclerotized tergal processes, positioned left and far right lateral of midline (fig. 66A); left tergal process subrectangular, apex pointed and slightly curved downward, distally serrate; far right tergal process linear, elongate, with expanded lobed base, distally serrate; ventral margin of genital opening slightly convex; phalloguide sclerotized and round ventrad to right paramere articulation, with serrate margin (fig. 66A). **Left paramere:** Strongly expanded medially, subtriangular; sensory lobe prominent, expanded, margins slightly indented, so lobe appears swollen; sensory lobe with dark brown, bristlelike setae; apophysis moderately elongate, inner margin smooth; apex with blunt hook (fig. 66B). **Right paramere:** Hammer shaped; medial flange on inner lateral margin, small and rounded, directed downward; subapical dorsal margin, expanded with large lobe; apex not greatly expanded (shorter than subapical lobe), strongly curved, with flattened distal edge; toothlike spines present intermittently spaced on subapical lobe and in two rows on inner and outer margin along apex; light-brown, short, bristlelike setae on apex (fig. 66C). **Phallotheca:** Dorsal opening small, drop shaped; closed medially; round distally, without pointed apex; basal margin of opening V-shaped; small subapical tumescence on ventral surface (fig. 66D). **Aedeagus:** Unknown.

Female: Subequal size to male, body length 3.34–3.42 mm, pronotal width 0.95–0.97 mm. GENITALIA: IRS posterior margin convex. Interramal lobes (fig. 74): mIRL entirely separated from laIRL; laIRL linear, uniform width, weakly curved inward distally, base spiniferous with small spiniferous lobe; mIRL half height of laIRL, subrectangular, distally round, and serrate.

Etymology: Named after Mt. Molloy, near the type locality, on the Atherton Tablelands in northeastern Queensland. Noun in apposition.

Host plant: Known from *Callitris intratropica* (table 2), a slight variant morphologically in this area near Mt. Molloy (Paul Gadek, personal commun.).

Holotype: **AUSTRALIA: Queensland:** 12.8 km NW of Mt. Molloy, on Hwy 81, 16.63719°S 145.23661°E, 401 m, 24 May 2006, Cassis, Barrow, Finlay, and Symonds, *Callitris intratropica*, det. RBG Sydney, 1♂ (AMNH_PBI 00005756) (QM).

Paratypes: **AUSTRALIA: Queensland:** 12.8 km NW of Mt. Molloy, on Hwy 81, 16.63719°S 145.23661°E, 401 m, 24 May 2006, Cassis, Barrow, Finlay, and Symonds, *Callitris intratropica*, det. RBG Sydney, 1♀ (AMNH_PBI 00005758) (AM), 1♀ (AMNH_PBI 00005757) (QM).

Other specimens examined: **AUSTRALIA: Queensland:** 12.8 km NW of Mt. Molloy, on Hwy 81, 16.63719°S 145.23661°E, 401 m, 24 May 2006, Cassis, Barrow, Finlay, and Symonds, *Callitris intratropica*, det. RBG Sydney, 1 juv. (AMNH_PBI 00005760) (AM), 1 juv. (AMNH_PBI 00005759) (QM).

Distribution: Known from one locality in northeastern Queensland on the Atherton Tablelands near Mt. Molloy (map 5).

Remarks: The aedeagus of the only male specimen of this species was not fully formed, and was not examined. However, differences found in the parameres, tergal processes, and phallotheca are sufficient to distinguish this species. *Erysivena molloy* is closely related to *E. majori, E. bundjalung*, and *E. mareeba*, and is differentiated by the blunt hook on the left paramere, and the greatly expanded subapical dorsal process on the right paramere, which is longer than the apex (in the other species the subbasal lobe is small and round and significantly shorter than the apex).

Erysivena molloy and *E. mareeba* are both found in the Atherton Tablelands and on *Callitris intratropica*. However, the population of *Callitris intratropica* near Mt. Molloy, which is the host of *E. molloy*, is significantly different morphologically and is geographically separated from the other *Callitris intratropica* populations in the Atherton tablelands (Paul Gadek, personal commun.). This may be indicative of incipient speciation in the host plant, and putatively tracked by these *Erysivena* species. Additional morphological differences between *E. mareeba* and *E. molloy* are the elongate right tergal process on the pygophore that is without a basal lobe, and a more sclerotized and serrate lobe on the phalloguide. The female genitalia of these two species also differ, with the interramal lobes in *E. molloy* slightly narrower and shorter laIRL, and a more elongate basal lobe on the laIRL, in comparison to *E. mareeba*, as well as a broader mIRL (cf. fig. 74).

***Erysivena notodytika*,** new species

Figures 4B–D, 14, 67, 74; map 5

Diagnosis: Defined by the following characters: midsized; head strongly expanded anteriorly; eyes medium; labium extending to metacoxae; cuneus tip with slight hint of red, forewing membrane veins red; pygophore with one left lateral tergal process, subovate with entire margin serrate; left paramere moderately expanded, with broad, angular sensory lobe, apophysis elongate with unhooked apex; right paramere C-shaped, medial flange broad, weakly expanded, strongly curved apex, entire margin serrate from apex to medial flange; phallotheca compressed far right of midline at apex; aedeagus with complex PES and DES1 spicules; PES with short, straplike basal process; DES2 unbranched, with three distinct basomedial spines on ventral surface; DES1 expanded basally, basal processes attached opposite, bifurcate in distal third with distal branches of equal length; female laIRL elongate, tapering distally, with small spiniferous basal lobe; mIRL two-thirds height of laIRL, strongly curved inward and pointed distally.

Description: *Male*: Midsize, elongate, total length 3.91–4.08 mm, pronotal width 1.08–1.16 mm. COLORATION: Dorsum yellow-green, faded; cuneus tip with very slight hint of red; forewing membrane light gray-brown with darker patches laterally and in major cell, membrane veins red with color extending slightly onto surrounding membrane (fig. 14). VESTITURE: Dorsum with moderately dense distribution of medium to dark brown simple setae. STRUCTURE: **Head:** Strongly expanded anteriorly; eyes midsize, extending slightly beyond anterolateral angle of pronotum; antennae with AI 0.9× vertex width, AII 1.1× pronotal width; labium medium length, extending to metacoxae. **Hemelytra:** Cuneus and major cell of membrane moderately elongate, major membrane vein round (fig. 14). GENITALIA: **Pygophore:** Dorsal margin of genital opening strongly concave; one left lateral tergal process, subrectangular with entire serrate margin (fig. 67A); far right lateral tergal lobe absent; ventral margin of genital opening straight with round cup-shaped phalloguide, sclerotized at base of right paramere articulation. **Left paramere:** Moderately expanded medially; sensory lobe broad, outer margin angular; apophysis greatly elongate, inner margin smooth; apex curved inward slightly, not hooked (fig. 67B). **Right paramere:** C-shaped, medial flange on dorsal margin as broad, weakly expanded edge; apex strongly curved; medial flange (distally) and apex serrate, without smooth subapical shaft, serrations continuous along margin to apex; outer lateral surface with simple setae (fig. 67C). **Phallotheca:** Dorsal opening large;

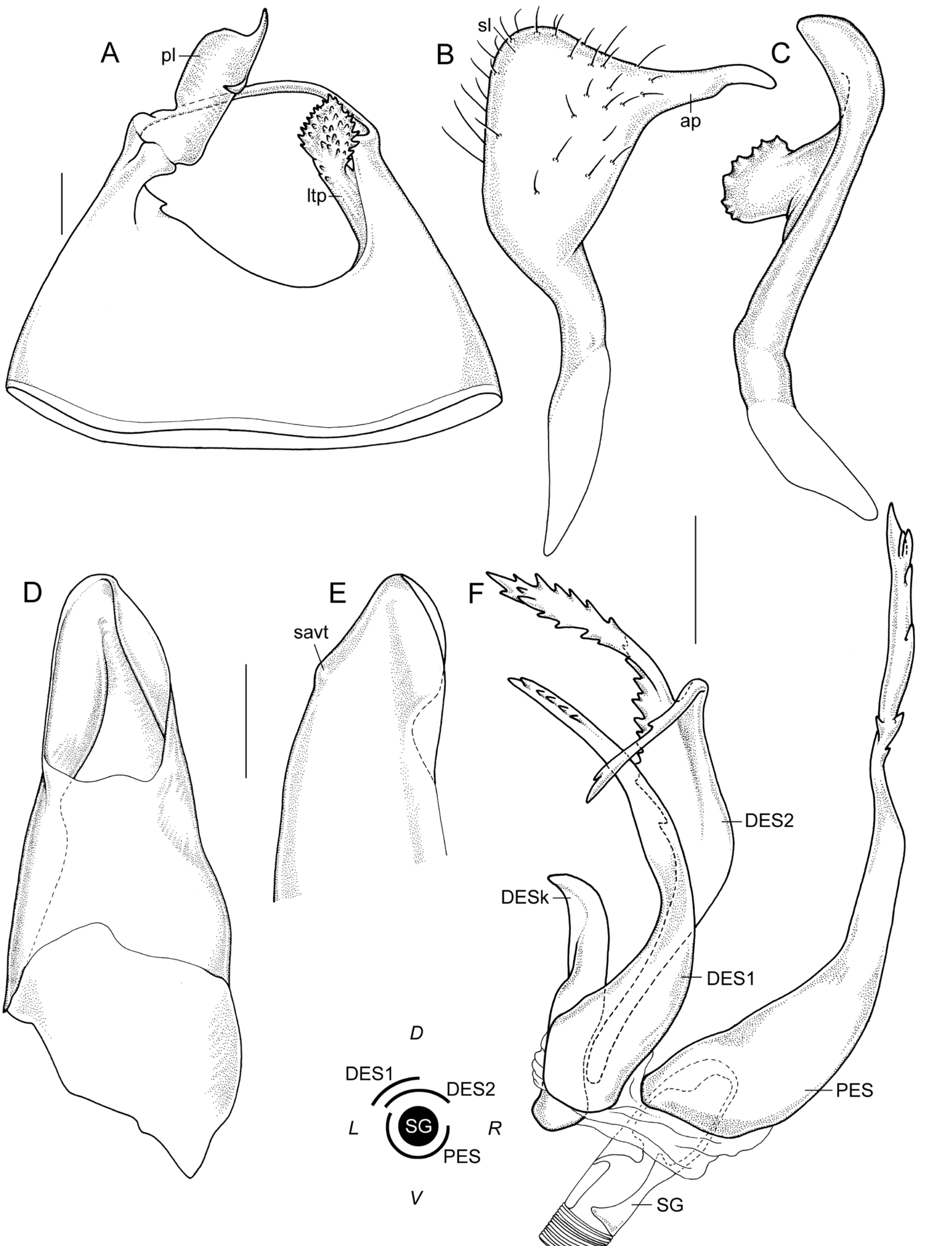


FIG. 68. Male genitalia of *Erysivena paluma.* **A.** Pygophore, dorsal. **B.** Left paramere, ventral. **C.** Right paramere, ventral. **D.** Phallotheca, dorsal. **E.** Phallotheca, right lateral. **E.** Aedeagus, left lateral. Scale bars = 0.1 mm.

round distally; compressed to far right of ventral midline; RHS dorsal margin without lobe (fig. 67D). **Aedeagus:** Spicule arrangement (fig. 67): PES left ventrolateral and almost entirely wrapped sheathlike around secondary gonopore, DES2 dorsal to secondary gonopore and PES, DES1 left dorsolateral to DES2, PES and DES2 joined by membrane sheath on right side of secondary gonopore, base of all spicules originating proximal to base of secondary gonopore; PES complex, acutely constricted above base, short, straplike subbasal process present, short basal process on base before constriction point present, processes subequal length; DES2 unbranched, weakly curved and twisted distally, medial threadlike process absent, three baso-medial spines present; DES1 complex, base expanded, basal processes attached opposite (i.e., next to each other at same height up spicule), bifurcates in distal third with branches narrow and equal length, basal keel (DESk) elongate (not illustrated) (fig. 67A).

Female: Very slightly shorter than male, body length 3.79–3.96 mm, pronotal width 1.08–1.20 mm. GENITALIA: IRS posterior margin medially convex. Interramal lobes (fig. 74): mIRL entirely separate from laIRL; laIRL curved inward and slightly tapered distally, base spiniferous, with small lobe; mIRL half height of laIRL, tapered and curved inward distally, distal half serrate.

Etymology: This species name reflects the distribution of the species in the southwestern corner of Western Australia, from the Greek *notos* ("south") and *dytikos* ("western").

Host Plants: Known from *Callitris preissii* (Perth) and *Callitris tuberculata* (Hellfire Bay) (table 2).

Holotype: **AUSTRALIA: Western Australia:** Mosman Park, Perth, trail b/w Minum Cove Park and Chidley Point Reserve, 32.01573°S 115.7626°E, 15 m, 01 Aug 2005–03 Aug 2005, G. Cassis, *Callitris preissii*, det. WA Herbarium PERTH 07620101, 1♂ (AMNH_PBI 00005477) (WAMP).

Paratypes: **AUSTRALIA: Western Australia:** Hellfire Bay, Cape Le Grande National Park, 34.00398°S 122.1696°E, 30 m, 24 Nov 1999, R.T. Schuh, G. Cassis, and R. Silveira, *Callitris tuberculata*, det. WA Herbarium PERTH 05670896, 10♂ (AMNH_PBI 00016411–00016419, 00016424), 12♀ (AMNH_PBI 00016425–00016436) (AM), 14♂ (AMNH_PBI 00000199, 00000201–00000204, 00000210–00000212, 00000214, 00000222, 00000226, 00000227, 00000228, 00000230,), 14♀ (AMNH_PBI 00000200, 00000205, 00000206, 00000209, 00000213, 00000215, 00000218, 00000219, 00000220, 00000221, 00000223–00000225, 00000229) (AMNH), 8♂ (AMNH_PBI 00000207, 00000208, 00000216, 00000217, 00016420–00016423), 8♀ (AMNH_PBI 00016437–00016444) (WAMP). Mosman Park, Perth, 32°S 115.75°E, 30 m, 05 Dec 2004, G. Cassis, *Callitris preissii*, 7♂ (AMNH_PBI 00016400-AMNH_PBI 00016406), 3♀ (AMNH_PBI 0001640700016420–00016423, 00016409) (AM). Mosman Park, Perth, trail b/w Minum Cove Park and Chidley Point Reserve, 32.01573°S 115.7626°E, 15 m, 01 Aug 2005–03 Aug 2005, G. Cassis, *Callitris preissii*, det. WA Herbarium PERTH 07620101, 3♂ (AMNH_PBI 00005479–00005481), 1♀ (AMNH_PBI 00005486) (AM), 1♂ (AMNH_PBI 00005483), 1♀ (AMNH_PBI 00005487) (UNSW), 1♂ (AMNH_PBI 00005478), 1♀ (AMNH_PBI 00005485) (WAMP).

Other specimens examined: **AUSTRALIA: Western Australia:** Hellfire Bay, Cape Le Grande National Park, 34.00398°S 122.1696°E, 30 m, 24 Nov 1999, R.T. Schuh, G. Cassis, and R. Silveira, *Callitris tuberculata*, det. WA Herbarium PERTH 05670896, 1♂ (AMNH_PBI 00016410), 5 juv. (AMNH_PBI 00016445–00016449) (AM).

Distribution: Known from two localities in coastal southwestern Western Australia, in Perth and Hellfire Bay, Cape Le Grande National Park (map 5), in the Southwest Botanical Zone. Collected with *Ngullamiris whadjuk* at Mosman Park, a suburb of Perth (table 2).

Remarks: *Erysivena notodytika* is most closely related to *E. drepanomorpha*, with which it shares two synapomorphic characters: the unique sickle shape of the left lateral tergal process on the dorsal margin of the pygophore and the complex shape of the DES1 spicule bifurcate and with two basal processes (figs. 67E, 53G).

Erysivena notodytika is readily distinguished from *E. drepanomorpha* by the following characters of the male and female genitalia (cf. figs. 67, 53, 74): more round and less angular shape of the left tergal process and the absence of a right lateral tergal lobe on the pygophore (fig. 67A); the left paramere with a slightly more angular sensory lobe, with the resting position inside the pygophore, and not extending over the ventral margin (fig. 67B); the right paramere serrated entirely from apex to the medial flange (fig. 67C); DES2 has a row of submedial spines (fig. 67E); DES1 is broad at the base and distally bifurcate (fig. 67E) (rather than medially bifurcate in *E. drepanomorpha*, fig. 53G); and the larger inwardly curving and apically pointed mIRL and presence of a small basal lobe on the laIRL. The laIRL is also more elongate and tapering distally (fig. 74).

***Erysivena paluma*, new species**

Figures 5E–F, 14, 68, 74; map 5

Diagnosis: Defined by the following characters: midsized; head strongly expanded anteriorly; large eyes; labium extending past metacoxae; basal inner third of cuneus and forewing membrane veins red; pygophore with one left lateral tergal process, reduced right lateral tergal lobe, elongate lobe on phalloguide ventrad to right paramere articulation, with two spines on dorsal and left lateral margin of lobe; left paramere strongly expanded, subtriangular, sensory lobe round, apophysis moderately elongate, apex not hooked; right paramere C-shaped, medial flange on inner dorsal margin round, with serrate margin, apex weakly curved and smooth; aedeagus with PES simple unbranched, distally sparsely serrate, DES2 bifurcate in distal third, expanded medially; DES1 simple, short, distally serrate only; female laIRL uniform width without spiniferous basal lobe; mIRL two-thirds height of laIRL, subrectangular.

Description: *Male*: Midsized, elongate-ovoid, body length 3.79–3.95 mm, pronotal width 0.99–1.12 mm. COLORATION: Dorsum bright yellow-green; cuneus tip and half of inner margin dark red, remainder pale green-yellow; forewing membrane dark gray-brown with slightly darker patches laterally and in major cell, membrane veins red with color confined to vein (fig. 14). VESTITURE: Dorsum with sparse distribution of pale to medium-brown simple setae. STRUCTURE: **Head:** Strongly expanded anteriorly; eyes large, extending well beyond anterolateral angle of pronotum; antennae with AI 1.3× vertex width, AII 1.3× vertex width; labium elongate, extending beyond metacoxae, over abdomen. **Hemelytra:** Cuneus and major cell moderately short, major membrane vein very slightly rounded (fig. 14). GENITALIA: **Pygophore:** Dorsal margin of genital opening strongly concave, asymmetrically; one sclerotized, elongate, distally serrate tergal process, positioned left lateral; apex of left tergal process expanded, leaf shaped, spinose; right tergal process absent; right lateral tergal lobe present, reduced, broad; ventral margin of genital opening sinuous, slightly concave on left side; phalloguide with elongate process ventrad to right paramere articulation, process flattened and curved, with two spines, on left margin, posteriorly and medially (fig. 68A). **Left paramere:** Strongly expanded medially, subtriangular shape; sensory lobe prominent expanded; apophysis moderately elongate, inner margin smooth; apex curved inward slightly, not hooked (fig. 68B). **Right paramere:** C-shaped; medial flange on inner dorsal margin directed inward, expanded and round in shape; apex short and weakly curved; medial flange with serrate margin, apex smooth; setae absent (fig. 68C). **Phallotheca:** Dorsal opening small and subovate; closed dorsal surface of translucent membrane; round distally; not compressed; slight subapical

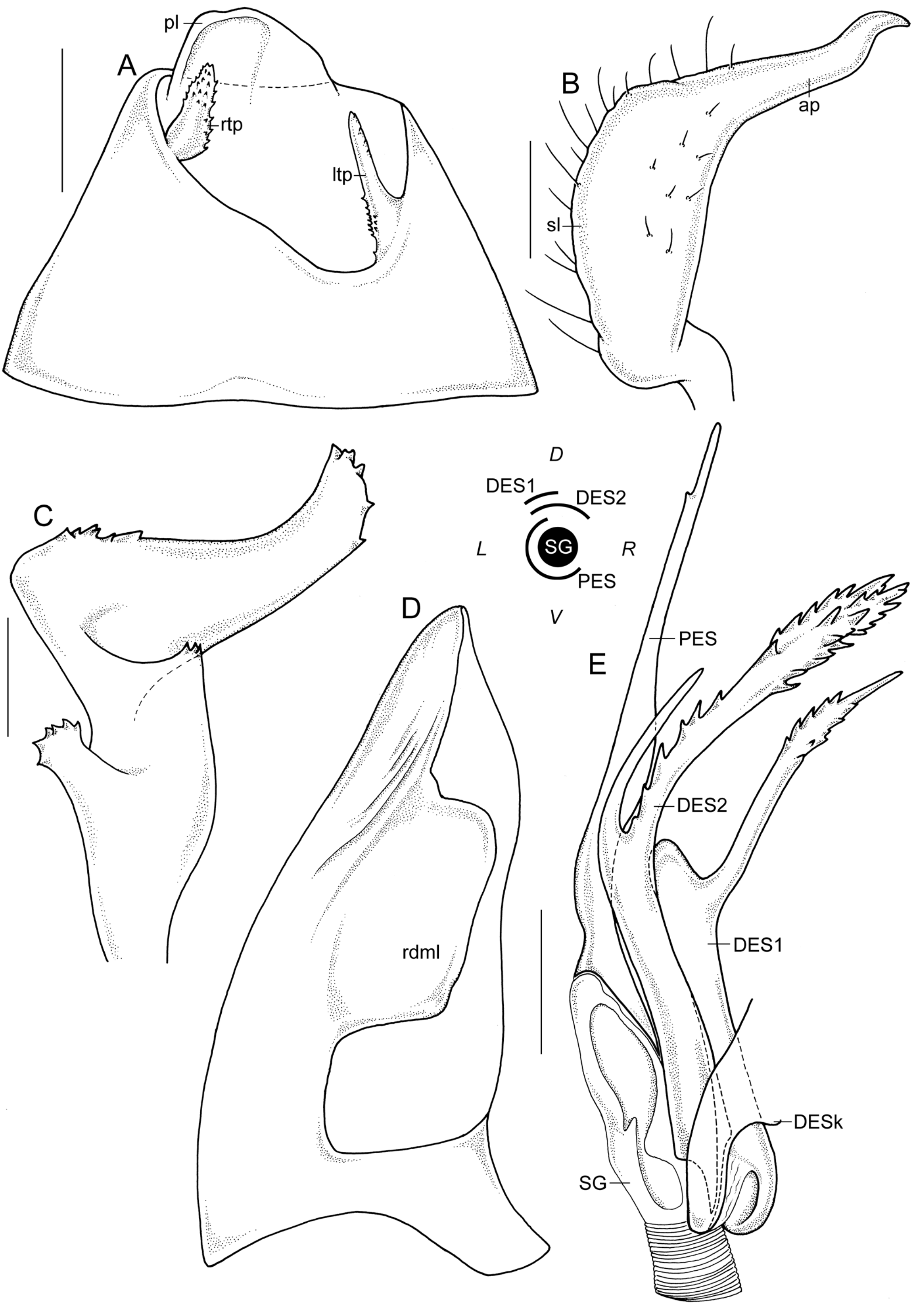


FIG. 69. Male genitalia of *Erysivena schuhi.* **A.** Pygophore, dorsal. **B.** Left paramere, ventral. **C.** Right paramere, left dorsolateral. **D.** Phallotheca, right lateral. **E.** Aedeagus, right lateral. Scale bars = 0.1 mm.

tumescence on ventral surface; lobes on dorsal margin absent (fig. 68D, E). **Aedeagus:** Spicule arrangement (fig. 68): PES left ventrolateral to and partially sheathing secondary gonopore, DES2 dorsal to secondary gonopore and PES, DES1 left lateral to DES2, base of PES originating distad to base of secondary gonopore, DES2 and DES1 originating proximal to base of secondary gonopore; PES simple, unbranched, apex acuminate, sparsely serrate in distal third; without medial process; DES2 bifurcate in distal third, branches subequal, left branch bent downward, medially serrate before bifurcation point on right margin; DES1 simple, unbranched, apex blunt and serrate, significantly shorter than PES and DES2 spicules, with basal keel (DESk) elongate, situated adjacent to DES2 (fig. 68F).

Female: Subequal in size to male, body length 3.73–4.01 mm, pronotal width 0.96–1.08 mm. GENITALIA: IRS posterior margin medially convex. Interramal lobes (fig. 74): laIRL curved inward slightly, uniform width, base spiniferous without lobe; mIRL two-thirds height of laIRL, subrectangular, serrations confined to margin mostly, with few small spines on distal surface.

Etymology: Named after the type locality near Paluma in northeastern Queensland. Noun in apposition.

Host plant: Known from *Callitris endlicheri* “Paluma,” an aberrant population with some morphological characteristics of *C. endlicheri*. It is only known from Paluma, where it grows along a small ephemeral watercourse, and is possibly a new species (Pye et al., 2003) (Paul Gadek, personal commun.).

Holotype: **AUSTRALIA: Queensland:** Hidden Valley, 20 km west of Paluma, 18.98853°S 146.0507°E, 756 m, 21 Apr 2005, C. Symonds, *Callitris endlicheri (*Paluma), det. Field ID (ref. Pye et al., 2003), 1♂ (AMNH_PBI 00005518) (QM).

Paratypes: **AUSTRALIA: Queensland:** 20.3 km W of Paluma, 18.98536°S 146.04188°E, 711 m, 20 May 2006, Cassis, Barrow, Finlay, and Symonds, *Callitris endlicheri* (Paluma), det. RBG Sydney (see Pye et al., 2003), 1♀ (AMNH_PBI 00005499), 2♂ (AMNH_PBI 00005500, 00005501) (AM), 2♂ (AMNH_PBI 00005502, 00005503) (QM). Hidden Valley, 20 km west of Paluma, 18.98853°S 146.0507°E, 756 m, 21 Apr 2005, C. Symonds, *endlicheri* (Paluma), det. Field ID (ref. Pye et al., 2003), 5♂ (AMNH_PBI 00005489, 00005490, AMNH_PBI 00005515–00005517), 7♀ (AMNH_PBI 00005492, 00005493, 00005495, 00005522–00005525) (AM), 4♂ (AMNH_PBI 00005491, 00005519–00005521), 5♀ (AMNH_PBI 00005494, 00005526–00005529) (QM).

Other specimens examined: **AUSTRALIA: Queensland:** 20.3 km W of Paluma, 18.98536°S 146.04188°E, 711 m, 20 May 2006, Cassis, Barrow, Finlay, and Symonds, *endlicheri* (Paluma), det. RBG Sydney (see Pye et al., 2003), 3 juv. (AMNH_PBI 00005496–00005498) (AM). Hidden Valley, 20 km west of Paluma, 18.98853°S 146.0507°E, 756 m, 21 Apr 2005, C. Symonds, *Callitris endlicheri* (Paluma), det. Field ID ref. Pye et al., 2003, 7 juv. (AMNH_PBI 00005488, 00005504–00005509) (AM), 5 juv. (AMNH_PBI 00005510–00005514) (QM).

Distribution: Known from one locality on the road to Hidden Valley, west of Paluma in the dry tropics of northeastern Queensland (map 5).

Remarks: *Erysivena paluma* is most closely related to *E. emeraldensis* on the basis of the distinct right paramere and the endosomal spicule configuration. In particular, the flattened medial flange on the inner dorsal margin and smooth apex of the right paramere, the similar endosomal spicule substructure, and the structure of the elongate phalloguide, which has marginal spines (figs. 68, 54). *Erysivena majori, E. bundjalung* and *E. mareeba* also have similar endosomal spicule configuration and structure. However, *E. emeraldensis* and *E. paluma* can be distinguished by the following characters: PES does not taper from base to apex (figs. 64C, 65C), but tapers to just above the midpoint and then widens again slightly with a broader serrate apex (fig. 68F, 54E); and DES1 is significantly shorter than PES and DES2 (figs. 68F, 54F), rather than subequal (figs. 64E, 65E). The elongate phalloguide and left and right paramere shapes are similar to the *E. schwartzi*, *E. endlicheriphila*, and *E. sydneyensis* clade (cf. figs. 68, 73). The endosomal spicule configuration and tergal processes on the pygophore are similar to the *E. majori, E. bundjalung*, and *E. mareeba* clade (cf. figs. 68 and 65).

Erysivena paluma is distinguished from E. *emeraldensis* by the lack of a right tergal process and the leaf-shaped left tergal process on the genital opening of the pygophore (cf. figs. 68A, 54A), the more subtriangular left paramere without a strongly hooked apex (cf. figs. 68B, 54B), and the more elongate apex on the right paramere (cf. figs. 68C, 54C). There are also subtle differences in body shape (fig. 14); *E. paluma* has shorter hemelytra, with the cuneus and major cell of the membrane shorter, the major vein slightly rounded and the membrane slightly truncate. Conversely, *E. emeraldensis* has more elongate hemelytra including the cuneus membrane and major cell, and a straight major vein that is parallel to the inner cuneal margin.

Erysivena schuhi, new species

Figures 14, 69, 74; map 5

Diagnosis: Defined by the following characters: midsized; head enlarged anteriorly; eyes large; labium extending to metacoxae; tip of cuneus and forewing membrane veins red; pygophore, dorsal margin strongly asymmetrically concave, with two tergal processes; left tergal process linear; far right tergal process linear, uniformly broad, without basal lobe; left paramere moderately expanded, with round, broad sensory lobe, apophysis elongate, unhooked apex, rests flexed back over ventral surface of pygophore; right paramere C-shaped, distinctive, with elongate smooth distal shaft, expanded medial flange, and small basal serrate process; aedeagus with PES complex, weakly constricted above broad base, without subbasal or medial process; DES2 unbranched with small medial process; DES1 unbranched, bent medially, with prominent medial lobe, distally serrate; female mIRL subquadrate, two-thirds height of laIRL.

Description: *Male*: Midsize, elongate, body length 3.68–4.12 mm, pronotal width 1.02–1.26 mm. COLORATION: Dorsum yellowish green, faded; cuneus tip red; forewing membrane light gray-brown with darker patches laterally and in major cell, membrane veins red with color bleeding onto surrounding membrane (fig. 14). VESTITURE: Dorsum with moderately dense distribution of light-brown simple setae. STRUCTURE: **Head:** Weakly expanded anteriorly; clypeus round in dorsal view; eyes large, extending well beyond anterolateral angle of pronotum; antennae with AI subequal to vertex width, AII 1.1× pronotal width; labium medium length, extending to metacoxae. **Hemelytra:** Cuneus and major cell of membrane moderately short, major membrane vein slightly round (fig. 14). GENITALIA: **Pygophore:** Dorsal margin of genital opening strongly asymmetrically concave, with two tergal processes; left lateral tergal process linear, elongate, margins serrate, curved downward distally; right lateral tergal process linear, margins serrate, broad at base, without basal lobe; ventral margin of genital opening slightly round (convex) with round cup-shaped phalloguide situated just inside and protruding over ventral margin; phalloguide with short, slightly sclerotized lobe ventrad to right paramere articulation, edge with very small serrations (not visible in illustration) (fig. 69A). **Left paramere:** Moderately expanded medially; sensory lobe broad, round; apophysis greatly elongate, inner margin smooth; apex curved inward slightly, apex not hooked (fig. 69B); left paramere flexed back over ventral surface of pygophore at rest. **Right paramere:** C-shaped, base of paramere with short serrate process; medial flange dorsal margin, expanded, subtriangular, directed inward; apex expanded, strongly curved round to medial flange, tip of apex curved outward; medial flange with few small toothlike serrations at point; apex and subapical outer margin serrate,

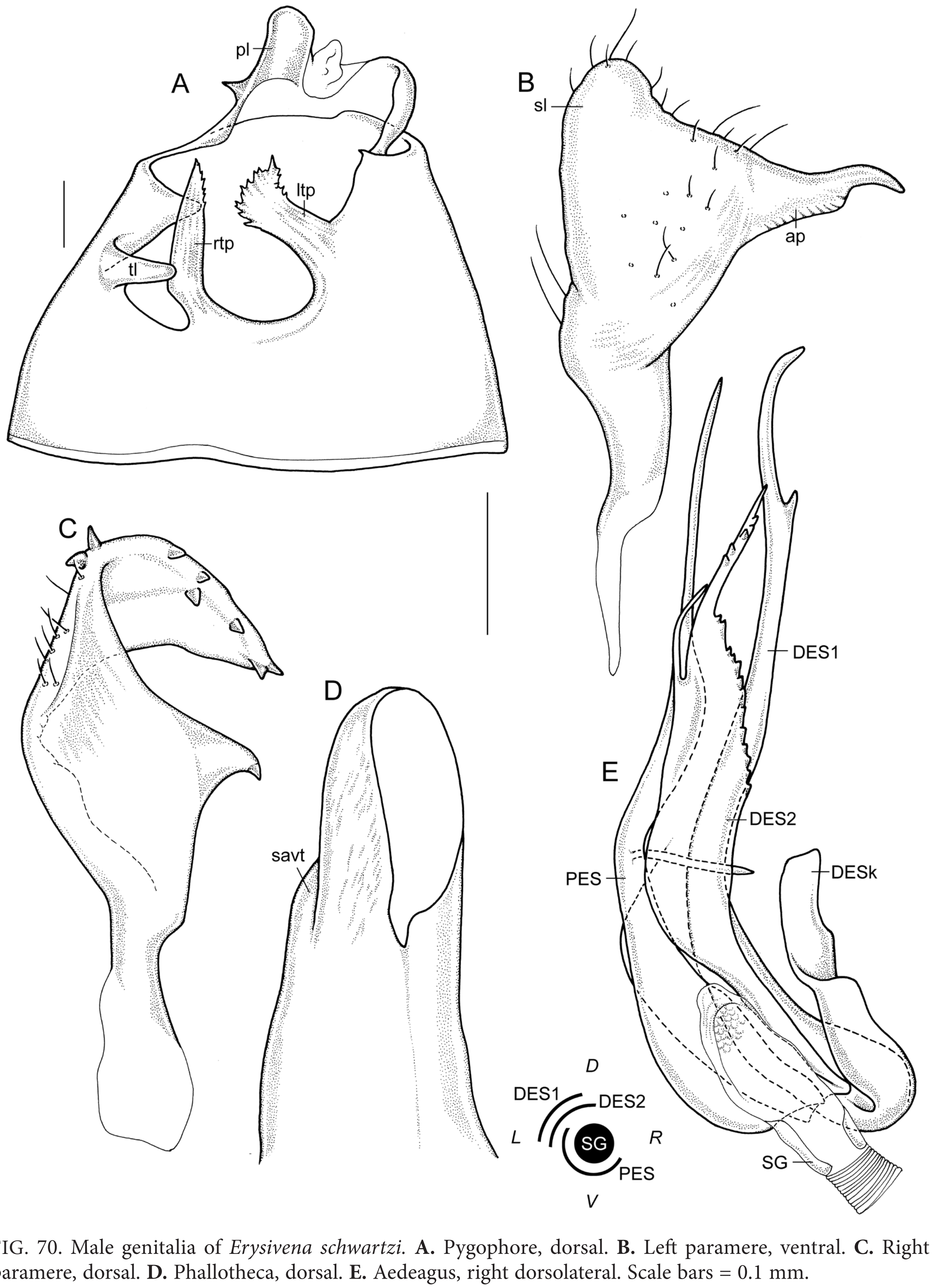


FIG. 70. Male genitalia of *Erysivena schwartzi*. **A.** Pygophore, dorsal. **B.** Left paramere, ventral. **C.** Right paramere, dorsal. **D.** Phallotheca, dorsal. **E.** Aedeagus, right dorsolateral. Scale bars = 0.1 mm.

with smooth apical shaft between (fig. 69C). **Phallotheca:** Dorsal opening large; apex round; ventral surface without lateral bicompression or tumescence; right dorsal margin with large lobe medially (fig. 69D). **Aedeagus:** Spicule arrangement (fig. 69): PES left lateral to slightly ventral of and partially sheathing secondary gonopore, DES2 dorsal to PES and secondary gonopore, DES1 dorsad of DES2, all originating proximal to base of secondary gonopore; PES complex, moderately narrow, weakly constricted above base, tapering to apex, few serrations present on distal margin; without subbasal straplike process; DES2 unbranched, medial threadlike process present; DES1 simple, unbranched, bent medially with large medial lobe, distally serrate, basal keel (DESk) elongate (fig. 69E).

Female: Subequal in size to male, body length 3.35–4.08 mm, pronotal width 1.06–1.13 mm. GENITALIA: IRS, posterior margin straight; mIRL entirely separated from laIRL; laIRL straight, very slightly curved inward at apex, base spiniferous but without lobe; mIRL two-thirds height of laIRL, subquadrate, distally serrate (fig. 74).

Etymology: Named in honor of Toby Schuh in recognition of his support for this project and immense contribution to the discovery and documentation of Australian Miridae.

Host plants: Known from *Callitris glaucophylla* in New South Wales and *Callitris verrucosa* and an unidentified *Callitris* species in South Australia (table 2).

Holotype: **AUSTRALIA: New South Wales:** Murda State Forest, 33.015°S 147.201°E, 24 Sep 1997, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 1♂ (UNSW_ENT 00041623) (AM).

Paratypes: **AUSTRALIA: New South Wales:** Euglo Dam, 33.415°S 147.135°E, 18 Sep 1997, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 2♂ (UNSW_ENT 00041667, UNSW_ENT 00041668) (AM); 17 Sep 1997, G. Cassis, *Callitris glaucophylla*, 1♀ (UNSW_ENT 00041769) (AM). Murda State Forest, 33.0175°S 147.26611°E, Sep 1997, F. Christie, *Callitris glaucophylla*, 5♂ (UNSW_ENT 00041715–UNSW_ENT 00041719), 1♀ (UNSW_ENT 00041726) (AM). Murda State Forest, 33.015°S 147.201°E, 24 Sep 1997, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 4♂ (UNSW_ENT 00041624–UNSW_ENT 00041627), 3♀ (UNSW_ENT 00041628–UNSW_ENT 00041630) (AM). Murda State Forest, Parkes-Condoblin, 33.015°S 147.201°E, 25 Sep 1997, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 16♂ (UNSW_ENT 00041637–UNSW_ENT 00041648, UNSW_ENT 00041708, UNSW_ENT 00041740–UNSW_ENT 00041742), 1 adult (sex unknown) (UNSW_ENT 00041649), 9♀ (UNSW_ENT 00041661–UNSW_ENT 00041666, UNSW_ENT 00041743–UNSW_ENT 00041745) (AM), 2♂ (UNSW_ENT 00041631, UNSW_ENT 00041632), 2♀ (UNSW_ENT 00041657, UNSW_ENT 00041658) (AMNH), 2♂ (UNSW_ENT 00041635, UNSW_ENT 00041636) (SAMA), 2♂ (UNSW_ENT 00041633, UNSW_ENT 00041634), 2♀ (UNSW_ENT 00041659, UNSW_ENT 00041660) (UNSW). Roadside remnant near Condobolin Tip, 33.07505°S 147.14466°E, 25 Sep 1997, Australian Museum, *Callitris glaucophylla*, 4♂ (UNSW_ENT 00041682, UNSW_ENT 00041683, UNSW_ENT 00041709, UNSW_ENT 00041712), 2♀ (UNSW_ENT 00041713, UNSW_ENT 00041714) (AM). Taratta State Forest, 32.8°S 147.03333°E, 25 Sep 1997, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 11♂ (UNSW_ENT 00041690–UNSW_ENT 00041699, UNSW_ENT 00041736) (AM). **South Australia:** Scorpion Springs Cons. Park, 35.62872°S 140.8598°E, 100 m, 09 Nov 1998, Schuh, Cassis, Silveira, *Callitris verrucosa*, det. RBG Sydney NSW427497, 2♀ (AMNH_PBI 00016558, 00016559) (AM). Scorpion Springs Cons. Park, 35.60421°S 140.8646°E, 125 m, 10 Nov 1998, Schuh, Cassis, Silveira, *Callitris verrucosa*, det. RBG Sydney NSW427497, 1♂ (AMNH_PBI 00016555) (AM), 2♀ (AMNH_PBI 00000190, 00000197) (AMNH), 2♀ (AMNH_PBI 00016556, 00016557) (SAMA). Road to Streaky Bay from Poochera, 32.73441°S 134.7605°E, 100 m, 21 Oct 1996, Schuh and Cassis, *Callitris* sp., det. Field ID, 1♀ (AMNH_PBI 00003929), 1♂ (AMNH_PBI 00000146) (AMNH).

Other specimens examined: **AUSTRALIA: New South Wales:** Murda State Forest, 33.015°S 147.201°E, 24 Sep 1997, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 10 juv. (UNSW_ENT 00041815–UNSW_ENT 00041824) (AM). Murda State Forest, Parkes-Condoblin, 33.015°S 147.201°E, 25 Sep 1997, AM Terr. Ecol. Dept., *Callitris glaucophylla*, 7 juv. (UNSW_ENT 00041650–UNSW_ENT 00041656) (AM).

Distribution: Known from nine localities in South Australia, Scorpion Springs Conservation Park and near Streaky Bay on the Eyre Peninsula from sandy shrublands and from the central western woodlands of New South Wales (map 5). Cooccurring with seven other species (table 2) in different parts of its range, most commonly with *Blattakeraia hochuli* in New South Wales, and recorded with three other *Erysivena* species, including the closely related *E. apta*.

Remarks: The right paramere of *E. schuhi* is very distinctive with a basal process and greatly elongate apex (fig. 69C), which is unique within *Erysivena*. *Erysivena schuhi* is closely related to *E. apta*, and can be distinguished by differences in the left paramere, right paramere, pygophore tergal processes, and DES1 and DES2 endosomal spicules (cf. figs. 69, 49). DES1 is simple, unbranched, and bent in both species, but in *E. schuhi* it is more downcurved at the apex and has a large medial swollen lobe (fig. 69E), whereas in *E. apta* DES1 is S-shaped and points upward at the apex (fig. 49F). DES2 has a medial process and broad serrate apex that is distally projected (fig. 69E), whereas in *E. apta*, DES2 lacks a medial process and is moderately tapered and down curved at the apex (fig. 49E). When collected with *E. apta*, males of *E. schuhi* can be easily distinguished by the linear, unbranched left tergal process of the genital opening (fig. 69A), the anteriorly flexed left paramere, and the greatly expanded right paramere (fig. 69C).

Females of *Erysivena schuhi* cannot be differentiated externally when collected with *E. apta*, as both species have the prominent red marking on the cuneus, the red from the hemelytral veins extending onto the surrounding membrane, and both have an elongate labium. The head shape of females of both species differs a little. As in the males, the females of *E. schuhi* have larger eyes and a shorter head anteriorly, compared to *E. apta*, whereas the females have reduced eye size compared to conspecific males.

Erysivena schuhi and *E. drepanomorpha* share a character that unique within the genus, namely the left paramere flexes back anteriorly over the ventral surface of the pygophore (e.g., fig. 52B). When collected with *E. drepanomorpha*, males and females of *E. schuhi* can be distinguished by the strong red cuneal tip and slight infusion of red from the veins onto the surrounding membrane (fig. 14). Males of these two species are readily separated by structures of the tergal processes and right parameres (cf. figs. 69 and 53).

When collected with *E. schwartzi*, which also has a red cuneal tip on the hemelytra, males of *E. schuhi* can be distinguished by the flexed left paramere and right paramere shape (cf. figs. 69C and 70C). The females of these two species are subtly differentiated by the smaller more subovate wing membrane vein and weak infusion of red from veins onto the membrane (fig. 14).

Erysivena schuhi also shares some characters with *E. kalbarri*. The left paramere and DES2 are similar to those of *E. kalbarri*. The medial process on DES2 in this species is still small but not as fine and short as that of *E. kalbarri* (fig. 59E).

***Erysivena schwartzi*, new species**

Figures 14, 70, 74; map 5

Diagnosis: Defined by the following characters: midsized; head strongly expanded anteriorly; eyes medium; labium extending to metacoxae; cuneus tip and forewing membrane veins red; pygophore with two tergal processes, far right lateral tergal lobe, elongate right lateral process on ventral phalloguide with right lateral spine; left paramere strongly expanded, subtriangular, apophysis moderately elongate, apex hooked; right paramere, C-shaped, expanded

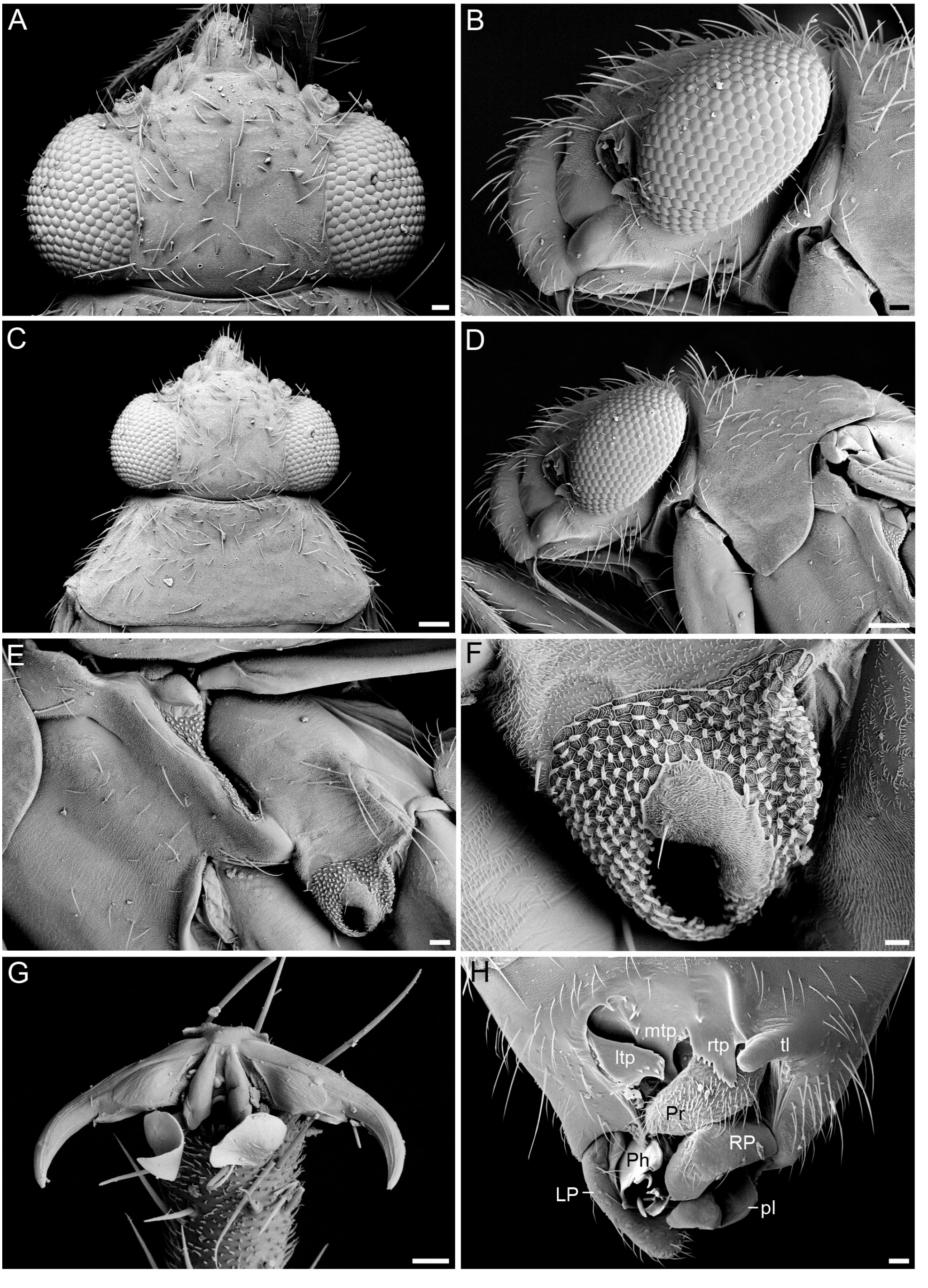


FIG. 71. External morphology of *Erysivena sydneyensis.* **A.** Head, dorsal, scale bar = 30 μm. **B.** Head, lateral, scale bar = 30 μm. **C.** Head and pronotum, dorsal, scale bar = 100 μm. **D.** Head, and pronotum, lateral, scale bar = 100 μm. **E.** Meso- and metathorax, scale bar = 30 μm. **F.** Metathoracic scent gland, scale bar = 10 μm. **G.** Tarsal claw, scale bar = 10 μm. **H.** Pygophore, dorsal, scale bar = 30 μm.

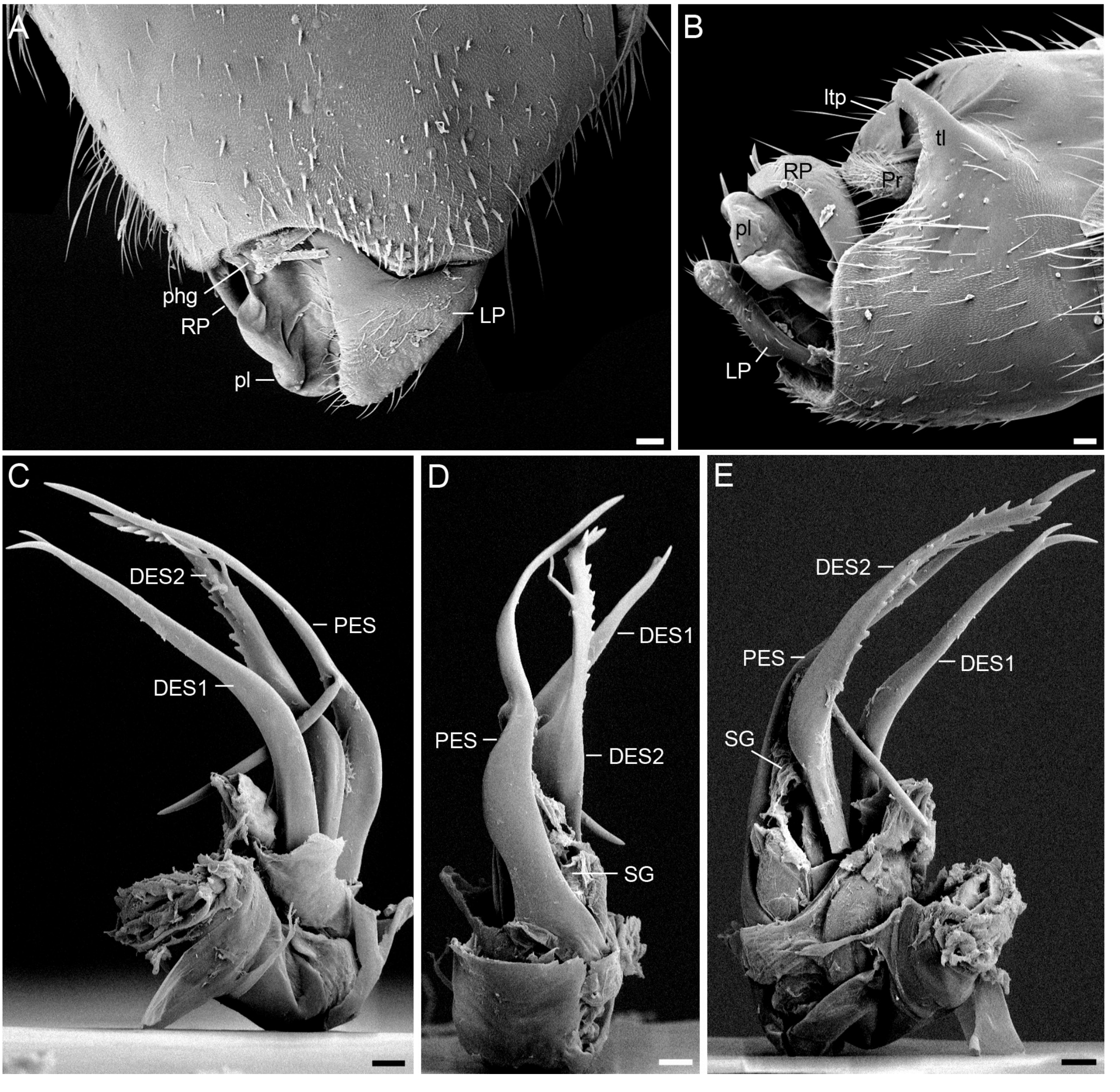


FIG. 72. Male genitalic morphology of *Erysivena sydneyensis*. **A.** Pygophore, ventral. **B.** Pygophore, right lateral. **C.** Aedeagus, left lateral. **D.** Aedeagus, ventral. **E.** Aedeagus, right dorsolateral. Scale bars = 30 μm.

medial flange on inner margin with one spine at tip, apex expanded, serrate, and strongly curved round to medial flange; aedeagus with PES simple, acuminate, with smooth margins and short medial process; DES2 unbranched, with subdistal threadlike process, expanded medially and acutely narrow apically; DES1 unbranched, margins smooth, bifurcate at apex forming C-shape where one branch is significantly longer and curved; female mIRL half height of laIRL, subrectangular, margin serrate; laIRL slightly curved inward at apex, with spiniferous base and small spiniferous basal lobe.

Description: *Male*: Midsize, elongate, body length 3.54–3.84 mm, pronotal width 0.95–1.02 mm. COLORATION: Dorsum yellowish green, faded; cuneus tip red; forewing membrane gray-brown with darker patches laterally and in major cell, veins orange-red with color confined to veins, subcuneal clear spot not enlarged (fig. 14). VES-

TITURE: Dorsum with sparse distribution of pale simple setae. STRUCTURE: **Head:** Strongly expanded anteriorly; eyes midsize, extending slightly beyond anterolateral angle of pronotum; antennae with AI subequal to vertex width, AII 1.2× pronotal width; labium midlength, extending to metacoxae. **Hemelytra:** Cuneus and major cell of membrane moderately elongate, major membrane vein straight (fig. 14). GENITALIA: **Pygophore:** Dorsal margin of genital opening strongly concave; two sclerotized, elongate tergal processes, positioned left lateral and right lateral; left tergal process slightly curved downward, apex weakly expanded and serrate only distally, uniform width (not narrowing apically); right tergal process with apex pointed and distally serrate; far right lateral tergal lobe present, elongate, weakly narrowing distally, apex round, directed inward; ventral margin of genital opening convex on left side; phalloguide with elongate process ventrad to right paramere articulation, apex bulbous, one sclerotized spine on right lateral margin of process (fig. 70A). **Left paramere:** Strongly expanded medially, subtriangular; sensory lobe prominent, expanded, margin indented on distal side so lobe appears swollen; apophysis moderately elongate, inner margin smooth; apex hooked (fig. 70B). **Right paramere:** C-shaped; medial flange on inner dorsal margin directed downward, expanded, and subtriangular; subapical dorsal margin with two large spines; apex, expanded, strongly curved; tip of medial flange with large spine, and margin of apex with two rows of large spines (fig. 70C). **Phallotheca:** Dorsal opening small, subovate; closed medially; round distally; without lobe on basal margin of dorsal opening; weak lateral bicompression subapically on ventral surface (fig. 70D). **Aedeagus:** Spicule arrangement (fig. 70): PES left ventrolateral to and partially sheathing secondary gonopore, DES2 left dorsolateral to secondary gonopore, DES1 left lateral to DES2, base of all spicules originate in line with base of secondary gonopore; PES simple (unbranched), with short medial process directed perpendicular to spicule, distally acuminate, margins smooth; DES2 unbranched, with subdistal threadlike process, expanded medially, apex very narrow and threadlike; DES1 simple, unbranched, margins smooth, straight, not expanded medially, unevenly bisected with one part significantly longer and curved, basal keel (DESk) elongate (fig. 70E).

Female: Slightly shorter than males on average, body length 3.23–3.67 mm, pronotal width 0.93–1.02 mm. GENITALIA: IRS posterior margin medially strongly convex. Interramal lobes (fig. 74): mIRL entirely separated from laIRL; laIRL uniform width, curved inward at apex, base spiniferous with small spiniferous lobe; mIRL half height of laIRL, subrectangular, margins serrate.

Etymology: Named in honor of Michael Schwartz for his significant contribution in the collecting and taxonomy of Australian Miridae, and in recognition of his authority on the Orthotylini worldwide.

Host plants: Known from *Callitris glaucophylla and C. gracilis* in Victoria, and unidentified *Callitris* species at two localities in South Australia (table 2).

Holotype: **AUSTRALIA: Victoria:** Wyperfeld National Park, Moonah Track, 35.46302°S 142.0464°E, 65 m, 04 Nov 2002, Cassis, Schuh, Schwartz, Silveira, *Callitris gracilis*, det. RBG Sydney NSW658101, 1♂ (AMNH_PBI 00005297) (MVMA).

Paratypes: **AUSTRALIA: South Australia:** 7 km E Para Wirra National Park near Williamstown, 34.70001°S 138.85°E, 250 m, 31 Oct 1995, Schuh, Cassis, and Gross, *Callitris* sp., det. Field ID, 5♂ (AMNH_PBI 00000241–00000244, 00000246), 1♀ (AMNH_PBI 00000247) (AMNH), 6♂ (AMNH_PBI 00000239, 00000240, 00000245, 00000248–00000250) (SAMA). 11 km W of Gawler, 34.60001°S 138.6167°E, 100 m, 31 Oct 1995, Schuh, Cassis, and Gross, *Callitris glaucophylla or gracilis*, det. K.D. Hill 1996 NSW 395960, 2♂ (AMNH_PBI 00000233, 00000235), 2♀ (AMNH_PBI 00000236, 00000238) (AMNH), 1♂ (AMNH_PBI 00000234), 1♀ (AMNH_PBI 00000237) (SAMA). Road to Streaky Bay from Poochera, 32.73441°S 134.7605°E, 100 m, 21 Oct

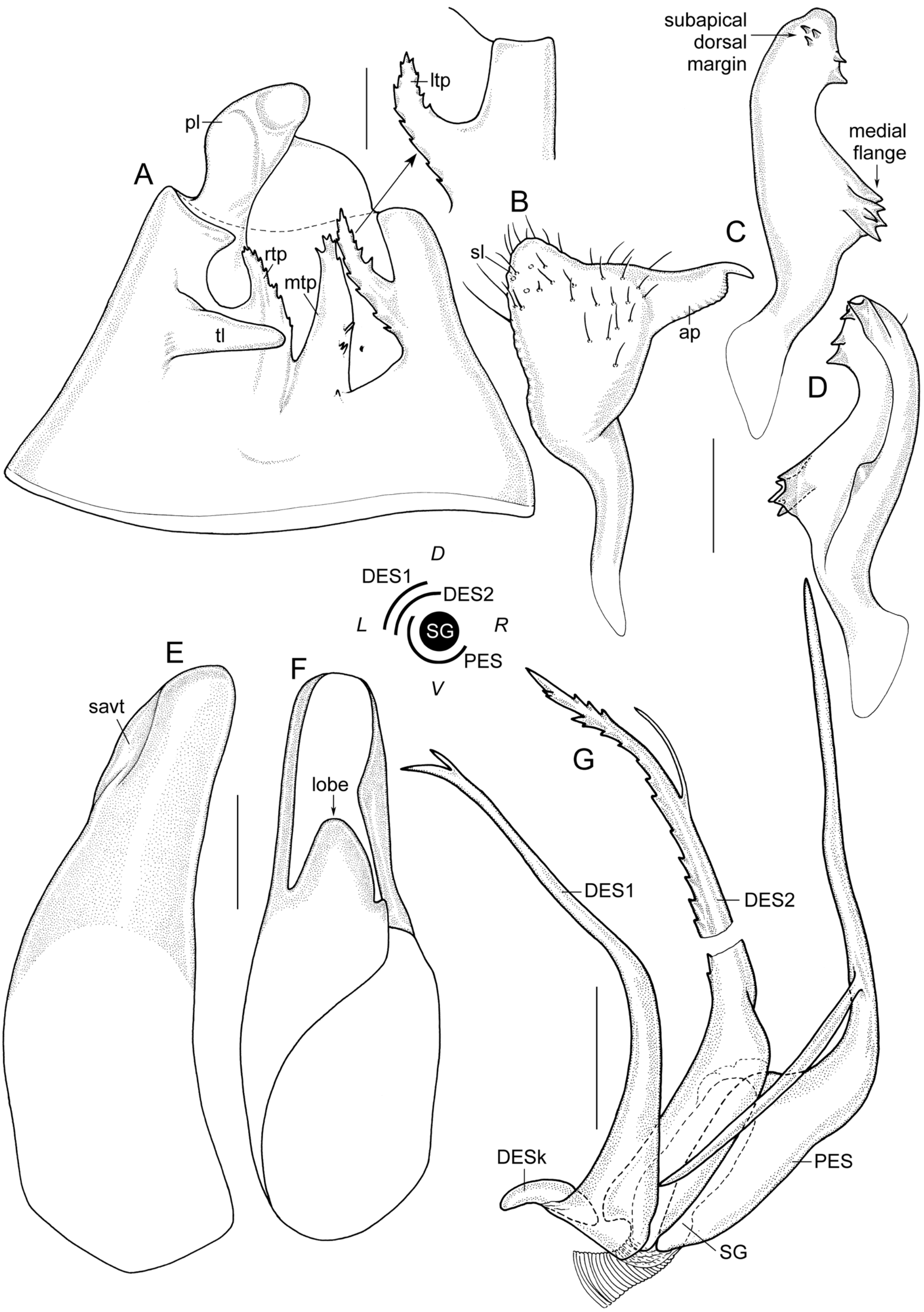


FIG. 73. Male genitalia of *Erysivena sydneyensis.* **A.** Pygophore, dorsal with left lateral detail. **B.** Left paramere, ventral. **C.** Right paramere, right dorsolateral. **D.** Right paramere, ventral. **E.** Phallotheca, ventral. **F.** Phallotheca, dorsal. **G.** Aedeagus, left lateral. Scale bars = 0.1 mm.

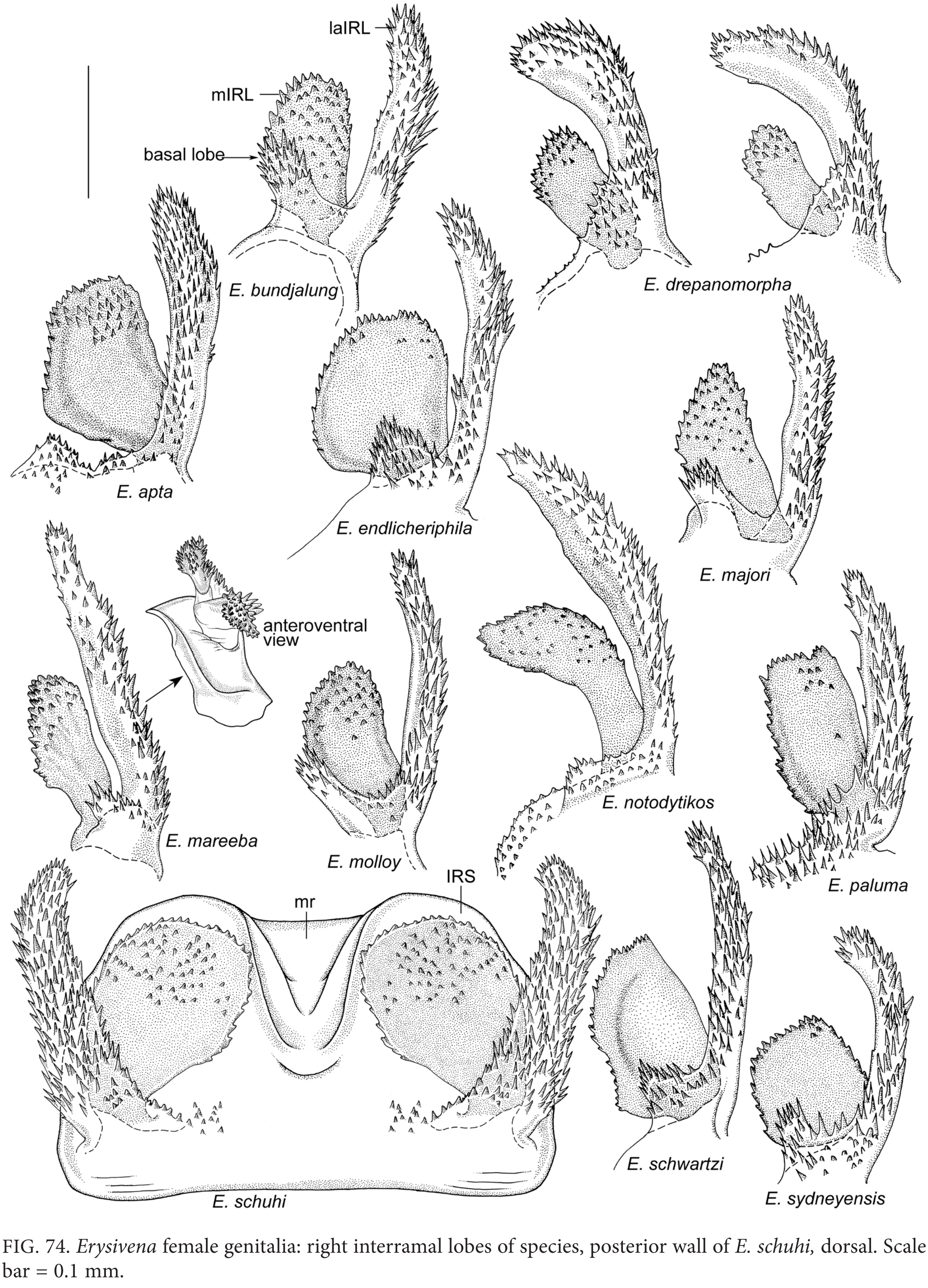


FIG. 74. *Erysivena* female genitalia: right interramal lobes of species, posterior wall of *E. schuhi,* dorsal. Scale bar = 0.1 mm.

1996, Schuh and Cassis, *Callitris* sp., det. Field ID, 1♂ (AMNH_PBI 00003926), 2♀ (AMNH_PBI 00003927, 00003928) *Callitris roei*, det. WA Herbarium PERTH 05095212, 1♂ (AMNH_PBI 00000151) (AMNH), *Callitris roei*, det. Field ID, 2♂ (AMNH_PBI 00003924, 00003925), 1♀ (AMNH_PBI 00000149) (SAMA). **Victoria:** Wemen, SSW of Robinvale, bank of Murray River, 34.78361°S 142.63550 °E, 65 m, 03 Nov 2002, Cassis, Schuh, Schwartz, Silveira, *Callitris glaucophylla*, det. RBG Sydney NSW658084, 2♂ (AMNH_PBI 00003955, 00003957), 6♀ (AMNH_PBI 00003958–00003963) (AMNH), 1♂ (AMNH_PBI 00003956), 2♀ (AMNH_PBI 00003964, 00003965) (MVMA). Wyperfeld National Park, Moonah Track, 35.46302°S 142.0464°E, 65 m, 04 Nov 2002, Cassis, Schuh, Schwartz, Silveira, *Callitris gracilis*, det. RBG Sydney NSW658101, 10♀ (AMNH_PBI 00005324–00005326, 00005328–00005333, 00016563), 17♂ (AMNH_PBI 00005300, 00005301, 00005303–00005315, 00005317, 00005318) (AM), 7♂ (AMNH_PBI 00003943–00003949), 1♀ (AMNH_PBI 00003951) (AMNH), 6♂ (AMNH_PBI 00003950, 00005295, 00005296, 00005298, 00005299, 00005302), 6♀ (AMNH_PBI 00003952, 00005319–00005323) (MVMA), 1♂ (AMNH_PBI 00005316), 1♀ (AMNH_PBI 00005327) (UNSW).

Other specimens examined: **AUSTRALIA: South Australia:** Road to Streaky Bay from Poochera, 32.73441°S 134.7605°E, 100 m, 21 Oct 1996, Schuh and Cassis, *Callitris* sp., det. Field ID, 1 juv. (AMNH_PBI 00003930) (AMNH).

Distribution: Known from four localities in southeastern Australia, from western Victoria to the Eyre Peninsula (map 5). Cooccurring with two *Callitricola* and two other *Erysivena* species (table 2).

Remarks: *Erysivena schwartzi* is closely related to *E. endlicheriphila* (fig. 56) and *E. sydneyensis* (fig. 73) but can be differentiated by the following characters: pygophore having only two dorsal tergal processes and ventral phalloguide with a small spine on the margin of the elongate process, ventrad to the right paramere articulation point (fig. 70A); the expanded and more mitten-shaped right paramere (fig. 70C); and the endosomal spicules with an expanded DES2 and unevenly bisected apex on DES1 (rather than the even fork shape of the other two species) (fig. 70E).

Where *E. schwartzi* is collected with *E. drepanomorpha* and *E. schuhi*, it is distinguished most easily (in males) by the left paramere situated along the pygophore ventral margin rather than flexed anteriorly as in these other two species. Females of *E. schwartzi* can be distinguished from those of *E. drepanomorpha* by a red cuneal tip. Females of *E. schwartzi* and *E. schuhi* are more subtly differentiated as both species have a red cuneal tip, however the hemelytral membrane veins are slightly more elongate and the red coloration is confined to the vein only in *E. schwartzi*. (cf. slightly rounded wing membrane veins and weak red infusion onto membrane in *E. schuhi*).

***Erysivena sydneyensis*, new species**

Figures 4A, 5A–B, 14, 71–74; map 5

Diagnosis: Defined by the following characters: midsized; head strongly expanded anteriorly; eyes large; labium extending to metacoxae; cuneus tip and forewing membrane veins red; pygophore with three tergal processes, far right lateral tergal lobe, elongate phalloguide; tergal processes subequal in length; left paramere strongly expanded, subtriangular, sensory lobe prominent, apophysis moderately elongate, apex hooked; right paramere C-shaped, expanded medial flange in inner margin with spiniferous tip, apex weakly curved, serrate; aedeagus with PES simple, unbranched, acuminate, with smooth margins and elongate medial process; DES2 unbranched, possessing subapical threadlike process on outer margin; DES1 unbranched, margins smooth, bifurcate at apex forming small fork; female mIRL half height of laIRL, subquadrate, margin serrate; laIRL slightly curved inward at apex and uniform width, with spiniferous base and small spiniferous basal lobe.

Description: *Male*: Midsized, elongate, body length 3.51–4.19 mm, pronotal width 0.88–1.08 mm. COLORATION: Dorsum yellowish green, faded; cuneus tip red; forewing membrane light gray-brown with darker patches laterally and in major cell, veins orange-red with color confined to vein, subcuneal clear spot not enlarged (fig. 14). VESTITURE: Dorsum with moderately dense distribution of light to dark simple setae. STRUCTURE: **Head:** Strongly expanded anteriorly; eyes large, extending well beyond anterolateral angle of pronotum, but only moderately exerted beyond outline of head (fig. 71A–D); antennae with AI subequal to vertex width, AII 1.3× pronotal width; labium medium length, extending to metacoxae. **Hemelytra:** Cuneus and major cell of forewing membrane elongate; major membrane vein straight (fig. 14). GENITALIA: **Pygophore:** Dorsal margin of genital opening strongly concave, asymmetrically, three sclerotized, linear, elongate, tergal processes, positioned left lateral, right lateral and right medial (figs. 71H, 73A); tergal processes subequal in length; left tergal process slightly curved downward, apex pointed, margins serrate (fig. 73A); right and right medial tergal processes adjoined at base, margins serrate (figs. 71H, 73A); far right lateral tergal lobe present, elongate, weakly narrowing distally, apex round, directed inward (figs. 71H, 72B, 73A); ventral margin of genital opening convex on left side (fig. 72A); phalloguide with elongate sclerotized process ventrad to right paramere articulation, apex bulbous, without any spines on margin of process (figs. 71H, 72A, B, 73A). **Left paramere:** Strongly expanded medially, subtriangular; sensory lobe prominent, expanded, margins straight, so lobe does not appear swollen; apophysis moderately elongate, inner margin with serrate edge; apex hooked (figs. 71H, 72A, 73B). **Right paramere:** C-shaped; medial flange on inner margin directed downward, expanded and constricted to point; subapical dorsal margin with few small spines; apex short and weakly curved; tip of medial flange and margin of apex with large spines (figs. 71H, 72B, 73C, D). **Phallotheca:** Dorsal opening small (fig. 71H), subovate, closed medially, round distally, lobe present on basal margin of dorsal opening (fig. 73F); weak lateral bicompression subapically on ventral surface, but not flattened, small subapical ventral tumescence (figs. 72B, 73E). **Aedeagus:** Spicule arrangement (fig. 73): PES left ventrolateral to and partially sheathing secondary gonopore (figs. 72, E), DES2 left dorsolateral to secondary gonopore (fig. 72E), DES1 left lateral to DES2 (fig. 72C), base of all spicules originate proximal with base of secondary gonopore (fig. 73G); PES simple, unbranched, with elongate medial process, directed downward, distally acuminate, margins smooth (figs. 72C, 73G); DES2 unbranched, with subdistal threadlike process (figs. 72D, 73G); DES1 simple, unbranched, margins smooth, straight, not expanded medially, apex bisected evenly and shallow; basal keel (DESk) moderately elongate (figs. 72C–E, 73G).

Female: Slightly shorter on average than male, body length 3.13–4.01 mm, pronotal width 0.85–1.05 mm. GENITALIA: IRS posterior margin medially convex. Interramal lobes (fig. 74): mIRL entirely separated from laIRL; laIRL uniform width, curved inward distally, base spiniferous with small spiniferous lobe; mIRL half height of laIRL, subquadrate, serrations confined to margin.

Etymology: Named after the city of Sydney, Australia, as it is the only callitroid-inhabiting Orthotylini species collected within the Sydney region (to date). Also, one of only two species known from *Callitris rhomboidea*, the Port Jackson pine, which is the only *Callitris* species commonly found in the Sydney region.

Host plants: Known from *Callitris rhomboidea* predominantly, *Callitris endlicheri* at two localities in inland New South Wales and *Callitris baileyi* for one population at Tabulum (table 2). Interestingly, where this species was collected from two sites in Wollemi National Park, *Callitris rhomboidea* grows alongside *Callitris endlicheri*. However, juvenile bugs and the majority of adults were collected only from *Callitris rhomboidea*, with a few adults found on *Callitris endli-*

cheri. This species was found in high densities on the *Callitris rhomboidea* (adults and juveniles) in Wollemi National Park. *Callitris rhomboidea* occurs in open forest and on exposed sandstone ridgetops in eastern New South Wales and occurs across southeastern Australia. *Callitris baileyi* is found in open forest on dry inland ranges of northeastern New South Wales and southeastern Queensland and is rare and listed as endangered in New South Wales (Hill, 1998).

Holotype: **AUSTRALIA: New South Wales:** Woronora Dam Picnic Area, 34.11613°S 150.9347°E, 211 m, 21 Dec 2004, C. Symonds, R. Silveira, M. Elliott, *Callitris rhomboidea*, det. Field ID, 1♂ (AMNH_PBI 00005389) (AM).

Paratypes: **AUSTRALIA: New South Wales:** 6 km NW of Hat Head, near Kempsey, 31.08334°S 153.05°E, 5 m, 22 Oct 1995, Schuh and Cassis, *Callitris rhomboidea*, det. K.D. Hill 1996 NSW 395915, 27♂ (AMNH_PBI 00000003, 00000006, 00000008, 00000014, 00000016, 00000017, 00000025, 00000030, 00000035, 00000038, 00000040, 00000041, 00000042, 00000045, 00000047, 00000050, 00000055, 00000057, 00000059, 00000063, 00000066, 00000073, 00000077–00000079, 00000080, 00000083), 57♀ (AMNH_PBI 00000001, 00000002, 00000004, 00000005, 00000007, 00000009–00000013, 00000015, 00000018–00000024, 00000026–00000029, 00000031–00000034, 00000036, 00000037, 00000043, 00000044, 00000046, 00000048, 00000049, 00000051–00000054, 00000056, 00000058, 00000060–00000062, 00000064, 00000065, 00000067–00000072, 00000074–00000076, 00000081, 00000082, 00000084, 00000085) (AMNH). 12 km E of Tabulam, 1 km N of Bruxner Hwy, W of Culmaran Ck Rd, 28.90217°S 152.6938°E, 183 m, 19 Jan 2005, C. Symonds, N. Tatarnic, *Callitris baileyi*, det. Field ID, 25♂ (AMNH_PBI 00005407–00005431), 8♀ (AMNH_PBI 00005432–00005439) (AM). Crescent Head, Loftus Rd, 31.17238°S 152.9684°E, 26 m, 18 Jan 2005, C. Symonds, N. Tatarnic, *Callitris rhomboidea*, det. Field ID, 24♂ (UNSW_ENT 00027461–UNSW_ENT 00027484), 17♀ (UNSW_ENT 00027485–UNSW_ENT 00027501) (AM). Dorrigo National Park, 0.7 km down track off Slingbys Rd, 30.32558°S 152.8002°E, 658 m, 20 Jan 2005, C. Symonds, N. Tatarnic, *Callitris rhomboidea*, det. Field ID, 1♂ (AMNH_PBI 00005343) (AM). Terrey Hills, McCarrs Ck Rd, 0.5 km N of Mona Vale Rd, 33.68343°S 151.2302°E, 217 m, 15 Mar 2005, C. Symonds, N. Tatarnic, *Callitris rhomboidea*, det. Field ID, 1♂ (AMNH_PBI 00005349), 3♀ (AMNH_PBI 00005350–00005352) (AM). Wollemi National Park, Glowworm Tunnel Rd, 21 km N of Bungleboori Picnic Area, 33.26031°S 150.2181°E, 942 m, 05 Feb 2005, C. Symonds, *Callitris rhomboidea*, det. RBG Sydney, 14♂ (AMNH_PBI 00005353–00005363, 00005366–00005368), 11♀ (AMNH_PBI 00005369–00005378, 00005381) *Callitris endlicheri*, det. C. Symonds, 1♂ (AMNH_PBI 00005341), 1♀ (AMNH_PBI 00005342) *Callitris* sp., 2♀ (AMNH_PBI 00005337, 00005339) (AM), *Callitris rhomboidea*, det. RBG Sydney, 2♂ (AMNH_PBI 00005364, 00005365), 2♀ (AMNH_PBI 00005379, 00005380) (UNSW). Woronora Dam Picnic Area, 34.11613°S 150.9347°E, 211 m, 21 Dec 2004, C. Symonds, R. Silveira, M. Elliott, *Callitris rhomboidea*, det. Field ID, 10♂ (AMNH_PBI 00005382, 00005383, 00005390–00005397), 8♀ (AMNH_PBI 00005398–00005405) (AM).

Other specimens examined: **AUSTRALIA: New South Wales:** 12 km E of Tabulam, 1 km N of Bruxner Hwy, W of Culmaran Ck Rd, 28.90217°S 152.6938°E, 183 m, 19 Jan 2005, C. Symonds, N. Tatarnic, *Callitris baileyi*, det. Field ID, 1 juv. (AMNH_PBI 00005406) (AM). Apple Tree Flat / Riverlea, 1.2 km along Riverlea Rd off Castlereagh Hwy, near Mudgee, 32.68958°S 149.72303°E, 519 m, 24 Nov 2008, C. Symonds & R. Hazali, *Callitris endlicheri*, det. Field ID, 4♂ (AMNH_PBI 00005762–00005765), 4♀ (AMNH_PBI 00005766–00005769) (AM). Dorrigo National Park, 0.7 km down track off Slingbys Rd, 30.32558°S 152.8002°E, 658 m, 20 Jan 2005, C. Symonds, N. Tatarnic, *Callitris rhomboidea*, det. Field ID, 2 juv. (AMNH_PBI 00005344, 00005345) (AM). Woronora Dam Picnic Area, 34.11613°S 150.9347°E, 211 m, 21 Dec 2004, C.

Symonds, R. Silveira, M. Elliott, *Callitris rhomboidea*, det. Field ID, 5 juv. (AMNH_PBI 00005384–00005388) (AM).

Distribution: A widely distributed species in eastern New South Wales, predominantly from forests on the coast and ranges. Known from nine localities in eastern New South Wales, from the Sydney region, including the Blue Mountains (Woronora Dam, Terrey Hills, Wollemi National Park) to the northern coast (Hat Head and Crescent Head) and northern tablelands of New South Wales (Tabulum and Dorrigo) (map 5). Cooccurring with *C. wollemi* (table 2).

Remarks: *Erysivena sydneyensis* is most closely related to *E. endlicheriphila*, and the two share the following characters: three tergal processes on the dorsal margin of the pygophore; the enlarged right lateral process of the ventral phalloguide of the pygophore with smooth round margins lacking spines; general shape of the right paramere and its medial flange; an elongate medial process on the PES spicule; and an unbranched, narrow DES2 spicule. This species is distinguished from *E. endlicheriphila* by the following characters: medial and right pygophore dorsal processes equal length to the left lateral process (cf. figs. 73A, 56A); the small fork-shaped apex of the DES1 spicule (cf. figs. 73G, 56F); the presence of a subapical threadlike process on the DES2 spicule (cf. figs. 73G, 56F); and a weakly curved and unexpanded apex of the right paramere (cf. figs. 73C, 56C).

Some morphological variation was observed between populations of *E. sydneyensis*, but this is continuous and includes: the presence or absence of spines on the medial flange of the right paramere; the position of the middle tergal process; the left tergal process on the genital opening varying from having a blunt to pointed apex; and the length of the PES spicule.

Ngullamiris, new genus

Type species: *Ngullamiris whadjuk*, n. sp., by original designation.

Diagnosis: Defined by the following characters: moderately elongate body, moderately large eyes; male with relatively narrow pronotum; dorsum with moderately dense distribution of simple setae; forewing membrane without subcuneal clear spot, forewing membrane veins colored (fig. 12); genital segment and all components of male genitalia small in relation to rest of body, pygophore tapering posteriorly (fig. 77A); pygophore with strongly rounded convex ventral margin to genital opening and strongly rounded concave dorsal margin, lacking tergal processes (fig. 75H); phallotheca and aedeagus very small, situated cupped within pygophore opening and not extending beyond ventral margin of opening, within curved parameres at rest (figs. 75H, 76A, C, 77A); parameres situated along ventral margin of pygophore, cupping phallotheca and meeting medioventrally, extending only slightly beyond ventral pygophore margin (figs. 75H, 76B); ventral surface of pygophore with short spinelike setae (fig. 76B, D); left paramere modified L-shape, apophysis short (fig. 77B, C); right paramere club- or C-shaped (figs. 76A, 77D); phallotheca simple with sides retracted, membranous dorsal and apical margins (figs. 76C, 77E); aedeagus with three sclerotized endosomal spicules, dorsal to secondary gonopore (figs. 15, 77); proximal endosomal spicule (PES) left dorsolateral to secondary gonopore, unbranched, base broad, tapering to fine ribbonlike, downcurved apex, margins smooth (fig. 77F); second dorsal endosomal spicule (DES2) right dorsolateral to secondary gonopore, bifurcate, apex downcurved (fig. 77F); first dorsal endosomal spicule (DES1) dorsal to DES2, shorter than DES2 and PES (fig. 77F), with basal hook; female vestibulum membranous (fig. 78A); ventral labiate plate (VLP) with mesial surface sparsely spiniferous, without lateral lobes (fig. 78A); interramal sclerites (IRS) joined medially (fig. 78B).

Description: *Male*: Macropterous, body elongate, lateral margins parallel (fig. 12). COLORATION: Antennae monocolorous; wing membrane uniformly translucent brown, without subcuneal clear spot (fig. 12A). SURFACE AND

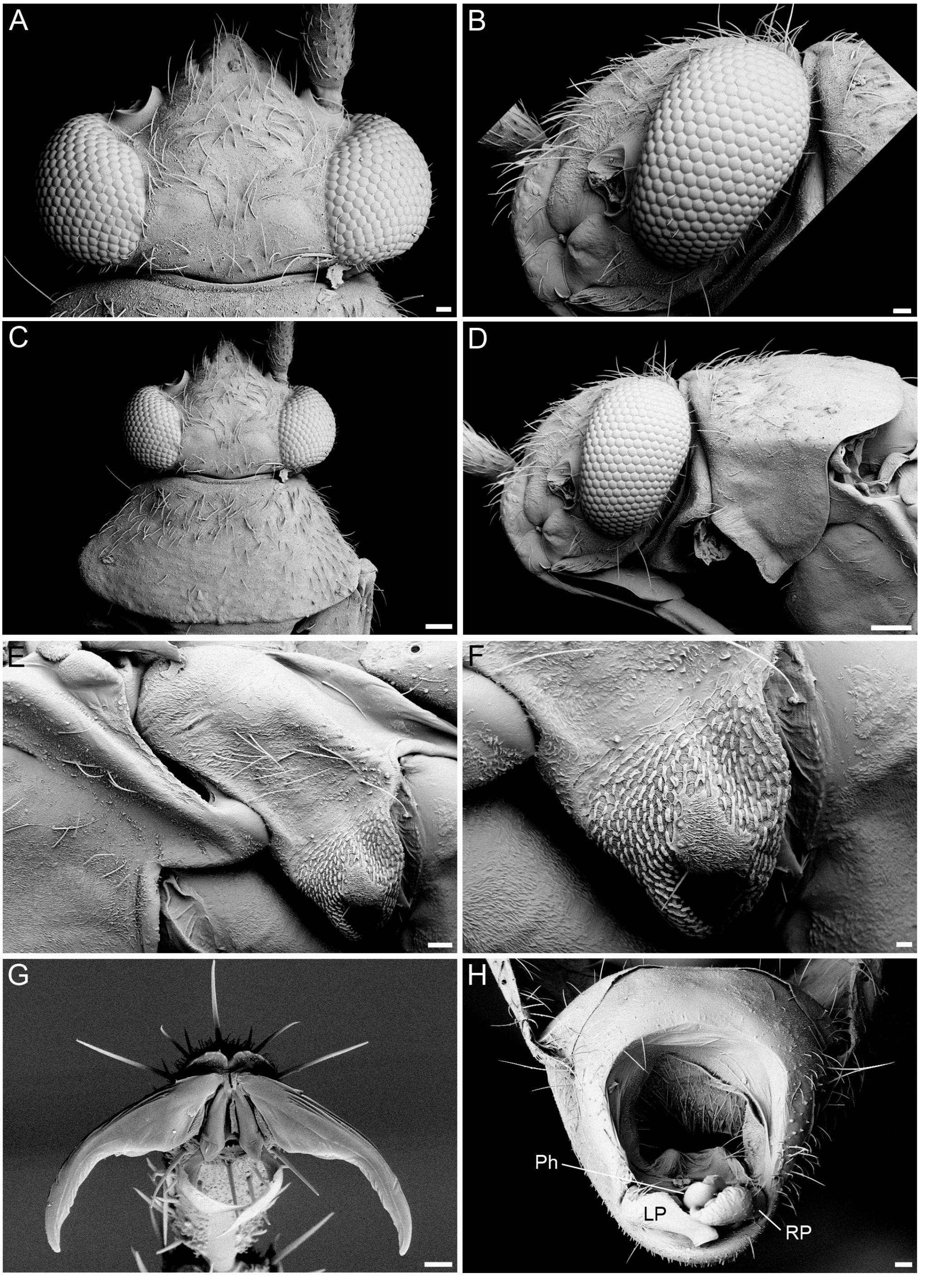


FIG. 75. External morphology of *Ngullamiris whadjuk*, male. **A.** Head, dorsal, scale bar = 30 µm. **B.** Head, lateral, scale bar = 30 µm. **C.** Head and pronotum, dorsal, scale bar = 100 µm. **D.** Head and pronotum, lateral, scale bar = 100 µm. **E.** Meso and metathorax, scale bar = 30 µm. **F.** Metathoracic scent gland, scale bar = 10 µm. **G.** Tarsal claw, scale bar = 10 µm. **H.** Pygophore, posterodorsal, scale bar = 30 µm.

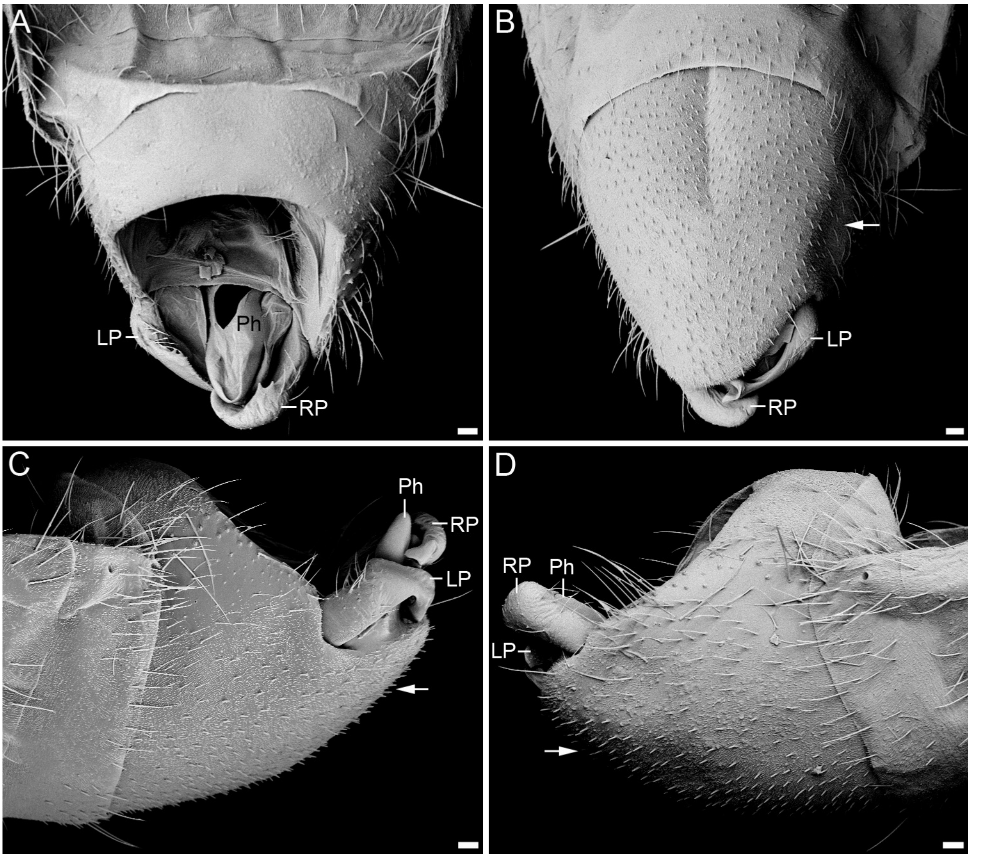


FIG. 76. Male external genitalic morphology of *Ngullamiris whadjuk*. Pygophore: **A.** dorsal; **B.** ventral; **C.** left lateral; **D.** right lateral. Arrows indicate short, spinelike setae. Scale bars = 30 μm.

VESTITURE: Dorsum smooth, weakly polished, with moderately dense distribution of semierect simple setae, some more elongate and bristlelike on head and along lateral dorsal margins; antennae with dense distribution of moderately short simple setae; AI also with few (~3) elongate erect spinelike setae; pygophore, ventral surface proximate to genital opening with short, dark, spinelike setae (figs. 76B–D); femora with some longer, erect, spinelike setae; hind tibiae with several rows of minute dark spinulae; sparsely distributed tibial spines, light brown. STRUCTURE: Head weakly to moderately expanded anteriorly, eyes bulbous, extending from outline of head (figs. 75A–C); antennae with AI at least subequal to vertex width; pronotum trapezoidal, short, callosite region weakly defined, posterior margin slightly rounded (fig. 75C, D); hemelytra and legs elongate (fig. 12). GENITALIA: **Pygophore:** Transverse, narrowing considerably posteriorly; dorsal margin strongly concave, lacking tergal processes; ventral margin of genital opening convex, round; phalloguide round and extending just beyond ventral margin of opening, with small, round lobe ventrad to right paramere articulation, left paramere positioned along ventral margin of pygophore; right paramere mostly visible with only base hidden within pygophore; parameres visible slightly beyond ventral pygophore margin, meeting medially, cupping phallotheca; phallotheca and aedeagus small, situated within opening of pygophore and

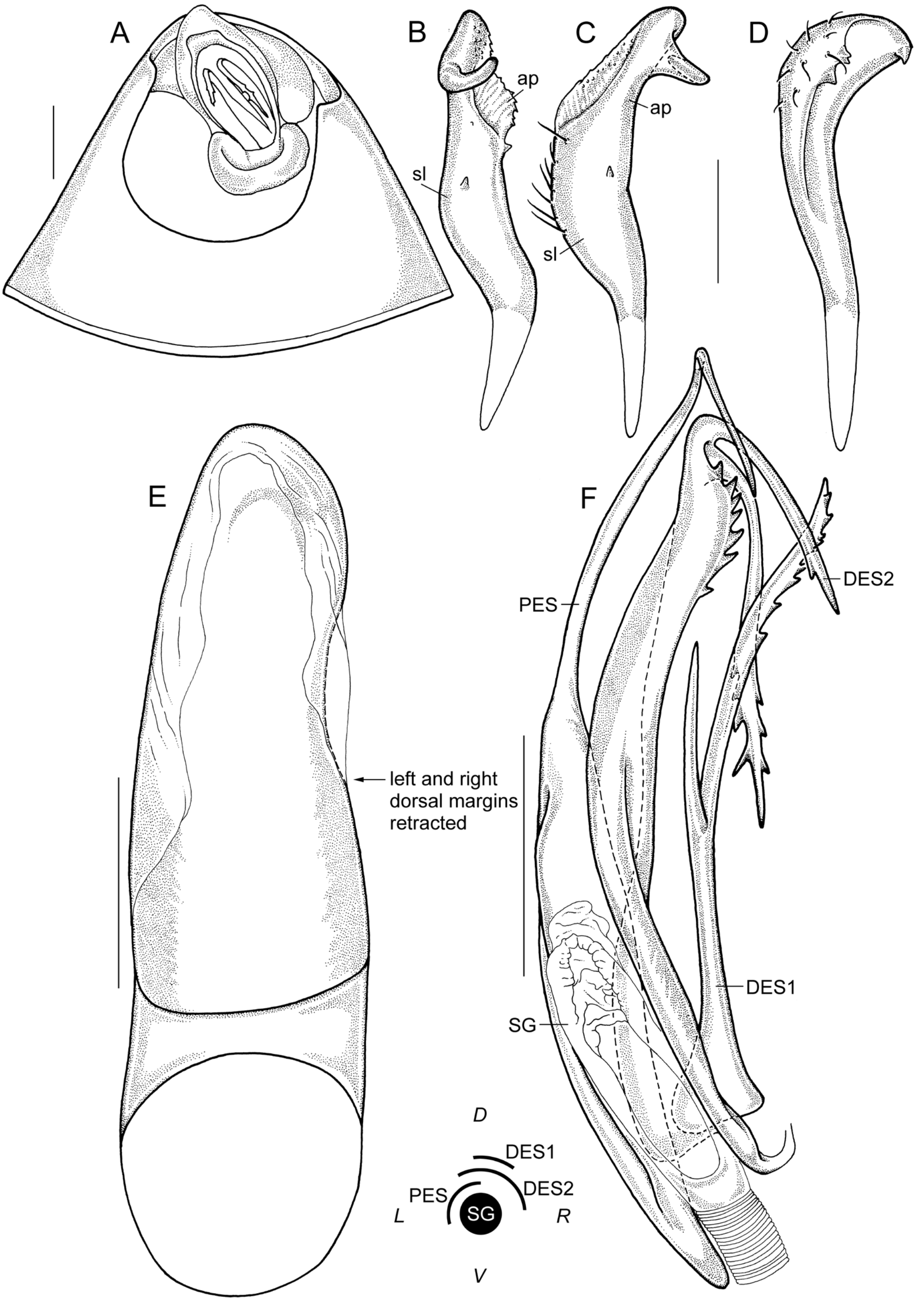


FIG. 77. Male genitalia of *Ngullamiris whadjuk.* **A.** Pygophore, dorsal. **B.** Left paramere, dorsal. **C.** Left paramere, ventral. **D.** Right paramere, dorsal. **E.** Phallotheca, dorsal. **F.** Aedeagus, ventral. Scale bars = 0.1 mm.

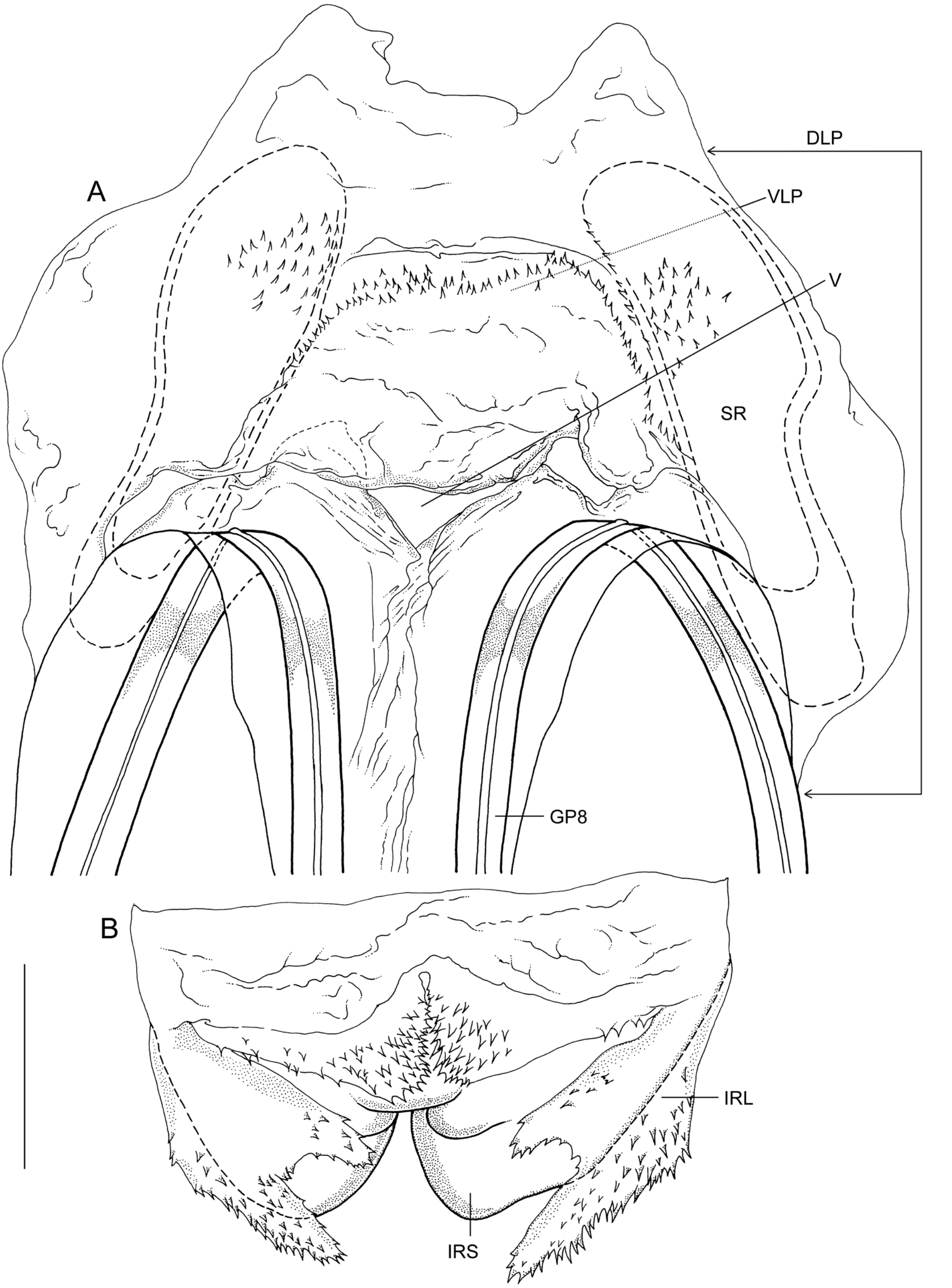
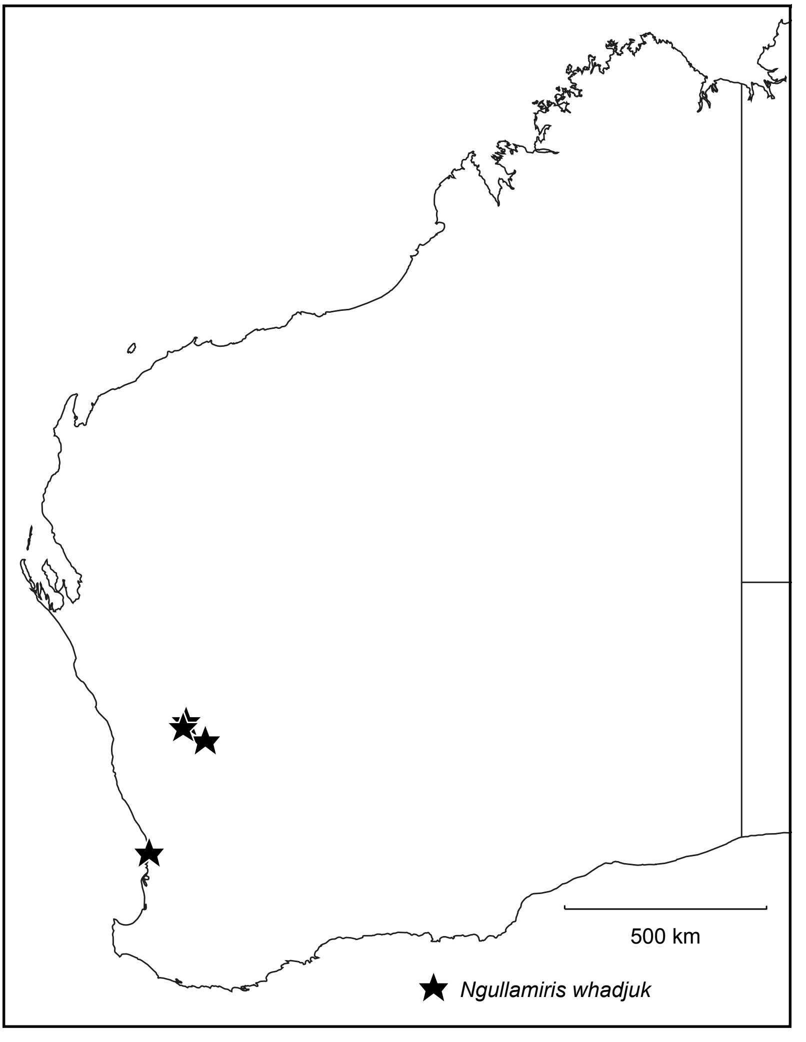


FIG. 78. Female genitalia of *Ngullamiris whadjuk*. **A.** Bursa copulatrix, ventral. **C.** Posterior wall, dorsal. Scale bar = 0.1 mm.



MAP 6. Distribution of *Ngullamiris whadjuk* from Western Australia.

not extending beyond ventral margin of opening (figs. 75H, 76A–D, 77A). **Left paramere:** Modified L-shape; base short; sensory lobe round; apophysis weakly curved, broad, apex truncate (figs. 75H, 77B, C). **Right paramere:** Club shaped to C-shaped, subovate in lateral view; apex curved inward and round, mesiolateral surface excavate; subapical dorsal margin round, unexpanded (figs. 76A, 77D). **Phallotheca:** Simple; lightly sclerotized; golden color; opening large, distal to medial; apex round; lateral/dorsal and apical margins reduced and membranous (fig. 76A, 77E). **Aedeagus:** Three endosomal spicules, positioned dorsal to secondary gonopore; spicule arrangement (fig. 11): PES and DES2 wrapped sheathlike partially around secondary gonopore, PES left dorsolateral, DES2 right dorsolateral of secondary gonopore, DES1 removed from secondary gonopore and dorsad to DES2; base of PES and DES2 flattened and broad, base of DES1 narrow; all spicules originating adjacently proximate to base of secondary gonopore or DES2 and DES1 distad to PES; PES unbranched, narrow medially and then uniformly narrow to apex, apex curved downward, margins smooth; DES2 bifurcate, with branches curved downward; DES1 shorter than PES and DES2, with basal keel (fig. 77F).

Female: Almost identical to male; slight sexual dimorphism in smaller size, smaller eyes and shorter hemelytra, in particular cuneus and forewing membrane less elongate; pronotum more transverse and broad, not as elongate and narrow, and anterior margin also broad and not narrow as in male. GENITALIA: Vestibulum membranous (fig. 78A); ventral labiate plate lightly sclerotized, mesial surface sparsely spiniferous (fig. 78A), without any lateral lobes; dorsal labiate plate without mediolateral lobes (fig. 78A); sclerotized rings large, subovate, slightly constricted medially, anterior margin round, anterior surface lightly spiniferous (fig. 78A); posterior wall lightly sclerotized; medial region of posterior wall (fig. 78B) not visible; interramal sclerites (IRS) lightly sclerotized, deeply divided with V-shaped junction, and forming posterior margin of posterior wall, posterior margin membranous, with broad spiniferous lobes basally, just posterior to base of IRLs; IRS with one pair of lightly sclerotized interramal lobes (IRL), attached laterally to IRS with narrow base (fig. 78B).

Etymology: *Ngulla* means "our" in the language of the Noongar people, the traditional custodians and original inhabitants of the southwest of Western Australia, from which the genus is known, combined with the typical mirid generic name *Miris*. The gender is feminine.

Remarks: *Ngullamiris* is morphologically more removed from the other four callitroid-inhabiting Orthotylini genera. While the other four genera have a relatively large pygophore and aedeagus in relation to body size, *Ngullamiris* has a small pygophore and aedeagus and in particular a cup-shaped convex ventral margin, within which the parameres and aedeagus are contained (fig. 76). The other four callitroid-inhabiting Orthotylini genera have a large round genital opening, with a more or less straight ventral margin. The pygophore and aedeagus and most often the parameres too, extend beyond the margins of the genital opening in the other four genera (e.g., figs. 17A–C, 25C–D, 44A–B, 72A–B). Also in contrast to the other four genera, spinelike setae in *Ngullamiris* extend across the entire ventral pygophore surface (fig. 76B). Where present in other callitroid-inhabiting Orthotylini genera, these ventral spinelike setae are situated proximal to genital opening and do not extend to the anterior of the pygophore (e.g., figs. 25A, 44A, 72A). The left paramere of *Ngullamiris* is a more modified L-shape in comparison to the other genera, with its linear shape, large and strongly recurved subapical hook and reduced apophysis (fig. 77B, C). In the aedeagus, the endosomal spicule orientation for *Ngullamiris* is similar to *Avititerra* and *Naranjakotta*, with PES left dorsolateral to the secondary gonopore (see fig. 11). See also remarks below for *Ngullamiris whadjuk*.

Ngullamiris whadjuk, new species

Figures 11, 12, 75–78; map 6

Diagnosis: Defined by the following characters: midsized, elongate body; large eyes; male with relatively narrow pronotum, narrow anterior pronotal margin; dorsum with moderately dense distribution of dark simple setae; bright yellow-green coloration; forewing membrane uniformly light brown, without subcuneal clear spot; forewing membrane veins bicolored, inner vein green, major membrane vein yellow, all color confined to veins; pygophore with spinelike setae covering entire ventral surface; phalloguide with small, round, very lightly sclerotized lobe ventrad to right paramere articulation; left paramere modified L-shape, sensory lobe unexpanded and round, apophysis weakly curved, uniformly broad, with flattened, serrate flange on dorsal margin subapically, and curved hooklike process on ventral margin subapically; right paramere club shaped to C-shaped, apex strongly curved inward and round, with few small serrations at apex and subapically, subapical dorsal margin unexpanded; aedeagus with PES and DES2 wrapped sheathlike partially around secondary gonopore, DES1 dorsad to DES2 with narrow tubular base; PES unbranched, medial half narrow with smooth margins, fine apex downcurved; DES2 bifurcate in distal third with narrow downcurved branches and serrate comb proximal to bifurcation point; DES1 bifurcate medially, branches unequal in length and straight, basal keel (DESk) short; female IRL lightly sclerotized, bifurcate, sparsely spiniferous, with broad spiniferous lobes on IRS just posterior to base of IRL.

Description: *Male*: medium to moderately large size; body elongate, lateral margins parallel; body length 4.22–4.79 mm, pronotal width 1.07–1.16 mm. COLORATION: Dorsum bright yellow-green, including head and hemelytra, sometimes faded with more yellow on head, mesoscutum, and scutellum, and lateral margins of pronotum; antennae yellow green; wing membrane translucent light brown, color uniform; forewing membrane major vein yellow, corium green, color confined to veins; venter and legs pale (faded) yellow-green, tarsi darkened (fig. 12). SURFACE AND VESTITURE: Dorsum with moderately dense distribution of dark, almost black, semierect simple setae, some more elongate and bristlelike on head and along lateral dorsal margins; pygophore, ventral surface with short, dark, spinelike setae (fig. 76). STRUCTURE: **Head:** subovate in lateral view; weakly to moderately expanded anteriorly (fig. 75A, B); maxillary plate subovate, anterodorsal margin round and aligned with round anterodorsal margin of mandibular plate, clypeus prominent, round or slightly pointed in dorsal view, dorsal edge round in lateral view, eyes large, three-quarters height of head, exerted well beyond outline of head, extending well beyond anterolateral angle of pronotum (fig. 75A, B); antennae with AI subequal to vertex width, AII 1.3× pronotal width, AIII 1.6× AIV, AIV subequal to AI; labium extending to mesocoxae. **Pronotum:** Trapezoidal, narrow; anterior margin narrow, straight; collar reduced to thin lip; callosite region undefined; lateral margins straight, strongly angled 45° to midline; humeral angles round; posterior margin straight to slightly convex (fig. 75C, D). **Metathorax:** Metathoracic spiracle elongate, narrow, tear shaped ventrally, with evaporative area spanning anterior margin and not expanded dorsally (fig. 75E); metathoracic scent gland with ostiole subovate, peritreme small, subovate, dorsal to ostiole, evaporative area with elongate evaporative bodies (fig. 75E, F). **Hemelytra:** Elongate, extending well beyond posterior of abdomen, abdomen extending to cuneal fracture or only slightly beyond; lateral margins parallel; cuneus elongate, narrow; major cell of membrane elongate, major membrane vein straight and parallel to inner margin of cuneus (fig. 12). **Legs:** Elongate, femora slightly flattened, very weakly incrassate; pretarsus with moderately long claws, pulvilli moderately sized, fleshy parempodia broad, apically convergent, and incurved (fig. 75G). GENITALIA: **Pygophore:** As in generic description; with medial groove on ventral surface anteriorly; retracted ventral margin at right paramere articulation point; phalloguide round and extending just beyond ventral margin of opening, with small, round, very lightly sclerotized lobe ventrad to right paramere articulation, lobe with rough, but not serrate, surface (figs. 75H, 76A–D, 77A). **Left paramere:** Modified L-shape; base very short; sensory lobe unexpanded, round; apophysis short, weakly curved, only very weakly at angle to sensory lobe, uniformly broad, with flattened flange on dorsal margin subapically, margin of flange serrate, and curved hooklike process on ventral margin subapically; apex truncate, round with minute spinelike serrations on inner surface; simple setae present on sensory lobe and outer surface (figs. 75H, 76A–C, 77B, C). **Right paramere:** Between club shaped and C-shaped, subovate in lateral view; apex strongly curved inward and round, with few small serrations at tip; mesiolateral surface weakly excavate; subapical dorsal margin round, unexpanded, with few small spinelike serrations on inner side of margin; simple setae present on outer subapical dorsal surface (figs. 75H, 76A–D, 77D). **Phallotheca:** As in generic description (figs. 75H, 76A, C, 77E). **Aedeagus:** Spicule arrangement (fig. 77): PES and DES2 wrapped sheathlike partially around secondary gonopore, PES left dorsolateral and DES dorsad of secondary gonopore, DES1 removed from secondary gonopore and dorsad to DES2; base of PES and DES2 flattened and broad, base of DES1 narrow; PES originating at base of secondary gonopore, DES2 and DES1 originating distad to base of PES; PES unbranched, narrow medially and then uniformly narrow to apex, apex curved downward, margins smooth; DES2 bifurcate in distal third, constricted at bifurcation point, with both branches curved downward, uniformly narrow, unequal in length and with serrate apical margins; margin of DES2 before bifurcation point with short row of prominent spinelike serrations; DES1 bifurcate medially, branches unequal in length and straight (uncurved), ventral branch smooth and short, dorsal branch longer with serrate apical margin, with short basal keel (DESk) (fig. 77F).

Female: As in generic description, significantly smaller in size to male, 0.8× length of male on average; body length 3.69–3.85 mm, pronotal width 1.10–1.17 mm. GENITALIA: IRS with broad spiniferous lobes basally, just posterior to base of IRL (fig. 78B); IRL lightly sclerotized, divided medially with inner branch shorter than outer branch, apical surface sparsely spiniferous (fig. 78B).

Etymology: Named for the type locality, after the Whadjuk or Wajuk language group of Noongar people who are the original inhabitants and traditional owners of the Perth region. Noun in apposition.

Host plants: Known from *Callitris preissii* on the coast and *Callitris glaucophylla* inland (table 2).

Holotype: **AUSTRALIA: Western Australia:** Mosman Park, Perth, trail b/w Minum Cove Park and Chidley Point Reserve, 32.01573°S 115.7626°E, 15 m, 01 Aug 2005–03 Aug 2005, G. Cassis, *Callitris preissii*, det. WA Herbarium PERTH 07620101, 1♂ (AMNH_PBI 00005482) (WAMP).

Paratypes: **AUSTRALIA: Western Australia:** Charles Darwin Reserve, track to Seven Mile Well, N of Wanarra Rd, 29.52483°S 117.01675°E, 265 m, 24 Sep 2009, C. Symonds, *Callitris columellaris*, det. WA Herbarium, 2♂ (AMNH_PBI 00404851, 00404852), 1♀ (AMNH_PBI 00404853) (UNSW). Lochada, Kelly Well, 29.08191°S 116.58677°E, 281 m, 17 Sep 2009, C. Symonds, *Callitris columellaris*, det. WA Herbarium, 1♂ (AMNH_PBI 00404846), 1♀ (AMNH_PBI 00404850) (AM), 1♂ (AMNH_PBI 00404845), 3♀ (AMNH_PBI 00404847–00404849) (UNSW), 5♂ (AMNH_PBI 00030435–00030439), 5♀ (AMNH_PBI 00030440–00030444) (WAMP). Lochada, Steves track, 29.23719°S 116.54694°E, 253 m, 20 Sep 2009, C. Symonds, *Callitris columellaris*, det. WA Herbarium, 1♂ (UNSW_ENT 00002936), 1♀ (UNSW_ENT 00002937) (AMNH), 2♀ (UNSW_ENT 00002938, UNSW_ENT 00002939) (UNSW). Mosman Park, Perth, trail b/w Minum Cove Park and Chidley Point Reserve, 32.01573°S 115.7626°E, 15 m, 01 Aug 2005–03 Aug 2005, G. Cassis, *Callitris preissii*, det. WA Herbarium PERTH 07620101, 1♂ (AMNH_PBI 00005476), 1♀ (AMNH_PBI 00005484) (AM).

Distribution: Known from southwestern Western Australia, one locality on the coast at Mosman Park in Perth, and three proximate localities in the Avon Wheatbelt region (map 6). Cooccurring with *E. notodytika* on *Callitris preissii* in Perth and *B. hochuli* at all three inland localities on *Callitris glaucophylla* (table 2).

Remarks: *Ngullamiris whadjuk* is distinguished externally from other callitroid-inhabiting Orthotylini species that are midsized and without contrasting wing membrane coloration, by the bright yellow-green dorsal coloration, the lack of a clear spot below the cuneus in the hemelytral membrane (cf. *Callitricola* species with subcuneal clear spot) (cf. fig. 12A, B). It is easily distinguished from other callitroid-inhabiting species of similar size and coloration that lack the membrane clear spot, by the presence of only simple setae on the dorsum (cf. *Avititerra* species with both simple and scalelike setae).

The male genitalia of *N. whadjuk* is distinctive from all other callitroid-inhabiting Orthotylini species, and in particular, the modified apophysis with an expanded flange and subapical, strongly recurved hook on the left paramere; and the small aedeagus, which does not protrude from the pygophore. Also, the ventral margin of the pygophore is strongly tapered, with the parameres articulated lower on the margins than in all other genera in this work (all have a larger and rounder genital opening and the parameres are articulated more submedially on the genital opening).

CHARACTER DESCRIPTIONS AND STATES

EXTERNAL

0. Dorsal vestiture with scalelike setae: **0,** absent (e.g., *Callitricola*, fig. 30A); **1,** present (e.g., *Avititerra*, fig. 16A).
1. Antennal segment I color: **0,** same as remainder, yellow-green (e.g., *Avititerra*, fig. 12); **1,** different from remainder, red-brown (e.g., *Blattakeraia*, fig. 12).
2. Prominent pronotal collar: **0,** absent (non-austromirine Orthotylini); **1,** present (e.g., *Austromirini* spp.).
3. Tip of cuneus red to red-black: **0,** absent (e.g., *Callitricola*, fig. 13; *E. drepanomorpha*, *E. notodytika*, fig. 14); **1,** present (e.g., most *Erysivena* spp., fig. 14).
4. Wing membrane with subcuneal clear spot: **0,** absent (fig. 12A; e.g., *Avititerra*, *Ngullamiris*, fig. 12); **1,** present (fig. 12B; e.g., *Blattakeraia*, fig. 12; *Callitricola*, fig. 13; *Erysivena*, fig. 14).
5. Wing membrane pattern of coloration: **0,** uniform (e.g., *Avititerra*, fig. 12A); **1,** patchy (e.g., *Callitricola*, fig. 12A; Blattakeraia, fig. 12).
6. Wing membrane vein color: **0,** orange or yellow (e.g., *C. graciliphila*, fig. 13); **1,** yellow-green or bright green (e.g., *C. wiradjuri*, fig. 13); **2,** red (e.g., *Erysivena*, fig. 14); **3,** other, no distinct color (e.g., *Orthotylus cuneatus*, fig. 7); **4,** bicolored—part yellow, part green (e.g., *N. whadjuk*, fig. 12).
7. Wing membrane with green spot in large areole: **0,** absent (e.g., *Avititerra*, fig. 12; *Erysivena*, fig. 14); **1,** present (e.g., *Blattakeraia*, fig. 12; *C. parawirra*, fig. 13).

MALE GENITALIA

PYGOPHORE

8. Dorsal margin of genital opening shape: **0,** weakly concave to straight (e.g., *C. pullabooka*, fig. 39F); **1,** moderately to strongly concave, sometimes asymmetrically (e.g., *E. drepanomorpha*, fig. 51H).
9. Left tergal process (ltp): **0,** absent (e.g., *B. hochuli*, fig. 24H; *C. cordylina*, fig. 30H); **1,** present (e.g., *C. pullabooka*, fig. 39F; *E. drepanomorpha*, fig. 51H).
10. Left tergal process length: **0,** short (e.g., *C. pullabooka*, fig. 39F; *C. wiradjuri*, fig. 43H); **1,** elongate (e.g., *ii drepanomorpha*, fig. 51H; *E. kalbarri*, fig. 57H).
11. Elongate left tergal process, shape: **0,** linear to C-shaped (*E. kalbarri*, fig. 57H, *E. mareeba*, fig. 64A); **1,** sickle-shaped, or broad and ovate (e.g., *E. drepanomorpha*, fig. 51H; *E. notodytika*, fig. 67A).
12. Short left tergal process, shape: **0,** submedial serrate comb (e.g., C. *pullabooka*, fig. 39F); **1,** far left lateral spine (e.g., *A. xerophila*, fig. 18A; *Orthotylus marginalis*, figs. 7, 8A); **2,** submedial to left lateral, rounded and/or serrate distally (e.g., *C. boorabbin*, fig. 14A; *C. graciliphila*, fig. 36A; *C. wiradjuri*, fig. 43H).
13. Right tergal lobe (tl): **0,** absent (e.g., *C. pullabooka*, fig. 39F; *E. kalbarri*, fig. 57H); **1,** present (e.g., *C. cordylina*, fig. 30H; *E. drepanomorpha*, fig. 51H; *E. mareeba*, fig. 63H; *E. sydneyensis*, fig. 71H).
14. Right tergal lobe shape: **0,** broad (e.g., *C. cordylina*; fig. 30H; *E. drepanomorpha*, fig. 51H); **1,** elongate (e.g., E. sydneyensis, fig. 71H).

15. Right tergal process (rtp): **0,** absent (e.g., *Avititerra*, *Blattakeraia*, *N. whadjuk*); **1,** present (e.g., *C. wiradjuri*, fig. 43H; *E. mareeba*, fig. 63H).
16. Right tergal process shape: **0,** lobe shaped, wider than long (*C. wiradjuri*, figs. 43H, 45A); **1,** elongate, longer than wide (e.g., *E. kalbarri*, fig. 57H).
17. Elongate right tergal process with posterior basal lobe: **0,** absent (e.g., *E. mareeba*, fig. 65A); **1,** present (e.g., *E. majori*, fig. 62A).
18. Medial tergal process (mtp): **0,** absent; **1,** present (*E. endlicheriphila*, fig. 56A; *E. sydneyensis* (figs. 71H, 73A).
19. Short spinelike setae on ventral surface, proximal to genital opening: **0,** absent (e.g., *Avititerra*, fig. 17B); **1,** present (e.g., *Blattakeraia*, fig. 21E; *Callitricola*, fig. 31A; *Erysivena*, fig. 52A; *Ngullamiris*, fig. 76; *Orthotylus cuneatus*, fig. 9C).
20. Ventral margin of genital opening, shape: **0,** straight or slightly convex, sometimes a bit sinuous (e.g., *Aviiterra*, figs. 17B, C; *Blattakeraia*, figs. 21B, C; *Callitricola*, figs. 31A, B; *Erysivena*, figs. 52A, B; *Orthotylus tantali*, figs. 9D–F); **1,** strongly convex, cup-shaped, up turned (e.g., *Ngullamiris*, figs. 75H. 76; *Orthotylus cuneatus*, figs. 9A–C).
21. Phalloguide (phg) with a sclerotized, sometimes serrate, right ventral lobe (pl): **0,** absent (e.g., Orthotylus marginalis, fig. 7); **1,** small groove, but no lobe (e.g., *N. sidnica*); **2,** small lobe, with sclerotized and/or serrate margin (e.g., *Blattakeraia*, figs. 22A, 25B; *Callitricola*, figs. 28A, 31B, 29B; *E. drepanomorpha*, fig. 52B; *E. mareeba*, fig. 64B); **3,** elongate lobe (e.g., *E. sydneyensis*, figs. 71A, B).
22. Dorsal spine on elongate right ventral lobe of phalloguide: **0,** absent (e.g., *E. sydneyensis*, fig. 73A); **1,** present (e.g., *E. paluma*, fig. 70A).

PARAMERES

23. Left paramere, general shape of apophysis (ap) and apex: **0,** uniformly broad (e.g., *A. lepidothrix*, fig, 15B; *B. actinostrobi*, fig. 22B); **1,** acuminate, tapering to apex or uniformly narrow (e.g., *C. ballina*, fig. 28B; *E. apta*, fig. 49B).
24. Left paramere, hooked apex: **0,** absent (e.g., *E. apta*; fig. 49B, *E. drepanomorpha*, fig. 52B); **1,** recurved, apical hook present (e.g., *C. wiradjuri*, fig. 45B; *E. bundjalung*, fig. 50B); **2,** blunt, apical hook present (e.g., *Orthotylus tantali*, fig. 7); **3,** large, curved, subapical hook (e.g., *N. whadjuk*, fig. 65B); **4,** weak, subapical hook, inset from apex (*Blattakeraia* spp., figs. 21D, 22B, 25D, 26B).
25. Left paramere, shape of sensory lobe (sl): **0,** rounded and not or only weakly expanded medially; **1,** rounded and moderately expanded; **2,** strongly expanded to form a large bulge, often subtriangular shape; **3,** acutely expanded such that paramere appears U-shaped.
26. Left paramere, sensory lobe with serrate margin: **0,** absent (e.g., *B. actinostrobi*, fig. 22B); **1,** present (e.g., *B. hochuli*, fig. 26B, *A. xerophila*, fig. 18A).
27. Left paramere, serrate sensory lobe: **0,** absent; **1,** square, flattened; **2,** rounded (e.g., *A. lepidothrix*, fig. 15B); **3,** acuminate (*B. hochuli*, fig. 26B).
28. Left paramere, short, strong, dark bristles on sensory lobe: **0,** absent (e.g., *E. apta*, fig. 49B); **1,** present (e.g., *E. mareeba*, fig. 65B).
29. Right paramere, general shape: **0,** club-shaped, not expanded or serrate medially (e.g., *C. ballina*, fig. 28C); **1,** hammer shaped, expanded distally only (e.g., *E. bundjalung*, fig. 50C); **2,** expanded or serrate medial margin without bulbous apex (e.g., *E. apta*, fig. 49C); **3,** expanded or serrate medial margin with bulbous apex (e.g., *A. xerophila*, fig. 18C); **4,** greatly expanded and spiral shaped distally (e.g., *Naranjakotta sidnica*).

PHALLOTHECA

30. General shape: **0,** simple: very open dorsally and narrowing distally (e.g., *Avititerra*, fig.

15E; *Ngullamiris*, fig. 65E); **1,** complex: enclosing aedeagus and sculpted (e.g., *Blattakeraia*, 22D; *Callitricola*, fig. 32D, E; *Erysivena*, figs. 49D, 50D).

31. Color: **0,** lightly sclerotized (e.g., figs. 15E, 56E, 22D); **1,** dark, heavily sclerotized (figs. 32E, D; 49D; 50D).
32. Dorsal opening: **0,** apically only, closed medially (e.g., *E. bundjalung*, fig. 50D); **1,** apically and medially (e.g., *E. apta*, fig. 49D).
33. Lobe on closed dorsal medial margin: **0,** absent (e.g., *E. bundjalung*, fig. 50D); **1,** present (e.g., *E. sydneyensis*, fig. 73F).
34. Shape of apex: **0,** rounded (e.g., *C. boorabbin*, fig. 29C; *C. finke*, fig. 33D); **1,** twisted point at tip (e.g., *C. ballina*, fig. 28D; *C. cordylina*, fig. 32E).
35. Apically compressed (crestlike): **0,** absent (e.g., *E. apta*, fig. 49D); **1,** present (e.g., *E. drepanomorpha*, figs. 52B, 53F).
36. Subapical ventral tumescence (savt): **0,** absent (e.g., *A. xerophila*, figs. 18D, E); **1,** present (e.g., *C. cordylina*, figs. 32D, E).
37. Size of subapical ventral tumescence: **0,** reduced (e.g., *C. boorabbin*, fig. 29C); **1,** enlarged (e.g., *C. graciliphila*, figs. 36E, G; C. wiradjuri, fig. 40A); **2,** doubled (e.g., *C. parawirra*, fig. 37F).
38. Left lateral tumescence (llt): **0,** absent (e.g., *C. pullabooka*, fig. 38E); **1,** present (e.g., *C. cordylina*, figs. 32D, E).
39. Right lateral tumescence (rlt): **0,** absent (e.g., *C. pullabooka*, fig. 38E); **1,** present (e.g., *C. cordylina*, figs. 32D, E).
40. Size of right lateral tumescence: **0,** reduced; **1,** enlarged (e.g., *C. cordylina*, figs. 32D, E).
41. Right basal tumescence (rbt): **0,** absent (e.g., *C. parawirra*, fig. 37E); **1,** present (e.g., *C. pullabooka*, fig. 38E).
42. Lobe on right dorsal margin (rdml), basal or medial: **0,** absent (e.g., *E. drepanomorpha*, fig. 53E; **1,** present (e.g., *C. parawirra*, fig. 37E; *E. schuhi*, fig. 69D).
43. Lobe on right dorsal margin (rdml) strongly produced: **0,** absent (e.g., *C. wiradjuri*, fig. 45D); **1,** present (e.g., *C. wollemi*, fig. 47A).

PHALLOTHECA AND AEDEAGUS

44. Position in pygophore: **0,** not everted, mostly not visible externally (e.g., *A. xerophila*, figs. 17B, C), can be situated in cup formed by strongly convex ventral pygophore margin (e.g., *N. whadjuk*, figs. 76B, C); **1,** everted, strongly visible externally (e.g., *B. hochuli*, figs. 25A, C; *C. cordylina*, figs. 31A, B; *E. drepanomorpha*, figs. 52A, B).
45. Relative size in relation to pygophore: **0,** small (e.g., N. whadjuk, fig. 74; *Orthotylus cuneatus*, figs. 9A–C); **1,** large (e.g., *B. actinostrobi*, fig. 25; *Orthotylus marginalis*, figs. 8A, B).

AEDEAGUS

46. Number of endosomal spicules: **0,** one (e.g., *Orthotylus cuneatus*, fig. 7); **1,** two (e.g., *Orthotylus marginalis*, figs. 7, 8); **2,** three (e.g., *N. whadjuk*, fig. 77F).
47. Position of spicules in relation to secondary gonopore: **0,** right dorsolateral e.g., *Fronsetta geraldtoni*; **1,** ventral round to left lateral (e.g., *Orthotylus marginalis*, figs. 7, 8D; *Callitricola*, *Erysivena*, figs. 11, 44D, 58D) **2,** dorsal (e.g., *Orthotylus cuneatus*, fig. 7; *Avititerra*, *Blattakeraia*, *Ngullamiris*, *Naranjakotta*, fig. 11, 17F).
48. Dorsal endosomal spicule(s) position in relation to proximal endosomal spicule (PES): **0,** dorsal, left dorsolateral, to left lateral (e.g., *Blattakeraia*, *Callitricola*, *Erysivena*, fig. 11); **1,** right dorsolateral to right lateral (e.g., *Avititerra*, *Ngullamiris*, fig. 11).
49. First dorsal endosomal spicule (DES1) position in relation to second dorsal endosomal spicule (DES2): **0,** left lateral to left dorsolateral (e.g., *C. boorabbin*, fig. 14; *E. apta*, fig. 49); **1,** dorsal (e.g., *B. actinostrobi*, fig. 22; *C. ballina*, fig. 28); **2,** right dorsolateral (e.g., *A. lepidothrix*, fig. 15).
50. PES sheathlike (at least in part) around secondary gonopore: **0,** absent (e.g., *A. lepidothrix*, fig. 15D; *C. ballina*, fig. 28F); **1,** present (e.g., *B. hochuli*, fig. 26E; *C. boorabbin*, fig. 29D; *E. apta*, fig. 49E).

51. PES wrapped entirely around secondary gonopore, which is exposed at apex: **0,** absent (e.g., *C. cordylina*, figs. 31C–E); **1,** present (e.g., *C. pullabooka*, fig. 40E; *C. wiradjuri*, figs. 29D, E)
52. PES shape: **0,** uniform width, tapering apically (e.g., *E. sydneyensis*, figs. 72D, 73G); **1,** broad basally, then constricted and narrow/ribbonlike to apex (e.g., *E. apta*, fig. 49E; *E. kalbarri*, fig. 58C, 59E).
53. PES with basal straplike process: **0,** absent (e.g., E. apta fig. 49E); **1,** present (e.g., *E. kalbarri*, fig. 58C, 59E).
54. PES structure: **0,** unbranched (*Erysivena*, *Ngullamiris*, e.g., fig. 11); **1,** bifurcate (*Avititerra*, *Blattakeraia*, *Callitricola*, e.g., fig. 11).
55. Downturned left lateral branch on bifurcate PES: **0,** absent (e.g., *A. xerophila*, fig. 18F, *B. hochuli*, fig. 26E); **1,** present (e.g., *C. cordylina*, figs. 31D, 32F).
56. PES submedial process: **0,** absent; **1,** present (e.g., *E. mareeba*, fig. 64C; *E. sydneyensis*, fig. 72C).
57. PES distal margins: **0,** smooth; **1,** serrate.
58. PES submedial process distal margins: **0,** smooth (e.g., *C. finke*, fig. 33F); **1,** serrate (e.g., *B. hochuli*, fig. 26E).
59. PES and DES2 joined by membrane on right lateral margins: **0,** absent (e.g., *C. wiradjuri*, fig. 44E; *E. sydneyensis*, fig. 72E); **1,** present (e.g., *E. drepanomorpha*, fig. 52E; *E. kalbarri*, fig. 58E).
60. DES2 structure: **0,** unbranched (e.g., C. gammonensis, fig. 35F; *C. finlayae*, fig. 34G); **1,** branched (e.g., *C. graciliphila*, fig. 36I; *C. boorabbin*, fig. 29D).
61. Bifurcate DES2: **0,** bifurcate distally (e.g., *E. bundjalung*, figs. 50E, F); **1,** bifurcate deep (e.g., *E. majori*, fig. 62E)
62. Bifurcate DES2: **0,** branches unequal length (e.g., *C. cordylina*, fig. 32F); **1,** branches equal length (e.g., *C. graciliphila*, fig. 36J).
63. DES2 medial process: **0,** absent; **1,** short and threadlike (e.g., *C. finlayae*, fig. 34G; *E. kalbarri*, fig. 58C); **2,** elongate (e.g., *C. finke*, fig. 33E, F).
64. DES2 distal margins: **0,** smooth (e.g., *B. hochuli*, fig. 26E); **1,** serrate (e.g., *A. xerophila*, fig. 18F).
65. DES2 medial margins: **0,** smooth (e.g., *C. cordylina*, figs. 31F, 32F); **1,** serrate (e.g., *E. mareeba*, figs. 64E, 65E).
66. DES1 structure: **0,** unbranched (e.g., *C. wiradjuri*, figs. 44C, 45D); **1,** bifurcate (e.g., *C. pullabooka*, figs. 38G, 40C).
67. DES1 with one or two basal processes: **0,** absent (e.g., *E. kalbarri*, figs. 58E, 59E); **1,** present (e.g., *E. drepanomorpha*, figs. 52E, 53G; *E. notodytika*, fig. 67E).
68. Bifurcate DES1: **0,** bifurcate distally (e.g., *B. actinostrobi*, fig. 22E); **1,** bifurcate deep (*C. cordylina*, figs. 31F, 32F; *E. drepanomorpha*, figs. 52C, 53G, H).
69. Bifurcate DES1: **0,** branches unequal length (e.g., *C. silveirae*, fig. 41F; **1,** branches equal length (*C. tatarnici*, fig. 42H).
70. DES1 medial margins: **0,** smooth (*C. pullabooka*, fig. 40C; *E. apta*, fig. 49E); **1,** serrate (e.g., *C. gammonensis*, fig. 35F; *E. bundjalung*, fig. 50F).
71. DES1 distal margins: **0,** smooth (e.g., *E. kalbarri*, figs. 58E, 59E); **1,** serrate (e.g., *C. finlayae*, fig. 34F).
72. Unbranched DES1: **0,** apex entire (e.g., *E. emeraldensis*, fig. 54F); **1,** apex divided (*E. endlicheriphila*, fig. 56F).
73. DES1 basal keel (DESk) linked with membranous base: **0,** absent (e.g., *Avititerra*, fig. 15F); **1,** present (e.g., *Callitricola*, fig. 37H).
74. DES1 basal keel situated more adjacent, or directly dorsad to DES2: **0,** absent (e.g., *C. ballina*, fig. 28E); **1,** present (e.g., *E. apta*, fig. 49F).
75. DES1 basal keel length: **0,** short (e.g., *A. xerophila*, fig. 18F; *C. silveirae*, fig. 41F); **1,** elongate (e.g., *C. ballina*, fig. 28E; *E. apta*, fig. 49F).

FEMALE GENITALIA

76. Vestibulum (V) opening asymmetrical structures: **0,** membranous (e.g., *Ngullamiris*, fig. 78); **1,** sclerotized (e.g., *Erysivena*, figs. 60A, 61).

77. Vestibulum opening, degree of sclerotization: **0,** light to moderate (e.g., *B. xerophila*, fig. 27B); **1,** strong (e.g., *C. emeraldensis*, fig. 55A).
78. Spiniferous structures proximate to posterior margins of bursa copulatrix: **0,** absent (e.g., *Ngullamiris*, fig. 78); **1,** mediolateral lobes (mll) (e.g., *Orthotylus marginalis*, fig. 10B; *A. xerophila*, fig. 19A; *C. wiradjuri*, fig. 46A); **2,** serrate ridge or band (e.g., *Orthotylus tantali*, fig. 10E).
79. Ventral labiate plate (VLP) with paired spiniferous lateral lobes (ll): **0,** absent (*Orthotylus marginalis*, fig. 10A; *A. xerophila*, fig. 19A); **1,** present (*B. hochuli*, fig. 27A; *C. wiradjuri*, fig. 46A; *E. kalbarri*, figs. 60C, 61A).
80. Interramal sclerites (IRS), general structure: **0,** undivided, joined before base (e.g., *E. kalbarri*, fig. 60D); **1,** fully divided, not joining at base (e.g., *Orthotylus marginalis*, fig. 10C).
81. Interramal sclerites, rounded ridge on inner margin: **0,** absent (e.g., *N. whadjuk*, fig. 78B); **1,** present (e.g., *A. xerophila*, fig. 19C).
82. Medial region (mr) of posterior wall: **0,** retracted, not visible or reduced well below base of posterior valvulae (e.g., *A. xerophila*, fig. 19C; *N. whadjuk*, fig. 78B); **1,** clearly visible, situated just below base of posterior valvulae (e.g., *B. hochuli*, fig. 27C; *Orthotylus marginalis*, not illustrated); **2,** flush with base of posterior valvulae (e.g., *E. kalbarri*, fig. 60D). Note: posterior valvulae not illustrated.
83. Interramal lobes (IRL), attachment to interramal sclerites: **0,** broadly fused along base of IRS, with a flat, pad shape (e.g., *Orthotylus cuneatus*, fig. 10F); **1,** laterally attached to IRS with a constricted base, with more complex shape, often branched (e.g., *E. kalbarri*, fig. 60D).
84. Interramal lobes, lateral lobe (laIRL) with serrate lobe or spiniferous pad at base: **0,** absent (e.g., *B. hochuli*, fig. 27C); **1,** present (e.g., *A. xerophila*, fig. 19C; *E. kalbarri*, fig. 60D).
85. Interramal lobes, lateral lobe with an inner branch: **0,** absent (e.g., *Orthotylus* spp., fig. 10; *Erysivena* spp., fig. 74); **1,** present (e.g., *A. xerophila*, fig. 19C).
86. Interramal lobes, with an additional medial interramal lobe (mIRL): **0,** absent (e.g., *A. xerophila*, fig. 19C); **1,** present (e.g., *Callitricola* spp., fig. 48; *Erysivena* spp., fig. 74).
87. Interramal lobes, medial lobe attachment/articulation: **0,** partially fused to elongate laIRL at base (e.g., *C. cordylina*, fig. 48); **1,** separate from elongate laIRL, embedded in a socket, proximate at base (e.g., *E. sydneyensis*, fig. 74).

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APPENDIX 1

Anatomical Abbreviations

ap	apophysis
DES	dorsal endosomal spicule
DES1	first dorsal endosomal spicule
DES2	second dorsal endosomal spicule
DESk	keel of (first) dorsal endosomal spicule
DLP	dorsal labiate plate
GP8	gonapophysis 8
GP8ra	gonapophysis 8 ramus
GP9	gonapophysis 9
GP9ra	gonapophysis 9 ramus
IRL	interramal lobe
IRS	interramal sclerite
laIRL	lateral interramal lobe
ll	lateral lobe
llt	left lateral tumescence
LP	left paramere
ltp	left tergal process
mIRL	medial interramal lobe
mlb	mediolateral band
mll	mediolateral lobe
mr	medial region (of posterior wall and interramal sclerites)
mt	medial tumescence
mtp	medial tergal process
PES	proximal endosomal spicule
Ph	phallotheca
phg	phalloguide
pl	phalloguide lobe right ventral to right paramere articulation point
Pr	proctiger
rbt	right basal tumescence
rdml	right dorsal margin lobe
rlt	right lateral tumescence
RP	right paramere
rtp	right tergal process
savt	subapical ventral tumescence
SG	secondary gonopore
sl	sensory lobe
SR	sclerotized ring
tl	tergal lobe
V	vestibulum
VLP	ventral labiate plate

APPENDIX 2

Callitris Species Names and Synonymy[1]

Name used in this work	Classification by Hill (1998)	Classification by Farjon (2005)	Distribution
Callitris acuminata	*Actinostrobus acuminatus*	*Actinostrobus acuminatus*	WA
Callitris arenaria	*Actinostrobus arenarius*	*Actinostrobus arenarius*	WA
Callitris baileyi	*Callitris baileyi*	*Callitris baileyi*	NSW, QLD
Callitris canescens	*Callitris canescens*	*Callitris canescens*	SA, WA
Callitris columellaris	*Callitris columellaris*	*Callitris columellaris*	NSW, QLD
Callitris drummondii	*Callitris drummondii*	*Callitris drummondii*	WA
Callitris endlicheri	*Callitris endlicheri*	*Callitris endlicheri*	ACT, NSW, QLD, VIC
Callitris glaucophylla	*Callitris glaucophylla*	*Callitris columellaris*	ACT, NSW, NT, QLD, SA, VIC, WA
Callitris gracilis	*Callitris gracilis* subsp. *gracilis* *Callitris gracilis* subsp. *murrayensis*	*Callitris preissii*	NSW, SA, VIC
Callitris intratropica	*Callitris intratropica*	*Callitris columellaris*	NT, QLD, WA
Callitris macleayana	*Callitris macleayana*	*Callitris macleayana*	NSW, QLD
Callitris monticola	*Callitris monticola*	*Callitris monticola*	NSW, QLD
Callitris muelleri	*Callitris muelleri*	*Callitris muelleri*	NSW
Callitris oblonga	*Callitris oblonga* subsp. *oblonga*	*Callitris oblonga* subsp. *oblonga*	TAS
Callitris oblonga	*Callitris oblonga* subsp. *corangensis*	*Callitris oblonga* subsp. *corangensis*	NSW
Callitris oblonga	*Callitris oblonga* subsp. *parva*	*Callitris oblonga* subsp. *parva*	NSW
Callitris preissii	*Callitris preissii*	*Callitris preissii*	WA
Callitris pyramidalis	*Actinostrobus pyramidalis*	*Actinostrobus pyramidalis*	WA
Callitris rhomboidea	*Callitris rhomboidea*	*Callitris rhomboidea*	NSW, QLD, SA, TAS, VIC
Callitris roei	*Callitris roei*	*Callitris roei*	WA
Callitris tuberculata	*Callitris tuberculata*	*Callitris preissii*	WA, SA, VIC
Callitris verrucosa	*Callitris verrucosa*	*Callitris verrucosa*	NSW, SA, VIC, QLD

[1] Information from the Australian Plant Name Index (Australian National Botanic Gardens). All names from both species concepts are currently valid on the Australian Plant Census (CHAH) accepted names list, except for *Callitris tuberculata*, which is considered a nomenclatural synonym of *Callitris preissii*. Discussions and analyses follow the first column and the host-plant records in the listings of types and specimens examined adhere to the original herbarium identifications.

On the cover: (*left to right*) *Erysivena sydneyensis*; *Callitris rhomboidea*, in low open woodland on sandstone, Newnes Plateau, Wollemi National Park, New South Wales.