

Biting the bullet: revisionary notes on the Oraseminae of the Old World (Hymenoptera, Chalcidoidea, Eucharitidae)

Roger A. Burks¹, John M. Heraty¹, Jason Mottern^{1,2},
Chrysalyn Dominguez¹, Scott Heacox¹

¹ Department of Entomology, University of California, Riverside, CA 92521 ² USDA Systematic Entomology Laboratory, Washington, DC 20013-7012

Corresponding author: John M. Heraty (john.heraty@ucr.edu)

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Abstract

Twelve genera of Oraseminae (Hymenoptera: Eucharitidae) are recognized in the Old World. The genus *Orasema* Cameron is now considered as found only in the New World, and the Old World species, previously treated as species groups, are now treated as distinct genera. Eight new genera are proposed: *Australosema* **gen. n.**, *Cymosema* **gen. n.**, *Hayatosema* **gen. n.**, *Ibitya* **gen. n.**, *Ivieosema* **gen. n.**, *Leiosema* **gen. n.**, *Matantas* **gen. n.**, and *Zuparka* **gen. n.** The genus *Losbanus* Watanabe is given **revised status** from *Orasema*. Nine new species are proposed: *Australosema polituræ* **sp. n.** (Australia), *A. verghetta* **sp. n.** (Australia), *Cymosema capelina* **sp. n.** (Australia), *C. waterworthæ* **sp. n.** (Australia), *Hayatosema plicator* **sp. n.** (Vietnam), *Ivieosema confluens* **sp. n.** (Madagascar), *Iv. limula* **sp. n.** (Madagascar), *Leiosema lesiolouna* **sp. n.** (Republic of Congo), and *Zuparka fisheri* **sp. n.** (Madagascar). **New combinations** (from *Orasema*) include *Australosema valgius* (Walker, 1839), *A. synempora* (Heraty, 1994), *Hayatosema assectator* (Kerrich, 1963), *H. delhiensis* (Narendran & G. Kumar, 2005), *H. initiator* (Kerrich, 1963), *H. kailashi* (G. Kumar & Sureshan, 2015), *H. nigra* (Heraty, 1994), *H. nirupama* (G. Kumar & Narendran, 2007), *H. siruvana* (G. Kumar & Sureshan, 2015), *Ibitya communis* (Risbec, 1952), *Ib. seyrigi* (Risbec, 1952), *Ivieosema fraudulentula* (Reichensperger, 1913), *Iv. striatosoma* (Heraty, 1994), *Leiosema glabra* (Heraty, 1994), *Losbanus bouceki* (Heraty, 1994), *L. ishii* (Heraty, 1994), *L. promecce* (Heraty, 1994), *L. rugulosa* (Heraty, 1994), *Matantas koghiana* (Heraty, 1994), and *Zuparka monomoria* (Heraty, 2000). *Losbanus uichancoi* Ishii, 1932 is given **revised status** from *Orasema*. Distribution records, a new host association of *Pheidole* (Myrmicinae) for *Ibitya communis*, and an identification key to the Old World genera and species are provided.

Keywords

Parasitoid, Formicidae, morphology, revision, Palaeotropical

Introduction

Oraseminae constitutes one of the major lineages of the family Eucharitidae, with the estimated number of species approaching 200 (Heraty 2002), all of which are parasitoids of ants (Hymenoptera: Formicidae). There are verified host records of Oraseminae attacking six genera in the ant subfamily Myrmicinae and dubious records on Ecitoninae and Formicinae (Heraty 1994, 2002, Lachaud and Pérez-Lachaud 2012). Hosts for the Old World Oraseminae are species of the myrmicine genera *Monomorium* Mayr and *Pheidole* Westwood (Table 1). While *Orasema* Cameron is present throughout the New World with a northern-most record from southern Canada, Old World Oraseminae are known only from the tropics and subtropics, with northern-most records in India (New Delhi), Taiwan, Iriomote Island of Japan, and the southwestern highlands of Yemen (Heraty 1994, 2002).

The Old World species of Oraseminae were previously revised by Bouček (1988) and Heraty (1994), with a new species of *Orasema* from Madagascar added by Heraty (2000). A total of 36 species of Old World Oraseminae were placed into four genera: *Indosema* Husain & Agarwal, *Orasema* Cameron, *Orasemorpha* Bouček, and *Timioderus* Waterston. The Old World species of *Orasema* were grouped into six species groups by Heraty (1994), with two new groups added by Heraty (2000). Based on an analysis of 62 morphological and behavioral characters, *Indosema*, *Timioderus* and *Orasemorpha* were monophyletic and sister to *Orasema*, with the Old World species groups of *Orasema* paraphyletic to the New World *Orasema* (Heraty 2000). Among these genera, *Timioderus* and *Indosema* were considered distinct because of fusion of the mesosoma across the transscutal articulation between the axillae, and because they have eggs that are cylindrical instead of stalked (Heraty 1994, 2000); all other known eggs of Eucharitidae are stalked with the exception of Gollumiellinae (Heraty et al. 2004). Both *Timioderus* and *Orasemorpha* are the only Oraseminae known to deposit multiple eggs into a single oviposition puncture (unknown in *Indosema*), whereas all known *Orasema sensu lato* deposit a single stalked egg into each oviposition puncture made by the specialized ovipositor (Das 1963, Heraty 1994, 2000, Ishii 1932). All Oraseminae can be defined by the presence of an enlarged, toothed and usually anteriorly curved ovipositor that is used to enlarge a hole in plant tissue to deposit their eggs.

When using molecular data, the New World species of *Orasema* are consistently monophyletic (Heraty et al. 2004, Murray et al. 2013). The Old World Oraseminae are either monophyletic (Heraty 1994, Heraty et al. 2004) or paraphyletic (Murray et al. 2013) to the New World *Orasema*. Monophyly of *Orasema* s.l. worldwide is never supported. More recent unpublished analyses consistently support either monophyly of the Old World Oraseminae (ribosomal analyses with 18S, 28S, COI), or their paraphyly (Anchored Enrichment, 366–411 loci) with respect to the New World *Orasema*, but

Table I. List of Old World Oraseminae, with their geographic distribution and ant host genus. For a more complete list of synonymies and host information see Heraty (1994, 2002) and Heraty (2017). Asterisk (*) denotes type species of genus. Australian refers to Australia including Tasmania. NR is new host record.

Genus	Species	Distribution	Host genus
<i>Australosema</i> gen. n. (= <i>valgus</i> group)	<i>A. polituræ</i> sp. n.	Australia	
	<i>A. synempora</i> (Heraty, 1994), comb. n.	Australia	
	<i>A. valgus</i> (Walker, 1839), comb. n. *	Australia	<i>Pheidole</i>
	<i>A. verghetta</i> sp. n.	Australia	
<i>Cymosema</i> gen. n.	<i>C. capelina</i> sp. n.	Australia	
	<i>C. waterworthæ</i> sp. n. *	Australia	
<i>Hayatosema</i> gen. n. (= <i>assectator</i> group)	<i>H. assectator</i> (Kerrich, 1963)*	Indo-Pacific	<i>Pheidole</i>
	<i>H. delhiensis</i> (Narendran & G. Kumar, 2005)	Indo-Pacific	
	<i>H. initiator</i> (Kerrich, 1963)	Indo-Pacific	
	<i>H. kailashi</i> (G. Kumar & Sureshan, 2015)	Indo-Pacific	
	<i>H. nigra</i> (Heraty)	Ethiopian	
	<i>H. nirupama</i> (G. Kumar & Narendran, 2007)	Indo-Pacific	
	<i>H. plicator</i> sp. n.	Indo-Pacific	
	<i>H. siruwanica</i> (G. Kumar & Sureshan, 2015)	Indo-Pacific	
<i>Ibitya</i> gen. n. (= <i>communis</i> group)	<i>I. communis</i> (Risbec, 1952), comb. n. *	Madagascar	<i>Pheidole</i> NR
	<i>I. seyrigi</i> (Risbec, 1952), comb. n.	Madagascar	
<i>Indosema</i>	<i>I. indica</i> Husain & Agarwal, 1983 *	India & Kenya	
<i>Iviosema</i> gen. n. (= <i>striatosoma</i> group)	<i>I. confluens</i> sp. n.	Madagascar	
	<i>I. limula</i> sp. n.	Madagascar	
	<i>I. fraudulentæ</i> (Reichensperger), comb. n.	Ethiopian	<i>Pheidole</i>
	<i>I. striatosoma</i> (Heraty), comb. n. *	Ethiopian	
<i>Leiosema</i> gen. n. (= <i>glabra</i> group)	<i>L. glabra</i> (Heraty, 1994), comb. n. *	Ethiopian	
	<i>L. lesiolouna</i> sp. n.	Ethiopian	
<i>Losbanus</i> rev. stat. (= <i>uichancoi</i> group)	<i>L. bouceki</i> (Boucek), comb. n.	New Guinea	
	<i>L. ishii</i> (Heraty), comb. n.	Taiwan	
	<i>L. promecæa</i> (Heraty), comb. n.	New Guinea	
	<i>L. rugulosa</i> (Heraty), comb. n.	New Guinea	
	<i>L. uichancoi</i> Watanabe comb. n. *	Philippines	
<i>Matantæa</i> gen. n. (= <i>koghisiana</i> group)	<i>M. koghisiana</i> (Heraty), comb. n. *	New Caledonia	
<i>Orasemorpha</i>	<i>O. didentata</i> (Girault, 1940)	Australia	
	<i>O. eribotes</i> (Walker, 1839)*	Australian	<i>Pheidole</i>
	<i>O. goethei</i> (Girault, 1934)	Australia	
	<i>O. myrmicæ</i> (Girault, 1936)	Australia	<i>Pheidole</i>
	<i>O. pytallus</i> (Walker, 1846)	Australia	
	<i>O. sparsepilosa</i> Heraty, 1994	Australia	
	<i>O. tridentata</i> (Girault, 1915)	Australia	<i>Pheidole</i>
	<i>O. varidentata</i> (Girault, 1936)	Australian	
	<i>O. xeniades</i> (Walker, 1839)	Australian	<i>Pheidole</i>
<i>Timioderus</i>	<i>T. acuminatus</i> Heraty, 1994	Ethiopian	<i>Pheidole</i>
	<i>T. coronula</i> Heraty, 1994	Ethiopian	
	<i>T. peridentatus</i> Heraty, 1994	Ethiopian	
	<i>T. coronula</i> Heraty, 1994	Ethiopian	
	<i>T. refringens</i> Waterston, 1916 *	Ethiopian	
<i>Zuparka</i> gen. n. (= <i>monomoria</i> group)	<i>Z. fisheri</i> sp. n.	Madagascar	
	<i>Z. monomoria</i> (Heraty, 2000), comb. n. *	Madagascar	<i>Monomorium</i>

in either case, *Orasema* is never monophyletic. Character support for a monophyletic *Orasema* s.l. as presented in Heraty (1994) is weak. Of the characters discussed, only the basal petiolar flange is likely derived, but this has proven to be highly variable in the Old World taxa although not as prominent as can be observed in the New World taxa. Heraty (2000) proposed only a single unambiguous morphological synapomorphy (#52:0) for *Orasema*, the first-instar larvae without a tergopleural line, the absence of which is now regarded as plesiomorphic for the family as based on outgroup comparison.

In support of several upcoming phylogenetic studies, we have decided to recognize the problems inherent in the Old World *Orasema*. Given the wealth of morphological differences in the three other genera of Oraseminae, the associated biological differences, and the lack of morphological and molecular support for *Orasema* s.l., the best approach is to fragment the Old World species groups of *Orasema* into different genera and recognize only the monophyletic New World clade as *Orasema sensu stricto*. Herein we recognize 12 Old World genera, of which eight are new and one, *Losbanus*, is given revised status. Several new species are described, bringing the number of Old World species to 45, which is far overshadowed by the incredible diversity of *Orasema* in the New World.

Materials and methods

Material was examined from **ANIC**: Australian National Insect Collection, Canberra; **BMNH**: Museum of Natural History, London, UK; **BPBM**: Bernice P. Bishop Museum, Honolulu, HI, USA; **CASC**: California Academy of Sciences, San Francisco, CA, USA; **CNCI**: Canadian National Collection of Insects, Ottawa, Canada; **MNHP**: Muséum National d'Histoire Naturelle, Paris, France; **NMPC**: National Museum (Natural History), Prague, Czech Republic; **PPRI**: Plant Protection Research Institute, Pretoria, South Africa; **ROME**: Royal Ontario Museum, Toronto, ON, Canada; **TMP**: Ditsong National Museum of Natural History (formerly Transvaal Museum), Pretoria, South Africa; **UCRC**: UCR Entomology Research Museum, Riverside, CA, USA; **UNMO**: University of Montana, Bozeman, MT, USA; **USNM**: National Museum of Natural History, Washington, DC, USA. Each specimen is labeled with a UCRCENT or CASENT barcode specimen identification number; UCRCENT codes include an additional reference to the museum of deposition. Georeferenced points for specimens estimated from Google Earth are italicized. Photographs were taken using a Leica Imaging System with a Z16 APO A microscope, and stacked using Zerene Stacker (version 1.04, Zerene Systems, LLC).

Morphological terms follow Heraty et al. (2013) and Burks et al. (2015). All terms were verified using the Hymenoptera Anatomy Ontology (<http://portal.hymao.org/>) when they are represented in that resource, and variations from their preferred terms are discussed here: palpomere formula follows a maxillary:labial format; mandibular tooth count follows a right:left format; surface sculptural terms follow illustrations provided by Harris (1979). Important features include the base of the petiole, which can either

be tapered to the articulating condyle within the propodeal foramen (Figs 20, 25) or truncate basally external to the foramen (Figs 5, 11, 67, 75), and if truncate then with an anterior transverse basal carina (apc, Figs 5, 67, 75).

In the following taxonomic treatments, we provide only new nomenclatorial acts or new information. We do not revisit the genera *Indosema*, *Orasemorpha* and *Timioderus*, which were revised in Heraty (1994). The identification key includes treatments only for the newly described species. Two undescribed genera are included along with illustrations that have only been collected as pharate adults (Figs 85, 86).

Key to Oraseminae of the Old World

- 1 Transscutal articulation medially sinuate; axillae strongly advanced laterally beyond posterior margin of mesoscutum (Figs 19, 24). Fore wing with anterior margin broadly rounded posterior to stigmal vein making fore wing appear ovate (Figs 15, 27). Petiole narrowed gradually into foramen (Fig. 20), lacking anterior petiolar flange (Australian; males unknown) ***Cymosema* gen. n.**...2
- Transscutal articulation either absent medially (Fig. 42) or present and at most slightly sinuate (usually straight) and axillae not strongly advanced (Figs 4, 10, 32). Fore wing with anterior margin relatively straight (Figs 7, 33). Petiole variable.....3
- 2 (1) Mandibles minute and lacking distinct teeth (Fig. 16, md). Mesosomal dorsum entirely smooth (Fig. 19)..... ***C. capelina* sp. n.**
- Mandibles 3/2 dentate with teeth narrow and weakly curved (Figs 21, 22). Mesosoma anteriorly reticulate (Fig. 24)..... ***C. waterworthae* sp. n.**
- 3 (1) Upper frons with a large pit immediately below median ocellus (Fig. 39, sd). Antenna with 7 funiculars; anellus transverse and distinct (Fig. 40). Petiole without anterior carina. Metasomal tergite margins laterally sinuate (Figs 45, 46) (Ethiopian and Malagasy)..... ***Iviosema* gen. n. (*striatosoma*-group of Heraty 1994)...**4
- Upper frons without dorsal pit. Other characters variable.....7
- 4 (3) Face reticulate. Transscutal articulation complete. Fore wing with moderately long setae; without swelling posterior to submarginal vein (Ethiopian)..... 5
- Face smooth (Figs 39, 47) or with fine sculpture (Fig. 50). Transscutal articulation fused medially. Fore wing with very short setae; with distinct longitudinal swelling posterior to submarginal vein (Figs 44, 55) (Malagasy)..... 6
- 5 (4) Mesoscutellum reticulate dorsally... ***Iviosema fraudulenta* (Reichensperger)**
- Mesoscutellum longitudinally striate..... ***Iviosema striatosoma* (Heraty)**
- 6 (5) Face smooth. Scape brown. Upper frons with two depressions between eye and antennal scrobe (Figs 39, 47) ***Iviosema confluens* sp. n.**

- Face smooth to shallowly reticulate. Scape white. Upper frons with single transverse depression between eye and antennal scrobe (Fig. 50).....
..... ***Iviosema limula* sp. n.**
- 7 (3) Transscutal articulation (between mesoscutum and axilla) obliterated medially. Maxillary and labial palpi absent **8**
- Transscutal articulation complete with a distinct transverse suture (Fig. 4). Maxillary and labial palpi present **9**
- 8 (7) Body metallic blue or green. Head and mesosoma strongly sculptured and either coriaceous or rugulose. Anellus present. Mandibles truncate or spatulate, maxilla small. Petiole not fused ventrally. Ovipositor curved ventrally. Body length at least 3.5 mm (Ethiopian) ***Timioderus* Waterston**
- Body black or brown. Head and mesosoma almost smooth. Anellus absent. Mandibles absent, maxilla enlarged and lobate. Petiole fused ventrally. Ovipositor long and relatively straight. Body length about 2 mm (Kenya [New Record: UCRCENT 00478780, Olorgesailie National Monument, R. Cope-land] and India)..... ***Indosema* Husain & Agarwal**
- 9 (7) Petiole of female transverse, at most as broad as long. Petiole of male may be twice as long as broad, but then distal third or half supported ventrally by swollen anterior expansion of first gastral sternite (Gs_1). Base of petiole lacking an anterior dorsal carina (Australian) **10**
- Petiole of both sexes cylindrical and at least as long as broad (Figs 5, 67, 86), but usually much longer and gaster never appearing sessile. Petiole of male with anterior margin of first gastral sternite (Gs_1) meeting apex of petiole (Figs 64, 86). Base of petiole usually truncate and usually with an anterior transverse carina (Fig. 75) (Old World tropics)..... **11**
- 10 (9) Antennal flagellomeres cylindrical. Base of petiole narrowed to condyle.....
..... ***Orasemorpha* Bouček**
- Antennal flagellomeres lobate (Fig. 85). Base of petiole truncate.....
..... **Undescribed and unplaced teneral male (new genus 1)**
Antenna encased in exuvia, collected from base of ant-infested termite mound, very distinct from other genera and shows some similarities with *Timioderus* (Australia: QLD: Mareeba; ANIC: UCRCENT00238798).
- 11 (9) Lower face lateral to clypeus finely reticulate (Fig. 29). Frenum and propodeum evenly sculptured, propodeum lacking a distinctly differentiated narrow median band of areolate sculpture. Prepectus evenly reticulate or rugose, dorsal margin without a raised rim and overlapped by ventral margin of mesoscutum. Callus at most with a few minute setae. Female antenna with 7–8 funiculars, male with 7–9 funiculars. Ventral valve of ovipositor with several minute lateral teeth (Fig. 35)
..... ***Hayatosema* gen. n. (assectator-group of Heraty, 1994)**
- Face variously sculptured, but if finely reticulate then propodeum with distinctly differentiated median channel (Fig. 11), prepectus broadly foveate with a distinctly raised dorsal margin (Fig. 12) or callus with dense patch of

- long hairs. Both sexes with 7–9 funiculars. Ventral valve of ovipositor with 3–4 lateral teeth (Figs 13, 76)..... **12**
- 12 (11) Antenna with 8–9 funiculars, if 7, then labrum with more than 7 digits, body black, and propodeal disc evenly sculptured (*Ib. seyrigi*, Madagascar). Ocellar-ocular sulcus usually distinct. Propodeal disc evenly sculptured, rarely smooth. Fore wing often without speculum **13**
- Antenna with 7 funiculars, if labrum with more than 7 digits, then body metallic blue green and propodeal disc smooth laterally. Ocellar-ocular sulcus absent. Fore wing setation variable..... **14**
- 13 (12) Face smooth laterally (Fig. 36). Labrum with more than 9 digits (one undescribed specimen with 5 digits). Antenna with 7–8 funiculars (Madagascar)... .. ***Ibitya* gen. n. (communis-group of Heraty, 2000; 2 species described)**
- Face evenly sculptured laterally. Labrum with 4 digits (one undescribed Australian species with 6). Antenna with 8–9 funiculars (Paleotropical excluding Madagascar) ***Losbanus* rev. stat. (uichancoi-group of Heraty, 1994; 5 species)**
- 14 (12) Propodeal disc evenly sculptured **15**
- Propodeal disc smooth laterally, usually with a distinct median longitudinal channel with strong areolate sculpture (Figs 11, 73), rarely weakly reticulate medially (Fig. 5) **17**
- 15 (13) Face and frenum completely smooth (Figs 57, 58, 62) (Ethiopian).....
- ***Leiosema* gen. n. (glabra-group of Heraty, 1994)...16**
- Face completely and evenly reticulate; scutellar disc and frenum rugose-reticulate (Fig. 86) (Australian).....
- **Undescribed and unplaced teneral male (new genus 2)**
- Antenna encased in exuvia, no ant host information, close to *Australosema* but very distinct from other species (Australia: QLD: Thornton Peak, QM:UCRCENT00241816).
- 16 (15) Mandibles 3:3 dentate (Fig. 62). Scutellar disc with prominent reticulate sculpture (Fig. 61). Pronotal neck extended anteriorly and reticulate (Fig. 61). Female unknown..... ***Leiosema lesiolouna* sp. n.**
- Mandibles 3:2 dentate. Pronotal neck not extended and smooth. Scutellar disc at most with shallow reticulate sculpture anteriorly, weakly reticulate or smooth posteriorly (Figs 59–60) ***Leiosema glabra* (Heraty)**
- 17 (14) Labrum with 6–8 digits. Face smooth (Papua New Guinea [undescribed] and New Caledonia) ***Matantas* gen. n. (koghisiana-group of Heraty, 1994), *M. koghisiana* (Heraty)**
- Labrum with 4 digits. Face smooth or reticulate **18**
- 18 (17) Antecostal sulcus present, dividing first gastral sternite and separating off a distinct acrosternite (Figs 1, 7). Face smooth or with at least some reticulate sculpture. Scrobes without parallel median channels. Male scape glands absent (Australian) ***Australosema* gen. n. (valgius-group of Heraty, 1994)...19**
- Antecostal sulcus absent (first gastral sternite smooth and uninterrupted). Face entirely smooth. Scrobes with parallel median channels (Fig. 79). Male

- scape glands present (Malagasy)
 **Zuparka gen. n. (monomia-group of Heraty, 2000) ...22**
- 19 (18) Face entirely smooth (Fig. 2) **A. politurae sp. n.**
 – Face with at least frons with reticulate sculpture (Fig. 8) **20**
- 20 (19) Frenum with median longitudinal groove (Fig. 10). Scape dark metallic
 brown in both sexes **A. verghetta sp. n.**
 – Frenum without median longitudinal groove. Scape yellow or dark brown **21**
- 21 (20) Lateral lobe of mesoscutum and axilla smooth and polished
 **A. synempora (Heraty)**
 – Lateral lobe and axilla coriaceous to rugose, axilla weakly carinate with sur-
 face imbricate to reticulate. Scape yellow to dark brown (see Heraty 1994 for
 discussion of variants) **A. valgius (Walker)**
- 22 (18) Face entirely smooth (Figs 69, 79). Propodeal disc with lateral areas smooth
 (Fig. 73) **Z. fisheri sp. n.**
 – Frons weakly coriaceous (Fig. 81). Propodeal disc with lateral areas weakly
 sculptured **Z. monomia (Heraty)**

***Australosema* Heraty & Burks, gen. n.**

<http://zoobank.org/9A5268EF-48B5-4293-9562-46A528062AAE>

Figs 1–14

Type species. *Eucharis valgius* Walker: 412–414. Heraty 1994: 79–81, figs 122, 124, 131, 192, 221, 238, 248, 262–263.

Etymology. Random combination of letters and referring to the distribution; gender feminine.

Discussion. Defined by Heraty (1994) as the *Orasema valgius* group for two species from Australia, and was distinguished from the *glabra* and *koghisiana* groups in part by an at least partly reticulate face and a labrum with 4 digits (Heraty, 1994). *Australosema politurae* and related species expand the definition of the group to include an almost or completely smooth face. Originally recognized to include two species, *Australosema synempora* (Heraty) and *A. valgius* (Walker). Herein we add two new species, *A. politurae* and *A. verghetta*.

Diagnosis. Separated from *Orasema* s.s. by a relatively weak or absent basal petiolar flange, and smooth lateral areas on the propodeal disc in combination with a rugose-areolate or reticulate median channel. Distinguished from other Old World genera by the head subtriangular in frontal view (Fig. 2); scrobal depression evenly impressed and lacking parallel channels or dorsal depressions; dorsal occipital margin abrupt and rounded or carinate; funicle 7-segmented; labrum with 4-digits; mesonotum with only minute setae; mesoscutal lateral lobes and frenum sculptured or smooth; transscutal articulation complete and relatively straight; propodeal disc with lateral areas at most weakly sculptured (Fig. 5), but usually smooth (Fig. 11), and with a broad sculptured

median channel; prepectus foveate and tightly articulated with pronotum ventrally (Fig. 12); fore wing with basal area bare and specular area either bare or pilose (Figs 1, 7), wing disc with very short setae; postmarginal vein much longer than stigmal vein and reaching about half distance to wing apex; petiole base truncate with weak basal flange (Fig. 5); antecostal sulcus present and smooth, at most weakly foveate laterally; first valvula of ovipositor with 3–4 lateral teeth and robust oblique subapical carina. Male scape lacking ventral pores.

Similar genera that have a smooth face and smooth lateral regions on the propodeal disc include *Leiosema*, *Matantas*, and *Zuparka*. *Australosema* is distinguished from *Leiosema* and *Zuparka* by several features, including the absence of a parallel channeled scrobes with dorsal depressions, 3–4 large teeth on the ventral (first) valvula of the ovipositor instead of 9–10 minute teeth, and absence of ventral pores on the male scape. It differs from *Matantas* primarily by having a 4-digitate rather than 6–8 digitate labrum.

Host association. Myrmicinae: *Pheidole* (Girault 1913[175], Heraty 2000).

Distribution. Four species. Australia including Tasmania.

***Australosema politurae* Burks, sp. n.**

<http://zoobank.org/D4F9B53D-B548-4676-832B-68DD3FD08CC8>

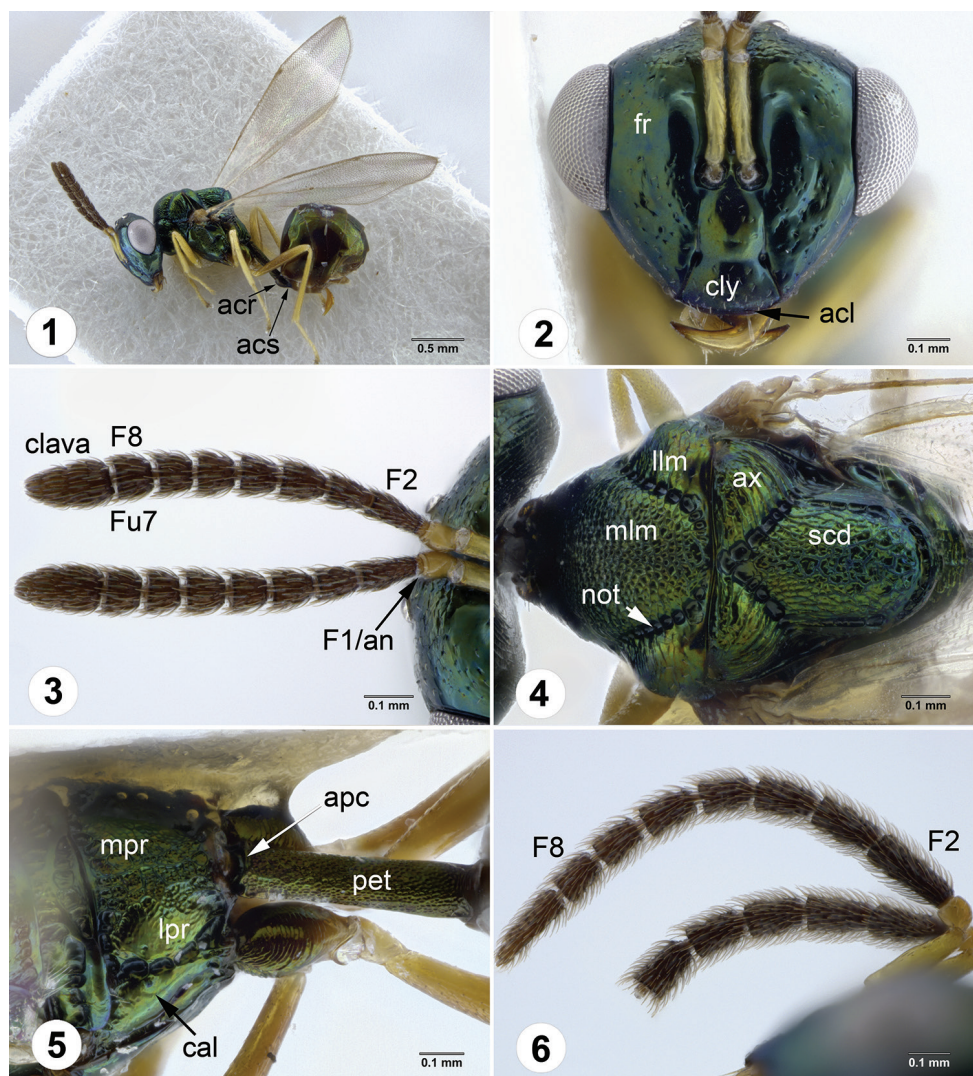
Figs 1–6

Etymology. Latin noun in genitive case meaning “a polishing,” referring to the smooth face.

Diagnosis. Differs from most *Australosema* by having an almost entirely smooth face, with the frons not swollen and the dorsal occipital carina weak. It differs from *A. synempora* in several features, including having a completely sculptured axilla and mesoscutal lateral lobe and a less densely setose fore wing. *Matantas koghisiana* also has a smooth face and frenum, but *A. politurae* has four labral digits and a more elongate mesosoma. Additional features include the lateral lobe of mesoscutum almost entirely rugose-reticulate, smooth near posterior edge; axilla reticulate (Fig. 4); mesepisternum not swollen anterior to mesocoxae (Fig. 1). Propodeum sublaterally nearly smooth (Fig. 5), and in the female the F2 is longer than F3 and expanding apically (Fig. 3).

Female. Length 2.2–3 mm. Head and mesosoma dark metallic green, petiole black, gaster brown with faint metallic luster. Scape, pedicel, anellus yellowish, funiculars and clava brown. Coxae metallic green basally, becoming yellowish apically, femora pale brown except yellowish at tips, remainder of leg yellowish. Fore wing venation pale brown, setae dark. Gaster brown to dark brown, with metallic luster.

Head (Figs 2–3), 1.1–1.2× as broad as high. Face almost entirely smooth except for minute setal pits ventrally, dorsally with shallow irregular sculpture near ocellar triangle; scrobal depression narrow and impressed, without dorsal scrobal foveae; without longitudinal furrow between torulus and eye; supraclypeal area and clypeus smooth, supraclypeal area slightly protruding, anteclypeus present; vertex weakly carinate posterior to ocellar triangle. Labrum with 4 digits. Palpal formula 3:3. Flagellum



Figures 1–6. *Australosema politurae*. Paratype female: **1** habitus, lateral **2** head, anterior **3** antennae, ventral **4** mesosoma, dorsal **5** propodeum and petiole, oblique dorsal. Paratype male: **6** antennae, lateral. acf = anteclypeus; acr = acrosternite; acs = antecostal sulcus; apc = anterior petiolar carina; ax = axilla; cal = callus; cly = clypeus; F = flagellomere; fr = frons; Fu = funicular; F1/an = anellus; llm = mesoscutal lateral lobe; lpr = lateral propodeal disc; mlm = mesoscutal midlobe; mpr = median propodeal disc; pet = petiole; not = notauli; scd = scutellar disc.

1.1–1.3× head height, with 7 funiculars; anellus transverse; F2 2.0–2.8× as long as broad, F2 1.4–1.6× as long as F3.

Mesosoma (Figs 4–5). Mesoscutal midlobe densely reticulate, lateral lobe shallowly transversely rugose-reticulate and becoming smooth posteriorly. Axilla rugose-reticulate, with longitudinal carinae posteriorly that extend across the scutoscutellar suture;

mesoscutellar disc finely rugose-reticulate, with some wrinkle-like carinae posteriorly; frenal line carinate, frenum rugose-reticulate; axillular sulcus carinate, axillula glossy and very shallowly sculptured aside from a few longitudinal carinae. Mesepisternum anterodorsally mostly smooth but not overlapping posterior edge of prepectus, posteroventrally smooth, not becoming horizontal anterior to mesocoxa; upper and lower mesepimeron mostly smooth except for foveate area at posterior edge, transepimeral sulcus foveate. Propodeum with broad rugose-reticulate median channel, sublaterally nearly smooth; callus smooth, with a few tiny setae. Metacoxa shallowly rugose-reticulate dorsolaterally. Fore wing 2.3–2.4× as long as broad; costal cell with 1 uninterrupted row of ventral setae; basal cell bare; speculum present; cubital fold with uninterrupted ventral row of setae; subcubital fold setose posterior to speculum, bare posterior to basal cell; stigmal vein 1.5–2.0× as long as broad, only slightly expanded at uncus; marginal vein about 6× as long as stigmal vein. Hind wing costal cell with a few ventral setae in apical third.

Metasoma. Petiole 4.0–4.8× as long as broad, 1.6–1.7× as long as metacoxa, finely longitudinally rugose-reticulate, with some incomplete longitudinal carinae laterally and ventrally (Fig. 5). Antecostal sulcus of Gs_1 smooth, very shallow medially; acrosternite smooth, uniformly rounded or with a transverse elevation near midlength. Cercus with a curved seta that is much longer than the others. Hypopygium with a few short setae and a slightly longer posterolateral seta on each side. Ovipositor yellow medially, orange laterally, dorsal valve with 7–8 medially interrupted sawtooth-like annuli; ventral valve with 3–4 weakly defined teeth along lateral carina, and with oblique lateral carina immediately basal to toothed apex (as in Fig. 7).

Male. Length 2.1–2.6 mm. Antennal flagellum (Fig. 6) densely covered with long decumbent setae, with longitudinal sensilla extending beyond funicular apices, funiculars separated by stalk-like constrictions; F7 as long or longer than F6, shorter than F8; scape and pedicel yellow, flagellum brown. Mesoscutal midlobe transversely rugose-reticulate; mesoscutellum rugose-areolate with underlying reticulate sculpture. Petiole 5.7–6.8× as long as broad, 1.9–2.4× as long as metacoxa, narrowest slightly beyond midlength, finely reticulate but becoming smooth posteriorly.

Material examined. Holotype: Australia: QLD: Mt. Glorious, 27°19'54"S, 152°45'29"E, 7–13.ii.1998, N. Power, Malaise trap [1♀, ANIC: UCRCENT00091415]. **Paratypes: Australia: QLD:** Brisbane Forest Pk, 27°25'04"S, 152°49'48"E, 29.xi–5.xii.1997, N. Power, dry sclerophyll, Malaise Trap 3 [1♂, ANIC: UCRCENT00312131]. Lamington Nat. Park, Binna Burra, 28°11'53"S, 153°11'16"E, 10.xii.2002, George, Hawks, Munro, & Owen, rainforest, sweep [1♀, UCRC: UCRCENT00312128]. Mt. Glorious, 27°19'54"S, 152°45'29"E, 10–16.i.1997, N. Power, Malaise Trap [1♀, UCRC: UCRCENT00312135]. Mt. Glorious, 27°19'54"S, 152°45'29"E, 13–24.iii.1998, N. Power, Malaise Trap [1♂, UCRC: UCRCENT00312133]. Mt. Glorious, 27°19'54"S, 152°45'29"E, 24–30.xi.1997, T. Hiller, MT 3 [3♂, UCRC: UCRCENT00312060 – UCRC: UCRCENT00312060–62]. Mt. Glorious, 27°19'54"S, 152°45'29"E, 3–9.i.1998, T. Hiller, MT 2 [1♀, UCRC: UCRCENT00312063].

Similar species. A single specimen (gaster missing, likely female; UCR-CENT0092152, D0161) from southeast QLD is molecularly similar and is placed as the sister of *A. politurae*. It is distinct by having a completely smooth face with a strongly swollen frons. Two other series (all males from QLD) likely represent another two species that share similar features to the D0161 specimen. All specimens have a 4-digitate labrum, 7 funiculars, a completely smooth face, and a strongly carinate dorsal occipital margin.

***Australosema verghetta* Burks, sp. n.**

<http://zoobank.org/F282DE42-2C64-4FF4-B131-0752F56D00BA>

Figs 7–14

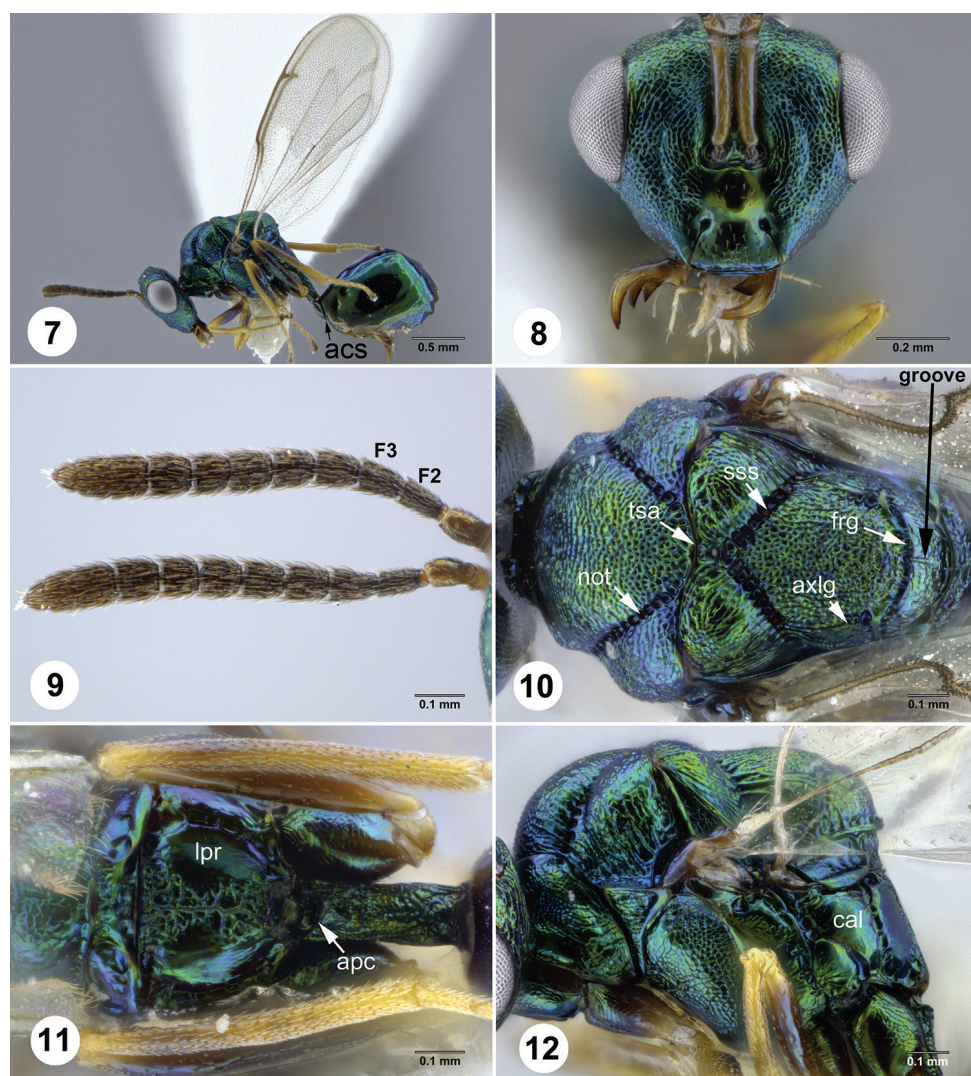
Etymology. Italian noun used in heraldry to refer to a line along the middle, referring to the longitudinal scutellar groove present in females.

Diagnosis. Differs from other *Australosema* by the presence of a longitudinal median groove on the frenum of females, and similar to some of the included species, the frons is rugose-reticulate and the lower face smooth. The female also has F2 much narrower than F4, not longer than F3, with few longitudinal sensilla (Fig. 9). Males are very similar to those of *A. valgius* (Walker), but differ in having a mostly or entirely dark brown scape (Fig. 8), while that of *A. valgius* is almost entirely yellow.

Female. Length 2.1–2.6 mm. Head and mesosoma metallic green to blue-green, metasoma brown with metallic green luster. Scape and pedicel dark brown; anellus pale brown; flagellum dark brown. Coxae metallic green basally, becoming brownish to yellowish apically, remainder of leg yellowish except femora mostly dark brown and with yellowish tips. Fore wing venation brown, setae dark. Gaster metallic green.

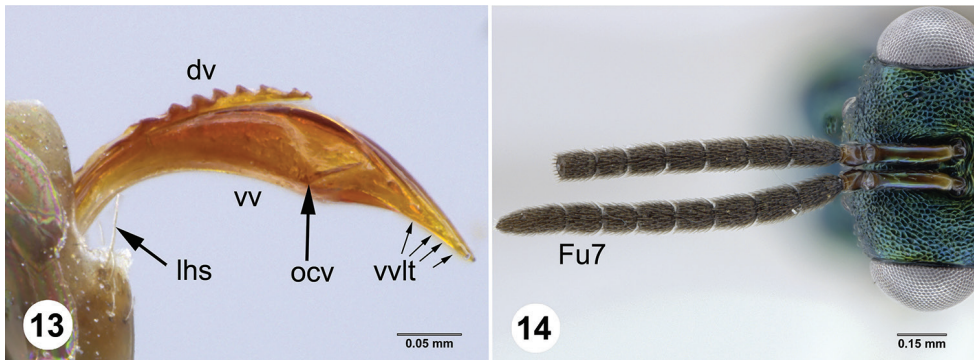
Head (Figs 8–9) 1.2–1.3× as broad as high. Face mostly reticulate, smooth ventrally adjacent to mouthparts; vertex with weak carina posterior to ocellar triangle; scrobal depression narrow and impressed, without dorsal scrobal foveae; longitudinal furrow present amidst sculpture between torulus and eye; supraclypeal area and clypeus smooth and separated by only a very shallow depression, with short decumbent setae, supraclypeal area protruding, anteclypeus present. Labrum with 4 digits. Palpal formula 3:3. Flagellum 1.1–1.2× height of head, with 7 funiculars, dark brown; anellus transverse; F2 1.7–2.3× as long as broad, 0.7–1.0× as long as F3, nearly parallel-sided and having few longitudinal sensilla (Fig. 9, F2).

Mesosoma (Figs 10–12). Mesoscutum transversely rugose-reticulate, lateral lobe nearly smooth at posterior margin. Axilla rugose-reticulate and with longitudinal carinae that extend across the scutoscutellar suture; mesoscutellar disc rugose-reticulate except peripherally with many subparallel carinae; frenal line posteriorly carinate, frenum rugose-reticulate and with median longitudinal groove; axillular sulcus foveate, axillula with reticulate sculpture laterally, and with subparallel longitudinal carinae. Mesepisternum anterodorsally smooth and overlapping posterior lower



Figures 7–12. *Australosema verghetta*. Paratype female: **7** habitus, lateral **8** head, anterior **9** antennae, dorsal **10** mesosoma, dorsal; **11** propodeum and petiole, dorsal **12** mesosoma, lateral. acs = antecostal sulcus; apc = anterior petiolar carina; axlg = axiular groove; cal = callus; F = flagellomere; frg = frenal groove; lpr = lateral propodeal disc; not = notaulix; SSS = scutoscuteal sulcus; tsa = transscutal articulation.

margin of prepectus, posteroventral surface with horizontal shelf that is shorter than mesepimeron but swollen and smooth anterior to mesocoxa; upper and lower mesepimeron smooth, transepimeral sulcus foveate. Propodeal disc with a meandering median carina crossed by short transverse carinae, sublaterally smooth; callus smooth and with very short setae. Metacoxa basally rugose-reticulate, apically smooth. Fore wing 2.4–2.5× as long as broad; costal cell ventrally setose in apical half; basal cell



Figures 13–14. *Australosema verghetta*. Paratype female: **13** ovipositor, lateral. Paratype male: **14** antenna, ventral. Fu = funicle; dv = dorsal valve; lhs = lateral hypopygial seta; ocv = oblique carina of ventral valvula; vv = ventral valve; vvt = ventral valve lateral teeth.

bare; speculum present; cubital fold setose ventrally posterior to basal cell but bare posterior to speculum; subcubital fold setose along speculum but bare posterior to basal cell; stigmal vein 1.5–2.0× as long as broad, only slightly expanded at uncus; postmarginal vein about 5.0× as long as stigmal vein. Hind wing costal cell setose in apical third, bare in basal two thirds.

Metasoma (Figs 11, 13). Petiole 0.9–1.1× as long as metacoxa, 2.4–3.1× as long as broad, transversely rugose-reticulate and with a few short longitudinal wrinkle-like carinae; basally truncate with at most a weak basal flange. Antecostal sulcus of Gs₁ smooth to finely sculptured laterally; acrosternite smooth. Cercus with 1 curved seta that is much longer than the others. Hypopygium with a few short setae and 1 longer posterolateral seta on each side (Fig. 13, lhs). Ovipositor dorsal valve with 7–8 medially interrupted annuli; ventral valve with 4–5 weakly defined teeth, and with oblique subapical carina immediately basal to toothed apex (Fig. 13, ocv).

Male. Length 2.4–2.6 mm. Scape dark brown for most or all of its length (Fig. 14), yellowish in only a small basal area if at all; antennal flagellum densely covered with short decumbent setae, with longitudinal sensilla extending beyond funicular apices; F7 shorter than F6 and F8; entire antenna dark brown and scape with metallic luster. Frenum without longitudinal groove; axillula with reticulate sculpture and longitudinal carinae. Metatibia dark brown except at apices. Petiole 5.9–7.4× as long as broad, 2.2–2.6× as long as metacoxa, narrow at midlength, reticulate.

Material examined. Holotype: Australia: SA: Mt. Barker, 511m, 35°04'00"S, 138°55'17"E, 22–23.i.1999, J. Heraty, Eucalyptus scrub [1♀, ANIC: UCR-CENT00091308]. **Paratypes: Australia: SA:** Mt. Barker, 511m, 35°04'00"S, 138°55'17"E, 22–23.i.1999, J. Heraty, Eucalyptus scrub [14♂ 19♀, ANIC: UCR-CENT00311977–81, UCRC: UCR-CENT00091307, UCR-CENT00091309, UCR-CENT00311982–89, UCRC: UCR-CENT00312042–59].

***Cymosema* Heraty & Burks, gen. n.**

<http://zoobank.org/8A987051-99CE-482E-ABB1-165B9ACDB8FF>

Figs 15–27

Type species. *Cymosema waterworthae* Burks & Mottern sp. n.

Etymology. Based on the Greek κύμα (*kyma*) for wave and referring to the sinuate transscutal articulation; gender feminine.

Discussion. The two species in this group are each known from single specimens collected in Australia, both among the smallest known Eucharitidae. They differ from previously described species of *Orasema* by having a cylindrical ventrally fused petiole that tapers basally to the articulating condyle (Figs 20, 25), reduced mouthparts (Figs 16, 21), and advanced axillae (Figs 19, 24). The mesoscutum and mesoscutellum are separated by a distinct transscutal articulation, but the sclerites are tightly associated and the axillae are advanced (thus somewhat resembling the state in *Timioderus* and *Indosema*). Based on morphological (reduced anellus, reduced mouthparts, smooth head and mesosoma) and molecular evidence, they are the potential sister group of *Indosema*. The fore wing shape is unique within Eucharitidae, with the anterior leading edge of the fore wing anteriorly curved at the stigmal vein giving the wing an oval-shaped appearance (Fig. 27); in other Eucharitidae the wing margin beyond the stigmal vein is straight (Fig. 7). Male unknown.

Diagnosis. Recognized from most Oraseminae by the sinuate closely associated transscutal articulation, minute discoidal anellus, reduced mouthparts that are at most bidentate and medially directed (not falcate), basally tapered petiole and elongate slightly curved ovipositor. Distinguished from other Old World genera by the head transverse in frontal view and mostly smooth (Figs 16, 21); scrobal depression strongly impressed and forming weak parallel channels, but without dorsal foveae; dorsal occipital margin abrupt and rounded; funicle 7-segmented; mandibles, chisel-shaped and slightly broader than long or bidentate with both teeth projecting medially (not falcate as in other Eucharitidae); labrum appears to be membranous and without digits; palpi greatly reduced; mesonotum appearing bare, at most with minute setae; mesoscutal lateral lobes entirely smooth or weakly reticulate laterally; frenum smooth; transscutal articulation sinuate and distinct but sclerites closely associated and appearing fused; callus bare; propodeal disc smooth (Fig. 20) or weakly reticulate with single median carina (Fig. 24); prepectus foveate and loosely articulated with pronotum ventrally (Fig. 18); fore wing with basal area and specular area evenly covered with minute setae, and anterior margin of fore wing disc curved at stigmal vein (Fig. 27); postmarginal vein short and about 1.5× as long as stigmal vein; petiole base tapered and without transverse flange (Figs 20, 25); petiole fused ventrally, basally tapering to condyle and without basal flange; acrosternite swollen and finely reticulate, antecostal sulcus not apparent, but a distinct transition to the smooth posterior region of Gs₁; ovipositor long and slightly curved anteriorly (Fig. 26); first valvula with 3–4 lateral teeth and with a strong oblique subapical ridge.

Host association. Unknown.

Distribution. Two species. Australia (Queensland and Western Australia).

***Cymosema capelina* Burks & Mottern, sp. n.**

<http://zoobank.org/4E96F380-F80F-417C-B154-D49256EABA22>

Figs 15–20

Etymology. Noun from Spanish, meaning wide-brimmed floppy hat, referring to the head shape.

Diagnosis. Mandibles highly reduced, broader than long and truncate. Funiculars tapering to apex. Frons smooth. Submarginal vein with several long setae, fore wing with distinct marginal fringe.

Female. Length 1.3 mm. Head and mesosoma dark brown with very faint metallic luster. Scape, pedicel and anellus pale brown, funiculars and clava brown. Leg brown to milky brown, with slightly darker areas on the coxa basally, femur except at its tips, tibia subbasally, and last two tarsomeres. Fore wing hyaline; venation pale brown, setae dark. Gaster brown with faint metallic luster.

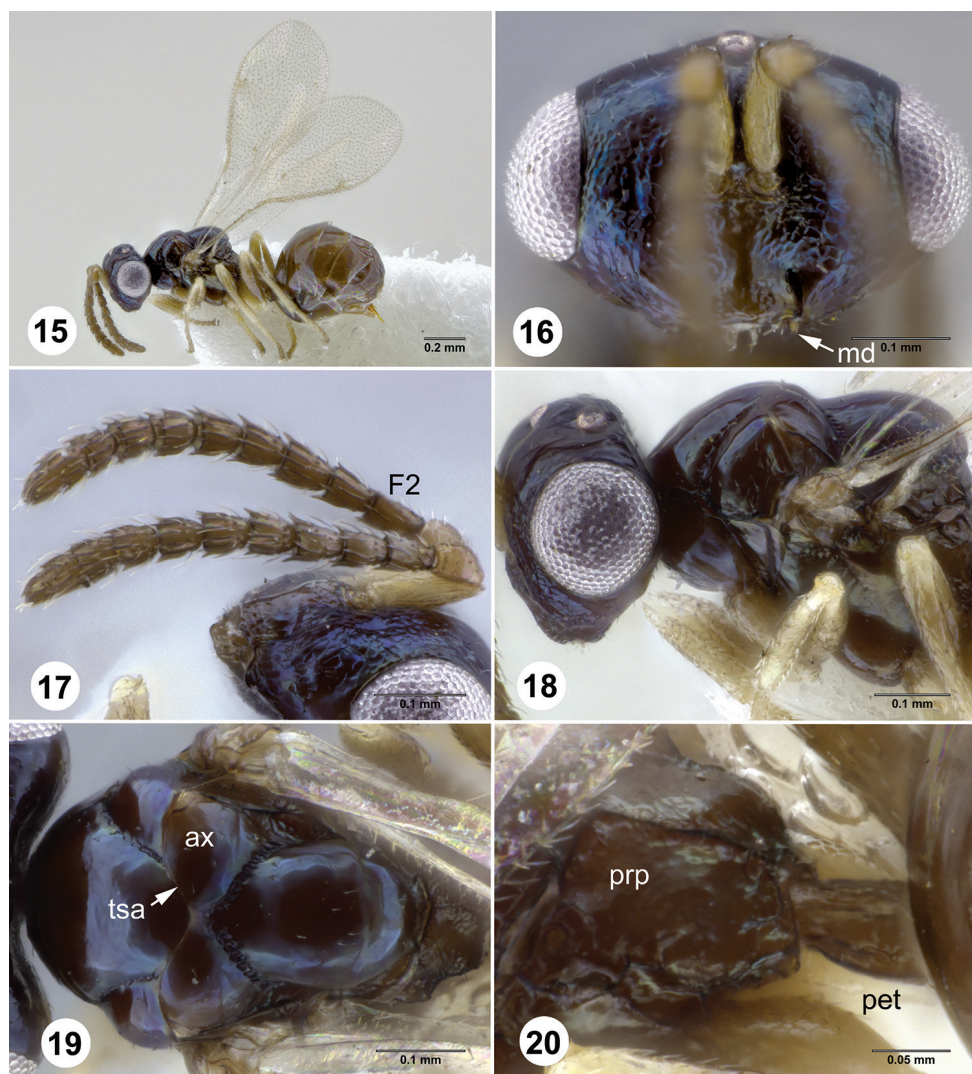
Head (Figs 16–17) transverse, $1.4\times$ as broad as high. Head receding ventral to toruli (Fig. 18); face dorsally smooth, ventrally coriaceous; supraclypeal area and clypeus medially smooth and laterally shallowly coriaceous, anteclypeus absent; vertex not carinate. Mandibles truncate and broader than long, broadly separated. Palpal formula 2:1, palpi long. Pedicel broader than F2; anellus small but easily visible; flagellum $1.4\times$ head height, with 7 funiculars that expand apically and have semi-erect long setae arising from their bases; F2 $1.3\times$ as long as broad, $1.0\times$ as long as F3.

Mesosoma (Figs 18–19). Mesoscutum smooth and glossy, notauli evenly impressed and smooth. Axilla strongly advanced, smooth; scutoscutellar suture finely foveate; mesoscutellar disc and axillula smooth, without axillular sulcus; frenum distinguished by a slight change in elevation at frenal line, smooth. Propodeal disc with median carina, weakly sculptured laterally; callus bare, separated from propodeal disc by wrinkle-like longitudinal carinae. Metacoxa smooth to shallowly reticulate. Fore wing spatulate, $2.6\times$ as long as broad; costal cell with 1 complete row of ventral setae; submarginal vein with several long hairs; basal cell setose dorsally and ventrally; speculum absent; cubital and subcubital folds setose; marginal fringe present; stigmal vein $1.5\times$ as long as broad; dorsal setae of disc much longer than ventral setae; postmarginal vein about $1.5\times$ as long as stigmal vein. Hind wing costal cell with a few setae in apical third.

Metasoma. Petiole $0.7\times$ as long as metacoxa, $1.8\times$ as long as broad, smooth except for longitudinal carinae, including a median carina dorsally, narrowing anteriorly to abruptly expand at the anterior condyle, without anterior transverse carina, ventrally smooth (Fig. 20). Antecostal sulcus of Gs_1 crossed by many longitudinal carinae; acrotermite smooth. Cercus with all setae subequal in length. Hypopygium bare. Ovipositor only slightly exerted in holotype and features not distinguished.

Male. Unknown.

Material examined. Holotype: Australia: Queensland: Heathlands, $11^{\circ}27'00''S$, $142^{\circ}21'00''E$, 25.vii–18.viii.1992, P. Zborowski, J. Cardale, Malaise trap [1♀, ANIC: UCRCENT00238787], deposited in ANIC.



Figures 15–20. *Cymosema capelina*. Holotype female: **15** habitus, lateral **16** head, anterior **17** antennae, lateral **18** mesosoma, lateral **19** mesosoma, dorsal **20** propodeum and petiole, oblique dorsal. ax = axilla; F = flagellomere; md = mandible; pet = petiole; prp = propodeum; tsa = transscutal articulation.

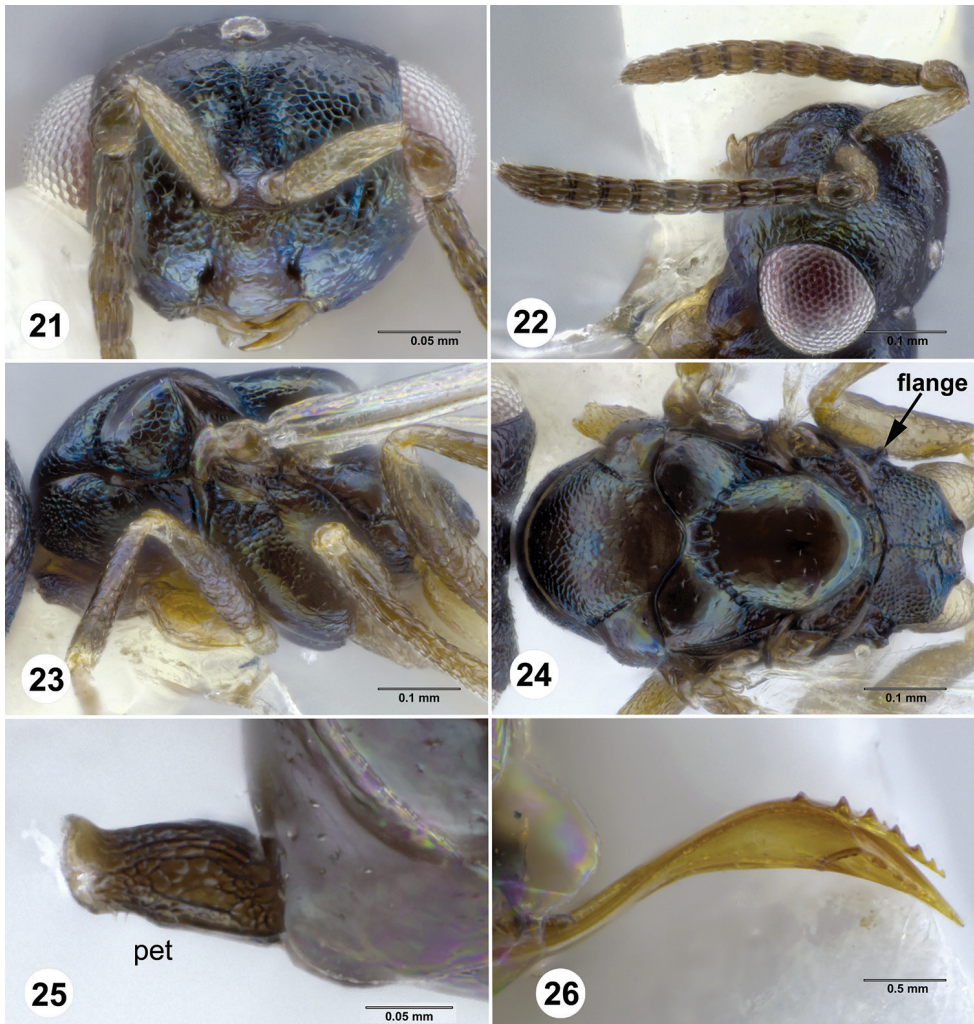
***Cymosema waterworthae* Burks & Mottern, sp. n.**

<http://zoobank.org/8C723EBE-7AFA-4B38-8671-285CF7E2B443>

Figs 21–27

Etymology. Named in honor of the collector, Rebecca Waterworth.

Diagnosis. Mandibles bidentate and overlapping, teeth of equal length and projecting medially. Funiculars cylindrical. Frons weakly reticulate. Submarginal vein bare, fore wing without marginal fringe.



Figures 21–26. *Cymosema waterworthae*. Holotype female: **21** head, anterior **22** antennae, lateral **23** mesosoma, lateral **24** mesosoma, dorsal **25** petiole, lateral **26** ovipositor. pet = petiole.

Female. Length 1.4 mm. Head, mesosoma, and metasoma brown with metallic luster. Scape yellowish-brown, pedicel and flagellum brown. Legs brown, with tibial apices, and first four tarsomeres pale brown. Fore wing hyaline; venation pale brown, setae dark. Gaster brown with faint metallic luster.

Head (Figs 21–22) transverse, $1.6\times$ as broad as high. Head receding ventral to toruli; face reticulate, including supraclypeal area; clypeus shallowly transversely rugose-reticulate, anteclypeus present; vertex not carinate. Mandibles bidentate, both teeth projecting medially, narrow and only weakly curved (Fig. 21). Palpal formula 2:1, palpi minute. Pedicel broader than F2; scape and pedicel reticulate; flagellum $1.5\times$



Figure 27. *Cymosema waterworthae*. Holotype female: fore wing. arrow points to end of postmarginal vein.

head height, with 7 parallel-sided funiculars; anellus minute and hardly visible; F2 $1.6\times$ as long as broad, F2 $1.1\times$ as long as F3.

Mesosoma (Figs 23–24, 27). Mesoscutal midlobe coriaceous anteriorly, becoming smooth posteriorly, lateral lobe mostly smooth but with shallow irregular sculpture anteriorly and laterally; notauli deep anteriorly but very shallow posteriorly. Axilla strongly advanced, smooth anteriorly, coriaceous posteriorly; mesoscutellar disc smooth to very shallowly coriaceous; frenal line indicated by narrow groove, frenum smooth; axillular sulcus narrow, axillula coriaceous. Mesepisternum reticulate anterodorsally, becoming smooth ventrally and forming a rounded horizontal shelf anterior to mesocoxae; mesepimeron shallowly reticulate and without a transepimeral sulcus. Propodeal disc finely reticulate, with a weak median carina, sublaterally reticulate and with an oblique elevation anterior to a steep descent towards the broad petiolar foramen; callus bare, with a flange-like elevation posterolateral to spiracle (Fig. 24, flange). Metacoxa shallowly reticulate dorsolaterally. Fore wing spatulate (Fig. 27), $2.7\times$ as long as broad; costal cell and submarginal vein bare; basal cell ventrally setose, also with a few dorsal setae near basal fold; speculum absent; cubital and subcubital folds setose; marginal fringe absent; stigmal vein $2.0\times$ as long as broad; postmarginal vein about $1.5\times$ as long as stigmal vein. Hind wing costal cell bare.

Metasoma (Figs 25–26). Petiole $1.6\times$ as long as broad, $1.0\times$ as long as metacoxa, finely longitudinally rugose-reticulate, with a pair of complete lateral longitudinal carinae and some additional incomplete longitudinal carinae anteriorly, narrowing anteriorly to abruptly expand anteriorly at the condyle, without anterior transverse carina, ventrally with a longitudinal groove that expands at apices. Acrosternite with irregular raised sculpture, swollen and differentiated across indistinct antecostal sulcus from remaining smooth G_{s1} . Cercus with all setae subequal in length. Hypopygium bare. Ovipositor elongate and slightly recurved, dorsal valve with 7 medially interrupted annuli; ventral valve with 5–6 teeth, and with oblique carina ending in a notch immediately basal to toothed apex.

Male. Unknown.

Material examined. Holotype: Australia: Western Australia: D'Entrecasteaux N.P., Coastal Survivors Walk, 105m, 34°50'19"S, 116°00'17"E, 8.xii.2009, R. Waterworth, sweep [1♀, UCRC: UCRCENT00364784], deposited in UCRC. Gaster mounted separately on card.

***Hayatosema* Heraty & Burks, gen. n.**

<http://zoobank.org/D6C6360D-85FB-458C-9EC8-DFAD4F930030>

Figs 28–35

Type species. *Orasema assectator* (Kerrich, 1963: 367–368). Heraty, 1994: 74–75, figs 111–112.

Etymology. Named after Mohammad Hayat of Aligarh Muslim University; gender feminine.

Discussion. This group and three of its seven previously described species were characterized as the *Orasema assectator*-group by Heraty (1994: 73–74). The four Indian species described in Narendran and Girish Kumar (2005), Girish Kumar and Narendran (2007) and Girish Kumar and Sureshan (2015) are readily placed in the *assectator*-group and hence in this genus (Table 1). *Hayatosema* is morphologically similar to species in the New World placed in the *cockerelli* and *bakeri* species groups. They were not resolved from these taxa based on the morphological analyses of Heraty (1994, 2000), and molecular data clearly place them as distinct and placed with the other Old World genera (Murray et al. 2013, Heraty unpublished). The only consistent differentiating feature from *Orasema* is that the lateral aspect of the mesepisternum is reticulate with the ventral aspect smooth and shining in all *Hayatosema*, whereas if it is reticulate laterally in *Orasema s.s.*, it is at least weakly sculptured ventrally. The antennal funicular count is unusual in the African species, with *O. nigra* Heraty having from 7–8 funiculars in females and 8–9 funiculars in males, all from the same collecting event. The Indo-Pacific species all have 7 funiculars in both sexes. Notably, molecular analyses fail to support the monophyly of the African and Indo-Pacific species, although sampling is currently very poor.

Diagnosis. Distinguished from other Old World genera by the head subtriangular in frontal view (Fig. 29); lower face excluding clypeal region finely reticulate; scrobal depression evenly impressed, lacking parallel channels and dorsal foveae; dorsal occipital margin abrupt with a rounded or carinate margin; antenna with 7–8 funiculars in females (Fig. 30) and 7–9 funiculars in males; labrum with 4-digits; mesonotum appearing bare, at most with minute setae, notauli deeply and broadly impressed; mesoscutal lateral lobes and frenum evenly sculptured; transscutal articulation complete and weakly sinuate, axillae not advanced; propodeal disc evenly sculptured without distinctly differentiated narrow median area (Fig. 34); prepectus finely reticulate or rugose with undifferentiated dorsal margin that is partially overlapped by lateral margin of mesonotum (Fig. 31); tightly articulated with mesepisternum ventrally (Fig. 31); fore wing with basal area and specular area bare (Fig. 33), wing disc with dense long

setae; postmarginal vein relatively short, less than 1/3 distance to apex of wing; petiole base truncate with weak basal flange (Fig. 34); antecostal sulcus foveate or irregularly sculptured; first valvula of ovipositor with 7-10 minute lateral teeth (Fig. 35). Male scape lacking ventral pores.

Host association. *Hayatosema initiator* (Kerrich) reared from *Pheidole* (Das 1963; Kerrich 1963).

Distribution. Four species. Ethiopian and Indo-Pacific (Heraty, 1994).

***Hayatosema plicator* Burks, sp. n.**

<http://zoobank.org/0F73EB6C-36D2-4BB8-AC07-45177DDE900B>

Figs 28–35

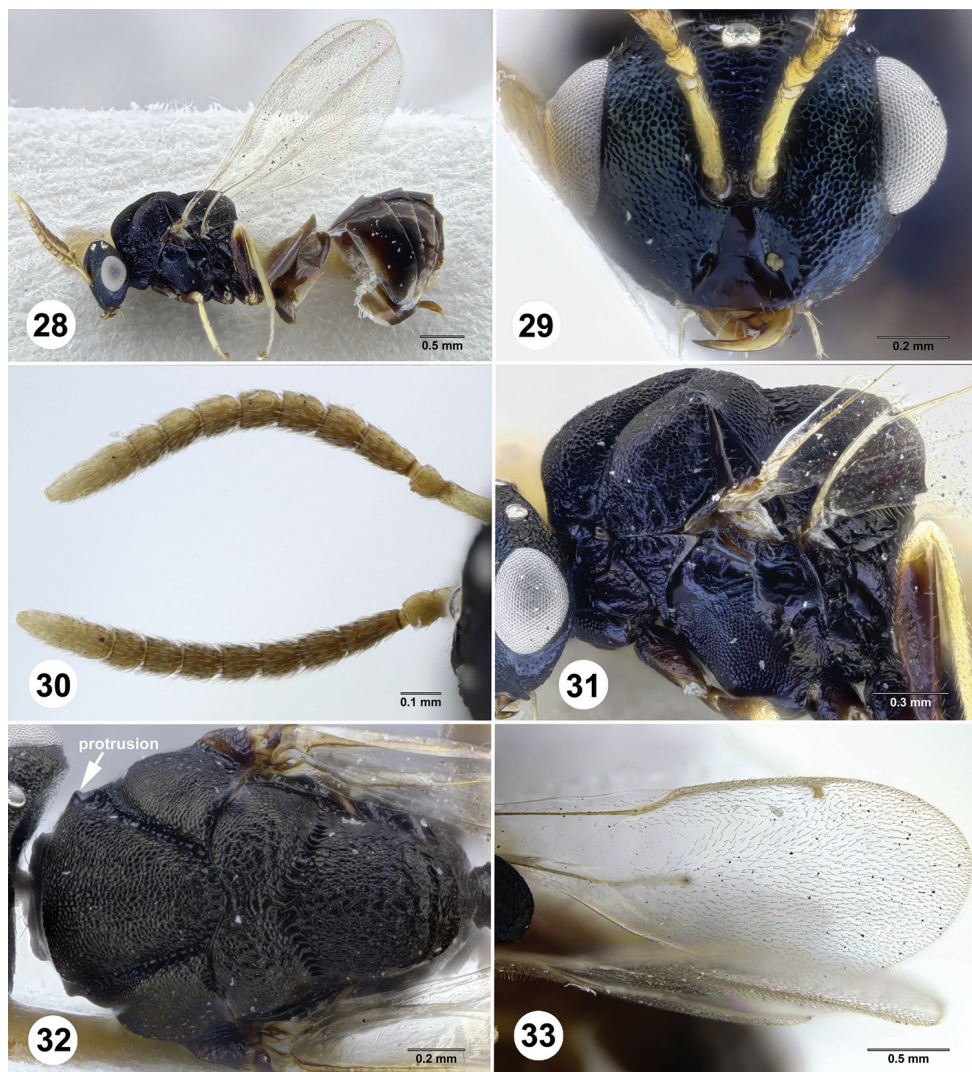
Etymology. A noun meaning “one who folds clothing,” derived from the Latin verb *plicare* (to fold). Refers to the rough propodeal and petiolar surface sculpture.

Diagnosis. Flagellum with 7 funiculars (Fig. 30). Prepectus rugose, mostly smooth, and without evenly reticulate sculpture as in all other species. Supraclypeal area and clypeus smooth (Fig. 29). Mesoscutal midlobe strongly elevated anteriorly; pronotum with rounded anterolateral protrusions (Fig. 32). Propodeal disc evenly areolate, with irregular, incomplete median carina (Fig. 34). This species keys to *O. initiator* in Heraty (1994), but differs by having a proportionally longer antennal flagellum to head height (1.3 versus 1.1–1.2), longer F2 (2.0 versus 1.4–1.5), frenum finely rugose-reticulate (versus reticulate), and a distinctly areolate (versus finely reticulate or nearly smooth) propodeum. It will key to *O. assectator* in Girish Kumar and Sureshan (2015), but differs most distinctly by the rugose versus reticulate prepectus.

Female. Length 3.5 mm. Head, mesosoma, and petiole black with slight metallic blue to purple luster. Antenna pale yellow. Coxae black to dark brown, with faint metallic purple luster; femora dark brown except white at tips; tibiae and tarsi pale yellow. Fore wing venation yellowish-white. Gaster dark brown.

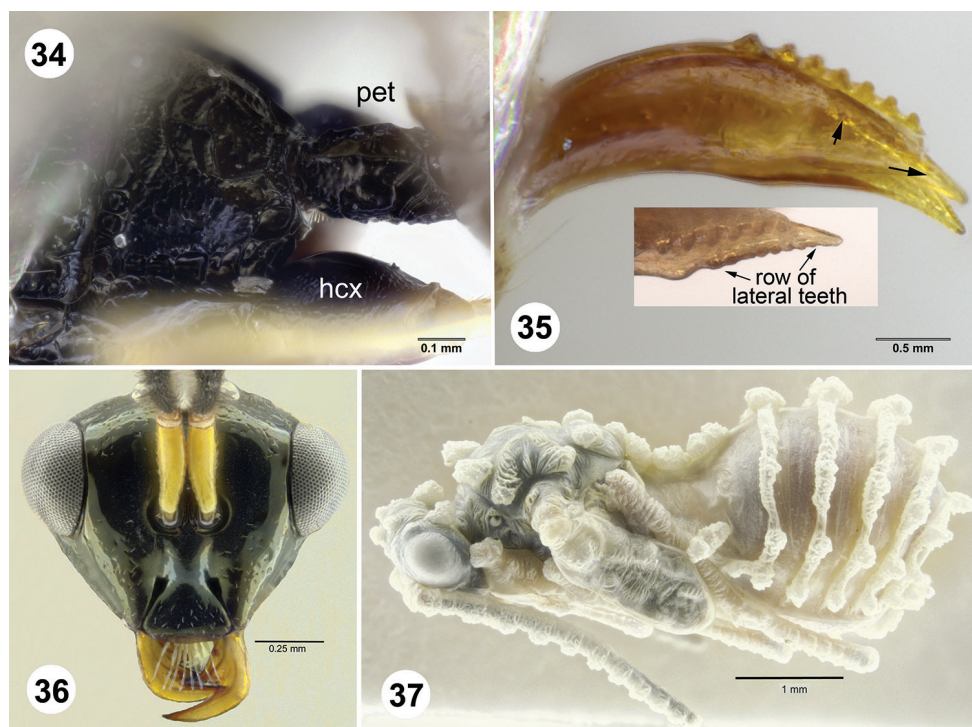
Head (Figs 29–30) 1.4× as broad as high. Face rugose-reticulate; supraclypeal area and clypeus smooth; anteclypeus absent; vertex reticulate. Labrum with 4 digits. Palpal formula 3:3 but with minute 2nd palpomeres. Flagellum 1.3× height of head; anellus transverse; F2 2.0× as long as broad, F2 1.3× as long as F3.

Mesosoma (Figs 31–34). Pronotum with small protrusion ventral to mesothoracic spiracle (Fig. 32: protrusion). Mesoscutum finely rugose-reticulate, posterior margin sinuate and midlobe strongly convex posteromedially, mesoscutal midlobe abruptly elevated above lateral lobes; notauli broadly and deeply impressed anteriorly. Axilla finely rugose-reticulate; mesoscutellar disc finely rugose-reticulate; frenal line as a deep groove with a carinate edge posteriorly; frenum finely rugose-reticulate; axillular sulcus not indicated, axillula finely rugose-reticulate. Mesepisternum anteriorly with a smooth area dorsolaterally, laterally finely reticulate and ventrally smooth; not overlapping prepectus; ventrally smooth and forming a rounded horizontal surface anterior to mesocoxae; upper mesepimeron elevated and smooth; transepimeral sulcus foveate;



Figures 28–33. *Hayatosema plicator*. Holotype female: **28** habitus, lateral **29** head, anterior **30** antennae, dorsal **31** mesosoma, lateral **32** mesosoma, dorsal **33** fore wing, dorsal.

lower mesepimeron glossy, shallowly irregularly sculptured. Propodeal disc medially areolate with some underlying irregular sculpture, with irregular median carina that is present only for a short distance near propodeal midlength, sublaterally rugose-reticulate; callus bare, smooth over most of surface but coarsely areolate to foveate peripherally, including foveate depression separating metapleuron from hind wing base. Metacoxa rugose-reticulate, glossy posteriorly. Fore wing 2.4× as long as broad; costal cell with ventral row of setae apically, bare basally; basal cell with 2 ventral setae anteriorly; speculum present, partially crossed by a patch of ventral setae near midlength of fore



Figures 34–37. 34–35 *Hayatosema plicator*. Holotype female: **34** propodeum and petiole, dorsal oblique **35** ovipositor, dorsal **36–37**: *Ibitya communis*. Female: **36** head, frontal **37** pupa. hcx = hind coxa; pet = petiole.

wing; cubital fold with only a single ventral seta posterior to basal cell, bare posterior to speculum; subcubital fold bare posterior to basal cell, with only some ventral setae posterior to speculum; wing disc covered by dense long setae (Fig. 33); stigmal vein $2.0\times$ as long as broad, only slightly expanded at uncus; postmarginal vein about $3.0\times$ as long as stigmal vein. Hind wing costal cell with only a few ventral setae apically.

Metasoma (Figs 34–35). Petiole $1.7\times$ as long as broad; $0.9\times$ as long as metacoxa, with sharp anterior transverse carina, areolate and with a complete dorsal median carina. Antecostal sulcus of Gs_1 finely sculptured laterally, becoming smooth and very shallow medially; acrosternite smooth. Hypopygium with a few short setae, and 1 slightly longer posterolateral seta on each side. Ovipositor dorsal valve with 7 medially interrupted annuli; ventral valve with 7–8 minute teeth along lateral carina, with only a rounded elevation basal to toothed apex.

Male. Unknown.

Material examined. **Holotype:** Vietnam: Thua Thien-Hue: Bach Ma Natl. Pk. Parashorea Trail, 9 km from park entrance, 100m, $16^{\circ}12'02.4''N$, $107^{\circ}50'49.6''E$, 26.v-13.vi.2001, D.C. Darling, N. Tatarnic, B. Hubley, Dipterocarp forest-closed canopy, Malaise trap (fine) [1♀, ROME 2001504], deposited in ROME.

***Ibitya* Heraty & Burks, gen. n.**

<http://zoobank.org/F1DA0653-6359-4DB9-9110-3703880DDB18>

Figs 36, 37

Type species. *Orasema communis* Risbec, 1952: 412–414. Heraty 1994: 59–60, figs 80, 82, 84–85.

Etymology. Named after one of the Madagascar collecting localities, Ibity; gender feminine.

Discussion. Heraty (1994) proposed a *uichancoi*-group that included *Ibitya seyrigi* (Risbec) and *I. communis* (Risbec) as well as five other Indo-Pacific species of *Orasema* (now *Losbanus*). Based largely on all of the Malagasy species having more than 8 labral digits (Fig. 36), Heraty (2000) proposed a separate *communis*-group. Herein we recognize the two currently described *communis*-group species as the genus *Ibitya*, although other potential species from Madagascar have been identified. Illustrations and a key to species, as *Orasema*, are provided in Heraty (1994).

Diagnosis. Separated from other Oraseminae by having the apex of the first valvula of the ovipositor with sinuate ridges as opposed to distinct lateral teeth. Distinguished from other Old World genera by the head subtriangular in frontal view; face entirely smooth laterally, scrobal depression evenly impressed and lacking parallel channels and dorsal foveae; dorsal occipital margin abrupt and rounded or carinate; antenna with 7 or 8 funiculars (11–12 antennal segments); labrum with 8–10 digits (rarely 5) (Fig. 36); mesonotum appearing bare, at most with minute setae; mesoscutal lateral lobes and frenum evenly sculptured and never smooth and shining; transscutal articulation complete; propodeal disc evenly sculptured; prepectus foveate and tightly articulated with pronotum ventrally; fore wing with basal area pilose or bare, and with specular area pilose, wing disc with dense long setae; postmarginal vein much longer than stigmal vein and reaching beyond half distance to wing apex; petiole base truncate with weak basal flange; antecostal sulcus smooth and distinctly impressed; first valvula of ovipositor with 3–4 sinuate lateral ridges. Male scape lacking ventral pores.

Host association. Myrmicinae: *Ibitya communis* reared from *Pheidole veteratrix* Forel.

Distribution. Madagascar.

***Ibitya communis* (Risbec), comb. n.**

Fig. 37

Orasema communis Risbec, 1952: 412–414. Type data: Madagascar: Bekily. Lectotype male (examined), by subsequent designation Heraty, 1994: 59. Type depository: MNHP. Citations: Heraty, 1994: 59–61 (subsequent description, both sexes, illustrated); Heraty, 2002: 51 (catalog).

Discussion. A new host record is made for *Pheidole veteratrix* Forel based on a single collection that included a soldier gripping the wing of an adult *I. communis*, 5 female

and 1 male pupae, and two unparasitized ant larvae. The pupa has the basic features of an *Orasema*, but with additional pustulate swellings not found in other taxa.

Pupa (Fig. 37). Length 5.1–5.5 mm. Typical morphology for *Orasema*, including three swollen tubercles over the petiolar region and pronounced linear swellings along the posterior margins of Mt₁₋₅. Additional atypical tubercular swellings occur over each anellus, each side of the occiput, on the dorsal margin of each flagellomere, laterally on the anterior face of the mesoscutal midlobe, axilla, laterally (paired) on the mesoscutellum as well as a single medial posterior tubercle, and with paired lateral swellings associated with the linear swellings on each of Mt₁₋₅.

New host record. Myrmicinae: *Pheidole veteratrix*.

New material examined. Madagascar: 45 km S Ambalavao, 785m, 22°13'00"S, 47°01'00"E, 2.x.1993, B.L. Fisher, nest, rotten log rainforest, ex: *Pheidole veteratrix* [1♂, 1♀, 6♀ pupae, 1 ♂ pupa: CASC: UCRCENT00417452, UCRC: UCRCENT00417446–00417451, UCRC: UCRCENT00417453]. La Mandraka, 18°54'19"S, 47°55'13"E, ii.1944, A. Seyrig [1♂, NMPC: UCRCENT00416474]. **Antananarivo Prov.:** Ankokoy Forest, 3 km E of Ibity, 1700m, 20°04'03"S, 46°59'58"E, 14-24.xi.2008, M.Irwin, R.Harin'Hala, Uapaca forest, Malaise trap [1♂, CASC: CASENT02212472]. **Antsiranana Prov.:** botanical garden near the entrance to Andasibe National Park, 1025m, 18°55'35"S, 48°24'28"E, 1-5.ix.2001, R. Harin'Hala, tropical forest, Malaise trap [2♂, CASC: UCRCENT00091471–72]. **Fianarantsoa Prov.:** 7 km W Ranomafana, 1100m, 24°34'04"S, 46°50'13"E, 15-21.ix.1988, C. Kremen, montane rainforest, small clearing, Malaise Trap [1♂, EMEC: UCRCENT00404908]. 7 km W Ranomafana, 900m, 21°15'33"S, 47°23'12"E, 23-28.ii.1990, W.E. Steiner, montane rainforest, Malaise trap in small clearing [1♀, USNM: UCRCENT00416660]. Parc National Ranomafanae, radio tower at forest edge, 1130m, 21°15'03"S, 47°24'26"E, 16.x-8.xi.2001, 6-17.vii.2003, R. Harin'Hala, mixed tropical forest, Malaise trap [3♂ 1♀, CASC: UCRCENT00417457–59, UCRCENT00417550].

Distribution. Madagascar.

Ibitya seyrigi Risbec, comb. n.

Orasema seyrigi Risbec, 1952: 414–416. Type data: Madagascar: Bekily. Holotype female (examined), by monotypy. Type depository: MNHN. Citations: Heraty 1994: 61–62 (subsequent description of female, illustrated); Heraty 2002: 55 (catalog).

Discussion. The redescription and illustrations provided by Heraty (2002) are accurate for this species. The holotype was missing the antennae and the labrum was not visible. Based on the new material: antenna with 11 segments, all flagellomeres beyond anellus densely pilose with numerous longitudinal sensilla; flagellum 1.5× head height; 7 funiculars; F2 1.9× as long as broad, 1.1× as long as F3; clava as long as preceding

two flagellomeres. Labrum with 9 long digits, each with a long apical seta, digits arranged in clusters of 1-1-3-3-1. Ovipositor as described for *O. communis* Risbec in Heraty (2002: fig. 82), but distinctly curved cephalad.

A single male of a different species (Reserve Betampona, from sifted litter; CAS, UCRCENT 00417456) also has an antenna with 11 segments and 7 funiculars, a labrum with 7 digits, and a long petiole about as long as the hind femur. The male shares many features with *I. seyrigi*, and may be the same species, however there are dramatic differences in especially the coarsely rugose scutellar disc.

New material examined. Madagascar: Fianarantsoa Prov.: Parc National Ranomafanae, radio tower at forest edge, 1130m, 21°15'03"S, 47°24'26"E, 6-17. vii.2003, R. Harin'Hala & M. Irwin, mixed tropical forest, Malaise trap (1♀, CAS: UCRCENT00417549).

Distribution. Madagascar.

***Iviosema* Heraty & Burks, gen. n.**

<http://zoobank.org/11180142-ED8D-4F39-AE24-6358C767A9D8>

Figs 38–54

Type species. *Orasema striatosoma* Heraty, 1994: 68–70, figs 98–105.

Etymology. Named after Michael Ivie of Montana State University; gender feminine.

Discussion. Defined by Heraty (1994: 68) as the *Orasema striatosoma*-group. *Iviosema* previously contained two mainland African species, which Heraty (1994) noted as being very different from other *Orasema*. The two new Malagasy species that we include are even more different from other Oraseminae in many ways, but share several features with *Iviosema striatosoma* (Heraty), and to a lesser degree with *Iviosema fraudulentum* (Reichensperger): a large pit immediately ventral to the median ocellus (Fig. 39), continuous striae extending from the axillae to the mesoscutellar disc (Figs 42, 52), propodeal shape and sculpture (Figs 41, 43, 52), and the laterally sinuate posterior margin of the gastral tergites (Figs 45–46, 49). They differ from the African *I. striatosoma* and *I. fraudulentum* in several major ways, including the presence of two additional pairs of depressions between the eye and antennal scrobe, prepectus slightly swollen rather than weakly foveate, lack of any indication of an anterior transverse petiolar carina, and presence of a thickened basal fold in the fore wing. They also exhibit further reductions in surface sculpture, mouthparts and wing setation. All of the species have a closely appressed pronotum and prepectus that appear fused in the Malagasy species, a nearly quadrate anellus, and a thickened marginal vein. Notably the anterior margin of the fore wing beyond the stigmal vein is rounded similar to that of *Cymosema*.

Diagnosis. Separated from other Oraseminae by the deep sharply impressed pit just below the median ocellus (Fig. 39). Distinguished from other Old World genera by the head subtriangular in frontal view (Figs 39, 50); scrobal depression below pit

broadly impressed, lacking parallel channels or dorsal scrobal foveae; dorsal occipital margin abrupt and rounded; funicle 7-segmented; labrum with 4-digits; mesonotum appearing bare, at most with minute setae; mesoscutal lateral lobes and frenum finely sculptured; transscutal articulation complete or fused medially; propodeal disc evenly and finely sculptured (Figs 43, 52); prepectus with upper panel broad and flat, at most with a slightly raised posterior margin, very tightly appressed to posterior margin of pronotum (Figs 41, 52); fore wing with basal area pilose or bare (Figs 44, 55), wing disc with dense long setae (African species) or lacking setae but with sockets apparent (Malagasy species); marginal vein thickened along entire length; postmarginal vein absent or not much longer than stigmal vein; petiole base narrowed into foramen and lacking basal flange (Figs 45, 52); antecostal sulcus present and smooth; posterior lateral margin of gastral tergites 1–4 sinuate; first valvula of ovipositor with several fine lateral teeth. Male scape lacking ventral pores.

Host association. Myrmicinae: *Ivieosema fraudulenta* reared from *Pheidole megacephala* Fabricius (Reichensperger 1913).

Distribution. Ethiopian and Malagasy regions.

***Ivieosema confluens* Burks, sp. n.**

<http://zoobank.org/DD89153A-F762-43D6-80DE-B823E00EC907>

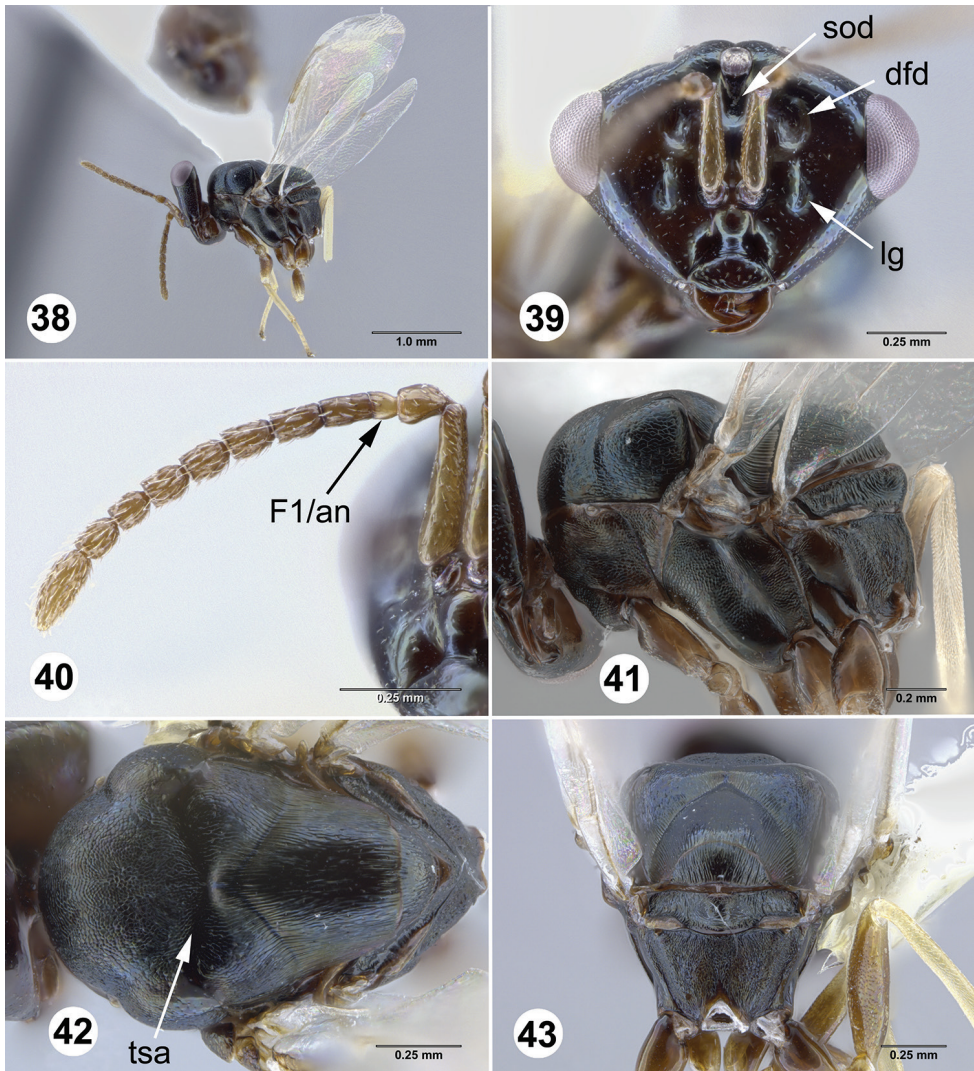
Figs 38–48

Etymology. Latin noun meaning “a place where rivers meet,” referring to the mesosomal surface sculpture.

Diagnosis. Recognized from other *Orasema* and African *Ivieosema* by the fore wing lacking setae and with a medial longitudinal fold. Distinguished from *I. limulus* by the smooth face, frons with 2 depressions between eye and antennal scrobe (Fig. 39), and the basal gastral tergite with a laterally carinate median longitudinal depression extending the equivalent length of the petiole.

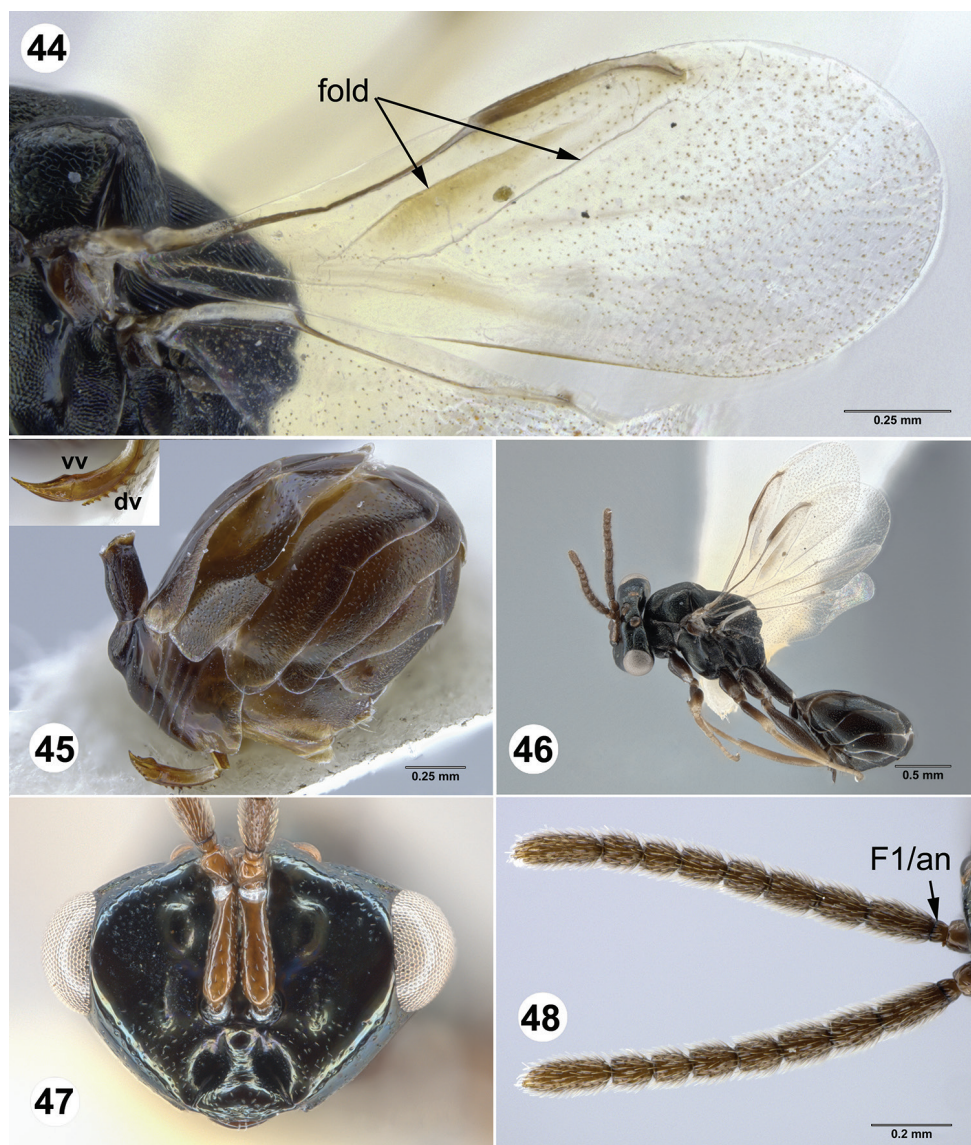
Female. Length 2.8 mm. Head and mesosoma dark brown. Scape, pedicel, and anellus light brown, rest of flagellum darker brown. Coxae, trochanters, most of femora and last tarsomere dark brown; femoral apices, tibiae and tarsi pale white yellow with last tarsomere brown. Fore wing venation glossy and brown. Gaster brown.

Head (Figs 39–40) broadly subtriangular, 1.4× as broad as long. Face flat and smooth; scrobal depression broad and shallow, extending laterally well beyond toruli and forming a single dorsal frontal depression (Fig. 39, dfd); lower frons with a vague longitudinal groove; scrobal area with a single medial large pit just below median ocellus; supraclypeal area smooth, clypeus with shallow transverse sculpture, anterior tentorial pits very deep and broad, anteclypeus short laterally and absent medially; scrobal depression shallow and hardly evident; vertex not carinate. Labrum with 4 digits. Maxillary and labial palps absent. Mandibular formula 3:2, mandibles small but falcate. Flagellum 1.0× head height, 7 funiculars; anellus longer than broad (Fig. 40, F1); F2 1.7× as long as broad, 1.1× as long as F3.



Figures 38–43. *Ivieosema confluens*. Paratype female: **38** head and mesosoma, lateral **39** head, anterior **40** antenna, medial **41** mesosoma, lateral **42** mesosoma, dorsal **43** mesosoma, posterior. dfd = dorsal frontal depression; F1/an = anellus; lg = longitudinal groove; sod = subocellar depression; tsa = transscutal articulation.

Mesosoma (Figs 41–44). Mesoscutal midlobe finely reticulate, lateral lobe mostly coriaceous, notauli very shallow and with vague margins; transscutal articulation represented only by a vague depression medially (Fig. 42, tsa). Axilla anteriorly reticulate, posteriorly longitudinally striate; mesoscutellum and axillula finely longitudinally striate; frenal line as a smooth raised strip. Metascutellum protruding, not separated from rest of metanotum. Mesepisternum reticulate dorsally, smooth ventrally, forming a short rounded horizontal area anterior to mesocoxae; mesepimeron reticulate, without



Figures 44–48. *Ivieosema confluens*. Paratype female: **44** fore wing **45** metasoma, lateral, lateral view of ovipositor in top left corner. Holotype male: **46** habitus, lateral **47** head, anterior **48** antennae, dorsal. dv = dorsal (2nd) valvula, F1/an = anellus; vv = ventral (1st) valvula.

transepimeral sulcus. Propodeum finely reticulate, callus bare and smooth to shallowly reticulate. Metacoxa smooth. Fore wing 2.3× as long as broad; slightly infusate along cubital fold and posterior to marginal and submarginal veins, and between the oblique folds in the speculum; venation with only a few tiny setae, including on submarginal vein; costal cell bare; basal cell bare; speculum present, with two oblique folds (Fig. 44, fold) that converge towards stigma and basal fold; marginal vein very thick basally and

narrowing apically, not separate from wing margin at base of stigmal vein; stigmal vein 4.5× as long as broad, without an uncus; postmarginal vein absent; cubital and subcubital folds bare; marginal fringe absent. Hind wing costal cell bare.

Metasoma (Fig. 45). Petiole 1.7× as long as broad, 0.9× as long as metacoxa, longitudinally shallowly rugose-reticulate. Gt_1 with a deep longitudinal median depression with carinate lateral margins equal to length of petiole; shallower smooth depression present on Gt_2 . Antecostal sulcus of Gs_1 smooth, very shallow medially; acrosternite swollen and with shallow irregular sculpture; posterior Gs_1 smooth to finely punctate. Cercus with all setae subequal in length. Hypopygium with a few small subapical setae laterally. Ovipositor dorsal valve with 9 annuli, including a basal annulus that is broadly separated from the rest; ventral valve with 5–6 lateral teeth and with transverse carina basal to toothed apex.

Male (Figs 46–48). Length 2.5 mm. Antennal flagellum densely covered with long decumbent setae, with only a few longitudinal sensilla extending beyond funicular apices; F7 shorter than F6 and F8; entire antenna brown. Petiole 1.3× as long as broad, 2.5× as long as metacoxa. Gaster with broad, striate longitudinal depression on Gt_1 . Digitus with 6 spines; parameres present.

Holotype. Madagascar: Toliara Prov.: 18 km NNW Betroke, 825m, 23°09'48"S, 45°58'07"E, 24.x-4.xii.1994, M.A.Ivie & D.A.Pollock, FIT [1♂, UNMO: UCR-CENT00435300], deposited in TMP. **Paratype: Madagascar: Toliara Prov.:** Tsimanampetsotsa National Park, Mitoho Forest, 120m, 24°02'55"S, 43°45'08"E, 24-29.x.2008, M. Irwin & R. Harin'Hala, transitional forest, Malaise trap [1♀, CASC: CASENT2022276].

***Iviosema limula* Burks, sp. n.**

<http://zoobank.org/2985A405-15F7-4588-A216-E1C5C76FC5D6>

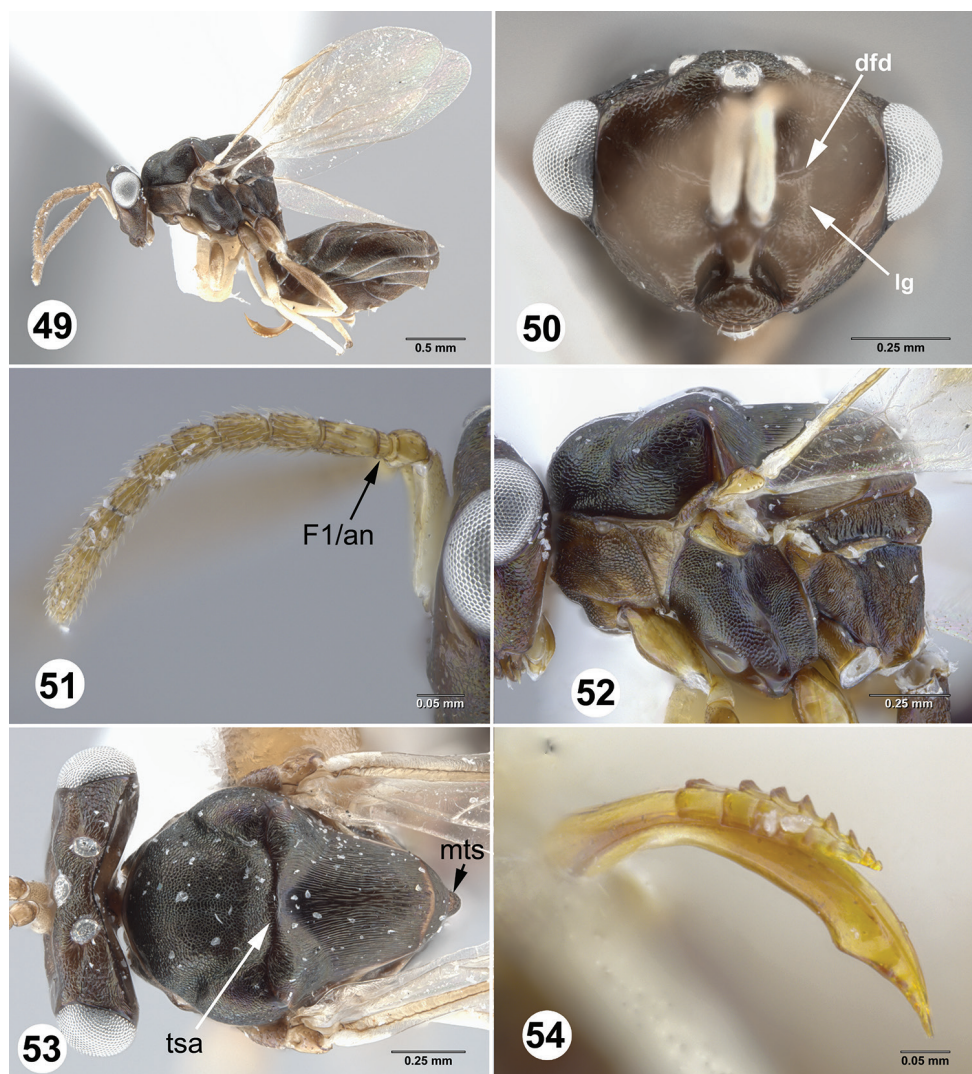
Figs 49–55

Etymology. Latin noun meaning “small file (carpenter’s or sculptor’s tool),” referring to the finely striate mesosomal surface sculpture.

Diagnosis. Recognized from other *Orasema* and African *Iviosema* by the fore wing lacking setae and presence of a medial longitudinal fold. Distinguished from *I. confluens* by the reticulate facial sculpture, frons with a single depression between eye and antennal scrobe (Fig. 50), and the basal gastral tergite with a laterally smooth median longitudinal depression extending the entire length of the tergite.

Female. Length 3.1 mm. Head and mesosoma almost entirely dark brown, without metallic luster; pronotum ventrally, prepectus, and acropleuron yellowish-brown. Scape white; pedicel and flagellum pale brown. Coxae and most of femora pale brown; trochanters, femoral apices, tibiae, and tarsi white. Fore wing venation glossy and milky brown. Gaster brown to dark brown.

Head (Figs 50–51) 1.4× as broad as long. Face flat and smooth; medial scrobal depression absent, but frons with paired dorsal frontal depressions lateral to scrobal



Figures 49–54. *Ivieosema limula*. Holotype female: **49** habitus, lateral **50** head, anterior **51** antenna, lateral **52** mesosoma, lateral **53** mesosoma, dorsal **54** ovipositor, lateral. dfd = dorsal frontal depression; F1/an = anellus; lg = longitudinal groove; mts = metascutellum; tsa = transscutal articulation.

area (Fig. 50, dfd); lower frons with a distinct vertical groove (Fig. 50, lg); scrobal area with a single medial large pit just below median ocellus; supraclypeal area smooth, clypeus shallowly irregularly sculptured, anterior tentorial pits very deep and broad, anteclypeus very short; scrobal depression broadly and shallowly impressed; vertex not carinate. Labrum with 4 digits. Maxillary and labial palps absent. Flagellum 1.2× head height, 7 funiculars; anellus slightly broader than long, expanding apically (Fig. 51, F1); F2 2.0× as long as broad, F2 1.1× as long as F3.

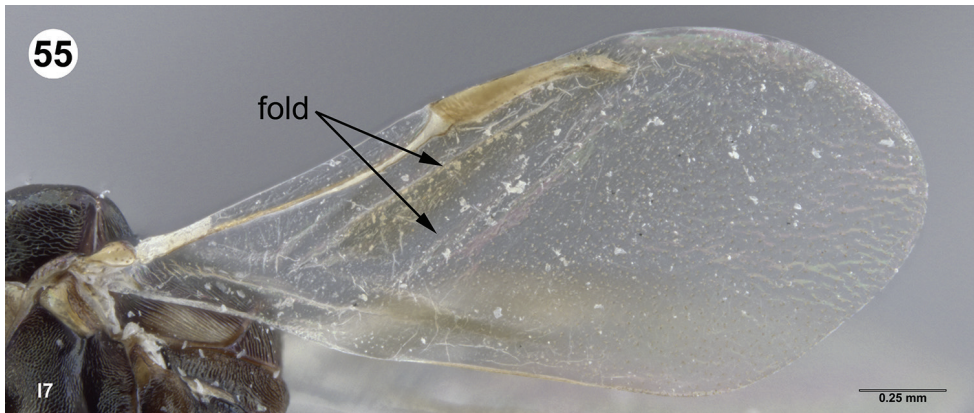


Figure 55. *Iviceosema limula*. Holotype female: fore wing.

Mesosoma (Figs 52–53, 55). Mesoscutum finely reticulate, with a shallow median depression; notauli finely reticulate in their troughs, with vague margins and not foveate, merging posteriorly as a transverse depression anterior to the transscutal articulation, which is present medially (Fig. 53, tsa). Axilla anteriorly reticulate, posteriorly longitudinally striate; mesoscutellum and axillula finely longitudinally striate; frenal line as a pale strip slightly elevated above frenum. Metascutellum narrow and protruding, not separated from rest of metanotum but with fine reticulate sculpture antero-medially. Mesepisternum finely reticulate dorsally and anteriorly, smooth posteroventrally, forming a short protruding horizontal surface anterior to mesocoxa. Propodeum finely reticulate, with a shallow and vague median carina; callus bare, glossy and more shallowly reticulate than propodeal disc. Metacoxa smooth. Fore wing (Fig. 55) 2.2× as long as broad; venation with only a few tiny setae, including on submarginal vein; costal cell bare; basal cell bare; speculum present, with two oblique folds that converge anteriorly towards stigma and diverge posteriorly; marginal vein very thick basally and narrowing apically, separating from wing margin to smoothly form the stigmal vein; stigmal vein 1.4× as long as broad; postmarginal vein absent; cubital and subcubital folds with only a few tiny setae beyond speculum; marginal fringe absent. Hind wing costal cell bare.

Metasoma (Fig. 54). Petiole 1.7× as long as broad, 0.9× as long as metacoxa, nearly smooth medially but longitudinally rugose-reticulate laterally, without transverse anterior carina and narrowest anteriorly immediately posterior to the condyle. Gt_1 with a deep longitudinal median depression extending length of tergite and with smooth lateral margins. Antecostal sulcus of Gs_1 smooth; acrosternite smooth to very shallowly reticulate. Cercus with all setae subequal in length. Hypopygium with a few setae submedially. Ovipositor dorsal valve with 8 medially interrupted annuli, including a basal annulus that is broadly separated from the rest; ventral valve with 4 lateral teeth and with a vague transverse elevation immediately basal to toothed apex.

Male. Unknown.

Material examined. Holotype: Madagascar: Toliara Prov: Manderano, 70m, 23°31'39"S, 44°05'18"E, 23.vi–28.vii.2002, Frontier Wilderness Project, gallery forest at the edge of marsh, 5m from road, Malaise trap [1♀, CAS: CASENT2022276], deposited in CAS.

***Leiosema* Heraty & Burks, gen. n.**

<http://zoobank.org/F7181858-49AC-491A-ABD2-6E035D26DBFF>

Figs 56–67

Type species. *Orasema glabra* Heraty, 1994: 72–73, figs 119, 125–128, 130, 132.

Etymology. Combination of the Greek λείος (*leios*) for smooth and a contraction of *Orasema*, referring to the smooth and polished head and frenum; gender feminine.

Discussion. Originally treated within *Orasema* as the *glabra* group by Heraty (1994: p. 72). Heraty (1994) speculated that some of the characteristic features were shared with species in the New World *coloradensis* group. However, there is a greater similarity with *Zuparka* (Madagascar), including the entirely smooth face (Figs 57–58, 62), scrobal channels with dorsal foveae (Fig. 57), labrum with 4 digits (Figs 57, 62), and fore wing with bare basal area and speculum (Fig. 65). However, *Zuparka* has a laterally smooth or very weakly sculptured propodeal disc (Figs 73, 82) and the pronotum and prepectus are more rigidly associated ventrally (Fig. 82). *Australosema synempora* Heraty also has the mesosomal sidelobes, axillae and frenum smooth, but the face is reticulate and the propodeum has lateral glabrous areas. *Matantas* also has a similar smooth face, axilla and frenum, but the face is distinctly subtriangular, the labrum has 6–8 digits and the propodeum is laterally glabrous. Each of these other genera have only 3 or 4 lateral subapical teeth on the first valvula in contrast to the 6–10 minute lateral teeth of *Leiosema*.

Diagnosis. Separated from *Orasema* by the presence of male scape glands (pores) (Fig. 56, vp), broadly impressed rugulose antecostal sulcus and the combination of smooth head, 4-digitate labrum, and smooth frenum (Figs 59–61). Distinguished from the other Old World genera by having the head smooth and subcircular in frontal view (Figs 57–62); scrobal depression with parallel channels and dorsal foveae (Fig. 57); dorsal occipital margin rounded; funicle 7-segmented; labrum with 4 digits; mesonotum with scattered short setae; mesoscutal lateral lobes and frenum smooth; transscutal articulation complete; propodeal disc evenly rugose; prepectus foveate and loosely articulated with pronotum ventrally (Fig. 63); fore wing with basal area and specular area bare (Fig. 65), with dense and relatively long wing disc setae; postmarginal vein 1.5–3.2× as long as stigmal vein; petiole base truncate with prominent basal flange (Fig. 67); antecostal sulcus broad and reticulate; first valvula of ovipositor with 6–10 minute lateral teeth. Male scape with distinct ventral pores (glands) set in circular depressions across entire ventral surface (Fig. 56).

Distribution. Sub-saharan Africa (Democratic Republic of the Congo, South Africa, Tanzania, Zimbabwe), and Yemen.

***Leiosema lesiolouna* Heraty & Burks, sp. n.**

<http://zoobank.org/9AA354CA-AF78-4523-ACB0-170734056A65>

Figs 61–62, 64, 66

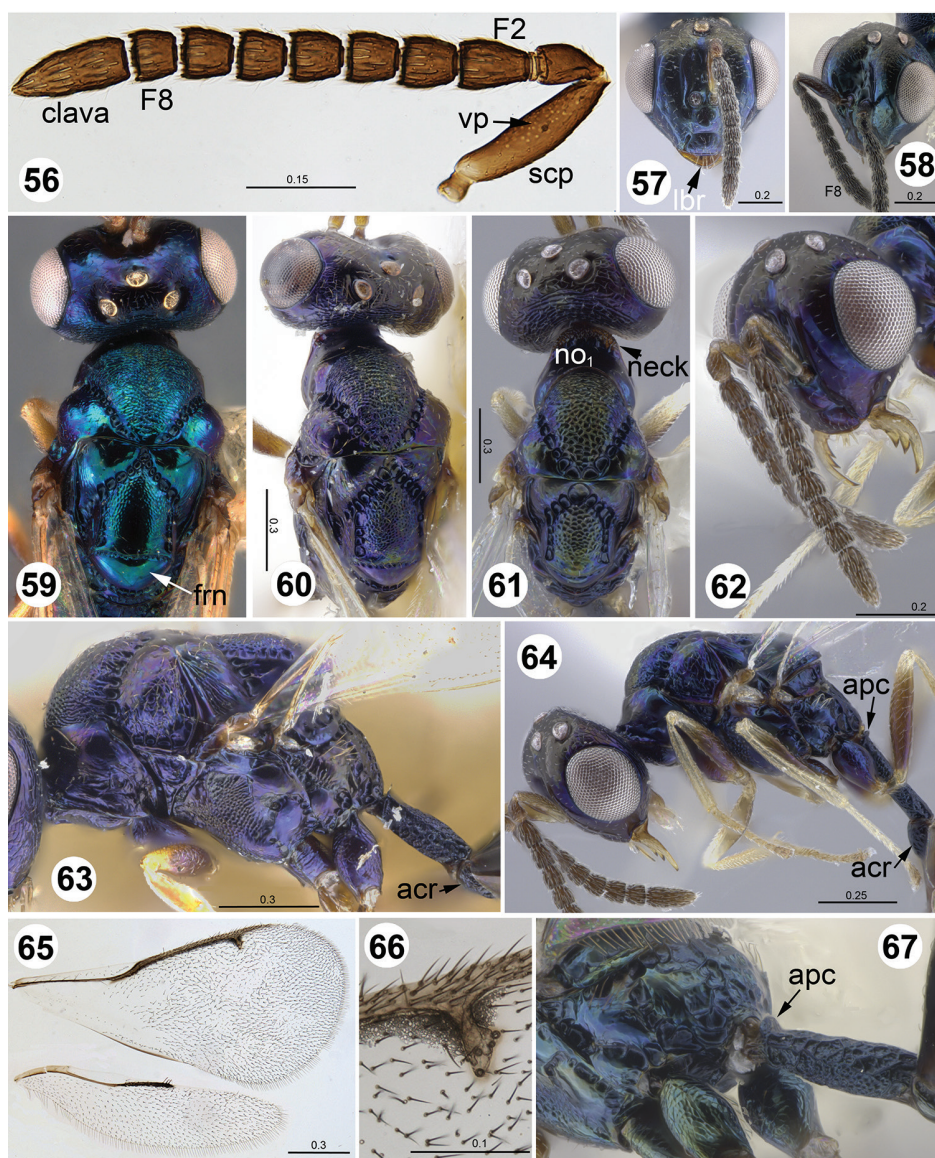
Etymology. Named for the collection locality of the holotype.

Diagnosis. The female is unknown, but the male is easily distinguished by the 3:3 dentate mandibles (Fig. 62), strongly reticulate mesoscutal midlobe and scutellar disc, and all tibiae yellow. It can be further differentiated from *L. glabra* by the anteriorly extended reticulate pronotal neck (Fig. 61), and petiole 4.7× as long as broad, with a strong transverse basal carina (flange) but without a lateral carina.

Male. Length 1.6 mm. Head and mesosoma blue. Scape brown; pedicel brown; anellus yellowish brown; flagellum brown. Mandible yellow, ventral mandibular setae acute; maxilla and labium yellowish brown. Coxae dark blue; fore and mid femur mostly brown, apically yellowish; hind femur mostly dark brown to black, apically yellow; tibiae yellow, but with hind tibia slightly darker basally. Fore wing hyaline; venation clear. Petiole same color as mesosoma; gaster dark brown; acrosternite same color as petiole.

Head (Figs 61–62) 1.2× as broad as high; inter-ocular distance 1.2× eye height; malar space 0.4× eye height; supraclypeal area longer than broad, smooth; clypeus smooth; epistomal sulcus distinct and sharply defined; anteclypeus distinct, straight. Mandibular formula 3:3, apical tooth elongate. Maxilla and labium of normal size, palpal formula 3:2. Occiput striate, shallowly emarginate in dorsal view, dorsal margin evenly rounded, temples present, rounded and coriaceous. Antenna 11-segmented; scape narrow and cylindrical, not reaching median ocellus; pedicel subconical, as broad as F1; flagellum 1.4× head height; anellus minute, difficult to distinguish, F2 1.2× as long as broad, 1.2× as long as F3; following funiculars subequal in length, equal in width; clava subcylindrical, longer than preceding 2 funiculars, clava without distinct separation of fused clavomeres.

Mesosoma (Figs 61, 64). Mesoscutal midlobe reticulate, interstices rounded, dorsally with few sparse setae; lateral lobe smooth and shining; notauli deeply impressed. Axilla smooth; dorsally rounded, on roughly same plane as scutellum; scutoscuteellar sulcus broad, irregularly foveate. Scutoscuteellar sulcus meeting transscutal articulation; scutellar disc about 1.5× as long as broad, reticulate, smooth just anterior to frenal line; frenal line as distinct crenulate groove; axillular sulcus distinct and foveate; axillula very weakly reticulate. Propodeal disc broadly rounded, without depression or carina, rugose-areolate; callus smooth, with several long hairs; callar nib absent. Prepectus evenly triangular, sculpture broadly foveate. Mesepisternum reticulate laterally, smooth ventrally, broadly rounded anterior to mid coxa. Upper mesepimeron smooth; lower mesepimeron smooth; transepimeral sulcus distinct. Propleuron convex, smooth. Postpectal carina prominent. Hind coxa 1.8× as long as broad, smooth with very weak reticulate sculpture; hind femur 5.7× as long as broad, with even cover of appressed long setae; hind tibia densely setose. Fore wing 2.4× as long as broad; basal cell and speculum bare, costal cell and wing disc densely setose, wing disc setae



Figs 56–67. *Leiosema glabra*. Male: **56** antenna, lateral (Tanzania, TZ) **57** head, frontal, (Yemen) **58** head, oblique (TZ). Female holotype **59** head and mesosoma, dorsal; Male: **60** head and mesosoma, dorsal (South Africa) **63** mesosoma, lateral (SA) **65** wings, dorsal (TZ) **66** stigmal vein (TZ) **67** propodeum and petiole, oblique (TZ). *Leiosema lesiolouna*. Holotype male: **61** head and mesosoma, dorsal **62** head, oblique **64** head and mesosoma, lateral. acr = acrosternite; apc = anterior petiolar carina; F = flagellomere; frn = frenum; lbr = labrum; no₁ = pronotum; scp = scape; vp = ventral pores.

long; marginal fringe relatively long; submarginal vein with several long setae; marginal vein with minute setae; stigmal vein more than 2.5× as long as broad, slightly angled, slightly narrowed basally and capitate apically (Fig. 66); uncus absent; stigma

with 3 sensilla in a straight line; postmarginal vein 1.9× as long as stigmal vein. Hind wing costal cell with a broad bare area.

Metasoma. Petiole cylindrical, linear in profile, 4.6× as long as broad, 1.7× as long as hind coxa, reticulate, anterior carina strong, lateral margin rounded, ventral sulcus present with margins narrowly separated. Antecostal sulcus rugulose; acrosternite posteriorly angulate, raised and smooth medially and laterally broadly impressed and reticulate. Genitalia protruding: parameres elongate, digitus broad and flattened with 4 marginal spines.

Female. unknown.

Holotype. Republic of Congo: Pool Dept.: Iboubikro, Lesio-Louna Pk., 340m, 3°16'12"S, 15°28'16"E, 23.vii.2008, Sharkey & Braet, Malaise trap #3 [1♂, UCRC: UCRCENT00408466].

***Leiosema glabra* (Heraty), comb. n.**

Figs 56–60, 63, 65–67

Orasema glabra Heraty, 1994: 72–73. Holotype, South Africa, Transvaal [♀, CNCI].

Mistakenly figured in Heraty (1994) with 6 funicular segments (cf. Fig. 126) instead of 7.

Diagnosis. Both sexes with mandibles 3:2 dentate, mesoscutal midlobe and scutellar disc weakly reticulate, becoming smooth posteriorly (Figs 59–60). The pronotal neck is not extended, and is reticulate only along the anterior margin (Fig. 60). Male petiole 2.6–2.9× as long as broad, female petiole 1.5–2.1× as long as broad, with a strong basal carina continuous with a lateral carina and extending 1/3 to 2/3 length of petiole (Fig. 67).

Variation. The few specimens that are known were collected across a broad geographic range from Yemen to South Africa. Females from South Africa, Yemen and Zimbabwe all have a pale brown scape and a completely yellow fore and mid tibia, whereas the female from Tanzania has an almost black scape and all tibiae are basally dark brown. Males generally have the scape and tibiae dark brown, but again these are much darker in specimens from Tanzania. In the description below, the primary measurements are for what appear to be typical *L. glabra* specimens from South Africa and Zimbabwe. There are a few minor ratio differences for specimens from Tanzania and Yemen (included in parentheses) that are outside of the range of variation from the typical *L. glabra* specimens. While these are currently considered to be one species, as more material becomes available, additional species will likely need to be recognized. An additional collection from Gambia shows variation that is likely representative of another species that has a more distinctly reticulate mesoscutellum, but we do not treat this as there seems to be a need to collect more material across Africa to assess the patterns of variation.

Male. Length 1.8–2.4 mm. Head and mesosoma dark blue, violet or green. Scape dark brown to black; pedicel black; anellus brown; flagellum black. Mandibles dark

brown; maxilla and labium brown. Coxae dark blue; femora mostly dark brown to black, with tips pale; fore and mid tibia yellow to almost completely black with pale apex; hind femur dark brown to black with metallic reflections; hind tibia mostly dark brown to black, tips pale. Fore wing hyaline; venation pale brown. Petiole and acrosternite same as mesosoma; gaster dark metallic.

Head (Figs 61–62) 1.1–1.2× as broad as high; inter-ocular distance 1.4–1.5× eye height; malar space 0.3–0.7× eye height; supraclypeal area slightly broader than long, longer than clypeus, smooth; clypeus smooth; epistomal sulcus distinct and sharply defined; anteclypeus weakly differentiated, straight. Mandibular formula 3:2. Flagellum 1.0–1.2× head height. F2 1.2–1.3× as long as broad, 1.2–1.3× as long as F3; clava subconical, longer than preceding two funiculars and weakly segmented.

Mesosoma (Figs 61, 64). Mesosoma 1.5–1.7× as long as high. Mesoscutal lateral lobe smooth and shining dorsally, weak rugulose laterally. Scutellar disc 1.5–1.7× as long as broad, reticulate; axillula weakly rugulose, nearly smooth. Pronotal neck not extended, at most reticulate along anterior margin. Mesepisternum straight anterior to mid coxa. Propleuron coriaceous. Hind coxa 1.1–2.0× as long as broad, smooth to coriaceous; hind femur 4.2–5.4× as long as broad, with even cover of elongate, semi-erect setae. Fore wing 2.1–2.3× as long as broad; marginal vein with long setae; stigmal vein 1.5–2.6× as long as broad, slightly angled; stigma nearly quadrate but with short apical anterior extension; stigma with 3 sensilla in a straight line; postmarginal vein 1.1–3.2× as long as stigmal vein. Hind wing costal cell bare.

Metasoma. Petiole 2.6–2.9× as long as broad, 1.2–1.4× as long as hind coxa, lateral margin rounded with only short lateral carina in basal 1/4. Acrosternite posteriorly rounded with rugulose sculpture, antecostal sulcus rugulose.

Female (redescription) (Fig. 59, holotype). Length 2.0–2.6 mm. Scape yellow. Fore femur mostly dark brown to black, tip pale; fore tibia yellow; mid femur mostly dark brown to black, tip pale; mid tibia yellow; hind femur mostly dark brown to black, tip pale; hind tibia pale brown basally, yellow apically.

Head 1.0–1.1× as broad as high; eyes separated by 1.3–1.5× eye height; malar space 0.4–0.6× eye height. Flagellum length 0.8–1.0× head height (0.9–1.0 in type material); flagellum with 7 funiculars, anellus disc-shaped, F2 1.1–1.4× as long as broad, 1.1–1.2× as long as F3.

Mesosoma 1.6–2.1× as long as high. Fore wing 2.3–2.6× as long as broad.

Metasoma. Petiole 1.5–2.1× as long as broad, 0.9–1.3× as long as hind coxa, apical setae of hypopygium with 2–4 long hairs clustered on each side of midline. Ovipositor slightly curved cephalad; first (ventral) valvula with 6–10 small, narrowly separated teeth, second (dorsal) valvula with 6–7 annuli that are broadly separated dorsally by smooth area; subapical carina present; third valvula separated.

Material examined. South Africa: Eastern Cape: Port St. John, 31°37'00"S, 29°32'00"E, i.1974, A. Watsham [1♂, NMPC: UCRCENT00416408]. **Orange Free State:** Koppies Nat. Res., 26°10'11"S, 27°59'46"E, 22–23.ii.1993, M. Stiller, *Acacia* karroo, sweep [1♀, NMPC: UCRCENT00416471]. **Transvaal:** Blyderivierspoort, 1200m, 24°53'00"S, 30°45'00"E, iii.1981, G. L. Prinsloo [1♂, PPRI: UCR-

CENT00298795]. Waterberg nr Nylstroom [Modimolle], 1200m, 24°48'00"S, 28°25'51"E, i.1980, G. L. Prinsloo [1♂, PPRI: UCRCENT00298796]. Strijdom Tunnel, 730 m, 24°27'47"S, 30°36'31"E, 24-25.xi.1991, G.L. Prinsloo [1♀, NMPC: UCRCENT00416472]. **Tanzania: Tanga:** West Usambara, Mgwashi env., 1460m, 4°45'47"S, 38°28'30"E, 31.i-1.ii.2015, P. Jansta & J. Straka [3♂ 1♀ 2♀, UCRC: UCRCENT00479260–65]. **Zimbabwe: Harare:** Chishawasha, 1416m, 17°45'46"S, 31°12'31"E, A. Watsham [2♀, NMPC: UCRCENT00416454, UCRCENT00416456]. **Zimbabwe: Mashonaland:** Mazowe, 125m, 17°30'32"S, 30°58'19"E, i.1975, A. Watsham [6♀, NMPC: UCRCENT00416459–61, UCRCENT00416466–67, UCRCENT00416519]. Makumbi Miss., 17°31'12"S, 31°15'22"E, A. Watsham [1♂, NMPC: UCRCENT00416462].

Orasema near glabra: **Gambia: Banjul:** Kotu Stream, 3m, 13°27'41"N, 16°42'13"W, 14.xi.1981, K-J. Hedqvist [5♂ 4♀, BMNH: UCRCENT00309860–68]. Kotu Stream, 4m, 13°27'42"N, 16°42'13"W, 18.xi.1981, K-J. Hedqvist [1♀, BMNH: UCRCENT00309871]. **North Bank Division:** Upper Baddibu, Farafenni, 13m, 13°34'03"N, 15°44'56"W, 1-2.xi.1977, Michael Söderlund, Meadow (mostly resorts) with baobab [1♂, BMNH: UCRCENT00309873]. **Western Division:** Kombo St Mary, Bakau, 10m, 13°28'47"N, 16°40'14"W, 28-29.x.1977, Michael Söderlund, shore meadow [1♂, BMNH: UCRCENT00309872]. Kombo St Mary, Sara Job Kunda, 25m, 13°26'40"N, 16°42'46"E, 29.x.1977, Michael Söderlund, grassland with palms [1♂, BMNH: UCRCENT00309859].

***Losbanus* Ishii, rev. stat.**

Losbanus Ishii, 1932: 210. Type species: *Losbanus uichancoi* Ishii 1932: 210–211, by monotypy.

Losbanus; Hedqvist, 1978: 229. Short redescription and key to species, most of which are now attributed to *Neolosbanus* (Eucharitinae).

Losbanus; Watanabe, 1958, 26. Subsequent description.

Gollumiella; Bouček, 1988: 521. Incorrectly placed as senior synonym of *Gollumiella*.

Orasema; Heraty, 1992: 586. Synonymy based on transfer of *L. uichancoi* to *Orasema*.

Orasema; Heraty, 1994: 54–57. Description and treatment as *Orasema uichancoi*-group.

Orasema; Heraty, 2000: 378. Separation of *communis* and *uichancoi* species groups.

Discussion. *Losbanus* was first described for a single species, *L. uichancoi*. Bouček (1988) incorrectly used this as a senior synonym of *Gollumiella*. Heraty (1992) transferred the type species to *Orasema*, then used it to represent the *Orasema uichancoi*-group in Heraty (1994), and in a more restricted sense for all of the Indo-Pacific species in Heraty (2000). Herein we recognize this more restricted *uichancoi* group (*sensu* Heraty, 2000) as *Losbanus*. We have discovered two new species (not described) that expand the geographic and morphological limits of *Losbanus*. A single male from the Republic of the Congo (UCRC: UCRCENT00434658) fits all of the characteris-

tics of the group and extends the distribution to Africa. Another series of males from northeastern Queensland in Australia (Charmillin Creek and Baldy Mountain Rd; QM: UCRCENT00241810–14) overall fit the description of the genus, but lack the ocellar-ocular sulcus and have a 5–7 digitate labrum, whereas the other species have 4 digits. All species of *Losbanus* have 8–9 funiculars, a 12–13 segmented antenna, and densely pilose wings. The following species are transferred from *Orasema*: *L. bouceki* (Heraty), comb. n., *L. ishii* (Heraty), comb. n., *L. promecea* (Heraty), comb. n., *L. rugulosa* (Heraty), comb. n., and *L. uichancoi* Ishii comb. n. (key in Heraty, 1994).

Diagnosis. Separated from most *Orasema* and other Oraseminae by having 8–9 funiculars versus 7, a weak basal petiolar flange, usually a distinct ocellar-ocular sulcus, 4–7 digitate labrum, and the callar region usually with several long setae (African male with a single long seta). Distinguished from other Old World genera by the head broadly subtriangular to transverse in frontal view; face smooth or sculptured; presence of an ocellar-ocular sulcus in all but the Australian species; scrobal depression evenly impressed and lacking parallel channels and dorsal foveae; dorsal occipital margin abrupt and rounded or carinate; funicle 8–9 segmented; labrum with 4–7 digits (usually 4); mesonotum appearing bare, at most with minute setae; mesoscutal lateral lobes and frenum sculptured or smooth; transscutal articulation complete and only slightly sinuate; propodeal disc evenly sculptured, smooth laterally only in the Australian species; prepectus foveate and tightly articulated with pronotum ventrally; fore wing with basal area and specular area pilose or bare, wing disc with dense long setae; postmarginal vein much longer than stigmal vein and reaching over half distance to wing apex; petiole base truncate with weak basal flange; antecostal sulcus broad and smooth or foveate; first valvula of ovipositor with 3–5 lateral teeth, subapical teeth sometimes formed by oblique ridges. Male scape lacking ventral pores.

Biology. The oviposition habits and morphology of the egg and first instar were described by Ishii (1932) for *L. uichancoi*. The egg is stalked as in most Eucharitidae. A revised interpretation of the planidium was presented in Heraty (1994) and larvae are the same as for *Orasema*, with tergites I and II separated and not fused as illustrated by Ishii. Oviposition was made in short parallel rows into incisions made into the undersurface of leaves of *Celtis philippinensis* Blanco (Cannabaceae) and *Leucaena glauca* Benth. (Fabaceae).

Host association. Unknown.

Distribution. Five species described from southeast Asia (Heraty, 1994). Palearctic (Australia: Queensland (undescribed); Republic of Congo (undescribed), Papua New Guinea, Philippines, Taiwan).

Matantas Heraty & Burks, gen. n.

<http://zoobank.org/6556925F-B592-4324-B97C-110902691CF2>

Type species. *Orasema koghisiana* Heraty, 1994: 71–72, figs 107–108, 110, 189–190, 211–212, 219, 236, 247.

Etymology. Named after one of the New Caledonia collecting localities, Matanta; gender feminine.

Discussion. Defined by Heraty (1994: 71) as the *Orasema koghisiana*-group. No genetic sequence data are available for the group. *Matantas koghisiana* (Heraty) comb. n. is the only species described for the genus.

Diagnosis. Separated from *Orasema* by the combination of smooth lateral areas on the propodeal disc in combination with a rugose-areolate or reticulate median channel, smooth face, and labrum with 6–8 digits. Distinguished from other Old World genera by the head subtriangular in frontal view; face smooth and relatively flattened, scrobal depression evenly impressed and lacking parallel channels or dorsal foveae; dorsal occipital margin abrupt and rounded, at most with a weak dorsal carina; funicle 7-segmented; labrum with 6–8 digits; mesonotum appearing bare, at most with minute setae; mesoscutal lateral lobes and frenum smooth; transscutal articulation complete and relatively straight; propodeal disc smooth with a broad sculptured median channel; prepectus foveate and tightly articulated with pronotum ventrally; fore wing with basal area and specular area bare, wing disc setae relatively long and dense; postmarginal vein much longer than stigmal vein and reaching about half distance to wing apex; petiole base truncate with strong basal flange; antecostal sulcus present and smooth; first valvula of ovipositor with 3 or 4 lateral teeth. Male scape lacking ventral pores.

Host association. Unknown.

Distribution. One species described. New Caledonia (another undescribed species from Vanuatu, BPBM: UCRCENT00422296).

***Zuparka* Heraty & Burks, gen. n.**

<http://zoobank.org/17C35918-BF49-424D-BFE0-F3541C898EBB>

Figs 68–86

Type species. *Zuparka monomoria* Heraty, 2000: 375–378, figs 1–7.

Etymology. Named after Robert Zuparko of the California Academy of Sciences; gender feminine.

Discussion. Defined by Heraty (2000: 375) as the *Orasema monomoria* group as based on the single species *Z. monomoria* (Heraty), comb. n. and on a single recently emerged teneral female. Another distinctive species is recognized herein, *Z. fisheri* sp. n. The two species are morphologically distinct from each other, and the divergence in their ribosomal and mitochondrial data is generally what is expected between different genera in other Oraseminae. However, morphological features support recognition of a single genus. *Zuparka* is most similar to the African *Leiosema*, the only other orasemine with ventral pores on the male scape. Based on *Z. monomoria*, *Zuparka* is the only genus with a pupa that lacks pronounced tubercles over the petiolar region (c.f. Fig. 37) or laterally on the lateral abdominal region (Heraty, 2000). It is also the only genus known to attack *Monomorium* (Myrmicinae).

Diagnosis. Separated from other Oraseminae by the presence of ventral pores on the male scape, 4-digitate labrum (Figs 69, 79), parallel scrobal depressions with a dorsal fovea (Fig. 79, dsd), sculptured frenum (Fig. 70, frn), presence of a basal petiolar carina (Fig. 75, apc), and absence of an antecostal sulcus. Distinguished from the other Old World genera by having the head smooth or very weakly coriaceous, and subtriangular in frontal view (Figs 69, 79, 81); scrobal depression with parallel channels and dorsal fovea (Fig. 79); occiput rounded; funicle 7-segmented; labrum with 4 digits; mesonotum appearing bare, at most with few minute setae; mesosomal lateral lobes and frenum sculptured; transscutal articulation complete and relatively straight; propodeal disc has either smooth or nearly smooth lateral areas on the propodeal disc in combination with a rugose-areolate or reticulate median channel (Fig. 73), or more weakly sculptured propodeum with a weak median channel and a median carina; prepectus foveate dorsally and tightly articulated with pronotum ventrally (Figs 70, 82); fore wing with basal area and specular area bare (Figs 74, 83), wing disc with relatively long dense setae; postmarginal vein less than twice as long as stigmal vein; petiole with prominent basal flange; antecostal sulcus absent; first valvula of ovipositor with 3–4 lateral teeth. Male scape with distinct ventral pores (glands) set in circular depressions across entire ventral surface (Fig. 78).

Host association. Myrmicinae: *Z. monomoria* reared from *Monomorium* sp. (Heraty 2000).

Distribution. Madagascar.

***Zuparka fisheri* Heacox & Dominguez, sp. n.**

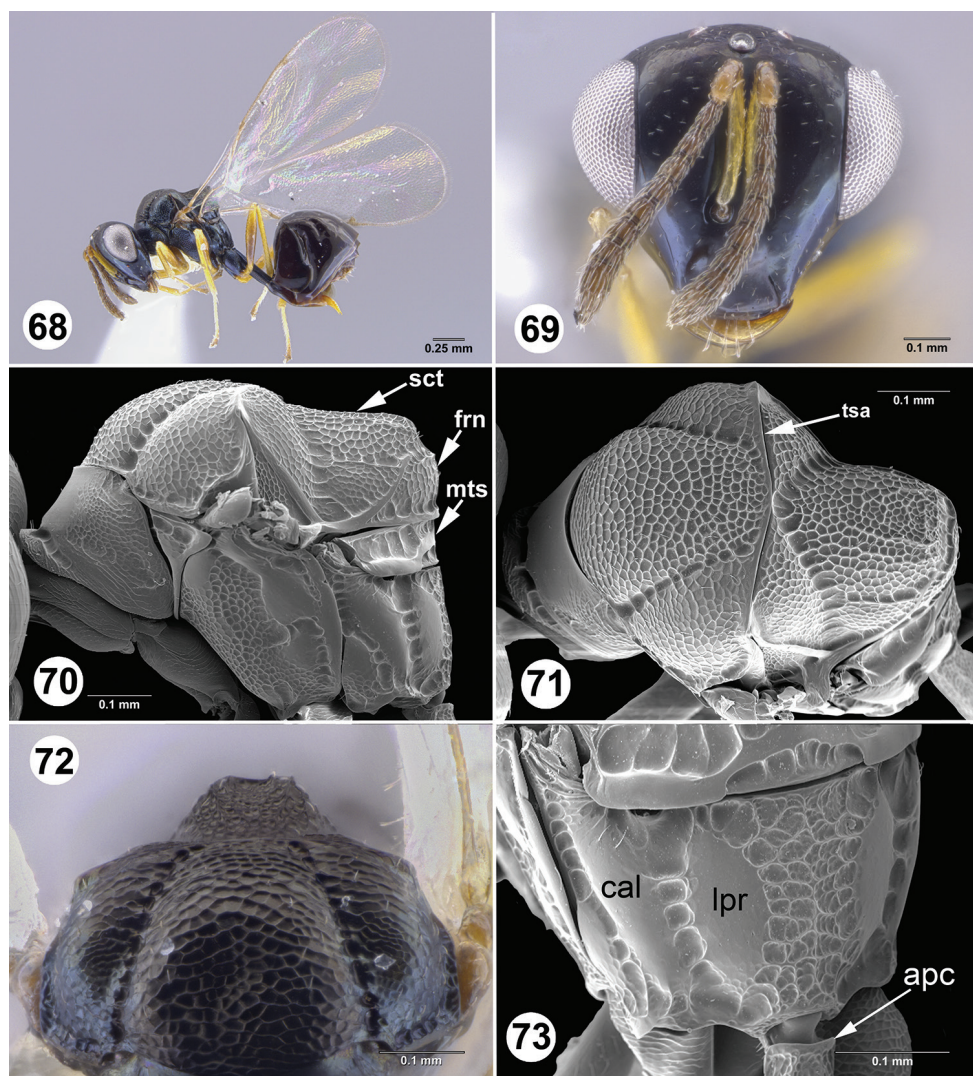
<http://zoobank.org/A2294EE0-09AF-4A98-B9AA-B8D207366A13>

Figs 68–80

Etymology. Named after Brian Fisher of the California Academy of Sciences for his tremendous collecting efforts that have contributed to the understanding of the fauna of Madagascar.

Diagnosis. Face entirely smooth. Scutellum vaulted anterior to frenum and medially depressed. Propodeal disc laterally smooth. This species resembles *Zuparka monomoria*, but can be easily differentiated by the presence of an elevated medial region of the scutellar disc (Fig. 70) with a median depression (Figs 71, 72), sculptured axilla (Fig. 71), torulus with ventral margins roughly on the same plane as the ventral margins of the eyes (Figs 69, 79). Based on differing structures of the male antenna, what we are currently recognizing as *Z. fisheri* may ultimately be a complex of species.

Female. Length 1.8–2.4 mm. Head and mesosoma, including mid and hind coxae and petiole, dark bluish-black; fore coxae dark bluish-black and yellow apically. Flagellum brown; scape, pedicel and anellus yellow to brown. Legs beyond coxa yellow with femora medially brown and tarsomeres apically pale brown. Gaster dark brown. Wings hyaline, venation pale yellowish-brown.



Figures 68–73. *Zuparka fisheri*. Paratype female: **68** habitus, lateral **69** head, anterior **70** mesosoma, lateral **71** mesosoma, oblique dorsal **72** mesosoma, anterior **73** propodeum, oblique dorsal. apc = anterior petiolar carina; cal = callus; frn = frenum; lpr; lateral propodeal disc; mts = metascutellum; sct = mesoscutellum; tsa = transscutal articulation.

Head (Figs 69, 77–79) 2.2–2.6× as broad as long; face broadly rounded, smooth and polished with faint indication of cellulate sculpture on upper frons and vertex; interocular distance 1.3–1.4× eye height; malar space 0.5–0.7× eye height; distance from anteclypeus to ventral margin of toruli 0.3–0.4× head height; clypeus smooth and with scattered setae, lateral margins and epistomal sulcus strongly impressed; anteclypeus distinct and subtruncate. Mandibular formula 3:2; palpal formula 3:3.

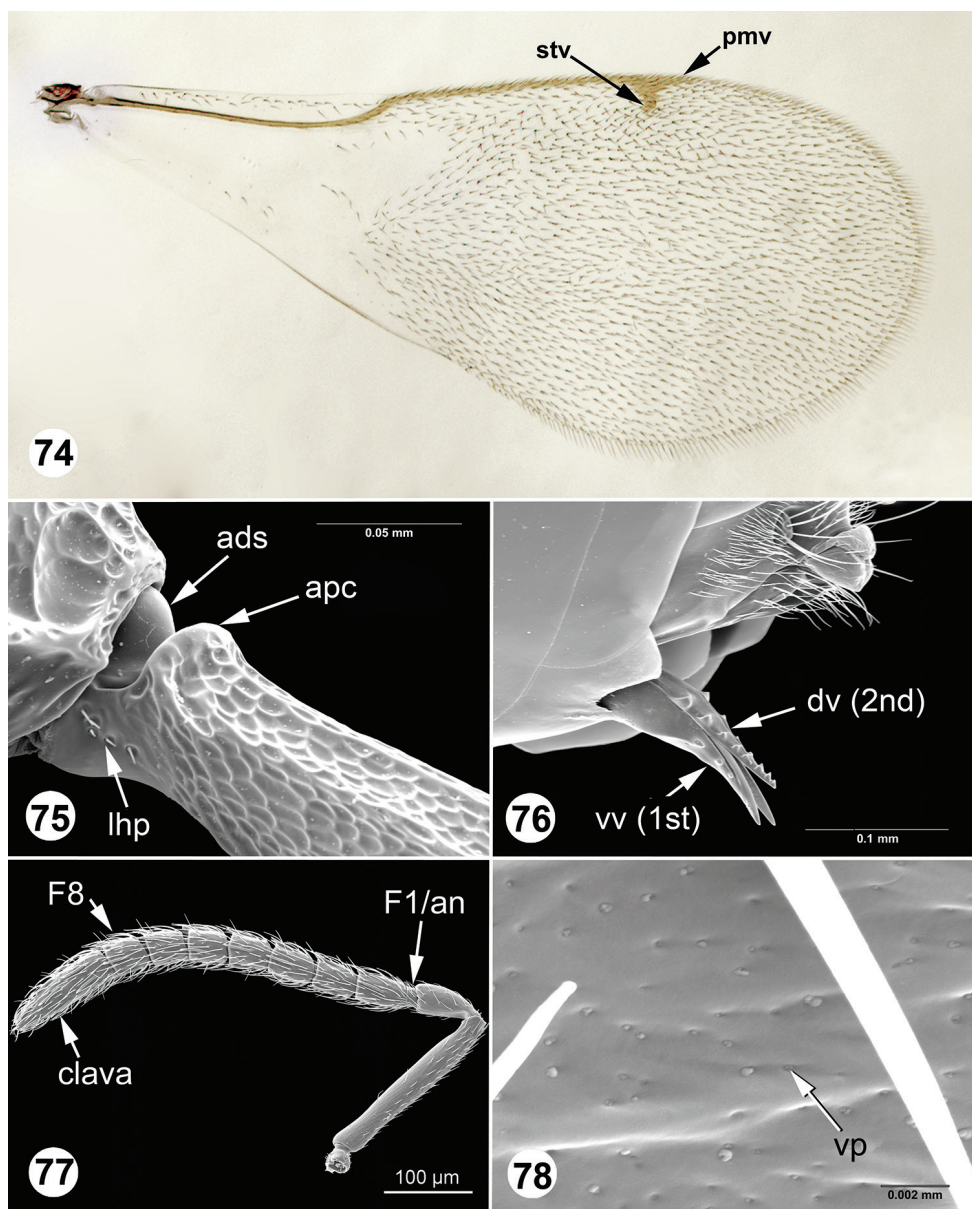
Occiput transversely aciculate, dorsal margin broadly rounded, occipital carina absent; temples broad. Antenna 11-segmented (Fig. 77); scape narrow and cylindrical, slightly broadening medially and reaching median ocellus, at least $7\times$ as long as broad; pedicel $1.3\text{--}2.0\times$ as long as broad, apex broader than anellus; flagellum $0.8\text{--}0.9\times$ head height; funicle 7-segmented; flagellar segments beyond anellus densely setose with numerous longitudinal sensilla; F2 $1.2\text{--}1.6\times$ as long as broad, following segments becoming more transverse; clava subconical, about as long as preceding three segments.

Mesosoma (Figs 70–74). Midlobe of mesoscutum and mesoscutellum finely reticulate; notauli foveate, reaching transscutal articulation (TSA) and broadly separated posteriorly; lateral lobe and axilla broadly rounded; scutellar disc abruptly vaulted anterior to frenum (Fig. 70) and with weak median depression (Figs 71–72); scutellar disc about as long as broad, separated from axillae and TSA by deep foveate scutoscutellar sulcus that is continuous medially; axillular sulcus and frenal line medially foveate with a weak carina along ventral margin of sulcus, continuing laterally as a smooth ridge; frenum semicircular and vertical. Propodeal disc rounded, areolate medially, smooth laterally (Fig. 73); callar region smooth with few setae dorsally; metepimeron smooth dorsally and ventrally reticulate. Upper and lower mesepimeron mostly smooth; transepimeral sulcus irregularly foveate; femoral groove obscure. Prepectus foveate dorsally, with a strong posterior flange, ventrally narrow and smooth. Pronotum reticulate laterally and smooth medially. Propleuron imbricate. Fore and mid coxae imbricate; hind coxae reticulate. Fore wing $2.6\text{--}2.9\times$ as long as mesosoma, $2.4\text{--}2.6\times$ as long as broad; basal cell setose; costal cell ventrally pilose, remainder of wing pilose; stigmal vein as long or slightly longer than wide and perpendicular to wing margin; postmarginal vein $0.1\text{--}0.2\times$ length of marginal vein, about twice length of stigmal vein. Hind wing costal cell with several ventral setae in apical half.

Metasoma (Figs 75–76) with petiole cylindrical, $1.6\text{--}1.9\times$ as long as hind coxa; finely reticulate; ventral sulcus absent. Gt_1 as long as or slightly shorter than femur, smooth and bare; Mt_7 densely pilose anterior to cercus, cercus with 5 long setae; Gs_1 smooth and without antecostal sulcus. Hypopygium with 2 pairs of minute subapical setae. Ovipositor expanded subapically and curved forward; first valvula with 3 lateral teeth and sinuate subapical ridge; second valvula with 8 lateral teeth (Fig. 76).

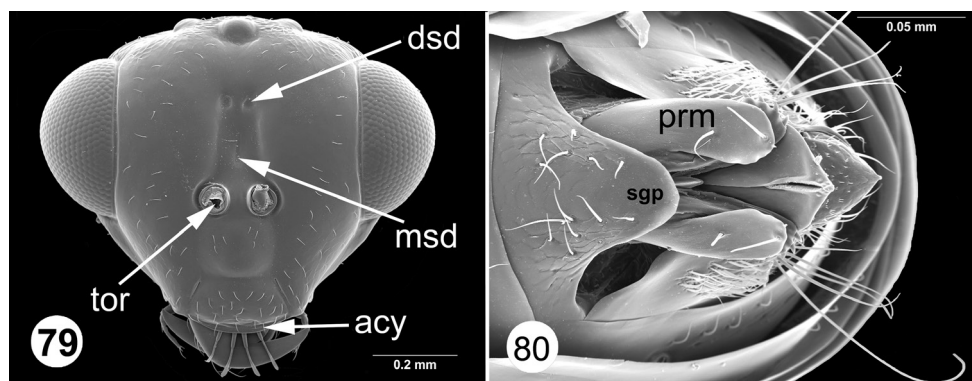
Male. Length 1.7–1.8 mm. Scape yellow to brown, flagellomeres brown. Fore coxa bluish-black and brown apically; legs yellow to yellowish-brown, hind femur darker with yellow tips, tarsomeres yellow to brown. Scape ventroapically with dense minute pores. Gs_8 apically strongly convex with sparse ventral hairs; Ms_8 densely setose near cerci. Genitalia with broad flattened parameres with two subapical setae, digiti with 4 lateral spines; aedeagus subapically expanded (Fig. 80).

Holotype. Madagascar: Fianarantsoa Prov.: Parc National Ranomafana, Belle Vue at Talataky, 1020m, $21^{\circ}15'59''S$, $47^{\circ}25'07''E$, 2-10.i.2002, R. Harin' Hala, secondary tropical forest, Malaise trap [1♀, CASC: UCRCENT00417485].
Paratypes: Madagascar: Antananarivo Prov.: 3 km 41 degrees NE Andranomay,



Figures 74–78. *Zuparka fisheri*. Paratype female: **74** fore wing **75** petiolar base **76** ovipositor. Paratype male: **77** antenna **78** pores on scape ventrally. ads = anterodorsal swelling of petiole; apc = anterior petiolar carina; dv = dorsal (2nd) valvula; F = flagellomere; F1/an = anellus; lhp = petiolar lateral hair patch; vp = ventral pore of scape; pmv = postmarginal vein; stv = stigmal vein; vv = ventral (1st) valvula.

11.5 km 147 degrees SSE Anjozorobe, 1300m, 18°28'24"S, 47°57'36"E, 5-13. xii.2000, Fisher, Griswold et al., montane rainforest, Malaise trap [1♂, CASC: UCRCENT00417369]. **Antsiranana Prov.:** Parc National Montagne d'Ambre,



Figures 79–80. *Zuparka fisheri*. Paratype male: **79** head, anterior **80** genitalia and subgenital plate, ventral. acy = anteclypeus; dsd = dorsal scrobal fovea; msd = median scrobal depression; prm = paramere; sgp = subgenital plate; tor = torulus.

960m, 12°30'52"S, 49°10'53"E, 12.ii-4.iii.2001, 4-19.iii.2001, R. Harin'Hala, Malaise [5♂ 1♀, CASC: UCRCENT00175169, UCRCENT00278241–45]. Parc National Montagne d'Ambre, 1125m, 12°31'13"S, 49°10'45"E, 29.i-11.ii.2001, 5-21.iv.2001, 14-30.v.2001, 30.v-6.vi.2001, R. Harin'Hala, Malaise trap [4♂ 1♀, CASC: CASENT02014649, CASENT02015483, CASENT02015488, UCRCENT00417343, UCRCENT00417345]. Sakalava Beach, 10m, 12°15'46"S, 49°23'51"E, 16-31.v.2001, R. Harin'Hala, dwarf littoral forest, sandy trail, Malaise trap [1♂, CASC: UCRCENT00417339]. **Fianarantsoa Prov.:** Parc National Ranomafana, Belle Vue at Talatakely, 1020m, 21°15'59"S, 47°25'13"E, 28.xi-6.xii.2001, M. Irwin & R. Harin'Hala, secondary tropical forest, Malaise Trap [1♂ 1♀, CASC: UCRCENT00417551, UCRCENT00417553]. Parc National Ranomafana, radio tower at forest edge, 1130m, 21°15'03"S, 47°24'26"E, 16.x-8.xi.2001, 24.v-4.vi.2002, 7-17.v.2003, R. Harin'Hala, mixed tropical forest, Malaise [2♂ 4♀, CASC: UCRCENT00417386–487, UCRCENT00417388, UCRCENT00417489, UCRCENT00417490, UCRCENT00417492]. Parc National Ranomafana, Vohiparara at broken bridge, 1110m, 21°13'34"S, 47°22'11"E, 21-28.i.2002, 4-12.ii.2002, M. Irwin and R. Harin'Hala, high altitude rain forest, Malaise trap [1♂ 2♀, CASC: UCRCENT00417509–10, UCRCENT00417537]. **Toamasina Prov.:** bot. garden near entrance to Andasibe National Park, 1025m, 18°55'35"S, 48°24'28"E, 16-24.x.2001, 24.x-1.xi.2001, 1-7.xi.2001, R. Harin'Hala, tropical forest, Malaise Trap [2♂ 2♀, CASC: UCRCENT00417486, UCRCENT00417497, UCRCENT00417513, UCRCENT00417538].

Additional material examined. Madagascar: Antsiranana Prov.: Parc National Montagnad'Ambre, 1125m, 12°31'13"S, 49°10'45"E, 12.ii-4.iii.2001, 19.iii-5.iv.2001, 12-14.v.2001, R. Harin'Hala, Malaise trap [3♀ 1♂, CASC: CASENT02015492, UCRCENT00417340, UCRCENT00417344, UCRCENT00417346]. Sakalava Beach, 10m, 12°15'46"S, 49°23'51"E, 16-31.v.2001, R. Harin'Hala, dwarf littoral forest, sandy trail, Malaise trap [1♀, CASC: UCRCENT00417338].

***Zuparka monomoria* (Heraty), comb. n.**

Figs 81–84

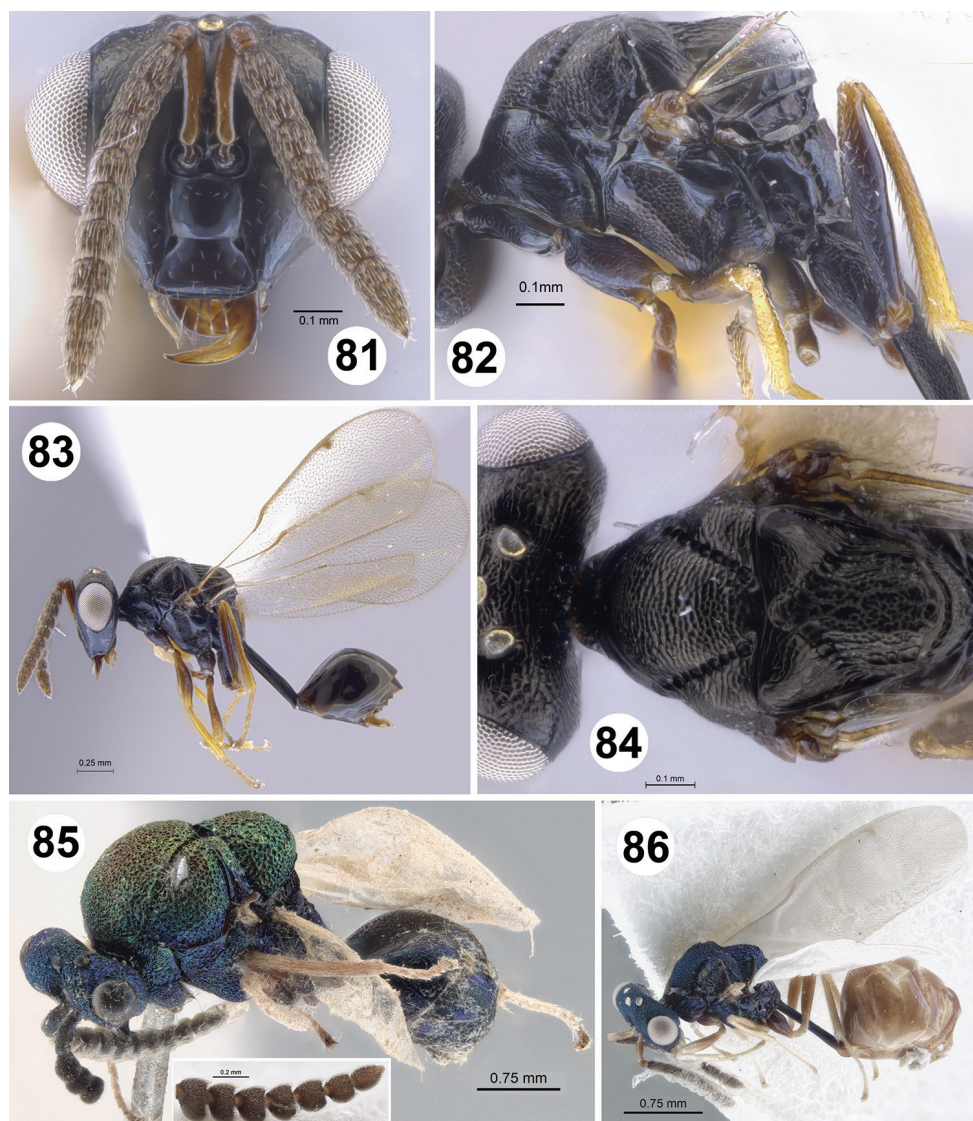
Orasema monomoria Heraty, 2000: 376–378.

Diagnosis. Frons weakly coriaceous. Scutellum evenly rounded anterior to frenum. Propodeal disc laterally weakly sculptured.

Discussion. Previously described from a single female that had recently emerged. The new material examined fits the description of the single female.

Distribution. Madagascar.

Holotype. Madagascar: Fianarantsoa Prov.: Res. Andringitra, 8.5 km SE of Antanitosy, 1990m, 22°10'00"S, 46°58'00"E, 6.iii.1997, Sylvian, montane rainforest [1♀, UCRC: UCRCENT00417370]. **Additional material examined: Madagascar:** Majunga Ampijoroa National Park, 160 km N of Maevatanana on RN 04, 43m, 16°19'10"S, 46°48'48"E, Rin'ha Harin'Hala, deciduous forest, Malaise trap [1♀, CASC: UCRCENT00417389]. **Antananarivo Prov.:** 3km 41d NE Andranomay, 1300m, 18°28'24"S, 47°57'36"E, 5-13.xii.2000, Fisher, Griswold, et al. CASC, montane rainforest, Malaise trap [1♂, CASC: UCRCENT00278242]. Ankokoy Forest, 3 km E of Ibity, 1700m, 20°04'03"S, 46°59'58"E, 12-22.xii.2008, M.Irwin, R.Harin'Hala, Uapaca forest, Malaise trap [1♀, CASC: UCRCENT00352446]. **Antsirana Prov.:** Parc National Montagne d'Ambre, 960m, 12°30'52"S, 49°10'53"E, 4-19.iii.2001, 5-21.iv.2001, R. Harin'Hala, Malaise trap [3♀, CASC: CASENT02015482, CASENT02015484, CASENT02015487]. **Diego Suarez:** PN Montange d'Ambra, 960m, 12°30'52"S, 49°10'53"E, 21-26.i.2001, M.E. Irwin, E.I. Schlinger & R. Harin'Hala, Malaise trap [1?, CASC: UCRCENT00417358]. **Fianarantsoa Prov.:** Miandritsara Forest, 40 km S Ambositra, 825m, 20°47'34"S, 47°10'32"E, 28.xii.2006-4.i.2007, M. Irwin, R. Harin'Hala, low altitude rainforest, Malaise trap [1♀, CASC: CASENT02174550]. near Isalo National Park, at stream E of Interpretive Cntr., 750m, 22°37'36"S, 45°21'29"E, 7-17.v.2003, R. Harin'Hala, mixed tropical forest, Malaise trap in open area [1♀, CASC: UCRCENT00417378]. Parc Nacional Ranomafana, Belle Vue at Talatalely, 1020m, 21°15'59"S, 47°25'13"E, 22.xi.2001, 6-12.xii.2001, 28.xi-6.xii.2001, 19-26.ii.2002, 10-14.i.2002, 12-19.ii.2002, 23-28.iv.2002, 5-13.v.2002, 15-22.xi.2002, 16-26.ii.2003, 26.ii-10.iii.2003, 10-21.iii.2003, 28.v-6.vi.2003, R. Harin'Hala, secondary forest, Malaise [4♂ 21♀, CASC: CASENT02174558–60, CASENT02174556, CASENT02174592, CASENT02174594–97, UCRCENT00417360; UCRC: UCRCENT00417481, UCRCENT00417495–96, UCRCENT00417503, UCRCENT00417514, UCRCENT00417531–33, UCRCENT00417535, UCRCENT00417390–93]. Parc National Ranomafana, JIRAMA water works, 690m, 21°14'55"S, 47°27'08"E, 28.i-4.ii.2002, R.Harin Hala, near river, Malaise Trap [1♀, CASC: CASENT02174591]. Parc National Ranomafana, radio tower at forest edge, 1130m, 21°15'03"S, 47°24'26"E, 14-21.i.2002, 28.i-4.ii.2002, 4-12.ii.2002, 7-17.v.2003, 7-18.vi.2003, 27.vi-7.vii.2003, R. Harin'Hala, mixed tropical forest, Malaise trap [14♀ 3♂, CASC: UCRCENT00417467, UCRCENT00417371–77,



Figures 81–86. 81–84 *Zuparka monomoria*. Female: 81 head, frontal 82 mesosoma, lateral 83 habitus, lateral 84 head and mesosoma, dorsal 85 unknown male Oрасeminae, Australia: URCRNT00238798 (couplet 10) 86 unknown male Oрасeminae, Australia: URCRNT00241816 (couplet 15).

URCRNT00417379–85, URCRNT00417387, URCRNT00417530]. Parc National Ranomafana, Vohiparara at broken bridge, 1110m, 21°13'34"S, 47°22'11"E, 6–15.xii.2001, 14–21.i.2002, 21–28.i.2002, 4–12.ii.2002, 19–26.ii.2002, 6–15.v.2002, M. Irwin and R. Harin'Hala, high altitude rain forest, Malaise trap [5♂ 9♀ 3?, CAS: CASENT02174562, CASENT02174583, CASENT02174587–89; UCRC: URCRNT00417508, URCRNT00417511–12, URCRNT00417525–29, UC

RCENT00417534, UCRCENT00417465–66, UCRCENT00417468]. Parc National Ranomafanae, radio tower at forest edge, 1130m, 21°15'03"S, 47°24'26"E, 12-19.ii.2002, R. Harin'Hala, mixed tropical forest, Malaise trap [2♂ 1♀, CASC: UCRCENT00417443, UCRCENT00417501–02]. Parc National Ranomafanae, radio tower at forest edge, 1130m, 21°15'03"S, 47°24'26"E, 21-28.i.2002, 4-12.iii.2002, 12-19.iii.2002, 27.ii-9.iii.2003, 20.iii-3.iv.2003, 15-27.iv.2003, 24.v-4.vi.2002, 6-17.vii.2003, R. Harin'Hala, mixed tropical forest, Malaise trap [6♂ 7♀ 1?, CASC: CASENT02174580–81, UCRCENT00417441, UCRCENT00417488, UCRCENT00417491; UCRCENT00417493–94, UCRCENT00417498, UCRCENT00417504–07, UCRCENT00417536, UCRCENT00417554]. Ranomafana National Park Talatakelo area, 900m, 21°15'02"S, 47°25'10"E, 9-19.i.2001, D.H. & K.M. Kavanaugh, R.L. Brett, E. Elsom, F. Vargas, mixed tropical forest, flight intercept trap [1♀, CASC: UCRCENT00417347]. Res. Andringitra, 8.5 km SE of Antanitosy, 1990m, 22°10'00"S, 46°58'00"E, 6.iii.1997, Sylvian, montane rainforest [1♀ 1?, UCRCENT00412588–89]. **Toamasina Prov.:** bot. garden near entrance to Andasibe National Park, 1025m, 18°55'35"S, 48°24'28"E, 16-23.xi.2001, R. Harin'Hala, tropical forest, Malaise Trap [1♂, CASC: UCRCENT00417494].

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