Zootaxa 2645: 1–48 (2010)
www.mapress.com/zootaxa/

Article

ISSN 1175-5326 (print edition)
ZOOTAXA
ISSN 1175-5334 (online edition)

Systematics of Cyphacolus Priesner (Hymenoptera: Platygastridae s.l.), an Old World genus of spider egg parasitoid

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Accepted by M. Buffington: 6 Aug. 2010; published: 14 Oct. 2010

Abstract

The genus *Cyphacolus* Priesner is unusual among members of the Baeini in having fore wings contoured to the convex surface of metasoma and lacking fore wing venation. It is closely allied to *Odontacolus* Kieffer based on the laterally compressed metasomal horn and pedunculate metasoma. Here we redescribe two of the three previously known species, *C. bhowaliensis* (Mani & Mukerjee) (India) and *C. veniprivus* Priesner (Egypt), and describe as new 13 additional species: *C. asheri* **n. sp.** (Sri Lanka), *C. axfordi* **n. sp.** (Australia), *C. copelandi* **n. sp.** (Kenya, Nigeria, Zimbabwe, Thailand), *C. diazae* **n. sp.** (Kenya), *C. harteni* **n. sp.** (Yemen, Ivory Coast, Paskistan), *C. jenningsi* **n. sp.** (Australia), *C. leblanci* **n. sp.** (Guinea), *C. lucianae* **n. sp.** (Ivory Coast, Madagascar, South Africa, Swaziland, Zimbabwe), *C. normani* **n. sp.** (India, United Arab Emirates), *C. sallyae* **n. sp.** (Australia), *C. tessae* **n. sp.** (Australia), *C. tullyae* **n. sp.** (Australia), and *C. watshami* **n. sp.** (Cameroon, Ivory Coast, Kenya, Madagascar, South Africa, Zimbabwe). In addition, we present a key to separate the species (including *Cyphacolus bouceki* Iqbal & Austin), a preliminary cladistic analysis to examine relationships among species and species groups, and a discussion of the biology, distribution and likely affinities of the genus. An electronic version of the identification key is available at WaspWeb[1]. As part of our phylogenetic study, one of the outgroup species, *Idris floris* (Kononova & Fursov) **n. comb.**, is here transferred from *Ceratobaeus* Ashmead. The electronic version of this document has been formatted with embedded links to additional resources available online via the internet, both to enhance the content and as a demonstration of the utility of international standards for biodiversity informatics.

Key words: Hymenoptera, egg-parasitoid, phylogeny, spider host, ovipositor

Introduction

The genus *Cyphacolus* (Fig. 1) was proposed by Priesner (1951) from a single female, described as *C. veniprivus*, collected in Cairo in 1937. Priesner postulated that the genus was related to *Ceratobaeus* Ashmead and *Odontacolus* Kieffer based on the presence of a metasomal horn, but that it could be distinguished from them by the absence of fore wing venation and having a dark infuscate patch in the fore wing. He further indicated that *Cyphacolus* and *Odontacolus* were more closely related to each other based on their more transverse scutellum and having a "distinctly developed propodeum", a statement that presumably refers to the pair of large spine-like flanges that flank the metasomal horn. Since Priesner (1951), the genus has virtually been ignored except for taxonomic citations (e.g. Muesebeck & Walkley 1956; Johnson 1992), although Kozlov (1971) included *Cyphacolus* in a key to genera. More recently, Iqbal & Austin (2000) included a single undescribed species in their phylogenetic analysis of the Baeini, while Austin & Iqbal (2005) described a new species from Australia, and discussed the putative relationships of the genus.

Over the past 26 years, the phenomenal effort of one of us (LM) to develop a synoptic collection of Platygastroidea from all biogeographic regions has been responsible for amassing much of the material used in the current study. However, apart from a few widely distributed common taxa, most species are represented by very few specimens, indicating that they are either rare in the environment or are not readily sampled using mass collecting techniques such as yellow pans and Malaise traps. Here our aim is to fully revise the taxonomy of the genus and describe the 13 new species. At the same time we present a key to the identification of all species, a preliminary cladistic analysis to examine relationships among species and species groups, and a discussion of the biology, distribution and likely affinities of the genus.

Material and methods

The following collections provided specimens for this study (arranged by acronym order): Australian National Insect Collection Australia, Canberra, Australia (ANIC)[2]; The Natural History Museum, London, United Kingdom (BMNH)[3]; California Academy of Sciences, San Francisco, USA (CASENT)[4]; Canadian National

1. http://www.waspweb.org/Platygastroidea/Keys/index.htm
2. http://biocol.org/urn:lsid:biocol.org:col:32981

Collection of Insects, Arachnids and Nematodes, Ottawa, Canada (CNCI)[5]; Cairo University, Cairo, Egypt (CUE)[6]; National Museum of Kenya, Nairobi, Kenya (NMKE)[7]; C.A. Triplehorn Insect Collection, Ohio State University , Ohio, USA (OSUC)[8]; Queensland Department of Primary Industries, Indooroopilly, Queensland, Australia (QDPI)[9]; Queensland Museum, Queensland, Australia, (QMBA)[10]; South Australia Museum, Adelaide, Australia (SAMA)[11]; Iziko Museums of Cape Town, Cape Town, South Africa (SAMC)[12]; National Museum of Natural History, Washington D.C., USA (USNM)[13]; Western Australian Museum, Perth, Australia, (WAMP)[14]; Waite Insect & Nematode Collection, The University of Adelaide, Australia (WINC)[15].

This work is a product of the Platygastroidea Planetary Biodiversity Inventory, a project funded by the U.S. National Science Foundation (N.F. Johnson, Ohio State University, and A.D. Austin, The University of Adelaide, Principal Investigators). One of the primary objectives of this project is to use biodiversity informatics tools to accelerate the taxonomic process and to make real-time collaboration possible within the community of researchers with appropriate expertise. Details on the data associated with these specimens may be accessed at the following link, purl.oclc.org/NET/hymenoptera/hol, and entering the identifier (e.g., OSUC 231234) in the form. Morphological terminology generally follows Mikó *et al.* (2007). All the life sciences identifiers (LSIDs) may be resolved at http://lsid.tdwg.org (i.e. urn:lsid:zoobank.org:act:85B4E914-30E6-481C-8678-766A449E5B62).

Material illustration and data citation. Images were taken with a JVC 3 CCD camera (model KY-575U) attached to a Leica Z16 APO with a Planapo 1.0x objective and a Nikon DXM 1200 digital camera attached to a Leica MZ16 stereomicroscope. Specimens were illuminated with a 4 channel LED dome light from Advanced Illumination. Figures were produced using Auto-Montage Pro versions 4.02 and 5.10 and post-processed with Adobe Photoshop; because of the Auto-Montage version 4.02 did not provide a scale bar, the figures are presented in the following text without them.

Specimen measurements were performed using a micrometer in a Weiss stereomicroscope with 10x oculars and a maximum magnification of 80x, or a Wild Heerbrugg stereomicroscope with 10x oculars and a maximum magnification of 50x. Specimens were oriented parallel to the optical field of the stereomicroscope and measurements taken at the maximum magnification. Measurements in the text are in millimeters and recorded to two decimal places.

In the Material Examined sections, the locality data reported for holotypes are not literal transcriptions of the labels: abbreviations are expanded; additional data from the collectors is also included. Holotypes are unambiguously identifiable by means of both the unique identifier and a red holotype label. The numbers prefixed with “OSUC” are unique identifiers for the individual specimens.

The contributions of the individual authors are: A.A. Valerio: character definition, species concept development; key development, imaging, capture of specimen data, manuscript preparation, phylogenetic analysis and illustration; A.D. Austin: species concept development, manuscript preparation, key development and phylogenetic analysis; L. Masner, specimen acquisition, character development.

Phylogenetic analysis. The analysis was carried out using the program TNT (Tree analysis using New Technology) ver. 1.1 (Golobof *et al.* 2003) employing the ‘xmult’ command and using 300 replications. A

3. http://biocol.org/urn:lsid:biocol.org:col:1009
4. http://biocol.org/urn:lsid:biocol.org:col:1011
5. http://biocol.org/urn:lsid:biocol.org:col:33138
6. http://biocol.org/urn:lsid:biocol.org:col:33170
7. http://biocol.org/urn:lsid:biocol.org:col:34022
8. http://biocol.org/urn:lsid:biocol.org:col:1014
9. http://biocol.org/urn:lsid:biocol.org:col:34158
10. http://biocol.org/urn:lsid:biocol.org:col:34163
11. http://biocol.org/urn:lsid:biocol.org:col:34982
12. http://biocol.org/urn:lsid:biocol.org:col:1018
13. http://biocol.org/urn:lsid:biocol.org:col:1019
14. http://biocol.org/urn:lsid:biocol.org:col:34579
15. http://biocol.org/urn:lsid:biocol.org:col:34593

single run was also undertaken using implied weighting employing the same commands. TNT was used to calculate the Bremer support indexes at each node on the tree. Bootstrap analysis using 10,000 replications was undertaken using the program Winclada (K.C. Nixon; http://www.cladistics.com/about_winc.htm). This program was also used to generate the figure for the consensus tree which was edited in Adobe™ Illustrator © CS3.

The outgroups used for the analysis included three undescribed *Odontacolus*, given this genus is the suspected sister group of *Cyphacolus* and may be rendered paraphyletic by it (Austin & Iqbal 2005). Three undescribed *Idris* spp. were also used as more distant outgroups, and a fourth species, *Idris floris* (Kononova & Fursov) (**n. comb.** transferred from *Ceratobaeus*; this species belongs to *Idris s. str.* and was incorrectly recognized as a member of *Ceratobaeus* by Kononova & Fursov (2005)) (OSCU 250617) was used to root the tree. We are currently revising Old World *Odontacolus*, and the three species used here (from Australia, Thailand and India; OSUC 237929, OSUC 238804, OSUC 237931) will be cross-referenced between the two studies. The three *Idris* species include taxa traditionally referred to as *Idris s. str.* (species 1, OSUC 233340, and 2, OSUC 228297) and *Ceratobaeus* (species 3, OSUC 190640), and are illustrated (Figs 3–10) to show their morphological diversity and to facilitate their future identification.

A total of 34 morphological characters were used from which 32 were parsimony informative (see Appendix for character description). Characters related to the genitalia were coded directly from Austin and Field (1997).

Taxonomy

Cyphacolus Priesner

Cyphacolus Priesner, 1951:123. Original description. Type: *Cyphacolus veniprivus* Priesner, by monotypy and original designation. Muesebeck & Walkley, 1956: 345 [citation of type species]; Kozlov 1971: 36 [keyed, citation of type species]; Masner 1976: 64 [tribal placement]; Johnson 1992: 366 [catalog of world species]; Austin & Field, 1997: 15 [revised tribal placement, host record]; Austin & Iqbal, 2005: 18 [diagnosis and key to species].

Zoobank registration: urn:lsid:zoobank.org:act:85B4E914-30E6-481C-8678-766A449E5B62

Diagnosis. *Cyphacolus* can be distinguished from all other genera of Platygastroidea by the following combination of characters: metasoma pedunculate in shape; first metasomal tergite with laterally compressed horn (elliptical in cross-section); fore wing contoured to convex surface of metasoma (elytriform), distal venation absent but with dark infuscate patch at fore wing margin; propodeum with pair of large, spine-like flanges that flank metasomal horn.

Description. Body mainly appearing smooth and shiny, often with dichromatic markings.

Head. In anterior view suboval or subtriangular, not elongate in buccal region; female antenna 7-segmented, clava large and unsegmented or with indistinct suture lines; male antenna short, 11-segmented but appearing to be 10–segmented as last two funicle segments are closely joined, distal funicular segments becoming progressively broader so that antenna is almost subclavate.

Mesosoma. Notauli usually present as distinct grooves reaching no more than about half way to anterior margin of mesoscutum, sometimes hidden by coarse longitudinal sculpture; mesoscutellum either flat and transverse, with posterior margin usually straight in middle part, or dorsally convex and semicircular or oval in shape; propodeum with pair of broad, elongate spines which are blunt or truncate apically; macropterous, never brachypterous, fore wing narrow basally with transverse fold about 1/3 distance from body, broad in apical half, remainder of fore wing surface sinuate, convex apically, molded to dorsal surface of metasoma; fore wing venation lacking except submarginal vein, pronounced infuscate patch at position of marginal (C+R) and stigmal veins (r-rs) and sometimes elsewhere. Vein r-rs absent.

Metasoma. Pedunculate in dorsal view, i.e. T1 square or rectangular (rarely more transverse) with parallel or slightly curved lateral margins, metasoma otherwise broad, oval, in lateral view dorsal surface slightly to strongly convex; T1 with large, laterally compressed horn-like process (i.e. ellipsoidal in cross-section); T3

slightly longer than T2, sometimes subequal in length with T2; ovipositor at least 1.5x length of metasoma, with shaft curled back on itself within rounded head of the horn on T1; gonoplacs elongate, approximately 0.75x length of metasoma.

Comments. The taxonomy and likely phylogenetic affinities of the genus have been discussed by Austin & Iqbal (2005). The genus is putatively monophyletic based on the unusual shape and venation of the fore wing, and the shape of the metasomal horn, the latter character otherwise found only in *Odontacolus* Kieffer. *Cyphacolus* + *Odontacolus* clearly form a monophyletic group within the Baeini, based on the metasomal horn, presence of large blunt spines on the propodeum, and the pedunculate metasoma. As discussed by Austin & Iqbal (2005), the shape of the horn is apparently linked to the functional mechanics of the ovipositor system, as the ovipositor is retracted within the metasoma and is curled around in the curved head of the horn so that it forms an elongated, bent U-shape (Austin 1983). However, although *Cyphacolus* is putatively monophyletic, Odontacolus does not possess any obvious synapomorphies, and thus may be paraphyletic with respect to the former genus. We are currently revising the Old World species of Odontacolus and, as part of that study, we intend to examine this question by undertaking a morphological phylogenetic analysis including a broad sampling of members of both genera.

More problematic is the position of *Cyphacolus* and *Odontacolus* within the Baeini. This is an extremely diverse tribe of platygastroid wasps with generally uncertain relationships, whose members are presumed to be all endoparasitoids of spider eggs (Austin 1985; Austin & Field 1997; Austin *et al.* 2005). More recently, one *Cyphacolus* Australian species was reared from an unknown spider's egg sac, potentially confirming this trend for the Baeini clade.

The preliminary analysis of Iqbal & Austin (2000) employing 35 morphological characters, placed these two genera within a basal clade along with *Hickmanella* Austin and several undescribed species of *Idris* Foerster *s. str.* and *Ceratobaeus* Ashmead, the latter possessing a metasomal horn and being treated as a synonym of *Idris* by some authors (see Johnson 1992). However, the results of this analysis lacked stability because of the extremely high level of reductional synapomorphies (i.e. character losses) displayed by the Baeini, particularly the reduction of wing length and convergence of the highly fusiform body shape associated with cryptobiotic habits of some taxa, typified by *Baeus* Haliday (Austin *et al.* 2005; Stevens & Austin 2007) . Interestingly, these reductional states do not occur in *Cyphacolus* and *Odontacolus*, and they show no apparent specializations for searching out host egg sacs in leaf-litter, with possibly one exception, i.e., the contoured to convex surface of metasoma-like fore wings of some *Cyphacolus*. This character is strongly reminiscent of the situation in the ambositrine diapriid genus *Acanthobetyla* Dodd, where the contoured fore wings of the female also lack venation and the wings are heavily sclerotised and deeply infuscate (Naumann 1982). This arrangement presumably protects the surface of the fore wings when females are moving through litter, and the same may also apply to members of *Cyphacolus*, although at this stage we know very little about the biology of this genus.

Recently, Carey *et al.* (2006) examined the phylogeny of the Baeini using sequence data from the nuclear *28S rRNA* and mitochondrial *CO1* genes for an exemplar set of 21 ingroup taxa. Although preliminary in nature given the immense diversity of the tribe, the results of this study are interesting in that they show 1) the tribe is only monophyletic with the exclusion of the Australian genus *Mirobaeoides* Dodd, 2) that *Baeus* is the sister taxa to all remaining Baeini, 3) that *Odontacolus* is sister to a clade comprising *Hickmanella* Austin, *Idris* and *Ceratobaeus*, and 4) that neither of the latter two genera are monophyletic. Nonetheless, this study did not include any *Cyphacolus* species.

Link to distribution map.[16] *Cyphacolus* is found throughout the Old World tropics and subtropics, but extends into seasonally arid and semiarid regions outside of the tropics. It is found in South, West and East Africa (South Africa, Zimbabwe, Cameroon, Guinea, Ivory Coast, Kenya), Madagascar, the Middle East (Egypt, Yemen, United Arab Emirates), Pakistan, India, Sri Lanka, Thailand and Australia. It has so far not been recorded from south-east Asia south of latitude 16.5°N but very likely has a continuous distribution between India and northern Australia (Fig. 2).

16. http://osuc.biosci.ohio-state.edu/HymOnline/map-large.html?id=468

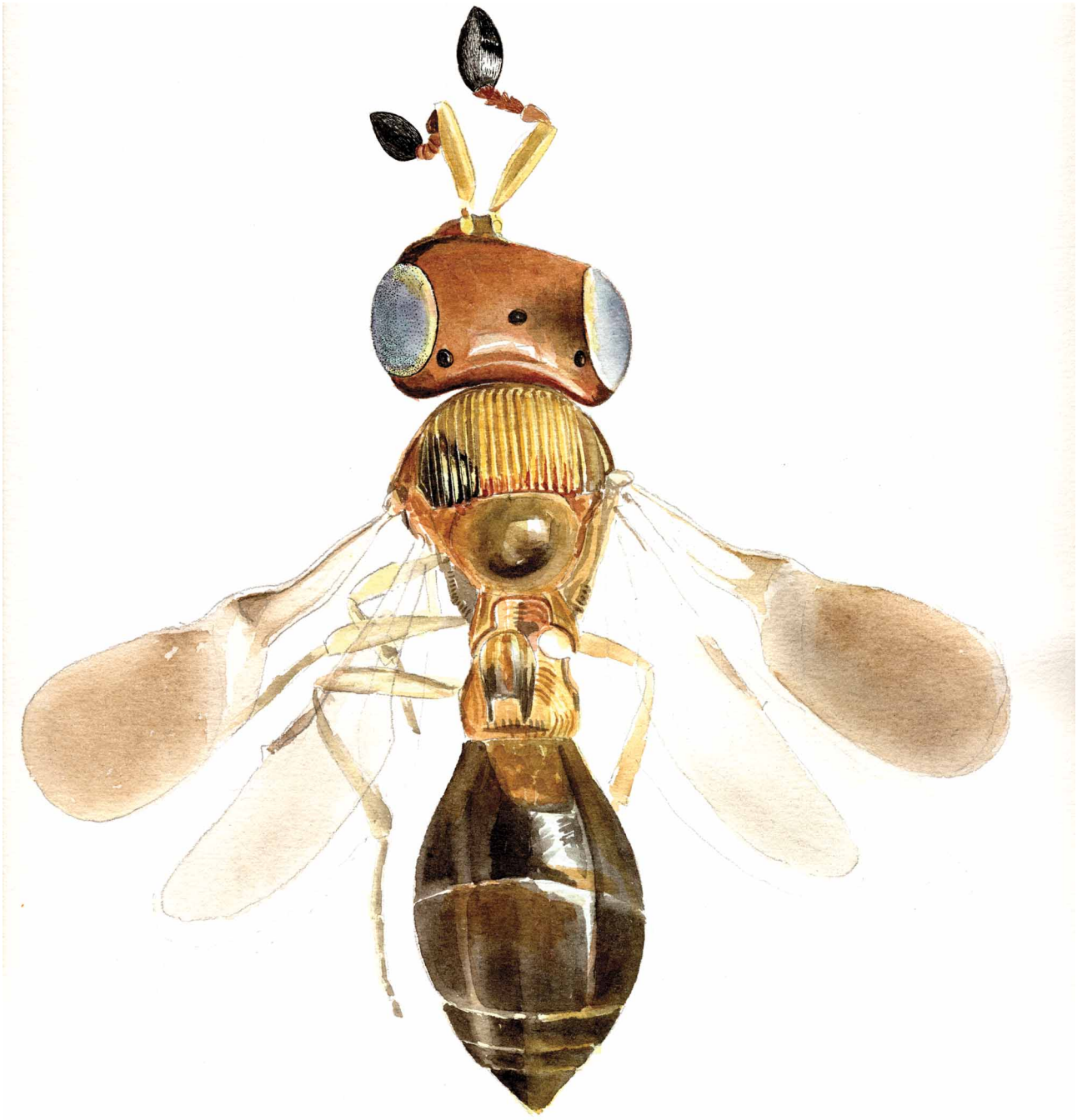


FIGURE 1. *Cyphacolus copelandi* **n. sp.** dorsal view, water color illustration by Rev. Anthony Watsham.

Relationships among species. The phylogenetic analysis found eight trees of 141 steps from which a strict consensus tree was calculated (CI=0.530, RI=0.663, Fig. 3). *Cyphacolus* was confirmed to be monophyletic (bootstrap = 75; Bremer = 4), as was *Odontacolus* (bootstrap = 60; Bremer = 5) which was also recovered as sister to *Cyphacolus*. Monophyly of *Cyphacolus* is supported by four character-states: lack of a facial keel, glabrous compound eyes, lack of a stigmal vein (r-rs) in the forewing, and the convexity of the fore wings. The main characters supporting the monophyly of *Odontacolus* are the longer mid-mandibular tooth when compared with the upper and lower teeth, the very setose compound eyes (*Cyphacolus* compound eyes are glabrous), and the presence of a well-defined netrion. Although *Odontacolus* is resolved here as monophyletic we have included only three of an estimated 40 species for the genus, and further testing of the monophyly of the genus is needed with a broader set of *Odontacolus* species.

Within *Cyphacolus* two major clades are resolved which we attribute here to species groups. The *bouceki* species group is composed of *C. axfordi, C. bouceki, C. sallyae, C. jenningsi,* and *C. tullyae*. This clade is

supported by the mainly smooth metasomal horn having some longitudinal costate sculpture on the posterior edge. This group contains only species from Australia, with *C. tessae* being the only taxon from the continent not included in this group.

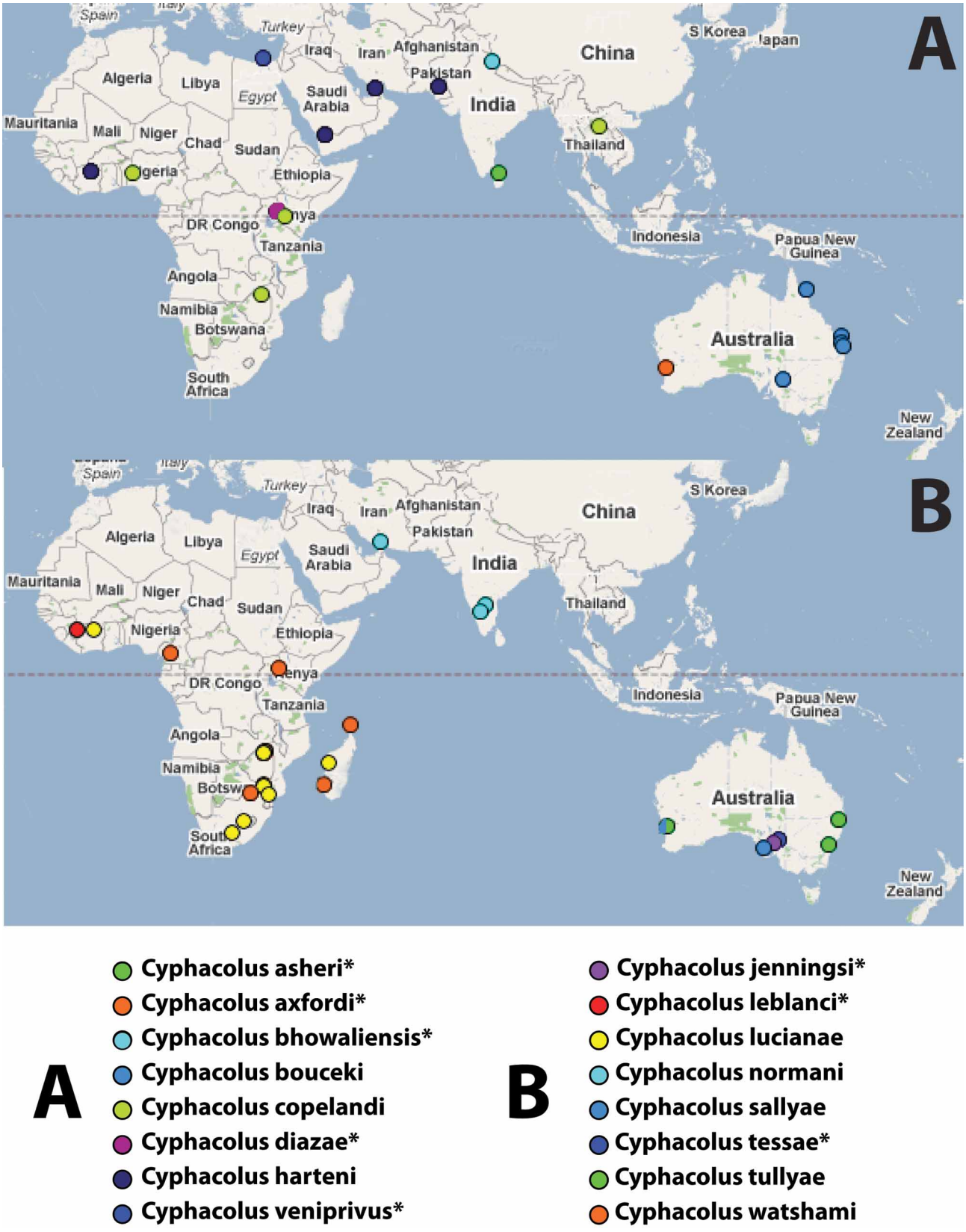


FIGURE 2. Distributional map of the genus *Cyphacolus* Priesner. *= species that are known from a single location.

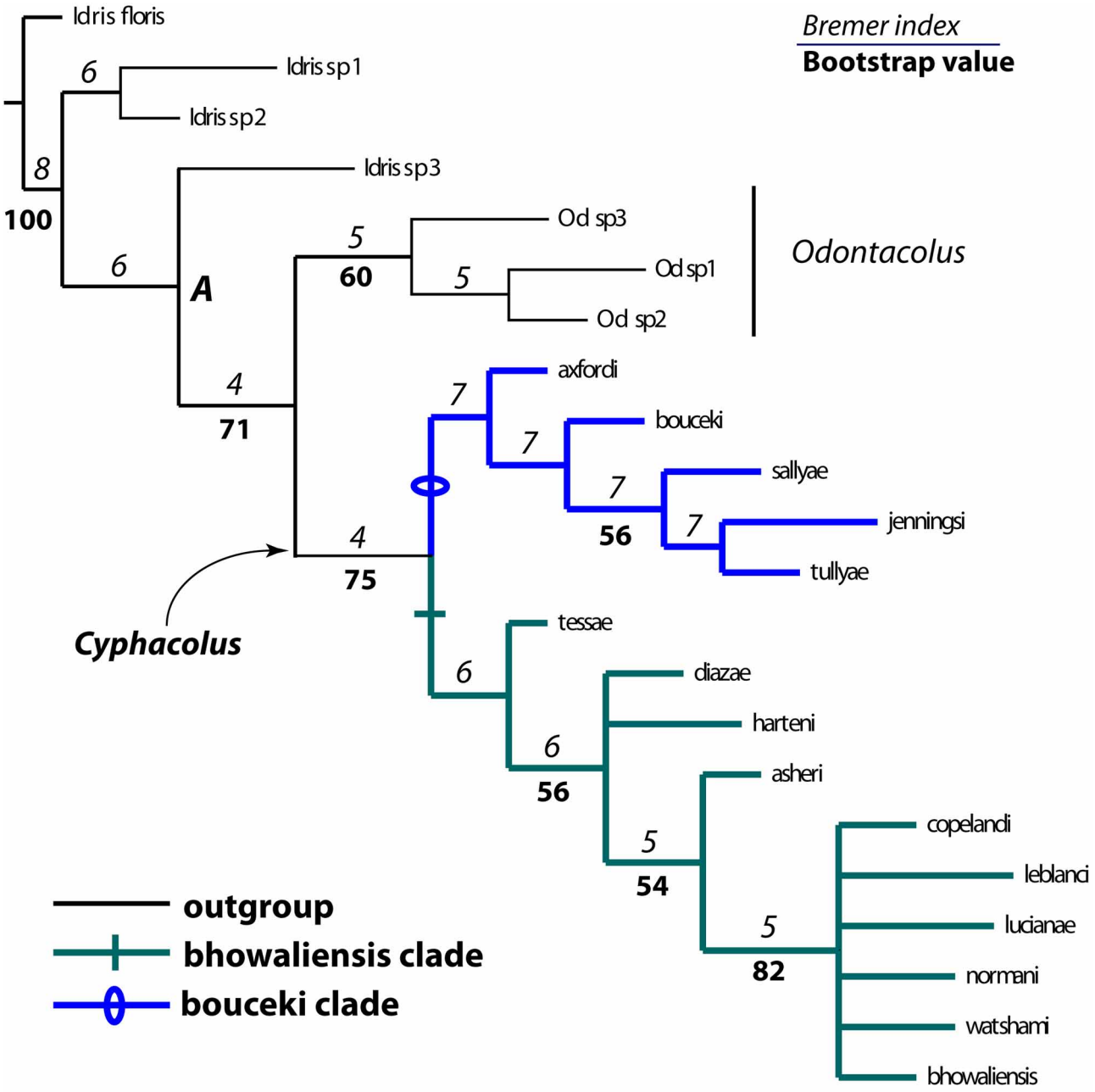


FIGURE 3. Strict consensus tree for species of *Cyphacolus* Priesner under Maximum Parsimony.

The *bhowaliensis* species group includes *C. tessae, C. hardeni, C. diazae, C. asheri, C. copelandi, C. lucianae, C. normani, C. watshami* and *C. bhowaliensis*. This clade is supported by the presence of posterior lateral carinae on the metasomal horn, and by the absence of sculpture on the posterior area of the horn. With the exception of *C. tessae* (from Australia), all species comprising this group are found from Africa to India, with a single specimen of *C. copelandi* known from Thailand.

Within the *bhowaliensis* species group the relationships among several species are noteworthy. The species *C. tessae, C. diazae and C. harteni* do not have longitudinal costate sculpture on the mesoscutum, a character that is present for the remainder of species within the *bhowalensis* clade. Additionally, *C. diazae* and *C. harteni* can be separated from *C. tessae* by the occipital carina which is well separated from the orbital carina. Also contained within the *bhowaliensis* group is a tightly knit group of species comprising *C. asheri* and the six taxa in the unresolved clade at the apex of the tree (Fig. 3). These conspicuous species are united by having an unusual and pronounced globular mesoscutellum and the notauli absent. Members of the

unresolved clade (comprising *C. copelandi, C. lucianae, C. normani, C. watshami* and *C. bhowaliensis*) are further distinguished by a range of character states including antennal scrobes and malar space with confused sinuate transverse costate sculpture throughout, and the propodeal spines with lobate areas apically and being wider apically than at their base. This group of species has the metasoma very strongly convex and normally polished dorsally, and the anterior margin of the fore wing sinuate just basal of the mid-point. *Cyphacolus asheri*, according to the present analysis, potentially belongs to this group but currently is known only from a single male, and there is the possibility that the female will show a different morphology based on the sexually dimorphic nature of this genus. The exclusion of *C. asheri* from the analysis hardly affects the relationships depicted in Figure 3, the only significant change being that *C. harteni* is basal to *C. diazae*.

Key species of *Cyphacolus* females (Unknown for *C. asheri*)

1 Mesoscutellum flat and transverse in shape (Fig. 32, 33) 2
- Mesoscutellum globose in shape (Fig. 4, 5) 10
2 Notauli present, well defined, 0.5x length of mesoscutum, clear of sculpture (Fig. 56); netrion completely covered or almost so by well-developed longitudinal costate sculpture (Fig. 57) 3
- Notauli absent; netrion well defined and clearly evident, partially covered by longitudinal costate sculpture 8
3 Occipital carina strongly bent downwards medially, V-shaped (Fig. 56); apex of fore wing conspicuously setose; metasomal sterna with longitudinal costate sculpture ..... *Cyphacolus jenningsi* Valerio, Masner & Austin, **n. sp.**
- Occipital carina only slightly bent downwards medially or slightly convex (normal in shape); apex of fore wing glabrous; metasomal sterna without longitudinal costate sculpture 4
4 Mesoscutum with obvious coriaceous sculpture (Fig. 22); mesoscutellum and frons with dense confused rugulose sculpture ..... *Cyphacolus axfordi* Valerio, Masner & Austin, **n. sp.**
- Mesoscutum and mesoscutellum mostly smooth or with granulate sculpture (Fig. 32, 80); frons mostly smooth or with very few setigerous punctures 5
5 Mid posterior area of head deeply depressed; propodeal anterior spines short and broad; body size large (1.63–1.71 mm); T1 elongate in dorsal view; body color dark brown ..... *Cyphacolus sallyae* Valerio, Masner & Austin, **n. sp.**
- Mid posterior area of head not deeply depressed (normal in shape); propodeal anterior spines elongated and acute; body size smaller (< 1.60 mm); T1 shorter in shape in dorsal view; body color yellowish 6
6 Frons without clearly defined punctate sculpture; mesoscutum with coriaceous sculpture; lateral ocelli very small and well separated from occipital carina by more than 2x ocellar width ..... *Cyphacolus bouceki* Austin & Iqbal
- Frons with clearly defined punctures; mesoscutum variable in sculpture, but never totally covered with coriaceous sculpture; lateral ocelli normal in size and separated from occipital carina by less than 1.3x ocellar width 7
7 Fan-like sculpture well developed on frons, reaching at least to mid height of frons (Fig. 94); mesoscutum smooth (Fig. 92); body color mostly honey yellow ..... *Cyphacolus tullyae* Valerio, Masner & Austin, **n. sp.**
- Fan-like sculpture on frons very weak and limited to lower 1/3 of frons (Fig. 88); mesoscutum with weak longitudinal sculpture on most of posterolateral 2/3, anterior 1/3 with coriaceous sculpture (Fig. 86); body color yellow .... *Cyphacolus tessae* Valerio, Masner & Austin, **n. sp.**
8 Hypostomal carina heavily crenulate at mid upper area; laterodorsal areas of pronotum smooth .... *Cyphacolus diazae* Valerio, Masner & Austin, **n. sp.**
- Hypostomal carina not heavily crenulate at mid upper area; laterodorsal areas of pronotum with few, fine, weak transverse costae 9
9 Mesoscutellum about 3x as wide as long; T3 with longitudinal alutaceous sculpture, and transverse dark band; remainder of terga amber yellow ..... *Cyphacolus veniprivus* Priesner
- Mesoscutellum 3.5x as wide as long (Fig. 50); T3 mainly smooth, without any longitudinal sculpture (Fig. 53); metasoma light yellow with infuscate transverse areas across T2–T3, distal half of T4–T7 and distal 1/3 of propodeal spines ..... *Cyphacolus harteni* Valerio, Masner & Austin, **n. sp.**
10 Mesoscutum completely covered by broad, longitudinal costae which converge anteriorly (Fig. 74) 11
- Mesoscutum completely covered by broad, parallel, longitudinal costae, which do not converge anteriorly (Fig. 98) 13
11 Frons almost completely covered with semicircular fine ridges (Fig. 76); mesoscutellum in dorsal view large, strongly convex, oval in shape, posterior edge smooth ..... *Cyphacolus normani* Valerio, Masner & Austin, **n. sp.**
- Frons completely covered by dense, sinuate, transverse carinae (Fig. 40); mesoscutellum not as large and elongate, always sculptured dorsally, posterior edge with broad, longitudinal, costate sculpture 12
12 Upper lateral edge of pronotum with dense, punctate sculpture (Fig. 39)..... ..... *Cyphacolus copelandi* Valerio, Masner & Austin, **n. sp.**

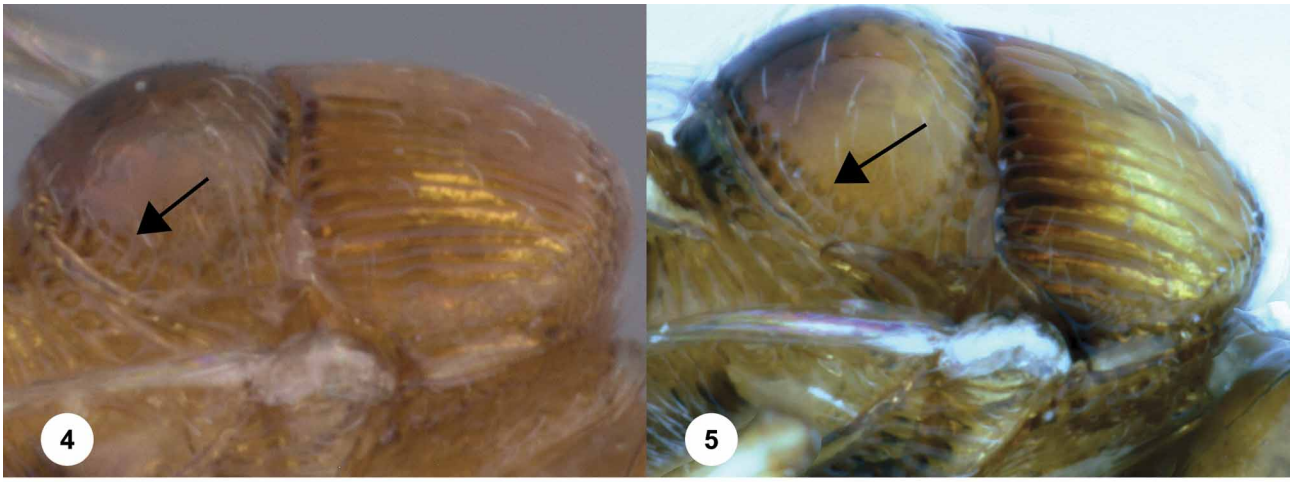
- Upper lateral edge of pronotum with sparse, short, elongate foveate sculpture ..... *Cyphacolus bhowaliensis* (Mani & Mukerjee)

13 Mesoscutellum with single row of punctures laterally, mostly smooth medially (Fig. 4); frons smooth..... *Cyphacolus watshami* Valerio, Masner & Austin, **n. sp.**

- Mesoscutellum with two rows of punctures laterally (Fig. 5); frontal sculpture variable, but never completely smooth 14

14 Horn on T1 in posterior view short and broad, lateral areas of posterior surface with carinae strongly reduced (almost absent in some specimens); body mostly dark brown (Fig. 61); frons mainly smooth except for antennal scrobes with transverse costae ..... *Cyphacolus leblanci* Valerio, Masner & Austin, **n. sp.**

- Horn on T1 in posterior view elongate and narrow, posterior lateral carinae conspicuously cristate; body mostly yellow (Fig. 67); frons with weak coriaceous sculpture throughout ..... C*yphacolus lucianae* Valerio, Masner & Austin, **n. sp.**



FIGURES 4–5. *Cyphacolus watshami* **n. sp.**, female paratype (OSUC 237861).**4,** Mesoscutellum, lateral view. *C. lucianae* **n. sp.**, female paratype (OSUC 237832).**5,** Mesoscutellum, lateral view. Arrows point to row(s) of punctate sculpture on mesoscutellum. Morphbank[17]

Key to the known species of *Cyphacolus* males

1 Mesoscutum with dense, fine, costate sculpture; mesoscutellum globose 3

- Mesoscutum mainly smooth except for notauli (if notauli present), without any costate sculpture; mesoscutellum flat 2

2 Notauli present, length approximately 0.5x mesoscutum length; posterior edge of mesoscutum without short longitudinal costae; compound eye normal in size, malar space as large as compound eye height; body mainly dark honey brown ..... *C. tullyae* Valerio, Masner & Austin, **n.sp.**

- Notauli absent; posterior edge of mesoscutum with short longitudinal costae (Fig. 102); compound eye minute, malar space nearly 1.5x larger than compound eye height; body pale yellow with metasomal terga honey yellow .... *C. harteni* Valerio, Masner & Austin, **n.sp.**

3 Posterolateral areas of mesoscutellum with broad, longitudinal ridges which are shorter at midposterior area, remainder of mesoscutellum smooth; body color yellow with T2–T6 dark brown; body size large (1.8 mm)..... ..... *C. asheri*Valerio, Masner & Austin, **n.sp.**

- Posterolateral areas of mesoscutellum never with longitudinal ridges; body color mainly honey yellow or completely dark brown; body size variable 4

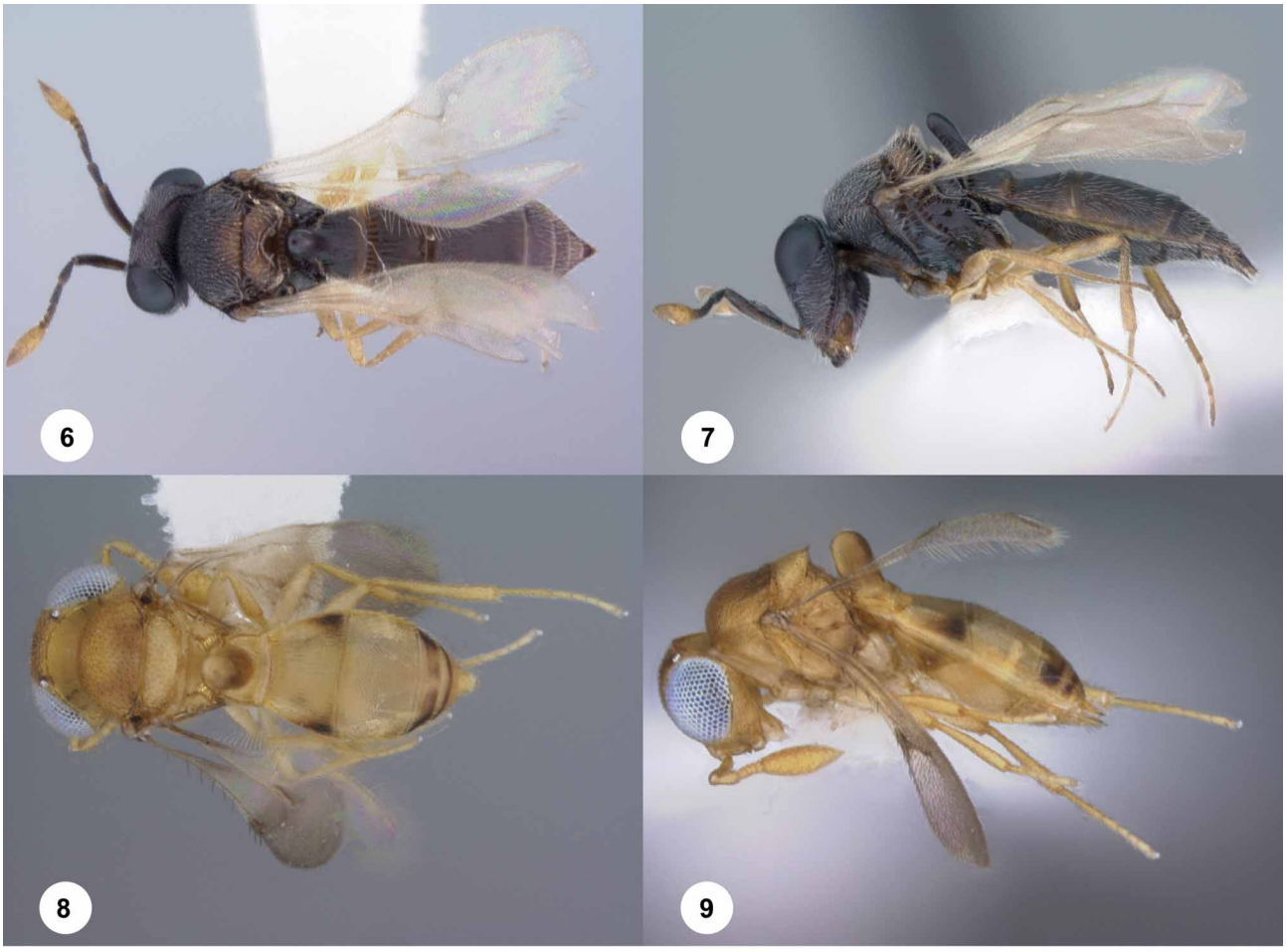
4 Mesoscutellum completely covered with granulate sculpture; lower 1/3 of head in anterior view with a transverse dark band; body size large (1.98 mm)..... *C. lucianae* Valerio, Masner & Austin, **n.sp.**

- Mesoscutellum smooth medially, coriaceous anterolaterally; transverse dark band on face present or absent; body size smaller (< 1.60 mm) 5

5 Head in anterior view without a clearly defined dark band in lower 1/3; T1 midlongitudinal area with a long V-shaped carina; body size large (1.56 mm) ..... *C. leblanci* Valerio, Masner & Austin, **n.sp.**

17. http://www.morphbank.net/?id=514202

- Head in anterior view with dark band at lower 1/3; T1 midlongitudinal area with simple, longitudinal carina; body size smaller (1.2 mm) ..... *C. watshami* Valerio, Masner & Austin, **n.sp.**



FIGURES 6–9. *Idris floris* (Kononova & Fursov) female (OSUC 250617). **6,** Dorsal habitus; **7,** Lateral habitus. *Idris* sp.1 female (OSUC 23340). **8,** Dorsal habitus; **9,** Lateral habitus. Scale bars in millimeters.

Species descriptions

***Cyphacolus asheri* Valerio, Masner & Austin, new species**
urn:lsid:zoobank.org:act:D0DA3622-BD2E-492F-918E-CB3C3AB06ECC
urn:lsid:biosci.ohio-state.edu:osuc_concepts:240884
Figures 14–19; Morphbank[18]

Description. *Male*. Body length: 1.8 mm (n=1).

Antenna color: completely yellow. Body color: mostly yellow except for dark, transverse band on lower head, area around ocelli, mesoscutum, lower half of mesopleuron and mid-anterior area of metapleuron honey yellow, distal area of metasomal T2 and S2, T3–T7 and S3–S6 black. Coxae color: whitish yellow. Leg color (excluding the coxae): light yellow. Fore wing color: basal 1/3 and area at 2/5 hyaline, area below stigma infuscate as well as area beyond basal 1/3.

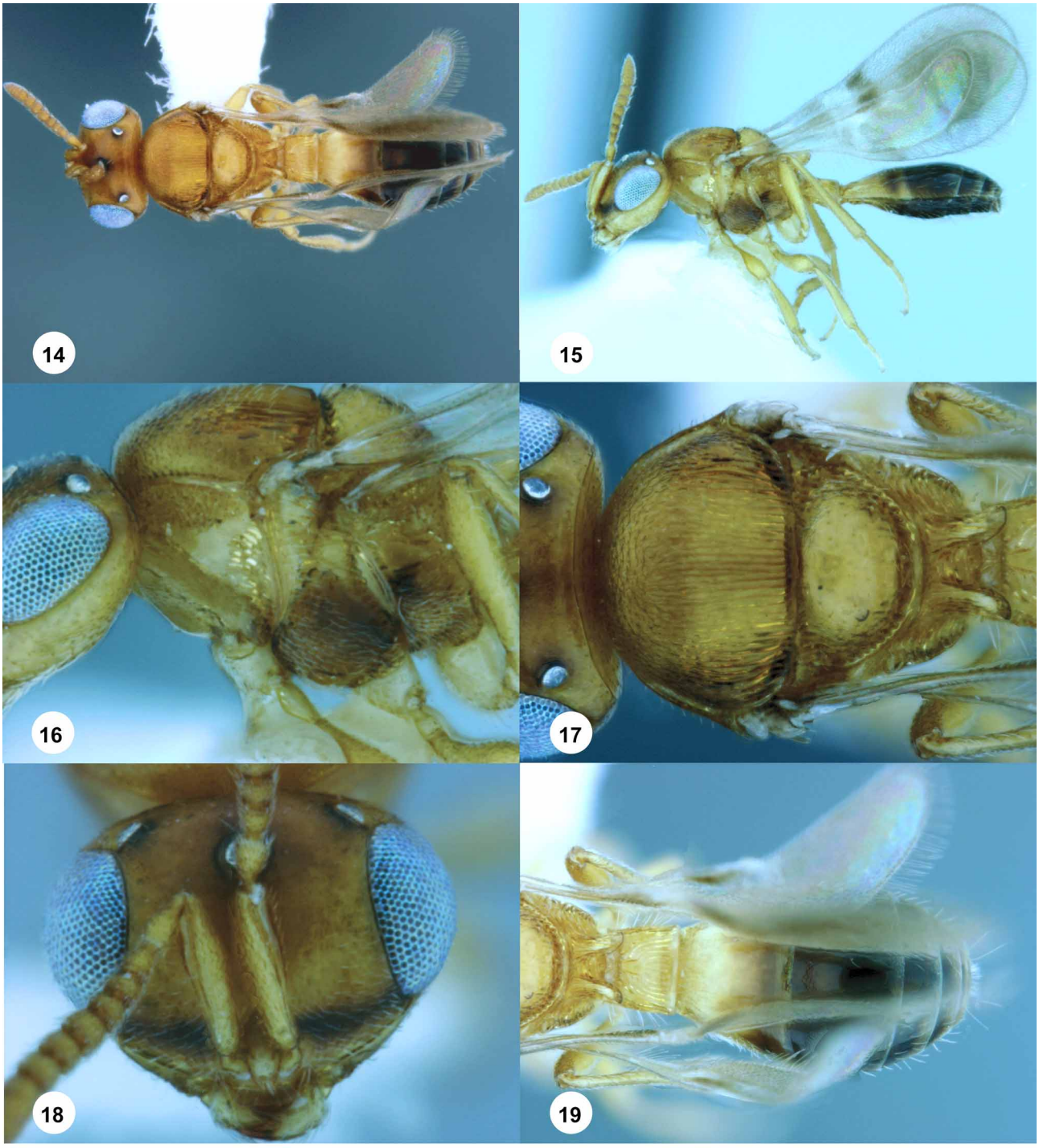
Head shape in lateral view: broad, short. Sculpture of antennal scrobe: weakly coriaceous. Shape of torular triangle: not bulging, flat. Development of central keel on frons: completely absent. Sculpture of frons:

18. http://www.morphbank.net/?id=514186

completely coriaceous. Sculpture of malar space: with fan-like striae, striae not extending into antennal scrobe. Medial surface of vertex: flat to weakly convex (normal). Size of lateral ocellus: large (as in *C. axfordi*). Distance between lateral ocellus and occipital carina: 0.5–1.2x maximum ocellar width. Length of OOL: ≤ 1/3 width of ocellus. Sculpture of vertex: coriaceous. Surface of occiput: evenly concave (normal). Sculpture of occipital carina: largely simple, at most with few, weak crenulae medially. Proximity of occipital carina to orbital carina: well separated by distance at least 2x width of occipital carina. Shape of occipital carina: simply arcuate medially. Sculpture of occiput: weakly rugulose-aciculate.

FIGURES 10–13. *Idris* sp. 2, female (OSUC 228297) **10,** Dorsal habitus; **11,** Lateral habitus. *Idris* sp. 3, female (OSUC 190640). **12,** Dorsal habitus; **13,** Lateral habitus.

Sculpture of pronotal cervical area: smooth medially, otherwise with elongated foveae. Sculpture of pronotal lateral area: upper 1/3 with dorsoventrally elongate foveae, medial triangular area smooth, otherwise longitudinally lineate. Netrion: absent, obscured by longitudinal sculpture on lateral pronotum. Notauli: absent. Sculpture of mesoscutum: anterior 1/3 densely but weakly coriaceous, otherwise with fine, parallel, dense, longitudinal costae. Sculpture of mesoscutellum: mainly smooth except for lateroposterior half with broad, longitudinal ridges (meson area with shorter ridges than lateral areas), midlateral section with two large, obvious punctures. Mesoscutellum shape: strongly convex, wider than long. Sculpture of lateral propodeum: densely, transversely costate. Shape of propodeal anterior spines: elongate, narrow, apex rounded. Sculpture of propodeum between anterior spines: transversely costate. Sculpture of ventral mesepisternum: weakly foveolate. Density of longitudinal costae on dorsal mesepisternum: dense. Thickness of longitudinal costae on dorsal mesepisternum: thin. Length of longitudinal costae on dorsal mesepisternum: reaching to approximately half of speculum width. Sculpture of mesopleural femoral depression: smooth. Sculpture of metapleuron: upper 1/3 almost smooth except for one transverse ridge across its length, remainder of pleurite with dense, fine, longitudinal costae.



FIGURES 14–19. *Cyphacolus asheri* **n. sp.**, holotype male (OSUC 2337817). **14**, Dorsal habitus; **15**, Lateral habitus; **16**, Mesosoma, dorsal view; **17**, Mesosoma, lateral view; **18**, Head, anterior view; **19**, Metasoma, dorsal view. Morphbank[19]

Shape of wings: very convex in lateral view, with a conspicuous constriction at 2/5 of its length.

Shape of horn on T1 (in posterior view): absent. Lateral carinae on T2: present, poorly developed. Sculpture of T2: largely finely costate, smooth along posterior margin and midline. Sculpture of T3: largely smooth, weakly coriaceous lateromedially. Sculpture of S3–S6: mainly smooth, with sparse setigerous punctulae.

Female. Unknown.

19. http://www.morphbank.net/?id=514186

Diagnosis. This species is easily identified from all other known species with males by the large body size and the very dense and fine longitudinally costate sculpture on the mesoscutum in combination with a globose mesoscutellum.

Etymology. This species is named after Asher Farrington, daughter of our colleague Lachlan Farrington.

Link to distribution map.[20]

Material examined. Holotype male: **SRI LANKA**: Central Prov., Kandy Dist., Victoria-Randenigala–Rantambe Sanctuary, 25.VIII–29.VIII.1999, malaise trap, M. Wasbauer, OSUC 237817 (deposited in CNCI).

***Cyphacolus axfordi* Valerio, Masneri & Austin, new species**

urn:lsid:zoobank.org:act:5DC02DB6-8525-4A9A-A571-4B669205B349

urn:lsid:biosci.ohio-state.edu:osuc_concepts:240840

Figures 20–25; Morphbank[21]

Description. *Female*. Body length: 1.4 mm (n=1).

Antenna color: mostly yellow except clava dark brown. Body color: mostly honey yellow except T1 lighter than rest of metasoma, metasomal horn same color as metasoma. Coxae color: honey yellow. Leg color (excluding the coxae): yellow. Fore wing color: area below and after stigma infuscate, remainder of wing hyaline.

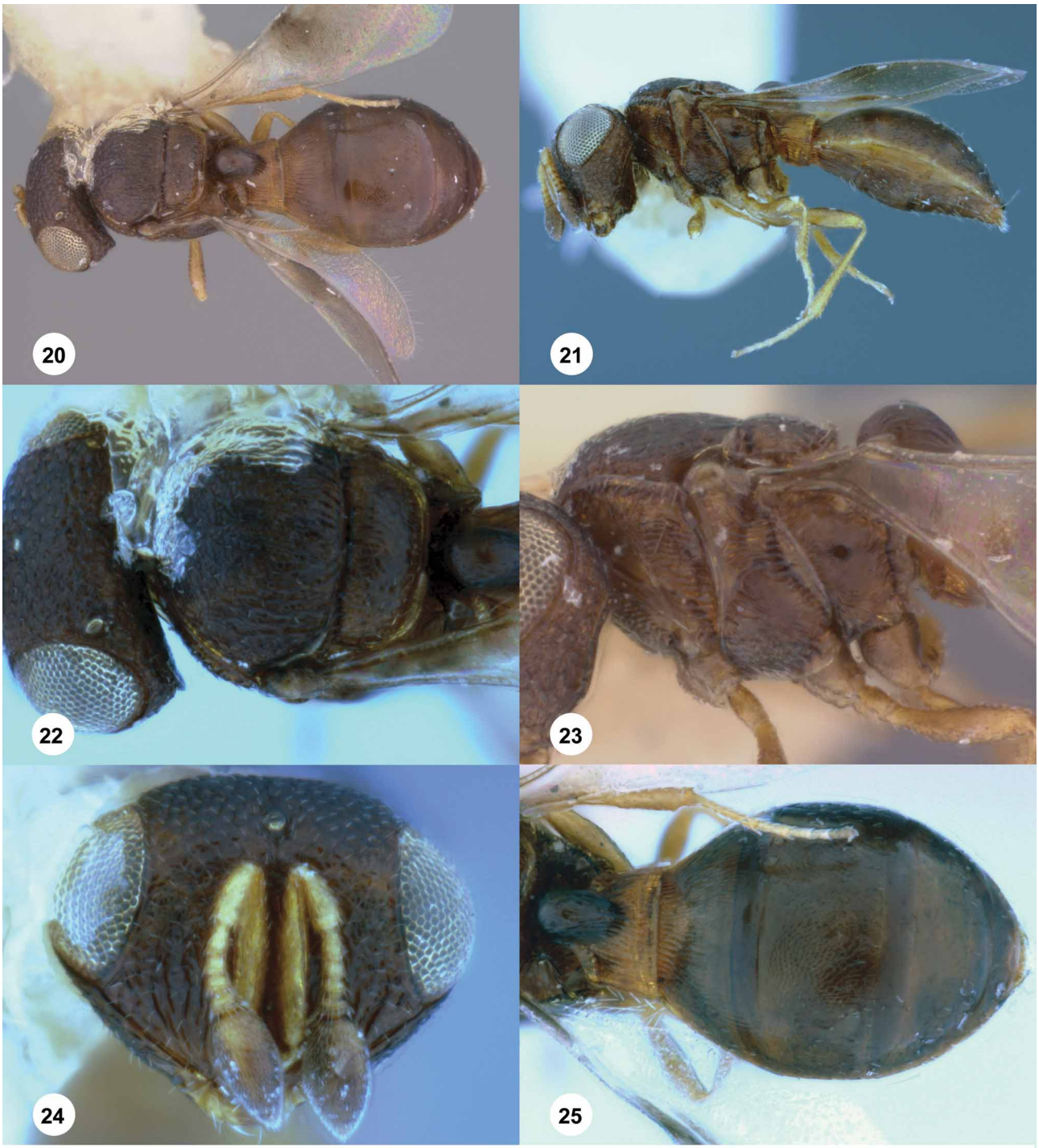
Head shape in lateral view: broad, short. Sculpture of antennal scrobe: weakly rugulose. Shape of torular triangle: not bulging, flat. Development of central keel on frons: completely absent. Sculpture of frons: weakly rugulose aciculate. Sculpture of malar space: with fan-like striae extending onto antennal scrobe. Medial surface of vertex: flat to weakly convex (normal). Size of lateral ocellus: large (as in *C. axfordi*). Distance between lateral ocellus and occipital carina: >1.5x maximum ocellar width. Length of OOL: approximately 0.5x width of ocellus. Sculpture of vertex: completely cover by weak, rugulose-aciculate sculpture. Surface of occiput: evenly concave (normal). Sculpture of occipital carina: strongly crenulate throughout. Proximity of occipital carina to orbital carina: separated by distance slightly greater than width of occipital carina. Shape of occipital carina: simply arcuate medially. Sculpture of occiput: weakly rugulose-aciculate.

Sculpture of pronotal cervical area: foveate, foveae generally rounded to weakly ovoid. Sculpture of pronotal lateral area: smooth. Netrion: absent, obscured by longitudinal sculpture on lateral pronotum. Notauli: absent. Sculpture of mesoscutum: anterior 1/3 weakly rugulose-aciculate, otherwise with sinuate, longitudinal carinae superimposed on weak, rugulose-aciculate background. Sculpture of mesoscutellum: completely cover with sinuate, longitudinal, costate sculpture. Mesoscutellum shape: flat, conspicuously wider than long. Sculpture of lateral propodeum: sparsely, transversely costate. Shape of propodeal anterior spines: elongate, narrow, apex rounded. Sculpture of propodeum between anterior spines: smooth. Sculpture of ventral mesepisternum: with longitudinally costae. Density of longitudinal costae on dorsal mesepisternum: dense. Thickness of longitudinal costae on dorsal mesepisternum: broad. Length of longitudinal costae on dorsal mesepisternum: reaching to meso-metapleural suture. Sculpture of mesopleural femoral depression: smooth. Sculpture of metapleuron: with weak to well-defined longitudinal costae throughout.

Shape of wings: slightly convex, not constricted at base.

Shape of T1 horn on T1 (in posterior view): narrow and short. Lateral carinae on posterior part of horn: absent. Sculpture of upper portion of T1 horn: smooth. Sculpture of posterior portion of T1 horn: mostly smooth, with few longitudinal carinae. Lateral carinae on T2: absent. Sculpture of T2: largely finely costate, smooth along posterior margin and midline. Sculpture of T3: largely weakly coriaceous, posterior margin smooth or sculpture strongly effaced. Sculpture of S3–S6: largely coriaceous, smooth medially.

20. http://osuc.biosci.ohio-state.edu/HymOnline/map-large.html?id=240884.
21. http://www.morphbank.net/?id=514187



FIGURES 20–25. *Cyphacolus axfordi* **n. sp.**, holotype female (OSUC 237901). **20**, Dorsal habitus; **21**, Lateral habitus; **22**, Mesosoma, dorsal view; **23**, Mesosoma, lateral view; **24**, Head, anterior view; **25**, Metasoma, dorsal view. Morphbank[22]

Male. Unknown.

Diagnosis. This species can be easily identified by the mesoscutum having a transverse row of elongate punctures/foveae at its posterior edge, the remainder of mesoscutum with coriaceous sculpture throughout, a flat mesoscutellum, and the presence of notauli.

22. http://www.morphbank.net/?id=514187

Etymology. This species is named after the Axford family in recognition of their support for arthropod research developed by Dr. Michelle Guzik (The University of Adelaide) on their property in Western Australia.

Link to distribution map.[23]

Material examined. Holotype female: **AUSTRALIA**: WA, airport site, PA 7, Perth, 31°58'34"S 115°58'25"E, 6.I–18.III.1994, pitfall trap, M. S. Harvey & J. M. Waldock, OSUC 237901 (deposited in WAMP)

***Cyphacolus bhowaliensis* (Mani & Mukerjee)**

urn:lsid:zoobank.org:act:44DDAB34-7E3A-4190-AB18-9A21ED4D524C

urn:lsid:biosci.ohio-state.edu:osuc_concepts:28150

Figures 26–29; Morphbank[24]

Tetrabaeus bhowaliensis Mani & Mukerjee, 1976: 524 (original description); Mani & Sharma, 1982: 202 (description).
Cyphacolus bhowaliensis (Mani & Mukerjee): Austin & Iqbal, 2005: 18, 21 (generic transfer, keyed).

Description. *Female*. Body length: 1.98 mm (n=1).

Antenna color: antennal A1 yellow, remainder of antenna dark brown. Body color: mostly light honey yellow except transverse band on lower head, metapleuron, dorsal and lateroposterior 1/3 of metasomal horn on T1, lateroposterior areas of metasoma T2, distal half of T3 and posterior 1/4 of T4 dark brown. Coxae color: honey yellow. Leg color (excluding the coxae): honey yellow. Fore wing color: basal 1/3 and area at 2/5 hyaline, area below stigma infuscate as well as area beyond basal 1/3.

Head shape in lateral view: broad, short. Sculpture of antennal scrobe: with weak sinuate transverse costae. Shape of torular triangle: not bulging, flat. Development of central keel on frons: completely absent. Sculpture of frons: completely cover by fine, sinuate, transverse ridges. Sculpture of malar space: nearly completely cover by fine, semicircular ridges from antennal scrobe. Medial surface of vertex: flat to weakly convex (normal). Size of lateral ocellus: small (as in *C. bouceki*). Shape of occipital carina: simply arcuate medially. Sculpture of occiput: smooth.

Sculpture of pronotal cervical area: smooth medially, otherwise with elongated foveae. Sculpture of pronotal lateral area: upper half with dorsoventrally elongate foveae, otherwise smooth. Netrion: absent, obscured by longitudinal sculpture on lateral pronotum. Notauli: absent. Sculpture of mesoscutum: completely cover by broad longitudinal costae, these converging anteriorly. Sculpture of mesoscutellum: most of dorsal area smooth except posterior 1/3 with broad, longitudinal carina. Mesoscutellum shape: strongly convex, wider than long. Sculpture of lateral propodeum: densely, transversely costate. Shape of propodeal anterior spines: elongate, narrow, apex conspicuously broadened. Sculpture of propodeum between anterior spines: transversely costate. Sculpture of ventral mesepisternum: largely smooth, with sparse, setigerous punctulae. Density of longitudinal costae on dorsal mesepisternum: sparse. Thickness of longitudinal costae on dorsal mesepisternum: broad. Length of longitudinal costae on dorsal mesepisternum: reaching to approximately half of speculum width. Sculpture of mesopleural femoral depression: smooth. Sculpture of metapleuron: upper 2/3 mostly smooth, ventral area weakly rugulose, metapleural sulcus longitudinally costate.

Shape of wings: very convex in lateral view, with a conspicuous constriction at 2/5 of its length.

Shape of horn on T1 (in posterior view): narrow and short. Lateral carinae on posterior part of horn: present, cristate, not fused posteriorly. Sculpture on upper portion of T1 horn: longitudinally carinate. Sculpture of posterior portion of T1 horn: mostly smooth, with few longitudinal carinae. Lateral carinae on T2: present and conspicuously.

Male. Unknown.

23. http://http://osuc.biosci.ohio-state.edu/HymOnline/map-large.html?id=240840
24. http://www.morphbank.net/?id=514188

Diagnosis. See under diagnosis for *Cyphacolus copelandi* **n. sp.**

Link to distribution map.[25]

Material examined. Holotype female: **INDIA**: Uttarakhand St., Bhowali, 18.VI–20.VI.1974, M. S. Mani *et al.*, USNM HT 0005 (deposited in USNM). Holotype crushed, on slide.

FIGURES 26–29. *Cyphacolus bhowaliensis* (Mani & Mukerjee), USNM holotype female (slide mounted). **26**, Metasoma, dorsal habitus; **27,**Mesodorso-lateral habitus; **28**, Head, anterior view; **29**, Antenna, lateral view. Morphbank[26]

***Cyphacolus bouceki* Austin & Iqbal**

urn:lsid:zoobank.org:act:BA690E32-EA3E-4D3E-89AD-F60DE83D9159

urn:lsid:biosci.ohio-state.edu:osuc_concepts:195050

Figures 30–35; Morphbank[27]

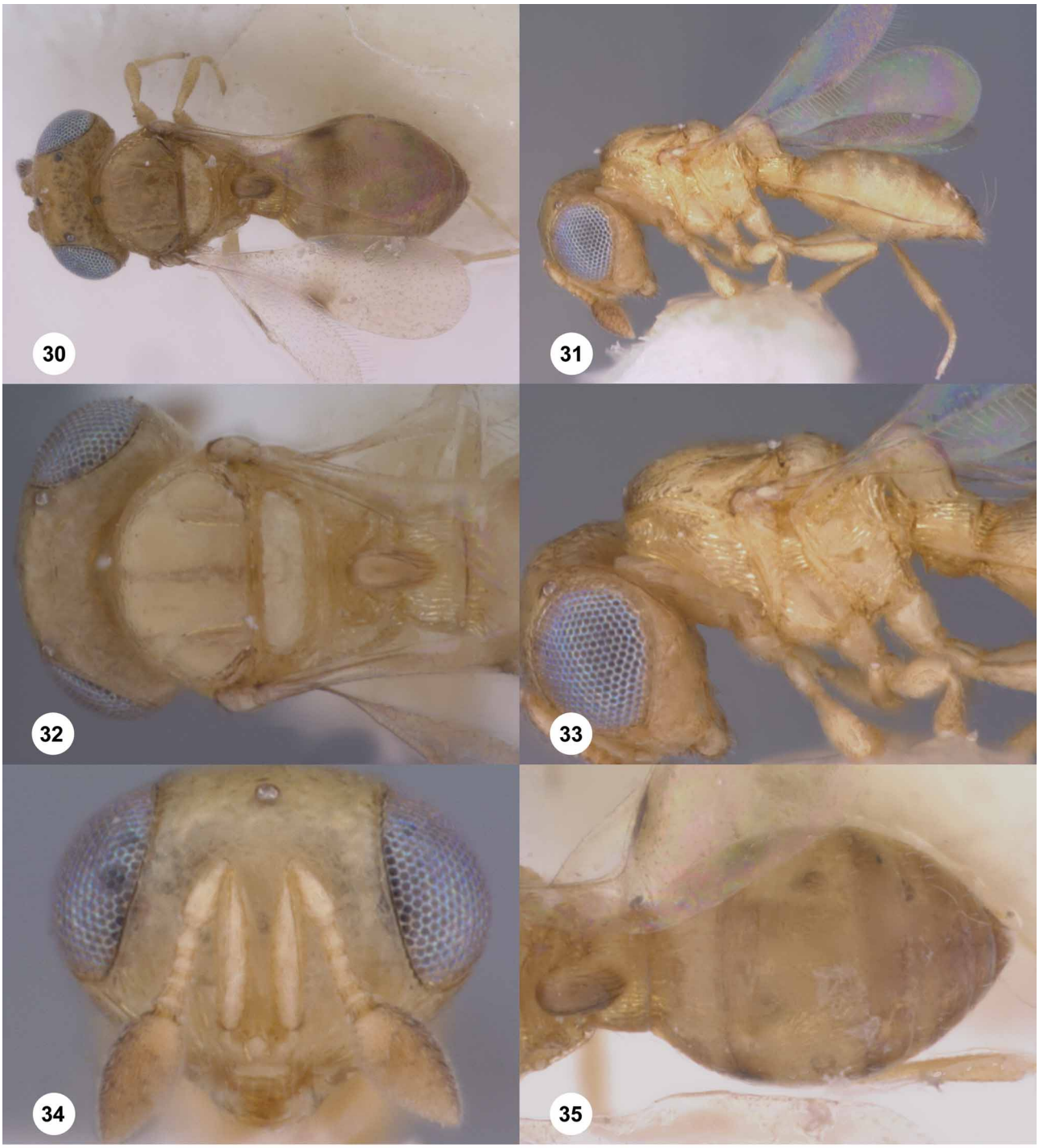
Cyphacolus bouceki Austin & Iqbal, 2005: 21.

Diagnosis. See under diagnosis for *C. tullyae* **n. sp.**

Link to distribution map[28].

25. http://osuc.biosci.ohio-state.edu/HymOnline/map-large.html?id=28150
26. http://www.morphbank.net/?id=514188
27. http://www.morphbank.net/?id=514189
28. http://osuc.biosci.ohio-state.edu/HymOnline/map-large.html?id=195050

Material examined. Holotype female: **AUSTRALIA**: QLD, via Mareeba, site 9, 16km up Davies Creek Road, 4.III–13.III.1993, interception trap, Storey & Titmarsh, OSUC 237870 (deposited in QMBA). Paratypes: **AUSTRALIA**: 13 females, OSUC 237881 (OSUC); OSUC 237871–237880, 237882–237883 (WINC). Other material: **AUSTRALIA**: 1 female, 5 males, OSUC 237884–237889 (CNCI).



FIGURES 30–35. *Cyphacolus bouceki* Austin & Iqbal, female paratype (OSUC 237881). **31**, Lateral habitus; **32**, Mesosoma, dorsal view; **33**, Mesosoma, lateral view; **34**, Head, anterior view. Holotype female (OSUC 237870). **30**, Dorsal habitus; **35**, Metasoma, dorsal view. Morphbank[29]

29. http://www.morphbank.net/?id=514189

***Cyphacolus copelandi* Valerio, Masner & Austin, new species**
urn:lsid:zoobank.org:act:8C981C61-B87E-45BE-9EE8-A386A1DE4AFC
urn:lsid:biosci.ohio-state.edu:osuc_concepts:240834
Figures36–41; Morphbank[30]

Description. *Female*. Body length: 1.65–2.15 mm (n=4).

Antenna color: antennal A1 yellow, remainder of antenna dark brown. Body color: mostly honey yellow except most of mesopleuron and metapleuron, area around ocelli and mesoscutum dark brown. Coxae color: yellow. Leg color (excluding the coxae): yellow. Fore wing color: basal 1/3 and area at 2/5 hyaline, area below stigma infuscate as well as area beyond basal 1/3.

Head shape in lateral view: broad, short. Sculpture of antennal scrobe: with weak sinuate transverse costae. Shape of torular triangle: not bulging, flat. Development of central keel on frons: completely absent. Sculpture of frons: completely cover by fine, sinuate, transverse ridges. Sculpture of malar space: with fine, sinuate, transverse ridges throughout. Medial surface of vertex: flat to weakly convex (normal). Size of lateral ocellus: normal (as in *C. copelandi*). Distance between lateral ocellus and occipital carina: 0.5–1.2x maximum ocellar width. Length of OOL: approximately 0.5x width of ocellus. Sculpture of vertex: completely cover by fine, sinuate, transverse ridges. Surface of occiput: evenly concave (normal). Sculpture of occipital carina: largely simple, at most with few, weak crenulae medially. Proximity of occipital carina to orbital carina: well separated by distance at least 2x width of occipital carina. Shape of occipital carina: simply arcuate medially. Sculpture of occiput: with dense, fine, transverse ridges.

Sculpture of pronotal cervical area: foveate, foveae generally rounded to weakly ovoid. Sculpture of pronotal lateral area: upper half punctate, otherwise smooth. Netrion: absent, obscured by longitudinal sculpture on lateral pronotum. Notauli: absent. Sculpture of mesoscutum: completely cover by broad longitudinal costae, these converging anteriorly. Sculpture of mesoscutellum: completely cover with sinuate, longitudinal, costate sculpture. Mesoscutellum shape: strongly convex, wider than long. Sculpture of lateral propodeum: densely, transversely costate. Shape of propodeal anterior spines: elongate, narrow, apex conspicuously broadened. Sculpture of propodeum between anterior spines: transversely costate. Sculpture of ventral mesepisternum: largely smooth, with sparse, setigerous punctulae. Density of longitudinal costae on dorsal mesepisternum: sparse. Thickness of longitudinal costae on dorsal mesepisternum: broad. Length of longitudinal costae on dorsal mesepisternum: reaching to approximately half of speculum width. Sculpture of mesopleural femoral depression: smooth. Sculpture of metapleuron: upper 2/3 mostly smooth, ventral area weakly rugulose, metapleural sulcus longitudinally costate.

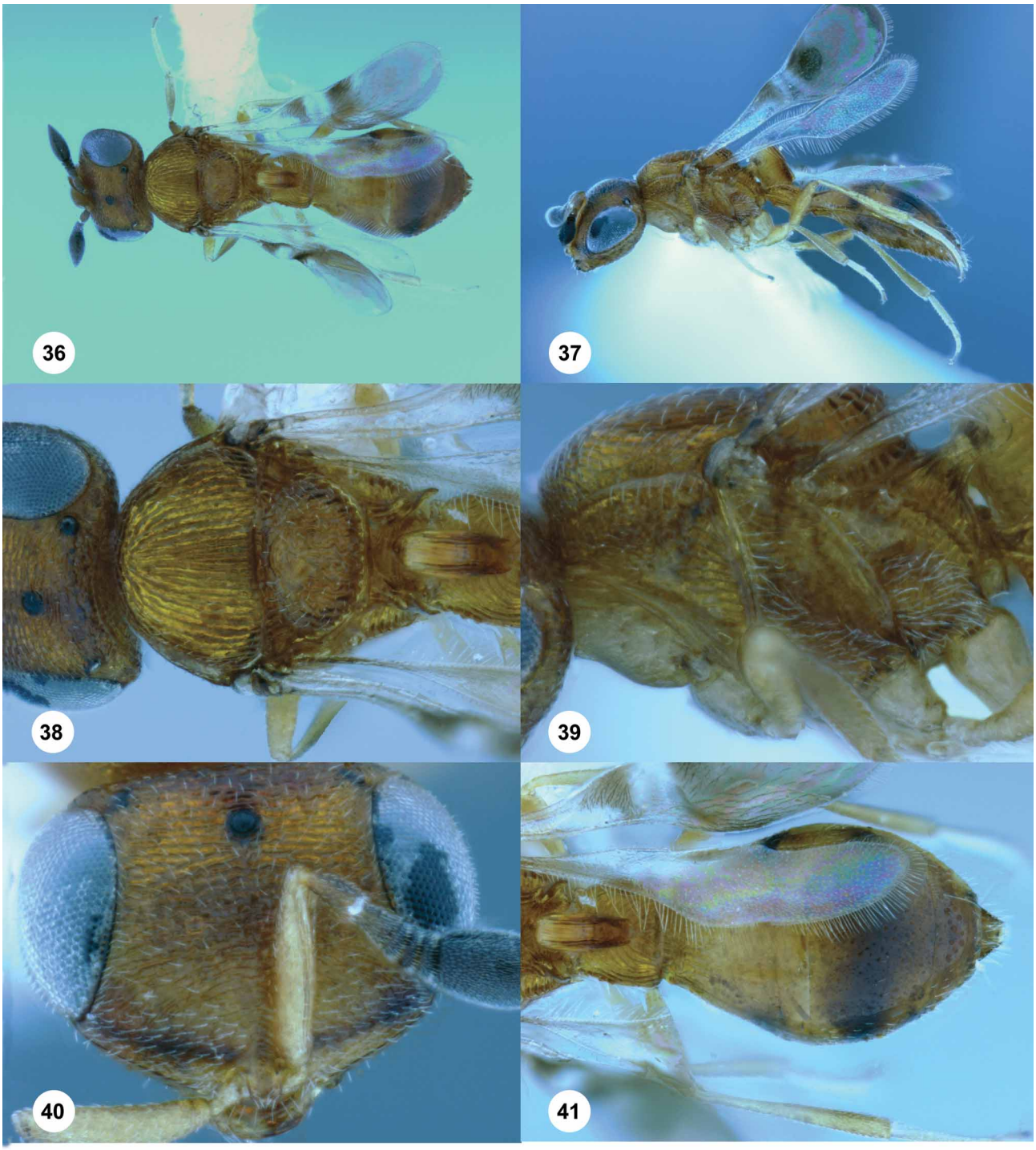
Shape of wings: very convex in lateral view, with a conspicuous constriction at 2/5 of its length.

Shape of horn on T1 (in posterior view): narrow and short. Lateral carinae on posterior part of horn: present, cristate, not fused posteriorly. Sculpture of upper portion of T1 horn: longitudinally carinate. Sculpture of posterior portion of T1 horn: mostly smooth, with few longitudinal carinae. Lateral carinae on T2: present and conspicuously. Sculpture of T2: largely smooth, anterior 1/3 broadly costate, these shorter medially. Sculpture of T3: largely smooth, weakly coriaceous lateromedially. Sculpture of S3–S6: mainly smooth, with sparse setigerous punctulae.

Male. Unknown.

Diagnosis. This species is very close to *Cyphacolus bhowaliensis* Priesner; however, the only difference between the slide mounted holotype of *C. bhowaliensis* and *C. copelandi* is the elongated foveate sculpture present on the upper area of the lateral pronotun for *C. bhowaliemsis* which contrasts with the dense and clearly punctate sculpture on *C. copelandi*. Both species are clearly separated from *C. normani* (with which they share a globose mesoscutellum and the mesoscutum having longitudinal costate sculpture emerging from one spot anteriorly) by the smaller and less elongate mesoscutum and the face completely covered with sinuate transverse carinae.

30. http://www.morphbank.net/?id=514190



FIGURES 36–41. *Cyphacolus copelandi* **n. sp.**, holotype female (OSUC 237814). **36**, Dorsal habitus; **37**, Lateral habitus; **38**, Mesosoma, dorsal view; **39**, Mesosoma, lateral view; **40**, Head, anterior view; **41**, Metasoma, dorsal view. Morphbank[31]

Etymology. This species is named after Robert Copeland who has contributed with lots of invaluable hymenopteran material from Africa to this study as well as entomological material to many other institutions around the world throughout his career.

Link to distribution map.[32]

31. http://www.morphbank.net/?id=514190

Material examined. Holotype female: **KENYA**: Rift Valley Prov., Nguruman, Kajiado, X-1999, malaise trap, J. Saibaku, OSUC 237814 (deposited in NMKE). Paratypes: (7 females) **KENYA**: 1 female, OSUC 238540 (NMKE). **NIGERIA**: 2 females, OSUC 237815–237816 (CNCI). **THAILAND**: 3 females, OSUC 261708–261710 (CNCI). **ZIMBABWE**: 1 female, OSUC 56304 (OSUC).

***Cyphacolus diazae* Valerio, Masner & Austin, new species**
urn:lsid:zoobank.org:act:A86117CC-4B3F-4E71-AC2A-A7F2DC4E844D
urn:lsid:biosci.ohio-state.edu:osuc_concepts:240833
Figures 42–47; Morphbank[33]

Description. *Female*. Body length: 1.43 mm (n=1).

Antenna color: antennal A1 yellow, remainder of antenna dark brown. Body color: mostly honey yellow, metasoma dark brown. Coxae color: honey yellow. Leg color (excluding the coxae): light yellow. Fore wing color: area below and after stigma infuscate, remainder of wing hyaline.

Head shape in lateral view: broad, short. Sculpture of antennal scrobe: upper half with semicircular fine ridges, otherwise smooth. Shape of torular triangle: not bulging, flat. Development of central keel on frons: completely absent. Sculpture of frons: largely smooth, with sparse setigerous punctulae. Sculpture of malar space: with fan-like striae, striae not extending into antennal scrobe. Medial surface of vertex: flat to weakly convex (normal). Size of lateral ocellus: small (as in *C. bouceki*). Distance between lateral ocellus and occipital carina: 0.5–1.2x maximum ocellar width. Length of OOL: ≥1x width of ocellus. Sculpture of vertex: coriaceous. Surface of occiput: evenly concave (normal). Sculpture of occipital carina: strongly crenulate throughout. Proximity of occipital carina to orbital carina: well separated by distance at least 2x width of occipital carina. Shape of occipital carina: simply arcuate medially. Sculpture of occiput: with conspicuous longitudinal ridges throughout.

Sculpture of pronotal cervical area: smooth medially, otherwise with elongated foveae. Sculpture of pronotal lateral area: foveate throughout. Netrion: absent, obscured by longitudinal sculpture on lateral pronotum. Notauli: absent. Sculpture of mesoscutum: largely smooth, with sparse setigerous punctures, posterior margin with short, longitudinal striae, these shorter medially. Sculpture of mesoscutellum: mainly smooth except for granulate sculpture at anterior and lateral edge, posterior edge with dense and small foveate sculpture. Mesoscutellum shape: flat, conspicuously wider than long. Sculpture of lateral propodeum: sparsely, transversely costate. Shape of propodeal anterior spines: short, broad, apex rounded. Sculpture of propodeum between anterior spines: smooth. Sculpture of ventral mesepisternum: coriaceous. Density of longitudinal costae on dorsal mesepisternum: sparse. Thickness of longitudinal costae on dorsal mesepisternum: broad. Length of longitudinal costae on dorsal mesepisternum: reaching to meso-metapleural suture. Sculpture of mesopleural femoral depression: weakly, longitudinally foveate. Sculpture of metapleuron: largely smooth, ventral region with 2–3 longitudinal carinae.

Shape of wings: very convex in lateral view, with a conspicuous constriction at 2/5 of its length.

Shape of horn on T1 (in posterior view): narrow and short. Lateral carinae on posterior part of horn: present, rounded, not fused posteriorly. Sculpture of upper portion of T1 horn: smooth. Sculpture of posterior portion of T1 horn: smooth. Lateral carinae on T2: present, poorly developed. Sculpture of T2: largely finely costate, smooth along posterior margin and midline. Sculpture of T3: anterior 2/3 with sparse weak longitudinal carinae, midline and remainder smooth. Sculpture of S3–S6: mainly smooth, with sparse setigerous punctulae.

Male. Unknown.

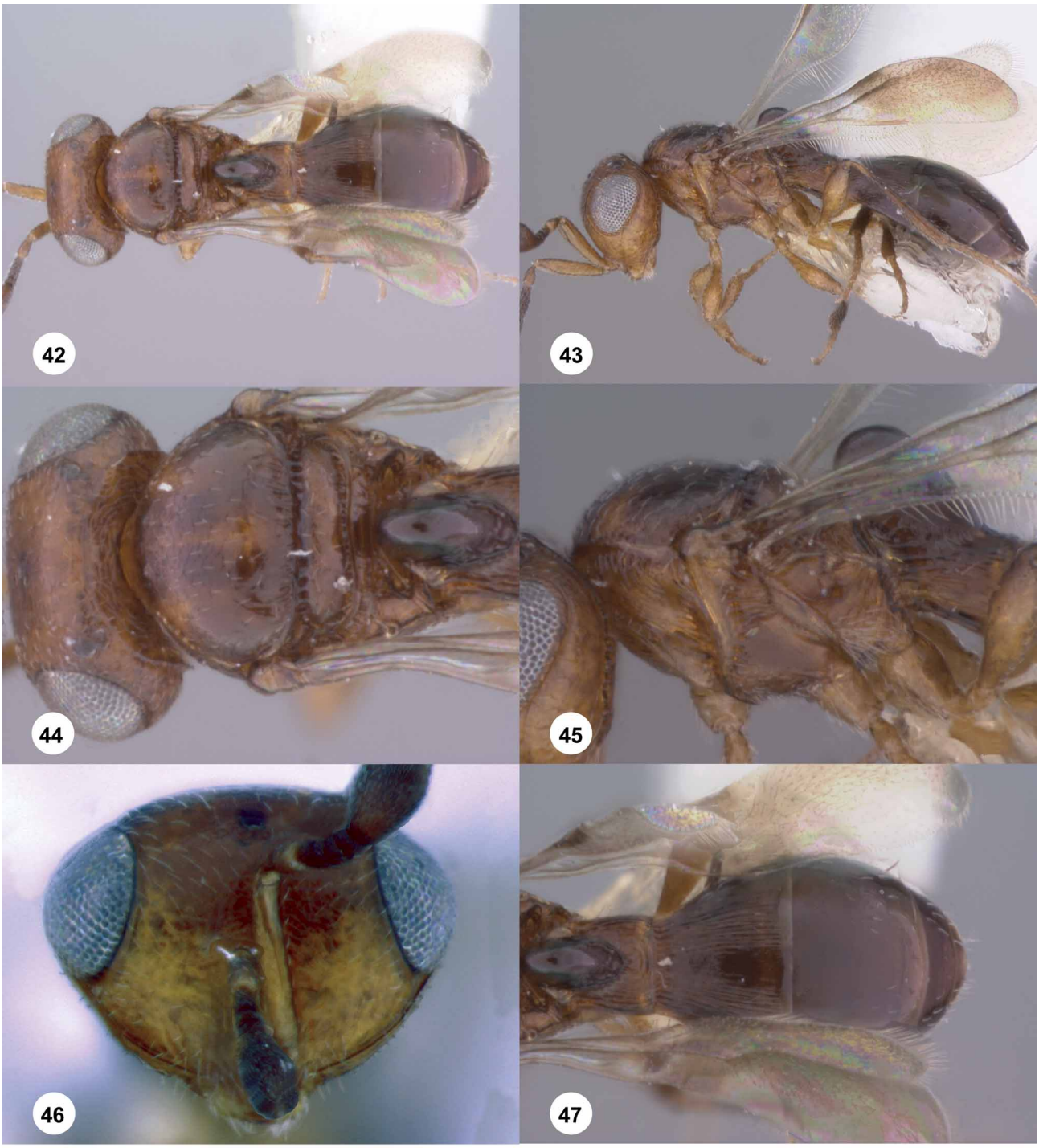
Diagnosis. This species can be identified from all other species by the absence of notauli, and having a flat mesoscutellum and a very cristate and ornamented occipital carina dorsally.

32. http://osuc.biosci.ohio-state.edu/HymOnline/map-large.html?id=240834
33. http://www.morphbank.net/?id=514191

Etymology. We are pleased to name this species after Jessica Diaz (wife of the first author); Thanks for the amazing Chicken liver pate!

Link to distribution map.[34]

Material examined. Holotype female: **KENYA**: Nyanza Prov., Lake Victoria, 0.615°S 34.092°E, 1145m, 17.VII–26.VII.1998, malaise trap, S. Miller, OSUC 237891 (deposited in NMKE).



FIGURES 42–47. *Cyphacolus diazae* **n. sp.**, holotype female (OSUC 237891). **42**, Dorsal habitus; **43**, Lateral habitus; **44**, Mesosoma, dorsal view; **45**, Mesosoma, lateral view; **46**, Head, anterior view; **47**, Metasoma, dorsal view. Morphbank[35]

34. http://osuc.biosci.ohio-state.edu/HymOnline/map-large.html?id=240833

***Cyphacolus harteni* Valerio, Masner & Austin, new species**
urn:lsid:zoobank.org:act:58400A23-1966-43B1-B0DF-A6302410F2C9
urn:lsid:biosci.ohio-state.edu:osuc_concepts:240832
Figures 48–53, 102–103; Morphbank[36]

Description. *Female*. Body length: 1.25–1.48 mm (n=11).

Antenna color: antennal A1 light yellow, remainder of antenna honey yellow. Body color: mostly honey yellow except anterior half of metasomal horn on T1 whitish, remainder of horn, transverse band across T2–T3, posterior half of T4–T7, and distal 1/3 of anterior propodeal spine dark brown. Coxae color: yellow. Leg color (excluding the coxae): light yellow. Fore wing color: basal 1/3 and area at 2/5 hyaline, area below stigma infuscate as well as area beyond basal 1/3.

Head shape in lateral view: broad, short. Sculpture of antennal scrobe: weakly coriaceous. Shape of torular triangle: not bulging, flat. Development of central keel on frons: completely absent. Sculpture of frons: completely coriaceous. Sculpture of malar space: granulate throughout, without fan-like striae. Medial surface of vertex: flat to weakly convex (normal). Size of lateral ocellus: small (as in *C. bouceki*). Distance between lateral ocellus and occipital carina: 0.5–1.2x maximum ocellar width. Length of OOL: approximately 0.5x width of ocellus. Sculpture of vertex: coriaceous. Surface of occiput: evenly concave (normal). Sculpture of occipital carina: simple in dorsal half, weakly crenulate ventrally. Proximity of occipital carina to orbital carina: well separated by distance at least 2x width of occipital carina. Shape of occipital carina: simply arcuate medially. Sculpture of occiput: with few longitudinal carinae at mid-dorsal area, otherwise smooth.

Sculpture of pronotal cervical area: with dense but weakly subcircular foveolae. Sculpture of pronotal lateral area: smooth. Netrion: conspicuously present, smooth. Notauli: absent. Sculpture of mesoscutum: anterior half with setigerous punctations mixed with coriaceous sculpture, posterior margin with longitudinally striate, these subequal in length, otherwise mesoscutum smooth. Sculpture of mesoscutellum: smooth, foveae of submarginal sulcus subequal in size. Mesoscutellum shape: flat, conspicuously wider than long. Sculpture of lateral propodeum: densely, transversely costate. Shape of propodeal anterior spines: short, broad, apex rounded. Sculpture of propodeum between anterior spines: smooth. Sculpture of ventral mesepisternum: with setigerous punctulae throughout. Density of longitudinal costae on dorsal mesepisternum: sparse. Thickness of longitudinal costae on dorsal mesepisternum: broad. Length of longitudinal costae on dorsal mesepisternum: reaching to meso-metapleural suture. Sculpture of mesopleural femoral depression: smooth. Sculpture of metapleuron: largely smooth, ventral region with 2–3 longitudinal carinae.

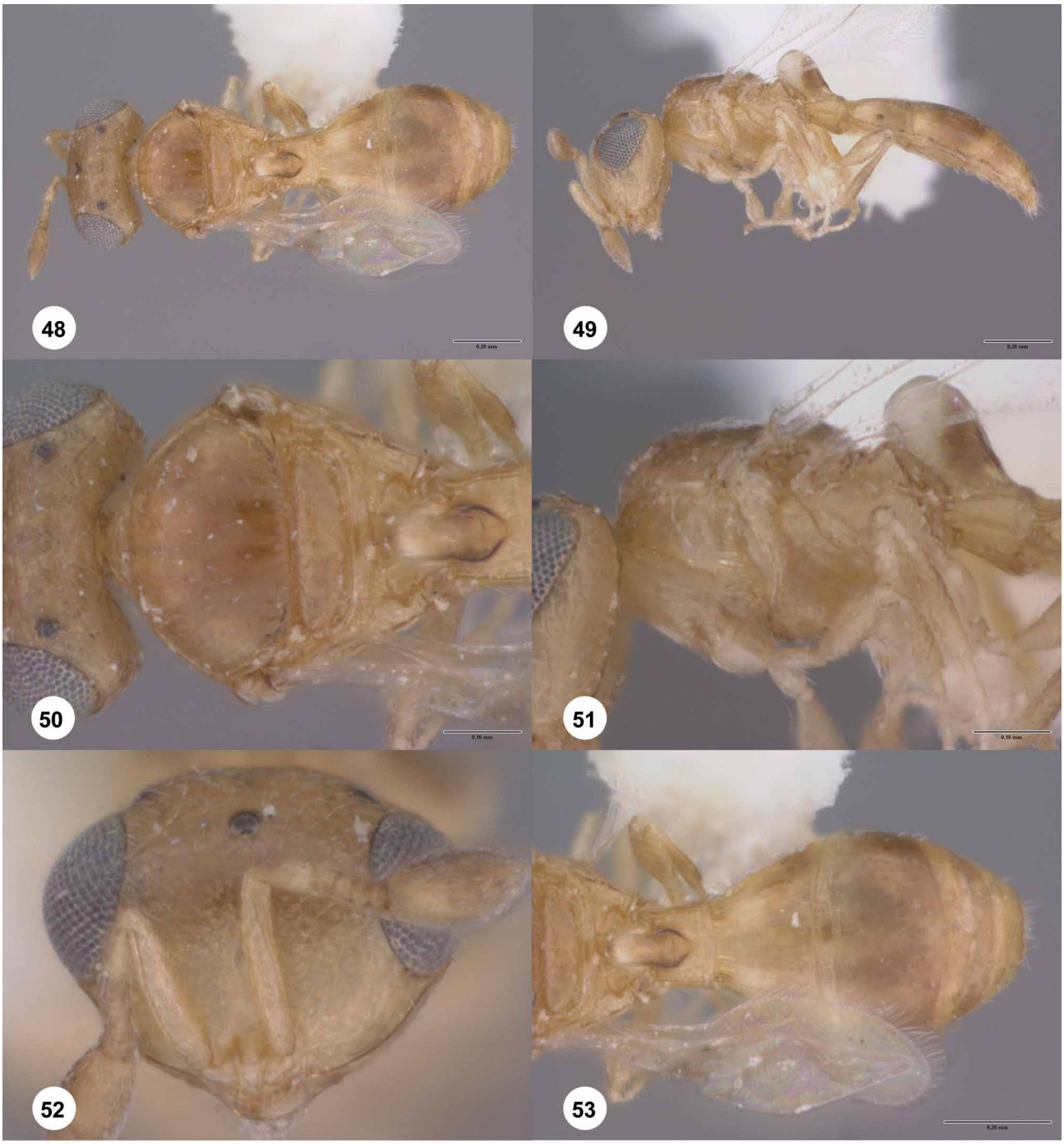
Shape of wings: slightly convex, not constricted at base.

Shape of horn on T1 (in posterior view): narrow and short. Lateral carinae on posterior part of horn: present, rounded, not fused posteriorly. Sculpture of upper portion of T1 horn: smooth. Sculpture of posterior portion of T1 horn: smooth. Lateral carinae on T2: present, poorly developed. Sculpture of T2: largely finely costate, smooth along posterior margin and midline. Sculpture of T3: largely smooth, weakly coriaceous lateromedially. Sculpture of S3–S6: mainly smooth, with sparse setigerous punctulae.

Male. Similar to female except for: metasomal terga T2–T6 with contrasting darker honey brown color, remainder of body whitish-yellow; wings less infumate; body length 1.14–1.18 mm; compound eyes very small; eye height approximately half of malar space height;occipital carina absent at dorsal meson;T2 without dense, fine costate sculpture; propodeal anterior spines wider and shorter.

Diagnosis. This species is very similar to *C. veniprivus* Priesner. Both can be identified by the transverse set of elongated punctures/foveae at the posterior edge of the mesoscutum, as well as by the lack of notauli; the presence of punctures on the frons and the weak fan-like sculpture on the lower area of the frons.They can be separatedby *C. veniprivus*havingT3 with longitudinal alutaceus sculpture which contrasts with the lack of longitudinal costae on T3 for*C. harteni*.

35. http://www.morphbank.net/?id=514191
36. http://www.morphbank.net/?id=514204



FIGURES 48–53. *Cyphacolus harteni* **n. sp.**, holotype female (OSUC 237906). **48**, Dorsal habitus; **49**, Lateral habitus; **50**, Mesosoma, dorsal view; **51**, Mesosoma, lateral view; **52**, Head, anterior view; **53**, Metasoma, dorsal view. Morphbank[37]

Etymology. This species is named after A. van Harten who collected all the known specimens of this species from Yemen and the United Arab Emirates.

Link to distribution map.[38]

Associations. Collected on *Tamarix indica* Willdenow [Violales: Tamaricaceae].

37. http://www.morphbank.net/?id=514192
38. http://osuc.biosci.ohio-state.edu/HymOnline/map-large.html?id=240832

Material examined. Holotype female: **YEMEN**: San'a' Muni., #492, Sanaa, IX-1991, A. van Harten, OSUC 237906 (deposited in CNCI). Paratypes: (10 females, 1 male) **IVORY COAST**: 1 female, OSUC 237910 (BMNH). **PAKISTAN**: 5 females, 1 male, OSUC 237911–237916 (BMNH). **UNITED ARAB EMIRATES**: 1 female, OSUC 238543 (CNCI). YEMEN: 3 females, OSUC 237907–237909 (CNCI).

***Cyphacolus jenningsi* Valerio, Masneri & Austin, new species**
urn:lsid:zoobank.org:act:087A1CEC-06D2-4788-B041-ABAAFF64880E
urn:lsid:biosci.ohio-state.edu:osuc_concepts:240843
Figures 54–59; Morphbank[39]

Description. *Female*. Body length: 1.85 mm (n=1).

Antenna color: antennal A1–A5 honey yellow, remainder of antenna dark brown. Body color: mostly honey yellow except posterior ¼ of mesoscutum, metasomal horn on T1 and T2–T7 dark brown. Coxae color: honey yellow. Leg color (excluding the coxae): honey yellow. Fore wing color: basal 1/3 and area at 2/5 hyaline, area below stigma infuscate as well as area beyond basal 1/3.

Head shape in lateral view: broad, short. Sculpture of antennal scrobe: smooth. Shape of torular triangle: not bulging, flat. Development of central keel on frons: completely absent. Sculpture of frons: largely smooth, with sparse setigerous punctulae. Sculpture of malar space: with fan-like striae extending onto antennal scrobe. Medial surface of vertex: flat to weakly convex (normal). Size of lateral ocellus: small (as in *C. bouceki*). Distance between lateral ocellus and occipital carina: > 1.5x maximum ocellar width. Length of OOL: ≤1/3 width of ocellus. Sculpture of vertex: largely smooth, with sparse, setigerous punctulae. Surface of occiput: evenly concave (normal). Sculpture of occipital carina: strongly crenulate throughout. Proximity of occipital carina to orbital carina: well separated by distance at least 2x width of occipital carina. Shape of occipital carina: strongly sinuate medially, M-shaped. Sculpture of occiput: with sinuate, curved, longitudinal sculpture.

Sculpture of pronotal cervical area: transversely costate. Sculpture of pronotal lateral area: longitudinally costate. Netrion: absent, obscured by longitudinal sculpture on lateral pronotum. Notauli: present, simple. Width of notauli: narrow. Length of notauli: approximately 0.5x length of mesoscutum. Sculpture of mesoscutum: largely smooth, with sparse, setigerous punctures. Sculpture of mesoscutellum: smooth, foveae of submarginal sulcus subequal in size. Mesoscutellum shape: flat, conspicuously wider than long. Sculpture of lateral propodeum: densely, transversely costate. Shape of propodeal anterior spines: short, narrow, apex rounded. Sculpture of propodeum between anterior spines: with strong, oblique ridges laterally. Sculpture of ventral mesepisternum: largely smooth, with sparse, setigerous punctulae. Density of longitudinal costae on dorsal mesepisternum: sparse. Thickness of longitudinal costae on dorsal mesepisternum: thin. Length of longitudinal costae on dorsal mesepisternum: reaching to meso-metapleural suture. Sculpture of mesopleural femoral depression: smooth. Sculpture of metapleuron: with weak to well-defined longitudinal costae throughout.

Shape of wings: very convex in lateral view, with a conspicuous constriction at 2/5 of its length.

Shape of horn on T1 (in posterior view): narrow and short. Lateral carinae on posterior part of horn: absent. Sculpture of upper portion of T1 horn: smooth. Sculpture of posterior portion of T1 horn: with well-defined longitudinal carinae. Lateral carinae on T2: absent. Sculpture of T2: largely finely costate, costae longer near midline, posterior margin smooth, lateral margin with setigerous punctulae. Sculpture of T3: anterior 1/4 densely, weakly coriaceous, posterior 1/4 smooth, otherwise with fine, dense costae. Sculpture of S3–S6: with broad, well-developed costae throughout.

Male. Unknown.

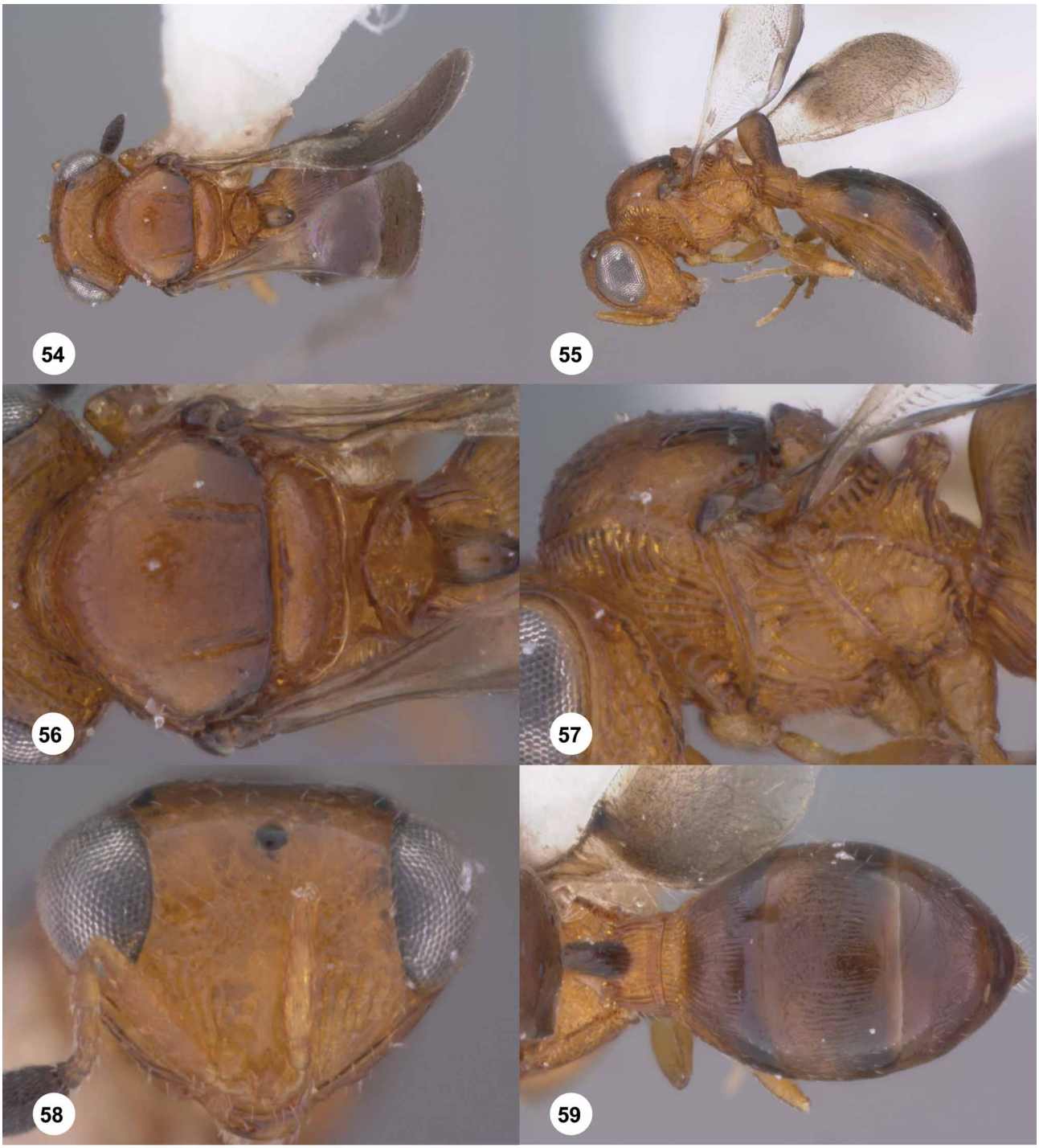
Diagnosis. This species can be easily identified from all other species by the very conspicuously bent down and M shaped mid-dorsal area of the occipital carina, the presence of notauli, and having a flat mesoscutellum.

39. http://www.morphbank.net/?id=514193

Etymology. This species is named after our close colleague John Jennings from The University of Adelaide.

Link to distribution map.[40]

Material examined. Holotype female: **AUSTRALIA**: SA, Waite Arboretum, Urrbrae, 27.III–10.IV.1996, OSUC 237890 (deposited in SAMA).



FIGURES 54–59. *Cyphacolus jenningsi* **n. sp.**, holotype female (OSUC 237890). **54**, Dorsal habitus; **55**, Lateral habitus; **56**, Mesosoma, dorsal view; **57**, mesosoma, lateral view; **58**, head, anterior view; **59**, metasoma, dorsal view. Morphbank[41]

40. http://osuc.biosci.ohio-state.edu/HymOnline/map-large.html?id=240843
41. http://www.morphbank.net/?id=514193

***Cyphacolus leblanci* Valerio, Masner & Austin, new species**
urn:lsid:zoobank.org:act:BC855770-AEA3-4E10-AD22-3443A3CA0219
urn:lsid:biosci.ohio-state.edu:osuc_concepts:240836
Figures 60–65, 104–105; Morphbank[42]

Description. *Female*. Body length: 1.3–1.55 mm (n=4).

Antenna color: antennal A1 yellow, remainder of antenna dark brown. Body color: mostly dark brown, pronotum slightly lighter than remainder of mesosoma. Coxae color: dark brown. Leg color (excluding the coxae): honey yellow with femora dark brown. Fore wing color: basal 1/3 and area at 2/5 hyaline, area below stigma infuscate as well as area beyond basal 1/3.

Head shape in lateral view: broad, short. Sculpture of antennal scrobe: with weak sinuate transverse costae. Shape of torular triangle: not bulging, flat. Development of central keel on frons: completely absent. Sculpture of frons: largely smooth, with sparse setigerous punctulae. Sculpture of malar space: smooth. Medial surface of vertex: flat to weakly convex (normal). Size of lateral ocellus: minute (as in *C. lucianae*). Distance between lateral ocellus and occipital carina: 0.5–1.2x maximum ocellar width. Length of OOL: approximately 0.5x width of ocellus. Sculpture of vertex: largely smooth, with sparse, setigerous punctulae. Surface of occiput: evenly concave (normal). Sculpture of occipital carina: largely simple, at most with few, weak crenulae medially. Proximity of occipital carina to orbital carina: well separated by distance at least 2x width of occipital carina. Shape of occipital carina: simply arcuate medially. Sculpture of occiput: smooth.

Sculpture of pronotal cervical area: foveate, foveae generally rounded to weakly ovoid. Sculpture of pronotal lateral area: weakly punctate. Netrion: absent, obscured by longitudinal sculpture on lateral pronotum. Notauli: absent. Sculpture of mesoscutum: completely cover by broad, parallel, longitudinal costae, which do not converge anteriorly. Sculpture of mesoscutellum: mainly smooth except anterior lateral half with fine coriaceous sculpture, lateral margin with two rows of punctate sculpture. Mesoscutellum shape: strongly convex, wider than long. Sculpture of lateral propodeum: sparsely, transversely costate. Shape of propodeal anterior spines: elongate, narrow, apex conspicuously broadened. Sculpture of propodeum between anterior spines: transversely costate. Sculpture of ventral mesepisternum: with longitudinally costae. Density of longitudinal costae on dorsal mesepisternum: sparse. Thickness of longitudinal costae on dorsal mesepisternum: broad. Length of longitudinal costae on dorsal mesepisternum: reaching to meso-metapleural suture. Sculpture of mesopleural femoral depression: smooth. Sculpture of metapleuron: with weak to well-defined longitudinal costae throughout.

Shape of wings: very convex in lateral view, with a conspicuous constriction at 2/5 of its length.

Shape of horn on T1 (in posterior view): broad and short. Lateral carinae on posterior part of horn: present, cristate, not fused posteriorly. Sculpture of upper portion of T1 horn: longitudinally carinate. Sculpture of posterior portion of T1 horn: with well-defined longitudinal carinae. Lateral carinae on T2: present and conspicuously. Sculpture of T2: largely smooth, anterior margin costate, costae subequal in length. Sculpture of T3: smooth. Sculpture of S3–S6: S3 with few weakly defined coarse granulae, S4–S6 largely smooth with sparse setigerous punctulae.

Male. Similar to female except for: body length 1.56 mm; fore wings darker; frons with transverse ridges not as cristate and curved; mesoscutellum not as globose;mesoscutum longitudinal costate sculpture denser; propodeum anterior spines subequal in width throughout their length, tip not conspicuously “spoon shaped”.

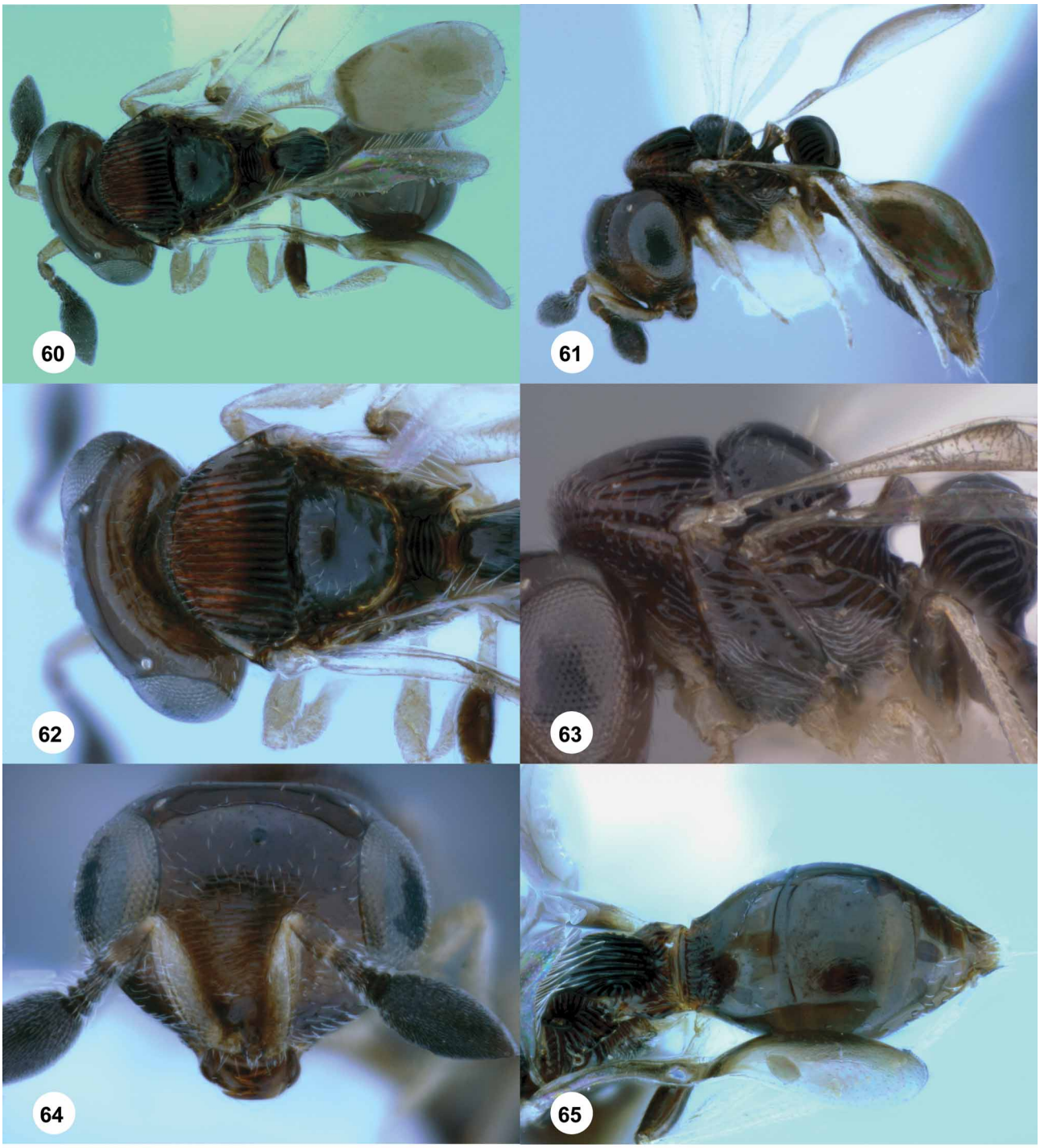
Diagnosis. This species is easily identified by the globose mesoscutellum exhibiting two rows of punctures laterally, the dark brown body color,and the mesoscutum having longitudinal costate sculpture not emerging from one spot anteriorly. No other species with a globose mesoscutellum exhibits such a dark colored body.

Etymology. This species is named after L. Leblanc who collected all of the specimens of this species.

Link to distribution map.[43]

42. http://www.morphbank.net/?id=514205
43. http://osuc.biosci.ohio-state.edu/HymOnline/map-large.html?id=240836

Material examined. Holotype female: **GUINEA**: Lola Pref., rainforest, Mount Nimba, 07°41-42'N 08°23'W, 514–740m, XII-1990 – III-1991, flight intercept trap, L. Leblanc, OSUC 237850 (deposited in CNCI). Paratypes: **GUINEA**: 3 females, 2 males, OSUC 237827, 237849, 237851, 238718–238719 (CNCI).



FIGURES 60–65. *Cyphacolus leblanci* **n. sp.**, holotype female (OSUC 237850). **60**, Dorsal habitus; **61**, Lateral habitus; **62**, Mesosoma, dorsal view; **63**, Mesosoma, lateral view; **64**, Head, anterior view; **65**, Metasoma, dorsal view. Morphbank[44]

44. http://www.morphbank.net/?id=514194

***Cyphacolus lucianae* Valerio, Masner & Austin, new species**
urn:lsid:zoobank.org:act:9BDE9B2B-9FF1-47D0-A119-94F67929DBB6
urn:lsid:biosci.ohio-state.edu:osuc_concepts:240838
Figures 5, 66–71, 106–107; Morphbank[45]

Description. *Female*. Body length: 1.43–2.24 mm (n=19).

Antenna color: antennal A1 light yellow, remainder of antenna honey yellow. Body color: mostly honey yellow except posterior 1/5 of mesoscutum, mesopleuron, lower 1/3 of metapleuron and metasoma dark brown, anterior 2/3 of metasomal horn on T1 whitish. Coxae color: honey yellow. Leg color (excluding the coxae): light yellow. Fore wing color: basal 1/3 and area at 2/5 hyaline, area below stigma infuscate as well as area beyond basal 1/3.

Head shape in lateral view: broad, short. Sculpture of antennal scrobe: with weak sinuate transverse costae. Shape of torular triangle: not bulging, flat. Development of central keel on frons: completely absent. Sculpture of frons: largely smooth, coriaceous near compound eye. Sculpture of malar space: mainly smooth, coriaceous near margin of compound eye. Medial surface of vertex: flat to weakly convex (normal). Size of lateral ocellus: minute (as in *C. lucianae*). Distance between lateral ocellus and occipital carina: > 1.5x maximum ocellar width. Length of OOL: ≤1/3 width of ocellus. Sculpture of vertex: largely smooth, with sparse, setigerous punctulae. Surface of occiput: evenly concave (normal). Sculpture of occipital carina: largely simple, at most with few, weak crenulae medially. Proximity of occipital carina to orbital carina: well separated by distance at least 2x width of occipital carina. Shape of occipital carina: simply arcuate medially. Sculpture of occiput: with sparse, weak, oblique carinae dorsolaterally.

Sculpture of pronotal cervical area: foveate, foveae generally rounded to weakly ovoid. Sculpture of pronotal lateral area: weakly punctate. Netrion: absent, obscured by longitudinal sculpture on lateral pronotum. Notauli: absent. Sculpture of mesoscutum: completely cover by broad, parallel, longitudinal costae, which do not converge anteriorly. Sculpture of mesoscutellum: mainly smooth except for 2rows of punctures at lateral margin and granulate sculpture. Mesoscutellum shape: strongly convex, wider than long. Sculpture of lateral propodeum: densely, transversely costate. Shape of propodeal anterior spines: elongate, narrow, apex conspicuously broadened. Sculpture of propodeum between anterior spines: transversely costate. Sculpture of ventral mesepisternum: with longitudinally costae. Density of longitudinal costae on dorsal mesepisternum: sparse. Thickness of longitudinal costae on dorsal mesepisternum: broad. Length of longitudinal costae on dorsal mesepisternum: reaching to meso-metapleural suture. Sculpture of mesopleural femoral depression: smooth. Sculpture of metapleuron: dorsal half smooth, anterior 2/3 of ventral region with weak, setigerous punctulae, posterior 1/3 of ventral region longitudinally costate.

Shape of wings: very convex in lateral view, with a conspicuous constriction at 2/5 of its length.

Shape of horn on T1 (in posterior view): narrow and short. Lateral carinae on posterior part of horn: present, cristate, not fused posteriorly. Sculpture of upper portion of T1 horn: smooth. Sculpture of posterior portion of T1 horn: smooth. Lateral carinae on T2: present and conspicuously. Sculpture of T2: largely smooth, anterior 1/4 with weak, granulate sculpture mixed with costae of uniform length. Sculpture of T3: largely weakly coriaceous, posterior margin smooth or sculpture strongly effaced. Sculpture of S3–S6: weakly coriaceous, with sparse setigerous punctulae.

Male. Similar to females except for: body color darker, lower face dark band wider and less defined; body length 1.98 mm; mesoscutum longitudinal costate sculpture denser, finer and shorter; mesoscutellum not as globose.

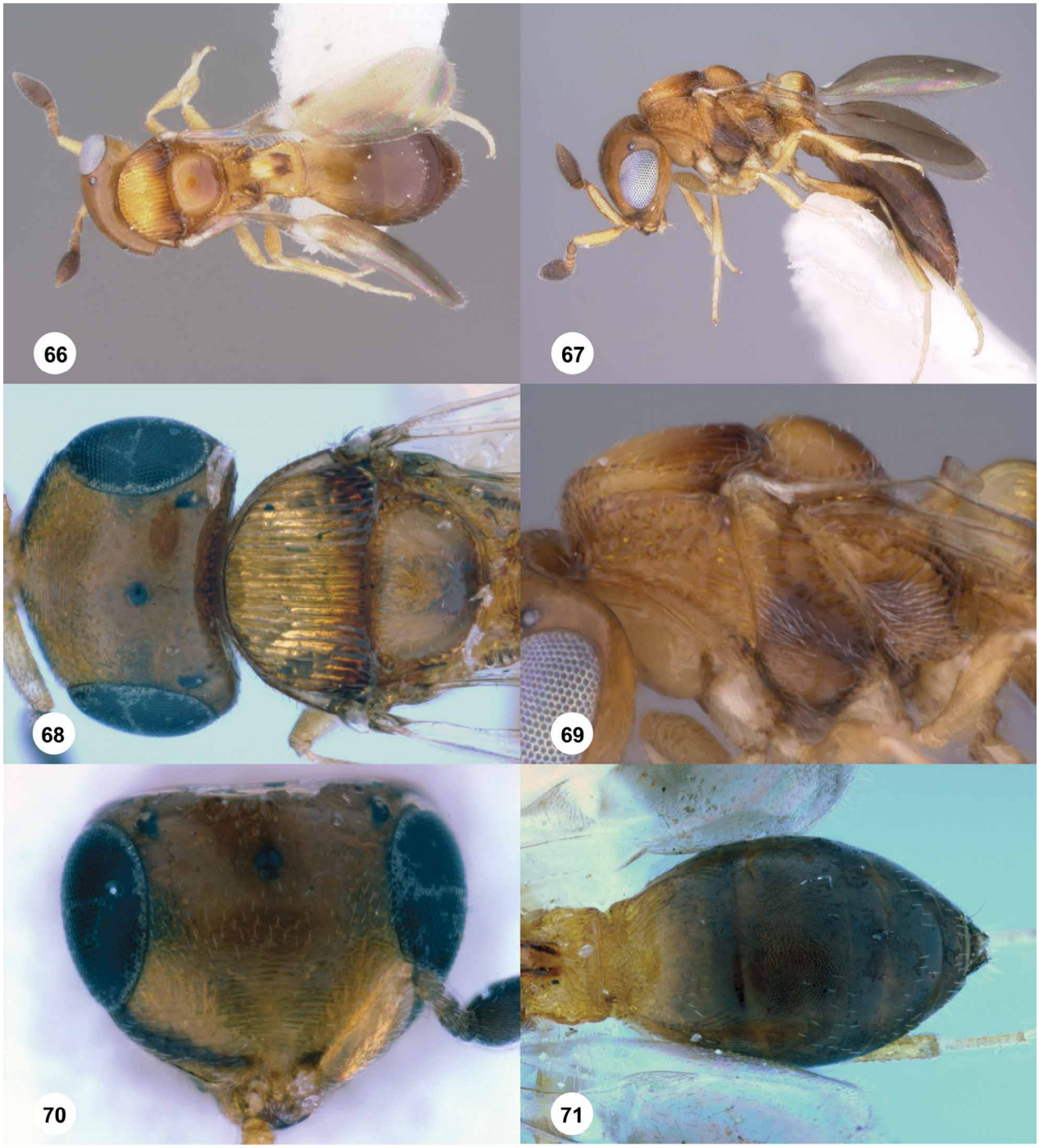
Diagnosis. This species can be easily identified by the presence of a double row of punctures at the lateral areas of the mesoscutellum, the mainly yellow body color, the mesoscutum having longitudinal costate sculpture not emerging from one spot anteriorly, and the globose mesoscutellum.

Etymology. This species is named after our colleague and close friend Luciana Musetti at Ohio State University for bringing a taste of Brazil to the Platy PBI.

45. http://www.morphbank.net/?id=514206

Link to distribution map.[46]

Material examined. Holotype female: **ZIMBABWE**: Harare (Salisbury), XI-1981, A. Watsham, OSUC 237834 (deposited in CNCI). Paratypes: (18 females, 6 males) **IVORY COAST**: 1 male, OSUC 237847 (CNCI). **MADAGASCAR**: 1 male, OSUC 237846 (CNCI). **SOUTH AFRICA**: 4 females, 2 males, OSUC 237828, 237838–237840, 237845, 237848 (CNCI). **SWAZILAND**: 1 female, OSUC 237819 (CNCI). **ZIMBABWE**: 13 females, 2 males, OSUC 237820–237826, 237829–237830, 237832–237833, 237836–237837, 237843–237844 (CNCI).



FIGURES 66–71. *Cyphacolus lucianae* **n. sp.**, holotype female (OSUC 237836). **66**, Dorsal habitus; **67**, Lateral habitus; **69**, Mesosoma, lateral view. *Cyphacolus lucianae* **n. sp.**, paratype female (OSUC 237832). **68**, Mesosoma, dorsal view; **70**, Head, anterior view; **71**, Metasoma, dorsal view. Morphbank[47]

46. http://osuc.biosci.ohio-state.edu/HymOnline/map-large.html?id=240838

***Cyphacolus normani* Valerio, Masner & Austin, new species**
urn:lsid:zoobank.org:act:F62D65FB-4F7A-432E-B4C1-9DE491D70378
urn:lsid:biosci.ohio-state.edu:osuc_concepts:240835
Figures 72–77; Morphbank[48]

Description. *Female*. Body length: 1.43 mm (n=1).

Antenna color: antennal A1–A2 yellow, remainder of antenna dark brown. Body color: mostly yellow, including anterior 2/3 of metasomal T1, remainder of metasoma and transverse band on lower head dark brown. Coxae color: yellow. Leg color (excluding the coxae): yellow. Fore wing color: basal 1/3 and area at 2/5 hyaline, area below stigma infuscate as well as area beyond basal 1/3.

Head shape in lateral view: broad, short. Sculpture of antennal scrobe: almost completely cover with semicircular fine ridges. Shape of torular triangle: not bulging, flat. Development of central keel on frons: completely absent. Sculpture of frons: largely smooth, with sparse setigerous punctulae. Sculpture of malar space: nearly completely cover by fine, semicircular ridges from antennal scrobe. Medial surface of vertex: flat to weakly convex (normal). Size of lateral ocellus: small (as in *C. bouceki*). Distance between lateral ocellus and occipital carina: 0.5–1.2x maximum ocellar width. Length of OOL: ≥1x width of ocellus. Sculpture of vertex: largely smooth, with sparse, setigerous punctulae. Surface of occiput: evenly concave (normal). Sculpture of occipital carina: largely simple, at most with few, weak crenulae medially. Proximity of occipital carina to orbital carina: well separated by distance at least 2x width of occipital carina. Shape of occipital carina: simply arcuate medially. Sculpture of occiput: smooth.

Sculpture of pronotal cervical area: with dense but weakly subcircular foveolae. Sculpture of pronotal lateral area: foveate throughout. Netrion: absent, obscured by longitudinal sculpture on lateral pronotum. Notauli: absent. Sculpture of mesoscutum: completely cover by broad longitudinal costae, these converging anteriorly. Sculpture of mesoscutellum: mainly smooth except anterior 1/4 with coriaceous sculpture, remainder of mesoscutellum with longitudinal costate sculpture. Mesoscutellum shape: strongly convex, length subequal to width. Sculpture of lateral propodeum: sparsely, transversely costate. Shape of propodeal anterior spines: elongate, narrow, apex conspicuously broadened. Sculpture of propodeum between anterior spines: transversely costate. Sculpture of ventral mesepisternum: largely smooth, with sparse, setigerous punctulae. Density of longitudinal costae on dorsal mesepisternum: sparse. Thickness of longitudinal costae on dorsal mesepisternum: broad. Length of longitudinal costae on dorsal mesepisternum: reaching to approximately half of speculum width. Sculpture of mesopleural femoral depression: smooth. Sculpture of metapleuron: dorsal half smooth, ventral half with few longitudinal ridges and weak setigerous punctulae, metapleural sulcus smooth.

Shape of wings: very convex in lateral view, with a conspicuous constriction at 2/5 of its length.

Shape of horn on T1 (in posterior view): narrow and short. Lateral carinae on posterior part of horn: present, cristate, fused posteriorly. Sculpture of upper portion of T1 horn: longitudinally carinate. Sculpture of posterior portion of T1 horn: mostly smooth, with few longitudinal carinae. Lateral carinae on T2: present and conspicuously. Sculpture of T2: largely smooth, anterior 1/3 broadly costate, these shorter medially. Sculpture of T3: smooth. Sculpture of S3–S6: mainly smooth, with sparse setigerous punctulae.

Male. Unknown.

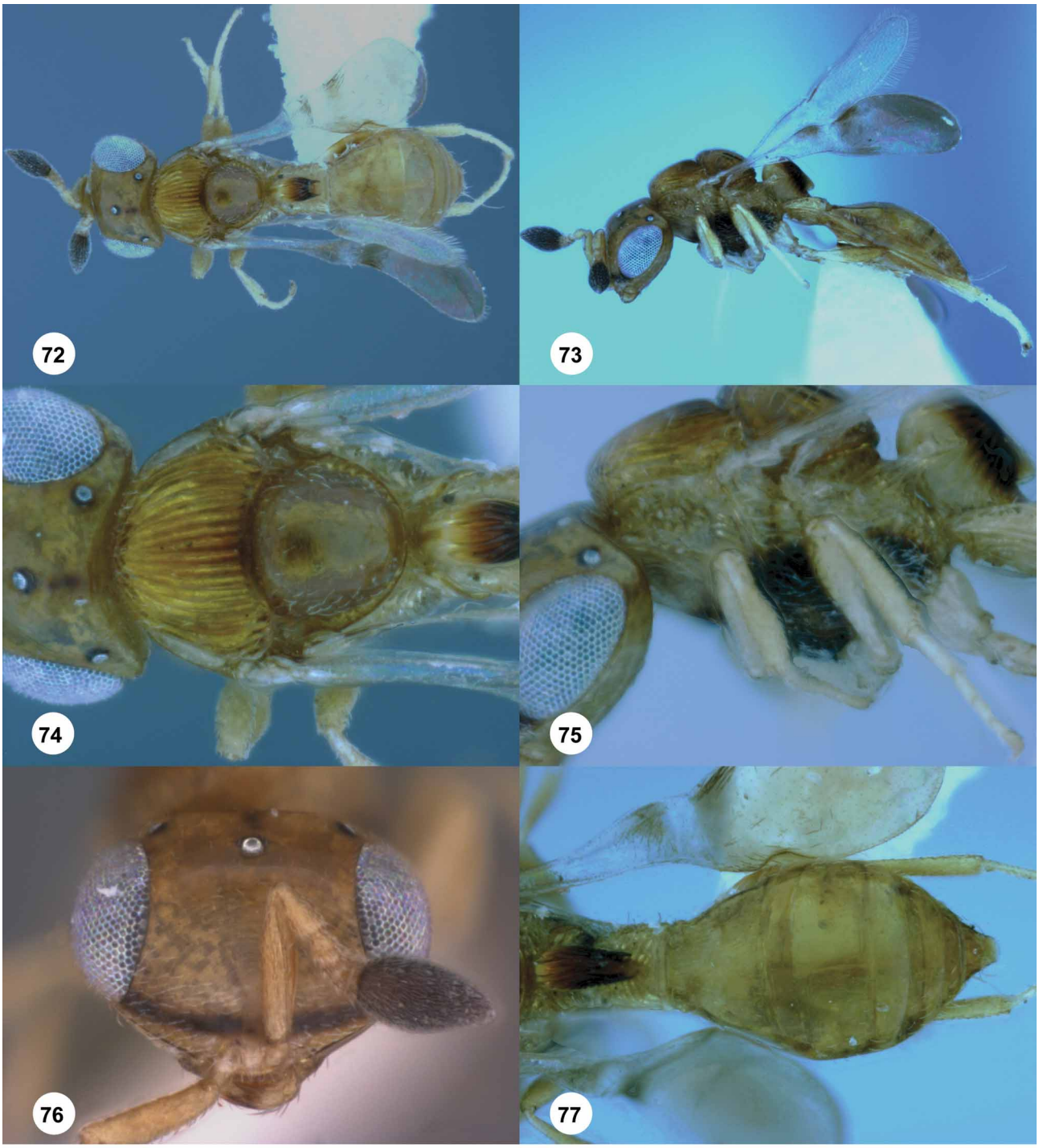
Diagnosis. This species can be identified from all other species by the very conspicuously oval and elongate globose mesoscutellum, and the mesoscutum longitudinal costate sculpture emerging from one spot anteriorly.

Etymology. This species is named after our colleague and friend Norman Johnson at Ohio State University, for his vision and dedication in developing the Platygastroidea PBI.

Link to distribution map.[49]

47. http://www.morphbank.net/?id=576239
48. http://www.morphbank.net/?id=514195
49. http://osuc.biosci.ohio-state.edu/HymOnline/map-large.html?id=240835

Material examined. Holotype female: **INDIA**: Karnataka St., Bandipur National Park, 900m, 20.VII–30.VII.1984, flight intercept trap, B. Gill, OSUC 237818 (deposited in CNCI). Paratypes: (2 females) **INDIA**: 1 female, OSUC 238717 (CNCI). **UNITED ARAB EMIRATES**: 1 female, OSUC 250615 (CNCI).



FIGURES 72–77. *Cyphacolus normani* **n. sp.**, holotype female (OSUC 237818). **72**, Dorsal habitus; **73**, Lateral habitus; **74**, Mesosoma, dorsal view; **75**, Mesosoma, lateral view; **76**, Head, anterior view; **77**, Metasoma, dorsal view. Morphbank[50]

50. http://www.morphbank.net/?id=514195

***Cyphacolus sallyae* Valerio, Masner & Austin, new species**
urn:lsid:zoobank.org:act:083299E6-885A-4685-A8D7-3281C34AF852
urn:lsid:biosci.ohio-state.edu:osuc_concepts:240839
Figures 78–83; Morphbank[51]

Description. *Female*. Body length: 1.63–1.71 mm (n=2).

Antenna color: mostly yellow except clava dark brown. Body color: mostly dark brown except gena, lateral areas of pronotal, metapleuron, mesoscutellum, propodeum and metasomal T1 other than horn honey yellow. Coxae color: yellow. Leg color (excluding the coxae): yellow. Fore wing color: basal 1/3 and area at 2/5 hyaline, area below stigma infuscate as well as area beyond basal 1/3.

Head shape in lateral view: broad, short. Sculpture of antennal scrobe: smooth. Shape of torular triangle: not bulging, flat. Development of central keel on frons: completely absent. Sculpture of frons: largely smooth, with sparse setigerous punctulae. Sculpture of malar space: with fan-like striae extending onto antennal scrobe. Medial surface of vertex: flat to weakly convex (normal). Size of lateral ocellus: minute (as in *C. lucianae*). Distance between lateral ocellus and occipital carina: > 1.5x maximum ocellar width. Length of OOL: approximately 0.5x width of ocellus. Sculpture of vertex: largely smooth, with sparse, setigerous punctulae. Surface of occiput: with wide, sharply defined depression. Sculpture of occipital carina: strongly crenulate throughout. Proximity of occipital carina to orbital carina: separated by distance slightly greater than width of occipital carina. Shape of occipital carina: simply arcuate medially. Sculpture of occiput: weakly foveate.

Sculpture of pronotal cervical area: transversely costate. Sculpture of pronotal lateral area: longitudinally costate. Netrion: absent, obscured by longitudinal sculpture on lateral pronotum. Notauli: present, simple. Width of notauli: narrow. Length of notaulus: approximately 0.5x length of mesoscutum. Sculpture of mesoscutum: largely smooth, with sparse, setigerous punctures. Sculpture of mesoscutellum: smooth, foveae of submarginal sulcus subequal in size. Mesoscutellum shape: flat, conspicuously wider than long. Sculpture of lateral propodeum: sparsely, transversely costate. Shape of propodeal anterior spines: short, very broad, apex rounded. Sculpture of propodeum between anterior spines: longitudinally costate. Sculpture of ventral mesepisternum: largely smooth, with sparse, setigerous punctulae. Density of longitudinal costae on dorsal mesepisternum: sparse. Thickness of longitudinal costae on dorsal mesepisternum: thin. Length of longitudinal costae on dorsal mesepisternum: reaching to meso-metapleural suture. Sculpture of mesopleural femoral depression: smooth. Sculpture of metapleuron: with weak to well-defined longitudinal costae throughout.

Shape of wings: slightly convex, not constricted at base.

Shape of horn on T1 (in posterior view): narrow and short. Lateral carinae on posterior part of horn: absent. Sculpture of upper portion of T1 horn: smooth. Sculpture of posterior portion of T1 horn: mostly smooth, with few longitudinal carinae. Lateral carinae on T2: absent. Sculpture of T2: largely finely costate, smooth along posterior margin and midline. Sculpture of T3: largely weakly coriaceous, posterior margin smooth or sculpture strongly effaced. Sculpture of S3–S6: sparsely, finely costate laterally, otherwise with setigerous punctulae.

Male. Unknown.

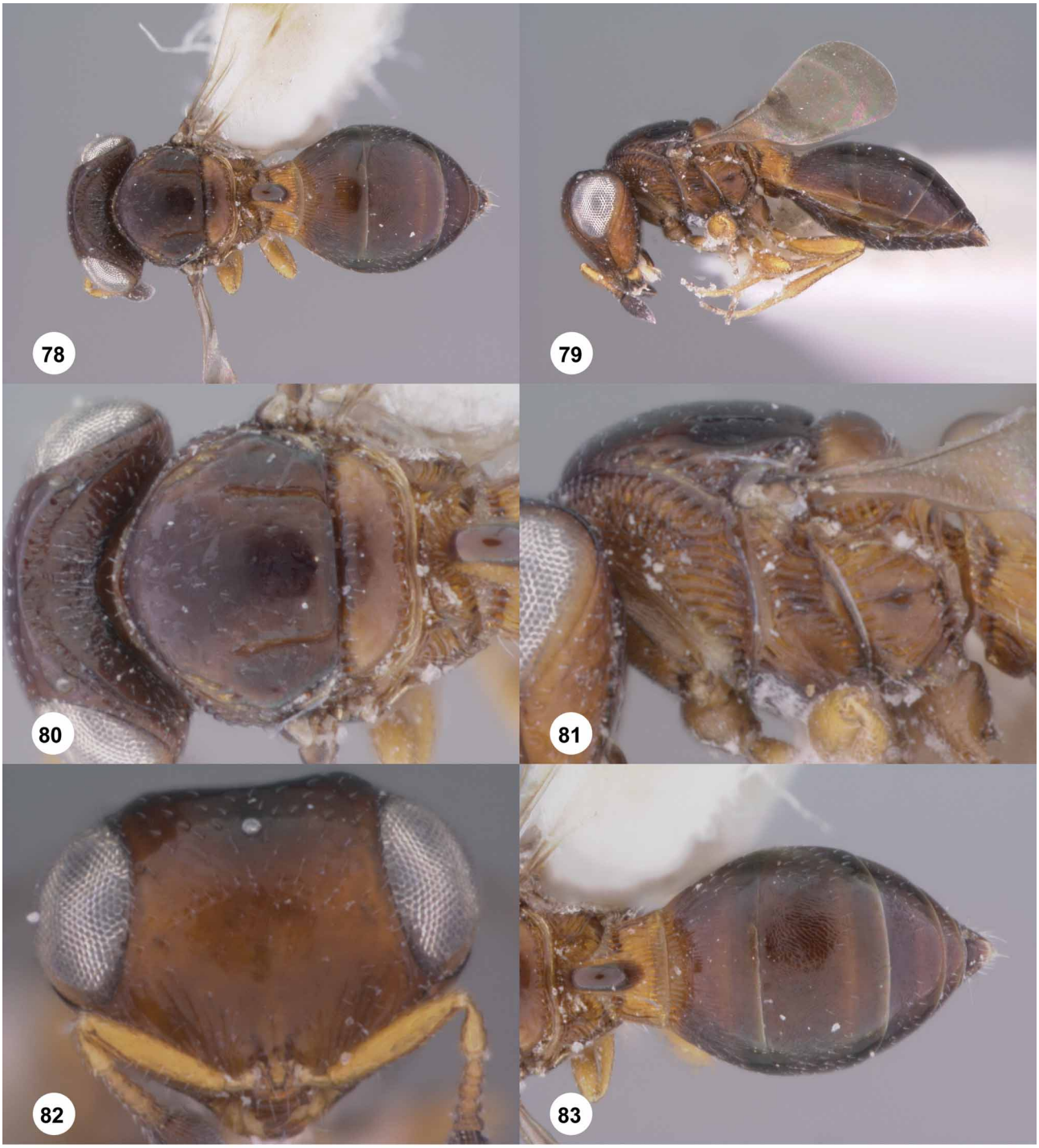
Diagnosis. This species can be easily identified by the very conspicuously depressed midposterior area of the head, the flat mesoscutellum, and the presence of notauli.

Etymology. We have much pleasure in describing this species after Sally Collins who is a leading expert in all things to do with Shetland ponies.

Link to distribution map.[52]

Material examined. Holotype female: **AUSTRALIA**: SA, Kangaroo Isl., West Bay, coastal mallee, Flinders Chase National Park, I-1986, A. D. Austin, OSUC 237892 (deposited in SAMA). Paratype: **AUSTRALIA**: 1 female, OSUC 237893 (CNCI).

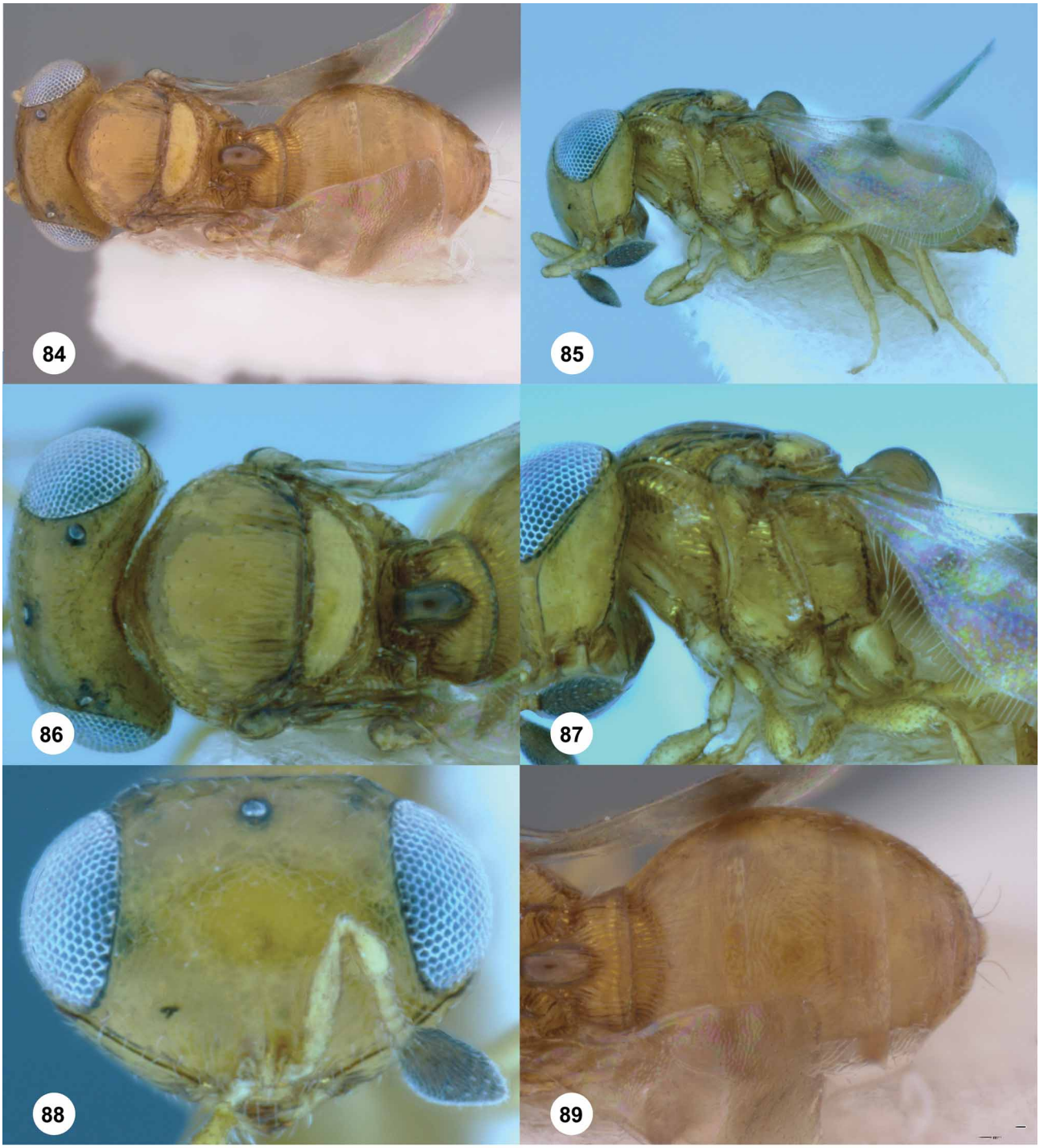
51. http://www.morphbank.net/?id=514196
52. http://osuc.biosci.ohio-state.edu/HymOnline/map-large.html?id=240839



FIGURES 78–83. *Cyphacolus sallyae* **n. sp.**, holotype female (OSUC 237892). **78**, Dorsal habitus; **79**, Lateral habitus; **80**, Mesosoma, dorsal view; **81**, Mesosoma, lateral view; **82**, Head, anterior view; **83**, Metasoma, dorsal view. Morphbank[53]

Cyphacolus tessae **Valerio, Masner & Austin, new species**
urn:lsid:zoobank.org:act:FABD2860-7D4B-4D5E-897B-7F7F11EF34E6
urn:lsid:biosci.ohio-state.edu:osuc_concepts:240842
Figures 84–89; Morphbank[54]

53. http://www.morphbank.net/?id=514196



FIGURES 84–89. *Cyphacolus tessae* **n. sp.**, holotype female (OSUC 237905). **84**, Dorsal habitus; **85**, Lateral habitus; **86**, Mesosoma, dorsal view; **87**, Mesosoma, lateral view; **88**, Head, anterior view; **89**, Metasoma, dorsal view. Morphbank[55]

Description. *Female*. Body length: 1.24 mm (n=1).

Antenna color: mostly yellow except clava dark brown. Body color: mostly yellow except dorsal area of metasomal horn on T1dark honey yellow. Coxae color: yellow. Leg color (excluding the coxae): yellow. Fore wing color: basal 1/3 and area at 2/5 hyaline, area below stigma infuscate as well as area beyond basal 1/3.

54. http://www.morphbank.net/?id=514197
55. http://www.morphbank.net/?id=514197

Head shape in lateral view: broad, short. Sculpture of antennal scrobe: smooth. Shape of torular triangle: not bulging, flat. Development of central keel on frons: completely absent. Sculpture of frons: largely smooth, with sparse setigerous punctulae. Sculpture of malar space: with fan-like striae, striae not extending into antennal scrobe. Medial surface of vertex: flat to weakly convex (normal). Size of lateral ocellus: normal (as in *C. copelandi*). Distance between lateral ocellus and occipital carina: 0.5–1.2x maximum ocellar width. Length of OOL: ≤1/3 width of ocellus. Sculpture of vertex: largely smooth, with sparse, setigerous punctulae. Surface of occiput: evenly concave (normal). Sculpture of occipital carina: strongly crenulate throughout. Proximity of occipital carina to orbital carina: separated by distance slightly greater than width of occipital carina. Shape of occipital carina: simply arcuate medially. Sculpture of occiput: with conspicuous longitudinal ridges throughout.

Sculpture of pronotal cervical area: smooth medially, otherwise with elongated foveae. Sculpture of pronotal lateral area: longitudinally costate dorsally, otherwise punctate. Netrion: absent, obscured by longitudinal sculpture on lateral pronotum. Notauli: present, simple. Width of notauli: narrow. Length of notaulus: approximately 2/5x length of mesoscutum. Sculpture of mesoscutum: anterolateral margin sparsely foveate, anterior half with well-defined setigerous punctures on coriaceous background, otherwise weakly, longitudinally striate, this more evident laterally. Sculpture of mesoscutellum: smooth except for anterior edge with weak, small, coriaceous sculpture, posterior edge with fovea of subequal size. Mesoscutellum shape: flat, conspicuously wider than long. Sculpture of lateral propodeum: densely, transversely costate. Shape of propodeal anterior spines: short, broad, apex rounded. Sculpture of propodeum between anterior spines: smooth. Sculpture of ventral mesepisternum: with longitudinally costae. Density of longitudinal costae on dorsal mesepisternum: dense. Thickness of longitudinal costae on dorsal mesepisternum: broad. Length of longitudinal costae on dorsal mesepisternum: reaching to meso-metapleural suture. Sculpture of mesopleural femoral depression: smooth. Sculpture of metapleuron: dorsal half and ventral 1/3 with fine longitudinal costae, otherwise smooth.

Shape of wings: slightly convex, not constricted at base.

Shape of horn on T1 (in posterior view): narrow and short. Lateral carinae on posterior part of horn: present, rounded, not fused posteriorly. Sculpture of upper portion of T1 horn: smooth. Sculpture of posterior portion of T1 horn: smooth. Lateral carinae on T2: present, poorly developed. Sculpture of T2: largely finely costate, smooth along posterior margin and midline. Sculpture of T3: largely weakly coriaceous, posterior margin smooth or sculpture strongly effaced. Sculpture of S3–S6: sparsely, finely costate laterally, otherwise with setigerous punctulae.

Male. Unknown.

Diagnosis. See diagnosis under *C. tullyae* **n. sp.**.

Etymology. We have much pleasure in describing this species for Tess Austin for her tenacity, perseverance, sense of humour and love of animals.

Link to distribution map.[56]

Material examined. Holotype female: **AUSTRALIA**: SA, mallee w/ Triodia, MT 1, Brookfield Conservation Park, 34°19'S 139°30'E, 2.XII–2.I.1992, malaise trap, J. Stelman & S. Williams, OSUC 237905 (deposited in ANIC).

***Cyphacolus tullyae* Valerio, Masner & Austin, new species**

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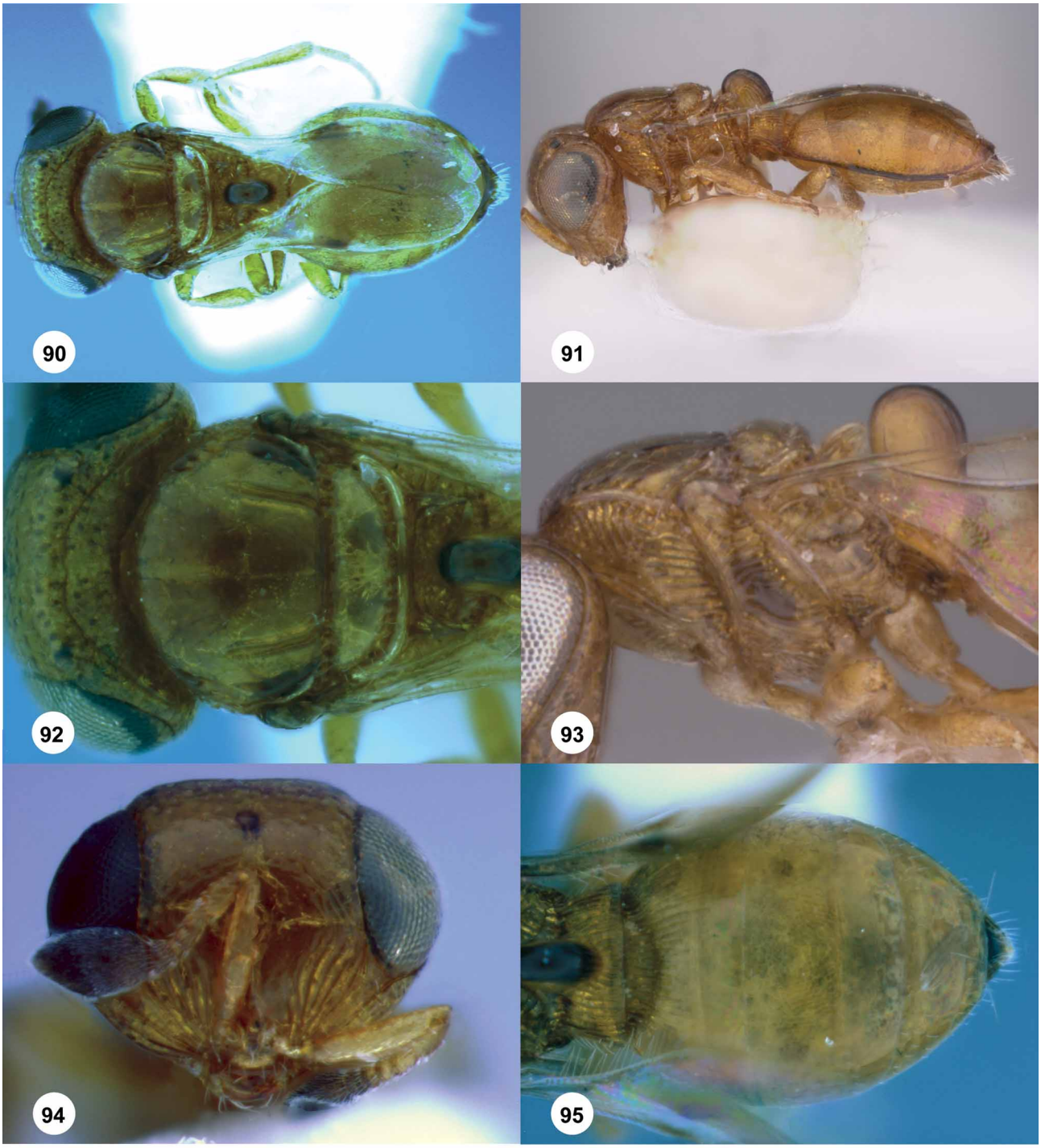
urn:lsid:biosci.ohio-state.edu:osuc_concepts:240841

Figures 90–95, 108–109; Morphbank[57]

Description. *Female*. Body length: 1.1–1.58 mm (n=7).

56. http://osuc.biosci.ohio-state.edu/HymOnline/map-large.html?id=240842

57. http://www.morphbank.net/?id=514207



FIGURES 90–95. *Cyphacolus tullyae* **n. sp.**, holotype female (OSUC 237896). **90**, Dorsal habitus; **91**, Lateral habitus; **92**, Mesosoma, dorsal view; **94**, Head, anterior view. *Cyphacolus tullyae* **n. sp.**, female (OSUC 237900). **93**, Mesosoma, lateral view; **95**, Metasoma, dorsal view. Morphbank[58]

Antenna color: mostly yellow except clava dark brown. Body color: yellow, metasoma slightly lighter than head and dorsal mesosoma, except antennal clava and dorsal area of metasomal horn on T1 dark brown. Coxae color: yellow. Leg color (excluding the coxae): yellow. Fore wing color: slightly infuscate throughout.

Head shape in lateral view: broad, short. Sculpture of antennal scrobe: smooth. Shape of torular triangle: not bulging, flat. Development of central keel on frons: completely absent. Sculpture of frons: largely smooth,

58. http://www.morphbank.net/?id=514198

with sparse setigerous punctulae. Sculpture of malar space: with fan-like striae extending onto antennal scrobe. Medial surface of vertex: flat to weakly convex (normal). Size of lateral ocellus: normal (as in *C. copelandi*). Distance between lateral ocellus and occipital carina: 0.5–1.2x maximum ocellar width. Length of OOL: ≥ 1x width of ocellus. Sculpture of vertex: largely smooth, with sparse, setigerous punctulae. Surface of occiput: evenly concave (normal). Sculpture of occipital carina: strongly crenulate throughout. Proximity of occipital carina to orbital carina: separated by distance slightly greater than width of occipital carina. Shape of occipital carina: weakly concave medially. Sculpture of occiput: with dense, broad, longitudinal ridges.

Sculpture of pronotal cervical area: smooth medially, otherwise with elongated foveae. Sculpture of pronotal lateral area: longitudinally costate dorsally, otherwise smooth. Netrion: absent, obscured by longitudinal sculpture on lateral pronotum. Notauli: present, simple. Width of notauli: narrow. Length of notaulus: approximately 2/3x length of mesoscutum. Sculpture of mesoscutum: largely smooth, anterolateral margin with sparse, short, broad carinae. Sculpture of mesoscutellum: smooth, foveae of submarginal sulcus slightly smaller medially. Mesoscutellum shape: flat, conspicuously wider than long. Sculpture of lateral propodeum: sparsely, transversely costate. Shape of propodeal anterior spines: short, broad, apex rounded. Sculpture of propodeum between anterior spines: longitudinally costate. Sculpture of ventral mesepisternum: with longitudinally costae. Density of longitudinal costae on dorsal mesepisternum: dense. Thickness of longitudinal costae on dorsal mesepisternum: thin. Length of longitudinal costae on dorsal mesepisternum: reaching to meso-metapleural suture. Sculpture of mesopleural femoral depression: finely, densely costate. Sculpture of metapleuron: dorsal half and ventral 1/3 with fine longitudinal costae, otherwise smooth.

Shape of wings: slightly convex, not constricted at base.

Shape of horn on T1 (in posterior view): narrow and short. Lateral carinae on posterior part of horn: absent. Sculpture of upper portion of T1 horn: smooth. Sculpture of posterior portion of T1 horn: with well-defined longitudinal carinae. Lateral carinae on T2: absent. Sculpture of T2: largely finely costate, smooth along posterior margin and midline. Sculpture of T3: largely weakly coriaceous, posterior margin smooth or sculpture strongly effaced. Sculpture of S3–S6: S3 with few weak costae, otherwise S3 and S4–S6 essentially smooth.

Male. Similar to female except for: body length 1.42 mm; vertex coverwithgranulate sculpture; occipital carina dorsal meson with sinuate and long transverse ridges; mesoscutellum with clearly defined granulate sculpture; notauli wider and with few weak transverse ridges along their length, not reaching upper edge of furrow;propodeum anterior spines minute.

Diagnosis. This species can be identified by the well-developed fan-like sculpture that reaches at least to themid height of the face,having a flat mesoscutum, and the frons with clearly defined punctures. *Cyphacolustessae* **n. sp.** is very similar butcan be easily identified from *C. tullyae* **n. sp.** by the weak fan-like sculpture constrained manly to the lower 1/3 of the frons, as well by the mesoscutum with weak longitudinal sculpture on most of the posterior lateral 2/3 of its length contrasting with the smooth mesoscutum of*C. tullyae*. *Cyphacolus bouceki* Austin & Iqbalis also similar but this species can be identified by its very small lateral ocelli which are well separated from the occipital carina and the smooth frons.

Etymology. This species is named after Tully Farrington, the daughter of our colleague Lachlan Farrington.

Link to distribution map.[59]

Material examined. Holotype female: **AUSTRALIA**: NSW, 22km SE Wollomombi, Falls Road, Styx River State Park, 15.XII.1984, flight intercept trap, K. MacGregor, OSUC 237896 (deposited in ANIC). Paratypes: **AUSTRALIA**: 6 females, 2 males, OSUC 237894–237895, 237897–237900 (CNCI); OSUC 237902–237903 (WAMP).

***Cyphacolus veniprivus* Priesner**

urn:lsid:zoobank.org:act:6860C830-5428-46F8-B0E0-411C230F8A86

urn:lsid:biosci.ohio-state.edu:osuc_concepts:4239

59. http://osuc.biosci.ohio-state.edu/HymOnline/map-large.html?id=240841

Cyphacolus veniprivus Priesner, 1951: 124 (original description); Muesebeck & Walkley, 1956: 345 (citation of species); Kozlov 1971: 36 (citation of species); Johnson 1992: 366 (citation of species); Austin & Iqbal, 2005: 21 (keyed).

Material. Holotype female: **EGYPT**: Al Jizah Governature, Cairo, Orman Botanical Gardens, 12.VIII.1937, M. Hafez.

Diagnosis. See diagnosis under *C. harteni* **n. sp.**.

Link to distribution map.[60]

Comments. We were unable to locate the holotype of this species. However, Priesner's (1951) description is relatively detailed and includes measurements of various body parts which have allowed us to include it in the key and distinguish the new species C*yphacolus harteni* from *C. veniprivus*.

***Cyphacolus watshami* Valerio, Masner & Austin, new species**

urn:lsid:zoobank.org:act:DDCD845D-3E11-45E1-87A0-A8D1EBED2C2D

urn:lsid:biosci.ohio-state.edu:osuc_concepts:240837

Figures 4, 96–101, 110–111; Morphbank[61]

Description. *Female*. Body length: 1.13–1.5 mm (n=14).

Antenna color: antennal A1 honey yellow, remainder of antenna dark brown. Body color: mostly honey yellow except area around lateral ocelli, mesopleuron, metapleuron, dorsal and posterior 1/3 of metasomal horn on T1, posterolateral areas of metasomal T2–T3 and metasomal T4–T6 dark brown, remainder of metasoma yellow. Coxae color: honey yellow. Leg color (excluding the coxae): honey yellow. Fore wing color: basal 1/3 and area at 2/5 hyaline, area below stigma infuscate as well as area beyond basal 1/3.

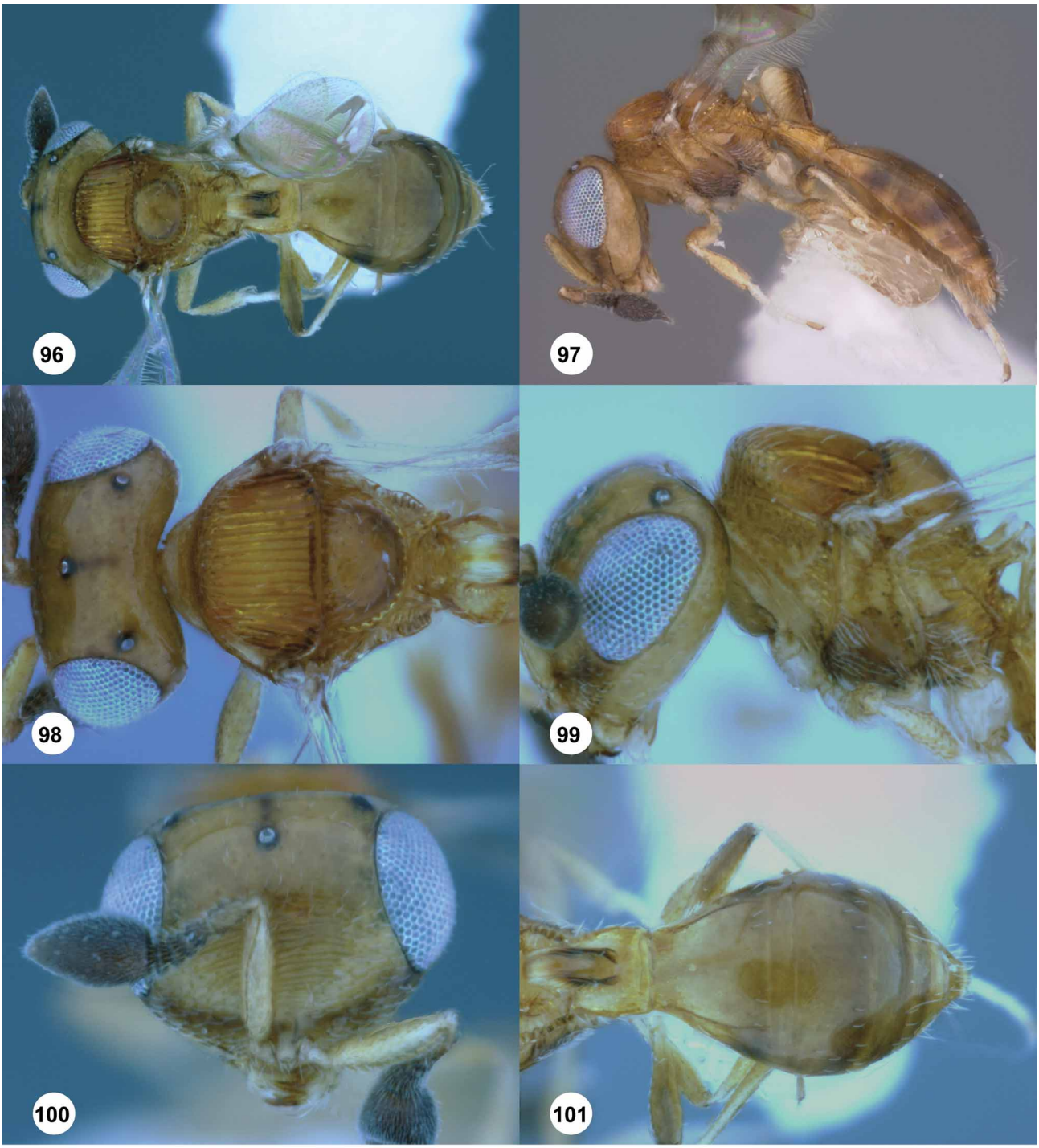
Head shape in lateral view: broad, short. Sculpture of antennal scrobe: with weak sinuate transverse costae. Shape of torular triangle: not bulging, flat. Development of central keel on frons: completely absent. Sculpture of frons: largely smooth, with sparse setigerous punctulae. Sculpture of malar space: with fine, sinuate, transverse ridges throughout. Medial surface of vertex: flat to weakly convex (normal). Size of lateral ocellus: minute (as in *C. lucianae*). Distance between lateral ocellus and occipital carina: 0.5–1.2x maximum ocellar width. Length of OOL: approximately 2/3x width of ocellus. Sculpture of vertex: largely smooth, with sparse, setigerous punctulae. Surface of occiput: evenly concave (normal). Sculpture of occipital carina: largely simple, at most with few, weak crenulae medially. Proximity of occipital carina to orbital carina: well separated by distance at least 2x width of occipital carina. Shape of occipital carina: simply arcuate medially. Sculpture of occiput: smooth.

Sculpture of pronotal cervical area: foveate, foveae generally rounded to weakly ovoid. Sculpture of pronotal lateral area: upper 2/3 punctate, otherwise smooth. Netrion: absent, obscured by longitudinal sculpture on lateral pronotum. Notauli: absent.Sculpture of mesoscutum: completely cover by broad, parallel, longitudinal costae, which do not converge anteriorly. Sculpture of mesoscutellum: mainly smooth except for one row of punctures at lateral margin, anterior edge with weak, small, coriaceous sculpture, posterior edge with foveae of subequal size. Mesoscutellum shape: strongly convex, wider than long. Sculpture of lateral propodeum: densely, transversely costate. Shape of propodeal anterior spines: elongate, narrow, apex conspicuously broadened. Sculpture of propodeum between anterior spines: transversely costate. Sculpture of ventral mesepisternum: with longitudinally costae. Density of longitudinal costae on dorsal mesepisternum: sparse. Thickness of longitudinal costae on dorsal mesepisternum: broad. Length of longitudinal costae on dorsal mesepisternum: reaching to meso-metapleural suture. Sculpture of mesopleural femoral depression: smooth. Sculpture of metapleuron: dorsal half smooth, anterior 2/3 of ventral region with weak, setigerous punctulae, posterior 1/3 of ventral region longitudinally costate.

Shape of wings: very convex in lateral view, with a conspicuous constriction at 2/5 of its length.

60. http://osuc.biosci.ohio-state.edu/HymOnline/map-large.html?id=240841

61. http://www.morphbank.net/?id=514208



FIGURES 96–101. *Cyphacolus watshami* **n. sp.**, paratype female (OSUC 237861). **96**, Dorsal habitus; **98**, Mesosoma, dorsal view; **99**, Mesosoma, lateral view; **100**, Head, anterior view; **101**, Metasoma, dorsal view. *Cyphacolus watshawi* **n. sp.**, holotype female (OSUC 237854) **97**, Lateral habitus. Morphbank[62]

Shape of horn on T1 (in posterior view): narrow and short. Lateral carinae on posterior part of horn: present, cristate, not fused posteriorly. Sculpture of upper portion of T1 horn: mostly smooth with few longitudinal carinae. Sculpture of posterior portion of T1 horn: mostly smooth, with few longitudinal carinae. Lateral carinae on T2: present and conspicuously. Sculpture of T2: largely smooth, anterior margin costate, costae subequal in length. Sculpture of T3: largely smooth, weakly coriaceous lateromedially. Sculpture of S3–S6: mainly smooth, with sparse setigerous punctulae.

62. http://www.morphbank.net/?id=514199

FIGURES 102–107. *Cyphacolus harteni* **n. sp.**, paratype male (OSUC 0237916). **102**, Dorsal habitus; **103**, Lateral habitus. *C. leblanci* **n. sp.**, paratype male (OSUC 237851). **104**, Dorsal habitus; **105**, Lateral habitus. *C. lucianae* **n. sp.**, paratype male (OSUC 237842). **106**, Dorsal habitus; **107**, Lateral habitus. Morphbank[63]

Male. Similar to females except for: metasoma tergum darker colored areas more diffused and spread out; head and mesosoma uniformly honey brown; body length 1.2 mm; frons almost completely smooth except for sparse punctulate sculpture;mesoscutum longitudinal costate sculpture denser, finer and shorter; T1 (in dorsal view) slightly more elongated.

63. http://www.morphbank.net/?id=514200

FIGURES 108–111. *Cyphacolus tullyae* **n. sp.**, paratype male (OSUC 237894). **108**, Dorsal habitus; **109**, lateral habitus. *C. watshami* **n. sp.**, male paratype (OSUC 237866). **110**, Dorsal habitus; **111**, Lateral habitus. Morphbank[64]

Diagnosis. This species can be easily identified by the single row of punctate sculpture laterally on the globose mesoscutellum which is otherwise mostly clean of sculpture dorsally and smooth.

Etymology. We have much pleasure in describing this species for Anthony Watsham for his dedicated collecting of parasitic Hymenoptera in Africa and his fantastic paintings and drawings of microhymenoptera, including the genus *Cyphacolus* (see Fig. 1).

Link to distribution map.[65]

Material examined. Holotype female: **SOUTH AFRICA**: Limpopo Prov., 15km E Klaserie, Guernsey Farm, 19.XII–31.XII.1985, M. Sanborne, OSUC 237854 (deposited in SAMC). Paratypes: (18 females, 5 males) **CAMEROON**: 1 female, OSUC 237855 (CNCI). **KENYA**: 1 female, OSUC 238571 (CNCI). **MADAGASCAR:** 3 females, CASENT 2134270 (CASC); OSUC 207804, OSUC 229729 (OSUC). **SOUTH AFRICA**: 3 females, 2 males, OSUC 237852–237853, 237867, 237869 (CNCI); OSUC 207749 (OSUC). **ZIMBABWE**: 10 females, 3 males, OSUC 237831, 237842, 237856–237863, 237865–237866, 237868 (CNCI).

64. http://www.morphbank.net/?id=514201
65. http://osuc.biosci.ohio-state.edu/HymOnline/map-large.html?id=240837

Acknowledgements

We wish to thank our colleagues Norman Johnson, Luciana Musetti, Andrew Polaszek, John Jennings and other members of the PBI team for their help and support during this project. Additionally, we wish to thank Sarah Mantel (The University of Adelaide) for her automontage assistance. This work was funded by the National Science Foundation under grant No. DEB–0614764 (to N.F. Johnson and A.D. Austin), the Australian Biological Resources Study under grant 208-58, and The University of Adelaide. Also, we would like to thank Matthew L Buffington for comments and suggestion during the submission of this manuscript.

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Appendix

Head
1. Head shape in lateral view
    0. broad and short
    1. elongated and slim

2. Antennal scrobe sculpture
    0. smooth or mainly so
    1. with sculpture other than semicircular ridges throughout
    2. with confuse sinuate transverse costate sculpture throughout
    3. upper half with semicircular fine ridges, remainder of scrobe smooth
    4. almost completely cover with semicircular fine ridges

3. Shape of torular triangle
    0. slightly bulging
    1. not bulging

4. Face central keel
    0. completely absent
    1. present (partially or throughout antennal scrobe height)

5. Mandible teeth shape
    0. all subequal in length
    1. mid tooth clearly
    2. longer than upper and lower tooth
    3. upper and mid teeth subequal in length, lower tooth conspicuously smaller

6. Malar space sculpturing
    0. smooth or mainly smooth, without fan-like sculpture
    1. with conspicuous fan-like sculpture

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82. http://lsid.tdwg.org/urn:lsid:biosci.ohio-state.edu:osuc_pubs:1146
83. http://lsid.tdwg.org/urn:lsid:biosci.ohio-state.edu:osuc_pubs:345
84. http://lsid.tdwg.org/urn:lsid:biosci.ohio-state.edu:osuc_pubs:21213

2. completely cover by sinuate transverse fine ridges
3. almost completely cover with semicircular fine ridges from antennal scrobes
4. completely cover by granulate sculpture, withoutfan-like sculpture present

7. Shape of mid-longitudinal area of vertex
0. slightly depressed
1. slightly round in shape

8. Compound eye setosity
0. not evident, if present then very short and sparse
1. evident, large and dense
2. evident, short and dense

9. Lateral ocelli size
0. minute (as in *C. lucianae*)
1. normal (as in *C. copelandi*)
2. large (as in *C. axfordi*)
3. small (as in *C. bouceki*)

10. Distance between lateral ocellus and occipital carina
0. approximately 0.49 x or less ocellar width
1. 0.5 to 1.2x ocellar width
2. more than 1.5x ocellar width

11. Distance between lateral ocellus and compound eye
0. by approx. 0.5x ocellar width
1. by approx.0.33x or less ocellar width
2. by approx. 0.66x ocellar width
3. by approx. 1x or more ocellar width

12. Vertex shape in dorsal view
0. not bent (normal)
1. conspicuously bent medially

13. Occipital carinadistanceto orbital carina
0. well separated by distance at least 2x width of occipital carina
1. separated by distance slightly greater than width of occipital carina
2. contiguous or nearly so, separated by distance subequal to width of occipital carina

14. Shape of midupper area of occipital carina
0. sharply bent down, "M" shaped
1. slightly bent
2. slightly curved upwards (normal)
3. practically absent

Mesosoma
15. Netrion
1. present
2. represented only by sculpture at lateral pronotal areas

16. Notauli
0. absent
1. present as a clean furrow
2.absent due to longitudinal costate sculpture
3. present with transverse elements on it length

17. Mesoscutum sculpture
0. mainly smooth
1. cover with broad longitudinal sculpture

2. completely cover by one type of sculpture other than longitudinal or granulate sculpture
4. completely cover by granulate sculpture
3. anterior area with sculpture different to remainder of mesoscutum

18. Mesoscutellum sculpture
0. completely smooth
1. mainly smooth with row(s) of punctures laterally
2. mainly smooth with sculpture other than puncture rows at lateral areas
3. completely cover in sinuate longitudinal costate sculpture
4. completely cover by granulate or rugulose sculpture

19. Mesoscutellum shape (in dorsal view)
0. flat, conspicuously wider than long
1. globose or very globose

20. Mesoscutellum shape of posterior edge (in dorsal view)
0. lobed medially, 'U' shaped
1. extremely bent medially, 'W' shaped
2 more or less straight
3. conspicuously curved

21. Lateral propodeal areas
1. with transverse ridges (dense or not)
2. without transverse ridges
3. with longitudinal ridges
4. upper half with longitudinal ridges, remainder with granulate sculpture
5. with confused areolate-foveate sculpture

22. Propodeal anterior spines shape (in lateral view)
0. short, small, round at tips
1. approximated same width throughout, elongated and round at tips
2. with lobate areas at apex that are much wider than basal area
3.spines absent

23. Inter propodeal anterior spine area (in dorsal view)
0. smooth
1. with transverse costate sculpture
2. with longitudinal costate sculpture
3. with few lateral semitransverse ridges

Metasoma
24. Shape of T1 horn
0. elongated and thin
1. short and broad
2. short and thin
3. horn absent

25. T1 horn posterior lateral carinae
0. absent
1. present but not conspicuously cristate or fused at lower posterior area
2. present, conspicuously cristate, fused or not basally
3. horn absent

26. T1 horn sculpturing in upper area
0. smooth
1. with longitudinal carinae
2. mostly smooth with few longitudinal carinae
3. horn absent

27. T1 horn sculpturing in posterior area
    0. smooth
    1. with well-defined longitudinal carinae present
    2. mostly smooth with few longitudinal carinae
    3. with transverse ridges throughout
    4. horn absent

28. T2 lateral carinae
    0. absent
    1. present but not well-developed
    2. conspicuously present

29. Shape of T1 horn in cross section
    0. subcircular or dorsoventrally compressed
    1. laterally compressed
    2. horn absent

30. Metasomal T2 length vs. length of T3
    0. T2 longer than T3
    1. T2 subequal or smaller than T3

31. Ovipositor shape
    0. straight or curved into T1 horn
    1. ovipositor bent over itself inside T1 horn (i.e. U-shaped)

32.Metasoma shape
    0. short and compact
    1. elongated, T1 thin and elongated
    2. elongated, T1 short and broad

Wings
33. Stigmal vein
    0. absent
    1. present

34. Shape of wings
    0. slightly convex, without a drastic constriction at 2/5 of its length
    1. very convex in lateral view, with a conspicuous constriction at 2/5 of its length
    2. flat, not convex, without obvious constriction

Matrix:

Idris_floris	10120110100022202401432020000002l2
Idris_sp1	01022111001022102400230101300000l2
Idris_sp2	01020111311022202402232101100000l2
Idris_sp3	01110112311012204402332333402000l2
Od_sp1	11111411101003114402510001221112l2
Od_sp2	10111011121002104402510001001112l2
Od_sp3	00011111120001134402l0?00010111012
asheri	01100110211002223212111????1111101
axfordi	01100110220012203302110200201110l0
copelandi	02100210110002221312121221221111l1
diazae	03100110313002200202110210011111l1
harteni	01100410310002100002100210011111l0
jenningsi	00100110321000210002113200101110l1
leblanci	02100010010002221112121131121111l1
lucianae	02100010021002221112121220021111l1
normani	04100310313002221212121221221111l1
sallyae	00100110020112210002102200201110l0
tessae	00100110111012213202110210011110l0
tullyae	00100110113011210002102200101110l0
watshami	02100210012002221112121222221111l1
bhowaliensis	021003103????222121212122122111l01
bouceki	00120110321011213202101200201110l0

Note: Od = *Odontacolus.*