

# Taxonomic revision of *Bracalba* Dodd (Hymenoptera, Platygasteridae s.l.), a parasitoid wasp genus endemic to Australia

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## Abstract

The endemic Australian parasitic wasp genus *Bracalba* (Hymenoptera: Platygasteridae) is revised. Sixteen species are recognized: *B. cuneata* Dodd, *B. laminata* Dodd and *B. nigrescens* (Dodd) are redescribed and thirteen new species are recognized; *B. clavata* Burks, **sp. n.**, *B. globosa* Burks, **sp. n.**, *B. hesperia* Burks, **sp. n.**, *B. intermedia* Burks, **sp. n.**, *B. magnirubra* Burks, **sp. n.**, *B. parvirubra* Burks, **sp. n.**, *B. pinnula* Burks, **sp. n.**, *B. plana* Burks, **sp. n.**, *B. propodealis* Burks, **sp. n.**, *B. sculptifrons* Burks, **sp. n.**, *B. sparsa* Burks, **sp. n.**, *B. tricolorata* Burks, **sp. n.**, and *B. tridentata* Burks, **sp. n.** The genus is found continent-wide but mostly south of the Tropic of Capricorn, and with the highest species diversity occurring in the Pilbara and south-western regions of Western Australia. The hosts of *Bracalba* are unknown but specimens reared from eggs confirm that the genus is associated with orthopteran hosts. A preliminary phylogeny of species did not indicate that species groups were monophyletic, but they are retained despite paraphyly because they are convenient for specimen identification.

## Keywords

Platygastroidea, Platygastridae s.l., Scelionidae, *Bracalba*, Scelioninae, key, revision, database, endemism, parasitoid

## Introduction

The Platygastroidea are a highly diverse component of the Australian parasitoid wasp fauna with 666 described species in 80 genera (ABRS 2012). However, like most parasitoid families, the real species richness of the group is very much larger than this. The scope of this disparity was recently indicated in a revision of *Idris* (*Ceratobaeus*) (Iqbal and Austin 2000) that resulted in an initial four-fold increase in species to 130+ taxa, and this increase appears to generally hold true for revisions of other platygastroid genera.

The first Australian scelionids were described by Walker (1839) from material collected by Charles Darwin along the east coast of the continent. However, the majority of Australian species (63%) were described by A.P. Dodd between 1913 and 1939 and, testament to his taxonomic abilities, virtually all of his species remain valid, although many have been transferred to other genera (Johnson 1992; ABRS 2012). Other than the taxonomic treatment of a number of small genera by various authors, the most influential post-Dodd studies on the Australian fauna have been the revision of the telenomine genera *Psix* (Johnson and Masner 1985) and *Trissolcus* (Johnson 1991), the spider-associated genera *Baeus* (Stevens and Austin 2007), *Idris* (*Ceratobaeus*) (Iqbal and Austin 2000) and *Mirobaeoides* (Austin 1986), the acridid egg parasitoid genus *Scelio* (Dangerfield et al. 2001), and the generic overview provided by Galloway and Austin (1984). Platygastrids are mostly endoparasitoids of insect and spider eggs, including all taxa previously accommodated in the family Scelionidae, while many platygastroids (*s.str.*) oviposit either in the egg or early larva of gall midges (Cecidomyiidae) and complete their development in the larvae (Austin and Field 1997; Austin et al. 2005).

The current study focuses on one of the few genera, *Bracalba* Dodd, that is endemic to the Australian continent. Among other characters, the genus is recognised by its stout, sculptured body, obviously setose eyes, face with pronounced frontal depression, and very long fore wing postmarginal vein (R1). Previously known from only three species, two from south-eastern Queensland and one from south-western Western Australia, this revision treats 16 species in total. In addition, we document the distribution of all species, present a key to their identification, and undertake a preliminary analysis of species-level relationships.

The contributions of the individual authors are as follows; R.A. Burks: character definition, species concept development; key development, imaging, capture of specimen data, manuscript preparation, phylogenetic analysis and illustration; L. Masner: specimen acquisition, and generic overview; N.F. Johnson: generic concept development and manuscript preparation ; A.D. Austin: initial species concept development, manuscript preparation, and taxonomic overview.

## Materials and methods

Specimens examined were provided by the following collections: The American Entomological Institute, Gainesville, Florida, USA (AEIC)<sup>1</sup>; Australian Museum, Sydney, Australia (AMSA)<sup>2</sup>; Australian National Insect Collection, Canberra, Australia (ANIC)<sup>3</sup>; The Natural History Museum, London, United Kingdom (BMNH)<sup>4</sup>; Canadian National Collection of Insects, Arachnids and Nematodes, Ottawa, Canada (CNCI)<sup>5</sup>; Museum of Victoria, Entomology, Melbourne, Australia (MVMA)<sup>6</sup>; Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA (MCZC)<sup>7</sup>; C.A. Triplehorn Insect Collection, Ohio State University, Columbus, Ohio (OSUC)<sup>8</sup>; Queensland Primary Industries and Fisheries Insect Collection, Indooroopilly, Australia (QDPC)<sup>9</sup>; Queensland Museum, Brisbane, Australia (QMBA)<sup>10</sup>; R.M. Bohart Museum, University of California, Davis, USA (UCDC)<sup>12</sup>; Western Australian Museum, Perth, Australia (WAMP)<sup>13</sup>; Waite Insect and Nematode Collection, Adelaide, Australia (WINC)<sup>14</sup>. South Australian and Northern Territory holotypes for species newly described in this manuscript are deposited in the South Australian Museum, Adelaide, Australia (SAMA)<sup>11</sup>.

This revision is a product of the Platygastroidea Planetary Biodiversity Inventory, funded by the U.S. National Science Foundation (N.F. Johnson, Ohio State University; A.D. Austin, University of Adelaide; Principal Investigators). One objective of this project is to use biodiversity informatics resources to accelerate taxonomic processes, making real-time collaboration possible within a community of researchers. Data associated with specimens examined in this study can be accessed at [hol.osu.edu](http://hol.osu.edu) and by entering the unique specimen identifier (e.g. OSUC 238448) in the search form. Morphological terminology follows Mikó et al. (2007), except for: 1) antennal features discussed by Bin (1981), 2) anteclypeus and postclypeus used sensu Dangerfield et al. (2001), 3) dorsal epomial carina and vertical epomial carina, which are mentioned by Masner and Johnson (2007) and defined by Talamas et al. (2011), 4) a newly coined “metasomal bend,” which is a ventrad bend occurring near the midlength of the 4th metasomal segment, and 5) ovipositor features described by Austin and Field (1997). Surface sculptural terms are used in part based on Eady (1968), with general terms added for descriptive purposes: “mesh” to define a polygonal, ovate or circular area enclosed by raised or sunken borders; “septa” to define distinctive borders that enclose meshes; and “interspaces” to define areas separating individual sculptural features. Note that sculptural septa can be differentiated, as in the longitudinal septa being much stronger than the transverse septa. They are also repeated corresponding to the number of sculptural meshes present. The aforementioned terminology is used instead of calling all raised sculpture “carinae,” which would remove all recognizable meaning from the word. Instead, “carina” is used for a raised sculptural element that does not correspond to repeated enclosed meshes. Life science identifiers (LSIDs) can be resolved at <http://lsid.tdwg.org> (i.e. [urn:lsid:zoobank.org:act:E5095F58-4603-4796-9D22-03A759B7B29](http://urn:lsid:zoobank.org:act:E5095F58-4603-4796-9D22-03A759B7B29)).

**Illustration and data citations.** Photographs were taken using a Visionary Digital BK+ Imaging System, November 2010 model, with either a K2 Long Distance Microscope or a 65 mm varifocal lens. Source photos were stacked using Zerene Stacker version 1.04 and enhanced using Adobe Photoshop CS5.

**Phylogenetic analysis.** An exact search using implicit enumeration (branch-and-bound) was performed using TNT (Tree analysis using New Technology) version 1.1 (Goloboff et al. 2003, 2008). Bootstrapping was performed with 1,000 replicates using New Technology searches at an initial level of 95. The outgroup specimens coded in this analysis were from an undescribed species of *Chromoteleia* Ashmead from Belize, (OSUC 064028, OSUC 064021), chosen because of the overall morphological similarity between *Chromoteleia* and *Bracalba*. A total of 42 characters were used, of which 38 were parsimony informative (see Appendix II for characters and matrix).

## Taxonomy

### *Bracalba* Dodd

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<http://species-id.net/wiki/Bracalba>

*Bracalba* Dodd 1931: 78 (original description. Type: *Bracalba laminata* Dodd, by original designation); Muesebeck and Walkley 1956: 336 (citation of type species); Masner 1976: 22, 23 (description, key to separate *Baryconus* Förster, *Bracalba* Dodd, *Chromoteleia* Ashmead, *Oxyscelio* Kieffer); Galloway and Austin 1984: 8, 13 (diagnosis, list of species described from Australia, keyed); Johnson 1992: 354 (catalog of world species); Austin and Field 1997: 18, 68 (structure of ovipositor system, discussion of phylogenetic relationships, genus misplaced in Baryconini).

**Diagnosis.** Eye setose; frontal depression present; antenna 12-segmented; netrion present; postmarginal vein of fore wing present, longer than marginal and stigmal veins; mesotibia and metatibia each with 1 spur; metascutellum setose dorsally and ventrally; ovipositor *Scelio*-type.

**Description.** Body length: 2.75–6.88 mm (n=78).

**Head.** Head shape in dorsal view: transverse. Hyperoccipital carina: absent. Occipital carina: present laterally, broadly interrupted medially; present, complete medially. Occipital carina sculpture: crenulate. OOL: lateral ocellus nearly contiguous with inner orbits, OOL < 0.5 OD. Upper frons: convex, without frontal shelf. Scrobe shape: frons with shallow unmarginated depression above antennal foramina. Frons sculpture: areolate rugose, transversely striate within scrobe; areolate rugose,

scrobe sparsely punctate. Submedian carina: absent. Orbital carina: absent. Inner orbits: diverging ventrally. IOS/EH: IOS slightly less than EH. Interantennal process: triangular in lateral view, well-developed. Central keel: absent. Antennal foramen opening: nearly anteriorly. Lower frons striae: absent. Malar sulcus: present. Compound eye size: of normal proportions, not significantly reduced. Compound eye setation: densely setose; sparsely setose. Gena: narrow, weakly convex, receding behind posterior orbit. Clypeus shape: transversely rectangular. Apical margin of clypeus: rounded; with a small median point. Anteclypeus: absent. Postclypeus: absent. Labrum: not visible. Mandible shape: moderate. Mandibular teeth: apex with 2, acute, subequal teeth; apex tridentate, teeth acute, middle tooth distinctly shortest. Arrangement of mandibular teeth: transverse. Number of maxillary palpomeres: 4. Shape of maxillary palpomeres: cylindrical. Number of labial palpomeres: 2.

**Antenna.** Number of antennomeres in female: 12. Number of antennomeres in male: 12. Insertion of radicle into A1: parallel to longitudinal axis of A1. Shape of A1: more or less cylindrical, not flattened. Length of A3 of female: distinctly longer than A2. Number of clavomeres in female antenna: 8. Claval formula of female antenna: A12-A7/1-2-2-2-2-2; A12-A6/1-2-2-2-2-2-2; A12-A6/1-2-2-2-2-2-1. Arrangement of doubled multiporous plate sensilla on female clava: in longitudinal pairs. Tyloid distribution on male antenna: A5 only. Shape of male flagellum: filiform.

**Mesosoma.** Mesosoma shape in dorsal view: longer than wide. Mesosoma shape in lateral view: longer than high. Medial portion of transverse pronotal carina: absent. Posterior apex of pronotum in dorsal view: straight, bifid apically to articulate with tegula. Vertical epomial carina: absent. Dorsal epomial carina (lateral portion of transverse pronotal carina of Vilhelmsen et al. (2010)): absent. Central pronotal area: vertical, not visible in dorsal view. Lateral face of pronotum: weakly concave below position of dorsal epomial carina. Netrion: present. Netrion shape: moderately wide, closed ventrally. Anterior portion of mesoscutum: vertical, flexed ventrally to meet pronotum. Mesoscutum shape: pentagonal in outline, posterolateral corner rounded. Skaphion: absent. Notauli: present, percurrent. Parapsidal lines: absent. Admedial lines: absent. Transscutal articulation: well-developed, crenulate. Shape of mesoscutellum: quadrate to trapezoidal. Armature of mesoscutellum: absent. Surface of mesoscutellum: convex throughout. Median longitudinal furrow on mesoscutellum: absent; present. Shape of axillula: small, dorsal margin sinuate. Metascutellum in dorsal view: clearly differentiated. Metascutellar armature: produced into flattened plate. Metascutellar setation: setose dorsally and ventrally. Metapostnotum: not defined externally. Extent of metasomal depression of propodeum: percurrent, extending anteriorly to anterior margin of propodeum. Lateral propodeal projection: well-developed, extending clearly beyond anterior margin of T1. Mesopleural carina: absent or strongly abbreviated, present only near mid coxa. Mesal course of acetabular carina: projecting anteriorly, but too short to intercede between fore coxae. Mesopleural pit: absent. Sternaulus: absent. Posterodorsal corner of mesopleuron: rounded anteriorly.

**Legs.** Number of mid tibial spurs: 1. Number of hind tibial spurs: 1. Dorsal surface of hind coxa: smooth. Hind tibia shape: cylindrical, ecarinate. Trochantellus: indicated by transverse sulcus on femur.

**Wings.** Wing development of female: macropterous. Wing development of male: macropterous. Tubular veins in fore wing: present. Bulla of fore wing R: absent. Extent of marginal venation of fore wing: distinct marginal or postmarginal veins developed. Origin of r-rs in fore wing: arising at junction of R/R1 with costal margin. Development of basal vein (Rs+M) in fore wing: nebulous, weakly pigmented. Development of R in hind wing: elongate, extending to costal margin.

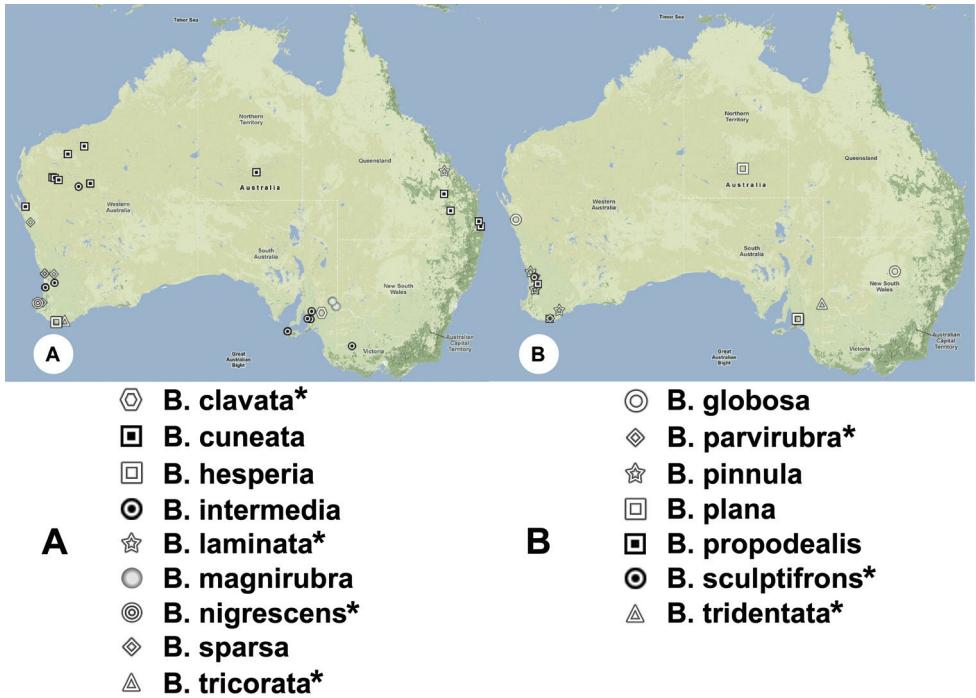
**Metasoma.** Number of external terga in female: 6. Number of external sterna in female: 6. Number of external terga in male: 8. Number of external sterna in male: 7. Shape of metasoma: acuminate, widest submedially. Laterotergites: present, narrow. Laterosternites: present. T1 of female: raised medially into low, rectangular or subelliptical platform, laterally depressed. Relative size of metasomal terga: T2–T4 largest, subequal in size. Terga with basal crenulae: T1–T4. Sublateral carinae on terga: absent. Median longitudinal carina on metasomal terga: absent; present. Distribution of felt fields: absent. Ovipositor type: Scelio-type (Austin and Field 1997).

**Etymology.** Dodd did not specify the source of the name for this genus, but presumably it is derived the name of the Queensland town of Bracalba. (Dodd also used the names of Merriwa, NSW and Nyleta, QLD for other genera.) He originally combined this name with two species epithets of variable gender, both coined in feminine form: *Bracalba cuneata* and *Bracalba laminata*, clearly indicating that he intended *Bracalba* to be a feminine noun.

**Distribution.** *Bracalba* has been collected only from Australia (Fig. 1), and has seldom been collected north of the Tropic of Capricorn. The furthest north that any *Bracalba* has been collected was at 24°39'S, and only two species have been found north of Alice Springs, NT. Location records show that the highest species diversity occurs in the Pilbara and south-western regions of Western Australia.

**Biology.** The hosts of *Bracalba* are unknown but the structure of the ovipositor (*Scelio*-type; Austin and Field 1997) and specimens reared from eggs confirm that the genus is associated with orthopteran hosts. These eggs could not be identified beyond the ordinal level.

**Relationships among species.** The implicit enumeration search found two optimum trees of 166 steps (strict consensus: Fig. 2). *Bracalba* was monophyletic with respect to the *Chromoteleia* outgroup (bootstrap = 100). Intuitively-based species groups were not monophyletic in the analysis, but this was likely due to homoplasy resulting from inclusion of many sculptural and coloration characters that have mainly descriptive value. Species with a bend at metasomal segment 4 in females did not form a monophyletic group, but this was complicated by the smooth transition in this character from being distinctively present to clearly absent. One feature that was helpful in determining species group, but which was not reported in the key because it was too difficult to accurately and consistently assess, was the lateral margin of the dorsal axillar area. In the *cuneata*-group, the dorsal axillar area was essentially triangular, broadening posteriorly,



**Figure 1.** Collection events for each *Bracalba* species. \* = species known from only one locality.

with the lateral margin sometimes forming a posterior tooth. In the *laminata*-group the dorsal axillar area was generally more nearly semicircular, broadest at midlength, and with the lateral margin not forming a posterior tooth. Apparent variation, and difficulty in observing this character with confidence, caused us to omit it from the key.

**Key to species of *Bracalba***

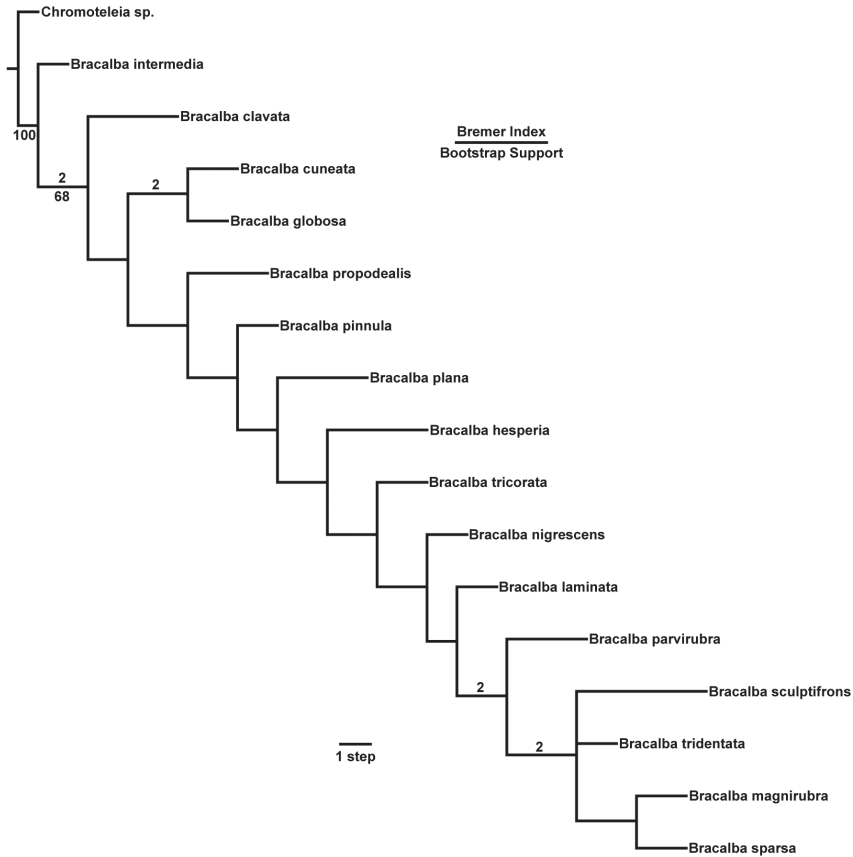
**Note:** It is imperative to consult figures when using the below key, as shape features of the metascutellum and metasoma are very important in identifying *Bracalba* species with any hope of accuracy.

- 1 Mandibles bidentate with no hint of a third tooth (Fig. 11), teeth narrowly separated and of nearly the same length. Females: T4 without bend or hump (Figs 4, 7); fore wings extending to middle of T5 or beyond when folded over body ..... **2 (*cuneata*-group)**
- Mandibles either tridentate with a small middle tooth (Fig. 40) or very rarely bidentate, but with teeth broadly separated and/or dorsal tooth much longer than ventral tooth (Figs 52, 58). Females: T4 with or without bend or hump (bend: Fig. 33, hump: Fig. 56); fore wings extending only to middle or apex of T4 when folded over body ..... **4 (*laminata*-group)**

- 2 Metascutellum flat (Figs 12–13), not projecting dorsally. Male: A3 short: 1.1–1.2× as long as broad (Fig. 13)..... ***Bracalba plana* Burks, sp. n.**
- Metascutellum projecting dorsally (Figs 4, 7). Male: A3 over 1.5× as long as broad..... **3**
- 3 Mesoscutellum sparsely foveolate, with smooth interspaces (Fig. 8). Mesoscutum smoothly and regularly convex anteriorly and posteriorly (Figs 7–8)..  
.....***Bracalba globosa* Burks, sp. n.**
- Mesoscutellum densely foveolate, interspaces with irregular longitudinal rugae (Fig. 3). Mesoscutum abruptly convex only anteriorly, flattened or irregularly convex posteriorly (Figs 3–4).....***Bracalba cuneata* Dodd**
- 4 Propodeum with sharp protrusions (from lateral propodeal area) protruding dorsally immediately posterior to metascutellum, reaching at least the same height as the dorsal surface of metascutellum (Figs 47–48). Males unknown  
.....***Bracalba propodealis* Burks, sp. n.**
- Propodeum without such protrusions..... **5**
- 5 Metascutellum strongly narrowed apically (Figs 28, 32, 36, 40, 55), tapering to an incised or narrowly truncate apex that is narrower than the maximum metascutellar length; metasomal bend or hump present in females (Figs 33, 56)..... **6**
- Metascutellum with apex broadly truncate, as broad or broader than total metascutellar length (Figs 14, 19, 24, 43, 47, 60); metasomal bend present or absent in females..... **10**
- 6 Mesosoma truncate anteriorly (Figs 28, 32), with antero-lateral pronotal corners protruding anteriorly. Metascutellum incised apically..... **7**
- Mesosoma smoothly rounded anteriorly (Fig. 36), with antero-lateral pronotal corners much weaker, more rounded, and not protruding anteriorly. Metascutellar apex variable ..... **8**
- 7 Mesoscutellum without median carina (Fig. 32). Females with a mostly reddish metasoma and very large body (at least 6.5 mm long).....  
.....***Bracalba magnirubra* Burks, sp. n.**
- Mesoscutellum with median carina (Fig. 28). Color of metasoma in females unknown. Female body length 4.25 mm [using Dodd’s (1930) description, which is probably an underestimate].....***Bracalba laminata* Dodd**
- 8 Antennal scrobes crossed by transverse carinae that meet at torular triangle (Fig. 38). Females unknown .....***Bracalba nigrescens* (Dodd)**
- Antennal scrobes foveolate or smooth. Females with hump near midlength T4 (Figs 41, 56)..... **9**
- 9 Antennal scrobes smooth and distinct. Clypeus with blunt median carina (Fig. 42). Female: S6 without apical incision (Fig. 42); T5, S5 with many strong longitudinal carinae (Figs 40, 42).....***Bracalba parvirubra* Burks, sp. n.**
- Antennal scrobes foveolate and indistinct (Fig. 57). Clypeus without median carina (Fig. 58). Female: S6 with strong apical incision (Fig. 59); T5, S5 with at most a median carina (Figs 55, 59) ..... ***Bracalba sparsa* Burks, sp. n.**



- 10 Frontal depression with strong longitudinal carina that is crossed by a strong transverse carina dorsally. Clypeus with median carina and transverse dorsal carina (Fig. 53). Metascutellum broadly trapezoidal (Fig. 51). Females: metasoma reddish, T5 and S5 with many longitudinal carinae, S6 without apical notch (Fig. 54).....***Bracalba sculptifrons* Burks, sp. n.**
- Frontal depression without such a set of carinae. Clypeus with weaker or no carinae (Figs 20, 45, 64). Metascutellum variable (Figs 19, 62). Females: metasoma brown to black, T5, S5, and S6 variable.....**11**
- 11 Metascutellum elongate-trapezoidal with concave lateral margins (Fig. 62). Female: S6 with strong apical notch (Fig. 65); T5, S5 with distinct longitudinal carinae (Figs 62, 65). Males unknown.....***Bracalba tridentata* Burks, sp. n.**
- Metascutellum broadly trapezoidal with straight lateral margins (Figs 19, 43, 60), or subrectangular to weakly convex with irregular lateral margins (Figs 14, 24). Female: S6 without apical notch (Figs 17, 23, 46); T5, S5 variable.....**12**
- 12 Mesoscutellum with a set of incomplete median longitudinal grooves (Fig. 19). Middle mandibular tooth almost as long as the other two (Fig. 20). Clypeus with weak median carina. Female: S5 with longitudinal carinae (Fig. 23). Males unknown.....***Bracalba hesperia* Burks, sp. n.**
- Mesoscutellum without median grooves (Fig. 43). Middle mandibular tooth tiny, much smaller than the other two (Figs 16, 26, 45). Clypeus without median carina. Female: S5 with or without carinae.....**13**
- 13 Mesoscutellum sparsely foveolate, with broad interspaces (Fig. 60). Female: S5 with longitudinal carinae (Fig. 61).....***Bracalba tricolorata* Burks, sp. n.**
- Mesoscutellum densely foveolate (interspaces very narrow) except sometimes a small smooth antero-median area (Figs 14, 24, 43). Female: S5 finely foveolate, without longitudinal carinae (Figs 17, 46).....**14**
- 14 Metascutellum trapezoidal in dorsal view, with straight lateral margins (Fig. 43). Female: Antenna with seven apical segments bearing large ventral sensilla, forming a more or less distinct 7-segmented club that includes A6 .....***Bracalba pinnula* Burks, sp. n.**
- Metascutellum in dorsal view irregularly subrectangular or cushion-like, with irregular margins (Figs 14, 24). Female: Antenna with large ventral sensilla on only the six apical segments, these expanded into a 6-segmented club that is distinct from A6 (Figs 14–15) .....**15**
- 15 Mesoscutellum with fine wrinkles or carinae in interspaces between foveolae (Fig. 14). Female: T6 broader than long (Fig. 14) .....***Bracalba clavata* Burks, sp. n.**
- Mesoscutellum with smooth interspaces between foveolae (Fig. 24); occasionally smaller foveolae may be present in the interspaces, or the interspaces themselves could be raised to form large wrinkles. Female: T6 longer than broad (Fig. 24).....***Bracalba intermedia* Burks, sp. n.**



**Figure 2.** Strict consensus phylogram of two most parsimonious trees for species of *Bracalba* using implicit enumeration (branch-and-bound exact search), score = 166. Bootstrap support values found using TNT new technology search (set initial level = 95). Bremer support values above 1, and bootstrap values about 50% indicated on branches.

### *Bracalba cuneata* Species Group

#### *Bracalba cuneata* Dodd

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urn:lsid:biosci.ohio-state.edu:osuc\_concepts:4126

[http://species-id.net/wiki/Bracalba\\_cuneata](http://species-id.net/wiki/Bracalba_cuneata)

Figures 3–6; Morphbank<sup>15</sup>

*Bracalba cuneata* Dodd 1931: 80 (original description); Galloway 1976: 87 (type information); Galloway and Austin 1984: 99 (figure of antenna); Johnson 1992: 354 (catalogued).

**Description.** *Female.* Body length 3.25–4.00 mm (n=29). Color of antenna beyond radicle: yellowish-brown. Radicle color: same as scape. Number of claval segments with ventral gustatory sensilla: 7. Number of ventral gustatory sensilla on A6: 2.



**Figures 3–6.** *Bracalba cuneata* Dodd, holotype female (QMBA HY4733). **3** Dorsal habitus **4** Lateral habitus, female (OSUC 238135) **5** Head, anterior view **6** Metasomal sterna 5–6, ventral view. Morphbank<sup>15</sup>

Ocular setae: short and dense. Frontal depression: smooth dorsally, ventrally with longitudinal carina and with additional carinae arising from medial margins of antennal foramina. Smooth depression extending dorsolaterally from antennal foramen: present. Dorsal clypeal margin: but without other sculpture. Clypeal median carina: absent. Ventral clypeal margin: with a small median point. Mandibular teeth: two, separated by narrow incision. Smooth area obliquely posterior to lateral ocellus: present. Genal sculpture: reticulate-rugose with strong dorsoventral carinae. Mandibular color: dark basally and at teeth, becoming lighter reddish brown between these areas.

Dorsal pronotal area: not set off by carina ventrally. Anterolateral corner of dorsal pronotal area: truncate anteriorly. Sculpture of posteromedian area of mesoscutum: foveolate with broad longitudinal septa. Lateral margin of dorsal axillar area: triangularly expanded or with posterior tooth, broadest posteriorly. Mesoscutellar sculpture: densely foveolate. Metascutellum in dorsal view: trapezoidal with broad apex. Dorsal surface of metascutellum: apex protruding dorsally. Femoral depression: crossed by rounded carinae. Anterior corner of lateral propodeal carina: flat, without tooth. Posteromedial corner of lateral propodeal area: protruding posteriorly. Leg color: yellowish-brown except for dorsal external part of coxae and sometimes tarsomeres 2-5.

Metasoma color: black to dark reddish brown. Median lobe of T1: with 7 or more longitudinal carinae, or with median smooth area interrupting carinae. Metasoma at middle of T4: without bend. T5 median carina: absent. Longitudinal sculptural septa

on T5: weak, blunt and hardly raised. Transverse sculptural septa on T5: about as strong as the longitudinal septa. T5 setae: directed posteriorly, arising from anterior edge of sculptural mesh. T6: as broad or broader than long. T6 laterotergite: overlapping S6. S4 median carina: absent. Transverse sculptural septa on S5: weak or absent, much weaker than the longitudinal septa. S5 setae: directed posteriorly, arising from anterior edge of sculptural mesh. Lateral carinae of S6: absent. Apex of S6: without notch.

*Male.* Body length 3.12–3.80 mm (n=15). Flagellomere length: A3 over 1.5× as long as broad, most others as long or longer than broad. T7: flat and posteriorly truncate.

**Diagnosis.** *Female.* A6 with 2 large ventral sensilla; 2 mandibular teeth; antero-lateral corner of dorsal pronotal area truncate anteriorly; metascutellum trapezoidal in dorsal view, with a broad apex, protruding dorsally; metasomal bend absent; T4–T6 without median carina, S4–S6 without median carina; T6 broader than long; S6 without apical notch.

**Link to distribution map.** <http://hol.osu.edu/map-full.html?id=4126>

**Associations.** Collected near flowering *Scaevola spinescens* R. Br.: [Asterales: Goodeniaceae]

**Material examined.** Holotype, female: AUSTRALIA: QLD, Chinchilla, 8.II.1928, A. P. Dodd, QMBA HY4733 (deposited in QMBA). Paratypes: AUSTRALIA: 2 females, OSUC 238448-238449 (ANIC). Other material: AUSTRALIA: 32 females, 20 males, OSUC 238516 (BMNH); OSUC 238120, 238123-238128, 238130-238153, 238159-238166, 238171-238173, 238176, 238180-238181, 238188, 238201-238202 (CNCI); OSUC 376915 (MCZC); OSUC 238451, QM Reg. No. T35161 (QDPC); OSUC 231779 (WINC).

**Comments.** *Bracalba cuneata* is the most commonly collected species of its genus. Our concept of this species includes some slight variation in metascutellar length and pronotal sculpture. This variation included many intermediates and did not correlate with other characters or with collection locality.

### ***Bracalba globosa* Burks, sp. n.**

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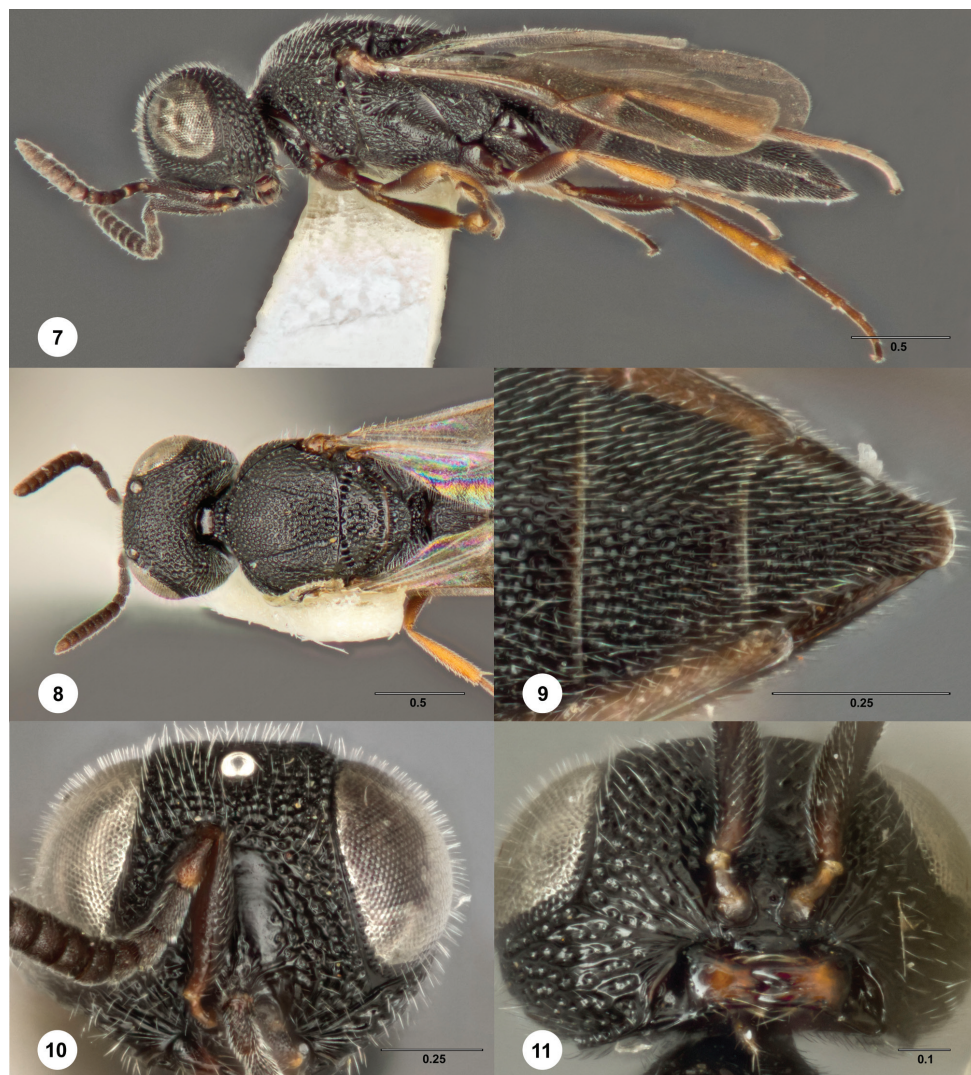
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[http://species-id.net/wiki/Bracalba\\_globosa](http://species-id.net/wiki/Bracalba_globosa)

Figures 7–11; Morphbank<sup>16</sup>

**Description.** *Female.* Body length 3.12–3.25 mm (n=2). Color of antenna beyond radicle: entirely dark. Radicle color: lighter than scape. Number of claval segments with ventral gustatory sensilla: 7. Number of ventral gustatory sensilla on A6: 2.

Ocular setae: short and dense. Frontal depression: smooth dorsally, torular triangle foveolate with 1 transverse carina extending laterally from inner margin of antennal foramen. Smooth depression extending dorsolaterally from antennal foramen: present. Dorsal clypeal margin: but without other sculpture. Clypeal median carina: absent. Ventral clypeal margin: with a small median point. Mandibular color: dark basally



**Figures 7–11.** *Bracalba globosa* sp. n., paratype female (OSUC 148612). **7** Lateral habitus **8** Head and mesosoma, dorsal view **9** Metasomal sternite 5–6, ventral view **11** Head, ventral view, holotype female (OSUC 148701) **10** Head, anterior view. Morphbank<sup>16</sup>

and at teeth, becoming lighter reddish brown between these areas. Mandibular teeth: two, separated by narrow incision. Smooth area obliquely posterior to lateral ocellus: present. Genal sculpture: reticulate-rugose without any strong carinae.

Dorsal pronotal area: not set off by carina ventrally. Anterolateral corner of dorsal pronotal area: weakly rounded anteriorly. Sculpture of posteromedian area of mesoscutum: foveolate with slightly stronger longitudinal septa. Lateral margin of dorsal axillar area: triangularly expanded or with posterior tooth, broadest posteriorly. Mesoscutellar sculpture: densely foveolate with slightly stronger longitudinal septa. Metas-

cutellum in dorsal view: trapezoidal with broad apex. Dorsal surface of metascutellum: apex protruding dorsally. Femoral depression: crossed by rounded carinae. Leg color: dark except for tibiae, 2nd trochanter, and tarsomeres 2–5. Anterior corner of lateral propodeal carina: flat, without tooth. Posteromedial corner of lateral propodeal area: protruding posteriorly.

Metasoma color: black to dark reddish brown. Median lobe of T1: with a set of rugae that merge with one another. Metasoma at middle of T4: without bend. Posterolateral margins of metasomal terga: without protrusions. T5 median carina: absent. Longitudinal sculptural septa on T5: weak, blunt and hardly raised. Transverse sculptural septa on T5: about as strong as the longitudinal septa. T5 setae: directed posteriorly, arising from anterior edge of sculptural mesh. T6: as broad or broader than long. T6 laterotergite: overlapping S6. S4 median carina: absent. Transverse sculptural septa on S5: weak or absent, much weaker than the longitudinal septa. S5 setae: directed posteriorly, arising from anterior edge of sculptural mesh. Lateral carinae of S6: absent. Apex of S6: without notch.

*Male.* Body length 2.88 mm (n=1). Flagellomere length: A3 over 1.5× as long as broad, most others as long or longer than broad. T7: flat and posteriorly truncate.

**Diagnosis.** *Female.* A6 with 2 large ventral sensilla; 2 mandibular teeth; anterolateral corner of dorsal pronotal area weakly rounded anteriorly; metascutellum trapezoidal with a broad apex, extending dorsally; metasomal bend absent; T4–T6 without median carina, S4–S6 without median carina; T6 broader than long; S6 without apical notch. *Bracalba globosa* is very similar to *B. cuneata*, but differs mainly in mesosomal shape and sculpture. The metascutellum also differs subtly between most specimens of the two species, being smaller in most *B. globosa*. *Bracalba plana* is also very similar to *B. globosa*, but has a very different mesosomal shape.

**Etymology.** Latin adjective, named after the convex mesoscutum of most specimens in this species.

**Link to distribution map.** <http://hol.osu.edu/map-full.html?id=302153>

**Material examined.** Holotype, female: AUSTRALIA: WA, Kalbarri National Park, 12.XII-19.XII.1986, malaise trap/pan trap, J. S. Noyes, OSUC 148701 (deposited in WAMP). Paratype: AUSTRALIA: 1 female, OSUC 148612 (CNCI).

***Bracalba plana* Burks, sp. n.**

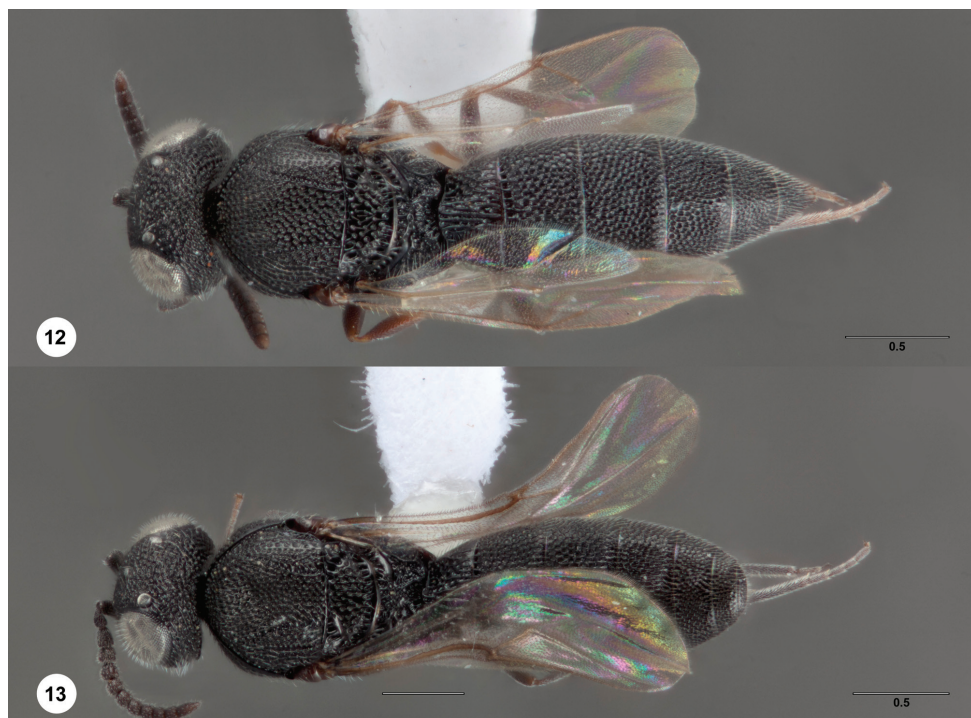
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urn:lsid:biosci.ohio-state.edu:osuc\_concepts:302159

[http://species-id.net/wiki/Bracalba\\_plana](http://species-id.net/wiki/Bracalba_plana)

Figures 12–13; Morphbank<sup>17</sup>

**Description.** *Female.* Body length 2.75–3.13 mm (n=3). Color of antenna beyond radicle: mostly dark, ventral parts of pedicel apex, A4–A12 variably lighter. Radicle color: lighter than scape. Number of claval segments with ventral gustatory sensilla: 7. Number of ventral gustatory sensilla on A6: 2.



**Figures 12–13.** *Bracalba plana* sp. n., holotype female (OSUC 230804). **12** Dorsal habitus, paratype male (OSUC 148706) **13** Dorsal habitus. Morphbank<sup>17</sup>

Ocular setae: short and dense. Frontal depression: with many irregularly transverse rugae. Smooth depression extending dorsolaterally from antennal foramen: present. Dorsal clypeal margin: absent between antennal foramina. Clypeal median carina: absent. Ventral clypeal margin: with a small median point. Mandibular color: dark basally and at teeth, becoming lighter reddish brown between these areas. Mandibular teeth: two, separated by narrow incision. Smooth area obliquely posterior to lateral ocellus: present. Genal sculpture: deeply reticulate-rugose with some septa much stronger than others, forming distinct rows differing in height.

Dorsal pronotal area: not set off by carina ventrally. Anterolateral corner of dorsal pronotal area: weakly rounded anteriorly. Sculpture of posteromedian area of mesoscutum: densely foveolate. Lateral margin of dorsal axillar area: triangularly expanded or with posterior tooth, broadest posteriorly. Mesoscutellar sculpture: sparsely foveolate, with large smooth interspaces. Metascutellum in dorsal view: semicircular. Dorsal surface of metascutellum: flat. Femoral depression: centrally smooth, peripherally foveolate. Leg color: coxae dark, leg becoming gradually lighter apically. Anterior corner of lateral propodeal carina: flat, without tooth. Posteromedial corner of lateral propodeal area: protruding posteriorly.

Metasoma color: black to dark reddish brown. Median lobe of T1: with 7 or more longitudinal carinae. Metasoma at middle of T4: without bend. Posterolateral margins of metasomal terga: without protrusions. T5 median carina: absent. Longitudinal sculp-

tural septa on T5: weak, blunt and hardly raised. Transverse sculptural septa on T5: about as strong as the longitudinal septa. T5 setae: directed posteriorly, arising from anterior edge of sculptural mesh. T6: as broad or broader than long. T6 laterotergite: overlapped by rim from S6. S4 median carina: absent. Transverse sculptural septa on S5: about as strong as the longitudinal septa. S5 setae: directed posteriorly, arising from anterior edge of sculptural mesh. Lateral carinae of S6: absent. Apex of S6: without notch.

*Males.* Body length 2.75–3.00 mm (n=2). Flagellomere length: A3 1–1.2× as long as broad, most others transverse. T7: flat and posteriorly truncate.

**Diagnosis.** *Female.* A6 with 2 large ventral sensilla; 2 mandibular teeth; anterolateral corner of dorsal pronotal area weakly rounded anteriorly; metascutellum trapezoidal with a broad apex, flat dorsally; metasomal bend absent; T4–T6 without median carina, S4–S6 without median carina; T6 broader than long; S6 without apical notch. This species is very similar to *B. globosa*, but differs mainly in having a shorter, more flat metascutellum and shorter flagellomeres in males.

**Etymology.** Latin adjective, referring to the flat mesoscutum, mesoscutellum, and metascutellum of most specimens of this species.

**Link to distribution map.** <http://hol.osu.edu/map-full.html?id=302159>

**Material examined.** Holotype, female: AUSTRALIA: NT, Centre for Zone Research (CSIRO), Alice Springs, XI-1992, malaise trap, Austin & Dangerfield, OSUC 230804 (deposited in SAMA). Paratypes: AUSTRALIA: 5 females, 3 males, OSUC 148706, 238115, 238168, 238170 (CNCI); OSUC 230802-230803, 230805-230806 (WINC).

**Comments.** Most specimens have a flat mesoscutum and mesoscutellum, but these features were not constant within this species nor in others of the genus.

### *Bracalba laminata* species group

#### *Bracalba clavata* Burks, sp. n.

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[http://species-id.net/wiki/Bracalba\\_clavata](http://species-id.net/wiki/Bracalba_clavata)

Figures 14–18; Morphbank<sup>18</sup>

**Description.** *Female.* Body length 3.25–3.38 mm (n=2). Color of antenna beyond radicle: mostly dark, ventral parts of pedicel apex, A4–A12 variably lighter. Radicle color: base lighter than scape. Number of claval segments with ventral gustatory sensilla: 6. Number of ventral gustatory sensilla on A6: 0.

Ocular setae: short and dense. Frontal depression: with many irregularly transverse rugae, or smooth dorsally, ventrally with oblique carinae converging on a longitudinal ruga. Smooth depression extending dorsolaterally from antennal foramen: present. Dorsal clypeal margin: forming a complete connection between antennal foramina medially. Clypeal median carina: absent. Ventral clypeal margin: with a small median point. Mandibular color: dark basally and at teeth, becoming lighter reddish brown





**Figures 14–18.** *Bracalba clavata* sp. n., holotype female (OSUC 384555). **14** Dorsal habitus **15** Lateral habitus, paratype female (OSUC 384558) **16** Head, ventral view, paratype female (OSUC 384559) **17** Metasomal sterna 5–6, ventral view, paratype male (OSUC 384556) **18** Dorsal habitus. Morphobank<sup>18</sup>

between these areas. Mandibular teeth: three, but middle tooth tiny. Smooth area obliquely posterior to lateral ocellus: present. Genal sculpture: deeply reticulate-rugose with some septa much stronger than others, forming distinct rows differing in height.

Dorsal pronotal area: not set off by carina ventrally. Anterolateral corner of dorsal pronotal area: weakly rounded anteriorly. Sculpture of posteromedian area of mesoscutum: foveolate with broad longitudinal septa. Lateral margin of dorsal axillar area: triangularly expanded or with posterior tooth, broadest posteriorly. Mesoscutellar sculpture: densely foveolate but with smooth central area. Metascutellum in dorsal

view: strongly transverse, subrectangular. Dorsal surface of metascutellum: flat, or convex. Femoral depression: centrally smooth, peripherally foveolate. Leg color: coxae, femora (aside from their apices), and at least the last two tarsomeres dark, otherwise yellowish brown. Anterior corner of lateral propodeal carina: flat, without tooth. Posteromedial corner of lateral propodeal area: not protruding posteriorly.

Metasoma color: black to dark reddish brown. Median lobe of T1: with 7 or more longitudinal carinae. Metasoma at middle of T4: with very weak bend. Posterolateral margins of metasomal terga: with tooth-like protrusions. T5 median carina: absent. Longitudinal sculptural septa on T5: strong, sharply raised. Transverse sculptural septa on T5: about as strong as the longitudinal septa. T5 setae: directed posteriorly, arising from anterior edge of sculptural mesh. T6: as broad or broader than long. T6 laterotergite: overlapping S6. S4 median carina: present. Transverse sculptural septa on S5: weak or absent, much weaker than the longitudinal septa. S5 setae: directed posteriorly, arising from anterior edge of sculptural mesh. Lateral carinae of S6: absent. Apex of S6: without notch.

*Male.* Body length 2.75–3.25 mm (n=5). Flagellomere length: A3 over 1.5× as long as broad, most others as long or longer than broad. T7: flat and posteriorly truncate.

**Diagnosis.** *Female.* A6 without large ventral sensilla, separate and much smaller than A7 (therefore only 6 distinct claval segments present); 3 mandibular teeth with the middle tooth much smaller than the others; metascutellum subrectangular and very short; metasomal bend present but very weak; sculpture posterior to metasomal bend with longitudinal and transverse septa of about equal strength and hardly different from those anterior to the bend; T4–T6 without longitudinal carina; S4–S6 with longitudinal carina; T6 about as long as broad; S6 without apical notch. This species is very similar to *B. pinnula* and to some species without a T4 bend. It differs in the unusual antenna, short metascutellum, and in its shorter wings that reach only to the middle of T4.

**Etymology.** Latin adjective meaning “clavate,” named for the clavate antenna with its distinct separation between the 6-segmented club and the basal flagellomeres.

**Link to distribution map.** <http://hol.osu.edu/map-full.html?id=302166>

**Material examined.** Holotype, female: AUSTRALIA: SA, Brookfield Conservation Park, 34°21'S, 139°29'E, 24.XI–26.XI.1992, yellow pan trap, I. Naumann & J. C. Cardale, OSUC 384555 (deposited in ANIC). Paratypes: AUSTRALIA: 2 females, 6 males, OSUC 230820, 367520, 384556, 384558–384559, 384564–384566 (ANIC).

***Bracalba hesperia* Burks, sp. n.**

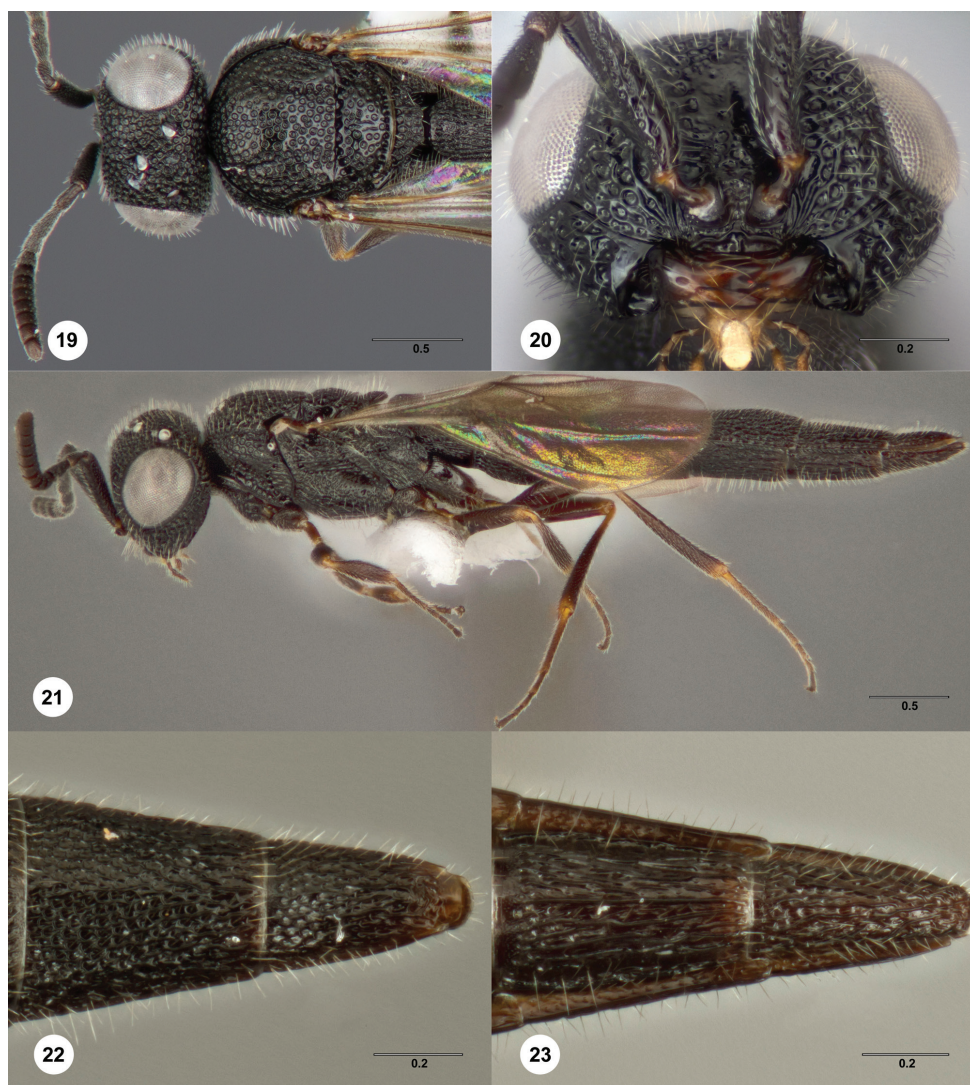
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[http://species-id.net/wiki/Bracalba\\_hesperia](http://species-id.net/wiki/Bracalba_hesperia)

Figures 19–23; Morphbank<sup>19</sup>

**Description.** *Female.* Body length 5.76–6.06 mm (n=2). Color of antenna beyond radicle: entirely dark. Radicle color: same as scape. Number of claval segments with ventral gustatory sensilla: 7. Number of ventral gustatory sensilla on A6: 1.



**Figures 19–23.** *Bracalba hesperia* sp. n., holotype female (OSUC 148713). **19** Head and mesosoma, dorsal view **20** Head, ventral view **21** Lateral habitus; **22** Metasomal terga 5–6, dorsal view **23** Metasomal sterna 5–6, ventral view. Morphbank<sup>19</sup>

Ocular setae: short and sparse. Frontal depression: smooth dorsally, torular triangle foveolate with transverse carinae lateral to this area. Smooth depression extending dorsolaterally from antennal foramen: present. Dorsal clypeal margin: wrinkle-like with a median peak. Clypeal median carina: present. Ventral clypeal margin: with a small median point. Mandibular color: dark basally and at teeth, becoming lighter reddish brown between these areas. Mandibular teeth: three of roughly equal size. Smooth area obliquely posterior to lateral ocellus: present. Genal sculpture: reticulate-rugose without any strong carinae.

Dorsal pronotal area: not set off by carina ventrally. Anterolateral corner of dorsal pronotal area: weakly rounded anteriorly. Sculpture of posteromedian area of mesoscutum: densely foveolate. Lateral margin of dorsal axillar area: with a semi-circular expansion, broadest near midlength. Mesoscutellar sculpture: densely foveolate with one or two median longitudinal channels. Metascutellum in dorsal view: trapezoidal with broad apex. Dorsal surface of metascutellum: convex. Femoral depression: centrally smooth, peripherally foveolate. Leg color: dark except for trochanters, tips of femora and tibiae, and tarsomeres 1–4. Anterior corner of lateral propodeal carina: flat, without tooth. Posteromedial corner of lateral propodeal area: protruding posteriorly.

Metasoma color: black to dark reddish brown. Median lobe of T1: with 7 or more longitudinal carinae. Metasoma at middle of T4: with metasomal bend and abrupt transition in sculpture. Posterolateral margins of metasomal terga: without protrusions. T5 median carina: absent. or present. Longitudinal sculptural septa on T5: weak, blunt and hardly raised. Transverse sculptural septa on T5: about as strong as the longitudinal septa. T5 setae: directed posteriorly, arising from anterior edge of sculptural mesh. T6: longer than broad. T6 laterotergite: overlapped by rim from S6. S4 median carina: absent. Transverse sculptural septa on S5: weak or absent, much weaker than the longitudinal septa. S5 setae: not directed posteriorly, arising from center of sculptural mesh. Lateral carinae of S6: absent. Apex of S6: without notch.

*Male.* unknown.

**Diagnosis.** *Female.* A6 with 1 large ventral sensillum; 3 mandibular teeth of approximately equal length; metascutellum broadly trapezoidal with a broad and slightly concave apex; metasomal bend present but weak; sculpture posterior to metasomal bend with transverse septa about as strong as the longitudinal septa; T4–T6 and S4–S6 without median carina; T6 longer than broad; S6 without apical notch. This species is similar to *B. tridentata*, but in that species S6 has a strong apical notch. It is also near *B. nigrescens*, but no complete female specimens of that species are known.

**Etymology.** Latin adjective, referring to the geographic distribution of this species.

**Link to distribution map.** <http://hol.osu.edu/map-full.html?id=302154>

**Material examined.** Holotype, female: AUSTRALIA: WA, 3km W Walpole, Keystone Road, 34°59.01'S, 116°40.76'E, no date, yellow pan trap, George, Hawks & Munro, OSUC 148713 (deposited in WAMP). Paratypes: AUSTRALIA: 2 females, OSUC 148702, 238154 (CNCI).

**Comments.** Some singleton specimens similar to *B. hesperia* have been examined but left undescribed, most collected from Western Australia. They all exhibit a stronger metasomal bend and stronger longitudinal sculpture posterior to the bend than in *B. hesperia*, but are variable in these and other characters. Together these specimens and *B. hesperia* may represent members of a species complex. Some specimens within this complex possess longitudinal median grooves on the mesoscutellum, but this character may be variable within species.

***Bracalba intermedia* Burks, sp. n.**

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[http://species-id.net/wiki/Bracalba\\_intermedia](http://species-id.net/wiki/Bracalba_intermedia)Figures 24–27; Morphbank<sup>20</sup>

**Description.** *Female.* Body length 3.25–3.88 mm (n=7). Color of antenna beyond radicle: entirely dark. Radicle color: lighter than scape. Number of claval segments with ventral gustatory sensilla: 6. Number of ventral gustatory sensilla on A6: 0.

Ocular setae: short and dense. Frontal depression: medially smooth, torular triangle sparsely foveolate, or foveolate dorsally, torular triangle foveolate, areas lateral to it with transverse carinae. Smooth depression extending dorsolaterally from antennal foramen: absent. Dorsal clypeal margin: bordering antennal foramina, absent between them. Clypeal median carina: absent. Ventral clypeal margin: convex. Mandibular color: dark basally and at teeth, becoming lighter reddish brown between these areas. Mandibular teeth: three, but middle tooth tiny. Smooth area obliquely posterior to lateral ocellus: present. Genal sculpture: reticulate-rugose without any strong carinae.

Dorsal pronotal area: not set off by carina ventrally. Anterolateral corner of dorsal pronotal area: weakly rounded anteriorly. Sculpture of posteromedian area of mesoscutum: foveolate with slightly stronger longitudinal septa. Lateral margin of dorsal axillar area: triangularly expanded or with posterior tooth, broadest posteriorly. Mesoscutellar sculpture: densely foveolate with slightly stronger longitudinal septa. Metascutellum in dorsal view: strongly transverse, subrectangular. Dorsal surface of metascutellum: flat. Femoral depression: centrally smooth, peripherally foveolate. Leg color: coxae, femora (aside from their apices), and at least the last two tarsomeres dark, otherwise yellowish brown. Anterior corner of lateral propodeal carina: flat, without tooth. Posteromedial corner of lateral propodeal area: protruding posteriorly.

Metasoma color: black to dark reddish brown. Median lobe of T1: with a set of rugae that merge with one another. Metasoma at middle of T4: without bend. Posterolateral margins of metasomal terga: without protrusions. T5 median carina: absent. Longitudinal sculptural septa on T5: weak, blunt and hardly raised. Transverse sculptural septa on T5: about as strong as the longitudinal septa. T5 setae: directed posteriorly, arising from anterior edge of sculptural mesh. T6: longer than broad. T6 laterotergite: overlapping S6. S4 median carina: present. Transverse sculptural septa on S5: weak or absent, much weaker than the longitudinal septa. S5 setae: directed posteriorly, arising from anterior edge of sculptural mesh. Lateral carinae of S6: absent. Apex of S6: without notch.

*Male.* Body length 2.62–3.25 mm (n=18). Flagellomere length: A3 over 1.5× as long as broad, most others as long or longer than broad. T7: flat and posteriorly truncate.

**Diagnosis.** *Female.* A6 without large ventral sensilla; 3 mandibular teeth with middle tooth much smaller than the others; metascutellum broad and subrectangular,



**Figures 24–27.** *Bracalba intermedia* sp. n., paratype female (OSUC 180713). **24** Dorsal habitus **25** Ventral habitus, paratype female (OSUC 148707) **26** Head, ventral view, paratype male (OSUC 227576) **27** Dorsal habitus. Morphbank<sup>20</sup>

very short; metasomal bend absent; T4–T6 without median carina, S4–S6 with at least a vague median carina; T6 longer than broad; S6 without apical notch. The antenna and short metascutellum help distinguish it from similar species. It is very similar to *B. pinnula*, but differs in having a much shorter metascutellum. It is also very similar to *B. clavata*, but has no distinct metasomal bend and has a longer T6 in females.

**Etymology.** Latin adjective, referring to its unusual mixture of characters.

**Link to distribution map.** <http://hol.osu.edu/map-full.html?id=302155>

**Material examined.** Holotype, female: AUSTRALIA: WA, via Dwellingup, Yarragil 4P Catchment, 18.II–25.II.1981, malaise trap, A. Postle, OSUC 230811 (deposited in QMBA). Paratypes: AUSTRALIA: 8 females, 23 males, OSUC 148705, 148707–148708, 180713, 238105–238109, 238111, 238179, 238182, 238184–238186 (CNCI); OSUC 230809–230810, 230812, 230814, 238450 (QDPC); OSUC 227572–227578, 230801, 238454, 238457, 384567 (WINC).

**Comments.** *Bracalba intermedia* lacks a metasomal bend, but the three mandibular teeth, elongate metasoma, and sculptural features suggest that it belongs in the *laminata* group. Specimens from the eastern localities tend to be slightly smaller and have some reduction in sculpture, but are retained in our concept of this species.

***Bracalba laminata* Dodd**

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[http://species-id.net/wiki/Bracalba\\_laminata](http://species-id.net/wiki/Bracalba_laminata)

Figures 28–31; Morphbank<sup>21</sup>

*Bracalba laminata* Dodd 1931: 78 (original description); Galloway 1976: 88 (type information); Johnson 1992: 354 (catalogued).

**Description.** *Female.* Number of claval segments with ventral gustatory sensilla: 7. Number of ventral gustatory sensilla on A6: 2.

*Male.* Body length = 3.38 mm (n=1). Flagellomere length: A3 over 1.5× as long as broad, most others as long or longer than broad. Ocular setae: long and dense. Frontal depression: densely foveolate. Smooth depression extending dorsolaterally from antennal foramen: present. Dorsal clypeal margin: absent between antennal foramina. Clypeal median carina: absent. Ventral clypeal margin: with a small median point. Mandibular teeth: three, but middle tooth tiny. Smooth area obliquely posterior to lateral ocellus: present. Genal sculpture: deeply reticulate-rugose with some septa much stronger than others, forming distinct rows differing in height. Mandibular color: dark basally and at teeth, becoming lighter reddish brown between these areas.

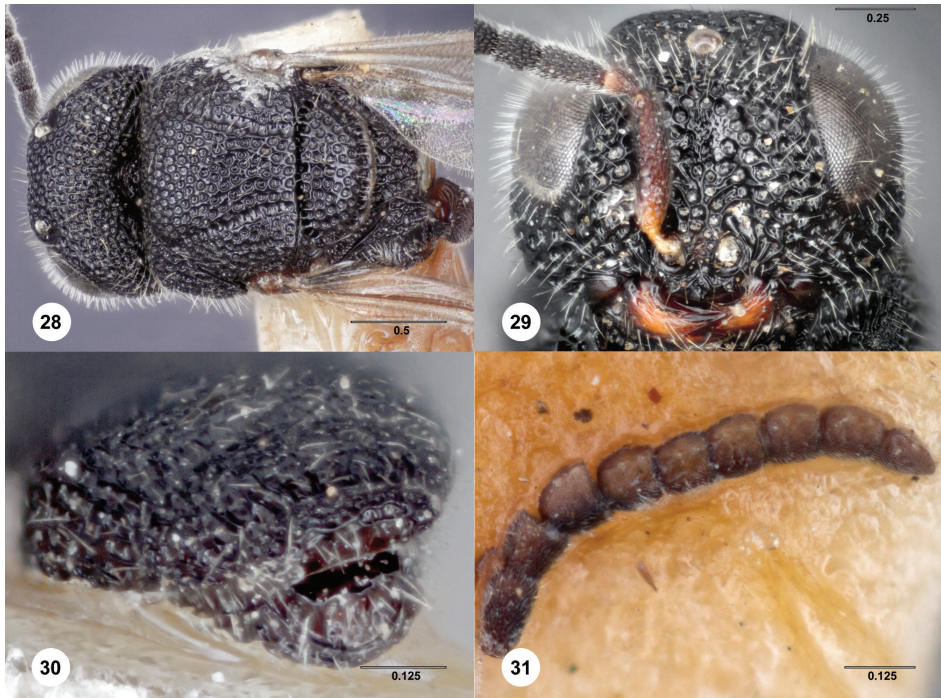
Dorsal pronotal area: not set off by carina ventrally. Anterolateral corner of dorsal pronotal area: truncate anteriorly. Sculpture of posteromedian area of mesoscutum: foveolate with slightly stronger longitudinal septa. Lateral margin of dorsal axillar area: with a semicircular expansion, broadest near midlength. Mesoscutellar sculpture: densely foveolate with a longitudinal carina. Metascutellum in dorsal view: elongate-trapezoidal but with incised apex. Dorsal surface of metascutellum: apex protruding dorsally. Femoral depression: crossed by rounded carinae. Anterior corner of lateral propodeal carina: flat, without tooth. Posteromedial corner of lateral propodeal area: protruding posteriorly. T7: arched and posteriorly concave.

**Diagnosis.** Males: Lateral margin of dorsal axillar area semicircularly expanded; mesosoma broadly truncate anteriorly; mesoscutellum with median carina; metascutellum elongate-trapezoidal with incised apex.

**Link to distribution map.** <http://hol.osu.edu/map-full.html?id=4127>

**Material Examined.** Holotype, female: AUSTRALIA: QLD, Gogango, 40mi W Rockhampton, III-1928, A. P. Dodd, QMBA HY4732H (deposited in QMBA). Allotype: AUSTRALIA: 1 male, QMBA HY4732A (QMBA). Other material: AUSTRALIA: 3 males, OSUC 365210-365212 (UQIC).

**Comments.** Only the antenna and a few legs of the female holotype of *B. laminata* remain. The syntopic allotype male strongly resembles the holotype of *B. nigrescens*, but differs in the presence of a partial median carina on the mesoscutellum, the anteriorly truncate mesosoma, and denser sculpturing on the thoracic dorsum. No other female specimens are known aside from the holotype. The allotype shares characteris-



**Figures 28–31.** *Bracalba laminata* Dodd, allotype male (QMBA HY4732A). **28** Head and mesosoma, dorsal view **29** Head, anterior view **30** Metasomal terga 6–8, posterior view, holotype female (QMBA HY4732H) **31** Antenna, ventral view. Morphbank<sup>21</sup>

tics with *B. hesperia*, *B. magnirubra*, and *B. tridentata*, but differs enough that it cannot definitively be associated with any of these species.

Because the antenna and some legs of the holotype remains, they now represent the holotype. A neotype cannot be properly designated without first requesting that the existing holotype be set aside. This was considered unnecessary, as the antenna clearly belongs to *Bracalba*, based on the number and arrangement of ventral sensilla. Therefore, there is no doubt that the holotype agrees with our concept of *Bracalba*. There is also no reason to conclude that the allotype male would be from a different species than the female, based on its morphology compared with Dodd's (1931) description of the now lost parts of the female's body.

***Bracalba magnirubra* Burks, sp. n.**

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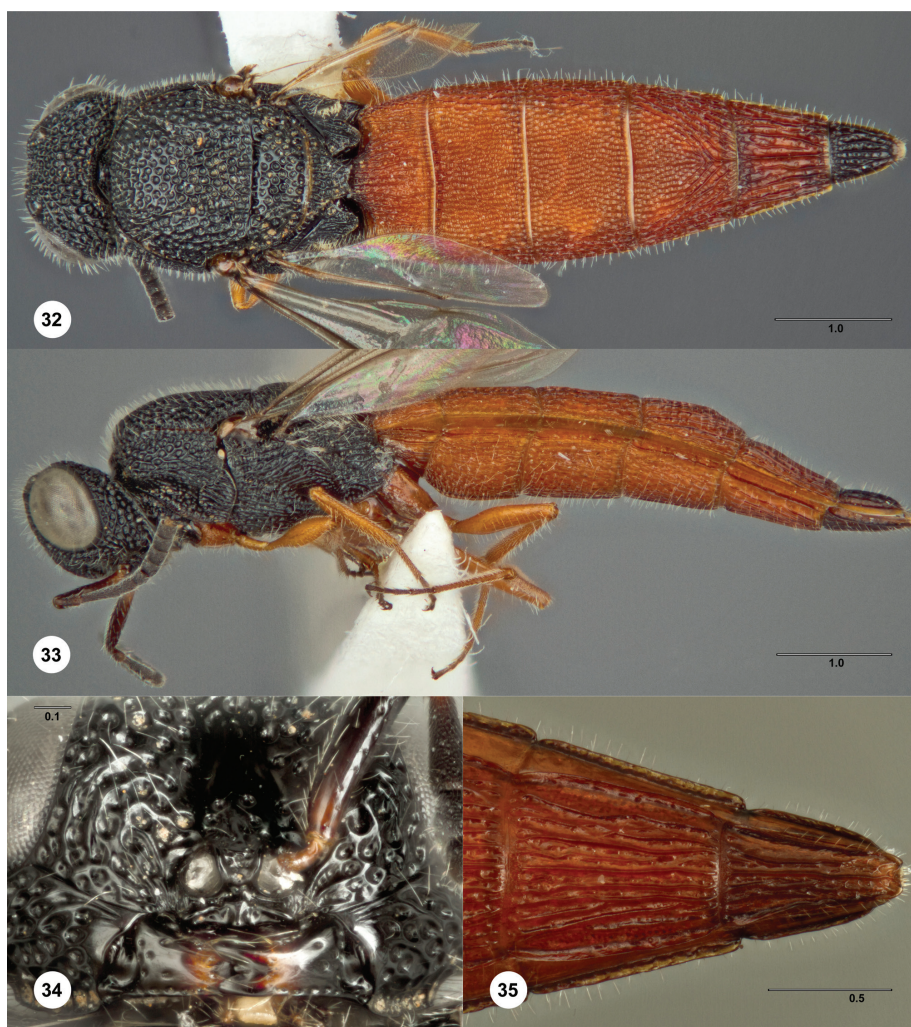
urn:lsid:biosci.ohio-state.edu:osuc\_concepts:302156

[http://species-id.net/wiki/Bracalba\\_magnirubra](http://species-id.net/wiki/Bracalba_magnirubra)

Figures 32–35; Morphbank<sup>22</sup>

**Description.** *Female.* Body length 6.50–6.88 mm (n=3). Color of antenna beyond radicle: mostly dark, extreme base of scape becoming reddish. Radicle color: lighter





**Figures 32–35.** *Bracalba magnirubra* sp. n., paratype female (OSUC 238178). **32** Dorsal habitus **34** Head, ventral view, holotype female (OSUC 148715) **33** Lateral habitus, paratype female (OSUC 238112) **35** Metasomal sterna 5–6, ventral view. Morphbank<sup>22</sup>

than scape. Number of claval segments with ventral gustatory sensilla: 7. Number of ventral gustatory sensilla on A6: 1.

Ocular setae: long and sparse. Frontal depression: medially smooth, torular triangle sparsely foveolate. Smooth depression extending dorsolaterally from antennal foramen: present. Dorsal clypeal margin: interrupted by a median areole below interantennal process. Clypeal median carina: present. Ventral clypeal margin: with a small median point. Mandibular color: dark basally and at teeth, becoming lighter reddish brown between these areas. Mandibular teeth: three, but middle tooth tiny. Smooth area obliquely posterior to lateral ocellus: present. Genal sculpture: reticulate-rugose without any strong carinae.

Dorsal pronotal area: not set off by carina ventrally. Anterolateral corner of dorsal pronotal area: protruding anteriorly. Sculpture of posteromedian area of mesoscutum: densely

foveolate. Lateral margin of dorsal axillar area: with a semicircular expansion, broadest near midlength. Mesoscutellar sculpture: densely foveolate. Metascutellum in dorsal view: elongate-trapezoidal but with incised apex. Dorsal surface of metascutellum: apex protruding dorsally, or convex. Femoral depression: crossed by rounded carinae. Leg color: reddish but with at least last two tarsomeres dark. Anterior corner of lateral propodeal carina: flat, without tooth. Posteromedial corner of lateral propodeal area: protruding posteriorly.

Metasoma color: reddish, with last segment variably dark. Median lobe of T1: with 7 or more longitudinal carinae. Metasoma at middle of T4: with metasomal bend and abrupt transition in sculpture. Posterolateral margins of metasomal terga: with tooth-like protrusions. T5 median carina: present. Longitudinal sculptural septa on T5: strong, sharply raised. Transverse sculptural septa on T5: weak or absent, much weaker than the longitudinal septa. T5 setae: not directed posteriorly, arising from center of sculptural mesh. T6: longer than broad. T6 laterotergite: overlapping S6. S4 median carina: present. Transverse sculptural septa on S5: weak or absent, much weaker than the longitudinal septa. S5 setae: not directed posteriorly, arising from center of sculptural mesh. Lateral carinae of S6: not meeting apically. Apex of S6: with notch.

*Male.* Body length 4.75–5.00 mm (n=5). Flagellomere length: A3 over 1.5× as long as broad, most others as long or longer than broad. T7: arched and posteriorly concave.

**Diagnosis.** *Female.* A6 with 1 large ventral sensillum; 3 mandibular teeth with middle tooth smaller than the others; metascutellum trapezoidal and relatively long, with a truncate or slightly incised apex; metasomal bend present; sculpture posterior to metasomal bend with strong longitudinal septa but without transverse septa; T4–T6 and S4–S6 with median carina; T6 longer than broad; S6 with apical notch.

**Etymology.** Compound adjective using the Latin adjectives *magnus* and *ruber*.

**Link to distribution map.** <http://hol.osu.edu/map-full.html?id=302156>

**Material examined.** Holotype, female: AUSTRALIA: SA, 32km N Renmark, Amalia Dam, xeric mallee scrub, MT 4, ROM 2000040, Bookmark Biosphere Reserve, 33°53'S, 140°43'E, 263m, 15.II–15.IV.2000, malaise trap, D. C. Darling, OSUC 148715 (deposited in SAMA). Paratypes: AUSTRALIA: 4 females, 6 males, OSUC 365208, 367506–367507 (ANIC); OSUC 238112, 238117–238119, 238121–238122, 238178 (CNCI).

**Comments.** This is the largest-bodied species of *Bracalba* known. It resembles *B. sculptifrons* and *B. sparsa*, but differs from both in a large number of characters.

### *Bracalba nigrescens* (Dodd)

urn:lsid:zoobank.org:act:3692A700-53E1-4B03-8247-BEE9AC332619

urn:lsid:biosci.ohio-state.edu:osuc\_concepts:4128

[http://species-id.net/wiki/Bracalba\\_nigrescens](http://species-id.net/wiki/Bracalba_nigrescens)

Figures 36–39; Morphbank<sup>23</sup>

*Chromoteleia nigrescens* Dodd 1920: 329 (original description); Masner 1965: 71 (type information).

*Bracalba nigrescens* (Dodd): Dodd 1931: 80 (generic transfer); Galloway 1976: 88 (type information); Johnson 1992: 354 (catalogued).

**Description.** *Male.* Body length 3.38 mm (n=1). Flagellomere length: A3 over 1.5× as long as broad, most others as long or longer than broad. Ocular setae: long and dense. Frontal depression: with many irregularly transverse rugae. Smooth depression extending dorsolaterally from antennal foramen: present. Dorsal clypeal margin: absent between antennal foramina. Clypeal median carina: absent. Ventral clypeal margin: with a small median point. Mandibular teeth: three, but middle tooth tiny. Smooth area obliquely posterior to lateral ocellus: present. Genal sculpture: deeply reticulate-rugose with some septa much stronger than others, forming distinct rows differing in height. Mandibular color: mostly reddish brown, dark at teeth.

Dorsal pronotal area: not set off by carina ventrally. Anterolateral corner of dorsal pronotal area: weakly rounded anteriorly. Sculpture of posteromedian area of mesoscutum: sparsely foveolate, with large smooth interspaces. Lateral margin of dorsal axillar area: with a semicircular expansion, broadest near midlength. Mesoscutellar sculpture: sparsely foveolate, with large smooth interspaces. Metascutellum in dorsal view: elongate-trapezoidal but with incised apex. Dorsal surface of metascutellum: apex protruding dorsally. Femoral depression: crossed by rounded carinae. Anterior corner of lateral propodeal carina: flat, without tooth. Posteromedial corner of lateral propodeal area: protruding posteriorly. Leg color: coxae and at least the last three tarsomeres dark, otherwise yellowish. T7: arched and posteriorly concave.

**Diagnosis.** Males: Lateral margin of dorsal axillar area semicircularly expanded; mesosoma weakly rounded anteriorly; mesoscutellum without median carina; metascutellum elongate-trapezoidal with incised apex.

**Link to distribution map.** <http://hol.osu.edu/map-full.html?id=4128>

**Material examined.** Holotype, male, *C. nigrescens*: **AUSTRALIA:** WA, Yallingup, 1.XII-12.XII.1913, R. E. Turner, B.M. TYPE HYM. 9.499 (deposited in BMNH).

**Comments.** The male holotype of *B. nigrescens* cannot be associated with any known female *Bracalba*. It is very similar to *B. laminata* even though the two species occur on opposite sides of the Australian continent. These species may be closely related to *B. hesperia* and *B. tridentata*.

### ***Bracalba parvirubra* Burks, sp. n.**

urn:lsid:zoobank.org:act:9B615296-D426-4E5E-937A-9AC299199003

urn:lsid:biosci.ohio-state.edu:osuc\_concepts:302157

[http://species-id.net/wiki/Bracalba\\_parvirubra](http://species-id.net/wiki/Bracalba_parvirubra)

Figures 40–42; Morphbank<sup>24</sup>

**Description.** *Female.* Body length 3.38–3.63 mm (n=3). Color of antenna beyond radicle: mostly dark, extreme base of scape becoming reddish. Radicle color: same as scape. Number of claval segments with ventral gustatory sensilla: 7. Number of ventral gustatory sensilla on A6: 1.

Ocular setae: long and sparse. Frontal depression: smooth dorsally, torular triangle foveolate, areas lateral to it smooth. Smooth depression extending dorsolaterally from



**Figures 36–39.** *Bracalba nigrescens* (Dodd) holotype male (B.M. TYPE HYM. 9.499). **36** Head and mesosoma, dorsal view **37** Metasomal terga 6–8, postero-lateral view **38** Head, anterior view **39** Head, ventral view. Morphbank<sup>23</sup>

antennal foramen: present. Dorsal clypeal margin: arched, interrupted by broad median carina. Clypeal median carina: present. Ventral clypeal margin: with a small median point. Mandibular color: dark basally and at teeth, becoming lighter reddish brown between these areas. Mandibular teeth: three, but middle tooth tiny. Smooth area obliquely posterior to lateral ocellus: present. Genal sculpture: deeply reticulate-rugose with some septa much stronger than others, forming distinct rows differing in height.

Dorsal pronotal area: not set off by carina ventrally. Anterolateral corner of dorsal pronotal area: protruding anteriorly. Sculpture of posteromedian area of mesoscutum: foveolate with slightly stronger longitudinal septa. Lateral margin of dorsal axillar area: with a semicircular expansion, broadest near midlength. Mesoscutellar sculpture: densely foveolate with one or two median longitudinal channels. Metascutellum in dorsal view: elongate-trapezoidal but with incised apex. Dorsal surface of metascutellum: flat, or convex. Femoral depression: crossed by many sharply defined carinae. Leg color: yellowish-brown except for dorsal external part of coxae and sometimes tarsomeres 2–5. Anterior corner of lateral propodeal carina: flat, without tooth. Posteromedial corner of lateral propodeal area: protruding posteriorly.

Metasoma color: centrally reddish with some vague dark intrusions, peripherally becoming black. Median lobe of T1: with 7 or more longitudinal carinae. Metasoma at



**Figures 40–42.** *Bracalba parvirubra* sp. n., holotype female (OSUC 238194). **40** Dorsal habitus **41** Lateral habitus **42** Ventral habitus. Morphbank<sup>24</sup>

middle of T4: with metasomal bend and abrupt transition in sculpture. Posterolateral margins of metasomal terga: with tooth-like protrusions. T5 median carina: absent. Longitudinal sculptural septa on T5: strong, sharply raised. Transverse sculptural septa on T5: about as strong as the longitudinal septa. T5 setae: directed posteriorly, arising from anterior edge of sculptural mesh. T6: as broad or broader than long. T6 laterotergite: overlapped by rim from S6. S4 median carina: present. Transverse sculptural septa on S5: weak or absent, much weaker than the longitudinal septa. S5 setae: directed posteriorly, arising from anterior edge of sculptural mesh. Lateral carinae of S6: forming complete peripheral carina. Apex of S6: without notch.

*Male*. unknown.

**Diagnosis.** *Female*. A6 with 1 large ventral sensillum; 3 mandibular teeth with middle tooth much smaller than the others; metascutellum trapezoidal and strongly narrowing to an incised apex; metasomal bend present; sculpture posterior to metasomal bend with strong longitudinal and transverse septa; T4–T6 without distinct median carina; S4–S6 with median carina; T6 about as broad as long; S6 without apical notch. This species is similar to *B. sculptifrons* and *B. sparsa*, but lacks the S6 notch and frontal carinae.

**Etymology.** Compound adjective using the Latin adjectives parvus and ruber.

**Link to distribution map.** <http://hol.osu.edu/map-full.html?id=302157>

**Material examined.** Holotype, female: AUSTRALIA: WA, 20km N Denmark, 16.I.1987, J. S. Noyes, OSUC 238194 (deposited in WAMP). Paratypes: AUSTRALIA: 3 females, OSUC 238191, 238193, 238196 (CNCI).

***Bracalba pinnula* Burks, sp. n.**

urn:lsid:zoobank.org:act:29EE41F2-7AE8-46F5-AE0C-C9250E6A5771

urn:lsid:biosci.ohio-state.edu:osuc\_concepts:302158

[http://species-id.net/wiki/Bracalba\\_pinnula](http://species-id.net/wiki/Bracalba_pinnula)

Figures 43–46; Morphbank<sup>25</sup>

**Description.** *Female*. Body length 3.37–3.75 mm (n=7). Color of antenna beyond radicle: entirely dark. Radicle color: lighter than scape. Number of claval segments with ventral gustatory sensilla: 7. Number of ventral gustatory sensilla on A6: 1, or 2.

Ocular setae: short and dense. Frontal depression: with many strong transverse carinae, sparsely foveolate at torular triangle. Smooth depression extending dorsolaterally from antennal foramen: present. Dorsal clypeal margin: absent between antennal foramina. Clypeal median carina: absent. Ventral clypeal margin: with a small median point. Mandibular color: dark basally and at teeth, becoming lighter reddish brown between these areas. Mandibular teeth: three of roughly equal size. Smooth area obliquely posterior to lateral ocellus: present. Genal sculpture: deeply reticulate-rugose with some septa much stronger than others, forming distinct rows differing in height.

Dorsal pronotal area: not set off by carina ventrally. Anterolateral corner of dorsal pronotal area: weakly rounded anteriorly. Sculpture of posteromedian area of mesoscutum: densely foveolate. Lateral margin of dorsal axillar area: with a semicircular expansion, broadest near midlength. Mesoscutellar sculpture: densely foveolate. Metascutellum in dorsal view: trapezoidal with broad apex. Dorsal surface of metascutellum: flat, or convex. Femoral depression: centrally smooth, peripherally foveolate. Leg color: coxae and femora dark, but tibiae, tarsi, and sometimes 2nd trochanters yellowish brown. Anterior corner of lateral propodeal carina: flat, without tooth. Posteromedial corner of lateral propodeal area: protruding posteriorly.

Metasoma color: black to dark reddish brown. Median lobe of T1: with a set of rugae that merge with one another. Metasoma at middle of T4: with metasomal bend



**Figures 43–46.** *Bracalba pinnula* sp. n., paratype female (OSUC 231794). **43** Dorsal habitus **45** Head, ventral view, holotype female (OSUC 231797) **44** Lateral habitus **46** Metasomal sterna 5–6, ventral view. Morphbank<sup>25</sup>

and abrupt transition in sculpture. Posterolateral margins of metasomal terga: without protrusions. T5 median carina: absent. Longitudinal sculptural septa on T5: weak, blunt and hardly raised. Transverse sculptural septa on T5: about as strong as the longitudinal septa. T5 setae: directed posteriorly, arising from anterior edge of sculptural mesh. T6: as broad or broader than long. T6 laterotergite: overlapping S6. S4 median carina: present. Transverse sculptural septa on S5: about as strong as the longitudinal septa. S5 setae: directed posteriorly, arising from anterior edge of sculptural mesh. Lateral carinae of S6: absent. Apex of S6: without notch.

*Male.* Body length 2.75–3.13 mm (n=4). Flagellomere length: A3 over 1.5× as long as broad, most others as long or longer than broad. T7: flat and posteriorly truncate.

**Diagnosis.** *Female.* A6 with 1 or 2 large sensilla; 3 mandibular teeth of approximately equal length; metascutellum trapezoidal with a broad and truncate or slightly concave apex; metasomal bend present but very weak; sculpture posterior to metasomal bend with longitudinal and transverse septa of about equal height and hardly differing from those anterior to the bend; T4–T6 and S4–S5 without median carina; S4 sometimes with a slight median carina; T6 longer than broad; S5 with longitudinal septa not stronger than transverse septa; S6 without apical notch. *Bracalba pinnula* has only a very slight metasomal bend, and therefore it can easily be confused

with those species that lack the bend. It differs from most of these species in that the fore wings reach to the middle of T<sub>4</sub>, and from *B. intermedia* in having a long and trapezoidal metascutellum.

**Etymology.** Latin noun, meaning “a small fin.” This is considered to be a noun in apposition to the generic name.

**Link to distribution map.** <http://hol.osu.edu/map-full.html?id=302158>

**Material examined.** Holotype, female: AUSTRALIA: WA, WA122401, 7km N Stirling Range National Park, 34°19'S, 118°11'E, 900ft, 24.XII.1994, malaise trap, L. S. Kimsey & R. B. Kimsey, OSUC 231797 (deposited in WAMP). Paratypes: AUSTRALIA: 12 females, 11 males, OSUC 149756 (AEIC); OSUC 230822–230824, 367508, 367512–367519 (ANIC); OSUC 148700, 231780–231781 (CNCI); OSUC 238452 (QDPC); OSUC 179086, 179088–179089, 231794–231796 (UCDC).

***Bracalba propodealis* Burks, sp. n.**

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urn:lsid:biosci.ohio-state.edu:osuc\_concepts:302160

[http://species-id.net/wiki/Bracalba\\_propodealis](http://species-id.net/wiki/Bracalba_propodealis)

Figures 47–50; Morphbank<sup>26</sup>

**Description.** *Female.* Body length 3.62–3.88 mm (n=3). Color of antenna beyond radicle: entirely dark. Radicle color: base lighter than scape. Number of claval segments with ventral gustatory sensilla: 7. Number of ventral gustatory sensilla on A6: 1.

Ocular setae: short and dense. Frontal depression: present as a vague smooth triangle. Smooth depression extending dorsolaterally from antennal foramen: present. Dorsal clypeal margin: absent between antennal foramina. Clypeal median carina: absent. Ventral clypeal margin: with a small median point. Mandibular color: dark basally and at teeth, becoming lighter reddish brown between these areas. Mandibular teeth: three, but middle tooth tiny. Smooth area obliquely posterior to lateral ocellus: present. Genal sculpture: deeply reticulate-rugose with some septa much stronger than others, forming distinct rows differing in height.

Dorsal pronotal area: not set off by carina ventrally. Anterolateral corner of dorsal pronotal area: weakly rounded anteriorly. Sculpture of posteromedian area of mesoscutum: foveolate with broad longitudinal septa. Lateral margin of dorsal axillar area: with a semicircular expansion, broadest near midlength. Mesoscutellar sculpture: sparsely foveolate, with large smooth interspaces. Metascutellum in dorsal view: very short, subrectangular. Dorsal surface of metascutellum: convex. Femoral depression: irregularly foveolate but not crossed by carinae. Leg color: coxae, femora (aside from their apices), and at least the last two tarsomeres dark, otherwise yellowish brown. Anterior corner of lateral propodeal carina: with longitudinal tooth-like crest extending dorsally above level of metascutellum. Posteromedial corner of lateral propodeal area: protruding posteriorly.

Metasoma color: black to dark reddish brown. Median lobe of T<sub>1</sub>: with 7 or more longitudinal carinae. Metasoma at middle of T<sub>4</sub>: with metasomal bend and abrupt





**Figures 47–50.** *Bracalba propodealis* sp. n., holotype female (OSUC 227590). **47** Dorsal habitus, paratype female (OSUC 227591) **48** Lateral habitus, paratype female (OSUC 238190) **49** Head, ventral view **50** Metasomal sterna 5–6, ventral view. Morphbank<sup>26</sup>

transition in sculpture. Posterolateral margins of metasomal terga: without protrusions. T5 median carina: absent. Longitudinal sculptural septa on T5: weak, blunt and hardly raised. Transverse sculptural septa on T5: about as strong as the longitudinal septa. T5 setae: directed posteriorly, arising from anterior edge of sculptural mesh. T6: longer than broad. T6 laterotergite: overlapping S6. S4 median carina: present. Transverse sculptural septa on S5: about as strong as the longitudinal septa. S5 setae: not directed posteriorly, arising from center of sculptural mesh. Lateral carinae of S6: absent. Apex of S6: without notch.

*Male.* unknown.

**Diagnosis.** *Female.* A6 with 1 large ventral sensillum; 3 mandibular teeth with the middle tooth much smaller than the others; metascutellum subrectangular, very short and broad; anteromedial margins of lateral propodeal area extending dorsally above the metascutellar surface as distinct protrusions; metasomal bend extremely weak; sculpture posterior to metasomal bend with longitudinal septa stronger than those anterior to the bend, transverse septa as strong or slightly weaker than longitudinal septa; T4–T6 and S6 without median carina, S4–S5 with median carina; S6 without apical notch.

**Etymology.** An adjective, combining the anatomical term propodeum with the Latin adjectival suffix *-alis*, referring to its unique propodeum.

**Link to distribution map.** <http://hol.osu.edu/map-full.html?id=302160>

**Material examined.** Holotype, female: AUSTRALIA: WA, Mount Cooke, 28.I-17.II.1991, malaise trap, M. S. Harvey & J. M. Waldock, OSUC 227590 (deposited in WAMP). Paratypes: AUSTRALIA: 2 females, OSUC 238190 (CNCI); OSUC 227591 (WINC).

**Comments.** The propodeum in this species is unique among the specimens studied. It is very difficult to determine in all examined specimens if the metasomal bend is present or not.

***Bracalba sculptifrons* Burks, sp. n.**

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urn:lsid:biosci.ohio-state.edu:osuc\_concepts:302161

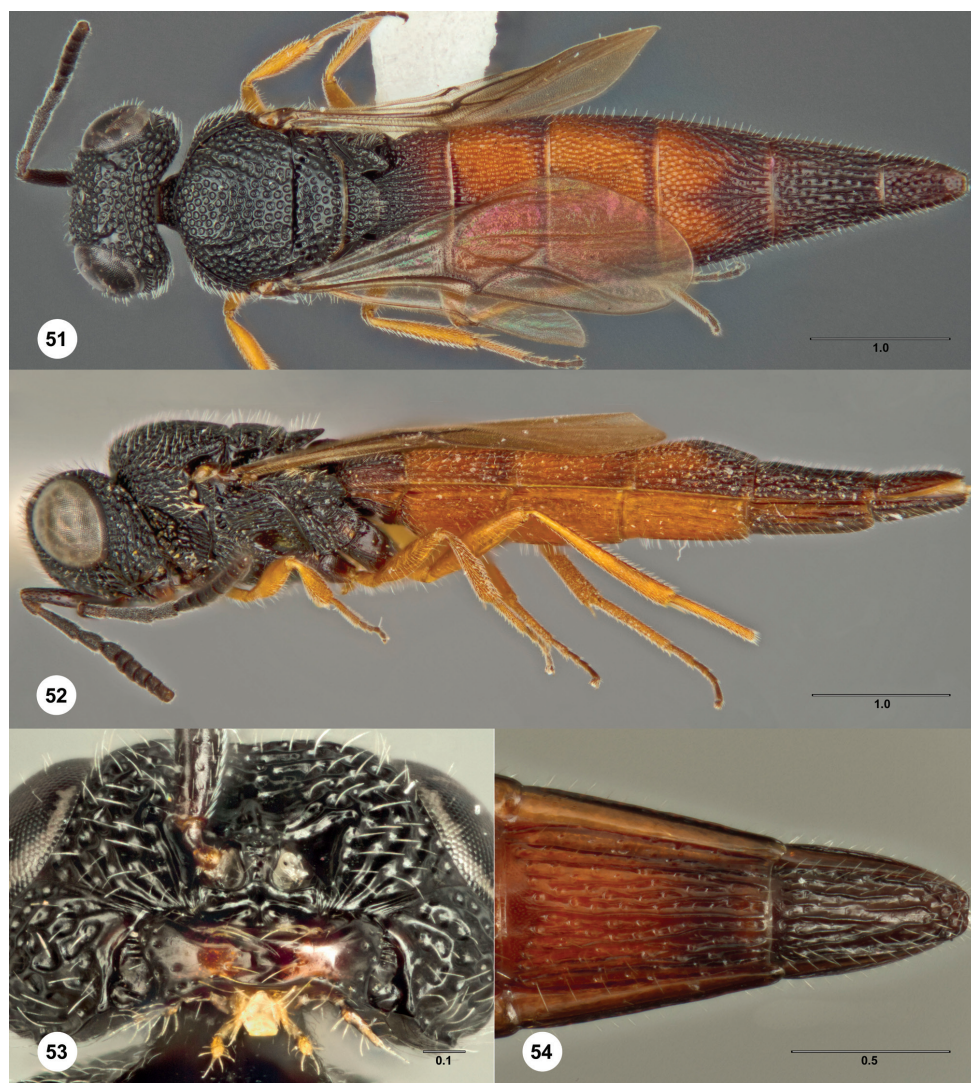
[http://species-id.net/wiki/Bracalba\\_sculptifrons](http://species-id.net/wiki/Bracalba_sculptifrons)

Figures 51–54; Morphbank<sup>27</sup>

**Description.** *Female.* Body length 5.75–6.13 mm (n=2). Color of antenna beyond radicle: entirely dark. Radicle color: same as scape. Number of claval segments with ventral gustatory sensilla: 7. Number of ventral gustatory sensilla on A6: 2.

Ocular setae: short and dense. Frontal depression: with irregular rugae indicating large foveae. Smooth depression extending dorsolaterally from antennal foramen: present. Dorsal clypeal margin: angular, emarginate medially. Clypeal median carina: present. Ventral clypeal margin: with a small median point. Mandibular color: dark basally and at teeth, becoming lighter reddish brown between these areas. Mandibular teeth: three, but middle tooth tiny. Smooth area obliquely posterior to lateral ocellus: present. Genal sculpture: reticulate-rugose with strong dorsoventral carinae.

Dorsal pronotal area: not set off by carina ventrally. Anterolateral corner of dorsal pronotal area: truncate anteriorly. Sculpture of posteromedian area of mesoscutum: densely foveolate. Lateral margin of dorsal axillar area: with a semicircular expansion, broadest near midlength. Mesoscutellar sculpture: densely foveolate. Metascutellum in dorsal view: trapezoidal with broad apex. Dorsal surface of metascutellum: apex protruding dorsally. Femoral depression: centrally smooth, peripherally foveolate. Leg color: coxae and at least the last three tarsomeres dark, otherwise reddish. Anterior



**Figures 51–54.** *Bracalba sculptifrons* sp. n., paratype female (OSUC 148704). **51** Dorsal habitus **53** Head, ventral view **54** Metasomal sterna 5–6, ventral view, holotype female (OSUC 231799) **52** Lateral habitus. Morphbank<sup>27</sup>

corner of lateral propodeal carina: flat, without tooth. Posteromedial corner of lateral propodeal area: protruding posteriorly.

Metasoma color: T2 to flat part of T4, troughs of S1 to variable part of S5 reddish, otherwise dark. Median lobe of T1: with 7 or more longitudinal carinae. Metasoma at middle of T4: with metasomal bend and abrupt transition in sculpture. Posterolateral margins of metasomal terga: without protrusions. T5 median carina: absent. Longitudinal sculptural septa on T5: strong, sharply raised. Transverse sculptural septa on T5: weak or absent, much weaker than the longitudinal septa. T5 setae: not directed

posteriorly, arising from center of sculptural mesh. T6: longer than broad. T6 laterotergite: overlapping S6. S4 median carina: present. Transverse sculptural septa on S5: weak or absent, much weaker than the longitudinal septa. S5 setae: not directed posteriorly, arising from center of sculptural mesh. Lateral carinae of S6: not meeting apically. Apex of S6: without notch.

*Male.* unknown.

**Diagnosis.** *Female.* A6 with 2 large ventral sensilla; 3 mandibular teeth, with middle tooth much smaller than the others; metascutellum broadly trapezoidal with a broad truncate apex; metasomal bend present; sculpture posterior to metasomal bend strong longitudinal septa and weaker transverse septa; T4–T6 and S4–S6 with or without median carina; T6 longer than broad; S6 without apical notch. This species is very similar to *B. magnirubra* in coloration and in having a relatively large body, but it differs in many characters, especially in lacking the apical S6 notch in females.

**Etymology.** Used as a noun in apposition to the generic name, derived from a combination of the Latin participle sculptus and noun frons, referring to its strong network of frontal carinae.

**Link to distribution map.** <http://hol.osu.edu/map-full.html?id=302161>

**Material examined.** Holotype, female: AUSTRALIA: WA, ~25km E Perth, John Forrest National Park, 23.XII-27.XII.1986, J. S. Noyes, OSUC 231799 (deposited in WAMP). Paratype: AUSTRALIA: 1 female, OSUC 148704 (CNCI).

### ***Bracalba sparsa* Burks, sp. n.**

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urn:lsid:biosci.ohio-state.edu:osuc\_concepts:302162

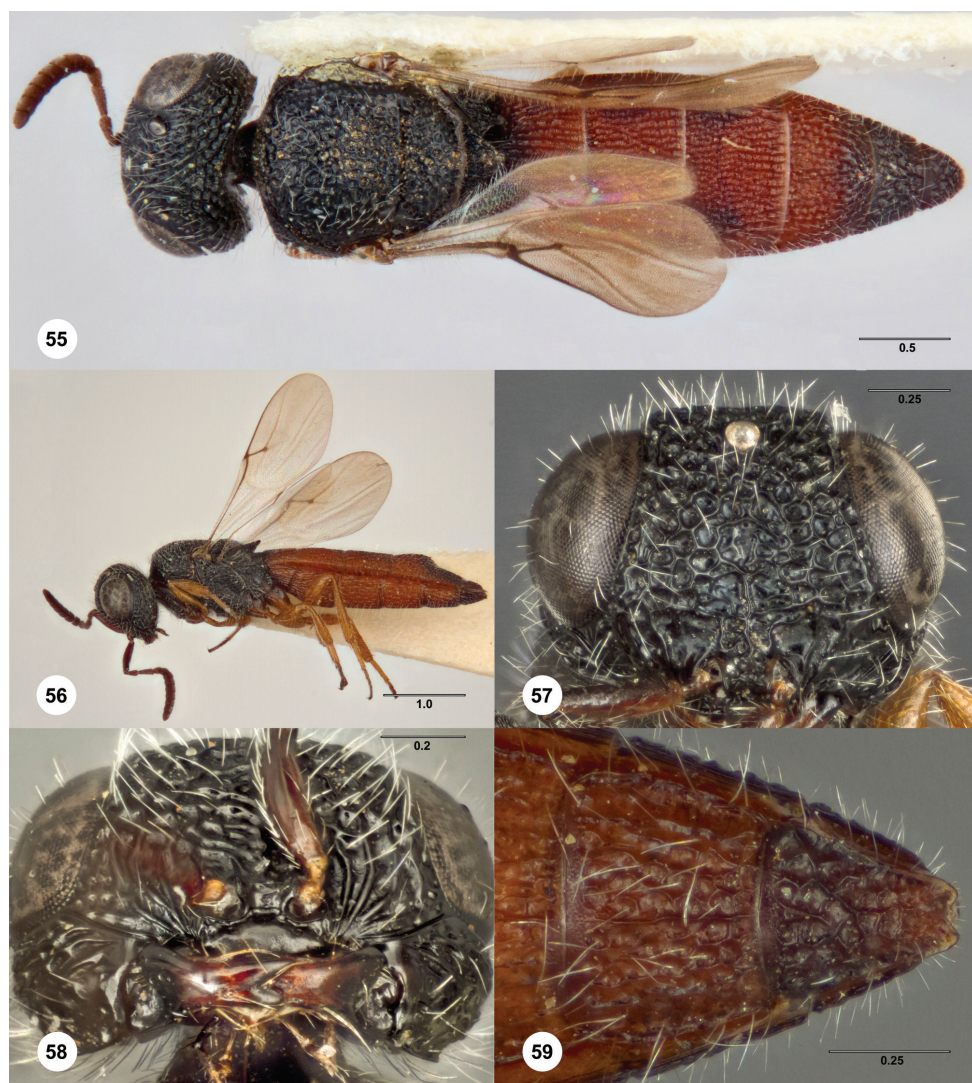
[http://species-id.net/wiki/Bracalba\\_sparsa](http://species-id.net/wiki/Bracalba_sparsa)

Figures 55–59; Morphbank<sup>28</sup>

**Description.** *Female.* Body length 3.37–4.00 mm (n=6). Color of antenna beyond radicle: reddish-brown, darker at scape apex, pedicel, and A3. Radicle color: lighter than scape. Number of claval segments with ventral gustatory sensilla: 7. Number of ventral gustatory sensilla on A6: 1.

Ocular setae: long and sparse. Frontal depression: with irregular rugae indicating large foveae. Smooth depression extending dorsolaterally from antennal foramen: present. Dorsal clypeal margin: forming a complete connection between antennal foramina medially. Clypeal median carina: absent. Ventral clypeal margin: with a small median point. Mandibular color: dark basally and at teeth, becoming lighter reddish brown between these areas. Mandibular teeth: two, separated by narrow incision. Smooth area obliquely posterior to lateral ocellus: present. Genal sculpture: reticulate-rugose without any strong carinae.

Dorsal pronotal area: not set off by carina ventrally. Anterolateral corner of dorsal pronotal area: truncate anteriorly. Sculpture of posteromedian area of mesoscutum: densely foveolate. Lateral margin of dorsal axillar area: with a semicircular expansion,



**Figures 55–59.** *Bracalba sparsa* sp. n., holotype female (OSUC 231798). **55** Dorsal habitus **56** Lateral habitus **58** Head, ventral view, paratype female (OSUC 238205) **57** Head, anterior view **59** Metasomal sterna 5–6, ventral view. Morphbank<sup>28</sup>

broadest near midlength. Mesoscutellar sculpture: densely foveolate. Metascutellum in dorsal view: trapezoidal but tapering to narrow apex. Dorsal surface of metascutellum: apex protruding dorsally. Femoral depression: crossed by rounded carinae. Leg color: entirely reddish. Anterior corner of lateral propodeal carina: flat, without tooth. Posteromedial corner of lateral propodeal area: protruding posteriorly.

Metasoma color: mostly reddish, variably dark at T4 bend, T5-T6, with variable smaller dark areas elsewhere. Median lobe of T1: with 7 or more longitudinal carinae. Metasoma at middle of T4: with metasomal bend and abrupt transition in sculpture.

Posterolateral margins of metasomal terga: with tooth-like protrusions. T5 median carina: absent. Longitudinal sculptural septa on T5: strong, sharply raised. Transverse sculptural septa on T5: weak or absent, much weaker than the longitudinal septa. T5 setae: not directed posteriorly, arising from center of sculptural mesh. T6: as broad or broader than long. T6 laterotergite: overlapping S6. S4 median carina: present. Transverse sculptural septa on S5: weak or absent, much weaker than the longitudinal septa. S5 setae: not directed posteriorly, arising from center of sculptural mesh. Lateral carinae of S6: not meeting apically. Apex of S6: with notch.

*Male.* Body length 3.5 mm (n=1). Flagellomere length: A3 over 1.5× as long as broad, most others as long or longer than broad. T7: arched and posteriorly concave.

**Diagnosis.** *Female.* A6 with 1 large ventral sensillum; 2 mandibular teeth; metascutellum subtrapezoidal but strongly tapering to a narrow truncate apex; metasomal bend expressed as a raised hump with posterior metasomal segments not tilted downwards; sculpture posterior to metasomal hump with strong longitudinal and transverse septa; T4–T6 without longitudinal carina; T6 broader than long; S4–S6 with longitudinal carina; S6 with apical notch.

**Etymology.** Latin participle meaning “scattered,” recalling the sparsely distributed setae of this species.

**Link to distribution map.** <http://hol.osu.edu/map-full.html?id=302162>

**Material examined.** Holotype, female: AUSTRALIA: WA, Toodyay, 31.X.1979, R. M. Bohart, OSUC 231798 (deposited in WAMP). Paratypes: AUSTRALIA: 4 females, 3 males, OSUC 230821 (ANIC); OSUC 148703, 238204–238206, 238208 (CNCI); OSUC 55870 (OSUC).

**Comments.** *Bracalba sparsa* represents a distinctive element within the genus, with its unique metasoma and unusual metascutellum.

### ***Bracalba tricolorata* Burks, sp. n.**

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urn:lsid:biosci.ohio-state.edu:osuc\_concepts:302163

[http://species-id.net/wiki/Bracalba\\_tricolorata](http://species-id.net/wiki/Bracalba_tricolorata)

Figures 60–61; Morphbank<sup>29</sup>

**Description.** *Female.* Body length 3.88–4.25 mm (n=4). Color of antenna beyond radicle: entirely dark. Radicle color: same as scape. Number of claval segments with ventral gustatory sensilla: 7. Number of ventral gustatory sensilla on A6: 1.

Ocular setae: short and sparse. Frontal depression: with many strong transverse carinae, sparsely foveolate at torular triangle. Smooth depression extending dorsolaterally from antennal foramen: present. Dorsal clypeal margin: bordering antennal foramina, absent between them. Clypeal median carina: absent. Ventral clypeal margin: with a small median point. Mandibular color: mostly yellowish brown, dark at teeth. Mandibular teeth: three, but middle tooth tiny. Smooth area obliquely posterior to lat-



**Figures 60–61.** *Bracalba tricolorata* sp. n., holotype female (OSUC 238541). **60** Dorsal habitus **61** Ventral habitus. Morphbank<sup>29</sup>

eral ocellus: present. Genal sculpture: deeply reticulate-rugose with some septa much stronger than others, forming distinct rows differing in height.

Dorsal pronotal area: not set off by carina ventrally. Anterolateral corner of dorsal pronotal area: weakly rounded anteriorly. Sculpture of posteromedian area of mesoscutum: foveolate with slightly stronger longitudinal septa. Lateral margin of dorsal axillar area: with a semicircular expansion, broadest near midlength. Mesoscutellar sculpture: sparsely foveolate, with large smooth interspaces. Metascutellum in dorsal view: trapezoidal with broad apex. Dorsal surface of metascutellum: convex. Femoral depression: crossed by rounded carinae. Leg color: coxae, femora (aside from their apices), and at least the last two tarsomeres dark, otherwise yellowish brown. Anterior corner of lateral propodeal carina: flat, without tooth. Posteromedial corner of lateral propodeal area: protruding posteriorly.

Metasoma color: black to dark reddish brown. Median lobe of T1: with a set of rugae that merge with one another. Metasoma at middle of T4: with very weak bend. Posterolateral margins of metasomal terga: without protrusions. T5 median carina: absent. Longitudinal sculptural septa on T5: weak, blunt and hardly raised. Transverse sculptural septa on T5: about as strong as the longitudinal septa. T5 setae: directed posteriorly, arising from anterior edge of sculptural mesh. T6: as broad

or broader than long. T6 laterotergite: overlapped by rim from S6. S4 median carina: absent. Transverse sculptural septa on S5: weak or absent, much weaker than the longitudinal septa. S5 setae: directed posteriorly, arising from anterior edge of sculptural mesh. Lateral carinae of S6: forming complete peripheral carina. Apex of S6: without notch.

*Male.* Body length 3.75–4.00 mm (n=3). Flagellomere length: A3 over 1.5× as long as broad, most others as long or longer than broad. T7: arched and posteriorly concave.

**Diagnosis.** *Female.* A6 with 1 large ventral sensillum; 3 mandibular teeth with the middle tooth much smaller than the others; metascutellum broadly trapezoidal with a broad apex that is truncate or sometimes slightly incised; metasomal bend present but very weak; sculpture posterior to metasomal bend with transverse septa about as strong as the longitudinal septa; T4–T6 without median carina, S4–S6 with or without median carina; T6 about as broad as long; S5 with longitudinal septa much stronger than transverse septa; S6 without apical notch. This species is very similar to *B. pinnula*, but has distinctly different ventral metasomal sculpture.

**Etymology.** Latin participle meaning “tricky,” named for its strong similarity to some other species and its very subtle metasomal bend.

**Link to distribution map.** <http://hol.osu.edu/map-full.html?id=302163>

**Material examined.** Holotype, female: AUSTRALIA: WA, 20km N Denmark, 16.I.1987, J. S. Noyes, OSUC 238541 (deposited in WAMP). Paratypes: AUSTRALIA: 3 females, 3 males, OSUC 148699, 238192, 238195, 238197, 238199-238200 (CNCI).

### ***Bracalba tridentata* Burks, sp. n.**

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urn:lsid:biosci.ohio-state.edu:osuc\_concepts:302164

[http://species-id.net/wiki/Bracalba\\_tridentata](http://species-id.net/wiki/Bracalba_tridentata)

Figures 62–65; Morphbank<sup>30</sup>

**Description.** *Female.* Body length 5.12–5.38 mm (n=3). Color of antenna beyond radicle: entirely dark. Radicle color: same as scape. Number of claval segments with ventral gustatory sensilla: 7. Number of ventral gustatory sensilla on A6: 1.

Ocular setae: long and sparse. Frontal depression: with many irregularly transverse rugae. Smooth depression extending dorsolaterally from antennal foramen: present. Dorsal clypeal margin: arched, interrupted by broad median carina. Clypeal median carina: present. Ventral clypeal margin: with a small median point. Mandibular color: dark basally and at teeth, becoming lighter reddish brown between these areas. Mandibular teeth: three, but middle tooth tiny. Smooth area obliquely posterior to lateral ocellus: present. Genal sculpture: deeply reticulate-rugose with some septa much stronger than others, forming distinct rows differing in height.

Dorsal pronotal area: not set off by carina ventrally. Anterolateral corner of dorsal pronotal area: truncate anteriorly. Sculpture of posteromedian area of mesoscutum:





**Figures 62–65.** *Bracalba tridentata* sp. n., paratype female (OSUC 238116). **62** Dorsal habitus **64** Head, ventral view, metasomal sterna 5–6, ventral view **65** Metasomal sterna 5–6, ventral view, holotype female (OSUC 238113) **63** Lateral habitus. Morphbank<sup>30</sup>

densely foveolate. Lateral margin of dorsal axillar area: with a semicircular expansion, broadest near midlength. Mesoscutellar sculpture: densely foveolate. Metascutellum in dorsal view: trapezoidal with broad apex, or elongate-trapezoidal but with incised apex. Dorsal surface of metascutellum: apex protruding dorsally. Femoral depression: crossed by 4–6 dorsal carinae, 7–8 ventral carinae interrupted by central smooth area. Leg color: yellowish-brown except for dorsal external part of coxae and sometimes tarsomeres 2–5. Anterior corner of lateral propodeal carina: flat, without tooth. Posteromedial corner of lateral propodeal area: protruding posteriorly.

Metasoma color: black to dark reddish brown. Median lobe of T1: with 7 or more longitudinal carinae. Metasoma at middle of T4: with metasomal bend and abrupt transition in sculpture. Posterolateral margins of metasomal terga: without protrusions. T5 median carina: absent. Longitudinal sculptural septa on T5: strong, sharply raised. Transverse sculptural septa on T5: about as strong as the longitudinal septa. T5 setae: not directed posteriorly, arising from center of sculptural mesh. T6: as broad or broader than long. T6 laterotergite: overlapping S6. S4 median carina: absent. Transverse sculptural septa on S5: weak or absent, much weaker than the longitudinal septa. S5 setae: not directed posteriorly, arising from center of sculptural mesh. Lateral carinae of S6: not meeting apically. Apex of S6: with notch.

*Male.* unknown.

**Diagnosis.** *Female.* A6 with 1 large ventral sensillum; middle mandibular tooth present but much smaller than the others; metascutellum broadly trapezoidal and with a broadly truncate apex that may have a conspicuous median notch; metasomal bend strong; sculpture posterior to metasomal bend distinctly different from that anterior to it, with very weak transverse septa and strong longitudinal septa; T6 about as long as broad; S6 with apical notch. This species is very similar to *B. hesperia*, but S6 in that species does not have an apical notch. It is also similar to *B. sparsa*, but that species has a unique metasomal bend and metascutellar shape.

**Etymology.** Latin adjective, named for the usually 3-pronged pattern formed apically by dark cuticle on T6.

**Link to distribution map.** <http://hol.osu.edu/map-full.html?id=302164>

**Material examined.** Holotype, female: AUSTRALIA: SA, 32km N Renmark, Amalia Dam, xeric mallee scrub, MT 4, ROM 2000041, Bookmark Biosphere Reserve, 33°53'S, 140°43'E, 263m, 15.II-15.IV.2000, malaise trap, D. C. Darling, OSUC 238113 (deposited in SAMA). Paratypes: AUSTRALIA: 2 females, OSUC 238114, 238116 (CNCI).

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## Endnotes

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## Appendix I

### Characters

#### *Color of antenna beyond radicle*

1. entirely dark
2. entirely reddish
3. mostly dark, extreme base of scape becoming reddish
4. reddish-brown, darker at scape apex, pedicel, and A3
5. mostly dark, ventral parts of pedicel apex, A4-A12 variably lighter
6. yellowish-brown
7. dark except for pedicel apex
8. claval segments brown, basal segments yellowish

#### *Radicle color*

1. same as scape
2. base lighter than scape
3. lighter than scape

#### *Number of claval segments with ventral gustatory sensilla*

1. 6
2. 7

#### *Number of ventral gustatory sensilla on A6*

1. 1
2. 2
3. 0

#### *Ocular setae*

1. short and dense
2. long and sparse
3. short and sparse
4. long and dense
5. absent

#### *Frontal depression ventral sculpture*

1. with transverse rugae
2. with large areoles
3. smooth or foveolate
4. with median longitudinal carina
5. inapplicable (frontal depression absent)

*Frontal depression dorsal sculpture*

1. with transverse rugae
2. with large areoles
3. smooth or foveolate
4. with median longitudinal carina
5. inapplicable (frontal depression absent)

*Smooth depression extending dorsolaterally from antennal foramen*

1. absent
2. present

*Dorsal clypeal margin*

1. absent between antennal foramina
2. interrupted by a median areole below interantennal process
3. interrupted by median carina
4. complete only between antennal foramina medially
5. wrinkle-like with median peak
6. angular, emarginate medially
7. uniformly arched without interruption

*Clypeal median carina*

1. present
2. absent

*Ventral clypeal margin*

1. straight
2. with a small median point
3. convex
4. concave

*Mandibular color*

1. dark basally and at teeth, becoming lighter reddish brown between these areas
2. entirely dark
3. mostly yellowish brown, dark at teeth
4. mostly reddish brown, dark at teeth

*Mandibular teeth*

1. three of roughly equal size
2. two, separated by narrow incision
3. three, but middle tooth tiny
4. two, broadly separated by an angled flat area

*Smooth area obliquely posterior to lateral ocellus*

1. present
2. absent

*Genal sculpture*

1. reticulate-rugose with strong dorsoventral carinae
2. reticulate-rugose without any strong carinae
3. deeply reticulate-rugose with some septa much stronger than others, forming distinct rows differing in height

*Dorsal pronotal area*

1. not set off by carina
2. set off by carina

*Anterolateral corner of dorsal pronotal area*

1. protruding anteriorly
2. truncate anteriorly
3. weakly rounded anteriorly

*Sculpture of posteromedian area of mesoscutum*

1. sparsely foveolate, with large smooth interspaces
2. with many longitudinal carinae
3. densely foveolate
4. foveolate with broad longitudinal septa
5. foveolate with slightly stronger longitudinal septa
6. foveolate, with some interspersed additional tiny foveae

*Lateral margin of dorsal axillar area*

1. not expanded
2. broadly expanded
3. triangularly expanded or with posterior tooth, broadest posteriorly
4. with a semicircular expansion, broadest near midlength

*Mesoscutellar sculpture*

1. densely foveolate
2. sparsely foveolate, with large smooth interspaces
3. densely foveolate with one or two median longitudinal channels
4. densely foveolate but with smooth central area
5. densely foveolate with slightly stronger longitudinal septa
6. foveolate, with some interspersed additional tiny foveae
7. densely foveolate with a longitudinal carina
8. medially smooth except for a few irregular carinae



*Metascutellum in dorsal view*

1. strongly transverse, subrectangular
2. trapezoidal with broad apex
3. trapezoidal but tapering to narrow apex
4. elongate-trapezoidal but with incised apex
5. very short, subrectangular
6. semicircular
7. elongate-rectangular

*Dorsal surface of metascutellum*

1. flat
2. apex protruding dorsally
3. convex

*Femoral depression*

1. crossed by rounded carinae
2. irregularly foveolate but not crossed by carinae
3. smooth, not crossed by carinae
4. crossed by 4-6 dorsal carinae, 7-8 ventral carinae interrupted by central smooth area
5. centrally smooth, peripherally foveolate
6. shallowly sculptured but not crossed by carinae
7. crossed by many sharply defined carinae

*Leg color*

1. entirely dark
2. entirely reddish
3. coxae dark, all else reddish
4. coxae, femora (aside from their apices), and at least the last two tarsomeres dark, otherwise yellowish brown
5. coxae and at least the last three tarsomeres dark, otherwise reddish
6. reddish but with at least last two tarsomeres dark
7. dark except for 2nd trochanter of fore leg and mid leg, tip of mid and hind metatibia
8. reddish except for variable antero-dorsal portion of coxae
9. dark except for trochanters, tips of femora and tibiae, and tarsomeres 1-4
10. coxae and femora dark, but tibiae, tarsi, and sometimes 2nd trochanters yellowish brown
11. dark except for tips of tibiae and at least 1st tarsomere
12. yellowish-brown except for dorsal part of coxae and sometimes tarsomeres 2-5
13. dark except for tibiae, 2nd trochanter, and tarsomeres 2-5
14. dark, except trochanters, femoral apices, variable parts of tibiae, and tarsi pale
15. coxae, femora, and apical two tarsomeres dark, trochanters, tibiae, and other tarsomeres yellowish brown
16. coxae dark, leg becoming gradually lighter apically

17. coxae and at least the last three tarsomeres dark, otherwise yellowish
18. entirely yellowish

*Anterior corner of lateral propodeal carina*

1. flat, without tooth
2. with longitudinal tooth-like crest extending dorsally above level of metascutellum

*Posteromedial corner of lateral propodeal area*

1. not protruding posteriorly
2. protruding posteriorly

*Metasoma color*

1. black to dark reddish brown
2. entirely reddish
3. reddish, with last segment variably dark
4. reddish, with last two segments dark
5. reddish, with last 2.5 segments dark
6. T2 to flat part of T4, troughs of S1 to variable part of S5 reddish; otherwise dark
7. mostly reddish, variably dark at T4 bend, T5-T6, with variable smaller dark areas elsewhere
8. centrally reddish with some vague dark intrusions, peripherally becoming black

*Median lobe of T1*

1. with 7 or more longitudinal carinae
2. with a set of rugae that merge with one another
3. with median smooth area interrupting carinae
4. with 6 carinae
5. with 5 carinae

*Metasoma at middle of T4*

1. with metasomal bend and abrupt transition in sculpture
2. without bend
3. with very weak bend

*Posterolateral margins of metasomal terga*

1. with tooth-like protrusions
2. without protrusions

*T5 median carina*

1. absent
2. present

*Longitudinal sculptural septa on T5*

1. strong, sharply raised
2. weak, blunt and hardly raised

*Transverse sculptural septa on T5*

1. about as strong as the longitudinal septa
2. weak or absent, much weaker than the longitudinal septa

*T5 setae*

1. directed posteriorly, arising from anterior edge of sculptural mesh
2. not directed posteriorly, arising from center of sculptural mesh

*T6*

1. longer than broad
2. as broad or broader than long

*T6 laterotergite*

1. overlapped by rim from S6
2. overlapping S6

*S4 median carina*

1. absent
2. present

*Transverse sculptural septa on S5*

1. weak or absent, much weaker than the longitudinal septa
2. about as strong as the longitudinal septa

*S5 setae*

1. directed posteriorly, arising from anterior edge of sculptural mesh
2. not directed posteriorly, arising from center of sculptural mesh

*Lateral carinae of S6*

1. forming complete peripheral carina
2. not meeting apically
3. absent
4. weak and ruga-like, becoming indistinct posteriorly

*Apex of S6*

1. without notch
2. with notch
3. roundly concave

*Flagellomere length*

1. A3 over 1.5× as long as broad, most others as long or longer than broad
2. A3 1–1.2× as long as broad, most others transverse

*T7*

1. arched and posteriorly concave
2. flat and posteriorly truncate

**Matrix**

Chromoteleia sp.	7002444010221101223052200H02111000100020011
Bracalba_cuneata	50110[23][23]16111000[01]132[04]11001B0[02]101001100020011
Bracalba_globosa	02110[23][23]161110100242111001C01101001100020011
Bracalba_plana	4211000101110200222150401F00101001001020111
Bracalba_clavata	41020[03][02]13112020023230[02]400300200001110020001
Bracalba_hesperia	00102021401001002232124018000[01]1000000120?1?
Bracalba_intermedia	0202022061220100242400401301101000110020011
Bracalba_laminata	?11302101120200143631001?????????????0?0
Bracalba_magnirubra	221012211012010002303[12]001520010110110111000
Bracalba_nigrescens	???300101120230203131001G?????????????0?0
Bracalba_parvirubra	201012012012020004323[02]601B70000001010000?0?
Bracalba_pinnula	021[01]00010110020022301[02]401901001001111020011
Bracalba_sculptifrons	00110[13][13]150120000123011401450000110110110?1?
Bracalba_propodealis	0110022101120200233142111300001000111120?1?
Bracalba_tricolorata	0010200101120220243112001301201001000000010
Bracalba_sparsa	3210122131110100123021001160000111110111000
Bracalba_tridentata	00101001201202001230[13]1301B00000011100111?1?

## Appendix 2

Taxonomic records for all records used in the present paper. (doi: 10.3897/zookeys.236.3434.app2) File format: DarwinCore Archive.

**Explanation note:** Darwin Core Archive (DwC-A) is the preferred format for publishing data to the Global Biodiversity Information Facility (GBIF) network. Together with Dublin Core (on which its ideas are based), it is used by GBIF and others to encode data about organism names, taxonomies and species information.

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**Citation:** Burks RA, Masner L, Johnson NF, Austin AD (2012) Taxonomic revision of *Bracalba Dodd* (Hymenoptera, Platygasteridae s.l.), a parasitoid wasp genus endemic to Australia. *ZooKeys* 236: 1–53. doi: 10.3897/zookeys.236.3434.app2

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## Appendix 3

Locality records for all records used in the present paper. (doi: 10.3897/zookeys.236.3434.app3) File format: DarwinCore Archive.

**Explanation note:** Darwin Core Archive (DwC-A) is the preferred format for publishing data to the Global Biodiversity Information Facility (GBIF) network. Together with Dublin Core (on which its ideas are based), it is used by GBIF and others to encode data about organism names, taxonomies and species information.

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**Citation:** Burks RA, Masner L, Johnson NF, Austin AD (2012) Taxonomic revision of *Bracalba Dodd* (Hymenoptera, Platygasteridae s.l.), a parasitoid wasp genus endemic to Australia. *ZooKeys* 236: 1–53. doi: 10.3897/zookeys.236.3434.app3

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# A new species of *Decimiana* Uvarov (Insecta, Mantodea, Acanthopidae) from Brazil, with remarks on the distribution of *Decimiana bolivari* (Chopard)

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<sup>‡</sup> [urn:lsid:zoobank.org:author:4999C681-C5D4-4F46-AC46-73D87C33D17A](http://urn:lsid:zoobank.org:author:4999C681-C5D4-4F46-AC46-73D87C33D17A)

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[urn:lsid:zoobank.org:pub:70F61D62-70F9-4E46-9640-0814D76B295D](http://urn:lsid:zoobank.org:pub:70F61D62-70F9-4E46-9640-0814D76B295D)

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**Citation:** Menezes EC, Bravo F (2012) A new species of *Decimiana* Uvarov (Insecta, Mantodea, Acanthopidae) from Brazil, with remarks on the distribution of *Decimiana bolivari* (Chopard). ZooKeys 236: 55–64. doi: 10.3897/zookeys.236.3477

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## Abstract

*Decimiana* Uvarov is a Neotropical genus of Mantodea with five South American species, three of them known from Brazil: *Decimiana tessellata* (Charpentier); *Decimiana clavata* Ippolito & Lombardo; and *Decimiana bolivari* (Chopard). A fourth species from Brazil is described and new records of *Decimiana bolivari* (Chopard) from Brazil are presented and its distribution discussed.

## Keywords

Dictyoptera, Neotropical region, Bahia, Chapada Diamantina, Caatinga

## Introduction

The *Decimiana* name was proposed by Uvarov (1940) to replace the genus name *Decimia*, designated by Stål (1877), due to homonymy with a genus of Lepidoptera (Travassos 1945). This genus was created in monotype to *Acanthops tessellata* Charpentier, 1841 (Travassos 1945; Lombardo 2000).

*Decimiana tessellata* (Charpentier, 1841), was designated based on Seba's illustration (1765: 75, Fig. 11) (Travassos 1945). Illustration which historically were also attributed the representation of species *Acanthops falcataria* (Goeze, 1778) [= *Mantis falcataria* Goeze] and *Mantis bisubulata* Goeze, 1778 considered a junior synonym of *D. tessellata* despite the name priority (Travassos 1945; Lombardo 2000). Lombardo (2000) to analyze the same Seba's illustration concludes that represent *D. tessellata*.

Lombardo (2000) in his revision of the genus includes *Decimiana bolivari* (Chopard, 1916) [= *Acanthops bolivari* Chopard], *Decimiana rehni* (Chopard, 1913) [= *Plesiacanthops rehni* Chopard], transferred from other genera, and described *Decimiana hebardei* Lombardo. Later Ippolito and Lombardo (2004) described *Decimiana clavata*, a species know only from the holotype male. In his revision Lombardo (2000) affirms describe the first time the males of *D. bolivari*, species that had been described based on females. However, in a study of morphologic stamp, Heitzmann-Fontenelle (1964) describes and figure the male and female of *Acanthops erosula* Stål, 1877, which corresponds in reality to *D. bolivari* (Lombardo and Ippolito 2004).

The genus *Decimiana* has Neotropical distribution and their five species are recorded only in South America (Lombardo 2000, Ippolito and Lombardo 2004). Of which three species occurs in Brazil: *Decimiana bolivari* (Chopard) from Paraguay and Brazil (Bahia State, in the northeastern region, and Mato Grosso do Sul State, in the central-western region); *Decimiana clavata* Ippolito & Lombardo from Brazil (with no mention of a specific locality); *Decimiana hebardei* Lombardo from Bolivia; *Decimiana rehni* (Chopard) from Argentina and Paraguay; and *Decimiana tessellata* (Charpentier) from Paraguay and Brazil (Mato Grosso and Goiás states, central-western region) (Terra 1995, Lombardo 2000, Ippolito and Lombardo 2004).

In this contribution, we described a new species of *Decimiana* from Bahia State in the northeastern region of Brazil. Additionally, we provide and discuss new distributional records for *D. bolivari* from Brazil.

## Methods

All of the specimens were collected using a light trap. To study the male genitalia, the abdomens of the specimens were detached behind the eighth segment and treated according to the protocols of Cumming (1992). The male genitalia were stored in plastic microvials containing glycerin and pinned with their corresponding specimen. The terminology for external morphological follows Terra (1995), whereas genitalia terminology is based on Cerdá (1993). The studied specimens were deposited in the Coleção Entomológica Professor Johann Becker do Museu de Zoologia da Universidade Estadual de Feira de Santana (MZUEFS), Feira de Santana, Bahia State, Brazil; the Museu de Zoologia da Universidade Federal da Bahia (UFBA), Salvador, Bahia State, Brazil and Centro de Pesquisa Gonçalo Moniz da Fundação Oswaldo Cruz (FIOCRUZ), Salvador, Bahia State, Brazil.



## Taxonomy

The new species have the following diagnostics characteristics of the genus: presence of compound eyes with conical tubercle; costal margin of the mesothoracic wings with slight concavity; posterior wings with black stripes on cross veins; mid and hind legs without lobes, and anterior process of the ventral lamina developed (*sensu* Lombardo 2000).

### *Decimiana elliptica* sp. n.

urn:lsid:zoobank.org:act:7F0879A2-1852-4ACE-8518-F7B4475EF1F2

[http://species-id.net/wiki/Decimiana\\_elliptica](http://species-id.net/wiki/Decimiana_elliptica)

Figures 1–3

**Type material.** Holotype male: BRASIL, Bahia, Palmeiras, Posto do Pai Inácio, 12°27.00"S, 41°28.00"W, ca. 900 m a.s.l. 09.XII.2007, Bravo, F., Zacca, T., Silva-Neto, A., Resende, J., & Almeida, C. col., (MZUEFS #42169). Paratype male: BRASIL, Bahia, Mucugê, Chapada Diamantina, Parque Municipal de Mucugê, 30.I.2011, light trap, Mahlmann, T. & Hipólito cols. (UFBA).

**Etymology.** The name makes reference to the shape the anterior lobe of the left dorsal phallomere.

**Diagnosis.** Compound eyes conical with apical tubercle; mesothoracic wings opaque, brown, with costal margin slightly concave; posterior wings with black bands between the crossveins; anterior process of the left dorsal phallomere with distal sclerotized lobe elliptical.

**Description male.** Body stout, brown (Fig. 1), length 38.64–42.68 mm from head to subgenital plate.

Head (Fig. 2A). Triangular, 1.67 times as wide as width of supracoxal dilatation. Antennae moniliform, brown, 1.07 times the length of the pronotum. Ocelli developed, elliptical. Vertex: rectilinear, below the imaginary line connecting top of compound eyes (not including the apical tubercle). Frontal shield transversal, 0.53 times wider than high.

Thorax. Pronotum, 0.27 times as long as length of body, 4.87 times longer than its smallest width, lateral margins smooth, surface with scattered small tubercles, distributed along sides of the medial carina (Fig. 2B). Prozona: anterior margin rounded, lateral margins slightly convergent. Metazona 2.05 times as long as length of prozona, with two basal flattened tubercles.

Fore legs. Coxae: stout, reaching base of proesternum, 0.75 as long as length of pronotum; anterior, posterior, and external margins with minute dispersed spines; posterior external face with small scattered tubercles, inner face with some circular ocher spots. Fore femora: stout, triangular, 0.94 times as long as the length of the pronotum; external face with small tubercles; 16 inner spines, except the spines of the genicular lobes; femoral spines of the three series black at tip. Fore tibiae: 0.55 as long



**Figure 1.** *Decimiana elliptica* sp. n., holotype, dorsal habitus. Scale bar = 10.00mm.

as length of pronotum (not including the tibial claw); 20–21 external spines in left leg and 18–19 in right leg; 16 inner spines; external and inner tibial spines black at tips.

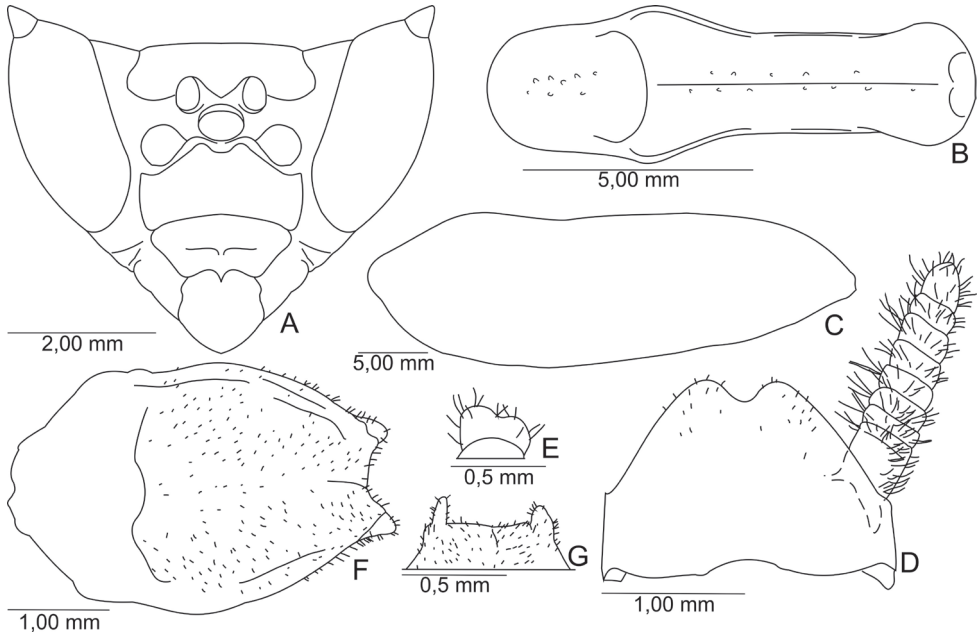
Mesothoracic wings: 3.29 times as long as length of pronotum, surpassing the abdomen at rest, and same length as posterior wings. Surface opaque and brown. Costal margin slightly concave and with small apical lobe (Fig. 2C). Venation brown. Venules of the costal area anastomosed.

Mid legs: pubescent; femora and tibiae 0.58 times as long as length of pronotum; first tarsomere shorter than length of all remaining tarsomeres.

Metathoracic wings: 3.03 times as long as length of pronotum, surface semi-hyaline; venation brown.

Hind legs: pubescent; femur 0.70 times as long as length of pronotum; tibiae 0.73 times as long as length of pronotum; first tarsomere shorter than length of all remaining tarsomeres.

Abdomen. Cylindrical; second to fourth and sixth tergite with distal black stripe, fifth tergite black; fourth and sixth tergite with rounded lateral lobe. Supranal plate: 1.47 times wider than length, distal margin bidentate (Fig. 2D). Cerci: bristly, cylin-



**Figure 2.** A–D, F holotype; E, G paratype. **A** Head, frontal view **B** Pronotum, dorsal view **C** Shape of the left mesothoracic wings, dorsal view **D** Supranal plate and cercus, dorsal view **E** Last cercomerum **F** Subgenital plate, ventral view **G** Distal margin of the subgenital plate, ventral view.

drical, eight cercomeri, last cercomerum cylindrical or bilobed (Fig. 2E) and slightly flattened. Subgenital plate: pubescent, oval (Fig. 2F). Styles: bristly, separated, small or more developed (Fig. 2G).

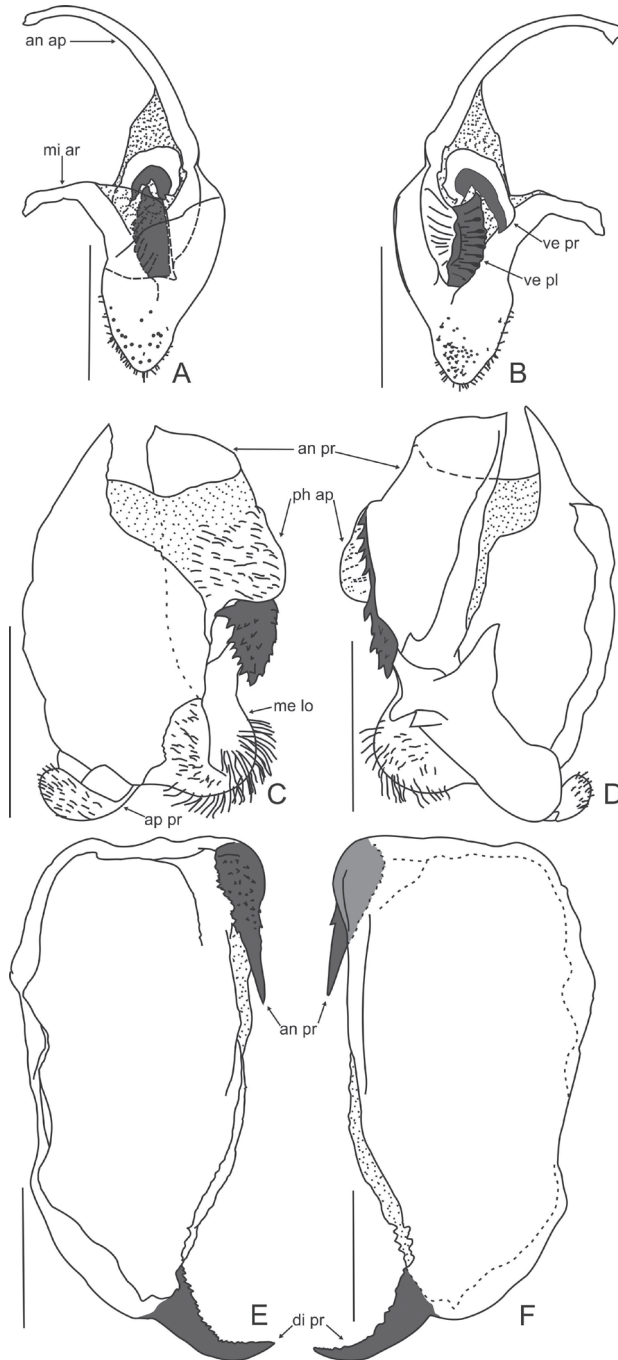
**Phallic complex.** Right dorsal phallomere. Dorsal lamina triangular (Fig. 3A). Mid arm: developed, arched. Anterior apodeme long and narrow. Ventral plate sclerotized, well developed, trapezoidal, projected, with transverse grooves. Ventral process sclerotized, curved and well developed, as long as of ventral plate, forming acute angle backward (Fig. 3B).

Left dorsal phallomere. Dorsal lamina: ample, basal region narrow; right basal region membranous (Fig. 3C). Ventral lamina long and wide forming an anterior process, with distal sclerotized elliptical dentate lobe, connected to a lateral row of teeth which can be undeveloped (Fig. 3D). Apical process flattened, folded toward base of phallomere. Phalloid apophysis membranous, forming a relatively large and pilose lobe. Membranous lobe wide (approx. half the width of dorsal lamina), rounded and with long hair.

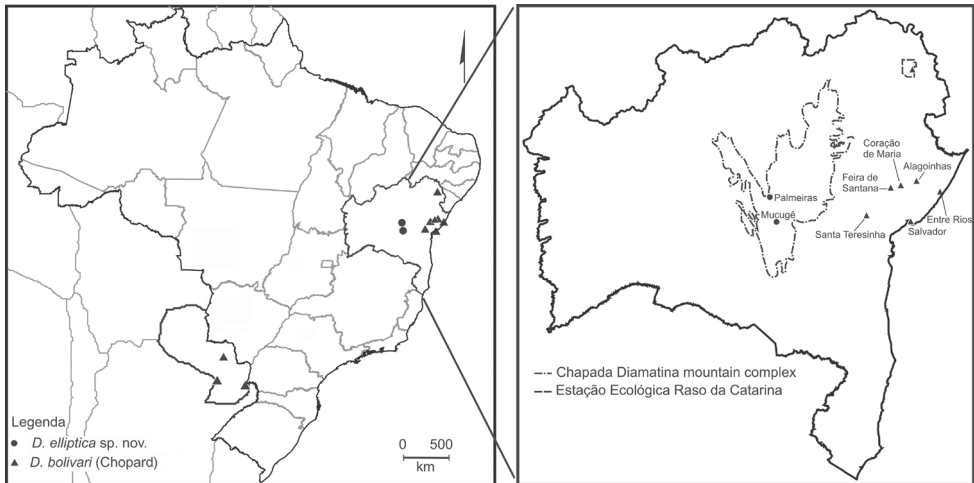
Ventral phallomere (Figs 3E, 3F). Elongated (approx. 1.84 times longer than wide). Tip of the right margin with well-sclerotized and acute anterior process, its surface covered with denticles. Distal process sclerotized, upward, with small denticles on anterior margin.

Female unknown.

**Measurements** (mm). Holotype: body length 38.64, pronotum length 10.6, mesothoracic wings 34.93, metathoracic wings 32.2, fore coxae 8.0, fore femura 9.97, fore tibiae 5.91, mid femura 6.15, mid tibiae 6.15, hind femura 7.4, hind tibiae 7.82.



**Figure 3.** *Decimiana elliptica* sp. n., holotype. **A** Right dorsal phallomere, dorsal view **B** Right dorsal phallomere, ventral view **C** Left dorsal phallomere, dorsal view **D** Left dorsal phallomere, ventral view **E** Ventral phallomere, dorsal view **F** Ventral phallomere, ventral view. Abbreviations: **an ap** = anterior apodeme, **an pr** = anterior process, **di pr** = distal process, **me lo** = membranous lobe, **mi ar** = mid arm, **ph ap** = phalloid apophysis, **ve pl** = ventral plate, **ve pr** = ventral process. Scale bar = 1.00 mm.



**Figure 4.** Geographical records of *Decimiana elliptica* sp. n. and *Decimiana bolivari* (Chopard).

Paratype: body length 42.68, pronotum length 11.71, mesothoracic wings 38.58, metathoracic wings 35.57, fore coxae 8.83, fore femura 11.01, fore tibiae 6.52, mid femura 6.79, mid tibiae 6.79, hind femura 8.17, hind tibiae 8.63.

**Type localities.** The type specimens were collected in two localities in the Chapada Diamantina Mountain Range in Bahia State, northeastern Brazil: Parque Municipal de Mucugê (municipality of Mucugê) and near a mountain known as Morro do Pai Inácio (municipality of Palmeiras) (Fig. 4). The Chapada Diamantina represents the northern portion of the Espinhaço Range (Rocha et al. 2005) and according Velloso et al. (2002) it is considered an eco-region of the Caatinga (dryland) Biome, with a rainy season generally from November to April. The vegetation of the Chapada Diamantina is a mosaic of “caatinga”, “cerrado de altitude”, “campos rupestres”, and semideciduous and deciduous forests.

## Discussion

Regarding the right dorsal phallomere is only possible to compare with *D. bolivari*, accurately illustrated by Heitzmann-Fontenelle (1964) Fig. 5. Fact that we attest by confrontation with the material examined of *D. bolivari*. Since the literature uses the lack of description and illustration of this phallomere in the other species of genus.

The ventral lamina in the right dorsal phallomere in *D. elliptica* sp. n. is grooved while in *D. bolivari* is covered by spines. The ventral process in the new species is more curved in the base and more elongated than in *D. bolivari*.

The anterior process of the left dorsal phallomere is developed and anteroposteriorly perpendicular to phallomere in *D. elliptica* sp. n., *D. bolivari*, *D. herbardi*, *D. rehni* and *D. tessellata* (Figs 3C, 3D; Heitzmann-Fontenelle 1964: Fig. 6; Lombardo 2000:

Figs 27–29,31), and . differs from *D. clavata* because the anterior process is less developed and oblique (Ippolito and Lombardo 2004: Figs 4, 5). In the new species the anterior process of the left dorsal phallomere has truncated shape, while *D. bolivari*, *D. herbaridi*, *D. rehni* it is sack-shaped and in *D. tessellata* has an expanded apex.

On the surface of the anterior process of the left dorsal phallomere are absent in *D. elliptica* sp. n. the minute spines that are present in *D. bolivari* and *D. herbaridi*, as well as, are absent in the new species the teeth present in *D. rehni* and the large apical teeth observed in *D. tessellata*.

The anterior process of the left dorsal phallomere in *D. elliptica* sp. n. and *D. clavata* has a distal esclerotized lobe, which it is absent in *D. bolivari*, *D. herbaridi*, *D. rehni* and *D. tessellata*. However, this sclerotized lobe is elliptical in *D. elliptica* sp. n. and bludgeon-shaped in *D. clavata*.

The membranous lobe of the left dorsal phallomere the new species is relatively greater and more rounded than the other species, except for *D. clavata* which it is most similar.

*D. elliptica* sp. n. has the ventral phallomere more elongated than the other species (Fig. 3E). The anterior process of the ventral phallomere elongated as in *D. bolivari* (Heitzmann-Fontenelle 1964: Fig. 2), *D. rehni* (Lombardo 2000: Fig. 25) and *D. herbaridi* (Lombardo 2000: Fig. 26). The distal process of the ventral phallomere of new species resembles that of *D. bolivari* in the form, curved upwards. However differs the distal process of *D. tessellata* who is backwards, and the distal process of *D. rehni* which is more curved and short.

### Notes on the distribution of *Decimiana bolivari* (Chopard, 1916)

Material examined: BRASIL, Bahia: Alagoinhas, 24.X.1993, D. H. Smith, col., male (UFBA). Coração de Maria, Distrito de Retiro, 07.XI.2010, Franklin Machado col., male (MZUEFS #53183); *ib.*, female (MZUEFS #53180). Entre Rios, 07.V.2008, Silva-Neto, A. col., male (MZUEFS #39218). Feira de Santana, 16.XII.1999, Márcia col., male (MZUEFS #13268); *ib.*, 14.V.2001, Ivan Castro col., male (MZUEFS #13269); *ib.*, 08.XI.2003, F. Bravo col., male (MZUEFS #13285). Salvador, 23.IV.1985, D. H. Smith, col., male (UFBA); *ib.*, 2.X.1952, Afonso Braga, col., 1 male (FIOCRUZ); *ib.*, 13.V.1962, Ivo Silva col., male (FIOCRUZ). Santa Teresinha, Serra da Jibóia, ca. 800 m a.s.l., VIII.2004, Raimunda col., male (MZUEFS #28123); *ib.*, 29.III.2009, male (MZUEFS #46032). Estação Ecológica Raso da Catarina, 14.VI.1981, D. H. Smith, col., male (UFBA).

In his review of *Decimiana*, Lombardo (2000) stated that *D. bolivari* was only present in Paraguay (known records from Asunción, “central Paraguay”, Horqueta, Puerto Bertoni, Puerto San Pablo y Sapucay, *sensu* Lombardo 2000); however, he did not comment on the Brazilian records made by Terra (1995), who reported (without mentioning specific localities) that *D. bolivari* occurs in the Brazilian states of Mato Grosso do Sul and Bahia. He also no mention Heitzmann-Fontenelle (1964) that record *D. bolivari* in state of Mato Grosso do Sul, Serra do Urucum. Because of the lack of refe-

rences to specific material, it was impossible to locate the specimens studied by Terra (1995) and thus these records cannot be confirmed. Ehrmann (2002) and Agudelo et al. (2007) followed the distributions of *D. bolivari* presented by Lombardo (2000).

However, we confirm herein the occurrence of *D. bolivari* in Bahia state for the following localities: Alagoinhas, Coração de Maria, Entre Rios, Feira de Santana, Salvador, Santa Teresinha (Serra da Jibóia) and Estação Ecológica Raso da Catarina (Fig. 4). These confirmed records considerably expand the distribution of *D. bolivari*, to the Brazilian northeast.

It is important to mention that the specimens of *D. bolivari* from Bahia were collected in various ecosystems encompassing a wide array of different climates and plant formation. This species was recorded from localities in ombrofilous Atlantic Rain Forest with a moist climate (Entre Rios and Salvador), in transitional ecosystems between Caatinga (dryland) and Atlantic Rain forests (Alagoinhas, Coração de Maria, Feira de Santana, Santa Teresinha) with semi-arid to moist climates, and in semideciduous forest/caatinga and semi-arid caatinga/deciduous forest (Raso da Catarina Ecological Station) (Velloso et al. 2002, IBGE 2011, SEI 2011). *D. bolivari* was also collected at sea level (e.g. Entre Rios and Salvador) and up to approximately 800 (Santa Teresinha, Serra da Jibóia) (IBGE 2011, SEI 2011, collection data). and Pantanal region, domained. In Mato Grosso do Sul state (Serra do Urucum), *D. bolivari* is recorded in the Pantanal ecosystem, where occurs the plant formations: steppic savanna/seasonal forest; savanna/steppic savanna and steppic savanna grass-woody (IBGE 2004).

*D. bolivari* seems to be a species well adapted to different biotic, environmental, and altitudinal conditions, further collections will provide a additional insights on the actual extent of its distribution.

## Acknowledgments

The authors would like to thank the Programa de Pesquisa em Biodiversidade do Semi-árido (PPBio/ Semi-árido) for financing the research and collections. To Thiago Mahlmann by the specimen collection and sending to the first author. To the entomological collection of the Universidade Federal da Bahia and Centro de Pesquisa Gonçalo Moniz da Fundação Oswaldo Cruz for the loan specimens to MZUEFS.

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# The first hypothelminorheic Crustacea (Amphipoda, Dogielinotidae, *Hyaella*) from South America

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## Abstract

Most of known troglobiotic species occur in caves and subterranean environments from great depths. However, recently more attention has been given to other subterranean environments, such as the hypothelminorheic habitats. It comprises the most superficial among all subterranean habitats. This kind of environment is characterized by the constant presence of wet spots, absence of light and very particular abiotic characteristics, comprising unique species. The first hypothelminorheic Amphipoda from South America is here described, a new species of the genus *Hyaella* which occurs in a wetland on Southern Brazil. The new species differs from other troglobiotics of the genus by the presence of a curved seta on the inner ramus of uropod 1 and elongation of appendices, as the first pair of antennae and pereopods 6 and 7. However, human impacts in the area where the new species occurs have changed heavily their habitat, which may have led the species to a critical level of threat or even extinction, demonstrating the fragility of this environment.

## Keywords

Amphipoda, hypothelminorheic, *Hyaella*, biodiversity, conservation

## Introduction

For decades cave organisms, especially those more adapted, were thought to be associated mainly to deep portions of caves. Although it was known that the subterranean environment was much wider than macro-caves, the study of cave fauna has been historically focused on them. There are many studies concerning other subterranean habitats, especially the MSS (“*Milieu Souterrain Superficiel*”), and many troglobiotic species (exclusively subterranean-dwellers) were found in such habitats (Juberthie et al. 1980, Racovitza 1983, Juberthie and Decu 1994, Růžička 1999, Juberthie 2000, Culver and Pipan 2009a, 2009b). However, recently more attention has been given to superficial subterranean compartments, which are generally called “shallow subterranean habitats” (Culver and Pipan 2009a).

Among a great variety of such habitats, there is the hypothelminorheic habitat. This habitat comprises the most superficial subterranean habitat. It is characterized by the presence of persistent wet spots fed by subterranean water in depressions of moderately sloped areas (Culver et al. 2006, Culver and Pipan 2009a). There is no light in such habitats, like in caves; physical and chemical properties are unique, such as the abundance of organic matter, drainage area of less than 10.000 m<sup>2</sup>, high conductivity and lower annual variation of temperature when compared with surface waters (Culver et al. 2006). Hypothelminorheic habitats may comprise species unique to this habitat or common to other subterranean environment (Culver and Pipan 2009a).

Amphipods are among the species that may be found in hypothelminorheic habitats (Fiser et al. 2010). In Europe and North America, there are species known to be restricted to such habitats. However, there are no records of hypothelminorheic species from South America, especially due to the lack of studies concerning this kind of habitat. The Neotropics comprises about 7% of described freshwater species, and the diversity of South America in family, genus and species levels is relatively low when compared with other regions of the planet (Väinölä et al. 2008).

Freshwater South American amphipods belong to the families Dogielinotidae, Bogdiellidae, Ingolfeiliidae, Phreatogammaridae, Pontogeneiidae and Paraleptamphopidae. However, in South America, these families are restricted to subterranean environments, except Dogielinotidae, and most of them comprise few species. On the other hand, Dogielinotidae is widespread, the genus *Hyaletta* Smith, 1874 is found in many different epigeic habitats, besides some troglobiotic species that occur in caves (Grosso and Peralta 1999).

At present, there are 56 described species for this genus, of which 14 occur in Brazil (Bastos-Pereira and Bueno 2012). Two of them are troglobiotic and both occur in caves of the São Paulo state, Southeastern of the country (Cardoso et al. 2011). Certainly the diversity of *Hyaletta* is underrepresented, particularly with respect to species that occur in subterranean environments, what results from few studies concerning the genus (Väinölä et al. 2008).

The aim of this work is to describe the first hypothelminorheic *Hyaletta*, which also represents the first hypothelminorheic species described for South America. We also discuss about the habitat loss of this new species, considering even the possibility of its extinction due to anthropogenic actions.

## Material and methods

The specimens were collected in July 2002, on a wetland in the municipality of Roque Gonzales, Rio Grande do Sul state, Southern Brazil. The sampling was made with the aid of a handnet, which collected the sediment, water column and the riparian vegetation.

Body and head length of the animals were measured through an optic microscope with a milimetric scale. The body measurement was made from the tip of the head to the base of telson. Ten animals (five males and five females) were dissected and the appendices were mounted on permanent slides, which were used to illustrate the new species.

The description was made based on main morphological characteristics of Brazilian species of *Hyalella*, such as the gnathopods, uropods and telson, according to González et al. (2003a, 2003b), González et al. (2006), Cardoso et al. (2011), and Bastos-Pereira and Bueno (2012). The terminology used for setae of the appendices follows Zimmer et al. (2009).

Type material is deposited on Coleção de Crustáceos da Universidade Federal de Lavras (UFLA) and Museu Nacional do Rio de Janeiro (MNRJ).

The pictures of fixed animals were taken through a stereomicroscope ZEISS STEMI 2000-C connected to a photographic camera, using CARL ZEISS AXIOVISION program SE64 REL 4.8.3. The images from the site of occurrence of new species were taken from Google Earth.

## Systematics

**Order Amphipoda Latreille, 1816**

**Suborder Gammaridea Latreille, 1802**

**Family Dogielinotidae Gurjanova, 1953**

**Genus *Hyalella* S. I. Smith, 1874**

***Hyalella imbya* Rodrigues & Bueno, sp. n.**

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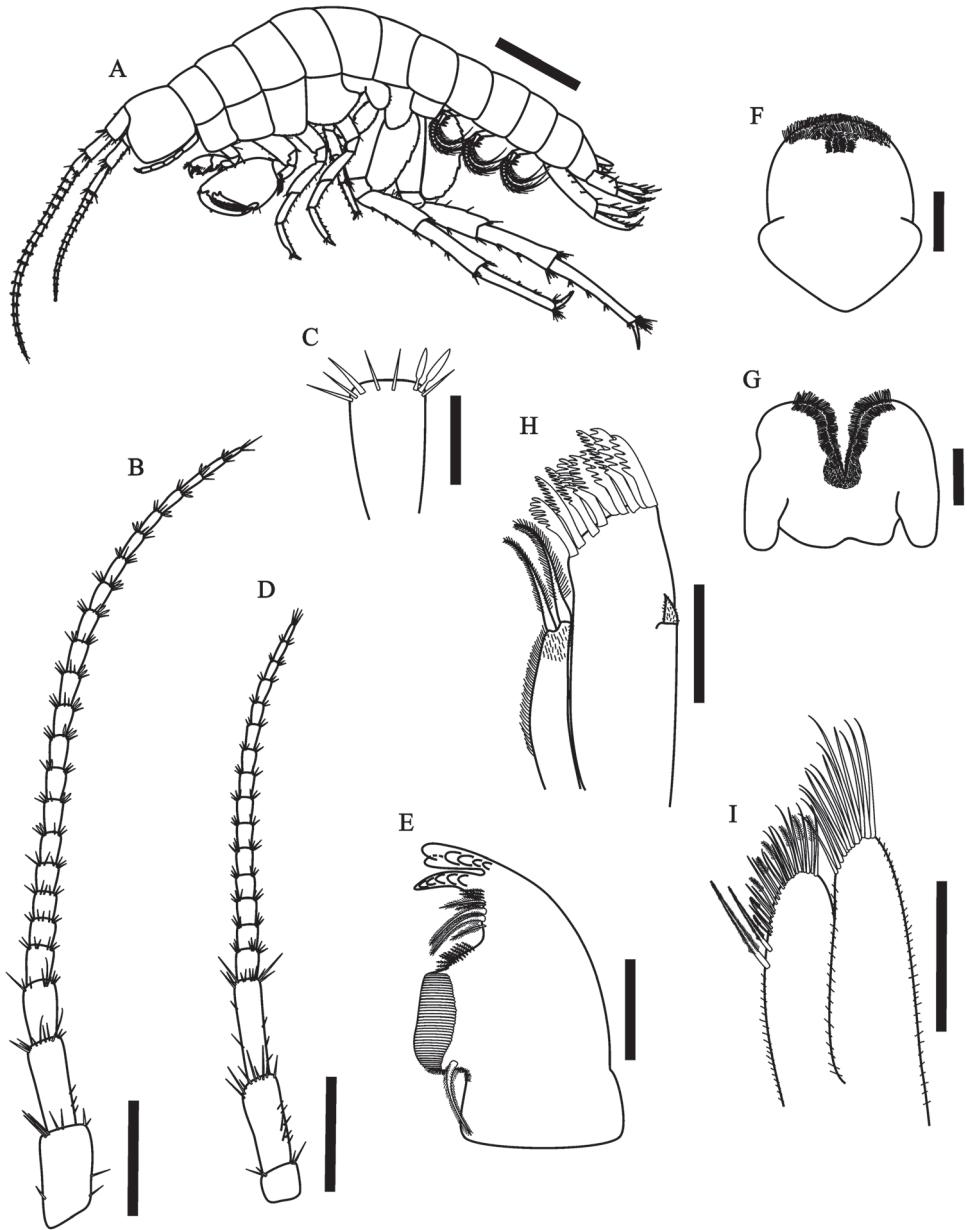
[http://species-id.net/wiki/Hyalella\\_imbya](http://species-id.net/wiki/Hyalella_imbya)

Figs 1–5

**Type material.** Holotype: male, Brazil, Rio Grande do Sul state, Roque Gonzales municipality, wetland, Ijuí watershed, Uruguay hydrographic region, (28°13'55.6"S, 54°58'37.3"W) (MNRJ 23384), allotype female (MNRJ 23385), July, 7, 2002, Stenert, C. coll.

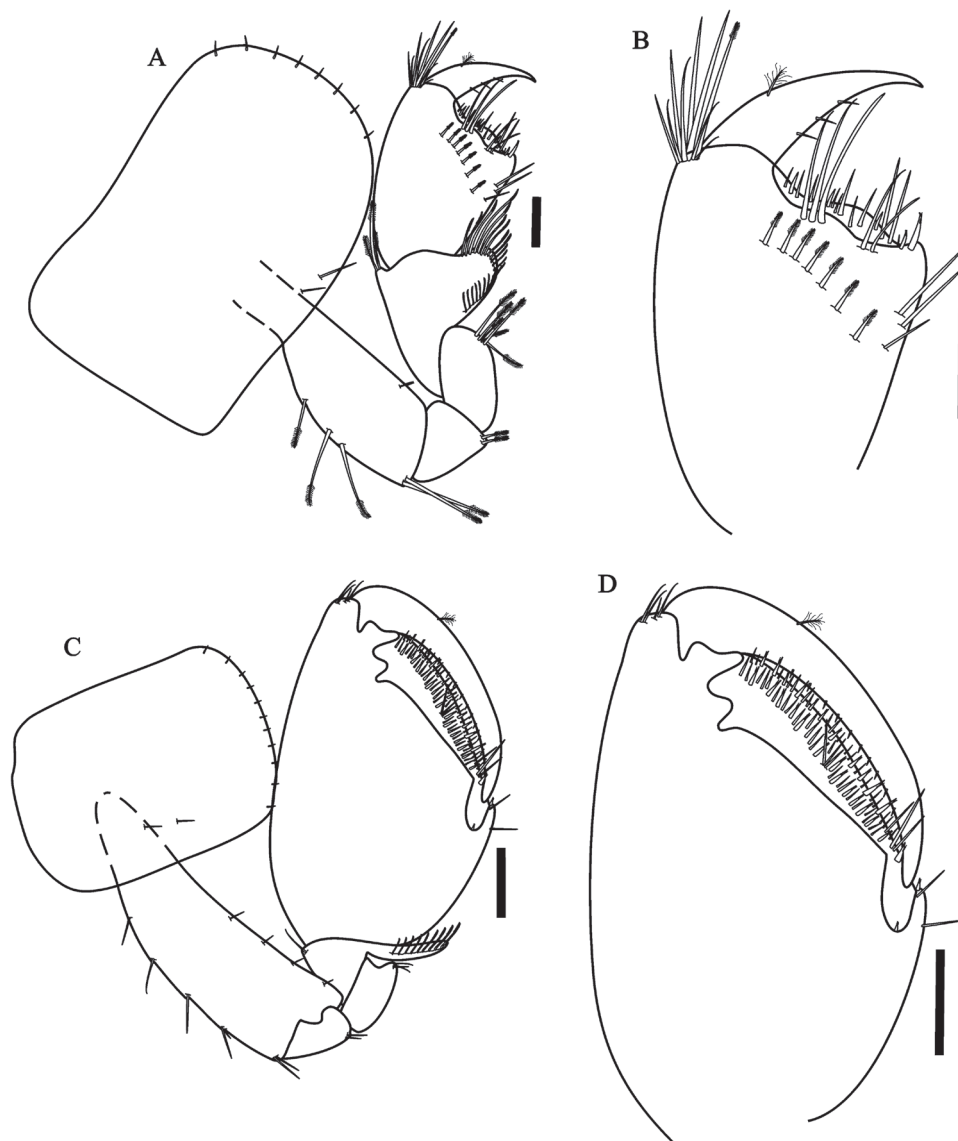
**Paratypes.** MNRJ 23386 (5 males; 5 females; 5 juveniles), UFLA 0187 (10 males; 10 females; 10 juveniles) with the same data as the holotype.

**Type locality.** Brazil, Rio Grande do Sul state: Roque Gonzales municipality, 28°13'55.6"S, 54°58'37.3"W, wetland, Ijuí watershed, Uruguay hydrographic region, ca 200 m high, July 7 2002, Stenert, C. coll.



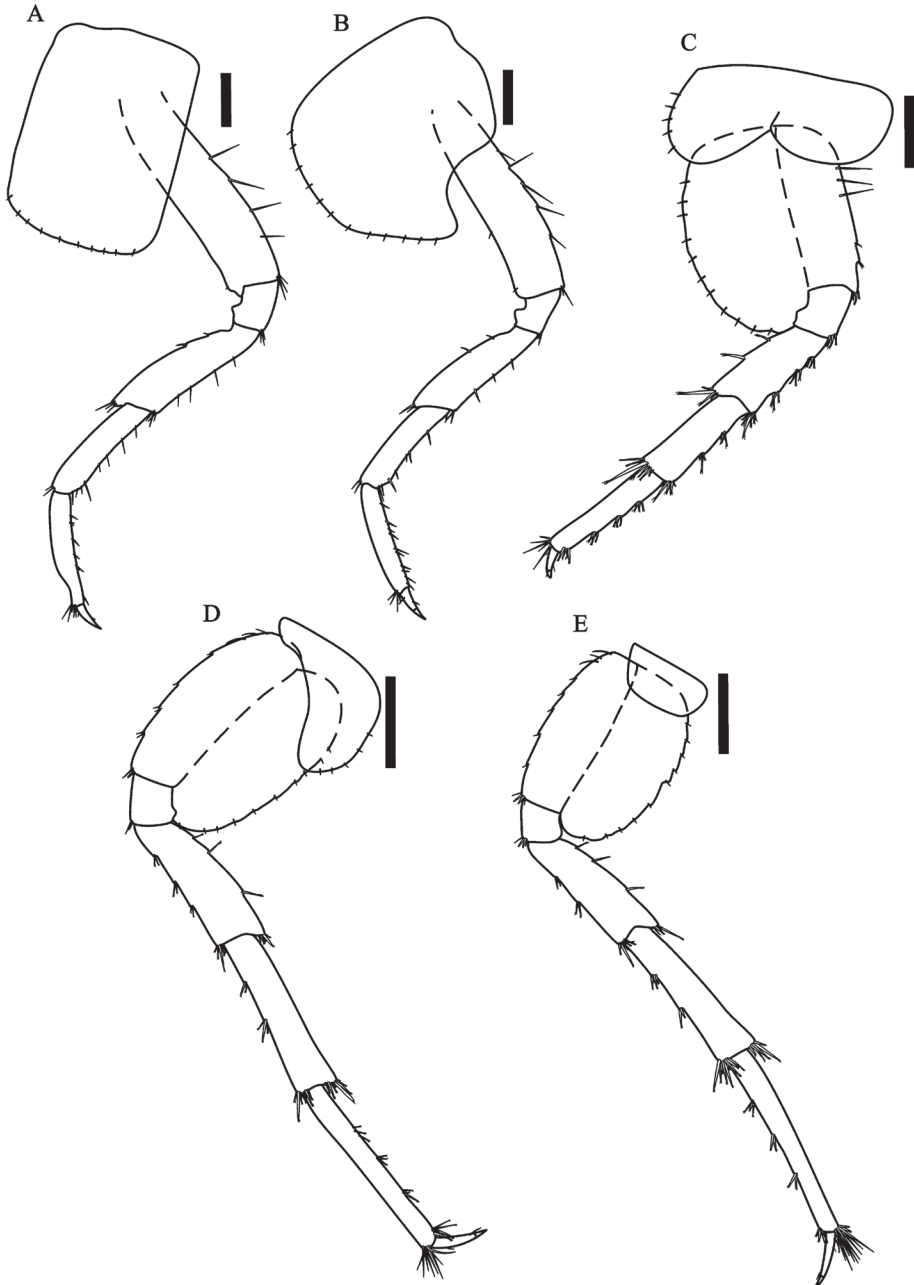
**Figure 1.** *Hyaella imbya* sp. n. Rodrigues and Bueno (male paratype, UFLA 0187). **A** habitus from holotype **B** antenna 1 **C** antenna 1 article showing two aesthetascs **D** antenna 2 **E** left mandible **F** upper lip **G** lower lip **H** maxilla 1 **I** maxilla 2. Scale bar equal 1 mm for **A**; 500 µm for **B**; 100 µm for **C–I**.

**Diagnosis.** Body surface smooth. Eyes absent. Antenna 1 longer than antenna 2, flagellum with 18–23 articles. Antenna 2 less than half body length, flagellum with 14–16 articles. Maxilliped with distal nail longer than dactylus. Gnathopod 1 propodus length less than twice maximum width, hammer shape, inner face with 7 pappose setae,



**Figure 2.** *Hyaella imbya* sp. n. Rodrigues and Bueno (male paratype, UFLA 0187). **A** gnathopod 1 **B** gnathopod 1 propodus and dactylus **C** gnathopod 2 **D** gnathopod 2 propodus and dactylus. Scale bars equals 100  $\mu$ m for A–D.

without comb-scales. Gnathopod 2 carpus wider than long, posterior lobe elongated without comb-scales or denticles in the border; propodus ovate, without comb-scales, palm sub-equal to posterior margin, slope oblique, palm with two rows of several cuspidate setae with an accessory setae and simple setae. Peraeopod 5 smaller than others; peraeopod 6 and 7 much more longer than others. Uropod 1 inner ramus of male with a short curved seta, four cuspidate setae with an accessory seta apically, with one of



**Figure 3.** *Hyalella imbya* sp. n. Rodrigues and Bueno (male paratype, UFLA 0187). **A** pereopod 3 **B** pereopod 4 **C** pereopod 5 **D** pereopod 6 **E** pereopod 7. Scale bars equals 200  $\mu$ m for **A–E**.

them almost half length of the outer ramus. Uropod 3 shorter than telson, peduncle wider than ramus, with one cuspidate seta with an accessory seta distally. Telson wider than long, with two long simple apical setae. Sternal gills present on segments 3 to 7.

**Description of male.** Mean body length:  $5.03 \pm 0.85$  mm, mean head length:  $0.46 \pm 0.07$  mm (n=10). Body surface smooth; epimeral plates not acuminate (Fig. 1A, Fig. 6A).

Head smaller than 2 thoracic segments, rostrum absent. Eyes absent (Fig. 6B).

Antenna 1 (Fig. 1B) longer than antenna 2, more than half body length; peduncle surpassing head length; flagellum with 18 to 23 articles; aesthetascs (Fig. 1C) occurring in pairs distally on flagellum after article 5.

Antenna 2 (Fig. 1D) peduncle not surpassing the second pereonite, less than half body length, peduncle slender, longer than head; flagellum with 14 to 16 articles, longer than peduncle.

Mandible basic amphipodan (in the sense of Watling 1993), but without palp; incisor toothed; left lacinia mobilis with six teeth (Fig. 1E); seta row on left mandible with five main pappose setae plus accessory setae, right mandible with three main pappose setae plus accessory setae; molar large, cylindrical and triturative with setules around its circumference.

Upper lip (Fig. 1F) margin rounded; distal border covered by setules on dorsal and ventral faces.

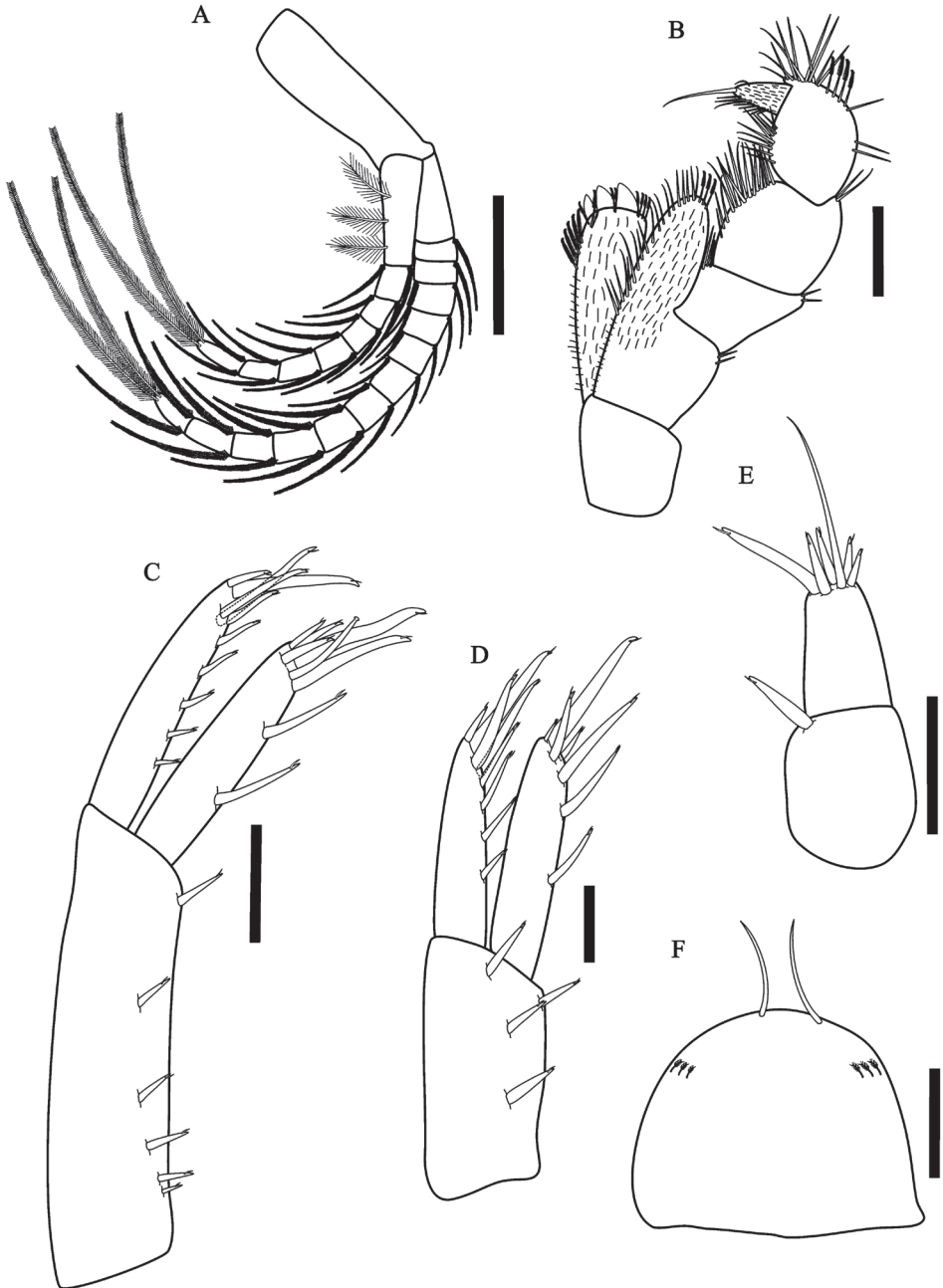
Lower lip (Fig. 1G) outer lobes rounded, with setules on dorsal and ventral faces.

Maxilla 1 (Fig. 1H) palp uniarticulate, short, longer than wide, covered by several simple setae and reaching less than half length the distance between the base of palp and tip of setae on outer plate. Inner plate slender, shorter than outer plate, with two long papposerate apical setae, several simple setae on inner margin; outer plate with 8–9 long serrate setae.

Maxilla 2 (Fig. 1I) inner plate shorter than outer plate, with two long papposerate, eight serrulate and several simple apical setae; outer plate with abundant long simple setae; outer and inner plates with several setules.

Maxilliped (Fig. 4B) inner plate with three strong cuspidate setae apically, several pappose setae on apical and inner borders, inner plate recovered by abundant short setule; outer plate larger than inner plate, recovered by setule and with three pappose setae and several simple setae; palp longer than outer plate, four articles; article 1 wider than long, outer and inner faces with short simple setae; article 2 wider than long, inner face with several long simple setae; article 3 wider than long, outer and inner faces with several long simple setae and outer face with four pappose setae; dactylus unguiform recovered by short simple setae, shorter than third article, inner border with several simple setae; distal nail longer than dactylus.

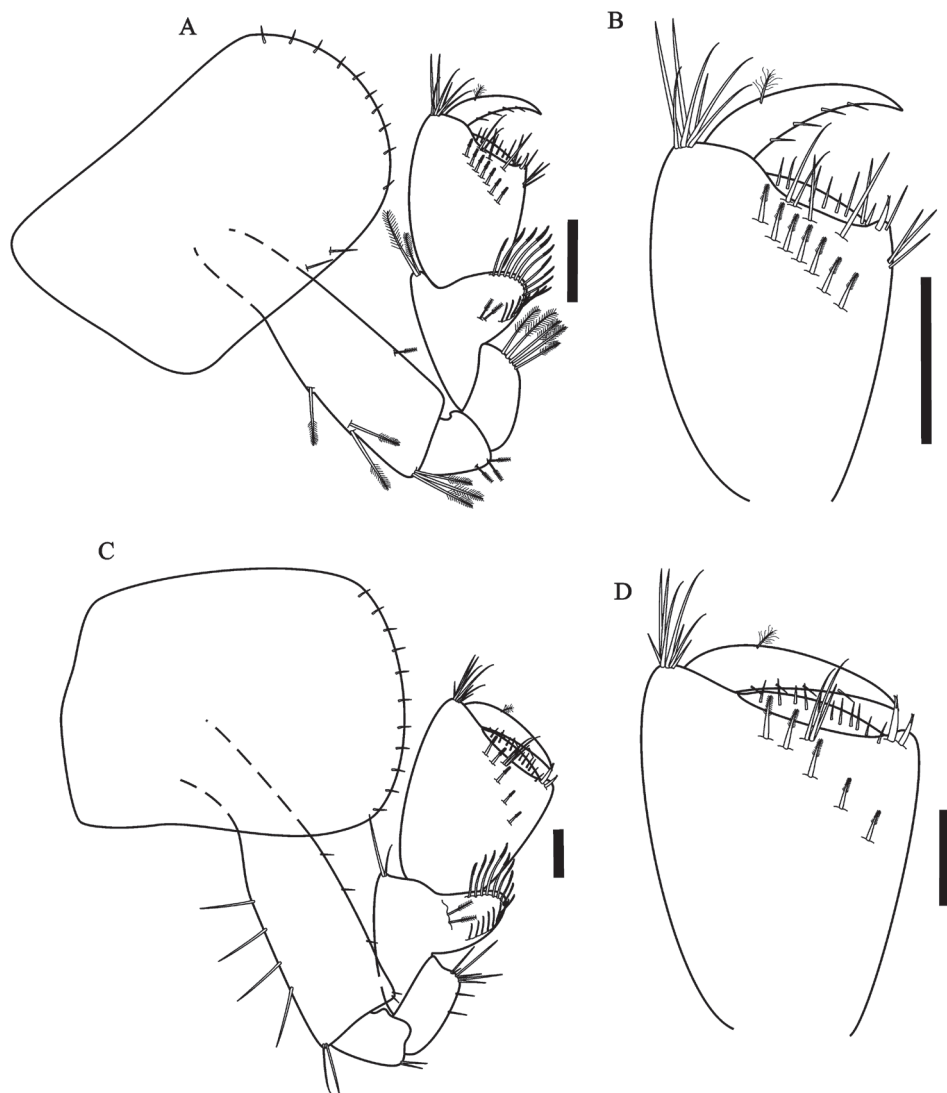
Gnathopod 1 (Fig. 2A) subchelate; coxal plate wider than long, with simple setae on the border; basis, ischium and merus with serrate setae dorsally; carpus longer than wide, shorter than propodus, with lateral distal lobe produced and forming a scoop-like structure, border pectinate with several serrate setae, without denticles and comb-scales in their basis; border propodus width  $3/4$  of maximum length, hammer-shaped (Fig. 2B), without setae on anterior border, without comb-scales, inner face with 7 serrate setae, with simple setae on the disto-posterior border; palm slope transverse, margin slightly concave, posterior distal corner with two cuspidate setae with an accessory seta; dactylus claw-like without comb-scales, one plumose seta dorsally and few setae ventrally.



**Figure 4.** *Hyalella imbya* sp. n. Rodrigues and Bueno (male paratype, UFLA 0187). **A** pleopods **B** maxiliped **C** uropod 1 **D** uropod 2 **E** uropod 3 **F** telson. Scale bars equals 200  $\mu\text{m}$  for **A**; 100  $\mu\text{m}$  for **B–F**.

Gnathopod 2 (Fig. 2C) subchelate; basis hind margin with five groups of simple setae; merus with few setae on posterior margin; carpus wider than long, posterior lobe slim produced between merus and propodus, border pectinate with several short





**Figure 5.** *Hyaella imbya* sp. n. Rodrigues and Bueno (female allotype, UFLA 0187). **A** gnathopod 1 **B** gnathopod 1 propodus and dactylus **C** gnathopod 2 **D** gnathopod 2 propodus and dactylus. Scale bars equals 100  $\mu\text{m}$  for A–D.

serrate setae, without denticles or comb-scales; propodus ovate (Fig. 2D), length 1.4 maximum width, without comb-scales; palm sub-equal than posterior margin of propodus, slope oblique, palm with two rows of several cuspidate setae with an accessory setae and simple setae, posterior distal corner with few simple setae and with a cup for dactylus; dactylus claw-like, congruent with palm, with few endal setae and a plumose seta dorsally, few setae ventrally, without comb-scales.

Peraeopods 3 (Fig. 3A) and 4 (Fig. 3B) merus and carpus posterior margin with clusters of simple setae; propodus posterior margin with six to seven groups of simple



**Figure 6.** *Hyalella imbya* sp. n. Rodrigues and Bueno (male holotype, UFLA 0187). **A** male specimen fixed (body length = 4.8 mm, head length = 0.47 mm) **B** detail of the head showing the absence of eyes in the male specimen fixed **C** female specimen fixed (body length = 4.5 mm, head length = 0.45 mm). Scale bar equal 1 mm for **A**; 0.5 mm for **B**; 1 mm for **C**.

setae; dactylus less than half-length of propodus. Peraeopods 5 to 7 dactylus less than half-length of propodus; merus, carpus and propodus posterior margin with 4–5 marginal clusters of 2–9 cuspidate setae with an accessory setae. Peraeopod 3 sub-equal to peraeopod 4; peraeopod 5 (Fig. 3C) smaller than others; peraeopods 6 (Fig. 3D) and 7 (Fig. 3E) much longer than others. Coxal plates - peraeopod 3: longer than wide, width about half its length; peraeopod 4: wider than long; peraeopod 5: wider than long, with two lobes; peraeopod 6: ovate; peraeopod 7: wider than long. All coxal plates with simple setae on the border.

Pleopods (Fig. 4A) peduncle smaller than flagellum, without coupling spines; rami with several plumose setae; plumose setae of the last article longer 1.4 times than peduncle.

Uropod 1 (Fig. 4C) peduncle 1.7 times longer than rami; outer ramus longer than inner ramus; outer ramus with six cuspidate setae with an accessory seta, four cuspidate setae with an accessory seta apically, one smaller and three more longer, one of them with almost half length of the outer ramus; inner ramus with two dorsal cuspidate setae with an accessory seta on inner margin, male with a short curved seta apically on the ramus, five cuspidate setae with an accessory seta apically, three smaller and two more longer, one of them more than half of the length of the inner ramus; peduncle setation present.

Uropod 2 (Fig. 4D) shorter than uropod 1; ramus and peduncle of the same length; inner ramus with three dorsal setae and four distal setae, one more than half the length of the inner ramus; outer ramus with four dorsal setae and four distal setae,



**Figure 7.** Habitat of *Hyaella imbya* sp. n. Rodrigues and Bueno. **A** The area bounded by a dotted line represents the region where specimens were found **B** the riparian vegetation was removed from a tributary stream (white arrows) from Ijuí river **C** the São José reservoir already filled.

one more than half the length of the outer ramus; peduncle wider than ramus with four cuspidate setae with an accessory setae.

Uropod 3 (Fig. 4E) shorter than telson, shorter than peduncle of uropod 1 and uropod 2; inner ramus absent; outer ramus uniarticulate; peduncle longer than wide with one cuspidate seta with an accessory seta distally; ramus shorter than peduncle; basal width 1.8 times the width of ramus apex, with five cuspidate setae with an accessory seta and one long simple seta, longer than peduncle.

Telson (Fig. 4F) entire, apically rounded, more than 1.2 times wider than long, with two long simple apical setae; sometimes with plumose setae laterally.

Coxal gills sac-like present on pereonites 2 to 6. Sternal gills tubular present on pereonites 3 to 7.

**Female.** Mean body length:  $4.8 \pm 0.43$  mm, mean head length:  $0.48 \pm 0.03$  mm (n=10) (Fig. 6C). Antenna 1 flagellum with 19 to 20 articles; antenna 2 similar in shape to male; flagellum with 15 to 16 articles.

Gnathopod 1 (Fig. 5A) similar in size and shape to gnathopod 2; without comb-scales; propodus (Fig. 5B) longer than wide; similar to male gnathopod 1 except that propodus is less narrow and shorter. Gnathopod 2 (Fig. 5C) different from male gnathopod 2 in shape and smaller; propodus (Fig. 5D) length 1.1 times maximum width, subchelate, inner face with five serrate setae, palm transverse, without comb-scales.

**Etymology.** The specific name, *imbya*, honors the indigenous tribe Mbyá-Guarani that inhabited the local before the colonization of european immigrants.

**Habitat.** Freshwater, hypothelminorheic.

**Remarks.** The area where specimens of *H. imbya* were collected was severely altered in the last recent years (Fig. 7). The area suffered during decades with agriculture, but the recent impacts were even more harmful. Such area is drained to a tributary stream which flows to Ijuí river (its margin was about 3.5 km far from the sampled area). In 2011 the riparian vegetation of this tributary was removed (Fig. 7B) and a reservoir was filled, flooding the deforested area (Fig. 7C). The phreatic level was altered since the distance between the sampled area and the nearest reservoir's margin was reduced to about 2 km. In a visit made on March 30, 2012 by two of the authors (S. G. Rodrigues and A. A. P. Bueno) to the same area no specimen was found. The area was completely dry and no spring was observed. It seems that changes in the hydrological parameters due to the building of São José reservoir altered the species habitat. Further considerations regarding such impacts will be discussed later.

## Discussion

### Affinities

There are four troglobiotic species of *Hyalella* described: *H. anophthalma* Ruffo, 1957; *H. caeca* Pereira, 1989, *H. muerta* Baldinger, Shepard and Threlhoff, 2000, and *H. spelaea* Bueno and Cardoso, 2011. Two of these, *H. caeca* and *H. spelaea*, occur in Brazil, both in caves of São Paulo, Southeastern Brazil (Cardoso et al. 2011). *Hyalella anophthalma* occurs in a cave at Venezuela (Ruffo 1957) and *H. muerta* also occurs in subterranean environment in Death Valley National Park, California, USA (Baldinger et al. 2000).

*Hyalella imbya* has the first pair of antennae elongated, which is longer than the second pair, a characteristic previously observed only for *H. muerta* (Table 1). However, the largest size of the antenna is more pronounced for *H. imbya*, which presents many more articles than other troglobiotic species. The two species have sternal gills from pereonite 3 to 7, while others present such gills on pereonites 2 to 7.

**Table 1.** Characters of troglotibiotic species of *Hyalella* (A1: Antenna 1; A2: Antenna 2; G1: Gnathopod 1; G2: Gnathopod 2; U1: Uropod 1).

Characters	<i>H. anophthalma</i> Ruffo, 1957	<i>H. caeca</i> Pereira, 1989	<i>H. muerta</i> Baldinger, Shepard & Threloff, 2000	<i>H. spelaea</i> Bueno & Cardoso, 2011	<i>H. imbya</i> Rodrigues & Bueno, 2012
A1: No. of articles of flagellum	6	10	9	9	18-23
A2: No. of articles of flagellum	9	14	8	16	14-16
Proportion of A1 and A2	A1<A2	A1<A2	A1>A2	A1<A2	A1>A2
Body length (mm)	3.2	6.0	3.3	4.35	5.03
G1: Comb-scales in propodus	Present	Absent	Absent	Present	Absent
G1: No. of setae in the inner face	--	8	5	7	7
G2: Lobiform process of propodus on the palmar corner	Present	Present	Absent	Absent	Absent
U1: Curved seta in the inner ramus	Absent	Absent	Absent	Absent	Present
Sternal gills tubular	2-7	2-7	3-7	2-7	3-7
Telson	Absence of setae	Two short simple apical setae	Four long simple apical setae	Two short simple apical setae	Two long simple apical setae

*Hyalella imbya* does not present comb-scales on propodus of gnathopod 1 and 2, even as *H. caeca* and *H. muerta*. Similarly to *H. muerta* and *H. spelaea*, the new species does not have a lobiform process on the propodus of gnathopod 2. When compared to *H. anophthalma*, it is possible to note that the two species do not exhibit characteristic in common, only the absence of eyes.

Moreover, *H. imbya* also has particular characteristics that make it differ from other troglotibiotic species: the presence of curved seta in the inner ramus of uropod 1; reduction in size of uropod 3 and posterior lobe in carpus of gnathopod 2; elongation of appendices, as the first pair of antennas and the pereopods 6 and 7.

### Conservation status

Problems concerning the hypothelminorheic habitat conservation were already discussed (Boulton 2005, 2009, Fiser et al. 2010). According to Fiser et al. (2010), the main threats to this habitat are land drainage and agricultural improvement. The superficial nature of the hypothelminorheic habitat allied to the restricted distribution of the species makes them especially vulnerable to impacts (Culver et al. 2006). In South America, such habitats have been completely neglected and consequently not studied.

The region where the new species was found represents a very threatened type of ecosystem, the wetlands. This ecosystem presents a high diversity, with high levels of endemism, and is among the most productive environments of the world. Such traits make the wetlands priority ecosystem for conservation (Barbier et al. 1997, Mitsch and Gosselink 2000).

About half of South America wetlands are located in Brazil, and the state of Rio Grande do Sul has the greatest record for these ecosystems: 3.441 areas covering 10.7% of the total area of the state (Maltchik et al. 2003). Despite their great environmental importance, these ecosystems are among the most threatened habitats in the world (Mitsch and Gosselink 2000).

It is estimated that 90% of these areas in Rio Grande do Sul have already disappeared due to urban development, construction of dams and reservoirs, as well as expansion of areas of agriculture, especially rice and soybean, causing fragmentation and deterioration of these ecosystems (Maltchik and Rolon 2010).

The agricultural expansion is one of the main factors that affect and hinder the conservation of wetlands. The soil of these ecosystems can produce up to 50 times more vegetal organic matter area than a similar natural field, and eight times more than a cultivated field, which makes them targets for growing crops of economic importance, such as rice (Barbier et al. 1997). The state of Rio Grande do Sul is the leading producer of rice in Brazil. This type of plant has a dynamic water regime, with variations between terrestrial and aquatic stages. Since the remaining surface of the culture can stay up to two years without water, this can cause a great impact to the community of plants and animals, as well as throughout the landscape as a whole (Maltchik and Rolon 2010).

The severe impacts caused by the bulding of São José reservoir apparently altered the hypothelminorheic habitat of the area, furthermore nowadays the site of occurrence of *H. imbya* is inserted in a large area of soybean farming. Since only a single visit was made to the area after such impacts, it is impossible to assess the real status of the species and its habitat. Hypothelminorheic habitats are characterized by persistent wet spots, but this condition is no longer observed in the area. The species may eventually be associated from subterranean habitats at the present moment, but one cannot discard the possibility of its extinction. We can assume minimally that it is critically threatened at the moment.

The Brazilian laws concerning cave fauna has been recently altered. Although it is somewhat restrictive in some cases (assuring the protection of rare troglobiotic species), it obviously lacks a broader conception of subterranean habitats. Accordingly, it is important to incorporate in such laws the protection of shallow subterranean habitats, especially those strongly threatened, as the hypothelminorheic.

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# First record of the aphid genus *Neonipponaphis* Takahashi (Hemiptera, Aphididae, Hormaphidinae) from China, with a description of one new species

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## Abstract

The aphid genus *Neonipponaphis* Takahashi is reviewed and reported in China for the first time, with a description of one new species, *Neonipponaphis pustulosus* sp. n. on *Castanopsis eyrei* from Fujian. A key to species, morphological descriptions, features, host plants, and distributions are provided. Holotype and paratypes are deposited in the National Zoological Museum of China, Institute of Zoology, Chinese Academy of Sciences, Beijing, China.

## Keywords

*Neonipponaphis*, Aphididae, new record genus, new species, China

## Introduction

The aphid genus *Neonipponaphis* was erected by Takahashi (1962), with description of type species *Neonipponaphis shiiae*. It was distinguished by prosoma of apterae distinctly separated from abdominal segments II–VII, bearing numerous fine setae and abdominal tergite VIII with 4–6 setae, as well as abdomen of alatae with many dorsal

setae and siphunculi large in diameter at base, with distinct minute papillae. Until now, this genus is only known by the type species which occurs in Japan (Takahashi 1962; Ghosh and Raychaudhuri 1973; Blackman and Eastop 1994; Remaudière and Remaudière 1997). After identifying the specimens from Fujian, China and checking the specimens of the type species, we report a new species of *Neonipponaphis* from China, *Neonipponaphis pustulosis* sp. n., feeding on *Castanopsis eyrei*.

## Materials and methods

Specimens of the new species were collected from Mount Wuyi (Wuyishan City) by J. Chen, Q. H. Liu, and X. T. Li.

Aphid terminology in this paper generally follows Takahashi (1962). The unit of measurements in this paper is millimeters (mm).

In Table 1, the following abbreviations have been used: Ant.I, Ant.II, and Ant. IIIb, for antennal segments I, II, and the base of antennal segment III, respectively; PT, processus terminalis; Ant.IIIBW, basal width of antennal segment III; URS, ultimate rostral segment; BW URS, basal width of ultimate rostral segment; 2HT, second hind tarsal segment; MW Hind tibia, mid-width of hind tibia; BW Cauda, basal width of cauda; AP, anal plate; GP, genital plate.

Specimen depositories: all specimens studied are deposited in the National Zoological Museum of China, Institute of Zoology, Chinese Academy of Sciences, Beijing, China (NZMCAS).

**Table 1.** Morphometric data of species of *Neonipponaphis* (in mm).

Parts (For abbreviations see Materials and methods)		<i>Neonipponaphis pustulosis</i> sp. n.			<i>Neonipponaphis shiiae</i> Takahashi		
		Apterous vivipara (n=14)			Apterous vivipara (n=10)		
		Mean	Range	Standard Deviation	Mean	Range	Standard Deviation
Length (mm)	Body length	1.532	1.406–1.628	0.062	1.169	1.114–1.238	0.049
	Body width	1.388	1.184–1.628	0.126	1.058	0.960–1.171	0.074
	Whole antenna	0.242	0.221–0.259	0.011	0.211	0.187–0.221	0.010
	URS	0.078	0.072–0.086	0.005	0.071	0.067–0.077	0.004
	Hind trochanter and femur	0.122	0.115–0.134	0.009	0.092	0.077–0.096	0.007
	Hind tibia	0.160	0.144–0.173	0.013	0.112	0.106–0.115	0.006
	2HT	0.057	0.053–0.062	0.004	0.044	0.038–0.048	0.003
	Cauda	0.028	0.024–0.034	0.003	0.028	0.024–0.029	0.002
	BW Cauda	0.053	0.048–0.058	0.004	0.055	0.053–0.058	0.002
	Ant.IIIBW	0.022	0.019–0.026	0.002	0.019	0.017–0.022	0.001
	MW Hind tibia	0.034	0.029–0.036	0.003	0.027	0.026–0.029	0.001
	Cephalic setae	0.047	0.038–0.058	0.009	0.064	0.053–0.074	0.008
	Setae on Tergum I	0.068	0.060–0.079	0.008	0.073	0.058–0.091	0.010
	Setae on Tergum VIII	0.055	0.046–0.077	0.010	0.037	0.034–0.043	0.004
Setae on Hind tibia	0.030	0.026–0.036	0.004	0.028	0.024–0.034	0.004	

Parts (For abbreviations see Materials and methods)		<i>Neonipponaphis pustulosis</i> sp. n.			<i>Neonipponaphis shiiae</i> Takahashi		
		Apterous vivipara (n=14)			Apterous vivipara (n=10)		
		Mean	Range	Standard Deviation	Mean	Range	Standard Deviation
No. of setae on	Ant.I		1			1	
	Ant.II		2			2	
	Ant.IIIb		0			0	
	PT		0+3			0+3	
	URS		6			6	
	Terga II–VII		17–27			14–20	
	Tergum VIII		6–8			4–6	
	Cauda		7–10			8–10	
	Each lobe of AP		4–6			4–6	
	GP		14–18			14–19	
Ratio (times)	Whole antenna / Body	0.16	0.14–0.17	0.008	0.18	0.17–0.19	0.008
	Hind tibia / Body	0.11	0.10–0.11	0.007	0.10	0.09–0.10	0.009
	URS / BW URS	1.63	1.43–1.78	0.173	1.24	1.17–1.45	0.102
	URS / 2HT	1.43	1.23–1.64	0.203	1.57	1.47–1.67	0.066
	Cauda / BW Cauda	0.54	0.48–0.64	0.058	0.50	0.45–0.55	0.040
	Cephalic setae / Ant. III BW	2.21	1.60–2.88	0.547	3.31	2.67–3.88	0.460
	Setae on Tergum I / Ant.III BW	3.00	2.27–3.75	0.676	3.77	3.00–4.75	0.572
	Setae on Tergum VIII / Ant.III BW	2.49	1.91–3.20	0.416	1.89	1.56–2.25	0.253
Setae on Hind tibia / MW Hind tibia	0.88	0.79–1.00	0.102	1.00	0.91–1.17	0.120	

## Taxonomy

### *Neonipponaphis* Takahashi

<http://species-id.net/wiki/Neonipponaphis>

*Neonipponaphis* Takahashi, 1962: 9. Type species: *Neonipponaphis shiiae* Takahashi, 1962; by monotypy.

*Neonipponaphis* Takahashi: Ghosh and Raychaudhuri 1973: 164; Blackman and Eastop 1994: 775; Remaudière and Remaudière 1997: 187; Nieto Nafria et al. 2011: 281.

**Generic diagnosis.** In apterae, body round, flat, and strongly sclerotized. Prosoma consisting of fused head, thorax, and abdominal segment I; abdominal segments II–VII fused and distinctly separated from prosoma; abdominal segment VIII free. Dorsum of prosoma with scattered oval or irregular-shaped pustules and numerous fine setae; abdominal tergites II–VII with scattered shorter setae; each tergite with a pair of submarginal setae, setae on tergites V and VI shorter than setae on the other tergites; tergites II and VII each with a pair of spinal setae; abdominal tergite VIII with 4–8 setae. Eyes with 3 facets in apterae and compound in alatae. Antennae in apterae indis-

tinctly 3-segmented, with primary rhinaria placed wide apart on the terminal segment, in alatae 5-segmented with annular secondary rhinaria. Rostrum short and thick. Ultimate rostral segment blunt wedge-shaped, with 2 pairs of primary setae and a pair of secondary setae. Legs normal, tibial setae long and fine, hind tibiae with several short peg-like setae on distal part; tarsi 2-segmented, claws normal, first tarsal chaetotaxy in apterae: 2, 2, 2. Abdomen with many long dorsal setae and 4 pairs of spiracles in alatae. Siphunculi in apterae small, pore-like, in alatae low but much expanded basally, with distinct minute papillae around the pore. Cauda knobbed and constricted at base. Anal plate bilobed. Wings dusky and reticulated; fore wings with pterostigma dark and broadly rounded at hind margin, media once branched; hind wings with 2 obliques.

**Distribution.** Japan and here newly recorded from China (Fujian).

**Host plants.** *Castanopsis cuspidata* and *C. eyrei*.

**Comments.** This genus is related to *Nipponaphis* Pergande, sharing several characters such as body of apterae aleyrodiform, flattened dorsoventrally, consisting of three parts - prosoma, fused abdominal segments II–VII, and separate abdominal segment VIII; dorsum of prosoma with scattered pustules; abdominal tergites II–VII with 6 pairs of submarginal setae and a pair of posteromesial setae on abdominal tergite VII; siphunculi pore-like; tarsi normal, 2-segmented, with normal claws; abdomen of alatae with 4 pairs of spiracles, and median vein of fore wings once branched. *Neonipponaphis* is distinguished by abdominal tergites II–VII distinctly separated from prosoma and the presence of numerous fine setae on the dorsum of prosoma and abdominal tergites II–VII in apterae.

**Key to species of *Neonipponaphis***

(Apterous viviparous females)

- 1 Body large, 1.41–1.63 mm long, with longer hind legs, the hind tibiae being 0.10–0.11 times as long as body. Pustules on prosoma small. Spinal and submarginal setae on dorsum of prosoma distinctly longer, thicker, and stiffer than the scattered dorsal setae. Abdominal tergite VIII with 6–8 dorsal setae .....***N. pustulosis* sp. n.**
- Body relatively small, 1.11–1.24 mm long, with shorter hind legs, the hind tibiae being 0.09–0.10 times as long as body. Pustules on prosoma large. Spinal and submarginal setae on dorsum of prosoma longer than the scattered dorsal setae but similar to the latter in thickness and hardness. Abdominal tergite VIII with 4–6 dorsal setae .....***N. shiiae* Takahashi**

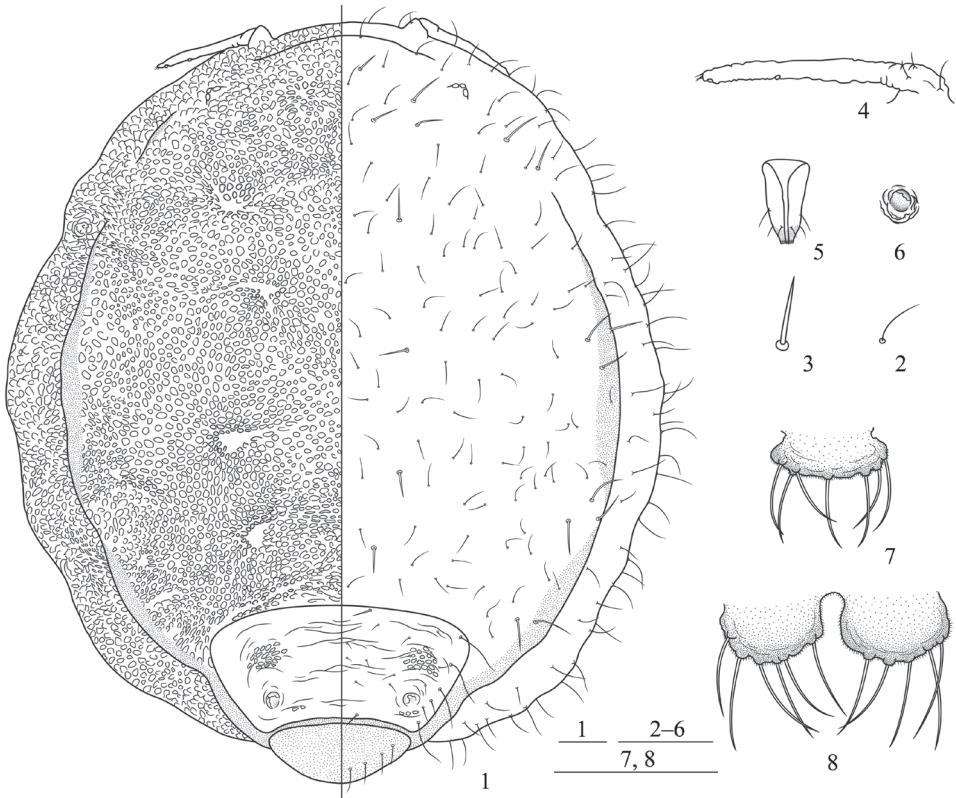
***Neonipponaphis pustulosis* sp. n.**

urn:lsid:zoobank.org:act:ED5004C9-48A1-4503-B6C3-60B8746CFC6C

http://species-id.net/wiki/Neonipponaphis\_pustulosis

Figures 1–19

**Locus typicus.** China (Fujian, 27.73279°N, 117.64512°E, altitude 1080 m).

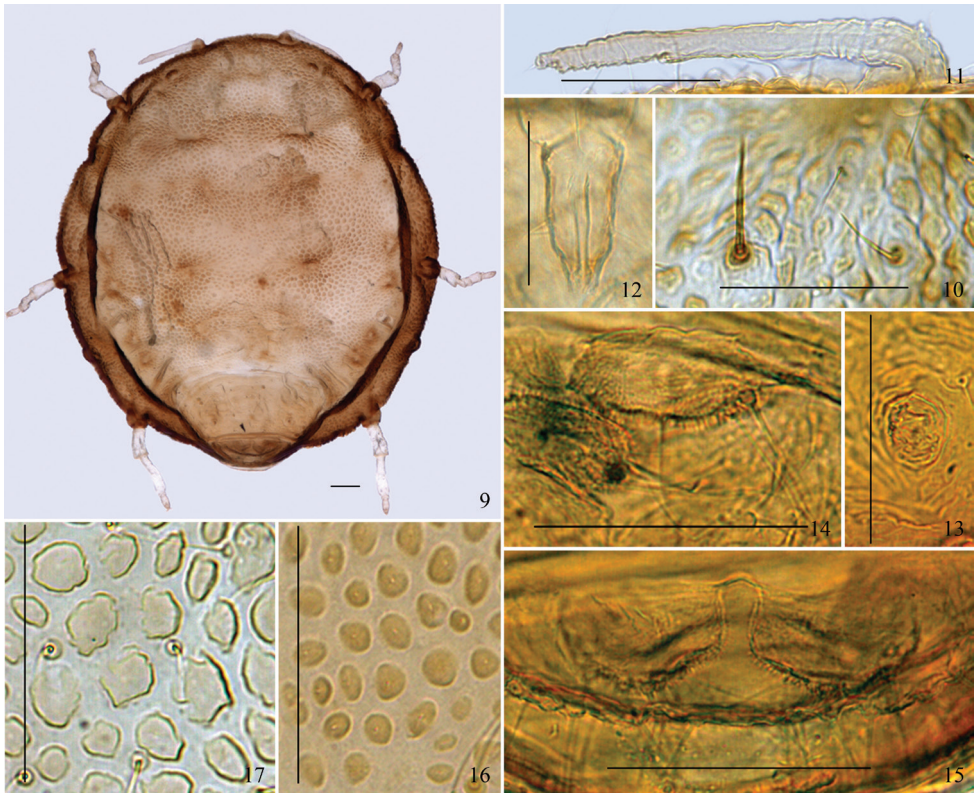


**Figures 1–8.** *Neonipponaphis pustulosis* sp. n. Apterous viviparous female: **1** dorsal view of body, with pustules in left and chaetotaxy in right **2** fine and pointed scattered dorsal seta **3** long, thick, and stiff dorsal seta **4** antenna **5** ultimate rostral segment **6** siphunculus **7** cauda **8** anal plate. Scale bars = 0.10 mm.

**Etymology.** The new species is named for the small and crowded pustules on the dorsum of prosoma. “*Pustulosus*” (Latin) means “blister, bubble”.

**Description.** *Apterous viviparous females:* Body round, flat, thickened, and strongly sclerotized (Figs 1, 9, 19). Reddish brown or blackish brown in life (Figs 18, 19). For morphometric data see Table 1.

**Mounted specimens.** Body brown; antennae and legs light brown. Prosoma consisting of fused head, thorax, and abdominal segment I; abdominal segments II–VII fused and distinctly separated from prosoma; abdominal segment VIII free (Figs 1, 9). Dorsum of prosoma with many oval or irregular-shaped pustules, small and crowded (Figs 1, 9, 16); pustules on vertical area of body similar, but those around the thoracic spiracles much smaller, protuberant, and conical in shape. Muscle attachment plates distinct, forming radial pattern with dorsal pustules (Figs 1, 9). Abdominal tergites II–VII wrinkled and with irregular oval markings (Fig. 1). Cauda (Figs 7, 14), anal plate (Figs 8, 15), and genital plate with spinulose sculptures. Dorsum of prosoma and marginal vertical area of body with numerous fine and pointed setae; head with a pair of cephalic setae, thick, stiff, and pointed; dorsum



**Figures 9–17.** (9–15) *Neonipponaphis pustulosis* sp. n. Apterous viviparous female: **9** dorsal view of body **10** dorsal setae (long, thick, and stiff seta in left, fine and pointed seta in right) **11** antenna **12** ultimate rostral segment **13** siphunculus **14** cauda **15** anal plate. (16–17) Dorsal pustules on the same scale: **16** *Neonipponaphis pustulosis* sp. n. **17** *Neonipponaphis shiiae* Takahashi. Scale bars = 0.10 mm.

of prosoma with 13 pairs of submarginal setae, long, thick, and stiff, head dorsum with 3 pairs, pronotum with 2 pairs, mesonotum with 3 pairs, metanotum with 3 pairs, abdominal tergite I with 2 pairs; pro-, meso-, metanotum, and abdominal tergite I each with a pair of spinal setae, long, thick, and stiff; abdominal tergites II–VII with 17–27 scattered fine and pointed setae, shorter than dorsal setae on prosoma; tergites II–VII each with a pair of long submarginal setae, setae on tergites V and VI shorter; tergites II and VII each with a pair of spinal setae, stiff and pointed; tergite VIII with 6–8 dorsal setae (Fig. 1). Cephalic setae, marginal setae on abdominal tergite I, and dorsal setae on tergite VIII 1.60–2.88 times, 2.27–3.75 times, and 1.91–3.20 times as long as basal width of antennal segment III, respectively. Medial frons not protuberant (Figs 1, 9). Eyes 3-faceted (Fig. 1). Antennae short, indistinctly 3-segmented, 0.14–0.17 times as long as body (Figs 4, 11). Setae on antennae sparse; segments I–III each with 1, 2, 0+0 setae, respectively; processus terminalis with 3 apical setae. Primary rhinaria small, round, protuberant, and



**Figures 18–19.** *Neonipponaphis pustulosis* sp. n. **18** a colony on the twig of *Castanopsis eyrei*, attended by an ant **19** apterous viviparous females in life.

placed wide apart at the apex of terminal segment. Rostrum short and thick, not reaching mid-coxae. Ultimate rostral segment blunt wedge-shaped, 1.43–1.78 times as long as its basal width, 1.23–1.64 times as long as second hind tarsal segment, with 2 pairs of primary setae and a pair of secondary setae (Figs 5, 12). Legs short, smooth, trochanter and femur fused (Fig. 9). Hind tibia 0.10–0.11 times as long as body. Setae on legs sparse, tibiae setae long and fine, hind tibiae with several short peg-like setae on distal part. Setae on hind tibia 0.79–1.00 times as long as its mid-width. First tarsal chaetotaxy: 2, 2, 2. Claws normal. Siphunculi small, pore-like, on abdominal tergite VI (Figs 6, 13). Cauda knobbed, constricted at base, 0.48–0.64 times as long as its basal width, with 7–10 setae (Figs 7, 14). Anal plate bilobed, each lobe with 4–6 setae (Figs 8, 15). Genital plate transversely oval, with two anterior setae and 12–16 setae along the posterior margin.

**Specimens examined.** Holotype: apterous viviparous female, **CHINA:** Fujian (Wuyishan City, Xingcun Town, Mount Wuyi, 27.73279°N, 117.64512°E, altitude 1080 m), 11 Jun. 2011, No. 26868-1-3, on *Castanopsis eyrei*, coll. J. Chen, Q. H. Liu, and X. T. Li (NZMCAS). *Paratypes:* 13 apterous viviparous females, with the same collection data as holotype.

**Taxonomic notes.** The new species is similar to the type species *N. shiiae* Takahashi, but differs in morphology by the characters given in the key.

**Host plant.** *Castanopsis eyrei*.

**Biology.** Apterous exules live on the twigs of the host plants and are attended by ants (Figs 18, 19). Other morphs and life cycle are unknown. Typical life cycle of nipponaphidines is host-alternating and holocyclic, with gall formation on *Distylium*. Thus, this species is either anholocyclic on *Castanopsis eyrei* or has gall-inhabiting generations still unknown or known under another name on *Distylium*. Field observations, transfer experiments, and molecular study are needed to elucidate its life cycle.

***Neonipponaphis shiiae* Takahashi**

[http://species-id.net/wiki/Neonipponaphis\\_shiiae](http://species-id.net/wiki/Neonipponaphis_shiiae)

Figure 20

*Neonipponaphis shiiae* Takahashi, 1962: 9.

*Neonipponaphis shiiae* Takahashi: Blackman and Eastop 1994: 775; Remaudière and Remaudière 1997: 187.

**Specimens examined.** 10 apterous viviparous females, **JAPAN:** Gifu Prefecture, 20 Jul. 1968, No. E534, on *Castanopsis* sp., coll. M. Sorin (NZMCAS).

**Distribution.** Japan.

**Host plant.** *Castanopsis cuspidata*.

**Biology.** This species colonizes the branches and shoots of the host plants (Takahashi 1962).



**Figure 20.** *Neonipponaphis shiiae* Takahashi. Apterous viviparous female, dorsal view of body. Scale bar = 0.10 mm.

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