



A new species of *Boethella* Bennett, 2003 (Hymenoptera: Ichneumonidae: Tryphoninae) from Brazil, redescription of the genus and a key to world species

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Abstract

Boethella jatai sp. nov. is described from a savanna area in the southeast of Brazil. The genus is redescribed to include the new species and an identification key for world species is provided.

Key words: Neotropical region, parasitoid, taxonomy, wasp

Introduction

Tryphoninae is a cosmopolitan Ichneumonidae subfamily with approximately 1300 described species classified in 56 extant genera (Bennett 2015; Yu *et al.* 2016; Kasparyan 2019). These wasps are koinobiont ectoparasitoids of Lepidoptera and Symphyta larvae and known by their very unusual stalked eggs (Gauld *et al.* 1997). Females of many tryphonine species carry an egg externally on the ovipositor and attach them to various locations on the host, most often behind the head (Kasparyan 1973; Gauld *et al.* 1997). Only the stalk passes down the lumen of the ovipositor, except in some Oedemopsini (Fitton & Ficken 1990).

Bennett (2003) described the Neotropical genus *Boethella* and five species: *B. canilae* Bennett (Brazil: Espírito Santo, São Paulo and Mexico: Chiapas) (Figs 1–5), *B. curriei* Bennett (Peru: Cusco) (Figs 6, 7), *B. darlingi* Bennett (Brazil: Rio de Janeiro) (Figs 8, 9), *B. guidottiae* Bennett (Brazil: Amazonas, Mato Grosso) (Figs 10–13) and *B. hublei* Bennett (Brazil: Santa Catarina) (Figs 14, 15) (Bennett 2003; Rodrigues-Berrio *et al.* 2009). This genus is closely related to *Boethus* Förster, 1869 as in both, fore wing vein *2m-cu* has a single bulla, the areolet is open, and the occipital carina, epomia and notauli are absent. However, in all *Boethella* species, the propodeal, epicnemial and submetapleural carinae are present (these structures are absent in *Boethus*) and the ovipositor is slightly upcurved with the dorsal valve strongly overlapping the ventral valve medially (Bennett 2003) (straight to slightly downcurved with dorsal valve not overlapping ventral valve in *Boethus*) (Bennett 2015). Nothing is known about their hosts or other biological information, although it is assumed that they parasitize sawflies because of their placement in the tribe Tryphonini. The sister genus *Boethus* parasitizes Argidae (Gauld *et al.* 1997).

In this paper we describe a new species of *Boethella* from a savanna area in southeastern of Brazil. The genus is redescribed and an identification key for all describe species is provided.

Material and methods

Morphological terminology mainly follows Gauld (1991). Type material of the new species is deposited in the Departamento de Ecologia e Biologia Evolutiva da Universidade Federal de São Carlos, SP, Brazil (DCBU) and Museu de Zoologia da Universidade de São Paulo, São Paulo, SP, Brazil (MZSP). Images of the new species were obtained using a Leica stereomicroscope M205C attached to a MC1170HD camera and were combined using Leica Application Suite mounting software v4.12. Scanning electron micrographs were made using a FEI Quanta 250. Images of material at the Canadian National Collection of Insects, Arachnids and Nematodes, Ottawa, Ontario, Canada (CNCI) were taken using a Leica MZ16 stereomicroscope with motorized focus drive attached to a Leica DFC420 digital camera. Photos were combined and edited using Leica Application Suites Multifocus software version X and Adobe Photoshop CS4. Photos taken at Utah State University, Logan, Utah, United States of America (EMUS) were taken with an EntoVision micro-imaging system. This system consists of a Leica M16 zoom lens attached to a JVC KY-75U 3-CCD digital video camera that feeds image data to a desktop computer. The program Archimed 5.3.1 was used to merge an image series (representing typically 15–30 focal planes) into a single in-focus image. Lighting was provided by an EntoVision dome light. The distribution map for all Brazilian species (Fig. 21) was made with the software Quantum GIS (<http://www.qgis.org>). Locality data for specimens were obtained from specimen labels and from Bennett (2003).

Taxonomy

Boethella Bennett

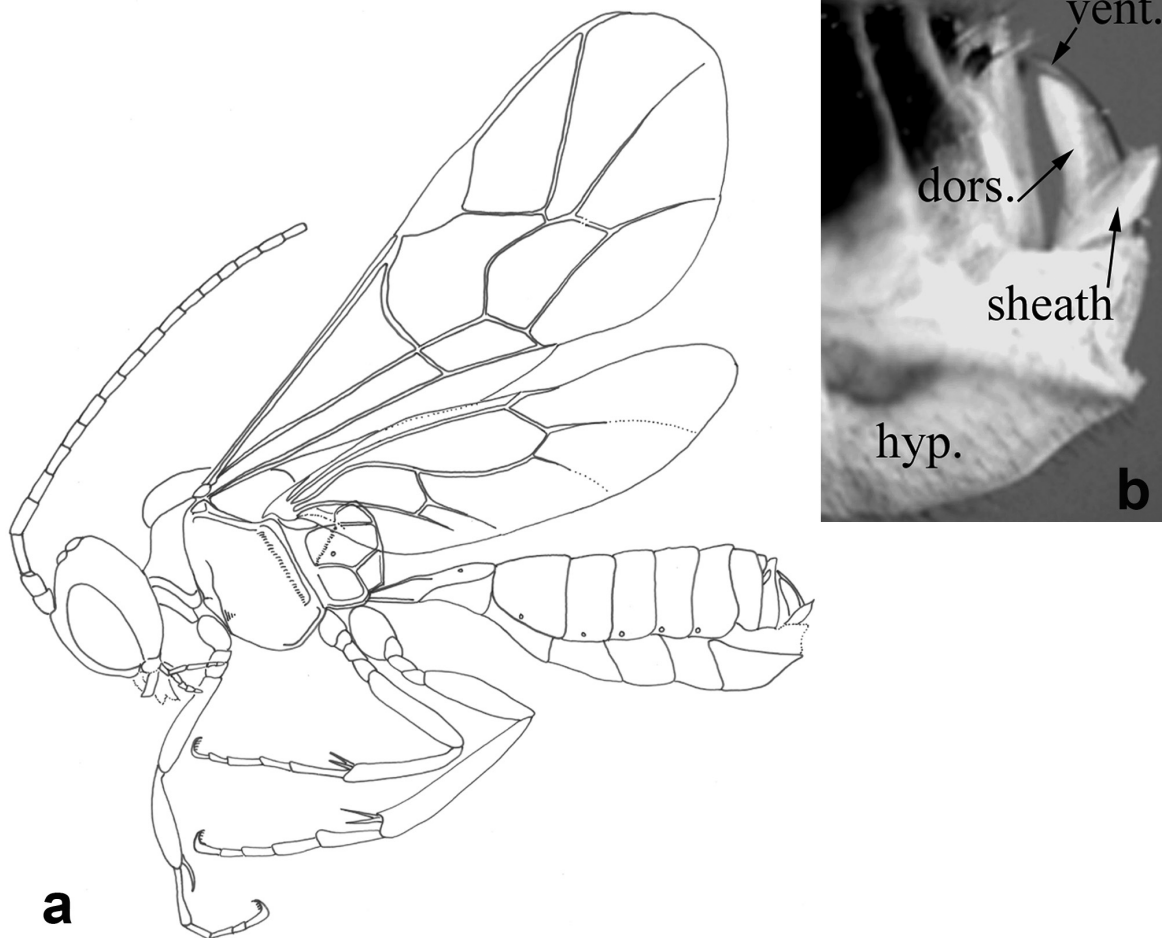
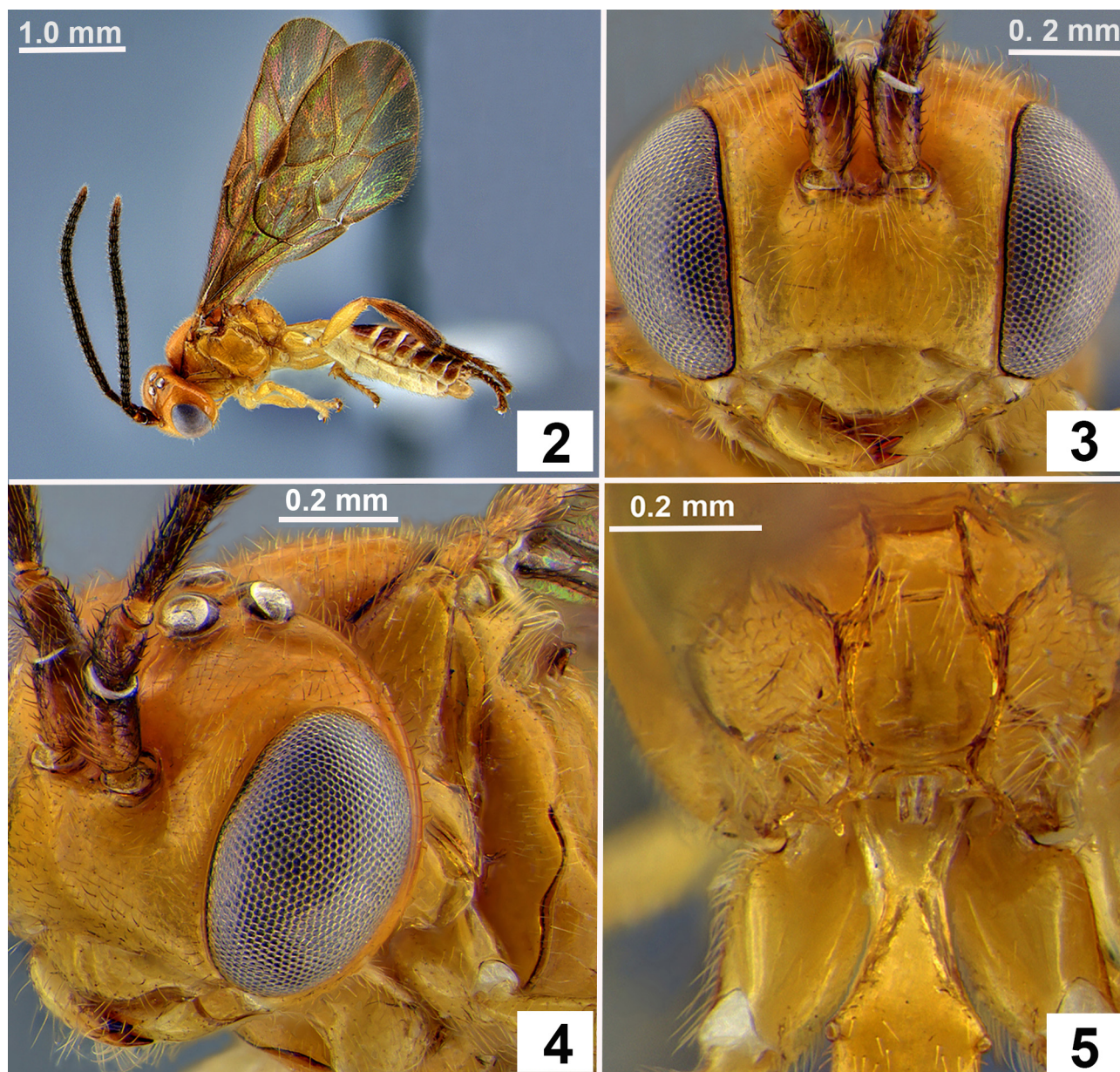


FIGURE 1. *Boethella canilae*, holotype female. a = Habitus, b = Lateral view of posterior metasoma showing ovipositor: vent. = ventral valve of ovipositor; dors. = dorsal valve of ovipositor; sheath = ovipositor sheath; hyp. = hypopygium (adapted from Bennett 2003).

Diagnosis. *Boethella* can be distinguished from all other genera of Tryphoninae by combination of the following characters: 1) occipital carina completely absent; 2) propodeal carinae strong and mostly or completely present.

Description (Figures 1–22). Fore wing length 2.9 to 4.8 mm.



FIGURES 2–5. *Boethella canilae*, non-type male (CNCI). 2: Lateral habitus. 3: Head, anterior. 4: Head and mesopleuron, anterolateral. 5: Propodeum, dorsoposterior.

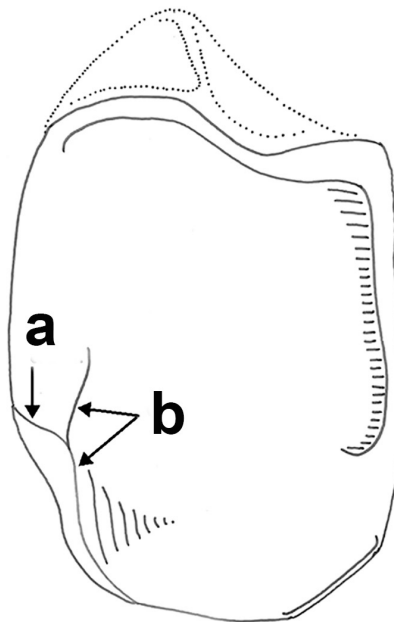
Head. Clypeus without a transverse line separating it into dorsal and ventral faces, apical margin without paired tubercles (medial notch absent) (Figs 3, 11, 17); outer surface of base of mandibles punctate and not strongly inflated, malar space obliterated (mandibular socket contiguous with ventral edge of eye) (Figs 4, 12, 15) in all species except *B. darlingi* in which space is 0.5× basal width of mandible (Fig. 9); labiomaxillary complex moderately elongate, glossae visible in anterior view in most specimens; occipital carina absent, postgena without a tooth.

Mesosoma. Epomia absent; epicnemial carina present, not dorsally curving toward anterior edge of mesopleuron; auxiliary carina of mesopleuron either joining epicnemial carina (Fig. 7) or not joining (Figs 1, 4, 15, 18); sternaulus present; subtegular ridge slightly curving out laterally, not produced into a vertical lamella that nearly reaches tegula when tegula is down; notauli absent; projection on posterolateral edge of mesoscutum absent; scutel-

lum orange to yellow; propodeal carinae mostly present, lateral and/or sublateral abscissae of anterior transverse carina may be absent, medial abscissae of anterior and/or transverse carina weak in some species, medial longitudinal carinae strongly raised (Figs 5, 13, 19); submetapleural carina present; mid and hind tibiae with two spurs each; tarsal claws pectinate to apex or nearly to apex; fore wing vein *3rs-m* absent; fore wing vein *2m-cu* weakly to strongly inclivous with one bulla; wings hyaline (except for slight darkening apically) (Fig. 20) to moderately infumate from base to apex.



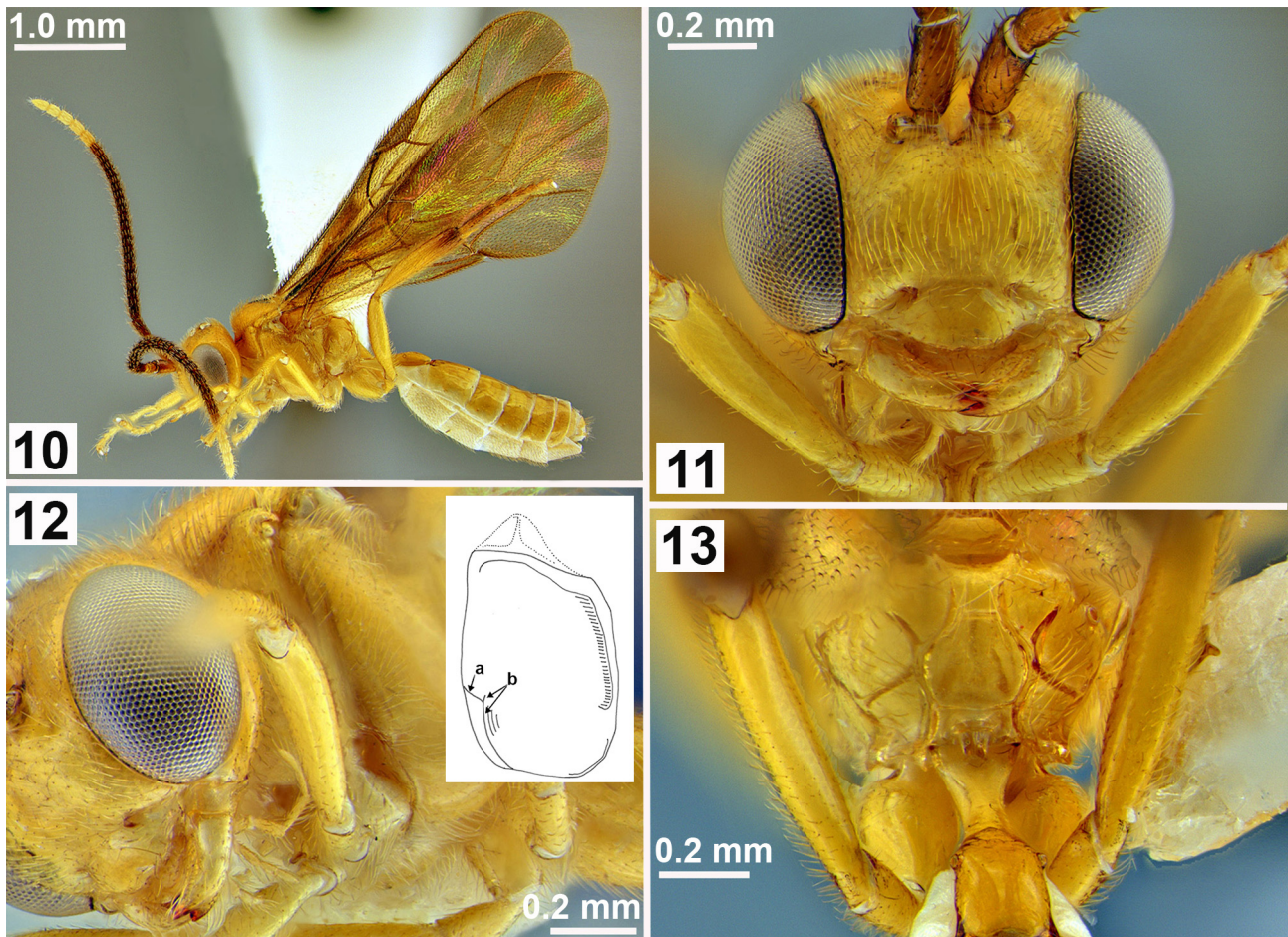
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FIGURES 6–7. *Boethella curriei*, holotype male (EMUS). 6: Lateral habitus. 7: Mesopleuron. a = auxiliary carina, b = epicnemial carina (adapted from Bennett 2003).



FIGURES 8–9. *Boethella darlingi*, holotype male (EMUS). 8: Lateral habitus. 9: Head and mesosoma, anterolateral.



FIGURES 10–13. *Boethella guidottiae*, holotype female (CNCI). 10: Lateral habitus. 11: Head, anterior. 12: Head and mesosoma, anterolateral (a = auxiliary carina and b = epicnemial carina) (hand drawn inset adapted from Bennett 2003). 13: Propodeum, dorsoposterior.

Metasoma. T1 petiolate with spiracle at 0.6 to 0.75 (Fig. 1), dorsal carinae absent, dorsolateral carinae indistinct or absent anterior to spiracle, T1 sculpture impunctate, glymma absent (most species), indistinct or present; membranous portion of S1 not or only slightly projecting lateral to sclerotized portion of T1; ovipositor moderately upcurved, dorsal valve thick and rounded apically (Fig. 1), overlapping ventral valve laterally.

Mature larva. Unknown.

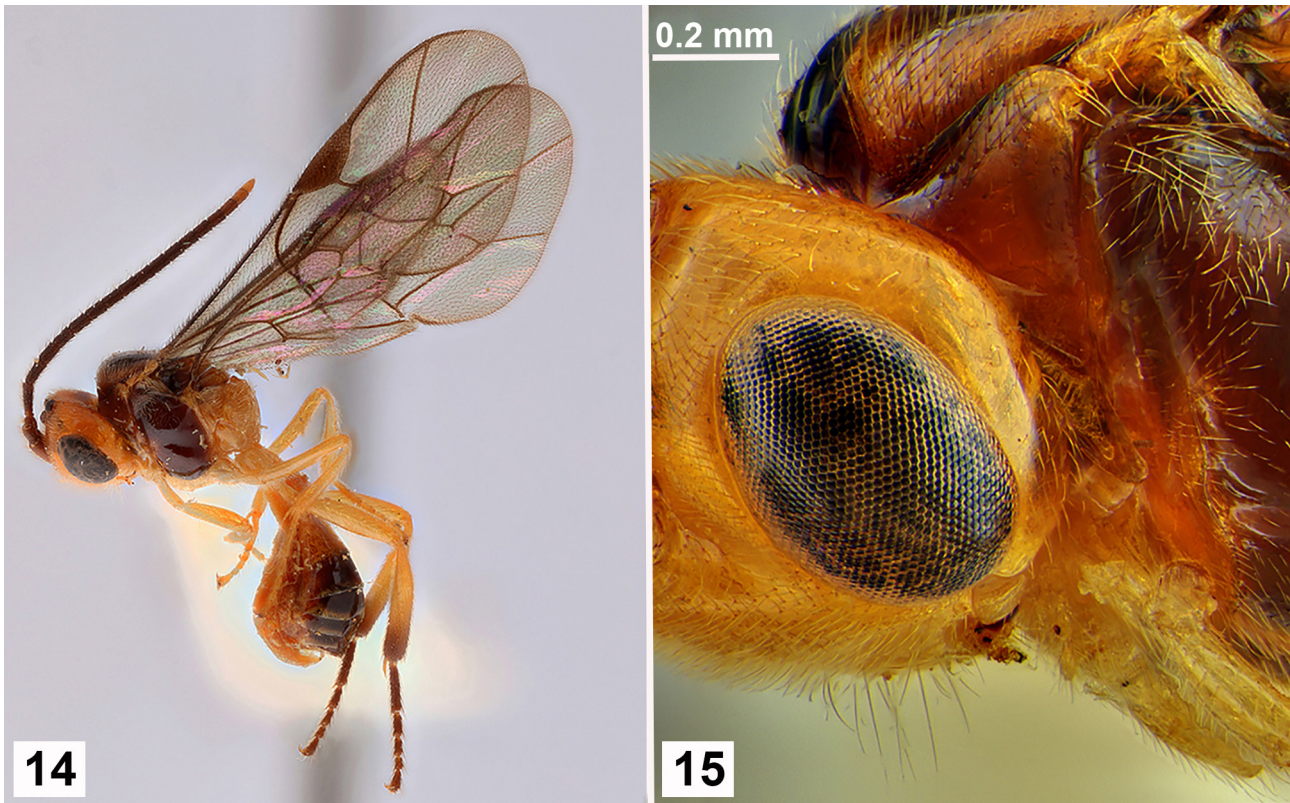
Egg. Unknown.

Distribution. Neotropical from southern Mexico to southeastern Brazil.

Host. Unknown, but assumed to be sawflies since the sister genus *Boethus* has been reared from Argidae (Gauld *et al.* 1997).

Species included. Six described species (see introduction and key).

Comments. The description is written to distinguish *Boethella* from all genera of Tryphonini and Exenterini (= the *Exenterus* group of genera of Tryphonini) (Bennett 2015). The definition of the genus has been modified slightly from that of Bennett (2003, 2015) following description of the current new species in that *B. jatai* **sp. nov.** has a distinct glymma on the first metasomal tergite. Previously, this character was described as follows: “glymma absent (slight depression present ventral to dorsolateral carina in some specimens, but not a glymma)”. *Boethella* is the second genus of Tryphoninae that is variable in terms of the presence or absence of the glymma following *Hercus* Townes (Oedemopsini) (Gupta 1984). Within the Neotropical region, *Boethella* can be most easily mistaken for *Boethus* which lacks propodeal and epicnemial carinae, and *Chiloplatys* Townes and Townes and *Lagoleptus* Townes, both of which have a complete occipital carina.



FIGURES 14–15. *B. hubleyi*, holotype female (CNCI). 14: Lateral habitus. 15: Head and mesosoma, lateral

Key to species of *Boethella*

1. Malar space 0.5× basal width of mandible (Fig. 9) *B. darlingi*
- Malar space obliterated, mandible margin contiguous with ventral edge of eye (Figs 4, 12, 15) 2
2. Auxiliary carina of mesopleuron extending from anterior edge and joining epicnemial carina (Fig. 7) 3
- Auxiliary carina of mesopleuron not extending to epicnemial carina (Figs 1, 4, 18) 4
3. Epicnemial carina extending dorsal to point of union of auxiliary carina by at least the length of auxiliary carina (Fig. 7); T4 predominantly brown, yellow laterally and sometimes with a yellow median longitudinal stripe or spot (Fig. 6) *B. curriei*
- Epicnemial carina extending dorsal to point of union of auxiliary carina by much less than the length of auxiliary carina (Fig. 12), or not extending at all; T4 entirely yellow or yellow with a trace of brown in apical 0.2 and with a longitudinal brown or brown and white region in median apical 0.3 (Fig. 10) *B. guidottiae*
4. Auxiliary carina of mesopleuron curving sharply at midpoint so it runs parallel to anterior edge of mesopleuron (Fig. 18); hind femur black (Fig. 16) *B. jatai* sp. nov.
- Auxiliary carina of mesopleuron not curving sharply at midpoint; hind femur yellow or orange. 5
5. Hind tibia dark brown, except light brown at base (Fig. 2) *B. canilae*
- Hind tibia basal 0.7 yellow, apical 0.3 brown (Fig. 14) *B. hubleyi*

Boethella jatai Ferreira, Onody, Pentead-Dias & Bennett sp. nov.

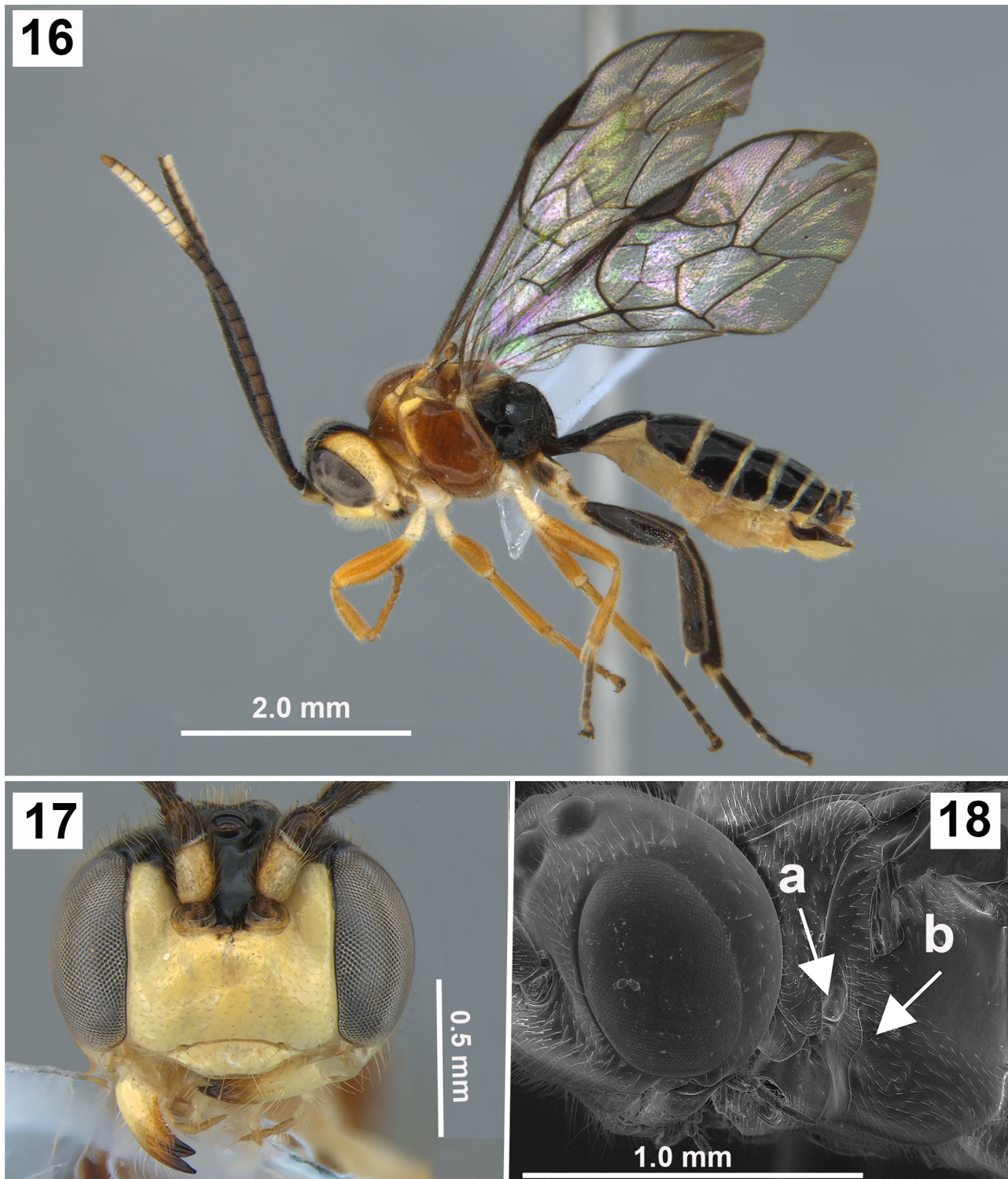
(Figs 16–22)

Material examined. *Holotype*: BRAZIL. São Paulo: 1 ♂ (DCBU 208470), Luiz Antônio, Estação Ecológica do Jataí, 21°36.25'S 47° 47.66'W, 565 m, Malaise 2, 27.ix–09.x.2014, A. S. Soares col. Condition of type: intact, except distal two flagellomeres of right antenna and left tarsus are missing.

Paratypes: 5 ♂ (DCBU 209797; 209799; 352202; 352203; 352205) and 1 ♂ (DCBU 208469) same as holotype; 1 ♂ (DCBU 352204), same as holotype except 27.iv.2014; 2 ♂ (MZSP) same as holotype except, 11.xi.2014.

Diagnosis. *Boethella jatai* sp. nov. is the only species in which the auxiliary carina of the mesopleuron curves strongly dorsally, so that it runs parallel to the anterior edge of the mesopleuron (Fig. 18) (mostly straight in all other

species). It also has the deepest glymma of any species and is the darkest species. It is the only species with black in any of the following areas: vertex, propodeum, T1 of metasoma and hind femur. In all other species, these structures range from yellow to dark brown.

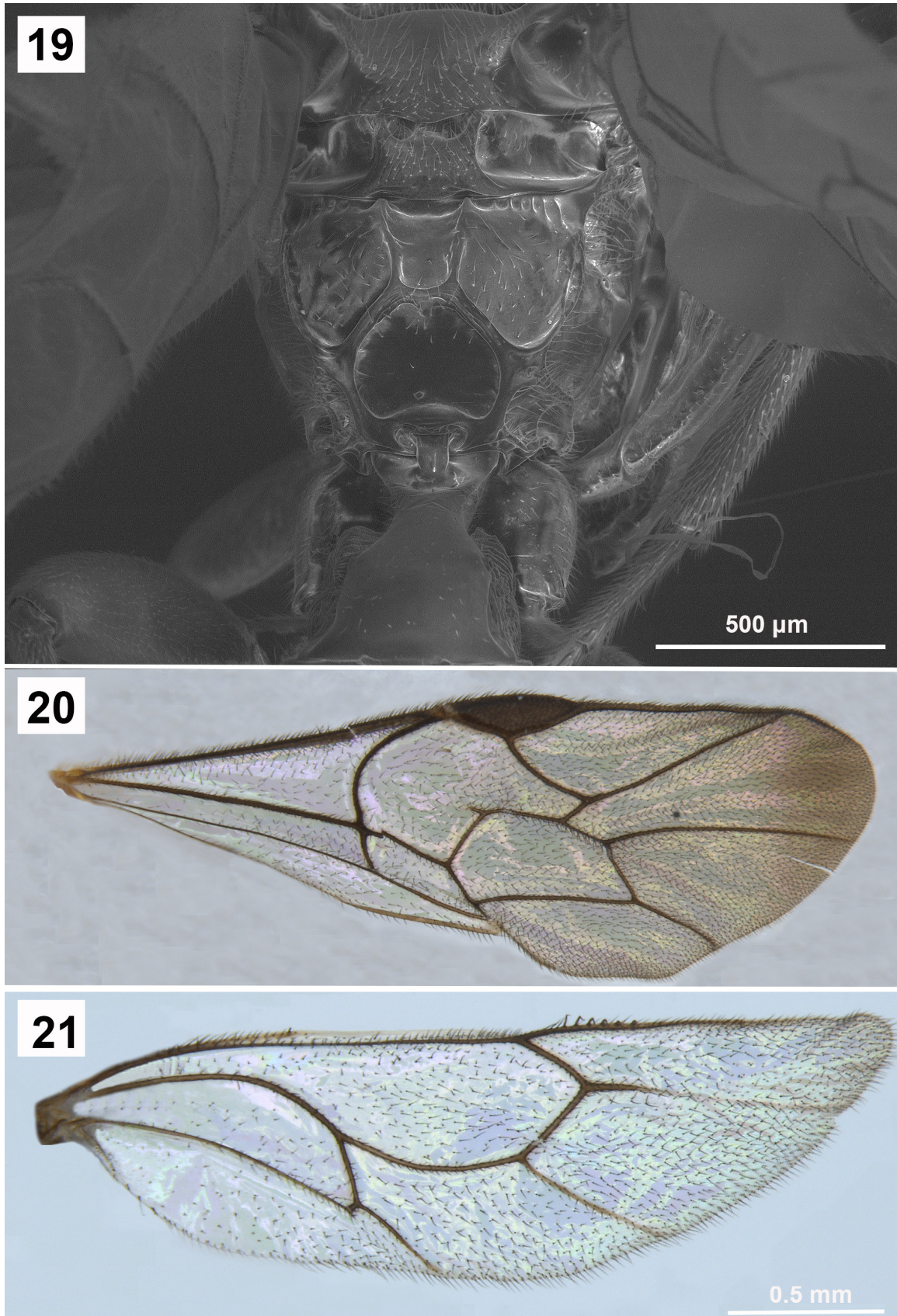


FIGURES 16–18. *Boethella jatai* sp. nov. males (DCBU). 16: Holotype, lateral habitus. 17: Paratype, head anterior. 18. Paratype, head and mesosoma, anterolateral (a = auxiliary carina and b = epicnemial carina).

Description. Male. Fore wing length 4.2–4.3 mm.

Head. Mostly smooth and shiny, finely and sparsely punctate and with long pilosity, genae moderately glabrous; mandibular teeth about same length, sometimes lower tooth slightly longer; antenna with 20–21 flagellomeres, first flagellomere 3.0–3.3× as long as width and 1.1–1.3× as long as the second flagellomere; lateral ocelli separated

from eye $1.8\times$ their own diameter and $0.9\times$ from each other; face $1.8\times$ as wide as high; clypeus flat, about $3.5\text{--}3.7\times$ as wide as high, its apical margin truncated (Fig. 17); malar space obliterated, base of mandible contiguous with ventral edge of eye.



FIGURES 19–21. *Boethella jatai* sp. nov., male paratypes. 19: Propodeum, dorsoposterior. 20: Fore wing. 21: Hind wing.

Mesosoma. Mostly smooth and shiny, finely and sparsely punctate and with long pilosity, areola of propodeum, mesopleuron and pronotum centrally glabrous; mesopleuron 0.7–0.8× as long as high; scutellum with lateral carinae absent; epicnemial carina reaching near the mid-posterior margin of the pronotum; auxiliary carina of mesopleuron curving strongly dorsally, not joining epicnemial carina (Fig. 18); sternaulus present as a weak depression; propodeum with all carinae present and strong except the sublateral abscissae of the anterior transverse carina (= costulae) absent (Fig. 19), spiracle circular, distant from pleural carina by 3.0–3.5× its own diameter; fore wing (Fig. 20) with *Rs+M* strongly curved and slightly distad from *cu-a*; hind wing (Fig. 21) with *Rs* spectral apically, *1A* absent apically and with 5–6 distal hamuli; tarsal claws pectinate to apex.

Metasoma. Mostly smooth and sparsely pilose; first tergite 1.7–1.9× as long as apically wide, spiracle at about 0.6 of length, glymma present, dorsal and dorsolateral carinae lacking; T2 subquadrate and T3+ rectangular, thyridium present.



FIGURE 22. Distribution map for all *Boethella* species in South America (*B. canilae* also known from Chiapas, Mexico).

Coloration. Head mostly yellowish white, except mandible teeth dark brown, labial and maxillary palpi apex slightly orange, gena, occiput and antennae black, except apical flagellomeres dorsally white and scape and pedicel ventrally yellowish white. Mesosoma predominantly orange, except propodeum black, axillary trough of metanotum and of mesonotum, tegula, pronotum basally and apically and mesopleuron apically yellowish white (mesoscutum, pronotum and mesopleuron sometimes darker with brown to black spots). Anterior and mid legs orange except coxa, trochanter and trochantellus white, tarsomeres apically slightly darker to light brown; posterior legs with femur, tibia and tarsus dark brown to black, tibial spurs yellowish white, coxa, trochanter and trochantellus yellowish with brown spots. Wings hyaline, apically slightly infusate, pterostigma brown. Metasoma with tergites black, T2+ apically white, sternites white, subgenital plate dark brown to black laterally.

Female. Unknown.

Distribution. Brazil: São Paulo State (Fig. 22).

Host. Unknown.

Etymology. The specific name refers to the Estação Ecológica do Jataí where this species was collected.

Comments. Brazilian species have been collected predominantly in areas of rain forests, Amazonian and Atlantic Forest (Fig. 22). Specimens of *Boethella jatai* **sp. nov.** were sampled in a savanna area (cerrado *sensu stricto*), but mostly in the wet period.

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