JHR 68: 19–28 (2019)
doi: 10.3897/jhr.68.28403
http://jhr.pensoft.net

RESEARCH ARTICLE

JOURNAL OF Hymenoptera RESEARCH
A peer-reviewed open-access journal
The International Society of Hymenopterists

A new species of *Platygaster* (Hymenoptera, Platygastroidea) from India with an unusual antenna

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Academic editor: *E. Talamas* | Received 16 July 2018 | Accepted 20 December 2018 | Published 25 February 2019

http://zoobank.org/A2202633-7406-4093-93A1-16D485327A08

Citation: Popovici OA, Veenakumari K, Mitroiu M-D (2019) A new species of *Platygaster* (Hymenoptera, Platygastroidea) from India with an unusual antenna. Journal of Hymenoptera Research 68: 19–28. https://doi.org/10.3897/jhr.68.28403

Abstract

A new species, *Platygaster harpagoceras* Popovici & Veenakumari, is described from India. The most unusual features of this species are the acuminate shape of the last antennomere and the 9-merous antenna in both sexes. The male and female are described and illustrated with brightfield and scanning electron microscopy. We provide a comparative analysis of the acuminate distal antennomere in the superfamily Chalcidoidea, including several genera of Pteromalidae (*Callitula* Spinola, *Homoporus* Thomson, *Norbanus* Walker, *Rhaphitelus* Walker).

Keywords

taxonomy, new species, Platygastridae, SEM

Introduction

The "mega-genus" *Platygaster* Latreille is apparently one of the most speciose genera of Platygastroidea, but its taxonomy is presently in a state of confusion. With around 640 described species (various contributors 2018) and few taxonomically reliable external characters, *Platygaster* offers a unique challenge to any specialist dealing

with the taxonomy of Platygastroidea. In some *Platygaster* species, previous authors have found a high degree of variability. For example, in *P. depressiventris* Thomson the size of the last tergite varies significantly, which Huggert (1974) considered "an ecological adaptation" for different "local populations" and in *P. mainensis* MacGown & Osgood were found three distinct "phena", which included one wingless specimen among more than 50 fully winged specimens (MacGown and Osgood 1971). Most "classical" species of *Platygaster* were described from Western Europe, so describing a new species using material from outside this geographical area may reveal additional problems as a consequence of geographical variation. Because of this, only very characteristic species can be described as new without a thorough revision and, preferably, when both sexes are available.

There are no comprehensive modern reviews of *Platygaster* for any region of the world. The species of "classical" authors were reviewed as follows: the species of Haliday and Walker preserved in the National Museum of Ireland and in the British Museum by Vlug (1984); the species of Zetterstedt and Thomson in Lund University, Sweden (Biological Museum – Entomological collections) by Buhl (1995), and the species of Förster by Buhl (1996). To study *Platygaster*, students have to use the monograph of Kieffer (1926) or some identification keys concerning local faunas, e.g. Buhl (1999) for species of Fennoscandia and Denmark, or Buhl (2006) for the species of Denmark.

Material and methods

The material described in this paper is deposited in the collection of the Hungarian Natural History Museum (Budapest) and in the National Bureau of Agricultural Insect Resources, Bengaluru.

Photographs were produced using a Leica DFC-500 camera on a Leica 205A stereomicroscope (facilities of the Integrated Centre of Environmental Science Studies in the North East Region – CERNESIM, from the Faculty of Biology, Iași, Romania), using the illumination protocol described in Fusu and Polaszek (2017) and Popovici et al. (2019). Single montage images were produced from image stacks with Zerene Stacker (Zerene Systems LLC, http://www.zerenesystems.com/) using the PMax algorithm. For SEM, the dried specimen was mounted on a double adhesive tape, coated with gold and imaged with a VEGA TESCAN SEM (WD=6.0146 mm; HV=30.00 kV).

Morphological terminology follows Masner (1979, 1980), Masner and Huggert (1989), and Mikó et al. (2007). The terminology of surface sculpturing follows Harris (1979).

Abbreviations:

HNHM	Hungarian Natural History Museum (Budapest, Hungary)
BMNH	The Natural History Museum (London, UK)
NBAIR	National Bureau of Agricultural Insect Resources (Bengaluru, India)

Results

We place the newly described species in *Platygaster* based on the following characters: number of maxillary palpal sclerites: 2; number of labial palpal sclerites: one; malar sulcus: absent; malar striae: absent; distal two antennomeres: not tightly joined; lateral compression of mesosoma: absent; notauli: obviously converging to the scutoscutellar suture; spines or tuft of hairs on the mesoscutellum: absent; foamy structure of propodeum: absent; lateral propodeal carinae: separated (MacGown 1979, Austin and Field 1997); tibial spur formula: 1:2:2 (MacGown 1979); forewing venation: absent; number of apparent terga (female): 6; number of apparent terga (male): 7; horn of T1: absent.

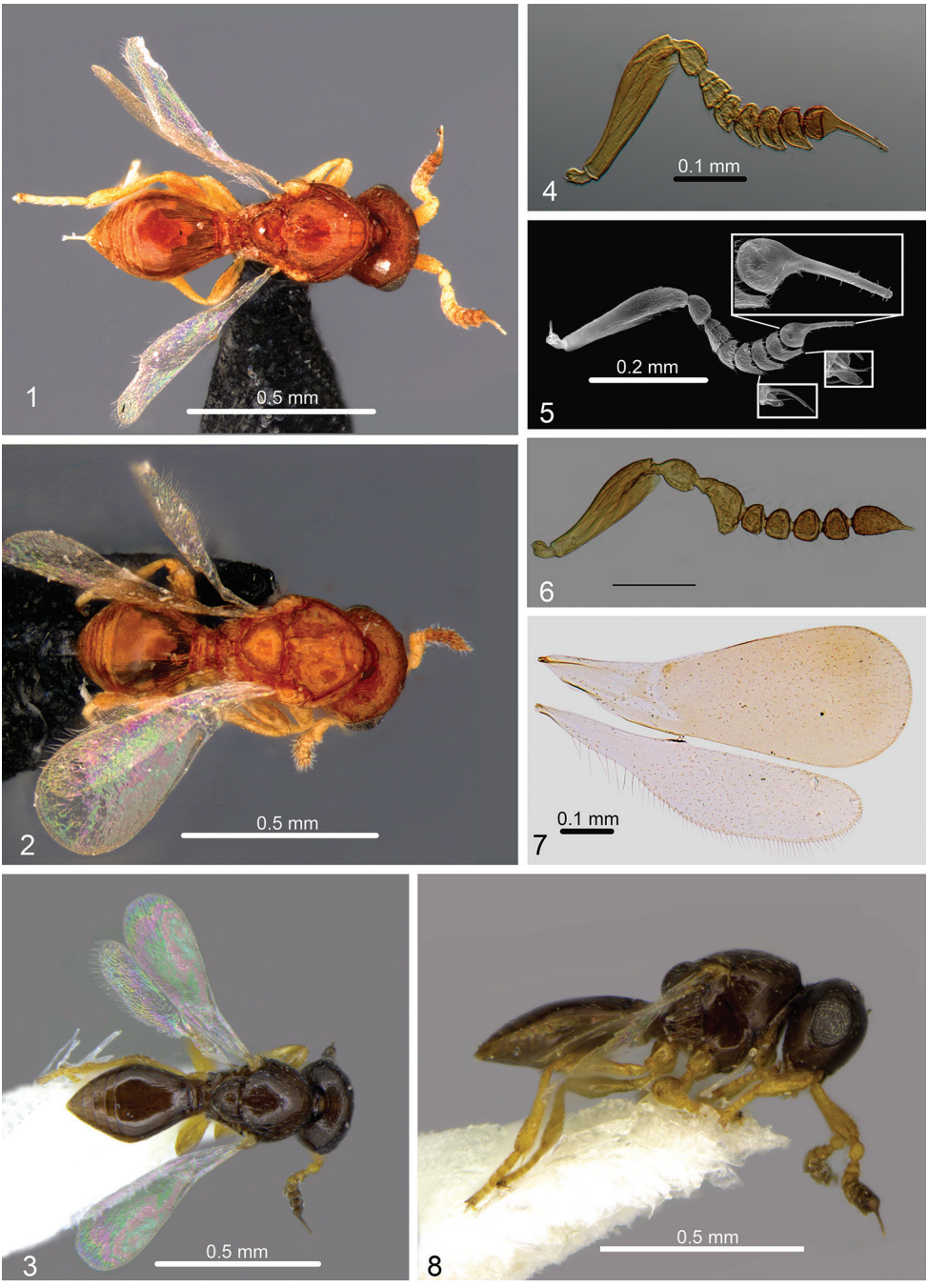
Platygaster harpagoceras Popovici & Veenakumari

Description. Female (Figs 1, 3, 8–10). Colour (Figs 3, 8): Head, mesosoma, and metasoma dark brown with uneven patches of black, posterior tergites paler than anterior tergites; black band above occipital carina; legs and tegula yellowish brown; A1–A4 yellowish brown, A5–A6 slightly darker than preceding antennomeres, A7–A9 blackish brown; mandibles yellowish brown. The lighter colour of the specimens pictured in Figs 1 and 2, compared with the specimen in Figs 3 and 8, is attributed to the older age of these specimens.

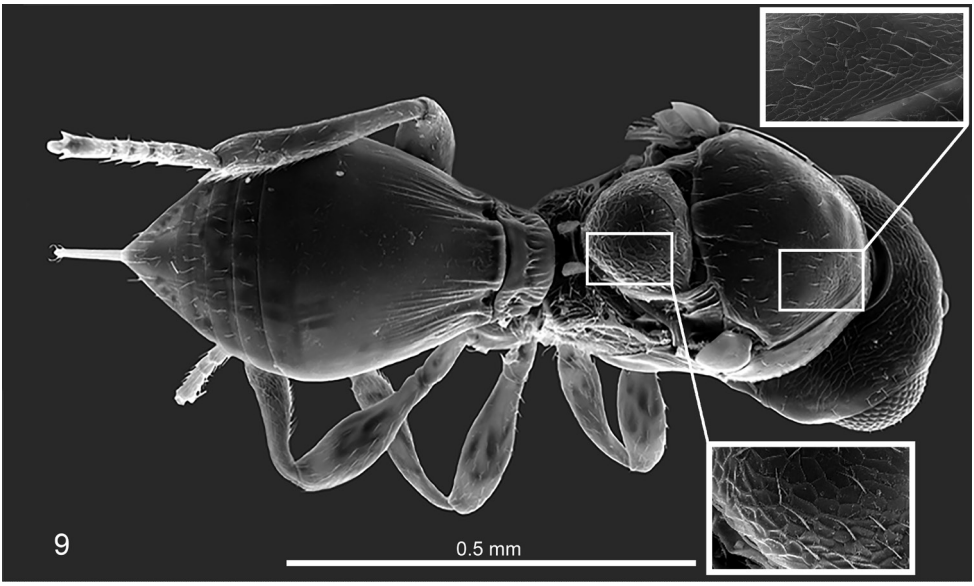
Head. Shape of head in dorsal view: subellipsoidal, 1.8–1.9 times as wide as long; occipital carina: present, not crenulate, weak; sculpture of posterior vertex: coriaceous-imbricate, transversally arranged; pilosity of posterior vertex: sparse, short setae, generally in two transverse rows; sculpture of temple: coriaceous-imbricate; hyperoccipital carina: absent; sculpture of interocellar area: coriaceous-imbricate to reticulate; ratio OOL/OD: OOL 2.3–2.5 times as long as OD; OOL/POL/LOL: 1:2:1; sculpture of frons: reticulate, but above toruli similar to sculpture of posterior vertex; IOS/EH: IOS longer than EH (IOS 1.8–1.9 times as long as EH); setation of eyes: short, with fine scattered hairs (visible at 70 X magnification); interantennal process: not prominent, concave; width of interantennal process: about equal to diameter of torulus; mandible: bidentate.

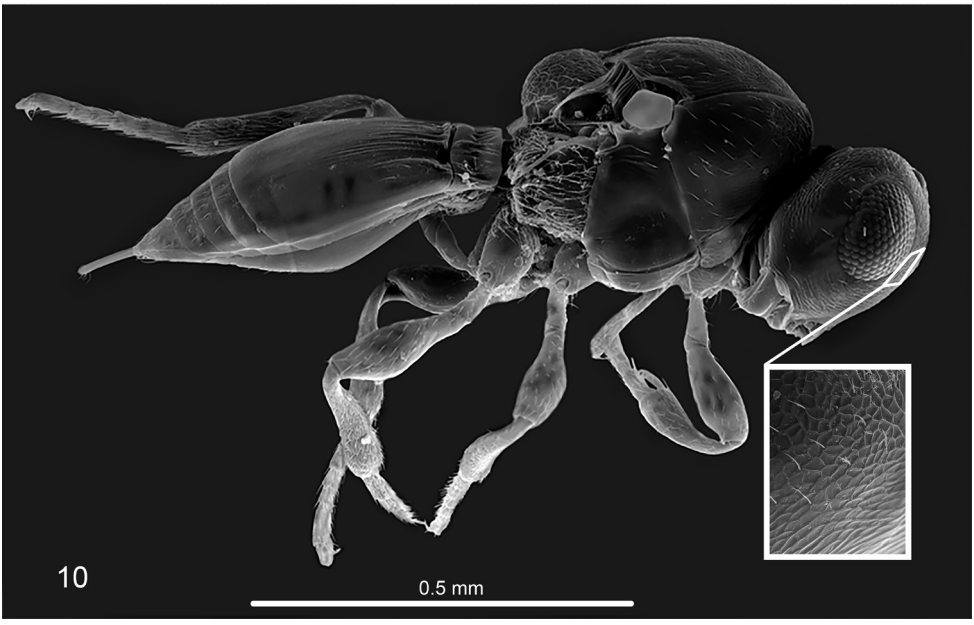
Antenna (Figs 4, 5). Number of female antennomeres: 9; number of clavomeres: 4; abrupt clava: absent; compact clava: absent; sensillar formula (A9–A6): 1:1:1:1; A6–A8: distinctly projecting anteroventrally, resembling a tooth; A9: distinctly acuminate.

Dorsal mesosoma (Figs 1, 3, 9). Pronotum: distinctly visible; pronotal shoulders: not enlarged; epomial carina: well developed; cervical pronotal area: weakly concave; setation of cervical pronotal area: absent; sculpture of mesoscutum: finely imbricate-coriaceous; sculpture of mesoscutellum: reticulate; antero-admedian line: absent; parapsidal line: absent; notauli: abbreviate, superficial, convergent posteriorly; mid lobe on posterior margin of mesoscutum: extending onto mesoscutellum; transaxillar and axillular carinae: fused, the resulting carina clearly visible; posterior mesoscutellar rim: not distinct; metanotum: narrow, smooth; metascutellum: not visible dorsally,



Figures 1–8. *Platygaster harpagoceras*: **1** Holotype female (dorsal) stored in HNHM (Budapest) **2** Paratype male (dorsal) stored in HNHM (Budapest) **3** Paratype female (dorsal), stored in NBAIR (Bengaluru) **4** Female antenna-light microscopy **5** Female antenna (SEM) **6** Male antenna-light microscopy **7** Fore and hind wing **8** Paratype female (lateral), stored in NBAIR (Bengaluru).





Figures 9, 10. *Platygaster harpagoceras*, female (SEM): **9** Habitus, dorsal **10** Habitus, lateral.

covered by mesoscutellum; setation of propodeum: long, dense laterally, absent medially; lateral propodeal carinae: distinct, parallel; metasomal depression: narrow; propodeal spiracle: clearly visible.

Lateral mesosoma (Figs 8, 10). Transverse pronotal sulcus: weak, glabrous; lateral propleural area: weakly convex; sculpture of lateral propleural area: uniform imbricate-coriaceous; setation of lateral propleural area: some sparse setae on the dorsal half;

transaxillar carina, in lateral view: with numerous longitudinal striae; mesopleural depression: weakly indicated; transepisternal line: weakly indicated; transepisternal line: almost transverse, deep, and sharply incised, nearly parallel with mesopleural carina; sculpture of mesopleuron: absent, except for sparse striae dorsally; setation of mesopleuron: absent; sculpture of metapleuron: absent; setation of metapleuron: relatively dense, present throughout; metapleural carina: prominent, well developed; metapleural pit: not visible; metapleural sulcus: not visible.

Fore wing (Fig. 7).Venation: absent; colour of fore wing: faintly infuscate; setation of fore wing: short, sparse microtrichia; fore wing length/width ratio: 2.6 times as long as wide; marginal fringe of fore wing: absent. Hind wing (Fig. 7).Venation: absent; colour of hind wing: hardly infuscated; number of hamuli: 2; setation of hind wing: rare, sparse microtrichia; hind wing length/width ratio: 4.3–4.4 times as long as wide; marginal fringe of hind wing: short, almost 0.2 times as long as hind wing width.

Metasoma. Length of metasoma: shorter than head and mesosoma combined; shape of metasoma in lateral view: convex dorsally; number of visible tergites: 6; shape of T1: trapezoidal; anterior pits of T1: clearly visible; sculpture of T1: medially costate, costae longer laterally; setation of T1: sparse laterally, absent on medial sculptured area; the largest tergite: T2; anterior pits of T2: present; setation of T2: few setae on lateral T2; sculpture of anterior T2: smooth between anterior pits, laterally longitudinally striate); length of striae on T2: surpassing the middle of T2; sculpture of T3–T6: absent; setation of T3–T5: sparse (~ 12–14 setae), in a single transverse row; laterotergites: present, distinct; setation of S1: present throughout; setation of S2: absent; setation of S3–S6: sparse to absent.

Male (Fig. 2): similar to female, differing in the structure of antenna (Fig. 6), with A4 longer than A3, A5–A8 having almost the same shape and size, and metasoma consisting of 7 visible tergites with a rounded apex.

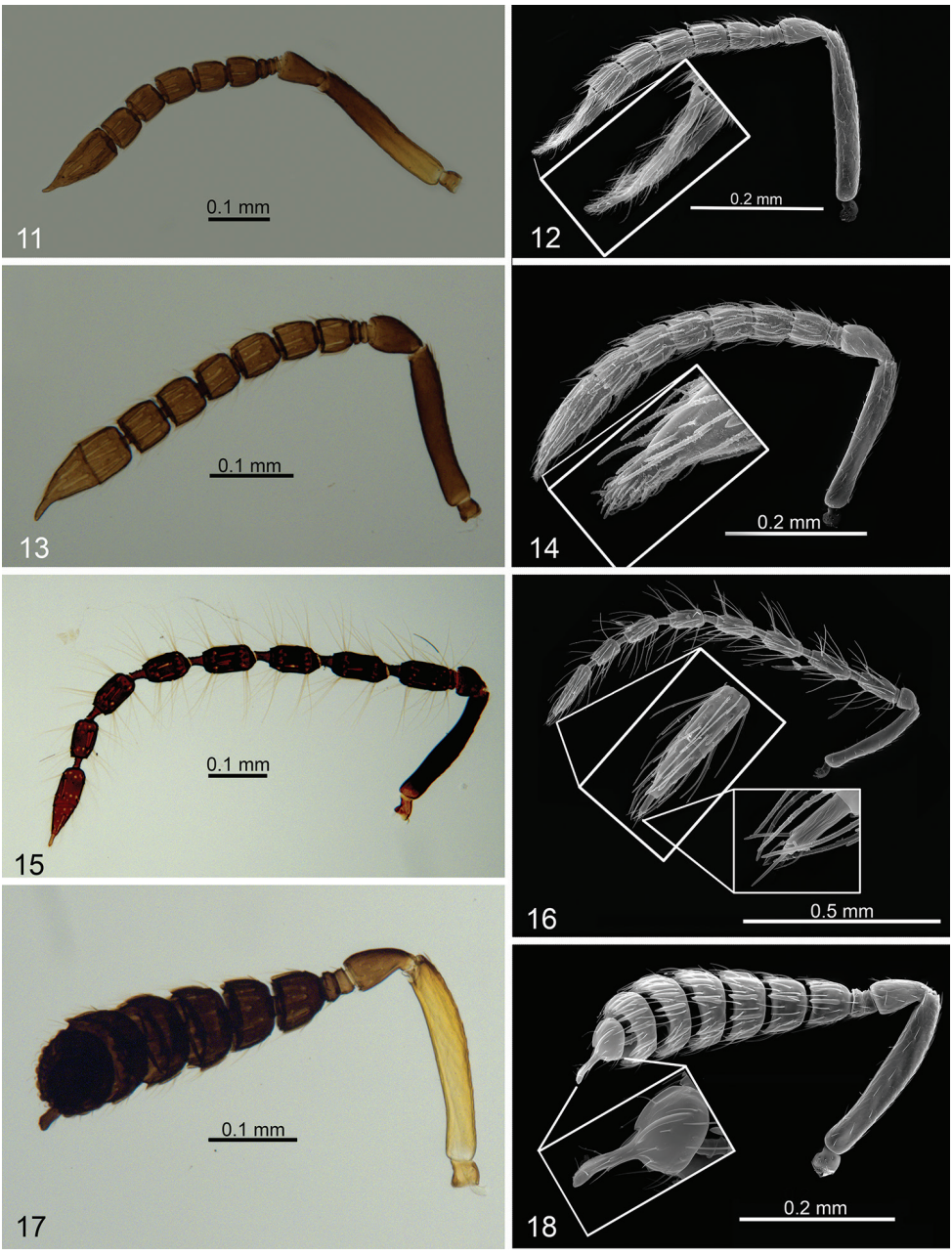
Diagnosis. In *Platygaster*, a 9-merous antenna is known only from *P. harpagoceras* and *P. novemarticulata* Buhl, 2009. *Platygaster harpagoceras* can be distinguished by the acuminate A9, A6–A8 transverse, A6–A8 with anteroventral projection, frons reticulate, and longitudinal striae on T2 surpassing the middle of T2.

Etymology. The epithet "harpagoceras" given to this species refers to the characteristic antenna (gr. "harpagos" – hook, and gr. "kéras" – horn).

Material examined. Holotype: 1 female, "India, Orissa Jajpur-Keonjahr Dists., Daitari, 28.xii.1966, leg. Topál" (Deposited in HNHM); Paratypes: 1 male and 1 female the same data as the holotype (HNHM); 1 female, India, Tamil Nadu, Kanyakumari, Manalodai, 11.25220°N, 78.69680°E, yellow pan trap, 13.v.2013, leg. A. Rameshkumar (NBAIR).

Discussion

The generic limits of *Platygaster* Latreille have not been clearly established and the genus is characterized primarily by the absence of characters that define other genera. There are no studies regarding the phylogeny of the genus *Platygaster*, and its monophyly is dubious, considering its high degree of morphological heterogeneity. Detailed study of the distribution of morphological characters throughout *Platygaster* is badly



Figures 11–18. Antenna (light and SEM microscopy): **11, 12** *Callitula* **13, 14** *Homoporus* **15, 16** *Norbanus* **17, 18** *Rhaphitelus*.

needed to infer monophyletic lineages that may be treated as separate genera and to construct a classification that is navigable at the species-level.

For comparison, we analyzed the acuminate shape of the last antennomere in the superfamily Chalcidoidea, where this trait is fairly common in members of several

families, including Pteromalidae and Eulophidae. In Pteromalidae, common genera, such as *Callitula* Spinola (Figs 11, 12), *Homoporus* Thomson (Figs 13, 14), *Norbanus* Walker (Figs 15, 16), and *Rhaphitelus* Walker (Figs 17, 18), have the distal antennomere spiculated in both sexes (Lotfalizadeh 2015, Mitroiu 2015).

Spiculated antennae are an extreme case of acuminate antennae, where the apical part of the clava distinctly narrows into a terminal projection of various lengths. In Pteromalidae a 'terminal button' (Heraty et al. 2012), which could be regarded as the 4th clavomere, is common in many genera. Whether the spicula represents the terminal button was investigated using SEM images. No suture has been observed in the antenna of the investigated genera, but in the male antenna of *Norbanus* it is evident that the spicula is distinct from the last antennomere. Hence, it is possible that the 4th clavomere of the female antenna is fused to the previous one, at least in Pteromalidae.

Another possibility we investigated was that this terminal structure represents a large sensillum. Tselikh (2010) and Zeiri et al. (2015) state that the female antenna of *Rhaphitelus* has a 'baculiform sensillum' at its apex. However, our SEM images of the female clava of *Rhaphitelus* show the presence of setae on the terminal structure and no discontinuity with the rest of the clava, which suggests the first is part of the antennomere and not a distinct structure. This is also true for the other pteromalid genera, and for *P. harpagoceras*.

Of all previously mentioned pteromalid genera, the clava of *P. harpagoceras* is most similar to that of *Rhaphitelus*, where the male also displays a much reduced spicula compared with the female. Pteromalidae and *Platygaster* are only distantly related, so this character state is clearly a convergence. This seems to be the case within Pteromalidae as well, except for *Norbanus* and *Homoporus*, which are probably closely related based on other features. The function of this particular shape of the distal antennomere is not known.

The anteroventral projections of A6–A8 are another peculiarity of *P. harpagoceras* and are similar to the projections of A7 and A8 in some species of *Allotropa* Förster (Sceliotrachelinae). Similar projections on A6–A9 were illustrated by Buhl (2001) in *Platygaster dilata* Buhl, which has 10 antennomeres, but A10 is not acuminate.

P. harpagoceras is the second known species of *Platygaster* having 9-merous antennae. As Buhl (2009) states, it is not necessary to erect a new genus for these species, at least not at the present level of study, taking into account that among platygastrids there are some genera containing species with 9 or 10 antennomeres (e.g. *Fidiobia* Ashmead, *Metanopedias* Brues). We consider the reduced number of antennomeres and the peculiar morphology of the apical antennomere to be apomorphic characters. Erecting new genera for species with striking apomorphies have to be carefully decided as it could be "detrimental to the construction of a natural classification if it renders other taxa paraphyletic" (Talamas and Buffington 2014).

Acknowledgements

Sincere thanks to Zoltán Vas (HNHM) for providing access to the collection, to David Notton (BMNH) for looking for similar specimens in the Indian material stored in

BMNH, and to Dr. Luciana Musetti and Dr. Norman Johnson for access to Hymenoptera Online (hol.osu.edu) – the most valuable resources for any student of Platygastroidea. We are grateful to Dr. Elijah Talamas for his suggestions regarding the etymology and name construction, and to Dr. István Mikó and to Mr. Zachary Lahey for providing useful comments on the manuscript. This work was supported in part by the SYNTHESYS project HU-TAF-6368 and by the UEFISCDI project PN-III-P4-ID-PCE-2016-0233.

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