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Research article

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Embidobia Ashmead (Hymenoptera, Platygastroidea, Scelionidae) of the Indian region with descriptions of new species

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Abstract. *Embidobia* (Platygastroidea: Scelionidae) are known to be egg parasitoids of Embioptera. The type species *Embidobia urichi* was described by Ashmead in 1896. In the last 127 years, eleven species of *Embidobia* were described worldwide of which two (*Embidobia brittanica* Girault, 1917 and *E. orientalis* Dodd, 1939) are from the Oriental region. While the former was described from India, the latter was from Sri Lanka. In this paper we describe 13 new species from India – *Embidobia agastya* Veenakumari sp. nov., *E. barbarika* Veenakumari sp. nov., *E. dooranetra* Veenakumari sp. nov., *E. gauriputra* Veenakumari sp. nov., *E. hiranya* Veenakumari sp. nov., *E. hrdaya* Veenakumari sp. nov., *E. jatayu* Veenakumari sp. nov., *E. mahabali* Veenakumari sp. nov., *E. omkara* Veenakumari sp. nov., *E. procera* Veenakumari sp. nov., *E. sankirna* Veenakumari sp. nov., *E. saroma* Veenakumari sp. nov. and *E. yuyutsu* Veenakumari sp. nov. The two previously known species, *E. orientalis* and *E. brittanica*, are redescribed. A key to the females of all Oriental species is provided along with illustrations.

Keywords. Biodiversity, Embioptera, oophagous parasitoids, Oriental, webspinners.

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Introduction

Webspinners, also called footspinners, belong to the order Embioptera Lameer, 1900 (Miller 2009). They live in silken galleries, generally under the bark of trees, in tree trunks, under rocks, on open ground, etc. Both nymphs and adults of this subsocial insect produce silk using silk glands present on their enlarged basal tarsomeres. Around 400 species belonging to 13 families and 90 genera have so far been described (Miller & Edgerly 2008; Miller 2009; Miller *et al.* 2012). They are found on all continents except Antarctica.

The genus *Embidobia* was erected for a single species *E. urichi* by Ashmead (1896). These small, fragile parasitoids were reared by F.W. Urich from the eggs of Embioptera in Trinidad, West Indies (Ashmead 1896). Priesner (1951) erected a new genus *Efflatounina* with *E. gryontoides* Priesner, 1951 as the type species with specimens collected from detritus in an irrigation canal running for a long stretch in the desert near Meadi, Egypt. Later, Masner (1964) synonymized *Efflatounina* and *Embidobia*, considering the differences to be insignificant at the generic level. This was further supported by Dodd's descriptions of species of *Embidobia* exhibiting morphological divergence between species in the genus (Dodd 1939).

Embidobia was first recorded from India by Girault (1917) describing a new species *E. brittanica*. He described this species with the specimens reared by Imms from eggs of *Parembia major* (Imms, 1913) (Embioptera: Embiidae) which were collected from the Himalaya.

Eleven species of *Embidobia* are currently known worldwide from five zoogeographical regions: *Embidobia africana* Mineo & Maniglia, 1983 and *E. formosa* Mineo & Maniglia, 1983 (Afrotropical region); *E. australica* Dodd, 1939, *E. longipennis* Dodd, 1939, *E. metoligotomae* Dodd, 1939 and *E. oaxes* (Dodd, 1914) (Australian region); *E. gryontoides* (Priesner, 1951) and *E. sicula* Mineo & Maniglia, 1983 (Palearctic region); *E. brittanica* Girault, 1917 and *E. orientalis* Dodd, 1939 (Oriental region); and *E. urichi* Ashmead, 1896 (Neotropical region) (Ashmead 1896; Dodd 1914, 1939; Girault 1917; Priesner 1951; Mineo & Maniglia 1983; Johnson 1992; MBD 2024). Of the two Oriental species, *E. brittanica* was described from India and *E. orientalis* from Sri Lanka (formerly Ceylon).

Platyastroidea Haliday, 1833 collected from different ecosystems in India using various collection methods (pan traps, sweep nets, light traps) yielded 13 new species. All the new species, as well as the type specimens of both *E. brittanica* and *E. orientalis*, are described and illustrated. A key to the females of *Embidobia* of the Oriental region is provided.

Material and methods

All specimens were collected during the course of our ongoing studies on the biodiversity of oophagous parasitoids using the following methods: yellow pan trap (YPT), sweep net (SN) and light trap. They were sorted under a stereo binocular light microscope (Carl Zeiss, Stemi 305) and preserved in ethyl alcohol (70 per cent) at 4°C in a refrigerator. Later these specimens were cleaned, spread on paper, dried and mounted on card-point tips.

SEM studies were conducted with a Hitachi Table top microscope TM3030 (SEM: Environmental Scanning Electron Microscope). The specimens were not metal or carbon coated; nor were they dehydrated in the variable pressure vacuum system (VPSEM/environmental SEM). They were attached using two sided conductive adhesive copper tape to the aluminium stub. Each specimen was carefully oriented to enable different parts to be imaged. All measurements were taken during the imaging process.

A Leica M205A stereo microscope, with 1 × objective and Leica DFC-500 digital camera with LED ring light illuminator was employed for the colour images which were stacked using the Leica Application

Suite (LAS) software. Measurements were taken following Mikó *et al.* (2010). Lengths of all metasomal tergites were taken medially.

The terminology of Masner (1980), Mikó *et al.* (2007, 2010) and Yoder *et al.* (2014) was adopted for morphological characters, while that of Harris (1979) was followed for describing macro- and micro-sculpture.

Images of the lectotype of *E. brittanica* were accessed at the Ohio State University's Museum of Biological Diversity database (MBD 2024) whereas that of *E. orientalis* were from QMBA. When it was not possible to discern the character states from the images of previously described species, the original descriptions of the respective species were relied upon for the redescrptions as well as for the formulation of keys.

The holotypes and paratypes of all the new species described are deposited in the National Insect Museum (NIM), Indian Council of Agricultural Research-National Bureau of Agricultural Insect Resources, Bangalore, Karnataka, India (ICAR-NBAIR).

Abbreviations

A1–A12	=	antennomeres 1–12 (A1 = scape, A2 = pedicel)
IOS	=	interorbital space
L	=	length
m	=	marginalis
OOL	=	ocular ocellar line
pm	=	postmarginalis
stg	=	stigmalis
T1–T6	=	metasomal tergites 1–6
W	=	width

The following abbreviations are used for the museums holding the type specimens referred to in this work.

NIM	=	National Insect Museum, ICAR-National Bureau of Agricultural Insect Resources, Bengaluru, India
QMBA	=	Queensland Museum, Brisbane, Queensland, Australia
USNM	=	United States National Museum of Natural History, Washington DC, USA

Results

Class Insecta Linnaeus, 1758
Order Hymenoptera Linnaeus, 1758
Superfamily Platygastroidea Haliday, 1833
Family Scelionidae Haliday, 1839
Subfamily Scelioninae Haliday, 1839

Genus *Embidobia* Ashmead, 1896

Embidobia Ashmead, 1896: 264. Type: *Embidobia urichi* Ashmead, 1896, by monotypy. Keyed.
Efflatounina Priesner, 1951: 126. Type: *Efflatounina gryontoides* Priesner, 1951, by monotypy and original designation. Synonymized by Masner (1964).

Diagnosis (based on Masner 1964, 1976)

Eyes large with dense setae. Lateral ocelli distant from inner orbits of eyes, with OOL generally shorter than median ocellar diameter, rarely exceeding it. Female antenna has 11 antennomeres with a 4 segmented clava; male antenna with 12 antennomeres. Antennal scrobe distinct. Central keel distinct extending on to interantennal process. Facial striae and malar striae generally prominent. Mesoscutum devoid of notaulus. Mesoscutellum unarmed and semicircular, sometimes extending over metascutellum. Metascutellum narrow. Propodeum visible only laterally in dorsal view. Netrion present, netrion sulcus prominent and generally indicated as transverse costae. Mesopleural carina distinct. Fore wing with submarginalis slightly dipping before reaching marginalis; in some cases submarginalis weakly broken before reaching marginalis; marginalis elongate but distinctly shorter than stigmalis except in *E. sicula*; postmarginalis generally very long except in *E. metoligotomae*. Stout and long bristles present on the venation. Metasoma with well-developed submarginal ridge. T1 transverse, sometimes with a weak hump anteromedially in females; T1 shorter than T2 in length in majority of species; generally T2 is longer than T3, sometimes it is either equal to or shorter than T3.

Key for identification of *Embidobia* (based on Masner & Dessart 1972)

1. Wings micropterous without distinct venation; habitus covered with dense silvery setae *Echthrodesis* Masner, 1968
– Wings macropterous; wing venation distinct; habitus with sparse setae 2
2. Stigmalis distinctly longer than marginalis; postmarginalis as long as or longer than stigmalis; eyes longer than gena *Embidobia* Ashmead, 1896
– Stigmalis much shorter than marginalis; postmarginalis absent; eyes shorter than gena *Endecascelio* Masner & Dessart, 1972

Distribution

Neotropic, Palearctic, Oriental, Australian, Afrotropical.

Description of species

Embidobia agastya Veenakumari sp. nov.

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Figs 1, 2A

Diagnosis

This is the only Oriental species with T1 and T2 predominantly smooth and T3 with imbricate sculpture.

Etymology

The species epithet ‘agastya’ is in honour of the distinguished sage who composed many verses in the Rig Veda, the oldest text in the Hindu liturgical canon. The name is treated as a noun in apposition.

Material examined

Holotype

INDIA – **Karnataka** • ♀; Bengaluru, Hesaraghatta; 13°08'01" N, 77°29'27" E; 859 m; 7 Jul. 2014; YPT; NIM, ICAR-NBAIR P5001.

Paratypes

INDIA – **Andaman and Nicobar Islands** • 1 ♀; South Andaman, Garacharma, Central Island Agricultural Research Institute (CIARI); 11°36'41" N, 92°42'56" E; 56 m; 22 Feb. 2012; YPT; NIM, ICAR-NBAIR P5027. – **Karnataka** • 16 ♀♀; same data as for holotype; NIM, ICAR-NBAIR P5002

to P5017 • 1 ♀; Bengaluru, Hebbal; 13°02'08" N, 77°35'49" E; 906 m; 21 Aug. 2012; PFT; NIM, ICAR-NBAIR P5018 • 1 ♀; same locality as for preceding; 15 May 2010; PFT; NIM, ICAR-NBAIR P5019 • 3 ♀♀; Udupi, Brahmavara; 13°25'51" N, 74°44'43" E; 36 m; 28 May 2014; YPT; NIM, ICAR-NBAIR P5020 to P5022 • 1 ♀; Bengaluru, Attur; 13°05'48" N, 77°33'59" E; 936 m; 16 Jul. 2013; PFT; NIM, ICAR-NBAIR P5023 • 1 ♀; Bengaluru, Hebbal, National Bureau of Agricultural Insect Resources (NBAIR); 13°01'38" N, 77°35'03" E; 927 m; 3 Jul. 2015; YPT; NIM, ICAR-NBAIR P5024 • 1 ♀; Tumkur, Kunigal, Ranganathaswamy Betta; 13°02'02" N, 76°58'18" E; 901 m; 20 Sep. 2011; SN; NIM, ICAR-NBAIR P5025 • 1 ♀; Dakshina Kannada, Kidu, Central Plantation Crops Research Institute (CPCRI); 12°42'24" N, 75°34'27" E; 143 m; 19 Feb. 2015; YPT; NIM, ICAR-NBAIR P5026.

Description

Female

MEASUREMENTS. Body length = 0.86–1.07 mm (n = 15).

COLOUR. Head yellow-brown; radicle, A1–A7 yellow-brown, remaining antennomeres black-brown; mesosoma brown; meso and metascutellum darker than mesoscutum; metasoma brown with yellow patches towards posterior margin of tergites; anterior margin of T1 with a black band; legs yellow-brown.

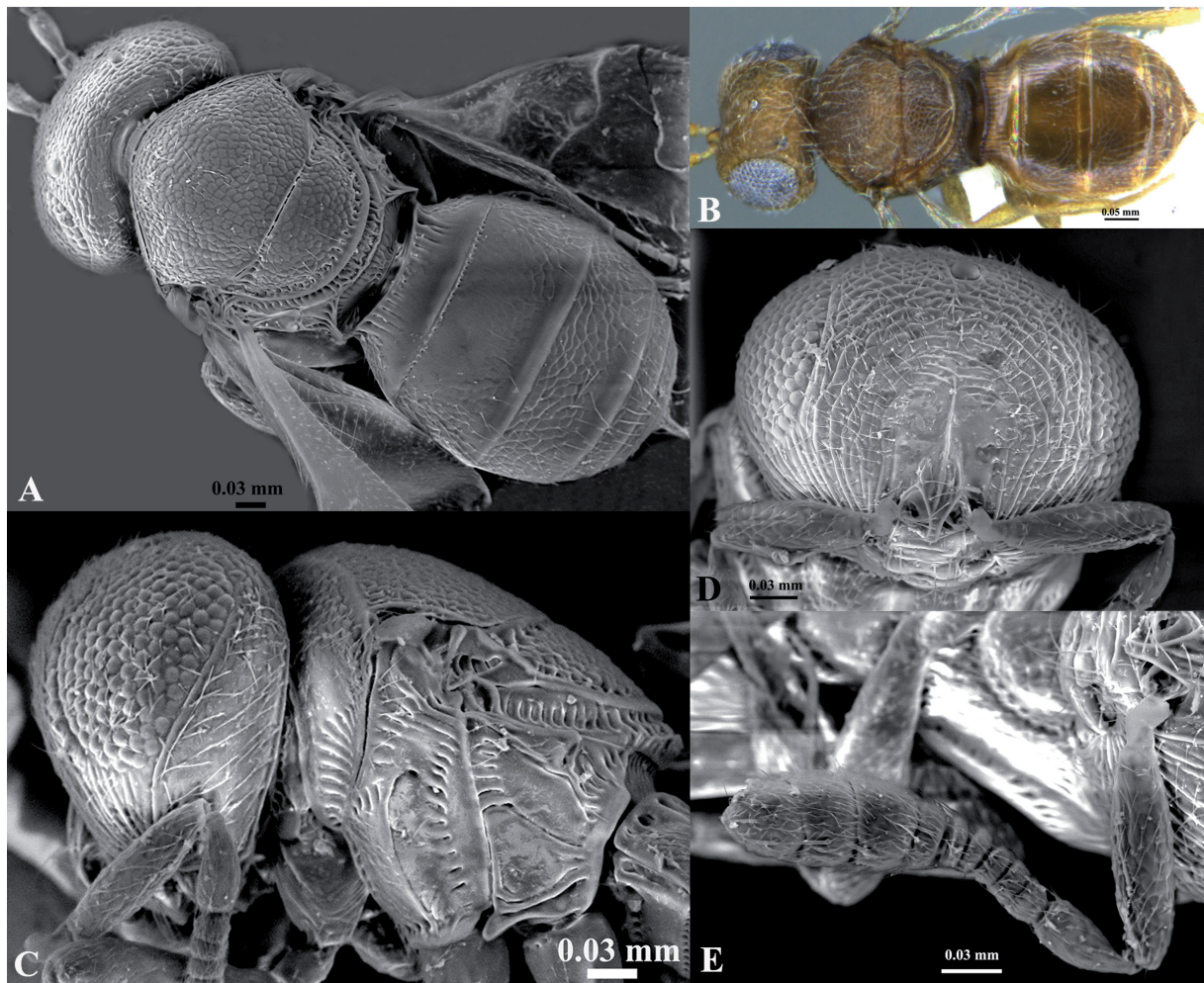


Fig. 1. *Embidobia agastya* Veenakumari sp. nov., holotype, ♀ (NIM, ICAR-NBAIR P5001). A–B. Habitus dorsal view. C. Head and pleuron. D. Frons. E. Antenna.

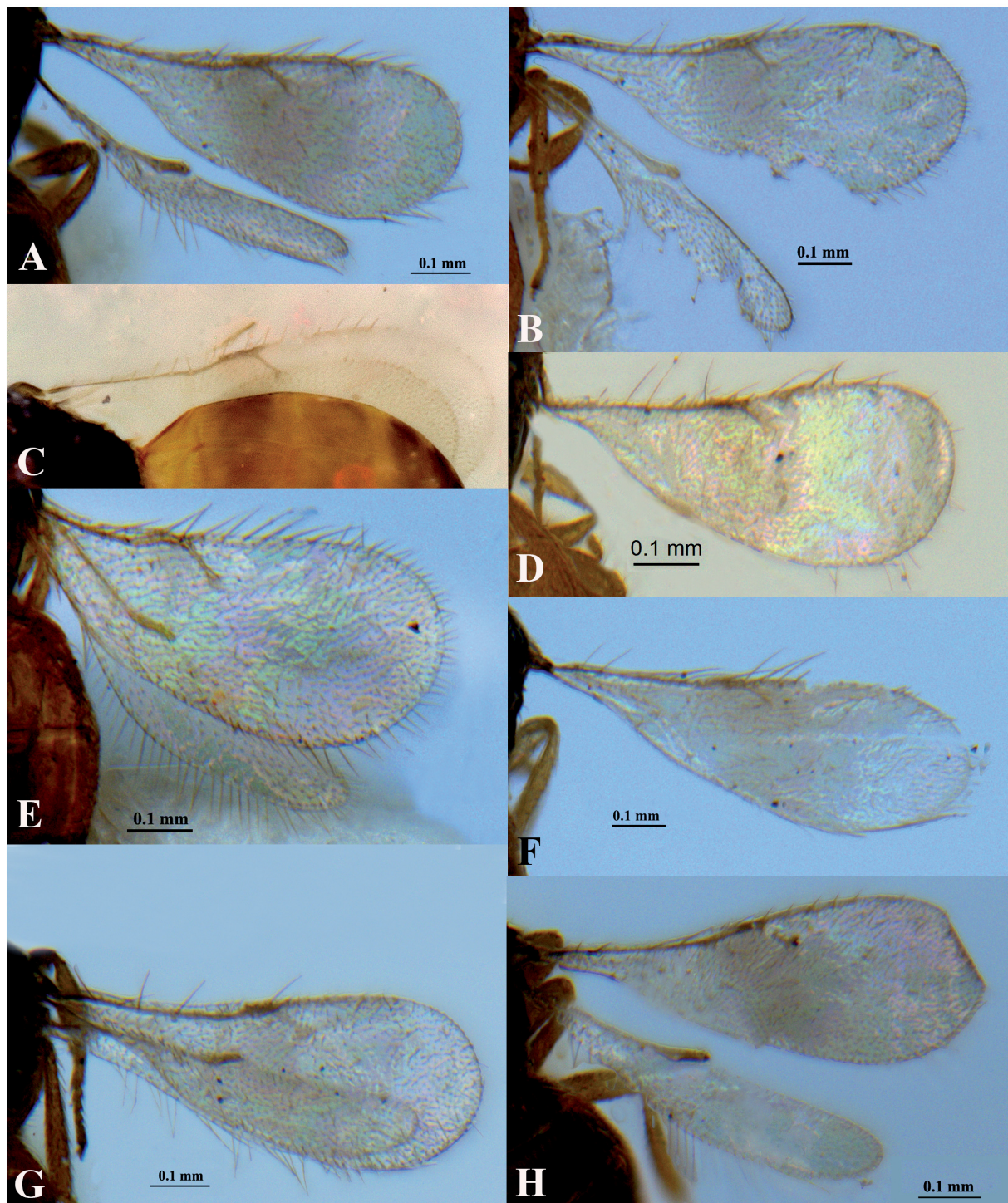


Fig. 2. Wings. **A.** *Embidobia agastya* Veenakumari sp. nov., holotype, ♀ (NIM, ICAR-NBAIR P5001). **B.** *E. barbarika* Veenakumari sp. nov., holotype, ♀ (NIM, ICAR-NBAIR P5063). **C.** *E. britannica* Girault, 1917, lectotype, ♀ (USNM, Type No. 2060). **D.** *E. dooranetra* Veenakumari sp. nov., holotype, ♀ (NIM, ICAR-NBAIR P5103). **E.** *E. gauriputra* Veenakumari sp. nov. holotype, ♀ (NIM, ICAR-NBAIR P5076). **F.** *E. hrdaya* Veenakumari sp. nov., holotype, ♀ (NIM, ICAR-NBAIR P5114). **G.** *E. jatayu* sp. nov., holotype, ♀ (NIM, ICAR-NBAIR P5028). **H.** *E. mahabali* Veenakumari sp. nov. holotype, ♀ (NIM, ICAR-NBAIR P5038).

HEAD. Head: $1.3 \times$ as wide as high, $1.3 \times$ as high as long. IOS: $0.7 \times$ head width, $1.2 \times$ eye length. OOL: $0.8 \times$ width of median ocellus. Compound eye: ovate (L:W = 14.1:10.0). Sculpture of frons: lower frons medially smooth with uneven longitudinal carinae on either side; several short transverse carinae present dorsal to central keel; upper frons with short uneven transverse carinae. Central keel: $0.4 \times$ head height. Sculpture of gena: predominantly smooth with long setae. Facial and malar striae: prominent. Sculpture of vertex: rugose. Interantennal process: elongate, posteriorly truncate.

MESOSOMA. L:W of mesoscutum: 16.2:24.0. Sculpture of mesoscutum: rugose. Mesoscutal humeral sulcus: not foveate. Mesoscutal suprahumeral sulcus: not foveate. Scutoscutellar sulcus: foveate laterally. L:W of mesoscutellum: 9.0:18.0. Sculpture of mesoscutellum: rugose. Posterior mesoscutellar sulcus: foveate. Metascutellum when viewed dorsally: visible. Sculpture of metascutellum: unevenly sculptured interspersed with foveae. Posterior margin of metascutellum: evenly rounded. Sculpture of lateral propodeal area: anteriorly smooth, posteriorly costate with foveae in between. Sculpture of lateral pronotal area: dorsally imbricate, ventrally smooth. Netrion: present, smooth, linear. Netrion sulcus: costate. Pronotal suprahumeral sulcus: not foveate. Pronotal cervical sulcus: indicated with a furrow. Prespecular sulcus: with transverse foveae. Speculum of mesopleuron: transversely carinate. Episternal sulcus: with transverse foveae. Postacetabular sulcus: foveate. Mesepimeral sulcus: with transverse foveae. Mesepimeral area: smooth. Mesopleural carina: present. Sculpture of femoral depression: smooth. Mesopleural pit: present. Sculpture of metapleuron: smooth. Metapleuron sulcus: with transverse foveae. Paracoxal sulcus: indicated by a weak furrow. Metapleuron epicoxal sulcus: indicated by transverse carinae and furrows. Anteroventral extension of metapleuron: as long as wide. L:W of fore wing: 69.2:26.9. Infusate patch on fore wing: present as a longitudinal patch medially. Ratio of length of m:pm:stg: 5.1:23.0:9.2. Metasomal depression: longitudinally costate except for smooth areas laterally.

METASOMA. L:W of metasoma: 31.8:28.8. Sculpture of T1: basal foveae present; short longitudinally costate present anterosublaterally, remainder smooth except setose reticulate patch sublaterally. Sculpture of T2: small basal foveae present; predominantly smooth except for lateral setose reticulate patch. Sculpture of T3: entirely imbricate but smooth toward posterior margin. Length of T1:T2:T3: 5.7:11.4:9.0.

Male

Unknown.

Embidobia barbarika Veenakumari sp. nov.

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Figs 2B, 3

Diagnosis

Embidobia barbarika sp. nov. is close to *E. procera* sp. nov. but differs from it in having a short, wide interantennal process and carinae on upper frons continuous and elongate; whereas in *E. procera* interantennal process is elongate and narrow and carinae on upper frons are short and oblique.

Etymology

The species epithet refers to Barbarika, the little known, invincible warrior in the Hindu epic Mahabharatha, who was convinced by the god Krishna to abstain from participating in the war between the Kuru cousins at Kurukshetra. The name is treated as a noun in apposition.

Material examined

Holotype

INDIA – Karnataka • ♀; Bengaluru, Jarakabande Kaval; 13°05'41" N, 77°32'35" E; 921 m; 18 Apr. 2013; YPT; NIM, ICAR-NBAIR P5063.

Paratypes

INDIA – **Arunachal Pradesh** • 1 ♀; Pasighat, College of Horticulture and Forestry (CHF); 28°04'28" N, 95°19'28" E; 173 m; 5 May 2014; YPT; NIM, ICAR-NBAIR P5075. – **Karnataka** • 1 ♀; Bengaluru, Attur; 13°05'48" N, 77°33'59" E; 936 m; 15 Mar. 2014; PFT; NIM, ICAR-NBAIR P5064 • 1 ♀; Bengaluru, Gandhi Krishi Vigyan Kendra (GKVK); 13°04'25" N, 77°34'49" E; 938 m; 22 Dec. 2014; YPT; NIM, ICAR-NBAIR P5065 • 1 ♀; Bengaluru, Hesaraghatta; 13°08'01" N, 77°29'27" E; 859 m; 26 Mar. 2014; YPT; NIM, ICAR-NBAIR P5066 • 1 ♀; Tumkur, Kunigal; 13°01'31" N, 77°01'31" E; 803 m; 10 Jan. 2014; YPT; NIM, ICAR-NBAIR P5067. – **Kerala** • 2 ♀♀; Kasaragod, CPCRI; 12°31'29" N, 74°57'52" E; 6 m; 20 Feb. 2015; YPT; NIM, ICAR-NBAIR P5073, P5074. – **Odisha** • 3 ♀♀; Bhubaneswar, Orissa University of Agriculture and Technology (OUAT); 20°15'52" N, 85°48'50" E; 45 m; 31 Jan. 2016; YPT; NIM, ICAR-NBAIR P5068 to P5070. – **Tamil Nadu** • 1 ♀; Hosur, Uddanapalli; 12°37'28" N, 77°55'29" E; 758 m; 31 Jan. 2015; YPT; NIM, ICAR-NBAIR P5071 • 1 ♀; Dindugul, Thandikudi, Regional Coffee Research Station (RCRS); 10°18'34" N, 77°38'34" E; 1305 m; 26 Nov. 2016; YPT; NIM, ICAR-NBAIR P5072.

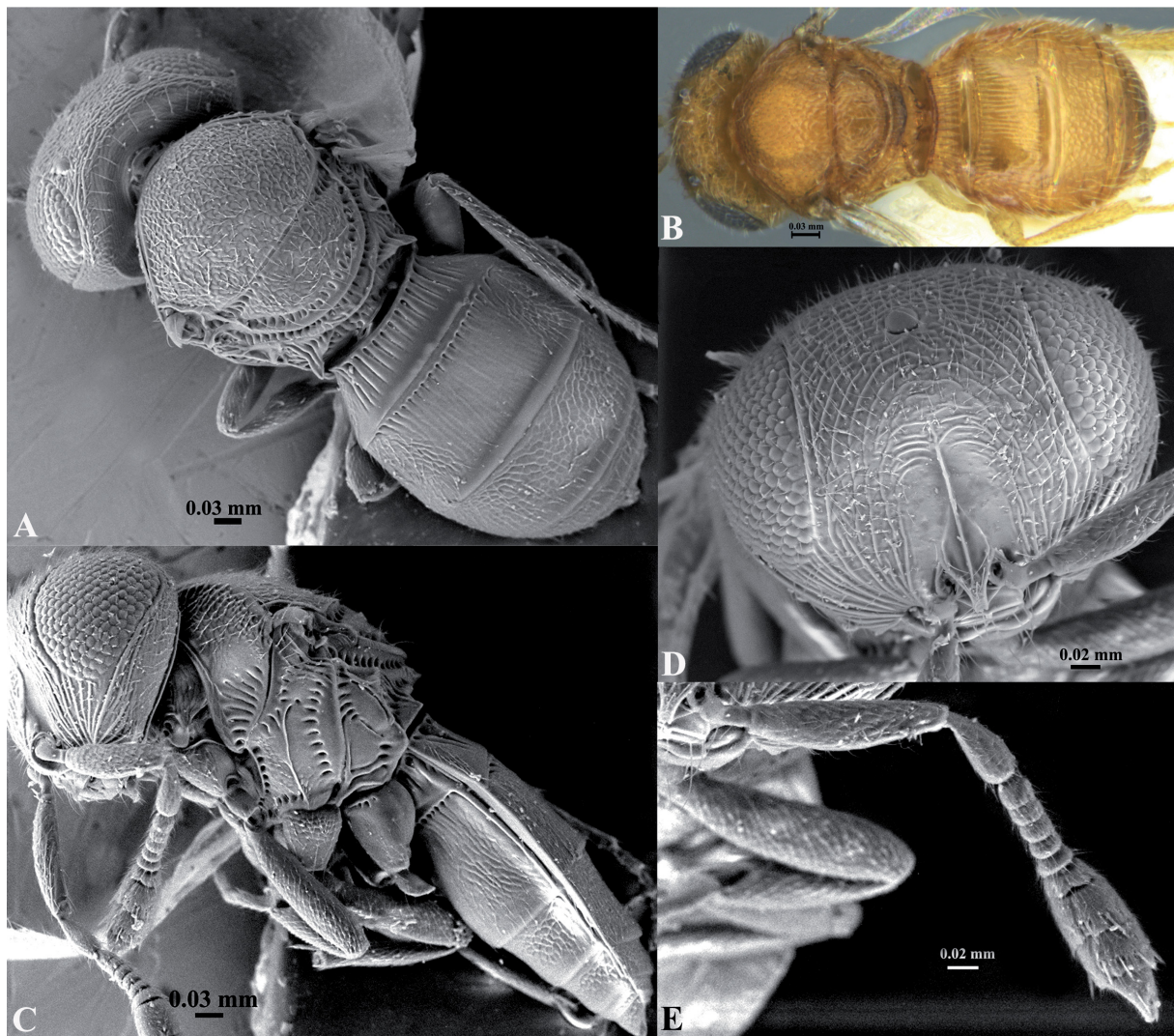


Fig. 3. *Embidobia barbarika* Veenakumari sp. nov., holotype, ♀ (NIM, ICAR-NBAIR P5063). A–B. Habitus dorsal view. C. Head and pleuron. D. Frons. E. Antenna.

Description

Female

MEASUREMENTS. Body length = 0.92–1.10 mm (n = 10).

COLOUR. Head, mesosoma and metasoma yellow except brown-black metascutellum; radicle, A1, A3–A7 yellow-brown, remaining antennomeres black-brown; legs yellow-brown.

HEAD. Head: $1.3 \times$ as wide as high, $1.3 \times$ as high as long. IOS: $0.5 \times$ head width, $1.1 \times$ eye length. OOL: $0.5 \times$ width of median ocellus. Compound eye: ovate (L:W = 15.1:12.6). Sculpture of frons: lower frons medially smooth with several short uneven carinae on either side; several short transverse carinae present dorsal to central keel; carinae on upper frons continuous and elongate. Central keel: $0.5 \times$ head height. Sculpture of gena: predominantly smooth with long setae. Facial and malar striae: prominent. Sculpture of vertex: with short transverse carinae. Interantennal process: short, truncate posteriorly.

MESOSOMA. L:W of mesoscutum: 16.1:25.1. Sculpture of mesoscutum: imbricate. Mesoscutal humeral sulcus: with a furrow. Mesoscutal suprahumeral sulcus: indicated with a furrow. Scutoscutellar sulcus: foveate laterally. L:W of mesoscutellum: 9.0:6.5. Sculpture of mesoscutellum: rugose with a smooth patch anteromedially. Posterior mesoscutellar sulcus: foveate. Metascutellum when viewed dorsally: visible. Sculpture of metascutellum: smooth with foveae on anterior margin. Posterior margin of metascutellum: convex and extending posteriorly. Sculpture of lateral propodeal area: entirely longitudinally costate with foveae in between. Sculpture of lateral pronotal area: dorsally imbricate, ventrally smooth. Netrion: present, smooth, linear. Netrion sulcus: costate. Pronotal suprahumeral sulcus: not foveate. Pronotal cervical sulcus: indicated as a furrow. Prespecular sulcus: foveate. Speculum of mesopleuron: transversely carinate. Episternal sulcus: obliquely foveate. Postacetabular sulcus: foveate. Mesepimeral sulcus: with transverse foveae. Mesepimeral area: smooth, narrow. Mesopleural carina: present. Sculpture of femoral depression: smooth. Mesopleural pit: present. Sculpture of metapleuron: smooth. Metapleuron sulcus: with transverse foveae. Paracoxal sulcus: indicated by a furrow. Metapleuron epicoxal sulcus: indicated by transverse carinae and furrows. Anteroventral extension of metapleuron: $2 \times$ as long as wide. L:W of fore wing: 77.3:30.6. Infusate patch on fore wing: present as a longitudinal patch medially. Ratio of length of m:pm:stg: 4.3:9.3:17.2. Metasomal depression: longitudinally costate except for smooth areas laterally.

METASOMA. L:W of metasoma: 34.7:28.4. Sculpture of T1: basal foveae present; longitudinally costate, costae extending $0.7 \times$ length of tergite, posteriorly smooth and laterally with a setose reticulate patch. Sculpture of T2: anteromedially with a narrow smooth band followed by basal foveae; medially longitudinally weakly striate; posteriorly smooth and laterally with a setose reticulate patch. Sculpture of T3: reticulate with posterior margin smooth. Length of T1:T2:T3: 3.5:13.6:9.7.

Male

Unknown.

Embidobia brittanica Girault, 1917

Figs 2C, 4

Diagnosis (based on Girault 1917)

Embidobia brittanica is close to *E. dooranetra* sp. nov. but differs from it in having OOL subequal to diameter of the median ocellus; T1 and T2 striate only basally. Whereas in *E. dooranetra* OOL is long, at least $1.3 \times$ the diameter of the median ocellus; striae on T1 and T2 elongate, extending $>0.8 \times$ length of the tergite.

Material examined

Lectotype (images only)

INDIA • 1 ♀; Uttar Pradesh, Kumaon, Bhowali; 24 Aug. 1912; A.D. Imms leg.; ex eggs *Perembia major* (= *Embia major* Imms); USNM, Type No. 2060.

Label data: “Lectotype designated by L. Masner (1964); Lectotype Masner & Muesebeck, 1968; *Embidobia* sp. emerged from eggs of *Embia* 23–27th Aug. 1912: A.D. Imms”.

Description

The description given by Girault (1917) is scanty and as the specimens are mounted on a glass slide, it is difficult to discern the details of the morphological characters from the images. Although Mineo & Maniglia (1983) mention that they studied the holotype of *E. britannica*, nothing has been mentioned about this species. To the extent possible characters in addition to those mentioned by Girault (1917) are detailed here.

Female body length = 0.70 mm.



Fig. 4. *Embidobia britannica* Girault, 1917, lectotype, ♀ (USNM, Type No. 2060). **A.** Habitus dorsolateral view. **B.** Slide with specimens and type labels. Photos: ©Queensland Museum, N.F. Johnson.

Head and mesosoma brown-black; metasoma yellow; legs pale yellow; antenna yellow with brown clava. OOL subequal to median ocellar diameter. Fore wing infusate medially and apically. Propodeum longitudinally costate.

Following Girault (1917) in numbering the tergites by counting “the first body segment as 2”: T1 is shorter than T2; T1 is striate at proximal half; T2 is striate at base; and T3 is shorter than T2.

Girault (1917) mentioned that marginalis is almost as long as stigmalis. However stigmalis is $1.3 \times$ as long as marginalis (Fig. 2C).

Embidobia dooranetra Veenakumari sp. nov.

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Figs 2D, 5

Diagnosis

Embidobia dooranetra sp. nov. is close to *E. brittanica* but differs from it in having an elongate OOL, at least $1.3 \times$ the diameter of the median ocellus; striae on T1 and T2 are elongate, extending $>0.8 \times$ length of the tergite. Whereas in *E. brittanica* OOL is subequal to diameter of median ocellus and T1 and T2 are striate only at base.

Etymology

The Sanskrit epithet ‘dooranetra’ means ‘eyes set far apart’, referring to the placement of the lateral ocelli, which are present far from the orbits. The name is treated as an adjective.

Material examined

Holotype

INDIA – **Tamil Nadu** • ♀; Chidambaram, Annamalai University, Agriculture College; 11°23'30" N, 79°42'48" E; 21 m; 3 Jul. 2016; YPT; NIM, ICAR-NBAIR P5103.

Paratypes

INDIA – **Karnataka** • 2 ♂♂; Mandya; 12°33'51" N 76°44'01" E; 749 m; 7 Jan. 2017; YPT; NIM, ICAR-NBAIR P5108, P5109. – **Odisha** • 1 ♀; Bhubaneswar, Baramunda, Puri road; 20°16'23" N, 85°47'31" E; 46 m; 2 Feb. 2016; YPT; NIM, ICAR-NBAIR P5105. – **Punjab** • 1 ♀; Pathankot, Sali Kulian; 32°15'14" N, 75°39'28" E; 332 m; 12 Jul. 2006; SN; NIM, ICAR-NBAIR P5106 • 1 ♀; Pathankot, Sujampur; 32°18'45" N, 75°36'05" E; 329 m; 10 Jul. 2006; SN; NIM, ICAR-NBAIR P5107. – **Tamil Nadu** • 1 ♀; Chidambaram, Annamalai University, Agriculture College; 11°23'30" N, 79°42'48" E; 21 m; 3 Jul. 2016; YPT; NIM, ICAR-NBAIR P5104.

Description

MEASUREMENTS. Female body length = 0.91–1.09 mm (n = 5); male body length = 0.78–0.84 mm (n = 2).

Female

COLOUR. Head and mesosoma brown-black; metasoma yellow-brown except black posterior tergites; radicle, A1, A2–A7 yellow-brown, remaining antennomeres black-brown; legs yellow-brown.

HEAD. Head: $1.4 \times$ as wide as high, $1.4 \times$ as high as long. IOS: $0.6 \times$ head width, $1.3 \times$ eye length. OOL: $1.3 \times$ width of median ocellus. Compound eye: ovate (L:W = 13.5:0.2). Sculpture of frons: lower frons medially smooth with uneven longitudinal carinae on either side; several short transverse carinae present dorsal to central keel; upper frons with several short semicircular carinae. Central keel:

0.5× head height. Sculpture of gena: predominantly smooth with long setae. Facial and malar striae: prominent. Sculpture of vertex: rugose. Interantennal process: short, pointed posteriorly.

MESOSOMA. L:W of mesoscutum: 17.1:22.3. Sculpture of mesoscutum: dorsally imbricate, remainder weakly rugose. Mesoscutal humeral sulcus: indicated as a furrow. Mesoscutal suprahumeral sulcus: indicated as a furrow. Scutoscutellar sulcus: almost entirely foveate. L:W of mesoscutellum: 8.3:17.1. Sculpture of mesoscutellum: smooth with weak impressions of rugae. Posterior mesoscutellar sulcus: foveate. Metascutellum when viewed dorsally: visible. Posterior margin of metascutellum: semicircular. Sculpture of metascutellum: anteriorly foveate and posteriorly with a depression. Sculpture of lateral propodeal area: entirely costate with foveae in between. Posterior margin of metascutellum: semicircular. Sculpture of lateral pronotal area: dorsally imbricate, anterodorsally with sparse oblique carinae, ventrally smooth. Netrion: poorly defined. Netrion sulcus: costate. Pronotal suprahumeral sulcus: foveate posteriorly. Pronotal cervical sulcus: indicated as a furrow. Prespecular sulcus: with transverse foveae. Speculum of mesopleuron: transversely carinate. Episternal sulcus: with transverse foveae. Postacetabular sulcus: foveate. Mesepimeral sulcus: with transverse foveae. Mesepimeral area: smooth, narrow. Mesopleural carina: present. Sculpture of femoral depression: smooth. Mesopleural pit: present. Sculpture of metapleuron: smooth. Metapleural sulcus: with transverse foveae. Paracoxal sulcus: indicated by a furrow. Metapleural epicoxal sulcus: indicated by transverse carinae and furrows. Anteroventral extension of metapleuron: 2× as long as wide. L:W of fore wing: 63.8:28.1. Infusate patch on fore wing: present as a longitudinal patch medially. Ratio of length of m:pm:stg: 4.2:20.1:7.5. Metasomal depression: longitudinally costate except for smooth areas laterally.

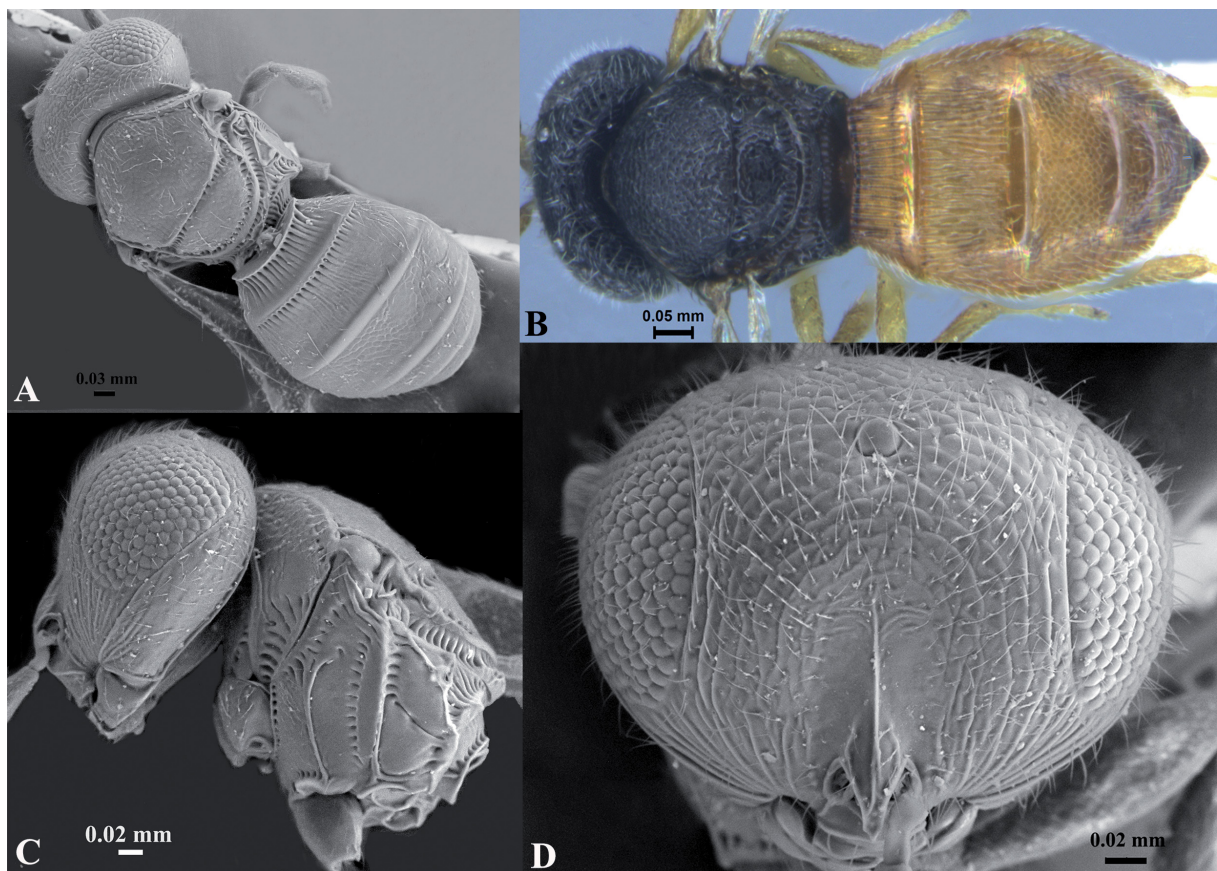


Fig. 5. *Embidobia dooranetra* Veenakumari sp. nov., holotype, ♀ (NIM, ICAR-NBAIR P5103). **A–B.** Habitus dorsal view. **C.** Head and pleuron. **D.** Frons.

METASOMA. L: W of metasoma: 31.7:30.1. Sculpture of T1: basal foveae present; longitudinally costate, costae extending almost the entire length of tergite; laterally with a setose reticulate patch. Sculpture of T2: basal foveae present; medially longitudinally striate, sublaterally smooth, laterally with a setose reticulate patch and posteriorly with a wide smooth band. Sculpture of T3: weakly reticulate except for smooth areas laterally and posteriorly. Length of T1 : T2 : T3: 6.0 : 10.7 : 9.8.

Male

Similar to female except for antennal measurements.

Embidobia gauriputra Veenakumari sp. nov.

urn:lsid:zoobank.org:act:86AE1FEE-D71E-4219-84C7-5623BB7CEC47

Figs 2E, 6

Diagnosis

Embidobia gauriputra sp. nov. is close to *E. saroma* sp. nov. These two may be separated by the presence of prominent facial and malar striae and distinct ocelli in *E. gauriputra*; while in *E. saroma* facial striae are weak and malar striae and ocelli are absent.

Etymology

The species is named 'gauriputra' – 'son' ('putra') of Gauri – after the Hindu God Ganesha. The name is treated as a noun in apposition.

Material examined

Holotype

INDIA – **Karnataka** • ♀; Bengaluru, Hebbal; 13°02'08" N, 77°35'49" E; 906 m; 7 Feb. 2010; YPT; NIM, ICAR-NBAIR P5076.

Paratypes

INDIA – **Karnataka** • 1 ♀; Bengaluru, Hebbal; 13°02'08" N, 77°35'49" E; 906 m; 5 Jan. 2010; YPT; NIM, ICAR-NBAIR P5077 • 2 ♀♀; same locality as for preceding; 6 Feb. 2010; PFT; NIM, ICAR-NBAIR P5078, P5079 • 1 ♀; same locality as for preceding; 5 Jan. 2010; PFT; NIM, ICAR-NBAIR P5080 • 1 ♀; Bengaluru, Hebbal, NBAIR; 13°01'38" N, 77°35'03" E; 927 m; YPT on third floor (terrace) of building; NIM, ICAR-NBAIR P5081. – **Tamil Nadu** • 1 ♀; Yercaud, Horticulture Research Station (HRS); 11°47'44" N, 78°12'42" E; 1399 m; 6 Aug. 2014; YPT; NIM, ICAR-NBAIR P5082 • 1 ♀; same data as for preceding; 23 Jul. 2014; NIM, ICAR-NBAIR P5083.

Description

Female

MEASUREMENTS. Body length = 0.98–1.13 mm (n = 8).

COLOUR. Head, mesoscutellum and metascutellum brown, mesoscutum brown-yellow; T1 yellow, T2 yellow-brown, remaining tergites brown-black with yellow patches laterally; radicle, A1–A7 yellow-brown, remaining antennomeres black-brown; legs yellow-brown.

HEAD. Head: 1.2 × as wide as high, 1.2 × as high as long. IOS: 0.6 × head width, 1.3 × eye length. OOL: 0.7 × width of median ocellus. Compound eye: ovate (L:W = 13.6:0.5). Sculpture of frons: smooth. Central keel: 0.4 × head height. Sculpture of gena: smooth with long setae. Facial and malar striae: prominent. Sculpture of vertex: smooth. Interantennal process: short, truncate posteriorly.

MESOSOMA. L:W of mesoscutum: 17.6:22.5. Sculpture of mesoscutum: smooth. Mesoscutal humeral sulcus: with a furrow. Mesoscutal suprahumeral sulcus: not foveate. Scutoscutellar sulcus: weakly foveate laterally. L:W of mesoscutellum: 8.6:16.8. Sculpture of mesoscutellum: smooth. Posterior mesoscutellar sulcus: foveate. Metascutellum when viewed dorsally: visible. Sculpture of metascutellum: smooth. Sculpture of lateral propodeal area: smooth with foveae on posterior margin. Posterior margin of metascutellum: semicircular. Sculpture of lateral pronotal area: dorsally imbricate, ventrally smooth. Netrion: present, subovate. Netrion sulcus: costate. Pronotal suprahumeral sulcus: foveate posteriorly. Pronotal cervical sulcus: indicated as a furrow. Prespecular sulcus: foveate. Speculum of mesopleuron: not transversely carinate. Episternal sulcus: foveate. Postacetabular sulcus: foveate. Mesepimeral sulcus: foveate. Mesepimeral area: smooth. Mesopleural carina: present. Sculpture of femoral depression: smooth. Mesopleural pit: present. Sculpture of metapleuron: smooth. Metapleuron sulcus: with transverse foveae. Paracoxal sulcus: not foveate. Metapleuron epicoxal sulcus: indicated by a transverse carina and a furrow. Anteroventral extension of metapleuron: $2\times$ as long as wide. L:W of fore wing: 68.4:31.4. Infusate patch on fore wing: absent. Ratio of length of m:pm:stg: 4.2:25.7:10.0. Metasomal depression: smooth with foveae posteriorly.



Fig. 6. *Embidobia gauriputra* Veenakumari sp. nov., holotype, ♀ (NIM, ICAR-NBAIR P5076). A–B. Habitus dorsal view. C. Head and pleuron. D. Frons. E. Antenna.

METASOMA. L:W of metasoma: 34.9:30.1. Sculpture of T1: basal foveae present; entirely smooth with setose reticulate patch laterally. Sculpture of T2: basal foveae absent; entirely smooth with setose reticulate patch laterally. Sculpture of T3: smooth. Length of T1:T2:T3: 5.6:12.3:10.5.

Male

Unknown.

Embidobia hiranya Veenakumari sp. nov.

urn:lsid:zoobank.org:act:E21AA8C5-C936-4576-9429-4C41BDE72AD8

Fig. 7

Diagnosis

Embidobia hiranya sp. nov. is close to *E. yuyutsu* sp. nov. but differs from it in having a T3 longer than T2 and a posteriorly protruding metascutellum, which is anteriorly foveate and posteriorly longitudinally costate; while in *E. yuyutsu*. T2 and T3 are equal in length, and the metascutellum is posteriorly evenly rounded, anteriorly foveate and posteriorly with depressions.

Etymology

The Sanskrit epithet 'hiranya' refers to the golden colour of the habitus. The name is treated as an adjective.

Material examined

Holotype

INDIA – **Karnataka** • ♀; Shivamogga, Honnavalli, University of Agricultural and Horticultural Sciences (UAHS); 13°58'24" N, 75°34'36" E; 614 m; 10 Jan. 2017; YPT; NIM, ICAR-NBAIR P5061.

Paratype

INDIA – **Tamil Nadu** • 1 ♀; Dindigul, Kanapadi; 11°07'02" N, 78°42'55"E; 120 m; 13 May 2013; YPT; NIM, ICAR-NBAIR P5062.

Description

Female

MEASUREMENTS. Body length = 1.11–1.27 mm (n = 2).

COLOUR. Head, mesosoma and metasoma yellow-brown; radicle, A1–A7 yellow-brown, remaining antennomeres black-brown; legs yellow-brown.

HEAD. Head: 1.3 × as wide as high, 1.3 × as high as long. IOS: 0.6 × head width, 1.2 × eye length. OOL: 0.7 × width of median ocellus. Compound eye: ovate (L:W = 16.1:12.1). Sculpture of frons: lower frons medially smooth with longitudinal carinae on either side; several short transverse carinae present dorsal to central keel; upper frons with several short transverse carinae. Central keel: 0.3 × head height. Sculpture of gena: smooth with long setae. Facial and malar striae: prominent. Sculpture of vertex: with short transverse carinae. Interantennal process: elongate, truncate posteriorly.

MESOSOMA. L:W of mesoscutum: 16.7:26.2. Sculpture of mesoscutum: imbricate. Mesoscutal humeral sulcus: indicated as a furrow. Mesoscutal suprahumeral sulcus: not foveate. Scutoscutellar sulcus: foveate laterally. L:W of mesoscutellum: 9.8:21.0. Sculpture of mesoscutellum: medially smooth, laterally rugose. Posterior mesoscutellar sulcus: foveate. Metascutellum when viewed dorsally: visible. Sculpture of metascutellum: anteriorly foveate and remainder smooth with sparse short longitudinal carinae. Posterior margin of metascutellum: projecting posteromedially. Sculpture of lateral propodeal

area: entirely longitudinally costate with foveae in between. Sculpture of lateral pronotal area: dorsally imbricate, ventrally smooth. Netrion: poorly defined. Netrion sulcus: costate. Pronotal suprahumeral sulcus: foveate. Pronotal cervical sulcus: indicated as a weak furrow. Prespecular sulcus: with transverse foveae. Speculum of mesopleuron: transversely carinate. Episternal sulcus: with transverse foveae. Postacetabular sulcus: foveate. Mesepimeral sulcus: foveate. Mesepimeral area: smooth. Mesopleural carina: present. Sculpture of femoral depression: smooth. Mesopleural pit: present. Sculpture of metapleuron: smooth. Metapleural sulcus: with transverse foveae. Paracoxal sulcus: indicated as a furrow ventrally. Metapleural epicoxal sulcus: indicated with transverse carinae and furrows. Anteroventral extension of metapleuron: $2.5\times$ as long as wide; an additional short extension present dorsally. Metasomal depression: longitudinally costate.

METASOMA. L: W of metasoma: 44.3 : 31.3. Sculpture of T1: basal foveae present; longitudinally costate, costae shorter medially; posteriorly smooth and laterally with a setose reticulate patch. Sculpture of T2: basal foveae distinct; medially longitudinally striate, posteriorly smooth and laterally with a

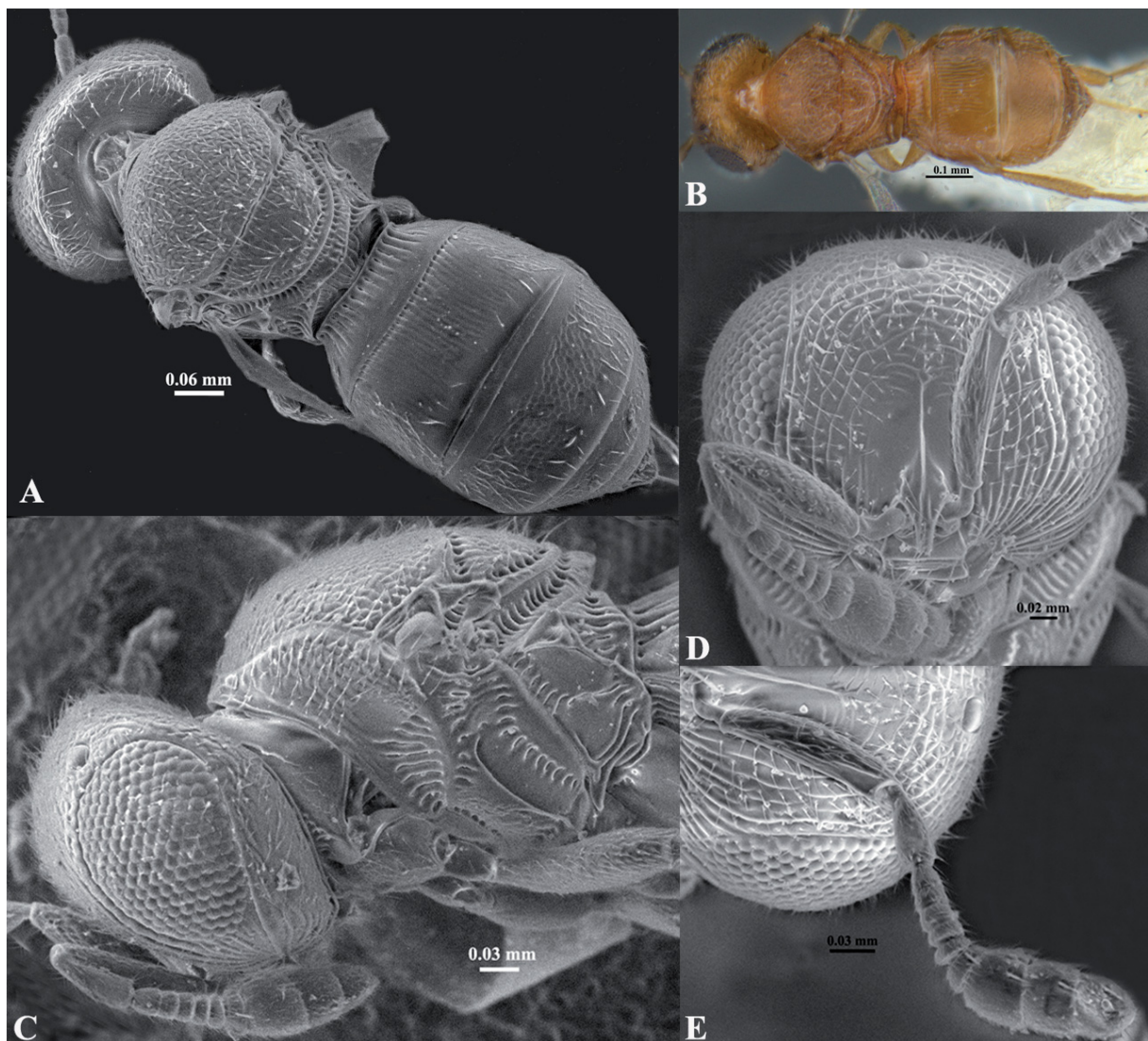


Fig. 7. *Embidobia hiranya* Veenakumari sp. nov., holotype, ♀ (NIM, ICAR-NBAIR P5061). **A–B.** Habitus dorsal view. **C.** Head and pleuron. **D.** Frons. **E.** Antenna.

setose reticulate patch. Sculpture of T3: dorsally with a wide smooth transverse band followed by an areolate transverse patch; laterally with a reticulate patch; posteriorly smooth. Length of T1:T2:T3: 6.9:13.1:16.1.

Male

Unknown.

Embidobia hrdaya Veenakumari sp. nov.

urn:lsid:zoobank.org:act:ED6833AA-B143-4C39-9C11-9DB585867CA0

Figs 2F, 8

Diagnosis

Embidobia hrdaya sp.nov. is close to *E. omkara* sp. nov. but differs from it in having a short metasoma and a mesoscutellum which extends beyond posterior margin of metascutellum; while in *E. omkara* metasoma is longer and the mesoscutellum extends just up to posterior margin of metascutellum.

Etymology

The Sanskrit epithet 'hrdaya' means 'heart' referring to the shape of the mesoscutellum. The name is treated as an adjective.

Material examined

Holotype

INDIA – **Karnataka** • ♀; Mandya; 12°33'51" N, 76°44'01" E; 749 m; 16 Jul. 2016; YPT; NIM, ICAR-NBAIR P5114.

Paratypes

INDIA – **Karnataka** • 3 ♀♀; same data as for holotype; NIM, ICAR-NBAIR P5115 to P5117 • 3 ♂♂; same data as for holotype; NIM, ICAR-NBAIR P5118 to P5120. – **Tamil Nadu** • 1 ♀; Theni, Periyakulam, HCRI; 10°07'41" N, 77°35'59" E; 297 m; 16 Aug. 2013; SN; NIM, ICAR-NBAIR P5121.

Description

MEASUREMENTS. Female body length = 1.10–1.29 mm (n = 5); male body length = 0.95–1.10 mm (n = 3).

Female

COLOUR. Head and mesosoma black-brown; T1 yellow-brown, remaining tergites brown with yellow patches laterally; radicle, A1–A7 yellow-brown, remaining antennomeres black-brown; legs yellow-brown.

HEAD. Head: 1.7 × as wide as high, 1.3 × as high as long. IOS: 0.6 × head width, 1.4 × eye length. OOL: 1.1 × width of median ocellus. Compound eye: ovate (L:W = 14.8:10.1). Sculpture of frons: lower frons medially smooth with short arched carinae discontinuous carinae on either side; upper frons with several short arched transverse carinae. Central keel: 0.3 × head height, bifurcating dorsally. Sculpture of gena: smooth with long setae. Facial and malar striae: prominent. Sculpture of vertex: rugose. Interantennal process: short, pointed posteriorly.

MESOSOMA. L:W of mesoscutum: 21.9:28.5. Sculpture of mesoscutum: rugose-imbricate. Mesoscutal humeral sulcus: indicated as a furrow. Mesoscutal suprahumeral sulcus: not foveate. Scutoscutellar sulcus: foveate laterally. L:W of mesoscutellum: 10.8:20.8. Sculpture of mesoscutellum: medially smooth, laterally rugose. Posterior mesoscutellar sulcus: foveate. Metascutellum when viewed dorsally: not visible. Sculpture of metascutellum: concealed beneath mesoscutellum. Posterior margin of

metascutellum: concealed beneath mesoscutellum. Sculpture of lateral propodeal area: smooth with foveae on posterior margin. Sculpture of lateral pronotal area: dorsally imbricate, ventrally smooth. Netrion: present, subovate, open dorsally. Netrion sulcus: costate, costae short. Pronotal suprahumeral sulcus: not foveate. Pronotal cervical sulcus: indicated as a furrow. Prespecular sulcus: foveate. Speculum of mesopleuron: transversely carinate. Episternal sulcus: not foveate. Postacetabular sulcus: not foveate. Mesepimeral sulcus: foveate. Mesepimeral area: smooth. Mesopleural carina: present. Sculpture of femoral depression: smooth. Mesopleural pit: present. Sculpture of metapleuron: smooth. Metapleurale sulcus: with transverse foveae. Paracoxal sulcus: indicated with a carina ventrally. Metapleurale epicoxal sulcus: indicated with transverse carinae and furrows. Anteroventral extension of metapleuron: $4\times$ as long as wide. L: W of fore wing: 80.6:28.3. Infusate patch on fore wing: present as a longitudinal patch medially. Ratio of length of m: pm: stg: 6.4:27.0:8.1. Metasomal depression: entirely smooth with weak longitudinal striae medially.

METASOMA. L: W of metasoma: 37.2:36.4. Sculpture of T1: basal foveae present; longitudinally striate except for smooth patch posteriorly and setose reticulate patch laterally. Sculpture of T2: basal foveae barely visible; anteriorly and posteriorly smooth, medially with weak transverse reticulate band and

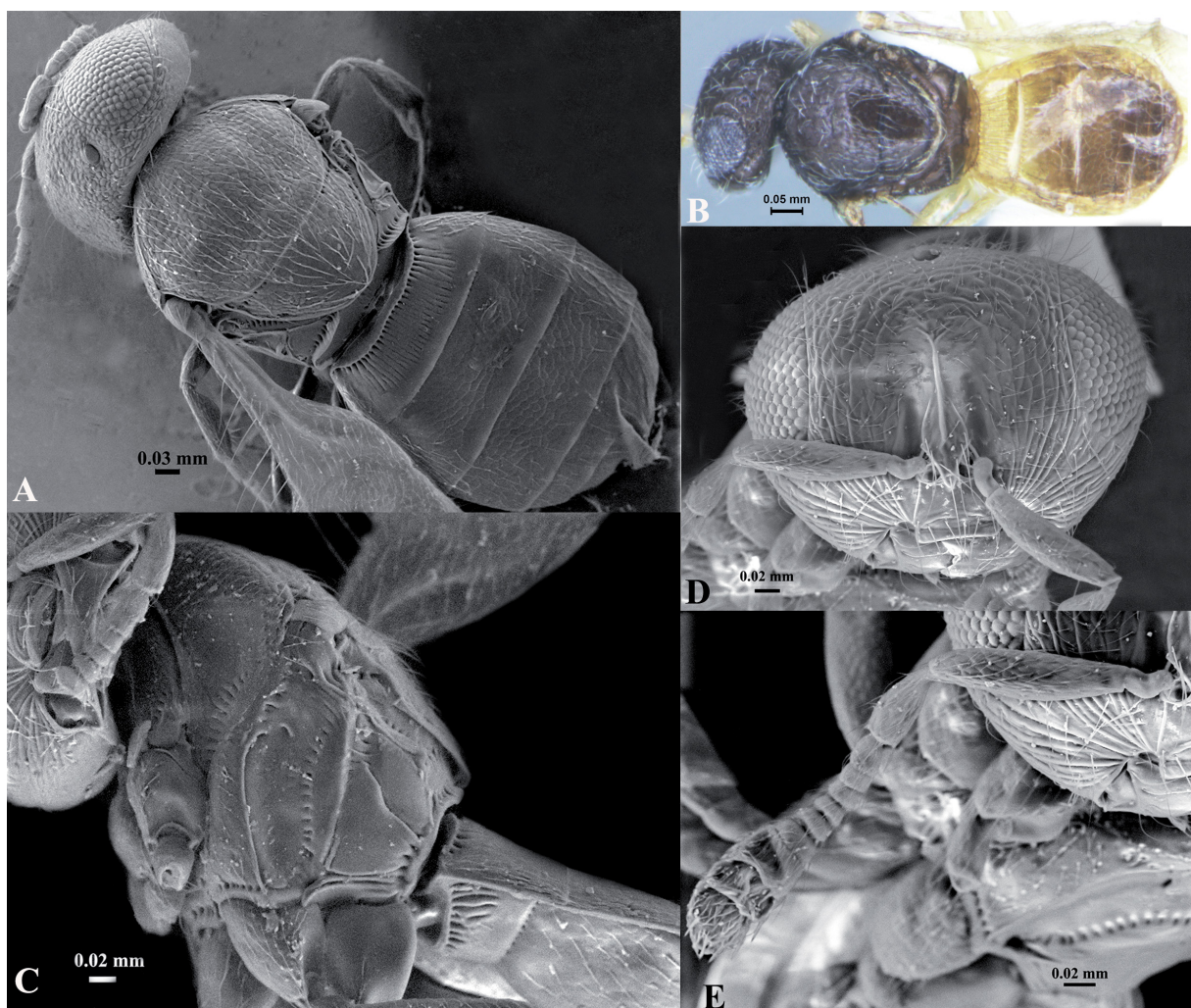


Fig. 8. *Embidobia hrdaya* Veenakumari sp. nov., holotype, ♀ (NIM, ICAR-NBAIR P5114). **A–B.** Habitus dorsal view. **C.** Head and pleuron. **D.** Frons. **E.** Antenna.

laterally with setose reticulate patch. Sculpture of T3: reticulate with smooth patch posteriorly. Length of T1:T2:T3: 8.1:10.2:10.2.

Male

Similar to female except for length of antennomeres.

Embidobia jatayu Veenakumari sp. nov.

urn:lsid:zoobank.org:act:49C3210D-28D1-4AA4-8084-2B971BC2FCE0

Figs 2G, 9

Diagnosis

Embidobia jatayu sp. nov. is close to *E. sankirna* sp. nov. but differs from it in having a metascutellum longitudinally costate and submarginalis of the fore wing not broken in front of marginalis. Whereas in *E. sankirna* metascutellum is anteriorly foveate and posteriorly with depressions; the submarginalis of fore wing is broken in front of marginalis.

Etymology

This species is named after Jatayu, the king of vultures in the Hindu epic Ramayana, who died attempting to rescue Sita (wife of the hero Rama) from Ravana, her abductor. The interantennal process resembles the beak of a bird of prey. The name is treated as a noun in apposition.

Material examined

Holotype

INDIA – **Karnataka** • ♀; Chikkaballapur, Nandi Hills; 13°37'02" N, 77°41'34" E; 1448 m; 18 Jun. 2014; YPT; NIM, ICAR-NBAIR P5028.

Paratypes

INDIA – **Karnataka** • 1 ♀; Bengaluru, Hebbal; 13°02'08" N, 77°35'49" E; 906 m; 20 Jan. 2015; YPT; NIM, ICAR-NBAIR P5029 • 1 ♀; Bengaluru, Jarakabande Kaval; 13°05'41" N, 77°32'35" E; 921 m; 12 Sep. 2014; YPT; NIM, ICAR-NBAIR P5030 • 1 ♀; Bengaluru, Hesaraghatta; 13°08'01" N 77°29'27" E; 859 m; 26 Mar. 2014; YPT; NIM, ICAR-NBAIR P5031 • 1 ♂; same locality as for preceding; 7 Jul. 2014; YPT; NIM, ICAR-NBAIR P5032 • 1 ♀; Bengaluru, Attur; 13°05'48" N, 77°33'59" E; 936 m; 1 Aug. 2015; YPT; NIM, ICAR-NBAIR P5033 • 1 ♀; Udupi, Brahmavara; 13°25'51" N, 74°44'43" E; 36 m; 28 May 2014; YPT; NIM, ICAR-NBAIR P5034. – **Tamil Nadu** • 1 ♀; Chidambaram, Annamalai University, Agriculture College; 11°23'30" N, 79°42'48" E; 21 m; 1 Jul. 2016; YPT; NIM, ICAR-NBAIR P5035 • 1 ♀; same locality as for preceding; 2 Jul. 2016; NIM, ICAR-NBAIR P5036 • 1 ♀; Theni, Periyakulam, Horticulture College and Research Institute (HCRI); 10°07'41" N, 77°35'59" E; 297 m; 19 Aug. 2013; SN; NIM, ICAR-NBAIR P5037.

Description

MEASUREMENTS. Female body length = 1.01–1.18 mm (n = 9); male body length = 1.7 mm (n = 1).

Female

COLOUR. Head and mesosoma black-brown; radicle, A1–A7 yellow-brown, remaining antennomeres black-brown; T1 yellow-brown, T2–T3 brown with yellow patches laterally, remaining tergites red-brown; legs yellow-brown.

HEAD. Head: 1.2× as wide as high, 1.3× as high as long. IOS: 0.6× head width, 1.2× eye length. OOL: 0.8× width of median ocellus. Compound eye: ovate (L:W = 15.5:11.3). Sculpture of frons: lower frons medially smooth with uneven longitudinal carinae on either side; several short transverse carinae

present dorsal to central keel; upper frons with several semicircular carinae. Central keel: $0.5 \times$ head height. Sculpture of gena: predominantly smooth with long setae. Facial and malar striae: prominent. Sculpture of vertex: imbricate. Interantennal process: elongate, with V-shaped carina in posterior half.

MESOSOMA. L:W of mesoscutum: 17.5:27.5. Sculpture of mesoscutum: weakly rugose, with a smooth patch posteromedially. Mesoscutal humeral sulcus: with a furrow. Mesoscutal suprahumeral sulcus: indicated as a furrow. Scutoscutellar sulcus: foveate laterally. L:W of mesoscutellum: 10.0:19.0. Sculpture of mesoscutellum: smooth. Posterior mesoscutellar sulcus: foveate. Metascutellum when viewed dorsally: visible. Sculpture of metascutellum: longitudinally costate and with foveae between costae. Posterior margin of metascutellum: evenly rounded. Sculpture of lateral propodeal area: anteriorly smooth, posteriorly costate with foveae in between. Sculpture of lateral pronotal area: dorsally imbricate, ventrally smooth. Netrion: present, smooth, linear. Netrion sulcus: costate. Pronotal suprahumeral sulcus: not foveate. Pronotal cervical sulcus: indicated as a furrow. Prespecular sulcus: with transverse foveae. Speculum of mesopleuron: transversely carinate. Episternal sulcus: with transverse foveae. Postacetabular sulcus: foveate. Mesepimeral sulcus: with transverse foveae. Mesepimeral area: smooth. Mesopleural carina: present. Sculpture of femoral depression: smooth.

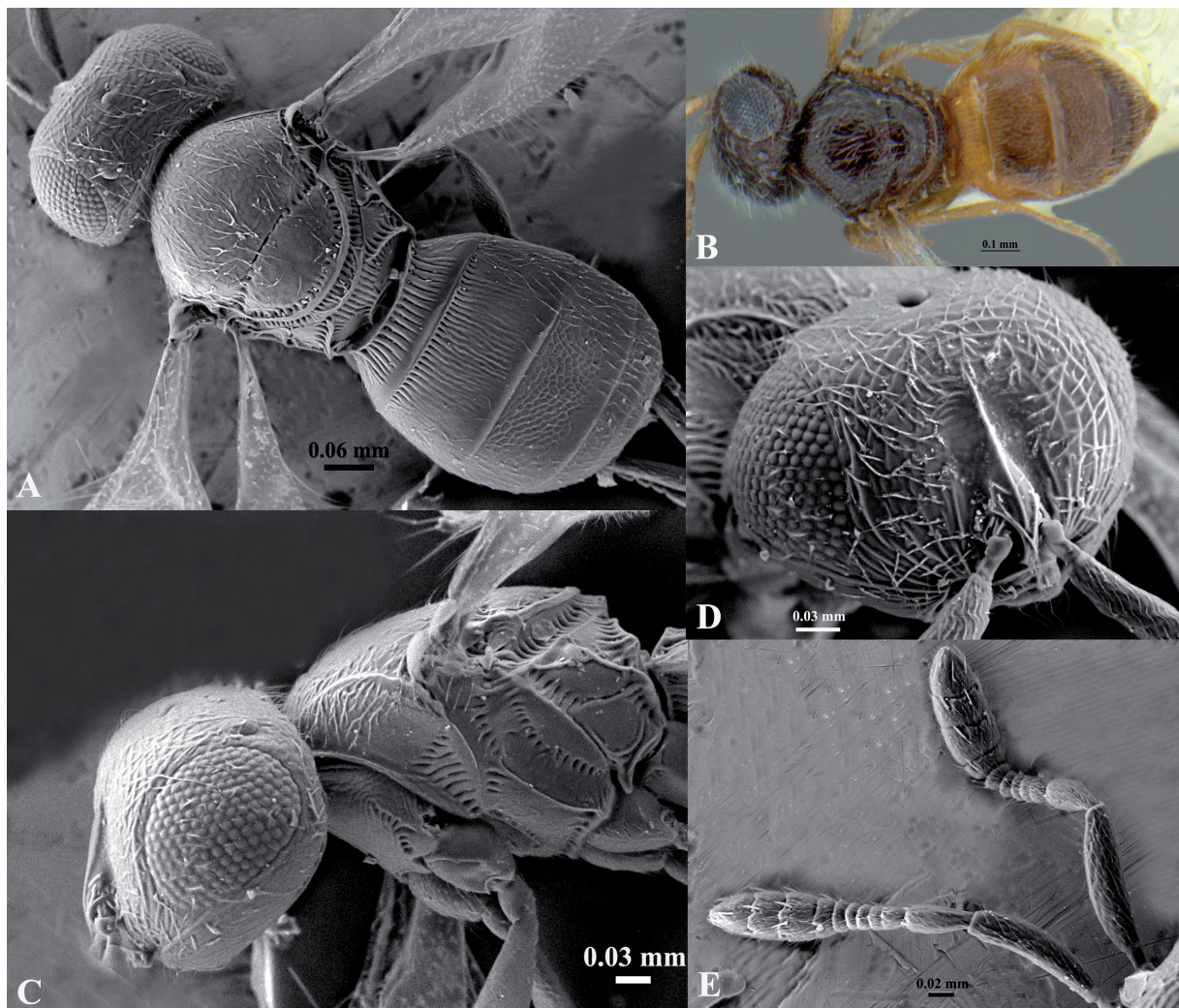


Fig. 9. *Embidobia jatayu* Veenakumari sp. nov., holotype, ♀ (NIM, ICAR-NBAIR P5028). A–B. Habitus dorsal view. C. Head and pleuron. D. Frons. E. Antenna.

Mesopleural pit: present. Sculpture of metapleuron: smooth. Metapleural sulcus: with transverse foveae. Paracoxal sulcus: indicated by a furrow. Metapleural epicoxal sulcus: indicated as transverse carinae and a furrow. Anteroventral extension of metapleuron: $2\times$ as long as wide. L:W of fore wing: 71.9:27.3. Infusate patch on fore wing: present as a longitudinal patch medially. Ratio of length of m:pm:stg: 4.9:21.1:8.8. Metasomal depression: longitudinally costate except for smooth areas laterally.

METASOMA. L:W of metasoma: 35.0:31.5. Sculpture of T1: basal foveae present; longitudinally costate except for a narrow smooth area posteriorly and a setose reticulate patch laterally. Sculpture of T2: basal foveae present; entirely longitudinally striate except for smooth area posteriorly and setose reticulate patch laterally. Sculpture of T3: medially areolate, laterally and posteriorly smooth with setae. Length of T1:T2:T3: 6.0:12.5:11.0.

Male

Similar to female except for length of antennomeres.

Embidobia mahabali Veenakumari sp. nov.

urn:lsid:zoobank.org:act:53D34C40-2296-48E2-8FBB-809225F6B902

Figs 2H, 10

Diagnosis

Embidobia mahabali sp. nov. is close to *E. procera* sp. nov. and *E. barbarika* sp. nov. but differs from them in mesoscutum having well defined rugae and upper frons with several short raised carinae arranged in semicircular fashion; whereas in the latter two species mesoscutum is with imbricate sculpture and upper frons is either with short or long oblique carinae.

Etymology

This species is named after Mahabali, an exemplary king in Hindu mythology, whose increasing popularity and power disconcerted the gods prompting the god Vishnu to deceitfully banish him from this world, nevertheless permitting him to visit his people once every year. The name is treated as a noun in apposition.

Material examined

Holotype

INDIA – **Karnataka** • ♀; Bengaluru, Hesaraghatta; 13°08'01" N, 77°29'27" E; 859 m; 7 Jul. 2014; YPT; NIM, ICAR-NBAIR P5038.

Paratypes

INDIA – **Karnataka** • 1 ♀; same data as for holotype; NIM, ICAR-NBAIR P5039 • 1 ♀; same locality as for holotype; 28 Mar. 2014; YPT; NIM, ICAR-NBAIR P5040 • 1 ♀; Bengaluru, Hebbal, Veterinary College; 13°02'08" N, 77°35'49" E; 906 m; 21 Apr. 2015; YPT; NIM, ICAR-NBAIR P5041.

Description

Female

MEASUREMENTS. Body length = 0.96–1.08 mm (n = 4).

COLOUR. Head and mesosoma red-brown; metasoma red-brown with black patches sublaterally; radicle, A1–A7 yellow-brown, remaining antennomeres black-brown; legs yellow-brown.

HEAD. Head: $1.4\times$ as wide as high, $1.3\times$ as high as long. IOS: $0.5\times$ head width, $1.1\times$ eye length. OOL: $0.6\times$ width of median ocellus. Compound eye: ovate (L:W = 13.7:9.1). Sculpture of frons: lower

frons medially smooth, with uneven longitudinal carinae on either side; several short transverse carinae present on either side of central keel dorsally; upper frons with several short arched carinae arranged in a semicircular fashion. Central keel: $0.4 \times$ head height. Sculpture of gena: predominantly smooth with long setae. Facial and malar striae: prominent. Sculpture of vertex: unevenly rugose. Interantennal process: elongate, truncate posteriorly.

MESOSOMA. L:W of mesoscutum: 13.6:21.9. Sculpture of mesoscutum: rugose. Mesoscutal humeral sulcus: indicated as a furrow. Mesoscutal suprahumeral sulcus: weakly foveate. Scutoscutellar sulcus: foveate laterally. L:W of mesoscutellum: 8.5:17.9. Sculpture of mesoscutellum: rugose. Posterior mesoscutellar sulcus: foveate. Sculpture of metascutellum: smooth with foveae on anterior margin and a furrow on posterior margin. Posterior margin of metascutellum: almost straight. Sculpture of lateral propodeal area: anteriorly smooth, posteriorly costate with foveae in between. Sculpture of lateral pronotal area: dorsally imbricate, ventrally smooth and sparse oblique carinae anteromedially. Netrion: present, smooth, linear. Netrion sulcus: costate. Pronotal suprahumeral sulcus: weakly foveate. Pronotal cervical sulcus: indicated as a furrow. Prespecular sulcus: with transverse foveae. Speculum of mesopleuron: with several transverse carinae. Episternal sulcus: with transverse foveae. Postacetabular sulcus: foveate. Mesepimeral sulcus: with transverse foveae. Mesepimeral area: smooth. Mesopleural carina: present.

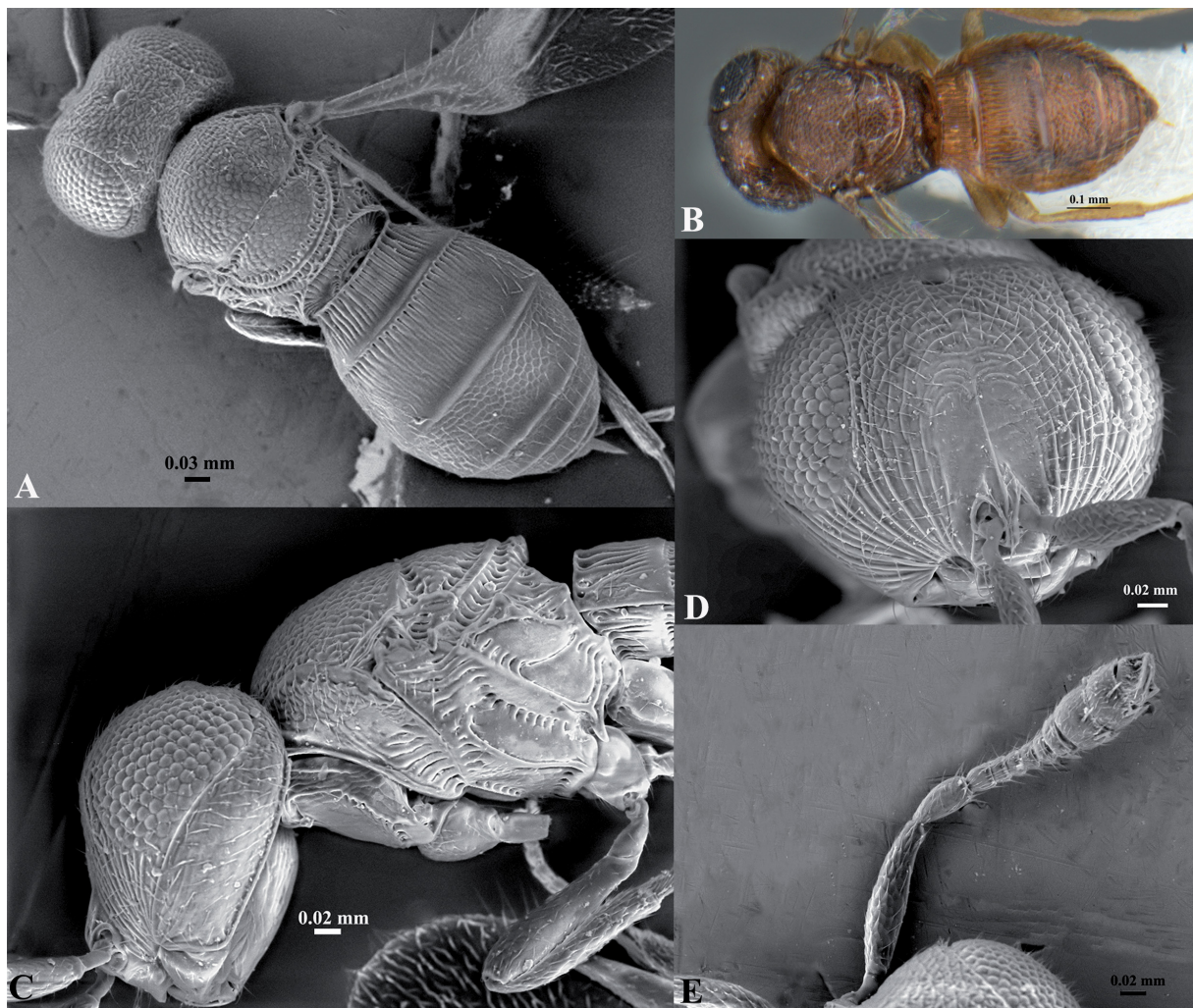


Fig. 10. *Embidobia mahabali* Veenakumari sp. nov., holotype, ♀ (NIM, ICAR-NBAIR P5038). A–B. Habitus dorsal view. C. Head and pleuron. D. Frons. E. Antenna.

Sculpture of femoral depression: smooth. Mesopleural pit: present. Sculpture of metapleuron: smooth. Metapleural sulcus: with transverse foveae. Paracoxal sulcus: indicated as a furrow. Metapleural epicoxal sulcus: indicated as carinae and furrows. Anteroventral extension of metapleuron: $3 \times$ as long as wide; an additional short extension present dorsally. L:W of fore wing: 71.6:27.2. Infusate patch on fore wing: present as a longitudinal patch medially. Ratio of length of m : pm : stg: 4.0 : 22.8 : 8.0. Metasomal depression: longitudinally costate except for smooth areas laterally.

METASOMA. L:W of metasoma: 35.3 : 26.6. Sculpture of T1: basal foveae present; longitudinally costate with narrow smooth area posteriorly and setose reticulate patch laterally. Sculpture of T2: basal foveae present; longitudinally striate, with smooth area posteriorly and setose reticulate patch laterally. Sculpture of T3: areolate and smooth towards posterior margin. Length of T1 : T2 : T3: 6.8 : 12.3 : 8.8.

Male

Unknown.

Embidobia omkara Veenakumari sp. nov.

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Figs 11, 12A

Diagnosis

Embidobia omkara sp. nov. is close to *E. hrdaya* sp. nov. but differs from it in having a longer metasoma and mesoscutellum just extending up to the posterior margin of metascutellum; while in the latter species metasoma is distinctly short and mesoscutellum extends beyond the posterior margin of metascutellum.

Etymology

This species is named after Omkara, the Hindu god of the sacred, invocatory sound 'om', a sonic representation of the divine. The name is treated as a noun in apposition.

Material examined

Holotype

INDIA – **Karnataka** • ♀; Mandya; 12°33'51" N, 76°44'01" E; 749 m; 7 Jan. 2017; YPT; NIM, ICAR-NBAIR P5084.

Paratypes

INDIA – **Karnataka** • 4 ♀♀; same data as for holotype; NIM, ICAR-NBAIR P5085 to P5088 • 10 ♀♀; same data as for preceding; 16 Jul. 2016; NIM, ICAR-NBAIR P5089 to P5098 • 4 ♂♂; same data as for preceding; NIM, ICAR-NBAIR P5099 to P5102.

Description

MEASUREMENTS. Female body length = 1.15–1.27 mm (n = 8); male body length = 0.92–1.13 mm (n = 4).

Female

COLOUR. Head and mesosoma brown-black; T1 brown-yellow; remaining tergites brown with sparse black patches sublaterally and laterally; radicle, A1–A7 yellow-brown, remaining antennomeres black-brown; legs yellow-brown.

HEAD. Head: $1.4 \times$ as wide as high, $1.3 \times$ as high as long. IOS: $0.6 \times$ head width, $1.3 \times$ eye length. OOL: $1.2 \times$ width of median ocellus. Compound eye: ovate (L:W = 15.2:10.5). Sculpture of frons: lower frons medially smooth with several short uneven longitudinal carinae on either side; several short transverse carinae present dorsal to central keel; upper frons with imbricate sculpture. Central keel: $0.4 \times$ head

height. Sculpture of gena: smooth with long setae. Facial and malar striae: prominent. Sculpture of vertex: rugose. Interantennal process: short, pointed posteriorly.

MESOSOMA. L: W of mesoscutum: 18.2: 27.6. Sculpture of mesoscutum: rugose, smooth posteromedially. Mesoscutal humeral sulcus: indicated with a furrow. Mesoscutal suprahumeral sulcus: not foveate. Scutoscutellar sulcus: foveate laterally. L: W of mesoscutellum: 11.4: 21.8. Sculpture of mesoscutellum: rugose, smooth medially and posteriorly. Posterior mesoscutellar sulcus: foveate. Metascutellum when viewed dorsally: only posterior margin visible. Sculpture of metascutellum: concealed beneath mesoscutellum. Posterior margin of metascutellum: semicircular. Sculpture of lateral propodeal area: smooth with foveae on posterior margin. Sculpture of lateral pronotal area: dorsally imbricate, ventrally smooth. Netrion: present, subovate, open dorsally. Netrion sulcus: costate. Pronotal suprahumeral sulcus: not foveate. Pronotal cervical sulcus: indicated as a furrow. Prespecular sulcus: foveate. Speculum of mesopleuron: transversely carinate. Episternal sulcus: foveate. Postacetabular sulcus: indicated as a furrow. Mesepimeral sulcus: foveate. Mesepimeral area: smooth. Mesopleural carina: present. Sculpture of femoral depression: smooth. Mesopleural pit: present. Sculpture of metapleuron: smooth. Metapleuralsulcus: with transverse foveae. Paracoxal sulcus: not distinct. Metapleuralepicoxal sulcus: indicated by

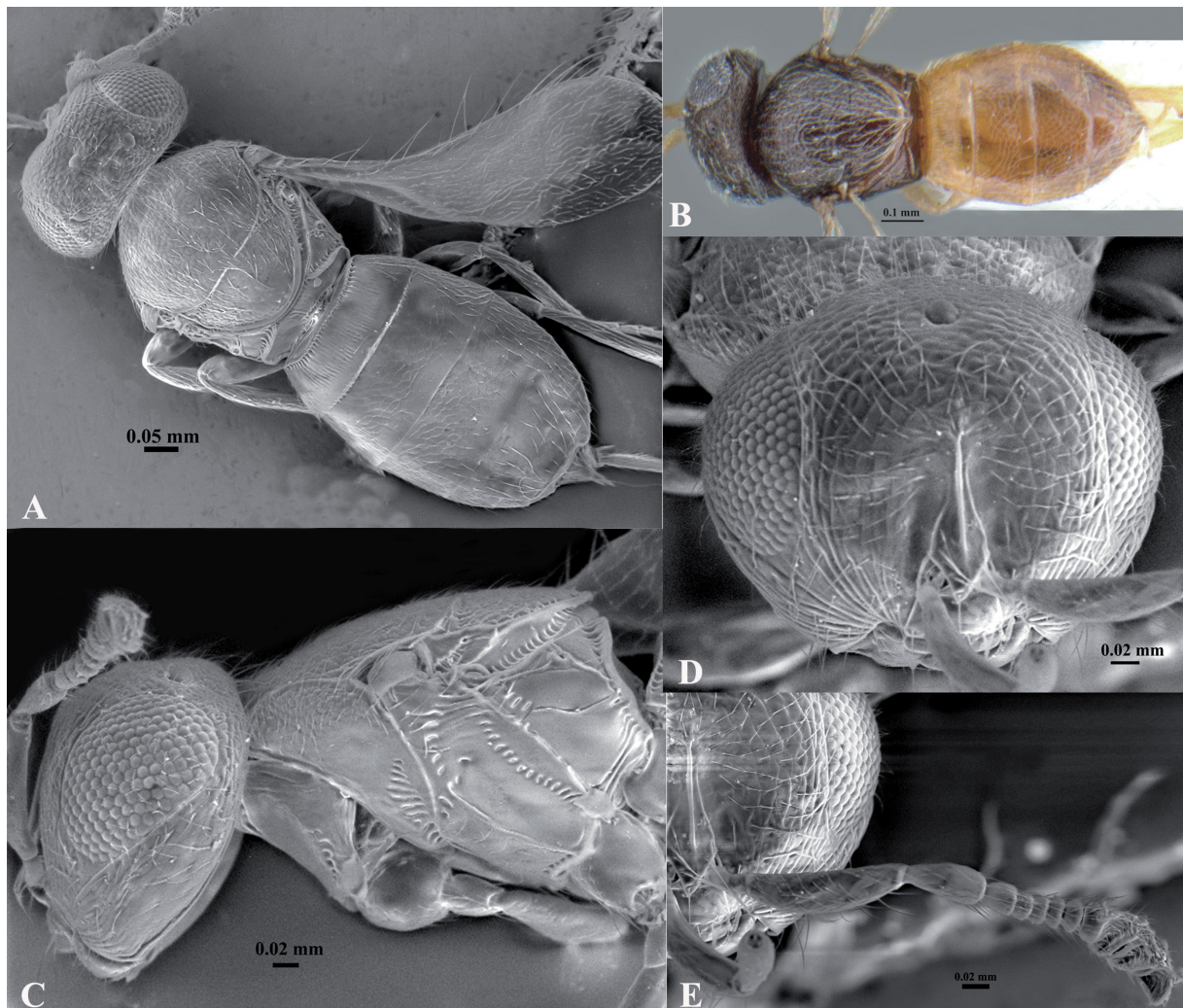


Fig. 11. *Embidobia omkara* Veenakumari sp. nov., holotype, ♀ (NIM, ICAR-NBAIR P5084). A–B. Habitus dorsal view. C. Head and pleuron. D. Frons. E. Antenna.

transverse carinae and furrows. L:W of fore wing: 74.0:25.4. Infusate patch on fore wing: present as a longitudinal patch medially. Ratio of length of m:pm:stg: 4.8:26.2:7.5. Metasomal depression: predominantly smooth with weak longitudinal carinae medially.

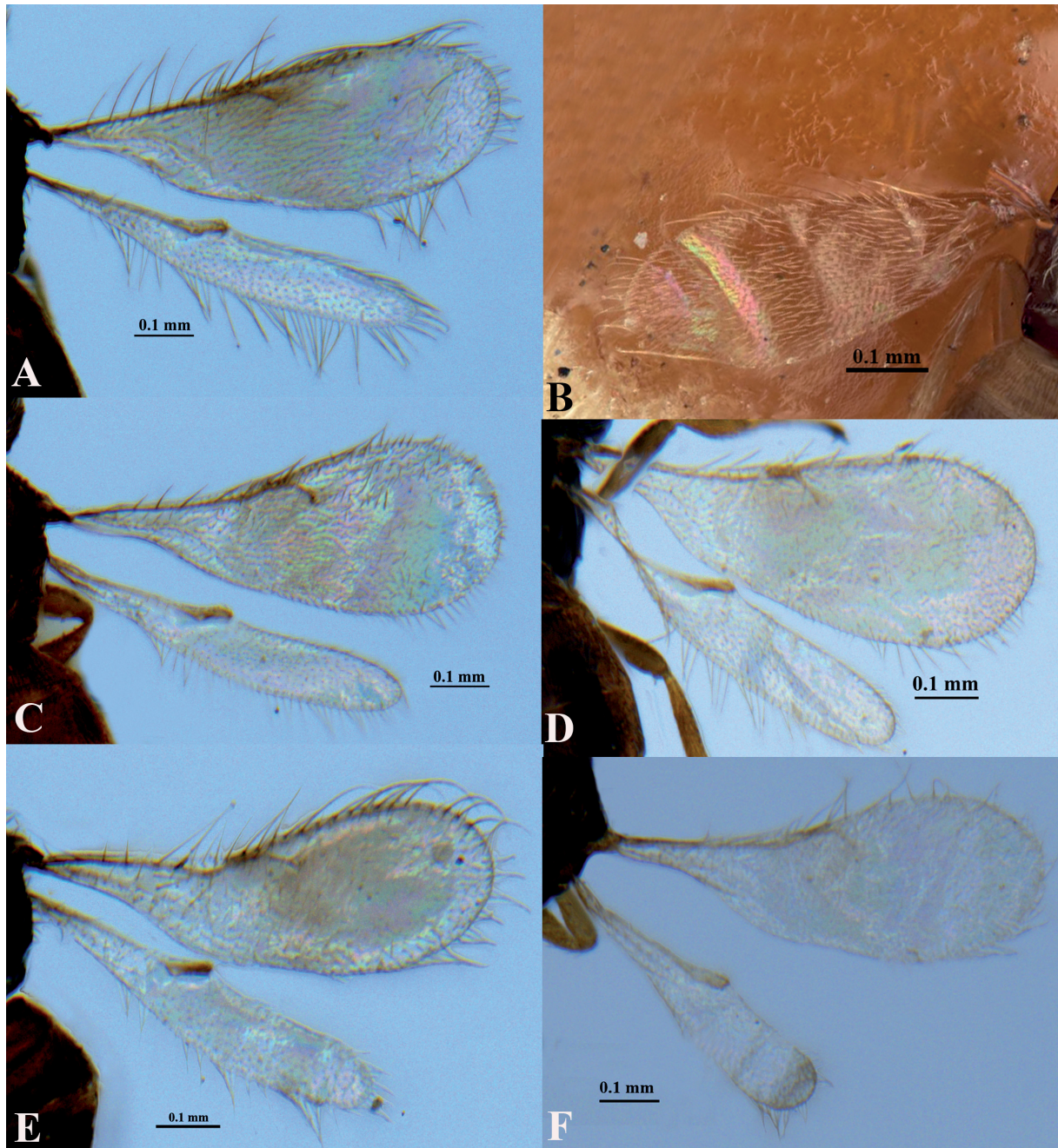


Fig. 12. Wings. **A.** *Embidobia omkara* Veenakumari sp. nov., holotype, ♀ (NIM, ICAR-NBAIR P5084). **B.** *E. orientalis* Dodd, 1939, holotype, ♀ (QMBA T99253). **C.** *E. procera* Veenakumari sp. nov., holotype, ♀ (NIM, ICAR-NBAIR P5055). **D.** *E. sankirna* Veenakumari sp. nov., holotype, ♀ (NIM, ICAR-NBAIR P5122). **E.** *E. saroma* Veenakumari sp. nov., holotype, ♀ (NIM, ICAR-NBAIR P5110). **F.** *E. yuyutsu* Veenakumari sp. nov., holotype, ♀ (NIM, ICAR-NBAIR P5112).

METASOMA. L:W of metasoma: 48.3:32.1. Sculpture of T1: basal foveae present; longitudinally striate except for smooth patch posteriorly and a setose reticulate patch laterally. Sculpture of T2: weakly reticulate with posterior margin smooth and setose reticulate patch laterally. Sculpture of T3: reticulate and smooth posteriorly. Length of T1:T2:T3: 9.1:11.5:11.6.

Male

Similar to female except for the length of antennomeres.

Embidobia orientalis Dodd, 1939

Figs 12B, 13

Diagnosis

Embidobia orientalis is close to *E. omkara* sp. nov. and *E. hrdaya* sp. nov. but differs from them in having a strongly coriaceous reticulate sculpture on T2 and T3; T2 is longer than T3. While in the latter two species T2 and T3 are with weak reticulate sculpture and both these tergites are subequal in length.

Material examined

Holotype (images only)

SRI LANKA [labelled: Ceylon] • ♀; Colombo; 7 Jan. 1939; C. Davis leg.; in nest of *Oligotoma* sp.; [in the nest of *Oligotoma greeniana* Enderlin in bark (Dodd 1939)]; QMBA T99253.

Description

Female

MEASUREMENTS. Body length = 0.85 mm.

COLOUR. Head and mesosoma brown-black; T1 brown, remaining tergites darker than T1; antennomeres yellow-brown, clava brown-black; legs yellow-brown. Entire body covered with dense stout white setae.

HEAD. OOL $1.4 \times$ median ocellus diameter. Central keel: not extending beyond half the length of distance to anterior ocellus. Sculpture of gena: smooth with long setae. Facial and malar striae: prominent. Sculpture of vertex: rugose.

MESOSOMA. Sculpture of mesoscutum: rugose. Mesoscutal humeral sulcus: foveate. Scutoscutellar sulcus: foveate laterally. Sculpture of mesoscutellum: entirely rugose. Posterior mesoscutellar sulcus: foveate. Metascutellum when viewed dorsally: not visible, concealed beneath mesoscutellum. Sculpture of metascutellum: concealed beneath mesoscutellum. Posterior margin of metascutellum: not visible. Sculpture of lateral propodeal area: smooth with foveae on posterior margin. Sculpture of lateral pronotal area: smooth. Netrion: present, subovate, open dorsally. Netrion sulcus: costate. Pronotal suprahumeral sulcus: not foveate. Prespecular sulcus: with transverse foveae. Speculum of mesopleuron: transversely carinate. Episternal sulcus: foveate. Postacetabular sulcus: foveate. Mesepimeral sulcus: with transverse foveae. Mesepimeral area: smooth. Mesopleural carina: present. Sculpture of femoral depression: smooth. Mesopleural pit: present. Sculpture of metapleuron: smooth. Metapleurul sulcus: with transverse foveae. Paracoxal sulcus: indicated as a furrow. Marginalis $\frac{2}{3}$ the length of stigmalis. Metasomal depression: predominantly smooth with weak longitudinal carinae medially.

METASOMA. L:W of metasoma: $1.4 \times$ as long as wide. Sculpture of T1: basal foveae present; almost entirely longitudinally striate and with a setose reticulate patch laterally. Sculpture of T2: coriaceous reticulate with a narrow smooth band posteriorly. Sculpture of T3: coriaceous reticulate with a narrow smooth band posteriorly. Length of T1:T2:T3: 6.8:11.0:9.2.

Male
Unknown.



Fig. 13. *Embidobia orientalis* Dodd. 1939, holotype, ♀ (QMBA, T99253). A. Habitus dorsal view. B. Habitus lateral view. C. Metasoma. D. Vertex and pleuron. E. Type label. Photos: ©Queensland Museum, Geoff Thompson.

Embidobia procera Veenakumari sp. nov.

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Figs 12C, 14

Diagnosis

Embidobia procera sp. nov. is close to *E. barbarika* sp. nov. but differs from it in having an elongate and narrow interantennal process and the carinae on upper frons are short and oblique; whereas in *E. barbarika* interantennal process is short and wide and the carinae on upper frons are continuous and elongate.

Etymology

Derived from Latin, the species epithet refers to its long interantennal process. The name is treated as an adjective.

Material examined

Holotype

INDIA – **Karnataka** • ♀; Shivamogga, Honnavalli, University of Agricultural and Horticultural Sciences (UAHS); 13°58'24" N, 75°34'36" E; 614 m; 10 Jan. 2017; YPT; NIM, ICAR-NBAIR P5055.

Paratypes

INDIA – **Andaman and Nicobar Islands** • 1 ♀; South Andaman, Bloomsdale; 11°38'25" N, 92°39'40" E; 26 Mar. 2016; YPT; NIM, ICAR-NBAIR P5060. – **Karnataka** • 1 ♀; Bengaluru, Hesaraghatta; 13°08'01" N, 77°29'27" E; 859 m; 29 May 2010; YPT; NIM, ICAR-NBAIR P5056 • 1 ♀; Udupi, Brahmavara; 13°25'51" N, 74°44'43" E; 36 m; 28 May 2014; YPT; NIM, ICAR-NBAIR P5057. – **Madhya Pradesh** • 1 ♀; Bhopal; Central Institute of Agricultural Engineering (CIAE); 23°18'48" N, 77°24'27" N; 499 m; 15 Jun. 2011; YPT; NIM, ICAR-NBAIR P5059. – **Tamil Nadu** • 1 ♀; Krishnagiri, Kelamangalam, Jakkeri; 12°42'17" N, 77°48'37" E; 899 m; 2 Feb. 2015; YPT; NIM, ICAR-NBAIR P5058.

Description

Female

MEASUREMENTS. Body length = 0.89–1.07 mm (n = 6).

COLOUR. Head and mesosoma red-brown and metasoma paler than mesosoma; radicle, A1–A7 yellow-brown, remaining antennomeres black-brown; legs yellow-brown.

HEAD. Head: 1.4 × as wide as high, 1.4 × as high as long. IOS: 0.5 × head width, 1.1 × eye length. OOL: 0.8 × width of median ocellus. Compound eye: ovate (L:W = 13.3:10.1). Sculpture of frons: lower frons medially smooth with several short uneven longitudinal carinae on either side; several short transverse carinae present dorsal to central keel; upper frons with short uneven transverse and oblique carinae. Central keel: 0.4 × head height. Sculpture of gena: predominantly smooth with long setae. Facial and malar striae: prominent. Sculpture of vertex: imbricate. Interantennal process: elongate, very narrow, truncate posteriorly.

MESOSOMA. L:W of mesoscutum: 13.8:23.4. Sculpture of mesoscutum: imbricate. Mesoscutal humeral sulcus: with a furrow. Mesoscutal suprahumeral sulcus: indicated with a furrow. Scutoscutellar sulcus: foveate laterally. L:W of mesoscutellum: 8.7:17.4. Sculpture of mesoscutellum: weakly rugose. Posterior mesoscutellar sulcus: foveate. Metascutellum when viewed dorsally: visible. Sculpture of metascutellum: smooth with foveae on anterior margin. Posterior margin of metascutellum: semicircular. Sculpture of lateral propodeal area: anteriorly smooth, posteriorly costate with foveae in between.

Sculpture of lateral pronotal area: dorsally imbricate, ventrally smooth. Netrion: present smooth, linear. Netrion sulcus: costate. Pronotal suprahumeral sulcus: not foveate. Pronotal cervical sulcus: indicated as a furrow. Prespecular sulcus: foveate. Speculum of mesopleuron: transversely carinate. Episternal sulcus: with transverse foveae. Postacetabular sulcus: foveate. Mesepimeral sulcus: with transverse foveae. Mesepimeral area: smooth, narrow. Mesopleural carina: present. Sculpture of femoral depression: smooth. Mesopleural pit: present. Sculpture of metapleuron: smooth. Metapleurual sulcus: with transverse foveae. Paracoxal sulcus: indicated by a furrow. Metapleurual epicoxal sulcus: indicated by transverse carinae and furrows. Anteroventral extension of metapleuron: 2× as long as wide. L:W of fore wing: 72.0:29.1. Infusate patch on fore wing: present as a longitudinal patch medially. Ratio of length of m:pm:stg: 4.5:17.5:7.3. Metasomal depression: longitudinally costate except for smooth areas laterally.

METASOMA. L:W of metasoma: 31.8:29.8. Sculpture of T1: basal foveae present; longitudinally costate, costae shorter medially and longer laterally; posteriorly smooth and laterally with setose reticulate patch. Sculpture of T2: basal foveae present; medially longitudinally striate, posteriorly smooth and laterally

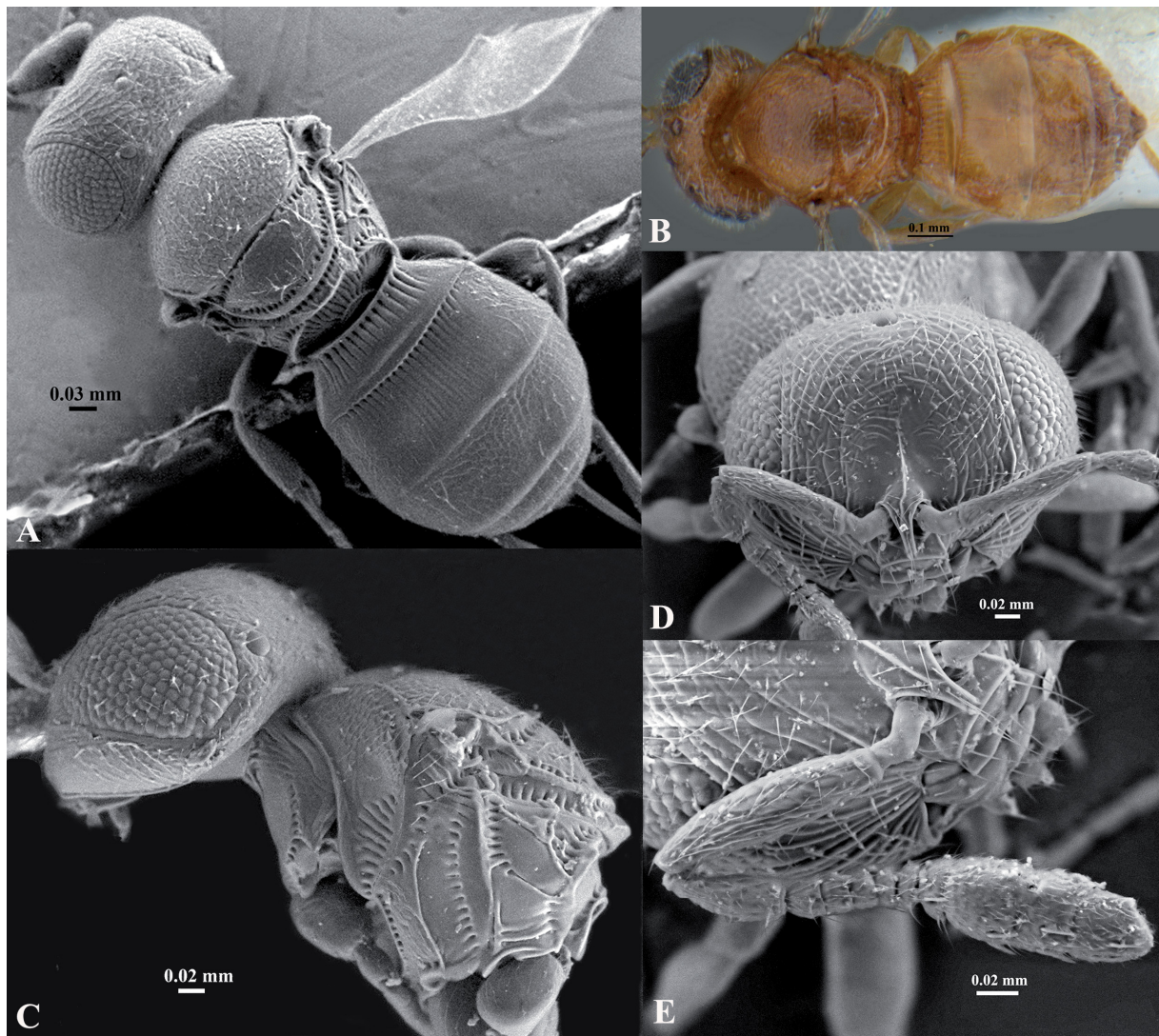


Fig. 14. *Embidobia procera* Veenakumari sp. nov., holotype, ♀ (NIM, ICAR-NBAIR P5055). A–B. Habitus dorsal view. C. Head and pleuron. D. Frons. E. Antenna.

with a setose reticulate patch. Sculpture of T3: medially areolate laterally and posteriorly smooth with setae. Length of T1 : T2 : T3: 6.8 : 11.5 : 9.5.

Male

Unknown.

Embidobia sankirna Veenakumari sp. nov.

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Figs 12D, 15

Diagnosis

Embidobia sankirna sp. nov. is close to *E. jatayu* sp. nov. but differs from it in having a spindle shaped metasoma; metascutellum is anteriorly foveate and posteriorly with depressions; submarginalis of fore wing is broken in front of marginalis. Whereas in *E. jatayu* metasoma is ovate; metascutellum is longitudinally costate and submarginalis of fore wing is not broken in front of marginalis.

Etymology

The Sanskrit epithet 'sankirna' means 'narrow' referring to the narrow metasoma. The name is treated as an adjective.

Material examined

Holotype

INDIA – **Rajasthan** • ♀; Ajmer, Tabeji, National Research Centre for Seed Spices (NRCSS); 26°21'56" N, 74°35'36" E; 445 m; 22 Sep. 2016; YPT; NIM, ICAR-NBAIR P5122.

Paratypes

INDIA – **Uttarakand** • 2 ♀♀; Roorkee, Lal Tappal; 29°51'15" N, 77°53'16" E; 271 m; 2 Oct. 2009; SN; NIM, ICAR-NBAIR P5123, P5124.

Description

Female

MEASUREMENTS. Body length = 0.97–1.21 mm (n = 3).

COLOUR. Head and mesosoma black-brown; metasoma yellow-brown; radicle, A1–A7 yellow-brown, remaining antennomeres black-brown; legs yellow-brown.

HEAD. Head: 1.2 × as wide as high, 1.4 × as high as long. IOS: 0.6 × head width, subequal to eye length. OOL: 0.8 × width of median ocellus. Compound eye: ovate (L : W = 14.2 : 12.1). Sculpture of frons: lower frons medially smooth with discontinuous longitudinal carinae on either side; upper frons with several short arched carinae. Central keel: 0.4 × head height. Sculpture of gena: smooth with long setae. Facial and malar striae: prominent. Sculpture of vertex: with short transverse carinae. Interantennal process: elongate and truncate posteriorly.

MESOSOMA. L : W of mesoscutum: 15.7 : 22.3. Sculpture of mesoscutum: imbricate. Mesoscutal humeral sulcus: indicated as a furrow. Mesoscutal suprahumeral sulcus: foveate. Scutoscutellar sulcus: foveate laterally. L : W of mesoscutellum: 8.0 : 16.0. Sculpture of mesoscutellum: smooth. Posterior mesoscutellar sulcus: foveate. Metascutellum when viewed dorsally: visible. Sculpture of metascutellum: anteriorly foveate and posteriorly with depressions. Posterior margin of metascutellum: evenly rounded posteromedially. Sculpture of lateral propodeal area: entirely with longitudinal costate except for a smooth area anteriorly. Sculpture of lateral pronotal area: dorsally imbricate, ventrally smooth, anterodorsally with oblique carinae. Netrion: present, smooth, linear. Netrion sulcus: costate. Pronotal suprahumeral

sulcus: weakly foveate posteriorly. Pronotal cervical sulcus: indicated as a furrow. Prespecular sulcus: with transverse foveae. Speculum of mesopleuron: transversely carinate. Episternal sulcus: foveate. Postacetabular sulcus: foveate. Mesepimeral sulcus: with transverse foveae. Mesepimeral area: smooth. Mesopleural carina: present. Sculpture of femoral depression: smooth. Mesopleural pit: present. Sculpture of metapleuron: smooth. Metapleural sulcus: with transverse foveae. Paracoxal sulcus: indicated with a furrow. Metapleural epicoxal sulcus: indicated with transverse carinae and furrows. Anteroventral extension of metapleuron: $1.5 \times$ as long as wide; an additional short extension present dorsally. L:W of fore wing: 72.1:29.0. Infusate patch on fore wing: present as a longitudinal patch medially. Ratio of length of m:pm:stg: 4.9:18.9:7.8. Metasomal depression: longitudinally costate.

METASOMA. L:W of metasoma: 40.0:27.6. Sculpture of T1: basal foveae present; entirely costate except for a smooth band posteriorly and a setose reticulate patch laterally. Sculpture of T2: basal foveae present, entirely longitudinally striate except for a setose reticulate patch laterally. Sculpture of T3: areolate, with reticulate patches laterally and a smooth band posteriorly. Length of T1:T2:T3: 6.1:13.3:10.4.

Male

Unknown.

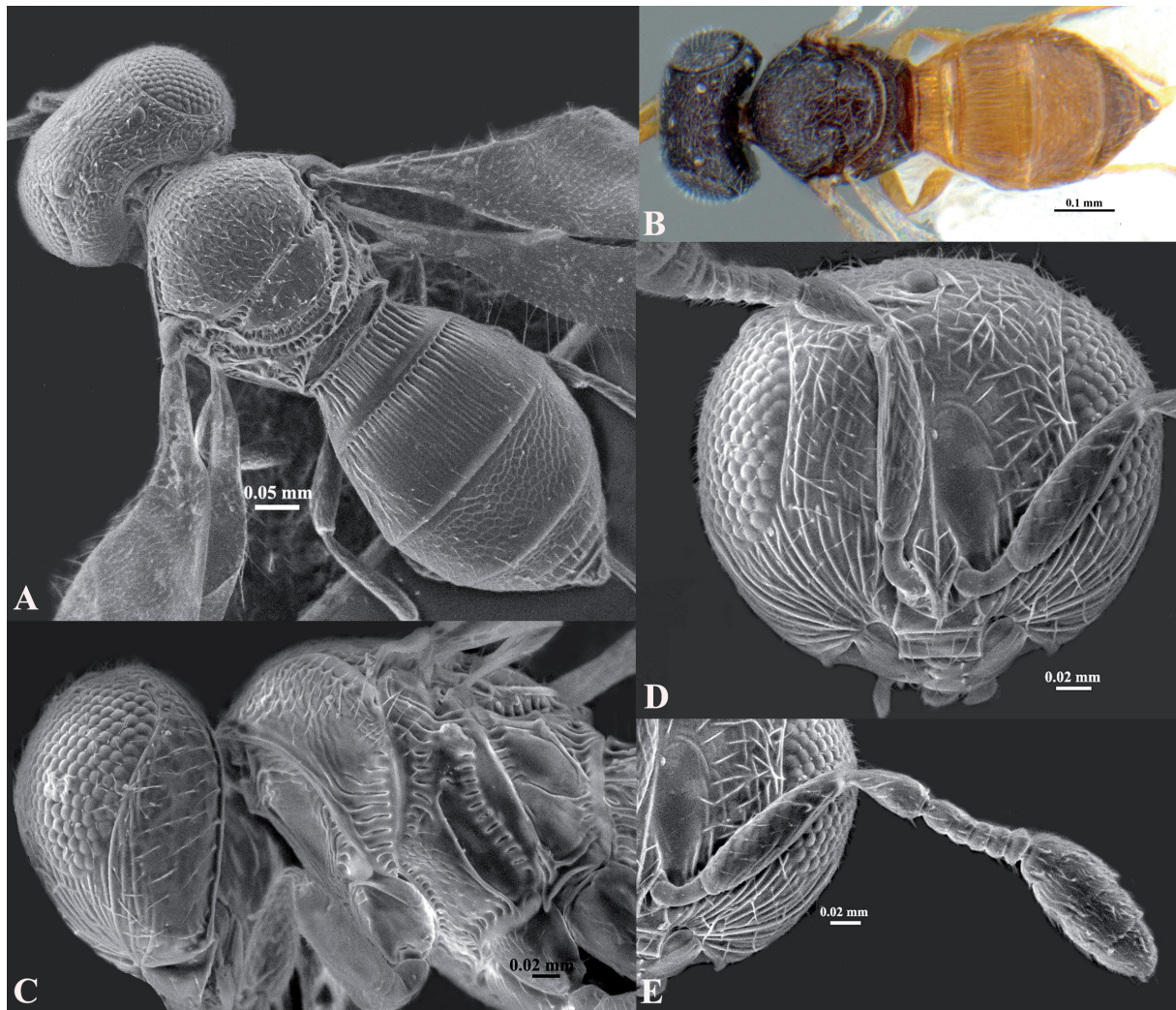


Fig. 15. *Embidobia sankirna* Veenakumari sp. nov., holotype, ♀ (NIM, ICAR-NBAIR P5122). A–B. Habitus dorsal view. C. Head and pleuron. D. Frons. E. Antenna.

Embidobia saroma Veenakumari sp. nov.

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Figs 12E, 16

Diagnosis

This species is close to *E. gauriputra* sp. nov. but can be differentiated from it by the absence of ocelli and malar striae; T1 and T2 are of subequal length in *E. saroma* sp. nov. While in *E. gauriputra* ocelli and malar striae are distinct; T1 is shorter than T2.

Etymology

The Sanskrit epithet ‘saroma’ means ‘hairs’ referring to the long recumbent setae on the body. The name is treated as an adjective.

Material examined

Holotype

INDIA – **Karnataka** • ♀; Bengaluru, Hesaraghatta; 13°08′01″ N, 77°29′27″ E; 859 m; 7 Jul. 2014; YPT; NIM, ICAR-NBAIR P5110.

Paratype

INDIA – **Tripura** • 1 ♂; Agartala, Lembucherra, ICAR Research complex for NEH region; 23°54′50″ N, 91°18′58″ E; 49 m; 27 Jun. 2016; light trap; NIM, ICAR-NBAIR P5111.

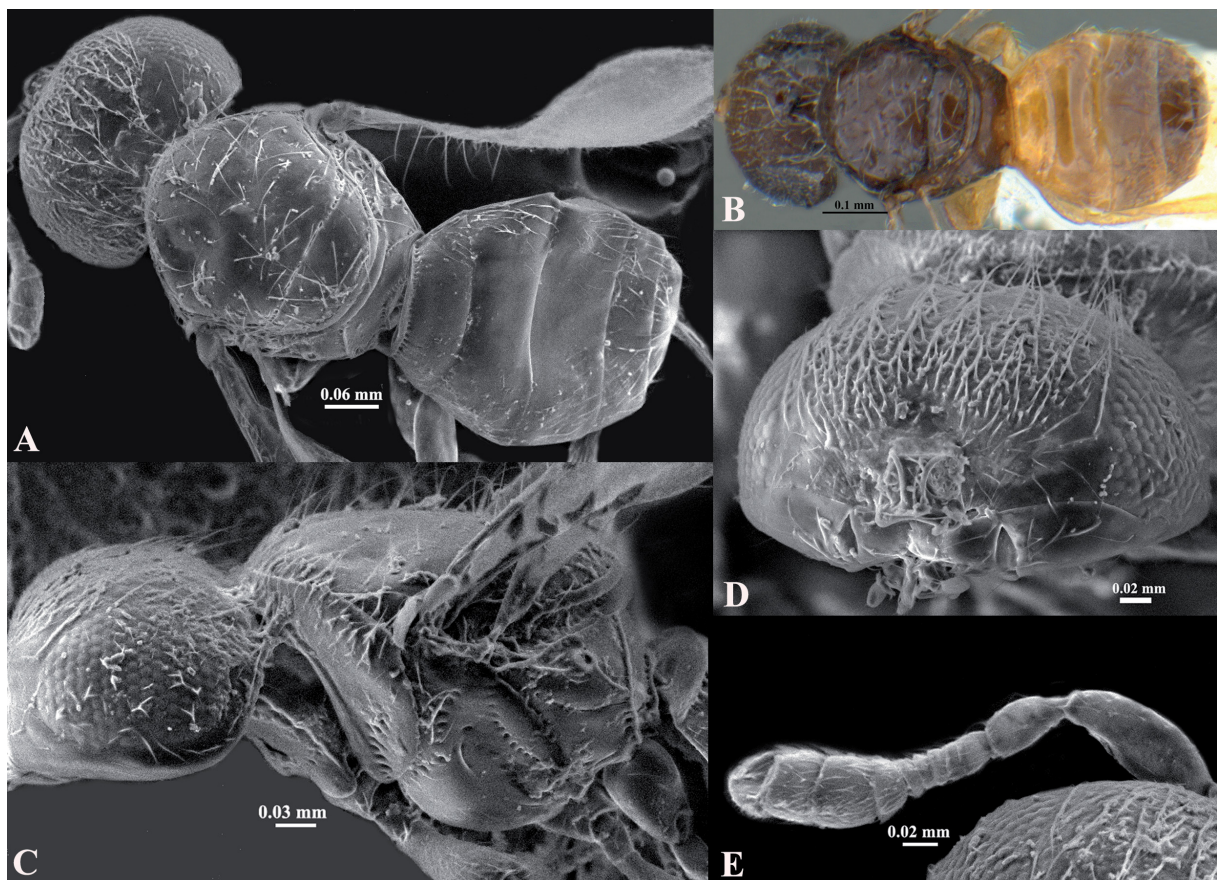


Fig. 16. *Embidobia saroma* Veenakumari sp. nov., holotype, ♀ (NIM, ICAR-NBAIR P5110). A–B. Habitus dorsal view. C. Head and pleuron. D. Lower frons. E. Antenna.

Description

MEASUREMENTS. Female body length = 0.87 mm (n = 1); male body length = 0.73 mm (n = 1).

Female

COLOUR. Head and mesosoma dark brown; T1–T2 yellow brown, remaining tergites brown; radicle, A1–A7 yellow-brown, remaining antennomeres black-brown; legs yellow-brown.

HEAD. Head: $1.6 \times$ as wide as high, $1.3 \times$ as high as long. IOS: $0.6 \times$ head width, $1.2 \times$ eye length. Ocelli: absent. Compound eye: ovate (L:W = 14.4:12.0). Sculpture of frons: smooth with dense setae. Central keel: absent. Sculpture of gena: smooth with long setae. Facial and malar striae: facial striae weak, malar striae absent. Sculpture of vertex: smooth with dense setae. Interantennal process: not distinct.

MESOSOMA. L:W of mesoscutum: 19.4:24.8. Sculpture of mesoscutum: smooth with long recumbent setae. Mesoscutal humeral sulcus: indicated as a furrow. Mesoscutal suprahumeral sulcus: not foveate. Scutoscutellar sulcus: foveate laterally. L:W of mesoscutellum: 7.4:19.2. Sculpture of mesoscutellum: smooth with long recumbent setae. Posterior mesoscutellar sulcus: not foveate. Metascutellum when viewed dorsally: visible. Sculpture of metascutellum: smooth. Posterior margin of metascutellum: evenly rounded. Sculpture of lateral propodeal area: smooth with foveae on posterior margin. Sculpture of lateral pronotal area: smooth with setae. Netrion: distinct, subovate. Netrion sulcus: costate. Pronotal suprahumeral sulcus: not foveate. Pronotal cervical sulcus: indicated as a weak furrow. Prespecular sulcus: foveate. Speculum of mesopleuron: weakly transversely carinate. Episternal sulcus: foveate. Postacetabular sulcus: foveate. Mesepimeral sulcus: foveate. Mesepimeral area: smooth. Mesopleural carina: present, abbreviated. Sculpture of femoral depression: smooth. Mesopleural pit: present. Sculpture of metapleuron: smooth. Metapleurale sulcus: foveate. Paracoxal sulcus: not foveate. Metapleurale epicoxal sulcus: indicated with transverse carinae and furrows. Anteroventral extension of metapleuron: short. L:W of fore wing: 70.0:25.9. Infusate patch on fore wing: present as a longitudinal patch medially. Ratio of length of m:pm:stg: 5.5:26.4:8.2. Metasomal depression: smooth with foveae on anterior and posterior margins.

METASOMA. L:W of metasoma: 30.4:28.0. Sculpture of T1: basal foveae present; entirely smooth with setose patch laterally. Sculpture of T2: basal foveae absent; entirely smooth with setose patch laterally; posterior margin indented medially. Sculpture of T3: entirely smooth. Length of T1:T2:T3: 7.1:7.1:8.4.

Male

Similar to female except for length of antennomeres.

Embidobia yuyutsu Veenakumari sp. nov.

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Figs 12F, 17

Diagnosis

Embidobia yuyutsu sp. nov. is close to *E. hiranya* sp. nov. but differs from it in having T2 and T3 of equal length; metascutellum is evenly rounded posteriorly and is anteriorly foveate and posteriorly with depressions. While in *E. hiranya*. T3 is longer than T2 and metascutellum is posteriorly protruding and is anteriorly foveate and posteriorly longitudinally costate.

Etymology

The species epithet 'yuyutsu' refers to Yuyutsu, born out of wedlock from the union of king Dhritharashtra and his wife's maid Sugadha, the only one among his sons who survived the Kurukshetra war in the Indian epic Mahabharatha. The name is treated as a noun in apposition.

Material examined

Holotype

INDIA – **Karnataka** • ♀; Mandya; 12°33'51" N, 76°44'01" E; 749 m; 7 Jan. 2017; YPT; NIM, ICAR-NBAIR P5112.

Paratype

INDIA – **Karnataka** • 1 ♂; same data as for holotype; 16 Jul. 2016; NIM, ICAR-NBAIR P5113.

Description

MEASUREMENTS. Female body length = 1.27 mm (n = 1); male body length = 1.03 mm (n = 1).

Female

COLOUR. Head and mesosoma brown; metasoma yellow brown; radicle, A1–A7 yellow-brown, remaining antennomeres black-brown; legs yellow-brown.

HEAD. Head: 1.3 × as wide as high, 1.4 × as high as long. IOS: 0.6 × head width, 1.4 × eye length. OOL: subequal to width of median ocellus. Compound eye: ovate (L:W = 13.2:10.0). Sculpture of frons: lower frons medially smooth with sparse discontinuous longitudinal carinae on either side; upper frons with several short transverse carinae. Central keel: 0.3 × head height. Sculpture of gena: smooth with long setae. Facial and malar striae: prominent. Sculpture of vertex: anteriorly rugose, posteriorly imbricate. Interantennal process: elongate and pointed posteriorly.

MESOSOMA. L:W of mesoscutum: 14.4:27.0. Sculpture of mesoscutum: entirely smooth except for sparse imbricate sculpture dorsally. Mesoscutal humeral sulcus: indicated as a furrow. Mesoscutal suprahumeral sulcus: weakly foveate. Scutoscuteellar sulcus: foveate laterally. L:W of mesoscutellum: 9.6:18.3. Sculpture of mesoscutellum: smooth. Posterior mesoscutellar sulcus: foveate. Metascutellum when viewed dorsally: visible. Sculpture of metascutellum: anteriorly weakly foveate and posteriorly with large depressions. Posterior margin of metascutellum: almost straight posteromedially. Sculpture of lateral propodeal area: entirely with longitudinal costae except for a smooth area anteriorly. Sculpture of lateral pronotal area: dorsally imbricate, anterodorsally weakly striate, ventrally smooth. Netrion: present, smooth, linear. Netrion sulcus: costate. Pronotal suprahumeral sulcus: weakly foveate posteriorly. Pronotal cervical sulcus: indicated as a weak furrow. Prespecular sulcus: with transverse foveae. Speculum of mesopleuron: transversely carinate. Episternal sulcus: with transverse foveae. Postacetabular sulcus: foveate. Mesepimeral sulcus: with transverse foveae. Mesepimeral area: smooth. Mesopleural carina: present. Sculpture of femoral depression: smooth. Mesopleural pit: present. Sculpture of metapleuron: smooth. Metapleuron sulcus: with transverse foveae. Paracoxal sulcus: indicated as a furrow. Metapleuron epicoxal sulcus: indicated with transverse carinae and furrows. Anteroventral extension of metapleuron: 2 × as long as wide. L:W of fore wing: 68.6:26.6. Infusate patch on fore wing: a weak vertical band present. Ratio of length of m:pm:stg: 3.9:25.0:5.9. Metasomal depression: longitudinally costate.

METASOMA. L:W of metasoma: 44.6:34.6. Sculpture of T1: basal foveae present; entirely costate except for a smooth band posteriorly and a setose reticulate patch laterally. Sculpture of T2: basal foveae present, weakly striate medially in anterior half, laterally weakly reticulate and posteriorly smooth. Sculpture of T3: medially weakly reticulate in anterior $\frac{2}{3}$ remainder smooth. Length of T1:T2:T3: 7.3:13.3:13.3.

Male

Similar to female except for length of antennomeres.

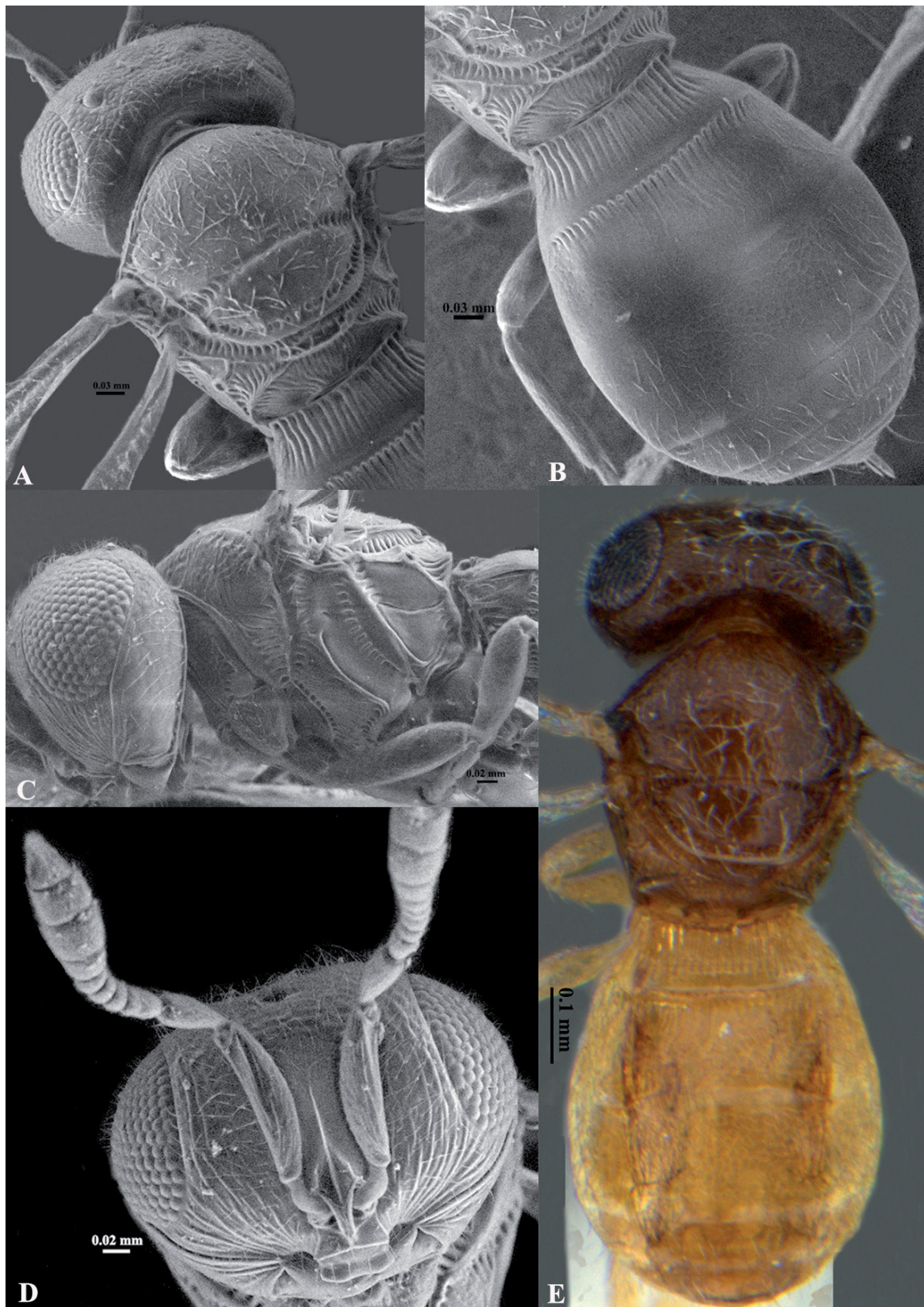


Fig. 17. *Embidobia yuyutsu* Veenakumari sp. nov., holotype, ♀ (NIM, ICAR-NBAIR P5112). **A.** Head and mesonotum. **B.** Metasoma. **C.** Head and pleuron. **D.** Frons and antennae. **E.** Habitus dorsal view.

Key to the females of Oriental species of *Embidobia* Ashmead, 1896

1. Vertex, mesosoma and metasoma smooth (Figs 6A, 16A) 2
 - Vertex, mesosoma and metasoma either entirely or partially sculptured (e.g., Figs 1A, 3A, 5A, 7A) 3
2. Facial and malar striae prominent (Fig. 6D); ocelli present; posterior mesoscutellar sulcus foveate; metascutellum protruding posteriorly (Fig. 6A); mesopleural carina entire (Fig. 6C); cilia on postmarginalis short, at most $0.2 \times$ width of fore wing (Fig. 2E); T1 shorter than T2; T2 longer than T3 (Fig. 6A); entire habitus yellow-brown (Fig. 6B) *E. gauriputra* Veenakumari sp. nov.
 - Facial striae weak and malar striae absent (Fig. 16D); ocelli absent; posterior mesoscutellar sulcus not foveate; metascutellum posteriorly evenly rounded (Fig. 16A); mesopleural carina abbreviated (Fig. 16C); cilia on postmarginalis elongate, more than half the width of fore wing (Fig. 12E); T1 and T2 subequal in length; T2 shorter than T3 (Fig. 16A); head and mesosoma brown-black, metasoma yellow-brown (Fig. 16B) *E. saroma* Veenakumari sp. nov.
3. Metascutellum not visible when viewed dorsally, concealed beneath mesoscutellum; lateral propodeal area entirely smooth with foveae on posterior margin; metasomal depression predominantly smooth (Figs 8A, 11A, 13A) 4
 - Metascutellum visible when viewed dorsally; lateral propodeal area longitudinal costate; metasomal depression costate (e.g., Figs 1A, 3A, 5A, 7A) 6
4. T2 $1.2 \times$ longer than T3; T1 entirely longitudinally striate; T2 and T3 strongly coriaceous reticulate (Fig. 13C); mesoscutellum entirely rugose (Fig. 13A); foveae of mesepimeral sulcus wide and transverse (Fig. 13D) *E. orientalis* Dodd, 1939
 - T2 and T3 equal in length; T1 longitudinally striate with a smooth posterior margin; T2 and T3 with fine weak reticulations; mesoscutellum medially smooth and laterally rugose (Figs 8A, 11A); foveae of mesepimeral sulcus not transverse except basally (Figs 8C, 11C) 5
5. Metasoma elongate, at least $1.5 \times$ as long as wide; mesoscutellum reaching posterior margin of metascutellum (Fig. 11A); interantennal process in posterior half wide (Fig. 11D)
 - *E. omkara* Veenakumari sp. nov.
 - Metasoma short, subequal in length and width; mesoscutellum extending beyond posterior margin of metascutellum (Fig. 8A); interantennal process in posterior half narrow (Fig. 8D)
 - *E. hrdaya* Veenakumari sp. nov.
6. T2 and T3 either equal in length or T3 longer than T2 (Figs 7A, 17B) 7
 - T2 longer than T3 (e.g., Figs 1A, 3A, 5A, 9A) 8
7. T3 at least $1.2 \times$ as long as T2; mesoscutellum medially smooth, laterally rugose; metascutellum posteromedially protruding; metascutellum anteriorly foveate and posteriorly with short longitudinal carinae; medial longitudinal costae on T1 short, extending at most $0.4 \times$ the length of tergite; T3 smooth with a transverse band of areolate sculpture medially (Fig. 7A)
 - *E. hiranya* Veenakumari sp. nov.
 - T2 and T3 subequal in length; mesoscutellum entirely smooth; metascutellum posteromedially evenly rounded; metascutellum anteriorly foveate and posteriorly with depressions; medial longitudinal costae on T1 elongate, extending at least $0.8 \times$ the length of tergite; T3 anteriorly reticulate and posteriorly smooth (Fig. 17A) *E. yuyutsu* Veenakumari sp. nov.

8. T1 smooth, with longitudinal costae sublaterally; T2 predominantly smooth with weak impressions of reticulations posterad; basal foveae on T2 minute (Fig. 1A) *E. agastya* Veenakumari sp. nov.
 – T1 longitudinally costate; T2 longitudinally costate; basal foveae on T2 large and distinct (e.g., Figs 5A, 9A, 10A, 14A) 9
9. OOL either longer or equal to median ocellar diameter (Figs 4A, 5A) 10
 – OOL shorter than the median ocellar diameter (Figs 3A, 9A, 10A, 14A, 15A) 11
10. T1 striate at basal half; T2 longitudinally striate at base; OOL subequal to median ocellar diameter (Fig. 4A) *E. brittanica* Girault, 1917
 – T1 striate $0.9 \times$ the length of the tergite; T2 striate, striae extending $0.8 \times$ length of tergite; OOL at least $1.3 \times$ median ocellar diameter (Fig. 5A) *E. dooranetra* Veenakumari sp. nov.
11. Mesoscutellum entirely smooth (Figs 9A, 15A) 12
 – Mesoscutellum either partially or entirely rugose or rugose-imbricate (Figs 3A, 10A, 14A) 13
12. Metasoma ovate, at most $1.2 \times$ as long as wide; metascutellum longitudinally costate with foveae between costae; lateral propodeal area anteriorly smooth and posteriorly longitudinally costate (Fig. 9A); upper frons with several semicircular carinae (Fig. 9D); submarginalis of fore wing not broken in front of marginalis (Fig. 2G) *E. jatayu* Veenakumari sp. nov.
 – Metasoma spindle shaped $> 1.5 \times$ as long as wide; metascutellum anteriorly foveate and posteriorly with depressions; lateral propodeal area entirely longitudinally costate (Fig. 15A); upper frons with several short arched carinae (Fig. 15D); submarginalis of fore wing broken in front of marginalis (Fig. 12D) *E. sankirna* Veenakumari sp. nov.
13. Mesoscutum with well defined rugae; T1 longitudinally costate almost the entire length of tergite (Fig. 10A); upper frons with several short raised carinae arranged semicircular fashion (Fig. 10D); speculum of mesopleuron densely transversely carinate, carinae extending up to mesopleural pit (Fig. 10C) *E. mahabali* Veenakumari sp. nov.
 – Mesoscutum with imbricate sculpture; T1 longitudinally costate with a wide smooth patch posteriorly (Figs 3A, 14A); upper frons either with long or short oblique carinae (Figs 3D, 14D); speculum of mesopleuron sparsely transversely carinate, carinae terminating way above mesopleural pit (Figs 3C, 14C) 14
14. Interantennal process elongate and narrow (Fig. 14D); mesoscutellum with impressions of weak rugae; posterior propodeal projections short and blunt; posterior margin of metascutellum weakly rounded (Fig. 14A); upper frons with short uneven transverse and oblique carinae (Fig. 14D)
 *E. procera* Veenakumari sp. nov.
 – Interantennal process short and wide (Fig. 3D); mesoscutellum with imbricate sculpture; posterior propodeal projections elongate and sharp; posterior margin of metascutellum projecting (Fig. 3A); carinae on upper frons continuous and elongate (Fig. 3D) *E. barbarika* Veenakumari sp. nov.

Discussion

Embidobia are oophagous parasitoids of various species of Embioptera such as *Parembia major* (Imms, 1913), *Oligotoma greeniana* Enderlin, 1912, *O. gurneyi* Froggatt, 1904, *Metoligotoma ingens* Davis, 1936, *M. illawarrae* Davis, 1938, *M. intermedia* Davis, 1938, *M. extorris* Davis, 1936, *M. pentanesiana*, Davis, 1936, *M. tasmanica* Davis, 1938, and *Notoligotoma nitens* Davis, 1936 (Ashmead 1896; Girault 1917; Dodd 1939). All known parasitoids of Embioptera are confined to two insect orders – Hymenoptera Linnaeus, 1758 and Diptera Linnaeus, 1758. Tachinidae Bigot, 1853 is the only dipteran family parasitizing embiids (Badano *et al.* 2022), while the hymenopteran parasitoids belong to three

families: Sclerogibbidae Ashmead, 1902 (obligate ectoparasitoids of nymphs) (Crosskey 1980; Ross 2000), Braconidae Nees, 1811 (Shaw & Edgerly 1986) and Scelionidae Haliday, 1839 (Ashmead 1896; Dodd 1939; Masner & Dessart 1972). In the Scelionidae, *Embidobia*, *Embioctonus* Masner, 1980, *Palaeogryon* Masner, 1969 and an undescribed genus from the Neotropics are known to parasitize the eggs of Embioptera (Masner 1969, 1980; Masner & Dessart 1972).

In the 127 years after the genus *Embidobia* was erected 11 species were added worldwide (Johnson 1992; MBD 2024). In this study we add 13 new species of *Embidobia* to the Indian fauna. The exploration of unexplored and underexplored ecosystems and regions for their *Embidobia* fauna will in all likelihood lead to the discovery of many new species.

Phylogenetic studies, though far between, have been forthcoming following the observation by Austin *et al.* (2005) that just as for most groups of parasitoids, the higher taxonomy of Platygastroidea too was in need of more detailed cladistic studies to establish relationships between taxa at all levels. Recent studies establish the monophyly of the superfamily Platygastroidea and two Scelionidae subfamilies (sensu Masner 1976): Teleasinae Ashmead, 1902 and Telenominae Thomson, 1860; while Scelioninae Förster, 1856, which includes *Embidobia* was polyphyletic.

The first molecular phylogenetic study of the Platygastroidea as a whole (Murphy *et al.* 2007) came soon after this appraisal. A species of *Embidobia* was the only embidobiine in the study, but a number of taxa of the closely related Baeini Ashmead, 1893 were included. The Baeini (sensu Austin & Field 1997) as a whole was polyphyletic, but *Baeus* Haliday, 1833, *Idris* Förster, 1856 and *Ceratobaeus* Ashmead, 1893 formed a monophyletic group, while *Neobaeus* Austin, 1988 and *Mirobaeoides* Dodd, 1914 formed another, but distant monophyletic group with *Embidobia* as its sister taxon (not significant). In the earlier molecular analysis by Carey *et al.* (2006) too, *Embidobia* and *Neobaeus* + *Mirobaeoides* Dodd, 1914 were identically associated though with low support.

The large phylogenetic study by Popovici *et al.* (2017) with 129 genera representing 75 per cent of the extant scelionid genera based on the morphology of the maxillolabial complex included the largest number of embidobiines to date. Embidobiini Kozlov, 1970 (sensu Masner 1976) and Baeini were both found to be polyphyletic. *Echthrodesis* Masner, 1968, *Endecascelio* Masner & Dessart, 1972 and *Embidobia* (Embidobiini) formed a grade at the base of a large clade that included the polyphyletic Baeini. *Palaeogryon* occurred within the Gryonini Szabo, 1966, and *Embioctonus* was the sister of a highly diverse clade. Additionally *Mirobaeoides* + (*Neobaeus* + *Mirobaeoides*) exhibited monophyly.

The most recent phylogenetic study (Chen *et al.* 2021) using both molecular and morphological data was based on 166 species in 93 platygastroid genera. While *Echthrodesis* and *Embidobia* formed a grade at the base of the monophyletic *Mirobaeoides* + *Neobaeus*; *Idris*, *Ceratobaeus* and *Baeus* resolved into a monophyletic group as in the earlier studies.

Galloway & Austin (1984) had very early on reasoned that Baeini and Embidobiini could be closely related, as members of both tribes search for hosts enclosed in silk. This unique host searching ability they felt must be an apomorphy. Subsequent analyses (Carey *et al.* 2006; Murphy *et al.* 2007; Popovici *et al.* 2017; Chen *et al.* 2021) point to the veracity of this hypothesis.

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