Two new species of Chalcididae (Hymenoptera: Chalcidoidea) from India

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Author Contribution: TCN identified the taxa and described the new species and prepared the paper. FRK collected the taxa.

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Abstract: Two new species of Chalcididae viz. *Psilochalcis mathuraensis* sp. nov. and *Brachymeria neoatteviae* sp. nov. are described and compared with similar species. Illustrations of important features are provided.

Keywords: *Brachymeria*, Chalcididae, India, new species, *Psilochalcis*.

INTRODUCTION

The family Chalcididae is economically important because several of its species parasitize agricultural insect pests. While the majority of Chalcididae species are primary parasitoids of Lepidoptera, Diptera and Coleoptera, some are hyperparasitic via Hymenoptera or Diptera primary parasitoids. Several workers have contributed to the taxonomy of Chalcididae, with the most significant contributions being: Oriental fauna: Bouček & Narendran (1981), Mani (1989), Narendran (1989) and Wijesekara (1997); Japanese fauna: Habu (1960); Australasian fauna: (Bouček 1988; Naumann 1986); European fauna: Steffan (1951, 1959, 1976), Nikolskaya (1952, 1960) and Bouček (1952); New world fauna: Burks (1960, 1975, 1979), Delvare & Bouček (1992), and Halstead (1990, 1991). We report here two recently discovered species: a new species of *Psilochalcis* being the first record from India of the *benoisti* group of *Psilochalcis* with strongly projecting roof of clypeus; and a new species of *Brachymeria* that resembles known *Brachymeria* such as *atteviae* Joseph, Narendran and Joy, *nephantidis* Gahan, and *hime* Habu in the pattern of hind leg colouration and mesosoma structure, but distinct from all known *Brachymeria* to justify description.

Abbreviations: AOL - distance between front and hind ocelli; OOL - distance between eye and adjacent hind ocellus; LOL - hind ocellar diameter; POL - distance between hind ocelli; PMV - postmarginal vein; MV - marginal vein; SMV - submarginal vein; STV - stigmal vein length; T1-T6 - gastral tergites 1-6; WIOS - width of interocular space; DZCU - Department of Zoology,University of Calicut; ZDAMU - Department of Zoology,Aligarh Muslim University; INPC - National Pusa Collection of Indian Agricultural Research Institute, New Delhi, India.

RESULTS

Psilochalcis Kieffer

Psilochalcis Kieffer, 1905: 49: 250. Type species *Psilochalci longigena* Kieffer, by monotypy.

Leptochalcis Kieffer, 1905: 49: 251.Type species *Leptochalcis filicornis* Kieffer, by Monotypy (synonymy with *Psilochalcis* Kieffer by Bouček, 1992) .

Euchalcidia Masi, 1929: 6: 209. Type species *Euchalcidia elongatula* Masi, by monotypy (synonymy with *Psilochalcis* Kieffer by Bouček 1992).

Invreia Masi, 1929: 6: 210. Type species: *Invreia subaenea* Masi by original designation (synonymy with *Psilochalcis* Kieffer by Bouček 1992).

Parinvreia Steffan, 1951: 6: 7. As subgenus of *Invereia* Masi. Type Species: *Invreia frequens* Masi by designation of Bouček (1984) (synonymy with *Psilochalcis* Kieffer by Bouček 1992).

Peltochalcidia Steffan, 1948: 53: 121. Type species *Peltochalcidia benoisti* Steffan, by original designation (synonymy with *Psilochalcis* Kieffer by Bouček 1992).

Hyperchalcidia Steffan, 1951: 67. Type species *Hyperchalcidida soudanensis* Steffan; by original designation (synonymy with *Psilochalcis* Kieffer by Narendran 1989).

Chalcidiopsis Masi, 1933: 12: 4. Type-species: *Chalcidiopsis odontomera* Masi, by monotypy (synonymy with *Psilochalcis* Kieffer by Narendran & Sudheer 2005).

For other synonyms see Noyes (2010). So far only eight species of *Psilochalcis* are known from India. These are *Psilochalcis carinigena* (Cameron), *P. keralensis* Narendran (Narendran, 1989), *P. adhara* (Narendran, 1989) (from *Invreia*), *P. hayati* (Narendran, 1989) (from *Invreia*), *P. crassicornis* (Masi, 1929) (from *Euchalcididia*), *P. ghanii* (Habu, 1970) (from *Invreia*) and *P. erythropus* (Cameron, 1897) (from *Halticella*). Bouček (1992) revised the generic synonymy of *Psilochalcis*.

Diagnosis: Antennae 13 segmented; in female antennae inserted at clypeus; in male, antennae inserted a little distance above it; scape not reaching anterior ocellus; head in front view roundly triangular or subrectangular as in *soudanensis* group; outer surface of clypeus gradually turns downwards and its upper edge projects slightly to strongly in different species; body densely setose in some species; mesosoma sturdy, in some species propodeum is almost horizontal with very distinct carinae submediae, accessoriae, sublaterales and costae lateralis; scutellum flatly arched, posteriorly broadly rounded or truncated; hind femur with a ventral row of comb of teeth, basal tooth massive in *Chalcidiopsis* and typical *Psilochalcis*. Gaster with large, tongue shaped, posteriorly rounded T1.

Hosts: Parasites of lepidopterous pupae.

Distribution: North and Central America, Europe, Africa, Madagascar, Oriental region and Japan.

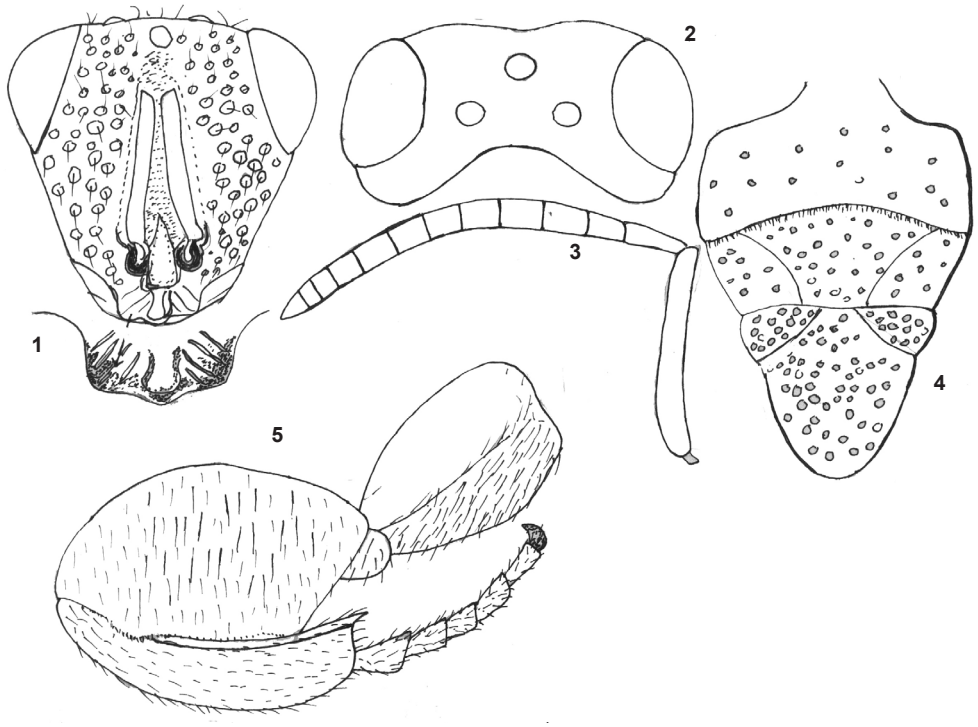
Psilochalcis mathuraensis sp. nov. (Figs. 1-5)

Material examined

Holotype: Female, 30.viii.2007, Nagla Chiranji, Mathura, Uttar Pradesh, India, coll. F.R. Khan (DZCU 1001 (pending transfer to INPC)).

Description: Length 3.72mm. Black with following parts as follows; scape, pedicel and F1 pale brownish-yellow; all coxae concolrous with body; remaining leg segments pale brownish-yellow with carinae and ventral comb of teeth of hind femur black; eye and ocellus pale grayish yellow; pubescence white; wings hyaline with veins brown; pilosity of wing disc brown.

Head: Width in anterior view subequal to its height; width in dorsal view 1.97x its length; frons with close(interstices narrower than diameter of a pit) umbilicate setigerous pits; interstices ecarinate, smooth and shiny; scrobe not clearly marked from frons, not distinctly reaching front ocellus, weakly cross striate; POL a little over 2x OOL; AOL longer than OOL (8:6); WIOS 2.92x POL; vertex similarly pitted as in frons; occiput concave without a cross carina; area immediately below insertion of antenna reduced into a flat quadrangular plate over mouth so that mandible not visible completely in anterior view, this flat lobe a little convex medially; malar ridge distinct, reaching ventral margin of eyes; distance between lower margin of eye to lower margin of gena 0.78x eye height in profile; genotemporal margin carinate, gena with setigerous pits, interstices smooth and shiny, shorter than diameter of a pit; antennal formula 11083; antenna inserted near mouth; scape not reaching near front ocellus; relative length of antennal segments: scape =



Figures 1-5. *Psilochalcis mathuraensis* sp. nov. Female
1- Head anterior view (with enlaged Clypeal roof);
2 - Head dorsal view;
3 - Antenna;
4 - Part of mesosoma dorsal view;
5 - Hind leg

43; pedicel = 13; F1 = 8; F2 = 9; F3 = 9; F4 = 8; F5 = 7; F6 = 7; F7 = 8; F8 = 6; clava = 13.

Mesosoma: Pronotum with widely scattered shallow setigerous pits; interstices much wider than diameter of a pit; pronotum including collum longer and wider than mesoscutum; posterior margin of pronotum with a thick row of short setae; lateral panel of pronotum with a deep close umbilicate pits with interstices carinate, area close to lower margin of panel coriaceous; lateral panel separated from fore coxa by a deep furrow; mesoscutum with widely spaced (with interstices wider than a pit) setigerous pits; scutellum with widely spaced pits with interstices wider than a pit; posterior margin of scutellum rounded; propodium in the anterior two thirds subhorizontal, posterior third more sloping; carinae submediae, accessoriae, sublaterale and costae lateales very distinct; secondary transverse carinae short but distinct, bottom of the areola shiny; carina media lacking; metapleuron with close deep umbilicate setigerous pits; mesopleura with distinct anterior ridge, delimited facies femoralis, with transverse, oblique dorsally horizontal wrinkles; fore coxa subrectangular in side view with four to five oblique carinae; mid coxa with a deep concavity in side view; hind coxa densely pubescent on ventral half; hind femur arched 1.83x as long as wide, smooth with relatively small pits (smaller than pits of scutellum); pubescence moderately dense, longest hairs 0.5x width of hind tibia; ventral margin with a comb of 33-34 teeth; forewing 3.4x as long as wide.

Gaster: A little shorter than mesosoma (23:25); dorsally oval, broadest distinctly behind the middle, posteriorly not pointed; T1 exceeding beyond middle, smooth and shiny; ovipositor sheath hardly protruding, not visible from dorsal side.

Male: Unknown.

Host: Unknown.

Etymology: The species name is after the place Mathura from the holotype is collected.

Remarks: This new species differs from all other oriental species (Narendran 1989) in having protruded roof like clypeus (a character of *benoisti* group). It comes near *Psilochalcis benoisti* (Steffan) in general appearance (especially in having projecting clypeus) but differs from *P. benoisti* in having: (i) Clypeus with transverse projecting roof with median convex lobe (Fig. 1); (in *P. benoisti* the clypeal roof simply roundly quadrangular without any median convex part); (ii) Hind femur with ventral comb of 33-34 teeth (in *P. benoisti* hind femur with ventral comb of 45-50 teeth); and (iii) Hind femur 1.83x as long as wide (in *P. benoisti* hind femur 2.25x as long as wide). This new

species differs from *Psilochalcis adhera* Narendran in having; (i) roof of clypeus much more protruded than that of *P. adhera*; (ii) T1 smooth and shiny (closely pitted in *P. adhera*) and (iii) POL 2x OOL (in *P. adhera* POL 3.6x OOL)

Brachymeria Westwood

Brachymeria Westwood, in Stephens, 1829: 36. Type species *Chalcis minuta* Fabricius; designated by Westwood, 1939.

Thaumatelia Kirby, 1883: 60. Type species: *Chalcis separata* Walker, by monotypy (synonymy with *Brachymeria* Westwood by Halstead 1998).

Onchochalcis Cameron, 1904: 162. Type species: *Oncochalcis marginata* Cameron, by monotypy (synonymy with *Brachymeria* Westwood by Nikolskaya 1960).

Holochalcis Kieffer, 1905: 258. Type species: Type species: *Holochalcis madagascariensis* Kieffer, by subsequent designation of, Gahan, A.B.; Fagan, M.M. (1923), (synonymy with *Brachymeria* Westwood by Narendran (in Subba Rao, B.R. 1987: 438)

Tumidicoxa Girault, 1911[88]: 378. Type species *Tumidicoxa nigra* Girault; by original designation. (synonymy with *Brachymeria* Westwood by Girault 1913(158)).

Thaumatelia Kirby: 1883: 60.Type species Chalcis separate, by monotypy (synonymy With *Brachymeria* Westwood by Halstead 1991)

Thaumateliana Girault, 1912: 160-161. Type species: *Thaumateliana bicolor* Girault, by monotypy (synonymy with *Thaumatelia* Kirby by Narendran & Verghese 1989).

Pseudepitelia Girault, 1913[136]: 104. Type species *Pseudepitelia rubrifemur* Girault, by original designation (synonymy with *Brachymeria* Westwood by Girault 1915 [245]).

Brachypitelia Girault, 1913[136]: 106. Type species *Brachypetelia rubripes* Girault, by original designation and monotypy (synonymy with *Brachymeria* Westwood by Girault 1915[245]).

Tumidicoxoides Girault, 1913[159]: 86. Type species *Tumidicoxoides kurandaensis* Girault, by original designation (synonymy with *Brachymeria* Westwood by Girault 1926[399]).

Tumidicoxella Girault, 1913[175]: 74. (as a subgenus of *Tumidicoxa*); Type species: *Tumidicoxa* (*Tumidicoxella*) *nigra* Giralut.by original designation.

Microchalcis Girault, 1915[245]: 328. Type species: *Microchalcis atricorpus* Girault by original designation (synonymy by Bouček, 1988).

Dirrhinomorpha Girault & Dodd, 1915[245]: 327. Type species: *Dirrhinomorpha angusta* Girault & Dodd, by original designation (synonymy with *Brachymeria* Westwood and treated as subgenus of *Brachymeria* by Bouček 1988).

Meyeriella Krausse, 1917: 95. Type species: *Meyeriella indica* Krausse, by monotypy (synonymy with *Brachymeria* Westwood by Narendran 1986).

Neobrachymeria Masi 1929: 196-198 (as a subgenus of *Brachymeria*); Type species: *Brachymeria confalonierii* Masi by original designation.

Matsumurameria Habu, 1960: 209 (as a subgenus of *Brachymeria*). Type species: *Chalcis taiwanus* Matsumura, original designation.

Gahanula Burks, 1960: 261. Type species: *Brachymeria discreta* Gahan, original designation (as a subgenus of *Brachymeria*).

Australochalcis Girault, 1939[457]326. Type species: *Australochalcis humilicrus* Girault, original designation and monotypy (listed as synonym of *Brachymeria* Westwood by Bouček 1988).

The genus *Brachymeria* Westwood occurring in the Oriental region was revised first by Joseph, Narendran & Joy (1973), and later Narendran (1989) again revised Oriental *Brachymeria* in his monograph on 'Oriental Chalcididae'. Since then, Farooqi et al. (1991), described four new species and two new subspecies of *Brachymeria*. The new species described by these authors are: *Brachymeria kurukshetraensis*, *B. neomegaspila*, *B. rossicorporis* and *B.gauhatiensis*. From the descriptions of these species it is clear that *Brachymeria kurukshetraensis* is a junior synonym of *B. albicrus* (Klug) (syn. nov.) and that *B.neomegaspila* is a form of *B.megaspila* (Cameron, 1991) (syn. nov.). Unadilla (1996) later described *Brachymeria encarpae* Ubaidillah from Indonesia. Joseph, Narendran and Joy (1973) and Narendran (1989) revised oriental *Brachymeria* and provided keys.

Diagnosis: Head oval in profile; scrobe deep with carinate margins; in some species head with preorbital or postorbital carinae or with both carinae present; malar sulcus carinate or ridged; antennal formula 11171 (clava 1 to 3 segmented). Mesosoma with umbilicate punctures; forewing with PMV usually half or about

half as long as MV and usually twice as long as STV. Hind coxa in female in some cases with an inner ventromesal tooth; hind femur with a ventral row of irregular teeth and in some species with an inner basal tooth; hind tibia arcuate; gaster sessile, T1 always the longest; ovipositor sheath slightly compressed slightly exerted; in some species gaster elongate.

Biology: The species are mostly primary parasitoids in pupae of holometabolous insects, especially of Lepidoptera but some species attack Diptera, Coleoptera and Hymenoptera. Most species are primary parasitoids. Some are hyperparasitoids attacking Lepidoptera through parasitic Hymenoptera or Diptera.

Distribution: World wide.

Brachymeria (Brachymeria) neoatteviae sp. nov. (Figs. 6-11)

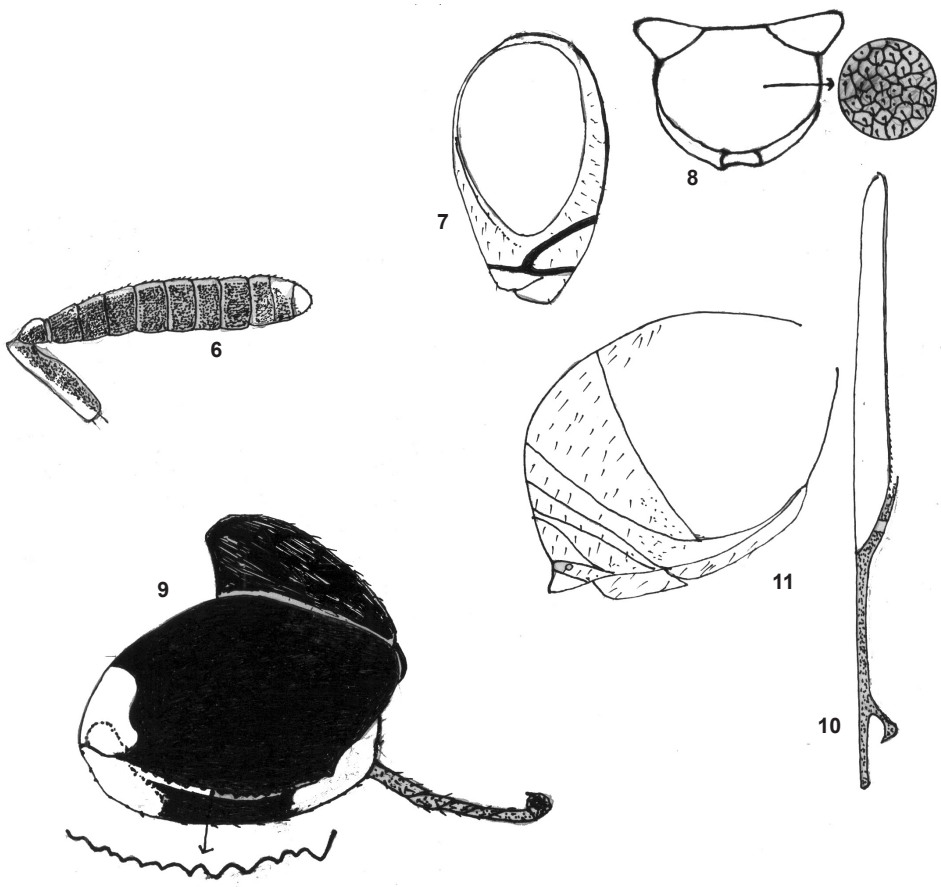
Material examined

Holotype: Female, 25.v.2008, Mati Khata, Cooch Bihar, West Bengal, India (DZCU 1002; peding transfer to INPC).

Paratypes: 2 females, 22.v.2008, Khocha Barihat, New Alipurduar, West Bengal, India (DZCU 1003 and DZCU 1004); 1 female, 1 male, 21.xi.2007, Bhanpur, Cuttack, Orissa, India (DZCU 1005), (DZCU 1006); 1 female, 15.xii.2007, Sarbahal, Angul, Orissa, India (DZCU 1007); 2 females, 03-04.xii.2007, Kadurai & Harrajpor, Khorda, Orissa, India (DZCU 1008 and DZCU 1009). All paratypes deposited in DZCU pending transfer to ZDAMU. All specimens collected by F.R. Khan.

Description: Length 3.75mm. Black, tegula yellow; coxae black; trochanters black; femora black with apex yellow; hind tibiae yellow with median black band; wings hyaline with veins dark brown; pubescence silvery.

Head: As wide as mesosoma (excluding tegulae); width in anterior view 1.3x its height; width in dorsal view 2.12x its length; frons and vertex strongly pitted, pits close or shorter than half diameter of a pit and interstices carinate; scrobe smooth and shiny with slightly rugose at apex; almost reaching front ocellus;



Figures 6-11. *Brachymeria neoattevae* sp. nov.
6 - Antenna;
7 - Head side view;
8 - cutellum and axillae dorsal view;
9 - Hind leg;
10 - Forewing veins;
11 - Gaster side view

distance between outer margin of hind ocelli (= width of ocellar area) 0.8x WIOS; POL 4x OOL, 2.7x LOL; AOL longer than LOL; preorbital carina weakly represented; postorbital carina reaching genotemporal margin; area below scrobe with a relatively small smooth area below base of interantennal projection; height of malar space 0.19x height of eye in profile, eye height 1.54x its length in profile; front genal angle acute, hind genal angle a little obtuse; right mandible with two teeth and left mandible with two teeth. Antenna stout; scape not reaching front ocellus, almost equal to combined length of F1 to F4; pedicel a little longer than wide; clava a little over 2x as long as preceding segment; relative L:W of antennal segments; scape = 22:5; pedicel = 5:4; F1 = 6:7; F2 = 5:8 ; F3 = 6:9; F4 = 6:9; F5 = 5:10; F6 = 5:10; F7 = 5:10; clava = 12:10.

Mesosoma: Provided with umbilicate pits, interstices carinate and rugose; mesoscutum 1.13x as wide as its length; scutellum well high at base, subperpendicularly declined towards apical part; apical flange slightly emarginated at middle, explanate; dorsal margin of lateral panel of pronotum complete and not interrupted anteriorly; hind coxa on ventral side densely pitted and pubescent, without an inner ventromesal tooth, dorsal side smooth; hind femur 1.62x as long as wide; outer disc rather mat like, pubescent, outer ventral margin with a row of 12 differently sized teeth. Forewing 2.56x as long as broad; relative length of SMV = 66, MV = 31, PMV = 14; STV = 6.

Gaster: Shorter than mesosoma; not pointed at apex; T1 smooth and shiny; T2 microsculptured all over with dense pubescence on side; T6 with 6 transverse rows of rugose pits; ovipositor a little visible from dorsal side.

Male: Similar to female except for a shorter gaster.

Etymology: Named after *Brachymeria atteviae* Joseph,Narendran & Joy for its superficial resembence to the new species.

Remarks: This new species comes very close to *Brachymeria atteviae* Joseph, Narendran and Joy in general appearance and comes close to *Brachymeria atteviae* in the key to species by Narendran (1989), but differs from *B. attevae* in having: (i) gaster shorter than mesosoma (in *B atteviae* gaster longer than mesosoma); (ii) gaster subrounded and not at all pointed at apex (in *B. atteviae* gaster pointed and not at all subrounded); (iii) front genal angle acute (in *B. atteviae* front genal angle nearly rectangular); (iv) area below scrobe with a small smooth shiny area (in *B. atteviae* no such smooth area below scrobe), and (v) MV 2.33x PMV (in *B. atteviae* MV 2.67x PMV).

This new species may also get confused with *Brachymeria nephantidis* Gahan and *Brachymeria hime* Habu since both these two species have somewhat similar colour pattern of hind leg, similar punctures on mesosoma and in the nature of scutellum. However, the new species differs from *Brachymeria nephantidis* Gahan, in having: (i) base of hind tibia yellow (in *B. nephantidis* base of hind tibia black or brown with reddish tinge or pale brownish red); (ii) fore and mid tibia yellow completely (in *B. nephantidis* fore and hind tibia yellow with black band medially); (iii) MV 2.33x PMV (in *B. nephantidis* MV more than 4x PMV); (iv) metasoma shorter than mesosoma (in *B. nephantidis* metasoma longer than mesosoma), and (v) gaster not pointed posteriorly (in *B. nephantidis* gaster pointed posteriorly). This new species differs from *Brachymeria hime* Habu in having different colour pattern of fore and mid tibiae and black band of hind tibia much shorter than that of *B. hime*. Besides front genal angle is acute in the new species where as it is almost rectangular in *B. hime*. In the new species metasoma is shorter than mesosoma where as metasoma is longer than mesosoma and pointed in *B. hime*.

REFERENCES

Bouček, Z. (1952). The first revision of the European species of the family Chalcididae (Hymenoptera). *Sborník Entomologického Oddeleni Národního Musea* v27 (supplement 1): 1-108+17pls.

Bouček, Z. & T.C. Narendran (1981). Indian chalcid wasps (Hymenoptera) of the genus *Dirhinus* parasitic on synanthropic and other Diptera. *Systematic Entomology* 6: 229-251

Bouček, Z. (1984). On *Schwarzella*, *Invreia* and some other Hybothoracini (Hymenoptera: Chalcididae). *Bollettino del Laboratorio di Entomologia Agraria 'Filippo Silvestri', Portici* 41: 57

Bouček, Z. (1988). *Australasian Chalcidoidea (Hymenoptera). A Biosystematic Revision of Genera of Fourteen Families, with A Reclassification of Species*. CAB International, Wallingford, Oxon, U.K., Cambrian News Ltd., Aberystwyth, Wales, 832pp.

Bouček, Z. (1992). The new world genera of Chalcididae.

Memoirs of American Entomological Institute 53: 49-118, 443-446.

Burks, B.D. (1960). A revision of the genus *Brachymeria* Westwood in America north of Mexico (Hymenoptera: Chalcididae). *Transactions of the American Entomological Society* 86(3): 263

Burks, B.D. (1975). The species of Chalcidoidea described from North America north of Mexico by Francis Walker (Hymenoptera). *Bulletin of the British Museum (Natural History) (Entomology)* 32(4): 139-170

Burks, B.D. (1979). Torymidae (Agaoninae) and all other families of Chalcidoidea (excluding Encyrtidae), pp. 748-749, 768-889, 967-1043. In: *Catalog of Hymenoptera in America North of Mexico - 1.* Krombein, K.V., P.D. Hurd jr., D.R. Smith, B.D. Burks (eds.). Smithsonian Institute Press, Washington, D.C.

Cameron, P. (1904). On some new genera and species of Hymenoptera. *Entomologist* 37: 162.

Farooqi, S.I., T. Husain & S. Ghai (1991). Description of four new species, two new subspecies and new host records of the genus *Brachymeria* Westwood (Hymenoptera: Chalcididae) from India. *Annals of Entomology* 9(2): 11-24.

Gahan, A.B. & M.M. Fagan (1923). The type species of the genera of Chalcidoidea or Chalcid-flies. *Bulletin of the United States National Museum, Washington* 124: 72.

Girault, A.A. (1911)[88]. Beitrage zur Kenntnis der Hymenopteren fauna von Paraguay auf Grund de Sammlungen und Beobachtungen von Prof. J.D. Anistis. IX New chalcidoid genera and species from Paraguay. *Zoologische Jahrbücher, Abteilung für Systematik* 31: 378

Girault, A.A. (1913)[158]. On several new genera and species of Australian Hymenoptera Chalcidoidea. *Canadian Entomologist* 45: 104.

Girault, A.A. (1913)[175]. New genera and species of chalcidoid Hymenoptera in the South Australia Museum, Adelaide. *Transactions of the Royal Society of South Australia* 37: 74.

Girault, A.A. (1915)[245]. Australian Hymenoptera Chalcidoidea - XIV. The family Chalcididae with descriptions of new genera and species. *Memoirs of the Queensland Museum* 4: 314-365.

Girault, A.A. (1939)[457]. Five new generic names in the Chalcidoidea (Australia). *Ohio Journal of Science* 39: 326.

Habu, A. (1960). A revision of the Chalcididae (Hymenoptera) of Japan with description of sixteen new species. *Bulletin of National Institute of Agricultural Sciences, Tokyo (C)* 11: 209.

Habu, A. (1970). Description of a new *Invreia* species parasitic on paddy stem borer in Pakistan (Hymenoptera: Chalcididae). *Mushi 43*(4): 45-49.

Halstead, J.A. (1990). Revision of *Hockeria* Walker in the Nearctic region with descriptions of males and five new species. *Proceedings of the Entomological Society of Washington* 92: 619-640.

Halstead, J.A. (1991). *Thaumatelia* Kirby, a generic synonym of *Brachymeria* Westwood (Hymenoptera: Chalcididae). *Proceedings of the Entomological Society of Washington* 93(4): 951-952.

Joseph, K.J., T.C. Narendran & P.J. Joy (1973). Oriental *Brachymeria* (Hymenoptera: Chalcidoidea). Zoological Monograph No. 1: Department of Zoology, University of Calicut publication, 215pp.

Kieffer, J.J. (1905). New Eucharinae and Chalcidinae. *Berliner Entomologische Zeitschrift* 49: 244-265.

Kirby, W.F. (1883). Remarks on the genera of the subfamily Chalcidinae, with synonymic notes and descriptions of new species of Leucospidinae and Chalcidinae. *Journal of the Linnean Society (Zoology)* 17: 60.

Krausse, A. (1917). Eine neue südindische chalcididen-Gattung. *Archiv für Naturgeschichte (A)* 82(1): 95.

Mani, M.S. (1989). *The Fauna of India and Adjacent Countries, Chalcidoidea (Hymenoptera. Part I). Agaontidae, Torymidae, Leucospidae, Chalcididae, Eurytomidae, Perilampidae, Eucharitidae, Cleonymidae, Miscogasteridae, Pteromalidae, Eupelmidae and Encyrtidae*: Zoological Survey of India, Calcutta, xiv+1067pp.

Masi, L. (1929). Contributo alla conoscenza dei Chalcididi Orientali della Sottofaminglia Chalcidinae. *Bulletino del Laboratorio di Entomologia del R. istituto Superiore Agrario di Bologna* 2: 155-188.

Masi, L. (1933). H. Sauters Formosa - Ausbeute. Chalcididae (Hym.). II. Teil. *Konowia* 12: 4.

Narendran, T.C. (1984). Key to Indian genera of the family Chalcididae (Hym.: Chalcidoidea). *Entomophaga* 29(4) pp. 431-438

Narendran, T.C. (1987). Errata, pp. 438-439. In: Rao, S. & Hayat (eds.). *Additions and Corrections to the catalogue of Chalcidoidea (Hymenoptera) of India and Adjacent Countries*.Addenta and Errata to Chalcid Catalog, 3pp.

Narendran, T.C. (1989). *Oriental Chalcididae (Hymenoptera). Zoological Monograph*. Department of Zoology, University of Calicut Publication, 440pp.

Narendran, T.C. & K. Sudheer (2005). Descriptions of two new species of *Antrocephalus* Kirby (Hymenoptera: Chalcididae) from Oriental region and notes of the synonymy of a genus and species of Chalcididae. *Journal of Ecobiology* 17(1): 89-98.

Naumann, I.D. (1986). A revision of the Indo-Australian Smicromorphinae (Hymenoptera: Chalcididae). *Memoirs of the Queensland Museum* 22: 169-187.

Nikol'skaya, M.N. (1952). The Chalcid fauna of the USSR (Chalcidoidea) -1593. Originally published in 1952 by Academy of science of USSR (translated from Russian by A. Birron and Z.S.Cole in 1963) Published for National Science Foundation, Washington, D.C. by the Israel programme for scientific translation.

Nikol'skaya, M.N. (1960). Hymenoptera 7, 5. Chalcids of fam. Chalcididae and Leucospidae. *Fauna SSSR (n.s.)* 76: 1-221.

Noyes, J.S. (2010). Universal Chalcidoidea data base. http://www.nhm.ac.uk/entomology.chalcidoidea (Accessed on 2010).

Steffan, J.R. (1948). Deux nouveaux genres d'Haltichellinae (Hym. Chalcididae). *Bulletin de la Société Entomologique de France* 53: 121.

Steffan, J.R. (1951). Les espèces françaises d'Haltichellinae (Hyménoptères Chalcididae). *Feuille des Naturalistes* 6(1/2): 7.

Steffan, J.R. (1959). Revision de la tribu des Cratocentrini (Hymen. Chalcididae). *Acta Entomologica Musei Nationalis Pragae* 33: 287-325.

Steffan, J.R. (1976). Les *Euchalcidia* Masi du basin méditerranéen (Hym. Chalcididae).*Bulletin de la Société Entomologique de France* 81(1/2): 52-63.

Ubaidillah, R. (1996). A new species of *Brachymeria* (Hymenoptera: Chalcididae), Parasitic on Cocoa husk borer *Crytophlebia encarpa* (Lepidoptera: Torticidae) in Malaysia. *Bulletin of Entomological Research* 86: 481-484.

Stephens, J.F. (1829). *A Systematic Catalogue of British Insects*. Baldwin, London, xxxiv+416pp.

Westwood, J.O. (1839). Synopsis of the genera of British insects. Order VI. Trichoptera Kirby. Order VII. Hymenoptera Linn. (Piezata Fab.). Introduction to the modern classification of insects founded on the natural habits and corresponding organisation; with observations on the economy and transformations of the different families. 2(XIII) (appendix):49-80 Longman, Orme, Brown, Green, and Longmans, London

Wijesekara, G.A.W. (1997). Phylogeny of Chalcididae (Insecta: Hymenoptera) and its congruence with contemporary hierarchical classification. *Contributions of the American Entomological Institute* 29(3): 61.