Five new species of *Homalotylus* Mayr (Hymenoptera: Encyrtidae) – from India with a key to Indian species

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ABSTRACT

Five new species of *Homalotylus* Mayr (Hymenoptera: Encyrtidae) – *H. noyesi* sp. nov., *H. biharensis* sp. nov., *H. varicolorus* sp. nov. (from Bihar province), *H. montanus* sp. nov. (from Tamil Nadu province) and *H. insularis* sp. nov. (from Andaman and Nicobar Island) – are described from India. A revised key to the Indian species of *Homalotylus* is provided.

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KEYWORDS

Chalcidoidea; Encyrtinae; Echthroplexiellini; new species; key

Introduction

Homalotylus was erected by Mayr (1876) for *Encyrtus flaminus* Dalman. This genus belongs to the subfamily Encyrtinae and the tribe Echthroplexiellini, and has six other synonyms (Noyes 2010). *Homalotylus* species are generally primary parasitoids of larvae of lady bird beetles (Coleoptera: Coccinellidae) and more rarely parasitise Chrysomelidae (Domenichini 1957; Klausnitzer 1976). However, Trjapitzin (2011) mentioned that the report of Walker (1838) rearing *H. flaminus* from the pupa of *Galeruca calvariensis* Walker (Coleoptera: Chrysomelidae) in England needed to be confirmed. Further, he reported that 30 species were reared from grubs and pupae of ladybirds. Anis and Hayat (1998) added that the hosts of *Homalotylus* are definitely lady bird beetles, and host records of mealy bugs and aphids are undoubtedly erroneous and indicate that the real hosts, which normally live among these hemipterous pests, are overlooked. Sixty-four species of *Homalotylus* have been described globally (Noyes 2015). Currently, 24 species are known from the Oriental region (Xu and He 1997; Noyes 2015). From India, Anis and Hayat (1998) last described two new species, *H. agarwali* Anis and Hayat and *H. formosus* Anis and Hayat, and provided a key to 12 known Indian species.

In this paper, we describe five new species of *Homalotylus* from Tamil Nadu, Bihar and Andaman Nicobar Island, India, and provide a revised key to the Indian species.

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Methods

The length of whole specimens is in millimetres. All other measurements were taken from a micrometer directly fitted into the eyepiece of a Leica S8 APO stereozoom trinocular microscope at 80× (one micrometer division = 0.0125 mm) for card-mounted specimens, or at 100× (one micrometer division = 0.01 mm) using a Leica DM750 phase contrast microscope for slide-mounted parts. Images of card-mounted specimens were captured using a Leica M205C stereozoom trinocular microscope with a DMC2900 camera, and those of slide-mounted parts using a DFC295 camera attached to a Leica DM750 phase contrast microscope.

The following abbreviations are used:

AOL = minimum distance between a posterior ocellus and the anterior ocellus.

OCL = minimum distance between a posterior ocellus and the occipital margin.

OOL = minimum distance between a posterior ocellus and the corresponding eye margin.

POL = minimum distance between posterior ocelli.

F1, F2, etc. = funicle segments 1, 2, etc.

T1, T2, etc. = tergites 1, 2, etc. of gaster.

YPT = yellow pan trap.

The following acronyms are used for the specimen repositories:

EDAU = Entomology Department, Annamalai University, Chidambaram, India.

NHM = Natural History Museum, London.

NBAIR = National Bureau of Agricultural Insect Resources, Bangalore, India.

Taxonomy

Homalotylus Mayr

Homalotylus Mayr, 1876: 752. Type species *Encyrtus flaminus* Dalman, by designation of Ashmead, 1900: 377.

Synonymy. See Noyes and Hayat (1984); Hayat (2006).

Diagnosis

Female body relatively large, measuring 0.9 – 2.3 mm in length, body dark brown to fully black or orange-yellow to brown; some dark species with metallic lustre. Head with frontovertex evenly curved and gradually merging with face; ocellar triangle with apical angle acute or 90°; posterior ocelli very close to eye margins; antennal torulus separated from mouth margin by about one-third its own length; eye kidney shaped, dorsally elongate, nearly reaching occipital margin; malar space short, not longer than eye width and generally with a weak malar sulcus. Mandible 3-dentate, rarely with only 2 teeth; maxillary palp 4-segmented, labial palp 3-segmented. Antennal funicle 6-segmented; clava solid or 3-segmented with oblique truncation.

Thorax slightly convex; pronotum entire; mesoscutum with complete notaular lines; mid tibial spur frequently conspicuously serrate, varying from a little shorter to distinctly longer than mid basitarsus; basitarsus usually with only line of ventral pegs, rarely with up to 2 rows; hind tibia not broadened and flattened or hardly so, varying from 6–10× as long as broad. Fore wing with marginal vein quadrate to slightly longer than broad; post-marginal vein length variable; stigmal vein long; centre of disc densely and finely infusate with brown setae, about basal third and apical third with transparent setae. Mesopleuron clearly separated from gaster by propodeum which broadly touches hind coxa; side of propodeum with dense setae, these often slightly flattened, scale-like and silvery. Gaster with anterior margins of T2–T6 medially incised and with a median, longitudinal membranous strip, that on T5 and T6 are rarely incomplete; syntergum broadly shallowly concave without median incision or median membranous strip; syntergum very short, moderately to strongly transverse, 1.8–4.6× as broad as long, usually with a broad apical, semicircular invagination giving it a truncate appearance, rarely apically rounded; sternites II–V of gaster generally with a median membranous strip; hypopygium reaching apex of gaster, anterior margin concave with a median projection, posterior margin varying from virtually straight to acute, with a shallow median invagination; ovipositor varying from not exerted to strongly exerted; outer plate of ovipositor triangular, about 3–4× as long as broad, with up to 8 subapical setae; ovipositor varying from about two-thirds as long as mid tibia to more than twice as long; second valvifer usually without any subapical setae, but with up to 2 when present; gonostylus free, from less than one-tenth as long as mid tibia to about as long (modified from Anis and Hayat 1998; Noyes 2010).

Male. Sexual dimorphism very little. It is difficult to differentiate the sexes in species with a non-exserted ovipositor. Antennal scape in some species with a concavity on dorsal surface. T7 of gaster relatively longer, cercal plates situated at about distal third of gaster. External genitalia with a tubular phallobase, with aedeagal apodemes contained within the phallobase; parameres absent or reduced; digiti well developed, each digitus usually with three denticles (Anis and Hayat 1998).

Comments

Homalotylus can be differentiated from other encyrtid genera using the keys given by Tachikawa (1963) for Japan, Noyes and Hayat (1984) for the Indo-Pacific region, Hayat (1985, 2006) for India and the adjacent countries, and Trjapitzin (1989) for Palaearctic region.

Revised key to Indian species of *Homalotylus* (females)

1. Body completely dark brown to nearly black and partly with metallic shine, occasionally frontovertex and partly the scutellum testaceous yellow; hind legs, excluding tarsi, dark brown 2
- Body not completely dark brown; most of head, largely the axillae and scutellum, and sides of thorax yellow or yellow brown, occasionally with pale fuscous suffusions; hind legs, excluding tarsi, not completely dark brown 10

- 2(1). Pedicel about 3.2× as long as wide and as long as F1 and F2 combined (Anis and Hayat 1998, fig. 1) *H. longipedicellus* (Shafee and Fatma)
 – Pedicel at most 2.8× as long as wide and shorter than F1 and F2 combined 3
- 3(2). Ovipositor at most 0.6× as long as mid tibia 4
 – Ovipositor at least as long as mid tibia 6
- 4(3). Hind tarsus dark brown; clava white (pedicel 2.26× as long as wide; scape 7.37× as long as wide (F1–F6, rarely F1–F5, dark brown to black).....*H. hemipterinus* (De Stefani) [= *eytelweinii* (Ratzeburg) misidentification, see Noyes 2010]
 – Hind tarsus white; clava basal third or so dark brown to infusate brown and distal two third or so whitish or clava black except paler apex (funicle always dark brown) 5
- 5(4). Mid tibial spur not serrate; scape about 6.4× as long as wide; clava in basal third or so dark brown to infusate brown and distal two third or so whitish (Anis and Hayat 1998, fig. 5) *H. flaminus* (Dalman)
 – Mid tibial spur serrate; scape about 8.8× as long as wide; clava black except apex paler (Figure 1b)) *H. biharensis* sp. nov.
- 6(3). Ovipositor about 2× as long as mid tibia; scape not more than 6.5× as long as wide (pedicel about 2.4× as long as wide; antenna with radicle, scape, pedicel and F1–F3 dark black; F4 ventrally light brown, dorsally white; F5–F6 and clava white (Figure 3b)) *H. montanus* sp. nov.
 – Ovipositor at most 1.3× as long as mid tibia; scape at least 7× as long as wide . 7
- 7(6). Scape at most 7.5× as long as wide 8
 – Scape at least 8.3× as long as wide 9
- 8(7). Pedicel about 2.2× as long as wide; F1–F2 dark brown, F3–F6 and clava white; hind tarsi fully dark brown; fore wing with uniformly pale brown setae distad of infuscation, without an oval area of transparent setae (Anis and Hayat 1998, fig. 35)..... *H. agarwali* Anis and Hayat
 – Pedicel about 2.7× as long as wide; F1–F4 dark brown, F5–F6 and clava white; hind tarsi white except apitarsus brown; fore wing with an oval area of transparent setae adjacent to distal margin of infuscation (Anis and Hayat 1998, fig. 32) *H. scymnivorus* Tachikawa
- 9(7). Scape about 8.3× as long as wide; antenna blackish brown except clava white (Anis and Hayat 1998, fig. 18); hind tarsus at least partially white.....
 H. turkmenicus Myartseva
 – Scape at least about 8.8× as long as wide; antenna with scape, pedicel and F1–F3 dark brown, F4 light brown, F5 white, F6 and clava orange (Figure 2(a)); hind tarsus completely dark brown *H. insularis* sp. nov.
- 10(1). Pedicel not more than 1.5× as long as wide (ovipositor 2.0× as long as mid tibia; F1 2.0× as long as wide; antenna brownish black, F5–F6 and clava white)
 H. mexicanus Timberlake
 – Pedicel at least 2.0× as long as wide 11

- 11(10). Ovipositor at most 0.6× as long as mid tibia 12
 – Ovipositor at least 1.1× as long as mid tibia 13
- 12(11). Entire funicle (Noyes 2010, fig. 243), mid femur and tibia dark brown.....
 H. terminalis (Say)
 – F5–F6 white (Anis and Hayat 1998, fig. 15); mid femur and tibia yellowish brown.
 H. formosus Anis and Hayat
- 13(12). Scape at most 7.2× as long as wide 14
 – Scape at least 8.5× as long as wide 16
- 14(13). Ovipositor about 2.2× as long as mid tibia (Figure 4(d)); pedicel at least 2.7× as
 long as wide *H. varicolorus* sp. nov.
 – Ovipositor at most 1.6× as long as mid tibia; pedicel at most 2.3× as long as
 wide 15
- 15(14). Flagellum dusky yellow, becoming paler towards distal end of clava (Anis and
 Hayat 1998, fig. 47); propodeum dark brown with faint bronzy shine; AOL 1.16×
 as long as OCL *H. indicus* (Agarwal)
 – Flagellum with F1–F4 dorsally brown, ventrally light brown, F5–F6 and clava
 white (Figure 6(b)) propodeum medially yellowish brown, laterally light brown;
 AOL 1.40× as long as OCL *H. noyesi* sp. nov.
- 16(13). F1–F2 and base of F3 brown, rest of F3, F4–F6 and clava white; fore tibia and
 tarsi yellow *H. ferrierei* Hayat, Alam and Agarwal
 – F1–F5 dark brown, F6 and clava white; fore tibia and tarsi brown.....
 H. albiclavatus (Agarwal)

Descriptions of new taxa

Homalotylus biharensis Krishnachaitanya and Manickavasagam, sp. nov.
 (Figure 1)

Female

Holotype. Length, 1.9 mm. Body dark brown to black with metallic green shine (Figure 1(a)). Head with eyes and frontovertex with silvery white setae. Antenna with radicle brown, scape with yellow band at base, remainder dark brown, pedicel and F1–F6 dark brown, clava brown except apex white. Mesosoma dark with metallic green shine; tegula basally white, remainder brown. Fore wing infusate from parastigma to end of venation, sub-basally and apically hyaline, hind wing hyaline. Legs dark brown except mid and hind tarsi 1–3 white. Metasoma dark brown, ovipositor sheath dark with ovipositor pale yellow.

Head in frontal view broader than high (60:57); in frontal view eye 1.6× as high as wide; frontovertex with punctate-reticulate sculpture, interantennal prominence, antennal scrobes with imbricate sculpture; mandible with 3 acute teeth. Antenna (Figure 1(b)) with scape slender, 8.75× as long as wide; pedicel 2.2× as long as wide; F1 1.25× as long as wide and slightly longer than F2–F6; clava obliquely truncate, 2.4× as long as wide. **Measurements:** head height:width, 57:60; eye height:width, 36:23; frontovertex width 14; POL 6; OOL 0.5; OCL 4.5; AOL 7; scape length:width, 35:4; pedicel length:width, 10:4.5; funicle length:width, F1, 7.5:6; F2, 7:6.5; F3, 6:6.5; F4, 6:6.5; F5, 7:7; F6, 7:7; clava length:width, 24:10.

Figure 1. *H. biharensis* F#: (a) Habitus image, (b) antenna, (c) fore wing, (d) ovipositor.

Mesosoma 1.4× as long as wide; mesoscutum 1.9× as wide as long; scutellum 1.25× as wide as long; pronotum and mesoscutum with imbricate sculpture, axillae and scutellum with punctate reticulate sculpture. Fore wing (Figure 1(c)) 2.8× as long as wide; costal cell 11× as long as wide; marginal vein clearly longer than wide; stigmal vein 2.2× as long as postmarginal vein. Mid tibia 3.2× as long as mid tibial spur; mid basitarsus with 16 pegs and 1.1× as long as mid tibial spur; mid tibial spur serrate. *Measurements*: mesosoma length:width, 65:47; mesoscutum length:width, 25:47; scutellum length:width, 28:35; forewing length:width, 165:58; costal cell length:width, 66:6; marginal vein length:width, 6:3.5; postmarginal vein length 6; stigmal vein length 13; mid tibia length 57; mid basitarsus length 20; mid tibial spur length 18.

Metasoma with posterior margin of T1 more or less straight; T2–T4 with posterior margin slightly convex; posterior margin of T5 and T6 concave; syntergum medially, broadly V-shaped; T2–T5 each with an anterior, median incision. Hypopygium extending to apex of gaster; ovipositor (Figure 1(d)) slightly exerted and 0.9× as long as mid tibia. *Measurements*: metasoma length 57; exerted ovipositor length, 10; ovipositor length 50.

Material examined

Holotype, 1 f# (on slide under 4 cover slips) labelled 'INDIA: Bihar, Banka, Bounsi (N25.14° E86.56°), 08.i.2014, YPT, Abhinav Kumar' (EDAU, Registration No. Enc/006/2015).

Male

Unknown.

Host

Unknown.

Comments

This species is similar to *H. sinensis* in having the ovipositor slightly to not exerted, whole antennal funicle black and pedicel at most 2.3× as long as wide, but differs in having ovipositor length, 2 mm; clava 3-segmented; scape 8.75× as long as wide; mid tibia 2.85× as long as mid basitarsus (ovipositor length, 1.8 mm; clava solid; scape 7.5× as long as wide; mid tibia 1.1× as long as mid basitarsus in *H. sinensis*).

Etymology

This species is named after the type locality, Bihar.

***Homalotylus insularis* Krishnachaitanya and Manickavasagam, sp. nov.**
(Figure 2)

Female

Holotype. Length, 1.47 mm. Body dark brown to black (Figure (2a)). Head, frontovertex with metallic green lustre and silvery white setae, interantennal prominence bluish green, eye with silvery white setae. Antenna with radicle, scape, pedicel and F1–F3 dark brown, F4 light brown, F5 white, F6 and clava orange. Mesosoma brown with green

Figure 2. *H. insularis* F#: (a) Habitus image, (b) antenna, (c) fore wing, (d) ovipositor.

shine; mesoscutum with dark setae and also with some setae basally dark but apically silvery white; scutellum with brown setae; tegula white in basal half, brown in apical half; fore wing with infusate band below venation, sub-basally and apically hyaline, hind wing hyaline. Legs dark brown except tarsi of mid leg yellow. Metasoma shiny brown, base of ovipositor sheath white, apex brown, ovipositor brownish yellow.

Head in frontal view broader than high (43:40); in frontal view, eye $2\times$ as high as wide; frontovertex with punctate-reticulate, interantennal prominence, antennal scrobes with imbricate sculpture; mandible with 3 acute teeth. Antenna ([Figure \(2b\)](#)) with scape slender, $8.75\times$ as long as wide; pedicel $2.75\times$ as long as wide; F1, $1.55\times$ as long as wide, slightly longer than other funicle segments and F2–F5 individually, slightly longer than wide, F6 quadrate; clava obliquely truncated, $2.1\times$ as long as wide. *Measurements*: head height:width, 40:43; eye height:width, 35:17; frontovertex width 9; POL 2.5; OOL 0; OCL 4; AOL 4; scape length:width, 35:4; pedicel length:width, 11:4; funicle length:width, F1, 7:4.5; F2, 6.5:4.5; F3, 6.5:4.7; F4, 6.5:5; F5, 6:5; F6, 5.5:5.5; clava length:width, 15:7.

Mesosoma $1.2\times$ as long as wide; mesoscutum $2.2\times$ as wide as long; scutellum $1.2\times$ as wide as long; pronotum and mesoscutum with imbricate sculpture, axillae and scutellum with imbricate-reticulate sculpture. Fore wing ([Figure \(2c\)](#)) $2.7\times$ as long as wide; costal cell $14\times$ as long as wide; marginal vein slightly longer than wide; stigmal vein $1.3\times$ as long as postmarginal vein. Mid tibia $2.5\times$ as long as mid tibial spur; mid basitarsus with 18 pegs and $0.95\times$ as short as mid tibial spur; mid tibial spur serrate. *Measurements*: mesosoma length:width, 47:39; mesoscutum length:width, 18:39; scutellum length:width, 25:29; forewing length:width, 117:43; costal cell length:width, 56:4; marginal vein length:width, 3:2.5; postmarginal vein length 6; stigma vein length 8; mid tibia length 50; mid basitarsus length 19; mid tibial spur length 20.

Metasoma with posterior margin of T1 more or less straight; posterior margin of T2–T4 convex; T5 with posterior margin more or less straight; posterior margin of T6 concave; syntergum medially, broadly V-shaped; T2–T6 each with an anterior, median incision. Hypopygium extending to apex of gaster; ovipositor ([Figure \(2d\)](#)) exerted and $1.2\times$ as long as mid tibia. *Measurements*: metasoma length 44; exerted ovipositor length, 22; ovipositor length 60.

Material examined

Holotype, 1 f# (on slide under 4 cover slips) labelled 'INDIA: North Andaman, Diglipur (N13. 16° E93.0°), 25.V.2012, Malaise trap, Manickavasagam Sagadai and A. Ramesh Kumar' (EDAU, Registration No. Enc/007/2015).

Host

Unknown.

Male

Unknown.

Comments

This species is similar to *H. scymnivorus* in having the ovipositor exerted and female body dark brown or black, but differs in having ovipositor more than $3\times$ as long as mid

basitarsus, scape 8.75× as long as wide; F1–F3 dark brown, F4 light brown, F5 white, F6 and clava orange (ovipositor less than 3× as long as mid basitarsus, scape 7.3× as long as wide; antenna black, shiny, F5, F6 and clava white in *H. scymnivorus*).

Etymology

The species epithet is a Latin adjective in reference to its island type locality

Homalotylus montanus Krishnachaitanya and Manickavasagam, sp. nov. (Figure 3)

Female

Holotype. Length, 2.1 mm. Body dark brown with metallic violet reflections (Figure 3a)). Head dark with metallic greenish blue reflections, ocelli transparent; eyes with silvery white setae. Antenna with radicle, scape, pedicel and F1–F3 dark black; F4 ventrally light brown, dorsally white; F5–F6 and clava white. Mesosoma dark with greenish-blue reflections on mesoscutum; pronotum, axillae and scutellum with dark setae, mesoscutum with dark setae and also setae with dark base and silvery white apices; tegula in basal half white, apical half dark brown to black. Fore wing with infusate band below venation, sub-basally and apically hyaline; hind wing hyaline; legs dark brown, except mid tarsi 1–4 segments and mid tibial spur white. Metasoma dark brown, ovipositor brownish yellow.

Head in frontal view slightly longer than wide (55:51); in frontal view, eye 1.85× as high as wide; head with imbricate sculpture; mandible with 3 acute teeth. Antenna (Figure 3b)) with scape slender, 6.5× as long as wide; pedicel 2.4× as long as wide; funicle width gradually increasing, F1 1.5× as long as wide, longer than F2–F6 individually, F6 quadrate; clava obliquely truncate, 2.25× as long as wide. *Measurements*: head height:width, 55:51; eye height:width, 39:21; frontovertex width 9; POL 3.5; OOL 0.5; OCL 4; AOL 7; scape length:width, 39:6; pedicel length:width, 12:5; funicle length:width, F1, 7.5:5; F2, 6:5; F3, 6:5.2; F4, 6:5.5; F5, 6:5.8; F6, 6:6; clava length:width, 18:8.

Mesosoma 1.3× as long as wide; mesoscutum 1.2× as wide as long; scutellum 1.1× as wide as long. Pronotum and mesoscutum with imbricate, axillae and scutellum with punctate-reticulate sculpture. Fore wing (Figure 3c)) 2.8× as long as wide; costal cell 14× as long as wide; marginal vein as long as wide; stigmal vein 1.2× as long as postmarginal vein. Mid tibia 1.6× as long as mid tibial spur; mid tibial spur 1× as long as mid basitarsus; mid tibial spur serrate; mid basitarsus with 23 pegs. *Measurements*: mesosoma length:width, 60:45; mesoscutum length:width, 27:45; scutellum length:width, 30:33; forewing length:width, 164:58; costal cell length:width, 70:5; marginal vein length:width, 3:3; postmarginal vein length 11; stigmal vein length 13; mid tibia length 45; mid basitarsus length 26; mid tibial spur length 28.

Metasoma with posterior margin of T1 more or less straight; posterior margin of T2–T5 convex; T6 with posterior margin concave; syntergum medially, broadly V-shaped. T2–T4 each with an anterior, median incision. Hypopygium extending to apex of gaster; ovipositor (Figure 3d)) exerted, 2× as long as mid tibia. *Measurements*: metasoma length 80; exerted ovipositor length 28; ovipositor length 90.

Figure 3. *H. montanus* F#: (a) Habitus image, (b) antenna, (c) fore wing, (d) ovipositor.

Material examined

Holotype, f# (on slide under 4 cover slips) labelled 'INDIA: Tamil Nadu, Salem, Yercaud, (N11 48.84, E078 12), 08.iii.2014, YPT, Krishnachaitanya, T. and S. Palanivel' (EDAU, Registration No. Enc/008/2015).

Host

Unknown.

Male

Unknown.

Comments

This species is similar to *H. agarwali* in having the ovipositor exerted, antennal scape less than 8× as long as wide, not constricted at middle, and hind tarsus dark brown, but differs from it in having ovipositor 2× as long as mid tibia; pedicel 2.4× as long as wide; F1–F3 dark black; F4 dorsally white, ventrally light brown; F5–F6 and clava white; (ovipositor 1.03× as long as mid tibia; pedicel 2.16× as long as wide; F1 dark brown, F2 dark brown but paler than F1; F3–F6 and clava white in *H. agarwali*).

Etymology

The species name is a Latin adjective in reference to the hilly terrain of the type locality.

Homalotylus varicolorus Krishnachaitanya and Manickavasagam, sp. nov.
(Figure 4)

Female

Holotype. Length, 1.31 mm. Body yellow to brown (Figure 4a)). Head with frontovertex brownish yellow, interantennal prominence yellow, ocelli dark brown. Antenna with radicle, scape and pedicel yellow, F1–F4 light brown, F5 ventrally light brown, dorsally white, F6 and clava white. Mesosoma with pronotum yellowish brown, mid lobe of mesoscutum dark brown with green tinge, lateral lobe yellowish brown, axillae and scutellum yellow, metanotum and propodeum brown; tegula basally white, apically light brown. Fore wing infusate from parastigma to end of venation and beyond, basally and apically hyaline. Legs whitish yellow except dorsum of hind femur (pale brown) and hind tibia brown, all tarsi white except apical tarsomere dark brown. Metasoma brownish yellow, hypopygium and ovipositor yellow to light brown.

Head in frontal view slightly longer than wide (42:40); eye in frontal view 1.2× as high as wide; head with polygonally reticulate sculpture; mandible with 3 acute teeth. Antenna (Figure 4b)) with scape slender, 7.2× as long as wide; pedicel 2.75× as long as wide; funicle width gradually increasing, F1 1.3× as long as wide and slightly longer than F2–F6, F6 quadrate; clava obliquely truncate, 3.3× as long as wide. *Measurements:* head height:width, 42:40; eye height:width, 25:15; frontovertex width 10; POL 2; OOL 0; OCL 4; AOL 4.5; scape length:width, 36:5; pedicel length:width, 11:4; funicle length:width, F1, 6.5:5; F2, 6:5; F3,6:5; F4,6:5.5; F5, 6:6; F6, 6:6.5; clava length:width, 20:6.

Figure 4. *H. varicolorus* F#: (a) Habitus image, (b) antenna, (c) fore wing, (d) ovipositor.

Mesosoma 1.4× as long as wide; mesoscutum 1.7× as wide as long; scutellum 1.2× as wide as long; pronotum and mesoscutum with polygonal reticulate, axillae and scutellum with punctate-reticulate sculpture. Fore wing (Figure (4c)) 3.2× as long as wide; costal cell 18× as long as wide; marginal vein slightly longer than wide; stigmal vein 1.8× as long as postmarginal vein. Mid tibia 2.5× as long as mid tibial spur; mid tibial spur 1.2× as long as mid basitarsus; mid tibial spur serrate; mid basitarsus with 24 pegs. *Measurements*: mesosoma length:width, 40:29; mesoscutum length:width, 17:29; scutellum length:width, 18:21; forewing length:width, 144:45; costal cell length:width, 63:3.5; marginal vein length:width, 6:3; postmarginal vein length 6; stigmal vein length 11; mid tibia length 47; mid basitarsus length 16; mid tibial spur length 19.

Metasoma with posterior margin of T1 bilaterally convex; posterior margin of T2–T3 more convex and T4 slightly convex; T5 and T6 posterior margin concave; syntergum with posterior margin more or less straight; T4–T6 each with an anterior, median incision. Hypopygium extending to apex of gaster; ovipositor (Figure (4d)) exerted, 2.2× as long as mid tibia. *Measurements*: metasoma length 35; exerted ovipositor length 40; ovipositor length 103.

Male

Similar to female (Figure (5a)), except F1–F4 light brown, F5–F6 and clava white (Figure (5b)); scape 6.6× as long as wide with a median concavity on dorsal surface; pedicel 2.2× as long as wide; clava 3.3× as long as wide. *Measurements*: scape length:width, 33:5; pedicel length:width, 10:4.5; clava length:width, 18:5.5; genitalia (Figure (5c)) length, 27.

Material examined

Holotype, 1 f# (on card) labelled 'INDIA: Bihar, Banka, Bounsi (N25.14° E86.56°), 08.i.2015, YPT, Abhinav Kumar' (EDAU, Registration No. Enc/009/2015).

Paratype. 1 f# (on slide under 4 cover slips) with same data as holotype (EDAU, Registration No. Enc/007P/2015).

Male

1 (on card) labelled 'INDIA: Bihar, Banka, Bounsi (N25.14° E86.56°), 08.i.2015, YPT, Abhinav Kumar' (EDAU, Registration No. Enc/007M/2015).

Host

Unknown.

Comments

This species is similar to *H. noyesi* in having the ovipositor exerted, scape 7× as long as broad and F1–F4 light brown, F6 and clava white, but differs from it as given below: ovipositor 2.2× as long as mid tibia; pedicel 2.75× as long as wide; fore wing 3.2× as long as wide; clava 3.3× as long as wide; head frontally 1.05× as long as wide; (ovipositor 1.5× as long as mid tibia; pedicel 2.25× as long as wide; fore wing 2.8× as long as wide; clava length 2.7× as long as wide; head frontally 0.92× as long as wide in *H. noyesi*).

Etymology

The species epithet is a Latin noun in reference to the numerous colours on the body.

Figure 5. *H. varicolorus* M#: (a) Habitus image, (b) antenna, (c) genitalia.

***Homalotylus noyesi* Krishnachaitanya and Manickavasagam, sp. nov.**
(Figure 6)

Female

Holotype. Length, 1.51 mm. Body orange yellow to brown (Figure (6a)). Head with frontovertex and scrobal cavity metallic yellow, between ocellar triangle dusky brown, ocelli transparent; eye with silvery white setae. Antenna with radicle, scape and pedicel yellow to light brown, F1–F4 dorsally brown, ventrally light brown, F5–F6 and clava white. Mesosoma, dorsal view of mesosoma shiny brownish yellow; pronotum medially light brown, laterally metallic yellow, mid lobe of mesocutum light brown, lateral lobes yellow with silvery white setae; tegula in basal half white, apical half light brown; scutellum yellow with dark brown setae; propodeum medially yellowish brown, laterally light brown; mesopleuron yellowish with a descending brown band. Fore wing basally infusate, followed by hyaline area till middle 1/3, with a brown band in middle 1/3, apical 1/3 lightly infusate; hind wing hyaline. Legs with all coxae and trochanters white; fore and middle femur white, dorsally brown; fore tibia yellow, mid tibia dorsoventrally white, laterally brown, hind tibia ventrally dark brown, dorsally white; fore tarsi yellow, middle and hind tarsus white. Metasoma dorsally brown, laterally and ventrally yellowish brown with base whitish; hypopygium yellowish brown, ovipositor sheath yellow.

Head in frontal view broader than high (39:36); eye in frontal view 1.2× as high as wide; frontovertex with scattered polygonal reticulate sculpture, interantennal prominence, antennal scrobes with imbricate sculpture; mandible with 3 acute teeth. Antenna (Figure (6b)) with scape slender, 7× as long as wide; pedicel 2.25× as long as wide; funicle length and width gradually increasing, F1 1.1× as long as wide and F2–F6 quadrate; clava obliquely truncate, 2.7× as long as wide. *Measurements*: head height: width, 36:39; eye height:width, 17:14; frontovertex width 11; POL 3; OOL 0; OCL 2.5; AOL 3.5; scape length:width, 28:4; pedicel length:width, 9:4; funicle length:width, F1, 4:3.5; F2, 4:4; F3,4:4; F4,4.5:4.5; F5, 4.5:4.5; F6, 4.5:4.7; clava length:width, 16:6.

Mesosoma 1.4× as long as wide; mesoscutum 1.6× as wide as long; scutellum 1× as long as wide; pronotum and mesoscutum with imbricate, axillae and scutellum with punctate-reticulate sculpture. Fore wing (Figure (6c)) 2.8× as long as wide; costal cell 14.7× as long as wide; marginal vein slightly longer than wide; stigmal vein 1.5× as long as postmarginal vein. Mid tibia 2.6× as long as mid tibial spur; mid basitarsus with 14 pegs and as long as mid tibial spur; mid tibial spur serrate. *Measurements*: mesosoma length:width, 40:29; mesoscutum length:width, 18:29; scutellum length:width, 23:22; forewing length:width, 101:36; costal cell length: width, 44:3; marginal vein length:width, 3.5:2.5; postmarginal vein length, 5, stigmal vein length, 7.5; mid tibia length, 42; mid basitarsus length, 16; mid tibial spur length, 16.

Metasoma with posterior margin of T1–T3 convex; T4 posterior margin slightly convex; T5 with posterior margin more or less straight and T6 concave; syntergum medially, broadly V-shaped; T2–T6 each with an anterior, median incision. Hypopygium extending to apex of gaster; ovipositor (Figure (6d)) exerted, 1.5 × as long as mid tibia. *Measurements*: metasoma length 53; exerted ovipositor length, 20; ovipositor length, 64.

Figure 6. *H. noyesi* F#: (a) Habitus image, (b) antenna, (c) fore wing, (d) ovipositor.

Material examined

Holotype, 1 f# (on slide under 4 cover slips) labelled 'INDIA: Bihar, Banka, Bounsi (N25.14° E86.56°), 08.i.2014, YPT, Abhinav Kumar' (EDAU, Registration No. Enc/010/2015).

Host

Unknown.

Male

Unknown.

Comments

This species is similar to *H. varicolorus* in having the ovipositor exerted, scape 7× as long as broad and F1–F4 light brown, and F6 and clava white, but differs in the following characters: ovipositor 1.5× as long as mid tibia; pedicel 2.25× as long as wide; fore wing 2.8× as long as wide; clava length 2.7× as long as wide; head frontally 0.9× as long as wide; stigmal vein 1.5× as long as postmarginal vein (ovipositor 2.2× as long as mid tibia; pedicel 2.75× as long as wide; fore wing 3× as long as wide; clava 3.3× as long as wide; head frontally 1× as long as wide; stigmal vein 1.8× as long as post marginal vein in *H. varicolorus*).

Etymology

This species is named after the encyrtid specialist Dr. John. S. Noyes of the NHM, London.

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No potential conflict of interest was reported by the authors.

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References

- Anis SB, Hayat M. 1998. The Indian species of *Homalotylus* (Hymenoptera: Encyrtidae). *Oriental Insects*. 32:191–218.
- Domenichini G. 1957. Contributo all conoscenza dei parassiti e iperparassiti dei Coleoptera Coccinellidae. *Bollettino di Zoologia agraria e Bachicoltura*, Milan. 22:215–246.

- Hayat M. 1985. Family Encyrtidae. The Chalcidoidea (Insecta: Hymenoptera) of India and the adjacent countries. Subba Rao BR, Hayat M, editors. Oriental Insects. 19:192–223.
- Hayat M. 2006. *Indian Encyrtidae (Hymenoptera: Chalcidoidea)*. Viii+496pp. Published by M. Hayat. India: Department of Zoology, Aligarh Muslim University.
- Klausnitzer B. 1976. Katalog der Entomoparasiten der mitteleuropäischen Coccinellidae. *Studia Entomologica Forestalia*. 2:121–130.
- Mayr G. 1876. Die europäischen Encyrtiden. *Verhandlungen Der Zoologisch-Botani-schen Gesellschaft in Wien*. 25:675–778.
- Noyes JS. 2010. Encyrtidae of Costa Rica (Hymenoptera: Chalcidoidea), 3. Subfamily Encyrtinae: Encyrtini, Echthroplexiellini, Discodini, Oobiini and Ixodiphagini, parasitoids associated with bugs (Hemiptera), insect eggs (Hemiptera, Lepidoptera, Coleoptera, Neuroptera) and ticks (Acari). *Memoirs Am Entomol Inst*. 84:848pp.
- Noyes JS (2015) Universal Chalcidoidea Database. World Wide Web electronic publication; [cited 20 May 2015]. Available from: <http://www.nhm.ac.uk/chalcidoids>
- Noyes JS, Hayat M. 1984. A review of the genera of Indo-Pacific Encyrtidae (Hymenoptera: Chalcidoidea). *Bulletin of the British Museum (Natural History) (Entomology)*. 48:131–395.
- Tachikawa T. 1963. Revisional studies on the Encyrtidae of Japan (Hymenoptera: Chalcidoidea). *Memoirs of Ehime Univ*. 9:1–264.
- Trjapitzin VA. 1989. Parasitic Hymenoptera of the Fam. Encyrtidae of Palaearctics. *Opredeletelipo Faune SSSR, Izdavavaemiye Zoologiya In – Tom SSSR*. 158:1–489. [In Russian]
- Trjapitzin VA. 2011. On species of the genus *Homalotylus* Mayr, 1876 (Hymenoptera: Encyrtidae) from the Russian Far East. *Far Eastern Entomologist*. 231:1–4.
- Walker F. 1838. *Monographia Chalciditum*. *Entomologist's Magazine*. 5:35–55, 102–118, 418–431, 518.
- Xu Z, He J. 1997. Notes on four new species of *Homalotylus* Mayr (Hym.: Encyrtidae). *Wuyi Sci J*. 13:85–93.