

Research Article

First record of family Xenasteiidae (Diptera: Brachycera: Cyclorrhapha) from India in association with *Aleurodicus rugioperculatus* Martin (Hemiptera: Aleyrodidae) with cautionary notes on associated parasitoids

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ABSTRACT: First ever record of family Xenasteiidae (Diptera: Brachycera: Cyclorrhapha) from mainland India is provided. Most of the previous records of this family are from coastal sites, as they have usually been found on islands in the Indian and Pacific Oceans. For the first time biology and life stages of *Xenasteia* are illustrated. *Xenasteia* members were found associated with an exotic rugose spiraling whitefly (RSW) colony of *Aleurodicus rugioperculatus* Martin (Hemiptera: Aleyrodidae) in the coastal areas of Karnataka in southern India, however no direct obligate association could be diagnosed. Also for the first time *Ooencyrtus* sp. (Hymenoptera: Encyrtidae) was recorded from the genus *Xenasteia* as its solitary parasitoid. Worldwide, this is the first ever report of parasitism associated with any member of this little-known family Xenasteiidae.

KEY WORDS: India, new record, Xenasteiidae

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INTRODUCTION

In an interesting and strange sighting of an exotic rugose spiraling whitefly (RSW) colony of *Aleurodicus rugioperculatus* Martin (Hemiptera: Aleyrodidae) from the coastal areas of Karnataka in southern India, a pristine association of RSW along with members of genus *Xenasteia* Hardy, belonging to the little-known family Xenasteiidae (Diptera: Brachycera: Cyclorrhapha), were discovered. This is the first ever record of family Xenasteiidae from mainland India. Most of the previous records of this family (10 species) are from coastal sites, as they have usually been found

On islands in the Indian and Pacific Oceans (Hawaiian Islands: Oahu; Marshall Islands: Bikini; Marianas: Guam, Saipan and Anatahan; Society Islands: Tahiti; Tuamotu Islands: Mangareva; Western Caroline Islands—Palau Islands: Angaur, Peleliu and Koror, Yap; Ryukyu Islands: Okinawa; Malaya: Pangkor Island, Perak and Indian Ocean: Aldabra, Mahe, Seychelles and Diego Garcia (Hardy, 1980).

The recent invasive pest rugose spiraling whitefly was found infesting coconut, banana, custard apple, mango, sapota, guava and several ornamental plants in Karnataka, Tamil Nadu, Andhra Pradesh and Kera-

la in India (Selvaraj *et al.*, 2016; Sundararaj and Selvaraj, 2017; Selvaraj *et al.*, 2017). On the lookout for the spread of this invasive pest various host plants were targeted. Interestingly, a plant of *Calophyllum inophyllum* L. (Calophyllaceae) commonly known as Indian laurel, severely infested with RSW was noticed. The infested leaves were found supporting few members of *Xenasteia*. In the present study for the first-time biology and life stages of *Xenasteia* are illustrated and the

details of first ever record of family Xenasteiidae from Indian mainland is provided.

MATERIALS AND METHODS

During the surveys undertaken in the first and last week of April, 2017 in and around the Malpe beach, Udupi, Karnataka, which is an important port and fishing harbor on the Karnataka coast, a plant of



Fig. 1. *Calophyllum inophyllum* L. A, Host plant in habitus view. B & C, Leaves infested with *Aleurodicus rugioperculatus* and *Xenasteia* sp.

C. inophyllum severely infested with RSW was noticed (Fig. 1A). On a much closer observation some debris aggregates were noticed on few leaves (Fig. 1B–C). The infested material was brought to the ICAR- National Bureau of Agricultural Insect Resources, Bengaluru laboratory for further observations. Images were taken with a Leica M 205 A stereozoom microscope with Leica DC 420 inbuilt camera using automontage soft-

ware (version 3.8). The images of host were taken with Sony DSLR-A100 Camera. The material examined was deposited at the ICAR-NBAIR insect repository.

Genus *Xenasteia* Hardy

Figs 2A–C

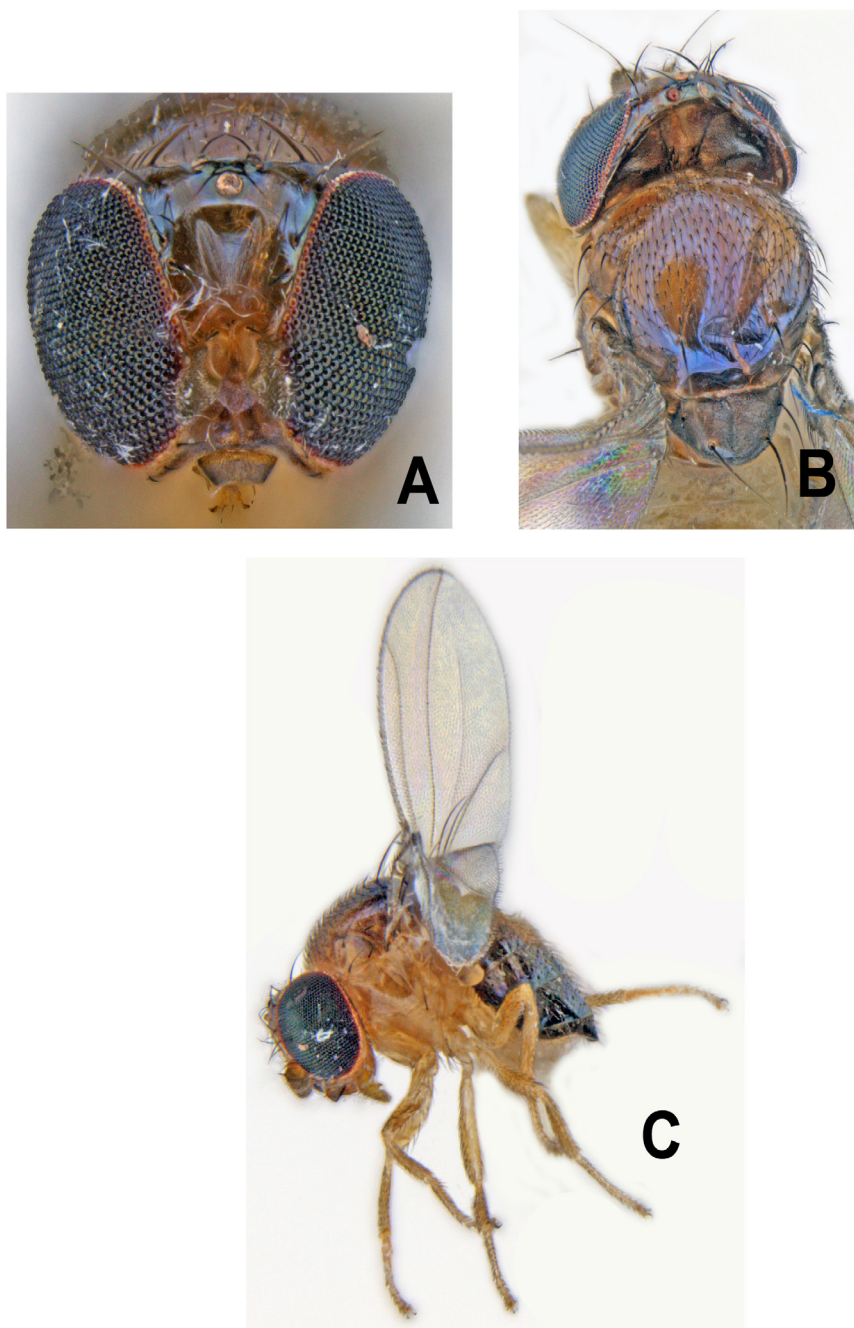


Fig. 2. *Xenasteia* sp. A. Head in frontal view, B. Head & mesosoma in dorsal view, C. Adult in habitus.

Diagnosis. Follows Hardy (1980).

Specimens examined: 5 males and females, INDIA, Karnataka, Udupi, Malpe beach, 6–8/iv/17 and 28–29/iv/17, 13.3555° N, 74.7044° E, on host *Calophyllum inophyllum* L. (Calophyllaceae), coll. K. Selvaraj, code - NBAIR/Dip/Xen/8417, 28417 (NBAIR).

Distribution: India, Karnataka: Udupi.

Biology (Figs 3A–E). The eggs of *Xenasteia* are white in colour, oval in shape with elongated streaks and slightly tilted to one side at apical end, and measure 500 μ m long. They were laid loose on the leaf surface. On an average two females when mated with a single male laid 25 eggs when fed with 50% honey after an incubation period of two days. Eggs hatched in 3–4 days after oviposition. The larvae are sluggish with a coat of debris and remnants of egg case on its

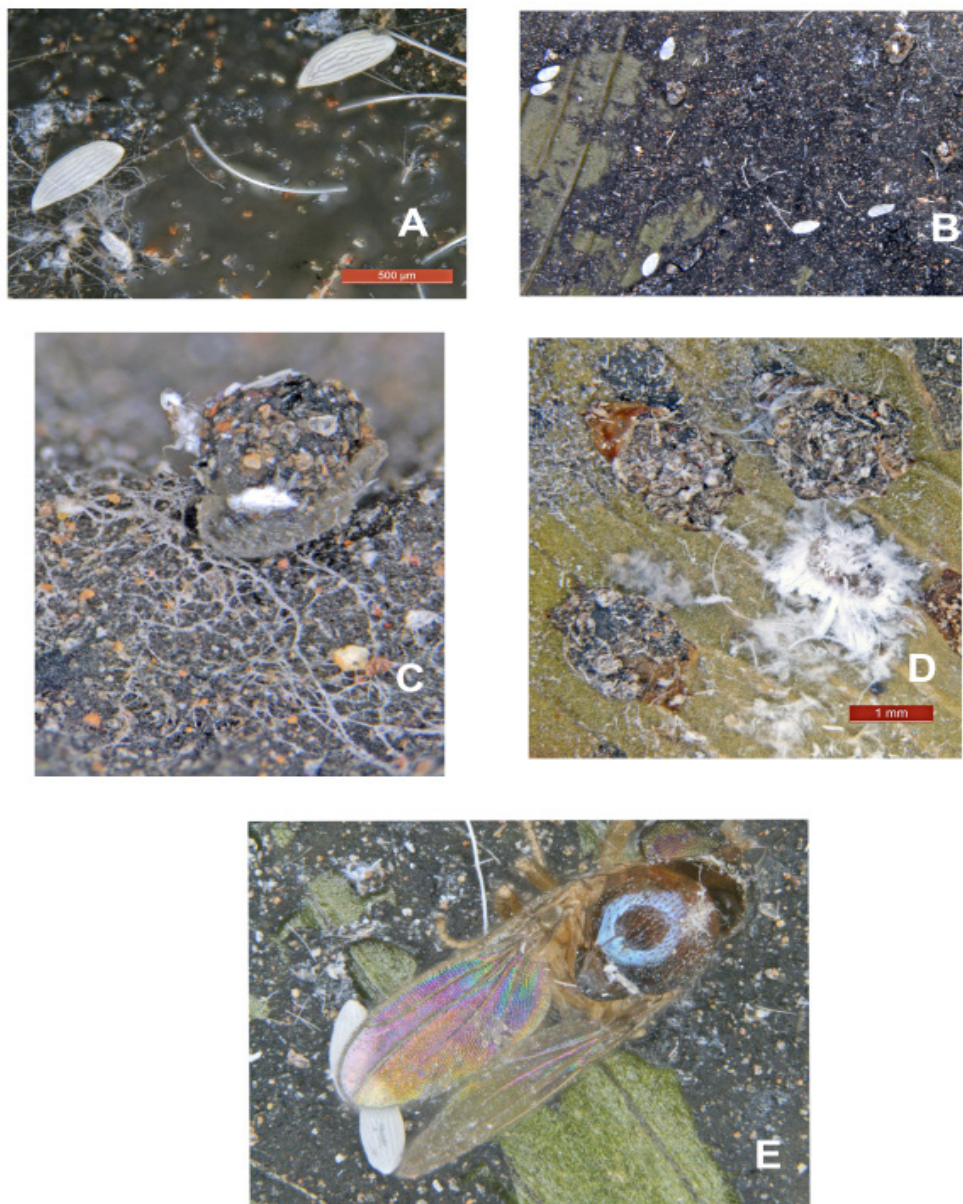


Fig. 3. Life stages of *Xenasteia* sp. A & B. Eggs, C. Larva feeding on fungal hyphae & sooty mould, D. Pupae, E. Adult fly.

dorsal surface, presumably for protection/camouflage. Larvae were observed feeding on sooty mould/fungal hyphae. Larval duration ranged from 9–10 days. The pupal stage lasts about 9–10 days. The average

life span from oviposition to adult emergence is 25 ± 2 days. The adult fly survived for one and a half month on 50% honey diet.

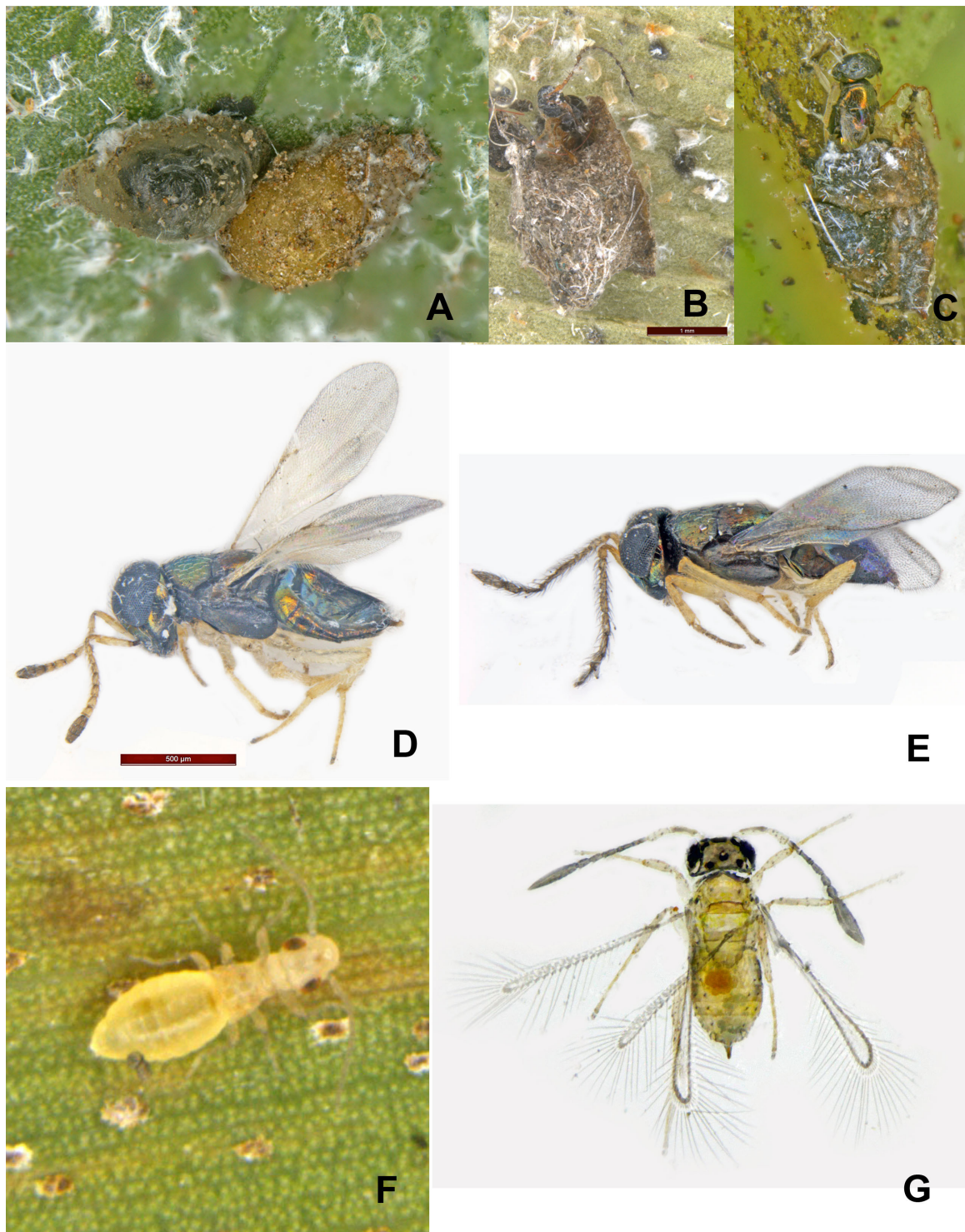


Fig. 4. A. *Xenasteia* puparia, B. male *Ooencyrtus* sp. emerging from pupa, C. Female *Ooencyrtus* sp. emerging from pupa, D. Female *Ooencyrtus* sp. E. Male *Ooencyrtus* sp. F. Psocid, G. *Alaptus* sp.

Host: The host plant *Calophyllum inophyllum* L. (Calophyllaceae) is native from East Africa, southern coastal India to Malaysia and Australia.

Comments: *Xenasteia* larvae develop on the naturally occurring organic debris deposited on the beaches (Papp, 1998). In our study, the rugose spiralling whitefly colony provided congenial environment for the development of *Xenasteia* on the leaves of *C. inophyllum* due to the sooty mould formed because of the honey dew secretion by the whitefly colony. The elevated humidity on the beach side was an added advantage for the development of *Xenasteia*.

Cautionary notes on parasitoids found in RSW niche

So, far only two species of parasitic wasps have been found to be directly associated with RSW in India- *Encarsia guadeloupae* Viggiani and *E. dispersa* Polaszek (Hymenoptera: Aphelinidae) (Poorani & Thanigairaj, 2017 and Selvaraj *et al.*, 2017).

In the present study, the parasitized puparia of *Xenasteia* were isolated carefully from the RSW colony to avoid confusion (Fig. 4A). For the first time *Ooencyrtus* sp. (Hymenoptera: Encyrtidae) (Fig. 4B,C) was recovered from the genus *Xenasteia* as its solitary parasitoid. A single wasp individual emerged from each parasitized pupa (Fig. 4D,E). Worldwide, this is the first ever report of parasitism associated with any member of this little-known family Xenasteiidae.

Also, *Alaptus* (Hymenoptera: Mymaridae) (Fig. 4G) was found emerging from the container with host leaves containing RSW colony and few members of Coccoidea. Since psocids were also recovered (Fig. 4F) hence it is presumed that there were Psocoptera eggs hidden somewhere on the host leaves. For the genus *Alaptus*, all the reliable records are from Psocoptera

(pers. comm. John Huber).

A word of caution is given to the researchers working on this pest to carefully examine the RSW colony as many other hosts share the same niche hence the parasitoids emerging need not necessarily be from RSW.

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spiraling whitefly *Aleurodicus rugioperculatus* Martin (Hemiptera: Aleyrodidae) along with parasitoids in Karnataka. *J Biol Control* **31**(2): 74–78. Crossref.

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A new species of *Ooencyrtus* Ashmead (Hymenoptera: Encyrtidae), parasitoid on pupae of *Xenasteia* sp. (Diptera: Xenasteiidae) from Karnataka, India

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Abstract

A new species of *Ooencyrtus* Ashmead (Hymenoptera: Encyrtidae), *O. xenasteiae* Hayat & Gupta, **sp. nov.**, is described. This species was reared from the pupae of a *Xenasteia* sp. (Diptera: Xenasteiidae), a sooty mould scavenger found associated with the recent invasive rugose spiralling whitefly, *Aleurodicus rugioperculatus* Martin (Hemiptera: Aleyrodidae) from coastal Karnataka, India.

Key words: Encyrtinae, mycophagous diptera

Introduction

The species of *Ooencyrtus* Ashmead (Hymenoptera: Encyrtidae: Encyrtinae) attack groups with many economically important species mainly from Lepidoptera, Hemiptera, Coleoptera, and occasionally from Neuroptera and Diptera. There are four species of *Ooencyrtus* recorded from Diptera; three species (*O. dipterae* (Risbec), *O. guamensis* Fullaway, *O. syrphidis* Noyes) from 7 species of the family Syrphidae, and one species (*O. sorkula* Noyes) from Drosophilidae (Prinsloo, 1987; Huang & Noyes, 1994; Noyes, 2010). Some encyrtid species in the genera *Bothriothorax* Ratzeburg, *Pseudencyrtus* Ashmead, *Cerchysius* Westwood, *Homalotylus* Mayr, *Syrphophagus* Ashmead, *Agromyzaphagus* Gahan, and *Agarwalencyrtus* Hayat are recorded from Syrphidae, Chamaemyiidae, Chloropidae, Cecidomyiidae, Drosophilidae, Phoridae, and Pipunculidae, but the majority of these are from the Palaearctic region (Trjapitzin, 1989).

Recently, in a rare and an interesting sighting, a few members belonging to the genus *Xenasteia* Hardy, of the little-known family Xenasteiidae (Diptera: Brachycera: Cyclorhapha) were discovered as sooty mould scavengers in association with the invasive rugose spiralling whitefly *Aleurodicus rugioperculatus* Martin (Hemiptera: Aleyrodidae) on *Calophyllum inophyllum* L. (Calophyllaceae), commonly known as Indian laurel, from the coastal areas of Karnataka in southern India. Presence of black sooty mould development on upper surfaces of the infested plants is one of the characteristic symptoms of the feeding damage by *A. rugioperculatus* which draws prompt attention. *Ooencyrtus* sp. (Hymenoptera: Encyrtidae) was reared from the pupae of *Xenasteia* as its solitary parasitoid from the same host plant infested with *A. rugioperculatus*. This was the first ever record of Xenasteiidae from mainland India along with its parasitism (Gupta *et al.* 2017).

In the present study, a new species of *Ooencyrtus* (*O. xenasteiae* Hayat & Gupta, **sp. nov.**), is described and illustrated from the host genus *Xenasteia* based on both sexes.

Material and methods

Collection site. During the first and last week of April 2017, surveys were conducted on *A. rugioperculatus* in and around Malpe beach, Udupi, Karnataka (13.35° N, 74.70° E), which is an important port and fishing harbour on the

Karnataka coast. A plant of *C. inophyllum* severely infested with *A. rugioperculatus* and with sooty mould deposition was discovered and collected by KS. Upon closer observation, some debris-like aggregates, which were later identified as puparia of *Xenasteia*, were noticed on the leaves along with the *A. rugioperculatus* colony. The infested leaves were brought to ICAR-National Bureau of Agricultural Insect Resources, Bengaluru laboratory, where the complete biology of the pest is being studied under laboratory condition. Puparia of *Xenasteia* were isolated from the *A. rugioperculatus* colony and kept in glass test tubes with damp sooty moulded leaves of *C. inophyllum*.

Description. Hayat (2006) is followed for terminology except for the use of the terms mesosoma for the thorax plus propodeum, and metasoma for the petiole plus gaster. Only body lengths are given in millimetres; all other measurements are relative, taken from the divisions of a linear scale micrometer placed in the eyepiece of a stereozoom binocular microscope at 10× Zoom 8 (one micrometer division = 0.01234 mm) for card-mounted specimens, and placed in the eyepiece of a compound microscope at 100× magnification (one micrometer division = 0.00987 mm), for slide-mounted parts.

Details of microscopes used for imaging: figures 1, 3 and 13, Leica M 205 A stereozoom microscope with a Leica DC420 inbuilt camera using automontage software (version 3.8); figures 2 and 4, Nikon SMZ25 Stereozoom binocular microscope with a digital camera; figures 5–12 and 14–16, Leica DM2500 compound microscope with a Leica DFC295 digital camera.

The following abbreviations are used in the text:

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

OCL = Minimum distance between the posterior ocellus and the occipital margin.

POL = Minimum distance between the posterior ocelli.

TI, TII, etc. = Tergites 1, 2, etc. of gaster.

The following acronyms are used for the depositories:

NBAIR = ICAR-National Bureau of Agricultural Insect Resources, Bengaluru, India.

ZDAMU = Insect Collections, Department of Zoology, Aligarh Muslim University, Aligarh, India.

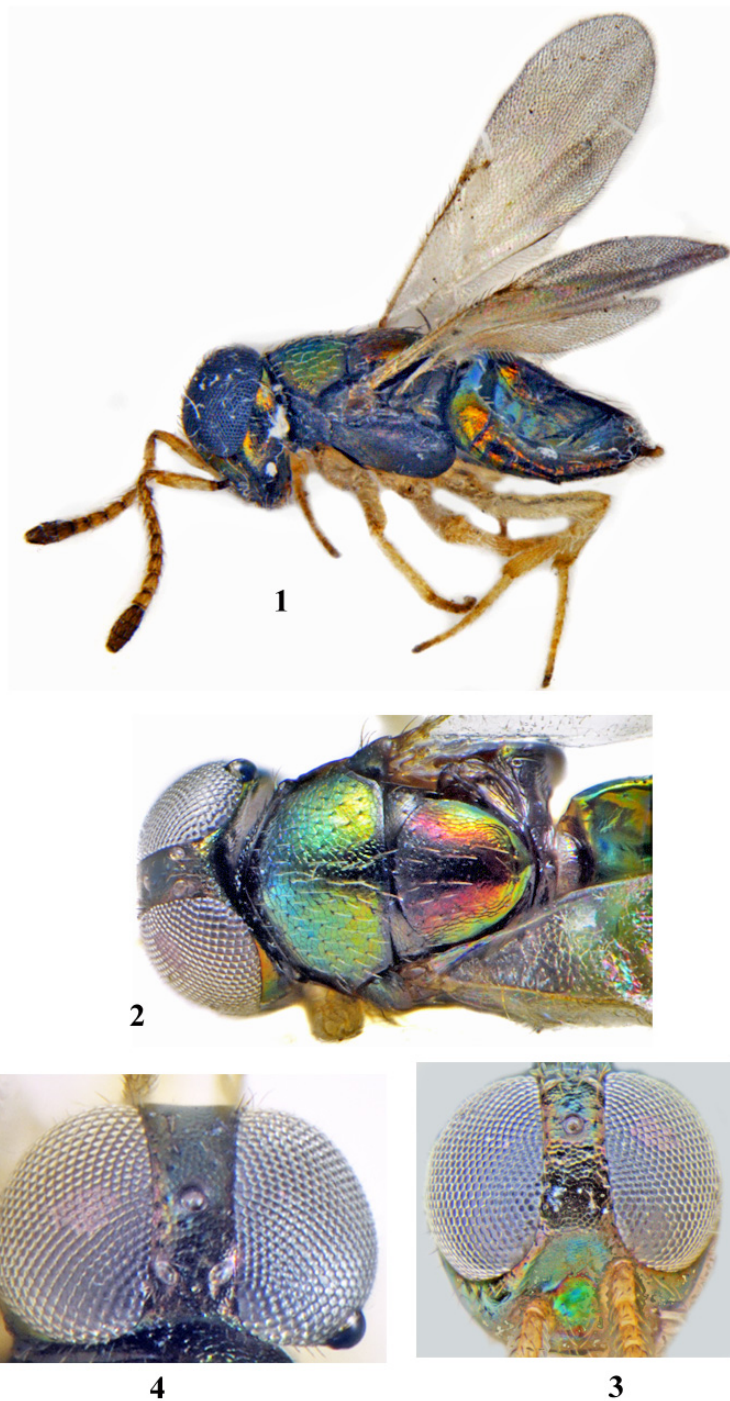
Taxonomy

Ooencyrtus xenasteiae Hayat & Gupta, sp. nov.

(Figures 1–20)

Female. Holotype. Length, 1.23 mm (gastral tergites slightly stretched). (Paratypes, 1.14–1.19 mm). Female habitus as in Fig. 1; body with metallic shine. Head with frontovertex dull purple, anteriorly light bluish; face and scrobes bluish; malar space largely dull purple with some greenish shine. Antenna with radicle dark brown; scape off-white with very pale brown infuscation distally; pedicel off-white, pale brown basally; funicle segments with some pale brown infuscation on F2 onwards; clava nearly dark brown. Mesosoma with pronotum dark brown; mesoscutum bluish green; scutellum largely purple, with sides and apex narrowly bluish green; tegula dark brown; propodeum with sides distal to spiracles light bluish. Wings hyaline. Legs, including coxae, off-whitish to yellowish. Gaster with TI bluish; other tergites light bluish with some violet shine; third valvula dark brown.

Head, in dorsal view (Fig. 4), with occipital margin narrow; eye slightly over-reaching occipital margin posteriorly; frontovertex width 0.2× head width; ocellar triangle with apical angle acute; POL less than OCL (2.5:3.5); head, in frontal view (Fig. 3), very slightly broader than high; scrobes inverted U-shaped, with margins rounded; eye height 2.08× malar space; frontovertex with slightly raised, polygonal reticulate sculpture, with the cells small; sculpture on face fine; malar space with elongate reticulate sculpture; setae on head white; eye with setae hyaline, each seta shorter than a facet diameter. Mandible (Fig. 5) with two teeth and a small truncation which may be rounded. Antenna (Fig. 6) with scape nearly 6× as long as broad, and 1.25× as long as clava; F1–F5 each longer than broad, F6 quadrate to slightly longer than broad; clava about as long as F4–F6 combined. *Relative measurements* (holotype, card): head dorsal width, 34; head frontal height, 33; frontovertex width, 7; eye height, 25; malar space, 12.



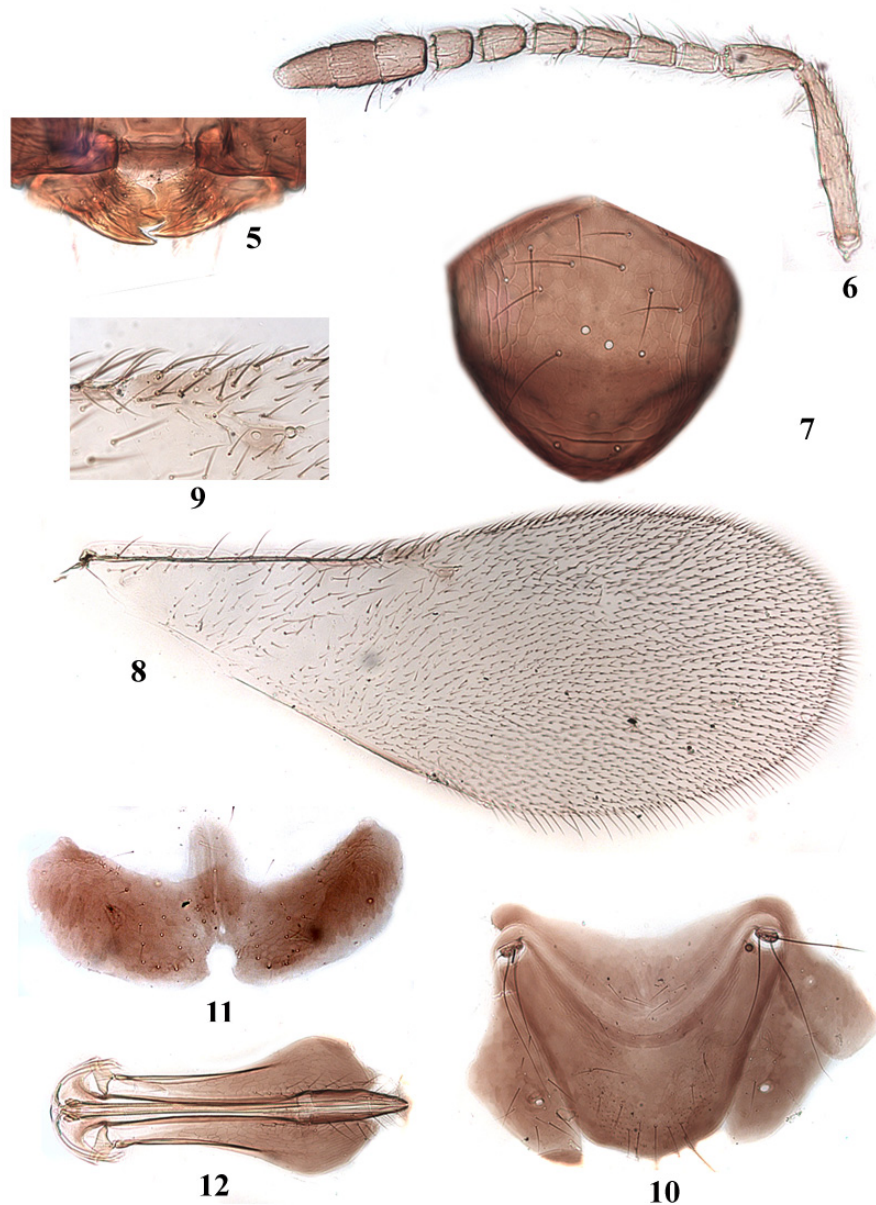
FIGURES 1–4. *Ooencyrtus xenasteiae* Hayat & Gupta, **sp. nov.** 1, female, lateral view, paratype. (2–4) Holotype, female: 2, head and mesosoma, dorsal view; 3, head, frontal view; 4, head, dorsal view.

Mesosoma (Fig. 2). Mesoscutum with regular, slightly raised, polygonal reticulate sculpture; scutellum largely with fine, hardly visible in slide mount, polygonal reticulate sculpture, in about one-fifth on each side with slightly raised, elongate reticulations, sides and apex narrowly smooth (Figs 2, 7); setae on pronotal collar, and mesoscutum (except 4 or 5 longer brown setae along posterior margin), white; on axilla and scutellum setae pale brown; propodeum distal to spiracles with seven silvery white setae. Fore wing $2.6\times$ as long as broad, linea calva closed posteriorly by one or two lines of setae; basal cell bare; marginal vein nearly $2\times$ as long as postmarginal vein, and slightly shorter than stigmal vein (Figs 8, 9, from slide EH.2337). Hind wing $5.53\times$ as long as broad. Mid tibia $2.76\times$ as long as mid basitarsus; mid tibial spur $0.69\times$ mid basitarsus length. *Relative measurements* (paratype,

slide, EH.2336): fore wing length (width), 96 (36.5); hind wing length (width), 68 (15); mid tibia length, 36; mid basitarsus length, 13; mid tibial spur length, 9.

Metasoma. Gaster subequal in length to mesosoma; ovipositor with second valvifer $2.57\times$ as long as third valvula; TVII, hypopygium and ovipositor as in Figs 10–12. *Relative measurements* (paratype, slide, EH.2336): TVII length (width), 30 (31); ovipositor length, 50; third valvula length, 14. [Ovipositor $1.38\times$ as long as mid tibia; third valvula slightly longer than mid basitarsus, and $1.55\times$ as long as mid tibial spur.]

Male. Length, 0.75 mm. Similar to female, except for head dimensions, antennal structure and genitalia. Male habitus as in Fig. 13.



FIGURES 5–12. *Ooencyrtus xenasteiae* Hayat & Gupta, **sp. nov.** Paratypes, females: 5, mandibles; 6, antenna; 7, scutellum; 8, fore wing; 9, distal veins of fore wing; 10, TVI and TVII of gaster; 11, hypopygium; 12, ovipositor. (Figures 8 and 9 from slide EH.2337; remaining figures from slide EH.2336)

Head (Fig. 15) with frontovertex width $0.37\times$ head width; head width $1.13\times$ head height; antennal torulus with upper margin slightly below lower margin of eye, and separated from mouth margin by height of a torulus. Antenna (Fig. 14) with scape slightly expanded in basal half; pedicel subtriangular, slightly shorter than F1; F1 shorter than F2 which is shorter than F3; funicle segments all longer than broad, F1 about $1.5\times$, F2 slightly more than $2\times$, and

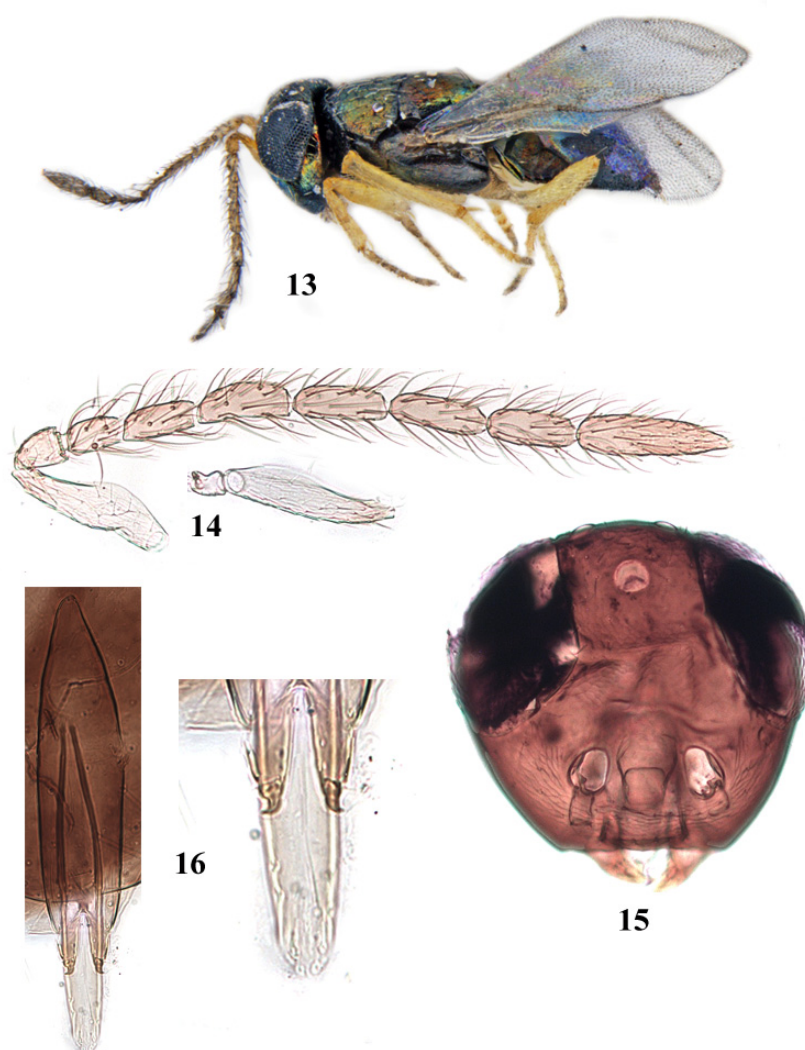
F3–F6 each at least about 3×, as long as broad; funicle segments with setae arranged in whorls, and setae shorter than 2× width of each segment; clava shorter than F5 and F6 combined. Genitalia (Fig. 16) with phallobase 1.58× as long as mid basitarsus.

Variation. There is little variation in the four paratype females. The width of the frontovertex varies from 0.21× to 0.23× head width.

Material examined. *Holotype*, ♀ (NBAIR, registration No. ICAR/NBAIR/1517 A), labelled “INDIA: KARNATAKA: Udupi, Malpe beach, 1.v.2017, Coll. K. Selvaraj” and “Ex. Pupa of *Xenasteia* sp. on *Calophyllum inophyllum* L.” *Paratypes*: 4 ♀, 3 ♂ (2 ♀ and 2 ♂ on 3 slides, Nos EH.2336, EH.2337, EH.2338), with data same as for holotype. (2 ♀ and 2 ♂, on 3 slides, in ZDAMU; registration No. HYM.CH.798; 2 ♀, 1 ♂, in NBAIR; registration Nos ICAR/NBAIR/1517 B).

Distribution. India: Karnataka.

Host. Pupae of *Xenasteia* sp. (Diptera: Xenasteiidae), on *Calophyllum inophyllum* L. (Calophyllaceae) (Figs 17–20).

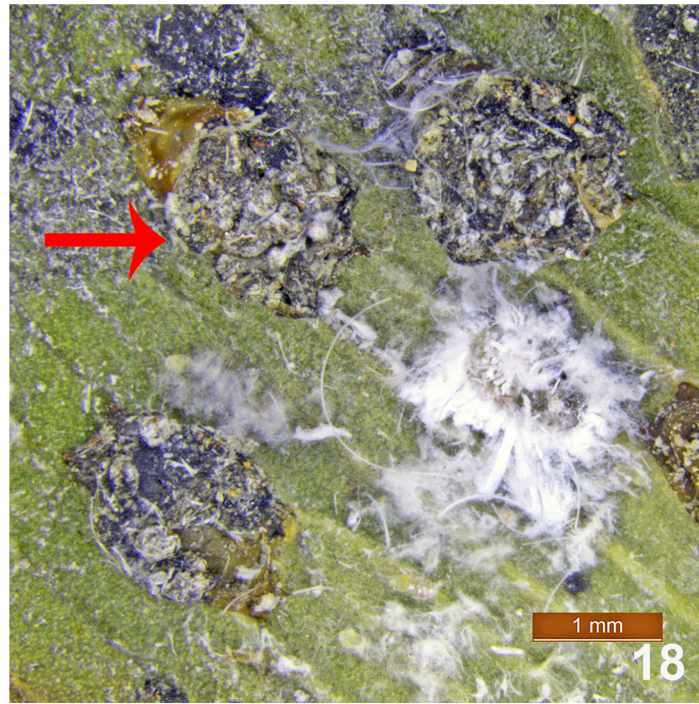


FIGURES 13–16. *Ooencyrtus xenasteiae* Hayat & Gupta, **sp. nov.** Paratypes, males: 13, body, lateral view; 14, antenna, with scape from a second antenna; 15, head, frontal view; 16, genitalia, with digiti enlarged and shown separately.

Etymology. The species name is derived from the generic name of the host insect, *Xenasteia*.

Comments. This new species does not run to any species in the keys to *Ooencyrtus* species by Noyes (1985, Neotropical species); Prinsloo (1987, sub-Saharan Africa); Trjapitzin (1989, Palaearctic species); Huang & Noyes (1994, Indo-Pacific species); Zhang *et al.* (2005, Chinese species); Noyes (2010, Costa Rican species); and Hayat *et al.* (2017, Indian species). The following combination of characters separate this new species from all the

described species of the genus characterized by body entirely dark brown with metallic shine and completely white to pale yellow legs; frontovertex width about one-fifth head width; mandible with two teeth and a small truncation which may be rounded; scutellum largely with fine, polygonal reticulate sculpture, clearly shallower than that on mesoscutum, except on sides with elongate reticulate sculpture; and ovipositor distinctly longer than mid tibia.



FIGURES 17–20. *Xenasteia* sp.: 17, pupae on leaf of *Calophyllum inophyllum* L. along with RSW colony; 18, pupae in enlarged view; 19, female of *O. xenasteiae* emerging from pupa; 20, male of *O. xenasteiae* emerging from pupa.

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A NEW SPECIES OF *NEASTYMACHUS* GIRAULT (HYMENOPTERA: ENCYRTIDAE) FROM KARNATAKA STATE OF INDIA

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Abstract. A new species of the genus *Neastymachus* Girault (Hymenoptera: Encyrtidae), *N. notialis* Hayat & Gupta, **sp. nov.**, is described from a specimen collected in Udupi, Karnataka (India). This species is compared with two apparently similar species, *N. angustifrons* (Shafee et al., 1975) and *N. katakensis* Hayat, in Hayat et al. (2015).

Keywords: Encyrtinae, Discodini, new species, India.

Introduction

The genus *Neastymachus* Girault, 1915 (Hymenoptera: Encyrtidae) contains 20 world species. These species are distributed in the following Zoogeographical regions: Afrotropical (1, from South Africa and Swaziland); Australian (1, from Australia); Neotropical (2, from Costa Rica); Oriental (11, from India); Palearctic (5; 2 from Russia, 1 from Japan, 2 from Saudi Arabia). A list of the then known 14 species with their region-wise distribution was given by Singh & Srinivasa (2012). Later, six species were described as follows: 2 from Saudi Arabia, *N. bolus* Hayat and *N. ceelus* Hayat (Hayat et al., 2014); and 4 from India, *N. gemosus* Hayat, *N. katakensis* Hayat (Hayat et al., 2015), *N. ameri* Hayat, *N. tamilnadensis* Hayat (Hayat & Veenakumari, 2017). In the present paper a new species, *Neastymachus notialis* Hayat & Gupta, **sp. nov.**, is described from a single specimen collected in Karnataka State of India.

Methods

Only body length is given in millimeters; all other measurements are relative, taken from the divisions of a linear scale of a micrometer placed in the eye piece of a stereozoom binocular microscope at 10× Zoom 8 (one micrometer division = 0.01234 mm) for carded specimen, and placed in the eye piece of a compound microscope at 100× magnification (one micrometer division = 0.00987 mm) for slide-mounted parts.

Body colour and measurements of various body parts were noted from the card-mounted holotype, prior to mounting the specimen on a slide in balsam.

The following abbreviations are used in the text:

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

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 the posterior ocelli.

TI = Tergite 1 of gaster.

The following acronym is used for the depository:

NBAIR = ICAR-National Bureau of Agricultural Insect Resources, Bengaluru, India.

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***Neastymachus notialis* Hayat & Gupta, sp. nov.**

(Figures 1–4)

Female. Holotype. Length, 1.85 mm. Head with frontovertex yellow; face from upper level of scrobes pale whitish, but inter-scrobal area brownish yellow; malar space below eye pale yellow, but ventral third or so brownish yellow. Antenna with radical yellow; scape yellow, with dorsal margin and about distal third brown; pedicel upper two-thirds dark brown, lower third white; funicle segments in upper third to half or more brown, lower two-thirds to one-third white; clava dark brown. Mesosoma pale brownish yellow; pronotum yellow, with collar translucent, and anteriorly brown; tegula yellowish white; metanotum black, shiny; propodeum pale brownish yellow, medially brownish; mesopleuron yellow. Wings hyaline. Legs, including coxae, whitish; mid tibia in about upper half pale brownish yellow, apically brown; hind femur upper margin, and hind tibia pale brown. Gaster largely yellowish white; T1 brownish yellow with sides dark brown; otherwise tergites pale brownish yellow; third valvulae yellow.

[Note. Head, after clearing and mounting on slide, became translucent, and got slightly distorted.]

Head (Fig. 1), with occipital margin sharp; frontovertex width $0.25\times$ head width; ocellar triangle with apical angle acute, OCL greater (about $3\times$) than POL; OOL about half ocellus diameter; eye posteriorly over-reaching occipital margin; head, in frontal view, $1.36\times$ as broad as high; frontovertex with slightly raised, polygonal reticulate sculpture; face with cells slightly transversely elongate; malar space with lineolate reticulate sculpture; setae on frontovertex pale brown, otherwise head with hyaline setae; eye rather sparsely setose, setae hyaline, and each seta shorter than a facet diameter. Mandible (Fig. 2) 3-dentate, middle tooth rounded, and upper tooth slightly receding, appears as a small truncation. Antenna (Fig. 3) with scape slightly flattened in about distal two-thirds, $3.88\times$ as long as broad; pedicel short, about $0.55\times$ F1 length; funicle segments all longer than broad; F1 longest segment, $1.79\times$ as long as pedicel, and $1.22\times$ as long as F2; F6 shortest, but $1.29\times$ as long as broad; clava slightly longer than F5 and F6 combined. *Relative measurements* (holotype, card): head dorsal width, 49; frontovertex width, 12.5; head frontal height, 36.

Mesosoma (Fig. 1). Mesoscutum with slightly raised, polygonal reticulate sculpture, anteriorly the cells transversely elongate, cells small; scutellum with sculpture similar to that on mesoscutum; setae on pronotal collar brown; mesoscutum (except a few white setae anteriorly), axilla and scutellum with setae dark brown; scutellum with $8 + 7$ setae, arranged in an anterior curved line of 5 setae, and two submedian lines of 5 each; propodeum distal to each spiracle with a few silvery white setae. Fore wing $2.5\times$ as long as broad; basal triangle with a large bare area; venation and setation as in Fig. 4. Hind wing $3.58\times$ as long as broad. Mid tibia $3.68\times$ as long as mid basitarsus; mid tibial spur $1.22\times$ as long as mid basitarsus. *Relative measurements* (holotype, slide): fore wing length (width), 163 (65); hind wing length (width), 107.5 (30); mid tibia length, 81; mid basitarsus length, 22; mid tibial spur length, 27.

Metasoma (Fig. 1). Gaster shorter than mesosoma, but on slide, appears subequal in length to mesosoma; third valvula $0.24\times$ second valvifer length. *Relative measurements* (holotype, slide): ovipositor length, 71; third valvula length, 14. [Ovipositor $0.87\times$ mid tibia length; third valvula shorter than both mid basitarsus and mid tibial spur, 14:22:27.]

Male. Unknown.

Material examined. Holotype, female (on slide, under 4 coverslips, slide No. EH.2339), labelled "INDIA: KARNATAKA: Udupi, Malpe, iv.2017, Coll. K. Selvaraj. (NBAIR, registration No. NBAIR/ENC/Neas/30417A)

Host. Unknown.

Distribution. India: Karnataka.

Comments. This new species of *Neastymachus* belongs to a group of species characterized by having the basal triangle of the fore wing bare (Hayat, 1999; Noyes, 2010). Among the species of this group, the new species appears similar to *N. angustifrons* (Shafee et al., 1975) and *N. katakensis* Hayat, in Hayat et al. (2015), but differs as follows: frontovertex width $0.25\times$ head width; antennal scrobes not meeting above; antennal scape $3.88\times$ as long as broad; pedicel $0.55\times$ F1 length; funicle segments all longer than broad, F1 1.22 as long as F2, F6 $1.29\times$ as long as broad; clava about as long as F5 and F6 combined. Fore wing hyaline, with marginal vein subequal in length to stigmal vein; ovipositor $0.87\times$ mid tibia length, and third valvula $0.24\times$ second valvifer length.

In *N. angustifrons*: frontovertex width $0.2\times$ head width; antennal scrobes meeting above; scape at least $5\times$ as long as broad; pedicel subequal in length to F1; funicle with distal three segments quadrate (F4) to broader than long, F1 slightly longer than F2, and distinctly longer than F4–F6 individually; clava about as long as F4–F6 combined; fore wing hyaline, with a light infuscation below distal veins, marginal vein about two-thirds length of stigmal vein. (Details on this species are taken from the original description, and the key and figures given by Hayat, 2006) (Details of ovipositor are not given, as the paratype slide lacks the gaster, and the holotype and other paratypes are on cards.)

In *N. katakensis*: frontovertex width $0.22\times$ head width; scrobes meeting above; scape slightly more than $5\times$ as long as broad; pedicel $1.48\times$ as long as F1; funicle segments all longer than broad, and (except F3 which is slightly longer than both F2 and F4) subequal in length, but gradually increasing in width distally; clava slightly longer than F4–F6 combined; fore wing infusate from base to slightly distal to stigmal vein, marginal vein from about three-fourths to equal in length, to stigmal vein; ovipositor $1.29\times$ as long as mid tibia, and third valvula $0.31\times$ second valvifer length.

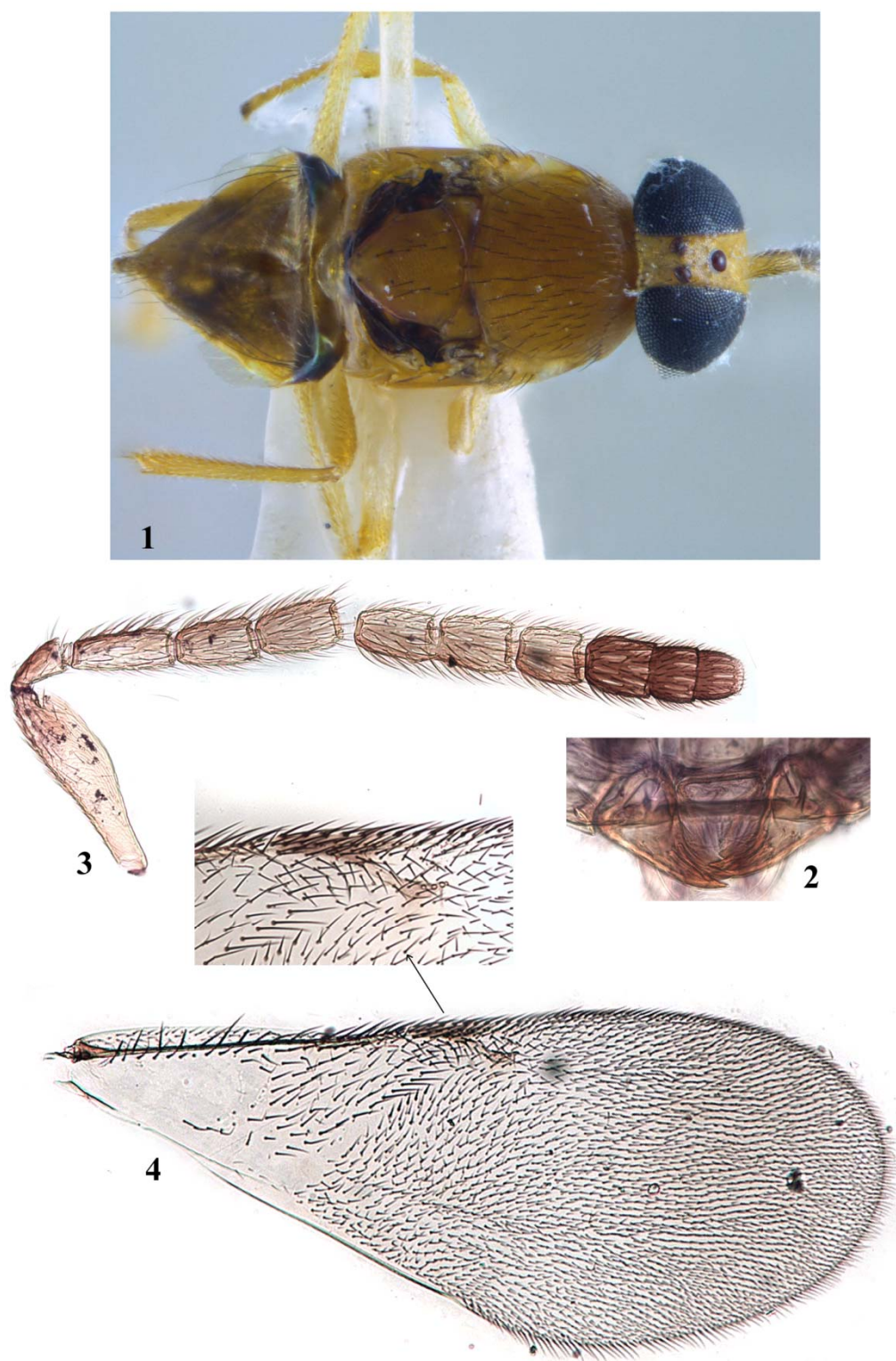
Etymology. Latin, *notialis* = southern, as the type was collected in Karnataka, a southern State of India.

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FIGURES 1–4. *Neastymachus notialis* Hayat & Gupta, **sp. nov.** Holotype, female: 1, body dorsal, from card; 2, mandibles; 3, antenna; 4, fore wing, with distal veins enlarged.