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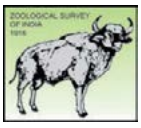

Description of two new species of *Eulophus* Geoffroy, 1762 (Hymenoptera: Chalcidoidea: Eulophidae) from India

Mohd Tanjeem Raza and Shahid Bin Zeya*
Department of Zoology, Aligarh Muslim University, Aligarh 202002, Uttar Pradesh, India.

Abstract

Two new species of *Eulophus* Geoffroy (Eulophidae: Eulophinae), namely *Eulophus orientalis* Raza & Zeya, sp. nov. and *E. almoriensis* Raza & Zeya, sp. nov. are described from India. A revised key to Indian species of *Eulophus* is also given.

Keywords: Hymenoptera, Eulophinae, new species.

Introduction

Eulophus Geoffroy generally similar to *Necremnus* Thomson by having the funicle 3-segmented and notauli incomplete, but is distinguished from it by having reduced mandibles with teeth not reaching each other and basitarsus of mid leg shorter than second. The species are gregarious larval parasitoids of insects belonging to the orders Lepidoptera, Hymenoptera, Diptera and Coleoptera (Narendran, 2011). The genus is represented by 79 species from the world (Noyes, 2019), of which only 4 species are known from India viz., *E. razaki* Narendran, *E. velosus* Narendran, *E. abdominalis* Nees and *E. chennaicus* Narendran and eight are currently unavailable names. In the present paper we describe two new species, *Eulophus orientalis* Raza & Zeya sp. nov. and *E. almoriensis* Raza & Zeya sp. nov. from Uttarakhand, India.

Material and Methods

The specimens were collected by a sweep-net from the Nainital and Almora districts of Uttarakhand. All collected specimens were transferred in 80% alcohol and mounted the specimen on rectangular cards using water soluble glue. Body colour was noted from the card-mounted specimens. The wings and antennae were mounted on slides following methods provided by Noyes (1982). The terms and body sculpture followed Hayat (2006) and Narendran (2011). Body length is given in millimetres. Other measurements are relative taken mainly from the carded specimens at 80× magnification by using stereozoom binocular (Nikon SMZ 1000) except the relative measurements of antenna and wings, which were mounted on slides and taken at 100× magnification with the help of linear divisions of an ocular micrometres placed in the eye piece of compound microscope (Nikon Eclipse E200). The card-mounted parts were photographed with digital camera (Nikon DS-Fi2) attached to a stereo-zoom binocular (Nikon SMZ25) and for slide-mounted body parts were photographed with digital camera (Nikon DS-Fi1c) attached to compound microscope (Nikon Eclipse Ci). The photographs were further enhanced using Adobe Photoshop®.

The following morphological abbreviations are used in the text:

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

C1, C2, etc. = Claval segments 1, 2, etc.

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

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

*Author for correspondence : drsbz1966@gmail.com Mob/WhatsApp +91 9690236032
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OOL = Minimum distance between a posterior ocellus and the corresponding eye margin.

POL = Minimum distance between the posterior ocelli.

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

WIOS = Width of inter-ocular space.

The following acronym is used for the depository:

ZDAMU – Insect Collection, Department of Zoology, Aligarh Muslim University, Aligarh, India.

Results and Discussion

Genus *Eulophus* Geoffroy

Eulophus Geoffroy, 1762*:* 312. Type species *Ichneumon ramicornis* Fabricius, by monotypy.

Comedo Schrank, 1802: 308. Type species *Ichneumon larvarum* Linnaeus, by monotypy 195. Synonymy by Peck, 1951:430.

Cratotechus Thompson, 1878*:* 208, 219. Type species *Ichneumon larvarum* Linnaeus; designated by Ashmead 1904. Synonymy by Bouček & Askew, 1968:60.

Onychocomedo Graham, 1959: 183. Type species *Eulophus thespius* Walker;designated by Graham, 1959. Synonymy by Bouček, 1959: 160.

Diagnosis: *Female* :Antennae with funicle 3-segmented; mandibles reduced, not meeting medially; notauli incomplete or indistinct; basitarsus, at least of mid leg shorter than second tarsal segment; gaster rounded or sub-rounded (Narendran, 2011).

Key to Indian species of *Eulophus* Geoffroy, females

1. Gaster with a pale yellow patch on gaster 2
-. Gaster without any pale yellow patch on gaster 5
2. Gaster with a pale yellow patch covering T1 and T2 medially (Figure7) 3
-. Gaster with a pale yellow patch covering more than two basal tergites of gaster (Narendran 2011: Figure179) 4
3. Antennal scape reaching level of the vertex; clava 2.7–2.8× as long broad , slightly shorter than F2 & F3 combined (Figure 5) ..... *E.orientalis* **sp. nov**.
-. Antennal scape not reaching level of the vertex; clava 3.3–3.6× as long broad, distinctly longer than F2 & F3 combined (Figure9) ..... *E. almoriensis* **sp. nov**.
4. Metasoma with petiole distinctly longer than broad ..... *E. velosus* Narendran
-. Metasoma without petiole or petiole indistinct ..... *E. abdominalis* Nees
5. Fore and mid coxae and all femora yellow; body black with strong metallic green refringence ..... *E. razaki* Narendran
-. All coxae black and femora brownish black with bases and apices pale; body black with very slight metallic green refringence ..... *E. chennaicus* Narendran

Description of new species

1. *Eulophus orientalis* Raza & Zeya, sp.nov.

(Figs 1–7)
urn:lsid:zoobank.org:act:D19A16C8-1F0F-4919-87F1-038C251B6615

Diagnosis. *Eulophus orientalis* sp. nov. apparently looks similar to *E. velosus* Narenran, but it differs as follows: head and mesosoma metallic dark brown to black; fore wings subhyaline with a brown infuscate patch in the middle of the disc; gaster with a large pale yellow patch covering T1 and T2 medially; POL 1.71× OOL; fore and hind coxae brown; petiole broader than long. In *E. velosus*: head and mesosoma black and without metallic refringence; fore wings subhyaline without any infuscate patch; gaster with a large pale yellow patch covering T1, T2 and T3 medially; POL 3.5× OOL; all coxae black; petiole distinctly longer that broad (Narendran, 2011). Furthermore, the following features are taken to distinguish the species from other Indian species. These

are: head dark brown with frontovertex metallic brown with green luster; F1 & F2 subequal in length; clava 2.7 – 2.8× as long as broad, slightly shorter than F2 & F3 combined; fore wing with submarginal vein+parastigma 1.16× as long as marginal vein; marginal vein at most 1.8× as long as post marginal vein.

Description.

Female. Holotype. Length, 2 mm (Paratype, 2 mm). Head dark brown with frontovertex metallic brown with green luster; ocelli reflecting white; mandible and palpi brown. Antennal scape pale white, slightly darker at apex; pedicel and flagellum brown (Figure5). Mesosoma metallic dark brown to black; tegula brown. Fore wings subhyaline with a brown infuscate patch in the middle of the disc; venation brown. Fore leg with coxa brown, femur brown with pale brown apically; mid leg with coxa pale yellow, femur in basal half pale yellow, rest brown to pale brown; hind leg with coxa brown, femur in basal half pale yellow, rest brown; tibiae and tarsi of all legs pale yellow. Metasoma with petiole pale yellow; gaster brown with a large pale yellow patch covering T1 and T2 medially.

Head. Head in dorsal view, 1.1× as broad as high (Figure4); POL as long as 1.71× OOL (12:7); AOL 0.57× OOL (4:7); WIOS as broad as 2.5× POL (30:12); eye height 2.5× as long as malar space; Antennal toruli situated just little below the lower ocular line and scape reaching level of the vertex, 6.60× (paratype 4.6×) as long as broad; pedicel 2.25× (paratype 1.8×) as long as broad; funicle with 2 anelli, F1and F2 subequal; F3 is the shortest; clava 3-segmented, 2.8× (paratype 2.7×) as long as broad, slightly shorter than F2& F3 combined.

Mesosoma. Mesosoma (Figure 6) gibbous, 1.2× (paratype 1.3×) as long as broad, 1.07× (paratype 0.85) as long as metasoma with raised polygonal reticulate sculpture; prepectus with reticulate sculpture; pronotum shorter and broad; mesoscutum transverse, 0.63× (paratype 0.64×) as long as broad, and 1.75× (paratype 1.6×) as long as scutellum; scutellum oval and gibbous, 1.25× as broad as long; propodeum with a strong median carina; spiracle round touching the anterior margin of propodeum. Fore wing (Figure 2) 2.3× as long as broad; submarginal vein + parastigma 1.16× as long as marginal vein; marginal vein 1.8× as long as post marginal vein and 2.30× as long as stigmal vein, setation as in figure 2. Hind wing (Figure 3) 4.0× (paratype 5.1) as long as broad. Legs with fore and hind coxae reticulated.

Metasoma. (Figure7). Petiole 3.3× (paratype 2×) as broad as long, gaster little shorter than mesosoma; ovipositor not exerted beyond apex of gaster.

Relative measurements. (Holotype): Head (card) in dorsal view , head length: width, 20:55; eye height, 30; malar space, 12. Antennal segments (slide): Length: width – scape, 33:5; pedicel, 9:4; F1, 15:6; F2,15:8; F3, 13:8; C1, 10:6; C2, 10:8 ; C3, 5:5. Mesosoma length: width, 70:55; mesoscutum length: width, 35:55; scutellum length: width, 20:25. Fore wing length: width, 220:95; marginal vein length, 60; submarginal length, 50; parastigma length, 20; stigmal vein length, 26; postmarginal vein length, 32. Hind wing length: width, 160:40; Metasoma length: width, 55:30. Petiole length: width, 3:10.

Male. Unknown.

Material examined: Holotype: Female (one antenna and right wings on slides under two coverslips, slide No. EULT212, rest of the body on card), INDIA: Uttarakhand: Nainital, Kathgodam, 7.xi.2020; Coll: T. Raza, M. Ahmad (ZDAMU).

Paratype: 1female (one antenna and right wings on slides under two coverslips, slide No. EULT235, rest of the body on card), data as for holotype (ZDAMU).

Host. Unknown.

Distribution. India: Uttrakhand.

Etymology. The name of species is derived from the Oriental region as the Indian subcontinent is a sub-region of Oriental realm.

2. *Eulophus almoriensis* Raza & Zeya, sp.nov.

(Figs. 8–15)
urn:lsid:zoobank.org:act:D91C9E2F-E5A7-40A8-A167-6DBAA93C1FBC

Diagnosis. *Eulophus almoriensis* sp. nov. comes close to *E. orientalis* sp. nov. in having more or less similar body colour and antennal configuration and a patch of infuscation on the fore wing, but differs from the later by the character as follows: POL as long as 2.3–3× OOL; AOL 1 –1.1× OOL; (POL as long as 1.71× OOL; AOL 0.57× OOL in *orientalis*); marginal vein 1.5× as long as post marginal vein (marginal vein 1.8× as long as post marginal vein in *orientalis*) and also by the characters given in the key. Furthermore, *E. almoriensis* sp.nov. is distinguished from other Indian

species in the following characters: head dark brown to black with frontovertex coppery bluish shine; POL as long as 2.3 –3× as long as OOL; clava more than 3× as long as broad, longer than F2 & F3 combined; fore wing with submarginal vein+parastigma 1.3× as long as marginal vein; marginal vein at most 1.5× as long as post marginal vein.

Female. Holotype (Figure 8). Body length, 1.7 mm (paratype, 2.2 mm). Head dark brown to black; frontovertex with coppery and bluish shine; gena and area around mouth metallic black; ocelli dark brown; mandible brown and palpi dark brown. Antenna with scape pale brown, dorsal margin and apex with brown infuscation; pedicel brown; flagellum and clava dark brown. Mesosoma black; tegula pale brown. Fore wing subhyaline with a brown infuscate in middle of the disc; hind wing subhyaline. Legs with fore coxa black, fore femur brown with pale apices; mid coxa pale yellow; mid femur in basal third pale yellow, rest dark brown; hind coxa dark brown; hind femur in basal half pale yellow, rest dark brown, tibiae and tarsi and trochanters of all legs pale yellow. Metosoma with petiole pale yellow; gaster dark brown to black, with a large pale yellow patch covering T1 and T2 medially.

Head. Head in dorsal view, 1.1× (paratype 1.3×) as broad as high, with reticulate sculpture (Figure 12); POL as long as 2.3× (paratype, 3×) OOL (14:6), AOL 1.1× (paratype, 1×) OOL (7:6) ; WIOS as broad as 2.2× (paratype 2.3×) POL (32:14); eye height 3× (paratype, 2×) as long as malar space. Antennal toruli situated just below the lower ocular line; scape not reaching level of vertex, scape 6× (paratype, 6.4×) as long as broad, 3.7× (paratype, 3.2×) as long as pedicel; pedicel 1.6× as long as broad; funicle with 2 distinct anelli; F1 longer than F2 and F3 individually; F3 the shortest; clava 3-segmented, 3.3× (paratype, 3.6×) as long as broad; clava longer than preceding two funicle segments combined.

Mesosoma. Mesosoma gibbous (Figure13), 1.2× (paratype, 1.6×) as long as broad, 0.8× (paratype, 1×) metasoma; mesosoma with polygonal reticulate sculpture; prepectus strongly reticulated; pronotum transverse; mesoscutum with notauli indistinct, 1.5× as broad as long, 1.6× (paratype, 1.5×) as long as scutellum; scutellum gibbous, 0.9× as broad as long; propodeum (Figure 14) with a raised median carina; spiracle separated from metanotum from its own diameter. Legs with fore and hind coxae reticulated. Fore wing (Figure 10) 2.3× as long as broad; submarginal vein + parastigmal 1.3× as long as marginal vein; marginal vein 1.5× as long as post marginal vein, and 2× as long as stigmal vein. Hind wing (Figure11). 4.4× (paratype, 4×) as long as broad, setation as in figure 11.

Metasoma (Figure15). Petiole 2× (paratype, 1.5×) as broad as long; gaster 2.3× (paratype, 1.1×) as long as broad; ovipositor not exerted beyond apex of gaster.

Relative measurements (holotype). Head (card), in dorsal view, height: width, 45:50; eye height, 30; malar space, 10. Antennal segment (slide) length: width – scape, 30:5; pedicel, 8:5; F1, 14:8 ; F2,13:8; F3, 10:8 ; C1, 10:8; C2, 10:9; C3, 7:5. Mesosoma (card): mesosoma length: width, 60:50; pronotum length: width, 5:45; mesoscutum length: width, 32:50; scutellum length: width, 20:18. Fore wing (slide) length: width, 200:85; marginal vein length, 50; submarginal vein length, 45; parastigma length, 20; stigmal vein length, 25; postmarginal vein length, 32. Hind wing (slide) length: width, 150:34. Metasoma (card) length: width, 70:30; petiole length: width, 3:10.

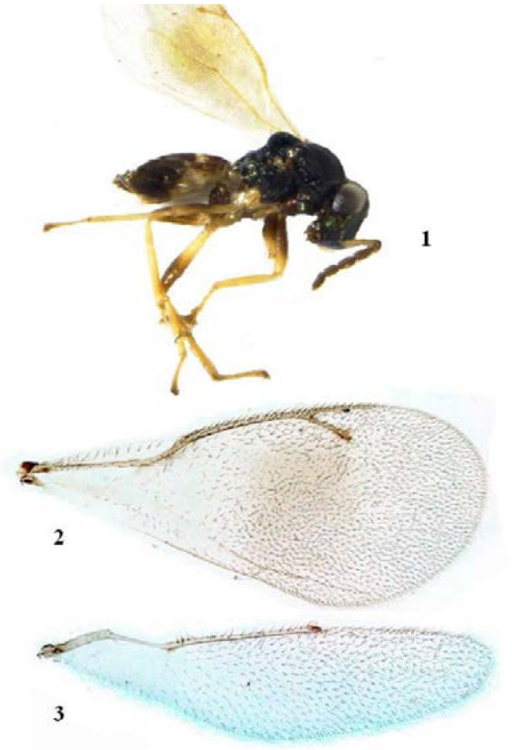
Material examined: Holotype: Female (one antenna and right wings on slides under two coverslips, slide No. EULT218, rest of body on card), INDIA: Uttarakhand: Almora, Ranikhet, 15.vi.2022; Coll: T. Raza, M. Ahmad (ZDAMU).

Paratype: 1female (one antenna and right wings on slides under two coverslips, slide No. EULT219, rest of body on card), data as for holotype. (ZDAMU).

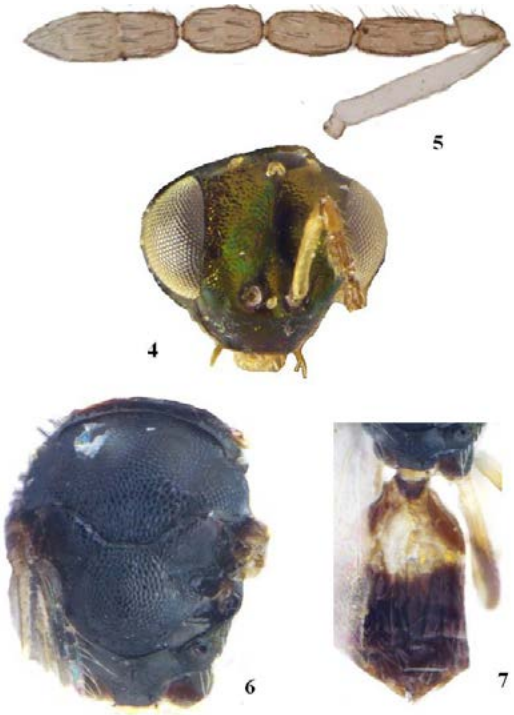
Host. Unknown.

Distribution. India: Uttarakhand.

Etymology. The species name is derived from the name of the district Almora in Uttarakhand, from where the holotype was collected.

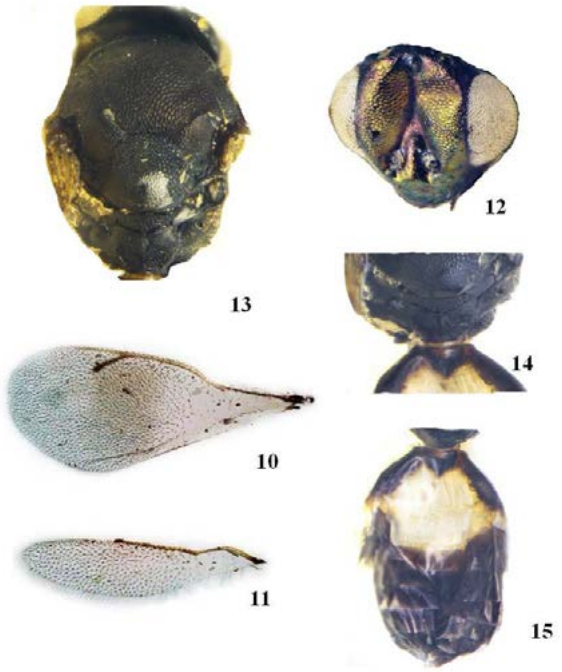


Figs 1–3: *Eulophus orientalis* sp. nov. female (holotype). 1. habitus; 2. fore wing; 3. hind wing.



Figs 4–7: *Eulophus orientalis* sp. nov. female (holotype). 4. head; 5. antenna; 6. mesosoma; 7. metasoma.

Figs 8–9: *Eulophus almoriensis* sp. nov. female (holotype). 8. habitus; 9. antenna;



Figs 10–15: *Eulophus almoriensis* sp. nov. female, (10–11, holotype). 10. fore wing; 11. hind wing; (12–15, paratype). 12 –head; 13. mesosoma; 14. propodeum; 15. metasoma.

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