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RESEARCH ARTICLE

Description of two new species of Tetracneminae Howard (Hymenoptera: Encyrtidae) from India with key to the species

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Abstract: Two new species of Tetracneminae (Hymenoptera: Chalcidoidea: Encyrtidae) are described from the material collected from Andhra Pradesh and Tamil Nadu states of India. They are: *Charitopus montibus* **sp. nov.** and *Eotopus elongare* **sp. nov.** A key to the Indian species of both genera is provided.

Key words: Insecta, Chalcidoidea, *Charitopus*, *Eotopus*, India, identification key.

Introduction

Charitopus was erected by Foerster in 1856 with *C. fulviventris* as the type species, and nineteen species are known across the world. In India, three species are known viz, *C. panchgania* (Mani & Saraswat), *C. fulviventris* Foerster and *C. apicatus* (Mani & Saraswat). The members of this genus are assumed to parasitize Coccoidea (Hemiptera) (Hayat 2006 & Noyes 2015), though there is no evidence of hosts for nearly 17 species. However from India, *C. panchgania* is known to parasitize *Icerya pilosa* Green on *Saccharum officinarum* L. (Shamim & Shafee 1984) and similarly *C. eristoi* Japoshvili is reared from *Heterococcopsis opertus* Borchsenius (Noyes 2015). *Eotopus* Noyes & Hayat was created in 1984 by transferring the species *Ericydnus beneficus* Shafee from *Ericydnus* to *Eotopus* and designated it as the type species. This is the only species known globally and the members of this genus are known to parasitize *Icerya pilosa* (Hemiptera: Margarodidae) on *Saccharum officinarum* (Shafee 1981).

In this paper, we describe two new species of Tetracneminae, one each of the above two genera from Andhra Pradesh and Tamil Nadu states of India.

Material and methods

Collections were made using yellow pan traps as described by Noyes (1982). The length of whole specimen is given in millimetres. All other measurements are relative and were taken from micrometer divisions directly fitted in the eye piece of Leica S8 APO stereozoom trinocular microscope at 80× (one micrometer division = 0.0125 mm) for card-mounted specimens or and at 100× and 400× using a Leica DM750 phase contrast microscope (one micrometer division = 0.01 and 0.0025 mm respectively) 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 stacked images were combined using combineZP software.

The following abbreviations are used:

AOL = Minimum distance between one of the posterior ocelli 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 metasoma.

The following acronyms are used:

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

RARS= Regional Agricultural Research Station, Chinthapalli, Andhra Pradesh, India.

ICAR-NBAIR= ICAR - National Bureau of Agricultural Insect Resources (Formerly NBAII), Bangalore, India.

Results

Charitopus Foerster, 1856

Charitopus Foerster, 1856: 31. Type species *Charitopus fulviventris* Foerster, by monotypy through subsequent reference of Foerster, 1860: 112.

Leptorhopala Motschulsky, 1863: 60. Type species *Leptorhopala cuprifrons* Motschulsky, by monotypy. Synonymy by transfer of type species to *Charitopus* by Trjapitzin, 1964: 242.

Eupelmomorpha Girault, 1915: 43. Type species *Eupelmomorpha quadricolor* Girault, by designation of Gahan & Fagan, 1923: 60. Synonymy by Noyes & Hayat, 1984: 248.

Diversicornia Mercet, 1916: 371. Type species *Diversicornia pinicola* Mercet, by monotypy and original designation. Synonymy by Mercet, 1922: 54.

Diagnosis (Modified from Motschulsky 1863): Female body size medium, with yellow to yellowish brown metallic reflections; Head rounded with dark metallic green or brownish yellow; forehead slightly excavated, eyes big and oval. Antennal scape slightly flattened; pedicel white or yellowish brown or brown and slightly longer than F1; funicle 6 segmented; clava 3 segmented; all flagellar segments with longitudinal sensillae except F1. Mesosoma flat, mesoscutum notaular lines complete; axillae meeting medially. Wings hyaline; posterior

margin of linea clava interrupted or not interrupted; filum spinosum absent; venation brownish yellow, submarginal vein with an inconspicuous apical hyaline break, marginal vein slightly removed from wing margin and with parastigma slightly swollen; marginal vein clearly longer than post marginal vein. Propodeum broad and clearly visible from dorsal view. Legs yellow or yellowish brown and slender; mid tibial spur as long as mid basitarsus; all tarsi 5 segmented. Metasoma sessile and yellowish brown; hypopygium more or less reaching apex of metasoma, ovipositor slightly exerted or not exerted.

Key to the Indian species of *Charitopus* (modified from Hayat 2006)

Note: *Charitopus apicatus* (Mani and Saraswat) is known only by male [For details of this species status, refer Hayat (2006)] and *C. montibus* sp. nov. is known only by female.

1. Antenna with funicle segments normal, not with dorsal rami. Females..... 2
 - Antenna with F2-5 each with a dorsal ramus. Males..... 4
2. Pedicel usually white; legs uniformly pale yellow except coxae brown *C. panchgania* (Mani & Saraswat)
 - Pedicel dark brown to black; legs not uniformly pale yellow, any one part of legs partly or fully, brown..... 3
3. Pedicel 3× as long as broad; scape 2.5× as long as pedicel; fore and hind femora brown; head 2.4× as broad as frontovertex..... *C. fulviventris* Foerster
 - Pedicel 1.8× as long as broad; scape 3× as long as pedicel; fore and hind femora yellow; head 1.86× as broad as frontovertex *C. montibus* **sp.nov.**
4. Mesoscutum with notaular lines incomplete, indicated only in about anterior half..... *C. apicatus* (Mani & Saraswat)
 - Mesoscutum with notaular lines complete..... 5
5. Legs yellow, with fore and hind coxae largely or completely dark brown..... *C. panchgania* (Mani & Saraswat)
 - Legs yellow, with major part of femora and a patch at base of tibiae, brownish..... *C. fulviventris* Foerster

Charitopus montibus Krishnachaitanya & Manickavasagam sp. nov. (Figs 1–6)

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Diagnosis: Body yellow to brown; legs yellow except dorso-later of hind coxa and basal half of hind tibia brown; antennal scape slightly flattened, maximum width at middle and 4.15× as long as wide; pedicel 1.80× as long as wide and slightly longer than F1; fore wing 2.85× as long as wide; marginal vein 1.6× as long as postmarginal; stigmal vein 1.4× as long as postmarginal; linea calva posteriorly open and anteriorly closed with one row of setae; ovipositor not exerted, and 0.55× as long as mid tibia.

Description (Female)

Holotype. Length, 1.68 mm. Body yellow to brown (Fig. 1). Head with dark metallic green reflections except eye pale brown. Antenna with radicle and basal 1/3 of scape yellow, remainder of scape brownish yellow; pedicel dorsally dark brown, ventrally and apical round yellow; flagellum dark brown to black. Mesosoma with pronotum yellow; mesoscutum apical border with greenish brown reflections, remainder yellow; axilla and scutellum shiny yellow.

Wings hyaline. Propodeum with shiny brown reflections. Legs yellow except dorso-later of hind coxa and basal half of hind tibia brown. Metasoma yellow except T3 and T4 and lateral borders of T1 and T2 brown.

Head (Fig. 3) in frontal view broader than high (41:35); antennal torulus situated below the lower eye margin; eye in frontal view $2.88\times$ as high as wide; frontovertex with imbricate sculpture, broad and $0.53\times$ head width. Antennal (Fig. 2) scape slightly flattened, maximum width at middle and $4.15\times$ as long as wide; pedicel $1.80\times$ as long as wide and slightly longer than F1; funicle width gradually increasing; F1 $1.83\times$ as long as wide and shorter than F2 and F3 individually; F4–F6 each shorter than F2–F3 individually; clava apically more or less round, $3\times$ as long as wide and little longer than F4–F6 combined; F2–F5 each with 2 longitudinal sensillae and F6 with 3 longitudinal sensillae; clava with 13 longitudinal sensillae. *Relative measurements*—(slide mounted $100\times$), Head width: height 41:35; AOL 20; OOL 15; OCL 4; POL 43; frontovertex width 22; eye height: width 26:9; malar space length 29 (slide mounted $400\times$), scape length: width 83:20; pedicel length: width 27:15; funicle length: width, F1, 22:12; F2, 26:15; F3, 26:15; F4, 23:16; F5, 23:18; F6, 22:20; clava length: width 75:25. .

Mesosoma (Fig. 5) $1.88\times$ as long as wide; mesoscutum $1.3\times$ as wide as long; pronotum, mesoscutum and axilla with imbricate sculpture; scutellum as long as wide, with longitudinal reticulate sculpture. Fore wing (Fig. 4) $2.85\times$ as long as wide; costal cell $11\times$ as long as wide; marginal vein $1.6\times$ as long as postmarginal; stigmal vein $1.4\times$ as long as postmarginal; linea calva posteriorly open and anteriorly closed with one row of setae; hind wing $5\times$ as long as wide. *Relative measurements*— (card mounted $80\times$), mesosoma length: width 49:26; mesoscutum length: width 20:26; scutellum length: width 17:17; (slide mounted $100\times$), fore wing length: width 114:40; costal cell length: width 44:4; marginal vein length 8; postmarginal vein length 5; stigmal vein length 7; hind wing length: width 85:17; mid tibia length 45; mid basitarsus length 13; mid tibial spur length 9.

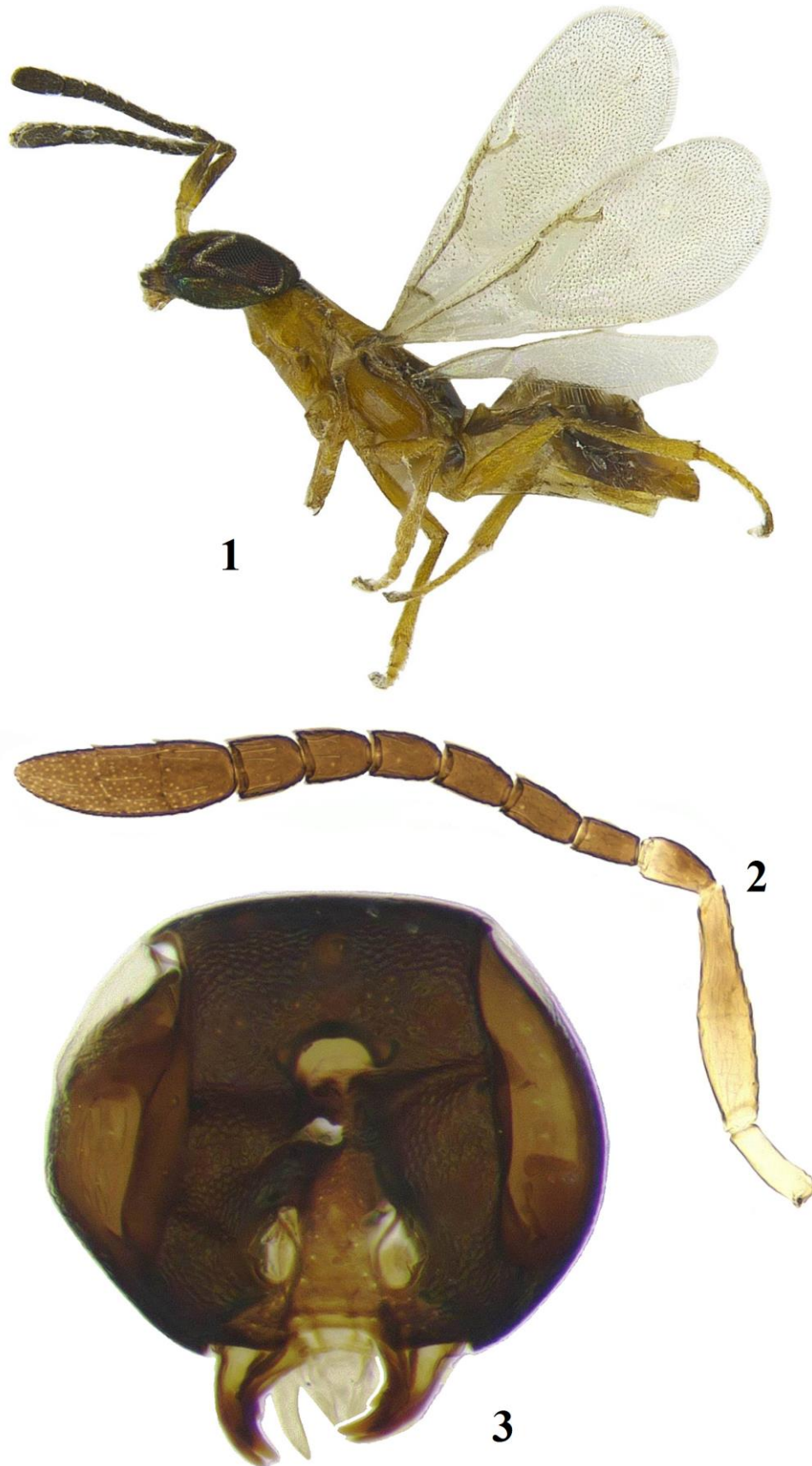
Metasoma longer than mesosoma (57:49); hypopygium more or less reaching apex of metasoma; ovipositor (Fig. 6) not exerted, and $0.55\times$ as long as mid tibia. *Relative measurements*— (card mounted $80\times$) metasoma length: width 57:25; (slide mounted $100\times$) ovipositor length 25.

Material examined: Holotype, female (on card) labelled “INDIA: Andhra Pradesh: Vishakapattanam, Chinthapalli, RARS (N18° 94”; E82° 61”), 06.vii.2015, (yellow pan trap), Coll. T. Krishnachaitanya” (EDAU, Registration No. Enc/016/2016). Paratypes. 2 females (on card), 1 female (on slide under 5 cover slips) and 1 female with apical half of metasoma along with ovipositor missing (on card) with same data as holotype (EDAU, Registration No. Enc/016/2016).

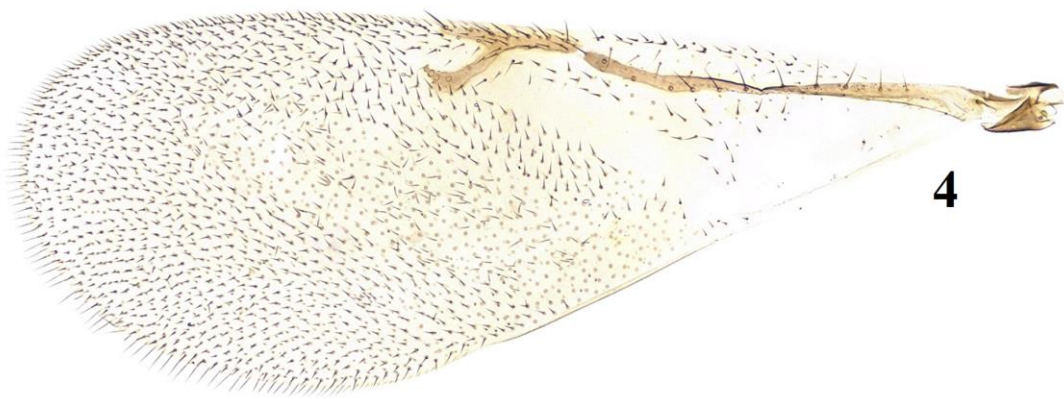
Host: Unknown.

Male: Unknown.

Comments: This species is closer to *C. fulviventris* in having, pedicel dark brown to black; legs, including coxae, any one of the part partly or fully brown, but differs from it in having, pedicel $1.8\times$ as long as broad; scape $3\times$ as long as pedicel; fore and hind femora yellow; head $1.86\times$ as broad as frontovertex (pedicel $3\times$ as long as broad; scape $2.5\times$ as long as pedicel; fore and hind femora brown; head $2.40\times$ as broad as frontovertex in *C. fulviventris*).



Figures 1–3. *Charitopus montibus* Krishnachaitanya & Manickavasagam sp. nov., ♀. **1**, habitus image; **2**, antenna; **3**, head frontal view.



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Figures 4–6. *Charitopus montibus* Krishnachaitanya & Manickavasagam sp. nov., ♀. **4**, fore wing; **5**, dorsal view of nota; **6**, ovipositor.

Etymology: The species epithet is an adjective, derived from the Latin word “mons” meaning mountain referring to the type locality.

***Eotopus* Noyes & Hayat, 1984**

Eotopus Noyes & Hayat, 1984: 269. Type species: *Ericydnus beneficus* Shafee, by monotypy and original designation.

Diagnosis: For detailed generic diagnosis one can refer to Noyes & Hayat 1984.

(Modified from Noyes & Hayat 1984): Head in facial view clearly broader than long; eye with posterior margin slightly concave, about one-half longer than broad, with dense fairly conspicuous translucent setae. Malar space about one-quarter eye length, with malar sulcus present. Frontoververtex about one-third head width; Antennal scrobes shallow; antennal torulus separated from mouth margin by a little less than its own diameter; antennal scape much longer than minimum width of frontoververtex, cylindrical, slightly wider near base, about 5 - 6× as long as broad, pedicel conical and 2.47× as long as wide; clava 3 segmented, 2.5 - 3× as long as wide, with apex more or less round; F1, F2 without longitudinal sensilla sometimes absent on F3 also. Mandible tridentate, the upper tooth short and blunt; maxillary palpus 3 and labial palpus 2 segmented. Metasoma, in side view, moderately deep with metapleurum distinct; in dorsal view, mesoscutum about one-half broader than long with notaular lines present anteriorly; axillae meeting medially. Fore wing hyaline, about 3× as long as broad; linea calva not interrupted and nearly closed near posterior margin of wing; filum spinosum absent; venation yellowish, submarginal vein with an inconspicuous apical hyaline break, parastigma clearly swollen, mid tibial spur shorter or longer than basitarsus. Metasoma a little shorter or longer than mesosoma; hypopygium reaching apex of metasoma; gonostyli fused to second valvifers; ovipositor 0.6 - 0.9× as long as mid tibia.

Key to species of *Eotopus* (Females)

1. Ovipositor 0.6× as long as mid tibia; mid tibial spur shorter than basitarsus; clava 2.5× as long as wide..... *E. beneficus* (Shafee)
- Ovipositor 0.9× as long as mid tibia; mid tibial spur 1.4× as long as basitarsus; clava 2.9× as long as wide..... *E. elongare* **sp. nov.**

***Eotopus elongare* Krishnachaitanya & Manickavasagam sp. nov. (Figs 7–11)**

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Diagnosis: Body pale yellow, except head metallic green; antennal scape cylindrical, 5.93× as long as wide; pedicel 2.46× as long as wide; clava 2.90× as long as wide and slightly longer than F4–F6 combined; fore wing 2.92× as long as wide; marginal vein long and 1.28× as long as postmarginal vein; stigmal vein 1.14× as long as postmarginal vein; linea calva posteriorly open and anteriorly closed with one row of setae; ovipositor slightly exerted, and 0.91× as long as mid tibia.

Description (Female)

Holotype. Length, 1.31 mm. Body (Fig. 7) pale yellow, except head metallic green; eyes pink brown; lateral corners of propodeum pale brown and lateral edges of metasoma dark brown; entire body with silvery white setae.

Head in frontal view 1.16× as wide as long; antennal torulus situated below lower eye margin; eye in frontal view 1.48× as high as wide; frontovertex broad and 0.47× head width. Antennal (Fig. 8) scape cylindrical, 5.93× as long as wide; pedicel 2.46× as long as wide; funicle width gradually increasing; F1 small, 1.70× as long as wide and shorter than F2–F6 individually; clava 2.90× as long as wide and slightly longer than F4–F6 combined; F4–F5 each with 1 longitudinal sensilla and F6 with 2 longitudinal sensillae, clava with 6 longitudinal sensillae. *Relative measurements*— (card mounted 100×), head height: width 36:42; AOL 4; OOL 7; OCL 3; POL 25; frontovertex width 20; eye height: width 37:25; malar space length 38 (slide mounted 400×), scape length: width 95:16; pedicel length: width 32:13; funicle length: width, F1, 17:10; F2, 20:12; F3, 21:13; F4, 22:14; F5, 22:15; F6, 22:16; clava length: width 61:21.

Mesosoma (Fig. 11) 1.35× as long as wide; mesoscutum 1.47× as wide as long; pronotum, mesoscutum and scutellum with imbricate sculpture; scutellum 1.15× as wide as long. Fore wing (Fig. 10) 2.92× as long as wide; costal cell 21× as long as wide; marginal vein long and 1.28× as long as postmarginal vein; stigmal vein 1.14× as long as postmarginal vein; linea calva posteriorly open and anteriorly closed with one row of setae; hind wing 6.76× as long as wide; mid tibia 7.6× as long as mid basitarsus. *Relative measurements*— (card mounted 100×), mesosoma length: width 42:31; mesoscutum length: width 21:31; scutellum length: width 19:22; (slide mounted 400×), fore wing length: width 111:38; costal cell length: width 42:2; marginal vein length 9; postmarginal vein length 7; stigmal vein length 8; hind wing length: width 88:13; mid tibia length 36; mid basitarsus length 5; mid tibial spur length 7.

Metasoma longer than mesosoma; hypopygium reaching apex of metasoma; ovipositor (Fig. 9) slightly exerted, and 0.91× as long as mid tibia. *Relative measurements*— (card mounted 100×) metasoma length 50; (slide mounted 400×), ovipositor length 33.

Material examined: Holotype, female (on slide under 4 cover slips) labeled “INDIA: Tamil Nadu, Salem, Attur, Kalvarayan hills, (N77° 32"; E78° 53") 26.iii.2016, Coll. S. Manickavasagam and T. krishnachaitanya.” (EDAU, Registration. No. Enc/017/2016). Paratype. One female (on slide under 4 cover slips (head missing while processing), labeled “INDIA: Tamil Nadu, Salem, Attur, Kalvarayan hills, (N77° 32"; E78° 53") ex. unidentified mealy bug from weed, 15.iii.2014, Coll. N. Gowthaman and S. Manickavasagam.” (EDAU, Registration. No. Enc/017/2016).

Host: Unidentified mealy bug from weed.

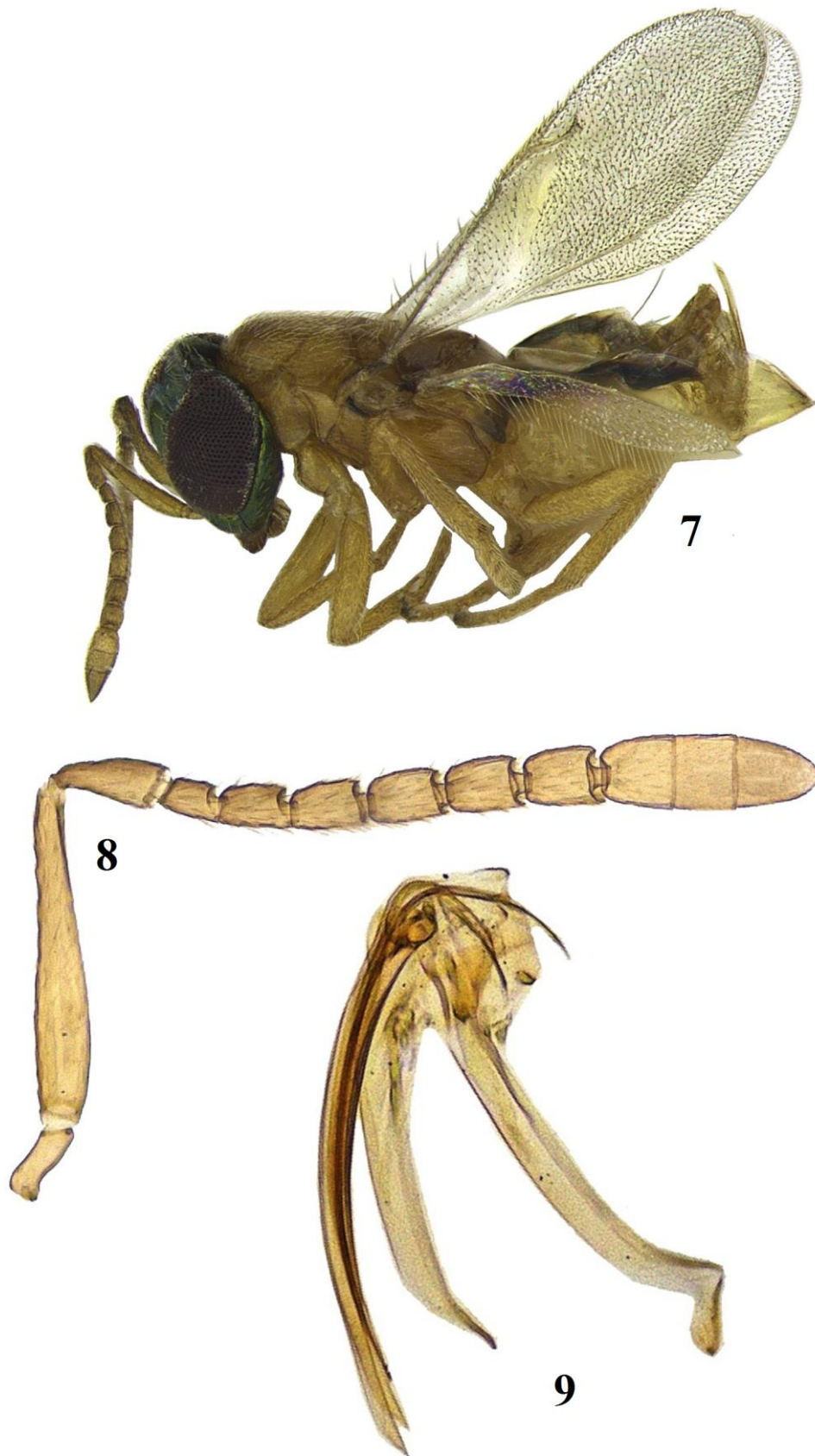
Male: Unknown.

Comments: The two species can be differentiated based on the characters given in the key.

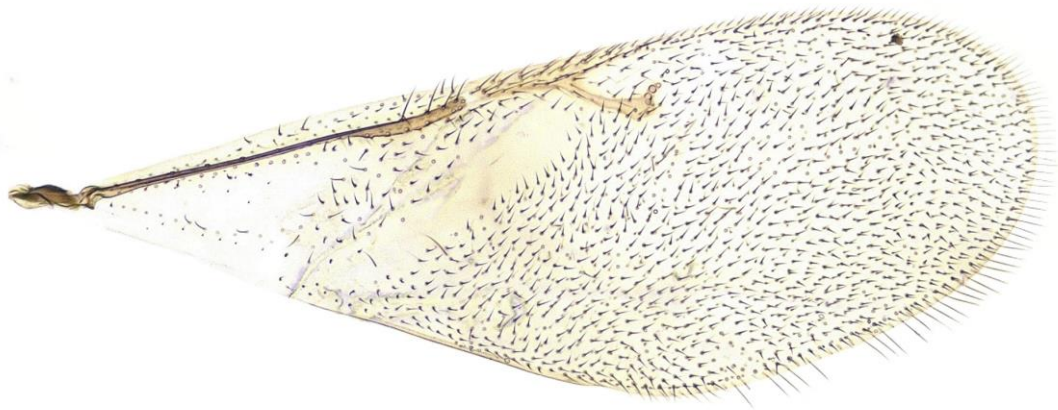
Etymology: The species epithet is a Latin verb referring to the elongated ovipositor, scape and mid tibial spur compared to the other species known.

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Figures 7–9. *Eotopus elongare* Krishnachaitanya & Manickavasagam sp. nov., ♀. **7**, habitus image; **8**, antenna; **9**, ovipositor.



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Figures 10–11. *Eotopus elongare* Krishnachaitanya & Manickavasagam sp. nov., ♀. **10**, fore wing; **11**, dorsal view of nota.

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