

## Research article

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## New species and new combination in *Calotelea* Westwood, 1837 (Hymenoptera: Scelionidae) from India

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**Abstract.** Four new species under the genus *Calotelea* Westwood, 1837 (Hymenoptera: Scelionidae) namely, *C. acuta* Rajmohana & Debnath sp. nov., *C. chitraka* Rajmohana & Debnath sp. nov., *C. foveata* Rajmohana & Debnath sp. nov. and *C. fulva* Rajmohana & Debnath sp. nov., are described from India. *Calotelea malabarica* (Narendran & Ramesh Babu, 1999) comb. nov. is transferred from *Calliscelio* Ashmead. In addition, a checklist and key to the Oriental species of *Calotelea* are provided.

**Keywords.** *Calliscelio*, *Calotelea*, India, new species, Scelionidae.

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### Introduction

*Calotelea* Westwood, 1837 (Hymenoptera: Scelionidae) with type species *C. aurantia* Hope, 1837 (Hope 1837) is a relatively small (Kamalanathan *et al.* 2022) and rare genus (Masner 1980a). They have a worldwide distribution except Antarctica, and many species are yet to be described (Masner 1976, 1980b). *Calotelea* are reported as the egg parasitoids of Odonata and Orthoptera (Kononova & Fursov 2007). Until now, only 56 species have been described of which 20 are Oriental, 13 Palearctic, 11 Nearctic, 6 Australian, 4 Afrotropical, and 2 Neotropical (Kamalanathan *et al.* 2022). It is rather interesting to note that all the Oriental species of *Calotelea* were described from India.

*Calotelea* can be distinguished by their slender, fusiform body, variable body color (yellow, or brown to black forms), sub-globose head (rarely transverse), frons without median depression, central keel present or absent, gena striate, lateral ocelli contiguous or close to inner orbital margin, antenna 12-merous in both sexes, clavate in females and filiform in males, radicle elongate, skaphion distinct, notauli present or

absent, metascutellar lamina present or absent, if present, with various shapes, fore wing with or without transverse bands, metasoma spindle-like, T3 largest of all tergites, females with dorsal horn on T1 and a short T7 (Popovici *et al.* 2013; Kamalanathan *et al.* 2022). Among the genera of Scelioninae from India, *Calotelea* resembles the most *Calliscelio* Ashmead, 1893. However, *Calliscelio* lacks skaphion, gena never striated, radicle is not elongate and T7 is short in females.

As a part of our ongoing taxonomic investigation on scelionids from India, we hereby describe four species of *Calotelea* as new to science – *C. acuta* Rajmohana & Debnath sp. nov., *C. chitraka* Rajmohana & Debnath sp. nov., *C. foveata* Rajmohana & Debnath sp. nov. and *C. fulva* Rajmohana & Debnath sp. nov. Further, *Calliscelio malabaricus* Narendran & Ramesh Babu, 1999 is transferred to *Calotelea* as *Calotelea malabarica* (Narendran & Ramesh Babu) comb. nov. Adding the above five species, an identification key, modified from Kamalanathan *et al.* (2022), is also provided.

## Material and methods

Specimens for this study belonged to National Zoological Collection (NZC) at Western Ghat Regional Center (WGRC), Zoological Survey of India (ZSI), Calicut and also those received on loan from Western Ghats Insect Inventory Programme of Ashoka Trust for Research in Ecology and the Environment (ATREE), Bangalore. The collected specimens were preserved in absolute ethanol and later card mounted. A Leica M205A stereo microscope with 1× objective, fitted with a Leica DFC 500 digital camera, was used for the taxonomic study and image acquisition. The images were later processed with Leica Application Suite (LAS) ver. 3.6 extended focus software. Morphological terminologies follow Masner (1976, 1980c), Mikó *et al.* (2007), Kamalanathan *et al.* (2022), measurements follow Mikó *et al.* (2010) and the description of surface sculpture follows Harris (1979). The type material is deposited in the NZC, WGRC, ZSI, Calicut, Kerala.

## Abbreviations for morphological terms

A1–A12	= antennomeres 1–12 (A1 = scape, A2 = pedicel)
HH	= head height
HW	= head width
IOS	= interorbital space
L	= length
LOL	= lateral ocellar line
<i>m</i>	= marginal vein
OD	= ocellar diameter
OOL	= ocular ocellar line
<i>pm</i>	= post-marginal vein
POL	= posterior ocellar line
<i>st</i>	= stigmal vein
T1–T6	= metasomal tergites 1–6
W	= width

## Results

### Taxonomy

Class Insecta Linnaeus, 1758  
Order Hymenoptera Linnaeus, 1758  
Superfamily Platygastroidea Naumann, 1991  
Family Scelionidae Haliday, 1839  
Genus *Calotelea* Westwood, 1837

*Calotelea acuta* Rajmohana & Debnath sp. nov.

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Fig. 1, Table 1

### Diagnosis

In the key to species of *Calotelea* by Kamalanathan *et al.* (2022), *C. acuta* Rajmohana & Debnath sp. nov. comes close to *C. laminaris* Rajmohana, 2013. But *C. acuta* can be distinguished by a slender, narrow metasoma,  $4.3 \times$  as long as wide (in *C. laminaris*,  $3.5 \times$  as long as wide), a foveolate pronotal cervical sulcus (in *C. laminaris*, pronotal cervical sulcus smooth), the presence of a mesopleural carina (in *C. laminaris*, mesopleural carina absent) and  $pm > 3.0 \times$  as long as  $m$  (in *C. laminaris*,  $pm < 3.0 \times m$ ).

### Etymology

The specific epithet is after the Latin word ‘*acutus*’ = ‘pointed’, due to the shape of the metasomal apex.

### Type material

#### Holotype

INDIA • ♀; Karnataka, Coorg, Talakavery wildlife sanctuary; 12.4326° N, 75.4555° E; 385 m a.s.l.; 5 Nov. 2013; P.M. Sureshan leg.; yellow pan trap; ZSI/WGRC/IR.INV.4280.

#### Paratype

INDIA • ♀; Karnataka, Biligirirangan Hills; 11.9988° N, 77.1398° E; 1246 m a.s.l.; Apr. 2007; Priyadarsanan leg.; Malaise trap; ZSI/WGRC/IR.INV.26852.

### Description

#### Female

MEASUREMENTS. Length of body = 2.15–2.17 mm (n = 2).

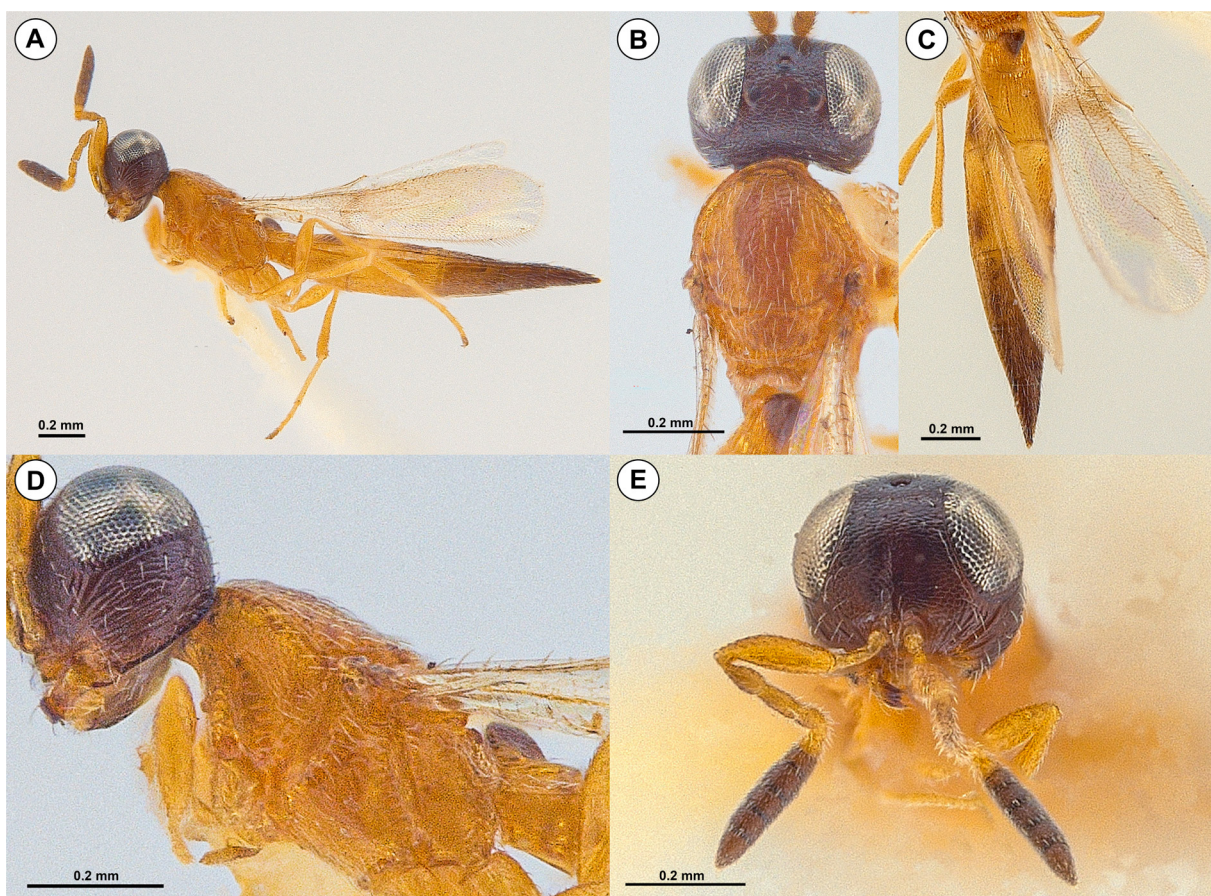
COLOR. Head black; body honey brown; apex of mandibles, medial longitudinal patches on mesoscutum and mesoscutellum, lateral patches towards posterior margin of T2 and T3, reddish-brown; dorsal horn on T1 and T4–T7 darker. Antenna honey brown, except last five claval segments being brownish black. Fore wing with obscure transverse band near to marginal vein.

HEAD.  $1.3 \times$  as wide as high,  $1.1 \times$  as high as long, with fine reticulate sculpture throughout, including frons, vertex and gena, very sparsely setose; vertex smoothly curved to occiput; occipital carina present; hyperoccipital carina absent. IOS  $0.4 \times$  of HW; POL > LOL > OOL in ratio of 10:5:1; OOL  $0.2 \times$  OD; central keel  $0.4 \times$  HH; frontal depression absent; eyes glabrous; malar sulcus smooth and with uniform width. Radicle elongate,  $0.5 \times$  of A1; A1  $3.1 \times$  as long as wide; A2  $1.2 \times$  as long as A3; proportions of length to medial width of A1 to A6 (19:6), (9:4), (7:4), (7:4), (3:3), (3:3); clava 6-merous,  $4.6 \times$  as long as wide.

MESOSOMA. L:W = 37:31; mesoscutum and mesoscutellum with same sculpture as on head and densely setose; skaphion with same sculpture as head; notauli absent; mesoscutum  $1.1\times$  as wide as long; mesoscutal humeral sulcus and suprahumeral sulcus foveolate; mesoscutellum  $2.2\times$  as wide as long; scutoscutellar sulcus foveolate laterally, medially smooth; posterior scutellar sulcus complete, foveolate; anterior margin of metascutellum and metanotal trough foveolate; metascutellar lamina transparent, longitudinally striate, except margined anteriorly by a row of minute fovea, posterior margin with distinct concave notch medially; posterolateral corners of metascutellum without projections; anteromedial corners of propodeum without projections; lateral propodeal carina not visible dorsally; epomial carina indistinct; pronotal cervical sulcus foveolate; pronotal suprahumeral sulcus foveolate; netrion present, smooth; netrion sulcus foveolate with 6 foveae; mesopleural carina present; mesopleural pit distinct; prespecular sulcus foveolate and foveae with uniform diameter; mesepimeral sulcus complete, foveolate and foveae with uniform diameter; femoral depression smooth; episternal sulcus foveolate; postacetabular sulcus smooth; metapleural sulcus present as smooth furrow, anterodorsally sulcate; posterodorsal metapleural sulcus sulcate; paracoxal sulcus smooth; metapleural carina distinct.

MACROPTEROUS. Fore wing (L:W = 12.5:3.5)  $3.5\times$  as long as wide;  $m:st:pm = 4:5:13$ ; microtrichia small. Hind wing  $6.7\times$  as long as wide.

METASOMA. L:W = 14:3.2; pedunculate; T1  $0.6\times$  of T2 length, with a dorsally smooth, laterally sparsely striate dorsal horn, rest of T1 with strong longitudinal costae; T2  $0.6\times$  of T3 length, transverse, basally



**Fig. 1.** *Calotelea acuta* Rajmohana & Debnath sp. nov., holotype, ♀ (ZSI/WGRC/IR.INV.4280). A. Lateral habitus. B. Dorsal view of mesosoma. C. Dorsal view of metasoma. D. Lateral view of head and mesosoma. E. Frontal view.

costate, medially longitudinally striate, laterally striolate, laterally setose; rest of tergites striate reticulate, laterally sparsely setose; proportions of length to width of T1 to T5 (15:16), (23:20), (36:30), (27:28), (19:18); ovipositor not extruded.

**Male**

Unknown.

**Biology**

Host unknown.

**Distribution**

Karnataka (India).

**Variation**

Nil, except minor difference in body length (see the description above).

*Calotelea chitraka* Rajmohana & Debnath sp. nov.

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Fig. 2, Table 1

**Diagnosis**

In the key to species of *Calotelea* by Kamalanathan *et al.* (2022), *C. chitraka* Rajmohana & Debnath sp. nov. comes close to *C. aurea* Veenakumari & Popovici, 2022. But *C. chitraka* can be distinguished in having a coriaceous sculpture throughout on the frons (in *C. aurea*, frons dorsally smooth, rest weakly rugose-reticulate), a dorsal horn on T1 with lateral striations (in *C. aurea*, T1 horn reticulate), and T4–T5 coriaceous (in *C. aurea*, T4–T5 smooth).

**Etymology**

The specific name is after the Sanskrit word ‘*chitraka*’ = ‘spotted’, due to the black lateral patches on T2 and T3.

**Type material**

**Holotype**

INDIA • ♀; Karnataka, Biligirirangan Hills; 11.9988° N, 77.1398° E; 1246 m a.s.l.; 20 Apr. 2007; Priyadarsanan leg.; Malaise trap; ZSI/WGRC/IR.INV.4233.

**Paratypes**

INDIA • 2 ♀♀; same data as for holotype; ZSI/WGRC/IR.INV.4234 to 4235.

**Description**

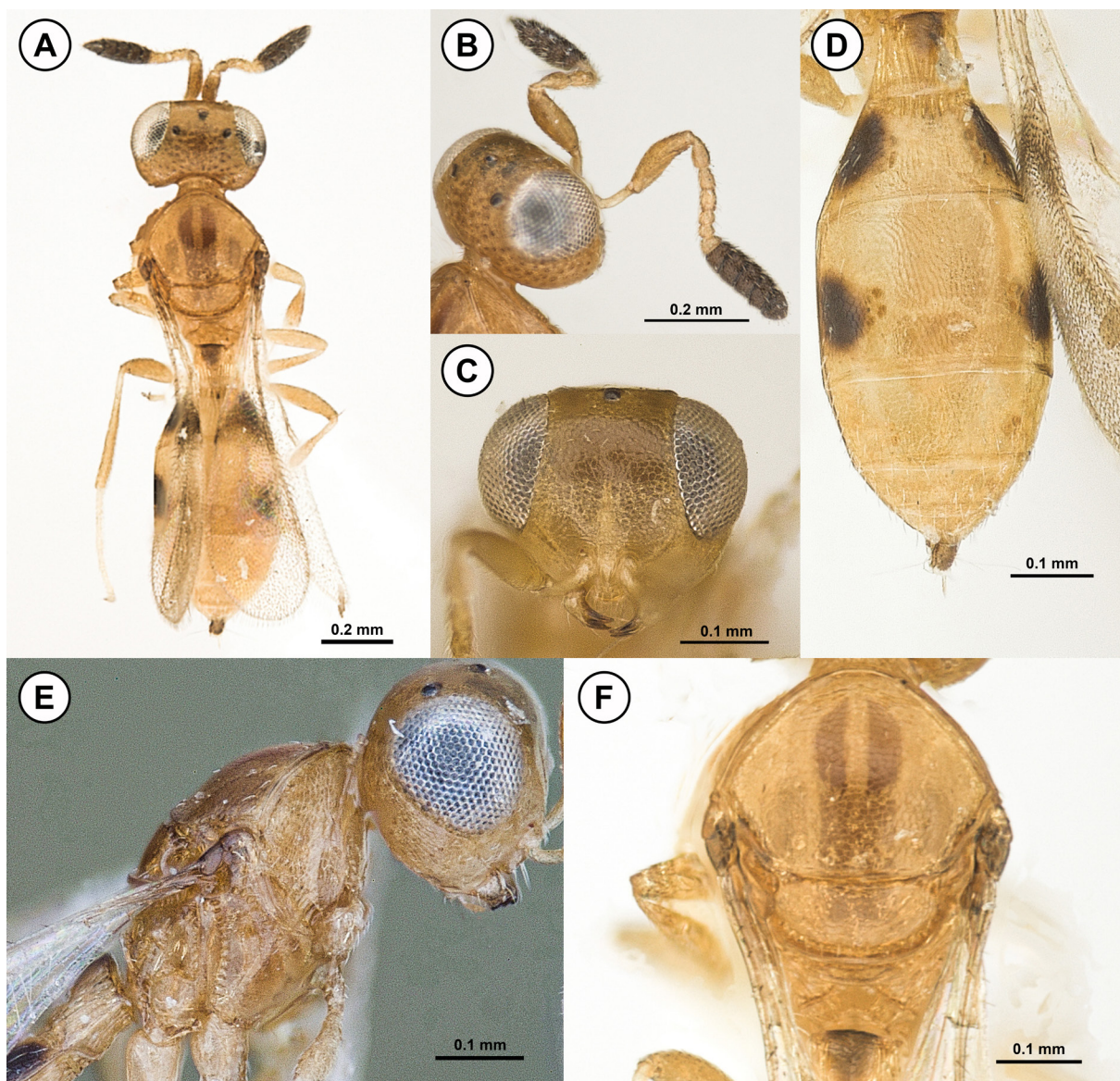
**Female**

MEASUREMENTS. Length of body = 1.56–1.62 mm (n = 3).

COLOR. Head and body golden yellow throughout, except dorsal horn on T1 and T6 brownish black; T2 and T3 with prominent black lateral patches towards its posterior end; tip of mandibles, patch on upper frons, spots on occiput and gena, medial longitudinal patches on mesoscutum and mesoscutellum reddish-brown; ocelli black. Antenna golden yellow, except last five claval segments being brownish black. Fore wing with dark obscure transverse band near to marginal vein.

HEAD.  $1.2\times$  as wide as high,  $1.1\times$  as high as long, with evenly coriaceous sculpture throughout including frons, vertex and gena, extremely sparsely setose; vertex smoothly curved to occiput; occipital carina present; hyperoccipital carina absent. IOS  $0.4\times$  of HW; POL > LOL > OOL in ratio of 128:72:10; OOL  $0.3\times$  of OD; central keel absent; frontal depression absent; eyes glabrous; malar sulcus smooth and with uniform width. Radicle elongate,  $0.5\times$  of A1; A1  $3.1\times$  as long as wide; A2  $1.4\times$  as long as A3; proportions of length to medial width of A1 to A6 (155:50), (55:38), (39:30), (39:32), (26:33), (22:31); clava 6-merous,  $3.3\times$  as long as wide.

MESOSOMA. L:W = 34.5:32; mesoscutum and mesoscutellum with same sculpture as on head and without any setae; skaphion with same sculpture on vertex; notauli absent; mesoscutum  $1.2\times$  as wide as long; mesoscutal humeral sulcus foveolate; mesoscutal suprahumeral sulcus smooth; mesoscutellum  $2.5\times$  as wide as long; scutoscullar sulcus foveolate laterally, medially smooth; posterior scutellar sulcus



**Fig. 2.** *Calotelea chitraka* Rajmohana & Debnath sp. nov., holotype, ♀ (ZSI/WGRC/IR.INV.4233). A. Dorsal habitus. B. Antenna. C. Frontal view. D. Dorsal view of metasoma. E. Lateral view of head and mesosoma. F. Dorsal view of mesosoma.

complete, foveolate; anterior margin of metascutellum and metanotal trough foveolate; metascutellar lamina absent; posterolateral corners of metascutellum without projections; anteromedial corners of propodeum without projections; lateral propodeal carina distinct, margined by row of fovea; epomial carina indistinct; pronotal cervical sulcus smooth; pronotal suprahumeral sulcus smooth; netrion present, smooth; netrion sulcus foveolate with 6 foveae; mesopleural carina present; mesopleural pit distinct; prespecular sulcus foveolate and foveae with uniform diameter; mesepimeral sulcus complete, foveolate and foveae with uniform diameter; femoral depression smooth; episternal sulcus smooth; postacetabular sulcus smooth; metapleural sulcus present as smooth furrow, anterodorsally sulcate; posterodorsal metapleural sulcus sulcate; paracoxal sulcus smooth; metapleural carina distinct.

MACROPTEROUS. Fore wing (L:W = 94.5:26.9)  $3.5\times$  as long as wide;  $m:st:pm = 62:80:181$ ; microtrichia small. Hind wing  $9.6\times$  as long as wide.

METASOMA. L:W = 84.9:36.7; pedunculate; T1  $0.8\times$  of T2 length, with a dorsally smooth, laterally sparsely striate dorsal horn, rest of T1 with strong longitudinal costae; T2  $0.5\times$  of T3 length, transverse, basally costate, medially longitudinally striate, laterally striolate, sublaterally sparsely setose, posteriorly smooth; T3 reticulate with trace of fine longitudinal striae medially, sparsely setose laterally and sublaterally; T4–T5 coriaceous sculpture except posterior smooth margin, laterally and sublaterally setose; T6 smooth; proportions of length to width of T1 to T5 (10.9:90), (12.3:13.7), (22.8:27.2), (11.3:27.6), (53:19.7); ovipositor not extruded.

#### Male

Unknown.

#### Biology

Host unknown.

#### Distribution

Karnataka (India).

#### Variation

Nil, except minor difference in body length (see the description above).

*Calotelea foveata* Rajmohana & Debnath sp. nov.

[urn:lsid:zoobank.org:act:67BB4451-F7D2-4634-9424-9D03FFF12538](https://zoobank.org/act:67BB4451-F7D2-4634-9424-9D03FFF12538)

Fig. 3, Table 1

#### Diagnosis

As per key to species of *Calotelea* by Kamalanathan *et al.* (2022), *C. foveata* Rajmohana & Debnath sp. nov. is keyed to *C. brevinotaularis* Veenakumari & Popovici, 2022. But *C. foveata* can be distinguished by notauli indicated as a pit anteriorly (in *C. brevinotaularis*, notauli prominent and present in anterior half), a lateral pronotal area with irregular reticulate sculpture, without any carina (in *C. brevinotaularis*, anterodorsally, dorsomedially and posterodorsally carinate but medially and posteroventrally smooth), a comparatively less elongate metasoma, only  $3.2\times$  as long as wide (in *C. brevinotaularis*,  $3.7\times$  as long as wide); a mesoscutal suprahumeral sulcus foveolate (in *C. brevinotaularis*, smooth) and a pronotal cervical sulcus foveolate (in *C. brevinotaularis*, smooth).

#### Etymology

The species is named '*foveata*' after its foveolate sulci.

**Type material**

**Holotype**

INDIA • ♀; Kerala, Konnakkad, Kasargod; 12.3672° N, 75.3733° E; 125 m a.s.l.; 7 Jan. 2013; Rajmohana leg.; yellow pan trap; ZSI/WGRC/IR.INV.26853.



**Fig. 3.** *Calotelea foveata* Rajmohana & Debnath sp. nov., holotype, ♀ (ZSI/WGRC/IR.INV.26853). A. Dorsal habitus. B. Lateral view of head. C. Dorsal view of mesosoma (arrows indicate notauli). D. Lateral view of mesosoma. E. Fore wing. F. Dorsal view of metasoma.

### Paratype

INDIA • ♀; Kerala: Mangaladevi, Periyar Tiger Reserve; 9.4631° N, 77.2287° E; 1340 m a.s.l.; 4 Sep. 2015; Nikhil leg.; yellow pan trap; ZSI/WGRC/IR.INV.26854.

### Description

#### Female

MEASUREMENTS. Length of body = 1.61–1.66 mm (n = 2).

COLOR. Body predominantly dark brown to black except legs and T2–T4 light brown; eyes and ocelli silvery. Antenna light brown except claval segments being brownish black. Wings hyaline.

HEAD. 1.2 × as wide as high, 1.1 × as high as long, with evenly coriaceous sculpture throughout including frons, vertex and gena, very sparsely setose; vertex smoothly curved to occiput; occipital carina and hyperoccipital carina absent; IOS 0.4 × of HW. POL > LOL > OOL in ratio of 109:66:11; OOL 0.4 × OD; central keel 0.4 × HH; frontal depression absent; eyes glabrous; malar region coriaceous; malar sulcus smooth and with uniform width; gena and post gena with same sculpture as vertex. Radicle elongate, 0.3 × of A1; A1 4.1 × as long as wide; A2 2.0 × as long as A3; proportions of length to medial width of A1 to A6 (162:39), (71:35), (34:21), (35:25), (25:24), (20:24); clava 5-merous, 4.1 × as long as wide.

MESOSOMA. L:W = 33:27; mesoscutum with same sculpture and setosity as head; mesoscutellum smooth; skaphion smooth; notauli indicated anteriorly as pit; mesoscutum nearly subequal in length and width; mesoscutal humeral sulcus not foveolate; mesoscutal suprahumeral sulcus foveolate towards tegula; mesoscutellum smooth and shiny, 2.3 × as wide as long; scutoscutellar sulcus foveolate laterally, medially smooth; posterior scutellar sulcus complete, foveolate; anterior margin of metascutellum and metanotal trough foveolate; metascutellar lamina absent; posterolateral corners of metascutellum without projections; anteromedial corners of propodeum without projections; lateral propodeal carina distinct, bordered by irregular foveae; epomial carina distinct; lateral propodeal area with irregular reticulate sculpture; pronotal cervical sulcus foveolate; pronotal suprahumeral sulcus foveolate; netrion present; netrion sulcus foveolate with 5 foveae; mesopleural carina present; mesopleural pit distinct; prespecular sulcus foveolate and foveae with uniform diameter; mesepimeral sulcus complete, foveolate and foveae with uniform diameter; femoral depression smooth; episternal sulcus smooth; postacetabular sulcus smooth; metapleural sulcus present as smooth furrow, anterodorsally sulcate; posterodorsal metapleural sulcus sulcate; paracoxal sulcus smooth; metapleural carina distinct.

MACROPTEROUS. Fore wing (L:W = 10.5:2.9) 3.6 × as long as wide;  $m:st:pm = 4:3:14$ ; microtrichia small. Hind wing 5.0 × as long as wide.

METASOMA. L:W = 97:30; pedunculate; T1 0.7 × of T2 length, with smooth dorsal horn, rest of T1 with strong longitudinal costae; T2 almost as long as T3, 0.9 × of T3 length, transverse, basally costate, rest striate reticulate except posterior smooth margin, sublaterally sparsely setose; rest of tergites with coriaceous sculpture except posterior smooth margin, laterally and sublaterally sparsely setose; proportions of length to width of T1 to T5 (15.1:15), (20:20.5), (20.5:28.5), (17.7:29.9), (11.3:21.4); ovipositor not extruded.

#### Male

Unknown.

### Biology

Host unknown.

### Distribution

Kerala (India).

### Variation

Nil, except minor difference in body length (see the description above).

*Calotelea fulva* Rajmohana & Debnath sp. nov.

[urn:lsid:zoobank.org:act:DF14E8F2-397E-4971-B370-F0426BA8D7DF](https://doi.org/10.21203/rs.3.rs-2811111/v1)

Fig. 4, Table 1

### Diagnosis

In the key to species of *Calotelea* by Kamalanathan *et al.* (2022), *C. fulva* Rajmohana & Debnath sp. nov. comes close to *C. trikona* Veenakumari & Popovici, 2022. But *C. fulva* can be distinguished by a metascutellar lamina medially concave and notched (in *C. trikona*, metascutellar lamina triangular), metasoma slender,  $3.5 \times$  as long as wide (in *C. trikona*, comparatively wider, only  $2.6 \times$  as long as wide) and a mesoscutal suprahumeral sulcus foveolate (in *C. trikona*, mesoscutal suprahumeral sulcus smooth). However, in the key provided here, *C. fulva* comes close to *C. kannagiae* Veenakumari & Popovici, 2022. But *C. fulva* can be distinguished from the latter by the following characters: head black (in *C. kannagiae*, brown); fore wing without vertical band (in *C. kannagiae*, vertical band present basally); horn on T1 smooth (in *C. kannagiae*, reticulate); pronotal suprahumeral sulcus smooth (in *C. kannagiae*, foveolate); OOL  $0.5 \times$  OD (in *C. kannagiae*, lateral ocellus contiguous with orbit).

### Etymology

The specific epithet is after the Latin word '*fulvus*' = 'dark', due to its dark, brown color.

### Type material

#### Holotype

INDIA • ♀; Karnataka, Coorg, Thalakaveri Wildlife Sanctuary; 12.4326° N, 75.4555° E; 378 m a.s.l.; 5 Nov. 2013; P. M. Sureshan leg.; sweep net; ZSI/WGRC/IR.INV.4236.

### Description

#### Female

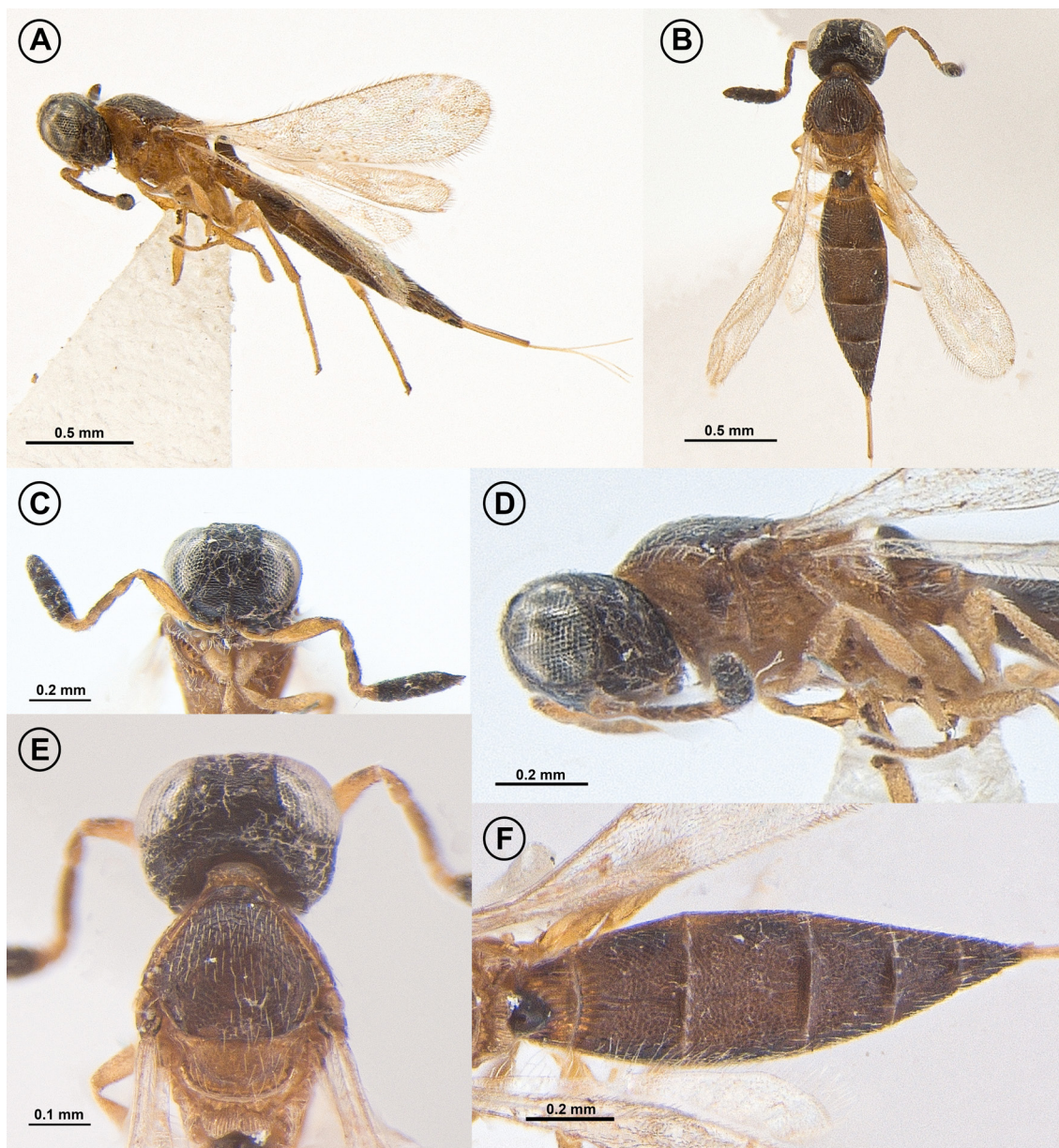
MEASUREMENTS. Length = 2.06 mm.

COLOR. Head, dorsal horn on T1 black; mesosoma and metasoma dark brown except light brown mesoscutellum; legs yellow. Antenna yellow, except last five claval segments being brownish black. Wings hyaline.

HEAD.  $1.2 \times$  as wide as high,  $1.3 \times$  as high as long, head with evenly coriaceous sculpture throughout, including frons, vertex, and gena, sparsely setose; vertex smoothly curved to occiput; occipital carina present, crenulate medially; hyperoccipital carina absent; IOS  $0.4 \times$  of HW. POL > LOL > OOL in ratio of 116:64:15; OOL  $0.6 \times$  of OD; central keel indistinct; frontal depression absent; eyes glabrous; malar sulcus smooth and with uniform width. Radicle elongate,  $0.4 \times$  of A1; A1  $4.0 \times$  as long as wide; A2  $0.9 \times$  A3 in length; proportions of length to medial width of A1 to A6 (233:58), (71:39), (74:33), (56:35), (34:34), (29:33); clava 6-merous,  $3.5 \times$  as long as wide.

MESOSOMA. L:W = 46:38; mesoscutum and mesoscutellum with same sculpture as on vertex and densely setose; skaphion with same sculpture as on vertex; notauli absent; mesoscutum  $1.1 \times$  as wide

as long; mesoscutal humeral and suprahumeral sulcus foveolate; mesoscutellum  $1.9\times$  as wide as long; scutoscutellar sulcus foveolate; posterior scutellar sulcus complete, foveolate; metanotal trough foveolate; metascutellar lamina transparent, longitudinally striate, but, margined anteriorly by row of minute fovea, posterior margin with distinct concave notch medially; posterolateral corners of metascutellum without projections; anteromedial corners of propodeum without projections; lateral propodeal carina present; epomial carina indistinct; pronotal cervical sulcus foveolate; pronotal suprahumeral sulcus smooth; netrion present, smooth; netrion sulcus foveolate with 6 foveae; mesopleural carina present; mesopleural pit distinct; prespecular sulcus foveolate and foveae with uniform diameter; mesepimeral sulcus complete, foveolate and foveae with uniform diameter; femoral depression smooth; episternal foveae distinct; postacetabular sulcus foveolate; metapleural pit distinct; metapleural sulcus present as



**Fig. 4.** *Calotelea fulva* Rajmohana & Debnath sp. nov., holotype, ♀ (ZSI/WGRC/IR.INV.4236). **A.** Lateral habitus. **B.** Dorsal habitus. **C.** Frontal view. **D.** Lateral view of head and mesosoma. **E.** Dorsal view of head and mesosoma. **F.** Dorsal view of metasoma.

smooth furrow medially, anterodorsally sulcate; posterodorsal metapleural sulcus sulcate; paracoxal sulcus smooth; metapleural carina distinct.

MACROPTEROUS. Fore wing (L:W = 146.7:40.9)  $3.5\times$  as long as wide; ratio of length of *m:st:pm* = 7:10:25; microtrichia small. Hind wing  $8.7\times$  as long as wide.

METASOMA. L:W = 12.4:3.7. T1  $0.6\times$  as long as T2, with a smooth dorsal horn, rest of T1 with strong longitudinal costae; T2  $0.7\times$  of T3 length, finely reticulate throughout, medial costae extending entire length of tergite, while lateral costae confined to basal margin, setose laterally and sublaterally, posteriorly smooth; T3–T4 finely reticulate throughout with trace of medial costae extending entire length of tergite, setose laterally and sublaterally, posteriorly smooth; rest of tergites coriaceous, setose laterally and sublaterally, except posterior smooth margin; proportions of length to width of T1 to T5 (15:19), (22:24.8), (29.6:35.6), (19.4:31.5), (15.2:21.4); ovipositor extruded.

#### Male

Unknown.

#### Biology

Host unknown.

#### Distribution

Karnataka (India).

*Calotelea malabarica* (Narendran & Ramesh Babu, 1999) comb. nov.

Fig. 5, Table 1

*Calliscelio malabaricus* Narendran & Ramesh Babu, 1999: 2, 9 (original description, keyed).

#### Diagnosis

##### Female

Head black; mesosoma and metasoma till T3 reddish brown; T3 medially yellowish brown; T4 onwards brownish black to black; mesoscutum medially with obscure reddish brown longitudinal patches; horn on T1 black; fore wing without transverse band. Head coriaceous, with moderately dense setigerous punctate; dorsal mesosoma with coriaceous leathery sculpture throughout; lateral ocelli nearly contiguous with orbits; gena striate; skaphion present; scutoscuteellar sulcus foveolate; posterior scutellar sulcus complete, foveolate; metascutellar lamina transparent, longitudinally striate, but, margined anteriorly by a row of minute fovea, posterior margin with distinct concave notch medially. Metasoma narrow, elongate,  $5.5\times$  as long as its maximum width; T1 with strong longitudinal striae; T2–T4 with longitudinal striolae, interspersed with dense reticulations; T5 and T6 mat.

The following combination of characters serves to distinguish *C. malabarica* (Narendran & Ramesh Babu, 1999) comb. nov. from the rest of the Oriental species: head with moderately dense setigerous punctate, metascutellar lamina longitudinally striate and with a deep medial notch, metasoma very elongate ( $5.5\times$  as long as wide), T1–T4 longitudinally striate.

#### Type material

##### Holotype

INDIA • ♀; Kerala, Malappuram, Chandakunnu; 24 Apr 1989; Narendran and party leg.; card mounted; ZSI/WGRC/IR.INV.1337.



**Fig. 5.** *Calotelea malabarica* (Narendran & Ramesh Babu) comb. nov., holotype, ♀ (ZSI/WGRC/IR.INV.1337). **A.** Dorsal habitus. **B.** Lateral habitus. **C.** Antenna. **D.** Lateral view of mesosoma. **E.** Dorsal view of head and mesosoma. **F.** Holotype label.

### Remarks

This generic transfer is based on the study of the holotype. Even the original description (Narendran & Ramesh Babu, 1999) stating “lower frons and gena with radiating carinae from the distal tip of the malar groove; skaphion slightly indicated”, supports the new placement of the species under *Calotelea*.

*Calotelea trikona* Veenakumari & Popovici, 2022

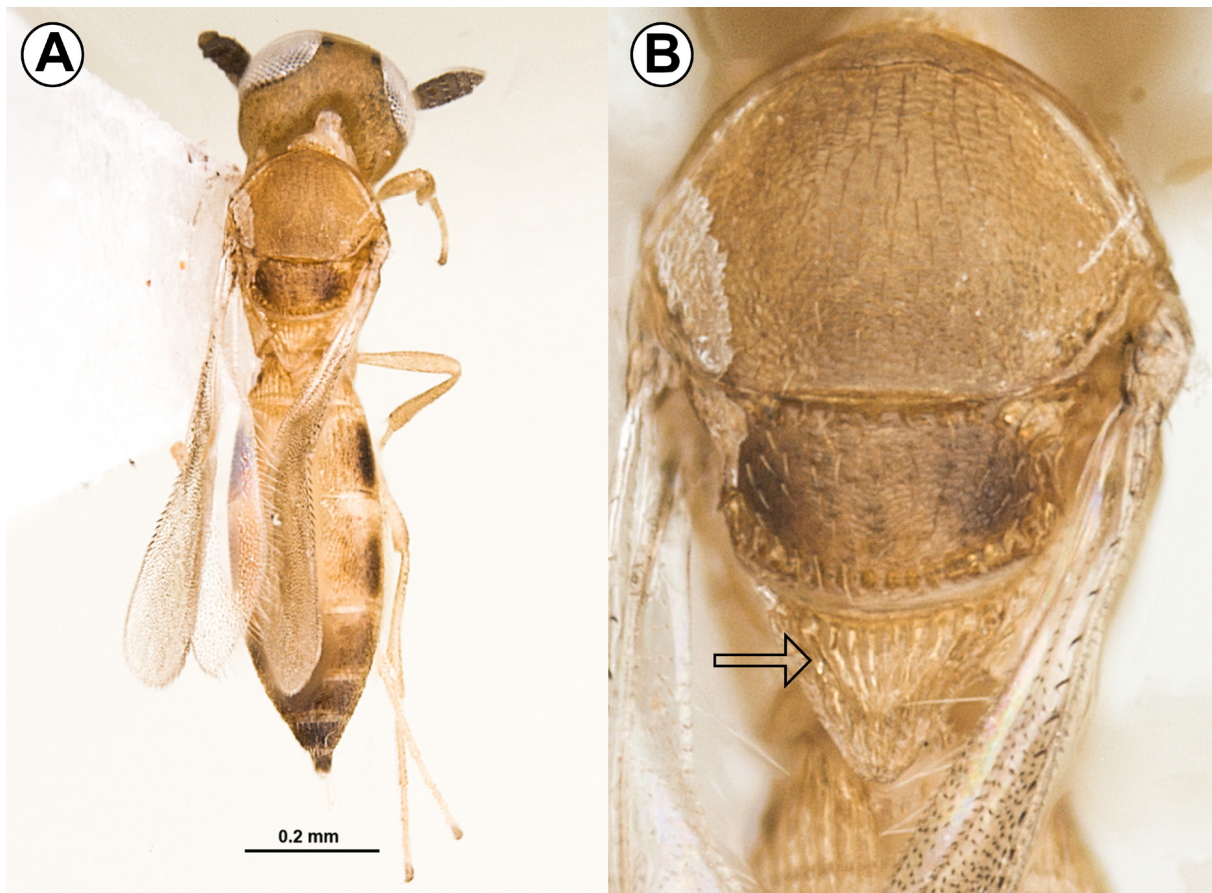
Fig. 6, Table 1

### Material examined

INDIA • ♀; Kerala, Wayanad, Kalpetta; 4 Oct 2015; Rajmohana leg.; yellow pan trap; ZSI/WGRC/IR.INV.26855.

### Distribution

Karnataka, Kerala, Meghalaya, Tamil Nadu, Uttar Pradesh (India).



**Fig. 6.** *Calotelea trikona* Veenakumari & Popovici, 2022 ♀ (ZSI/WGRC/IR.INV.26855). **A.** Dorsal habitus. **B.** Enlarged dorsal view of mesosoma (arrow indicates metascutellar lamina).

**Key to the Oriental species of *Calotelea* Westwood, 1837**

(based on females, modified from Kamalanathan *et al.* 2022)

1. Lateral ocelli far from orbits, OOL  $2.0 \times$  OD; fore wing with a closed medial cell ..... *C. indica* Mani, 1975
- Lateral ocelli contiguous or nearer to orbits, OOL at most  $0.5 \times$  OD (Figs 1B, 2A); fore wing without a closed medial cell (Fig. 4A) ..... 2
2. Metascutellar lamina present (Figs 1B, 4E, 6B) ..... 3
- Metascutellar lamina absent (Figs 2F, 3C) ..... 13
3. Metascutellar lamina triangular (Fig. 6B); metasoma  $< 2.6 \times$  longer than wide ..... *C. trikona* Veenakumari & Popovici, 2022
- Metascutellar lamina never triangular (Figs 1B, 4E); metasoma always  $> 3.0 \times$  longer than wide . 4
4. T3 to T6 smooth and shiny ..... *C. auriventria* Sharma, 1978
- T3 to T6 sculptured (Fig. 4F) ..... 5
5. Metascutellar lamina with a deep medial notch (Figs 1B, 4E) ..... 6
- Metascutellar lamina without deep medial notch ..... 10

6. Head moderately dense setigerous punctate (Fig. 5E); metasoma very elongate,  $5.5\times$  as long as wide ..... *C. malabarica* (Narendran & Ramesh Babu) comb. nov.  
 – Head not setigerous punctate, with variable sculptures; metasoma always  $< 4.5\times$  as long as wide 7
7. Central keel present, at least up to mid-level of eye (Fig. 1E) ..... 8  
 – Central keel indistinct (Fig. 4C) ..... 9
8. Metasoma  $4.3\times$  as long as wide (Fig. 4C); mesopleural carina present; post marginal vein  $> 3.0\times$  as long as marginal vein ..... *C. acuta* Rajmohana & Debnath sp. nov.  
 – Metasoma  $3.5\times$  as long as wide; mesopleural carina absent; post marginal vein  $< 3.0\times$  as long as marginal vein ..... *C. laminaris* Rajmohana, 2013
9. Head black; fore wing without any vertical band basally (Fig. 4A); T1 horn smooth .....  
 ..... *C. fulva* Rajmohana & Debnath sp. nov.  
 – Head brown; fore wing with a vertical band basally; T1 horn reticulate .....  
 ..... *C. kannagiae* Veenakumari & Popovici, 2022
10. Notauli percurrent; basal  $\frac{1}{3}$  of wings narrow ..... 11  
 – Notauli absent; wings gradually widening from base ..... 12
11. Apical end of horn on T1 bending posteriorly with a tooth anterodorsally; sculpture of horn on T1 reticulate; vertex and lateral notaular area reticulate; lateral pronotal area dorsally reticulate, ventrally smooth; all foveae on pleuron present as shallow impressions .....  
 ..... *C. andamanensis* Veenakumari & Popovici, 2022  
 – Apical end of horn on T1 not bending posteriorly; sculpture of horn on T1 predominantly smooth; vertex and lateral notaular area entirely smooth; lateral pronotal area entirely smooth; all foveae on pleuron deep ..... *C. microtrichiana* Veenakumari & Popovici, 2022
12. Head black; frons coriaceous reticulate; central keel indicated by a sharp continuous carina; occipital carina deeply foveolate; fore wing with a narrow vertical band basally and without infusate patch distally; marginal vein longer than stigma vein; T2 and T3 with longitudinal carinae medially; femoral depression smooth to weakly reticulate ..... *C. mandavyai* Veenakumari & Popovici, 2022  
 – Head yellowish-brown; frons transversely striate; central keel indistinct, indicated by discontinuous rugae; occipital carina not foveolate; fore wing with a wide vertical band basally in addition to infusate patch distally; stigma vein longer than marginal vein; T2 and T3 entirely reticulate except for basal costae on T2; femoral depression smooth with blunt transverse carinae .....  
 ..... *C. oloftoreni* Veenakumari & Popovici, 2022
13. Notauli incomplete or abbreviate as a pit (Fig. 3C) ..... 14  
 – Notauli completely absent (Fig. 2F) ..... 19
14. Mesopleural carina present ..... 15  
 – Mesopleural carina absent ..... 16
15. Notauli indicated only anteriorly, abbreviate and pit-like (Fig. 3C); mesoscutal suprahumeral sulcus foveolate ..... *C. foveata* Rajmohana & Debnath sp. nov.  
 – Notauli incomplete, confined to anterior half of mesoscutum; mesoscutal suprahumeral sulcus not foveolate ..... *C. brevinotularis* Veenakumari & Popovici, 2022
16. Metasoma never exceeding  $2.8\times$  of its width; T2 medially smooth; T5 and T6 wide, at least  $2.4\times$  and  $2.0\times$  as wide as long respectively ..... *C. lambodara* Veenakumari & Popovici, 2022  
 – Metasoma elongate, always exceeding  $4.0\times$  of its width; T2 with longitudinal striae medially; T5 and T6 comparatively less wide ..... 17

17. Netrion sulcus with four foveae; notauli reaching up to anterior half of mesoscutum; mesoscutellum narrow,  $3.8 \times$  as wide as long ..... *C. marykingsleyae* Veenakumari & Popovici, 2022  
 – Netrion sulcus with six to seven foveae; notauli reaching up to anterior  $\frac{3}{4}$  of mesoscutum; mesoscutellum wide,  $3.2 \times$  as wide as long ..... 18
18. Skaphion narrow,  $6.0 \times$  as wide as long; T3 and T4 longitudinally striate medially; scutoscutellar sulcus wide; anterior foveae of metascutellum visible when viewed dorsally; lateral propodeal area with large depressions; foveae of mesepimeral sulcus spaced apart; pronotal cervical sulcus ventrally foveolate; episternal sulcus entirely foveolate ..... *C. longistriata* Veenakumari & Popovici, 2022  
 – Skaphion wide,  $3.5 \times$  as wide as long; T3 and T4 anteriorly reticulate, posteriorly striate; scutoscutellar sulcus narrow; anterior foveae of metascutellum hidden beneath posteromedial mesoscutellum when viewed dorsally; lateral propodeal area smooth, with transverse carina; foveae of mesepimeral sulcus closely spaced; pronotal cervical sulcus not foveolate; episternal sulcus indicated with a single fovea dorsally ..... *C. hodgsoni* Veenakumari & Popovici, 2022
19. T2 and T3 predominantly smooth; fore wing without vertical bands; metasoma  $> 4.0 \times$  as long as wide ..... *C. immaculata* Sharma, 1978  
 – T2 and T3 sculptured (Fig. 2D); fore wing with vertical bands; metasoma  $< 3.5 \times$  as long as wide ..... 20
20. Central keel present; fore wing with two vertical bands ..... 21  
 – Central keel absent (Fig. 2C); fore wing with one vertical band ..... 22
21. Horn on T1 reticulate; anteromedial corners of propodeum projecting upwards as short spines ..... *C. sushrutai* Veenakumari & Popovici, 2022  
 – Horn on T1 sparsely striate; anteromedial corners of propodeum without upward projections ..... *C. nigriventris* Veenakumari & Popovici, 2022
22. Horn on entirely T1 smooth; mesopleural carina absent ..... *C. sibyllamerianae* Veenakumari & Popovici, 2022  
 – Horn on T1 sculptured at least in part; mesopleural carina present ..... 23
23. Frons coriaceous throughout (Fig. 2C); horn on T1 dorsally smooth, laterally sparsely striate; with lateral striations; T4 and T5 coriaceous (Fig. 2D) ..... *C. chitraka* Rajmohana & Debnath sp. nov.  
 – Frons dorsally smooth, rest weakly rugose-reticulate; horn on T1 reticulate; T4 and T5 smooth ..... *C. aurea* Veenakumari & Popovici, 2022

## Discussion

From the known diversity and distribution of the genus *Calotelea*, the center of evolution seems to be the tropics of both the Old and New World (Masner 1980b). All the species from the Oriental region are known from India (Table 1).

Till date, two species groups are recognized under *Calotelea* namely the ‘*ocularis*’ species group with a metascutellar lamina (Masner (1980b) and the ‘*elegans*’ species group without a metascutellar lamina (Popovici *et al.* 2013). Masner (1980b) also proposed two large subgroups namely a xanthic (bright xanthic females and generally darker males) one and a melanic (both sexes melanic) one under the *ocularis* group and for the Old world species. Primarily, the *ocularis* group included Nearctic and Neotropical species (Masner 1980a, 1980b). However, species groups were not designated for any of the Old world species except the European species, *Calotelea laminata* Masner & Popovici, 2013, belonging to the *ocularis* species group (Popovici *et al.* 2013). The recent revisionary work of *Calotelea* from India (Kamalanathan *et al.* 2022) did not assign any group or subgroup to the newly described species. However, the collections made and the descriptions of the Oriental species of *Calotelea* support the idea that species groups are present in the Oriental region.

**Table 1.** Checklist of species of *Calotelea* Westwood, 1837 of the Oriental region.

	Species	Distribution	Reference
1	<i>C. acuta</i> Rajmohana & Debnath sp. nov.	India (Karnataka)	present study
2	<i>C. andamanensis</i> Veenakumari & Popovici, 2022	India (Andaman and Nicobar Islands)	Kamalanathan <i>et al.</i> (2022)
3	<i>C. aurea</i> Veenakumari & Popovici, 2022	India (Karnataka, Tamil Nadu)	Kamalanathan <i>et al.</i> (2022)
4	<i>C. auriventria</i> Sharma, 1978	India (Western Ghats)	Saraswat & Sharma (1978)
5	<i>C. brevinotaularis</i> Veenakumari & Popovici, 2022	India (Karnataka)	Kamalanathan <i>et al.</i> (2022)
6	<i>C. chitraka</i> Rajmohana & Debnath sp. nov.	India (Karnataka)	present study
7	<i>C. foveata</i> Rajmohana & Debnath sp. nov.	India (Kerala)	present study
8	<i>C. fulva</i> Rajmohana & Debnath sp. nov.	India (Karnataka)	present study
9	<i>C. hodgsoni</i> Veenakumari & Popovici, 2022	India (Tamil Nadu, Karnataka)	Kamalanathan <i>et al.</i> (2022)
10	<i>C. immaculata</i> Sharma, 1978	India (Tamil Nadu)	Saraswat & Sharma (1978)
11	<i>C. indica</i> Mani, 1975	India (Maharashtra)	Mani (1975)
12	<i>C. kannagiae</i> Veenakumari & Popovici, 2022	India (Andaman and Nicobar Islands)	Kamalanathan <i>et al.</i> (2022)
13	<i>C. lambodara</i> Veenakumari & Popovici, 2022	India (Karnataka)	Kamalanathan <i>et al.</i> (2022)
14	<i>C. laminaris</i> Rajmohana, 2013	India (Karnataka)	Rajmohana (2013)
15	<i>C. longistriata</i> Veenakumari & Popovici, 2022	India (Tamil Nadu, Karnataka)	Kamalanathan <i>et al.</i> (2022)
16	<i>C. malabarica</i> (Narendran & Ramesh Babu, 1999) comb. nov.	India (Kerala)	Narendran & Ramesh Babu (1999); present study
17	<i>C. mandavyai</i> Veenakumari & Popovici, 2022	India (Tamil Nadu, Karnataka)	Kamalanathan <i>et al.</i> (2022)
18	<i>C. marykingsleyae</i> Veenakumari & Popovici, 2022	India (Tamil Nadu, Karnataka)	Kamalanathan <i>et al.</i> (2022)
19	<i>C. microtrichiana</i> Veenakumari & Popovici, 2022	India (Andaman and Nicobar Islands)	Kamalanathan <i>et al.</i> (2022)
20	<i>C. montana</i> (Kieffer, 1906)	India (Maharashtra)	Kieffer (1906); Popovici & Kamalanathan (2019)
21	<i>C. nigriventris</i> Veenakumari & Popovici, 2022	India (Karnataka)	Kamalanathan <i>et al.</i> (2022)
22	<i>C. oloftoreni</i> Veenakumari & Popovici, 2022	India (Great Nicobar)	Kamalanathan <i>et al.</i> (2022)
23	<i>C. sibyllamerianae</i> Veenakumari & Popovici, 2022	India (Karnataka, Tamil Nadu)	Kamalanathan <i>et al.</i> (2022)
24	<i>C. sushrutai</i> Veenakumari & Popovici, 2022	India (Tamil Nadu, Karnataka)	Kamalanathan <i>et al.</i> (2022)
25	<i>C. trikona</i> Veenakumari & Popovici, 2022	India (Karnataka, Kerala, Meghalaya, Tamil Nadu, Uttar Pradesh)	Kamalanathan <i>et al.</i> (2022)

In the present study, we propose *C. acuta* Rajmohana & Debnath sp. nov. and *C. fulva* Rajmohana & Debnath sp. nov. under the ‘*ocularis*’ group whereas *C. chitraka* Rajmohana & Debnath sp. nov. and *C. foveata* Rajmohana & Debnath sp. nov. fall under the ‘*elegans*’ group. Only *C. chitraka* is a xanthic species while the rest are melanic species. Currently, for *Calotelea*, molecular data are limited on the Barcode of Life Database (BOLD) and on GenBank. Hence, to enhance the understanding of evolutionary dynamics of this genus as well as for revision of the species groups, there is an urgent need for generation and integration of molecular data in future studies.

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