



## Redescription of three antlions (Neuroptera: Myrmeleontidae) from Kerala part of the Western Ghats and key to antlion genera in tribe Palparini, India

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**ABSTRACT.** *Indopalpares pardus* (Rambur, 1842), *Palpares contrarius* (Walker, 1853), and *Stenares harpyia* (Gerstaecker, 1863) are the species of the tribe Palparini which are recorded for the first time from the Kerala part of Western Ghats. All three taxa are redescribed and the genitalia features of *P. contrarius*, and *S. harpyia* are illustrated for the first time based on the freshly collected specimens. Lectotype and paralectotype specimens of *S. harpyia* are designated. The key to the genera of the tribe Palparini from India and the distribution of three species in India are also mapped. Moreover, their flight period in India is plotted.

**Keywords:** Distribution, *Indopalpares*, lectotype, *Palpares*, *Stenares*, Taxonomy

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## INTRODUCTION

Myrmeleontidae is the largest family of Neuroptera with 2138 species belonging to 299 genera (including both antlions and owlflies), of which, only 153 species belonging to 52 genera were reported from India (Ghosh, 2000; Chandra & Sharma, 2009; Machado et al., 2019; Suryanarayanan et al., 2022; Wachkoo et al., 2024). According to the recent classification by Machado et al. (2019), the status of the owlfly family (Ascalaphidae) was changed to the subfamily Ascalaphinae. It currently includes some antlion species and all the owlfly species.

Palparini is one of the principal antlion tribes of Ascalaphinae with 137 species under 20 genera, of which 14 species under 5 genera are known from India (Chandra & Sharma, 2009; Giaomino & Ábrahám, 2018; Machado et al., 2019; Hassan et al., 2023; Suryanarayanan & Bijoy, 2024a; Wachkoo et al., 2024; Oswald, 2025). However, there is another classification where the palparids are not considered as a tribe but as a family (Prost & Popov, 2021) or a subfamily (Aspöck et al., 2001; Stange, 2004; Hevin et al., 2023). In Palparini (or Palparinae, Palparidae), the cubitus posterior (Cup) and first anal vein (A<sub>1</sub>) of forewing do not unite but run separately to posterior margin. *Palpares* Rambur, 1842, *Palparellus* Navás, 1912[a], *Stenares* Hagen, 1866, *Tomatares* Hagen, 1866 and *Indopalpares* Insom & Carfi 1988 are the five genera of the Palparini reported from India (Chandra & Sharma, 2009). Among these genera, *Palpares* includes five species reported from India (Chandra & Sharma, 2009; Hassan et al., 2023), namely *P. astarte* Banks, 1913, *P. contrarius* (Walker, 1853), *P. rajasthanicus* Ghosh, 1991, *P. tigroides* (Walker, 1860) and *P. zebratus* Rambur,

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1842. There are five *Stenares* species (*S. acutus* Ghosh, 1990, *S. harpyia* (Gerstaecker, 1863), *S. hyaena* (Dalman, 1823), *S. improbus* (Walker, 1853) and *S. frazeri* Banks, 1931) reported from India. *Indopalpares* is a monotypic genus with *I. pardus* (Rambur, 1842) as the only species widely distributed in India.

In this study, we are reporting and redescribing one species from each genus i.e., *I. pardus* (Rambur, 1842), *P. contrarius* (Walker, 1853), and *S. harpyia* (Gerstaecker, 1863) for the first time from the Kerala part of Western Ghats, India. Since detailed illustrations of genitalia features of *P. contrarius* and *S. harpyia* are unavailable, as a part of this study, we are illustrating the same based on the freshly collected specimens. The distribution map and flight period of the three species from India are also plotted. Moreover, the key to the genera of the tribe Palparini from India is revised and updated.

## MATERIAL AND METHODS

Adult antlion specimens were collected using a sweep net and light trap (160 W mercury vapour bulb). Later, specimens were transferred to a killing jar containing ethyl acetate. Killed specimens were mounted, stretched, dried, labelled, and preserved. The specimens were examined through a Labomed® Luxeo 6Z stereomicroscope and identified by their venation according to Banks (1913) and Ghosh (1990, 2000). Photographs were taken using a Canon® 7D Mark II digital camera with a 100 mm F/2.8L macro lens. For the preparation of male genitalia, the last 3–4 abdominal segments were removed and placed in 10% KOH overnight. These were then washed in distilled water and kept for observation in 80% ethyl alcohol with a drop of glycerol. Photographs were taken under a Leica® M205 stereomicroscope with LAS V3.7® software. After photography, the genitalia of each specimen were transferred to a glass vial containing 80% ethyl alcohol. The terminology for male and female genitalia follows Aspöck et al. (1980), Aspöck & Aspöck (2008) and Badano et al. (2017). The specimens were deposited in the insect collections of the Shadpada Entomology Research Lab (SERL), Kerala, India. In this study, we examined the type and non-type specimens based on the photos from the two museum collections (MHNG and MfNB). In the present study, the traditional classification based on Aspöck et al. (2001), and Stange (2004) was followed. The distribution map of the species in India was prepared using the software QGIS 3.28.1. The adult flight period in India is prepared based on the collection details of the present study and the data in published literature.

**Abbreviation.** **Comb** – Combination, **Dist** – Distribution, **Mon** – Monograph, **Nom** – Nomenclature, **Odescr** – Original description, **Syn** – Synonym, **Tax** – Taxonomy; **MHNG** – Museum d'Histoire Naturelle, Geneva, Switzerland; **MfNB** – Museum für Naturkunde Berlin, Germany. **C** – Costa, **Sc** – Subcosta, **R** – Radius, **Mp** – Media posterior, **Mp<sub>1</sub>** – Media posterior 1, **Mp<sub>2</sub>** – Media posterior 2, **Cua** – Cubitus anterior, **Cua<sub>1</sub>** – Cubitus anterior 1, **Cua<sub>2</sub>** – Cubitus anterior 2, **Cup** – Cubitus posterior, **A<sub>1</sub>**, **A<sub>2</sub>** and **A<sub>3</sub>** – Anal veins 1, 2 and 3, **oRs** – origin of Rs, **pt** – pterostigma, **ect** – ectoproct, **T8** and **T9** – tergite 8 and 9, **S8** – **S9** sternite 7, 8 and 9, **gx** – gonocoxites, **gx8** – gonocoxites 8 (posterior gonopophysis), **gx9** (lateral gonopophysis) in female, **gx9** and **gx11** – gonocoxite 11 (parameres and gonarcus complex in male).

## RESULTS

### Taxonomic hierarchy

**Class Insecta Linnaeus, 1758**

**Order Neuroptera Linnaeus, 1758**

**Family Myrmeleontidae Latreille, 1802**

**Tribe Palparini Banks, 1911**

### Key to the genera of the tribe Palparini known from India

- 1 Double rows of cells in hindwing costal area, partial or whole length (Fig. 10C). ..... *Stenares* Hagen
- Only single rows of cells in hindwing costal area (Figs 2C, 6D). ..... 2
- 2 Forewing membrane predominantly bright yellow with large brown marks. .... 3

- Forewing membrane transparent with large brown marks. ....4
- 3 Pronotum completely black. .... *Palparellus* Navás
- Pronotum yellow with black pattern, forms from three merging spots or transverse band. ....  
..... *Tomatares* Hagen
- 4 Eye width almost equal with inter-ocular distance in frontal view (Fig. 6A). .... *Palpares* Rambur
- Eye width considerably longer (1.4×) than inter-ocular distance in frontal view (Fig. 2A).....  
..... *Indopalpares* Insom & Carfi

### Genus *Indopalpares* Insom & Carfi, 1988

*Indopalpares* Insom & Carfi, 1988:77 (Odescr), Hassan et al., 2023:567 (Redescr). Type species: *Palpares pardus* Rambur, 1842:375.

**Remarks.** The genus *Indopalpares* was described by Insom & Carfi (1988) in a partial revision of the genus *Palpares*. Since then, Hassan et al. (2023) provided new information regarding the diagnosis of the genus. It appears to be a monotypic genus in the Indian subcontinent.

**Distribution.** Southern Asia, India and surrounding countries.

### *Indopalpares pardus* (Rambur, 1842) (Figs 1–4).

*Palpares pardus* Rambur, 1842:375 (Odescr), Needham, 1909:200 (Dist), Sala de Castellarnau, 1946:122 (Dist), Ghosh & Sen, 1977:316 (Chlist), Ghosh, 1977:313 (Dist), 1983:296 (Dist), 1984:12 (Mon). Type locality: India (Maharashtra: Mumbai); *Myrmeleon expertus* Walker, 1853:311 (Odescr), Banks, 1913:188 (Syn). Type locality: Unknown; *Myrmeleon nepalensis* Hagen, 1866:444 (Odescr), Stange, 2004:40 (Syn). Type locality: Unknown; *Palpares pardus partitus* Banks, 1911b:100 (Odescr), Stange, 2004:40 (Syn). Type locality: India (Bombay, Bassein Fort); *Palpares pardus asanai* Kuwayama, 1933:44 (Odescr), Stange 2004:40 (Syn). Type locality: India (Maharashtra; Mumbai); *Palpares pardus stellatus* Navás, 1912a:223 (Odescr), Stange, 2004:40 (Syn). Type locality: Sri Lanka; *Indopalpares pardus* (Rambur, 1842) – Insom & Carfi, 1988:77 (Comb), Ghosh, 1991:92 (Dist), 1998:134 (Dist), 2000:72 (Mon), Chandra & Sharma, 2009:14 (Chlist), Chandra & Thilak, 2009:72 (Dist), Chandra et al., 2011:156 (Dist), Sharma & Chandra, 2012:486 (Dist), Sharma & Chandra, 2013:164 (Dist), Chandra et al., 2014:71 (Dist), Singh et al., 2020:505 (Dist), Wachkoo et al., 2024:60 (Dist).

**Materials examined.** 4♂♂, 3♀♀, INDIA, Kerala State, Malappuram District, Vazhayur, 76 m, 11°12'23.24"N, 75°54'28.51"E, 21.XI.2020, 24.X.2021, 14.XI.2021. leg.: Suryanarayanan. T.B., Mohammed Ramees. K., SERLNR104, SERLNR209, SERLNR210, SERLNR211, SERLNR212, SERLNR232, SERLNR233.

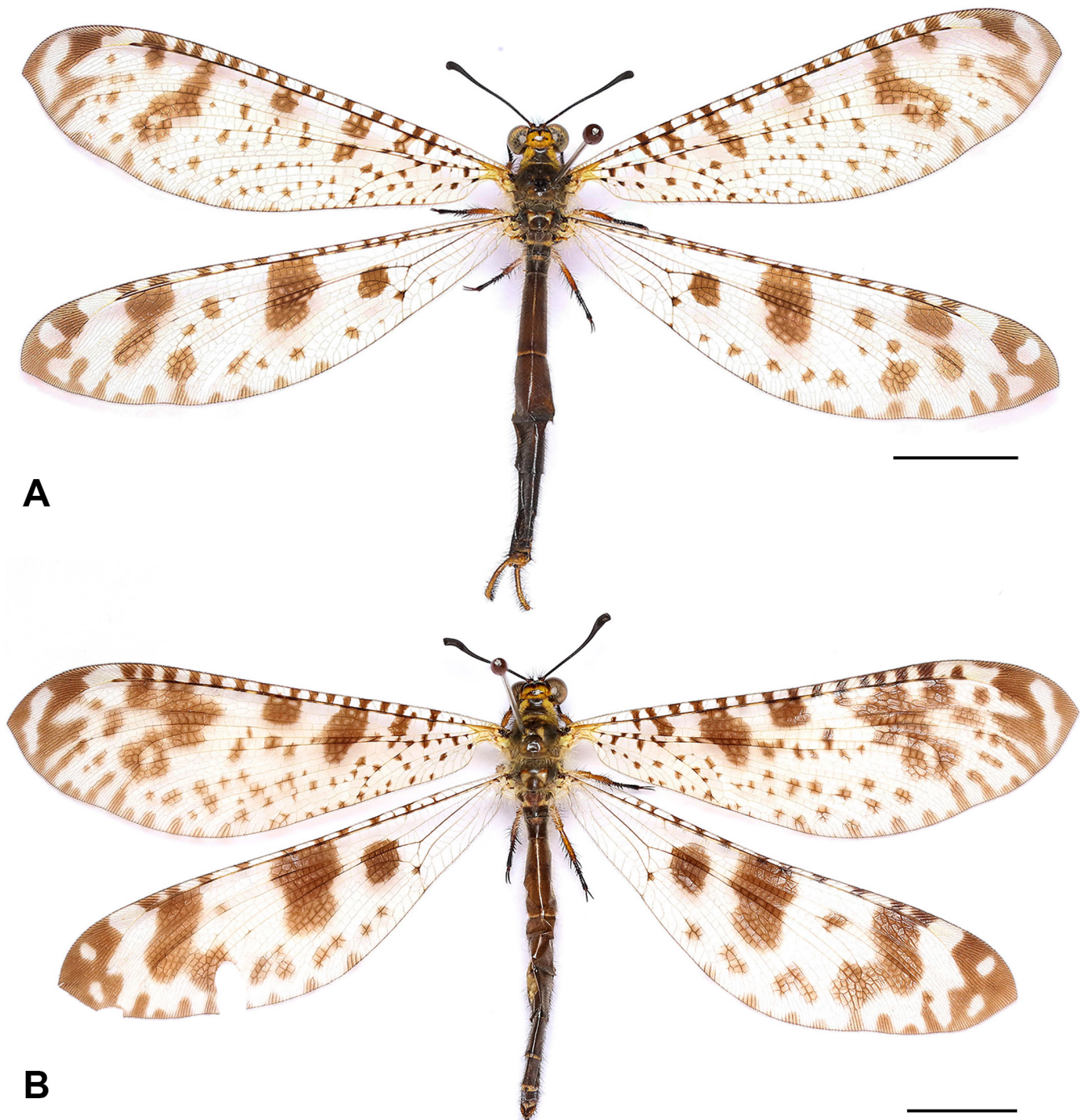
**Diagnosis.** Male body length larger than female. Eyes remarkably large, width 1.4x longer than inter-ocular distance in frontal view. Palpimacula oval, not reaching tip of labial palp. Pronotum yellow, medially with a longitudinal dark-brown stripe. General colour of body brown. Sub-apical marking not reaching hind margin in hindwing. Legs yellow, tarsi dark-brown; tibial spur as long as tarsal segments 1–3 together.

**Redescription.** — Male (n=4): Body length: 41–42 mm; forewing length: 44–45 mm, width 14 mm; hindwing: length 42–43 mm, width 12 mm. Female (n=3): Body length: 35–36 mm; forewing length: 42–43 mm, width: 13 mm; hindwing length: 40–41 mm, width: 12 mm (Fig. 1A–B).

**Head** (Fig. 2A–C). Vertex yellow, medially divided by dark-brown line, short black setae. Frons brown with dark-brown transversal stripe below and above scapus, with black setae, inter-antennal marking dark-brown, anterior tentorial pits brown. Gena yellow with black setae. Clypeus yellow, covered with long black setae; labrum, mandible dark-brown with black setae; maxillary and labial palps light-brown with long black setae. Eyes brownish-black, large, wider than half of head width. Antenna black, longer than length of head and prothorax combined; scape dark-brown; pedicel reddish-brown with light-brown distal annulations; flagellomeres annulated with dark-brown black setae. Club black, thicker at apex than at base.

**Thorax** (Fig. 2B). Pronotum much wider than long, yellow, medially with longitudinal dark-brown stripe, covered with long black setae on anterior and posterior margins; mesonotum and metanotum subdominantly dark-brown with small yellow markings, covered with long yellow and brown hairs on distal margins.

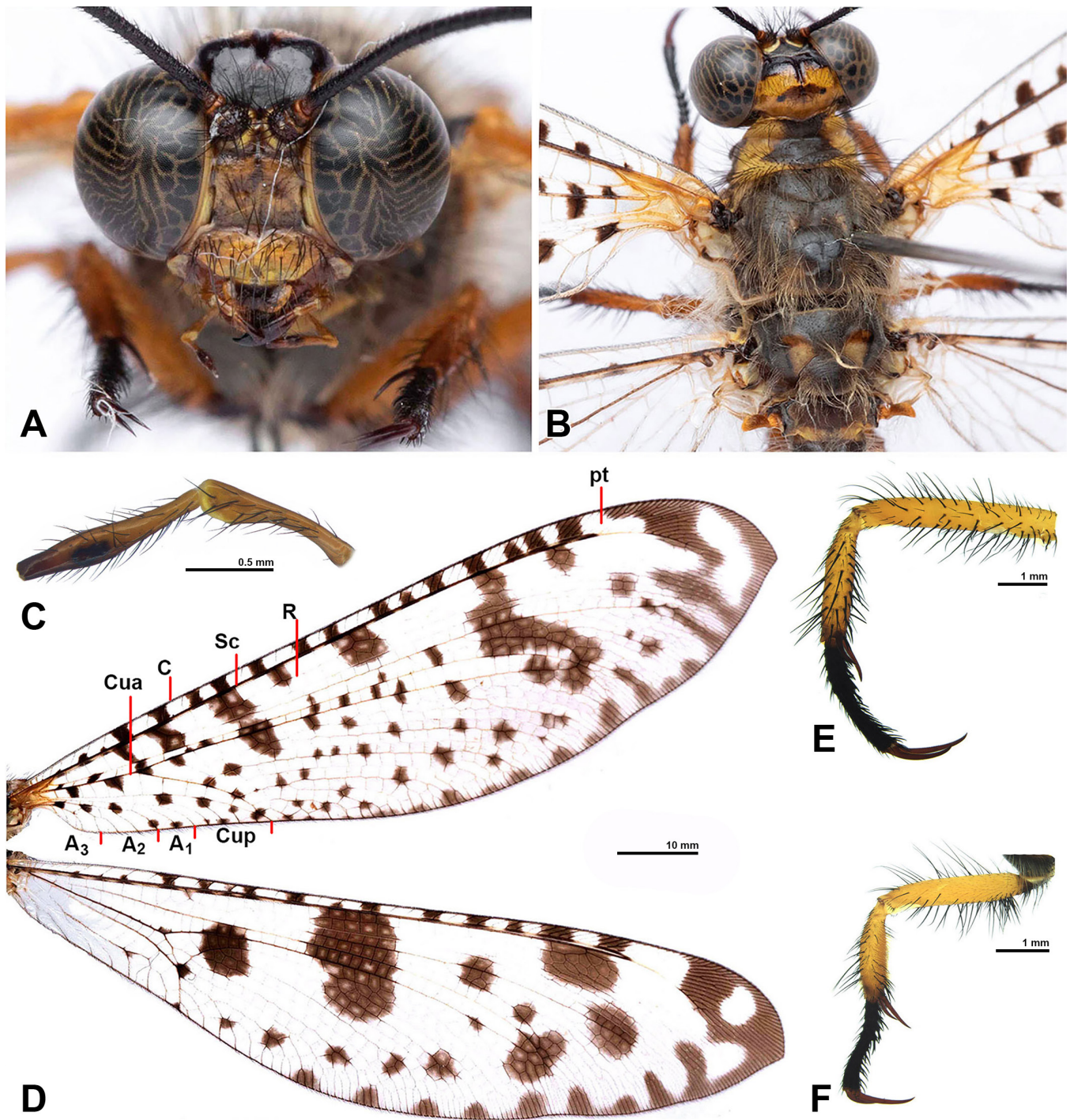




**Figure 1.** *Indopalpares pardus* (Rambur, 1842). **A.** Male habitus; **B.** Female habitus. Scale bar: 10 mm.

**Wings** (Fig. 2D). Forewing tips subacute and straight below, anal area obtuse, anal margin slightly concave, venation dense, scattered dark-brown spots throughout wing surface. Venation covered with short sparse brown setae. Costa dark-brown with short dense dark-brown setae. Costal area with single rows of cells, cells longer than wide, with discontinuous dark-brown shaded patches. Cross-veins simple near base, but 1-2 bifurcated cross-veins in front of pterostigma. Pterostigma with 9-10 veins, veins bifurcated basally and simple distally, pale basally, brown distally. Subcosta and R dark-yellow alternating dark-brown at cross-veins. 12 branches in radial sector, 5 cross-veins in front of origin of Rs.  $Mp$ ,  $Mp_1$  and  $Cua$ ,  $Cua_1$  also dark-yellow alternating dark-brown veins. Cross-veins dominantly yellow and highly shaded in basal medio-cubital area. Cubital fork ca.  $30^\circ$ , acute enough.  $A_1$ ,  $A_2$ , and  $A_3$  yellow basally and brown distally; between  $A_2$  and  $A_3$  with 2 cells,  $A_1$ ,  $A_2$ , and  $A_3$  bifurcated distally.

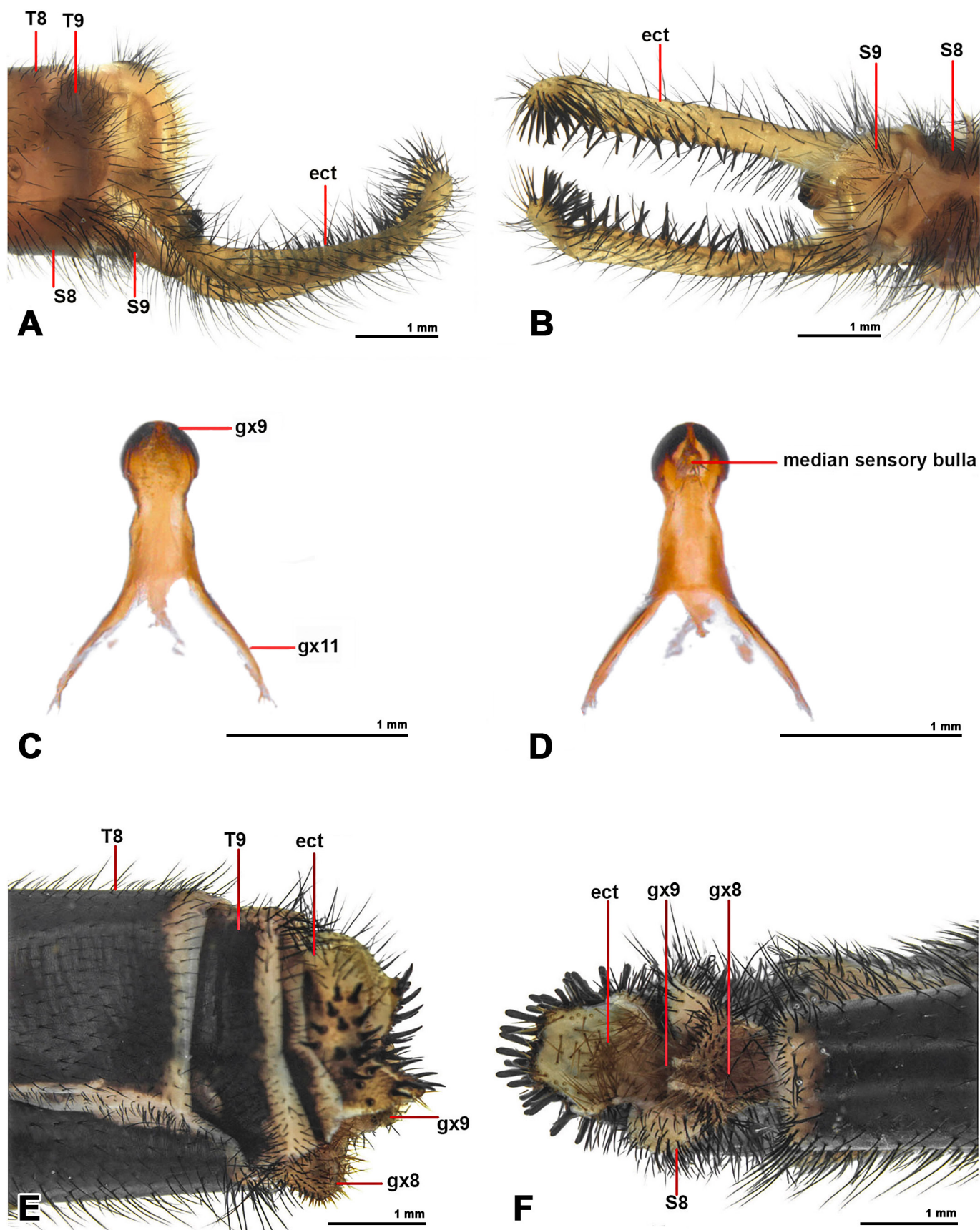




**Figure 2.** *Indopalpares pardus* (Rambur, 1842) male. **A.** Head in frontal view; **B.** Vertex and thorax in dorsal view, **C.** Labial palp, lateral view; **D.** Wing venation; **E.** Foreleg in lateral view; **F.** Hindleg in lateral view.

Membrane covered with scattered large dark-brown spots, relatively smaller spots than hindwing. Hindwing C yellow with short dark dense brown setae. 1 cross-vein bifurcated in front of pterostigma otherwise simple, both ends brown. Pterostigma with 2–3 bifurcated veins, dominantly faint yellow. Subcosta and R pale-yellow, with alternating dark-brown at cross-veins. 10–11 branches in radial sector, 6–7 cross-veins in front of origin of Rs. Media posterior,  $Mp_1$  pale-yellow but small dark-brown sections at meeting points with cross-veins. Cua,  $Cua_1$  dominantly dark-brown. Cross-veins dominantly brown basally yellow distally in medio-cubital area. Membrane covered with scattered large dark-brown bands, relatively much larger ones than on forewing.





**Figure 3.** *Indopalpares pardus* (Rambur, 1842). **A.** Male terminalia in lateral view; **B.** The same in ventral view; **C.** Male genitalia: gonarcus and parameres complex (gonocoxites gx9 + 11) in dorsal view (in sense Aspöck et al., 1980; Aspöck & Aspöck, 2008; Badano et al., 2017); **D.** The same in ventral view; **E.** Female terminalia in lateral view; **F.** The same in the ventral view.





**Figure 4.** *Indopalpares pardus* (Rambur, 1842). **A.** Adult male in natural habitat; **B.** Habitat of species in Vazhayur, Kerala. [photo: Mohammed Ramees K.]



**Legs** (Fig. 2E–F). Foreleg long, hindleg short and strong. Legs dominantly brownish-yellow with black hairs. Coxae dark-brown densely covered with long black hairs. Trochanter light-brown. Fore, mid and hind femora yellow, covered with upstanding long black bristles and short black hairs. Femora longer than tibiae. Fore and mid tibiae generally yellow, covered with long black bristles and short black hairs. Hind tibia yellow, covered with long black hairs and short yellow hairs. Tibial spurs almost straight, reddish-brown, as long as tarsomeres 1–3 together. Tarsi black, covered with long black setae. Tarsal claws slightly curved, reddish-brown, half long as tarsal segment 5.

**Abdomen.** Shorter than hindwing, dark-brown, covered with short black setae and long black hairs. Posterior margin of each tergum with dark-brown and pale brown longitudinal rings. Sternites dark-brown with long black hairs.

**Male terminalia and genitalia** (Fig. 3A–D). In lateral view, tergum 9 subquadrate; ectoproct base oval with evenly arched cylindrical processus, covered with medium long black hairs; tip of processus blunt. In ventral view, sternite 9 triangular-shaped, covered with black hairs, at base of ectoproct processus one rigid black bristle directed inwards. Caudal part two-thirds of processus, covered with strong pointed black setae inwardly. Genitalia as in Figure 3C–D in dorsal and ventral views. In ventral view, special sensory bulla with short black hairs between gonocoxites 9.

**Female terminalia** (Fig. 3E–F). In lateral view, tergum 8 and 9 quadrate, ectoproct ovoid plate, covered with stout black setae caudo-ventrally. In ventral view, gonocoxite 8 short, covered with long black hairs; gonocoxite 9 club-shaped, covered with some stout setae on margins.

**Distribution.** For distribution data, we cite only the publication that first mentions the occurrence of the species in a country. India (Rambur 1842), Myanmar (New, 2003), Pakistan (Iqbal & Yousuf, 1990), Sri Lanka (Navás 1912a).

**Flight period and habitat.** Adults are active at night, attracted by artificial light. In the daytime, it sits on grass blades and bushes at rest (Fig. 4A–B). The habitat of the larva is surrounded by semi-closed grassland in laterite soil with an altitude below 100 m. It is not a pit-building species. The adult flight period in India is mainly observed during January, March, July, August, September, October, and November based on the present study and the data in published literature (Fig. 15).

**Distribution in India** (Fig. 16). Bihar (Purnia, Pusa), Chhattisgarh (Bilaspur, Kabirdham, Koriya, Raipur, Surguja), Goa (Mollem), Gujarat (Surat), Himachal Pradesh (Kinnaur), Karnataka (Bangalore), Kerala (Vazhayur), Madhya Pradesh (Balaghat, Bhopal, Chhindwara, Damoh, Hoshangabad, Khandwa, Khargone, Mandla, Narmadapuram, Shahdol, Umariya), Maharashtra (Mumbai, Palghar, Ratnagiri, Satara), Odisha (Angul, Dhenkanal, Ganjam, Kalahandi, Khordha, Puri, Sambalpur), Rajasthan (Chittorgarh), Sikkim, Uttarakhand (Almora, Dehradun), West Bengal (Bankura, Birbhum, Darjeeling, Jalpaiguri, Purulia), Himalayan and Peninsular sectors of India.

### Genus *Palpares* Rambur, 1842

*Palpares* Rambur, 1842:365 (Odescr). Type species: *Hemerobius libelluloides* Linnaeus, 1764:401; *Negretus* Navás, 1912b:56 (Odescr), Stange, 2004:47 (Syn). Type species: *Negretus ertli* Navás, 1912b:57 (Odescr).

**Remarks.** The genus *Palpares* Rambur, 1842 was the first to be described in the tribe Palparini. Based on recent studies, some African species in *Palpares* were separated and placed into different genera (Insom & Carfi, 1988; Mansell, 1990, 1992a, 1992b, 1996, 2004, 2018; Hévin et al., 2023). *Indopalpares pardus* (Rambur, 1842) and *Palparellus astutus* (Walker, 1853) are the only included species in these studies from Indian fauna. *Palpares contrarius* (Walker, 1853) is morphologically very different from the type species *Palpares libelluloides* (Linnaeus, 1867). So it is likely that *Palpares contrarius* should be placed in a different genus. It will only be revealed by future revision on *Palpares* species. Therefore, we do not provide a genus-level diagnosis for the species, as this would only provide incorrect information.

**Distribution.** Palearctic, Afrotropical and Oriental regions (Stange, 2004; Machado et al., 2019).

### *Palpares contrarius* (Walker, 1853) (Figs 5–8).

*Myrmeleon contrarius* Walker, 1853:301 (Odescr). Type locality: Sri Lanka; *Palpares falcatus* McLachlan, 1867:236 (Odescr). Type locality: Myanmar (former Burma); *Symmathetes contrarius* (Walker, 1853) – McLachlan, 1867:237 (Comb); *Symmathetes falcatus* (McLachlan, 1867) – McLachlan, 1867:237 (Comb); *Lachlathetes contrarius* (Walker, 1853) – Navás, 1926:155 (Nom); *Lachlathetes falcatus* (McLachlan, 1867) – Navás, 1926:155 (Nom); *Palpares sinicus* C.-k. Yang, 1986:423 (Odescr), Giacomino & Abrahám, 2018 (Syn). Type locality: China (Yunnan); *Palpares contrarius* (Walker, 1853) – McLachlan, 1867 (Comb), Needham, 1909:200 (Dist), Ghosh & Sen, 1977:316 (Chlist), Ghosh, 1984:2 (Mon), 2000:73 (Mon), Chandra & Sharma, 2009:14 (Chlist), Chandra et al., 2011:157 (Dist), Sharma & Chandra, 2012:486 (Dist), Sharma & Chandra, 2013:164 (Dist), Anita & Tilak, 2024:26047 (Dist), Wachkoo et al., 2024:61 (Dist).

**Diagnosis.** Male (body length: 60 mm) larger than female (body length: 50 mm). Pronotum yellow, with a medial and two lateral dark-brown stripes. General colour of body brown. Tip of hindwing strongly concave below. Legs brown, tarsi dark-brown, tibial spurs as long as tarsal segments 1–2 together.

**Materials examined.** 2♀, INDIA, Kerala State, Palakkad District, Pudunagaram, 109 m, 10°40'57.72"N, 76°41'02.02"E, 20.X.2014, 22.X.2014, leg.: Bijoy. C., SERLNR034, SERLNR035; 1♀, Kerala State, Kollam District, Rose mala, 402 m, 8°54'54.00"N, 77°10'12.23"E, 28.III.2021, leg.: Suryanarayanan. T.B., SERLNR313; 1♀, Kerala State, Kollam District, Kattilapara, 315 m, 8°51'28.18"N, 77°13'03.08"E, 29.III.2021, leg.: Suryanarayanan. T.B., SERLNR314; 1♀, Kerala State, Kozhikode District, Payamthodu, 40 m, 11°42'22.10"N, 75°42'31.90"E, 02.IV.2021, leg.: Shahel. A Z., SERLNR123; 1♀, Kerala State, Kannur District, Kuthuparamba, 39 m, 11°49'54.78"N, 75°33'55.85"E, 08.IV.2021, leg.: Mohammed Anas. P. P., SERLNR128; 1♂, Kerala State, Wayanad District, Begur, 733 m, 11°52'56.80"N, 76°04'43.66"E, 12.III.2022, leg.: Abhin. M. Sunil. & Suryanarayanan. T. B., SERLNR265; 3♂, 2♀, Kerala State, Wayanad District, Thirunelly, 862 m, 11°54'40.17"N, 76°00'00.83"E, 21.III.2022, leg.: Suryanarayanan. T.B., SERLNR267, SERLNR268, SERLNR269, SERLNR270, SERLNR271; 1♂, Kerala State, Idukki District, Kolahalamedu, 1113 m, 09°39'03.96"N, 76°55'43.01"E, 12.III.2023, leg.: Mohammed Ramees K., SERLNR355.

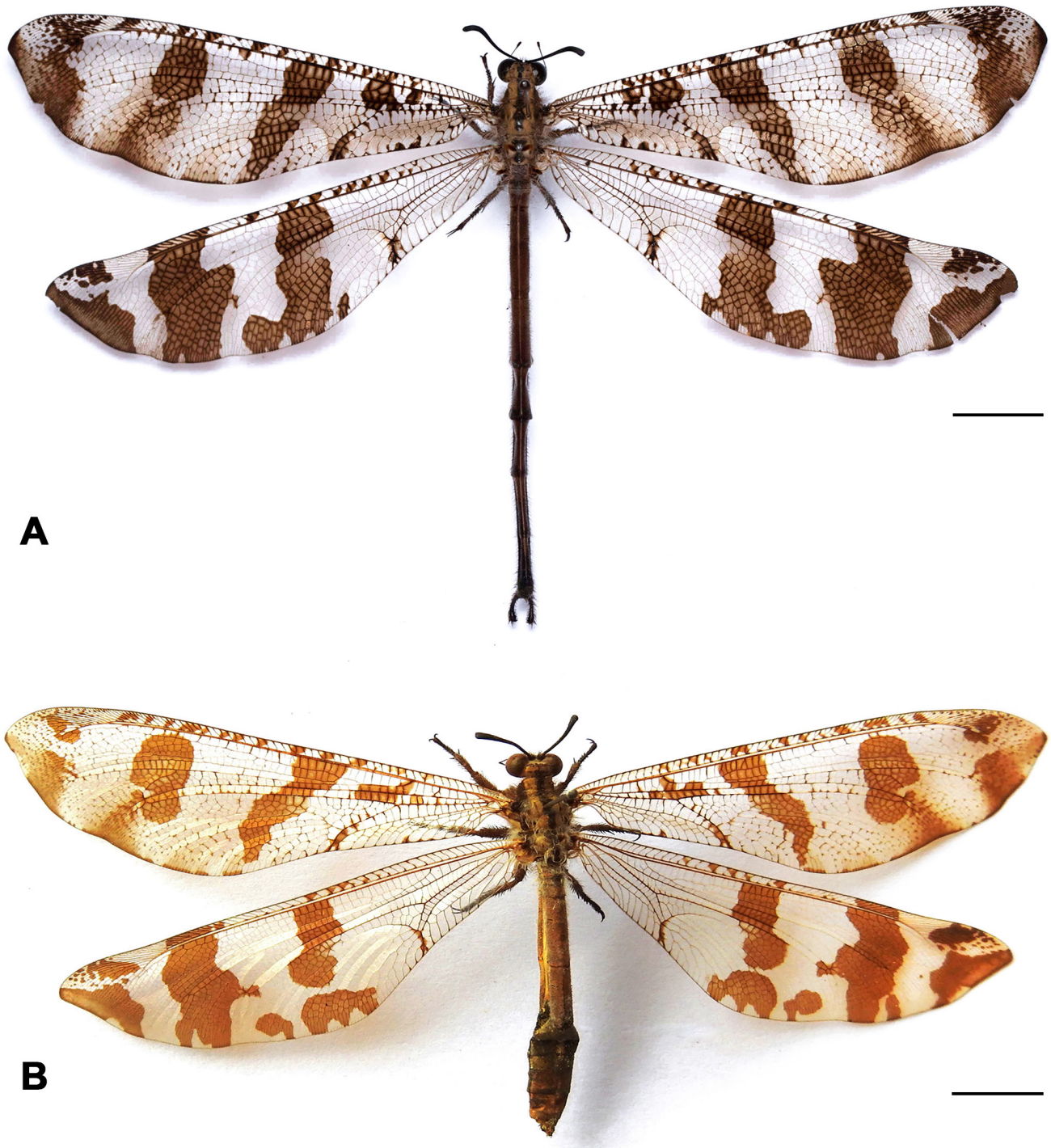
**Redescription.** — Male (n=4). Body length: 59–60 mm; forewing length: 57–58 mm, width 18 mm; hindwing: length 56–57 mm, width 16 mm. Female (n=4). Body length: 49–50 mm; forewing length: 62–63 mm, width: 18 mm; hindwing length: 60–61 mm, width: 17 mm (Fig. 5A–B).

**Head** (Fig. 6A–C). Vertex yellow with dark-brown band proximally joined to distal dark-brown band by median dark-brown line. Frons yellow with pale brown transverse stripe below and above scapus, with white setae, inter-antennal mark dark-brown, anterior tentorial pits brown. Gena dark-brown dorsally and yellow basally. Eyes large, slightly wider than frons. Scape large, dark-brown with black hairs; pedicel reddish-brown with dark-brown annulation; flagellomeres annulated with dark-brown and pale rings. Club dark-brown, thicker at tip than at base. Clypeus yellow with row of long black setae on dorsal margin; labrum yellow with ochreous setae on ventral margin, maxillary palps, labial palps dark-brown, palpmacula reaching tip distally; mandible dark-brown with black apices and inner surface.

**Thorax** (Fig. 6B). Pronotum wider than long, yellow, with one longitudinal dark-brown band medially and two bands laterally, covered with brown hairs, especially on margins; mesonotum and metanotum generally yellow, medially with narrow dark-brown stripe, covered with long white and brown hairs on distal margin.

**Wings** (Fig. 6D). Forewing tip subacute and slightly concave below, anal area obtuse, hind margin concave, venation dense, covered with short sparse dark-brown setae. Costa brown with short dense dark-brown setae. Costal area with single rows of cells, cells longer than wide, with dark-brown shaded patches. Cross-veins simple near base, but bifurcated in front of pterostigma. Pterostigma indistinct reddish-brown with 5–6 cross-veins, veins bifurcated basally and simple distally. Subcosta and R yellow alternating dark-brown at cross-veins. 6–7 cross-veins in front of origin of Rs. Mp, Mp<sub>1</sub> and Cua, Cua<sub>1</sub> also dark-brown alternating light-brown sections at cross-veins. Cross-veins dominantly brown and highly shaded in basal medio-cubital area. Cubital fork ca. 30°, acute enough. Membrane with four dark-brown bands (Fig. 6D). Hindwing wide enough, tip acute, strongly falcate below, hind margin slightly concave. Costa yellow with short dark dense brown setae. 2–3 cross-veins bifurcated in front of pterostigma otherwise simple, both ends brown. Pterostigma indistinct reddish-brown. Subcosta brown with alternating dark-brown at cross-veins R predominantly brown. 3–4 cross-veins in front of origin of Rs. Mp, Cua, Cua<sub>1</sub>, and Cup dominantly dark-brown with dark-brown sections at meeting points with cross-veins. Cross-veins dominantly dark-brown basally, brown distally in medio-cubital area. Membrane with three dark-brown bands (Fig. 6D).



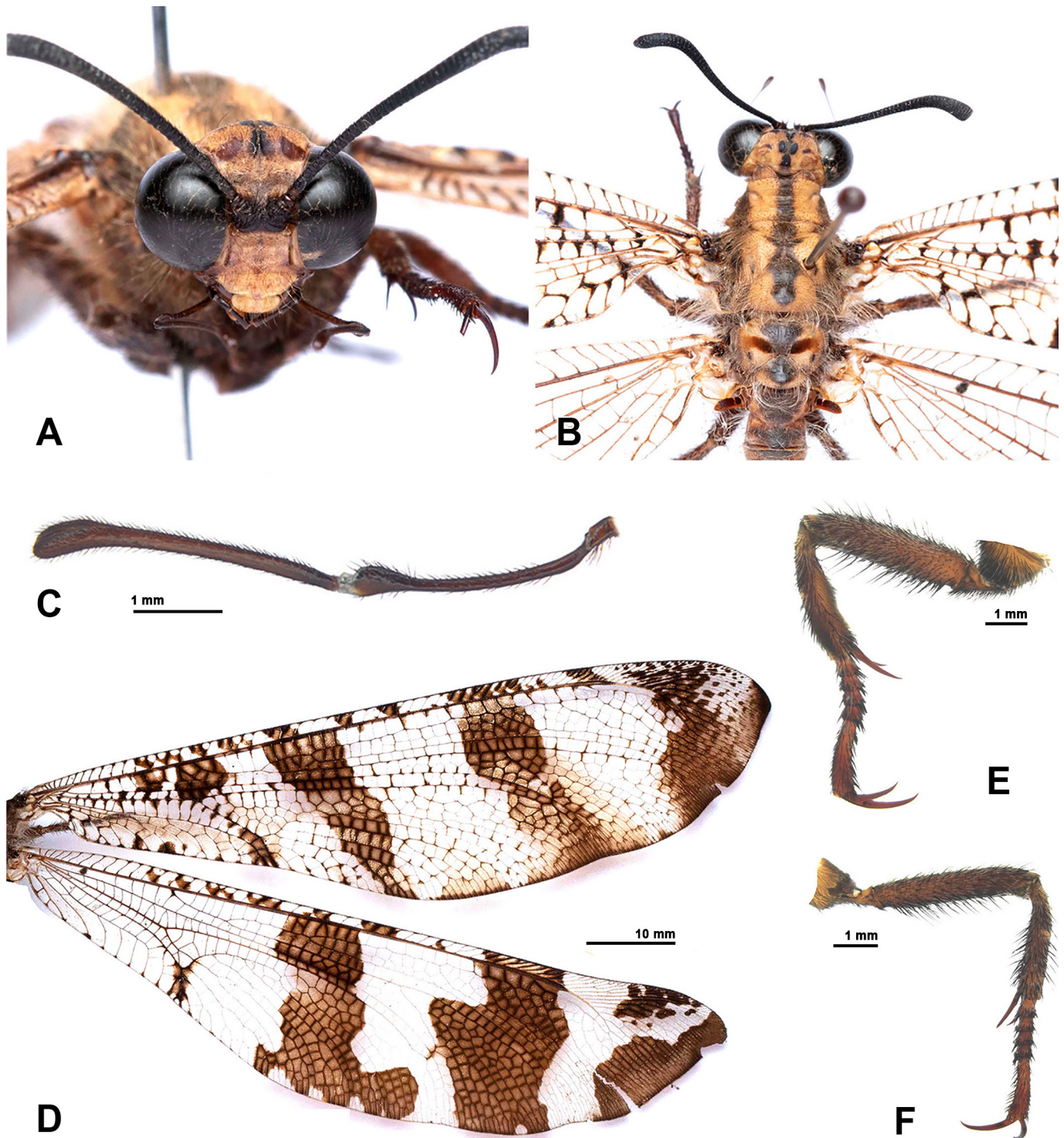


**Figure 5.** *Palpares contrarius* (Walker, 1853). **A.** Male habitus; **B.** Female habitus. Scale bar: 10 mm.

**Legs** (Fig. 6E–F). Short and strong, dark-brown with black bristles and short white hairs. Coxae dark-brown densely covered with long black bristles; trochanter dark-brown; mid and hind femur dark-brown, covered with long black bristles and short white setae laterally; tibiae generally dark-brown, covered with long black bristles and short brown and white setae; hind tibia dark-brown, covered with long black setae and short white setae, tibial spurs reddish-brown, as long as tarsomeres 1–2 together; tarsi dark-brown, covered with long black and short white setae; tarsal claws slightly curved, reddish-brown, 3/4 as long as tarsal segment 5.

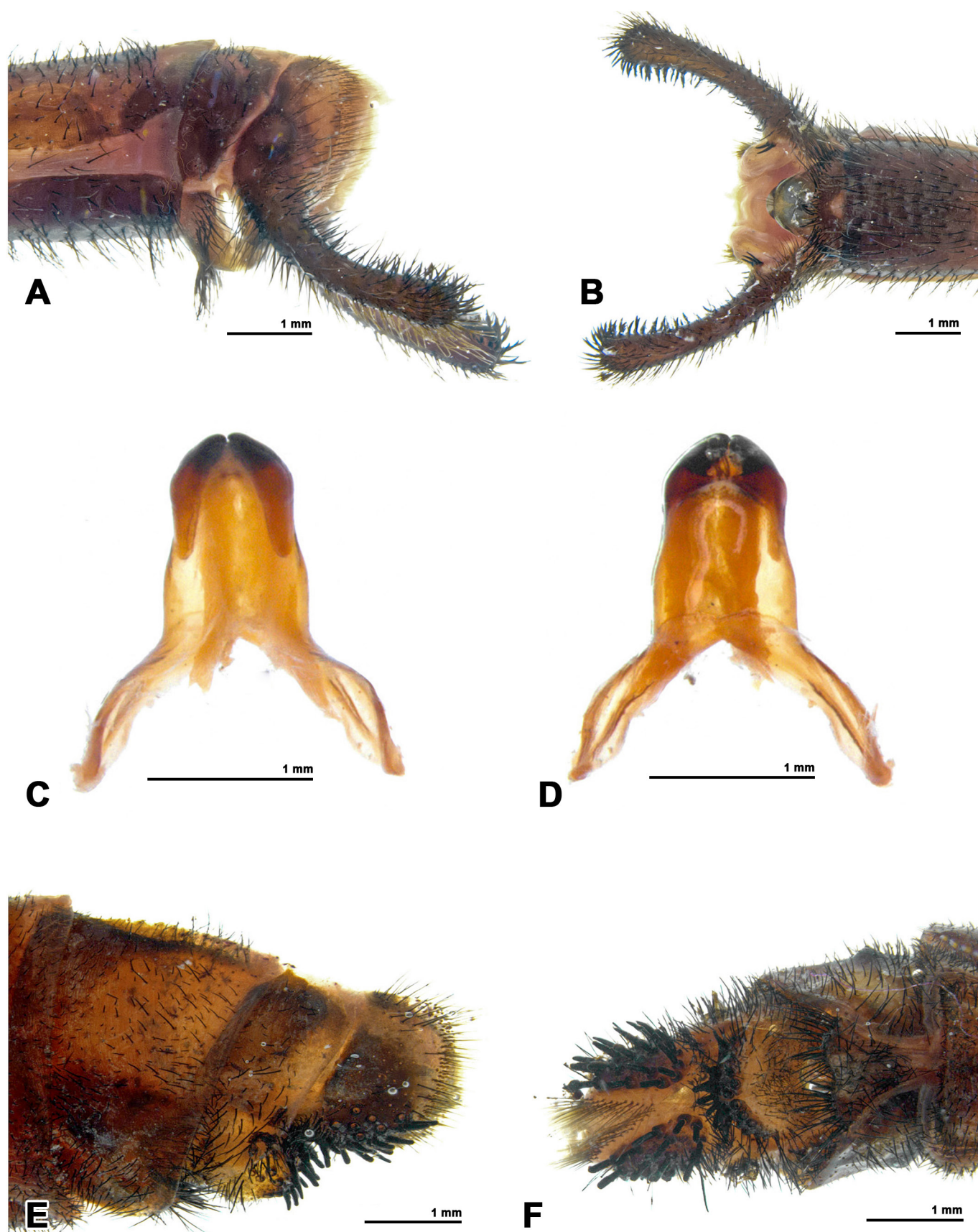
**Abdomen.** Shorter than hindwing, dark-brown, covered with short black setae. Distal margin of each tergum dark-brown with pale brown longitudinal line. Sternites dark-brown, with long black setae.





**Figure 6.** *Palpares contrarius* (Walker, 1853) male. **A.** Head in frontal view; **B.** Vertex and thorax in dorsal view; **C.** Labial palp in lateral view; **D.** Wing venation; **E.** Foreleg in lateral view; **F.** Hindleg in lateral view.

**Male terminalia and genitalia** (Fig. 7A-D). In lateral view, tergum 9 quadrate, ectoproct base oval with cylindrical, curved caudal-ventral processus, longer diagonal of base and length of processus almost equal. Ectoproct base covered with small black hairs, processus with dense, stiff, acute black setae. In ventral view, sternite 9 triangular, and covered with black hairs. Two or three strong acute bristles directed inwards on basal part of processus. Caudal part of processus also covered with strong short black bristles directed inwards. Genitalia as in Figure 7C-D in dorsal and ventral views.



**Figure 7.** *Palpares contrarius* (Walker, 1853). **A.** Male terminalia, in lateral view; **B.** The same, in ventral view; **C.** Male genitalia: gonocoxites gx9 + 11 in dorsal view (in sense Aspöck et al., 1980; Aspöck & Aspöck, 2008; Badano et al., 2017); **D.** The same in ventral view; **E.** Female terminalia in lateral view; **F.** The same, in ventral view.





**Figure 8.** *Palpares contrarius* (Walker, 1853). **A.** Adult male in natural habitat [photo: Mohammed Ramees K.]; **B.** Habitat of species in Thirunelly, Kerala.



**Female terminalia** (Fig. 7E–F). In lateral view, tergum 8 quadrate; ectoproct semicircular, covered with black hairs and with prominent short stout setae caudal-ventrally. In lateral view, gonocoxite 8 short with some stout setae, and gonocoxite 9 club-shaped, caudally covered with stout black setae.

**Distribution.** Cambodia (Navás, 1914), China (Ábrahám & Giacomino, 2020), India (Needham, 1909), Laos (Giacomino & Ábrahám, 2018), Myanmar (McLachlan, 1867), Sri Lanka (Walker, 1853), Thailand (Giacomino & Ábrahám, 2018), and Vietnam (Krivokhatsky, 1997).

**Flight period and habitat.** Adults are active at night, and attracted by artificial light. In the daytime, it sits on dry bushes at rest (Fig. 8A–B), because of the colour and pattern of the wing, it looks like an old dry leaf and can easily camouflage from the surrounding environment. The habitat is surrounded by trees and bushes in the forest as well as in synanthropic ecosystems which are recorded from different altitudes. It is not a pit-building species. The adult flight period in India is mainly observed during March, April, and October based on the literature (Fig. 15). The same pattern was observed by Suryanarayanan & Bijoy (2023).

**Distribution in India** (Fig. 16). Karnataka (Coorg), Kerala (Kattilapara, Kolahalamedu, Kuthuparamba, Payamthondy, Pudunagaram, Rosemala, Thirunelly), Madhya Pradesh (Pachmarhi), Maharashtra (Koyana), Mizoram (Chhimtuipui), Odisha (Cuttack, Mayurbhanj, Khordha), Tamil Nadu (Tambaram), Uttarakhand (Mussoorie).

**Comments.** Mathew (1993) recorded *Palpares infimus* (Walker, 1853) from Malayattoor in Ernakulam district, Kerala. This was the only reported *Palpares* species from the Kerala state. As the above specimen was destroyed in the collection, the species of the specimen was not fully confirmed by us. It may be misidentified and may be *Palpares contrarius* (Walker, 1853). Still, Malayattoor was not added to the list of *P. contrarius* from Kerala.

### Genus *Stenares* Hagen, 1866

*Stenares* Hagen, 1866:372, 460 (Odescr). Type species: *Myrmeleon hyaena* Dalman, 1823:89.

**Remarks.** In India, *Stenares* species were mainly reported by Navás (1932) and Ghosh (1990). Some African species were also included in their reports. According to Prost (2010), the presence of African species in the Indian fauna is based on an incorrect determination. We also agree with him because the West African *Stenares* species are distinct from the Pakistan, Indian, and Arabian species. They form separate groups within the genus *Stenares*. It is worth making a new diagnosis only on the basis of complete revision.

**Distribution.** This genus is spread from Sub-Saharan Western Africa to the Arabian Peninsula and the Indian subcontinent.

### *Stenares harpyia* (Gerstaecker, 1863) (Figs 9–14).

*Palpares harpyia* Gerstaecker, 1863:180 (Odescr); *Stenares harpyia* (Gerstaecker, 1863) – Hagen, 1866:460 (Comb), Banks, 1913:190 (Tax), Esben-Petersen, 1931:445 (Dist), Kimmins, 1945:99 (Tax, Dist), Ghosh & Sen, 1977:317 (Chlist), Ghosh, 1990:455 (Tax, Dist), Whittington, 2002:385 (Dist), Stange, 2004:67 (Mon), Chandra & Sharma, 2009:14 (Chlist), Wachkoo et al., 2024:62 (Dist).

**Diagnosis.** General colour dark-brown. Eyes conspicuously large, palpmacula reaching tip of last labial segment. Pronotum yellow with a wide dark-brown longitudinal stripe and small dark-brown spot on either side of stripe. Cells in costal area of both wings divided into two rows. Hind wing tip rounded. A narrow transparent stripe extending from tip to base of hindwing between two broad brown spots. Legs dark-brown to black, tibial spurs as long as tarsal segments 1–3 combined.

**Materials examined.** 2♂♂, INDIA, Kerala State, Wayanad District, Thirunelly, 862 m, 11°54'40.17"N, 76°00'00.83"E, 09.IV.2021, 23.III.2022, leg.: Suryanarayanan. T.B., SERLNR132, SERLNR275; 1♀, Kerala State, Pathanamthitta District, Gavi, 1179 m, 9°26'03.82"N, 77°09'52.21"E, 11.IV.2021, leg.: Vishnu Das. E. H. & Suryanarayanan. T. B., SERLNR142; 1♂, Kerala State, Idukki District, Vallakkadavu, 806 m, 9°34'19.64"N, 77°05'22.43"E, 26.II.2022, leg.: Vishnu. R. & Suryanarayanan. T. B., SERLNR263.

**Redescription.** — Male (n=3). Body length: 51–52 mm; forewing length: 65–66 mm, width 15 mm; hindwing: length 63–64 mm, width 15 mm. Female (n=1). Body length: 52 mm; forewing length: 70 mm, width: 18 mm; hindwing length: 68 mm, width: 17 mm (Fig. 9A–B).

**Head** (Fig. 10A–D). In dorsal view, vertex divided by dark-brown line medially and with dark-brown spots at least five rows transversely. In frontal view, vertex yellow and strongly arched. Frons yellow with narrow brown transverse stripe below and above scapus, with white setae, inter-antennal spot dark-brown, anterior tentorial pits brown. Gena black dorsally and yellow basally. Eyes blackish-brown, large, slightly wider than frons width. Antenna black, longer than length of head and prothorax combined; scape dark reddish-brown with black hairs; pedicel dark-brown; flagellomeres dark-brown and annulated short white and black setae; club black. Clypeus yellow, covered with sparse brown setae; labrum yellow, maxillary and labial palps dark-brown. Mandible dark-brown to black.

**Thorax** (Fig. 10B). Pronotum wider than long, yellow, medially with a longitudinal dark-brown stripe and dark-brown spot on either side of stripe covered with long white hairs; mesonotum and metanotum generally dark-brown with small yellow marks covered with long dense white and brown hairs in lateral margins.

**Wings** (Fig. 10C). Forewing tip obtuse and with straight margin below, anal area obtuse, anal margin slightly concave, venation dense, cross veins marked with small dark-brown dots entirely. Venation covered with short sparse dark-brown setae. Costa dark-brown with short dense dark-brown setae. Costal area with two rows of cells, cells longer than wide. Costal cross-veins simple near base but bifurcated in front of pterostigma. Pterostigma indistinct, yellow with 4–5 veins. Subcosta and R dark yellow alternating dark-brown sections at cross-veins. 3–4 regular cells and 6–7 irregular cells in 2–3 rows in front of origin of Rs. Mp, Mp<sub>1</sub>, Cua, and Cua<sub>1</sub> also dark-brown with alternating yellow sections. Cross-veins dominantly brown and strongly shaded in basal medio-cubital area. Cubital fork ca. 30°, acute enough. Dark-brown pattern as in Figure 9A, variable. A<sub>1</sub>, A<sub>2</sub>, and A<sub>3</sub> yellow basally and brown distally. Hindwing C dark-brown with short dark dense brown setae. Costal area with two rows of cells, cells longer than wide, with dark-brown shaded marks before pterostigma. Pterostigma indistinct, yellow with 4–5 bifurcated veins. Subcosta and R dark-yellow alternating dark-brown sections at cross-veins. 1–3 regular and 3–5 irregular cells in front of origin of Rs. Mp, Mp<sub>1</sub> and Cua, Cua<sub>1</sub> dominantly dark-brown. Cross-veins predominantly brown basally, and yellow distally in medio-cubital area. Pattern on membrane as in Figure 9B, variable.

**Legs** (Fig. 10E–F). Short, strong, and brown to dark-brown with dark-brown and black hairs and short rigid black bristles. Coxae brown densely covered with long black hairs; trochanters brown; mid and hind femora dark-brown covered with long black bristles and white setae; femora longer than tibiae. Fore and mid tibiae generally dark-brown, covered with long black bristles and small brown and white setae. Hind tibia dark-brown, covered with long black and short brown setae. Tibial spurs reddish-brown, as long as tarsomeres 1–3 together; tarsi dark-brown, covered with long black setae; tarsal claws slightly curved, reddish-brown, 1/2 as long as tarsal segment 5.

**Abdomen.** Shorter than hindwing, blackish-brown, covered with short black setae; Posterior margin of each tergum with shiny black rings. Sternites dark-brown, with long black setae.

**Male terminalia and genitalia** (Fig. 11A–D). Tergite 9 not fused. In lateral view, tergite 9 quadrate; ectoproct long oval, processus cylindrical, long, subacute at tip, covered with dense small black setae. Processus twice as long as base of ectoproct. In ventral view, sternum 9 subquadrate, covered with long black setae. Processus with prominent protuberance at base, covered with dense short setae. Dense short setae cover entire length of inner half of processus. Genitalia as in Figure 11C–D in dorsal and ventral views. Gonocoxites 9 less sclerotized, inclined outwards, and angular. Median bulla covered with very dense short setae in ventral view.

**Female terminalia** (Fig. 11E–F). In lateral view, tergite 8 almost trapezoidal; ectoproct ovoid, cauda-dorsally covered with black hairs and cauda-ventrally with short, strong, stout setae; gonocoxite 9 club-shaped, posteriorly covered with some stout setae. In ventral view, sternite 8 with stiff, acute bristles on caudal margin, gonocoxite 8 finger-shaped, covered with small black setae; gonocoxite 9 with stout and black setae, caudally.

**Distribution.** India (Esben-Petersen, 1931), Sri Lanka (Gerstaecker, 1863).



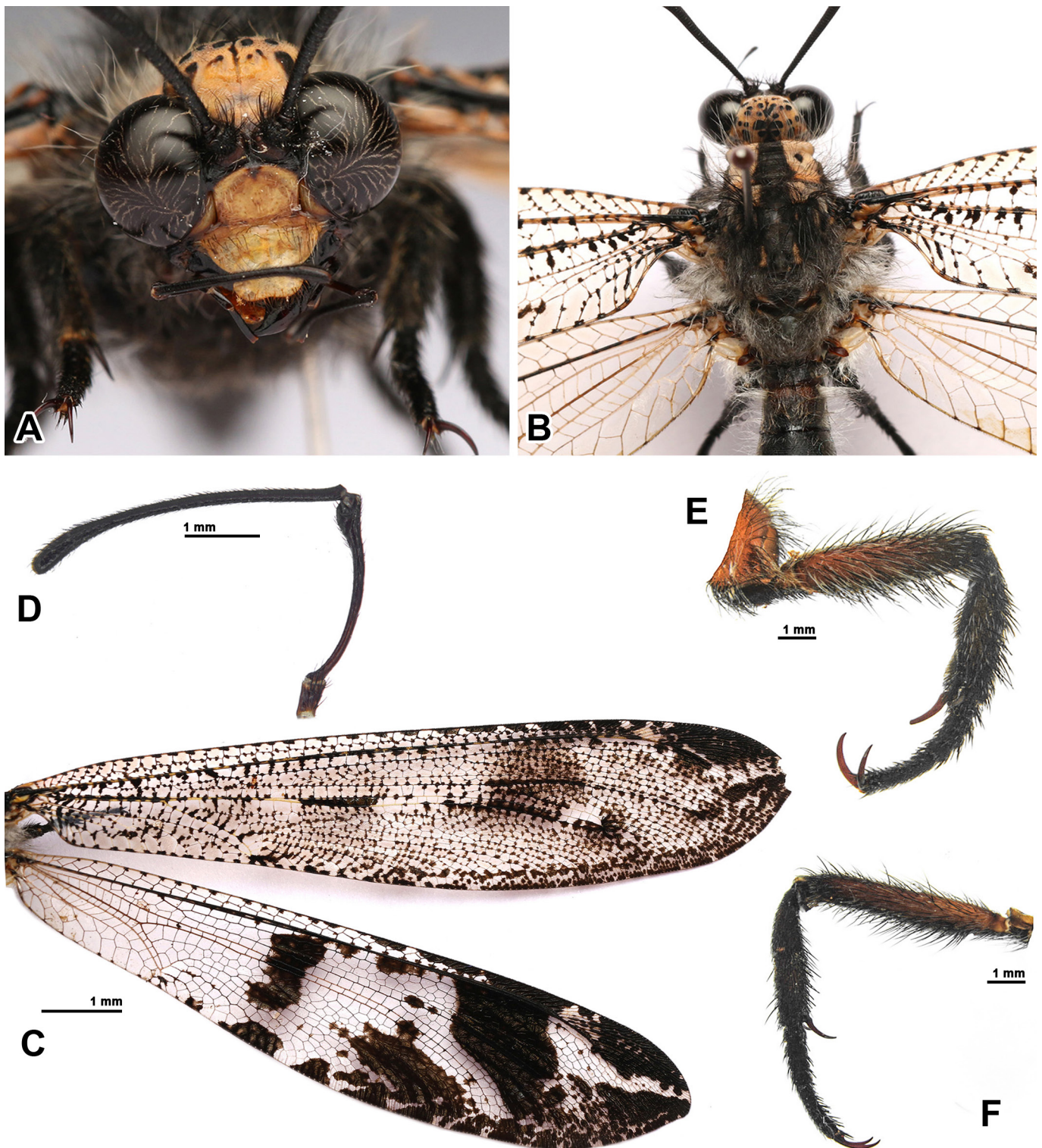
**Figure 9.** *Stenares harpyia* (Gerstaecker, 1863). **A.** Male habitus; **B.** Female habitus. Scale bar: 10 mm.

**Flight period and habitat.** Adults are active at night and attracted by artificial light. Some specimens are collected through this method. In the daytime, it sits on dry grass blades at rest and can easily camouflage from predators (Fig. 12A–B). The habitat is surrounded by grassland in the forest ecosystem which is recorded from above 800 m altitude. It is not a pit-building species. The adult flight period in India is mainly observed during February, March, April, and May based on this study and data in published literature (Fig. 15).

**Distribution in India** (Fig. 16). Kerala (Gavi, Thirunelly, Vallakkadavu), Tamil Nadu (Coimbatore), Telangana (Anantagiri Hills).

**Wing pattern variability** (Figs 9A–B; 13A–B; 14A–B). In the tribe Palparini, the pattern of the wings is usually variable. The variability of the forewing pattern is more significant than that of the hindwing pattern. We compared the wing pattern of the syntype specimens (2 females) from Sri Lanka (NfM, Berlin, Germany), the non-type specimens (MHNG, Geneva, Switzerland), which also come from Sri Lanka, and 3 males and 1 female collected in Kerala during the current study. We found that the wing patterns show significant differences on both wings and that the wing pattern is not gender-specific. The bands on the forewing are completely absent in one male and more or less visible in the other males. The apical mark is clearly visible and divided, and marginal spots are also visible on all specimens. The pattern on the hindwing is much more pronounced, the colour of the spots is basally dark brown, but depending on the storage conditions they can fade to reddish brown.

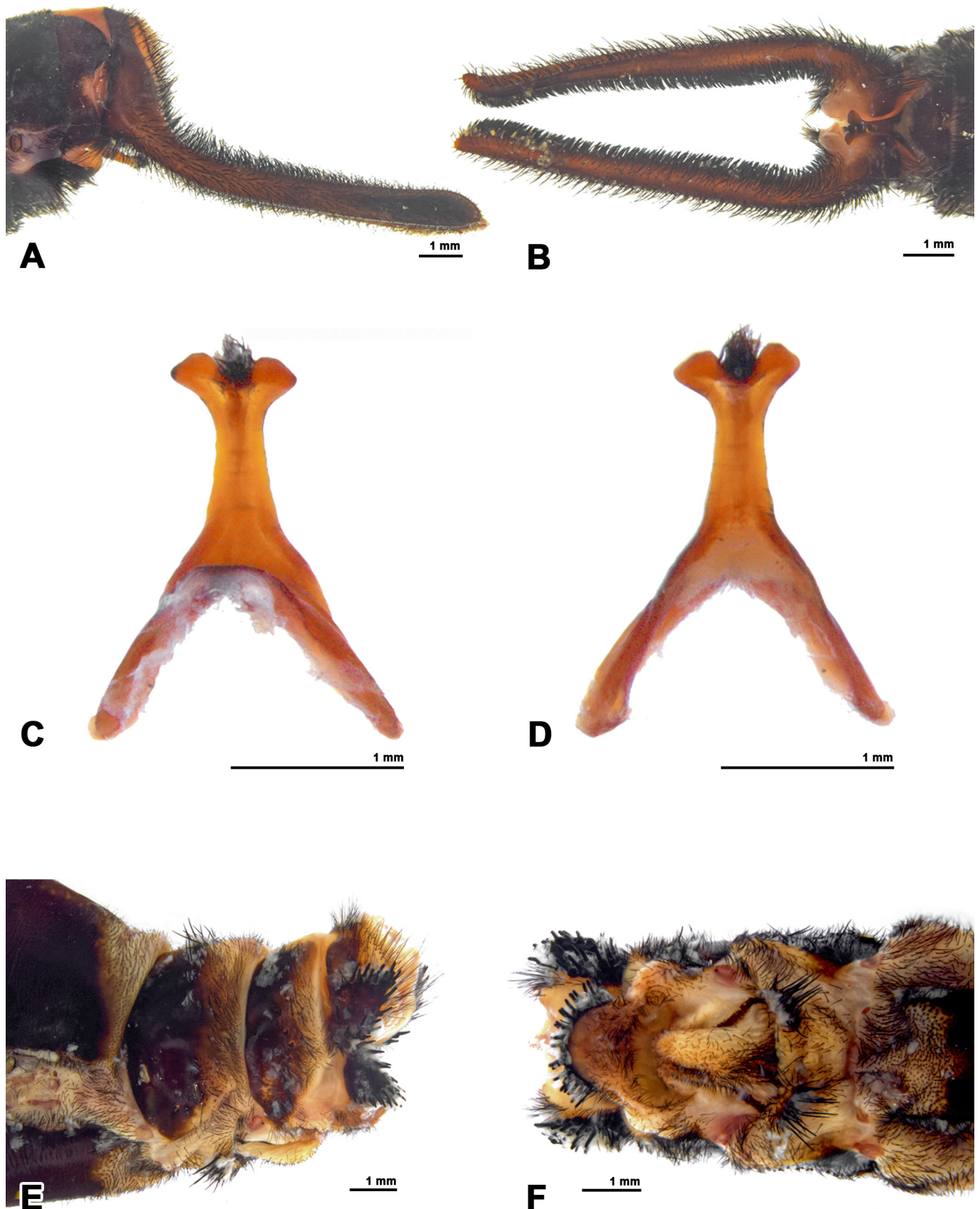




**Figure 10.** *Stenares harpyia* (Gerstaecker, 1863) male. **A.** Head in frontal view; **B.** Head and thorax in dorsal view; **C.** Wing venation; **D.** Labial palp in lateral view; **E.** Foreleg in lateral view; **F.** Hindleg in lateral view.

The basal band is missing on the hindwing, the medial band is divided into 2 or 3 parts. The shape of the prestigmal band can vary, in most cases, it reaches almost to the posterior margin. This band is separated from the marginal spot by a broad band extending towards the medial band. The apical mark is divided by a transparent narrow strip extending from the tip towards the wing base is also characteristic. The pattern of the hindwing of *S. harpyia* is typical of the species and can be easily distinguished. Previously published faunal data of *S. harpyia* from India need to be revised.





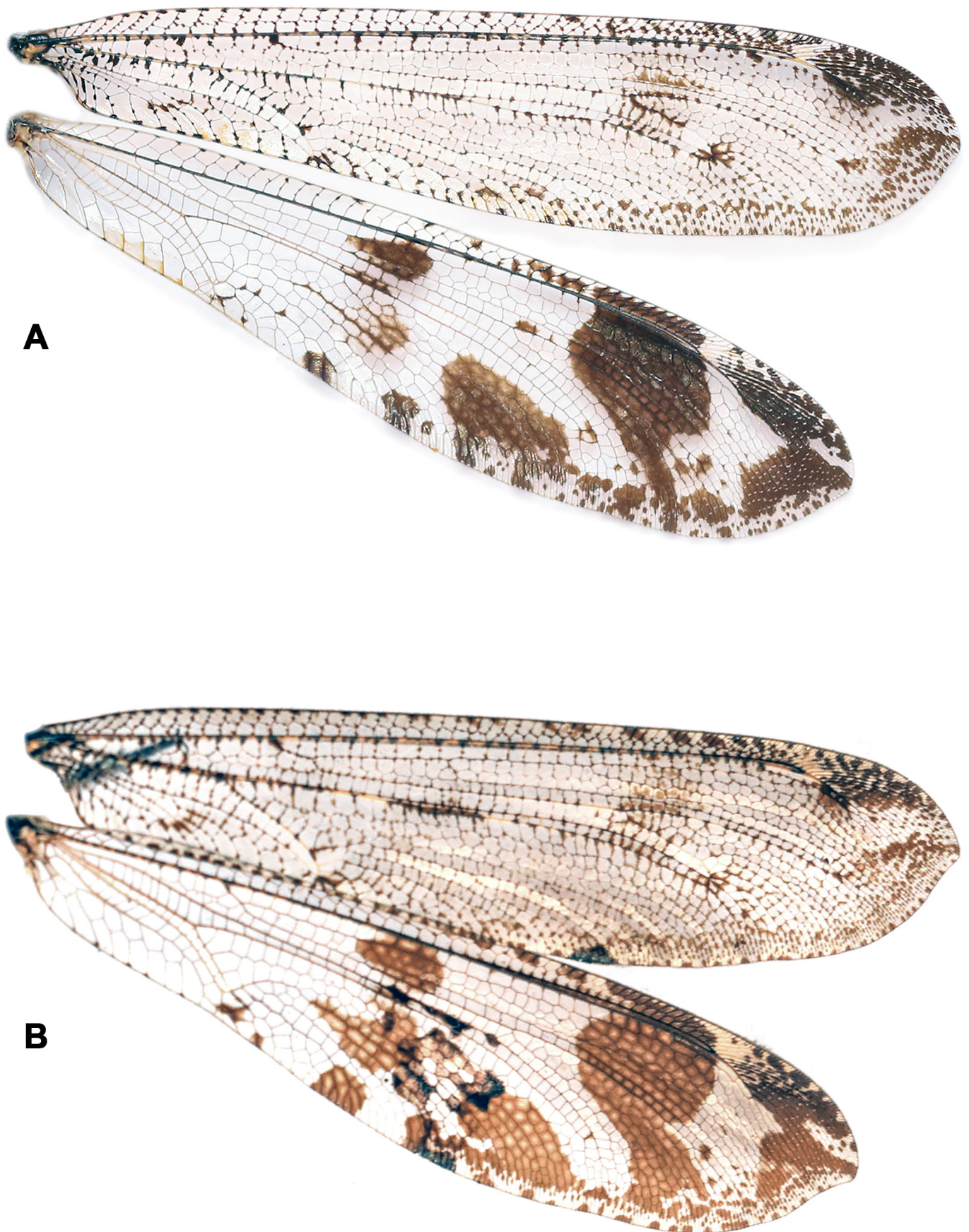
**Figure 11.** *Stenares harpyia* (Gerstaecker, 1863). **A.** Male terminalia, in lateral view; **B.** The same, in ventral view; **C.** Male genitalia: gonocoxites gx9 + 11 in dorsal view (in sense Aspöck et al., 1980; Aspöck & Aspöck, 2008; Badano et al., 2017); **D.** The same in ventral view; **E.** Female terminalia in lateral view; **F.** The same in ventral view.





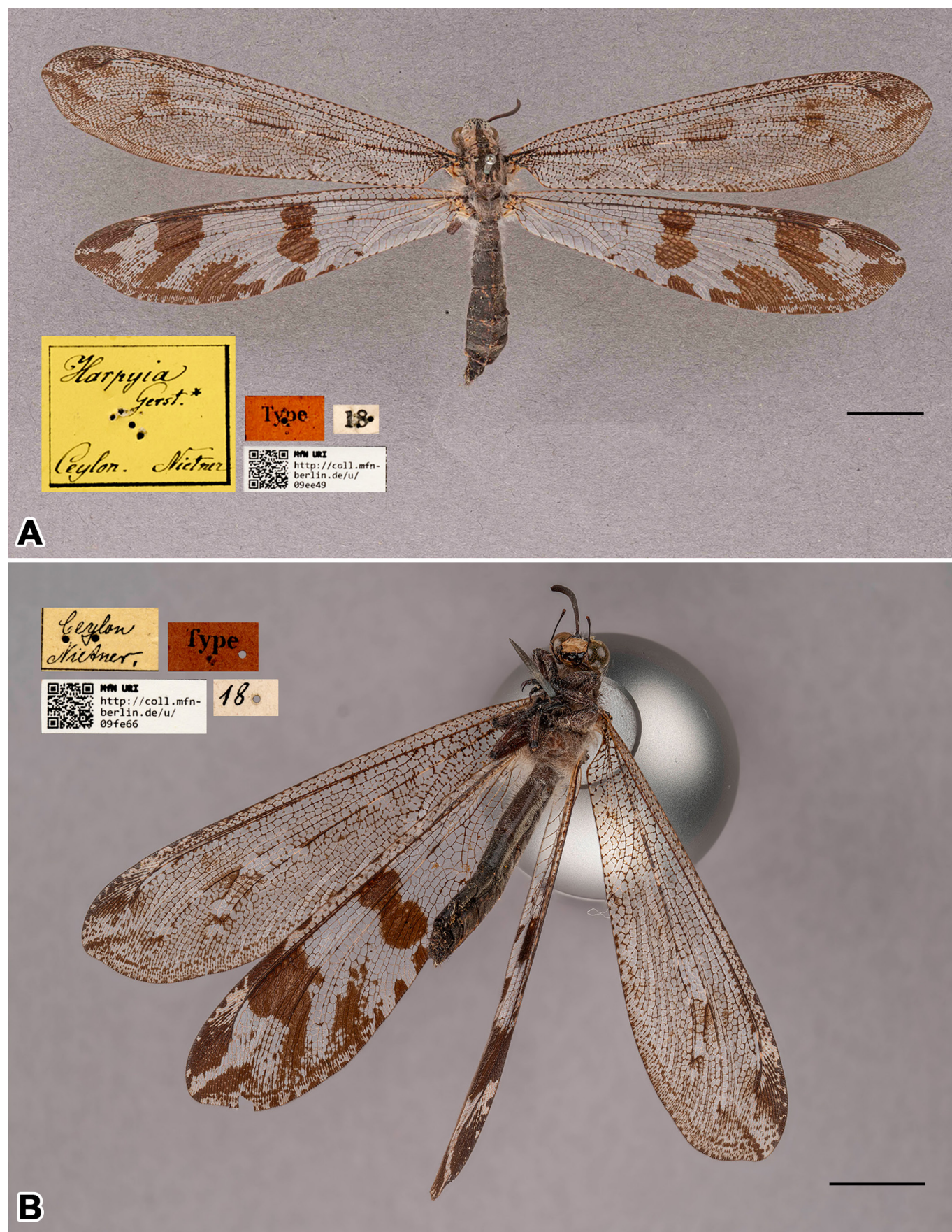
**Figure 12.** *Stenares harpyia* (Gerstaecker, 1863). **A.** Adult male in natural habitat; **B.** Habitat of species in Thirunelly, Kerala. [photo: Vivek Chandran A.]





**Figure 13.** *Stenares harpyia* (Gerstaecker, 1863) pattern variability of the wings. **A.** Male from Thrunelly, India; **B.** Male from Vallakadavu, India.





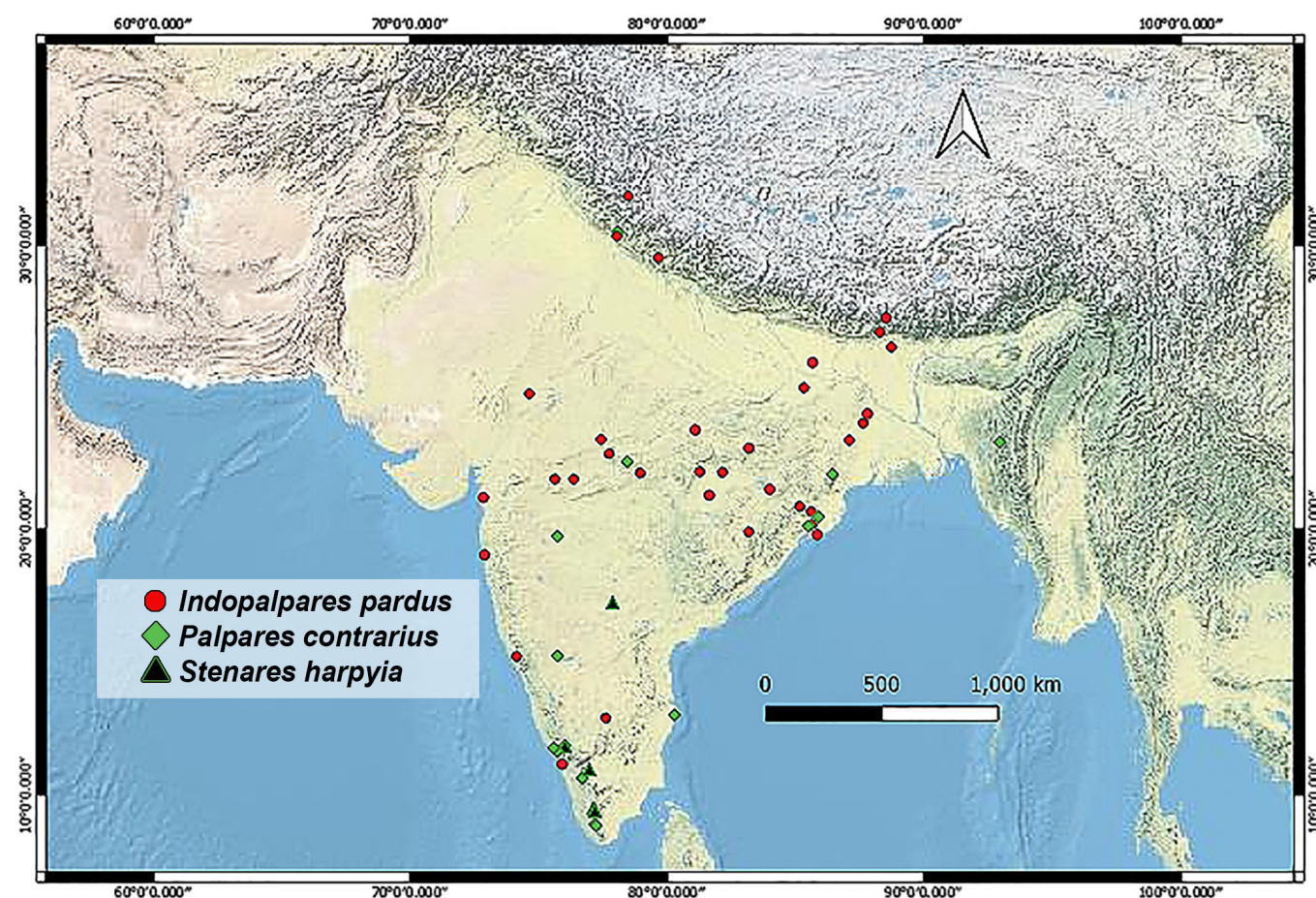
**Figure 14.** Female syntypes of *Palpares harpyia* Gerstaecker, 1863 (junior synonym of *Stenares harpyia*) in MfNB. **A.** Designated lectotype specimen in dorsal view; **B.** Designated paralectotype in ventral view. Scale bar: 10 mm.



**Comments.** *Stenares harpyia* specimens collected in Kerala are morphologically conspecific with the syntype specimens from Sri Lanka (Fig. 14A–B). However, other *Stenares* species reported from India require revision as they are characterised by sexual dimorphism and a high degree of variability between specimens. The known *Stenares* species require a complete morphological revision and their genetic examination is also essential.

Species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
<i>Indopalpares pardus</i>												
<i>Palpares contrarius</i>												
<i>Stenares harpyia</i>												

**Figure 15.** The flight period of *Indopalpares pardus* (Rambur, 1842), *Palpares contrarius* (Walker, 1853), and *Stenares harpyia* (Gerstaecker, 1863) from India, based on new faunistic data and details from published literature.



**Figure 16.** Distribution of *Indopalpares pardus* (Rambur, 1842), *Palpares contrarius* (Walker, 1853), and *Stenares harpyia* (Gerstaecker, 1863) from India, based on new faunistic data and published literature.

## DISCUSSION

Palparids belong to the ancient type of antlions, wings have dense venation and are morphologically distinct (cubitus posterior [Cup] and first anal vein [A<sub>1</sub>] of the forewing do not unite but run separately to posterior margin) from other groups of antlions. Their taxonomic classification (tribe, subfamily, family) seems to be contradictory (Mansell, 1992b; Machado et al., 2019; Prost & Popov, 2021; Hevin et al., 2023).

Most species of the Gondwanan origin group are still found in Africa (Mansell, 1990, Stange, 2004), but many species occur in the Palearctic, Europe, and southern Asia, especially in the Eremial area. In the Oriental area, the highest species richness is found in the Indian subcontinent (Hölzel, 1986). Although, India has the highest species richness, there may be some synonym species and incorrectly identified specimens. In the literature review, it became clear that the occurrence of several mentioned taxa from India seems impossible, e.g. *S. hyaena* native to West Africa (Prost & Popov, 2021). This is also confirmed by our observations and examination so far. However, we have not yet completed the full revision of the group. This revision covers not only the taxonomic status of the species but also the redetermination of the species kept in the collections to get a realistic picture of the distribution of the species in India. Previously, most of the species were classified in the genus *Palpares* based on morphological grounds, and now also with the help of genetic samples, the phylogenetic relationships are becoming more and more refined. The survey of the Indian fauna from this point of view has not yet begun.

The taxonomic studies and documentation of adult antlions from India are very minimal, due to the lack of neuropteran experts. There are many unidentified and uncatalogued antlion specimens in Indian museums. In recent years, there has been notable taxonomic revisions and distributional records in Neuroptera by Kaur et al. (2019a, 2019b, 2021); Winterton & Gupta (2020); Winterton et al. (2021); Suryanarayanan & Bijoy (2021a, 2021b, 2021c, 2021d, 2022, 2024b, 2024c); Suryanarayanan et al. (2022, 2023a, 2023b, 2024a, 2024b, 2024c, 2024d) based on comprehensive research on Indian Neuroptera fauna. These Neuroptera studies from India are necessary to identify the synonymous and misidentified species on the basis of type specimens. This will give a clear idea of the species diversity as well as their distribution in the country, which will ultimately help in identifying and describing many new species and genera.

## AUTHOR'S CONTRIBUTION

The authors confirm their contribution to the paper as follows: T.B. Suryanarayanan: Collecting and identification of specimens, writing the original manuscript; L. Ábrahám: Review and editing; B. Chenthamarakshan: Research supervisor, Review and editing. The authors read and approved the final version of the manuscript.

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## AVAILABILITY OF DATA AND MATERIAL

The specimens listed in this study are deposited in the insect collections of the Shadpada Entomology Research Lab (SERL), Kerala, India; Museum d'Histoire Naturelle, Geneva, Switzerland; Museum für Naturkunde Berlin, Germany, and are available from the curator, upon request.

## ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study only included arthropod material, and all required ethical guidelines for the treatment and use of animals were strictly adhered to in accordance with international, national, and institutional regulations. No human participants were involved in any studies conducted by the authors for this article.

## CONSENT FOR PUBLICATION

Not applicable.



## CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this paper.

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## توصیف مجدد سه گونه شیرمورچه (Neuroptera: Myrmeleontidae) از کرالا در ناحیه گهات غربی، هند و کلید شناسایی جنس‌های قبیله Palparini

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**چکیده:** سه گونه شیرمورچه شامل *Palpares contrarius* (Walker, 1853) و *Stenares harpyia* (Gerstaecker, 1863) متعلق به قبیله Palparini برای اولین بار از بخش کرالا در ناحیه گهات غربی هند گزارش شده‌اند. هر سه آرایه مجدداً توصیف شده و ویژگی‌های بخش جنیتالیا در *Palpares contrarius* و *Stenares harpyia* برای اولین بار بر اساس نمونه‌های تازه جمع‌آوری شده مستندسازی شد. نمونه‌های لکتوتیپ و پارالکتوتیپ برای گونه *Stenares harpyia* تعیین شدند. کلید شناسایی جنس‌های قبیله Palparini و محدوده انتشار سه گونه در هند نیز ارائه شد. علاوه بر این، دوره فعالیت و پرواز این گونه‌ها آن‌ها در هند نیز مشخص شد.

**واژگان کلیدی:** انتشار، *Indopalpares*، لکتوتایپ، *Palpares*، *Stenares*، تاکسونومی