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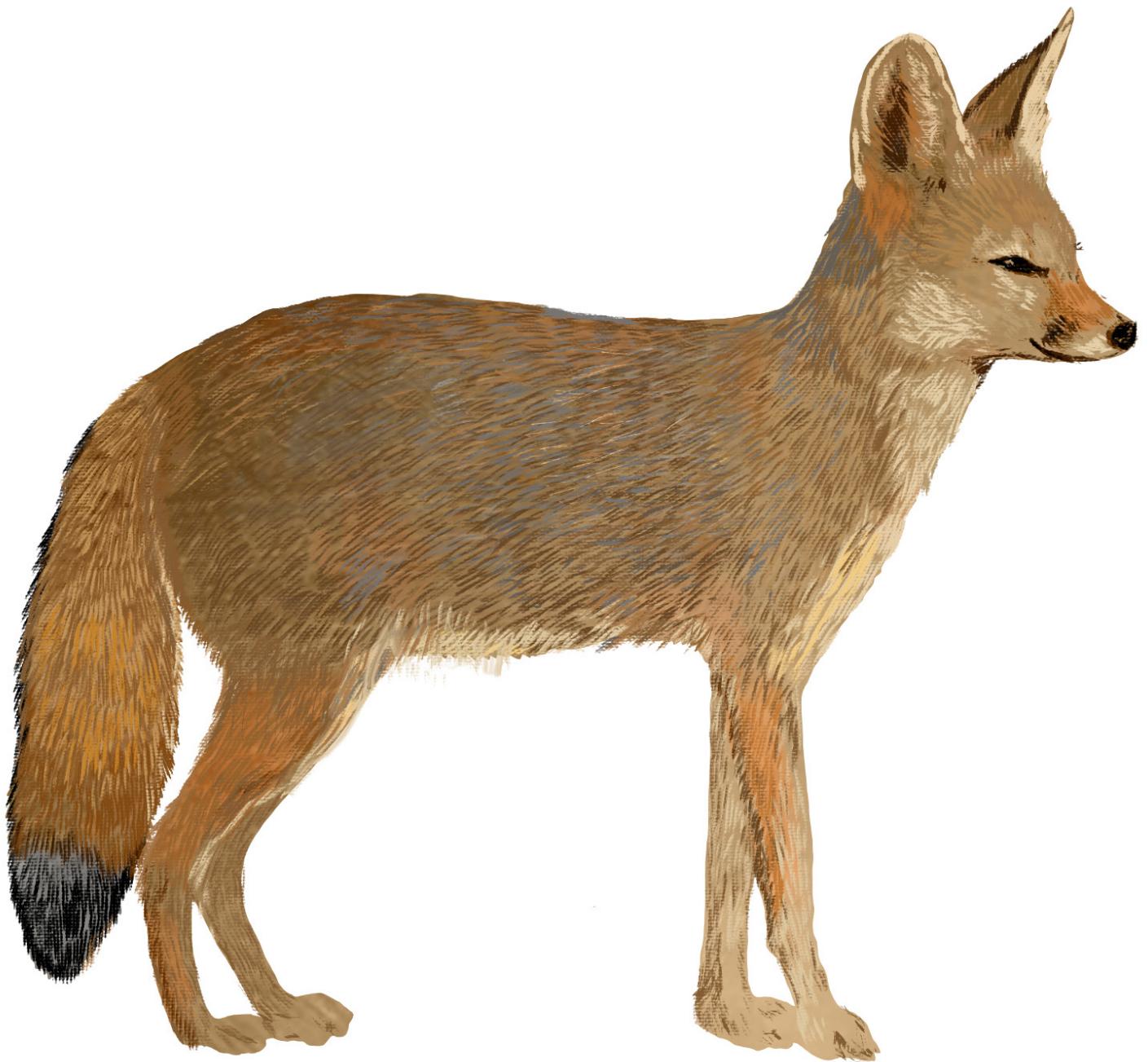
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Cover: Bengal Fox *Vulpes bengalensis*—digital illustration. © Alagu Raj.



The first report of an assassin bug of the genus *Ademula* McAtee & Malloch (Reduviidae: Emesinae) from India and its rediscovery from Sri Lanka

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Abstract: Emesine bug *Ademula contaminata* (Distant, 1903) is recorded from India for the first time and rediscovered from Sri Lanka. Details of its morphology, including the male genitalia, are presented along with images of the habitat. Images of living bugs in natural habitat are presented along with some comments on natural history of these bugs.

Keywords: Assassin bug, distribution, emesine bug, Emesini, natural history, Oriental region, thread-legged bugs.

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Author contributions: Ranasinghe and Sumanapala recorded natural history and did photography in Sri Lanka. Sankararaman and Agarwal recorded, photographed and collected Indian specimens. H.V. Ghate identified, dissected, prepared images and prepared the first draft. All authors contributed to revision of the first draft and preparation of final draft.

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INTRODUCTION

The subfamily Emesinae (Hemiptera: Heteroptera: Reduviidae), commonly called thread-legged assassin bugs, is one of the most remarkable and species-rich subfamilies of the family Reduviidae, as is evident from the monograph by Wygodzinsky (1966) and the catalogue of Reduviidae of the World by Capriles (1990). There are six tribes, about 90 genera, and 950 species of Emesinae (Wygodzinsky 1966; Schuh & Weirauch 2020) and new species continue to be added.

Ademula McAtee & Malloch, 1926 includes small macropterous species distributed in Australian, Ethiopian, and Oriental regions; key to the species described prior to 1966 was published by Wygodzinsky (1966); Capriles (1990) subsequently listed 13 species and the 14th species was added by Rédei (2005). Very recently, Chen et al. (2023) added two more species from southwestern China, so the total number of species of *Ademula* is now 16. The list of all *Ademula* species and their distribution has also been tabulated by Chen et al. (2023). Of the seven species recorded from the Oriental region, only one species, namely *Ademula contaminata* (Distant, 1903), is recorded from Sri Lanka. The genus *Ademula* has not been previously recorded from India (Ambrose 2006; Mukherjee et al. 2020). Following the latest classification (discussed later), the genus *Ademula* is now placed under tribe Emesini (formerly it was under Ploiariolini).

Ademula was erected by McAtee & Malloch (1926) to accommodate two species described simultaneously: *A. reticulata* as the type species of the genus (type locality: Singapore; a paratype from Sandakan, Borneo) and *A. nubecula* (type locality: Sandakan, Borneo); however, only comparative comments with reference to a few other genera like *Tridemula* Horváth, 1914 and *Empicoris* Wolff, 1811 were given by the original authors. A detailed diagnosis of the genus was subsequently given by Wygodzinsky (1966).

During a biodiversity survey in March 2021, one of the authors (TR) documented and photographed an Emesinae species from a garden in Kandumulla, Sri Lanka. Subsequent surveys revealed a few more individuals of the same bug as well as nymphs in other locations (Image 1a–f). Within a short time from the above discovery, two males of the same species were photographed (26 January 2022) and collected after few days, by two of the authors (HS & AA), in southern India. These were studied in detail to establish the identity of the species. This Emesinae species was identified as *Ademula contaminata* based on Wygodzinsky (1966)

and confirmed using recent keys for the Oriental species (Rédei 2005; Chen et al. 2023).

Distant (1903a) described *Ploiariola contaminata* from 'Biserat, Jalon' based on material collected during 1901–1902 expedition to the 'Siamese Malay States'; Wygodzinsky (1966) studied a specimen from Peradeniya, Ceylon (= Sri Lanka), preserved at NHM, London, and placed it in a new combination as *Ademula contaminata* and gave the distribution of this species as 'Malaya; Ceylon'. The original description and illustrations given by Distant (1903a) were also consulted and those helped further to confirm the identity of the species. The image of the type available in the database of the Natural History Museum, London (NHM) was also found to be useful; the colouration of forewing of the type is almost identical to what is seen in our material.

Ademula contaminata is described here in greater details, based on two male specimens collected from Padappai, Kanchipuram, Tamil Nadu, India, with several digital photos. Photos of live specimens from India as well as Sri Lanka, with some comments on the natural history, are also provided. Sri Lankan specimens were not collected but bugs were watched for behaviour and photographed.

Although the species has previously been recorded from Sri Lanka, there have been no subsequent reports from the country for more than 120 years – a fact probably related to lack of surveys and lack of taxonomic expertise in this group. This report is therefore the first record of this genus from India and an interesting rediscovery of the species from Sri Lanka.

MATERIALS AND METHODS

In Sri Lanka the various potential habitats for the bugs were explored using a visual encounter survey method. Observations of Emesinae bugs were documented with photographs, primarily using Canon EOS 7D or Canon EOS 7D Mark ii camera, fitted with a Canon EF 100 mm f/2.8 L IS USM macro lens.

In India, small patches of grass and shrub vegetation were being surveyed when these bugs were found. The bugs were collected and preserved in 70% alcohol and subsequently studied and photographed under a Leica Stereozoom MZ6 with attached Canon PowerShot S50. The methods of preparation of genitalia follow those outlined by Ghate et al. (2021).

RESULTS

Material examined: Two males collected from Padappai (12.88 °N, 80.01 °E), Kanchipuram, Tamil Nadu, India. Date 12.ii.2022; leg. HS and AA. Preserved in Modern College, Pune.

Taxonomic position

Family **Reduviidae** Latreille, 1807

Subfamily **Emesinae** Amyot & Serville, 1843

Tribe **Emesini** Amyot & Serville, 1843 [sensu Standing et al. 2023]

Genus *Ademula* McAtee & Malloch, 1926 (1926: 125); Wygodzinsky & Usinger (1960: 262 new species); Wygodzinsky (1966: 337, diagnosis, key to the species and distribution); Villiers (1970: 818, distribution of the genus, new species 1982: 27 new species); Capriles (1990: 141, catalogued); Ishikawa & Yasunaga (2004: 1, diagnosis, distribution, redescription); Rédei (2005: 128, distribution, new species); Chen et al. (2023: 702, diagnosis, distribution, new species, DNA Barcodes, key to Oriental species)

Ademula contaminata (Distant, 1903):

Ploiariola contaminata Distant, 1903 (1903a: 258, original description, habitus drawing)

Ademula contaminata (Distant): Wygodzinsky (1966: 339, new comb., in key, distribution); Capriles (1990: 142, catalogued); Rédei (2005: 131, in key); Chen et al. (2023: 710, in key)

Genus *Ademula*: diagnostic characters

Diagnostic characters of the genus *Ademula*, as given recently by Chen et al. (2023), are stated verbatim here: "Members of *Ademula* are small-sized and usually pale-coloured species with variable colour patterns on legs and forewings, and can be recognised within the tribe by the following combination of characters: the posterior pronotal lobe has a well-developed lateral carina; the scutellum and the abdominal tergite I each bears a spine-like process; the metanotum is rounded apically or has a small process; the fore tarsus is three-segmented; the fore wing has a single discal cell, and a single vein (M + Cu) is extending basally from the cell". Similarities and differences of *Ademula* with related genera are discussed later.

Redescription of *Ademula contaminata*

Colouration and vestiture: Colour (after preservation). General colour ochraceous with pale or dark brown areas on head, thorax, fore legs, and fore wings. Head uniformly brown, eyes dark brown to black; antennae: first antennomere pale, with subapical dark annulation;

remaining antennomeres darker; labium: first visible segment (actual second) very pale, remaining segments dark. Pronotum: disc of anterior lobe dark brown, posterior lobe with median and lateral longitudinal pale brown bands (Image 2a–c); area around scutellum dark brown. Fore legs: coxa pale brown, distal one third darker; femora with three incomplete annulations of dark brown which appear darker on external (posterior) face than on internal (anterior) face; femoral basal dark annulation occupies almost half length of femur, second large one near middle, third and smallest subapical; fore tibiae also possess three annulations of brown that are basal, near middle and apical in position; tarsal segments dark brown to blackish (Image 2e). Mid and hind femora with four dark spots or incomplete annulations, two before middle and two after middle; mid and hind tibiae show one dark, sub-basal dark annulation; mid and hind tarsi dark brown (Image 2f). Abdomen pale brown, segments V and VI with orange tinge. Pygophore brownish.

Body surface mostly dull, some parts of head and pronotum sub shining; all body except wings covered with short and long pubescence or setae, as shown in Images 2 and 3. Mid and hind legs with sparse macrochaetae.

Structure

Head short, broader than long due to very large eyes; ante-ocular slightly longer than postocular portion in lateral view, slightly convex dorsally; ante-ocular with sides parallel in dorsal view; postocular narrowed posteriorly, semiglobular in dorsal and lateral aspects. Eyes very large, occupying almost 50% area of head, as seen laterally, and appearing nearly sub-hemispherical in dorsal view (Image 2d). Labium 4 segmented but first segment not visible hence visible segments are actually second, third and fourth; labium curved, strongly bent between second and third segments; second segment longest and stout, third short and swollen in middle, fourth very slender and longer than third (Image 2b,c). Antenniferous tubercles large, inserted in front of eyes, towards anterior border of head; first antennomere (scape) with long setae. Transverse interocular sulcus curved, situated between eyes, almost at level of middle of eye in dorsal view.

Pronotum short, saddle like, constricted before middle; anterior lobe nearly as wide as long, its sides slightly rounded, disk with roundish or oval depression medially in posterior part; posterior lobe with its sides diverging posteriorly, its surface finely punctate, with short, lateral carina on anterior portion (Image 3a,b). Scutellum and first abdominal tergite with a distinct

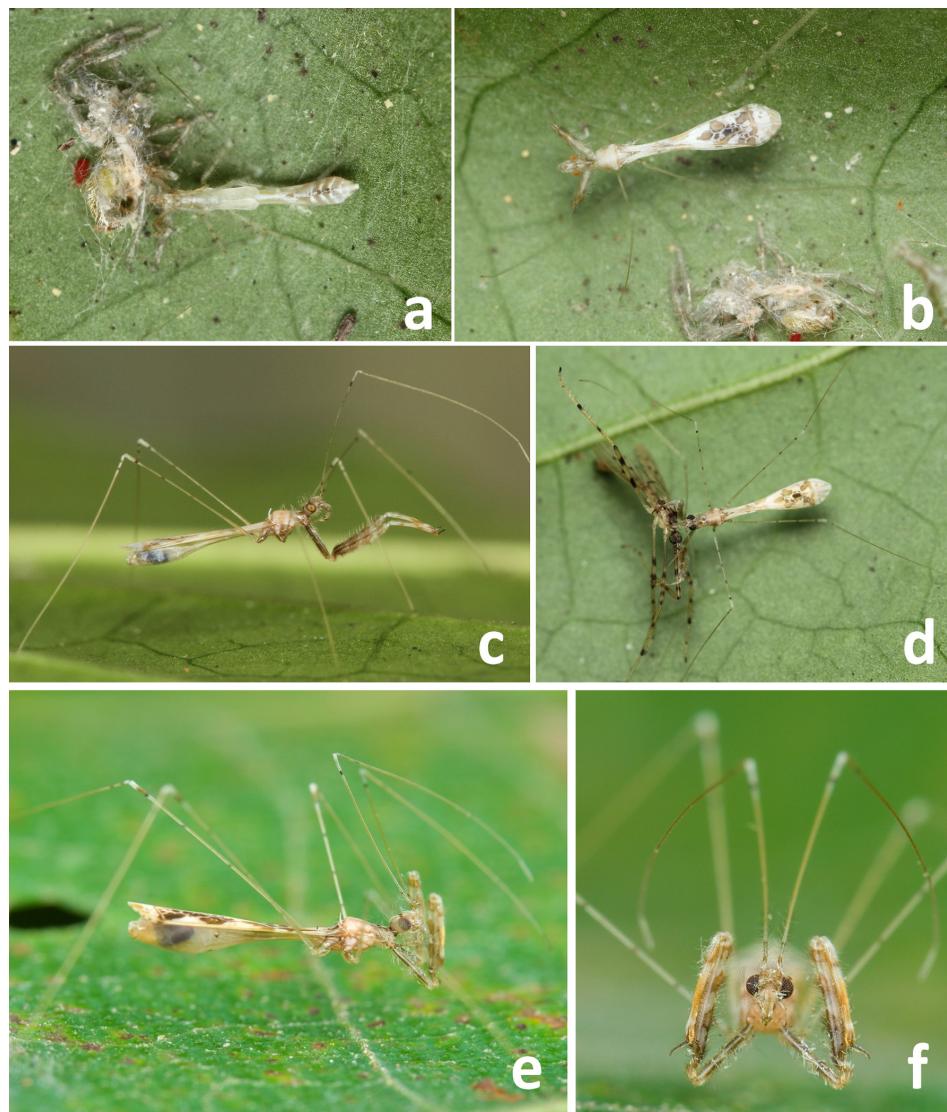


Image 1. *Ademula contaminata* live: a—last instar nymph | b—freshly moulted adult | c—adult | d—adult preying on a limoniid crane fly | a–d all from Kandumulla, Sri Lanka, © Ranasinghe | e—lateral view | f—frontal view | e–f—photographed in India, © Saravanaraja.

spine (Image 2b,f). Forewing smooth, passing apex of abdomen; one large discal cell present, pterostigma reaching apex of wing; venation, and pattern of dark patches as shown in Image 4.

Fore leg slender, its femur with usual two series of spiniferous processes. Posteroventral series, beginning close to base of article, including three relatively thick, long, prominent spiniferous processes and numerous short processes in between, long processes about one third shorter than diameter of femur; first long spiniferous processes close to base appears slightly longer than remaining two, second one situated close by, third farther, beyond middle of femur. Anteroventral series continuous, uninterrupted, starting slightly distal to first long spine of posteroventral series, without long

processes. Fore tibia long, thinner than femur, about four-fifths as long as femur, ventrally with series of strong decurved spine-like setae. Fore tarsus three segmented (see inset Image 3c). Claws of equal size. Mid and hind legs very slender, thread-like; hind femora distinctly surpassing apex of abdomen.

Abdomen elongate, narrow at base in lateral and ventral views, wide distally. Seventh tergite short in male, not projecting over pygophore; eighth sternite visible. Pygophore elongate, small, broader at base and narrowed apically, longer than high in lateral view, pygophoral process (superoposterior spine, SP) blunt spine-like as seen in ventral view (Image 5a,b). Parameres (P) short, slender, slightly curved at base, dilated beyond middle, with sparse, simple setae and sharp point at



Image 2. *Ademula contaminata* structure: a—lateral habitus, mm scale | b—anterior half, lateral view | c—head, lateral view | d—head and pronotum, dorsal view of wet specimen | e—fore leg showing colouration | f—mid and hind leg colouration. © H.V. Ghate.

one side in apical region (Image 5e). Phallus slightly sclerotized, dorsally with saddle-shaped sclerotization on phallotheca; vesica arms long and slender, with swollen base and apical thread-like part; articulatory apparatus well developed and sclerotised (Image 5c,d).

Notes on the habitat in India

The specimens were collected from a teak *Tectona grandis* plantation in an undisturbed suburban wild patch, with mixed vegetation of perennial trees and grassland. The bugs were resting on the under surface of teak leaves, in the low-lying branches of the trees, a couple of feet above the ground level. The collected bugs were docile as they were collected during day time. The pale colouration of the bugs made it difficult to spot them when they were resting on the dry leaves. Furthermore, the bugs remained almost flat, keeping their legs and entire body very close to the leaf surface when approached, merging totally with the environment. Some images of live specimen, before those were collected, are available on the

following links of iNaturalist (courtesy: Saravanaraja and Anubhav Agarwal), (<https://www.inaturalist.org/observations/105676730>), (<https://www.inaturalist.org/observations/105671338>). Habitat pictures are shown in Image 6a,b.

Natural history observed in Sri Lankan population

Both adults and nymphs appear to be arboreal and were observed in well wooded home gardens or forested areas. These bugs are nocturnal and the individuals observed in day time were found resting in abandoned spider webs under the leaves, about 1.5–2.0 m above the ground. If disturbed these bugs walk away from their resting place rather than flying. When resting, both adults and nymphs, usually keep their forelegs retracted and close to the head (Image 1a–f). These emesine bugs seemed to prefer well shaded undergrowth as their habitat. We observed both adults and nymphs in the same location, close to each other, but never on the same leaf.

Individuals observed at night seemed to be active

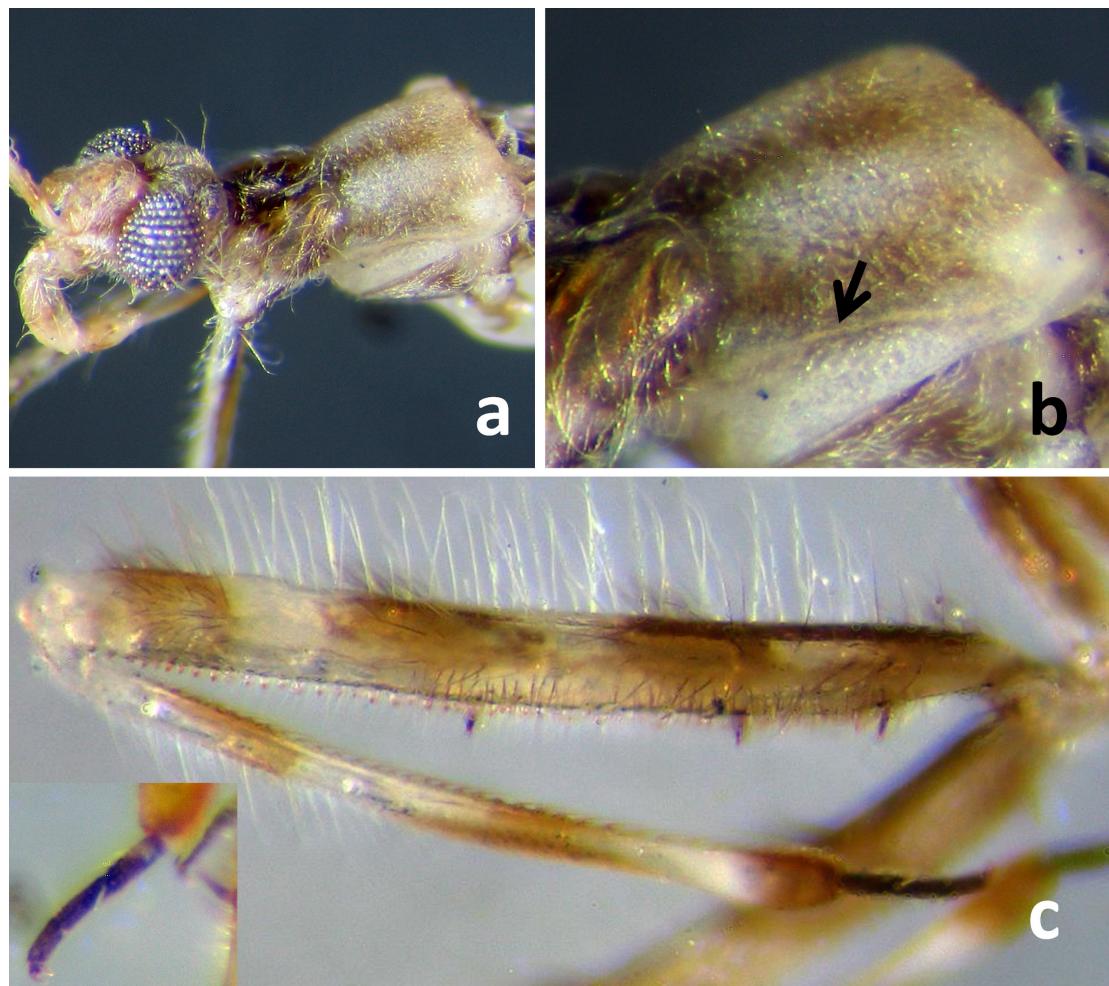


Image 3. *Ademula contaminata* structure: a—head and thorax in dorsolateral view | b—pronotum, arrow pointing lateral carina | c—forefemur, tibia and tarsus; inset—tarsus. © H.V. Ghate.

and foraging for prey and unlike in the daytime, these usually flew away if disturbed and landed on another leaf close by. One of the individuals recorded at night was observed preying on a limoniid crane fly (most probably *Styringomyia* sp.; Image 1d) which was slightly larger than the bug.

DISCUSSION

According to the keys given recently by Rédei (2005) and Chen et al. (2023), the diagnostic characters of *A. contaminata* are: 'mid- and hind-femora with a subapical annulus and three more annuli along its length; fore femur 10 times longer than its breadth and forewing with numerous large and small dark spots'. All these characters are present in the specimens shown here. The species is distributed widely in Sri Lanka (Image 7) but is known from a single locality in India so far.

There is not much information concerning biology of any species of *Ademula* described so far, except for the fact that *A. aemula* Rédei, 2005 was collected from dry, mixed subtropical forest when attracted to light (Rédei 2005) and two recently described species were found resting on underside of leaves and were collected by sweeping with net (Chen et al. 2023). In the present study, the specimens were collected from a similar habitat (Image 6a,b) in India, but during the day. A mummified spider *Myrmaplata plataleoides* (Salticidae) was found in close proximity to *Ademula*, although the bug was not found actually feeding on that spider. The habitats in which Emesinae are found are varied and this fact, along with comments on general bionomics and geographical distribution, has been discussed in detail by Wygodzinsky (1966).

Wygodzinsky (1966) had recognized six tribes under Emesinae: Collartidini Wygodzinsky, 1966; Leistarchini Stål, 1862; Deliastini Villiers, 1949; Metapterini Stål,

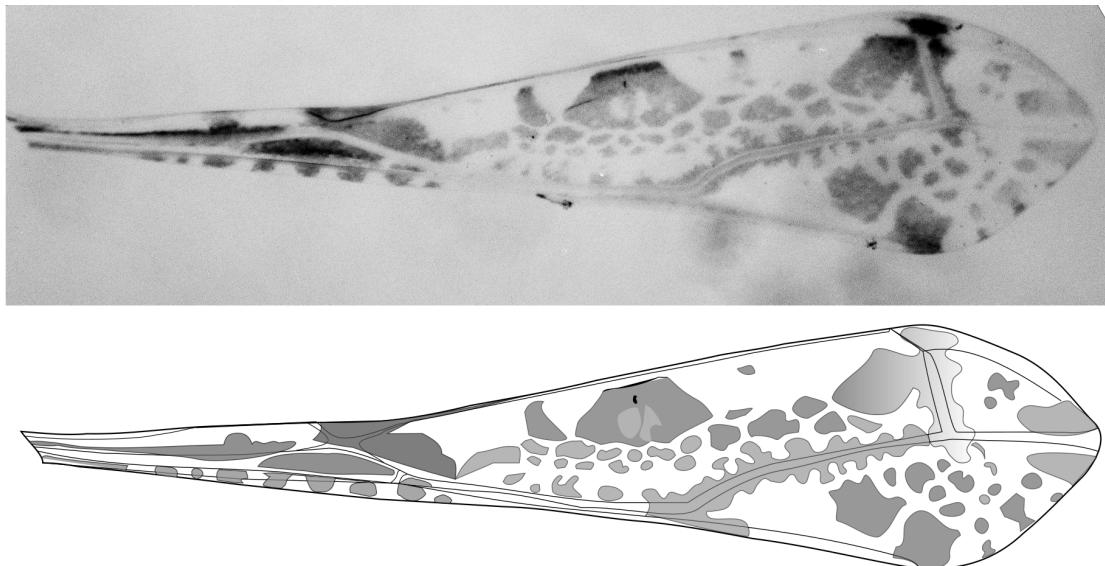


Image 4. *Ademula contaminata* structure: fore wing and its line drawing. © H.V. Ghate, line drawings Shruti Paripatyadar.

1874, *Emesini* Amyot & Serville, 1843, and *Ploiaroliini* Van Duzee, 1916. Very recently the classification of *Emesinae* was revised, based on morphological as well as molecular analyses; this new classification has treated the former subfamilies *Saicinae* Stål, 1859 and *Visayanocorinae* Miller, 1952 as tribes under *Emesinae*. This so called “Emesine Complex” now is said to include over 1,000 species and the currently recognized six tribes under *Emesinae* are: *Collartidini* Wygodzinsky, *Leistarchini* Stål, *Visayanocorini* Miller, *Emesini* Amyot & Serville, *Oncerotrachelini* Standring et al., 2023 and *Saicini* Stål. Former tribes such as *Metapterini* and *Ploiaroliini* are now treated as synonyms under *Emesini*; the tribe *Deliastini* was already treated as a junior synonym of *Metapterini* (Castro-Huertas et al. 2020; Standring et al. 2023).

Even though *Emesinae* in India have received considerable attention in the past few years, with new species descriptions as well as redescriptions of a few species, as referred before in Joshi et al. (2022), Sri Lankan *Emesinae* need detailed redescriptions; only one new species (Ghate et al. 2018) has been added since the work by Villiers (1970).

Earlier we reported and redescribed *Myiophanes greeni* Distant, 1903, and *Onychomesa susainathani* Wygodzinsky, 1966 [now treated as synonym of *O. alata* (Distant, 1903) which was originally described as *Ischnocytes alatus* (Distant 1903b): see Chen et al. 2024], both originally described from Sri Lanka; similarly, we also recently reported from India *Gardena melinarthrum* Dohrn, 1860, *Lutevula hortensis* (Distant,

1906), *Bagauda aelleni* Villiers, 1970 and *Hornylia nalanda* Wygodzinsky, 1966 – all species originally described from Sri Lanka (Kulkarni & Ghate 2016; Ghate & Sarode 2019; Hiremath et al. 2022; Ismavel & Ghate 2024; Ranasinghe et al. 2024; Boyane et al. 2024). Some of these species were also rediscovered from Sri Lanka after a considerable gap (Ranasinghe & Ghate 2022; Ranasinghe et al. 2024). *Ademula contaminata* becomes yet another Sri Lankan emesine recorded in southern India. Extensive surveys in India and Sri Lanka will surely recover more *Emesinae*, known or new, from both these countries.

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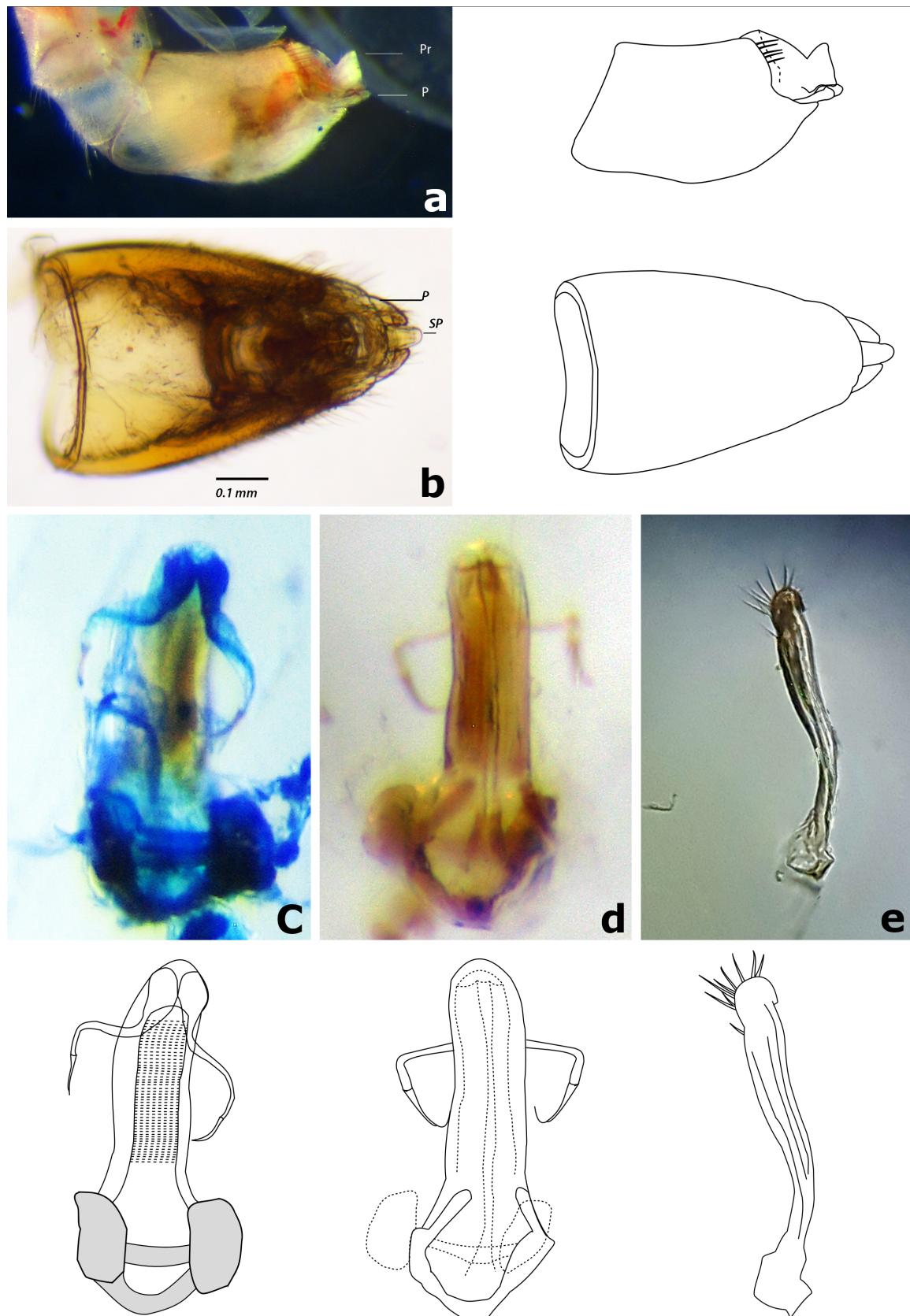
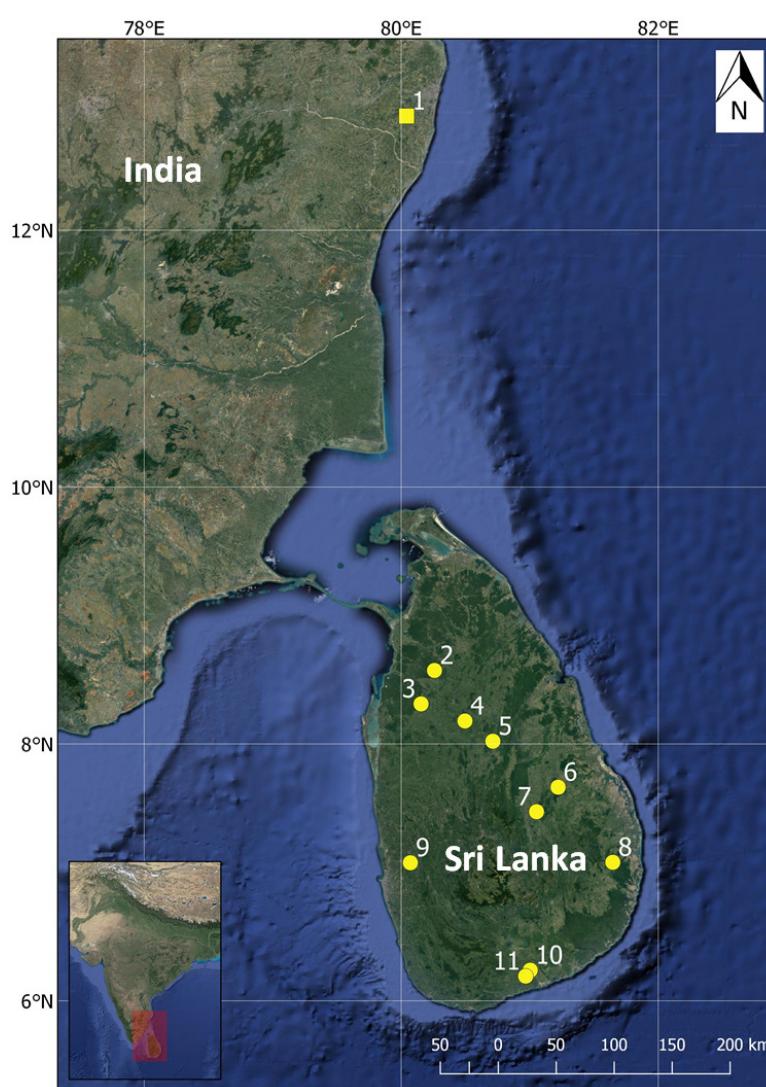


Image 5. *Ademula contaminata* structure: a—pygophore in lateral view and its drawing at right | b—pygophore in ventral view, its drawing at right | c—phallus in dorsal view, its drawing below | d—phallus in ventral view, its drawing below | e—paramere, its drawing below. Abbreviations: P—paramere | Pr—proctiger | SP—superoposterior spine. © H.V. Ghate, line drawings – Shruti Paripatyadar.



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