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Seven new records of bee flies (Bombyliidae, Diptera) from Saudi Arabia

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Abstract

Background: Bombyliidae (bee flies) are one of the largest dipterous families in Saudi Arabia with 116 hitherto recorded species. Larvae of these flies are predators or parasitoids of different stages of other insects in the orders Orthoptera, Neuroptera, Coleoptera, Lepidoptera, Hymenoptera and Diptera, in addition to spiders (order Araneae, class Arachnida), so they have potential use as biological control agents for pests belonging to these orders.

Results: In the present study, the list of Saudi Arabian fauna of bee flies (family Bombyliidae) is supplemented with seven new records in five genera and four subfamilies. The newly recorded species are *Parageron lutescens* (Bezzi, 1925) [Usiinae], *Phthiria salmayensis* Efflatoun, 1945 [Phthiriinae], *Heterotropus bisglaucus* Bezzi, 1925, *Heterotropus maculiventris* Bezzi, 1925, *Heterotropus xanthothorax* Efflatoun, 1945 [Heterotropinae], *Anthrax greatheadi* El-Hawagry, 1999, and *Desmatoneura brevipennis* (Bezzi, 1924) [Anthracinae]. World and local distributions of recorded species, diagnoses, remarks on feeding behaviors and some colored photographs were provided.

Conclusion: The present study supplements the bee fly fauna (family Bombyliidae) in Saudi Arabia with seven new records. This brings the total number of bee fly species in the country into 123 species classified in 40 genera, 12 tribes and 10 subfamilies.

Keywords: Bee flies, Bombyliidae, Distribution, New records, Saudi Arabia

Background

The family Bombyliidae (bee flies) is one of the largest dipterous families worldwide and therefore in Saudi Arabia. These flies are encountered in all continents except Antarctica and many oceanic islands especially in arid and semiarid environments, and they constitute a considerable percentage of the fly diversity in the desert regions of the world (Evenhuis and Greathead 2015).

El-Hawagry and Al-Dhafer (2019) catalogued this family as the first in a series of studies planned to catalogue the dipteran families which have potential importance in the biological pest control in Saudi Arabia. They listed 116 species classified in 40 genera, 12 tribes and

10 subfamilies. These flies may have biological control importance, as the vast majority of their larvae are predators or parasitoids of different stages of other insects in the orders Orthoptera, Neuroptera, Coleoptera, Lepidoptera, Hymenoptera and Diptera, in addition to spiders (order Araneae, class Arachnida). So, these flies may have potential use as biological control agents for pests belonging to these orders (Yeates and Greathead 1997).

In the present study, seven species of bee flies belonging to five genera and four subfamilies are recorded for the first time from Saudi Arabia.

Methods

The present newly recorded material was collected from different localities in Saudi Arabia since 2016 by the authors or/and their coworkers using aerial nets.

Efflatoun (1945), Greathead and Evenhuis (2001) and El-Hawagry (2021) have been consulted to identify the

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genera and species of the present study. Recorded species, tribes and subfamilies are systematically arranged following the classifications of the world catalogue (Evenhuis and Greathead 2015).

The type locality for both senior and junior synonyms for each recorded species is given. The world distributions matching to that given by Evenhuis and Greathead (2015), local distributions, diagnoses, remarks on feeding behaviors and some colored photographs are provided for recorded species. Countries in world distributions and regions in local distributions are listed in alphabetical order. Localities within each region are written after a colon and followed, between parentheses, by their coordinates and, between square brackets, by the governorates to which they belong, e.g., "Asir: Raydah Nature Reserve (18.2053°N, 42.4101°E) [Abha Gov.]"

Results

In the present study, the list of Saudi Arabian fauna of bee flies is supplemented with seven newly recorded species belonging to five genera and four subfamilies. The newly recorded species are *Parageron lutescens* (Bezzi 1925) [Usiinae], *Phthiria salmayensis* Eflatoun 1945 [Phthiriinae], *Heterotropus bisglaucus* Bezzi 1925, *Heterotropus maculiventris* Bezzi 1925, *Heterotropus xanthothorax* Eflatoun 1945 [Heterotropinae], *Anthrax greatheadi* El-Hawagry 1999 and *Desmatoneura brevipennis* (Bezzi 1924) [Anthraxinae].

Subfamily USIINAE
Tribe USIINI
Genus *Parageron* Paramonov

Parageron lutescens (Bezzi 1925)

Usia lutescens Bezzi 1925: 180. Type locality: Egypt.

Parageron orientalis Paramonov 1929: 189(127). Type locality: Turkmenistan.

Usia lutescens var. *minor* Eflatoun 1945: 223. Type locality: Egypt.

Distribution: PA: Egypt, Saudi Arabia (first record), Turkmenistan, Uzbekistan.

Local distribution: Riyadh: Wadi El-Dawaser (20.4203°N, 45.0621°E) [Wadi El-Dawaser Gov.].

Material examined: 1 female, Wadi El-Dawaser, 9.V.2018, Al-Dhafer et al., leg., KSMA.

Diagnosis

Small yellowish compact bee-like species, about 3 mm in length, entirely covered with rather sparse yellowish-white tomentum; flagellum without a second flagellomere, with a dorsal sulcus very close to the tip possessing a tiny basal sensillum not arista; scutum

grayish-yellow dusted with three broad dark longitudinal stripes; the median stripe entire with parallel outer margins and extends from the upper border of scutum downwardly to about its lower four-fifth, occupying the middle third of scutum; the lateral stripes are separated from the median one by narrow yellowish lines and each of them occupy the majority of the outer third of scutum; scutellum triangular, with upstanding pale yellowish pubescence longer than those on scutum; legs entirely yellowish, with mid and hind femora almost reddish-yellow, hind tibiae yellowish-brown apically, and tarsi blackish-brown apically, anal lobe well developed; and abdominal tergites with whitish apical margins.

Remarks

Many species of the tribe Usiini including this species are ectoparasitoids on pupae of the coleopteran family Tenebrionidae (Yeates and Greathead 1997).

Subfamily PHTHIRIINAE
Tribe PHTHIRIINI
Genus *Phthiria* Meigen

Phthiria salmayensis Eflatoun 1945

Phthiria salmayensis Eflatoun 1945: 112. Type locality: Egypt (South Sinai).

Distribution: AF: Saudi Arabia [as "South western part"] (first record). PA: Egypt.

Local distribution: Asir: Raydah Nature Reserve (18.2053°N, 42.4101°E) [Abha Gov.].

Material examined: 1 male, 1 female, Raydah Nature Reserve, 6.VI.2016, El-Hawagry, leg., MSHC.

Diagnosis

Small narrow-bodied rather bare flies, about 4 mm in length; frons generally blackish with short sparse black hairs; flagellum with an apical sulcus containing a style; wing with four posterior cells, i.e., vein M₂ present; scutum brownish-gray covered with short sparse black hairs becoming brownish-yellow on postpronotal lobes; gonocoxites barrel-shaped, broader than long, with the posterior processes approximately slightly longer than broad; and distiphallus narrow, only about one-fifth the length of the thick basiphallus.

Remarks

Larvae of *Phthiria* spp. are known as parasitoids on the lepidopteran families; Gelechiidae and Tortricidae (Yeates and Greathead 1997).

Subfamily HETEROTROPINAE
Genus *Heterotropus* Loew

Diagnosis

Flies with body rather bare, without bristles or scales, with a pattern of dark and pale cuticle, usually 3.5–8 mm in length; tibiae without spurs; discal medial cell (dm) very wide opposite r-m crossvein; posterior cubital cell (cup) closed; and abdomen cordate or ovate.

Remarks

All species of this genus including the following three newly recorded species are predators (Yeates and Greathead 1997).

***Heterotropus bisglaucus* Bezzi 1925**

Heterotropus bisglaucus Bezzi 1925: 184. Type locality: Egypt.

Distribution: PA: Egypt, Saudi Arabia (first record).

Local distribution: Al-Qassim: Ar Rass (25.8754 °N, 43.4430 °E) [Ar Rass Gov.]; Eastern Region: Al-Olayah Village (27.55285 °N, 47.70354 °E) [Al-Olayah Gov.]; Riyadh: Al-Majmaah (25.746954 °N, 44.986667 °E) [Al-Majmaah Gov.].

Material examined: 1 female, Ar Rass, 3.V.2018, Al-Dhafer et al., leg., KSMA; 1 male, Al-Olayah Village, 20.IV.2018, Al-Dhafer et al., leg., KSMA; 1 male,

Al-Majmaah, Ibrahim Almassed farm, 26.V.2021, H. Chebbi & H. Abbad, leg. KSMA.

Diagnosis

Male and female (Fig. 1): Body yellowish; antennae entirely yellow; proboscis yellowish, very short, much shorter than head; broad blackish longitudinal stripes on scutum obscured by tomentum and pubescence and the yellow ground color separating the median stripe from the lateral ones is obvious only on the posterior third of the scutum; all legs yellowish except two or three apical tarsomeres which are blackish; apical tarsomere distinctly broader than the preceding ones; and abdomen yellowish, with a very broad transverse blackish spot on each of 2nd to 6th tergites, and lower borders of these spots don't touch the lower margins of tergites.

***Heterotropus maculiventris* Bezzi 1925**

Heterotropus maculiventris Bezzi 1925: 185. Type locality: Egypt.

Heterotropus tewfiki Paramonov 1929: 147. Type locality: Egypt.

Distribution: AF: Saudi Arabia [as "South western part"] (first record). PA: Egypt.

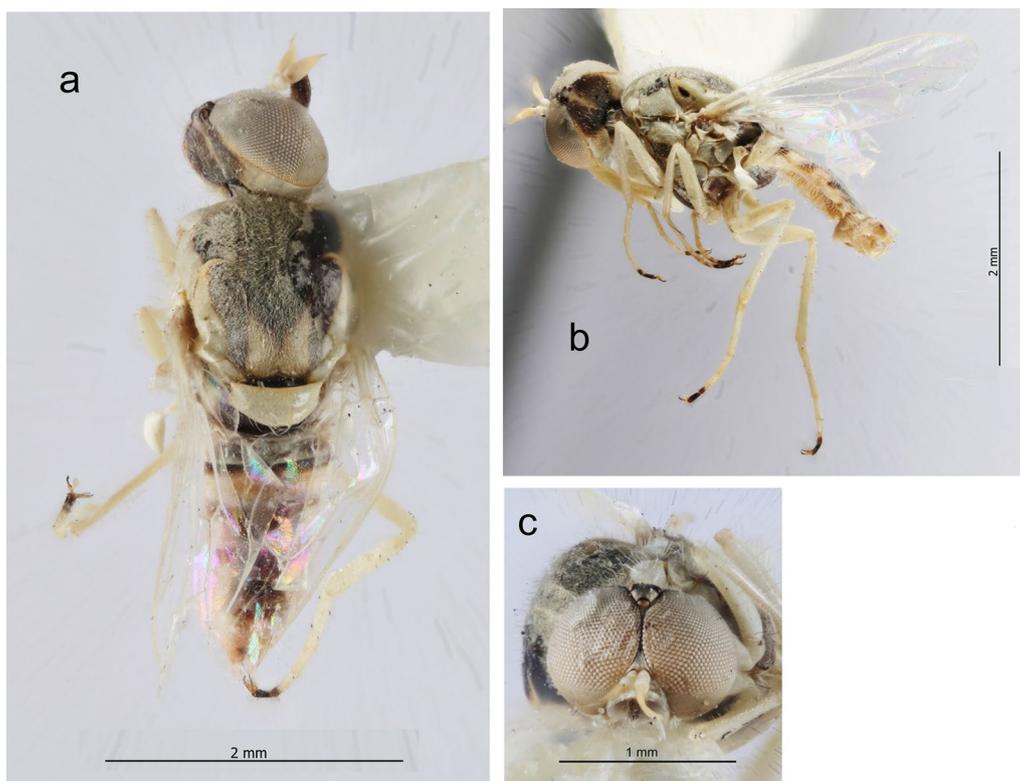


Fig. 1 *Heterotropus bisglaucus* Bezzi. **a** Male habitus, dorsal view. **b** same, lateral view. **c** Head, frontal view

Local distribution: Najran: Uruq Bani Ma'arid (19.107986 °N, 45.191925 °E) [Yadamah Gov.].

Material examined: 1 female, Uruq Bani Ma'arid, 2.III.2021, Abdel-Dayem M., Soliman A., Sharaf M., leg., KSMA.

Diagnosis

Female (Fig. 2): Body yellowish; face shining whitish-yellow with some small brownish markings; proboscis blackish, longer than twice the head length; thorax with three obvious broad blackish to pale brownish longitudinal stripes on scutum, with median stripe separated from the lateral ones on its entire length; abdominal tergites with black spots arranged in three rows along the abdomen, with the median row consisting of subcylindrical to triangular spots on the upper borders of tergites; however, spots of the lateral rows are broader and subquadrate.

Heterotropus xanthothorax Efflatoun 1945

Heterotropus xanthothorax Efflatoun 1945: 94. Type locality: Egypt.

Distribution: AF: Egypt [as "Gebel Elba"], Saudi Arabia [as "South western part"] (first record), Sudan.

Local distribution: Najran: Uruq Bani Ma'arid (19.107986°N, 45.191925°E) [Yadamah Gov.].

Material examined: 1 female, Uruq Bani Ma'arid, 6.IV.2021, Al-Dhafer H., Soliman A., Rassol I., leg., KSMA.

Diagnosis

Female (Fig. 3): Body yellowish, somewhat shining; flagellum conical, hardly longer than scape and pedicel together; proboscis, brownish, at most one and half the head length; thorax with the three longitudinal stripes on scutum relatively narrow and grayish in color; legs with all tarsi blackish, except the first and second tarsomeres which are blackish only at the tip; and abdomen with blackish transverse bands on the upper margins of 2nd to 5th tergites.

Subfamily ANTHRACINAE

Tribe ANTHRACINI

Genus *Anthrax* Scopoli

Anthrax greatheadi El-Hawagry 1999

Anthrax greatheadi El-Hawagry, 1999 ["1998"]: 108. Type locality: Egypt.

Distribution: PA: Egypt, Israel, Jordan, Saudi Arabia (first record).

Local distribution: Tabouk: Mudaysis (27.698676°N, 38.144024°E) [Tayma Gov.].

Material examined: 1 female, Mudaysis, 2.VIII.2019, Ali, leg., MSHC.

Diagnosis

Female (Fig. 4): About 6.5 mm in length; wing with confluent dark spots on the basal two thirds, however, the

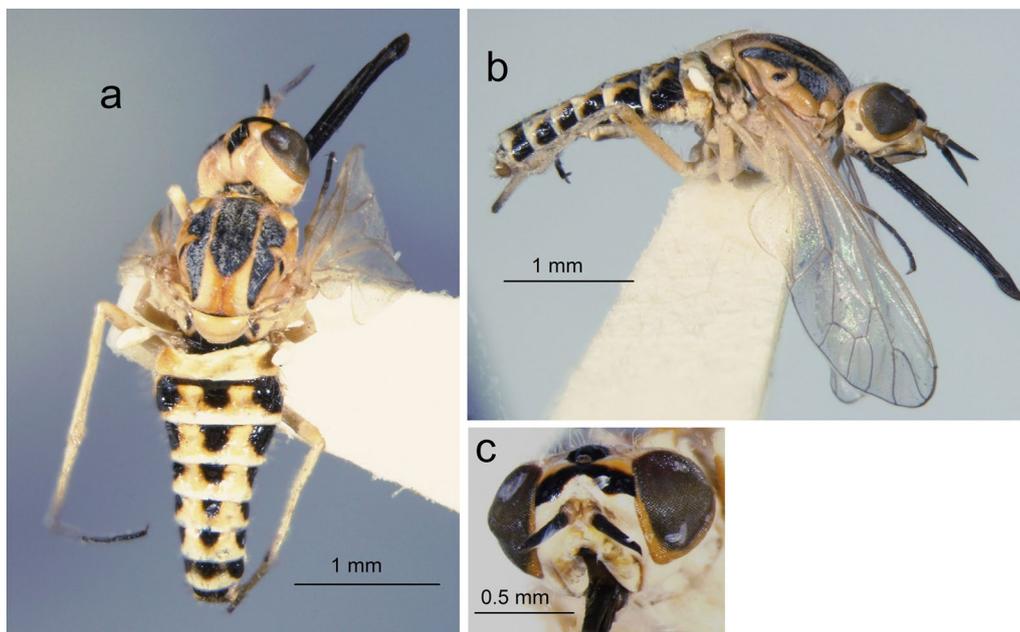


Fig. 2 *Heterotropus maculiventris* Bezzi. **a** Female habitus, dorsal view. **b** Same, lateral view. **c** Head, frontal view

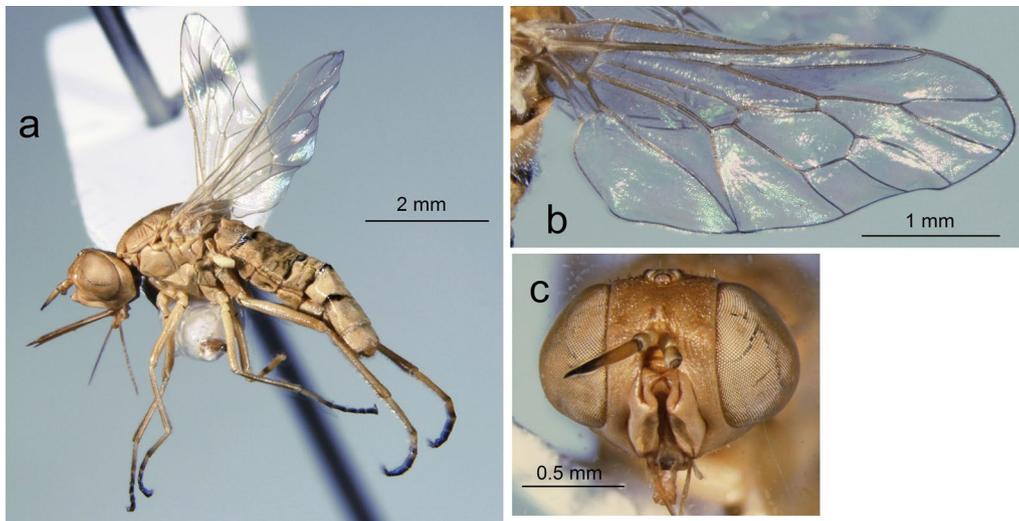


Fig. 3 *Heterotropus xanthothorax* Efflatoun. **a** Female habitus, lateral view. **b** Wing. **c** Head, frontal view



Fig. 4 *Anthrax greatheadii* El-Hawagry. **a** Female habitus, dorsal view. **b** Head, lateral view

apical third mostly hyaline; with a dark spot on base of cell R_4 confluent with upper dark infuscation; with a large dark spot on apical third of first radial cell (r_1), touching the anterior branch of radius (R_1) apically; posterior cubital cell (cup) infuscated at basal half, in addition to a large spot pre-apically; anal lobe (an lb) almost hyaline; 6th and 7th tergites with silvery white scales only on sides; and spermathecal bulb weakly sclerotized, club-shaped.

Remarks

Species of the genus *Anthrax* are known as ectoparasitoids of larvae and pupae of bees, wasps, antlions and tiger beetles (Yeates and Greathead 1997).

Tribe XERAMOEBINI

Genus *Desmatoneura* Williston

Desmatoneura brevipennis (Bezzi 1924)

Chiasmella brevipennis Bezzi 1924: 157. Type locality: Yemen.

Distribution: AF: Eritrea, Oman, Saudi Arabia [as "South western part"] (first record), United Arab Emirates, Yemen.

Local distribution: Najran: Uruq Bani Ma'arid (19.107986°N, 45.191925°E) [Yadamah Gov.].

Material examined: 1 female, Uruq Bani Ma'arid, 5.IV.2021, Al-Dhafer H., Soliman A., Rassol I., leg., KSMA.

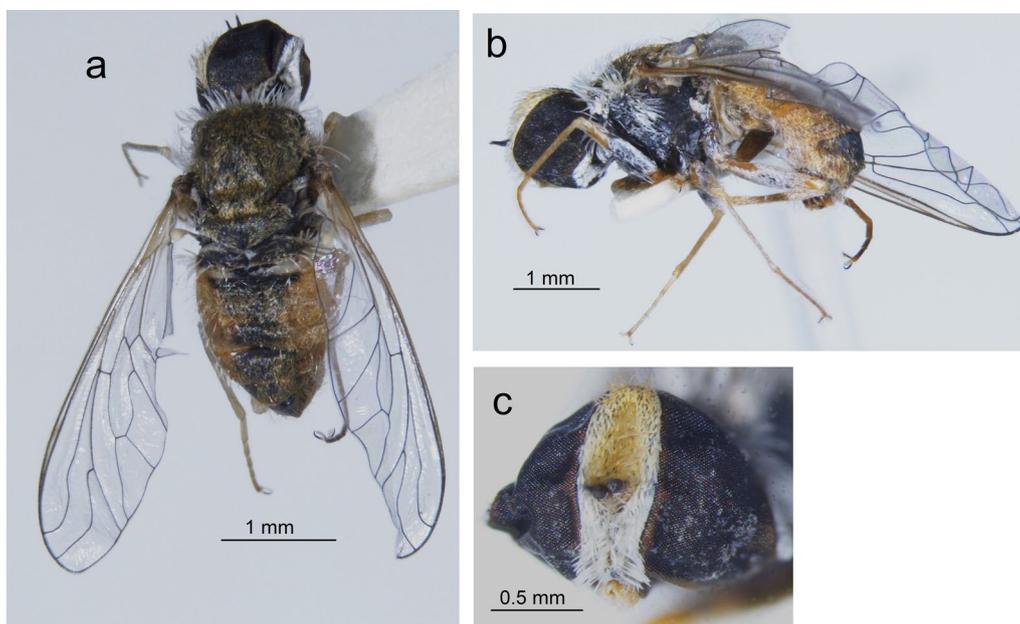


Fig. 5 *Desmatoneura brevipennis* (Bezzi). **a** Female habitus, dorsal view. **b** Same, lateral view. **c** head, frontal view

Diagnosis

Female (Fig. 5): Body relatively narrow; frons tumid and broad at level of antennae, with whitish-yellow hairs and white scales; flagellum with a single central bristle at apex; scutum and scutellum black, with whitish and yellowish tomentum; wing relatively broad, with alula lobe-like and large; origin of R_{2+3} almost opposite r-m crossvein; plumula reduced; and abdomen conical and reddish-brown, with white to whitish-yellow hairs.

Remarks

The feeding behavior of this species is not exactly known.

Discussion

The present results coincide to a great extent with many previous studies, e.g., Sclater (1858), Wallace (1876) and El-Hawagry et al. (2022), concerning the delineation between the Afrotropical and the Palearctic Regions in Saudi Arabia. These studies and many other studies considered the southwestern part of KSA including Al-Baha, Asir, Jazan and Najran regions as belonging to the Afrotropical Realm and the rest of the country as belonging to the Palearctic Realm. In the present study, *Heterotropus xanthothorax* (Eflatoun 1945) and *Desmatoneura brevipennis* (Bezzi 1924) which have Afrotropical affinities have been recorded from Najran Region which is located in the Afrotropical southwestern part of KSA. On the other hand, *Parageron lutescens* (Bezzi 1925), *Heterotropus bisglaucus* Bezzi 1925 and *Anthrax greatheadi* El-Hawagry 1999 which have Palearctic affinities have been

recorded from Al-Qassim, Eastern, Riyadh and Tabouk Regions which are located in the northern Palearctic part of KSA. *Phthiria salmayensis* Eflatoun 1945 and *Heterotropus maculiventris* Bezzi 1925 were described and known only from the Palearctic ecological zones of Egypt, and they have been recorded herein from Asir and Najran which are located in the Afrotropical southwestern part of KSA; consequently, this is the first record of these two species from the Afrotropical region.

Conclusions

The present study supplements the fauna of bee flies (family Bombyliidae) in Saudi Arabia with seven new records. This brings the total number of bee fly species in the country into 123 species classified in 40 genera, 12 tribes and 10 subfamilies.

Abbreviations

AF: Afrotropical; EFC: Eflatoun Bey's collection, Department of Entomology, Faculty of Science, Cairo University, Egypt; Gov.: Governorate; KSA: The Kingdom of Saudi Arabia; KSMA: King Saud University Museum of Arthropods, Riyadh, Saudi Arabia; MSHC: Personal collection of M. El-Hawagry; PA: Palearctic.

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Author contributions

ME collected and identified flies and drafted the manuscript. AA participated in identifying the flies and drafting the manuscript. AS participated in

identifying the flies. MA collected and photographed some flies. HA participated in collecting and identifying some flies. All authors participated in the study design and coordination and interpreted the data. All authors have read and approved the manuscript.

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Availability of data and materials

Data supporting the conclusions of this article are presented in the main manuscript.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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