Description of *Eretmocera hafeetensis* sp. nov. from UAE (Lepidoptera, Scythrididae)

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Abstract. *Eretmocera hafeetensis* **sp. nov.**, a moth in the family Scythrididae, is described and illustrated based on the examination of three male and 13 female specimens collected at the foot of Jebel Hafeet, an isolated 1,140 metres-high massif just south of Al Ain, after which the new species is named. The new species is distinct from congeners in details of its male and female genitalia and is also readily separated in the field from other *Eretmocera* species. The new addition brings the number of confirmed species in this genus represented in the UAE to three. The discovery of this species at Ain Al Waal, Jebel Hafeet highlights the conservation importance of this and similar nearby locations, which are beginning to reveal unique species among its already species-rich fauna at a time of huge human encroachment into the area.

Introduction

Moths in the family Scythrididae are often small-sized and somewhat cryptic in appearance. Although represented in most parts of the world, until late last century, only a small minority of the species described had been recorded in the Middle East (Bengtsson 2014).

Knowledge of Scythrididae species in Arabia is mostly derived from work in Oman and Yemen at around the turn of the 21st century, when Bengtsson (2002a, 2002b) described 45 new species and identified many others. Prior to that, some scythridids from Saudi Arabia had been recorded by Passerin d'Entrèves (1996).

In the UAE, knowledge of the fauna is less developed. Van Harten's literature review (van Harten 2005) – that was compiled prior to embarking on the first of six volumes in the Arthropod Fauna of the UAE series – documented only two species. As part of that project, van der Wolf (2008) brought to 12 the number of species of the family recorded from the UAE, six of them having been among those described from Oman and Yemen.

Two genera in Scythrididae are represented in the UAE, namely *Eretmocera* Zeller, 1952 and the more species-rich genus *Scythris* Hübner, 1825. The genus *Eretmocera* consists of rather small species with wingspan in general of 8–12 mm and are often recognisable in resting position by their dark brown upper wings with brightly coloured markings, and abdomen coloured with varying extents of orange, yellow and black. Many species have partly thickened antennae, especially in males. There are 50 species in *Eretmocera* worldwide (BÅB, private database). Most

species are found in the tropical zone, especially in Africa, but they also range to the Middle East, Asia and Australia.

Two species in the genus *Eretmocera* are known from the UAE, *E. impactella* (Walker 1864) and *E. bradleyi* (Amsel 1961), the former of which is found in small numbers on Jebel Hafeet. Two more, as yet unidentified species in the genus, have also been observed on the mountain with external markings quite distinct from each other, and different from *E. bradleyi*, *E. impactella* and *E. hafeetensis*.

The distinctively marked *E. hafeetensis* sp. nov. was first observed in 2010. Differences in its external appearance to other species in the region prompted discussion between the authors about its possible identity and led to specimens being collected for examination and dissection. Finding males among the specimens collected proved difficult, and indeed only females were present in the first two batches examined. The results bore confirmation that *E. hafeetensis* was indeed a new species, although it was not until later that males were found. A description of both male and female of the new species is provided here. The holotype is deposited in Natural History Museum, Abu Dhabi, UAE.

Figure 1. Type series of *Ertemocera hafeetensis* sp. nov. (pinned). Three males to the left (holotype at the top), the other specimens females.

Materials and methods

Specimens were collected, using sweep nets over various plants. Collected specimens were preserved and pinned, or they were sent as dry specimens to the laboratory in Sweden, where they were relaxed and mounted for dissection and examination.

Field photographs were taken using Nikon D850, D3 and Z9 camera bodies, with Nikkor 105 mm lenses and Nikon's R1 Wireless Close-Up Speedlight System. A stacked photograph (Fig. 6) was taken using Nikon D850 camera body using a 25mm f/2.8 Ultra-macro 2.5× -5.0× lens and a Cognisys Stackshot focus stacking rail. HELICON FOCUS 8.2.0 software was used for processing of the stacked image. Post processing was done using ADOBE PHOTOSHOP.

Genitalia slides (Figs 7a, b, 8a, b) were made according to the standard procedure described by Robinson (1976). The slides were photographed with Canon EOS 500D mounted on a compound microscope Euromex Arnheim EB No. 149508. The pictures were stacked with the software HELICON FOCUS Version 4.2.8 and then enhanced with ADOBE PHOTOSHOP Elements 2019.

Abbreviations

BÅB Private collection of Bengt Åke Bengtsson, Färjestaden, Sweden
NHMAD Natural History Museum Abu Dhabi, Abu Dhabi, UAE
HRCA Private Collection of Huw Roberts, Al Ain, UAE

Taxonomy

Eretmocera hafeetensis sp. nov.

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Type material. ***Holotype*:** • 1♂; UAE, Al Ain, Ain Al Waal; 24.067°N, 55.748°E; alt. ca 255 m; 15 May 2020; Huw Roberts leg. (at *Aerva javanica* / sweep net) – NHMAD.

***Paratypes*:** • 2♂, 5♀; UAE, Al Ain, Ain Al Waal; 24.067°N, 55.748°E; alt. ca 255 m; 15 May 2020; Huw Roberts leg. (at *Aerva javanica* / sweep net) – males with genitalia slides BÅB 2348X & 2349X. – NHMAD and HRCA. • 4♀; UAE, Al Ain, Ain Al Waal; 24.067°N, 55.748°E; alt. ca 255 m; end of May, 2014, Huw Roberts leg.; 78168–78171 [journal number in coll. BÅB]; genitalia on slides BÅB 2273X & 2274X. – In coll. BÅB, HRCA, and NHMAD. • 3 ♀; UAE, Al Ain, Ain Al Waal; 24.067°N, 55.748°E; alt. ca 255 m; 25 May 2020; Huw Roberts leg.; genitalia on slides BÅB 2333X. – In coll. HRCA and NHMAD. • 3 ♀; UAE, Al Ain, Ain Al Waal; 24.067°N, 55.748°E; alt. ca 255 m; 15 May 2020. 87698-70; Huw Roberts leg. – In. coll. HRCA and NHMAD.

Additional material. • 1 ♀; UAE, Al Ain, Ain Al Waal; 24.067°N, 55.748°E; alt. ca 255 m; 17 May 2022. Huw Roberts leg. – In. coll. HRCA.

Diagnosis. *Eretmocera hafeetensis* sp. nov. (Figs 2, 3, 4) is readily recognised in position of repose by the pale, X-shaped marking combined across the two forewings, most evidently in females. These markings are not observed in any other species in the genus. In contrast to most other species in *Eretmocera*, the antennae in the new species are only insignificantly thickened. The male genitalia are similar to those of e.g. *Eretmocera arabica* (Amsel 1961), but the structure of the gnathos differs in its diverging posterior prongs. They also resemble those of *E. bradleyi* (Amsel 1961), but the uncus is furnished with a row of sclerotized teeth. The female genitalia are characterised by the sclerotized structure in segment 8 with a pair of posteriorly directed extensions furnished with long bristles, and anteriorly displaying narrow, sclerotized "pockets".

Description. Male (Fig. 5): Wingspan 9–10 mm. Head, collar, and thorax blackish brown with semi-metallic shine. Labial palp slender, up-curved, ivory; second and third (pointed) segment of equal length. Antenna black and slightly thickened in basal part (segment 1–6) and with indication

Figures 2–4. 2. *E. hafeetensis* sp. nov. in resting position on *Chrozophora oblongifolia* (Ain Al Waal, 27.v.2012). **3.** *E. hafeetensis* sp. nov. in position of repose on *Aerva javanica*. (Ain Al Waal, 15.iv.2010). **4.** *E. hafeetensis* sp. nov. in resting position on *Chrozophora oblongifolia* (Ain Al Waal, 21.v.2014).

of erect scales on segments 4–10; length 0.7 of forewing length. Forewing dark brown or blackish brown, markings yellow: at base a short oblique patch; at one fourth a longer patch directed outwards; near tornus a round spot; and near apex a dorsal round spot. Hindwing with pale yellow tinge, covered by dark brown scales, denser apically. Ventral side of forewing ochreous yellow with faint markings, mirroring the markings on the dorsal side. Ventral side of hindwing ochreous yellow, darkening apically. Fringes in both wings dark fuscous, in hindwing with faint cilia line and richer brown basally. Coxa yellow; femur yellow with many dark brown scales; tibia dark brown with a broad yellow ring in middle; tarsal segments dark brown with few pale scales basally. Abdomen rich yellow-orange, segment 2–4 (5) with a blackish brown ring, in some specimens almost covering the whole segment, segment 5–6 with some blackish scales in middle, last segment black with yellow hair scales in middle.

Female (Fig. 6): Size, colouration, and markings as in male but antenna simple without indication of erect scales.

Male genitalia (Fig. 7a, b): Uncus thick, thorn-shaped. Gnathos large, V-shaped in posterior half. Tegumen conical. Valva slender, claviform, in posterior third densely bristled. Phallus slender, slightly sigmoid, tapered to a point. Vinculum large, spatular. Sternum VIII trapezoid with posterior indentation. Tergum VIII trapezoid, posteriorly and anteriorly concave.

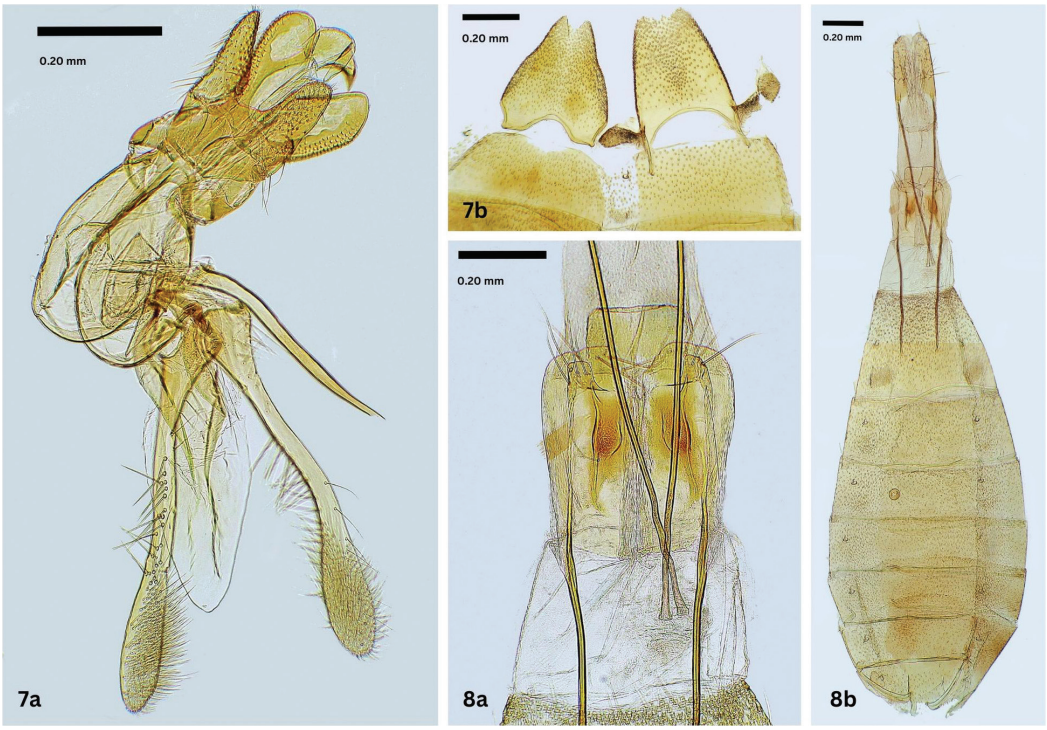
Female genitalia (Fig. 8a, b): See Diagnosis.

Etymology. The species is named after the mountain (Jebel Hafeet) on which it has been found, Jebel being the Arabic word for mountain.

Figure 5. Holotype male of *Eretmocera hafeetensis* sp. nov.

Figure 6. Adult female of *E. hafeetensis* sp. nov. leg. HR, Ain Al Waal, 17.v.2022.

Distribution. The majority of specimens were found on the west flank of Jebel Hafeet, a mountain that straddles the border between UAE and Oman. This isolated anticlinal massif springs up dramatically to over 1,140 metres from a 'pancake'-flat surrounding area just south of Al Ain, in



Figures 7, 8. 7a. Male genitalia of *E. hafeetensis* sp. nov. (ventral view) (BÅB 2349X); **7b.** Male genitalia S8 (left) & T8 (right) of *E. hafeetensis* sp. nov. (ventral view) (BÅB 2348X). **8a.** Female genitalia S8 and the ostium region of *E. hafeetensis* sp. nov. (ventral view) (BÅB 2274X); **8b.** Female genitalia of *E. hafeetensis* sp. nov. (ventral view) (BÅB 2274X).

Abu Dhabi emirate. The type locality is given as 24.067°N, 55.748°E (Figs 9, 10). The species was found on plants at elevations of ca. 255–370 m. Two other locations for this species are included in its known distribution, Ain Al Fayda Ladies' and Children's Park (historical), at 24.092°N, 55.719°E (elevation 242 m) and Wadi Nahyan, at 24.096°N, 55.751°E (elevation 290 m).

The discovery was made in the context of an ongoing faunal study of an area measuring 900 meters by 700 metres, at Ain Al Waal (Figs 9, 10). The study area is sandwiched between the mountain and a raised road that provides a barrier between it and a recently built housing area. It is characterized by mature trees (*Ziziphus spina-christi* (L.) Desf., *Prosopis cineraria* (L.) Druce and the non-native, invasive species *Prosopis juliflora* (Sw.) DC.) in the lower lying central area, giving way to scrub land with smaller plants such as *Physorrhynchus chamaerapistrum* (Boiss.) Boiss and *Ochradenus arabicus* S.Chaudhary, Hillc. & A.G.Mill on higher ground. Several wadis feed into this area, including one that features a series of semi-permanent pools, that have in the past been supplemented to render them permanent (for the benefit of a small population of wild Arabian Tahr, *Arabitragus jayakari* (Thomas, 1894) on the mountain). Also, deep holes and caves punctuate the landscape in many locations.

The lack of disturbance in this area over time has undoubtedly helped it to evolve a rich biodiversity. The city's expansion from being an oasis town with population of around 1,500 in 1950 to the fourth largest city in the UAE with a population of around 630,000 in 2022 (Worldpopula-

Figure 9. Type locality of *Eretmocera hafeetensis*: Ain Al Waal, Al Ain, UAE (24.067°N, 55.748°E).

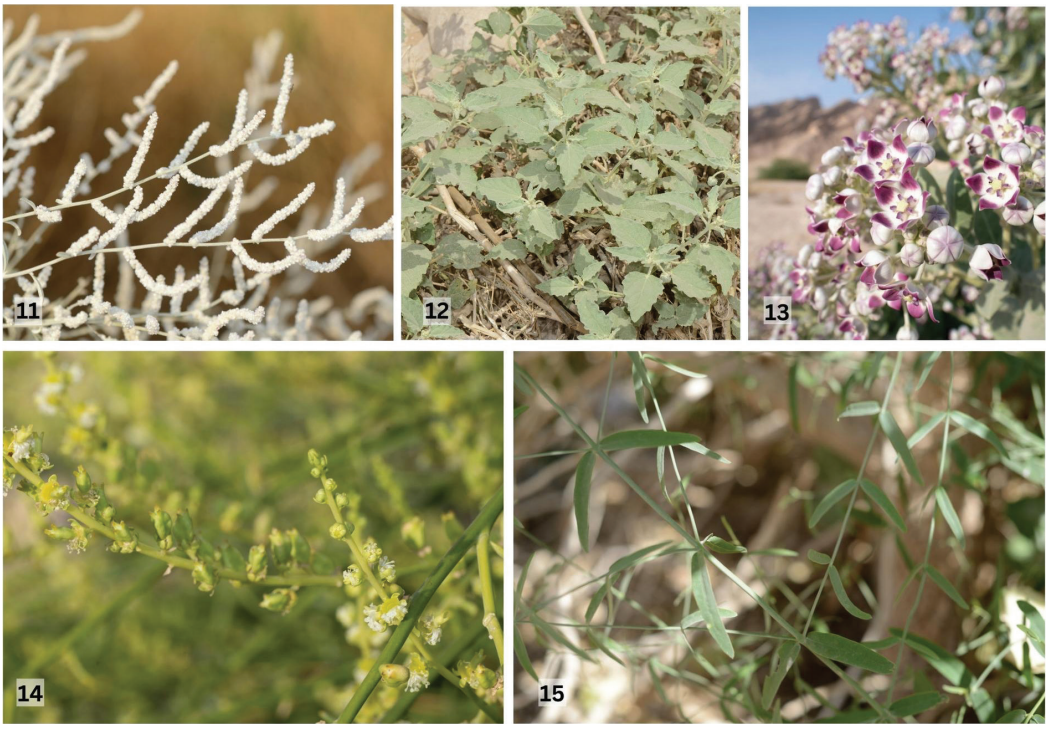
Figure 10. Coverage area of Ain Al Waal study. Map data 2019 (C) Google.

tionreview.com 2022) has until recent years concentrated in areas at least 10 km to the north. Even since 2014, as thousands of houses were being built nearby, security, via a border police presence and a security gate operated by the construction site's general contractor, kept the Ain Al Waal area free of human disturbance.

Climate, habitat and biology. The climate of the region is characterized by high temperatures and low rainfall. In summer, the mean temperature is 36.4 °C (Climate Data 2022), although daytime temperatures often exceed 50 °C. With an average of 17.7 °C, January is the coldest month. Rainfall is erratic, although in most years, there is some rain in January and February, which encourages the growth and proliferation of spring flowering plants.

From late April to June, in most years of average winter rainfall, the new species was found in good numbers, especially on *Aerva javanica*. It was also found once during November. Although the larvae and host plants were not identified during the study, adults were collected on the following plants:

Aerva javanica (Burm.f.) Shult. (Amaranthaceae) 15.iv.2010, 28.v.2012, 8.ii.2019, 19.v.2020, 21.v.2020, 28.v.2020 & 11.xi.2022 (Figs 3, 11)
Chrozophora oblongifolia (Delile) A.Juss. ex Spreng (Euphorbiaceae), 30.iv 2013 & 21.v.2014 (Figs 2, 4, 12)
Calotropis procera (Aiton) W.T.Aiton (Apocynaceae) 1.vi.2019 & 5.vi.2020 (Fig. 13)
Ochradenus aucheri (Boiss) (in Resedaceae) 21.iii.2022, 4.iii.3022, 8.iv.2022 & 17.iv.2022 (Fig. 14)
Salvadora persica L. (Salvadoraceae) at a nearby park, Ayn Al Fayda 3.v.2010 (Fig. 15)



Figures 11–15. Plants on which *Eretmocera hafeetensis* was found. **11.** *Aerva javanica* (Burm.f.) Shult. (Ain Al Waal, 20.xi.2014). **12.** *Chrozophora oblongifolia* (Delile) A.Juss. ex Spreng (Ain Al Waal, 22.v.2014). **13.** *Calotropis procera* (Aiton) W.T.Aiton (Ain Al Waal, 14.iv.2021). **14.** *Ochradenus aucheri* (Boiss) (Ain Al Waal, 7.iv.2023). **15.** *Salvadora persica* L. (Ain Al Waal, 16.vi.2014).

Discussion

Given that nearly all the specimens of this new species have been found at Ain Al Waal, its future prospects would appear to be closely tied up with that of the site itself. However, despite benefitting from an undisturbed environment so far, it is not guaranteed that the area will remain in its present state. While two layers of security have kept the area free of disturbance in recent years,

the encroachment of a human residential area to within metres of the site is likely to be a constant threat in the coming years.

Away from the type locality, there are a few possible habitats for *E. hafeetensis* nearby. Despite many searches on the eastern side of the mountain, and to a species-rich wadi that intersects the mountain from the north (Wadi Tarabat), surprisingly, the species has not been found at those other locations. Ain Al Waal is different in some ways (e.g., has a steeper face, more permeable and fractured composition and hundreds of deep holes and caves), but those other parts of the mountain share much of the fauna and flora occurring at Ain Al Waal, so it is speculated that there is a good chance that the species may be found there as well with a more concerted search.

The other location where this species has been recorded is Ain Al Fayda's Ladies' and Children's Park, 4 km further west, where a few of this species were observed in 2014. That location is no longer irrigated, and it is earmarked for development. That area is flat, and not a mountainside habitat, but the plant at which it was seen, *Salvadora persica*, is commonly planted and irrigated at roadsides. The new moth species may have dispersed away from the mountain, and this particular record does at least show that the species is not confined strictly to mountainside habitats.

Whether the new species might occur further away in the Hajar Mountain range in the northern Emirates (or Oman) is open to question. Between the two mountainous areas, there are differences climatically (the Hajars with more rainfall and cooler), geographically (at least 40 km separation), geologically (predominantly igneous rocks in the Hajars rather than tertiary sedimentary rock in Jebel Hafeet: Kirkham 2003) and in terms of the fauna and flora found in those areas. A large collecting effort by numerous entomologists over several years in recent times (van Harten 2008–2017) failed to discover this species among 12 scythridid species that they found during collections of tens of thousands of arthropod specimens, mostly in the Hajar range of mountains of the UAE.

The discovery of new species at Ain Al Waal will hopefully help to raise awareness of this site. A list of 800 terrestrial fauna species (Roberts unpublished) will show that it is an area that has a rich biodiversity.

Given that *Eretmocera hafeetensis* sp. nov. is not guaranteed to occur away from the mountain, hopes of its long-term survival are pinned on the mountain's new status as a National Park, which it received in 2017. This may lead to greater monitoring of this and other mountainside sites. That may be necessary to protect this new species and hundreds of others that are only now starting to be revealed.

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