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The *Ophiusa tirhaca* (Cramer, 1775) (Lepidoptera: Erebiidae) new record from Southern Iraq

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ABSTRACT

This study documents the first morphologically confirmed and geographically precise record of the moth *Ophiusa tirhaca* (Cramer, 1775) in southern Iraq, specifically in the Basrah Province. Specimens were collected from an agricultural orchard in the Shatt Al-Arab district and subsequently underwent comprehensive morphological evaluation. The studied morphological characteristics (total body length, wingspan, forewing and hindwing length, antennae length and type, larval length at maturity, pupa length, wing color and spot patterns, and reproductive characteristics) were compared with established taxonomic references to confirm the species identity. This is the first record of *O. tirhaca* in southern Iraq. Its presence on eucalyptus trees in the southern regions is also concerning, as it could become a major pest of other, more economically important hosts than the larger eucalyptus species.

Keywords: *Ophiusa tirhaca*, Erebiidae, New record, Iraq, taxonomy, Lepidoptera, Climate Change, Host Shift

1. INTRODUCTION

The order Lepidoptera, which includes butterflies and moths, is the second largest order of insects, comprising over 160,000 described species worldwide, the majority of which are moths. This order plays an important ecological role in pollinating flowering plants and is a key

component of the food chain. However, most moth species are considered serious agricultural pests and may provide environmental indicators of climate change and biodiversity loss [1].

The *Ophiusa tirhaca* moth belongs to the family Erebidae, a family rich in species that has recently undergone significant reclassification thanks to advancements in molecular studies. These studies have resulted in the merging of several former families, such as Noctuidae, into Erebidae, particularly within the subfamily Erebininae [2].

The most distinctive feature of this species is its yellowish color and the dark spot pattern on its forewings. It is found in tropical regions of Africa, India, South Asia, and parts of the Middle East [3].

The eucalyptus moth was first described by Kramer in 1775 [4]. It is known locally in some countries as the "pale green moth" or "eucalyptus moth". This name reflects its association with plants of the myrtle family, particularly eucalyptus species, which serve as the primary host for its larvae. Its presence has been detected in coastal environments, open forests, and even agricultural areas, demonstrating its adaptability to diverse environments [5].

Despite its relatively widespread distribution in Africa and Asia, this species has not been widely documented in the recent Iraqi entomological literature. While historical checklists have included the species in the general Iraqi fauna [6, 7], a detailed, confirmed record with specific locality data and comprehensive morphological evidence from the southern regions has been lacking.

This study aims to provide a precise diagnostic description of *O. tirhaca* based on its external and internal morphological characteristics, compare it with closely related species within the same genus, and determine whether this observation first documented and confirmed record of this species in the Basra Province, southern Iraq.

2. MATERIALS AND METHODS

2. 1. Insect Specimen Collection

The study was conducted in Basra province, southern Iraq, on March 25, 2024. Samples were collected from an orchard in the Shatt al-Arab (al-Jabasi) area (30.5328°N, 47.8569°E). This area is an agricultural region with diverse vegetation, including trees, shrubs, and vegetable crops. It has a subtropical climate (hot, dry summers and mild, humid winters), providing an ideal environment for many insects, including this *Ophiusa tirhaca*.

2. 2. Morphological Examination

Preliminary morphological analysis was performed using a Leica EZ4 stereomicroscope and compound microscope. Use the program ImageJ software (v.1.53) to dimensions [8]. Emphasis was placed on the following diagnostic characters: Overall body length, Wingspan, Forewing length, Hindwing length, Antennae length and type, Full-grown larva length, Pupa length, Coloration and spot patterns on wings, and Genital characteristics.

2. 3. Taxonomy and Comparative Analysis

Taxonomic identification of the specimen was performed using specialized keys for the Diagnosis was based on global taxonomic keys such as [5, 9] as well as databases including Fauna Europaea, [6].

3. RESULTS

Genus: *Ophiusa* Ochsenheimer, 1816

Species: *Ophiusa tirhaca* Cramer, 1773

3. 1. Taxonomic Identification

Morphological examination of the studied specimens confirmed precise anatomical congruence with the diagnostic characteristics of *Ophiusa tirhaca* [5, 9].

3. 2. Diagnosis

- **Overall body length** (Fig. 1A,B): 3.00-3.30 cm, wingspan, 4.00-5.00 cm, yellowish-brown and covered with fine hairs, showing a clear distinction between the paler thoracic color and the more orange-tinged abdomen.

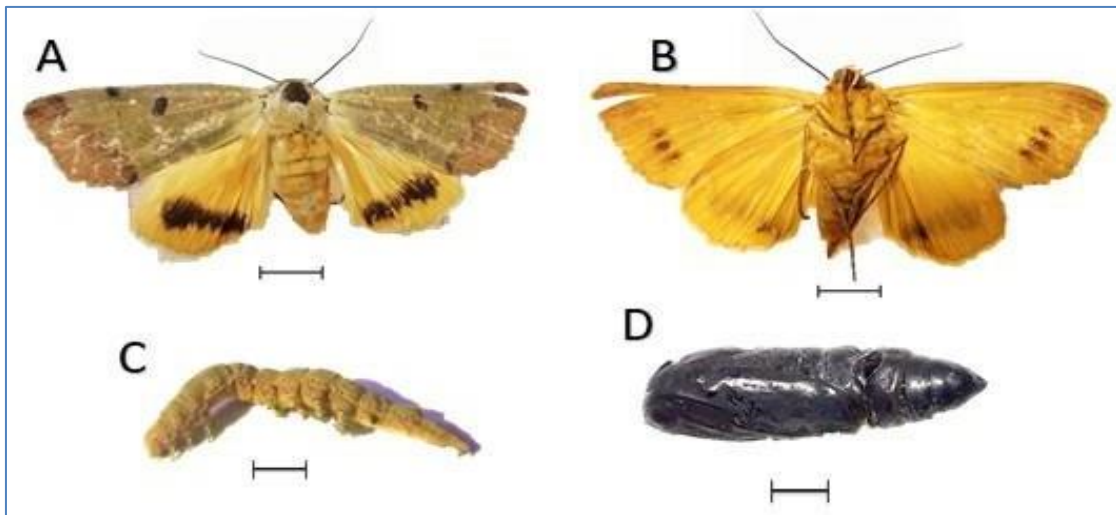


Figure 1. *Ophiusa tirhaca* ♂ A = Dorsal view, B = Ventral view, C = Full-grown larva, D = Pupa. Scale 1 cm.

- **Antennae** length 2 cm and filiform type a characteristic feature of the genus *Ophiusa*, without branches or lamellae as in some other genera. The compound eye is spherical in shape with a diameter of 0.21 mm.
- **Forewing** length 3.40-4.05 cm, width 2.00-2.22 cm, pale yellow to sandy in color, adorned with asymmetrically distributed dark brown spots. A distinct, semi-circular spot is present in the middle third of each wing, with a brown color gradient along the lower anterior edge of the wings.
- **Hindwing** length 2.50-2.80 cm, width 1.90-2.30 cm colored yellow to light orange, without a clear spot pattern. With the exception of a black tape on the apical margin, and are less ornate than the forewings, The venation is clearly visible. Legs Covered with

dense hairs, without spines or prominent structures that distinguish them from closely related species.

- **Full-grown larva** length (Fig. 1C) 5.40-6.24 cm, Pupa length (Fig. 1D), 3.10-3.24 cm. Body ground color: Olive green with yellowish-green shading along the lateral regions. Longitudinal white or pale yellow lines extend from the head to the posterior end. Some specimens show scattered small brown spots on the body segments. Head: Relatively small compared to the body, with a light brown to amber coloration. A pair of simple dark-colored ocelli (stemmata) are present. The body is covered with short, fine setae sparsely distributed. Pairs of prolegs are present on abdominal segments 3–6 and 10, ending in pale yellow-colored crochets. When disturbed, the larva curls into a ring-like shape as a defensive behavior.
- **Male Genitalia** Fig. 2, the valvae show a relatively rounded basal part, with a rod-shaped uncus and a long, straight aedeagus. The vesica is not equipped with prominent cornutus in the standard *O. tirhaca* model.

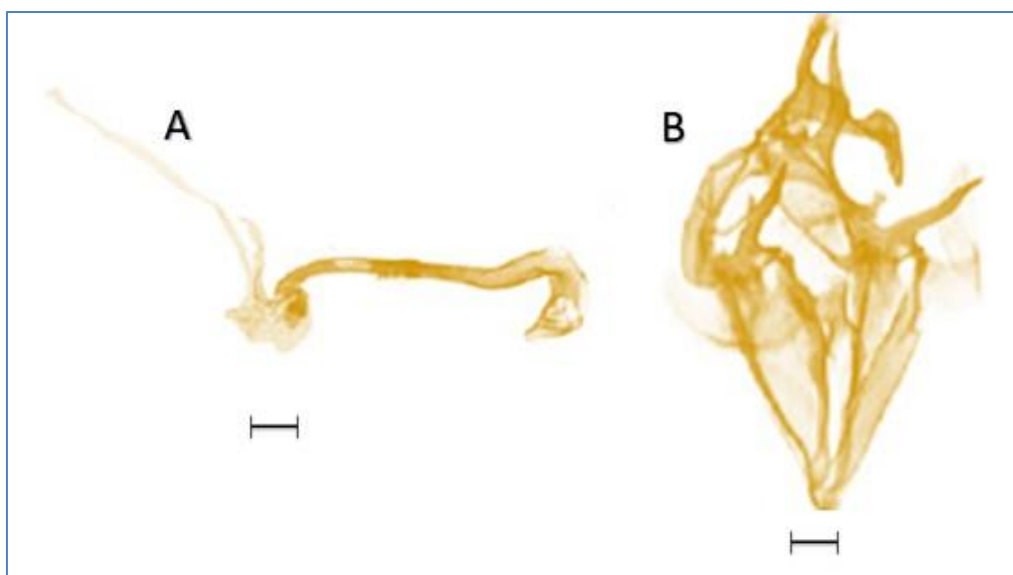


Figure 2. Male Genitalia *Ophiusa tirhaca* = A, lateral view = B, frontal view. Scale 0.1 mm.

3. 3. Material Examined

IRAQ • 1♂4♀; Basrah, Shatt al-Arab (Al-Jabasi) (30.5328°N, 47.8569°E).
25 March, 2024; M. Al-Etby leg. host plant is trees eucalyptus.

Depository: Natural History Museum, University of Basrah) UOB-ENT-2024-007–0033).

3. 4. Taxonomic Key *Ophiusa* Species. Figure 3

1) Outer margin (termen) of forewing straight or slightly concave; ground color of forewing dark brown or grey with dark zigzag lines...2

Outer margin of forewing distinctly convex; ground color of forewing pale yellow or sandy.. 3

2) Forewing with a narrow, well-defined white reniform spot; larger size (forewing width > 22 mm). Distribution: Southeast Asia.

..... *Ophiusa coronata* (Fabricius, 1775)

Reniform spot on forewing faint or absent, submerged in the general ground color; smaller size (forewing width < 20 mm). Distribution: Mediterranean Basin.

..... *Ophiusa algira* (Linnaeus, 1767)

3) Hindwing uniform yellow or light orange without a clear spot pattern ; submarginal line on forewing incomplete or faint.

..... *Ophiusa tirhaca* (Cramer, 1775)

Hindwing yellow with a broad dark brown marginal band; submarginal line on forewing white and distinctly wavy. Male genitalia: Aedeagus slightly curved and bearing one large cornutus.

..... *Ophiusa disjungens* (Walker, 1858).

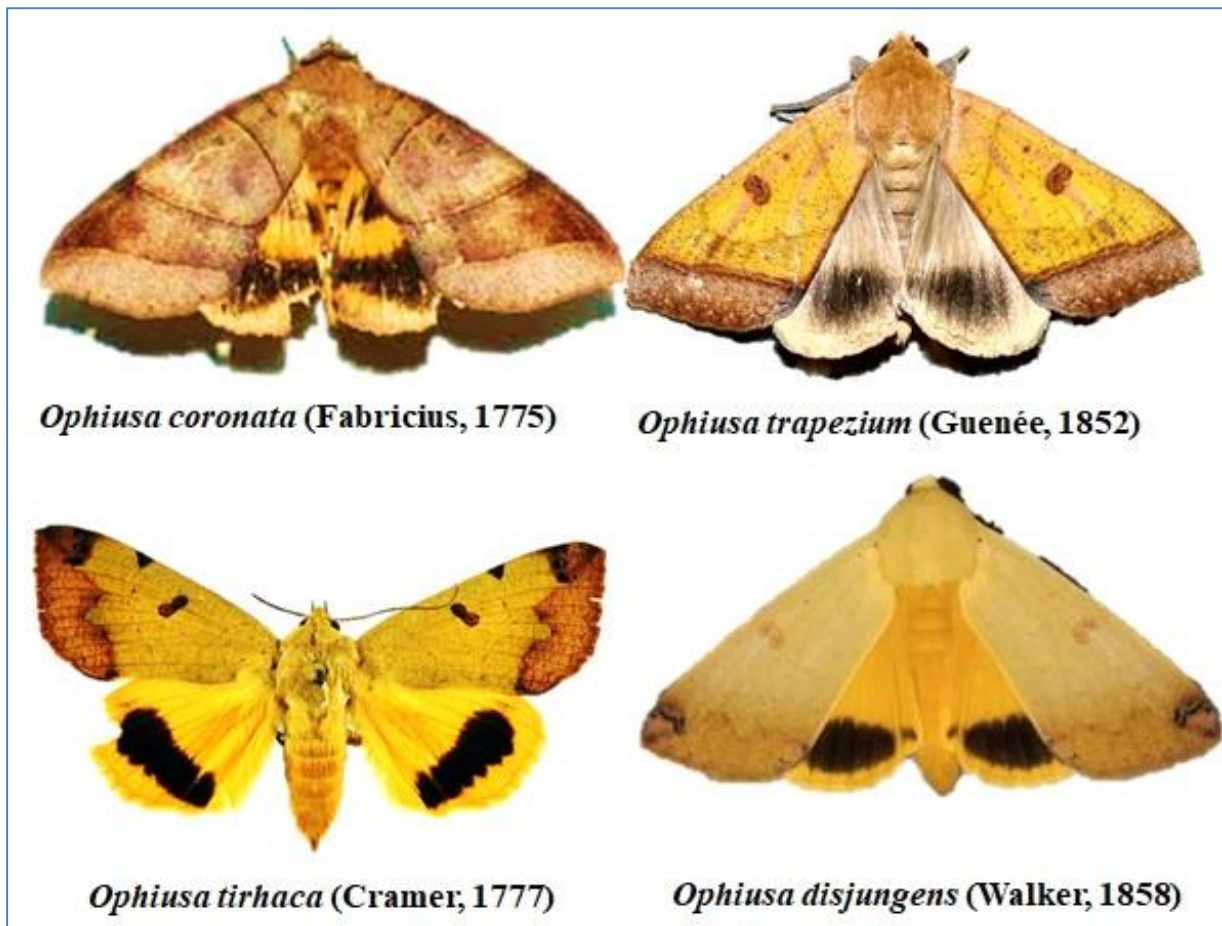


Figure 3. Comparison of *O. tirhaca* with closely related species within the same genus [5]

4. DISCUSSION

The first confirmed occurrence of *O. tirhaca* in southern Iraq (30.5328°N, 47.8569°E) represents a significant range extension for this tropical Erebidae species. Morphological congruence was established through diagnostic characters consistent with [9] descriptions.

4. 1. Contextualizing the Record: Confirmation and Range Refinement

The current finding, while representing the first morphologically confirmed and geographically precise record from the Basra Province, warrants a careful contextualization within the existing Iraqi faunal literature. Historical checklists, notably those by Wiltshire (1957) and the comprehensive list by Kemal & Koçak (2018) [6] [7], have previously included *O. tirhaca* in the general Iraqi fauna. However, these older records often lack the detailed diagnostic evidence, particularly the genitalic morphology presented here, which is increasingly required for the *Ophiusa* genus due to potential cryptic species complexes [12]. Therefore, this observation serves as a critical confirmation and range refinement, establishing a definitive baseline for the species' presence in the extreme southern, subtropical zone of Iraq.

4. 2. Climate Change and Northward Range Expansion

The detection of *O. tirhaca* at this latitude in Basra strongly supports the hypothesis of a climate-mediated northward range expansion [13]. Two non-exclusive hypotheses emerge: Undetected historical presence due to insufficient sampling and Recent northward expansion facilitated by climate-mediated habitat changes [13] and Increased Eucalyptus cultivation [14].

Recent entomological studies in the Middle East and Europe indicate a clear trend of Mediterranean Influx of thermophilic species, including members of the Erebidae family, into higher latitudes and previously unsuitable arid regions due to rising temperatures and milder winters [15], [16].

The subtropical climate of Basra, characterized by hot, dry summers, is becoming increasingly conducive to the establishment of species like *O. tirhaca*, which are typically associated with tropical and subtropical zones. This record provides empirical evidence of this biogeographical shift, underscoring the role of Iraq as a potential corridor for the dispersal of Afrotropical and Oriental fauna into the Palearctic region.

4. 3. Ecological and Agricultural Implications: Host Plant Shift and Pest Potential

The species' documented phenotypic plasticity [17] suggests potential for host shifts in Iraqi populations. The primary host plant observed was Eucalyptus, a non-native species widely cultivated in southern Iraq [14]. While Eucalyptus is the typical host, the presence of alternative hosts, such as *Pistacia lentiscus* (Pistachio) in neighboring regions [18], warrants serious agricultural monitoring.

The larvae of *O. tirhaca* are known to be polyphagous, feeding on plants from various families including Anacardiaceae, Ericaceae, and Myrtaceae. This host-plant plasticity is a key trait of successful invasive or range-expanding species, allowing them to exploit new resources in novel environments. Given the economic importance of fruit and nut orchards in the Basra region, the establishment of *O. tirhaca* poses a significant, albeit currently unquantified, risk of a host shift to more valuable crops. Future research must focus on monitoring local populations for signs of feeding on economically important native and cultivated plants.

4. 4. Future Taxonomic and Molecular Work

Taxonomically, our results support current Erebinæ classification [19]. However, to fully resolve the identity of the Iraqi population and its relationship to other regional populations, future work must incorporate modern molecular techniques. Specifically, Cytochrome Oxidase I (COI) barcoding is essential to determine if the Basra population belongs to a distinct cryptic species complex, as has been suggested for *O. tirhaca* in other parts of its range [12].

Furthermore, Geometric Morphometrics on wing and genitalic structures, coupled with Bioclimatic Zone Surveys using tools like MaxEnt, would provide a robust, multi-disciplinary assessment of the species' origin, dispersal pathway, and potential future distribution under various climate scenarios.

5. CONCLUSIONS

This study provides the first confirmed and documented record of *Ophiusa tirhaca* (Cramer, 1775) in the Basra Province of southern Iraq, expanding its known geographical distribution. Morphological and genitalic examination aligned with key diagnostic features described in global taxonomic literature. Given its association with host plants such as Eucalyptus and its potential for host shifts, the presence of *O. tirhaca* has significant ecological and agricultural implications for the region, suggesting a climate-driven range expansion. This finding highlights significant gaps in entomological research in Iraq, particularly in southern areas, emphasizing the urgent need for comprehensive biodiversity surveys and molecular studies to better understand and monitor local insect fauna and its pest potential.

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