

The Larval food-plants of *Apochima diaphanaria* ssp. *rjabovi* (Wehrli, 1936) (Lepidoptera: Geometridae) and its new larval parasitoid *Drino imberbis* (Wiedemann, 1830) record

Apochima diaphanaria ssp. *rjabovi* (Wehrli, 1936) (Lepidoptera: Geometridae)'nin larva besin bitkileri ve onun yeni larva parazitoidi *Drino imberbis* (Wiedemann, 1830)'in kaydı

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Abstract

The larval food plant of the *Apochima diaphanaria* ssp. *rjabovi* (Wehrli, 1936) in the Geometridae family has not been known until now. In this study, the medicinal plants *Ferula haussknechtii* H. Wolff ex Rech.f., *Prangos uloptera* DC. (Apiaceae) and *Rheum ribes* L. (Polygonaceae) species are identified for the first time as larval food plants of *Apochima diaphanaria* ssp. *rjabovi*. In addition, *Drino imberbis* (Wiedemann, 1830) (Diptera, Tachinidae) species is recorded as the first larval parasitoid of *Apochima diaphanaria* ssp. *rjabovi*. Pictures of the habitat, larva, pupa and adult individual of this moth subspecies, as well as pictures of the pupa and the adult individual of the larval parasitoid are present in the study.

Özet

Geometridae familyasında yer alan *Apochima diaphanaria* ssp. *rjabovi* (Wehrli, 1936)'nin larva besin bitkisi şimdiye kadar bilinmemekteydi. Bu çalışmada, tıbbi bitkilerden *Ferula haussknechtii* H. Wolff ex Rech.f., *Prangos uloptera* DC. (Apiaceae) ve *Rheum ribes* L. (Polygonaceae) türleri *Apochima diaphanaria* ssp. *rjabovi*'nin larva besin bitkileri olarak ilk kez için tespit edilmektedir. İlaveten, *Drino imberbis* (Wiedemann, 1830) (Diptera, Tachinidae) türü *Apochima diaphanaria* ssp. *rjabovi*'nin ilk larval parazitoidi olarak kaydedilmektedir. Larval parazitoidin ergin ve pupa resimlerinin yanı sıra, bu güve alttürünün habitat, larva, pupa ve ergin bireylerinin resimleri çalışmada yer almaktadır.

INTRODUCTION

Geometridae family is a rich group in Lepidoptera and is known with approximately 21.150 species in the world, while it is represented by nearly 683 species in Turkey (Heppner 2008, Kemal et al. 2018). The genus *Apochima* Agassiz, 1847 is known with 5 species in Palearctic, and among these species, *flabellaria* (Heeger, 1838) and *diaphanaria* (ssp. *rjabovi*) (Püngeler, 1904) are also known from Turkey (Kemal et al. 2018). *Apochima diaphanaria* (Püngeler, 1904) is distributed through Turkmenistan, Iran, Turkey and Armenia in the world, and it is known from Ağrı, Bingöl, Bitlis, Hakkari, Niğde, Siirt and Van provinces in Turkey (Koçak and Kemal 2018). Kemal et al. (2018) proposed the *Bellachima* genus for the

A. diaphanaria species. However, Müller et al. (2019) did not accept the *Bellachima* as a valid genus because they thought there were deficiencies in the molecular analysis made.

Tachinidae (Diptera) family is known worldwide with 8592 species, 2112 species of which are in the Palearctic (Ohara et al. 2020). Tschorsnig (2017) listed 827 tachinid species reared from 2672 arthropod hosts from the Palearctic region. Kara et al. (2020) reported 341 species for the Tachinidae fauna of Turkey. *Drino imberbis* (Wiedemann, 1830) (Tachinidae) species has been detected as parasite in some taxa of Lepidoptera families so far. These taxa are as follows: *Arctia caja* Linnaeus, 1758 (Arctiidae); *Apochima flabellaria* (Heeger, 1838),

Isturgia pulinda (Walker, 1860), Geometridae sp. (Geometridae); *Anadiasa obsoleta* Klug, 1830, *Eriogaster philippsi* Bartel, 1911, *Malacosoma castrensis* (Linnaeus, 1758), *M. franconica* ([Denis & Schiffermüller], 1775), *M. neustria* (Linnaeus, 1758), Lasiocampidae sp. (Lasiocampidae); *Dicallomera fascelina* (Linnaeus, 1758), *Euproctis fasciata* (Walker, 1855), *Euproctis* sp., *Parocneria terebinthi* (Freyer, [1838]) (Lymantriidae); *Athetis* sp., *Autographa gamma* (Linnaeus, 1758), *Chrysodeixis chalcites* (Esper, [1789]), *Heliothis peltigera* ([Denis & Schiffermüller], 1775), *Leucania loreyi* (Duponchel, 1827), *Simyra dentinosa* Freyer, 1839, *Spodoptera exigua* (Hübner, [1808]), *S. littoralis* (Boisduval, 1833), *Thiacidas postica* Walker, 1855, *Xylena exsoleta* (Linnaeus, 1758) (Noctuidae); *Earias insulana* (Boisduval, 1833) (Nolidae); *Phalera bucephala* (Linnaeus, 1758) (Notodontidae); *Acanthopsyche* sp. (Psychidae);

Clarina syriaca (Lederer, 1855), *Daphnis nerii* (Linnaeus, 1758), *Hyles livornica* (Esper, [1780]), *Theretra alecto* (Linnaeus, 1758) (Sphingidae); *Thaumetopoea solitaria* (Freyer, [1838]) (Thaumetopoeidae); *Zygaena afghana* (Moore, [1860]) (Zygaenidae) (Tschorsnig 2017).

Kambos Mountain, where the larvae were collected, is located in the southwest of the Bitlis province and its height ranges from 1300 to 2300 meters (Fig. 1). Located in the Iran-Turan Phytogeographical Region, Kambos Mountain has a rich flora and includes 650 plant taxa. Among the plants in the area, *Ferula haussknechtii* H. Wolff ex Rech.f., *Prangos uloptera* DC. (Apiaceae) and *Rheum ribes* L. (Polygonaceae) species are known as “Heliz”, “Dağ çakşırı” and “Işgın” respectively (Kurşat and Karataş 2017). These plants are of medicinal importance (Baytop 1999).



Figure 1. Kambos Mountain, collection locality of *Apochima diaphanaria* ssp. *rjabovi* larvae.

This study contributes to the biology of *Apochima diaphanaria* ssp. *rjabovi* (Wehrli, 1936), and for the first time, *Ferula haussknechtii* H. Wolff ex Rech.f., *Prangos uloptera* DC. and *Rheum ribes* L. species have been determined as larval food plants for this subspecies. Furthermore, *Drino imberbis* (Wiedemann, 1830) is a new record as larval parasitoid of *Apochima diaphanaria* ssp. *rjabovi*.

MATERIALS AND METHODS

The study material consists of larvae collected from Kambos Mountain on 20.05.2020 and 27.05.2020 on *Ferula haussknechtii* H. Wolff ex Rech.f., *Prangos uloptera* DC. (Apiaceae) and *Rheum ribes* L. (Polygonaceae) plants. After the larvae were collected from the field, they were taken into feeding boxes at Bitlis Eren University, Faculty of Arts and Sciences, Department of Biology, Zoology

Research Laboratory (Fig. 2). Larvae were regularly fed and observed under laboratory conditions. Adult lepidopteran individuals emerging from the pupa were

stretched in the form of museum material. Adult dipter individuals were preserved in collection cabinet after pinned.



Figure 2. Larvae of *Apochima diaphanaria* ssp. *rjabovi* (a-j), a-b. Younger caterpillar stages, i-j. Final stages before pupa.

RESULTS

In the field study carried out by the second author on 20.05.2020, two larvae were obtained on *Rheum ribes* L. plant. Later, in the field study conducted by both authors on 27.05.2020, a total of 17 larvae were collected on *Ferula haussknechtii* H. Wolff ex Rech.f., *Prangos uloptera* DC. and *Rheum ribes* L. plants. Individuals belonging to the *Apochima diaphanaria* ssp. *rjabovi* (Wehrli, 1936) were obtained from the pupae of these larvae (Figs. 3-4). In addition, two female individuals belonging to the *Drino imberbis* (Wiedemann, 1830) species emerged from a

parasitized larva. The development processes of these two taxa are as explained below.

The larvae fed on *Rheum ribes*;

One of the two larvae collected on 20.05.2020 pupated on 10.06.2020 and emerged as an adult on 08.09.2020. The other larva died before turning into a pupa. Four larvae collected on 27.05.2020 pupated on 14.06.2020. An adult emerged from one of these pupae on 11.10.2020, the remaining 3 are still pupae.

The larvae fed on *Ferula haussknechtii*;

Eleven larvae collected on 27.05.2020. One of these larvae pupated on 12.06.2020 and the other 9 on 14.06.2020. One larva is parasitized. Adult individuals emerged from 2 of these pupae on 28.09.2020, 1 of them on 02.10.2020, 3 of them on 09.10.2020 and 1 of them on 11.10.2020. Three of them remain as pupae.

The larvae fed on *Prangos uloptera*;

Two larvae collected on 27.05.2020 pupated, and an adult emerged from one of them on 30.09.2020. The other remained as a pupa.

The larva feeding on the *Ferula haussknechtii* died on 01.06.2020 and was taken into a separate box in case of parasitism. A dipter pupa was seen inside the box on 02.06.2020. Another dipter pupa was seen on 03.06.2020. Female *Drino imberbis* individuals emerged from these pupae on 15.06.2020 (Figs. 5-6).



Figure 3. Pupae of *Apochima diaphanaria* ssp. *rjabovi*, a. Early stage of the pupa, b. Mature pupa.



Figure 4. Adults of *Apochima diaphanaria* ssp. *rjabovi*.

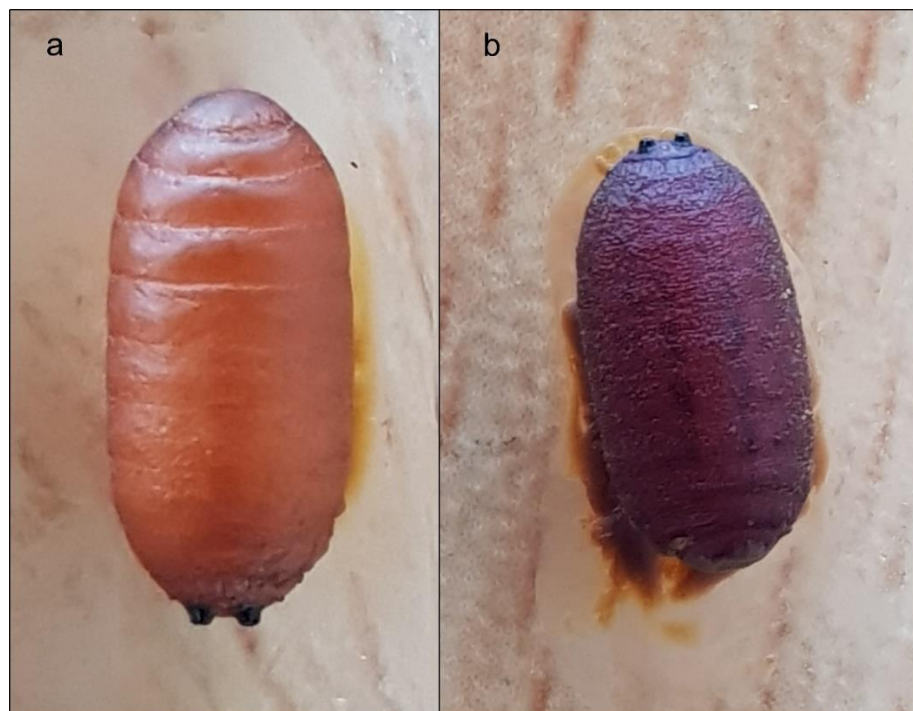


Figure 5. Pupae of *Drino imberbis*, a. Pupa, b. Pupa abandoned after adult emergence.



Figure 6. *Drino imberbis* adults taken from different angles.

DISCUSSION AND CONCLUSION

According to the literature searches, the larval food plant of neither *Apochima diaphanaria* (Püngeler, 1904) species nor ssp. *rjabovi* (Wehrli, 1936) subspecies were unknown. For the first time, *Ferula haussknechtii*, *Prangos uloptera* and *Rheum ribes* plants were identified as larval food plants for *Apochima diaphanaria* ssp. *rjabovi*. Again, for the first time, *Drino imberbis* is recorded as the larval parasitoid of *Apochima diaphanaria* ssp. *rjabovi*.

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