

New host-plant record for *Plutella xylostella* (L.) (Lepidoptera: Plutellidae) from Türkiye

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Abstract: Sunflower [*Helianthus annuus* L. (Asteraceae)] is a crop of considerable significance in agricultural production. This study was conducted during the 2023 growing season in Tokat Province to identify harmful Lepidoptera species associated with sunflower and their natural enemies. Preimaginal stages were periodically collected from sunflower fields at various phenological stages of the plant. These specimens were then reared under controlled laboratory conditions (25±2°C and 60±5% relative humidity) in containers containing sunflower leaves, and their development was monitored. The emerged adult Lepidoptera and parasitoids were subsequently identified. Taxonomic diagnoses revealed that the lepidopteran species was *Plutella xylostella* (Linnaeus, 1758) (Lepidoptera: Plutellidae), and its associated parasitoid was *Diadromus subtilicornis* (Gravenhorst, 1829) (Hymenoptera: Ichneumonidae). Based on these findings, sunflower was recorded as a new host plant for *P. xylostella*. Furthermore, *P. xylostella* was documented as a new faunistic record for Tokat Province. Additional information is provided regarding the host range, geographic distribution in Türkiye and globally, and known parasitoids of *P. xylostella*.

Keywords: *Diadromus subtilicornis*, parasitoid, sunflower, Tokat

Türkiye'den *Plutella xylostella* (L.) (Lepidoptera: Plutellidae) için yeni bir konukçu bitki kaydı

Öz: Bu çalışma, tarımsal üretimde önemli bir yere sahip olan ayçiçeği [*Helianthus annuus* L. (Asteraceae)] bitkisi üzerinde bulunan zararlı Lepidoptera türlerinin ve bunlara ait doğal düşmanların belirlenmesi amacıyla Tokat ilinde 2023 yılı yetiştirme sezonu boyunca yürütülmüştür. Arazi çalışmaları kapsamında, ayçiçeği tarlalarından bitkinin farklı dönemlerinden ergin öncesi dönemleri toplanmış ve 25±2°C sıcaklık ve %60±5 nem koşullarında içerisinde ayçiçeği yaprakları bulunan kaplar içerisinde laboratuvarında kültüre alınarak gelişimleri izlenmiştir. Elde edilen ergin lepidopter ve parazitoitlerin teşhisleri gerçekleştirilmiştir. Yapılan teşhis işlemleri sonucunda lepidopter erginlerinin *Plutella xylostella* (Linnaeus, 1758) (Lepidoptera: Plutellidae) ve parazitoitin ise *Diadromus subtilicornis* (Gravenhorst, 1829) (Hymenoptera: Ichneumonidae) olduğu anlaşılmıştır. Bulgular doğrultusunda, ayçiçeği bitkisinin *P. xylostella* için yeni bir konukçu kaydı olduğu belirlenmiştir. Yine *P. xylostella*'nın Tokat böcek faunası için yeni kayıt olduğu tespit edilmiştir. *P. xylostella* ve parazitoit *D. subtilicornis*'in konukçuları, Türkiye ve dünyadaki yayılışları ile *P. xylostella*'nın parazitoitleri hakkında bilgiler verilmiştir.

Anahtar kelimeler: *Diadromus subtilicornis*, parazitoit, ayçiçeği, Tokat

1. Introduction

Sunflower [*Helianthus annuus* L. (Asteraceae)] is one of the world's most important oilseeds and is second only to soybean oil in terms of consumption, used for both culinary and medicinal purposes (Meral, 2019). Numerous plant pests are known to damage sunflowers, among which some play a significant role. In Türkiye, the commonly reported pest species include *Agrotis ipsilon* (Hufn.), *A. segetum* (Schiff.), *Helicoverpa*

armigera (Hbn.) (Lepidoptera: Noctuidae), *Loxostege sticticalis* (L.) (Pyralidae), *Homoeosoma nebulellum* Denis & Schiffermüller (Lepidoptera: Pyralidae), *Lethrus brachiicollis* Fairm. (Coleoptera: Scarabaeidae), and *Agriotes* spp. (Elateridae) (Anonymous, 2022). The family Plutellidae, commonly known as diamondback moths, comprises approximately 150 known species worldwide. *Plutella* is a cosmopolitan genus comprising over 40 recognized species, most of which feed on

plants belonging to the Brassicaceae family (Pohl et al., 2015). In Türkiye, the genus *Plutella* is represented by two species: *P. porrectella* (Linnaeus, 1758) and *P. xylostella* (Koçak & Kemal, 2009, 2018). *Plutella xylostella* (Linnaeus, 1758), one of the most notable species of the genus *Plutella*, is a globally recognized pest and one of the micro-moths capable of long-distance migration (Pohl et al., 2015). *Plutella xylostella*, a notorious pest that causes damage to cruciferous crops globally (Ansari & Kumar, 2024), is a species that limits production in these crops (Massarolli et al., 2024). The economic impact of *P. xylostella* damage on the global economy is estimated at 4-5 billion dollars annually. (Furlong et al., 2013; Massarolli et al., 2024). Research on the biology, ecology, and host plants of *P. xylostella* (Furlong et al., 2013) remains limited, while studies on its natural enemies are significant for the development of new pest management strategies (Massarolli et al., 2024).

Research on natural enemies is crucial for identifying new parasitoid-host pairs and for developing strategies to conserve these enemies, which can help keep the pest under control within biological control programs (Massarolli et al., 2018). One of the most significant parasitoids of *P. xylostella* worldwide is *Diadegma insulare* (Cresson, 1865) (Hymenoptera: Ichneumonidae) (Mason et al., 2022). Commonly recognized larval parasitoids of *P. xylostella* include *Oomyzus sokolowskii* (Kurdjumov) (Hymenoptera: Eulophidae), *Apanteles piceotrichosus* Blanchard, and *Cotesia* spp. (Braconidae), while *Trichogramma pretiosum* Riley (Trichogrammatidae) is known as its egg parasitoid (Goodwin, 1979).

The family Ichneumonidae comprises parasitoid wasps in the order Hymenoptera and is a highly diverse group, with an estimated global species count exceeding 100,000. This family plays a crucial role in regulating pest insect populations, making it highly valuable for biological control efforts. Ichneumonid species typically parasitize the larvae or pupae of holometabolous insects and spiders, ultimately leading to their hosts' death (Anonymous, 2025). Research conducted in Türkiye has identified approximately 1,300 species within this family (Çaylak & Çoruh, 2020). *Diadromus subtilicornis* is an endoparasitoid belonging to the family Ichneumonidae, primarily parasitizing the pupae of lepidopteran species such as *Plutella xylostella*. Laboratory studies have demonstrated that *D. subtilicornis* exhibits a marked preference for

prepupal stages and 1–2-day-old pupae, indicating its potential significance in biological control programs (Tran & Takasu, 2000). In Türkiye, the presence of *D. subtilicornis* has been confirmed through several studies. It was first recorded in Erzurum by Avcı and Özbek (1990), and subsequently reported by Özdemir (1996) from the provinces of Ankara and Yozgat.

The aim of this study was to determine the species of Lepidoptera and their parasitoids on sunflower (*Helianthus annuus* L.) plants grown in the centre of Tokat.

2. Materials and Methods

Larvae and prepupae of *Plutella xylostella* were collected from *Helianthus annuus* leaves in the Tokat province of Türkiye, and surveys continued until the sunflower harvesting time. The collected specimens were transported to the Insect Rearing Laboratory at the Faculty of Agriculture, Tokat Gaziosmanpaşa University, where they were cultured in 30×30×30 cm plastic boxes with ventilation holes under controlled conditions of 25±2°C, 60±5% relative humidity, and a 16:8 light: dark photoperiod (Figure 1). The emerging parasitoids were euthanized using ethyl acetate, pinned, and prepared as museum specimens and were identified by Dr. Matthias Riedel (Zoologische Staatssammlung München, Germany). *Plutella xylostella* adult was also killed with ethyl acetate, pinned on a stretching board, and identification was performed by Prof. Dr. Feza CAN (Hatay Mustafa Kemal University, Hatay, Türkiye).

3. Results and Discussion

3.1. *Plutella xylostella* (Linnaeus, 1758) (Lepidoptera: Plutellidae)

Material collected: Tokat (Centre, Çerçi), 40°18'35.10"N, 36°24'45.89" E, 663 m, 8 June 2023, 1 larva and 2 prepupae.

Host plants: *Brassica carinata* A.Br. (Ayalew & Ogol, 2006), *B. oleracea* var. *capitata* (Brassicaceae) (Avcı & Özbek, 1995; Wei et al., 2013; Atay et al., 2019; Joshi & Pandey, 2022), *B. oleracea* var. *viridis* (Brassicaceae) (Ayalew & Ogol, 2006), *Passiflora edulis* Sims (Passifloraceae) (Pereira et al., 2023), *Medicago sativa* L., *Pisum sativum* L., *Trifolium* spp., *T. pratense* L., *T. repens* L. (Fabaceae), *Solanum tuberosum* L. (Solanaceae), *Zea mays* L. (Poaceae) (Ostrauskas, 2003), *Vitis vinifera* L. (Vitaceae) (Mustu & Altinok,

2019), *B. oleracea* var. *acephala*, *B. oleracea* var. *botrytis*, *B. oleracea* var. *bullata*, *B. oleracea* var. *capitata*, *B. oleracea* var. *gemmaifera*, *B. oleracea* var. *italica*, *B. alboglabra* (Bailey), *B. oleracea* var. *gongyloides* L., *B. rapa* subsp. *chinensis* (L.), *B. juncea* (L.), *B. napus* L., *B. nigra* (L.), *B. parachinensis*, *B. rapa* var. *sarson* (Prain), *Brassica* spp. (Brassicaceae), *Capparis sandwichiana* (Capparaceae), *Daucus carota* L. (Apiaceae), *Erysimum cheiri* (L.), *E. franciscanum* Greene, *Erysimum* spp. (Brassicaceae), *Galinsoga* spp. (Asteraceae), *Guettarda* spp. (Rubiaceae), *Iberis odorata* L., *Iberis* spp., *Lepidium* spp., *Lobularia maritima* (L.), *Lobularia* spp. (Brassicaceae), *Lonicera* spp. (Caprifoliaceae), *Matthiola annua* (L.), *M. incana* (L.), *Matthiola* spp., *Raphanus sativus* L., *Rorippa indica* (L.), *R. microphylla* (Boiss.), *Rorippa* spp. (Brassicaceae), *Saccharum officinarum* L. (Poaceae), *Shorea robusta* (Dipterocarpaceae), *Solanum melongena* L. (Solanaceae), *Spinacia oleracea* L. (Amaranthaceae), *Vicia faba* L. (Fabaceae) (Robinson et al., 2023).

H. annuus is recorded as a new host plant for *P. xylostella* (Robinson et al., 2023).



Figure 1. *Plutella xylostella* adult, ♂ a. Lateral view, b. Dorsal view, c. Wingspan, d. The silken web constructed by the *P. xylostella* larvae on sunflower plants

Distribution in Türkiye: Artvin (Alkan, 1965), Erzurum (Avcı & Özbek, 1995), Adana, Bitlis, Diyarbakır, Gaziantep, Hakkâri, Hatay, İstanbul, Kayseri, Malatya, Muğla, Muş, Van, Kırıkkale (Koçak & Kemal, 2018), Ankara, Konya, Şanlıurfa, Mersin (Koçak & Kemal, 2018; Saran & Genç, 2024), Nevşehir (Mustu & Altınok, 2019), Çanakkale (Atay et al., 2019; Saran & Genç, 2024), Balıkesir, Bursa, Samsun, Ordu, Manisa, İzmir (Saran & Genç, 2024).

Distribution in world: Asia: China, India, Japan, South Korea, Thailand, and Indonesia (Talekar & Shelton, 1993), Africa: Kenya and Ethiopia (Grzywacz et al.,

2010), Europe: England and Scotland (Chapman et al., 2002), America: USA, Canada, Brazil, and Chile (Shelton et al., 1993), Oceania: Australia and New Zealand (Furlong et al., 2013).

Parasitoids of *Plutella xylostella*: *Pteromalus semotus* (Walker, 1834) (Hymenoptera: Pteromalidae) (Braun et al., 2004; Mason et al., 2022), *Catolaccus aeneoviridis* (Girault 1911) (Hymenoptera: Pteromalidae), *C. cyanoideus* Burks (1954) (Hymenoptera: Pteromalidae) (Ulmer et al., 2004; Mason et al., 2022), *Diolcogaster claritibia* (Papp, 1959) (Hymenoptera: Braconidae) (Fernández-Triana et al., 2014), *Mesochorus bilineatus* Thomson, 1886 (Hymenoptera: Ichneumonidae) (Munir, 2019; Mason et al., 2022), *Itopectis maculator* (Fabricius, 1775) (Hymenoptera: Ichneumonidae), *Diadegma fenestrata* (Holmgren, 1860) (Hymenoptera: Ichneumonidae), *D. semiclausum* (Hellen, 1949) (Hymenoptera: Ichneumonidae), *Diadromus collaris* Wesm., 1845 (Hymenoptera: Ichneumonidae) (Haye et al., 2021), *D. subtilicornis* (Gravenhorst, 1829) (Hymenoptera: Ichneumonidae) (Haye et al., 2021; Mason et al., 2022), *D. insulare* (Cresson, 1865) (Hymenoptera: Ichneumonidae), *Microplitis plutellae* (Muesebeck, 1922) (Hymenoptera: Braconidae), *Oomyzus sokolowskii* (Kurdjumov, 1912) (Hymenoptera: Eulophidae), *Conura albifrons* (Walsh, 1861) (Hymenoptera: Chalcididae) (Mason et al., 2022).

3.2. *Diadromus subtilicornis* (Gravenhorst, 1829) (Hymenoptera: Ichneumonidae)

Reared specimen: 24 June 2023, 1♂, reared from *Plutella xylostella* prepupa (Figure 2.).



Figure 2. Adult of *Diadromus subtilicornis*

Distribution in Türkiye: Erzurum (Avcı & Özbek, 1990), Ankara and Yozgat (Özdemir, 1996), Ardahan (Çoruh et al., 2018).

Distribution in world: Europe: England (Shaw, 2003), Italy (Diller & Shaw, 2014), Netherlands (Teunissen, 1972), Ukraine (Varga et al., 2020), America: Canada (Mason et al., 2024).

Plutella xylostella is recognized as one of the most significant insect pests affecting cultivated Brassicaceae crops globally (Mpumi et al., 2020). This pest was found to damage cauliflower, broccoli, white cabbage, and collard in Türkiye (Saran & Genç, 2024). Avcı and Özbek (1995) reported that *P. xylostella* is the most important pest of cabbage in Erzurum. They observed that the larvae feed on the underside of the leaves, causing extensive perforations and damage to the foliage. In years of high pest population density, it causes significant yield losses. It can inhibit the growth of seedlings and young plants, and in severe cases, may lead to their complete desiccation (Anonymous, 2022).

Plutella xylostella is already recognized as a significant pest of cabbage in Türkiye, and control measures are being implemented. However, due to global climate change, many pest insects have begun to damage a broader range of host plants, including cultivated crops. Therefore, continuous monitoring of pest populations and identifying new host preferences are crucial for effective pest management and early detection of emerging threats. In addition, identifying the natural enemies of these pests and elucidating their host associations are essential steps in developing sustainable pest management strategies.

4. Conclusion

Plutella xylostella was detected for the first time as a pest of sunflower in this study. In addition, *P. xylostella* and *Diadromus subtilicornis* are newly recorded species for the entomofauna of Tokat. To prevent increases in pest populations and the resulting damage, it is essential to conduct regular monitoring of pest populations and assess current damage status through studies in sunflower cultivation areas within Tokat province and across Türkiye.

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Authorship contribution statement

B.T.: Host insect collected, culture reared, species identification and writing.

T.A.: Species identification, writing, supervision and editing.

Conflict of interest

The authors declare no conflicts of interest.

Ethical Statement

There is no need to obtain ethics committee approval for this study.

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