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### The first record for *Plutella xylostella* (Linnaeus, 1758) (Lepidoptera: Plutellidae) in Çanakkale province of Turkey and external and genital morphology of the species

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**Abstract:** This study was conducted in the field and the laboratory. *Plutella xylostella* was captured in cabbage fields in central district of Çanakkale, Ezine district and Ayvacık district during the day and night field studies. For during the day atrap, and for at night light traps were used. In the field studies, totally 35 male and 108 female specimens were collected. Specimens were dissected and male genitalia and wings microscope slides were prepared in the laboratory. We described the external and genital morphology of the male *Plutella xylostella* and diagnostic morphological features in detail. As a result of the study, *Plutella xylostella* is a new record for Çanakkale province.

**Keywords:** Çanakkale, Lepidoptera, *Plutella xylostella*, Plutellidae.

### Türkiye Çanakkale İlinde *Plutella xylostella* (Linnaeus, 1758) (Lepidoptera: Plutellidae)'nın İlk Kaydı ve Türün Dış ve Genital Morfolojisi

**Özet:** Bu çalışma saha ve laboratuvar çalışmaları şeklinde gerçekleştirilmiştir. *Plutella xylostella*, Çanakkale ili Merkez ilçesi, Ezine ilçesi, Ayvacık ilçesi ile Ezine ilçesindeki lahana tarlalarında gündüz ve gece sürdürülen arazi çalışmalarında yakalandı. Gündüzleri atrap, geceleri ise ışık tuzakları kullanılmıştır. Saha çalışmalarında toplam 35 erkek ve 108 dişi toplanmıştır. Örnekler laboratuvarında preparat yapımı için hazırlandı, erkek genital ve kanat preparatları yapıldı. *Plutella xylostella*'nın dış morfolojisi ve erkek genital organları ayrıntılı olarak tanımlandı. Çalışma sonucu olarak *Plutella xylostella* Çanakkale için ilk kayıttır.

**Anahtar Kelimeler:** Çanakkale, Lepidoptera, *Plutella xylostella*, Plutellidae.

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#### 1. Introduction

The family Plutellidae *sensu stricto* comprised 5 genera containing 58 species. *Eidophasia* (11 species), *Lunakia* (1 species), *Plutella* (22 species, 12 attributable to *Plutella sensu stricto*), *Leuroperna* (2 species) and *Rhigognostis* (22 species). Two further genera, the brachypterous subantarctic *Embryonopsis* (1 species) and the Australasian *Proditrix* (2 species) are only tentatively associated with the family (Robinson and Sattler, 2001). Diamondback moths, family Plutellidae, include four subfamilies Ypsolophinae, Plutellinae, Scythropiinae and Praydinae (Heppner, 2008). *Plutella* Schrank, 1802, is poorly defined genus with a worldwide distribution containing 22 species. The type species, *Plutella xylostella* (L.), Diamondback moth or Cabbage moth, is a notorious migratory pest of brassicaceous crops (Robinson and Sattler, 2001). The diamondblack moth, *Plutella xylostella* (L.) (Lepidoptera: Plutellidae), is one of the most serious pests of cultivated Brassicaceae worldwide (Moriuti, 1986; Avcı and Özbek, 1995; Hagerty et al., 2008; Bertolaccini et al.,

2011; Pengyan et al., 2012; De Bortoli et al., 2014; Bacci et al., 2018). This crucifer specialist may have its origin in Europe, South Africa, or East Asia, but is now present worldwide wherever its host plants exist (De Bortoli et al., 2014). The authors (De Bortoli et al., 2014) gave the following information about the larval feeding of the species; in the first instar, the larvae enter into the leaf parenchyma and feed between the upper and lower surfaces of leaves creating mines. In the second instar, the larvae leave the mines, and from the second to the third instar, they feed on the leaves, destroying the leaf tissue except for the upper epidermis, leaving transparent "windows" in the leaves. Fourth-instar larvae feed on both side of the leaves. This insect has a short life cycle, around 18 days, and its population may increase up to 60 fold from one generation to the next.

Avcı and Özbek (1995) state that this insect is damaging in cabbage and other Crucifer species in more than one hundred countries. Among the reasons for their significant detriment are the factors such as the ability to adapt to

different climatic conditions, the high reproductive power, and the resistance to all the pesticides used. The authors also report that the insect has the ability to migrate to far distances, migrating to distances over 1000 km or more by air flow through atmospheric pressure. Although this species has the ability to migrate to long distances, the ability of its natural enemies to migrate is very limited. This situation causes the insect to adapt more easily and cause significant damage in the new Crucifer cultivated fields. In Canada, *P. xylostella* leaves around 164 eggs per cabbage plant and gives 4-5 progeny per year. In Israel, the female of this species leaves an average of 280 eggs and gives 10 progeny per year. (Avcı and Özbek 1995).

Avcı and Özbek (1995), in their study of cabbage fields in Erzurum province in 1995, reported that *P. xylostella* significantly damaged to the plant, larvae fed on the lower face of the leaf and riddled like griddle. Adult female butterflies usually lay their eggs on the lower surface of the leaf of the host plant as individually or in groups of 2-8. In field conditions, the eggs are opened in 2-7 (4) days, the larval period is 8-18 (12) and the duration of pupa is 3-8 (5) days, thus the insect development is completed in 13-31 (21) days. (Avcı and Özbek 1995).

There are two species (*P. porrectella* (L., 1758); *P. xylostella*) belonging to the genus *Plutella* in Turkey (Koçak and Kemal, 2009; 2018). The first attempt on the checklist of the Turkish moths was listed by Koçak and Kemal (2006, 2007; 2018). Totally 4604 moth species were listed together with their synonymous named and updated provincial distributions. Later, the authors (Koçak and Kemal, 2009) reported that the Turkey Lepidoptera fauna was 5128 species belonging to 76 families. In addition, a total of 343 lepidoptera species, 240 Heterocera and 103 Rhopalocera, belonging to the province of Çanakkale were listed by the same authors. The species belonging to the genus *Plutella* are not found in Çanakkale. *P. xylostella* is a new record for the the lepidoptera fauna of Çanakkale.

## 2. Materials and Method

The study was conducted in the field and the laboratory.

### 2.1. Field Studies

Field studies were carried out in cabbage fields in Çanakkale province in September and October 2018. All the field works were done under suitable weather conditions (without precipitation and strong winds), and works started early in the morning and continued until sunset. *Plutella xylostella* was caught in various cabbage fields with light trap at night and atrap (butterfly net) during day. In the field studies, totally 35 male and 108 female specimens were collected.

### 2.1. Laboratory Studies

Before they were losing body water, the collected specimens were sorted according to body sizes, and were needed with a number 0 insect needles that matched the size of the custom sized boards, strain and inhibition couples

were strained in laboratory work. For the drying of the stretched specimens, they kept at room temperature for two weeks in a dark and dry place. Male genital organ was prepared for the identification of the species following morphological examinations and measurements on the male specimens. The needling of the moths, stretching of the wings and genital organ preparations were done accordingly the methods which defined in Atay's work (2006). The major taxonomic characters described. Important morphological organs of *Plutella xylostella* were photographed. The specimens stored at the Biology Department of Mustafa Kemal University in Hatay.

## 3. Results

### Genus *Plutella* Schrank, 1802 (*Plutellidae*)

Syn: *Anadetia* Hübner, [1825]; *Euota* Hübner, [1825]; *Creagria* Sodoffsky, 1837; *Evota* Agassiz, 1847; *Pseudoplutella* Baraniak, 2007 (Koçak and Kemal, 2009; 2018).

### *Plutella xylostella* (Linnaeus, 1758)

*Plutella Tinea xylostella* Linnaeus, 1758, Sys. Nat. Ed.: 538.  
*Cerostoma maculipennis* Curtis, 1832, Brit. Entomol. Pl. 420.

*Plutella cruciferarum* Zeller, 1843, Stett. Entomol. Ztg., 4:1281.

*Plutella brassicella* Fitch, 1856, Rep. Nox. Inst. New York, 1:170.

*Plutella limbipennella* Clemens, 1860, Proc. Acad. Nat. Sci. Philad., 12:6.

*Plutella mollipedella* Clemens, 1860, Proc. Acad. Nat. Sci. Philad., 12:6.

*Gelechia cicarella* Rondani, 1876, Bull.Soc. Entomol. Ital., 8:20.

*Tinea galeatella* Mabilie, 1888, Miss. Sci. Cap. Horn, 6:34.

*Cerostom dubiosella* Beutenmuller, 1839, Can. Entomol., 21:27. (Moriuti, 1986)

**The distribution of *Plutella xylostella* in Turkey;** Adana, Ankara, Bitlis, Diyarbakır, Gaziantep, Hakkari, Hatay, Mersin, İstanbul, Kayseri, Konya, Malatya, Muğla, Muş, Şanlıurfa, Van, Kırıkkale (Koçak and Kemal, 2009; 2018).

**The distribution of *Plutella xylostella* in the world;** Belgium, Austria, Albania, Afghanistan, Germany, Azerbaijan, United Arab Emirates, Switzerland, Czech Republic, Algeria, Denmark, Spain, France, Finland, Great Britain, Greece, Bulgaria, Hungary, Israel, India, Italy, Iceland, Ireland, Iran, Iraq, Lebanon, Luxembourg, Latvia, Lithuania, Malta, Moldova, Malaysia, Netherlands, Norway, Portugal, Poland, Romania, Saudi Arabia, Sweden, Thailand, Tunisia, Slovakia, Turkmenistan, Ukraine, Yugoslavia, Russia, Yemen, South Africa (Karsholt and Razowski, 1996; Koçak and Kemal, 2018).

**Material Examined:** Çanakkale-Center-Kumkale Village (39°59'01" N; 26°13'22" E, 42 m.); Çanakkale-Center-Tevfikiye Village (39°57'12" N; 26°14'43" E, 75 m.); Çanakkale- Center-Halileli Village (39°58'16" N; 26°16'34" E, 58 m.); Çanakkale-Ayvacı-Kösedere Village (39°39'43" N; 26°90'54" E, 5 m.); Çanakkale-Ezine-Hisaralan Village (39°76'18" N; 26°28'69" E, 185 m.); Çanakkale-Ezine-Kemallı Village (39°75'93" N; 26°23'54"

E, 160 m.); Çanakkale-Bayramiç (39°48'48" N; 26°35'42" E, 118 m.)

01.IX.2018 6♂, 20♀; 15.IX.2018 6♂, 21♀; 29.IX.2018 8♂, 20♀; 13.X.2018 6♂, 35♀; 27.X.2018 9♂, 12♀.

**Measurements of the Adults**

Body Length ♂: 5 mm, ♀: 5-6 mm.

Wingspan ♂: 13 mm, ♀: 13-14 mm.

Male (Figure 1): The adults of *Plutella xylostella* 5-6 mm in size and greyish brown in colour. There are four diamond shaped whitish beige patterns along the costal edge of the forewings, giving the moth its common name. These diamond shapes are more distinct in males than those of females.

On the head vertex and frons yellowish brown, scales dirty white tipped, these scales are long and pretty fluffy (Figure 2). Antenna fuscous light brownish with black rings and with short setae; about ¾ length of forewing. Labial palpus well developed, long, curled up, well visible; its second segment with forward directed triangular tuft. Haustellum is well developed and naked. Eyes are round, large and dark brown. On the head ocelli well developed. (Figure 3). Veins of forewing and hindwing of *Plutella xylostella* are in Figure 3.

Forewings are long, too narrow and pointed, its length 3,6 times longer than its width. The ground colour of the forewing is grayish brown with small yellowish brown stains. There are four diamond shaped whitish beige patterns along the costal edge of the forewings. Hindwings are narrow and its length 3,7 times longer than its width. The ground colour of the hindwings brown.

The male genital organ is in Figure 4.

Valva is long and very broad, sclerotized and large round at the end, its length 2 times longer than its width and covered with long and frequent hairs. Tegumen is strongly sclerotized. Aedeagus is long and straight, sharply pointed, needle like with bulbous base and pair of lateral hooks, without cornuti. Saccus is long and broad, triangular.

The larvae and damage shape of *P. xylostella* are in Figure 5.



Figure 1. Adults of *Plutella xylostella*.



Figure 2. The head structure of *Plutella xylostella*.

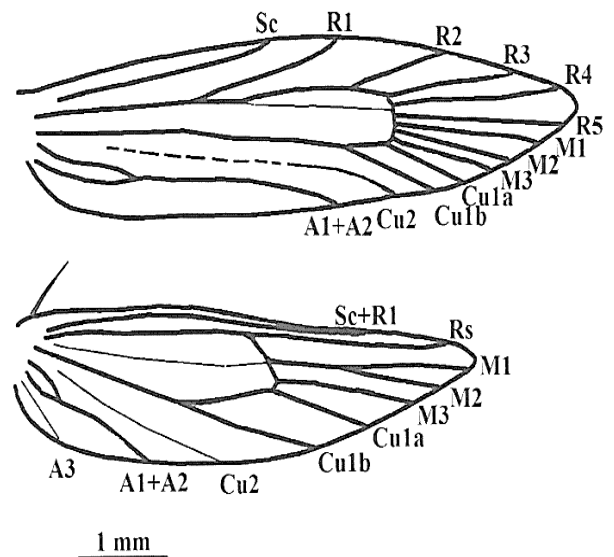


Figure 3. Veins of forewing and hindwing of *Plutella xylostella*

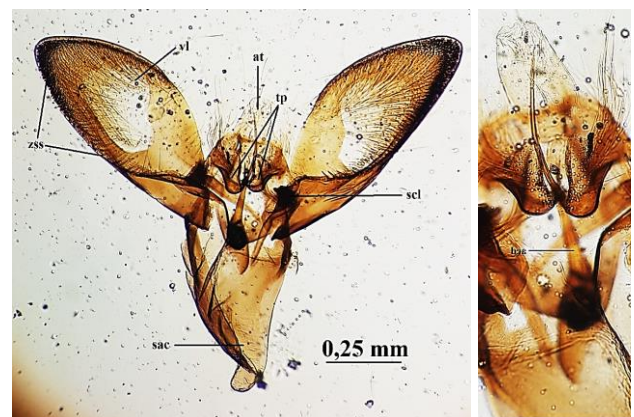
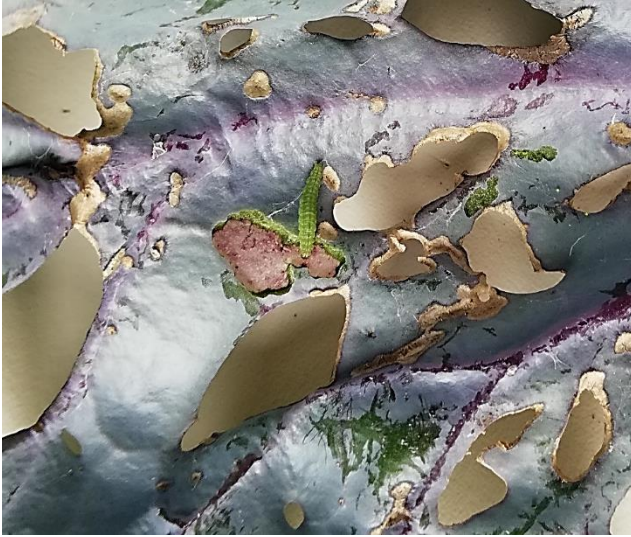


Figure 4. The Male Genitalia of *Plutella xylostella* and Aedeagus (aed = aedeagus, at = anal tube, sac = saccus, scl = sacculus, tp = teguminal process, vl = valva, zss = zone of spiniform setae.



**Figure 5.** The larvae and damage shape of *P. xylostella*

#### 4. Discussion

In this study, we described the external and genital morphology of the male *Plutella xylostella*. The important taxonomic characters belong to *P. xylostella* were described in detail. Each one of the external and genital taxonomic characters was measured with digital caliper and stereo microscope. This species is a new record for the the lepidoptera fauna of Çanakkale.

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