

**Original article (Original ara tırma)****A new host and natural enemies of *Dialectica scalariella* (Zeller) (Lepidoptera: Gracillariidae) in Turkey**

*Dialectica scalariella* (Zeller) (Lepidoptera: Gracillariidae)'nın yeni konukçu ve do al dü manları

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**Summary**

The study was carried out to determine leaf mining insects species feeding on *Echium italicum* L. (Boraginaceae) (Italian viper's bugloss) growing in wheat fields of Edirne and Samsun provinces in 2013. As result of this study, *Dialectica scalariella* (Zeller, 1850) (Lepidoptera: Gracillariidae) adults were obtained from the samples collected from both provinces. *D. scalariella* is a first record for insect fauna of Edirne and Samsun provinces. In addition, parasitoids *Apanteles* sp. (Hymenoptera: Braconidae) and *Sympiesis* sp. (Hymenoptera: Eulophidae) were obtained from *D. scalariella* larvae collected from *E. italicum* in Edirne.

**Key words:** *Dialectica scalariella*, *Echium italicum*, natural enemies, host plant, Turkey

**Özet**

Bu çalı ma, Edirne ve Samsun illerinde bu day üretim alanlarında bulunan talyan engerek otu (*Echium italicum* L.) (Boraginaceae) ile beslenen galeri böceklerini belirlemek amacıyla 2013 yılında yürütülmü tür. Çalı ma sonucunda Edirne ve Samsun illerinden toplanan örneklerden *Dialectica scalariella* (Zeller, 1850) (Lepidoptera: Gracillariidae)'nın erginleri elde edilmi tir. *D. scalariella* Edirne ve Samsun illeri böcek faunası için ilk kayıt niteliindedir. Ayrıca, Edirne den toplanan bitki örneklerindeki *D. scalariella* larvalarından parazitoitler elde edilmi tir. Bu türler *Apanteles* sp. (Hymenoptera: Braconidae) ve *Sympiesis* sp. (Hymenoptera: Eulophidae) olarak belirlenmi tir.

**Anahtar sözcükler:** *Dialectica scalariella*, *Echium italicum*, do al dü manlar, konukçu bitki, Türkiye

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## Introduction

*Echium italicum* (Boraginaceae) is a plant native to the Mediterranean Basin, specifically Italy (hence the name 'italicum'), that has been introduced in the United States (Anonymous, 2015). *Echium* spp. are widespread in agricultural areas and native habitats in different parts of Turkey (Ulu et al., 1993; Tepe, 1997; Özer et al., 1999; Özaslan, 2011).

Gracillariidae is the largest family of plant-mining Lepidoptera, with more than 1800 described species (De Prins & De Prins, 2005); moreover, it is the only family of Lepidoptera with sap-feeding larvae (Davis, 1987). Most species are leaf miners, but some are miners in fruits, shoots, or bark (Davis & Robinson, 1998). The post-embryonic morphogenesis of gracillariid moths is characterized by a striking hypermetamorphosis (Kumata, 1978; Wagner et al., 2000). The moth has high fecundity and oviposits on the leaves of *Echium* spp. and other Boraginaceae. The larvae destroy leaves by forming large bulbous blotch mines. The host restriction of the moth has been confirmed, as only boraginaceous plants are attacked. Wapshere & Kirk (1977) concluded that in terms of both effectiveness and specificity, *Dialectica scalariella* could serve as a biological control agent in Australia for *E. plantagineum*. *Dialectica scalariella* attaches opalescent eggs to the undersurface of host leaves. They hatch in 4–6 days, and the larvae enter leaves through the base of the chorion. In all Gracillariidae, the early instars are sap-feeding and use their horizontally aligned mandibles to cut cell walls. It is not known at which instar the larvae of *D. scalariella* develop the chewing mouthparts typical of most lepidopteran larvae. According to Wapshere & Kirk (1977), the first three instars enlarge the mine gradually, forming a transparent lens-like blotch mine in which all tissue between the two epidermal layers (apart from vascular bundles) has been consumed; the epidermis eventually turns brown. Within the mine, the final instar larva constructs a white cocoon in two layers; the relatively large white inner cocoon distinguishes this species from the related Indo-Australian species *Dialectica aemula* (Meyrick), in which the inner cocoon is attenuate and yellowish (Kumata & Horak 1997). *Dialectica scalariella*, which is common in Southern Europe, was introduced to Australia to control the weed *E. plantagineum*, commonly known as purple viper's bugloss or Paterson's curse (Anonymous, 2014).

This study was carried out to determine leaf mining insects species feeding on *E. italicum*.

## Materials and Methods

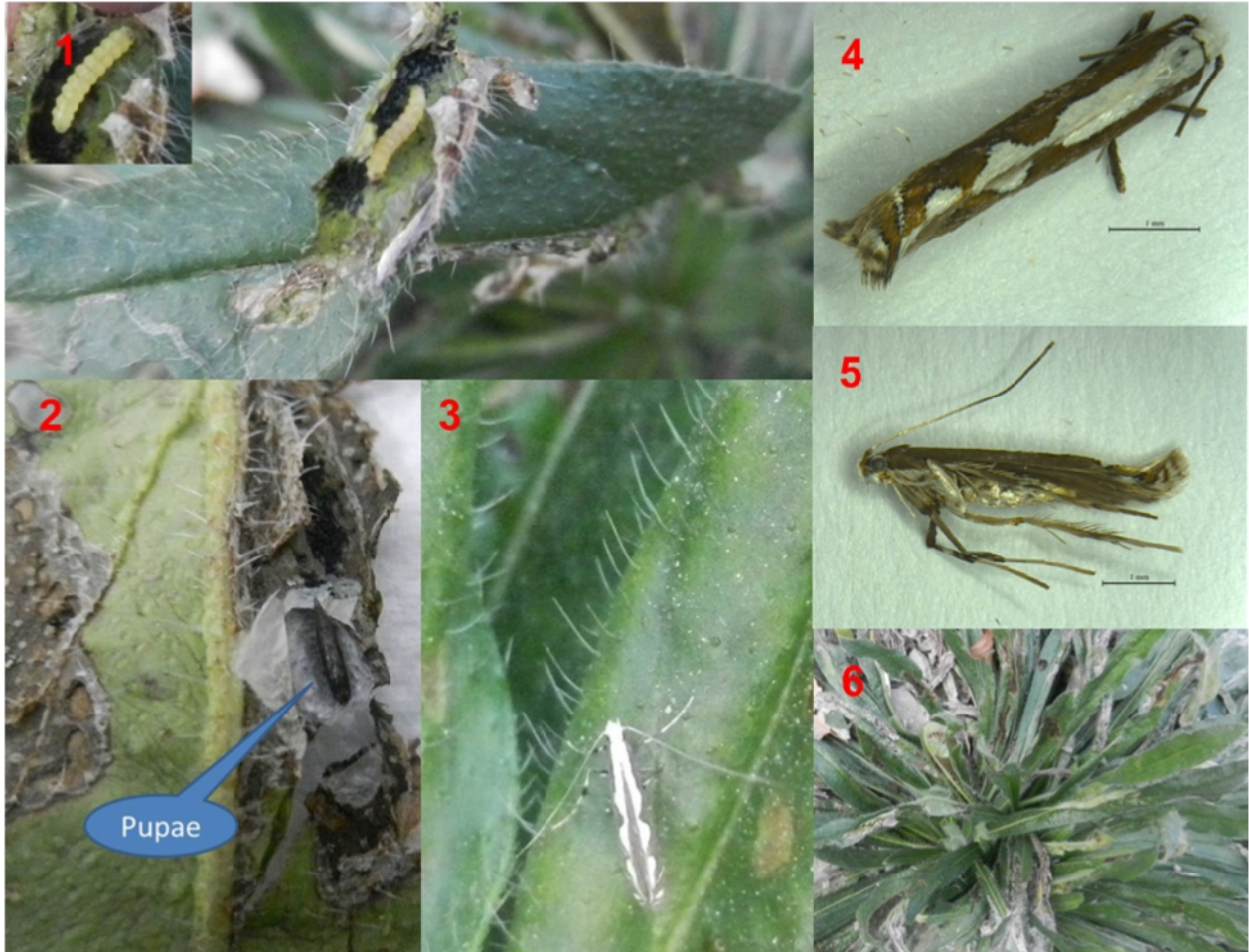
Larvae of *Dialectica scalariella* were collected from *Echium italicum* leaves in the Turkish provinces of Edirne and Samsun (35°57'N, 45°67'E; altitude, 174 m, date of samples 17.12.2013 and 37°26'N, 45°69'E; altitude, 328 m, date of samples 23.11.2013) during June and December 2013, and were brought to the laboratory for rearing. The larvae were reared in insect-rearing plastic boxes (20X20X30 cm) under controlled conditions at 26±1°C, a relative humidity of 65±5%, and illumination of 3500 lux for 16 h per day. The larvae were observed by daily. The last instar braconid larvae left the host and transformed into pupae next to the remains of their hosts. Host plant materials and braconid pupae were placed in separate petri dishes containing moistened cotton until the adult eulophid or braconid wasp emerged. *D. scalariella* was identified by the third author.

## Results and Discussion

As a result of this study, leaf mining insects species were obtained from the samples collected from *Echium italicum* in wheat fields. This species was identified as *Dialectica scalariella* (Zeller, 1850) (Lepidoptera: Gracillariidae). *D. scalariella* adults were obtained from the samples collected from both provinces. *D. scalariella* is a first record for insect fauna of Turkey. In addition, parasitoids *Apanteles* sp. (Hymenoptera: Braconidae) and *Sympiesis* sp. (Hymenoptera: Eulophidae) were obtained from *D. scalariella* larvae collected from *E. italicum* in Edirne.

***Dialectica scalariella* (Zeller, 1850) (Lepidoptera: Gracillariidae)**

Larvae (Figure 1), pupae (Figure 2), and adults (Figures 3–5) of the leaf mining moth *D. scalariella* from leaves of *E. italicum*. The damage *D. scalariella* caused on *E. italicum* leaves was observed during the survey (Figure 6).



Figures; 1. *Dialectica scalariella* larvae feeding on *Echium italicum* leaves; 2. *Dialectica scalariella* pupae in *Echium italicum* leaves; 3. *Dialectica scalariella* adult on *Echium italicum* during the survey; 4. *Dialectica scalariella* adult (dorsal view); 5. *Dialectica scalariella* adult (lateral view); 6. *Dialectica scalariella* larvae caused considerable destruction to *E. italicum* leaves.

Materials examined: Samsun, 37°26'N, 45°69'E, altitude, 328 m; Edirne, 35°57'N, 45°67'E, altitude, 174 m. Totally 93 adult specimens.

Distribution: *Dialectica scalariella* has been recorded in Southern Europe, Madeira, the Canary Islands, Asia Minor, Australia (deliberately introduced) (Hoare, 2001; Delfosse et al., 1987; Walsh et al., 1993; Kumata & Horak, 1997), Algeria (Walsingham, 1908), Austria (Rennwald et al., 2008), Bulgaria (Buszko & Beshkov, 2004), Croatia (Klimesch, 1942), France (Rebel & Rogenhofer, 1894; Walsingham, 1908), Germany (Rennwald et al., 2008), Greece (Gozmány, 1983), Israel (Amsel, 1936), Italy (Zeller, 1850; Hartig & Amsel, 1952), Jordan (Massa et al., 2001), Malta (Sammut, 1984), Morocco (Chrétien, 1922), Portugal (Walsingham, 1894; Rebel & Rogenhofer, 1894), Russia (Trjapitzin, 1978), Spain (Hering, 1936; Rebel, 1896), Switzerland (Hartig, 1956), Tunisia (Walsingham, 1908), Turkey (Koçak & Seven, 2001), Turkmenistan (Puplesis et al., 1996), Ukraine (Budashkin, 2004), and the United Kingdom (Agassiz, 2005).

Distribution in Turkey: This is a new record of the species in Edirne and Samsun. Koçak & Seven (2001) reported the presence of this species in Turkey, but gave no information on the host plant, place, or time of observation.

Recorded hosts: *Anchusa azurea* (Wapshere & Kirk, 1977; Skala, 1937), *Anchusa strigosa* (Amsel, 1936), *Borago* sp. (Skala, 1937), *Cynoglossum australe* (Kumata & Horak, 1997), *Cynoglossum creticum* (Rebel, 1939; Harting, 1964), *Cynoglossum officinale* (Klimesch, 1950), *Cynoglossum* sp. (Walsingham, 1908), *Echium aculeatum* (Hering, 1927), *Echium candicans* (Franquinho et al., 2006), *Echium fastuosum* (Hartig, 1964), *Echium giganteum* (Klimesch, 1979), *E. italicum* (Wapshere & Kirk, 1977), *Echium nervosum* (Franquinho et al., 2006), *E. plantagineum* (Hering, 1927; Hering, 1936; Skala, 1938; Hartig, 1964; Wapshere & Kirk, 1977; Kumata & Horak, 1997; Franquinho et al., 2006; Klimesch, 1979; Delfosse et al., 1987), *Echium* sp. (Massa et al., 2001; Klimesch, 1942; Walsingham, 1908; Mendes, 1910), *Echium spinosum* (Walsingham, 1908), *Echium vulgare* (Sammut & Mifsud, 2008; Lhomme, 1934; Agassiz, 2005; Rebel & Rogenhofer, 1894; Klimesch, 1950; Buszko & Beshkov, 2004; Kumata & Horak, 1997; Rennwald et al., 2008), *Myosotis macrocalycina* (Kuznetsov et al., 1998), and *Symphytum* sp. (Walsingham, 1908).

Host plant: *E. italicum* was recorded as a new host of *D. scalariella* for Turkey.

Parasitoid: *Apanteles* sp. (larval and pupal parasite).

Material examined: Edirne, 35°57'N, 45°67'E; altitude, 174 m 1 sample. This genus contains several members that are important larval parasitoids of lepidopteran pests (Ray & Yousuf, 2010).

Parasitoid: *Sympiesis* sp.

Material examined: Edirne, 35°57'N, 45°67'E; altitude, 174 m 6 samples. This is a large genus (in the Eulophidae) consisting of ectoparasitoids, hyperparasitoids, or larval and pupal parasitoids of Lepidoptera, Coleoptera, and Diptera (Zhu & Huang, 2003).

Reported parasitoids of *D. scalariella*: *Sympiesis* sp., *Copidosoma floridanum*, *Dialomorpha* sp., *Stenomesus japonicus*, and *Orgilus* sp. in Australia (James & Stevens, 1992), *Sympiesis gregori* and *Necremnus artynes* in France (Wapshere & Kirk, 1977), *S. gregori* in Russia (Trjapitzin, 1978), and *Semiela cher petiolata* in Jordan (Massa et al., 2001).

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