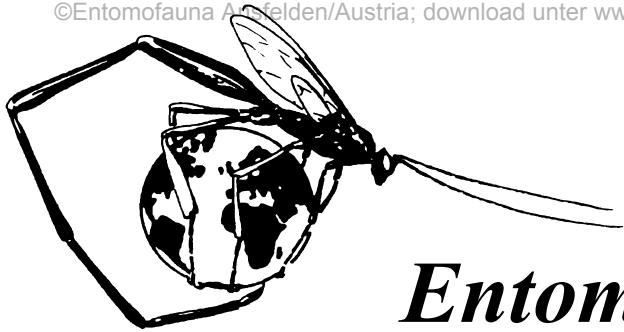

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Phytophagous Noctuidae (Lepidoptera) of the Western Black Sea Region and their ichneumonid parasitoids

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Abstract

Eleven agricultural and silviculturally important species of Noctuidae and their parasitoids were determined in 33 localities from the Western Black Sea region between 2001 and 2004. The ichneumonid biological control agents *Enicospilus ramidulus*, *Barylypa amabilis* and *Itoplectis alternans* were obtained by rearing the host larvae.

K e y w o r d s : Lepidoptera, Noctuidae, Hymenoptera, Ichneumonidae, parasitoidism, Western Black Sea Region, Turkey

Zusammenfassung

11 land- und forstwirtschaftlich bedeutende Noctuidae-Arten einschließlich ihrer Parasitoide aus 33 Standorten des Gebietes des westlichen Schwarzen Meeres wurden im Zeitraum 2001 bis 2004 studiert. Ichneumonidae der Arten *Enicospilus ramidulus*, *Barylypa amabilis* and *Itoplectis alternans* konnten durch Aufzucht der Wirtslarven festgestellt werden.

Introduction

The Noctuidae is the largest family of the Lepidoptera. Larvae of some species are particularly harmful to agricultural and silvicultural regions worldwide. Consequently, for years intense efforts have been carried out to control them through chemical, biological, and cultural methods (LIBURD et al. 2000; HOBALLAH et al. 2004; TOPRAK & GÜRKAN 2005). In the field, noctuid control is often carried out by parasitoid wasps (CHO et al. 2006). Ichneumonids are one of the most prevalent parasitoid groups of noctuids but they also parasitize on other many Lepidoptera, Coleoptera, Hymenoptera, Diptera and Araneae (KASPARYAN 1981; FITTON et al. 1987, 1988; GAULD & BOLTON 1988; WAHL 1993; GEORGIEV & KOLAROV 1999). In recent years, the use of ichneumonid wasps has accelerated as many appear to be important regulators of phytophagous insects (FERNANDEZ & CORLEY 2003; CAITLIN & WHITEHAUSE 2004).

The aim of this study was to identify the Noctuidae of the Western Black Sea region and their ichneumonid parasitoids. This region of Turkey consists of forests (67 % of the area) and agricultural fields and meadows (33 %) (MAYER & AKSOY 1998).

Methods

Adult specimens and larvae of Noctuidae and Ichneumonidae were collected from various habitats in the Western Black Sea region of Turkey (Fig. 1) with the help of a light trap at night and a sweeping net in day time in the Western Black Sea Region between the years 2001-2004. Larvae were then transferred into the laboratory and reared at 20-25 °C and 60-65 % relative humidity. The parasitoids emerging from noctuid larvae were identified. All specimens were mounted and identified following standard references (PIERCE 1967; DELRIO 1975; KASPARYAN 1981; KORNOŞOR 1982; FITTON et al. 1988; HACKER 1989, 1990; KOLAROV 1997; HACKER et al. 2002). For the identification of host plant species on which the noctuids were collected, POOLE (1989) and related web sites (http://www.leps.it, http://www.lepidoptera.neo.pl, http://www.nic.funet.fi, http://www.ukmoths.org.uk) were utilized.

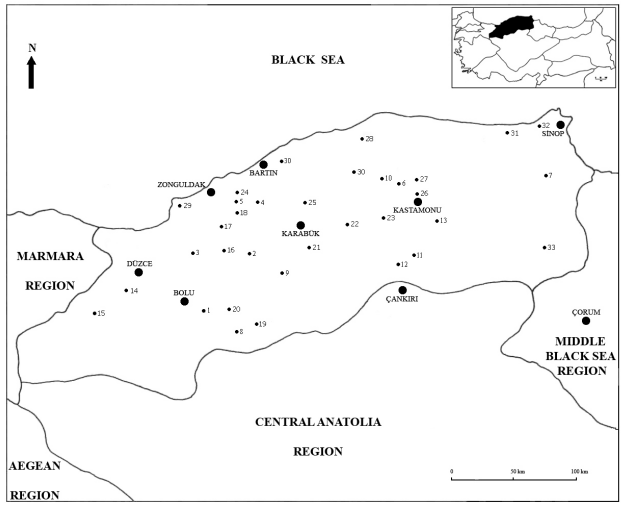

Fig. 1: The Location of the Western Black Sea Region.

For all species of noctuids herein reported, the number of collected specimens, sex, geographic distribution, host plants, and identified parasitoids are provided. Collecting localities, in numerical sequence, and their coordinates, altitudes, habitats and the date the insects were collected are shown in Tab. 1. All specimens are deposited in the collection of the Zoological Museum of Department of Biology, Trakya University, Turkey.

Tab. 1: Localities researched in west Black Sea Region and their coordinates, altitudes, habitats, and collecting dates.

Loc. No	Locality	Coordinates	Altitude (m.)	Habitat	Collecting Dates
1	Bolu-İzzet Baysal Üni. Campus	40° 31' 50" N 31° 37' 35" E	570	*Pinus* (Pinaceae) forest	27.06.2001 28.06.2003 15.07.2004
2	Bolu-Mengen-Kıyaslar	40° 58' 26" N 32° 04' 36" E	700	*Pinus* (Pinaceae), *Salix* (Salicaceae), meadow	28.06.2001 15.07.2004
3	Bolu-Mengen-Çukurören	40° 59' 30" N 31° 36' 40" E	700	*Pinus* (Pinaceae) forest, *Rubus* (Rosaceae), meadow	29.06.2001 15.08.2004
4	Zonguldak-Devrek-Davulga	41° 20' 49" N 32° 05' 45" E	280	*Quercus* (Fagaceae), *Urtica* (Urticaceae) *Rhododenron* (Ericaceae), *Trifolium* (Fabaceae), *Hypericum* (Clusiaceae),*Umbellifera*,	29.06.2001 19.07.2003 12.09.2004

Loc. No	Locality	Coordinates	Altitude (m.)	Habitat	Collecting Dates
				(Apiaceae), *Prunus* (Rosaceae)	
5	Zonguldak-Çaycuma-Kayıkçılar	41° 25' 10" N 31° 58' 20" E	20	*Populus* (Salicaceae), meadow	30.06.2001
6	Kastamonu-Daday-Sarpun	41° 30' 10" N 33° 31' 05" E	1350	*Abies* (Coniferae) forest, orchards [*Malus Prunus* (Rosaceae)]	01.07.2001
7	Sinop-Boyalı-Drenaz passage	41° 35' 10" N 35° 05' 40" E	1350	*Abies* (Coniferae) forest, *Rubus*, *Rosa canina* (Rosaceae), *Rhododendron* (Ericaceae), Pterophyta	07.09.2001 10.09.2003 08.06.2004 09.06.2004
8	Bolu-Gölcük	40° 24' 55" N 31° 57' 50" E	850	*Abies* and *Pinus* (both Pinaceae) forest	27.08.2002 28.06.2003 25.07.2004
9	Karabük-Eskipazar-Ortaköy	40° 45' 15" N 32° 20' 55" E	720	*Nicotina* (Solanaceae), orchard and wheat field, *Rumex* (Polygonaceae)	28.08.2002
10	Kastamonu-Daday-Ballıdağ	41° 34' 20" N 33° 24' 10" E	1750	*Abies* and *Pinus* (both Pinaceae) forest	29.08.2002 01.07.2003 29.08.2004
11	Kastamonu-Çatören	40° 56' 30" N 33° 39' 50" E	1000	*Abies* (Pinaceae) forest, *Rubus* (Rosaceae), *Urtica* (Urticaceae)	30.08.2002 07.09.2003 28.08.2004
12	Kastamonu-Ilgaz mountain	40° 50' 40" N 33° 30' 10" E	1820	*Abies* (Pinaceae) forest	30.08.2002 02.07.2003 05.09.2003
13	Kastamonu-Akkaya	41° 15' 20" N 33° 51' 45" E	1150	*Pinus* (Pinaceae) forest, *Zea mays* (Poaceae), meadow	31.08.2002
14	Düzce-Kabalar-Şifalısu	40° 40' 10" N 30° 45' 30" E	200	*Rubus* (Rosaceae), *Corylus* (Corylaceae), Leguminaceae	25.06.2003 03.09.2003
15	Bolu-Dokurcun-Sepetçiler	40° 31' 05" N 30° 24' 10" E	400	*Platanus* (Platanaceae) *Rubus* (Rosaceae), *Corylus* (Corylaceae), *Populus* (Salicaceae), and meadow	25.06.2003 16.07.2004 18.08.2004
16	Bolu-Mengen-Siyamoğlu	40° 59' 50" N 31° 45' 05" E	680	*Quercus* (Fagaceae) *Pinus* (Pinaceae), *Salix* (Salicaceae), meadow	26.06.2003 10.07.2003 16.08.2003 16.07.2004

Loc. No	Locality	Coordinates	Altitude (m.)	Habitat	Collecting Dates
17	Zonguldak-Devrek	41° 10' 10" N 31° 43' 45" E	60	*Platanus* (Platanaceae), *Pinus* (Pinaceae) forest, *Urtica* (Urticaceae), *Euphorbia* Euphorbiaceae), meadow, Pterophyta	27.06.2003 17.07.2003 19.08.2003 12.09.2004
18	Zonguldak-Devrek Forest office	41° 18' 30" N 31° 58' 50" E	700	*Platanus* (Platanaceae), *Pinus* (Pinaceae) forest, meadow, *Euphorbia* (Euphorbiaceae), Pterophyta	27.06.2003 29.06.2003 15.07.2003 25.08.2004
19	Bolu-Gölcük-Aladağ	40° 29' 20" N 32° 03' 55" E	1250	*Pinus* (Pinaceae) forest, graminae, *Rumex* (Polygonaceae)	28.06.2003 19.07.2003 04.08.2004
20	Bolu-Yeniçağ	40° 32' 35" N 31° 50' 10" E	700	*Quercus* (Fagaceae), *Rhododendron* (Ericaceae), *Urtica* (Urticaceae), meadow	28.06.2003
21	Karabük-Çayköy	41° 01' 30" N 32° 39' 20" E	295	Wheat field	29.06.2003 21.07.2003 06.08.2004
22	Kastamonu-Araç-İğdir	41° 11' 05" N 33° 02' 30" E	650	*Quercus* (Fagaceae) forest and Wheat field	29.06.2003 22.07.2003 17.07.2004
23	Kastamonu-Araç-Çukurpelit	41° 16' 50" N 33° 24' 50" E	650	*Quercus* (Fagaceae), *Salix*, *Populus* (Salicaceae)	29.06.2003 20.07.2003
24	Zonguldak-Çaycuma	41° 27' 40" N 31° 59' 10" E	90	*Platanus*, Platanaceae), *Populus* (Salicaceae),meadow, *Zea mays* (Poaceae), *Hipericum* sp. (Hypericaceae)	30.06.2003 12.07.2003 22.08.2004
25	Karabük-Safranbolu-İnceçay village-Sarıçiçek mountain	41° 20' 35" N 32° 36' 50" E	1000	*Pinus* (Pinaceae), *Quercus* (Fagaceae), *Ulmus* (Ulmaceae) forest, meadow	30.06.2003 05.07.2003 26.08.2004
26	Kastamonu	41° 25' 10" N 33° 42' 15" E	798	*Pinus* (Pinaceae) trees	01.07.2003 06.07.2003 27.08.2004
27	Kastamonu-Küre-Masruf passage	41° 31' 50" N 33° 41' 50" E	1250	*Abies* and *Pinus* (both Pinaceae) forest	01.07.2003 21.07.2004 07.08.2004

Loc. No	Locality	Coordinates	Altitude (m.)	Habitat	Collecting Dates
28	Kastamonu-Şenpazar-Isırganlı Mountain	41° 46' 15" N 33° 12' 45" E	950	*Abies* (Coniferae), *Pinus* (Pinaceae) forest and meadow	17.07.2003 13.07.2004 13.08.2004 24.09.2004
29	Zonguldak-Ereğli	41° 20' 20" N 31° 25' 55" E	10	*Rubus* (Rosaceae), *Corylus* (Corylaceae), Labitacea, Pterophyta, meadow	03.09.2003
30	Kastamonu-Azdavay-VallaCanyon	41° 38' 20" N 33° 05' 10" E	1100	*Salix* (Salicaceae), orchard, meadow	05.09.2003 06.06.2004
31	Sinop-Ayancık-Akgöl	41° 48' 15" N 34° 41' 15" E	15	*Abies* (Pinaceae) forest, *Rubus* (Rosaceae), Pterophyta	06.09.2003
32	Sinop-Yeniçam	41° 50' 20" N 34° 59' 20" E	25	*Populus* (Salicaceae), *Rubus* (Hypericaceae)	06.09.2003
33	Çorum-Kargı-Saraycıkdağı	41° 01' 05" N 35° 04' 25" E	1600	*Quercus* (Fagaceae), *Abies* and *Pinus* (both Pinaceae) forest	15.07.2004 16.08.2004

Systematic Entomology

A total of species of 65 Noctuidae were determined from 50 different localities. The eleven Noctuidae species are, as follows: *Agrotis segetum*, *A. ipsilon*, *Axylia putris*, *Melanchra persicariae*, *Lacanobia oleracea*, *Lamprosticta culta*, *Acronicta rumicis*, *Cosmia trapezina*, *Helicoverpa armigera*, *Earias clorana*, and *Autographa gamma*. The eight ichneumonid parasitoids are, as follows: *Anomalon cruentatum*, *Barylypa amabilis*, *Enicospilus ramidulus*, *Itoplectis alternans*, *I. maculator*, *Netelia* (*Bessobates*) *virgata*, *Parania geniculata*, and *Pimpla rufipes*). The three of the parasitoids (*Barylypa amabilis*, *Enicospilus ramidulus*, and *Itoplectis maculator*) emerged from larvae under laboratory conditions.

Agrotis segetum (DENIS-SCHIFFERMÜLLER 1775)

Material examined: **3**: 1♂; **7**: 1♂; **9**: 2♀♀; **12**: 1♂; **13**: 2♂♂; **18**: 1♀; **19**: 3♀♀; **21**: 3♂♂; **24**: 5♂♂, 4♀♀; **25**: 2♀♀, **26**: 1♂.

General distribution: Africa, America, Asia, Palaearctic (HACKER 1989).

Host plants: Herbaceous plants (POOLE 1989). Cucurbitaceae: *Cucumis* spp.; Fabaceae: *Phaseolus vulgaris*; Malvaceae: *Gossypium* spp., *Hibiscus esculentus*; Pedaliaceae: *Sesamum*; Solanaceae: *Solanum* spp.; *Lycopersicum esculentum*; *Nicotiana* spp; Poaceae: *Zea mays* (http://www.kkgm.gov.tr/birim/bitkikoruma/ teknik_talimat/ pamuk_hast_zar/bozkurtlar.pdf).

a. Parasitoid: *Barylypa amabilis* (TOSQUINET 1900)

Material examined: **13**: 1♀.

b. Parasitoid: *Enicospilus ramidulus* (LINNAEUS 1758)

Material examined: **3**: 2♂♂; **7**: 4♂♂; **9**: 1♀; **12**: 3♂♂; **13**: 2♀♀; **19**: 2♂♂, 1♀; **26**: 1♂, 1♀.

***Agrotis ipsilon* (HUFNAGEL 1766)**

Material examined: **2**: 1♂; **5**: **1**♀; **10**: 1♂; **22**: 1♂; **23**: **1**♀; **24**: **1**♀; **27**: 2♂♂, 3♀♀; **31**: **1**♀.

General distribution: Cosmopolite (HACKER 1989).

Host plants: Herbaceous plants (HACKER 1989).

Parasitoid: *Anomalon cruentatum* (GEOFFROY 1785).

Material examined: **2**: 1♀; **5**: 2♀♀; **10**: 2♂♂.

***Axylia putris* (LINNAEUS 1761)**

Material examined: **1**: 3♂♂, 1♀; **3**: 2♂♂; **7**: 4♂♂; **9**: 1♀; **12**: 3♂♂; **13**: 2♀♀; **17**: 1♂; **19**: 2♂♂; **26**: 1♀, 1♂.

General distribution: Euroasiatic (HACKER 1989).

Host plants: Caryophyllaceae: *Stellaria* spp.; Chenopodiaceae: *Atriplex* spp., Plantaginaceae: *Plantago* spp.; Polygonaceae: *Polygonum* spp., *Rumex* spp.; Rosaceae: *Galium* spp. (http://www.lepidoptera.neo.pl).

Parasitoid: *Enicospilus ramidulus* (LINNAEUS 1758).

Material examined: **3**: 2♂♂; **7**: 4♂♂; **9**: **1**♀; **12**: 3♂♂; **13**: 2♀♀; **19**: 2♂♂; **26**: 1♂, 1♀.

***Melanchra persicariae* (LINNAEUS 1761)**

Material examined: **3**: 3♂♂; **7**: 4♂♂; **9**: 1♀; **11**: 5♂♂, 3♀♀; **12**: 1♀; **13**: 6♂♂, 2♀♀; **17**: 9♂♂, 7♀♀; **19**: 2♂♂; **20**: 2♂♂, 2♀♀; **26**: 1♀.

General distribution: Asia, Europa, Siberia (HACKER 1989).

Host plants: The larvae feed on a wide range of garden and wild plants (http://www.ukmoths.org.uk).

Parasitoid: *Enicospilus ramidulus* (LINNAEUS 1758).

Material examined: **3**: 2♂♂; **7**: 4♂♂; **9**:1 ♀; **12**: 3♂♂; **13**: 2♀♀; **19**: 2♂♂; **26**: **1**♂, 1♀ (Nocturnal).

***Lacanobia oleracea* LINNAEUS 1758**

Material examined: **1**: 2♂♂, 4♀♀; **2**: 3♂♂, 2♀♀; **3**: 2♂♂; **7**: 2♀♀; **9**: 1♀ **12**: 3♂♂; **13**: 2♀♀; **19**: 8♂♂, 5♀♀; **26**: 1♀; **27**: 1♂, **3**♀♀.

General distribution: Euroasiatic (HACKER 1989).

Host plants: Large variety of low plants and shrubs (http://www.leps.it); peach orchards (MOLINEARI et al. 1995).

a. Parasitoid: *Enicospilus ramidulus* (LINNAEUS 1758).

Material examined: **3**: 2♂♂; **7**: 4♂♂; **9**: 1♀; **12**: 3♂♂; **13**: 2♀♀; **19**: 2♂♂; **26**: 1♂, 1♀.

b. Parasitoid: *Pimpla rufipes* (MILLER 1759).

Material examined: **13**: 2♂♂.

***Lamprosticta culta* (DENIS-SCHIFFERMÜLLER 1775)**

Material examined: **6**: 2♀♀; **12**: 1♂; **18**: **2**♂♂; **26**: 1♀.

General distribution: Mediterranean, Near East (HACKER 1989).

Host plants: Berberidaceae: *Berberis* spp.; Rosaceae: *Crataegus* spp., *Malus* spp., *Prunus spinosa*, *Pyrus* spp. (HACKER 1989).

Parasitoid: *Itoplectis maculator* (FABRICIUS 1775).

Material examined: **6**: 2♀♀; **12**: 2♀♀.

***Acronicta rumicis* (LINNAEUS 1758)**

Material examined: **13**: 3♂♂; **18**: 2♂♂; **29**: **1**♂.

General distribution: Euroasiatic (HACKER 1989).

Host plants: Plantaginaceae: *Plantago* spp.; Polygonaceae: *Rumex* spp.; Rosaceae: *Crataegus* spp.; Salicaceae: *Salix* spp., *Populus* spp. (http://www.lepidoptera.neo.pl).

Parasitoid: *Pimpla rufipes* (MILLER 1759).

Material examined: **13**: 2♂♂.

***Cosmia trapezina* (LINNAEUS 1758)**

Material examined: **1**: 2♂♂; **8**: 2♂♂, 3♀♀; **14**: 3♂♂, 3♀♀; **30**: **3**♂♂, 2♀♀.

General distribution: Europe, Near East, North Africa (HACKER 1989).

Host plants: Polyfag. Betulaceae: *Betula* spp.; Corylaceae: *Corylus avellana*; Fagaceae: *Quercus* spp.; Rosaceae: *Prunus* spp.; Ulmaceae: *Ulmus glabra* (http://www.lepidoptera.neo.pl).

Parasitoid: *Netelia* (*Bessobates*) *virgata* (GEOFFROY 1785).

Material examined: **1**: 2♂♂.

***Helicoverpa armigera* (HÜBNER 1803)**

Material examined: **13**: 2♀♀; **16**: **1**♂; **28**: 2♂♂, **2**♀♀; **32**:1 ♀.

General distribution: Paleotropik, Subtropik (HACKER 1989).

Host plants: Resedaceae: *Reseda* spp., Solanaceae: *Nicotiana* spp. (http://www.lepidoptera.neo.pl).

Parasitoid: *Barylypa amabilis* (TOSQUINET 1900).

Material examined: **13**: **2**♀♀.

***Earias clorana* (LINNAEUS 1761)**

Material examined: **18**: 1♀; **25**: 1♀.

General distribution: Europe, Near East (HACKER 1989).

Host plants: Salicaceae: *Salix* spp. (HACKER 1989).

Parasitoid: *Parania geniculata* (HOLMGREN 1857).

Material examined: **25**: 1♂.

***Autographa gamma* (LINNAEUS 1758)**

Material examined: **3**: 1♀; **4**: **2**♂♂; **6**: 4♀♀; **12**: 1♂; **15**: 1♀; **32**: 2♂♂, 1♀; **33**: **1**♂.

General distribution: Euroasiatic (HACKER 1989).

Host plants: Lamiaceae: *Lamium* sp., *Stachys* sp., *Galeopsis* sp., *Menta* sp., *Prunus* sp., *Rubus* sp., *Sambucus* sp. (POOLE 1989); agricultural plants grown in greenhouses (YAŞARAKINCI & HINCAL 1997).

a. Parasitoid: *Itoplectis alternans* (GRAVENHORST 1829).

Material examined: **4**: 2♀♀.

b. Parasitoid: *Itoplectis maculator* (FABRICIUS 1775).

Material examined: **6**: 2♀♀; **12**: 2♀♀.

Discussion

Enicospilus ramidulus, which is the parasitoid of 13 Noctuidae species worldwide (Taxapad, 2006), is the dominant parasitoid in our study area in four species of noctuids: *Agrotis segetum*, *Axylia putris*, *Melanchra persicariae*, and *Lacanobia oleracea*. *Barylypa amabilis* and *Itoplectis maculator* use more than one host in the same area by parasitizing *Agrotis segetum* as well as *Helicoverpa armigera* and *Lamprosticta culta* as well as *Autographa gamma*, respectively.

The presence of common host plant helps explaining the sympatry of *Agrotis segetum* (Noctuidae), *Barylypa amabilis*, and *Enicospilus ramidulus* (the latter two, Ichneumonidae,

Table 1). *Barylypa amabilis* feeds on *Trifolium* sp. and *Zea mays*, whereas *Enicospilus ramidulus* feeds on *Nicotiana* sp. and *Rumex* sp. (TAXAPAD, 2006). The host *Agrotis segetum* is a polyphagous species and uses same plants for food as its parasitoids. There are similar cases of habitat and food share of hosts and its parasitoids in the study area. For instance, *Enicospilus ramidulus* shares *Rumex* as food with its host *Axylia putris*, *Melanchra persicaria* and *Lacanobia oleracea*. *Helicoverpa armigera*, economically harmful on *Zea mays*, shares host this plant with its parasitoid *Barylypa amabilis*. *Prunus* and *Malus* are the common foods of *Itoplectis maculator* and its hosts *Lamprosticta culta* and *Autographa gamma*, whereas the former is the shared food of *Itoplectis alternans* and its host *Autographa gamma* (TAXAPAD 2006).

We expect that *Barylypa amabilis* and *Enicospilus ramidulus* will play important roles in future biological control of *Agrotis segetum*, an economically important species on cultivated plants in Turkey, such as *Cucumis* spp. (cucumber), *Phaseolus vulgaris* (bean), *Sesamum* spp. (sesame), *Solanum* spp. (potato), *Nicotiana* spp (tobacco) and *Zea mays* (corn).

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References

CAITLIN V.J. & M.E.A. WHITEHOUSE (2004): Mass rearing of two larval parasitoids of *Helicoverpa* spp. (Lepidoptera: Noctuidae): *Netelia producta* (BRULLÉ) and *Heteropelma scaposum* (MORLEY) (Hymenoptera: Ichneumonidae) for field release. – Australian Journal of Entomology **43**: 83-87.

CHO Y.-H., NAM S.-H. & O. KWON (2006): Interaction of *Acronicta rumicis* (Lepidoptera: Noctuidae) and its larval parasitoid, *Glyptapanteles liparidis* (Hymenoptera: Ichneumonidae). – Entomological Research **36**: 79-84.

DELRIO G.R. (1975): Revision des especes ouest-palearctiques du genre *Netelia* GRAY (Hym.: Ichneumonidae). – Annali Della Facolta di Agraria dell'Universita di Sassari **23**: 1-125.

FERNANDEZ-ARHEX V. & J.C. CORLEY (2003): The Functional Response of Parasitoids and its Implications for Biological Control. – Biocontrol Science and Technology **13** (4): 403-413.

FITTON M.G., SHAW M.R. & A.D. AUSTIN (1987): The Hymenoptera Associated With Spiders in Europe. – Zoological Journal of the Linnean Society **90**: 63-93.

FITTON M.G., SHAW M.R. & I.D. GAULD (1988): Pimpline Ichneumon-Flies, Hymenoptera, Ichneumonidae (Pimplinae). Handbooks for the Identification of British Insects. – Royal Entomological Society of London **7** (1): 1-110.

GAULD I.D. & B. BOLTON (1988): The Hymenoptera. British Museum (Natural History). – Oxford University Press. New York, U.S.A. 332 pp.

GEORGIEV G. & J. KOLAROV (1999): New Ichneumonidae (Hymenoptera) parasitoids of forest insect pests in Bulgaria. – Anzeiger für Schädlingskunde, Journal of Pest Science **72** (3): 57-61.

HACKER H. (1989): Die Noctuidae Griechenlands. Mit einer Übersicht der Fauna des Balkanraumes. – Herbipoliana, Marktleuthen, Deutschland **2**: 1-589 pp.

HACKER H. (1990): Die Noctuidae Vorderasiens (Lepidoptera). – Neue Entomologische Nachrichten **27**: 1-707.

HACKER H., RONKAY L. & M. HREBLAY (2002): Noctuidae Europeae Hadeninae I. – Entomological Press. Soro, Denmark. 419 pp.

HOBALLAH M.E., DEGEN T., DAVID B., SAVIDAN A., TAMO C. & T.C.J. TURLINGS (2004): Occurrence and direct control potential of parasitoids and predators of the fall armyworm (Lepidoptera: Noctuidae) on maize in the subtropical lowlands of Mexico. – Agricultural and Forest Entomology **6**: 83-88.

http://www.kkgm.gov.tr/birim/bitkikoruma/teknik_talimat/pamuk_hast_zar/bozkurtlar.pdf: Accessed on 05.V.2007.

http://www.leps.it: Accessed on 06.V.2007.

http://www.lepidoptera.neo.pl: Accessed on 07.V.2007.

http://www.nic.funet.fi: Accessed on 05.V.2007.

http://www.ukmoths.org.uk: Accessed on 05.V.2007.

KASPARYAN D.R. (1981): Opredelitel Nasekomich Europeiskoy Casti U.S.S.R. III. Part. – Prepontchatokrilie **3**: 1-688 (In Russian).

KOLAROV J. (1997): Hymenoptera, Ichneumonidae Part 1. Pimplinae, Xoridinae, Acaenitinae, Collyriinae. – Fauna Bulgarica 25 Editio Academica 'Prof. Marin Drinov & Pensoft. Sofia, Bulgaria. 320 pp. (In Bulgarian, with English keys).

KORNOŞOR S. (1982): Systematic of Çukurova Noctuidae (Lep.) Fauna and Hadeninae, Amphipyrinae adults. Associate Professor Thesis. – University of Çukurova, Faculty of Agriculture, Department of Plant Protection. Adana, Turkey. 210 pp. (In Turkish).

LIBURD O.E., FUNDERBURK J.E. & S.M. OLSON (2000): Effect of biological and chemical insecticides on *Spodoptera* species (Lep., Noctuidae) and marketable yields of tomatoes. – Journal of Applied Entomology **124** (1): 19-25.

MAYER H. & H. AKSOY (1998): Türkiye Ormanları (Forest of Turkey). Western Black Sea Forestry. – Research Institute Bolu, Turkey. 291 pp. (In Turkish).

MOLINARI F., REGUZZI M.C., QUAGLIA M., GALLIANO A. & P. CRAVEDI (1995): Damage by noctuid larvae in peach orchards. – Informatore Fitopatologico **45** (11): 17-26.

PIERCE N.F. (1967): The genitalia of the Group Noctuidae of the Lepidoptera of the British Islands. – Classey. Liverpool, England, United Kingdom. 88 pp.

POOLE R.W. (1989): Lepidopterum Catalogus Noctuidae Part 1-2. – Systematic Entomology Laboratory USDH c/o U.S. National Museum of Natural History Washington D.C.

TOPRAK U. & M.O. GÜRKAN (2005): An alternative management model of *Spodoptera littoralis* BOISD. (Lepidoptera: Noctuidae) to chemical control. – II. International Environmental Protection Symposium, Dumlupınar University, Kütahya-Turkey.

WAHL B.D. (1993): Family Ichneumonidae. pp. 395-509. – In: GOULET H. & J.T. HUBER (Eds), Hymenoptera of the World: an identification guide to families. Research Branch Agriculture Canada Publication 1894/E, Ottawa, Canada. 668 pp.

YAŞARAKINCI N. & P. HINCAL (1997): Investigations on harmful and useful species found on tomato, cucumber, pepper and lettuce grown in gren-houses in Izmir and their population densities. – Plant Protect Bulletin **37** (1-2): 79-89. (In Turkish).

YU D.S., ACHTERBERG C. & K. HORSTMANN (2006): Interactive Catalogue of World Ichneumonoidea Taxonomy, biology, morphology and distribution. – Compact Disc (Master version). Taxapad, Vancouver, Canada.

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