

Full Length Research Paper

Light trap surveys for moths in Sile region of Istanbul, Turkey

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In this study, Heterocera species collected by light trap method in Sile region, Istanbul province, Turkey during the years of 2007 - 2008 was evaluated. A total of 194 specimens were collected from 48 different locations in Sile. According to identification results, 70 species belonging to 15 families were recorded. The family Noctuidae was represented by the highest number of species (26), followed by Geometridae (16) and Notodontidae (6).

Key words: Light traps, moths, fauna, Sile.

INTRODUCTION

Lepidoptera, butterflies and moths, are very common insects and well known because of their very attractive colours and patterns on their wings. This order is recognized as one of the largest order of insects (Romoser and Stoffolana, 1994) having more than 120 000 described species (Groombridge, 1992). Lepidoptera are found in a wide variety of habitats but are almost always associated with higher plants, especially angiosperms. Nielsen and Common (1991) suggested that the evolution of the proboscis was a major factor in the success of the order. Adults of the majority of extant species feed on nectar, the juice of overripe fruit or other liquids. Larvae of almost all species are phytophagous, and no parts of plants remain unexploited. Because of their phytophagous habits and high reproductive rate, many species are important pests (Gillott, 2005). Some authors divide Lepidoptera into two different suborders; Rhopalocera (butterflies and skippers) and Heterocera (moths) (Romoser and Stoffolana, 1994).

Rhopalocera species differ from Heterocera species by some characteristic features such as: (1) thin antennae with knob on tips versus threadlike or feathery antennae with no knob on tips; (2) wings generally held vertically over body when at rest versus wings generally held flat, either out at sides or over the back; (3) usually diurnal

fliers rather than ordinarily nocturnal fliers; (4) brightly coloured instead of generally dull coloured; and (5) pupa in naked chrysalis versus pupa enclosed in cocoon or concealed under debris, wood, or rocks (Coulson and Witter, 1984). There are several regional studies to determine the Lepidoptera fauna in Turkey (Akbulut et al., 2003; Akkuzu et al., 2007; Avci, 1997; Beskardes, 2002; Can, 2008; Cebeci, 2003, De Lattin, 1950, 1951; Graves, 1925, 1926; Hakyemez, 1994; Hesselbarth et al., 1995; Kansu, 1963; Kaygin et al., 2009; Kornosor, 1987; Mathew, 1881; Mol, 1977; Okyar and Aktac, 1998, 1999; Rebel, 1903).

MATERIALS AND METHODS

The study was conducted between the years of 2007 and 2008 in 48 villages located within Istanbul Sile region (Figure 1). Sile (Şile) is a small holiday town on the Black Sea coasts, 70 km from the city of Istanbul. Forested area covers 57421 ha and that means 73% of the total area is forested area. Sile forests are in the form of deciduous forests, composed of various tree species and tall shrubs. In the forested area dominant trees are *Fagus orientalis*, *Quercus* spp., *Alnus glutinosa*, *Acer campestre*, *Fraxinus excelsior*, *Carpinus betulus*, *Castanea sativa*, *Tilia tomentosa* and *Pouulus tremula*. Having rich flora and suitable climate conditions enabled Sile owning rich and divergent Biodiversity.

Specimens were collected using a light trap, including 20 watt Philips energy saver white day light bulb. Captured specimens were put into tightly closed killing jars immediately and brought to the laboratory for preparation and identification. Ethyl acetate was used as a killing agent. The collecting dates and locations concerning each specimen were recorded in the field note book. Specimens were

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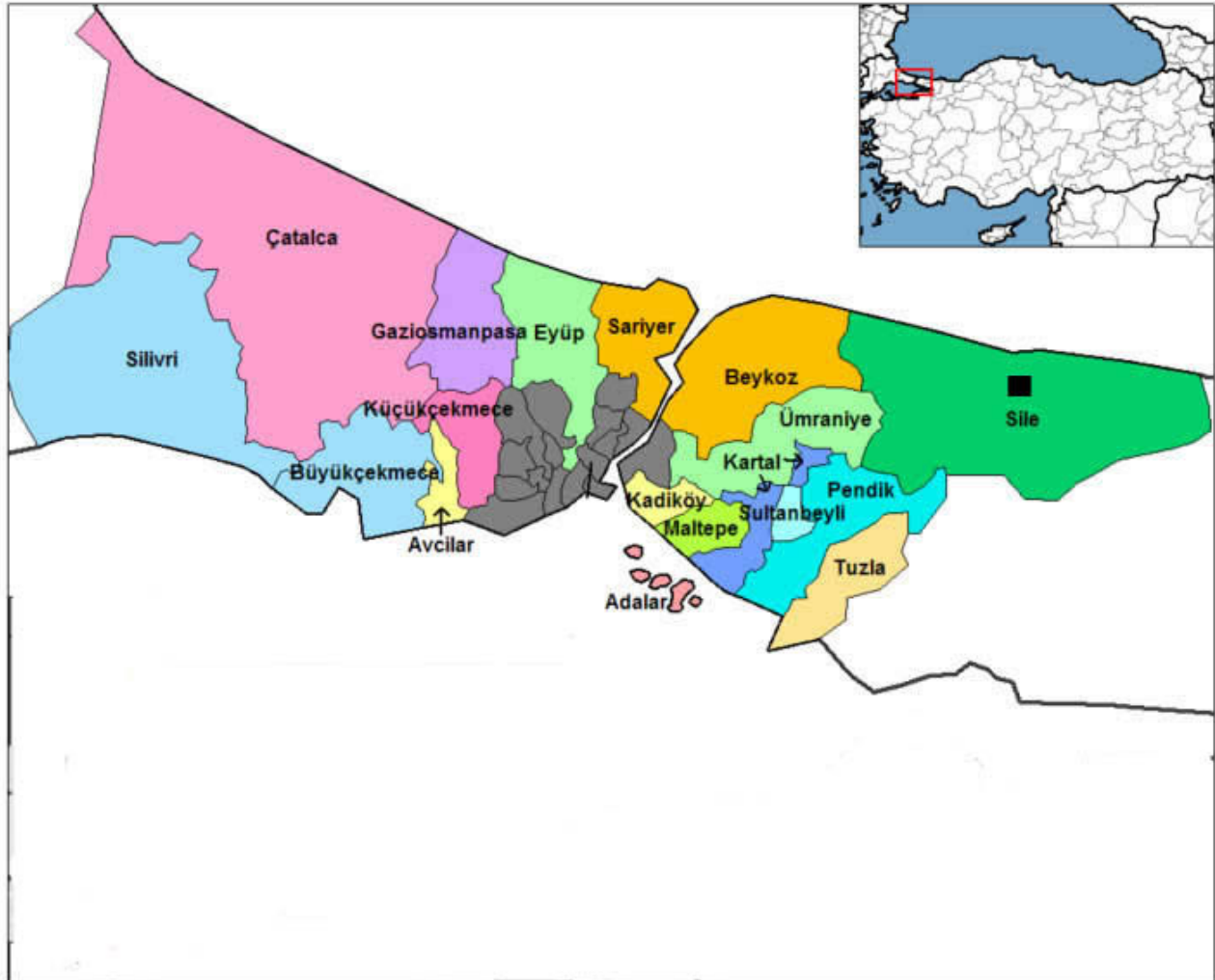


Figure 1. Sile region of Istanbul, Turkey.

pinned using insect pins (mostly, 3 - 4 - 5 sized) and were mounted on spreading boards. For identification, different studies (Fibiger, 1993; Forster and Wohlfahrt, 1971; Marini and Trentini, 1986; NHM, 2009; Savela, 2001; Spuler, 1910) were used. The Lepidoptera collections of Forest Entomology and Protection Department of Istanbul University, Faculty of Forestry were also used.

RESULTS AND DISCUSSION

A total of 194 Heterocera specimens were collected from 48 different localities in Sile region of Istanbul. 70 species belonging to 15 families of the order Lepidoptera were identified and listed as follows. Although, family names were listed according to phylogenetic rules (Kocak and Seven, 2001), species in each family were arranged alphabetically.

Order **LEPIDOPTERA** Linnaeus, 1758

Suborder **HETEROCERA**

Superfamily **OECOPHOROIDEA** Bruand, 1850

Family **ETHMIIDAE** Busck, 1909

Ethmia bipunctella (Fabricius, 1775)

Superfamily **YPONOMEUTOIDEA** Stephens, 1829

Family **YPONOMEUTIDAE** Stephens, 1829

Yponomeuta padella (Linnaeus, 1758)

Superfamily **COSSOIDEA** Leach, [1815]

Family **COSSIDAE** Leach, [1815]

Cossus cossus (Linnaeus, 1758)

Zeuzera pyrina (Linnaeus, 1761)

Superfamily **TORTRICOIDEA** Latreille, [1803]

Family **TORTRICIDAE** Latreille, [1803]

Tortrix viridana (Linnaeus, 1758)

Superfamily **PYRALOIDEA** Latreille, 1809

Family **PYRALIDAE** Latreille, 1809

Crambus pascuella (Linnaeus, 1758)

Dioryctria abietella (Denis & Schiffermüller, 1775)

Nomophila noctuella (Denis & Schiffermüller, 1775)

Oncocera semirubella (Scopoli, 1763)

Superfamily **BOMBYCOIDEA** Latreille, [1803]

Family **LASIOCAMPIDAE** Harris, 1841
Lasiocampa quercus (Linnaeus, 1758)

Family **SATURNIIDAE** Boisduval, 1837
Saturnia pavonia (Linnaeus, 1758)

Superfamily **GEOMETROIDEA** Leach, [1815]
 Family **GEOMETRIDAE** Leach, [1815]
Alcis repandata (Linnaeus, 1758)
Ascotis selenaria (Denis & Schiffermüller, 1775)
Campaea margaritata (Linnaeus, 1767)
Cosmorhoe ocellata (Linnaeus, 1758)
Geometra papilionaria (Linnaeus, 1758)
Gnophos sartata (Treitschke, 1827)
Hemistola chrysoprasaria (Esper, 1795)
Hemitea aestivaria (Hübner, 1789)
Idaea aversata (Linnaeus, 1758)
Idaea ochrata (Scopoli, 1763)
Melanthia procellata (Denis & Schiffermüller, 1775)
Opisthograptis luteolata (Linnaeus, 1758)
Peribatodes rhomboidaria (Denis & Schiffermüller, 1775)
Plagodis dolabraria (Linnaeus, 1767)
Scopula nigropunctata (Hufnagel, 1767)
Selenia lunaria (Hübner, 1788)

Superfamily **DREPANOIDEA** Boisduval, 1828
 Family **DREPANIDAE** Boisduval, 1828
Habrosyne pyritoides (Hufnagel, 1766)

Family **THYATIRIDAE** Smith, 1893
Thyatira batis (Linnaeus, 1758)

Superfamily **NOCTUOIDEA** Latreille, 1809
 Family **NOTODONTIDAE** Stephens, 1828
Drymonia dodonaea (Denis & Schiffermüller, 1775)
Phalera bucephala (Linnaeus, 1758)
Pheosia tremula (Clerck, 1759)]
Pterostoma palpina (Clerck, 1759)
Spatialia argentina (Denis & Schiffermüller, 1775)
Stauropus fagi (Linnaeus, 1758)

Family **THAUMETOPOEIDAE** Aurivillus, 1889
Thaumetopoea processionea (Linnaeus, 1758)

Family **LYMANTRIIDAE** Hampson, [1893]
Calliteara pudibunda (Linnaeus, 1758)
Euproctis chrysorrhoea (Linnaeus, 1758)
Lymantria dispar (Linnaeus, 1758)
Lymantria monacha (Linnaeus, 1758)

Family **ARCTIIDAE** Leach, [1815]
Arctia villica (Linnaeus, 1758)
Miltochrista miniata (Forster, 1771)
Phragmatobia fuliginosa (Linnaeus, 1758)
Spilosoma lubricipeda (Linnaeus, 1758)

Family **NOCTUIDAE** (Latreille, 1809)
Acronicta psi (Linnaeus, 1758)
Aedia funesta (Esper, 1786)
Agrotis cinerea (Denis & Schiffermüller, 1775)
Agrotis ipsilon (Hufnagel, 1766)
Amphipyra pyramidea (Linnaeus, 1758)
Autographa gamma (Linnaeus, 1758)

Bena bicolorana (Linnaeus, 1758)
Callopietria juvenina (Stoll, 1782)
Chersotis margaritacea (Villers, 1789)
Chloantha hyperici (Denis & Schiffermüller, 1775)
Conistra rubiginea (Denis & Schiffermüller, 1775)
Dysgonia algira (Linnaeus, 1758)
Emmelia trabealis (Scopoli, 1763)
Epilecta linogrisea (Denis & Schiffermüller, 1775)
Euplexia lucipara (Linnaeus, 1758)
Heliolithis peltigera (Denis & Schiffermüller, 1775)
Herminia tarsipennalis Treitschke, 1835
Lacanobia w-latinum (Hufnagel, 1766)
Melanchna persicariae (Linnaeus, 1761)
Minucia lunaris (Denis & Schiffermüller, 1775)
Moma alpium (Osbeck, 1778)
Mythimna vitellina (Hübner, 1808)
Noctua orbona (Hufnagel, 1766)
Noctua pronuba (Linnaeus, 1758)
Tyta luctuosa (Denis & Schiffermüller, 1775)
Xestia castanea (Esper, 1798)

The highest number of species belongs to Noctuidae (26, 37.2%), followed by Geometridae (16, 22.9%) and Notodontidae (6, 8.6%). The number of species in each family (Figure 2) and their ratios to the families were given in Table 1. In Table 2, the data concerning the capturing dates and the collecting locations about each specimen were given.

Conclusions

In this research, 70 species belonging to 15 families of suborder Heterocera were captured and identified in Sile region of Istanbul. Most of the species were from three families: Noctuidae (26, 37.2%), followed by Geometridae (16, 22.9%) and Notodontidae (6, 8.6%). Among the lepidopteran species collected, 33 were considered pests for forest trees: *C. cossus*, *Z. pyrina*, *T. viridana*, *D. abietella*, *L. quercus*, *S. pavonia*, *A. repandata*, *C. margaritata*, *G. papilionaria*, *H. aestivaria*, *P. dolabraria*, *S. lunaria*, *H. pyritoides*, *D. dodonaea*, *P. bucephala*, *P. tremula*, *P. palpina*, *S. argentina*, *S. fagi*, *T. processionea*, *C. pudibunda*, *E. chrysorrhoea*, *L. dispar*, *L. monacha*, *P. fuliginosa*, *S. lubricipeda*, *A. psi*, *A. pyramidea*, *B. bicolorana*, *C. rubiginea*, *L. w-latinum*, *M. lunaris* and *M. alpium* (Kimber, 2009; Savela, 2001). Oak (*Quercus* spp.) is the dominant tree in the region and according to the literature (Kimber, 2009; Savela, 2001), *C. cossus*, *T. viridana*, *L. quercus*, *S. pavonia*, *C. margaritata*, *H. aestivaria*, *S. lunaria*, *D. dodonaea*, *P. bucephala*, *S. argentina*, *T. processionea*, *C. pudibunda*, *E. chrysorrhoea*, *L. dispar*, *L. monacha*, *A. psi*, *A. pyramidea*, *B. bicolorana*, *C. rubiginea*, *L. w-latinum*, *M. lunaris* and *M. alpium* caterpillars prefer oak leaves as their food plants.

Z. pyrina differs from these species as its larvae food regimes. The adults of *Z. pyrina* fly during June and July

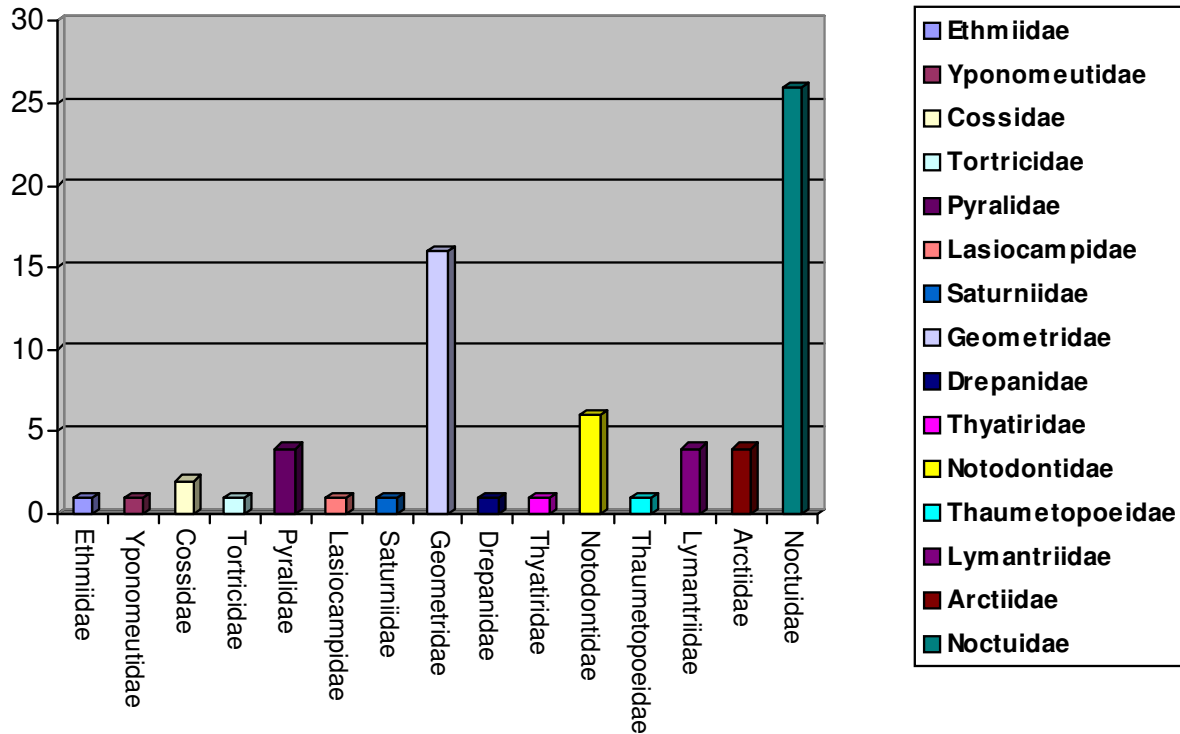


Figure 2. Number of species in each family.

Table 1. Number of species and rates of families.

Family	Number of species	Rate (%)
Ethmiidae	1	1.4
Yponomeutidae	1	1.4
Cossidae	2	3.0
Tortricidae	1	1.4
Pyralidae	4	5.7
Lasiocampidae	1	1.4
Saturniidae	1	1.4
Geometridae	16	22.9
Drepanidae	1	1.4
Thyatiridae	1	1.4
Notodontidae	6	8.6
Thaumetopoeidae	1	1.4
Lymantriidae	4	5.7
Arctiidae	4	5.7
Noctuidae	26	37.2
Total	70	100

were collected in the end of July and in the beginning of August. *L. monacha* adults are different from *L. dispar* adults by means of morphological appearances. They often show traces of bright pink colour on the body, especially the abdomen, which however is normally concealed when at rest. *L. monacha* was regarded as the first record for the region.

Most of the species obtained were collected in summer months. This was because summer is the most suitable season for the mating and regeneration activities of Lepidopteran adults.

As Kaygin et al. (2009) said: the habitats, where the butterfly and moth species have been abundantly observed should be protected and these particular

Table 2. The capturing dates and the collecting locations about each specimen in Sile region.

Species	Date and location
<i>Ethmia bipunctella</i>	23.08.2008 Bickidere (1). Totally 1 specimen
<i>Yponomeuta padella</i>	28.06.2007 Akcakese (1). Totally 1 specimen
<i>Cossus cossus</i>	09.06.2007 Sofular (1). Totally 1 specimen
<i>Zeuzera pyrina</i>	17.07.2007 Cayirbasi (1♂); 22.06.2008 Yenikoy (1♀). Totally 2 specimens
<i>Tortrix viridana</i>	24.07.2008 Hacilli (1). Totally 1 specimen
<i>Crambus pascuella</i>	03.08.2007 Ovacik (2); 05.08.2008 Tavsantepe Fire Tower (3). Totally 5 specimens
<i>Dioryctria abietella</i>	14.06.2008 Karabeyli (1); 15.06.2008 Imrendere (1). Totally 2 specimens
<i>Nomophila noctuella</i>	22.06.2007 Kabakoz (1). Totally 1 specimen
<i>Oncocera semirubella</i>	03.08.2008 Tavsantepe Fire Tower (1). Totally 1 specimen
<i>Lasiocampa quercus</i>	15.08.2008 Kizilca (1♂). Totally 1 specimen
<i>Saturnia pavonia</i>	20.04.2008 Darlik (1♂). Totally 1 specimen
<i>Alcis repandata</i>	15.06.2007 Erenler (1). Totally 1 specimen
<i>Ascotis selenaria</i>	25.08.2008 Bozkoca (1). Totally 1 specimen
<i>Campaea margaritata</i>	22.07.2007 Orucoglu (1); 28.07.2007 Gokmasli (1). Totally 2 specimens
<i>Cosmorhoe ocellata</i>	19.07.2007 Geredeli (1). Totally 1 specimen
<i>Geometra papilionaria</i>	13.06.2007 Satmazli (2). Totally 2 specimens
<i>Gnophos sartata</i>	06.08.2008 Tavsantepe Fire Tower (2). Totally 2 specimens
<i>Hemistola chrysoprasaria</i>	08.06.2008 Korucu (1). Totally 2 specimens
<i>Hemithea aestivaria</i>	29.06.2007 Kervansaray (1); 04.07.2008 Karamandere (1). Totally 2 specimens
<i>Idaea aversata</i>	29.06.2007 Kervansaray (1). Totally 1 specimen
<i>Idaea ochrata</i>	29.06.2007 Kervansaray (1); 17.07.2007 Cayirbasi (1); 15.07.2008 Cayirbasi (1); 23.07.2008 Avcikoru (3). Totally 6 specimens
<i>Melanthia procellata</i>	20.06.2007 Erenler (1). Totally 1 specimen
<i>Opisthograptis luteolata</i>	29.05.2007 Yaylali (1). Totally 1 specimen
<i>Peribatodes rhomboidaria</i>	09.05.2007 Ahmetli (1♂ and 1♀); 13.06.2007 Satmazli (1♂ and 2♀); 20.06.2007 Erenler (2♀); 25.07.2008 Karacakoy (1♂ and 1♀); 22.06.2008 Mesrutiyet (1♂ and 1♀); 23.06.2008 Mesrutiyet (3♂). Totally 14 specimens
<i>Plagodis dolabraria</i>	19.05.2007 Agacdere (1); 13.06.2007 Ovacik (1); 15.06.2008 Imrendere (1). Totally 3 specimens
<i>Scopula nigropunctata</i>	14.06.2007 Erenler (2); 17.06.2007 Erenler (1); 22.06.2008 Mesrutiyet (1); 17.07.2008 Ovacik (1); 06.08.2008 Tavsantepe Fire Tower (3). Totally 8 specimens
<i>Selenia lunaria</i>	29.05.2007 Yaylali (1). Totally 1 specimen
<i>Habrosyne pyritoides</i>	15.05.2008 Sahilkoy (4). Totally 4 specimens
<i>Thyatira batis</i>	10.06.2007 Alacali (3). Totally 3 specimens
<i>Drymonia dodonaea</i>	21.05.2008 Yazimanayir (1); 24.05.2008 Tekekoy (1); 27.05.2008 Sortullu (2). Totally 4 specimens
<i>Phalera bucephala</i>	29.06.2007 Kervansaray (2♂ and 1♀). Totally 3 specimens
<i>Pheosia tremula</i>	25.09.2008 Imrenli (1). Totally 1 specimen
<i>Pterostoma palpina</i>	30.08.2008 Goce (1♂ and 1♀). Totally 2 specimens
<i>Spatalia argentina</i>	30.06.2008 Kurfalli (3). Totally 3 specimens
<i>Stauropus fagi</i>	20.08.2008 Hacilli (1♂ and 1♀); 23.08.2008 Korucu (1♂). Totally 3 specimens
<i>Thaumetopoea processionea</i>	18.07.2007 Ovacik (1♂ and 1♀). Totally 2 specimens
<i>Calliteara pudibunda</i>	16.05.2007 Goce (2♂). Totally 2 specimens
<i>Euproctis chrysorrhoea</i>	01.07.2007 Kadikoy (1♂). Totally 1 specimen
<i>Lymantria dispar</i>	03.08.2008 Avcikoru (1♂ and 1♀). Totally 2 specimens
<i>Lymantria monacha</i>	23.07.2007 Karakiraz (1♂ and 1♀). Totally 2 specimens
<i>Arctia villica</i>	15.06.2007 Erenler (2); 09.05.2008 Karabeyli (1); 15.06.2008 Darlik (3). Totally 6 specimens
<i>Miltochrista miniata</i>	17.07.2007 Cayirbasi (3); 18.07.2007 Cayirbasi (2). Totally 5 specimens
<i>Phragmatobia fuliginosa</i>	25.07.2007 Karakiraz (2); 26.07.2007 Karakiraz (4). Totally 6 specimens
<i>Spilosoma lubricipeda</i>	20.06.2007 Karabeyli (1♂). Totally 1 specimen

Table 2. Contd.

<i>Acronicta psi</i>	15.06.2007 Erenler (1); 16.06.2007 Sile city center (1); 29.06.2008 Komurluk (2). Totally 4 specimens
<i>Aedia funesta</i>	17.07.2007 Cayirbasi (1). Totally 1 specimen
<i>Agrotis cinerea</i>	11.08.2008 Esenceli (1). Totally 1 specimen
<i>Agrotis ipsilon</i>	03.08.2008 Avcikoru (1); 03.08.2008 Tavsantepe Fire Tower (1); 04.08.2008 Kervansaray (1).Totally 3 specimens
<i>Amphipyra pyramidea</i>	17.07.2007 Kizilca (1). Totally 1 specimen
<i>Autographa gamma</i>	15.06.2007 Erenler (1); 16.06.2007 Sile city center (2); 04.08.2008 Kervansaray (2); 06.08.2008 Tavsantepe Fire Tower (2); 14.08.2008 Gokmasli (5).Totally 12 specimens
<i>Bena bicolorana</i>	25.07.2007 Korucu (3); 06.08.2008 Tavsantepe Fire Tower (2). Totally 5 specimens
<i>Callopietria juvenina</i>	13.06.2007 Satmazli (4). Totally 4 specimens
<i>Chersotis margaritacea</i>	23.05.2007 Kurna (1). Totally 1 specimen
<i>Chloantha hyperici</i>	22.06.2007 Kabakoz (1). Totally 1 specimen
<i>Conistra rubiginea</i>	09.08.2007 Sahilkoy (2). Totally 2 specimens
<i>Dysgonia algira</i>	15.06.2007 Erenler (1); 01.07.2007 Kadikoy (3). Totally 4 specimens
<i>Emmelia trabealis</i>	07.07.2007 Hasanli (2). Totally 2 specimens
<i>Epilecta linogrisea</i>	23.07.2007 Uvezli (1). Totally 1 specimen
<i>Euplexia lucipara</i>	10.08.2008 Alacali (2). Totally 2 specimens
<i>Heliothis peltigera</i>	15.05.2007 Osmankoy (1); 10.06.2007 Gokmasli (3); 17.08.2008 Bickidere (1). Totally 5 specimens
<i>Herminia tarsipennalis</i>	15.06.2007 Erenler (1). Totally 1 specimen
<i>Lacanobia w-latinum</i>	02.07.2008 Karamandere (1). Totally 1 specimen
<i>Melanchra persicariae</i>	29.06.2007 Kervansaray (1). Totally 1 specimen
<i>Minucia lunaris</i>	30.04.2007 Catakli (2). Totally 2 specimens
<i>Moma alpium</i>	30.06.2008 Kurfalli (2). Totally 2 specimens
<i>Mythimna vitellina</i>	23.07.2008 Avcikoru (2). Totally 2 specimens
<i>Noctua orbona</i>	03.08.2008 Isakoy (2). Totally 2 specimens
<i>Noctua pronuba</i>	13.06.2007 Satmazli (1); 22.06.2008 Mesrutiyet (2). Totally 3 specimens
<i>Tyta luctuosa</i>	17.07.2007 Kizilca (1). Totally 1 specimen
<i>Xestia castanea</i>	17.07.2007 Kizilca (6); 15.08.2008 Degirmencayiri (9). Totally 15 specimens
Totally 70 species	Totally 194 specimens

locations should be preserved as butterfly protection areas. Sile is one of the potential butterfly protection areas.

REFERENCES

- Akbulut S, Yuksel B, Keten A (2003). The Lepidoptera (Insecta) Fauna of Duzce Province, Turkey, Turk. J. Zool. 27(5): 257-268.
- Akkuzu E, Ayberk H, Inac S (2007). Hawk Moths (Lepidoptera: Sphingidae) of Turkey and their zoogeographical distribution. J. Environ. Biol. 28(4): 723-730.
- Avci M (1997). Tortricidae Fauna in forests of Marmara Region, Istanbul University, Forestry Faculty, Ph.D. Thesis. Istanbul.
- Beskardes V (2002). The butterfly and moth (Lepidoptera) species living in Istanbul Catalca Administration Forests. Istanbul University, Forestry Faculty, M.Sc. Thesis. Istanbul.
- Can F (2008). The Geometrid Moths (Lepidoptera) from the Middle and Eastern Black Sea Regions of Turkey. Turk J. Zool. 32: 351-358.
- Cebeci HH (2003). Entomological problems in Istanbul Regional Directorate, Istanbul University, Forestry Faculty, Ph.D. Thesis. Istanbul.
- Coulson RN, Witter JA (1984). Forest Entomology (Ecology and Management). John Wiley and Sons, New York, USA. p. 669.
- De Lattin G (1950). Türkische Lepidopteren I. Istanbul University Journal. 15(4): 301-328.
- De Lattin G (1951). Türkische Lepidopteren-II. Istanbul University Journal. 16(1): 45-73.
- Fibiger M (1993). Noctuidae Europaeae. Entomological Press, Soro, Denmark. p. 230.
- Forster W, Wohlfahrt A (1971). Die Schmetterlinge Mitteleuropas, Eulen (Noctuidae), Band: IV, Francksche Verlagshandlung Stuttgart, Germany. p. 329.
- Gillott C (2005). Entomology. Springer, Dordrecht, The Netherlands. 831.
- Graves PP (1925). Lepidoptera of the Constantinople. Entomologist, 63: 191-194.
- Graves PP (1926). Heterocera from Macedonia, Gallipoli and Central Greece. Entomologist's Rec. J. Var. 38: 152-158, 165-170.
- Groombridge B (1992). Global biodiversity: status of the Earth's living resources. Chapman and Hall, London, UK. p. 614.
- Hakyemez A (1994). The Forest Noctuidae species of Zonguldak Regional Directorate. Review of Faculty of Forestry, Istanbul University. 44(2): 111-133.
- Hesselbarth G, Van Oorschot H, Wagener S (1995). Die Tagfalter der Türkei, 3 band. Selbstverlag Sigbert Wagener Hemdener Weg 19, D 46399 Bocholt, Germany.
- Kansu A (1963). The list for Turkish Lepidoptera: V. Plant Prot. Bull. 3(3): 208-223.

- Kaygin AT, Yildiz Y, Avci M (2009). Lepidoptera fauna in Bartin province, in western black sea region of Turkey. *Afr. J. Agric. Res.* 4(9): 815-822.
- Kimber I (2009). UK moths web page from <http://www.ukmoths.org.uk/> [Verified 23 November 2009].
- Kocak AO, Seven S (2001). Tentative Checklist of the Turkish Lepidoptera web page from <http://www.members.tripod.com/entlep/Checklist.htm> [Verified 23 November 2009].
- Kornosor S (1987). Distribution and Systematics of Noctuidae and Plusiinae (Lep. Noctuidae) species in South and Southeast Region of Turkey. *Turk. Entomol. Congrees*, pp. 649-659.
- Marini M, Trentini M (1986). I Macrolepidotteri dell'appennino lucchese. *Universita degli Studi di Bologna, Istituto e Museo di Zoologia, Bologna, Italy*. p. 136.
- Mathew GF (1881). List of Lepidoptera observed in the neighbourhood of Gallipoli Turkey in 1878. *Entomologist's mon. Mag.* 18: 10-13, 29-32, 92-100.
- Mol T (1977). Gometridae species living in Marmara and Eagean Regional Forests. *Rev. of the Faculty of Forestry, University of Istanbul*, 2329(234): p. 125.
- NHM (2009). Natural History Museum web page from <http://www.nhm.ac.uk/jdsml/researchcuration/research/projects/lepindex/index.dsml> [Verified 23 November 2009].
- Nielsen ES, Common IFB (1991). Lepidoptera. In: *The Insects of Australia* (CSIRO eds). Victoria: Melbourne University Press.
- Okyar Z, Aktac N (1998). Additives to Heterocera (Lepidoptera) fauna of Thracian Region. *Turk. J. Entomol.* 22(1): 47-56.
- Okyar Z, Aktac N (1999). Faunistic and Taxonomic studies on the Geometridae species of Turkish Thrace. *Turk. J. Zool.* 23: 99-132.
- Rebel H (1903). Studien über die Lepidopterenfauna der Balkanlander I. (Bulgarien, Ostrumelien). *Annln. naturh. Mus. (Wien)*, 18: 123-347.
- Romoser SW, Stoffolano GJ (1994). *The Science of Entomology*. Wm. C. Brown Communications Inc., Iowa, USA. 532.
- Savela M (2001). K Lepidoptera web page from <http://www.funet.fi/pub/sci/bio/life/insecta/lepidoptera/index.htm> [Verified 23 November 2009].
- Spuler A (1910). *Die Schmetterlinge Europas*. E. Schweizerbartsche Verlagbuchhandlung, Stuttgart, Germany. p. 527.