

Three new Geometridae (Lepidoptera) species for the fauna of Istanbul Belgrad Forest, Turkey

Hamit Ayberk

Abstract. Belgrad Forest mainly is in the form of a deciduous forest, composed of various tree species and tall shrubs. The study was conducted between the years of 2007 and 2008 in related area. The objectives of this study were to investigate the Geometridae fauna of the area and to give the additional data on previously recorded Geometrid species in the related place. As a result of the study; a total of 63 species belonging to 4 subfamilies of the family Geometridae are determined, which of 3 are the new species for Istanbul Belgrad Forest.

Samenvatting. Drie nieuwe soorten Geometridae (Lepidoptera) voor de fauna van het Belgradwoud te Istanboel, Turkije.

Het Belgradwoud is hoofdzakelijk een loofbos, samengesteld uit verschillende boomsoorten en grote stuiken. Deze studie, met als doel de Geometridae fauna van dit woud te inventariseren en te vergelijken met literatuurgegevens, werd uitgevoerd tussen 2007 en 2008. In het totaal werden 63 soorten Geometridae gedetermineerd, behorend tot 4 subfamilies. Drie van deze soorten werden nooit eerder uit het woud vermeld.

Résumé. Trois espèces de géomètres (Lepidoptera) nouvelles pour la faune de la forêt Belgrad à Istanbul, Turquie.

La forêt de Belgrad est composée surtout d'arbres feuillus et de grandes arbustes. Cette étude, conduite en 2007 et 2008, a pour but d'établir la liste des géomètres de ce forêt et de la comparer avec des données publiés auparavant. En total 63 espèces de géomètres furent déterminés appartenant à 4 sous-familles. Trois espèces n'étaient jamais mentionnées de la forêt.

Key Words: Istanbul Belgrad Forest – Geometridae fauna – New species – Faunistics

Ayberk, H.: Istanbul University, Faculty of Forestry, Department of Forest Entomology and Protection, Bahcekoy 34473, Istanbul-Turkey. hayberk@istanbul.edu.tr.

Introduction

Belgrad Forest corresponds to 0.03% of the total forested areas in Turkey and covers an area of 5.444 ha. Elevation in the area ranges from 40–230 m. The climate of the Belgrad Forest, according to the Thorthwaite classification system, is humid, mesothermal oceanic with a moderate water deficit in summer. The soils are shallow to deep, gravely, loamy clay in texture, rich in organic matter with medium to good permeability rates. The area is geographically located on the Thracian side of Istanbul and spreads over the part of the land encased by Bosphorus on one side and the Black sea coastline on the other. Dominant vegetation of the area includes *Quercus frainetto*, *Q. cerris* and *Fagus orientalis* mixed with varying amounts of *Acer campestre*, *A. trautvetteri*, *Alnus glutinosa*, *Carpinus betulus*, *Castanea sativa*, *Populus tremula*, *Sorbus torminalis* and *Ulmus campestris* with a normal crown closure (Yaltırık 1966, Kantarcı 1980, Karaöz 1988).

The Geometridae form an extremely large and cosmopolitan group within the Lepidoptera with more than 20 000 species, about 10% of which are found in North America. Many Geometrids have slender abdomens and broad wings which are usually held flat with the hind wings visible. As such they appear

rather butterfly-like, but in most respects they are typical moths: the majority flies at night, they possess a frenulum to link the wings and the antennae of the males are often feathered. They tend to blend in to the background, often with intricate, wavy patterns on their wings. In some species, females have reduced wings, like winter moth (*Operophtera brumata*) and fall cankerworm (*Alsophila pometaria*). Most are of moderate size, about 3 cm in wingspan, but a range of sizes occur. They have distinctive paired tympanal organs at the base of the abdomen (lacking in flightless females). The name "Geometridae" ultimately derives from geometer ("earth-measurer"). This refers to the means of locomotion of the larvae or caterpillars, which lack most of the prolegs of other Lepidopteran caterpillars (Wikipedia 2001, Gillott 2005).

The objectives of this study were to investigate the Geometridae fauna of Istanbul Belgrad Forest and to give additional data on previously recorded Geometrid species from this locality.

Materials and methods

The study was conducted between the years 2007 and 2008. Species were collected using sweep nets and light traps, especially the Hiestand light trap. Each specimen was put into a killing jar and brought to the laboratory for preparation and identification process. Each specimen was pinned using insect pins and mounted on spreading boards. For identification, different studies (Spuler 1908, 1910, Mol 1977, Savela 2001) were used. The Lepidoptera collections of Forest Entomology and Protection Department of Istanbul University, Faculty of Forestry were also used.

Results

For Belgrad Forest, a total of 63 species belonging to 4 subfamilies of the family Geometridae have been listed to date. A number of 16 Geometridae species out of 63 was collected during this research. Collection dates for each species are given. The collection dates for the species previously recorded in Belgrad Forest were taken from the literature (Mol 1977, Okyar & Aktaş 1999). Although subfamily names are listed according to phylogenetic rules (Beccaloni *et al.* 2003), species within each subfamily are listed alphabetically. The subfamily Ennominae contains the highest number of species (27 – 42.9%), followed by Scopulinae (22 – 34.9%), Larentiinae (12 – 19.0%) and Geometrinae (2 – 3.2%).

Subfamily Geometrinae Leach, [1815]

1. *Geometra papilionaria* (Linnaeus, 1758); Recorded on 04.vii.1969 (Mol 1977).
2. *Hemithysa aestivaria* (Hübner, [1799]); Recorded on 08.vi.1969 and 23.vi.1969 (Mol 1977), 24.vi.1993 (Okyar and Aktaş 1999).

Subfamily Sxopulinae Duponchel, [1845]

3. *Cyclophora annulata* (Schulze, 1775); Recorded on 04.ix.1969 (Mol 1977).
4. *Cyclophora linearia* (Hübner, [1799]); Recorded on 25.vi.1969 and 02.vii.1969 (Mol 1977).
5. *Cyclophora porata* (Linnaeus, 1767); Collected on 25.vii.2008. It is a new species for the Geometridae fauna of Belgrad Forest.

6. *Cyclophora punctaria* (Linnaeus, 1758); Recorded on 10.ix.1969 (Mol 1977).
7. *Cyclophora puppillaria* (Hübner, [1799]); Recorded on 10.ix.1969 and 19.ix.1969 (Mol 1977).
8. *Idaea aversata* (Linnaeus, 1758); Recorded on 23.vi.1969 and 25.vi.1969 (Mol, 1977), 24.vi.1993 (Okyar and Aktaş 1999).
9. *Idaea consanguinaria* Lederer, 1853; Recorded on 02.vii.1970 (Mol 1977).
10. *Idaea degeneraria* (Hübner, [1799]); Collected on 06.vi.2008. It is a new species for the Geometridae fauna of Belgrad Forest.
11. *Idaea dilutaria* (Hübner, 1799); Recorded on 24.vi.1993 (Okyar and Aktaş 1999).
12. *Idaea moniliata* ([Denis-Schifferrmüller], 1775); Recorded on 24.vi.1993 (Okyar and Aktaş 1999). This species was collected on 17.viii.2008.
13. *Idaea ochrata* (Scopoli, 1763); Recorded on 02.vii.1970 (Mol 1977); 24.vi.1993 (Okyar and Aktaş 1999). Collected on 19.vi.2008 and 02.viii. 2008.
14. *Idaea politata* (Hübner, [1799]); Recorded on 02.vii.1970 (Mol 1977); 24.vi.1993 (Okyar and Aktaş 1999).
15. *Idaea subsericeata* (Haworth, [1809]); Recorded on 21.viii.1969 (Mol 1977).
16. *Idaea trigeminata* (Haworth, [1809]); Recorded on 24.vi.1993 (Okyar and Aktaş 1999).
17. *Pellonia vibicaria* (Clerck, 1759); Recorded on 10.ix.1969 as *Rhodostrophia vibicaria* (Clerck, 1759) (Mol 1977).
18. *Rhodostrophia calabra* (Petagna, 1786); Recorded on 24.vi.1993 (Okyar and Aktaş 1999).
19. *Scopula imitaria* (Hübner, [1799]); Recorded on 10.ix.1969 and 02.vii.1970 (Mol 1977); 24.vi.1993 (Okyar and Aktaş 1999).
20. *Scopula marginepunctata* (Goeze, 1781); Recorded on 04.ix.1969, 10.ix.1969, 16.ix.1969 and 02.x.1969 (Mol 1977).
21. *Scopula nigropunctata* (Hufnagel, 1767); Recorded on 21.viii.1969, 04.ix.1969 and 10.ix.1969 (Mol 1977); 24.vi.1993 (Okyar and Aktaş 1999). Collected on 16.ix.2007 and 09.ix.2008.
22. *Scopula ornata* (Scopoli, 1763); Recorded on 04.ix.1969, 10.ix.1969, 13.x.1969 and 02.vii.1970 (Mol 1977).
23. *Timandra brykaria* Nordström, 1943; Recorded on 07.v.1970 (Mol 1977).
24. *Timandra griseata* Petersen, 1902; Recorded on 24.vi.1993 (Okyar and Aktaş 1999). Collected on 10.vii.2007.

Subfamily Larentiinae Duponchel, 1845

25. *Aplocera fraudulentata* (Herrich-Schaffer, [1852]); Recorded on 29.v.1969, 22.x.1969, 03.v.1969, 06.11.1969 and 07.v.1970 as *Anaitis fraudulentata* (Herrich-Schaffer, [1852]) (Mol 1977).
26. *Asthena candidata* ([Denis-Schifferrmüller], 1775); Recorded on 24.vi.1993 (Okyar and Aktaş 1999).
27. *Calliclystis debiliata* (Hübner, 1817); Recorded on 24.vi.1993 (Okyar and Aktaş 1999).
28. *Calliclystis rectangulata* (Linnaeus, 1758); Recorded on 24.vi.1993 (Okyar and Aktaş 1999).
29. *Camptogramma bilineata* (Linnaeus, 1758); Recorded on 21.viii.1969 as *Euphyia bilineata* (Linnaeus, 1758) (Mol 1977); 24.vi.1993 (Okyar and Aktaş 1999). Collected on 08.vii.2007 and 10.vii.2007.
30. *Cosmorrhoe ocellata* (Linnaeus, 1758); Recorded on 05.v.1969, 29.v.1969 and 13.ix.1969 as *Lyncometra ocellata* (Linnaeus, 1758) (Mol 1977).
31. *Epirrhoe alternata* (Müller, 1764); Recorded on 12.v.1969 (Mol 1977).
32. *Epirrita dilutata* ([Denis-Schifferrmüller], 1775); Recorded on 19.xi.1969 and 26.xi.1969 as *Oporinia dilutata* Schifferrmüller, 1775 (Mol 1977). Collected on 02.xii. 2007.
33. *Euphyia picata* (Hübner, 1813); Recorded on 21.viii.1969 (Mol 1977).
34. *Lythria purpuraria* (Linnaeus, 1758); Collected on 10.viii.2007. It is a new species for the Geometridae fauna of Belgrad Forest.
35. *Operophtera brumata* (Linnaeus, 1758); Recorded on 24.xi-30.xii.1970 and 03.i-08.ii.1971 (Mol 1977).
36. *Orthonama obstipatum* (Fabricius, 1794); Recorded on 19.xi.1969 as *Nycterosea obstipata* (Fabricius, 1794) (Mol 1977).

Subfamily Ennominae Duponchel, 1845

37. *Agriopis aurantiaria* (Hübner, 1799); Recorded on 07.xii.1968 as *Erannis aurantiaria* (Hübner, 1799) (Mol 1977).
38. *Agriopis marginaria* (Fabricius, 1777); Recorded on 07.v.1969 and 09.v.1969 as *Erannis marginaria* (Fabricius, 1777) (Mol 1977).
39. *Alcis repandata* (Linnaeus, 1758); Recorded on 20.ix.1968 (Mol 1977).
40. *Amorphognia necessaria* (Zeller, 1849); Recorded on 03.iv.1970 (Mol 1977).
41. *Apeira syringaria* (Linnaeus, 1758); Recorded on 10.ix.1969 (Mol 1977).
42. *Apocheima hispidaria* ([Denis & Schiffermüller], 1775); Recorded on 26.ii.1970 as *Poecilopsis hispidaria* Schiffermüller, 1775 (Mol 1977).
43. *Apocheima pilosaria* ([Denis & Schiffermüller], 1775); Recorded on 02.i.1969 and 07.ii.1969 as *Phigalia pilosaria* (Denis-Schiffermüller, 1775) (Mol 1977).
44. *Aspitates ochrearia* (Rossi, 1794); Recorded on 07.v.1970 (Mol 1977).
45. *Biston strataria* (Hufnagel, 1767); Recorded on 27.iii.1970 (Mol 1977).
46. *Cabera pusaria* Linnaeus, 1758; Recorded on 24.vi.1993 (Okyar and Aktaş 1999).
47. *Campaea margaritata* (Linnaeus, 1767); Recorded on 29.v.1970 as *Campaea margaritaria* (Denis-Schiffermüller, 1775) (Mol 1977).
48. *Cepphis advenaria* (Hübner, 1799); Recorded on 24.vi.1993 (Okyar and Aktaş 1999).
49. *Colotois pennaria* (Linnaeus, 1761); Recorded on 26.xi–30.xi.1969, 09.xii.1969 (Mol 1977). Collected on 19.x. 2007 and 23.x.2007.
50. *Ematurga atomaria* (Linnaeus, 1758); Recorded on 24.vi.1993 (Okyar and Aktaş 1999). Collected on 15.vii.2007 and 17.vii.2008.
51. *Ennomos quercaria* (Hübner, 1813); Recorded on 21.iv–05.vi.1969 as *Deuteronomos quercaria* (Hübner, 1813) (Mol 1977). Collected on 12.vi.2007 and 14.vi. 2008.
52. *Ennomos quercinaria* (Hufnagel, 1767); Recorded on 24.vi.1993 (Okyar and Aktaş 1999).
53. *Erannis defoliaria* (Clerck, 1759); Recorded on 30.iv–28.v.1969, 25.iv.1970 (Mol 1977).
54. *Erannis leucophaearia* ([Denis & Schiffermüller], 1775); Recorded on 16.i.1969 (Mol 1977).
55. *Gnophos obfuscata* ([Denis & Schiffermüller], 1775); Recorded on 03.vi.1968, 04.ix.1968 and 29.v.1970 (Mol 1977).
56. *Gnophos sartata* (Treitschke, 1827); Recorded on 10.ix.1969, 13.ix.1969 and 17.ix.1969 (Mol 1977).
57. *Hypomecis danieli* (Wehrli, 1932); Recorded on 06.viii.1969 and 15.viii.1969 as *Boarmia danieli* Wehrli, 1932 (Mol 1977).
58. *Hyposidra corticata* Walker, 1866; Recorded on 02.vii.1970 (Mol 1977).
59. *Lomospilis marginata* (Linnaeus, 1758); Recorded on 29.v.1969 and 02.vii.1970 (Mol 1977).
60. *Nychiodes waltheri* Wagner, 1919; Recorded on 10.ix.1969 (Mol 1977). Collected on 01.ix.2007 and 11.ix.2008.
61. *Peribatodes rhomboidaria* ([Denis & Schiffermüller], 1775); Recorded on 02.vi.1970 (Mol 1977); 24.vi.1993 (Okyar and Aktaş 1999). Collected on 02.vii.2007 and 13.ix.2008.
62. *Peribatodes secundaria* ([Denis & Schiffermüller], 1775); Recorded on 14.viii.1969 and 13.ix.1969 (Mol 1977). Collected on 06.vii.2007, 14.vii.2007 and 13.ix.2008.
63. *Selenia lunaria* ([Denis & Schiffermüller], 1775); Recorded on 07.ix.1968 (Mol 1977). Collected on 11.x.2008.

Discussion

Insects are the largest group of living organisms. The number of species actually present in the world is not known but there are some estimates ranging from between 5 and 10 million to 30 million or more (Borror *et al.* 1989). The lepidopterous fauna of the world consists of more than 150 000 species and is considered to be the second largest order of insects (Demirsoy 1995). The Geometridae are a large family of the order Lepidoptera with around 26 000 described species in the world (Wikipedia 2001).

All the collected and listed species have previously been reported already for Turkey in different studies (Mathew 1881, Staudinger 1881, Rebel 1905, Graves 1925, 1926, Kansu 1963, Wiltshire 1964, De Lattin 1950, 1951, Güneyi & Şengün 1972, Mol 1977, Koçak & Seven 1991, Okyar & Aktaş 1999, Beşkardeş 2000). However, this is the first study aiming to determine only the Geometridae fauna of the Belgrad Forest.

Cyclophora porata, *Idaea degeneraria* and *Lythria purpuraria* are recorded for the first time in the Belgrad Forest. *Cyclophora porata* was first recorded as a new species for Turkish Thrace by Okyar during her PhD Thesis (Okyar & Aktaş 1999). Beşkardeş (2002) also recorded the species in Istanbul during his MSc Thesis. *Idaea degeneraria* was recorded in Istanbul by De Lattin (1950) and Beşkardeş (2002) respectively. Graves (1925) and Beşkardeş (2002) recorded *Lythria purpuraria* in Istanbul in different years.

Acknowledgements

The author is very grateful to Dr. Erol Akkuzu (Kastamonu University) and Dr. Vedat Beşkardeş (Istanbul University) for the revision of the manuscript and for useful suggestions.

References

- Beccaloni, G. W., Scoble, M. J., Robinson, G. S. & Pitkin, B. (Editors). 2003. The Global Lepidoptera Names Index (LepIndex). — www.nhm.ac.uk/research-curation/research/projects/lepindex/. [accessed 01/01/2009].
- Beşkardeş, V. 2002. *The Butterfly and Moth (Lepidoptera) species living in Istanbul Çatalca Administration Forests*. — Istanbul University Press, Istanbul, 154 pp.
- Borror, D. J., Triplehorn, C. A. & Johnson, N. F. 1989. *An Introduction to the Study of Insects*. — Saunders College Publishing, New York, 875 pp.
- 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.
- Demirsoy, A. 1995. *Yaşamın Temel Kuralları-Entomoloji (Omurgasızlar/Böcekler)*. — Meteksan Press, Ankara, 941 pp.
- Gillott, C. 1995. *Entomology*. — Springer Publishing, the Netherlands, 820 pp.
- Graves, P. P. 1925. Lepidoptera of Constantinople. — *Entomologist* **63**: 191–194.
- Graves, P. P. 1926. Heterocera from Macedonia, Gallipoli and Central Greece. — *Entomologist's Record and Journal of Variation* **38**: 152–158, 165–170.
- Güneyi, N. & Şengün, A. 1972. 1964–1969 Yıllarında Kefeliköy'de Toplanmış Kelebek Türleri II. Gece Kelebekleri. — *Istanbul University Journal* **37**(1/2): 125–128.
- Kansu, A. 1963. Türkiye Lepidoptera Faunası İçin İlk Liste: V. — *Plant Protection Bulletin* **3**(3): 208–223.
- Kantarci, M. D. 1980. *Untersuchungen über die boden-und standortkartierung im Belgrader Wald bei Istanbul*. — Istanbul University Press, Istanbul, 352 pp.
- Karaöz, M.Ö. 1988. Comparison of the certain edaphic and biomass characteristics of some coniferous and deciduous forest ecosystems in Belgrad Forest near Istanbul. — *Istanbul University Review of the Faculty of Forestry* **38**(1): 157–190.
- Koçak, A. & Seven, S. 1991. Faunistische Notizen über Türkisch-Thrazien Lepidopteren. — *Miscellaneous Papers* **10**: 4–12.
- Mathew, G. F. 1881. List of Lepidoptera observed in the neighbourhood of Gallipoli Turkey, in 1878. — *Entomologist's monthly Magazine* **18**: 10–13, 29–32, 92–100.
- Mol, T. 1977. *Marmara ve Ege Bölgeleri Ormanlarında Yaşayan Geometridae Türleri Üzerinde Araştırmalar*. — Istanbul University Press, Istanbul, 125 pp.

- Okyar, Z. & Aktaç, N. 1999. Trakya Bölgesi Geometridae Türlerinin Taksonomik ve Faunistik Yönden Araştırılması. — *Turkish Journal of Zoology* **23**(1): 99–132.
- Rebel, H. 1905. Anhang Verzeichnis der in der Umgebung Konstantinopels gesammelten Lepidopteren. — *Annalen des Naturhistorischen Museums* **20**(213): 218–219.
- Savela, M. 2001. Lepidoptera. — www.funet.fi/pub/sci/bio/life/insecta/lepidoptera/index.htm. [accessed 01/01/2009].
- Spuler, A. 1908. *Die Schmetterlinge Europas* I. — E. Schweizerbartsche Verlagsbuchhandlung, Stuttgart, 385 pp.
- Spuler, A. 1910. *Die Schmetterlinge Europas* II. — E. Schweizerbartsche Verlagbuchhandlung, Stuttgart, 527 pp.
- Staudinger, O. 1881. Lepidopterenfauna Kleinasien's. — *Horae Societatis entomologicae rossicae* **16**: 65–135.
- Wikipedia 2001. Wikipedia, the free encyclopedia. — en.wikipedia.org/wiki/Geometridae [accessed 01/01/2009].
- Wiltshire, E. P. 1964. Geometridae new for Turkey discovered in 1939–1942. — *Mitteilungen der Entomologischen Gesellschaft Basel* **14**: 151–153.
- Yaltırık, F. 1966. *Studies on the floral analysis of Belgrad Forest vegetation and the main formation*. — General Directorate of Forestry Press, Ankara, 233 pp.
-