



A faunistic study on the geometrid moths (Lepidoptera, Geometridae) of Maden district (Elazığ Province, Turkey)*

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Abstract

This paper is conducted on the Geometridae fauna of Maden (Elazığ) district. In total, 87 species are diagnosed in 47 genera of 6 subfamilies. Except *Charissa onustaria* (Herrich-Schäffer, [1852]), all of the determined species are new record for the research area and also 81 of the species are new record for Elazığ province. And, second location records of rare known species, *Idaea consociata* (Staudinger, 1900), *Gnophos sacraria* (Staudinger, 1895) and *Wehrliola inexpectata* Kemal & Uçak, 2018, are given from the study area.

Keywords: Lepidoptera, Geometridae, Maden, Elazığ, Turkey

Özet

Bu makale, Maden (Elazığ) ilçesi Geometridae faunası üzerine yapılmıştır. Toplamda 6 altfamilya içerisinde 47 cinse ait 87 tür tespit edilmiştir. *Charissa onustaria* (Herrich-Schäffer, [1852]) dışında, belirlenen türlerin tümü araştırma alanı için, 81'i ise Elazığ ili için yeni kayıttır. Nadir bilinen *Idaea consociata* (Staudinger, 1900), *Gnophos sacraria* (Staudinger, 1895) ve *Wehrliola inexpectata* Kemal & Uçak, 2018 türlerinin ikinci lokalite kayıtları çalışma alanından verilmiştir.

Anahtar Kelimeler: Lepidoptera, Geometridae, Maden, Elazığ, Türkiye

Introduction

Most Geometridae species are nocturnal, but they often fly preferably at dusk and others active mainly after midnight. Each species is characterized by a specific resting position: Planiform (wings are parallel to the ground), veliform (wings are vertically folded) or tectiform (wings are positioned like a roof) (Hausmann 2001). The adults of the geometrid moths are commonly small to medium in size, with broad wings. Flights of the adults are usually short distance and close to the ground. Geometridae species move in a characteristic "inching" and called to "measuring worms" because the larvae lack of prolegs (except Archiearinae). The larvae resemble twigs or leaf stems and feed on foliage. They seriously damage or destroy trees and crops, when their populations are excessive. The geometrid moths can be distinguished from other moth families by their long legs, thin abdomen and slim wings. However, in order to diagnosis of some taxa (such as *Scopula*, *Idaea* and *Eupithecia*), tergite/sternite and tympanal organs should be examined together with male and female genital structures (Hausmann 2001, Leraut 2009, Kemal and Seven, 2013).

Studies on the geometrid moths of Turkish fauna, and resources used for identification and distribution of the species in this survey are include: Zukowsky 1941, Doğanlar et al. 1982, S. Seven 1993,

Hausmann 2001, 2004, Karsholt and Razowski 1996, Okyar and Aktaç 1999, Schön 2002, Mironov 2003, Özdemir 2007, 2016, Leraut 2009, Hausmann and Viidalepp 2012, Rajaei et al. 2012, 2017, Kemal and Seven 2013, Seven 2014, 2015, 2018, Skou and Sihvonen 2015, Hausmann et al. 2017.

Geometridae species in the Turkish fauna are classified in Archiearinae Fletcher, 1951; Desmobathrinae Meyrick, 1886; Ennominae Duponchel, 1845; Geometrinae Stephens, 1829; Larentiinae Duponchel, 1845; Orthostixinae Meyrick, 1892 and Sterrhinae Meyrick, 1892 subfamilies (Özdemir 2007, Kemal and Seven 2013). Geometridae family is one of the species-rich group in Lepidoptera order after noctuid and pyralid moths. The number of known geometrid moths in the European continent is more than 900 (Hausmann 2001), and 638 species are reported in Turkey (Koçak and Kemal 2018). However, before the investigations, 16 geometrid species were known in Elazığ province (Koçak and Kemal 2007, 2018), and Geometridae fauna of Maden district was unknown.

Maden district is generally composed of mountainous areas and has a rich vegetation in woody and herbaceous species that contains mostly *Astragalus*, *Quercus*, *Juniperus* and *Pinus* species (Çakılcıoğlu and Civelek 2011, Tonbul et al. 2018). The area also hosts a large number of endemic and rare plant species (Khatun et al. 2012).

Material and Methods

The samples were collected from 17 localities (Figure 1) between in 2016 and 2017. A sweep net was utilized for catching of diurnal (daytime active) species and UV light traps were used for capturing of nocturnal (active at night) species. Studies were mostly carried out at night, because of majority of the members of Geometridae family were nocturnal. The samples were pinned and labelled and turned into museum materials. The Canon EOS 1100D macro lens camera was used for photographing of the samples and habitats. Also, for precise diagnosis, genitals of some species were prepared under Nikon SMZ1000 stereomicroscope by methods of Robinson (1976). At this stage the genitals were boiled with potassium hydroxide (KOH), taken to the alcohol and finally covered with Euparal between in lamella. The materials are deposited in the collection of Batman University, Faculty of Science and Arts, Department of Biology.

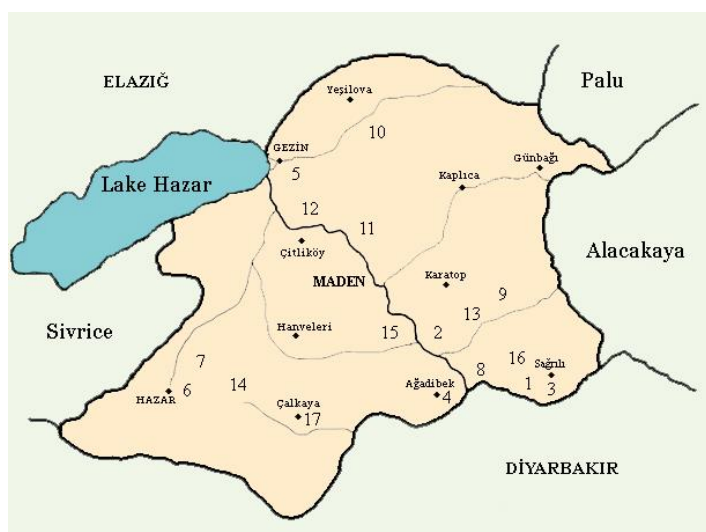


Figure 1. Studied locations in Maden district of Elazığ province.

The studied locations (Figure 1) and coordinates are as follows: 1. Kısabekir (38°21'20.37"N 39°44'27.04"E), 2. Soğuksu (38°24'0.45"N 39°39'29.26"E), 3. Sağrılı-1 (38°21'56.99"N 39°45'13.85"E), 4. Ağadibek (38°21'21.90"N 39°40'49.27"E), 5. Gezin (38°30'45.85"N 39°32'21.89"E), 6. Altıntarla (38°24'3.23"N 39°26'58.16"E), 7. Kavak (38°23'41.95"N 39°25'52.46"E), 8. Centre (Ergani road) (38°22'42.52"N 39°41'21.59"E), 9. Karatop (38°24'16.45"N 39°43'28.17"E), 10. Yeşilova (38°32'7.90"N 39°34'37.41"E), 11. Tekevler (38°27'58.75"N 39°36'23.46"E), 12. Çitliköy (38°28'44.31"N 39°32'52.66"E), 13. Centre (Alacakaya road) (38°23'41.91"N 39°41'31.64"E), 14. Hanevleri (38°24'17.55"N 39°33'2.03"E), 15. Dutpınar (38°24'58.32"N 39°37'36.76"E), 16. Sağrılı-2 (38°22'22.46"N 39°44'11.10"E), 17. Çalkaya (38°19'57.75"N 39°34'20.68"E).

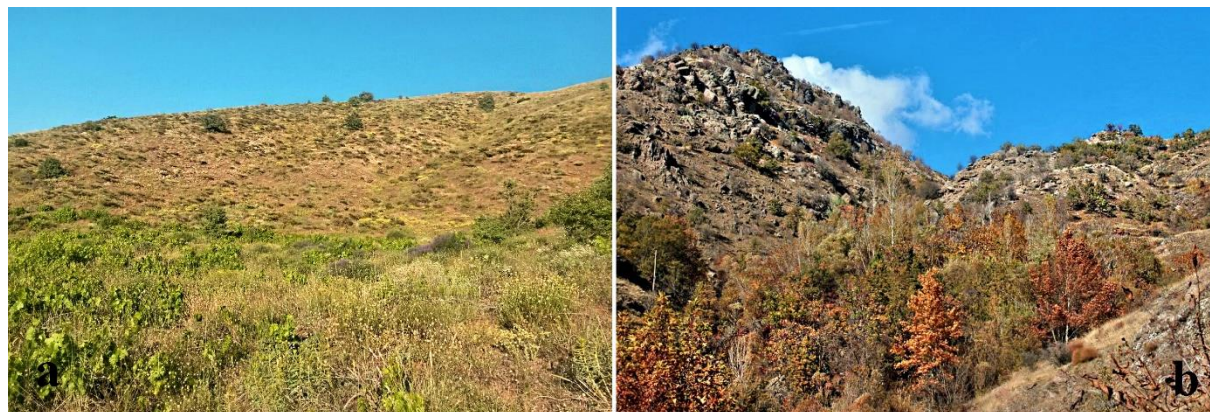


Figure 2. Habitats: a. Yeşilova, 1380 m, 22.09.2017; b. Tekevler, 1300 m, 10.11.2018

The species are evaluated in terms of their distributions as widespread, local or rare according to number of the samples and the number of localities they found. ‘Widespread’ is used for the species a large number of samples and found in many localities. Species observed only in a specific locality are specified as ‘Local’, and species with very few samples (1 or 2) are reported as ‘Rare’ in the conclusion part.

Results

As a result of the researches, 87 species belonging to 6 subfamilies of Geometridae family are determined in the study area. Among these, except 6 species: *Aplasta ononaria* (Geometrinae), *Aplocera plagiata*, *Camptogramma bilineatum* (Larentiinae), *Charissa onustaria*, *Nychiodes variabila* (Ennominae), *Scopula immistaria* (Sterrhinae), 81 species are new discovered from Elazığ province. Examined materials of each species are presented.

Family Geometridae Leach, 1815

Subfamily Desmobathrinae Meyrick, 1886

Myinodes shohami Hausmann, 1994

Material. 1♂, Soğuksu, 1020 m, 36.03.2017.

Subfamily Ennominae Duponchel, 1845

Agriopsis bajaria ([Denis & Schiffermüller], 1775)

Material. 2♂, Kısabekir, 860 m, 10.03.2017.

Aleucis orientalis (Staudinger, 1892)

Material. 5♂ 3♀, Kısabekir, 860 m, 10.03.2017, 13.04.2017; 1♂, Centre (Ergani road), 940 m, 20.04.2017.

Alsophila aceraria ([Denis & Schiffermüller], 1775)

Material. 1♂, Centre (Ergani road), 940 m, 24.03.2017.

Apochima flabellaria (Heeger, 1838)

Material. 3♂, Centre (Ergani road), 940 m, 24.03.2017.

Aspitates ochrearia (Rossi, 1794)

Material. 3♂, Kısabekir, 860 m, 23.04.2016; 1♂, Soğuksu, 1020 m, 17.05.2017.

Biston stratarius (Hufnagel, 1767)

Material. 4♂, Karatop, 1045 m, 30.03.2017.

Charissa dubitaria (Staudinger, 1892)

Material. 3♂, Tekevler, 1300 m, 05.08.2017, 12.06.2017; 1♂, Centre (Alacakaya road), 1160 m, 29.06.2017; 5♂ 5♀, Kısabekir, 860 m, 29.06.2017.

Charissa mucidaria (Hübner, [1799])

Material. 5♂ 5♀, Kısabekir, 860 m, 29.06.2017.

Charissa onustaria (Herrich-Schäffer, [1852])

Material. 8♂ 2♀, Sağrılı-1, 920 m, 25.05.2016, 27.07.2017; 7♂ 1♀, Tekevler, 1300 m, 10.05.2017, 22.09.2017; 1♂, Dutpınar, 1150 m, 30.07.2017; 3♀, Ağadibek, 915 m, 29.09.2017.

Chiasmia aestimaria (Hübner, [1809])

Material. 7♂ 4♀, Ağadibek, 915 m, 22.06.2016, 24.07.2017, 28.08.2017, 29.09.2017; 1♂, Kısabekir, 860 m, 29.06.2017; 1♂, Gezin, 1295 m, 15.08.2017.

Chiasmia clathrata (Linnaeus, 1758)

Material. 2♂, Kısabekir, 860 m, 23.04.2016; 3♂, Tekevler, 1300 m, 10.05.2017; 5♂ 1♀, Sağrılı-1, 920 m, 27.04.2017; 2♂, Soğuksu, 1020 m, 17.05.2017.

Colotois pennaria (Linnaeus, 1761)

Material. 1♂, Sağrılı-2, 930 m, 27.10.2017.

Crocallis elinguaris (Linnaeus, 1758)

Material. 13♂, Sağrılı-1, 920 m, 11.10.2017, 19.09.2017; 1♂, Kısabekir, 860 m, 11.10.2017; 34♂, Gezin, 1295 m, 25.09.2017; 6♂, Tekevler, 1300 m, 22.09.2017, 06.10.2017; 1♂, Ağadibek, 915 m, 29.09.2017; 1♂ 1♀, Soğuksu, 1020 m, 04.10.2017; 4♂ 1♀, Dutpınar, 1150 m, 10.09.2017; 1♂, Sağrılı-2, 930 m, 27.10.2017.

Crocallis tusciaria (Borkhausen, 1793)

Material. 23♂ 2♀, Sağrılı-2, 930 m, 27.10.2017; 1♂, Ağadibek, 915 m, 22.10.2017; 2♂, Kısabekir, 860 m, 11.10.2017.

Dasycorsa modesta (Staudinger, 1879)

Material. 3♂, Kısabekir, 860 m, 10.03.2017, 04.04.2017; 1♂, Altıntarla, 1355 m, 09.09.2017; 3♂, Centre (Ergani road), 940 m, 20.04.2017.

Dyscia innocentaria (Christoph, 1885)

Material. 1♂ 3♀, Tekevler, 1380 m, 22.09.2017; 5♂, Gezin, 1295 m, 25.09.2017; 2♂, Ağadibek, 915 m, 29.09.2017.

Eilicrinia cordiaria (Hübner, 1790)

Material. 3♂ 3♀, Soğuksu, 1020 m, 01.06.2016, 17.05.2017, 05.08.2017; 6♂ 2♀, Kısabekir, 860 m, 23.04.2016, 29.06.2017; 5♂ 2♀, Centre (Ergani road), 940 m, 20.04.2017; 5♂ 11♀, Yeşilova 1380 m, 18.06.2017, 16.07.2017, 02.08.2017; 1♂, Tekevler, 1300 m, 10.05.2017; 5♀, Çalkaya, 1350 m, 27.07.2017; 2♀, Ağadibek, 915 m, 24.07.2017.

Eumera hoeferi Wehrli, 1934

Material. 2♂, Ağadibek, 915 m, 29.09.2017; 7♂, Tekevler, 1300 m, 22.09.2017; 2♂, Dutpınar, 1150 m, 30.09.2017; 1♂, Kısabekir, 860 m, 11.10.2017.

Gnopharmia irakensis Wehrli, 1938

Material. 2♂, Çalkaya, 1350 m, 27.07.2017; 5♂, Sağrılı-1, 920 m, 23.07.2017; 6♂ 3♀, Kısabekir, 860 m, 29.06.2017; 3♂ 1♀, Soğuksu, 1020 m, 07.08.2016, 05.08.2017; 1♂, Çitliköy, 1265 m, 16.07.2017; 7♂, Ağadibek, 915 m, 24.07.2017.

Gnopharmia rubraria Staudinger, 1892

Material. 14♂ 3♀, Yeşilova, 1380 m, 18.06.2017, 12.07.2017, 16.07.2017, 02.08.2017, 23.08.2017; 2♂ 1♀, Çitliköy, 1265 m, 21.06.2017; 5♂, Soğuksu, 1020 m, 17.05.2017, 05.08.2017; 1♂, Tekevler, 1300 m, 10.05.2017; 8♂ 4♀, Kısabekir, 860 m, 29.06.2017; 3♀ Sağrılı-1, 920 m, 23.07.2017.

Gnophos pseudosnelleni Rjabov, 1964

Material. 8♂, Sağrılı-1, 920 m, 25.05.2016, 15.09.2017, 19.09.2017, 11.10.2017; 2♂, Yeşilova, 1380 m, 18.06.2017; 27♂ Ağadibek, 915 m, 30.05.2017, 29.09.2017, 22.10.2017; 3♂, Centre (Alacakaya road), 1160 m, 12.06.2017; 2♂, Gezin, 1295 m, 25.09.2017; 2♂, Çitliköy, 1265 m, 21.06.2017; 4♂, Dutpınar, 1150 m, 30.09.2017; 1♂ 13♀, Soğuksu, 1020 m, 01.06.2016, 04.10.2017; 20♂, Tekevler, 1300 m, 22.09.2017, 06.10.2017; 5♂, Kısabekir, 860 m, 15.09.2017, 11.10.2017.

Gnophos sartatus Treitschke, 1827

Material. 1♂, Sağrılı-1, 920 m, 25.05.2016; 2♀, Ağadibek, 915 m, 22.10.2017; 13♀, Soğuksu, 1020 m, 01.06.2016.

Gnophos sacraria Staudinger, [1895] (Figure 3 a)

Material. 2♂, Ağadibek, 915 m, 29.09.2017

Larerannis marginaria (Fabricius, 1777)

Material. 1♂, Kısabekir, 860 m, 10.03.2017

Lycia hirtaria (Linnaeus, 1761)

Material. 1♂ 1♀, Kısabekir, 860 m, 04.04.2017.

Neognopharmia stevenaria (Boisduval, 1840)

Material. 39♂ 7♀, Soğuksu, 1020 m, 01.06.2016, 17.05.2017, 05.08.2017; 1♂, Centre (Ergani road), 940 m, 20.04.2017; 5♂, Yeşilova, 1380 m, 18.06.2017, 16.07.2017; 12♂, Kısabekir, 860 m, 29.06.2017; 2♂ 7♀, Tekevler, 1300 m, 10.05.2017, 05.08.2017; 1♀, Ağadibek, 915 m, 24.07.2017; 7♂, Sağrılı-1, 920 m, 25.05.2016, 27.04.2017, 23.07.2017; 3♂, Çitliköy, 1265 m, 16.06.2017; 2♀, Çalkaya, 1350 m, 27.07.2017.

Nychiodes variabila (Brandt, 1938)

Material. 19♂ 2♀, Gezin, 1295 m, 03.07.2017, 15.08.2017; 31♂ 7♀, Yeşilova, 1380 m, 16.07.2017, 02.08.2017, 23.08.2017; 13♂ 1♀, Sağrılı-1, 920 m, 25.05.2016, 23.07.2017, 15.09.2017, 19.09.2017; 15♂ 1♀, Soğuksu, 07.08.2016, 05.08.2014, 12.09.2017; 17♂, Kısabekir, 860 m, 29.06.2017, 15.09.2017, 19.09.2017; 2♀, Centre (Ergani road), 940 m, 20.04.2017; 8♂, Çalkaya, 1350 m, 27.07.2017; 4♀, Tekevler, 1300 m, 05.08.2017; 15♂, Altıntarla, 1355 m, 24.08.2016, 09.09.2017; 2♀, Kavak, 1350 m, 09.09.2017; 2♂, Centre (Alacakaya road), 1160 m, 12.06.2017; 1♂, Çitliköy, 1265 m, 21.06.2017.

Peribatodes correptarius (Zeller, 1847)

Material. 2♂, Çitliköy, 1265 m, 21.06.2017.

Peribatodes rhomboidarius [Denis & Schiffermüller], 1775)

Material. 1♂, Soğuksu, 1020 m, 01.06.2017; 5♂, Yeşilova, 1380 m, 18.06.2017; 3♂ 1♀, Kısabekir, 860 m, 23.04.2016, 19.09.2017, 11.10.2017; 1♂, Kavak, 1350 m, 28.08.2016; 11♂ 1♀, Ağadibek, 915 m, 22.06.2016, 30.05.2017, 29.09.2017; 1♂, Gezin, 1295 m, 25.09.2017; 1♀, Tekevler, 1300 m, 22.09.2017.

Peribatodes umbrarius (Hübner, [1809])

Material. 1♀, Soğuksu, 1020 m, 01.06.2016; 1♂, Ağadibek, 915 m, 30.05.2017; 1♂, Tekevler, 1300 m, 22.09.2017.

Ramitia kufrana Seven, 2016 (Figure 3 b)

Material. 3♀, Sağrılı-1, 920 m, 27.04.2017.

Selidosema plumarium ([Denis & Schiffermüller], 1775)

Material. 6♂ 1♀, Altıntarla, 1355 m, 24.08.2016, 09.09.2017; 20♂ 1♀, Sağrılı-1, 920 m, 15.09.2017, 19.09.2017; 4♂, Kısabekir, 860 m, 19.09.2017; 1♂, Gezin, 1295 m, 15.08.2017; 1♂, Kavak, 1350, 28.08.2016, 09.09.2017; 8♂, Tekevler, 1300 m, 22.09.2017, 06.10.2017; 14♂, Ağadibek, 915 m, 29.09.2017.

Stegania dilectaria (Hübner, 1790)

Material. 3♂ 1♀, Yeşilova, 1380 m, 18.06.2017, 12.07.2017, 02.08.2017; 1♂, Kısabekir, 860 m, 29.06.2017; 1♂, Gezin, 1295 m, 15.08.2017.

Wehrliola inexpectata Kemal & Uçak, 2018

Material. 1♂, Soğuksu, 1020 m, 04.10.2017.

Wehrliola revocaria (Staudinger, 1892)

Material. 7♂, Ağadibek, 915 m, 29.09.2017; 5♂, Kısabekir, 860 m, 19.09.2017; 4♂, Sağrılı-1, 920 m, 15.09.2017, 19.09.2017.

Subfamily Geometrinae Stephens, 1829

Aplasta ononaria (Fuessly, 1783)

Material. 1♂, Kavak, 1350 m, 09.09.2017; 1♀, Yeşilova, 1380 m, 02.08.2017.

Phaiogramma etruscaria (Zeller, 1849)

Material. 25♂, Yeşilova, 1380 m, 16.07.2017, 02.08.2017, 23.08.2017; 5♂ 2♀, Çalkaya, 1350 m, 27.07.2017; 2♂ 1♀, Ağadibek, 915 m, 30.05.2017, 24.07.2017; 1♂, Kavak, 1350 m, 28.08.2016; 2♂, Gezin, 1295 m, 15.08.2017.

Proteuchloris neriaria (Herrich-Schäffer, [1852])

Material. 1♂, Yeşilova, 1380 m, 02.08.2017; 1♂, Ağadibek, 915 m, 22.06.2016.

Subfamily Larentiinae Duponchel, 1845

Aplocera plagiata (Linnaeus, 1758)

Material. 5♀, Kavak, 1350 m, 28.08.2016, 09.09.2017; 1♀, Ağadibek, 915 m, 22.10.2017; 1♂ 2♀, Gezin, 1295 m, 03.07.2016, 15.08.2017, 25.09.2017; 4♂ 1♀, Soğuksu, 1020 m, 01.06.2016, 17.05.2017; 1♂ 2♀, Yeşilova, 1380 m, 18.06.2017, 02.08.2017.

Camptogramma bilineatum (Linnaeus, 1758)

Material. 4♂, Kavak, 1350 m, 28.08.2016; 3♂ 2♀, Ağadibek, 915 m, 22.06.2016, 29.09.2017; 2♂, Altıntarla, 1355 m, 24.08.2016; 2♀, Sağrılı-1, 920 m, 23.07.2017; 4♀, Soğuksu, 1020 m, 07.08.2016; 2♂, Tekevler, 1300 m, 22.09.2017.

Cataclysmes riguata (Hübner, [1813])

Material. 38♂ 19♀, Yeşilova, 1380 m, 18.06.2017, 12.07.2017, 16.07.2017, 02.08.2017, 23.08.2017; 5♀, Hanevleri, 1602 m, 20.07.2017; 1♀, Altıntarla, 1355 m, 09.09.2017; 1♀, Kavak, 1350 m, 28.08.2016.

Catarhoe permixtaria (Guenée, [1858])

Material. 2♀, Yeşilova, 1380 m, 18.08.2017; 1♂, Sağrılı-1, 920 m, 25.05.2016.

Chesistege korbi (Bohatsch, 1909)

Material. 1♂, Sağrılı-2, 930 m, 27.10.2017; 1♀, Ağadibek, 915 m, 22.10.2017; 1♂, Kısabekir, 860 m, 11.10.2017.

Docirava mundata (Staudinger, 1892)

Material. 1♂ 1♀, Tekevler, 1300 m, 10.05.2017, 22.09.2017; 1♀, Ağadibek, 915 m, 29.09.2017.

Eulithis roessleraria (Staudinger, 1871) (Figure 3 c)

Material. 8♂, Yeşilova, 1380 m, 12.07.2017, 16.07.2017.

Euphyia frustata (Treitschke, 1828)

Material. 1♂, Tekevler, 1300 m, 22.09.2017.

Eupithecia breviculata (Donzel, 1837)

Material. 1♀, Sağrılı-1, 920 m, 25.05.2016; 1♂, Ağadibek, 915 m, 30.05.2017; 1♀, Soğuksu, 1020 m, 17.05.2017.

Eupithecia gueneata (Millière, 1862)

Material. 10♂ 6♀, Yeşilova, 1380 m, 18.06.2017, 12.07.2017, 16.07.2017, 02.08.2017, 23.08.2017; 1♂, Gezin, 1295 m, 15.08.2017.

Eupithecia impurata (Hübner, [1813])

Material. 1♂, Ağadibek, 915 m, 30.05.2017.

Eupithecia inconspicuata Bohatsch, 1893

Material. 1♂, Soğuksu, 1040 m, 17.05.2017.

Eupithecia mystica Dietze, 1910

Material. 1♂, Sağrılı-1, 920 m, 19.09.2017; 3♂ ♀, Tekevler, 1300 m, 22.09.2017; 3♂, Yeşilova, 1380 m, 12.07.2017, 18.07.2017; 1♂, Ağadibek, 915 m, 20.09.2017; 1♀, Altıntarla, 1355 m, 09.09.2017; 2♂, Gezin, 1295 m, 15.08.2017.

Eupithecia oblongata (Thunberg, 1784)

Material. 1♂, Yeşilova, 1380 m, 18.06.2017.

Eupithecia semigraphata (Bruand, [1847])

Material. 14♂ 8♀, Ağadibek, 915 m, 29.09.2017, 22.10.2017; 1♂, Sağrılı-1, 920 m, 15.09.2017; 1♂, Tekevler, 1300 m, 22.09.2017; 2♂ 3♀, Dutpınar, 1150 m, 30.09.2017; 1♂, Soğuksu, 1020 m, 04.10.2017.

Eupithecia silenicolata Mabille, 1867

Material. 1♂ 2♀, Yeşilova 1380 m, 12.07.2017, 16.07.2017; 1♂, Soğuksu, 1020 m, 17.05.2017.

Gymnoscelis rufifasciata (Haworth, [1809])

Material. 1♂, Altıntarla, 1355 m, 09.09.2017.

Larentia clavaria Haworth, [1809] (Figure 3 d)

Material. 1♂, Sağrılı-2, 930 m, 27.10.2017.

Nebula senectaria (Herrich-Schäffer, [1852])

Material. 1♂, Dutpınar, 1150 m, 30.09.2017.

Protorhoe corollaria (Herrich-Schäffer, [1848])

Material. 1♂, Kısabekir, 860 m, 23.04.2016.

Xanthorhoe fluctuata (Linnaeus, 1758)

Material. 1♂, Sağrılı-1, 920 m, 25.05.2016.

Subfamily Orthostixinae Meyrick, 1892

Orthostixis calcularia Lederer, 1853

Material. 1♂, Soğuksu, 1020 m, 17.05.2017.

Subfamily Sterrhinae Meyrick, 1892

Cleta perpusillaria (Eversmann, 1847)

Material. 1♀, Yeşilova, 1380 m, 18.06.2017.

Cyclophora suppunctaria (Zeller, 1847)

Material. 1♀, Sağrılı-1, 920 m, 27.04.2017; 1♂, Kısabekir, 860 m, 29.06.2017.

Idaea consociata (Staudinger, 1900)

Material. 1♂, Ağadibek, 915 m, 30.05.2017.

Idaea camparia (Herrich-Schäffer, [1852])

Material. 1♂ 3♀, Ağadibek, 915 m, 29.09.2017, 22.10.2017; 8♂, Sağrılı-1, 920 m, 19.09.2017; 1♂, Kısabekir, 860 m, 11.10.2017; 1♀, Soğuksu, 1020 m, 17.05.2017.

Idaea degeneraria (Hübner, [1799])

Material. 1♂ 6♀, Ağadibek, 915 m, 30.05.2017, 29.09.2017; 1♂ 4♀, Sağrılı-1, 920 m, 19.09.2017; 2♂, Kısabekir, 860 m, 19.09.2017; 2♂, Kavak, 1350 m, 09.09.2017; 5♂, Tekevler, 1300 m, 22.09.2017; 1♀, Dutpınar, 1150 m, 30.09.2017; 1♂, Centre (Alacakaya road), 1160 m, 12.06.2017; 1♀, Gezin, 1295 m, 25.09.2017.

Idaea determinata (Staudinger, 1876)

Material. 3♀, Çitliköy, 1265 m, 21.06.2017.

Idaea deversaria (Herrich-Schäffer, [1847])

Material. 8♂ 1♀, Kısabekir, 860 m, 29.06.2017, 19.09.2017; 4♂ 4♀, Yeşilova 1380 m, 12.07.2017, 16.07.2017, 02.08.2017; 1♂, Tekevler, 1300 m, 05.08.2017.

Idaea filicata (Hübner, [1799])

Material. 1♂ 1♀, Yeşilova 1380 m, 12.07.2017, 16.07.2017; 1♂ 1♀, Sağrılı-1, 920 m, 25.05.2016, 19.09.2017; 5♀, Tekevler, 1300 m, 22.09.2017; 2♂ 1♀, Ağadibek, 915 m, 30.05.2017, 29.09.2017, 22.10.2017; 2♂ 10♀, Kısabekir, 860 m, 29.06.2017, 15.09.2017, 19.09.2017; 1♂, Çitliköy, 1265 m, 16.07.2017.

Idaea ochrata (Scopoli, 1763)

Material. 65♀, Kısabekir, 860 m, 29.06.2017; 12♂ 24♀, Yeşilova, 1380 m, 18.06.2017, 12.07.2017, 16.07.2017; 3♀, Soğuksu, 1020 m, 01.06.2016; 2♀, Ağadibek, 915 m, 22.06.2016; 2♂, Çitliköy, 1265 m, 21.06.2017; 1♂ 1♀, Centre (Alacakaya road), 1160 m, 12.06.2017.

Idaea ossiculata (Lederer, 1871)

Material. 3♂, Ağadibek, 915 m, 30.05.2017; 3♂ 2♀, Centre (Alacakaya road), 1160 m, 12.06.2017; 6♂, Yeşilova, 1380 m, 18.06.2017.

Idaea ostrinaria (Hübner, [1813])

Material. 2♂, Çitliköy, 1265 m, 21.06.2017; 2♂, Ağadibek, 915 m, 30.05.2017; 3♀, Soğuksu, 1020 m, 01.06.2017.

Idaea politaria (Hübner, [1799])

Material. 5♀, Kısabekir, 860 m, 29.06.2017; 1♂, Sağrılı-1, 920 m, 23.07.2017.

Idaea rusticata ([Denis & Schiffermüller], 1775)

Material. 1♂ 5♀, Yeşilova, 1380 m, 12.07.2017, 16.07.2017; 1♂, Çitliköy, 1265 m, 16.07.2017; 1♀, Kısabekir, 860 m, 29.06.2017.

Idaea subsericeata (Haworth, [1809])

Material. 1♂ 1♀, Çitliköy, 1265 m, 21.06.2017.

Idaea textaria (Lederer, 1861)

Material. 3♂, Tekevler, 1300 m, 22.09.2017; 1♂, Yeşilova, 1380, 12.07.2017.

Idaea trigeminata (Haworth, [1809])

Material. 4♂, Yeşilova, 1380 m, 18.06.2017, 12.07.2017.

Rhodometra sacraria (Linnaeus, 1767)

Material. 1♂ 1♀, Kısabekir, 860 m, 19.09.2017; 1♂, Ağadibek, 915 m, 28.08.2017; 1♀, Sağrılı-2, 930 m, 27.10.2017.

Rhodostrophia auctata (Staudinger, 1879)

Material. 10♀, Yeşilova, 1380 m, 18.06.2017, 23.08.2017; 2♂, Gezin, 1295 m, 15.08.2017; 1♀, Altıntarla, 1355 m, 09.09.2017.

Rhodostrophia discopunctata Amsel, 1935

Material. 1♂, Ağadibek, 915 m, 30.05.2017; 6♂, Soğuksu, 1020 m, 01.06.2016; 25♂, Yeşilova, 1380 m, 18.06.2017; 2♂ 2♀, Çitliköy, 1265 m, 21.06.2017; 12♀, Centre (Alacakaya road), 1160 m, 12.06.2017.

Scopula decorata ([Denis & Schiffermüller], 1775)

Material. 1♂ 1♀, Yeşilova, 1380 m, 18.08.2017.

Scopula immistaria (Herrich-Schäffer, [1852])

Material. 6♂ 3♀, Kavak, 1350 m, 28.08.2016, 09.09.2017; 14♂ 5♀, Yeşilova, 1380 m, 18.06.2017, 16.07.2017, 02.08.2017, 23.08.2017.

Scopula marginepunctata (Goeze, 1781)

Material. 3♀, Hanevleri, 1600m, 20.07.2017; 4♀ 6♂, Kısabekir, 860m 23.04.2016, 11.01.2017, 29.06.2017, 19.09.2017; 6♂, Gezin, 1295m, 03.07.2016, 15.08.2017; 2♂ 1♀, Altıntarla, 1355m, 09.09.2017; 17♂ 2♀, Tekevler 1300m, 05.08.2017, 22.09.2017; 42♂ 2♀, Yeşilova 1380 m, 18.06.2017, 16.07.2017, 02.08.2017, 23.08.2017; 1♂ 2♀, Soğuksu, 1020 m, 05.08.2017; 16♂ 6♀, Ağadibek, 915 m, 22.06.2016, 30.05.2017, 28.08.2017, 29.09.2017, 22.10.2017; 3♂ 3♀, Sağrılı-1, 920 m, 15.09.2017 19.09.2017; 1♂, Kavak, 1350 m, 28.08.2016; 1♂ 1♀, Çitliköy, 1265 m, 21.06.2017; 3♂, Çalkaya, 1350 m, 27.07.2017.

Scopula minorata (Boisduval, 1833)

Material. 2♂ 1♀, Kavak, 1350 m, 09.09.2017, 1♂, Gezin, 1295 m, 15.08.2017, 1♂, Altıntarla, 1355 m, 09.09.2017.

Scopula ochraceata (Staudinger, 1901)

Material. 1♂, Yeşilova, 1380 m, 12.07.2017.

Scopula ornata (Scopoli, 1763)

Material. 1♀, Yeşilova, 1380 m, 02.08.2017.

Scopula submutata (Treitschke, 1828)

Material. 31♂ 17♀, Ağadibek, 915 m, 30.05.2017, 24.07.2017, 28.08.2017, 29.09.2017, 22.10.2017; 20♂ 184♀, Yeşilova, 1380 m, 18.06.2017, 12.07.2017, 16.07.2017, 02.08.2017, 23.08.2017; 5♂ 2♀, Soğuksu, 1020 m, 07.08.2016, 05.08.2017; 4♂, Kısabekir, 860 m, 29.06.2017; 3♂ 14♀, Sağrılı-1, 920 m, 15.09.2017, 19.09.2017, 11.10.2017; 1♂ 9♀, Gezin, 1295 m, 15.08.2017; 2♂, Sağrılı-2, 930 m, 27.10.2017; 7♀, Çalkaya, 1350 m, 27.07.2017; 1♂, Çitliköy, 1265 m, 16.07.2017; 2♂, Altıntarla, 1355 m, 09.09.2017.

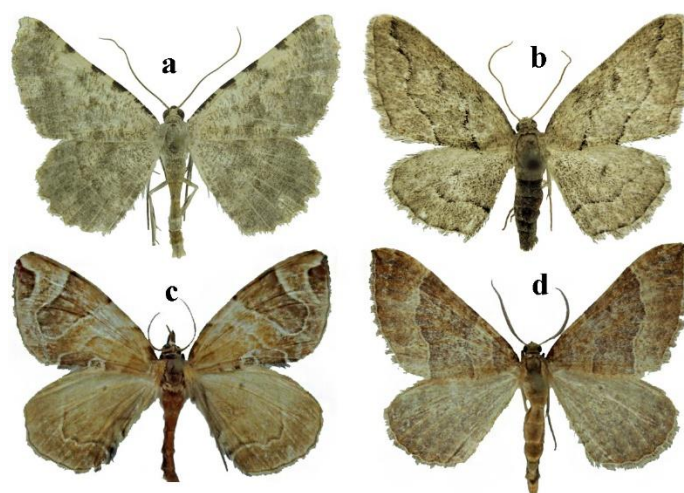


Figure 3. Adults of some species: a. *Gnophos sacraria*, b. *Ramitia kufrana*, c. *Eulithis roessleraria*, d. *Larentia clavaria*

Discussion and Conclusion

Geometridae fauna of Maden district was not studied in detail before. In this study, 87 Geometridae species are identified in 6 subfamilies from Maden (Elazığ) district. Except *Charissa onustaria*, all of the determined species are new record for the study area. And, 81 of them have been reported for the first time in Elazığ province.

Before the researches, 16 geometrid moths were known in Elazığ province (Koçak and Kemal 2007, 2018): *Aplasta ononaria*, *Aplocera plagiata*, *Camptogramma bilineatum*, *Cataclysmes subtilisparsata*, *Charissa mutilata*, *C. onustaria*, *Docirava mundulata*, *D. musculata*, *Euphyia sintenisi*, *Gnopharmia colchidaria*, *Idaea persidis*, *Lithostege buxtoni*, *Nychiodes variabila*, *Rhodostrophia bahara*, *Scopula immistaria*, *S. transcaspica*. Among these species, *Cataclysmes subtilisparsata*, *Charissa mutilata*, *Docirava mundulata*, *D. musculata*, *Euphyia sintenisi*, *Gnopharmia colchidaria*, *Idaea persidis*, *Lithostege buxtoni*, *Rhodostrophia bahara* and *Scopula transcaspica* are not found in Maden district during the surveys.

The number of the geometrid moths have reached to 97 species in Elazığ province with previously known 16 species and 81 new records. In the subfamilies, Ennominae is showed the biggest increase. Moreover, Orthostixinae and Desmobathrinae subfamilies are new reported from the fauna of Elazığ (Table 1).

Table 1. Species numbers of subfamilies before and after the surveys and new record numbers in Elazığ province

Subfamilies	Before the survey	After the survey	New records
Sterrhinae	4	26	25
Larentiinae	7	21	19
Ennominae	4	35	33
Geometrinae	1	3	2
Orthostixinae	0	1	1
Desmobathrinae	0	1	1
Total	16	87	81

The contribution of the study on Geometridae fauna is clearly seen when the number of the species in neighboring provinces (Koçak and Kemal 2018) and Maden district are compared (Table 2).

Table 2. Comparison of the species number in Maden district and neighboring provinces

Subfamilies	Maden (Elazığ)	Bingöl	Diyarbakır	Malatya	Tunceli
Sterrhinae	26	3	8	13	-
Larentiinae	21	3	11	17	4
Ennominae	35	6	18	24	4
Geometrinae	3	1	3	8	2
Orthostixinae	1	2	-	-	-
Desmobathrinae	1	-	1	1	-
Total	87	15	41	63	10

Furthermore, *Idaea consociata* is known only in Turkey, Mardin province until now. *Wehriola inexpectata* is described by Kemal and Uçak from Hakkari province (Turkey) in 2018. And, *Gnophos sacrararia* is known from Israel, Egypt and Turkey (Siirt prov.) (Seven 2014, Koçak and Kemal 2018). The second locality records of these rare known species are given from the study area.

Although the vast majority of the geometrid moths are active at night, some of them also fly at daytime. The diurnal species determined in the region are: *Camptogramma bilineatum*, *Chiasmia clathrata*, *Myinodes shohami*, *Orthostixis calcularia*, *Rhodostrophia discopunctata* and *Rhodometra sacraria*.

According to the information obtained from the conducted studies in the research region, the species were evaluated in terms of their distributions in 3 categories (widespread, local and rare) by the number of samples and the number of localities they found.

Widespread species (a large number of samples and observed in many localities): *Idaea ochrata*, *I. degeneraria*, *I. filicata*, *Scopula submutata*, *S. marginepunctata*, *Eupithecia mystica*, *Camptogramma bilineatum*, *Crocallis elinguaris*, *Peribatodes rhomboidarius*, *Gnophos pseudosnelleni*, *Nychiodes variabilis*, *Gnopharmia irakensis*, *Selidosema plumarium*, *Eilicrinia cordiaria*, *Neognopharmia stevenaria*.

Local species (collected only in a specific locality): *Idaea determinata*, *I. subsericeata*, *I. trigeminata*, *Scopula decorata*, *Eulithis roessleraria*, *Peribatodes correptarius*, *Charissa dubitaria*, *Gnophos sacraria*, *Apochima flabellaria*, *Agriopis bajaria*, *Lycia hirtaria*, *Biston stratarius*, *Ramitia kufrana*.

Rare species (represented by very few samples): *Idaea consociata*, *Scopula ochraceata*, *S. ornata*, *Cleta perpusillaria*, *Eupithecia inconspicua*, *E. impurata*, *E. oblongata*, *Nebula senectaria*, *Euphyia frustata*, *Gymnoscelis rufifasciata*, *Xanthorhoe fluctuata*, *Larentia clavaria*, *Protorhoe corollaria*, *Wehriola inexpectata*, *Alsophila aceraria*, *Larerannis marginaria*, *Colotois pennaria*.

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