

Contributions to the fauna of Geometridae in the north eastern provinces

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Abstract: This article is based on Geometridae species collected from Ardahan, Bayburt, Erzincan, Erzurum, Gumushane and Kars provinces in Türkiye in 2021. Geometridae species were collected using insect net and light traps. All collected samples were prepared and diagnosed in the laboratory. As a result, 4 subfamilies, 23 genera and 27 species were determined. Photos of all diagnosed species and material examined were presented. In addition, 7 from Ardahan, 8 from Bayburt, 5 from Erzincan, 5 from Erzurum, 8 from Gümüşhane and 3 from Kars were determined for the first time in this study Geometridae species.

Keywords: Geometridae, fauna, Lepidoptera, Türkiye

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1. Introduction

This study depends on Geometridae species which were collected from the eastern north east provinces of Türkiye in the summer of 2021 (Ardahan, Bayburt, Erzincan, Erzurum, Gümüşhane, Kars).

Adult period, it feeds on water and pollen and thus helps pollination. However, since the larva feeds on the green parts and fruits of the lice, it damages the plants. Geometridae species are known to damage low-rise plants, forest trees, and cultivated plants (Koyuncu and Kütük 2020).

In terms of the number of species in the Lepidoptera order, the second most crowded family is Geometridae. The Geometridae family is represented by more than 23,000 species in the world (Scoble and Hausmann 2007), 988 in Europe (Hausmann et al. 2007), and 687 species in Türkiye (Koçak and Kemal 2018).

This study aimed to contribute to the distribution of Geometridae in Türkiye. and as a result, four subfamilies, 23 genera and 27 Geometridae species were determined.

2. Materials and Method

Geometridae species were collected from the eastern north east provinces in the summer of 2021 (Figure 1). Insect net was used for Diurnal Geometridae species and a curtain light trap was used for nocturnal species. Obtained adult species were taken into the killing jar and the deceased species were deposited with their label information.

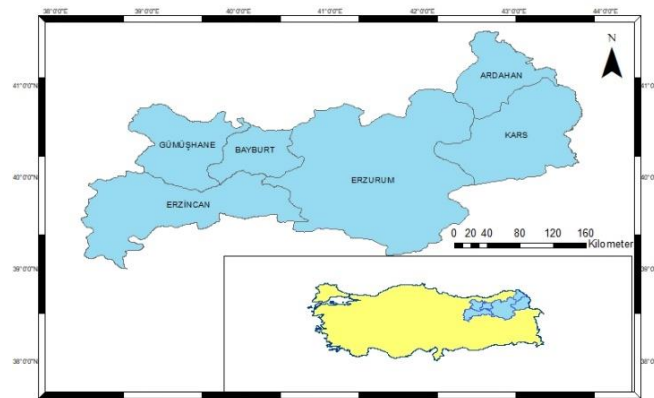


Fig. 1. Research area of collected specimens.

Fresh adult species were prepared in the laboratory. Dry species were relaxed according to Koyuncu and Kütük 2022 and then prepared. Labelling and diagnosis were made for all of the prepared species. Also genital preparations of all species were made for diagnosis. Species were diagnosed using following literatures: Hausmann 2001; Mironov 2003; Hausmann 2004; Redondo et al. 2009; Leraut 2009; Hausmann and Viidalepp 2012; Skou and Sihvonen 2015; Müller et al. 2019; Koyuncu and Kütük 2021.

3. Results

This article presents new contributions to the fauna of the eastern north east provinces of Türkiye. As a result of the study, 4 subfamilies, 23 genera and 27 species were

determined (Table 1). Photographs of all species (Figure B), reviewed material and individual numbers were presented. All species listed alphabetical order.

Table 1. List of Geometridae Species

Subfamily	Genus	Species
Ennominae	<i>Alcis</i>	<i>Alcis repandata</i>
	<i>Chiasmia</i>	<i>Chiasmia clathrata</i>
	<i>Cabera</i>	<i>Cabera pusaria</i>
	<i>Ematurga</i>	<i>Ematurga atomaria</i>
	<i>Isturgia</i>	<i>Isturgia murinaria</i>
	<i>Macaria</i>	<i>Macaria notata</i>
Geometrinae	<i>Aplasta</i>	<i>Aplasta ononaria</i>
	<i>Thalera</i>	<i>Thalera fimbrialis</i>
	<i>Thetidia</i>	<i>Thetidia smaragdaria</i>
Larentiinae	<i>Aplocera</i>	<i>Aplocera annexata</i>
	<i>Camptogramma</i>	<i>Camptogramma bilineata</i>
	<i>Epirrhoe</i>	<i>Epirrhoe alternata</i>
	<i>Odezia</i>	<i>Odezia atrata</i>
	<i>Philereme</i>	<i>Philereme transversata</i>
	<i>Schistostege</i>	<i>Schistostege nubilaria</i>
	<i>Scotopteryx</i>	<i>Scotopteryx chenopodiata</i>
	<i>Thera</i>	<i>Thera obeliscata</i>
	<i>Triphosa</i>	<i>Triphosa taochata</i>
Sterrhinae	<i>Cleta</i>	<i>Cleta filacearia</i>
	<i>Idaea</i>	<i>Idaea aureolaria</i>
		<i>Idaea aversata</i>
		<i>Idaea ochrata</i>
		<i>Idaea rufaria</i>
		<i>Idaea rusticata</i>
	<i>Lythria</i>	<i>Lythria purpuraria</i>
	<i>Rhodostrophia</i>	<i>Rhodostrophia auctata</i>
<i>Scopula</i>	<i>Scopula decorata</i>	

Alcis repandata (Linnaeus, 1758) Fig. 2-1
Material examined: 1♂, 1♀, **Ardahan**, Center, Universty Campus,, 41°07'35 N, 42°47'00 E, 1941m, 10.07.2021.

Aplasta ononaria (Fuessly, 1783) Fig. 2-2

Material examined: 3♂♂, **Erzincan**, Refahiye, Center, 39°53'47 N, 38°51'53 E, 1686m, 07.07.2021; 1♂, **Gümüşhane Ahmetli**, 39°52'25 N, 39°20'54 E, 2045m, 08.07.2021. 1♂, **Erzurum**, Center, Karagöbek, 40°09'29 N, 41°25'58 E, 1997m, 09.07.2021.

Aplocera annexata (Freyer, 1830) Fig. 2-3

Material examined: 3♀♀, **Bayburt**, Kop Mountain, Şehitlik, 40°01'56 N, 40°30'57 E, 2433m, 08.07.2021.

Cabera pusaria (Linnaeus, 1758) Fig. 2-4

Material examined: 1♂, **Bayburt**, Kop Mountain, Şehitlik, 40°01'56 N, 40°30'57 E, 2433m, 08.07.2021. 1♀, **Erzurum**, Center, Karagöbek, 40°09'29 N, 41°25'58 E, 1997m, 09.07.2021; 2♂♂, Pasinler, Center, 39°58'40 N, 41°37'35 E, 1630m, 11.07.2021. 3♂♂, 1♀, **Gümüşhane**, Center, Çimenli, 38°57'12 N, 39°24'40 E, 1722m, 08.07.2021.

Camptogramma bilineata (Linnaeus, 1758) Fig. 2-5

Material examined: 4♂♂, 5♀♀, **Erzurum**, Oltu, Tahtaköy, 40°39'55 N, 42°22'29 E, 1339m, 09.07.2021; 5♂♂, Pasinler, Center, 39°58'40 N, 41°37'35 E, 1630m, 11.07.2021. 1♂, **Gümüşhane**, Center, Çimenli, 38°57'12 N, 39°24'40 E, 1722m, 08.07.2021.

Chiasmia clathrata (Linnaeus, 1758) Fig. 2-6

Material examined: 2♂♂, **Ardahan**, Center, Universty Campus,, 41°07'35 N, 42°47'00 E, 1941m, 10.07.2021.

Cleta filacearia (Herrich-Schäffer, 1847) Fig. 2-7

Material examined: 7♂♂, 3♀♀, **Bayburt**, Kop Mountain, Şehitlik, 40°01'56 N, 40°30'57 E, 2433m, 08.07.2021.

Ematurga atomaria (Linnaeus, 1758) Fig. 2-8

Material examined: 2♂♂, **Erzincan**, Refahiye, Arpayazı, 39°49'51 N, 38°44'50 E, 1880m, 07.07.2021.

Epirrhoe alternata (Müller, 1764) Fig. 2-9

Material examined: 1♂, 1♀, **Bayburt**, Kop Mountain, Şehitlik, 40°01'56 N, 40°30'57 E, 2433m, 08.07.2021.

Idaea aureolaria (Denis & Schiffermüller, 1775) Fig. 2-10

Material examined: 1♂, **Ardahan**, Center, Çamlıçatak, 41°05'35 N, 42°49'05 E, 2034m, 10.07.2021.

Idaea aversata (Linnaeus, 1758) Fig. 2-11

Material examined: 2♂♂, **Gümüşhane**, Center, Çimenli, 38°57'12 N, 39°24'40 E, 1722m, 08.07.2021.

Idaea ochrata (Scopoli, 1763) Fig. 2-12

Material examined: 4♂♂, **Bayburt**, Center, 40°05'26 N, 39°43'11 E, 1774m, 08.07.2021; 2♂♂, Kop Mountain, Şehitlik, 40°01'56 N, 40°30'57 E, 2433m, 08.07.2021. 3♂♂, 1♀, **Erzincan**, Refahiye, Arpayazı, 39°49'51 N, 38°44'50 E, 1880m, 07.07.2021; 2♀♀, Refahiye, Center, 39°53'47 N, 38°51'53 E, 1686m, 07.07.2021. 2♂♂, **Gümüşhane**, Center, Çimenli, 38°57'12 N, 39°24'40 E, 1722m, 08.07.2021. 3♂♂, 2♀♀, **Kars**, Susuz, Kırkpınar, 42°52'06 N, 43°01'33 E, 2157m, 10.07.2021.

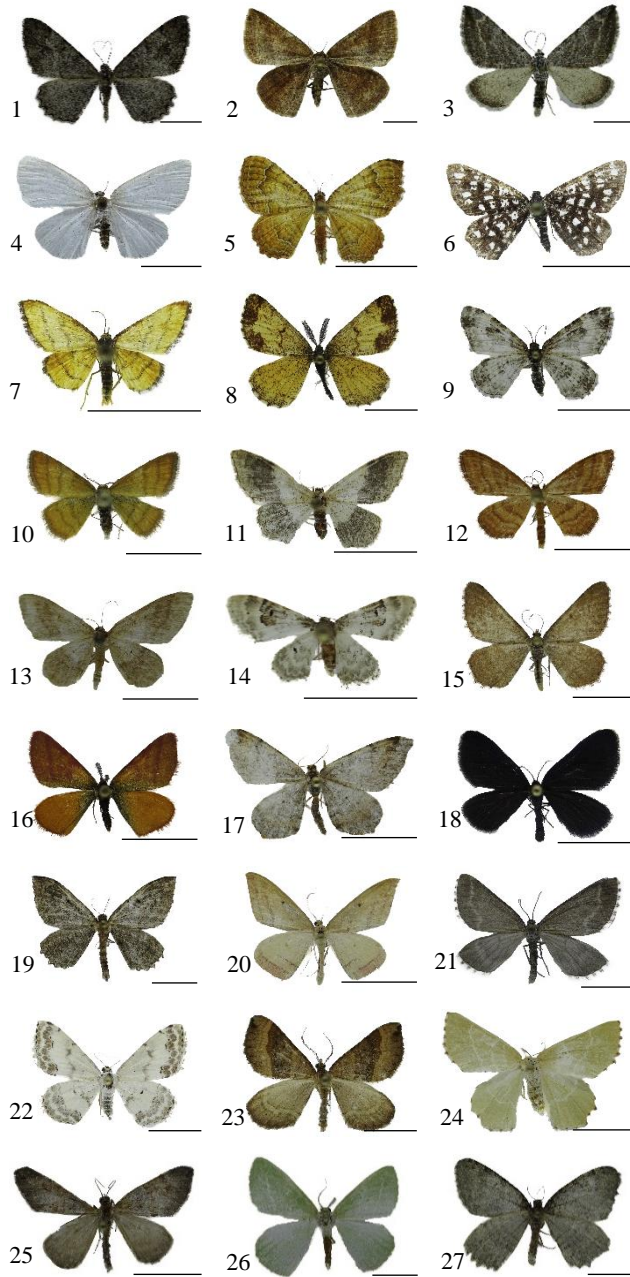


Fig. 2. Geometridae species: 1. *Alcis repandata*, 2. *Aplasta ononaria*, 3. *Aplocera annexata*, 4. *Cabera pusaria*, 5. *Camptogramma bilineata*, 6. *Chiasmia clathrata*, 7. *Cleta filicearia*, 8. *Ematurga atomaria*, 9. *Epirrhoe alternata*, 10. *Idaea aureolaria*, 11. *I. aversata*, 12. *I. ochrata*, 13. *I. rufaria*, 14. *I. rusticata*, 15. *Isturgia murinaria*, 16. *Lythria purpuraria*, 17. *Macaria notata*, 18. *Odezia atrata*, 19. *Philereme transversata*, 20. *Rhodostrophia auctata*, 21. *Schistostege nubilaria*, 22. *Scopula decorata*, 23. *Scotopteryx chenopodiata*, 24. *Thalera fimbrialis*, 25. *Thera obeliscata*, 26. *Thetidia smaragdaria*, 27. *Triphosa taochata*. (Scale bar: 1cm)

Idaea rufaria (Hübner, [1799]) Fig. 2-13

Material examined: 1♂, **Ardahan**, Center, Çamlıçatak, 41°05'35 N, 42°49'05 E, 2034m, 10.07.2021. 1♂, **Erzincan**, Gümüşhane Ahmetli, 39°52'25 N, 39°20'54 E, 2045m, 08.07.2021. 1♂, **Gümüşhane**, Center, Çimenli, 38°57'12 N, 39°24'40 E, 1722m, 08.07.2021.

Idaea rusticata (Denis & Schiffermüller, 1775) Fig. 2-14
Material examined: 2♀♀, **Erzurum**, Oltu, Tahtaköy, 40°39'55 N, 42°22'29 E, 1339m, 09.07.2021. 3♂♂, **Gümüşhane**, Center, Çimenli, 38°57'12 N, 39°24'40 E, 1722m, 08.07.2021.

Isturgia murinaria ([Denis & Schiffermüller], 1775) Fig. 2-15

Material examined: 1♀, **Bayburt**, Kop Mountain, Şehitlik, 40°01'56 N, 40°30'57 E, 2433m, 08.07.2021. 1♂, **Erzurum**, Center, Karagöbek, 40°09'29 N, 41°25'58 E, 1997m, 09.07.2021.

Lythria purpuraria (Linnaeus, 1758) Fig. 2-16

Material examined: 4♂♂, **Ardahan**, Center, Universty Campus,, 41°08'01 N, 42°46'45 E, 1966m, 10.07.2021; 1♂, Center, Çamlıçatak, 41°05'35 N, 42°49'05 E, 2034m, 10.07.2021. 1♂, **Erzurum**, Pasinler, Üğümü, 39°59'20 N, 40°43'49 E, 1689m, 11.07.2021. 1♂, **Gümüşhane**, Center, Çimenli, 38°57'12 N, 39°24'40 E, 1722m, 08.07.2021. 6♂♂, 2♀♀, **Kars**, Susuz, Kırkpınar, 42°52'06 N, 43°01'33 E, 2157m, 10.07.2021.

Macaria notata (Linnaeus, 1758) Fig. 2-17

Material examined: 2♂♂, **Ardahan**, Center, Universty Campus,, 41°07'35 N, 42°47'00 E, 1941m, 10.07.2021.

Odezia atrata (Linnaeus, 1758) Fig. 2-18

Material examined: 5♂♂, 4♀♀, **Bayburt**, Kop Mountain, Şehitlik, 40°01'56 N, 40°30'57 E, 2433m, 08.07.2021.

Philereme transversata (Hufnagel, 1767) Fig. 2-19

Material examined: 2♂♂, **Ardahan**, Center, Universty Campus,, 41°07'35 N, 42°47'00 E, 1941m, 10.07.2021

Rhodostrophia auctata Staudinger, 1887 Fig. 2-20

Material examined: 1♂, **Erzincan**, Gümüşhane Ahmetli, 39°52'25 N, 39°20'54 E, 2045m, 08.07.2021. 2♂♂, **Bayburt**, Kop Mountain, Şehitlik, 40°01'56 N, 40°30'57 E, 2433m, 08.07.2021.

Schistostege nubilaria (Hübner, 1799) Fig. 2-21

Material examined: 6♂♂, 2♀♀, **Kars**, Susuz, Kırkpınar, 42°52'06 N, 43°01'33 E, 2157m, 10.07.2021.

Scopula decorata (Denis & Schiffermüller, 1775) Fig. 2-22

Material examined: 2♂♂, **Bayburt**, Kop Mountain, Şehitlik, 40°01'56 N, 40°30'57 E, 2433m, 08.07.2021.

Scotopteryx chenopodiata (Linnaeus, 1758) Fig. 2-23

Material examined: 11♂♂, 7♀♀, **Ardahan**, Center, Universty Campus,, 41°07'35 N, 42°47'00 E, 1941m, 10.07.2021.

Thalera fimbrialis (Scopoli, 1763) Fig. 2-24

Material examined: 2♂♂, **Erzincan**, İliç, Bozçalı, 39°42'58 N, 38°36'37 E, 1400m, 07.07.2021. 2♂♂, **Erzurum**, Pasinler, Üğümü, 39°59'20 N, 40°43'49 E, 1689m, 11.07.2021. 1♂, **Gümüşhane**, Center, Çimenli, 38°57'12

N, 39°24'40 E, 1722m, 08.07.2021. 1♂, **Kars**, Susuz, Kırkpınar, 42°52'06 N, 43°01'33 E, 2157m, 10.07.2021.

Thera obeliscata (Hübner, 1787) Fig. 2-25

Material examined: 2♂♂, **Ardahan**, Center, Universty Campus,, 41°07'35 N, 42°47'00 E, 1941m, 10.07.2021.

Thetidia smaragdaria (Fabricius, 1787) Fig. 2-26

Material examined: 2♂♂, **Bayburt**, Kop Mountain, Şehitlik, 40°01'56 N, 40°30'57 E, 2433m, 08.07.2021.

Triphosa taochata Lederer, 1870 Fig. 2-27

Material examined: 2♂♂, **Ardahan**, Center, Universty Campus,, 41°07'35 N, 42°47'00 E, 1941m, 10.07.2021.

4. Discussion

According to the literatures, some Geometridae species reported previously from the eastern north east provinces (Koçak ve Kemal 2018). There were reported 51 species from Ardahan, 15 from Bayburt, 26 from Erzincan, 70 from Erzurum, 27 from Gümüşhane and 59 from Kars.

In this article, 10 species were determined from Ardahan province, 7 of which were reported for the first time (*Idaea aureolaria*, *Idaea rufaria*, *Lythria purpuraria*, *Macaria notata*, *Philereme transversata*, *Thera obeliscata*, *Triphosa taochata*). 10 species were determined from Bayburt province, 8 of which were reported for the first time (*Cabera pusaria*, *Cleta filacearia*, *Epirrhoe alternata*, *Idaea ochrata*, *Isturgia murinaria*, *Odezia atrata*, *Scopula decorata*, *Thetidia smaragdaria*) in this study. 6 species were determined from Erzincan province, 5 of which were reported for the first time (*Aplasta ononaria*, *Ematurga atomaria*, *Idaea ochrata*, *Idaea rufaria*, *Thalera fimbrialis*) in this study. 7 species were determined from Erzurum province, 6 of which were reported for the first time (*Aplasta ononaria*, *Cabera pusaria*, *Camptogramma bilineata*, *Isturgia murinaria*, *Lythria purpuraria*, *Thalera fimbrialis*) in this study. 8 species were determined from Gümüşhane province, 8 of which were reported for the first time (*Cabera pusaria*, *Camptogramma bilineata*, *Idaea aversata*, *Idaea ochrata*, *Idaea rufaria*, *Idaea rusticata*, *Lythria purpuraria*, *Thalera fimbrialis*) in this study. 4 species were determined from Kars province, 3 of which were reported for the first time (*Idaea ochrata*, *Lythria purpuraria*, *Thalera fimbrialis*) in this study (Table 2).

The order of insects has a wide distribution worldwide and is essential both ecologically and agriculturally. Thus, it is thought that faunistic studies on insects should be increased and agriculturally damaging species should be determined in our country. In addition, this study provides new faunistic contribution for Geometridae fauna of Türkiye.

Table 2. Distribution of Geometridae species in provinces

Geometridae species Provinces	Species count before this study	Determined species in this study	New record for provinces	Species count after this study
Ardahan	51	10	7	58
Bayburt	15	10	8	23
Erzincan	26	6	5	31
Erzurum	70	7	6	75
Gümüşhane	27	8	8	35
Kars	59	4	3	62

Authors' contributions:

MÖK: Sample collection, Preparation, Identification MK: sample collection MY: Sample collection, Identification

Conflict of interest disclosure:

The authors declare no conflict of interests

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