

THE GEOMETER MOTHS (LEPIDOPTERA, GEOMETRIDAE) FROM THE „R. STEPANOV” ENTOMOLOGICAL COLLECTION

Cristina ȚUGULEA, Andrian ȚUGULEA,
Nadejda MOCREAC, Valeriu DERJANSCHI

Rezumat

Geometridele (Lepidoptera, Geometridae) din colecția entomologică „R. Stepanov”. Lucrarea prezintă analiza fluturilor din familia Geometridae (Lepidoptera) conservate în colecția entomologică „R. Stepanov” care se află în fondurile Muzeului Național de Etnografie și Istorie Naturală din Chișinău. Cele 158 de exemplare aparțin la 58 specii incluse în 42 genuri și patru subfamilii: Ennominae (20 de specii), Geometrinae (2), Larentiinae (19) și Sterrhinae – 17 specii. Din punct de vedere numeric cel mai bine este reprezentată subfamilia Larentiinae, care însumează 75 de exemplare din 158, constituind 47,5 %. Este urmată de subfamilia Ennominae cu 43 de exemplare și Sterrhinae cu 37 de exemplare. Subfamilia Geometrinae înregistrează doar 3 exemplare. Genul *Acasis Duponchel*, 1845 și speciile *Acasis appensata* (Eversmann, 1842) și *Scopula decorata* (Denis și Schiffermüller, 1775) sunt taxoni noi pentru fauna Republicii Moldova.

Cuvinte-cheie: Geometridae, specii noi, colecția „R. Stepanov”, Republica Moldova

Introduction

The Geometridae moth is a very rich insect family in species and various regarding the sexual dimorphism. This is the second Lepidoptera family with about 23.000 described species occurring worldwide with the exception of the Polar Regions [8] and the most beautiful species being found in the tropics. The majority of the moth's species are mostly nocturnal than diurnal. The Geometridae caterpillars are popularly called inchworms or loopers which are dangerous species causing the development of mass outbreaks which lead to defoliation of crops, forests, of trees and shrubs from parks and squares.

Geometer moths have been studied in the Republic of Moldova since the early 1900's when Crulicovschi published the first data in 1906 [11]. In the same period (1908-1937) Miller, Zubovschi and Ruscinschi published similar studies [4-6, 10]. These works present the species list and collection points.

Data concerning the Geometridae fauna of the Republic of Moldova were published by Derjanschi et al., in 2016 in a comprehensive catalogue named “Catalogue of the N. Zubowsky entomological collection” [1]. This huge catalog includes 3609 specimens of butterflies, of which 1187 specimens of 177 species belong to Geometridae family. The „N. Zubowsky” entomological collection

is the oldest in the Republic of Moldova, elaborated during 1900-1940 years in Bessarabia and has a considerable scientific interest. This collection are preserved in the National Museum of Ethnography and Natural History, located in Chișinău, Republic of Moldova.

Besides this entomological collection in the National Museum of Ethnography and Natural History is stored another ancient valuable collection of R. Stepanov which was a famous naturalist too.

The „R. Stepanov” entomological collection consists of more than 20.000 insects from Orthoptera, Lepidoptera and Coleoptera order, which will be published in the future. Mainly specimens were sampled during 1905-1938 years from Bessarabia, which represents the current territory of the Republic of Moldova and a few localities that now belong to Ukraine. Also, in this ancient collection are preserved geometridae moths collected from various ecosystems, both anthropogenic and natural from Bessarabia and other countries from Europe. The entomological materials were collected in the night at light and of course during the day using the entomological sweep net.

The paper presents the list of geometer moths (Lepidoptera, Geometridae) from „R. Stepanov” entomological collection. The data from this paper serve as element of applicability in statistical analysis of biodiversity and at the enrichment of the entomological heritage in the chapter of Geometridae moths of the Republic of Moldova. Also, the material based on this research is a valuable source study for the specialists from biology, entomology, plant protection fields, etc.

Material and methods

The analysed material is represented by the species of the Geometridae family preserved in the „R. Stepanov” entomological collection of National Museum of Ethnography and Natural History, collected during 1905-1938 years.

The nomenclature and taxonomy of the species used in this work are consistent with the taxonomic system of Fauna Europaea and L. Rakosy [3, 7].

For each species, there were recorded: the number of specimens, the sites and the collection dates. Collection sites are listed in alphabetical order, and the collection dates, in chronological order of the years and moths of collection.

Results and discussions

After analyzing the 158 specimens, were identified 58 species included in 42 genera and four subfamilies. The distribution of specimens, species and genera in the four subfamilies is uneven (Table 1).

Table 1. The numerical spectrum of the analysed Geometridae family from „R. Stepanov” entomological collection

No.	Subfamily	Nr. of genera	Nr. of species	Nr. of specimens		
				Republic of Moldova	Other countries	No data
1.	Ennominae	20	20	38	3	2
2.	Geometrinae	2	2	2	0	1
3.	Larentiinae	13	19	64	5	6
4.	Sterrhinae	7	17	33	3	1
Total		42	58	136	11	11

From 158 geometrids specimens stored in the „R. Stepanov” entomological collection one come from Slovenia, ten from Ukraine, and 136 from 12 collecting sites from present territory of the Republic of Moldova (Table 2). About those eleven remained specimens nothing is known, because the labels with the collection date and place are missing. From these eleven unlabeled species *Eupithecia irriguata* (Hübner, 1813) and *Eupithecia extremata* (Fabricius, 1787) species weren't reported for the fauna of the Republic of Moldova. In the same time these two species were cited just for Romania, and not for Ukraine [3, 7].

Table 2. Collection sites list of Geometridae specimens from the „R. Stepanov” entomological collection

I. Republic of Moldova	8. Dănceni (Ialoveni district)	III. Ukraine
1. Baurci-Moldoveni (Cahul district)	9. Durlăști (Chișinău mun.)	1. Hotin
2. Bender	10. Grinăuți (Ocnița district)	2. Izmail
3. Bularda (Călărași district)	11. Hâncești	3. Tashbunar
4. Chișinău	12. Sadova (Călărași district)	4. Tatarbunar
5. Codru		5. Vilcovo
6. Condița (Strășeni district)	II. Slovenia	
7. Cornești (Ungheni district)	1. Rjavino	

In what follows, we present list of identified species in accordance with the taxonomic systems utilized in the Fauna Europaea and L. Rakosy [3, 7].

ORDER LEPIDOPTERA

Superfamily Geometroidea

Family Geometridae

Subfamily Ennominae

1. *Abraxas (Abraxas) grossulariata* (Linnaeus, 1758): Chișinău, 20.06.1917, 1 spec.
2. *Alsophila aescularia* (Denis & Schiffermüller, 1775): Durlești, 16.03.1930, 1 spec.:
3. *Angerona prunaria* (Linnaeus, 1758): Cornești, 08.06.1937, 2 specs.
4. *Ascotis selenaria* (Denis & Schiffermüller, 1775) [In collection as *Boarmia selenaria*]: Chișinău, 20.07.1922, 3 specs.; Hotin (Ukraine), 03.08.1912, 2 specs.
5. *Chiasmia clathrata* (Linnaeus, 1758) [In collection as *Semiothisa clathrate*]: Chișinău, 01.08.1932, 1 spec.; Dănceni 22.05.1932, 2 specs.; Sadova, 09.08.1911, 1 spec.
6. *Colotois pennaria* (Linnaeus, 1761): Chișinău, 26.09-06.10.1913, 2 specs.
7. *Crocallis elinguarina* (Linnaeus, 1758): Chișinău, 28.09.1927, 1 spec.
8. *Ematurga atomaria* (Linnaeus, 1758): Condrița, 28.04.1911, 1 spec.; Grinăuți, 1914, 1 spec.
9. *Ennomos (Deuteronomos) erosaria* (Denis & Schiffermüller, 1775), Cornești, 19.07.1938, 1 spec.
10. *Erannis defoliaria* (Clerck, 1759): Chișinău, 27.04.1924, 1 spec.; 29.10.1934, 1 spec.; 25.10.1936, 1 spec.
11. *Isturgia murinaria* (Denis & Schiffermüller, 1775) [In collection as *Tephrina murinaria*]: Bularda, 10.04.1932, 1 spec.; Chișinău, 04.06.1932, 1 spec.
12. *Lomographa bimaculata* (Fabricius, 1775) [In collection as *Bapta bimaculata*]: Cornești, 15.06.1937, 1 spec.
13. *Lycia hirtaria* (Clerck, 1759): Hâncești, 29.03.1923, 1 spec.
14. *Macaria notata* (Linnaeus, 1758) [In collection as *Semiothisa notata*]: no data of locality, 1 spec.
15. *Ourapteryx sambucaria* (Linnaeus, 1758): Grinăuți, 14.07.1912, 1 spec.
16. *Peribatodes rhomboidaria* (Denis & Schiffermüller, 1775) [In collection as *Boarmia rhomboidaria*]: Chișinău, 16.07-14.08.1916, 2 specs.; 08.08.1919, 1 spec.; 15.05.1924, 1 spec.; 29.08.1932, 1 spec.
17. *Pseudopanthera macularia* (Linnaeus, 1758): Chișinău, 21.04.1913, 1 spec.; Izmail (Ukraine), 23.07.1911, 1 spec.; no data of locality, 1 spec.
18. *Selenia lunularia* (Hübner, 1788): Cornești, 17.07.1938, 1 spec.
19. *Siona lineata* (Scopoli, 1763): Chișinău, 11.08.1914, 1 spec.; 12.08.1916, 1 spec.; 29.08.1932, 1 spec.; Cornești, 10-18.07.1938, 2 specs.; Durlești, 30.07.1938, 1 spec.; Grinăuți, 1914, 1 spec.
20. *Therapis flavicaria* (Denis & Schiffermüller, 1775) [In collection as *Caustoloma flavicuria*]: Chișinău, 22.04.1916, 1 spec., 11.08.1917, 1 spec.

Subfamily Geometrinae

21. *Geometra papilionaria* (Linnaeus, 1758): no data of locality, 1 spec.
22. *Thetidia (Antonechloris) smaragdaria* (Fabricius, 1787). [In collection as *Euchloris smaragdaria* and *Euchloris f. prosinaria*]: Chișinău, 20.08.1932, 1 spec.; Grinăuți, 28.03.1905, 1 spec.

Subfamily Larentiinae

23. **Acasis appensata* (Eversmann, 1842): Chișinău, 11.07.1916, 1 spec.
24. *Anticlea derivata* (Denis & Schiffermüller, 1775) [In collection as *Cidaria derivata*]: Chișinău, 25.04.1918, 1 spec.
25. *Aplocera plagiata* (Linnaeus, 1758) [In collection as *Anaitis plagiata*]: Chișinău, 25.08.1915, 1 spec.; 15.08.1916, 1 spec.; 27.08.1932, 1 spec.
26. *Asthena albulata* (Hufnagel, 1767): Durlești, 17.05.1931, 1 spec.
27. *Camptogramma bilineata* (Linnaeus, 1758) [In collection as *Cidaria bilineata*]: Chișinău, 09.06.1911, 1 spec.; 29.07.1919, 1 spec.; 11.07.1932, 1 spec.; Izmail (Ukraine), 09.06.1911, 1 spec.
28. *Colostygia pectinataria* (Knoch, 1781) [In collection as *Stegania delectaria*]: Chișinău, 09.10.1914, 1 spec.
29. *Eupithecia breviculata* (Donzel, 1837): no data of locality, 1 spec.
30. *Eupithecia centaureata* (Denis & Schiffermüller, 1775): Chișinău, 30.05.1912, 1 spec.
31. *Eupithecia simpliciatata* (Haworth, 1809) [In collection as *Eupithecia subnotata*]: Chișinău, 11.07.1916, 1 spec.; 10.08.1932, 1 spec.
32. *Eupithecia subfuscata* (Haworth, 1809): no data of locality, 1 spec.
33. ***Eupithecia irriguata* (Hübner, 1813): no data of locality, 1 spec.
34. ***Eupithecia extremata* (Fabricius, 1787): no data of locality, 1 spec.
35. *Lithostege farinata* (Hufnagel, 1767): Chișinău, 01.06.1914, 1 spec.; 25.06.1922, 1 spec.; Tashbunar (Ukraine), 15.06.1911, 1 spec.
36. *Lithostege griseata* (Denis & Schiffermüller, 1775): Chișinău, 10.05.1916, 1 spec.; Dănceni, 22.05.1932, 1 spec.; Grinăuți, 1914, 1 spec.; Tashbunar (Ukraine), 30.04, 16.06.1911, 2 specs.; no data of locality, 1 spec.
37. *Lythria purpuraria* (Linnaeus, 1758): Baurci-Moldoveni, 26-30.06.1911, 2 specs.; Chișinău, 26.04.1924, 1 spec.
38. *Operophtera brumata* (Linnaeus, 1758): Chișinău, 23.10.1913, 9 specs.; Codru, 03.11.1914, 19 specs.
39. *Pelurga comitata* (Linnaeus, 1758): Chișinău, 18.07, 02.08.1913, 4 specs.; 21-22.07, 03-04.08.1914, 4 specs.; 27.07.1915, 1 spec.; 10-15.08.1916, 2 specs.; 06.08.1918, 1 spec.; 16.07.1932, 1 spec.; Rjavino (Slovenia), 04.08.1912, 1 spec.

40. *Philereme transversata* (Hufnagel, 1767) [In collection as *Scotosia rhamnata*]: Chișinău, 03.07.1922, 1 spec.; 19.06.1924, 1 spec.; 09.07.1932, 1 spec.

41. *Xanthorhoe fluctuata* (Linnaeus, 1758) [In collection as *Cidaria fluctuata*]: Chișinău, 08.09.1913, 1 spec.; 08.08.1919, 1 spec.; 03.07.1922, 1 spec.; 22.08.1932, 2 specs.

Subfamily Sterrhinae

42. *Cyclophora (Codonia) punctaria* (Linnaeus, 1758) [In collection as *Cosymbia punctaria*]: Chișinău, 08.05.1928, 1 spec.; Dănceni, 22.05.1932, 1 spec.; Durlești, 10.07.1932, 1 spec.;

43. *Cyclophora linearia* (Hübner, 1799) [In collection as *Cosymbia linearia*]: Chișinău, 16.06.1918, 1 spec., 20.06.1924, 1 spec.; Bender, 08.06.1931, 1 spec.; Cornești, 26.06.1938, 1 spec.

44. *Idaea aversata* (Linnaeus, 1758) [In collection as *Sterrrha aversata*], Chișinău, 02.07.1932, 1 spec.

45. *Idaea degeneraria* (Hübner, 1799) [In collection as *Sterrrha degeneraria*], Chișinău, 08.08.1919, 1 spec.

46. *Idaea dilutaria* (Hübner, 1799) [In collection as *Sterrrha dilutaria*]: Chișinău, 04.06.1916, 1 spec.; Durlești, 10.07.1932, 2 specs.

47. *Idaea dimidiata* (Hufnagel, 1767) [In collection as *Sterrrha dimidiata*]: Chișinău, 14.07.1916, 1 spec.

48. *Idaea ochrata* (Scopoli, 1763) [In collection as *Sterrrha ochrata*]: Baurci-Moldoveni, 26.06.1911, 1 spec.; Izmail (Ukraine), 23.07.1911, 1 spec.

49. *Idaea rusticata* (Denis & Schiffermüller, 1775) [In collection as *Sterrrha rusticata*], Chișinău, 29.06.1914, 1 spec.; 15.08.1919, 1 spec.; 09.07, 01.08.1932, 2 specs.

50. *Idaea serpentata* (Hufnagel, 1767) [In collection as *Sterrrha serpentata*]: Cornești, 26.06.1938, 1 spec.

51. *Idaea straminata* (Borkhausen, 1794) [In collection as *Sterrrha inornata*]: Chișinău, 08-19.08.1916, 2 specs.; 05.08.1932, 1 spec.

52. *Idaea trigeminata* (Haworth, 1809) [In collection as *Sterrrha trigeminata*], Chișinău, 05.08.1932, 1 spec.

53. *Rhodostrophia vibicaria* (Clerck, 1759): Sadova, 09.08.1911, 1 spec.; Chișinău, 07.06.1912, 1 spec.; 05.07.1932, 1 spec.; Vilcovo (Ukraine), 01.06.1911, 1 spec.

54. *Scopula (Calothyisanis) incanata* (Linnaeus, 1758): Chișinău, 10.1918, 1 spec.

55. *Scopula immorata* (Linnaeus, 1758): Chișinău, 05.08.1919, 1 spec.; 30.07, 11.08.1932, 2 specs.; Izmail (Ukraine), 23.07.1911, 1 spec.

56. *Scopula rubiginata* (Hufnagel, 1767): Chișinău, 23.08.1916, 1 spec.; 02.09.1919, 1 spec.

57. **Scopula decorata* (Denis & Schiffermüller, 1775) [In collection as *Sterrrha congruata*]: Chișinău, 30.07.1932, 1 spec.

58. *Timandra griseata* Petersen, 1902 [In collection as *Calothysanis amata*]: Chișinău, 03.08.1915, 1 spec.; 10-11.08.1932, 2 specs.; no date of locality, 1 spec.

Remarks: * – new species, ** – species where the place and date of collection are unknown (were not reported for Republic of Moldova).

The best represented subfamily in terms of numbers is the Larentiinae subfamily, which sums up to 75 specimens of the 158 (Table 1), representing 47,47 %. It is followed by the Ennominae subfamily with 43 specimens (27,22 %) and Sterrhinae with 37 specimens (23,42 %). The Geometrinae subfamily lists only 3 specimens, what constitutes 1,90 %.

Regarding the distribution of species in four subfamilies, the Ennomine, Larentiinae and Sterrhinae families still owns most species – 20, 19 and 17, respectively. Geometridae subfamily includes only two species.

As a result of studying of the specialized literature [1, 4-6, 10-11] we have established new taxons for the fauna of the Republic of Moldova. Thus, the genus *Acasis* Duponchel, 1845, also *Acasis appensata* (Eversmann, 1842) and *Scopula decorata* (Denis & Schiffermüller, 1775) species are reported for the first time for Moldova. Below we give a brief feature of these two species

***Acasis appensata* Eversm.**

Geographical spread: a Palearctic element, the distribution extends especially across the Alps and Northern Europe [2].

Biology: the moths fly from May in a single generation. The caterpillars can be found from June to August. They live partly in the shelter of spun fruits or leaves [2].

Host plants: *Actaea spicata* (fruits, but secondary also leaves).

Habitat: *Acasis appensata* inhabits at least slightly damp forests with the larval host plants in the understory [2].

Conservation status: vulnerable (VU) [7].

***Scopula decorata* Den. & Schiff. (middle lace border)**

Geographical spread: a Palearctic element, being spread from North Africa and the Iberian Peninsula to Mongolia. The nucleus being the Mediterranean countries; the Northern Border – Southern Sweden, Southern Finland and the Baltic States; the South Border – from Asia Minor to Central Asia [9].

Biology: species overwinters as caterpillar.; the species has two generations or three (depending on locality). The adults of the first generation fly in May - June, and the second generation from late July to early September.

Host plants: the caterpillar lives on thyme species (*Thymus*), perhaps in Southern Europe also on other Lamiaceae [2].

Habitat: *Scopula decorata* inhabits sandy grasslands, rocky slopes, grasslands and similar locations.

Conservation status: near threatened (NT) [7].

Conclusions

The Geometer Moths (Lepidoptera, Geometridae) from the „R. Stepanov” entomological collection includes 158 specimens belong to a total of 58 species, which represent 42 genera and four subfamilies: Ennominae (20 species), Geometrinae (2), Larentiinae (19) and Sterrhinae – 17 species.

The species *Acasis appensata* (Eversmann, 1842) and *Scopula decorata* (Denis & Schiffermüller, 1775) are new for the fauna of Republic of Moldova. Also the genus *Acasis* Duponchel, 1845 is reported for the first time for our republic.

The results contribute to a better understanding of the Geometridae diversity and their habitat in the Republic of Moldova fauna.

Acknowledgement

The researches was carried in the projects 24 20.80009.0807.24 and 20.80009.7007.02 from State program of the National Museum of Ethnography & Natural History and Institute of Zoology.

References

1. Derjanschi V., Baban E., Calestru L., Stahi N., Țugulea C. Catalogue of the N. Zubowsky entomological collection. Chișinău: Bons Offices, 2016, 296 p.
2. European lepidoptera and their ecology. In: Website: <http://www.pyrgus.de/> (accessed April 2020).
3. Fauna Europaea, Web Service. Fauna Europaea version 2.6.2., 2013 (available online at <http://www.faunaeur.org>) (accessed April 2020).
4. Miller E., Zubowski N. Materialien zur Kenntnis der entomologischen Fauna Bessarabiens. Macrolepidoptera. In: Travaux de la Societe des Naturalistes et des Amateurs des sciences naturelles de Bessarabia. Kischineff, Teil I, 1908, p. 410-425; Teil II, 1910, p. 93-96; Teil III, 1913, p. 261-262.
5. Miller E., Zubowski N., Ruschtschinsky A. Materialien zur Kenntnis der entomologischen Fauna Bessarabiens. Macrolepidoptera Nachtrag IV. In: Buletinul Muzeului Național de Istorie Naturală. Fascicola 4. Chișinău: Tipografia Eparhială „Cartea Românească”, 1932, p. 25-38.

6. Miller E., Zubowski N., Ruscinski A. Materiale pentru fauna entomologică din Basarabia. Macrolepidoptera. In: Buletinul Muzeului Național de Istorie Naturală. Fascicola 3-4. Chișinău: Tipografia Eparhială – „Cartea Românească”, 1929, p.1-34.

7. Rákósy L., Goia M., Kovács Z. Catalogul Lepidopterelor României. Cluj-Napoca: Societatea Lepidopterologică Romană, 2003, 447 p.

8. Sihvonen P., Mutanen M., Kaila L. et al. Comprehensive Molecular Sampling Yields a Robust Phylogeny for Geometrid Moths (Lepidoptera: Geometridae). In: PLoS One, 2011, 6 (6), e20356. Published online 2011 Jun 1. doi: 10.1371/journal.pone.0020356.

9. Skou P. The Geometroid Moths of North Europe (Lepidoptera: Drepanidae and Geometridae). In: E. J. Brill & Scandinavian Science Press, Entomograph, 6. Leiden & Copenhagen, 1986, 348 p.

10. Zubowsky N., Ruscinski A. Materialien zur Kenntnis der entomologischen Fauna Bessarabiens. Macrolepidoptera. Nachtrag V. In: Buletinul Muzeului regional al Basarabiei din Chișinău, 1937, 8, p. 23-32.

11. Круликовский Л. К. К сведениям о чешуекрылых Бессарабии. В: Русское энтомологическое обозрение, 1906, 6 (3-4), с. 184-187.

Abstract

*The paper represents the analysis of the butterflies of the Geometridae family (Lepidoptera) preserved in the entomological collection „R. Stepanov” which is in the possession of the National Museum of Ethnography and Natural History of the Republic of Moldova. The 158 specimens belong to a total of 58 species included 42 genera and four subfamilies: Ennominae (20 species), Geometrinae (2), Larentiinae (19) and Sterrhinae (17 species). The best represented subfamily in terms of numbers is the Larentiinae subfamily, which sums up to 75 specimens of the 158, representing 47,5 %. It is followed by the Ennominae subfamily with 43 specimens and Sterrhinae with 37 specimens. The Geometrinae subfamily lists only 3 specimens. The species *Acasis appensata* (Eversmann, 1842) and *Scopula decorata* (Denis & Schiffermüller, 1775) are new to the fauna of Republic of Moldova. The genus *Acasis Duponchel*, 1845 was first reported for the fauna of the Republic of Moldova. The genus *Acasis Duponchel*, 1845, *Acasis appensata* (Eversmann, 1842) and *Scopula decorata* (Denis and Schiffermüller, 1775) species are new taxa for the fauna of the Republic of Moldova.*

Keywords: *Geometridae, new species, entomological collection “R. Stepanov”, Republic of Moldova*

**National Museum of Ethnography and Natural History,
Institute of Zoology, Chișinău, Republic of Moldova**