

## CONTRIBUTION TO THE KNOWLEDGE OF THE BUTTERFLY FAUNA (LEPIDOPTERA: RHOPALOCERA) FROM THE LEAOTA MOUNTAINS - ROMANIA

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**ABSTRACT.** In period May-September 2016, an inventory of the butterfly fauna (Lepidoptera: Rhopalocera) was made in Leaota Mountains. 14 transects were investigated, classified as: riparian area/deciduous forest edge, spruce forest edge/swamp, mountain meadow, alpine meadow, spruce forest edge, deciduous forest edge. 43 butterfly species were recorded, representing about 21.67% from the total number of species from Romania. They were grouped in six families: Hesperidae, Papilionidae, Pieridae, Lycaenidae, Nymphalidae and Erebididae. Taking into discussion the type of habitat, all species recorded a heterogeneous distribution. Considering the national conservation status of the butterflies, three vulnerable species were identified and six near threatened. According to the Habitats Directive - Council Directive 92/43/EEC of May 21, 1992, two protected butterfly species were identified: *Lycaena dispar* (Haworth, 1803) and *Euplagia (Callimorpha) quadripunctaria* (Poda 1761). Some conservation measures were provided, for all protected species.

**Keywords:** conservation, ecology, habitat, Lepidoptera.

**REZUMAT. Contribuții la cunoașterea faunei de fluturi (Lepidoptera: Rhopalocera) din Munții Leaota - România.** În anul 2016, perioada mai-septembrie, s-a realizat un inventar al faunei de fluturi (Lepidoptera: Rhopalocera), din Munții Leaota. Au fost investigate 14 transecte, clasificate astfel: zonă ripariană/lizieră de pădure de foioase, lizieră de pădure de molid/mlaștină, pajiște alpină, pajiște montană, lizieră de pădure de molid și lizieră de pădure de foioase. Au fost identificate 43 de specii, reprezentând 21.67% din numărul total de fluturi diurni, din România. Aceștia au fost grupați în șase familii: Hesperidae, Papilionidae, Pieridae, Lycaenidae, Nymphalidae și Erebididae. Luând în discuție tipul de habitat, toate speciile au înregistrat o distribuție heterogenă. Din punct de vedere conservativ, au fost identificate trei specii vulnerabile și șase parțial amenințate, la nivel național. Conform Directivei Habitate 92/43/EEC din 21 mai 1992, au fost identificate două specii protejate: *Lycaena dispar* (Haworth, 1803) și *Euplagia (Callimorpha) quadripunctaria* (Poda 1761). Au fost semnalate și câteva măsuri de conservare pentru speciile protejate.

**Cuvinte cheie:** conservare, ecologie, habitat, Lepidoptera.

## INTRODUCTION

According to the Rákósy (Rákósy, 2013), all butterfly species are considered important bioindicators of the environment quality, being very sensitive to the pollution and climate changes. They represent “umbrella species”, because through their conservation, many other invertebrates are protected, as well. In this context, any information about the butterfly diversity is important for their biology and ecology. In Romania, were made many inventories of the Lepidoptera species, in many types of ecosystems, as well in the mountain areas. Studies were made in Bucegi Mountains, Făgăraş Mountains, Retezat Mountains, Gilăului Mountains, Metaliferi Mountains, Hășmaş Mountains, Semenic Mountains, Vâlcan Mountains, Șureanu Mountains, Vrancei Mountains, Trascău Mountains, Perșani Mountains, Postăvaru Mountains, Apuseni Mountains, Rodnei Mountains, Poiana-Ruscă Mountains, Rarău Mountains, Piatra-Craiului Mountains, Bârsei Mountains, Piatra-Mare Mountains, Ciucaș Mountains, etc. (Burnaz & Balaz, 2011, Székely, 2008, Rákósy, 2013). Consulting the specialized bibliography, we found very few data about fauna of Lepidoptera from Leaota Mountains. The present study offer current information concerning the inventory and distribution of some butterfly species from six types of habitats from Leaota Mountains.

## MATERIALS AND METHODS

In the period May-August 2016 (May 25-27, June 26-28, July 3-5 and August 10-11), an inventory of butterflies (Lepidoptera: Rhopalocera) was made in Leaota Mountains.

The Leaota Mountains are located in central Romania, in Argeș, Dâmbovița and Brașov County (Fig. 1). Limits of the massif are: at the north and west the Dragoslavele-Bran Passage, to the south Subcarpații Ialomiței and to the east the Bucegi Mountains (Murătoreanu, 2009).

The maximum altitude was by 2,133 meters, Peak Leaota. The average annual temperature was recorded between 6 °C (at 1,000 meters altitude) and 0 °C (at 2,000 meters altitude) (Murătoreanu, 2009).

The butterflies have been collected with the entomological net. Another non-destructive used method, from the conservation point of view, was photos, (Sony, full HD 1080; 1090X1080 px). This method provides protection for butterflies' species and for their habitats. The taxonomical identification was made after determination keys (Niculescu, 1961, 1963, 1965, Brakefiel & Liebert, 1985, Ebert, 1997, Lafranchais, 2004, Tolman & Lewington, 2009).

The ecological requirements of the species are presented according to Rákósy (Rákósy, 2013). The conservation status for each species was established taking account of the criteria evaluated by the Rákósy (Rákósy 2003, 2005); national legislation - OUG 57/20. 06. 2007; European legislation - Directive Habitats 92/43 EEC and Red Data Book of European Butterflies (RDBEB) (van Swaay & Warren, 1999).

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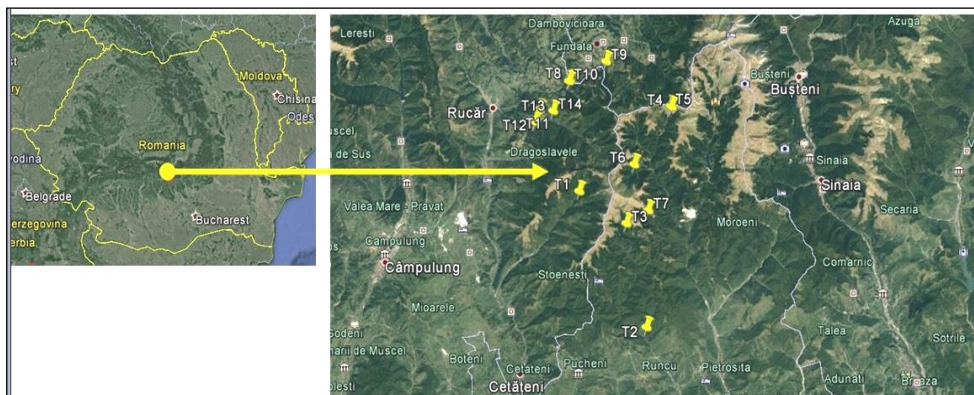


Figure 1- Geographical location of the investigated area from Leaota Mountains  
(<https://earth.google.com/download-earth.html>).

Butterflies collecting was made using the transect method. 14 transects were investigated, with length between 100 and 500 meters, and width between 10 and 20 meters, in concordance with field topometry. Transects altitude varied from 655 to 1,701 meters (Tab. 1).

Taking account of the investigated habitats, transects were classified as following: A = riparian area/deciduous forest edge (4), B = spruce forest edge/swamp (2), C = mountain meadow (2), D = alpine meadow (1), E = spruce forest edge (3), F = deciduous forest edge (2) (Tab. 1).

Table 1- Investigated transects from Leaota Mountains.

T	Altitude	Habitat	Toponymy
T1	1,072	Riparian area + deciduous forest	Bădenilor Valley
T2	655	Riparian area + deciduous forest	Ialomicioara Valley
T3	1,364	Spruce forest edge + swamp	Raciu Valley
T4	1,647	Mountain meadow	Bucșa Mountain
T5	1,701	Alpine meadow	Bucșa Mountain
T6	1,475	Spruce forest edge	Mitarca Mountain
T7	1,360	Spruce forest edge	Răteiu Mountain
T8	1,060	Deciduous forest edge	Crovului Valley
T9	1,247	Spruce forest edge	Cheii Valley
T10	926	Deciduous forest edge + swamp	Cheii Valley - La Uluce
T11	1,146	Mountain meadow	Colții Chimbavului
T12	1,016	Deciduous forest edge	Ghimbavului Valley - Menghea
T13	847	Riparian area + deciduous forest	Ghimbavului Valley - La Isăroi
T14	861	Riparian area + deciduous forest	Ghimbavului Valley

**Legend:** T = transect.

## RESULTS AND DISCUSSIONS

In investigated habitats, 43 butterfly species were recorded, classified in six families: Hesperiiidae, Papilionidae, Pieridae, Lycaenidae, Nymphalidae and Erebidae. This value represents about 21.67% from the total number of species from Romania (203 butterfly species) (Rakosy, 2013). If we compare the number of species from each family identified in Leaota Mountains, we observe that dominant were butterflies from Nymphalidae family (53.48%), followed by those from Lycaenidae families (18.60%) and Pieridae (16.27%). On the opposite are species from Papilionidae and Hesperidae families (4.64% each) (Tab. 2).

If we take into discussion the type of habitat, all species recorded a heterogeneous distribution. The habitat represented by riparian area and deciduous forest edge (beech and spruce), offered the most favorable environmental conditions for butterfly populations, being recorded 33 species. In spruce forest edge, the number of identified species (17) is relatively closed to that obtained in deciduous forest edge habitat (24). In mountain meadows were recorded 11 species and in those with spruce forest edge and swamp, only 9 species. Species *Erebia medusa* (Denis & Schiffermuller, 1775) was identified in alpine meadow. This heterogeneity is due to the fact that this study is not an ecological one, the main objective of this being a short inventory of the butterfly species from Leaota Mountains.

Table 2 - Butterfly species (Lepidoptera: Rhopalocera) identified on Leaota Mountains

No.	Taxon	A	B	C	D	E	F	E.r.
	<b>Ord. Lepidoptera</b>							
	<b>Fam. Hesperiiidae</b>							
1	<i>Pyrgus malvae</i> (Linnaeus, 1758)	+				+	+	mx
2	<i>Ocholdes sylvanus</i> (Esper, 1977)	+				+	+	u
	<b>Fam. Papilionidae</b>							
3	<i>Iphioides podalirius</i> (Linnaeus, 1758)	+				+	+	xt
4	<i>Papilio machaon</i> (Linnaeus, 1758)	+						m
	<b>Fam. Pieridae</b>							
5	<i>Leptidea sinapis</i> (Linnaeus, 1758)	+				+	+	m
6	<i>Anthocaris cardamines</i> (Linnaeus, 1758)	+				+	+	m
7	<i>Pieris napi</i> (Linnaeus, 1758)	+	+	+	+	+	+	u
8	<i>Pieris rapae</i> (Linnaeus, 1758)	+	+			+	+	e
9	<i>Gonepteryx rhamni</i> (Linnaeus, 1758)	+				+	+	m
10	<i>Colias croceus</i> (Fourcroy, 1785)			+			+	u
11	<i>Colias erate</i> (Esper, 1805)			+			+	xt
	<b>Fam. Lycaenidae</b>							
12	<i>Lycaena alciphron</i> (Rottemburg, 1775)	+	+					mh

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No.	Taxon	A	B	C	D	E	F	E.r.
13	<i>Lycaena dispar</i> (Werneburg, 1864)	+						h
14	<i>Plebeius argus</i> (Linnaeus, 1758)		+					m
15	<i>Lycaena virgaureae</i> (Linnaeus, 1758)	+						m
16	<i>Plebeius idas</i> (Linnaeus, 1761)						+	m
17	<i>Polyommatus icarus</i> (Rottemburg, 1775)			+			+	u
18	<i>Celastrina argiolus</i> (Linnaeus, 1758)			+			+	m
19	<i>Lysandra coridon</i> (Poda, 1761)			+			+	mx
	<b>Fam. Nymphalidae</b>							
20	<i>Vanessa atalanta</i> (Linnaeus, 1758)	+				+	+	u
21	<i>Vanessa cardui</i> (Linnaeus, 1758)	+		+		+	+	u
22	<i>Aglais urticae</i> (Linnaeus, 1758)	+		+		+	+	u
23	<i>Polygnia c-album</i> (Linnaeus, 1758)	+		+		+	+	m
24	<i>Araschnia levana</i> (Linnaeus, 1758)	+				+	+	m
25	<i>Neptis rivularis</i> (Scopoli, 1763)					+	+	m
26	<i>Aglais io</i> (Linnaeus, 1758)	+	+			+	+	u
27	<i>Argynnis paphia</i> (Linnaeus, 1758)	+	+			+	+	m
28	<i>Lasiommata maera</i> (Linnaeus, 1767)			+				xt
29	<i>Pararge aegeria</i> (Godart, 1821)			+				mx
30	<i>Nymphalis antiopa</i> (Linnaeus, 1758)	+						m
31	<i>Apatura ilia</i> (Denis & Schiffermuller, 1775)	+						m
32	<i>Issoria lathonia</i> (Linnaeus, 1758)	+				+	+	u
33	<i>Erebia medusa</i> (Denis & Schiffermuller, 1775)				+			M, x, h
34	<i>Aphantopus hyperantus</i> (Linnaeus, 1758)	+						m
35	<i>Erebia aethiops</i> (Esper, 1777)	+		+			+	m
36	<i>Argynnis addipe</i> (Denis & Schiffermuller, 1775)	+						M, xt
37	<i>Limenitis camilla</i> (Linnaeus, 1764)	+	+					m
38	<i>Maniola jurtina</i> (Linnaeus, 1758)	+						M.
39	<i>Coenonympha glycerion</i> (Borkhausen, 1788)			+			+	mx
40	<i>Neptis rivularis</i> (Scopoli, 1763)	+						m
41	<i>Boloria selene</i> (Denis & Schiffermuller, 1775)	+						mh
42	<i>Minois dryas</i> (Scopoli, 1763)	+						mx
	<b>Fam. Erebidae</b>							
43	<i>Euplagia quadripunctaria</i> (Poda, 1761)	+						xt

**Legend:** A = riparian area/deciduous forest edge, B = spruce forest edge/swamp, C = mountain meadow, D = alpine meadow, E = spruce forest edge, F = deciduous forest edge; E. r. = Ecological requirements: e = euroic; h = hygrophilous, m = mesophilous, mh = mesohygrophilous, mx = mesoxerophilous, u = ubiquitous, xt = xerothermophilous, x = xerophilous.

From all 43 identified species, mesophilous butterflies were dominant, representing 41.86%, followed by the ubiquitous ones (20.93%) and by the mesoxerophilous and xerothermophilous elements (11.62% each). The less represented were hygrophilous and xerophilous butterflies (2.32% the first group and 4.64% the second one). Only one euroic species was identified (*Pieris rapae*). It adapts easily to an environment but it uses all the resources quickly. Once all the resources are gone it has to migrate (Rakosy, 2013).

If we take into consideration the national conservation status of the butterflies, three vulnerable species were identified: *Iphiclides podalirius* (Linnaeus, 1758), *Lycaena alciphron* (Rottemburg, 1775), *Apatura ilia* Denis & Schiffermüller, 1775 and six near threatened (Rakosy, 2013): *Papilio machaon* Linnaeus, 1758, *Colias erate* (Esper, 1805), *Lycaena virgaureae* (Linnaeus, 1758), *Plebeius idas* (Linnaeus, 1761), *Nymphalis antiopa* (Linnaeus, 1758) and *Limenitis camilla* (Linnaeus, 1764). According to the Habitats Directive - Council Directive 92/43/EEC of May 21, 1992, OUG 57/2007 and Romanian law no. 49/2014, two protected butterfly species were identified: *Lycaena dispar* (Haworth, 1803) (vulnerable species - Annexes 2, 3, 4A) and *Euplagia (Callimorpha) quadripunctaria* (Poda, 1761) (least concern species - Annexes 2A and 3). The most favorable habitat for all protected species on national and international level was riparian area/deciduous forest edge (beech and spruce), especially from Ialomicioara Valley and Raci Valley (Fauna Europaea, 2017) (Fig. 2).

As conservation measures for the vulnerable and near threatened species on national level, we mentioned: maintenance of the investigated ecosystem heterogeneity; prohibiting the fragmentation of habitats; maintaining the forest edges; the proper management of forest ecosystems; prohibiting the burning of dry vegetation in autumn or spring; maintaining traditional, extensive agriculture; preventing grassland afforestation; avoiding excessive fertilization and preventing land abandonment.

Specific conservation measurements for *Lycaena dispar* (Haworth, 1803) were: conservation of the forest edges and riparian areas, providing the natural light by removal of invasive shrubs. Maintaining of the host plants for larvae, as *Rumex crispus* Linnaeus, 1753, *Rumex obtusifolius* Linnaeus, 1753, *Rumex sanguineus* Linnaeus, 1753 and of pollen source for the adults, as *Senecio* sp., *Crepis biennis* Linnaeus, 1753, *Ranunculus repens* Linnaeus, 1753, *Mentha longifolia* (L.) Huds., *Achillea* sp., *Cirsium palustre* (Linnaeus) Scopoli, 1772, *Cirsium arvense* (Linnaeus) Scopoli, 1772 and *Lythrum salicaria* Linnaeus, 1753. These plant species require high soil moisture, which can be maintained by protecting the riparian area or the temporal ponds and by prohibition of any anthropic intervention, which may lead to reduced water intake or clogging.

It is forbidden to burn the vegetation and we recommend the traditional mowing or controlled and extensive grazing or the maintenance of the habitat for butterfly larvae (with hygrophilous grasses and sedges) and for adult interaction (mating).

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Butterfly species	Investigated habitat
 <p data-bbox="363 757 746 790"><i>Lycaena dispar</i> (Werneburg, 1864)</p>	 <p data-bbox="943 763 1161 790">Ialomicioara Valley</p>
 <p data-bbox="331 1160 778 1216"><i>Euplagia (Callimorpha) quadripunctaria</i> (Poda, 1761)</p>	 <p data-bbox="938 1160 1166 1187">Ghimbavului Gorges</p>

Figure 2 - Protected butterfly species on European level, correlated with investigated habitats from Leaota Mountains.

In order to protect the species *Euplagia (Callimorpha) quadripunctaria* (Poda, 1761), we must to maintain their favorable habitat, riparian area/forest edges, closed to a scree area. Maintaining the forest edges means the protection of its differentiated structure (bushes and some high grass herbs, as *Eupatorium cannabinum* Linnaeus, 1753 *Lamium* sp., *Urtica dioica* Linnaeus, 1753), through controlled, extensive grazing or traditional mowing.

Other conservation actions are the prohibition of: the other forest roads construction, the vegetation burning, vegetation/forest cuttings, and the exploitation of geological and hydrological resources from the area.

### CONCLUSIONS

In Leaota Mountains, 43 butterfly species were identified, which represented 21.67% from the total number of Romanian species. The most abundant were represented by those from Nymphalidae family. Considering the type of habitat, all species recorded a heterogeneous distribution. The habitat

represented by riparian area and deciduous forest edge (beech and spruce), offered the most favorable environmental conditions for butterfly populations.

Taking into account of the ecological requirements of the butterflies, dominant were mesophilous species, less represented being hygrophilous and xerophilous lepidopterans.

Considering the national conservation status of the butterflies, three vulnerable species were identified and six near threatened. According to the Habitats Directive - Council Directive 92/43/EEC of May 21, 1992, two protected butterfly species were identified: *Lycaena dispar* (Haworth, 1803) and *Euplagia (Callimorpha) quadripunctaria* (Poda, 1761).

The general conservation measures for the protected butterflies were maintenance the ecosystem heterogeneity, proper management of forest ecosystems, including the forest edges; preventing habitat fragmentation, grassland afforestation and land abandonment and prohibiting the burning of dry vegetation.

In order to complete this inventory, in others habitats and on a larger areas, future researches were requested.

#### ACKNOWLEDGMENT

The field work was financed by Conservation Carpathia Foundation, under the contract "Biodiversity Baseline Survey Study on Leaota area" conducted in 2016. The theme of the article is according to the general framework of the project no. RO1567-IBB01/2016.

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