

## ***Changes in species richness of butterfly fauna (Lepidoptera, Hesperioidea and Papilionoidea) in the Pieniny Mountains***

Zmiany w bogactwie gatunkowym fauny motyli (*Lepidoptera*, *Hesperioidea*  
i *Papilionoidea*) w Pieninach

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**Abstract.** Based on literature data and original studies the species of butterflies occurring in Pieniny Mountains are listed. The author compares the numbers of registered butterfly species in the Slovak and the Polish part of Pieniny Mts. On the Polish part there were 105 species of butterflies, and on Slovak part, 89 species recorded (in the whole Pieniny Mts. 108 species are known). Although some new species of butterflies were recorded – *Colias erate* (ESPER, 1805), *Plebejus argyrognomon* (BERGSTRÄSSER, 1779), *Glaucopsyche alexis* (PODA, 1761), many species have already disappeared from the Pieniny Mts. – *Pyrgus carthami* (HÜBNER, 1813), *Thymelicus acteon* (ROTTEMBURG, 1775), *Cupido decoloratus* (STAUDINGER, 1886), *Cupido alcetas* (HOFFMANNSEGG, 1804), *Scolitantides orion* (PALLAS, 1771), *Polyommatus eroides* (FRIVALDSZKY, 1835) and *Melitaea didyma* (ESPER, 1779). For conservation of butterfly fauna in Pieniny Mts. it will be necessary to preserve the integrity of their habitats and to minimize negative anthropogenic influences.

### INTRODUCTION

Pieniny Mts. has been the object of research for scientists for a long time. There has been conducted a lot of research work from various scientific branches. It's interesting, that the Polish part of Pieniny Mts. has gained more interest from scientists than the Slovak part. This is due to longer research programs in Poland. As concerns the Slovak research was focused on Lepidoptera, especially on butterflies (superfamilies *Hesperioidea* and *Papilionoidea*).

The first information from the Polish part was

published in the second half of the 19<sup>th</sup> century (Nowicki 1869). The first information about the occurrence of the butterflies in the Slovak part was published much later (Panigaj 1986, 1993, 1999a, 1999b). Research of the lepidopterofauna in the Polish part was continued further, and more important works were published, for example by Sitowski (1906, 1910, 1948), Błęszyński, Razowski et Żukowski (1965), Dąbrowski (1982), Buszko (1997).

Until now the occurrence of the butterflies in the geomorphological complex of Pieniny Mts. was not discussed. The aim of the study is to sum up all known facts.

## STUDY AREA

In this study we consider the territory of orographical complex of Pieniny Mts. as a whole including the territory of two national parks – PIENAP in Slovakia and PPN in Poland.

The extent of PIENAP is 3 896 ha and of PPN is 2 231 ha. We can also determine the natural conditions in both parts of Pieniny Mts. which are divided by the Dunajec River. The Pieniny Mts. represent a distinct area with diversified relief having a number of narrow valleys and gorges at carsts and dolomites. Important country phenomenon is Dunajec gorge, where typical vertical inversion of species is observed – mountain and subalpine species on the bottom of gorge, and thermophilous species of flora and fauna on the top of klippes and slopes.

The altitude varies, from 440 m (level of Dunajec River), to 1050 m Vysoké skalky (on the Slovak part) and Three Crowns with 1000 m height (on the Polish part).

There are lot of very diversified habitats. The majority of the area of Pieniny Mts. is covered by forests with domination of beech, fir, and pine making communities such as *Fagetum carpaticum*, *Phyllitido-Aceretum*, *Tilio-Carpinetum*, relict *Pinetum dealpinum* and *Alnetum incanae*. Non-forest habitats include xerothermic communities, such as *Dendranthemo-Seslerietum*, *Festucetum pallentis*, *Origano-Brachypodietum pinnati* and *Anthylli-Trifolietum montani*. Many habitats in Pieniny Mts. are influenced and exploited by man – intensive grazing, mowed meadows, tourist and sport activities, construction of dam on the Dunajec River.

## RESULTS

Comparing the spectrum of butterflies in both parts of Pieniny Mts. it can be seen that there were some problems caused by the length of the study. Therefore it is necessary to concentrate on the data obtained during the last 20 years and compare them to see if there are some significant differences. For more detailed pictures of the dynamics in the species richness of the butterfly communities in Pieniny Mts. historical data can

be obtained from the Sitowski (1906, 1910, 1948) and Bleszyński, Razowski et Żukowski (1965).

Table I contains the results of study of butterfly fauna of superfamilies *Hesperioidea* and *Papilionoidea* in the time periods when they were determined. Nomenclature is used according to the work of Laštůvka ed. (1998).

## DISCUSSION

So far, 108 species of the butterflies were found in the area of Pieniny National Park.

During the years number of species has changed. Bleszyński, Razowski et Żukowski (1965) found 98 species butterflies on the Polish side, and in the next period (1963 – up-to-date) they found species such as *Pyrgus carthami* (HÜBNER, 1813) (collected in 1952), *Thymelicus acteon* (ROTTENBURG, 1775) (were also collected but in one individual in 1951), and in 1956 *Cupido decoloratus* (STAUDINGER, 1886) was collected (which was a new species for Poland), in 1938, *Cupido alcetas* (HOFFMANNSEGG, 1804) was found in one individual, but *Scolitantides orion* (PALLAS, 1771), *Polyommatus eroides* (FRIVALDSZKY, 1835) and *Melitaea didyma* (ESPER, 1779) were not found in any individual. In general these species are endangered, vulnerable or very rare and they are disappearing from their habitats.

The *Colias croceus* (FOURCROY, 1785), *Polyommatus amandus* (SCHNEIDER, 1792) (was found in one individual in 1951) and *Coenonympha arcania* (LINNAEUS, 1761) were found again in the years 1992–1993 by prof. Z. Witkowski in the area of construction of dam on the Dunajec River near the village Czorsztyn – according to the written announcement. These species were not found on the Slovak part of Pieniny Mts. Later there was a new group of species discovered in Polish fauna of Pieniny Mts. *Ochlodes venatus* (BREMER et GRAY, 1853), *Colias erate* (ESPER, 1805), *Cupido argiades* (PALLAS, 1771). It is necessary to remind the *Plebeius argyrognomon* (BERGSTRÄSSER, 1779) and *Glaucopsyche alexis* (PODA, 1761) according to the written announcement by prof. Z. Witkowski. Thus the total

**Table I.** Recorded species of the Butterflies in Pieniny Mts. (PL – Polish side, SK – Slovak side). Symbols in parenthesis – data by prof. Z. Witkowski (after the written announcement).

Wykaz gatunków motyli z Pienin (PL – strona polska, SK – strona słowacka). Symbole w nawiasach – dane prof. Z. Witkowskiego (wg publikacji).

N <sup>o</sup>	Species	PL: 1986–1997				N <sup>o</sup>	Species	PL: 1986–1997			
		PL: till year 1963	PL: 1986–1997	SK: 1978–1984	SK: 1987–2002			PL: till year 1963	PL: 1986–1997	SK: 1978–1984	SK: 1987–2002
<b>HESPERIIDAE</b>											
1.	<i>Erynnis tages</i> L.	+	+	+	+	35.	<i>Lycaena tityrus</i> PODA	+	+		
2.	<i>Carcharodus alceae</i> ESP.	+	+			36.	<i>Lycaena alciphron</i> ROTT.	+	+		+
3.	<i>Spialia sertorius</i> HFMSG.	+	+	+	+	37.	<i>Lycaena hippothoe</i> L.	+	+	+	+
4.	<i>Pyrgus malvae</i> L.	+	+	+	+	38.	<i>Thecla betulae</i> L.	+	+	+	+
5.	<i>Pyrgus armoricanus</i> OBTH.	+			+	39.	<i>Neozephyrus quercus</i> L.				+
6.	<i>Pyrgus alveus</i> HB.	+		+	+	40.	<i>Satyrrium pruni</i> L.	+	+	+	+
7.	<i>Pyrgus serratulae</i> RBR.	+	(+)			41.	<i>Satyrrium w-album</i> KN.	+	+	+	+
8.	<i>Pyrgus carthami</i> HB.	+				42.	<i>Satyrrium spini</i> D. ET SCH.	+	+		+
9.	<i>Carterocephalus palaemon</i> PALL.	+	+	+	+	43.	<i>Satyrrium accaciae</i> F.	+	+	+	+
10.	<i>Thymelicus sylvestris</i> PODA	+	+	+	+	44.	<i>Callophrys rubi</i> L.	+	+		
11.	<i>Thymelicus lineolus</i> O.	+	+	+	+	45.	<i>Cupido minimus</i> FUESSLY	+	+	+	+
12.	<i>Thymelicus acteon</i> ROTT.	+				46.	<i>Cupido argiades</i> PELLAS			+	+
13.	<i>Hesperia comma</i> L.	+	+	+	+	47.	<i>Cupido decoloratus</i> STDGR.	+			
14.	<i>Ochlodes venatus</i> BR. ET GREY		+	+	+	48.	<i>Cupido alcetas</i> HFMSG.	+			
<b>PAPILIONIDAE</b>											
15.	<i>Parnassius apollo</i> L.	+	+	+	+	49.	<i>Celastrina argiolus</i> L.	+	+		+
16.	<i>Parnassius mnemosyne</i> L.	+	+	+	+	50.	<i>Scolitantides orion</i> PALL.	+			
17.	<i>Iphiclides podalirius</i> L.	+	+	+	+	51.	<i>Glaucopsyche alexis</i> PODA			(+)	
18.	<i>Papilio machaon</i> L.	+	+	+	+	52.	<i>Maculineaalcon</i> D. ET SCH.	+	+	+	+
<b>PIERIDAE</b>											
19.	<i>Leptidea sinapis</i> L.	+	+	+	+	53.	<i>Maculinea arion</i> L.	+	+	+	+
20.	<i>Leptidea reali</i> REISSINGER				+	54.	<i>Plebeius argus</i> L.	+	+	+	+
21.	<i>Aporia crataegi</i> L.	+	+	+		55.	<i>Plebeius idas</i> L.			+	+
22.	<i>Pieris brassicae</i> L.	+	+	+	+	56.	<i>Plebeius argyrognomon</i> BRGSTR.			(+)	
23.	<i>Pieris rapae</i> L.	+	+	+	+	57.	<i>Aricia agestis</i> D. ET SCH.	+	+		
24.	<i>Pieris napi</i> L.	+	+	+	+	58.	<i>Cyaniris semiargus</i> ROTT.	+	+	+	+
25.	<i>Pontia daplidicae</i> L.	+	+		+	59.	<i>Polyommatus dorylas</i> D. ET SCH.	+	+	+	+
26.	<i>Anthocharis cardamines</i> L.	+	+	+	+	60.	<i>Polyommatus amandus</i> SCHN.	+	(+)		
27.	<i>Colias hyale</i> L.	+	+	+	+	61.	<i>Polyommatus icarus</i> ROTT.	+	+	+	+
28.	<i>Colias alfacarensis</i> RIBBE	+	+	+	+	62.	<i>Polyommatus eroides</i> FRIV.	+			
29.	<i>Colias croceus</i> FOURCR.	+	(+)		+	63.	<i>Polyommatus coridon</i> PODA	+	+	+	+
30.	<i>Colias erate</i> ESP.		+			64.	<i>Polyommatus bellargus</i> ROTT.	+	+	+	+
31.	<i>Gonepteryx rhamni</i> L.	+	+	+	+	65.	<i>Polyommatus daphnis</i> D. ET SCH.	+	+	+	+
<b>RIODINIDAE</b>											
32.	<i>Hamearis lucina</i> L.	+	+	+	+	<b>NYMPHALIDAE</b>					
<b>LYCAENIDAE</b>											
33.	<i>Lycaena phlaeas</i> L.	+	+	+	+	66.	<i>Apatura iris</i> L.	+	+	+	+
34.	<i>Lycaena virgaureae</i> L.	+	+	+	+	67.	<i>Apatura ilia</i> D. ET SCH.	+	+		+
						68.	<i>Limenitis populi</i> L.	+	+	+	+
						69.	<i>Limenitis camilla</i> L.	+	+	+	+
						70.	<i>Nymphalis polychloros</i> L.	+	+		+
						71.	<i>Nymphalis vaualbum</i> D. ET SCH.	+	+		
						72.	<i>Nymphalis antiopa</i> L.	+	+	+	+
						73.	<i>Inachis io</i> L.	+	+	+	+
						74.	<i>Vanessa atalanta</i> L.	+	+	+	+

Table I. Continued. – Tabela I. Kontynuacja.

N <sup>o</sup>	Species	PL: till year 1963	PL: 1986–1997	SK: 1978–1984	SK: 1987–2002
75.	<i>Cynthia cardui</i> L.	+	+	+	+
76.	<i>Aglais urticae</i> L.	+	+	+	+
77.	<i>Polygonia c-album</i> L.	+	+	+	+
78.	<i>Araschnia levana</i> L.	+	+	+	+
79.	<i>Argynnis paphia</i> L.	+	+	+	+
80.	<i>Argynnis aglaja</i> L.	+	+	+	+
81.	<i>Argynnis adippe</i> D. ET SCH.	+	+	+	+
82.	<i>Argynnis niobe</i> L.	+	+	+	+
83.	<i>Issoria lathonia</i> L.	+	+	+	+
84.	<i>Brenthis ino</i> ROTT.	+	+		+
85.	<i>Boloria selene</i> D. ET SCH.	+	+	+	+
86.	<i>Boloria euphrosyne</i> L.	+	+	+	+
87.	<i>Boloria dia</i> L.	+	+	+	+
88.	<i>Melitaea didyma</i> ESP.	+			
89.	<i>Melitaea diamina</i> LANG		+		+
90.	<i>Melitaea athalia</i> ROTT.	+	+	+	+
91.	<i>Melitaea aurelia</i> NICK.			+	
SATYRIDAE					
92.	<i>Melanargia galathea</i> L.	+	+	+	+
93.	<i>Brinthesia circe</i> F.	+			+
94.	<i>Erebia ligea</i> L.	+	+	+	+
95.	<i>Erebia euryale</i> ESP.	+	+		+
96.	<i>Erebia aethiops</i> ESP.	+	+	+	+
97.	<i>Erebia medusa</i> D. ET SCH.	+	+	+	+
98.	<i>Maniola jurtina</i> L.	+	+	+	+
99.	<i>Hyponephele lycaon</i> KÜHN	+	+	+	+
100.	<i>Aphantopus hyperanthus</i> L.	+	+	+	+
101.	<i>Coenonympha pamphilus</i> L.	+	+	+	+
102.	<i>Coenonympha tullia</i> MÜLLER	+	+		
103.	<i>Coenonympha arcania</i> L.	+	(+)		
104.	<i>Coenonympha glycerion</i> BKH.	+	+	+	+
105.	<i>Pararge aegeria</i> L.	+	+	+	+
106.	<i>Lasiommata megera</i> L.	+	+	+	+
107.	<i>Lasiommata maera</i> L.	+	+	+	+
108.	<i>Lasiommata petropolitana</i> F.	+	+	+	
Total		98	95	73	86

number of discovered species on the Polish side of Pieniny Mts. is 105 species.

From the Slovak side the number of published species is 74 species (PANIGAJ 1986), later on another 16 species have been discovered. While the

occurrence of *Leptidea reali* (REISSINGER, 1989), *Neozephyrus quercus* (LINNAEUS, 1758) and *Melitaea aurelia* (NICKERL, 1850) is not known on the Polish part, there is very important confirmation of the occurrence of *Pyrgus armoricanus* (OBERTHÜR, 1910) on the Slovak side. Primary published species *Spialia orbifer* (HÜBNER, 1823) was deleted from the list after revision, since it was found out to be *Spialia sertorius* (HOFFMAN-NSEGG, 1804). Together on the Slovak part of Pieniny Mts. 89 species are registred.

On the Slovak part the following species were also not registred *Carcharodus alcae* (ESPER, 1780), *Lycaena tityrus* (PODA, 1761) *Callophrys rubi* (LINNAEUS, 1758), *Aricia agestis* (DENIS et SCHIFFERMÜLLER, 1775), *Nymphalis vaualbum* (DENIS et SCHIFFERMÜLLER, 1775) and *Coenonympha tullia* (MÜLLER, 1764). The habitats on the Slovak part (absence of wetlands) are not suitable for the entirely hygrophilous species (f. e. *Coenonympha tullia* MÜLLER, 1764).

It would be possible to expect an occurrence of more species, for exemple *Leptidea morsei* (FENTON, 1881) and also *Polyommatus slovacus* (VÍTAZ, BÁLINT et ŽITŇAN, 1997). The taxonomic position of *Maculinea alcon* (DENIS et SCHIFFERMÜLLER, 1775) is questionable and it would be necessary to revise the known materials to eliminate interchange with *Maculinea rebeli* (HIRSCHKE, 1904).

There is a continuous occurrence of 68 species of the butterflies on both parts, which are mainly unpretentious and eurytopic species. Another species show unstable occurrence with population's fluctuation. It is interesting that among the butterflies which became extinct, most belong to the ecological group of termophilous species. Nowadays Lepidopterological value of Pieniny Mts. is because of the species which are bound to xerothermic habitats on calcareous ground. Some termophilous species have a northern border of distribution in Pieniny Mts.

The reasons why certain butterflies were disappearing were described by Dąbrowski (1982). According to his opinion anthropogenic influence such as – changing and destroying of original habitats, mainly in lower elevations, the increased effect of pollution and touristic activities have

been the major causes of the problem. Similar anthropogenic influence can also be seen on the Slovak side, nevertheless the Pieniny Mts. have status of a national park. But we suppose, that besides anthropic influences, also natural circumstances have influence on changing habitats, e. g. overgrowth of slopes by trees and long term climatic changes have impact on the butterfly population.

Restitution and artificial breeding are difficult ways of saving the endangered species. Nevertheless the population of *Parnassius apollo* (LINNAEUS, 1758) was saved with success (Witkowski et al. 1997, Danková 1997). For certain international cooperation will be necessary to carry on the research and implement the preservation means for the butterflies in Pieniny Mts.

In the area of the dam on the Dunajec River, a decrease in the number of species was observed, what was stated by prof. Z. Witkowski. In the years 1992–1993, 63 species were listed (Z. Witkowski, A. Kosior), 48 species in 1996, but only 38 species were listed in 1997 (B. Jenner). We can see that the presence of the dam has a negative effect on its surroundings. The influence of the dam on the butterfly fauna in the future is a object for monitoring at the present (Panigaj 1999a).

On the basis of the butterfly species richness, we consider the Polish and Slovak sides of Pieniny Mts. as an integral complex. This is indicated also by high faunistic similarity (85.6%) according Sorensen's similarity coefficient. For calculation of this coefficient all species of butterflies found in the Polish and Slovak part were used.

#### ACKNOWLEDGEMENT

I thank to prof. Z. Witkowski for information about butterfly fauna in the area of the dam on Dunajec River. This study was partly supported by the Slovak Scientific Grant Agency as a Project N<sup>o</sup> 1/7559/20 and a Phare-Credo Project N<sup>o</sup> 97/1 – SK/PO-008.

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#### STRESZCZENIE

Do tej pory wykazano z Pienin 108 gatunków motyli dziennych. Z tego z polskiej części Pienin znanych jest 105 gatunków, a ze słowackiej 87–89. Różnica ta wynika z niejednakowego stopnia zbadania obu części Pienin. Po polskiej stronie pierwsze prace z tego tematu były publikowane już pod koniec XIX wieku, a po stronie słowackiej dopiero w 1986 roku.

Kolejną przyczyną różnic w ilości dziennych motyli jest postępująca zmiana ekosystemów.

Zanikają w Pieninach stanowiska kserotermiczne i tym samym ustępują związane z nimi gatunki np.: *Pyrgus carthami* Hb., *Thymelicus acteon* Rott., *Scolitantides orion* Pall., *Melitaea didyma* Esp.

W ostatnich latach odkryto nowe dla Pienin gatunki motyli dziennych np.: *Colias erate* Frcr., *Glaucopsyche alexis* Poda, *Plebejus argyrognomon* Brgstr.

Dla zachowania fauny motyli dziennych w Pieninach konieczne jest utrzymywanie różnorodności siedlisk, minimalizowanie skutków ruchu turystycznego oraz zrównoważone użytkowanie terenów rolnych, głównie łąk. Interesująca będzie też obserwacja wpływu powstałego na Dunajcu zespołu zbiorników wodnych na faunę tych zwierząt.

## SÚHRN

Doteraz je z Pienin uvádzaných 108 druhov denných motýľov. Z toho z poľskej strany je známych 105 druhov a zo slovenskej strany 89 druhov. Tento rozdiel vyplýva už z nerovnakého

stupňa poznania oboch častí. Na poľskej strane boli prvé práce s touto problematikou publikované už koncom XIX. storočia, na slovenskej strane až v roku 1986. Hlavná príčina rozdielov v druhovom bohatstve denných motýľov je v postupujúcich zmenách v ekosystémoch. V Pieninách zanikajú xerotermné stanovišťa a v súvislosti s tým ustupujú druhy motýľov, ktoré sú na ne viazané, napr. *Pyrgus carthami* Hb., *Thymelicus acteon* Rott., *Scolitantides orion* Pall., *Melitaea didyma* Esp.

V posledných rokoch boli pre Pieniny objavené ako nové druhy denných motýľov napr. *Colias erate* Frcr., *Glaucopsyche alexis* Poda, *Plebejus argyrognomon* Brgstr.

Pre zachovanie fauny denných motýľov v Pieninách je rozhodujúce udržanie rôznorodosti stanovišť, minimalizácia vplyvov turistického ruchu a optimalizované využívanie poľnohospodárskych plôch, hlavne lúk. Zaujímavé bude tiež sledovanie vplyvu vodných nádrží na Dunajci na faunu týchto živočíchov