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**SPRINGTAILS (COLLEMBOLA) OF THE "BARNOWIEC" RESERVE IN THE BESKID SADECKI MOUNTAINS (POLISH CARPATHIANS)**

Смоліс А., Скаржинський Д. Ногохвістки (Collembola) заповідника "Барновець" в Судецьких Бескидах (Польські Карпати) // Наук. зап. Держ. природознавч. музею. – Львів, 2006. – Вип. 22. – С. 69-77.

У результаті фауністичних досліджень у заповіднику "Барновець" зареєстровано 120 видів ногохвісток, серед яких 3 – нові для науки (*Micranurida bescidica*, *Allonychiurus* sp., *Rusekianna* sp.), 1 – новий для фауни Польщі (*Desoria duodecemoculata*), 3 – нові для фауни Польських Карпат (*Mesaphorura critica*, *Folsomia hrabei*, *Appendisotoma abiskoensis*) і 59 видів – нові для фауни Судецьких Бескид. Виділено 7 зоогеографічних елементів колемболофауни заповідника. Вказано зоогеографічну диференціацію фауни ногохвісток дослідженої території стосовно фауни Польських Бещад та Українських Бескидів.

Смоліс А., Скаржинський Д. Ногохвостки (Collembola) заповідника "Барновець" в Судецьких Бескидах (Польские Карпаты) // Науч. зап. Гос. природоведч. музея. – Львов, 2006. – Вып. 22. – С. 69-77.

В результате фаунистических исследований в заповеднике "Барновець" зарегистрировано 120 видов ногохвосток, среди которых 3 – новые для науки (*Micranurida bescidica*, *Allonychiurus* sp., *Rusekianna* sp.), 1 – новый для фауны Польши (*Desoria duodecemoculata*), 3 – новые для фауны Польских Карпат (*Mesaphorura critica*, *Folsomia hrabei*, *Appendisotoma abiskoensis*) и 59 видов – новые для фауны Судецких Бескид. Выделено 7 зоогеографических элементов колемболофауны заповедника. Указано зоогеографическую дифференциацию фауны ногохвосток исследованной территории относительно фауны Польских Бещад и Украинских Бескид.

The Collembola fauna of the Beskid Sądecki Mountains is fairly well known, a total number of recorded species is 109 [2, 8, 9, 15, 19, 21, 22, 23, 24, 25, 32]. However real biodiversity of this area seems to be considerably higher. It is suggested by species richness of springtail faunas of neighbour mountain ranges as the Pieniny Mountains (c. 221 sp.) [6, 32], Bieszczady Mountains (c. 165 sp.) [3, 19, 29] and Beskid Niski Mountains (130 sp.) [14, 20, 22, 23, 32]. Knowledge on the Collembola fauna of natural biotopes of the Beskid Sądecki Mts is rather poor since the most valuable studies [8, 9] were focused to a high degree on antropogenic habitats. The aim of this work was to study the species composition of the springtail fauna in old growth forests protected in the „Barnowiec” reserve.

**Study area**

The „Barnowiec” is one of the oldest reserves (founded in 1905) in Polish Carpathians [26]. It is situated in the Jaworzyna Krynicka Range near village Barnowiec and includes a protected small fragment (21.6 ha) of E facing slope of the Sokołowska Góra at altitude 700–1027 m a. s. l. The rock core of the investigated area is built of Carpathian flysch. Slopes are very steep and eroded, sandstone rocks and stony fields are numerous. Brown mountain soils are most frequent. Carpathian beechwoods *Dentario glandulosae-Fagetum* and *Luzulo-Fagetum* cover almost all the area of the reserve. Occurrence of sycamore forest

(*Lunario-Aceretum*) is limited to only one patch [26]. The mean age of the trees is about 150 years, single firs being more than 250 years old. Herb layer is rather poorly developed, while moss one is well represented. The large live trees, the standing snags and decaying logs on the forest floor give the landscape really primeval character. The reserve borders upon woods changed by the forest management and artificially planted with spruce and beech.

### Material and methods

The material was collected in May, July and September 2003. Springtails were collected in various habitats in the whole area of the reserve, using commonly accepted methods, i.e. sampling of soil and litter, lichens, fungi, moss tufts and pieces of rotten wood. The samples were extracted in Tullgren apparatus. Also catches with an exhaustor under bark of trees, on plants and mushrooms was applied. A total of ca. 110 samples were collected.

### Results

120 species of springtails were found during the research of the “Barnowiec” reserve (Tab.), including 3 new to science – recently described *Micranurida bescidica* Smolis & Skarżyński, 2004 and *Allonychiurus* sp. and *Rusekianna* sp. which will be described soon after revision of the types of related species. Some other species recorded from the reserve are interesting from faunistic point of view. *Desoria duodecemoculata* (Denis, 1927) is new to the fauna of Poland and *Mesaphorura critica* Ellis, 1976, *Folsomia hrabei* Rusek, 1984 and *Appendisotoma abiskoensis* (Agrell, 1939) are new to the fauna of Polish Carpathians. It is noteworthy that as many as 59 species appeared to be new to the fauna of the Beskid Sądecki Mts and as a consequence a total number of species recorded from this range increased to 168. Basic information about interesting species recorded from the studied area are given below and in Table.

#### *Ceratophysella sigillata* (Uzel, 1891)

Numerous juveniles and adults were collected in forest litter. Palearctic mass occurring cyclomorphic species [1, 33] with little known distribution in Poland. Till now recorded from the Sudetes [10], Beskid Sądecki Mts (neighbourhood of Rytro) [8, 9], Wyżyna Krakowsko-Wieluńska Upland [30] and the Pieniny Mts [32].

#### *Friesea monoculata* Dunger, 1972

One specimen was collected in soil samples taken from under the stones in *Dentario glandulosae-Fagetum*. Rare species recorded from Germany, Ukraine [3, 4] and Poland, (Bieszczady Mts, Góry Stołowe Mts) [18, 29].

#### *Micranurida bescidica* Smolis & Skarżyński, 2004

Several specimens were collected in rotten wood in a hollow of a beech in *Luzulo-fagetum* and in mosses on stones. This species is recently described from the „Barnowiec” reserve [21]. Up to now it is known from the *locus typicus* and Slovakia (Slovak Karst, Carpathians) [5].

*Deutonura weinerae* Deharveng, 1982

Only one specimen was collected in litter of *Luzulo-Fagetum*. Hitherto reported from Ukrainian Carpathians [3, 4] and the Beskid Niski Mts [20].

*Mesaphorura critica* Ellis, 1976

A few specimens were collected in mosses on stones. Species described from Crete and recorded from South, Central and North Europe. In Poland known from the Nizina Mazowiecka Lowland [27, 28], the Wyżyna Krakowsko-Wieluńska Upland [31] and Białowieża Primeval Forest [16]. Species new to the fauna of Polish Carpathians.

*Folsomia hrabei* Rusek, 1984

Four specimens were collected in moss and soil under stones. Rare species known only from Czech Republic (*locus typicus*) and Poland (Wyżyna Krakowsko-Wieluńska Upland) [31]. Species new to the fauna of Polish Carpathians.

*Folsomia sensibilis* Kseneman, 1936

Numerous specimens were collected in moss and forest litter. European boreomontane species recorded from Czech Republic, Slovakia, Germany, Austria, Switzerland, S France, N Spain, N Italy, former Yugoslavia, W Ukraine, Norway, Finland and NW Russia [7]. In Poland known from the Sudetes [10] and the Bieszczady Mts [29].

*Appendisotoma abiskoensis* (Agrell, 1939)

A few specimens were collected in moss growing on shaded sandstone rocks. Rare bryophilous and hygrophilous species reported from Sweden, Norway, Germany, Austria and NW Russia [7]. In Poland known only from the Niecka Nidziańska Upland [13]. Species new to the fauna of Polish Carpathians.

*Pseudisotoma monocheta* (Kos, 1942)

Numerous specimens were collected in moss growing on large stones. Widely distributed species reported from most of European countries, Russia and Japan [7]. In Poland known only from the Tatra Mountains [24] and the Pieniny Mts [32].

*Desoria divergens* (Axelson, 1900)

Several specimens were collected in wet litter of *Lunario-Aceretum* and in mosses growing on stones in streams. Species recorded from North and Central Europe (Finland, Sweden, Russia, Germany). In Poland known from the Tatra Mts [24], Białowieża Primeval Forest [16] and the Sudetes [18].

*Desoria duodecemoculata* (Denis, 1927)

Numerous specimens were collected in moss and forest litter. Mountaineous European species of the taxonomically uncertain *nivalis* complex reported from Italy, Austria, Spain and France [7]. Morphology of this population fits the description of Potapov [7] in full. Species new to the fauna of Poland.

The list of springtails (Collembola) of the „Barnowicz” reserve

Species	Microhabitats					Gr
	A	B	C	D	E	
1	2	3	4	5	6	7
<b>Hypogastruridae</b>						
<i>Hypogastrura aequipilosa</i> (Stach, 1949)	-	+	-	-	-	M
<i>H. kelmendica</i> Peja, 1985	+	+	+	-	-	M
<i>Ceratophysella armata</i> (Nicolet, 1841)	+	-	+	-	+	H
* <i>C. denticulata</i> (Bagnall, 1941)	+	+	+	+	+	C
* <i>C. granulata</i> Stach, 1949	+	+	-	+	-	M
* <i>C. impedita</i> Skarżyński, 2002	+	-	-	-	-	U
<i>C. sigillata</i> (Uzel, 1891)	+	-	+	-	-	M
<i>C. silvatica</i> Rusek, 1964	+	+	+	-	+	M
<i>Choreutinula inermis</i> (Tullberg, 1871)	-	+	-	-	-	P
* <i>Xenylla boernerii</i> Axelson, 1905	+	+	-	+	-	P
* <i>X. brevisimilis</i> Stach, 1949	+	+	-	-	-	E
<i>Willemia anophthalma</i> Börner, 1901	+	+	-	+	-	H
* <i>W. denisi</i> Mills, 1932	+	-	+	+	-	H
* <i>W. scandinavica</i> Stach, 1949	+	-	+	-	-	H
<b>Odontellidae</b>						
* <i>Superodontella lamellifera</i> (Axelson, 1903)	+	+	-	-	-	E
* <i>S. montemaceli</i> Arbea & Weiner, 1991	+	-	+	-	-	U
* <i>S. pseudolamellifera</i> (Stach, 1949)	+	+	-	-	-	E
* <i>Xenyllodes armatus</i> Axelson, 1903	+	-	+	-	-	H
<b>Neanuridae</b>						
* <i>Frisea albida</i> Stach, 1949	+	-	-	-	-	M
<i>F. claviseta</i> Axelson, 1900	-	+	+	+	-	C
<i>F. mirabilis</i> (Tullberg, 1871)	-	+	-	-	-	C
* <i>F. monoculata</i> Dunger, 1972	-	-	+	-	-	M
* <i>F. truncata</i> Cassagnau, 1958	+	+	-	-	-	P
* <i>Pseudachorutes boernerii</i> Schött, 1902	-	+	-	-	-	P
<i>P. corticolus</i> (Schäffer, 1896)	-	+	-	-	-	P
<i>P. dubius</i> Krausbauer, 1898	+	+	-	-	-	P
<i>P. palmiensis</i> Börner, 1903	+	+	-	-	-	SE
* <i>P. parvulus</i> Börner, 1901	+	+	-	+	-	P
<i>P. subcrassus</i> Tullberg, 1871	+	+	-	-	-	P
<i>Pseudachorutella asigillata</i> (Börner, 1901)	+	-	+	-	-	P
<i>Micranurida bescidica</i> Smolis & Skarżyński, 2004	-	+	-	+	-	U
<i>M. granulata</i> Agrell, 1943	+	+	-	-	-	P
<i>M. pygmaea</i> Börner, 1901	+	+	+	+	-	C
* <i>M. spirillifera</i> Hammer, 1953 (= <i>endroedi</i> Dunger)	-	-	-	+	-	H
<i>Morulina verrucosa</i> (Börner, 1903)	+	+	-	-	-	M#
<i>Neanura minuta</i> Gisin, 1963	+	-	-	+	-	E
<i>N. parva</i> (Stach, 1951)	+	+	+	-	-	E
<i>N. pseudoparva</i> Rusek, 1963	+	+	-	-	-	E

1	2	3	4	5	6	7
<i>Deutonura albella</i> (Stach, 1920)	+	-	+	+	-	M
<i>D. stachi</i> (Gisin, 1952)	-	-	+	+	-	M
<i>D. weinerae</i> Deharveng, 1982	+	-	-	-	-	M#
<i>Endonura tatricola</i> (Stach, 1951)	+	-	-	+	-	M
<i>Thaumanura carolii</i> (Stach, 1920)	+	+	-	-	-	M
<b>Onychiuridae</b>						
<i>Tetrodontophora bielaniensis</i> (Waga, 1842)	+	+	-	-	+	M
<i>Micraphorura absoloni</i> (Börner, 1901)	+	+	-	+	-	H
* <i>Hymenaphorura polonica</i> (Pomorski, 1990)	+	+	-	+	-	BM
<i>Heteraphorura carpatica</i> (Stach, 1954)	+	-	+	+	-	M#
<i>Kalaphorura paradoxa</i> (Schäffer, 1900)	+	-	+	-	-	M
<sup>x</sup> <i>Allonychiurus</i> sp.	+	-	-	-	-	U
<i>Protaphorura armata</i> (Tullberg, 1869)	+	+	+	+	-	C
<i>P. aurantiaca</i> (Ridley, 1880)	+	-	+	-	-	E
* <i>P. campata</i> (Gisin, 1952)	+	+	+	+	-	E
<i>P. subarmata</i> (Gisin, 1957)	+	-	+	-	-	P
* <i>P. subuliginata</i> (Gisin, 1956)	+	+	+	+	-	P
* <i>Orthonychiurus rectopapillatus</i> (Stach, 1933)	+	+	+	+	-	M
<i>Onychiuroides granulosus</i> (Stach, 1930)	+	+	+	-	-	E
* <i>Mesaphorura hylophila</i> Rusek, 1982	+	+	+	+	-	E
** <i>M. critica</i> Ellis, 1976	-	+	-	-	-	E
* <i>M. italica</i> (Rusek, 1971)	+	-	+	+	-	P
* <i>M. sylvatica</i> (Rusek, 1971)	-	+	+	-	-	P
* <i>M. tenuisensillata</i> Rusek, 1974	+	+	+	+	-	E
* <i>M. yosii</i> Rusek, 1967	+	-	+	-	-	C
<b>Isotomidae</b>						
* <i>Tetracanthella fjellbergi</i> Deharveng, 1987	+	+	+	-	-	BM
<i>T. montana</i> Stach, 1947	+	+	+	-	-	M
* <i>Pseudanurophorus binoculatus</i> Kseneman, 1934	+	-	-	-	-	BM
** <i>Folsomia hrabei</i> Rusek, 1984	-	+	+	-	-	U
* <i>F. inoculata</i> Stach, 1947	+	+	-	+	-	M
* <i>F. manolachei</i> (Bagnall, 1939)	+	+	+	+	-	P
* <i>F. lawrencei</i> Rusek, 1984	+	-	-	+	-	E
<i>F. penicula</i> Bagnall, 1939	+	-	-	-	-	H
<i>F. quadrioculata</i> (Tullberg, 1871)	+	+	+	+	-	H
* <i>F. sensibilis</i> Kseneman, 1936	+	-	+	+	-	BM
* <i>Proisotoma minima</i> (Absolon, 1901)	-	-	-	+	-	C
** <i>Appendisotoma abiskoensis</i> (Agrell, 1939)	-	+	-	-	-	E
<i>Isotomiella minor</i> (Schäffer, 1896)	+	+	+	+	-	C
* <i>Pseudisotoma monocheta</i> (Kos, 1942)	-	+	-	-	-	P
<i>P. sensibilis</i> (Tullberg, 1876)	-	+	-	-	-	C
<i>Parisotoma notabilis</i> Schäffer, 1896	+	+	+	+	-	C
<i>Vertagopus cinereus</i> (Nicolet, 1841)	+	+	-	-	-	P
* <i>Desoria blekeni</i> (Leinaas, 1980)	+	+	-	+	-	BM
* <i>D. divergens</i> (Axelson, 1900)	+	+	-	-	-	E
*** <i>D. duodecemoculata</i> (Denis, 1927)	+	+	-	-	-	M
* <i>D. hiemalis</i> (Schött, 1893)	+	+	-	-	-	E

1	2	3	4	5	6	7
* <i>D. ruseki</i> (Fjellberg, 1979)	+	+	-	-	-	P
<i>D. tigrina</i> (Nicolet, 1842)	+	-	-	-	+	C
<i>D. violacea</i> Tullberg, 1876	+	+	-	+	-	P
<b>Oncopoduridae</b>						
* <i>Oncopodura crassicornis</i> Schoebotham, 1911	-	-	+	-	-	E
<b>Tomoceridae</b>						
<i>Tomocerus minor</i> (Lubbock, 1862)	+	+	+	-	-	H
<i>T. vulgaris</i> (Tullberg, 1876)	+	-	-	-	-	H
* <i>Plutomurus carpaticus</i> Rusek & Weiner, 1978	+	+	+	+	-	M#
<i>Pogonognathellus flavescens</i> (Tullberg, 1871)	-	+	-	+	-	H
<b>Entomobryidae</b>						
<i>Orchesella bifasciata</i> Nicolet, 1841	-	+	-	+	+	E
<i>O. flavescens</i> (Bourlet, 1839)	-	-	-	-	+	H
* <i>Heteromurus nitidus</i> (Templeton, 1835)	+	-	-	-	-	E
<i>Entomobrya corticalis</i> (Nicolet, 1841)	-	+	-	-	+	E
<i>E. marginata</i> (Tullberg, 1871)	-	+	+	-	+	P
<i>E. nivalis</i> (Linnaeus, 1758)	-	+	-	-	+	H
<i>Willowsia buski</i> (Lubbock, 1869)	-	+	-	-	-	H
<i>Lepidocyrtus cyaneus</i> Tullberg, 1871	-	+	+	-	-	E
<i>L. lanuginosus</i> (Gmelin, 1788)	+	+	+	-	-	E
<i>Pseudosinella zygophora</i> (Schille, 1908)	+	-	-	-	-	E
<b>Neelidae</b>						
* <i>Megalothorax incertus</i> Börner, 1903	+	+	+	+	-	C
<i>M. minimus</i> Willem, 1900	+	-	-	-	-	C
* <i>Neelides minutus</i> (Folsom, 1901)	+	-	-	-	-	H
<i>Neelus murinus</i> Folsom, 1896	+	-	+	-	-	C
<b>Symphyleona</b>						
<i>Sphaeridia pumilis</i> (Krausbauer, 1898)	-	+	-	-	-	C
* <i>Sminthurides parvulus</i> (Krausbauer, 1898)	-	+	-	-	-	E
* <i>Arrhopalites pygmeus</i> (Wankel, 1860)	+	+	-	-	-	H
* <i>A. secundarius</i> Gisin, 1958	+	-	-	-	-	P
* <i>A. spinosus</i> Rusek, 1967	+	+	-	-	-	E
<sup>x</sup> <i>Rusekianna</i> sp.	-	-	-	+	-	U
* <i>Gisiniianus flammeolus</i> (Gisin, 1957)	+	+	-	-	-	E
<i>Sminthurinus aureus</i> (Lubbock, 1862)	+	+	-	-	-	E
* <i>S. gisini</i> Gama, 1965	+	-	-	-	-	M
<i>Dicyrtoma fusca</i> (Lubbock, 1873)	-	+	-	-	-	H
<i>Dicyrtomina minuta</i> (O. Fabricius, 1783)	+	+	-	-	-	H
<i>D. ornata</i> (Nicolet, 1842)	+	-	+	-	-	P
<i>Allacma fusca</i> (Linnaeus, 1758)	+	+	-	-	-	H
<i>Caprainea marginata</i> (Schött, 1893)	+	-	-	-	+	E
<i>Lipothrix lubbocki</i> (Tullberg, 1872)	+	+	-	+	-	P

Abbreviations: \* – species new to the fauna of the Beskid Sądecki Mts, \*\* – species new to the fauna of Polish Carpathians, \*\*\* – species new to the fauna of Poland, <sup>x</sup> – a new species whose description will be published in separate paper, A – litter, B – mosses and lichens growing on stones, trees and stumps, C – soil, D – rotten wood, E – on plants and mushrooms, GR – geographical range (C – Cosmopolitan, H – Holarctic, P – Palearctic, E – European, SE – South European, BM – Boreo-montane, M – montane, # – Carpathian endemite, U – uncertain distribution).

### Zoogeographical and ecological remarks

The Collembola fauna of the „Barnowiec” reserve constitutes almost 26 % of the Polish fauna (462 sp.) [11, 12, 13, 22, 23] and should be regarded as very rich. The species composition is roughly similar to that of the forest fauna of the Pieniny Mts [6, 32], Beskid Niski Mts [14, 20, 23, 32] and Bieszczady Mts [3, 18, 29]. The differences between faunas of the „Barnowiec” reserve and the last mentioned mountain range are most evident. The following species: *Micranurida lvivska* Babenko, 1998, *Friesea denisi* Kseneman, 1936, *F. handschini* Kseneman, 1938, *Deutonura czarnohorensis* Deharveng, 1982, *Hymenaphorura valdegranulata* (Stach, 1954), *Folsomia albens* Kaprus' & Potapov, 1999 and *F. martynovae* Potapov, 2001 which live in Polish and/or Ukrainian Bieszczady Mts [3, 29] are entirely absent in West Carpathians. Though zoogeographic differentiation between East and West Carpathians is generally known phenomenon [29], it still requires further studies. Future faunistic data can provide information on thorough range of mentioned differentiation and its microgeographic picture.

The majority of species identified have wide geographical ranges: Cosmopolitan (15 species – 12.5 %), Holarctic (20 species – 16.6 %), Palearctic (23 species – 19.2 %) and European (28 species – 23.3 %) (Table). The share of the montane element in the springtail fauna of the reserve is considerably high (22 species – 18.3 %). This element consists of species which occur in mountains and on scattered localities in highlands in Europe (*Hypogastrura kelmendica*, *Ceratophysella granulata*, *C. silvatica*, *Friesea albida*, *F. monoculata*, *Deutonura albella*, *D. stachi*, *Thaumanura carolii*, *Tetrodontophora bielensis*, *Kalaphorura paradoxa*, *Orthonychiurus rectopapillatus*, *Endonura tatricola*, *Tetracanthella montana*, *Desoria duodecemoculata*, *Sminthurinus gisini*) and Palearctic (*Ceratophysella sigillata*, *Folsomia inoculata*, *Desoria violacea*). Such the montane species as *Morulina verrucosa*, *Deutonura weinerae*, *Heteraphorura carpatica* and *Plutomurus carpaticus* are Carpathian endemites. The share of the Boreo-montane and South European elements in the fauna of the reserve is small (4.2 % and 0.8 %). They consist of *Hymenaphorura polonica*, *Tetracanthella fjellbergi*, *Pseudanurophorus binoculatus*, *Folsomia sensibilis*, *Desoria blekeni* and *Pseudachorutes palmiensis* respectively.

The majority of recorded species are typical representatives of the Central-European forest fauna. Euedaphic and hemiedaphic species living in soil and litter, and bryophilous species constitute the most numerous groups.

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### **Сердечно вітаємо !**

З 60-річчям з дня народження професора, доктора біологічних наук, завідувача кафедри зоології Львівського національного університету імені Івана Франка, завідувача відділу популяційної екології Інституту екології Карпат НАН України, дійсного члена (академіка) Української екологічної академії наук, члена Наукового товариства імені Шевченка, Українського ботанічного товариства

### **Йосифа Володимировича Царика**

Вже кілька десятиліть триває наша творча співпраця та спільний поступ у науковому, наставницькому та суспільному житті. Ваші вагомні доробки в галузі популяційної екології, у пізнанні високогірних екосистем Карпат, у вченні про консорції та інших напрямках екології давно вже визнані піонерними і лягли в основу сучасних наукових тем і програм.

Весь Ваш життєвий шлях свідчить про щире відданість рідній землі і українській науці. До свого ювілею Ви підходите не тільки із здобутками, а й з далекосяжними планами, попереду ще роботи й роботи.

Бажаємо Вам, дорогий Йосифе Володимировичу, міцного здоров'я, нев'янучого оптимізму та незмінної творчої праці по усіх напрямках, втім й у складі редакційної колегії „Наукових записок” нашого музею.

Нехай Вас супроводжують радість і добробут у родинному колі, щира дружба і добрий гумор у близькому товаристві. Многая і блага лїта від нас усіх!

*Редакційна колегія*