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Oribatid mite communities (*Acari*: *Oribatida*) on postindustrial dumps of different kinds. II. Community organization

Abstract: Oribatid mites of five postindustrial dumps (zinc and iron metallurgic dumps, dumps of power and chemical plants and a galena-calamine mine dump) were investigated in the Upper Silesian Region (south Poland). The age of dumps and the development of the vegetation were similar. 108 species of *Oribatida* were found on dumps. Dominance and the species structure of oribatid communities and ecological data of mites were analysed. Different oribatid communities were described on each dump with regard to dominance structure, species combination and species diversity. The most stable and dissimilar was the oribatid community on the galena-calamine dump. The major part of the communities comprised eurytopic species of broad distribution. Although, the number of microphytophagous species was higher in general, panphytophages exceeded 50% of the total numbers on three dumps.

Key words: *Oribatida*, postindustrial dumps, community structure, species composition

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INTRODUCTION

In contrast to plants, little is known of changes in animal species, particularly soil arthropods, during secondary succession (SCHEU & SCHULZ 1996). Studies on soil animal communities at different stages of secondary succession are scarce (BECKMANN & SCHRIEFER 1989, HUHTA et al. 1979; HUTSON & LUFF 1978, PARR 1978, PIŻL 1992, STREIT et al. 1985, WASILEWSKA 1994) and little is known of changes in species composition and the structure of a community. Postindustrial dumps are a good object to observe succession of plants and animals.

Oribatid mites are usually the most abundant of mites occurring in stable soils. Many authors are of the opinion that oribatids do not take part in primary colonization of newly formed habitat (BROCKMANN et al. 1980, HERMOSILLA 1976, HUHTA et al. 1979, KOEHLER 1983, STREIT et al. 1985). Although, oribatids attain an important position in aged material, e.g. the sludge material (HUHTA et al. 1979). In the latter research their biomass became even higher than in the controls, and of the same magnitude as the average biomasses of *Oribatida* in spruce forests, which are the optimum of this group. Moreover, DUNGER (1968) observed substantial populations of oribatid mites 3 years after the revegetation of mine spoil. Studies on the colonization and succession of soil fauna in habitats degraded by human activities were developed in recent years. However, there are few papers which analyse oribatid communities on postindustrial dumps in details (BECKMANN 1988, BIELSKA 1982a, b, BIELSKA 1995, LUXTON 1982, SKUBAŁA 1995, 1996, 1997a, WEIGMANN 1982, ŻBIKOWSKA-ZDUN 1988).

This study focused on the later stage of the succession of *Oribatida*. Different postindustrial dumps representing similar stage of the secondary plant succession were chosen. The vegetation was well developed and deciduous trees or shrubs occurred at all investigated sites. The paper investigates whether the oribatid communities described on various types of dumps differ with regard to structural biocenotic parameters. The author gives also an account of some more numerous species, as well as ecological and zoogeographical analysis of oribatid communities on dumps are made. Abundance and species richness of mite communities were previously discussed (SKUBAŁA 1997b).

SITE DESCRIPTION AND METHODS

Following five postindustrial dumps have been chosen in the Upper Silesian Region for the analysis:

1. a dump of a coal-burning power plant in Jaworzno
2. a dump of a chemical plant in Oświęcim
3. a zinc metallurgic dump in Katowice
4. an iron metallurgic dump in Bytom
5. a galena-calamine mine dump at Bukowno

They were comprised of different industrial materials originated from different industrial processes. The age of all dumps were similar (about 30–40 years) and the tall herbage communities containing some trees or shrubs (Oświęcim) were developed on these sites. Detailed information concerning the site description and methods can be found in the first part of an article (SKUBAŁA 1997b).

The species composition was analysed using the Marczewski and Steinhaus formula (s) (MARCZEWSKI, STEINHAUS 1959) and classificatory method by MOUNTFORD (1962).

$s = w / a + b - w$

where a – number of species in I community, b – number of species in II community, w – number of species common to I and II communities.

Diversity of soil animals (H') was calculated using Shannon-Wiener index: $H' = - \Sigma p_i \ln p_i$, where p_i – the proportion of the total species represented by species "i". Furthermore, the species abundance relationship after LUDWIG & REYNOLDS (1988) was also used to compare the structure of the oribatid communities on dumps.

Oribatid mites were categorized into three trophic groups (LUXTON 1972): macro-, micro- and panphytophages. Species were also classified into groups which characterized their typical biotope in which mites usually occurred: forest, open habitats, mosses and lichens on hard substrata and eurytopic species. Furthermore, species were classified according to their geographical distribution: european, palaearctic, holarctic and cosmopolitan species.

RESULTS

The dominance structure of a community

The dominance structure of the analysed communities differed much. A different number of species and different species belonged to particular classes of dominance. The specimens of oribatids were most evenly shared between species on the galena-calamine dump at Bukowno, where 7 species reached the dominance index higher than 5.0%. On the dumps in Oświęcim and Bytom 6 and 5 species belonged to dominants but a relatively higher proportion of most numerous species was observed. *Tectocepheus velatus* reached high dominance on these dumps (34.0% – Oświęcim and 23.6% – Bytom). The lowest number of dominants and very high dominance of one species were observed on the remaining dumps. *Oppiella nova* reached 46.7% of the entire community on the dump in Jaworzno and 50.9% on the dump in Katowice (Fig. 1).

The structure of the mite communities was also examined using the species-abundance relationship. Individual rank/abundance plots for the total number of mites collected on the study sites are presented in Fig. 2. The species abundance relationship was much more steep on the dump in Katowice and rather of milder progress on the other dumps. All these curves differed from the species-abundance relationship observed in the natural beech forest in Polish mountains (SKUBAŁA, in press). Curves of communities from natural biotopes display a log-normal distribution (STENSETH 1979).

Species similarity and diversity

It is worth mentioning that only 4 species (*Liochthonius lapponicus, Quadroppia quadricarinata maritalis, Oppiella nova and Tectocepheus velatus*) occurred on all investigated sites (see Apendix) and as regards dominants, there were only 2 ubiquitous parthenogens (*O. nova* and *T. velatus*). But the proportion of these species in communities varying much. For example, *O. nova* reached over 50% of the total numbers in Katowice and only 0.25% in Bytom. 8 species were recorded on at least four dumps (*Brachychochthonius im-*

maculatus, *Eupelops tardus*, *Scheloribates laevigatus*, *Suctobelbella acutidens*, *S. messneri*, *S. perforata*, *S. sarekensis* and *S. subcornigera*). But only *Sch. laevigatus* and *E. tardus* reached higher dominance on some of the dumps (Fig. 1).

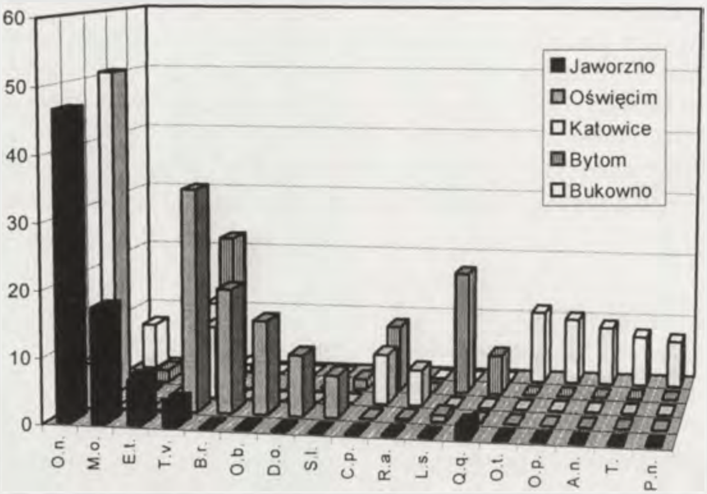

Fig. 1. Dominance of abundant oribatid species in communities on postindustrial dumps in Silesia. O.p. – *Oppiella nova*; M.o. – *Medioppia obsoleta*; E.t. – *Eupelops tardus*; T.v. – *Tectocepheus velatus*; B.r. – *Berniniella rafalskii*; O.b. – *Oribatella berlesei*; D.o. – *Dissorhina ornata*; S.l. – *Scheloribates laevigatus*; C.p. – *Ceratozetes peritus*; R.a. – *Ramusella assimilis*; L.s. – *Liebstadia similis*; Q.q. – *Quadroppia quadricarinata virginalis*; O.t. – *Oribatula tibialis*; O.p. – *Oribella paolii*; A.n. – *Achipteria nitens*; T. – *Tegoribates* sp.; P.n. – *Pergalumna nervosa*

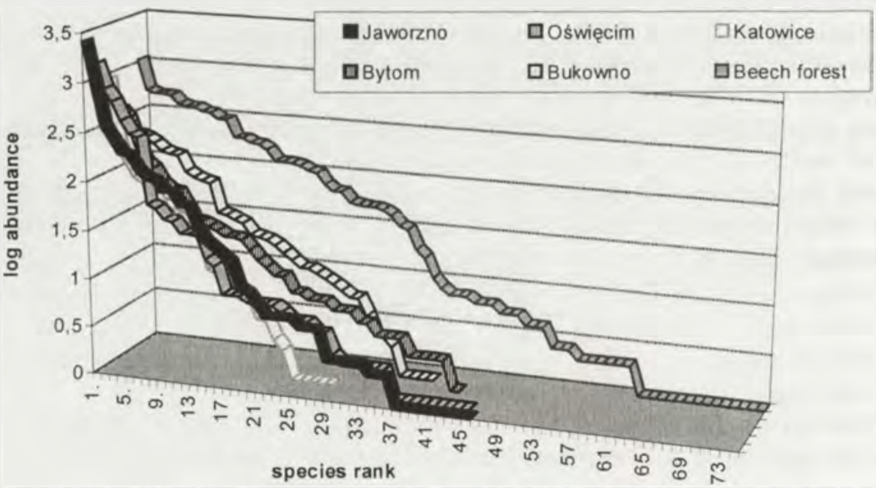

Fig. 2. The species abundance relation on the dumps in Silesia and in the natural beech forest. beech forest – forest in the Beskidy Mountains (SKUBAŁA in press)

Classification of analysed communities with regard to species similarity is illustrated in Figure 3. Similar analysis has been made also for plant species. As regards oribatid communities the value of the Marczewski and Steinhaus formula was highest for Jaworzno and Oświęcim (s = 0.28). The species composition of the community in Bytom was similar to the latters. The dendrogram displays a main separation between the dump at Bukowno and all other dumps. For example, there were only 10 common species for communities in Jaworzno and Bukowno (s = 0.12). The separate character of the oribatid community on the galena-calamine dump at Bukowno was also expressed by the highest number of speciess confined to one site (18).

Due to the similarity of plant assemblages on dumps, the relationship were different. In plants, the dumps in Oświęcim and Bytom were most similar. And the dump in Katowice was separated from other four dumps (Fig. 3).

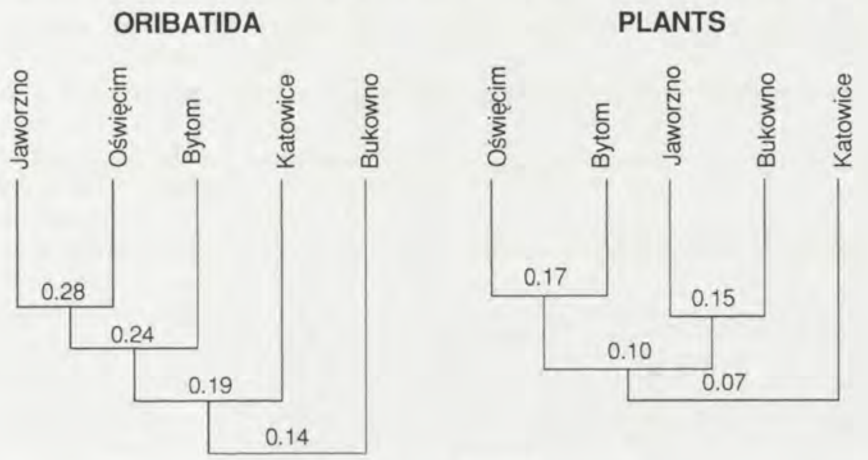

Fig. 3. Classification of oribatid communities and plant assemblages and values of indices of similarity between groups of dumps.

As regards species diversity of the oribatid communities, the most widely used Shannon index (H') was calculated. Its value increases as the number of species increases and as the distribution of individuals among the species becomes even. The oribatid community on the dump in Bukowno was the most diverse (H' = 2.9109) and a little lower was the diversity in Bytom (H' = 2.7889). On the other dumps its value was similar (Oświęcim – 2.0694, Jaworzno – 1.9927 and Katowice – 1.8822).

Ecological and zoogeographical analysis

As far as trophic preferences of oribatid mites are concerned, the major group was microphytophages. The number of these species was the highest on all dumps (ranged from 14 species at Bukowno to 24 species in Jaworzno). Although, they reached the highest percentage in total numbers only in the communities in Jaworzno (61.2%) and Katowice (67.3%). The highest proportion of panphytophages was recorded on the remaining dumps. It was because of very high dominance of panphytophagous species – *Tectocepheus velatus* on the dumps in Oświęcim and Bytom and high proportion of other panphytophages – *Oribatula tibialis, Eupelops tardus, Achipteria nitens and Pergalumna nervosa* at Bukowno. The proportion of macrophytophages was generally low, however they reached 10.5% of the total oribatid population at Bukowno.

Oribatid species which showed no preferences in habitats (eurytopic species) formed generally the major part of all communities. The species reached almost 40% of the total numbers on the dump in Bytom and about 75% on the dumps in Jaworzno and Katowice. The proportion of forest species was not high (ranged from 7.7% in Jaworzno to 19.4% in Bytom). However, very high number of forest species (15, 14 and 12) was recorded on some dumps (Jaworzno, Oświęcim and Bytom). Surprisingly, a high number of forest species was recorded on the dump in Oświęcim, where trees were absent. Only few meadow species (characteristic of open areas) was recorded on the dumps. They comprised the high percentage only on the dump in Bytom (32.4%).

In terms of geographical distribution of the recorded species, the major group was cosmopolitan species on all investigated sites. They comprised from 43.8% of the whole number in Bytom to 76.1% in Jaworzno. The number of cosmopolitan species was not the highest (the number of holarctic and palaearctic species was in many cases higher than cosmopolitan ones), but some of them reached very high abundance (e.g. *Achipteria nitens*, *Oppiella nova*, *Oribatula tibialis*, *Pergalumna nervosa*, *Tectocepheus velatus* and *Scheloribates laevigatus*). The proportion of holarctic and palaearctic species ranged from 6.8% (holarctic species at Bukowno) to 34.9% (palaearctic species in Oświęcim). Several european species were recorded on each dump. These species reached the highest proportion on the dump in Bytom (15.1%).

DISCUSSION

The observations conducted on several postindustrial dumps of similar age and development of vegetation allowed to describe five differently developed oribatid communities. They differed with regard to abundance, number of species (SKUBAŁA 1997b), the structure of a community (the differences in species structure were the most remarkable) and species diversity.

The analysis of the dominance structure of the communities revealed its different character in the investigated communities. The more balanced dominance structure was observed on the dump at Bukowno and Bytom. The structure of the remaining communities was much less stable. One species (*Oppiella nova* or *Tectocepheus velatus*) reached very high proportion in the communities in Jaworzno, Oświęcim and Katowice).

The species abundance relationship on the investigated dumps differed in comparison with the curve of the oribatid community in the natural beech forest (SKUBAŁA, in press) which showed a tendency towards a log-normal distribution (Fig. 2). It has been suggested that log-normal distributions are considered to be characteristic of greater environmental stability (STENSETH 1979). On the investigated dumps the curves were rather of logarithmic distribution, whereas on the zinc dump in Katowice log abundance declined most sharply in relation to species rank. A steep decline of the curves may indicates its early successional status (KOEHLER & BORN 1989).

As regards the values of the Shannon index, its value also differed between dumps (from H' = 1,8822 in Katowice to 2,9109 in Bukowno). In general the values of the species diversity index were not low. Values of this index varies from 2 to 3.5 in many natural forest biotopes (DZIUBA & SKUBAŁA 1986, NIEDBAŁA et al. 1981, RAJSKI 1961, STANTON 1979). As regards other investigated dumps, BIELSKA (1982b) recorded the Shannon index, H' = 1.8476 on the 30 years old mine dump and H' = 2.2643 on the 20 years old recultivated dump. Whereas ŻBIKOWSKA-ZDUN (1988) observed the value of the species diversity index, H' = 2.6452 on the recultivated mine dump.

Aboved characteristics indicated that the structure of the oribatid communities are different and mite communities on dumps in Jaworzno, Oświęcim and Katowice are not well developed and are in the earlier phase of succession than on two other dumps. And especially the dump in Bukowno is of greater stability due to species abundance relationships and the value of diversity index.

A striking differences in the species structure were observed (Fig. 1). Different oribatid species play an important role in each of the investigated communities. The species similarity was the highest for the communities in Jaworzno and Oświęcim (s = 0.28) and very low for communities at Bukowno and others (Fig. 3). In contrast to oribatids, the plant composition of the dump in Katowice was the most dissimilar. The differences in the similarity of oribatid and plant communities indicate that there are many other factors which influence the formation of the oribatid fauna. One of the reasons could be the presence of particular oribatid fauna around the dumps. It is worth mentioning that the species similarity between oribatid communities was much higher than between plant assemblages.

Species of the family *Oppiidae* dominated in communities on dumps in Jaworzno, Katowice and Oświęcim (*Berniniella rafalskii, Dissorhina ornata, Medioppia obsoleta, Oppiella nova* and *Ramusella assimilis*). Their proportion in the remaining communities was much lower. They are small body sized species, of weak sclerotization, inhabiting small pores in the soil, mainly eurybiotic mites. *Tectocepheus velatus* and species of similar morphological adaptations to the life in the soil (*Ceratozetes peritus, Liebstadia similis* and *Scheloribates laevigatus*) prevailed on the dumps in Oświęcim and Bytom. These are species of average size and sclerotization, lacking special morphological adaptation to the life in the soil or on the surface. Species of various type dominated on the galena-calamine dump. *Oribatula tibialis* and *Oribella paolii* are mites of similar specialization as *T.velatus* whereas *Eupelops tardus, Achipteria nitens, Tegoribates sp., Pergalumna nervosa* are strongly sclerotized mites with many protective adaptations, well adapted to the life on the surface. Furthermore, species of similar characteristic to the latter – *Oribatella berlesei* played an important role in the community in Oświęcim.

Some of the dominant species recorded on the dumps were previously found at postindustrial or disturbed sites at high numbers and are known as resistant to human impact. They are following species: *Dissorhina ornata, Liebstadia similis, Medioppia obsoleta, O. nova, Quadroppia quadricarinata, Ramusella assimilis, T. velatus* (Beckmann 1988, Bielska 1982a, b, 1995, Černova 1970, Luxton 1982, Skubała 1995, 1997a, Weigmann 1982). Furthermore, some other species were described as less sensitive to human perturbances, namely *Scheloribates laevigatus, Eupelops sp.* (Dindal 1977, Seniczak et al. 1991). The remaining dominant species from the analysed postindustrial dumps were absent or occurred in low numbers in similar researches.

As regards some ecological qualities of the recorded oribatids, species known to possess a broad ecological amplitude occurring in a wide variety of habitats throughout the world comprised the major part in all communities. It may be supposed that the proportion of cosmopolitan and eurytopic species will be decreasing in the following years as the vegetation will become more dense and the amount of organic matter will increase. The number of forest species was quite high on some dumps. Surely, the proportion of these mites will be also increasing in next years. A calculation of the relative proportion of trophic types in oribatid communities led to the following results: the number of microphytophagous species was the highest on all dumps, however on three investigated sites the proportion of panphytophages was higher, e.g. on the dumps in Oświęcim, Bytom and Bukowno. The proportion of microphytophages is considerably higher than panphytophages in more or less natural biotopes. For example, Niedbała et al. (1981) observed the percentage of microphytophages from 79% in dry-ground forest to 97.3% in mixed forest. Skubała (1998) found much higher number of microphytophagous species, whereas the proportion in the total numbers was identical for these two groups, in mountain forests. It seems that the analysed dumps are in the last but one stage of the formation of the mite community. As mentioned above it may be concluded that the proportion of microphytophagous species will be increasing during next years as the enviromental conditions will become more stable.

Further studies are necessary to have more detailed information concerning the occurrence of mites and driving forces responsible for the formation of their communities. This knowledge may be very useful for reclamation and conservation purposes.

CONCLUSIONS

1. The investigations on oribatids on postindustrial dumps have shown that it is impossible to describe a typical community common to various dumps.

2. Complex ecological conditions of these sites lead to a variety of species combinations.

3. The dominance structure of oribatid communities on 30–40 year old afforested dumps differed from that observed in natural biotopes.

4. Only two ubiquitous parthenogens – *Oppiella nova* and *Tectocepheus velatus* occurred on all sites and played an important role in most of the communities.

5. The proportion of eurytopic species of broad distribution was still high on the dumps in comparison with non-anthropogenic biotopes. Microphytophages or panphytophages prevailed in the communities with regard to abundance, whereas the total number of microphytophagous species was higher.

6. Six species new to the Polish fauna were recorded on the dumps. They were *Suctobelba lapidaria* MORITZ, 1970 and five other species noted down in first part of the article (SKUBAŁA 1997b).

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STRESZCZENIE

[Tytuł: Zgrupowania mechowców (*Acari*: *Oribatida*) na różnego typu zwałach poprzemysłowych. II. Analiza zoocenologiczna.]

Do badań nad zgrupowaniami mechowców wybrano 5 zwałów poprzemysłowych w rejonie Górnego Śląska. Były to: zwał elektrowni węgla kamiennego w Jaworznie, zakładów chemicznych w Oświęcimiu, zakładów cynkowych w Katowicach, hutnictwa żelaza w Bytomiu i kopalnictwa rud cynku i ołowiu w Bukownie. Wiek zwałów (około 30–40 lat) oraz stopień rozwoju szaty roślinnej (obecne drzewa lub krzewy liściaste) był zbliżony na wszystkich stanowiskach. W pierwszej części artykułu (SKUBAŁA 1997b) dyskutowano zagęszczenie i bogactwo gatunkowe zgrupowań roztoczy. Opisane zgrupowania mechowców różniły się między sobą z uwagi na strukturę dominacji, skład gatunkowy, różnorodność gatunkową oraz udział grup roztoczy o określonych cechach ekologicznych. Zgrupowanie mechowców o najbardziej stabilnej strukturze opisano na nieużytkach galeno-galmanowych w Bukownie. Cztery gatunki *Oribatida* (*Oppiella nova*, *Tectocepheus velatus*, *Liochthonius lapponicus* i *Quadroppia quadricarinata maritalis*) spośród 108 występowały na wszystkich zwałach, a tylko dwa pierwsze osiągnęły wysokie zagęszczenie na niektórych ze zwałów.

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Appendix: Check list of the oribatid mites on postindustrial dumps. J – Jaworzno, O – Oświęcim, K – Katowice, Byt – Bytom, Buk – Bukowno

Species	J	O	K	Byt	Buk	Species	J	O	K	Byt	Buk
1	2	3	4	5	6	1	2	3	4	5	6
Eobrachychthonius latior (Berlese 1910)					+	*Heminothrus peltifer* (C. L. Koch, 1839)		+			
Brachychochthonius cricoides (Weis-Fogh, 1948)				+		*Hypodamaeus riparius* (Nicolet, 1855)				+	
Brachychochthonius immaculatus Forsslund 1942	+	+	+	+		*Spatiodamaeus boreus* B.-Z., 1957		+		+	
Brachychthonius berlesei Willmann 1928			+			*Metabelba propexa* (Kulczyński 1902)			+		
Verachthonius laticeps (Strenzke 1951)	+					*Metabelba pulverulenta* (C. L. Koch, 1839)				+	
Liochthonius globuliferus (Strenzke 1951)	+					*Ctenobelba obsoleta* (C. L. Koch, 1841)				+	
Liochthonius lapponicus (Tragardh 1910)	+	+	+	+	+	*Fosseremus quadripertitus* Grandjean 1965			+		
Liochthonius perpusillus (Berlese 1910)	+					*Hafenrefferia gilvipes* (C. L. Koch, 1840)		+			
Liochthonius propinquus Niedbała 1972	+	+		+		*Liacarus coracinus* (C. L. Koch, 1841)				+	
Liochthonius sellnicki (Thor, 1930)	+	+		+		*Cultroribula bicultrata* (Berlese 1905)	+				
Liochthonius strenzkei Forslund 1963		+				*Tectocepheus velatus* (Michael, 1880)	+	+	+	+	+
Eniochthonius minutissimus (Berlese 1903)		+				*Machuella draconis* Hammer 1961					+
Hypochthonius luteus Oudemans 1917				+	+	*Medioppia obsoleta* (Paoli, 1908)	+	+		+	
Hypochthonius rufulus C. L. Koch, 1836		+		+	+	*Medioppia subpectinata* (Oudemans 1900)					+
Microtritia minima (Berlese 1904)	+	+				*Microppia minus* (Paoli, 1908)	+		+		
Rhysotritia ardua (C. L. Koch, 1841)	+	+		+		*Lauroppia falcata* (Paoli, 1908)	+				

1	2	3	4	5	6
Phthiracarus anonymus GRANDJEAN 1934				+	
Atropacarus (A.) striculus (C. L. KOCH, 1836)		+			+
Nothrus silvestris NICOLET, 1855				+	
Camisia spinifer (C. L. KOCH, 1835)	+				
Berniniella rafalskii (OPŁOTNA et RAJSKI, 1983)	+	+			
Oppia nitens C. L. KOCH, 1836		+			
Graptoppia foveolata (PAOLI, 1908)	+				
Ramusella (Rectoppia) fasciata (PAOLI, 1908)				+	
Ramusella (R.) assimilis (MIHELČIČ, 1956)	+	+	+		
Quadroppia quadricarinata maritalis LIONS, 1982	+	+	+	+	+
Quadroppia quadricarinata virginalis LIONS, 1982	+	+		+	
Suctobelba atomaria MORITZ, 1970					+
Suctobelba discrepans MORITZ, 1970	+				
Suctobelba lapidaria MORITZ, 1970		+			
Suctobelba sorretensis HAMMER, 1961	+				
Suctobelba trigona (MICHAEL, 1888)			+		
Suctobelbella acutidens (FORSSLUND, 1941)	+	+	+	+	
Lauroppia fallax (PAOLI, 1908)				+	
Lauroppia neerlandica (OUDEMANS, 1900)				+	
Oppiella nova (OUDEMANS, 1902)	+	+	+	+	+
Dissorhina ornata (OUDEMANS, 1900)	+	+			
Suctobelbella similis (FORSSLUND, 1941)	+				
Suctobelbella subcornigera (FORSSLUND, 1941)	+	+	+	+	
Suctobelbella subtrigona (OUDEMANS, 1900)			+		
Suctobelbella vera (MORITZ, 1964)	+	+			
Suctobelbella sp.	+				
Banksinoma lanceolata (MICHAEL, 1885)				+	
Oribella paolii (OUDEMANS, 1913)					+
Scutovertex sculptus MICHAEL, 1879		+		+	+
Hemileius initialis (BERLESE, 1908)			+		
Liebstadia similis (MICHAEL, 1888)		+		+	
Oribatula tibialis (NICOLET, 1855)	+	+			+
Oribatula sp.					+
Scheloribates laevigatus (C. L. KOCH, 1836)	+	+		+	+

1	2	3	4	5	6
Suctobelbella baloghi (FORSSLUND, 1958)					+
Suctobelbella bella (BERLESE, 1902)	+	+	+		
Suctobelbella forsslundi (STRENZKE, 1950)				+	
Suctobelbella messneri MORITZ, 1971	+	+	+	+	
Suctobelbella palustris (FORSSLUND, 1953)			+		
Suctobelbella perforata (STRENZKE, 1950)	+	+	+	+	
Suctobelbella perpendiculata (FORSSLUND, 1958)				+	
Suctobelbella sarekensis (FORSSLUND, 1941)	+		+	+	+
Ceratozetes gracilis (MICHAEL, 1884)					+
Ceratozetes mediocris BERLESE, 1908				+	
Ceratozetes peritus GRANDJEAN, 1951		+	+	+	
Ceratozetoides cisalpinus (BERLESE, 1908)	+		+		
Fuscozetes pseudosetosus SHALDYBINA, 1977					+
Trichoribates novus (SELLNICK, 1928)			+		
Trichoribates trimaculatus (C. L. KOCH, 1836)	+	+		+	
Latilamellobates incisellus (KRAMER, 1897)	+		+		+
Minuthozetes semirufus (C. L. KOCH, 1841)		+			
Scheloribates latipes (C. L. KOCH, 1841)		+		+	
Zygoribatula exilis (NICOLET, 1855)					+
Protoribates capucinus BERLESE, 1908					+
Protoribates pannonicus WILLMANN, 1951	+				
Protoribates variabilis RAJSKI, 1958			+		+
Chamobates borealis (TRÄGARDH, 1902)	+				
Chamobates voigtsi (OUDEMANS, 1902)	+				
Ceratozetella sellnicki (RAJSKI, 1958)		+			+
Oribatella berlesei (MICHAEL, 1898)	+	+			
Tegoribates sp.					+
Achipteria coleoptrata (LINNÉ, 1758)		+		+	+
Achipteria nitens (NICOLET, 1855)					+
Tectoribates ornatus SCHUSTER, 1958)					+
Acrogalumna longipluma (BERLESE, 1904)				+	
Galumna lanceata (OUDEMANS, 1900)		+	+		+
Galumna obvia (BERLESE, 1914)		+			+
Galumna sp. 1					+

1	2	3	4	5	6
Punctoribates punctum (C. L. Koch, 1839)	+		+	+	
Eupelops plicatus (C. L. Koch, 1835)		+			+
Eupelops tardus (C. L. Koch, 1836)	+	+		+	+
Peloptulus phaenotus (C. L. Koch, 1841)	+		+		+
Galumna sp. 2					+
Pergalumna nervosa (Berlese, 1914)					+
Pilogalumna tenuiclava (Berlese, 1908)	+	+			