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KNOWN MATERIALS OF UROPODINA (ACARI: MESOSTIGMATA) IN WIELKOPOLSKA FOREST RESERVES

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Abstract: The aim of the paper is to present and compare the number and diversity of mites from the suborder Uropodina since the 1950s until the first decade of the twenty-first century. The material used in this study comes from over 7000 samples collected in selected reserves of Wielkopolska over fifty years. In the analyzed samples, 43 species of the suborder Uropodina were found. The greatest diversity of mites (19) were found in the first decade of the twenty–first century. The species diversity and the number of individuals in the samples collected over six decades exhibit a clear increase over time. The key aspect of the protection of many groups of soil fauna, which are not legally protected, including mites from the suborder Uropodina, is to protect their natural habitats.

Keywords: protected area, community structure, composition of species, anthropopression

INTRODUCTION

The region of Wielkopolska covers an area of 29 826,51 km². Wielkopolska is the second largest province in Poland. Unfortunately, this quite diversified area has been greatly transformed by human activity. According to *Mapa roślinności potencjalnej* (Wojterski et al. 1978), the forest landscape of Wielkopolska is something natural for this region of Poland. The area was originally covered by deciduous forests with plant communities of the Central European oak-hornbeam forest (*Galio-Carpinetum*), a continental mixed coniferous forest (*Querco roboris-Pinetum*), and various types of riparian and alder forests (typical of areas with high ground water accumulations, either constantly or seasonally flooded). The huge woodiness of the region has been reduced over past centuries to 25%, mainly due to intensive agricultural activity (Pułk, Tybiszewska 2000). Besides the transformation of the forest landscape into agricultural areas, there also has been disturbance of water conditions. Numerous melioration and hydro-technical changes have led to a considerable decrease in the number of wetlands and the gradual loss of old river beds (Wodziczko 1947).

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In Wielkopolska there are 96 nature reserves (74 of these are forest reserves) (Rąkowski et al. 2006). Most of them have different types of water formations, e.g. floodplain terraces, marshes, swamps, and old river beds, to name but a few. These areas are extremely valuable because of their fauna and flora. A forest reserve is a place where all remains and fragments of the original primeval forest, all types of forest communities, and the positioning of trees on the border range are under constant protection (Rozporządzenie Ministra Środowiska z dnia 30 marca 2005 r. w sprawie rodzajów, typów i podtypów rezerwatów przyrody). In her previous studies Napierała (2008) shows that in the protected areas of Wielkopolska (both in nature reserves and in the Wielkopolska National Park), which constitute only 0.5% of the whole province, 80% of all the 56 Uropodina species found in Wielkopolska are protected (http://www.wir.org.pl/raporty/srodowisko 2000.htm). However, the occurrence of mites, their distribution, and species diversity in this region have not been sufficiently described. The brief review of the analyses presented in this paper is based on the material collected from the "Soil Fauna Databank" (Natural History Collections in the Department of Biology at Adam Mickiewicz University). The major aim of the present paper is to provide a short presentation of the studies on mites from the suborder Uropodina (Acari: Mesostigmata) living in the forest reserves of Wielkopolska. A more thorough examination of Uropodina communities and the association of the species with the particular habitats in which they occur may shed some new light on the problem and help protect mites and other groups of soil invertebrates.

The protection of the existing populations of Uropodina is very important because saprophagous, which decompose dead organic matter, constitute an important component of such ecosystems (Faasch 1967; Karg 1989). Moreover, most species of mites from the suborder Uropodina are steno- and oligobionts, with specific environmental requirements (Błoszyk 1983; Błoszyk 1999) and hence their presence or the gradual decline of a population can be a reliable, ecological indicator of soil environment conditions (Błoszyk 1984; Błoszyk Mason 2001, 1999; Błoszyk et al. 2003a; Błoszyk et al. 2004; Napierała 2008).

THE STUDY AREA

The study was conducted on the basis of the material collected in 27 selected forest reserves of Wielkopolska (Fig. 1, Tab. 1). The areas are located mainly in the central part of the region, especially along rivers and smaller watercourses that belong to the basin of the river Warta (including such rivers as: Rurzyca, Mogielnica, Górna Mogielnica, Gniła Byczyna, Prosna). The lowest number of reserves is in the cities of Jarocin, Koło, and Ostrów Wielkopolski.

MATERIALS AND METHODS

The paper also is based on materials from the "Soil Fauna Databank" (Natural History Collections, Department of Biology at Adam Mickiewicz University), collection cataloged in a computer database. The material contains 7232 qualitative and quantitative samples which were collected in the selected forest reserves of Wielkopolska in the years 1951–2007 (Tab. 2).

The quantitative samples were collected from an area of 30, 60 or 90 cm^2 with a metal cylinder to a depth of 7–10 cm. The qualitative samples were from sieved litter, soil, and decaying dead wood. The mites were extracted with Tullgren funnels for two or three days and then preserved (75%) in ethanol. The mites were identified with a stereoscopic microscope.

RESULTS

Uropodina species diversity in different reserves and decades

In the analyzed material, 43 species from the suborder Uropodina have been found (Tab. 3). The highest number of species occurs in Bytyńskie Brzęki reserve, where the material was collected from four different habitats (Tab. 2) and most of the samples come from different types of dead wood. The lowest number of species was recorded in Torfowisko Lis, where the samples were collected only from peatbogs. In three cases, that is in Buki nad Jez. Lutomskim, Dąbrowa koło Biadek Krotoszyńskich, and Olbina reserves no species of the analyzed group has been found in the samples collected so far (Tab. 2).

Both the number of species and the number of individuals in the analyzed material from different periods exhibit high variability with a strong tendency towards increase over time (Tab. 3). In the first period there were six species, whereas in the following period there are only three. In contrast to the second decade, the percentage of species recorded in the third decade was much higher. In the fourth decade the number of species is the same. A considerable decrease in the number of Uropodina species has been observed in the fifth decade, whereas the highest diversity of species occurs in the last period.

Changes of the Uropodina community structure over decades

Table 4 given below clearly shows that the studies on mites from the Uropodina cohort in the reserves of Wielkopolska became more intensive in the early 70s and the number of collected samples increased over time. This in turn resulted in finding species that had not been attested in these areas before that time.

Nature reserves in Wielkopolska

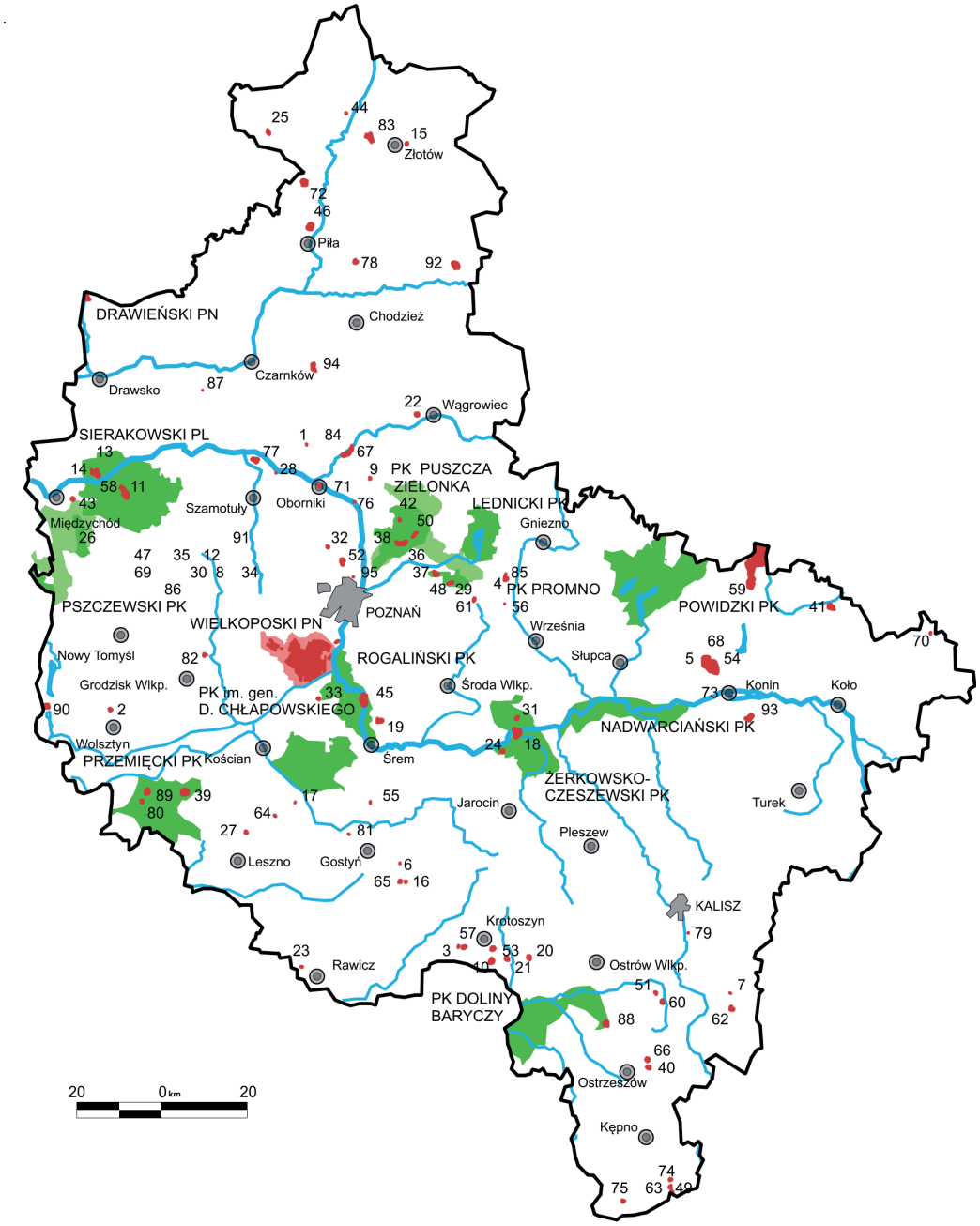

Fig. 1. Map of nature reserves in Wielkopolska

1. Bagno Chlebowo, 2. Bagno Chorzemińskie, 3. Baszków, 4. Bielawy, 5. Bieniszew, 6. Bodzewko, 7. Brzeziny, 8. Brzęki przy Starej Gajówce, 9. Buczyna, 10. Buczyna Helenopol, 11. Buki nad Jeziorem Lutomskim, 12. Bytyńskie Brzęki, 13. Cegliniec, 14. Czaple Wyspy, 15. Czarci Staw, 16. Czerwona Róża, 17. Czerwona Wieś, 18. Czeszewo, 19. Czmoń, 20. Dąbrowa koło Biadek Krotoszyńskich, 21. Dąbrowa Smoszew, 22. Dębina, 23. Dębno, 24. Dębno nad Wartą, 25. Diabli Skok, 26. Dolina Kamionki, 27. Dolinka, 28. Dołęga, 29. Drążynek, 30. Duszniczki, 31. Dwunastak, 32. Gogulec, 33. Goździk Siny w Grzybnie, 34. Huby Grzebieniskie, 35. Jakubowo, 36. Jezioro Czarne, 37. Jezioro Dębiniec, 38. Jezioro Pławno, 39. Jezioro Trzebidzkie, 40. Jodły Ostrzeszowskie, 41. Kawęczyńskie Brzęki, 42. Klasztorne Modrzewie koło Dąbrówki Kościelnej, 43. Kolno Międzychodzkie, 44. Kozie Brody, 45. Krajkowo, 46. Kuźnik, 47. Las grądowy nad Mogilnicą, 48. Las liściasty w Promnie, 49. Las łęgowy w dolinie Pomianki, 50. Las mieszany w Nadleśnictwie Łopuchówko, 51. Majówka, 52. Meteoryt Morasko, 53. Miejski Bór, 54. Mielno, 55. Miranowo, 56. Modrzew polski w Noskowie, 57. Mszar Bogdaniec, 58. Mszar nad jeziorem Mnich, 59. Nadgoplański park tysiąclecia, 60. Niwa, 61. Okrąglak, 62. Olbina, 63. Oles w Dolinie Pomianki, 64. Ostoja żółwia błotnego, 65. Pępowo, 66. Pieczyska, 67. Promenada, 68. Pustelnik, 69. Rezerwat na Jeziorze Zgierzynieckim, 70. Rogoźno, 71. Słonawy, 72. Smolary, 73. Sokółki, 74. Stara Buczyna w Rakowie, 75. Studnica, 76. Śnieżycowy Jar, 77. Świetlista Dąbrowa, 78. Torfowisko Kaczory, 79. Torfowisko Lis, 80. Torfowisko nad Jeziorem Świętym, 81. Torfowisko Źródliskowe w Gostyniu Starym, 82. Urbanowo, 83. Uroczysko Jary, 84. Wełna, 85. Wiązy w Nowym Lesie, 86. Wielki Las, 87. Wilcze Błoto, 88. Wydymacz, 89. Wyspa Konwaliowa, 90. Wyspa na Jeziorze Chobienickim, 91. Wyspy na Jeziorze Bytyńskim, 92. Zielona Góra, 93. Złota Góra, 94. Źródliska Flinty, 95. Żurawiniec (Poznań), 96. Żywiec Dziewięciolistny; after: Rąkowski et al. 2006

As many as 19 new species, which have never been found in earlier studies, have been discovered in the first decade of this century. An increase in the diversity of the species can be observed especially in the 70s and after the year 2000, which probably can be associated with the intensive research conducted in Jakubowo and Las Grądowy nad Mogielnicą (see Tab. 2, 3, and 4). Such species as *T. irenae, D. modesta*, *I. penicillata*, *P. tuberosa*, *N. breviunguiculata*, *P. calcarata*, *O. kargi*, *U. orbicularis*, and *N. stylifera* are extremely rare in the listed reserves of Wielkopolska. The presence of some of these species can stem from the fact that the studies cover unstable microhabitats, which are typical for these species.

The number of Uropodina communities in the selected reserves of Wielkopolska in different periods

The average number of specimens in a sample was highest in the first decade of the research and amounted to 124. During this period only two qualitative samples were collected in the Kolno Międzychodzki reserve. In the 60s the number was over 20 specimens per sample. In the late 60s and early 70s the number decreased to 70% of the original total. In the subsequent decades the number

Table 1. General characteristics of examined forest reserves in Wielkopolska

Name of reserve	Designated	Area (ha)	Object of protection
1	2	3	4
Bielawy	1954	20	Humid deciduous forest similar to a natural one: Central European oak-hornbeam forest (*Galio sylvatici-Carpinetum betuli*) and marshy forest (*Ficario-Ulmetum minoris*)
Brzęki przy Starej Gajówce	1959	6.7	Multi-species deciduous forest: Central European oak-hornbeam forest (*Galio sylvatici-Carpinetum betuli*)
Buki nad Jez. Lutomskim	1958	55.2	Beech woods with natural features occurring on the eastern border of the natural range: Central European oak-hornbeam forest and marshy forests
Bytyńskie Brzęki	1959	15.2	Mixed forest: Central European oak-hornbeam forest (*Galio sylvatici-Carpinetum betuli*)
Czeszewski Las	2004	223	Similar to the natural flora and fauna of marshy forests (*Alno-Ulmion*), on the flood terrace: oak-hornbeam forest and marshy forests (*Ficario-Ulmetum minoris*)
Dąbrowa koło Biadek Krotoszyńskich	1963	16	Oak forest, typical for Wielkopolska with old trees
Dąbrowa Smoczew	1963	14	Marshy forests (*Ficario-Ulmetum minoris*), (*Fraxino-Alnetum*) and Central European oak-hornbeam forest (*Galio sylvatici-Carpinetum betuli*)
Dębina	1957	31	One of the most unique old oak trees in Wielkopolska, which is calculated to be about 300 years old
Dębno nad Wartą	1974	21.6	Communities included in marshy forests (*Ficario-Ulmetum minoris*) and Central European oak-hornbeam forest (*Galio sylvatici-Carpinetum betuli*)
Diabli Skok	1961	21	Sizeable erosion valley with mixed old trees in something close to their natural state (*Galio odorati-Fagetum*)
Huby Grzebieniskie	1959	15	Deciduous forests, specifically a Central European oak-hornbeam forest (*Galio sylvatici-Carpinetum betuli*)
Jakubowo	1959	4	Central European oak-hornbeam forest (*Galio sylvatici-Carpinetum betuli*)

1	2	3	4
jezioro Pławno	1978	16.7	Pławno and Kociołek Lakes with plant communities and peat bogs
Klasztorne Modrzewie	1962	6	The oldest larch and pine trees in Wielkopolska estimated to be about 180–200 years old and 40 m high
Kolno Międzychodzkie	1959	14.8	Central European oak-hornbeam forest (*Galio sylvatici-Carpinetum betuli*) and marshy forest (*Ficario-Ulmetum minoris*)
Krajkowo	1958	160	Several hundred year old oak forests and marshy forests with willow (*Salicetum albo-fragilis*), poplars (*Populetum albae*), Marshy forests (*Fraxino-Alnetum*, *Ficario-Ulmetum minoris*), and oak trees (*Potentillo albae-Quercetum*)
Las Grądowy nad Mogielnicą	1959	7.4	Central European oak-hornbeam forest (*Galio sylvatici-Carpinetum betuli*)
Las Liściasty w Promnie	1954	6.1	Mixed forest, growing on moraine hills above the valley of the river Cybina: alder forests, marshy forests and oak trees
Las Mieszany	1962	11	Old oak-pine trees at ages of up to 200 years
Meteoryt Morasko	1976	54.5	Craters, formed by the fall of meteorites
Modrzew Polski	1954	1	Insular position of Polish larch
Niwa	1959	17	Forest with spruce and wild serviceberry: Central European oak-hornbeam forest (*Galio sylvatici-Carpinetum betuli*) and mixed pine forests (*Querco roboris-Pinetum*)
Olbina	1958	16.3	Continental mixed pine forests (*Querco roboris-Pinetum*)
Torfowisko Lis	1963	5	Peat bogs formed in the old Prosna riverbed
Wiązy w Nowym Lesie	1954	7	Humid deciduous forest similar to a natural one: Central European oak-hornbeam forest (*Galio sylvatici-Carpinetum betuli*) and marshy forest (*Ficario-Ulmetum minoris*)
Wielki Las	1959	79	Old marshy forest (*Ficario-Ulmetum minoris*) with more than 130 year old specimens
Żywiec Dziewięciolistny	1974	11	Most northerly position of the rare plant Dentaria enneaphyllos: Central European oak-hornbeam forest (*Galio sylvatici-Carpinetum betuli*)

Table 2. Type and number of samples collected in different periods

No.	Reserve	Quantity of samples	Quality of samples	Environments	Years	Number of species
1.	Kolno Międzychodzkie	–	2	Ś: 13b, 13a	1951	3
2.	Las Liściasty w Promnie	2	8	Ś: 8, 11, 13b, 20b, 22	1961–1983	11
3.	Czeszewski Las	–	3	Ś: 12, 13a, 13b	1962–1975	5
4.	Dębno nad Wartą	166	3	Ś: 34	1967–2007	11
5.	Buki nad Jez. Lutomskim	–	1	Ś: 14a	1972	0
6.	Dąbrowa koło Biadek Krotoszyńskich	–	1	Ś: 13a	1973	0
7.	Dąbrowa Smoczew	–	1	Ś: 13a	1973	3
8.	Jakubowo	3278	179	Ś: 13a, 34, 8, 16	1973–2006	24
9.	Las Grądowy nad Mogielnicą	1821	111	Ś: 13a	1973–2006	20
10.	Diabli Skok	2	7	Ś: 11, 14a, 16	1975–2001	13
11.	Dębina	6	28	Ś: 12, 13a	1976–2001	12
12.	Krajkowo	–	3	Ś: 12	1976	3
13.	Torfowisko Lis	1	–	Ś: 7a	1981	1
14.	Wielki Las	–	2	Ś: 12	1981	6
15.	Olbina	–	5	Ś: 7, 18	1982	0

16.	Niwa	–	4	Ś: 13a, 20b	1984–1985	5
17.	Bielawy	13	11	Ś: 13a	1986–2006	13
18.	Meteoryt Morasko	–	12	Ś: 19, 20, 20b, 22, 23, 13a	1999	5
19.	Las Mieszany	2	8	Ś: 13a	2001	7
20.	Klasztorne Modrzewie	12	16	Ś: 13b, 14, 14a, 19, 28	2001–2006	9
21.	Modrzew Polski	3	10	Ś: 19	2001–2006	7
22.	Brzęki przy Starej Gajówce	574	221	Ś: 22, 13a, 28	2001–2004	24
23.	Bytyńskie Brzęki	245	120	Ś: 13a, 22, 28, 16	2001–2003	25
24.	Huby Grzebieniskie	198	94	Ś: 13a, 13b, 28	2001–2003	21
25.	Jezioro Pławno	18	14	Ś: 11, 12, 16, 20b, 8, 15, 24	2006	9
26.	Wiązy w Nowym Lesie	9	3	Ś: 12, 13a, 13b	2006	3
27.	Żywiec Dziewięciolistny	6	9	Ś: 14, 28	2006	6
	Total	6356	876			

Environment: 1 – S: xerothermic, S: 5 – meadows, S: 7 – peat bogs, 7a – fens, S: 8 – sedges, S: 11 – swamp alder woods, S: 12 – riverine, S: 13 – mixed forests, 13b – mixed hardwood forests – more, S: 13a – hornbeam forests, S: 14a – beech – pomeranian, S: 15 – oak, S: 16 – pine forests, S: 19 – larch forests, S: 20b – mixed forests with pines, S: 20c – mixed forests with spruce, S: 22 – shrubs, S: 23 – parks, S: 25 – mammal nests, S: 26 – birds nests, S: 29 – hollows, S: 32 – rotting logs

Table 3. Occurrence of Uropodina in the analyzed decades
(+ /– presence/absence of a species)

Lp.	Species	Decade					
		1951–60	1961–70	1971–80	1981–90	1991–00	**< 2000**
1	2	3	4	5	6	7	8
1.	*Trachytes aegrota* (C. L. Koch, 1841)	+	+	+	+	+	+
2.	*Oodinychus ovalis* (C. L. Koch, 1839)	+	+	+	+	+	+
3.	*Urodiaspis tecta* (Kramer, 1876)	+	+	+	+	+	+
4.	*Oodinychus karawaiewi* (Berlese, 1903)	+	-	+	+	+	+
5.	*Olodiscus minima* (Kramer, 1882)	+	-	+	+	+	+
6.	*Trachytes pauperior* (Berlese, 1914)	-	-	+	+	+	+
7.	*Polyaspinus cylindricus* Berlese, 1916	-	-	+	+	+	+
8.	*Trachytes lamda* Berlese, 1903	-	-	+	+	-	-
9.	*Urodiaspis pannonica* Willmann, 1952	-	-	+	+	+	+
10.	*Cilliba rafalskii* sp.n	-	-	+	+	+	+
11.	*Cilliba cassideasimilis* sp.	-	-	+	+	-	+
12.	*Phaulodiaspis rackei* (Oudemans, 1912)	-	-	+	+	-	+
13.	*Janetiella pyriformis* (Berlese, 1920)	-	-	+	-	-	+
14.	*Leiodinychus orbicularis* (C. L. Koch, 1839)	-	-	+	-	-	+
15.	*Dinychus perforatus* Kramer, 1882	-	-	+	+	-	
16.	*Dinychus inermis* (C. L. Koch, 1841)	-	-	+	+	-	-
17.	*Pseudouropoda calcarata* (Hirschmann et Z.-Nicol, 1961)	-	-	-	+	-	+
18.	*Nenteria stylifera* (Berlese, 1904)	-	-	-	+	-	+
19.	*Cilliba cassidea* (Herman, 1804)	-	-	+	-	-	-
20.	*Olodiscus misella* (Berlese, 1916)	-	-	+	-	-	-
21.	*Olodiscus kargi* (Hirschamann et Z.-Nicol, 1969)	-	-	-	+	-	-
22.	*Trachytes irenae* Pecina, 1970	-	-	-	+	-	-

1	2	3	4	5	6	7	8
23.	*Discourella modesta* (Leonardi, 1889)	-	-	-	-	+	-
24.	*Apionoseius infirmus* Berlese, 1887	-	-	-	-	-	+
25.	*Polyaspis snasonei* Berlese, 1916	-	-	-	-	-	+
26.	*Trematurella elegans* (Kramer, 1882)	-	-	-	-	-	+
27.	*Iphiduropoda penicillata* (Hirschmann et Z.-Nicol, 1961)	-	-	-	-	-	+
28.	*Pseudouropoda tuberosa* (Hirschmann et Z.-Nicol, 1961)	-	-	-	-	-	+
29.	*Pseudouropoda sp*.	-	-	-	-	-	+
30.	*Olodiscus misella* (Berlese, 1916)	-	-	-	-	-	+
31.	*Janetiella pulchella* (Berlese, 1904)	-	-	-	-	-	+
32.	*Uroobovella obovata* (Canestrini et Berlese, 1884)	-	-	-	-	-	+
33.	*Uroobovella marginata* (C. L. Koch, 1829)	-	-	-	-	-	+
34.	*Trachyuropoda coccinea* (Michael, 1891)	-	-	-	-	-	+
35.	*Dinychura cordieri* (Berlese, 1916)	-	-	-	-	-	+
36.	*Discourella baloghi* (Hirschmann et Z.-Nicol, 1969)	-	-	-	-	-	+
37.	*Uropoda orbicularis* (Muller, 1776)	-	-	-	-	-	+
38.	*Nenteria breviunguiculata* (Willmann, 1949)	-	-	-	-	-	+
39.	*Dinychus arcuatus* (Tragardh, 1922)	-	-	-	-	-	+
40.	*Dinychus carinatus* (Berlese, 1903)	-	-	-	-	-	+
41.	*Dinychus* sp.	-	-	-	-	-	+
42.	*Dinychus woelkiei* (Hirschmann et Zirngiebl-Nicol, 1969)	-	-	-	-	-	+
43.	*Dinychus perforatus* Kramer, 1882	+	-	-	-	-	-
	Total	6	3	18	18	10	35

Table 4. The structure of Uropodina communities in different decades

Decade	1951–60	1961–70	1971–80	1981–90	1991–00	2001–07
Number of samples collected in a given decade	2	1	1375	2450	47	3357
Dominant species	*O. karawaiewi* *O. ovalis* *U. tecta*	*T. aegrota*	*O. minima* *T. aegrota* *T. pauperior*	*T. aegrota* *T. pauperior* *O. minima*	*T. aegrota* *O. ovalis* *O. minima*	*O. ovalis* *T. aegrota* *O. minima*
Most common species	*O. ovalis* *O. karawaiewi* *U. tecta*	*T. aegrota*	*O. minima* *T. aegrota* *T. pauperior*	*T. aegrota* *O. minima* *T. pauperior*	*T. aegrota* *O. minima* *T. pauperior*	*T. aegrota* *O. minima* *O. ovalis*
Rare species in a given decade	*O. minima* *T. aegrota*	*O. karawaiewi* *U. tecta*	*D. inermis* *J. pyriformis*	*T. irenae* *P. calcarata*	*P. cylindricus* *D. modesta*	*I. penicillata* *P. calcarata* *P. tuberosa* *N. breviunguiculata* *N. stylifera*

Species that appeared in a given decade			*T. pauperior* *T. lamda* *P. cylindricus* *L. orbicularis* *U. pannonica* *O. misella* *C. cassideasimilis* *C. cassidea* *C. rafalskii* sp.n *J. pyriformis* *P. rackei* *D. perforatus* *D. inermis*	*T. irenae* *P. calcarata* *O. kargi* *N. stylifera*	*D. modesta*	*A. infirmus* *P. sansonei* *T. elegans* *I. penicillata* *P. tuberosa* *Pseudouropoda* sp. *O. misella* *J. pulchella* *U. obovata* *U. marginata* *T. coccinea* *D. cordieri* *D. baloghi* *U. orbicularis* *N. breviunguiculata* *D. arcuatus* *D. carinatus* *Dinychus* sp. *D. woelkiei*
The increase in diversity over the previous decade (%)	–	–	600	–	–	350
Decline in diversity over the previous decade (%)	–	50	–	–	56	–

was lower. A slight increase in the number of Uropodina populations can be observed only in the period from 2001 to 2007 (Fig. 2).

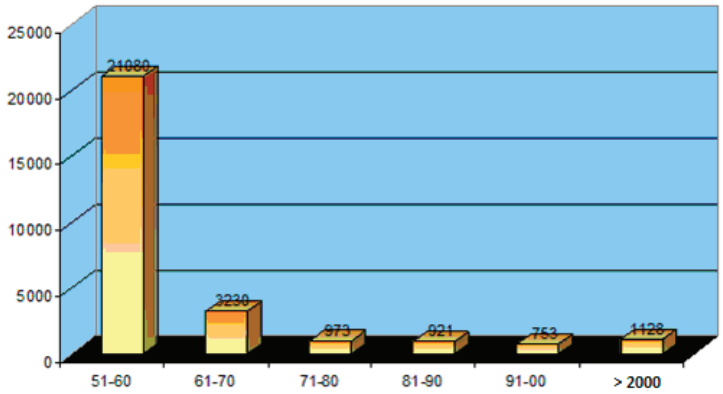

Fig. 2. Average number of Uropodina in different decades

DISCUSSION

The nature reserves of Wielkopolska are areas that are highly different from each other, both in terms of the natural conditions and the degree of anthropopressure to which they are exposed. There are be two major reasons for these differences. Firstly, the reserves are located in different regions of Wielkopolska and therefore most of the differences stem from the different morphological aspects of the climate, such as location at different heights above sea level and differences in the types of parent rocks. Secondly, some of these differences can be attributed to human activities, such as land drainage (mainly due to inaccurate land melioration), industrial and transportation pollution of the air, and water pollution. Furthermore, only some of the reserves are under permanent, long-term protection. A problem that should be mentioned here is that no new protected areas have been established in Wielkopolska. Most of the reserves (i.e. almost 54%) in which the studies were carried out were established in the 50s and 60s of the XX century (Fig. 3). Unfortunately, there are no new protected reserves in other parts of Poland either. However, the areas of the existing reserves and national parks have sometimes been extended to include new bits of land.

After analyzing the material collected so far, one can easily conclude that the fauna of Uropodina in these reserves has not been sufficiently examined (the same can certainly be said about the other groups of soil fauna found there). First of all, the extent to which each of the objects has been examined is not the same (Błoszyk et al. 2002). In three reserves, namely, Dąbrowa koło Biadek

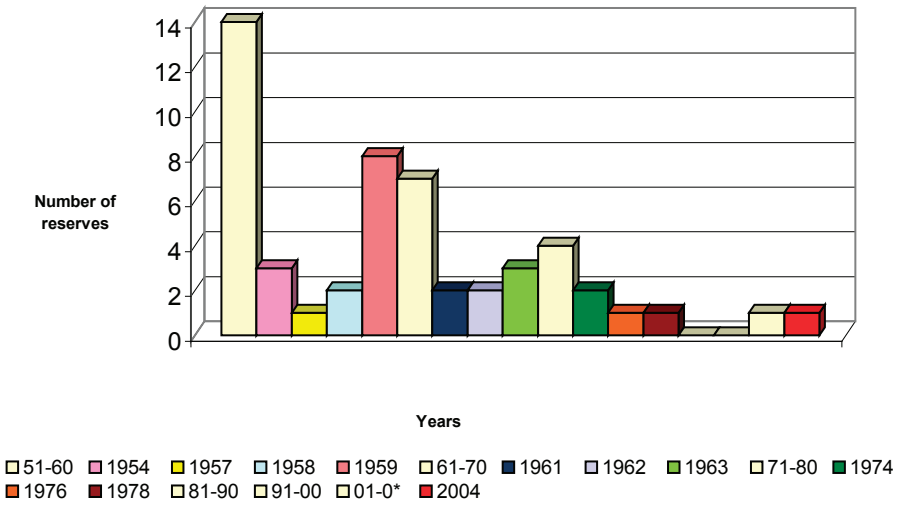

Fig. 3. The rate of establishment of nature reserves in Wielkopolska in the years 1951–2004

Krotoszyńskich, Dąbrowa Smoczew, and Torfowisko Lis only one sample was collected. The nature reserves that without doubt have been thoroughly scrutinized are Jakubowo, Las Grądowy nad Mogielnica, Bytyńskie Brzęki, Brzęki przy Starej Gajówce, and Huby Grzebieniskie. Extensive quantitative research has been conducted only in these reserves (Błoszyk 1999; Błoszyk et al. 2003; Napierała 2008). The research carried out in these areas provided numerous samples – including several thousand samples collected during various research projects, conducted over a period of thirty-three years (Błoszyk 1999; Napierała 2008; Napierała et al. 2009).

The state of the soil environment in the reserves in question can be described on the basis of the presence or absence of certain species that can serve the function of bioindicators. *Oodinychus karawaiewi* is one such species among Uropodina. It is a synantrophic species and its presence in the communities indicates that the state of the soil environment is deteriorating (Błoszyk et al. 2006; Napierała 2008). The highest number of individuals of this species was found in the material from the 50s collected in Kolno Międzychodzkie, where only two samples of litter were collected. In this case, however, the high number of individuals does not necessarily indicate a high degree of synanthropisation of the reserve but probably stems from the low number of samples. The gradual disappearance of rare stenotopic species such as *T. irenae*, *O. kargi*, and *P. sansonei*, whose presence in the analyzed material is extremely sporadic, is an important indicator which confirms the steady deterioration of the soil environment in the reserves.

In contrast to economic forests, the greatest advantage of reserves is their autonomous natural existence with relatively low human interference. A good example showing the real importance of reserves is the fact that such areas retain dead wood, which is one of the major habitats of Uropodina (Błoszyk et al. 2002; Błoszyk et al. 2003b; Błoszyk et al. – in press). Obviously, rotten logs are not removed but they remain there and decompose on the forest floor and afterwards become a favorable environment for the development of many groups of invertebrates (Gutowski et al. 2002). Both the structure and age of the tree stand are also important. Economic forests, which are quite frequently logged, usually require treatments which make the growth of old tree stands impossible. The variety of Uropodina species in these forests is therefore much lower than in the reserves, with old and well-developed tree stands (Napierała 2008).

CONCLUSION

The above tabulations and figures clearly show that the number of species found increases with both the number of the samples collected in different decades and the number of habitats. The large number of habitats in Wielkopolska, especially in the protected areas, suggests that the number of Uropodina species in these areas is much higher than that shown in previous studies. In the case where the number of samples is low, one should bear in mind that the samples could be collected in the wrong way, in the wrong environment, or in a place poorly representing the habitat. This in turn means that it is important to collect a sufficient number of samples to conduct a statistical analysis or contribute to long-term studies (intended to examine changes in the soil, environment of Wielkopolska) which take comparisons of fauna at different periods of time into account (see Napierała 2008).

The brief review of the studies presented above shows that the description of the species variety of mites from the suborder Uropodina occurring in the forest reserves of Wielkopolska is far from complete. This, of course, means that further research is necessary and the description would be more detailed if the analysis met the following formal criteria:

- the number of collected samples should be higher,
- the samples should be collected from a larger number of habitats,
- the samples should be collected at regular intervals,
- in the reserves with the lowest number of samples collected so far, the research should be more extensive and more intensive.

To sum up, it can be concluded that one of the key aspects of the protection of many groups of soil fauna which are not legally protected species, is to protect their natural habitats. It seems that the best way to do this is to establish more new nature areas and reserves.

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MATERIAŁY DO ZNAJOMOŚCI UROPODINA (ACARI: MESOSTIGMATA) REZERWATÓW LEŚNYCH WIELKOPOLSKI

Streszczenie

W artykule przedstawiono obecny stan badań nad Uropodina (Acari: Mesostigmata) w rezerwatach przyrody w Wielkopolsce, opierając się na badaniach przeprowadzanych od wczesnych lat 50. do końca wieku oraz w pierwszej dekadzie XXI w. Badania były przeprowadzone w 27 wybranych rezerwatach przyrody Wielkopolski. Badane rezerwaty różniły się: lokalizacją, morfologią, stanem klimatycznym oraz stopniem antropopresji. Materiał użyty w tych badaniach pochodzi z ponad 7000 prób zdeponowanych w ‘Banku Fauny Bezkręgowców’ (Zbiory Przyrodnicze na Wydziale Biologii UAM), zebranych w wybranych rezerwatach Wielkopolski na przestrzeni 50 lat.

W przeanalizowanych próbach znaleziono 43 gatunki Uropodina. Największą różnorodność gatunkowa stwierdzono w rezerwacie „Bytyńskie Brzęki”, gdzie próbki zostały zebrane z czterech różnych środowisk. Znaczna liczba zebranych próbek pochodziła z martwego drewna. Tylko jeden gatunek Uropodina został znaleziony w „Torfowisku Lis”. Ponadto, w trzech rezerwatach nie znaleziono gatunku Uropodina. Różnorodność gatunków oraz liczba osobników w próbkach zebranych przez ponad sześć dekad wykazują istotny wzrost w czasie. Liczba zebranych próbek wzrastała i była zbierana z większej liczby środowisk, co skutkowało stwierdzeniem nowych gatunków.

Po przeanalizowaniu zebranego materiału głównym wnioskiem, jaki można wysnuć, jest to, iż obecny stan zbadania fauny glebowej w rezerwatach Wielkopolski jest niezadowalający. Wnioski wypływające z analizy zaprezentowanej w artykule jednoznacznie pokazują, że stan zbadania roztoczy z kohorty Uropodina zmienił się na przestrzeni ostatnich 50 lat i niektóre rezer-

waty zostały przebadane dokładniej niż reszta. Warto również zaznaczyć, że roztocza z podrzędu Uropodina i wiele innych grup występujących w faunie glebowej to gatunki niechronione i dlatego jedyną możliwą drogą ich ochrony jest ochrona środowisk, w których naturalnie występują.