POLISH ACADEMY OF SCIENCES • INSTITUTE OF ZOOLOGY
MEMORABILIA ZOOLOGICA

| MEMORABILIA ZOOL. | 43 | 61–81 | 1989 |
|---|---|---|---|

MARIA STERZYŃSKA

# SPRINGTAILS (*COLLEMBOLA*) OF MOIST MEADOWS ON THE MAZOVIAN LOWLAND

## ABSTRACT

The species composition and structure of *Collembola* communities have been analysed on six *Arrhenatheretum medioeuropaeum* meadows on the Mazovian Lowland. Sixty-three species were recorded there, including one species new to Polish fauna — *Isotomodes armatus* (Naglitsch 1962) recorded from a site at Chylice. Typical meadow fauna of *Collembola* on the Mazovian Lowland is found only on humid meadows. Agrotechnical utilization causes that together with changing site conditions the *Collembola* communities of meadows undergo synanthropization. Numerous ubiquistic, mesophilous species appear, whereas those characteristic of meadows of *Arrhenatheretum* type recede.

## INTRODUCTION

The *Collembola*, apart from *Acarina*, are one of the most abundant and at the same time an important group of soil animals. In communities of *Collembola* the majority of species are typical soil (edaphic) ones or those living in the litter layer (hemiedaphic). They are the main catalyzers of a number of soil processes, especially of mineralization and humification of dead organic matter. *Collembola* are ideal for bioindicatory investigations of the environment because of their broad distribution and great community abundance.

The aim of the present study has been to learn about the species composition and structure of soil *Collembola* communities on moist meadows (*Arrhenatheretum medioeuropaeum*) of Mazovian Lowland.

Not much is yet known about the composition and structure of *Collembola* communities on moist meadows of Mazovian Lowland, let alone of Poland. Some data can be found in monographs on *Collembola* fauna of some Polish national parks (Kaczmarek 1973, Szeptycki 1967, Weiner 1981), in papers

dealing with urban green areas of Warsaw and suburban areas at Białołęka Dworska (Sterzyńska 1981, 1982, 1986), and concerning the fauna of arable fields (Łosiński 1953, 1972, 1974).

## STUDY AREA AND METHODS

The studies on the *Collembola* of moist meadows (*Arrhenatheretum medioeuropaeum*) of Mazovian Lowland were carried out between 1980 and 1983. The material was collected on five meadows at Klembów, Białołęka Dworska (meadows A and B), Chylice and Zbroszki (Tab. 1). An exact locality, aim and range of investigations conducted are given in the introductory papers (Bańkowska 1987a, b). Particular meadows varied as to mechanical composition, fertility, soil moisture and the way and intensity of agrotechnical management: meadow at Klembów — fertile, mown-grazed, not intensely utilized; meadow A at Białołęka Dworska — fertile, unused agrotechnically; meadow B at Białołęka Dworska — fertile, mown-grazed, not much used; meadow at Chylice — fertile, mown-grazed, intensively used; meadow at Zbroszki — an intensively grazed meadow. A detailed phytosociological and soil description of these meadows can be found in the introductory paper of Kotowska and Okołowicz (1989). Also the results of earlier investigations on *Collembola* communities on an intensively utilized mown-grazed meadow C at Białołęka Dworska have been used here (Sterzyńska 1981).

Each month, on all sites, soil samples were taken between April and October (only in 1983, on Chylice meadow, between February and November in order to observe better the changes in seasonal fluctuations). Each series consisted of 10 samples of a surface area 20 $cm^2$ each, and 10 cm in depth. Samples were extracted in Tullgren's apparatus. The material obtained consisted of 7.5 thousand of individuals.

Table 1. Number of samples and number of *Collembola* individuals collected in particular years from moist meadows on Mazovian Lowland

| Locality / Years of study | Klembów | | Białołęka Dworska | | | Chylice | | Zbroszki | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | | A | B | C | | | | |
| | 1980 | 1981 | 1980 | 1980 | 1976 | 1982 | 1983 | 1983 | |
| Number of samples | 50 | 60 | 70 | 70 | 50 | 50 | 100 | 30 | 480 |
| Number of individuals | 613 | 991 | 1,793 | 973 | 213 | 875 | 1,830 | 141 | 7,429 |

## SPECIES COMPOSITION

On all meadows examined altogether 62 *Collembola* species were found (Tab. 2). The greatest number of species (36) was found on the intensively utilized mown-grazed meadow at Chylice. A similar number of species was found on meadows A and B at Białołęka Dworska — 34 and 31 species, respectively. On other meadows the numbers of species were smaller. At Klembów 28 species were found on the meadow, 20 species — on the intensively grazed meadow at Zbroszki, and 16 species — on meadow C at Białołęka Dworska (Tab. 2).

Apart from the differences in the number of *Collembola* species in soils of particular meadows their species composition varied. The following species were noted only on the fertile meadow B at Białołęka Dworska: an eurytopic *Cryptopygus hermopilus*, *Xenylla grisea* — au oligotopic (xerophilous), open-habitats species, *Pseuda chorute parvulus* — a polytopic forest species, *Mesaphorura tenuisensillata* — a species not recorded yet from the Mazovian Lowland, in Poland known only from Pieniny (Weiner 1981). Only on mown-grazed meadow A at Białołęka Dworska occurred: *Entomobrya nivalis* — an eurytopic species, preferring arid habitats, *Orchesella spectabilis* — species encountered in dry and sunny habitats in open areas, *Orchesella flavescens* — very common on herbs, preferring forest association. Only on mown-grazed meadow C at Białołęka Dworska the eury-topic species *Lepidocyrtus lanuginosus* was found. On fertile mown-grazed meadow at Chylice only such species occurred as *Proisotoma minima* — a species recorded by Stach (1964) as a rare one but widely distributed, *Pogonognathellus flavescens* — a common species preferring humid habitats and *Isotomodes armatus* — eudaphic species connected with open areas (da Gama 1963, Naglitsh 1962), not recorded from Poland yet.

The similarity of species composition of *Collembola* communities on meadows examined was estimated using the qualitative Sörensen index. It was relatively low: 0.21–0.37, and the mean coefficient of similarity was 0.28 (Tab. 3). The most similar species composition was noted for communities from the intensively managed mown-grazed meadow at Chylice and the almost unused mown-grazed meadow at Klembów — 0.37. Such great similarity confirmed the similarity of site conditions on Chylice and Klembów meadows. The Klembów meadow is wet in places, whereas the Chylice one is a moist meadow on the alluvial soil (Kotowska, Okołowicz 1989). Furthermore, *Collembola* communities on moist meadow at Klembów showed the greatest average similarity to the communities on other meadows (0.31) and thus can be considered as the most typical of Mazovian Lowland meadows examined as regards the species composition of *Collembola*. The communities from three meadows at Białołęka Dworska had also a similar species composition (0.28 on the average). *Collembola* community on meadow A at Białołęka Dworska was quite similar to those on meadows B (0.33) and C (0.29). The least similar were the communities from mown-grazed meadow C

Table 2. Species composition, abundance and percentage of Collembola of moist meadows on Mazovian Lowland (d — density in thous. ind./m²)

| No. | Locality / Species | Klembów | | Białołęka Dworska | | | | | | Chylice | | Zbroszki | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | A | | B | | C | | | | | |
| | | d | % | d | % | d | % | d | % | d | % | d | % |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| 1 | *Hypogastrura vernalis* (Carl.) | — | — | 0.01 | 0.1 | 0.54 | 7.9 | — | — | — | — | — | — |
| — | *Hypogastruridae* spp. juv. | — | — | — | — | 0.04 | 0.5 | — | — | 0.01 | 0.1 | — | — |
| — | *Hypogastrura* sp. | — | — | — | — | 0.03 | 0.4 | — | — | — | — | — | — |
| 2 | *Ceratophysella denticulata* (Bagnall) | — | — | — | — | — | — | — | — | 0.02 | 0.2 | — | — |
| 3 | *Ceratophysella succinea* Gisin | — | — | 0.01 | 0.1 | 0.15 | 2.2 | — | — | — | — | — | — |
| 4 | *Xenylla grisea* Axels. | — | — | — | — | 0.01 | 0.2 | — | — | — | — | — | — |
| 5 | *Willemia intermedia* Mills | 0.01 | 0.1 | 0.01 | 0.1 | 0.13 | 1.9 | — | — | — | — | — | — |
| 6 | *Brachystomella parvula* (Schaff.) | — | — | 0.01 | 0.1 | 0.27 | 4.0 | — | — | 0.25 | 2.8 | — | — |
| 7 | *Friesea mirabilis* (Tullb.) | 0.06 | 0.8 | 0.04 | 0.3 | 0.01 | 0.2 | 0.06 | 2.8 | 0.29 | 3.2 | — | — |
| 8 | *Friesea afurcata* Denis | — | — | — | — | 0.03 | 0.4 | — | — | — | — | — | — |
| 9 | *Pseudachorutes parvulus* Börn. | — | — | — | — | 0.01 | 0.2 | — | — | — | — | — | — |
| — | *Pseudachorutes* sp. | — | — | — | — | 0.01 | 0.2 | — | — | — | — | — | — |
| 10 | *Neanura muscorum* (Templ.) | 0.01 | 0.1 | — | — | — | — | — | — | — | — | — | — |
| 11 | *Onychiurus armatus* s. Stach | 0.12 | 1.7 | 1.90 | 14.7 | 1.55 | 22.7 | 0.17 | 8.0 | 0.12 | 1.4 | 0.08 | 3.7 |
| 12 | *Onychiurus granulosus* Stach | 0.01 | 0.1 | 0.01 | 0.1 | — | — | — | — | — | — | — | — |
| 13 | *Onychiurus naglitschi* Gisin | — | — | 0.01 | 0.1 | — | — | — | — | — | — | — | — |
| — | *Onychiurus* sp. | 0.01 | 0.1 | 0.01 | 0.1 | — | — | — | — | — | — | — | — |
| 14 | *Mesaphorura krausbaueri* Börn. | 0.02 | 0.3 | 0.09 | 0.7 | 0.04 | 0.6 | — | — | 0.03 | 0.3 | 0.12 | 5.1 |
| 15 | *Mesaphorura macrochaeta* Rusek | 0.10 | 1.4 | 0.21 | 1.6 | 0.41 | 6.0 | 0.06 | 2.8 | 0.59 | 6.6 | 0.60 | 26.4 |
| — | *Mesaphorura* group of *krausbaueri* | 0.01 | 0.1 | — | — | — | — | — | — | — | — | 0.08 | 3.7 |
| 16 | *Mesaphorura critica* Ellis | 0.01 | 0.1 | 0.14 | 1.1 | 0.07 | 1.0 | — | — | 0.19 | 2.1 | 0.10 | 2.4 |
| 17 | *Mesaphorura hylophila* Rusek | 0.11 | 1.5 | — | — | — | — | — | — | — | — | — | — |
| — | *Mesaphorura* group of *sylvatica* | — | — | 0.06 | 0.5 | 0.03 | 0.4 | — | — | — | — | — | — |
| 18 | *Mesaphorura tenuisensillata* Rusek | — | — | — | — | 0.02 | 0.3 | — | — | — | — | — | — |
| — | *Mesaphorura* sp. | 0.11 | 1.5 | 0.17 | 1.4 | 0.33 | 4.8 | 0.11 | 5.1 | 0.06 | 0.6 | 0.10 | 4.4 |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19 | *Metaphorura affinis* (Börn.) | — | — | 2.13 | 16.6 | — | — | 0.26 | 12.2 | 0.01 | 0.1 | — | — |
| 20 | *Stenaphorura quadrispina* Börn. | 0.01 | 0.1 | 0.10 | 0.7 | 0.01 | 0.2 | 0.04 | 1.9 | 0.01 | 0.1 | 0.05 | 2.2 |
| 21 | *Folsomides parvulus* Stach. | — | — | — | — | 0.06 | 0.9 | — | — | — | — | — | — |
| 22 | *Isotomodes productus* (Axels.) | 0.02 | 0.3 | 0.34 | 2.7 | 0.22 | 3.2 | 0.08 | 3.8 | — | — | 0.15 | 6.4 |
| 23 | *Isotomodes armatus* Naglitsch | — | — | — | — | — | — | — | — | 0.29 | 3.3 | — | — |
| 24 | *Folsomia fimetaria* (L.) | 0.05 | 0.7 | 0.61 | 4.6 | 0.05 | 0.7 | — | — | 0.36 | 4.1 | — | — |
| 25 | *Folsomia quadrioculata* (Tullb.) | 0.02 | 0.3 | 3.20 | 25.0 | 0.09 | 1.3 | — | — | 3.60 | 39.9 | — | — |
| — | *Folsomia* sp juv. | 0.04 | 0.5 | — | — | 0.01 | 0.2 | — | — | — | — | — | — |
| 26 | *Proisotoma minima* (Abs.) | — | — | — | — | — | — | — | — | 0.02 | 0.2 | — | — |
| 27 | *Proisotoma minuta* (Tullb.) | 0.02 | 0.3 | — | — | — | — | — | — | 0.05 | 0.6 | — | — |
| — | *Proisotoma* sp. | — | — | — | — | 0.01 | 0.2 | — | — | — | — | — | — |
| 28 | *Cryptopygus bipunctatus* (Axels.) | 0.01 | 0.1 | 0.04 | 0.3 | 0.24 | 3.5 | — | — | 0.07 | 0.7 | — | — |
| 29 | *Cryptopygus thermophilus* (Axels.) | — | — | — | — | 0.01 | 0.2 | — | — | — | — | — | — |
| 30 | *Isotomiella minor* (Schaff) | 1.64 | 22.4 | 0.01 | 0.1 | 0.01 | 0.2 | 0.02 | 0.9 | 0.06 | 0.6 | 0.02 | 0.8 |
| 31 | *Isotoma notabilis* Schaff | 1.86 | 25.4 | 0.51 | 4.0 | 0.21 | 3.1 | 0.09 | 4.2 | 0.39 | 4.3 | 0.15 | 6.4 |
| 32 | *Isotoma viridis* Bourl. | 0.28 | 3.9 | 0.48 | 3.7 | 0.81 | 11.8 | 0.34 | 16.0 | 1.01 | 11.2 | 0.12 | 5.1 |
| 33 | *Isotomurus palustris* (Müll.) | 0.36 | 4.9 | — | — | — | — | — | — | 0.03 | 0.3 | — | — |
| — | *Isotomidae* spp. | — | — | — | — | 0.01 | 0.2 | — | — | — | — | — | — |
| 34 | *Cyphoderus albinus* Nic. | — | — | — | — | — | — | 0.04 | 1.9 | — | — | 0.03 | 1.4 |
| 35 | *Pogonognathellus flavescens* (Tullb.) | — | — | — | — | — | — | — | — | 0.01 | 0.1 | — | — |
| 36 | *Orchesella flavescens* Bourl. | — | — | 0.01 | 0.1 | — | — | — | — | — | — | — | — |
| 37 | *Orchesella spectabilis* Tullb. | — | — | 0.01 | 0.1 | — | — | — | — | — | — | — | — |
| 38 | *Heteromurus nitidus* Templ. | — | — | — | — | — | — | — | — | 0.01 | 0.1 | 0.03 | 1.4 |
| 39 | *Entomobrya quinquelineata* Börn. | — | — | — | — | 0.01 | 0.2 | 0.01 | 0.5 | — | — | — | — |
| 40 | *Entomobrya nivalis* L. | — | — | 0.01 | 0.1 | — | — | — | — | — | — | — | — |
| 41 | *Entomobrya multifasciata* Tullb. | — | — | — | — | 0.01 | 0.2 | — | — | 0.14 | 1.5 | — | — |
| 42 | *Entomobrya marginata* (Tullb.) | — | — | — | — | 0.01 | 0.2 | — | — | — | — | — | — |
| 43 | *Entomobryoeides myrmecophilus* (Reut.) | 0.24 | 3.3 | 0.04 | 0.2 | — | — | 0.01 | 0.5 | 0.08 | 0.9 | 0.02 | 0.8 |
| — | *Entomobryidae* spp. | — | — | 0.02 | 0.2 | — | — | — | — | — | — | — | — |
| — | *Entomobryidae* spp. juv. | — | — | 0.01 | 0.1 | 0.01 | 0.2 | 0.31 | 14.6 | — | — | — | — |
| 44 | *Lepidocyrtus paradoxus* Uzel. | — | — | 0.02 | 0.2 | — | — | 0.06 | 2.8 | — | — | — | — |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 45 | *Lepidocyrtus curvicollis* Bourl. | 0.01 | 0.1 | — | — | — | — | — | — | 0.01 | 0.1 | — | — |
| 46 | *Lepidocyrtus lignorum* F. | 0.70 | 9.7 | 0.73 | 5.7 | 0.02 | 0.3 | 0.01 | 0.5 | 0.52 | 5.9 | 0.15 | 6.5 |
| 47 | *Lepidocyrtus lanuginosus* (Gmel.) | — | — | — | — | — | — | 0.12 | 5.6 | — | — | — | — |
| 48 | *Lepidocyrtus cyaneus* Tullb. | 0.04 | 0.6 | 0.12 | 0.9 | 1.05 | 15.4 | 0.32 | 15.0 | 0.33 | 3.7 | 0.22 | 9.2 |
| 49 | *Lepidocyrtus ruber* Schött. | 0.20 | 2.7 | — | — | 0.02 | 0.3 | — | — | 0.05 | 0.5 | — | — |
| 50 | *Pseudosinella immaculata* (Lie Pett.) | — | — | 0.01 | 0.1 | — | — | — | — | 0.01 | 0.1 | — | — |
| 51 | *Pseudosinella alba* (Pack.) | — | — | 0.01 | 0.1 | — | — | — | — | — | — | 0.02 | 0.8 |
| 52 | *Pseudosinella zygophora* Schille | — | — | — | — | — | — | — | — | — | — | 0.02 | 0.8 |
| — | *Pseudosinella* sp. | — | — | 0.01 | 0.1 | 0.02 | 0.3 | 0.02 | 0.9 | — | — | — | — |
| 53 | *Megalothorax minimus* Will. | 0.03 | 0.4 | — | — | — | — | — | — | 0.03 | 0.3 | — | — |
| 54 | *Sphaeridia pumilis* (Krausb.) | 0.18 | 2.5 | — | — | — | — | — | — | 0.01 | 0.2 | 0.13 | 5.8 |
| 55 | *Arrhopalites caecus* (Tullb.) | 0.01 | 0.1 | 0.01 | 0.1 | — | — | — | — | 0.01 | 0.1 | — | — |
| 56 | *Sminthurinus niger* (Lubb.) | — | — | — | — | — | — | — | — | 0.01 | 0.1 | — | — |
| 57 | *Sminthurinus aureus* Lubb. | — | — | — | — | — | — | — | — | 0.05 | 0.5 | 0.02 | 0.8 |
| 58 | *Sminthurinus elegans* (Fitch.) | 0.01 | 0.1 | — | — | — | — | — | — | 0.02 | 0.2 | 0.12 | 5.1 |
| 59 | *Sminthurus flaviceps* Tullb. | — | — | 0.02 | 0.2 | — | — | — | — | — | — | — | — |
| 60 | *Caparinea marginata* Schött. | — | — | 0.01 | 0.1 | 0.01 | 0.2 | — | — | — | — | — | — |
| 61 | *Sminthurus viridis* L. | — | — | 0.01 | 0.1 | 0.09 | 1.3 | — | — | 0.01 | 0.1 | — | — |
| — | *Sminthuridae* spp. juv. | 1.01 | 13.8 | 1.66 | 12.9 | 0.13 | 1.8 | — | — | 0.25 | 2.8 | — | — |
| 62 | *Bourletiella hortensis* (Fitch.) | — | — | — | — | — | — | — | — | 0.01 | 0.1 | 0.02 | 0.8 |
| | Total | 7.32 | 100 | 12.81 | 100 | 6.80 | 100 | 2.13 | 100 | 9.02 | 100 | 2.35 | 100 |

Table 3. Similarity of species composition [after Sorensen formula] of *Collembola* communities of moist meadows on Mazovian Lowland

| | | Klembów | Białołęka Dworska | | | Chylice | Zbroszki |
|---|---|---|---|---|---|---|---|
| | | | A | B | C | | |
| Klembów | | — | 0.33 | 0.29 | 0.26 | 0.37 | 0.30 |
| Białołęka Dworska | A | 0.33 | — | 0.33 | 0.29 | 0.28 | 0.25 |
| | B | 0.29 | 0.33 | — | 0.24 | 0.26 | 0.21 |
| | C | 0.26 | 0.29 | 0.24 | — | 0.21 | 0.30 |
| Chylice | | 0.37 | 0.28 | 0.26 | 0.21 | — | 0.25 |
| Zbroszki | | 0.30 | 0.25 | 0.21 | 0.30 | 0.25 | — |

at Białołęka Dworska and the intensively grazed one at Zbroszki; mean value of both similarity coefficients as related to other communities was 0.26. This distinct character is the result of different site conditions. Meadow C at Białołęka Dworska and the Zbroszki meadow have been formed on a linden-oak-hornbeam forest site, but are relatively not very fertile and humid. Also the Zbroszki meadow is a very young one, which replaced an apple orchard, and this had to affect the composition and structure of the *Collembola* communities there.

According to the four-degree Tischler's scale the absolutely constant species ($75\% \leqslant C \leqslant 100\%$) on moist meadows examined are: *Onychiurus armatus* s. Stach, *Stenaphorura quadrispina*, *Isotoma notabilis*, *I. viridis*, *Lepidocyrtus lignorum*, *L. cyaneus*, *Mesaphorura macrochaeta*, *Isotomiella minor* ($C = 100\%$), *Friesea mirabilis*, *Mesaphorura krausbaueri*, *M. critica*, *Isotomodes productus*, *Entomobryoeides myrmecophilus* ($C = 83.3\%$). To the group of constant species ($50\% < C \leqslant 75\%$) belong: *Folsomia fimetaria*, *F. quadrioculata*, *Cryptopygus bipunctatus* ($C = 66.7\%$). The largest group within the absolutely constant and constant species are eurytopic species (*Isotoma notabilis*, *Isotomiella minor*, *Friesea mirabilis*, *Onychiurs armatus*, *Mesaphorura macrochaeta*) and species characteristic of open areas (*Stenaphorura quadrispina*, *Lepidocyrtus cyaneus*, *Mesaphorura krausbaueri*, *Isotoma viridis*, *Isotomodes productus*). A high constancy on moist meadows examined is shown by a myrmecophilous species *Entomobryoides myrmecophilus* and a synanthropic species *Cryptopygus bipunctatus* (occurring abundantly in Warsaw greenery). The group of accessory ($25\% < C \leqslant 50\%$) species is formed by 25 species. The most constant in this group are: *Willemia intermedia*, *Brachystomella parvula*, *Metaphorura affinis*, *Lepidocyrtus ruber*,

*Sphaeridia pumilis*, *Arrhopalites caecus*, *Sminthurus elegans* (C = 50%). Apart from eurytopic *Sphaeridia pumilis*, these are mainly species of open areas. The group of accidental species is formed by 22 species (C ⩽ 25%).

The list of the most constant species is to a great extent similar to that of dominant species, considering all moist meadows examined (Tab. 4). Among 16 species occurring with the highest constancy only three are not equally numerous. These are: *Stenaphorura quadrispina* — an inabundant species on all meadows examined, *Mesaphorura krausbaueri* — a species found only on the Zbroszki meadow, and *Cryptopygus bipunctatus* — polytopic species of open areas, expansive in *Collembola* communities of Warsaw greenery, abundantly occurring on several years' old mown-grazed meadow B at Białołęka Dworska. Whereas among 16 most abundant species there were absent *Metaphorura affinis* — a species common on arable fields and meadows, occurring abundantly on meadows A and C at Białołęka Dworska and in small numbers on the Chylice meadow, *Hypogastrura vernalis* — preferring dry habitats with alkaline soils, occurring exclusively on meadows A and B at Białołęka Dworska, on the former in small numbers and on the latter abundantly, and *Brachystomella parvula* — polytopic species of open areas, a synusial one for meadows of *Arrhenatheretum* type (Gisin 1943), found on meadows A and B at Białołęka Dworska and on the Chylice meadow. The great number of absolutely constant and constant species and the similarity between the list of constant and more abundant species may prove a considerable homoge-

Table 4. Most constant (C) and most abundant (D) *Collembola* species of moist meadows on Mazovian Lowland

| Class of constancy | | C | D | % |
|---|---|---|---|---|
| Absolutely constant | C = 100% | *Stenaphorura quadrispina* | *Folsomia quadrioculata* | 17.3 |
| | | *Onychiurus armatus* | *Onychiurus armatus* | 9.9 |
| | | *Isotoma notabilis* | *Isotoma notabilis* | 8.0 |
| | | *Isotoma viridis* | *Isotoma viridis* | 7.6 |
| | | *Lepidocyrtus lignorum* | *Metaphorura affinis* | 6.2 |
| | | *Lepidocyrtus cyaneus* | *Lepidocyrtus cyaneus* | 5.2 |
| | | *Mesaphorura macrochaeta* | *Mesaphorura macrochaeta* | 4.9 |
| | | *Isotomiella minor* | *Isotomiella minor* | 4.4 |
| | C = 83.3% | *Friesea mirabilis* | *Lepidocyrtus lignorum* | 3.9 |
| | | *Mesaphorura krausbaueri* | *Folsomia fimetaria* | 2.7 |
| | | *Mesaphorura critica* | *Isotomodes productus* | 2.0 |
| | | *Isotomodes productus* | *Hypogastrura vernalis* | 1.4 |
| | | *Entomobryoeides myrmecophilus* | *Mesaphorura critica* | 1.3 |
| Constant | | *Folsomia fimetaria* | *Brachystomella parvula* | 1.3 |
| | | *Folsomia quadrioculata* | *Friesea mirabilis* | 1.2 |
| | | *Cryptopygus bipunctatus* | *Entomobryoeides myrmecophilus* | 1.0 |

neity of conditions on meadows examined if not for the analysed earlier low qualitative similarity of communities and the fact that dominant species, and thus the most constant ones, are the eurytopic (ubiquistic) or polytopic forms of open areas.

## ABUNDANCE

The average *Collembola* density on meadows examined was 6.8 thous. ind./m$^2$. The highest density was found in the fallow at Białołęka Dworska (meadow A) — 12.8 thous. ind./m$^2$, slightly lower in soil of perennial mown-grazed meadows at Chylice and Klembów (9.0 and 7.3 thous. ind./m$^2$, respectively). The *Collembola* density in the soil of a several years' old mown-grazed meadow B at Białołęka Dworska was 7.0 thous. ind./m$^2$, but it was very low on the Zbroszki meadow and on meadow C at Białołęka Dworska — 2.4 and 2.1 thous. ind./m$^2$.

An analysis of *Collembola* density on Mazovian Lowland meadows showed their relatively high density on meadows located on moist, light sandy river mud, such as those at Chylice, Klembów and meadow B at Białołęka Dworska. Also the *Collembola* density on the Klembów meadow is limited by soil gleying process. However, the *Collembola* communities from meadows with fertile, heavy and loam soils are of relatively low abundance.

On one meadow only seasonal fluctuations of *Collembola* density were investigated between February and November (Fig. 1). These studies were conducted on an intensively mown-grazed meadow at Chylice. The *Collembola* communities on the meadow examined showed three abundance peaks, a high one at the beginning of May and lower ones in October and February. The curve illustrating the fluctuations of *Collembola* abundance on the meadow examined is more or less consistent with the seasonal changes in abundance of *Folsomia quadrioculata* — a species dominant there, but does not correspond to the fluctuations of *Isotoma viridis* — a co-dominant species. First of all, there are two peaks in abundance of this species in the period examined: a spring one in May and a late autumn one in November. This type of seasonal fluctuations with three abundance peaks is probably characteristic of *Collembola* communities on meadows intensively managed agrotechnically.

## ECOLOGICAL ANALYSIS

An ecological analysis of *Collembola* was made with consideration to the following characters of species: ecological amplitude and environmental preferences as regards habitat humidity and particular soil layers. For each aspect the analysis was made on the basis of the percentage of species representing a given element.

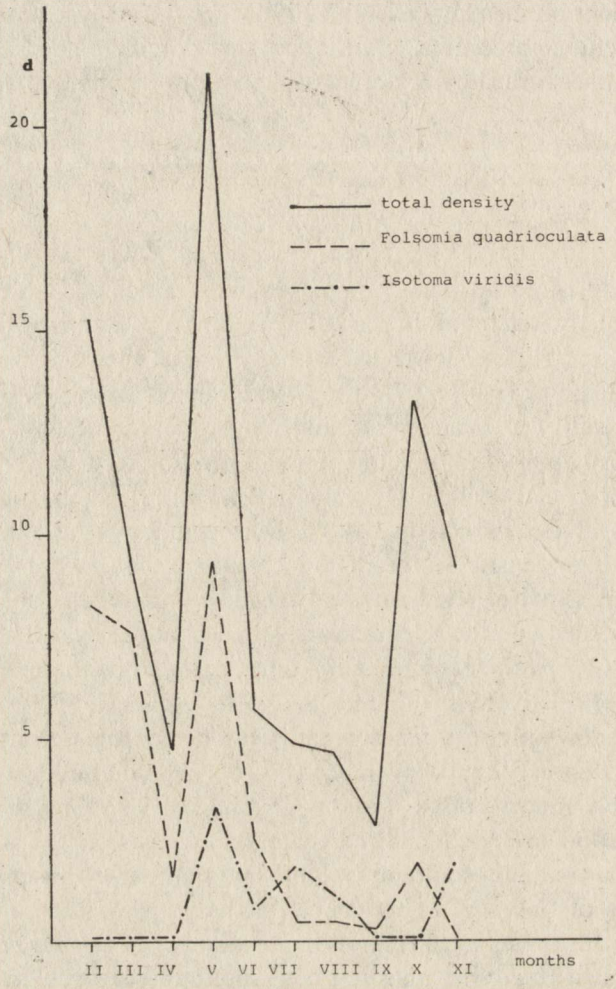


Fig. 1. Fluctuations in *Collembola* community abundance and dominant species on moist meadow at Chylice (d — density in thous. of ind./m²)

Ecological amplitude. In *Collembola* communities of moist meadows examined the highest percentage was that of eurytopic species (ubiquistic) and poly- and oligotopic ones of open areas. Quite understandably small was the percentage of forest species (Tab. 5). The latter group was represented by the following species: *Ceratophysella denticulata* (Chylice), *Pseudachorutes parvulus* (Białołęka Dworska, meadow B), *Onychiurus granulosus* (Klembów, Białołęka Dworska, meadow A), *Orchesella flavescens* (Białołęka Dworska, meadow A), *Pseudosinella zygophora* (Zbroszki). In relation to fauna of the entire area of Mazovian Lowland the percentage of particular ecological elements varied within the *Collembola*

Table 5. Percentage of species varying as to ecological amplitude and environmental preferences in *Collembola* communities of moist meadows on Mazovian Lowland (N — number of species)

| Element \ Locality | | Klembów | | Białołęka Dworska | | | | | | Chylice | | Zbroszki | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | A | | B | | C | | | | | |
| | | N | % | N | % | N | % | N | % | N | % | N | % |
| Eurytopic | | 14 | 50.0 | 11 | 32.3 | 11 | 35.4 | 9 | 56.2 | 17 | 47.2 | 11 | 55.0 |
| Politopic | forest | 1 | 3.6 | 4 | 11.8 | 1 | 3.2 | — | — | 1 | 2.8 | 1 | 5.0 |
| | open areas | 6 | 21.4 | 12 | 35.3 | 10 | 32.3 | 5 | 31.3 | 11 | 30.6 | 6 | 30.0 |
| Oligotopic | forest | — | — | — | — | — | — | — | — | — | — | — | — |
| | open areas | 3 | 10.7 | 4 | 11.8 | 7 | 22.6 | 2 | 12.5 | 4 | 11.1 | 1 | 5.0 |
| Unknown preferences | | 4 | 14.3 | 3 | 8.8 | 2 | 6.5 | — | — | 3 | 8.3 | 1 | 5.0 |
| Total | | 28 | 100 | 34 | 100 | 31 | 100 | 16 | 100 | 36 | 100 | 20 | 100 |

fauna of meadows examined. Apart from the decrease in percentage of the group of forest species (from 36.9 to 4.4%) the percentage of oligotopic species of open areas decreased slightly (from 19.7 to 12.3%), the percentage of polytopic species of open areas almost tripled (from 9.2 to 30.2%), and the percentage of eurytopic species doubled (from 21 to 46%).

Moisture requirements. Mesophilous and xerophilous species had the highest percentage in *Collembola* groups of meadows examined. Much lower was the percentage of higrophilous species (Tab. 6). The higrophilous species in groups of meadows examined were *Isotoma viridis* — an abundant species, constant in all meadow groups examined: *Brachystomella parvula* — a species found in small numbers in *Collembola* communities on meadow A at Białołęka Dworska (0.1%) and on meadow B (4.0%); *Isotomurus palustris* — a species found abundantly in *Collembola* communities on the Klembów meadow (5.1%) and in small numbers on the Chylice meadow (0.3%), and *Pogonognathellus flavescens* — a species occurring in small numbers (0.1%) on Chylice meadow. All these species, with the exception of *P. flavescens* have been indicated simultanously by Szeptycki (1967) as species characteristic of moist meadows (*Arrhenatheretum elatioris*) in the Prądnik Valley. The comparison of the percentage of higro-, meso- and xerophilous species of Mazovia in relation to their percentage in communities on meadows examined shows an almost double decrease in higrophilous species (from 17.1 to 7.0%), a slight decrease in xerophilous species (from 23.7 to 19.6%) and a slight increase in the case of mesophilous species (from 56.6 to 66.7%).

Requirements for particular soil layers. Among *Collembola* the highest percentage was that of soil (euedaphic) species, also hemiedaphic species were quite numerous. The undoubtedly lowest percentage was that of epigeic species (Tab. 7), what is a consequence of the methods employed. The comparison of the percentage of euedaphic, hemiedaphic, and epigeic species of Mazovia in relation to that on meadows examined showed that the percentage of soil species increased more than twice on meadows (from 27.6 to 49.4%), whereas the percentage of hemiedaphic species decreased (from 56.6 to 31.8%). The percentage of epigeic species remained on a similar level.

## DOMINANCE STRUCTURE

The dominance index was used first of all to estimate the dominance structure. The following classes of dominance were distinguished: eudominant (over 10%), dominant (5.1–10%), subdominant (1.1–5.0%) and recedent (below 1%). The highest percentage of dominant species on meadows examined was found in the communities on perennial mown-grazed intensively managed meadow at Chylice (39.9%), whereas the lowest one was that of the communities on meadow B at

Table 6. Percentage of species having different humidity requirements in *Collembola* communities of moist meadows on Mazovian Lowland (N — number of species)

| Element \ Locality | Klembów | | Białołęka Dworska | | | | | | Chylice | | Zbroszki | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A | | B | | C | | | | | |
| | N | % | N | % | N | % | N | % | N | % | N | % |
| Higrophilous | 2 | 7.1 | 2 | 5.8 | 3 | 9.7 | 1 | 6.3 | 3 | 8.3 | 1 | 5.0 |
| Mesophilous | 19 | 67.9 | 23 | 67.7 | 17 | 54.8 | 10 | 62.5 | 26 | 72.3 | 15 | 75.0 |
| Xerophilous | 3 | 10.7 | 7 | 20.6 | 9 | 29.0 | 5 | 31.2 | 4 | 11.1 | 3 | 15.0 |
| Unknown preferences | 4 | 14.3 | 2 | 5.9 | 2 | 6.5 | — | — | 3 | 8.3 | 1 | 5.0 |
| Total | 28 | 100 | 34 | 100 | 31 | 100 | 16 | 100 | 36 | 100 | 20 | 100 |

Table 7. Percentage of species associated with various soil layers in *Collembola* communities of moist meadows on Mazovian Lowland — (N — number of species)

| Element \ Locality | Klembów | | Białołęka Dworska | | | | | | Chylice | | Zbroszki | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | A | | B | | C | | | | | |
| | N | % | N | % | N | % | N | % | N | % | N | % |
| Euedaphic | 17 | 60.7 | 18 | 52.9 | 16 | 51.6 | 7 | 43.7 | 17 | 47.2 | 8 | 40.0 |
| Hemiedaphic | 8 | 28.6 | 9 | 26.5 | 10 | 32.3 | 6 | 37.5 | 11 | 30.6 | 7 | 35.0 |
| Epigeic | 3 | 10.7 | 7 | 20.6 | 5 | 16.1 | 3 | 18.8 | 8 | 22.2 | 5 | 25.0 |
| Total | 28 | 100 | 34 | 100 | 31 | 100 | 16 | 100 | 36 | 100 | 20 | 100 |

Białołęka Dworska (22.5%). The analysis of the evenness of dominant species distribution on meadows examined showed high differences in the percentage between dominant species in communities from intensively managed meadows (28.7% at Chylice and 19.9% at Zbroszki), whereas this difference was smaller on unutilized meadows: 3.6% at Klembów, 3.4% on meadow B at Białołęka Dworska and 10.4% on the several years' old fallow at Białołęka Dworska (A) (Fig. 2). Thus the type and intensity of meadow management affects the dominance structure.

On the examined moist meadows of Mazovian Lowland three basic types of communities of dominant *Collembola* species were distinguished. The first was the one with the eudominant *Isotoma notabilis* and three co-dominant species (*Isotomiella minor* and *Lepidocyrtus lignorum*, euerytopic ones, and higrophilous *Isotomurus palustris*) and seven subdominant species. This community occurred in the gleyed sandy soil on fertile mown-pastured meadow, unutilized agrotechnically, at Klembów. The second community was observed on an intensively utilized mown meadow at Chylice. The eudominant of this group was the eurytopic species *Folsomia quadrioculata*, which co-dominated with three species of *Isotoma viridis* (polytopic species of open areas), *Mesaphoruru macrochaeta* and *Lepidocyrtus lignorum* (eurytopic species) and with 9 subdominant species. The third type were communities characteristic of fertile moist meadows on loamy soils at Białołęka Dworska (meadows A, B, C) and on the meadow at Zbroszki. The comparison of species composition of the group of dominants showed that the community on meadow C was probably an initial one for other communities (6 common species among the 10 first dominants in each *Collembola* community). In the community on meadow C at Białołęka Dworska *Isotoma viridis* dominated, four species co-dominated: *Lepidocyrtus cyaneus*, *Metaphorura affinis* (polytopic species of open areas), *Onychiurus armatus*, *Lepidocyrtus lanuginosus* (eurytopic species). Seven subdominant species were recorded there. In the community on meadow B at Białołęka Dworska *Onychiurus armatus* was the dominant species, and four species co-dominated: *Lepidocyrtus cyaneus*, *Isotoma viridis* and *Hypogastrura vernalis*, only here among dominants, in other communities a recedent, and *Mesaphorura macrochaeta* — a subdominant species in the communities on other meadows at Białołęka Dworska. An intermediate type of community was found on meadow A at Białołęka Dworska. An eudominant here was *Folsomia quadrioculata* (characteristic of Chylice community). Three species co-dominated: *Metaphorura affinis* and *Onychiurus armatus*, typical of communites at Białołęka Dworska, and *Lepidocyrtus lignorum* found in Chylice community. In the community on the Zbroszki meadow a small soil species *Mesaphorura macrochaeta* dominated, six species co-dominated: *Lepidocyrtus cyaneus*, *Lepidocyrtus lignorum*, *Isotoma notabilis*, *Isotomodes productus*, *Sphaeridia pumilis*, *Isotoma viridis*.

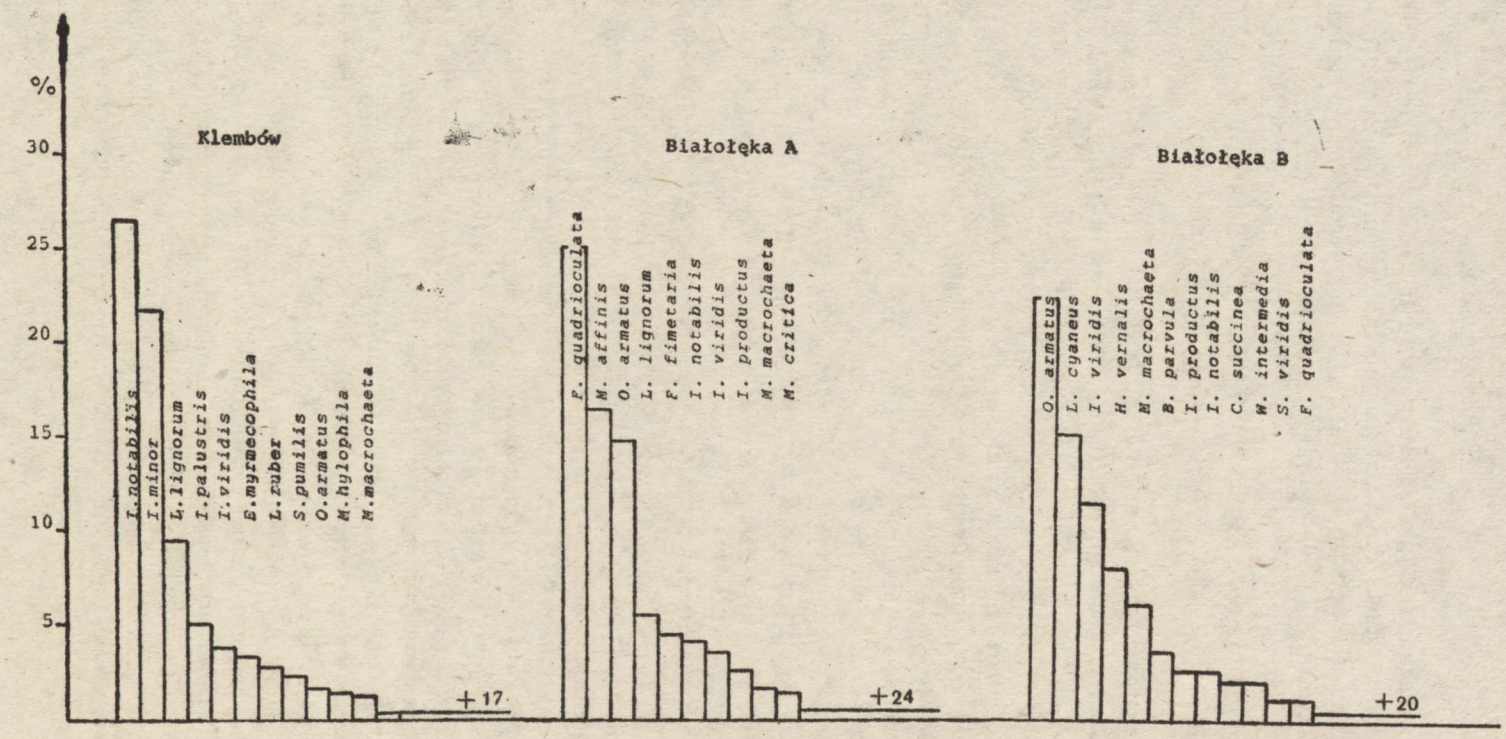


Fig. 2. Dominance structure of *Collembola* communities on moist meadows of Mazovian Lowland

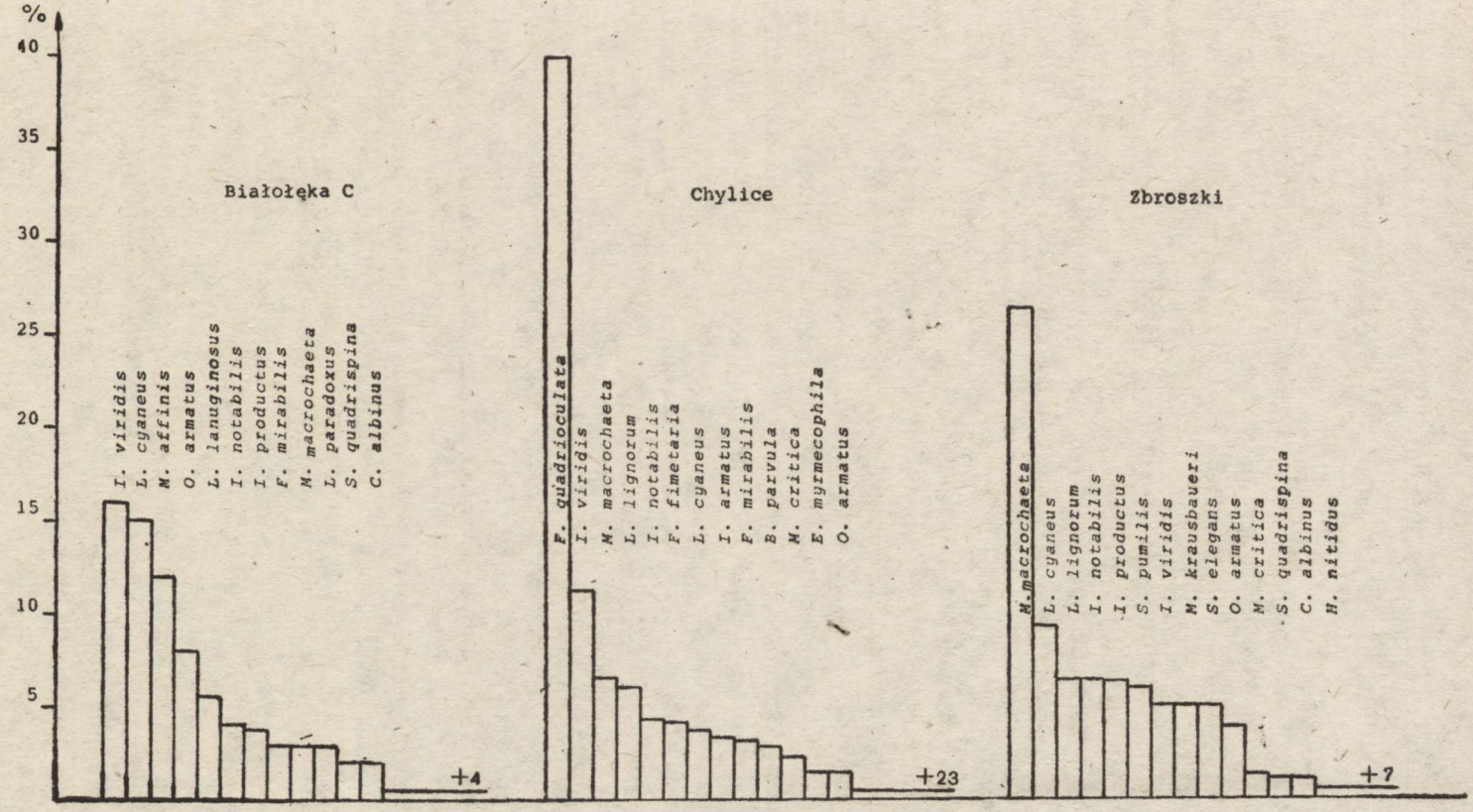


**Fig. 2. Dominance structure of *Collembola* communities on moist meadows of Mazovian Lowland**

## CONCLUSIONS

On moist meadows of Mazovian Lowland 62 *Collembola* species were found, including *Isotomodes armatus* Naglitsch, 1962, not recorded before from Poland. The most abundant environment was the Chylice meadow and meadows A and B at Białołęka Dworska, with 31–36 *Collembola* species in communities, i.e., over 50% of the fauna of meadows examined. On other meadows 16–28 *Collembola* species were found.

The communities on meadows examined were greatly differentiated. First of all the number of species varied, then did species composition, abundance and some elements of dominance structure. This was connected with a great variety of habitat conditions (mechanical composition, humidity or soil fertility) on meadows examined and with the method and intensity of their cultivation. The similarity of species composition on meadows examined was very small (0.28 on the average). Responsible for the differentiation of species composition were, first of all, accessory and accidental species, which were the least numerous ones. Nevertheless, some uniformity of species composition of *Collembola* communities on meadows examined was observed. The species composition of the group of absolutely constant and constant species overlapped with that of the group of abundant species. Both these groups consisted of species having a broad spectrum of environmental requirements, i.e., eurytopic or polytopic ones of open areas. These were: *Onychiurus armatus*, *Mesaphorura macrochaeta*, *Isotoma notabilis*, *I. viridis*, *Isotomiella minor*, *Lepidocyrtus lignorum*, *L. cyaneus*, *Friesea mirabilis*, *M. critica*, *Isotomodes productus*, *Entomobryoeides myrmecophilus*, *Folsomia fimetaria*, *F. quadrioculata*. The uniformity of composition of *Collembola* species on meadows examined observed in the group of constant and abundant species was probably the effect of synanthropization process. Similar tendencies to a greater uniformity of species composition of communities and their being dominated by ubiquitous species or those of open areas were observed in *Collembola* communities in urban greens (Sterzyńska 1986). It should be pointed out that the majority of *Collembola* species, listed as characteristic of the moist meadows (Gisin 1943, Rusek 1979, Strenzke 1949, Szeptycki 1967), were rarely members of groups of constant and abundant species on meadows examined (with the exception of *Isotoma viridis*).

*Collembola* community abundance depended largely on the type of soil. The highest density was recorded on moist, light sandy soils. Almost three times lower *Collembola* abundances were found on fertile, heavy, little aerated silty and loam soils. The intensity of meadow utilization affected the seasonal fluctuations in *Collembola* community abundance. At Chylice, on a meadow intensively utilized agrotechnically, three abundance peaks were recorded (in February, at the beginning of May and in October). Also the dominance structure of *Collembola* communities was connected with the method and intensity of meadow management.

On most intensively exploited meadows the disproportion between the percentage of the dominant and other species was the highest.

The *Collembola* fauna of moist meadows examined as compared to the typical Mazovian fauna was characterized by higher percentage of species having a broad spectrum of environmental requirements, i.e., of ubiquitous (eurytopic) species and those of open areas (fields and meadows), mesophilous and soil (euedaphic) ones.

In soils of meadows examined three types of communities of dominant *Collembola* species were present. The first one occurred in sandy soil of agrotechnically unused, fertile, mown-grazed meadow at Klembów — *Isotoma notabilis*, *Isotomiella minor*, *Lepidocyrtus lignorum* and *Isotomurus palustris*. The second type was characteristic of sandy soil of an intensively managed, fertile, mown-grazed meadow at Chylice — *Folsomia quadrioculata*, *Isotoma viridis*, *Mesaphorura macrochaeta*, *Lepidocyrtus lignorum*. The third group occurred in the soils of Białołęka Dworska and Zbroszki meadows — *Isotoma viridis*, *Lepidocyrtus cyaneus*, *Metaphorura affinis*, *Onychiurus armatus*, *Lepidocyrtus lanuginosus*.

Polska Akademia Nauk
Instytut Zoologii
ul. Wilcza 64, 00-679 Warszawa

## REFERENCES

Bańkowska R. 1989a. Study area and methods of material collecting on moist meadows on the Mazovian Lowland. Memorabilia Zool., 43: 7–15.

Bańkowska R. 1989b. The purpose and scope of zoocenotic studies on moist meadows on the Mazovian Lowland. Memorabilia Zool., 43: 3–6.

da Gama M. M. 1963. Monografia do genero *Isotomodes* (*Insects*, *Collembola*). Mem. Estud. Mus. Zool. Univ. Coimbra, 284: 1–44.

Gisin H. 1943. Ökologie und Lebensgemeinschaften der Collembolen in Schweizerischen Excursionsgebiet Basels. Rev. Suisse Zool., 50: 131–224.

Kaczmarek M. 1973. *Collembola* in the biotopes of the Kampinos National Park distinguished according to the natural succession. Pedobiologia. 13: 257–272.

Kotowska J., Okołowicz M. 1989. Geobotanical characteristics of meadow research sites on the Mazovian Lowland. Memorabilia Zool., 43: 17–30.

Łosiński J. 1953. Studia nad drobną fauną pól uprawnych. Część I. Dynamika populacji *Apterygota*. Ekol. Pol., A, 1:

Łosiński J. 1972. Wstępne obserwacje nad fauną *Collembola* w pryzmie kompostowej. Zesz. Nauk. Uniw. Mikołaja Kopernika w Toruniu, Nauki Mat. Przyr. Biol., 14: 37–58.

Łosiński J. 1974. Badania nad wpływem nawożenia organicznego i mineralnego na występowanie skoczogonków (*Collembola*) w uprawie ziemniaków. Studia Soc. Sci. Torun., Sec. E (Zool.), 9: 1–23.

Naglitsch F. 1962. Untersuchungen über die Collembolenfauna unter Luzernebestänaen auf verschiedenen Böden. Wiss. Z. Karl-Marx-Univ. Leipz., Math. naturwiss. Reihe. 11: 581–626.

Rusek J. 1979. Coenological characteristics of soil *Apterygota* in natural grassland at Kameničky. In: Function of Grasslands in Spring region Kameničky project. Brno. Progress report on MAB project No. 91.

Stach J. 1964. Owady bezskrzydłe. *Apterygota*. Kat. Fauny Pol., 15.

Sterzyńska M. 1981. Skoczogonki (*Collembola, Apterygota*). In: Zoocenologiczne podstawy kształtowania środowiska przyrodniczego osiedla mieszkaniowego Białołęka Dworska w Warszawie. Część I. Skład gatunkowy i struktura fauny terenu projektowanego osiedla mieszkaniowego. Fragm. Faun. Warszawa, 26: 217–234.

Sterzyńska M. 1982. Springtails (*Collembola*) of Warsaw and Mazovia. Memorabilia Zool., 36: 217–234.

Sterzyńska M. 1987. Structure of springtail (*Collembola*) communities in urban green of Warsaw. Memorabilia Zool., 42: 3–18.

Strenzke K. 1949. Ökologische Studien über die Collembolen gesellschaften feuchter Böden Ost-Holsteins. Arch. Hydrobiol., 42: 261–303.

Szeptycki A. 1967. Fauna of the springtails (*Collembola*) of the Ojców National Park in Poland. Acta Zool. Cracov., 12: 219–280.

Weiner W. M. 1981. *Collembola* of the Pieniny National Park in Poland. Acta Zool. Cracov., 25: 417–500.

## SKOCZOGONKI (*COLLEMBOLA*) ŁĄK ŚWIEŻYCH NIZINY MAZOWIECKIEJ

STRESZCZENIE

Na łąkach świeżych Niziny Mazowieckiej stwierdzono występowanie 62 gatunków w zgrupowaniach *Collembola*. Najbogatszymi środowiskami są łąka kośno-pastwiskowa w Chylicach— 36 gatunków oraz łąki A i B w Białołęce Dworskiej — odpowiednio 34 i 31 gatunków.

Podobieństwo składów gatunkowych, liczone wskaźnikiem jakościowym Sörensena, na badanych łąkach jest stosunkowo niskie (średnio 0,28). Ponadto, stwierdzono, że na wielkość podobieństwa składów gatunkowych zgrupowań *Collembola* ma przede wszystkim wpływ pochodzenie łąki i aktualne warunki siedliskowe, a zwłaszcza żyzność, wilgotność oraz wiek łąki. Najbardziej zbliżonym składem gatunkowym charakteryzują się zgrupowania z wieloletnich, wilgotnych, położonych na żyznych madach piaszczystych łąk w Klembowie i Chylicach (S = 0,37). Najbardziej wyodrębniają się zgrupowania *Collembola* z mało żyznych, a przede wszystkim charakteryzujących się niską wilgotnością łąk w Zbroszkach i w Białołęce Dworskiej (stanowisko C).

Gatunkami absolutnie stałymi i stałymi na łąkach świeżych Niziny Mazowieckiej są: *Onychiurus armatus, Mesaphorura macrochaeta, Stenaphorura quadrispina, Isotoma notabilis, Isotomiella minor, Isotoma viridis, Lepidocyrtus lignorum, L. cyaneus, Friesea mirabilis, Mesaphorura krausbaueri, M. critica, Isotomodes productus, Entomobryoeides myrmecophilus, Folsomia fimetaria, F. quadrioculata, Cryptopygus bipunctatus*. Lista gatunków najbardziej stałych jest w dużym stopniu zbieżna z listą gatunków najbardziej liczebnych w skali wszystkich badanych łąk.

Największe zagęszczenie skoczogonków stwierdzono w wilgotnych, piaszczystych glebach łąk świeżych w Klembowie i Chylicach (7–9 tys. osobn/m$^2$). Natomiast blisko trzykrotnie niższe liczebności *Collembola* stwierdzono w żyznych i ciężkich glebach pylastych i gliniastych w Zbroszkach i na łące C w Białołęce Dworskiej (2 tys. osobn./m$^2$). W Chylicach, a więc na łące intensywnie użytkowanej agrotechnicznie, zaobserwowano trzy szczyty liczebności (w lutym, na początku maja i w październiku).

Fauna *Collembola* badanych łąk świeżych różni się w odniesieniu do fauny całego obszaru Niziny Mazowieckiej zwiększonymi udziałami gatunków o szerokim spektrum wymagań środowiskowych. Na badanych łąkach świeżych najliczniejsze są gatunki ubikwistyczne (eurytopowe i gatunki terenów otwartych (pól i łąk), mezohigrofilne i glebowe (edaficzne).

W glebach badanych łąk świeżych funkcjonują trzy typy zgrupowań gatunków dominujących *Collembola*. Zgrupowanie pierwsze występuje w piaszczystej glebie żyznej łąki kośno-pastwiskowej w Klembowie, nie użytkowanej agrotechnicznie (*Isotoma notabilis*, *Isotomiella minor*, *Lepidocyrtus lignorum* i *Isotomurus palustris*), drugie w piaszczystej glebie żyznej łąki kośno-pastwiskowej w Chylicach, użytkowanej bardzo intensywnie (*Folsomia quadrioculata*, *Isotoma viridis*, *Mesaphorura macrochaeta*, *Lepidocyrtus lignorum*) i trzecie w gliniastych i pylastych glebach łąk z Białołęki Dworskiej i łąki w Zbroszkach (*Isotoma viridis*, *Lepidocyrtus cyaneus*, *Metaphorura affinis*, *Onychiurus armatus*, *Lepidocyrtus lanuginosus*).

## НОГОХВОСТКИ (*COLLEMBOLA*) СВЕЖИХ ЛУГОВ МАЗОВЕЦКОЙ НИЗМЕННОСТИ

РЕЗЮМЕ

Проанализирован видовой состав и структура сообществ *Colemmbola* из 6 лугов *Arrhenatheretum medioeuropaeum* на Мазовецкой низменности. Констатировано 62 вида ногохвосток, в том числе один новый вид для фауны Польши. Это *Isotomodes armatus* Naglitsch, 1962 из станции в Хылицах. Констатировано, что на Мазовецкой низменности типичные для лугов виды *Collembola* удерживаются только на влажных лугах. Агротехнические мероприятия ведут к изменениям условий среды, вследствие чего наступает синантропизация сообществ *Collembola* лугов. Появляются многочисленные виды убиквистов, мезофильные, а виды, характерные для лугов типа *Arrhenatheretum*, исчезают.