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Effects of single trees on the community structure of soil-dwelling *Collembola* in urban and non-urban environments

Abstract. Species composition and community structure of *Collembola* communities under the crowns of single trees were studied in non-urban and urban environments in order to reveal their possible significance in spatial organization in open biotopes. In a natural environments single trees may play an important role acting as refugia for forest species as well as a normal habitat for some eurytopic meadow forms. In urban habitats, the effect of single trees on collembolan community organization is much weaker. The ecotone effects of single trees is also discussed.

INTRODUCTION

The community structure of soil inhabitants depends to a considerable degree on the environmental conditions of a given biotope. Among plants of the temperate zone, trees are the plants which have the strongest influence on environmental conditions. They are able to alter nearly all environmental factors around them, including temperature, humidity, light, physical and chemical properties of soil etc. (KARPACHEVSKY 1977, BENIAMINO et al. 1991). As a result, different communities of soil animals can be found in different plant associations. All data concerning individual trees' influence on microarthropod communities indicate differences in abundance and structure of these communities differs under the tree canopies and beetwen the trees (KOPESZKI 1992, POOLE 1962, 1964, STREIT 1982). All those studies, however, concern on individual trees growing in forests, while the problem of influence on microarthropod communities of single trees situated outside a forest is virtually unknown. This study also sheds light on certain other ecological problems, such as spatial differentiation of microarthropod populations, ecotone influence on their organization and estimation of the environment-forming ability of trees in natural and disturbed conditions. The aim of our study was to clarify the effects

of single trees on species composition and community structure of *Collembola* in natural and urban environments.

MATERIAL AND METHODS

The fieldwork was carried out in the Moscow administrative region and in the town itself in the years 1991 and 1993. We investigated *Collembola* living under: lime (*Tilia cordata*) and oak (*Quercus robur*). Most of the trees selected for the study were 90–120 years old but some 20 years old trees were also investigated.

Three non-urban areas were selected:

Area 1. A single oak tree in a meadow near the village of Vostryakovo (Domodedovski Distr.) 9.10.1993. *Agrostis tenuis*, *Alchemilla vulgaris* and *Geranium pratense* were dominant in the grass cover.

Area 2. A single lime tree in a meadow in the grounds of "Malinki" Biological Station (Podolski Distr.) 25.09.1993. *Poa annuis*, *Geranium pratense* and *Anthriscus silvaticus* were dominant in the grass cover.

Area 3. A single lime tree in a meadow near "Malinki" Biological Station (Podolski Distr.) 10.09.1991. *Dactylis glomerata*, and *Agropyron repens* were dominant in the grass cover. In this area we also took samples from under a young 20-year-old lime tree to investigate the influence of trees of various ages on the distribution of *Collembola*.

Area 4. A single lime tree situated in the centre of Moscow, on the bank of the river Kremlin, 7.10.1993. *Poa depressa* was dominant in the lawn grass cover.

The grass cover under the tree canopy was a little different from the adjacent open biotopes (meadows and lawn). There were many fewer herbaceous plants under the trees on meadows but under the tree canopy in the town there was no ground flora. In all of the areas investigated human trampling was insignificant.

In each area, 16 samples were taken under the crown of the tree and 15–16 in the surrounding meadow or lawn. Eight of the samples taken under the crown of the tree were placed near the trunk base (approximately 20 cm away), while other eight were placed farther away from the trunk (approximately 1 m) (Fig. 1). The area of each sample was 8.5 sq. cm and the depth was 10 cm. The specimens were extracted in Tullgren funnels. The following numbers of samples were taken and specimens obtained in Areas 1–4 respectively: 32 samples – 373 individuals, 29 – 325, 41 – 428 and 32 – 112. The total number of samples was 134 and of specimens, 1238, belonging to 43 species.

Student's T – test was used to determine the significance of the differences between the series (confidence level $p = 0.05$).

Numerical methods for community classification using the TYTAN programme (BATKO, MORACZEWSKI 1990) were employed. The similarity matrix (distances between different groups) was estimated according to Czekanowski's formula. The basic clustering method was UPGMA (method of average linkage clustering).

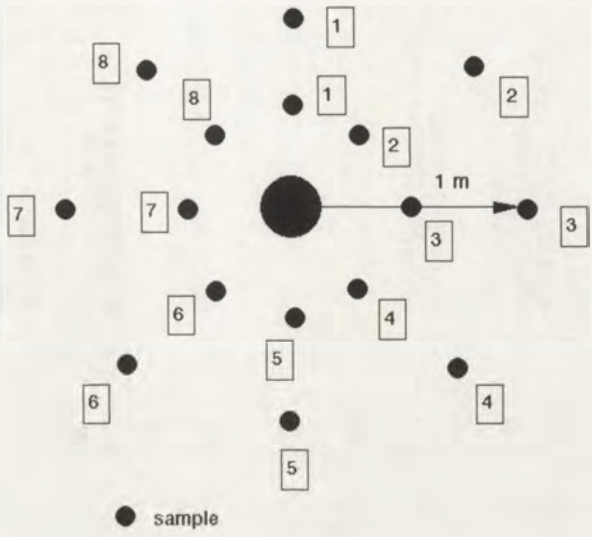

Fig. 1. Sampling design under trees

RESULTS

Collembola communities under the crown of old single trees (oak, lime) as compared to the surrounding open biotopes (meadow)

Area 1. The Collembola community of the meadow consisted of 15 species. Their total density was (8,200 ind./sq.m) (Tab. I, Fig. 2). *Mesaphorura hylophila, Lepidocyrtus lignorum, Isotoma notabilis, Mesaphorura krausbaueri* and *Protaphorura cancellata* were the dominant species (Tab. I). The meadow species of *Metaphorura affinis* was not abundant, but it was often recorded at the samples. *Proisotoma minima* was also characteristic of this meadow community.

Under the crown of the single oak tree, the total *Collembola* density was more than twice as high as in the meadow (difference significant with $p = 0.05$) (Tab. I, Fig. 2). This increase under the tree was due to a higher density of eurytopic species: *Isotoma notabilis, Mesaphorura krausbaueri* and *M. hylophila* and the forest species *Isotomiella minor*. Forests species *Oligaphorura absoloni* and eurytopic species *Folsomia quadrioculata* are only found under the crown of the tree (mostly in the proximity of the trunk) as were the corticophilous *Xenylla corticalis; Neanura muscorum, Pseudachorutes parvulus* and even the meadow species *Stenaphorura quadrispina*. On the other hand, *Proisotoma minima, Protaphorura cancellata, Metaphorura affinis, Mesaphorura macrochaeta, M. critica* and *Sminthurinus sp.*, were not found under the tree. As a result, the number of springtail species under the crown of the tree (16) and in the meadow (15) was similar. Only the species *Mesaphorura hylophila, M. krausbaueri* and *Isotoma notabilis* dominant in the meadow were able to preserve their position in the community under the crown of the tree.

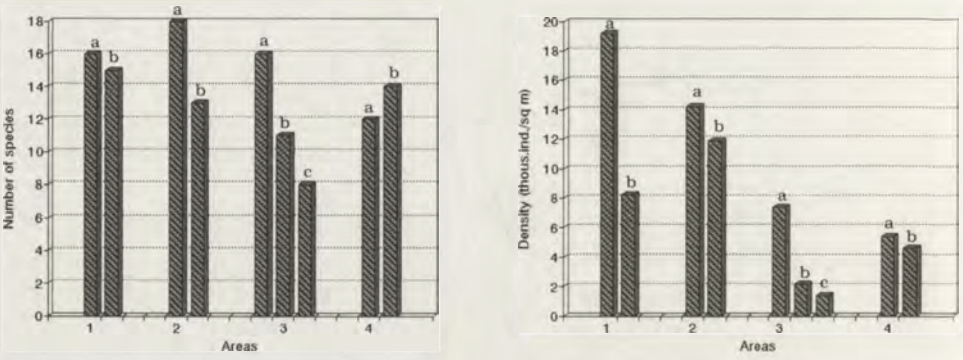

Fig. 2. Total density and number of *Collembola* species under crown of the single trees and in adjacent biotopes: Area 1 – a – oak, b – meadow; Area 2 – a – lime, b – meadow; Area 3 – a – old lime, b – young lime, c – meadow; Area 4 – a – lime, b – meadow

Table I. Abundance of Collembola species under crown of single oak tree and in the surrounding meadow

Species	Oak			Meadow
	Near trunk	1 m away from trunk	Total	
Isotoma notabilis SCHÄFF.	25	15	40	15
Mesaphorura krausbaueri BÖRN	37	26	63	11
Mesaphorura hylophila RUSEK	27	9	36	21
Isotomiella minor (SCHÄFF.)	16	11	27	2
Lepidocyrtus lignorum (FABR.)	12	7	19	17
Pseudosinella alba (PACK.)	3	4	7	1
Sphaeridia pumilis (KRAUSB.)	2	2	4	7
Folsomia quadriculata (TULLB.)	13	3	16	–
Oligaphorura absoloni (BÖRN.)	18	6	24	–
Friesea mirabilis (TULLB.)	7	–	7	4
Protaphorura campata GISIN	1	–	1	1
Megalothoruax minimus WILL.	–	8	8	2
Neanura muscorum (TEMPL.)	1	–	1	–
Pseudachorutes parvulus BÖRN.	2	–	2	–
Xenylla corticalis BÖRN.	–	4	4	–
Stenaphorura quadrispina BÖRN.	–	1	1	–
Protaphorura cancellata GISIN	–	–	–	10
Proisotoma minima (ABSOL.)	–	–	–	7
Mesaphorura macrochaeta RUSEK	–	–	–	5
Mesaphorura critica RUSEK	–	–	–	5
Metaphorura affinis (BÖRN.)	–	–	–	3
Sminthurinus sp. jv.	–	–	–	1
Number of samples	8	8	16	16
Total number of individuals	164	97	261	112
Average number of individuals in a sample	20.5 ± 4.5	12.1 ± 5.8	16.3 ± 3.7	7.0 ± 1.6

Area 2. The "meadow" *Collembola* community comprised 13 species. The community was characterized by a strong dominance of one species – *Protaphorura armata*, which accounted for nearly half of the total *Collembola* density (Tab. II, Fig.2). Other abundant species were *Folsomia quadrioculata*, *Stenaphorura quadrispina*, *Isotoma notabilis* and *Onychiurus variabilis*. On the whole, these abundant species, with the exception of *O. variabilis* species well represented in the community living under the crown of the single lime tree. Under the crown of the lime tree the proportion of the dominant *Protaphorura armata* decreased to 37.3%, while the number of species increased to 18. The corticophilous *Vertagopus cinereus*, the hygrophilous *Tomocerus vulgaris* and *Neanura muscorum* as well as *Entomobrya nivalis* and others were found only under the tree canopy (Tab. II). Three of the species recorded in the meadow (*Metaphorura affinis*, *Onychiurus variabilis* and *Sphaeridia pumilis*) were absent under the tree. The total springtail density under the lime tree was slightly higher (14,200 ind./sq.m.) compared to 11.900 ind.sq.m in the meadow, but these differences are not statistically significant.

Table II. Abundance of *Collembola* species under crown of a single lime tree and in the surrounding meadow

Species	Lime			Meadow
	Near trunk	1 m away from trunk	Total	
Protaphorura armata (TULLB.)	27	45	72	65
Folsomia quadrioculata (TULLB.)	34	7	41	26
Isotoma notabilis SCHÄFF.	14	14	28	12
Lepidocyrtus lignorum (FABR.)	7	5	12	7
Stenaphorura quadrispina BÖRN.	4	11	15	26
Mesaphorura hylophila RUSEK	1	1	2	2
Isotomiella minor (SCHÄFF.)	1	4	5	1
Sminthurinus sp. jv.	2	1	3	1
Megalothorax minimus WILL.	1	–	1	1
Willemia aspinata STACH	–	1	1	1
Pseudosinella alba (PACK.)	1	3	4	–
Mesaphorura critica RUSEK	1	1	2	–
Vertagopus cinereus (NIC.)	1	–	1	–
Neanura muscorum (TEMPL.)	1	–	1	–
Tomocerus vulgaris (TULLB.)	1	–	1	–
Protaphorura subuliginata GISIN	–	1	1	–
Entomobrya nivalis (L.)	–	2	2	–
Pogonognathellus flavescens (TULLB.)	–	1	1	–
Onychiurus variabilis STACH	–	–	–	10
Metaphorura affinis (BÖRN.)	–	–	–	2
Sphaeridia pumilis (KRAUSB.)	–	–	–	1
Number of samples	8	8	16	13
Number of individuals	96	97	193	132
Average number of ind. in a sample	12.1 ± 3.1	12.0 ± 4.3	12.1 ± 2.6	10.2 ± 1.7

Area 3 The *Collembola* community in the meadow was very sparse, consisting only of 8 species with two species recorded in one sample on average and a very low total density (Tab. III, Fig. 2). The eurytopic species: *Folsomia quadrioculata, Protaphorura armata, Lepidocyrtus lignorum* and the meadow species of *Isotoma viridis* were the most frequent forms in this plot.

Under the crown of the single lime tree, the density of the springtail community increased to 7,400 ind./sq.m compared to 1.400 ind./sq.m in the meadow (the difference is significant with p = 0 .05), and the number of species incresed to 16 (Tab. III).

The population densities of many eurytopic species (*Folsomia quadrioculata, Lepidocyrtus lignorum, Isotoma notabilis* etc.) were higher under the crown of the tree. The group of dominants was the same as in the meadow except for the addition of *I. viridis. Isotomiella minor, Anurophorus laricis, Neanura muscorum, Frisea mirabilis, Entomobrya nivalis, Tomocerus vulgaris*, some other species were only found under the crown of the tree and even the "meadow" species *Metaphorura affinis* and *Stenaphorura quadrispina* were also found there (Tab. III).

The following summarizes the *Collembola* fauna under crown of single trees as compared to communities inhabiting the surrounding meadows:

Table III. Abundance of *Collembola* species under crown of an old and young lime tree and in the surrounding meadow

Species	Lime		Meadow
	old	young	
Anurophorus laricis Stach	166	–	–
Lepidocyrtus lignorum (Fabr.)	30	50	5
Protaphorura armata (Tullb.)	20	7	6
Isotoma notabilis, Schäff.	23	9	1
Mesaphorura hylophila Rusek	1	1	1
Neanura muscorum (Templ.)	10	1	–
Isotomiella minor (Schäff.)	3	4	–
Friesea mirabilis (Tullb.)	3	1	–
Stenaphorura quadrispina Börn.	1	4	–
Metaphorura affinis (Börn.)	1	1	–
Pseudosinella alba (Pack.)	2	–	–
Tomocerus vulgaris (Tullb.)	1	–	–
Isotoma viridis Bourl.	1	–	3
Isotoma tigrina Tullb.	1	–	–
Dicyrtomina minuta (Fabr.)	–	1	–
Isotomurus palustris (Mull.)	–	–	1
Megalothorax minimus Will.	–	–	1
Number of samples	18	16	7
Number of individuals	331	87	24
Average number of ind. in a sample	9.8 ± 1.6	5.4 ± 0.9	3.3 ± 1.3

1) an increase in the number of *Collembola* species due to appearance of new eurytopic, forest, corticophilous and even meadow forms;
2) a decrease in or even absence of most meadow forms;
3) an increase in the total springtail density;
4) partial changes in the dominant group, a greater role of forest forms and a lesser role of meadow forms.

Collembola communities under the crown of an old single tree (lime) as compared to the surrounding open biotopes (lawn)

Area 4. The *Collembola* community investigated in an urban lawn turned out to be quite diverse. It consisted of 13 species, but the total density was rather low (4,500 ind./sq.m) (Tab. IV, Fig.2). The most common species were the ruderal *Isotoma anglicana, Protaphorura armata, Metaphorura affinis and Mesaphorura critica.*

Table IV. Abundance of *Collembola* species under crown of a single lime tree and in the surrounding lawn

Species	Lime			Lawn
	Near trunk	1 m away from trunk	Total	
Protaphorura armata (TULLB.)	9	11	20	11
Isotoma anglicana LUBB.	4	4	8	18
Mesaphorura critica RUSEK	5	6	11	5
Isotomiella minor (SCHÄFF.)	1	2	3	4
Cryptopygus bipunctatus (AXELS.)	10	1	11	–
Ceratophysella succinea (GISIN)	2	3	5	–
Folsomides parvulus STACH	1	1	2	–
Hypogastrura assimilis (KRAUSB.)	1	–	1	–
Sminthurinus niger (LUBB.)	–	2	2	–
Oligaphorura serratotuberculata (STACH)	–	1	1	–
Friesea mirabilis (TULLB.)	–	1	1	–
Metaphorura affinis (BÖRN)	–	3	1	–
Heteromurus nitidus (TEMPL.)	–	–	3	11
Pseudosinella alba (PACK.)	–	–	–	3
Stenaphorura quadrispina BÖRN	–	–	–	2
Lepidocyrtus cyaneus TULLB.	–	–	–	2
Lepidocyrtus lignorum (FABR.)	–	–	–	1
Willowsia buski (LUBB.)	–	–	–	1
Entomobrya marginata (TULLB.)	–	–	–	1
Isotoma notabilis SCHÄFF.	–	–	–	1
Specimen non det.	–	–	–	1
Number of samples	8	8	16	16
Number of individuals	33	36	69	62
Average number of ind. in a sample	4.1 ± 1.4	4.5 ± 1.0	4.3 ± 0.8	3.9 ± 0.8,

The first three species dominated under the crown of the single lime tree on the lawn as well, but *Metaphorura affinis* was rare in that plot. On the other hand, the ruderal *Cryptopygus bipunctatus* was there a dominant group. The total number of species (12) and their density (5,400 ind./sq.m.) were similar to those in the *Collembola* community of the lawn. It is interesting to note that in urban environment we can discover a broad and diverse spectrum of species including ruderal (*Cryptopygus bipunctatus, Isotoma anglicana, Heteromurus nitidus*), compost (*Hypogastrura assimilis, Lepidocyrtus cyaneus*) and meadow (*Folsomides parvulus, Ceratophysella succinea*) forms.

Collembola communities in natural lime forests

The following characteristic features of *Collembola* communities can be observed in undisturbed natural lime forests (KUZNETSOVA 1994):

– similarity of the species composition of the most numerous species group (irrespective of the time of study and geographical location of the plot), which is formed by *Isotoma notabilis, Protaphorura subarmata, Isotomiella minor, Folsomia quadrioculata, Lepidocyrtus lignorum*, and often *Megalothorax minimus, Pseudachorutes parvulus and Oligaphorura absoloni*;

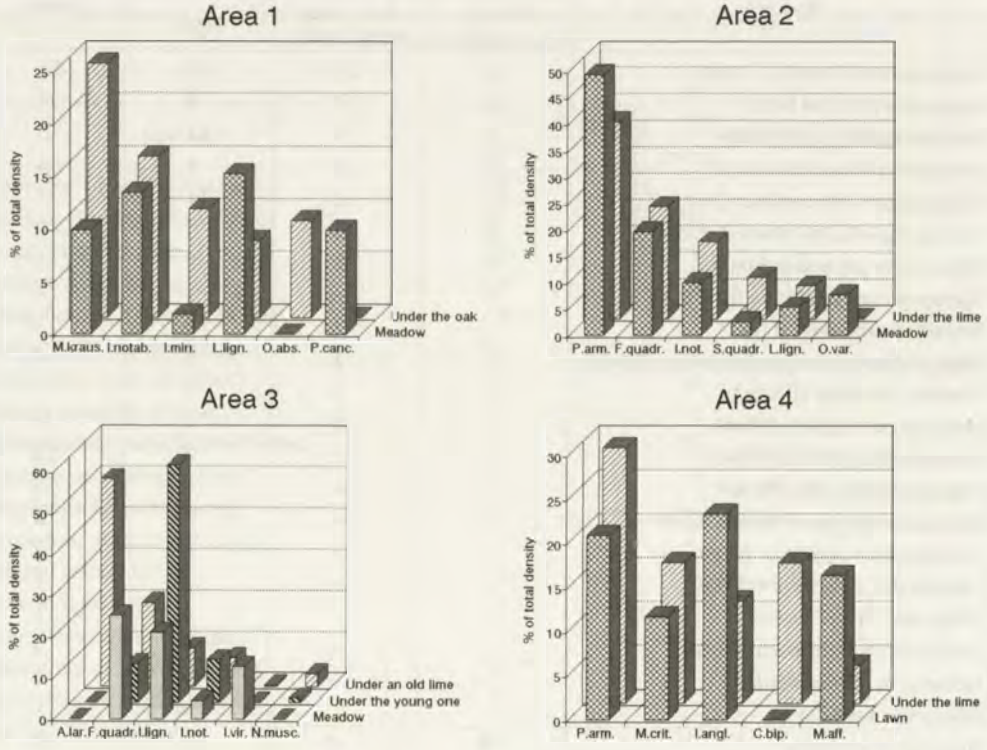

Fig. 3. Distribution of some *Collembola* species under crown of the single trees and in open biotopes

– the presence of typically forest *Collembola* such as *Oligaphorura absoloni, Pseudoanurophorus binoculatus, Isotoma hiemalis, Ptenothrix spp., Dicyrtoma fusca, Supraphorura sp., Arrhopalites cochlearifer* as well as the corticophilous forms *Anurophorus laricis, Vertagopus cinereus, Xenylla corticalis* etc. – which are very rare in forest litter and soil, but found on the tree trunks;

– compost, ruderal and meadow forms are extremely rare. Only one species *Stenaphorura quadrispina* of the above three groups was found in one of the forests investigated.

Distribution of *Collembola* in various microsites under crown of single trees

In non-urban conditions, an obligatory corticophilous species *Vertagopus cinereus* was found in the area around the base of the trunk (Area 2); a colony of *Anurophorus laricis* was registered under the crown of old lime (Area 3). *Oligaphorura absoloni*, a forest species, was also registered under the crown of oak (Area 1) (Fig. 3). An interesting fact is that the eurytopic species *Folsomia quadrioculata* also concentrated around the trunk base (Areas 1 and 2), although in Area 2 it was abundant in the meadow as well (Fig. 4).

None of the species we found showed a clear preference for a microsite distant from the trunk. Species abundant in the meadow, such as *Stenaphorura quadrispina* and *Protaphorura armata* – (Area 2) were recorded in that microsite when they occured under the tree canopy (Fig. 4).

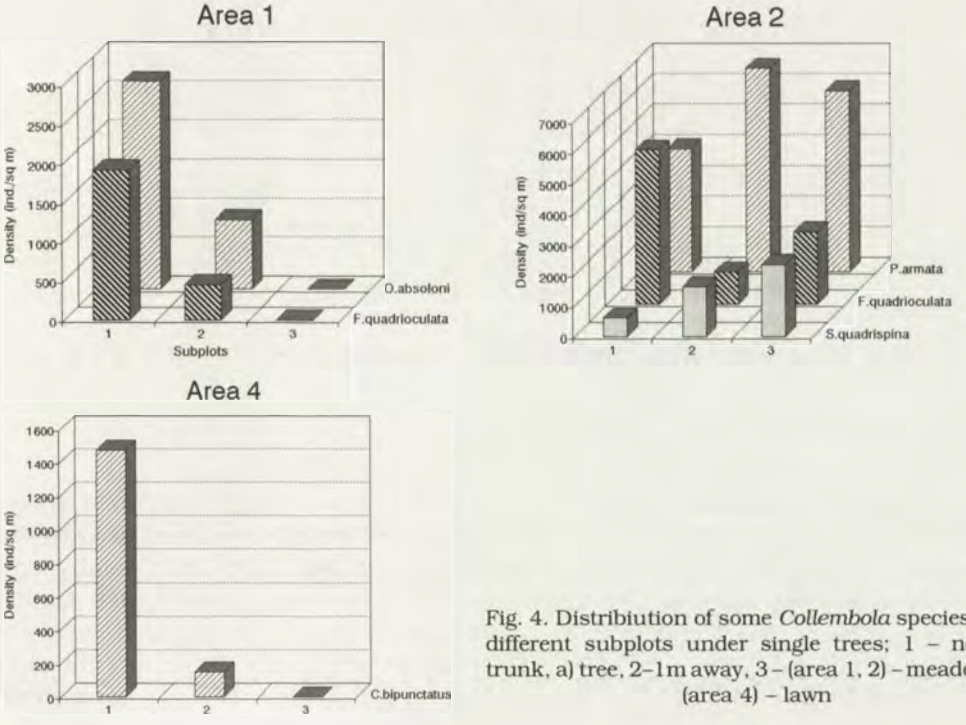

Fig. 4. Distribiution of some *Collembola* species in different subplots under single trees; 1 – near trunk, a) tree, 2–1m away, 3 – (area 1, 2) – meadow, (area 4) – lawn

In urban sites, only *Cryptopygus bipunctatus* concentrated near the trunk of the lime tree (Fig. 4). However, in other periods it was evenly distributed both in the microsites under the lime trees and in the lawn.

The total density of *Collembola* in the two microsites was practically the same both in natural and urban environments.

The influence of a single young tree on the *Collembola* community

The *Collembola* community under the crown of a young tree occupied an intermediate position between that of "meadow" and "old tree" communities both in terms of the number of species and the total density of *Collembola* (Tab. IV, Fig. 2). The dominant species in the community under the young lime tree was *Lepidocyrtus lignorum*, which accounted for more than a half of the total specimens (Fig. 3). Neither specifically forest nor corticophilous species were recorded in this community, but we found a forest species *Isotomiella minor* and *Neanura muscorum*. The latter was not found in any meadow studied. On the whole, we assumed that the influence of a tree on a *Collembola* community depends on the age of the tree. The "meadow" *Collembola* community is more similar to the community registered under the young lime tree than to that populations of *Collembola* inhabiting the area under the crown of an old tree (Fig. 5).

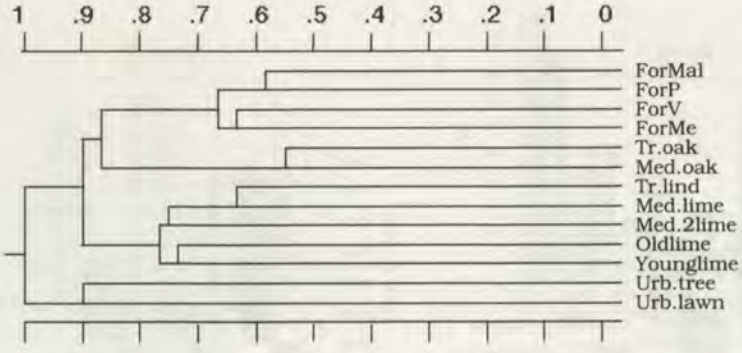

Fig. 5. Dendrogram of the similarity of the communites of *Collembola* investigated

DISCUSSION

In *Collembola* communities under single trees, the number of forest species and their role in the community are insignificant when compared to springtail communities in natural lime forests (KUZNETSOVA 1994). Only one typically forest species (*Oligaphorura absoloni*) was found under the trees investigated. Another forest species, *Isotomiella minor*, which plays an important role in forest springtail communities (up to 42% of total abundance), decreases its share considerably under single trees, accounting for 2–3, rarely 10%, of a community.

On the other hand, meadow species, which are practically absent from natural forests, are quite often found under single trees, where they can constitute 8% of a community. An interesting fact is that obligatory corticophilous forms, which are rare in forest litter, are frequently found under single trees. There is hardly any differentiation of *Collembola* density between microsites surrounding single tree trunks. In forests, on the other hand, a conspicuous gradient of total *Collembola* density and abundance of most species is observed with increasing distance from the trunk (CHERNOVA 1977, STREIT 1982). Thus, it can be said that the influence of single trees on *Collembola* communities appear to be weaker than of trees in a forest.

Single trees can also be considered refugia not only for eurytopic and forest species, but also for certain meadow species of springtails. This may be associated with greater stability of hydrothermical regime in an undisturbed natural environments. In a polluted environment, however, trees may lose their ability to athact soil animals but also become unfavourable habitats. This is due to increased acidity and concentration of heavy metals around trunks from polluted sediments settling on trunks and moving down, which has an adverse effect on soil animals, including *Collembola* (KOPESZKI 1992, FRITSCH 1993).

Single trees may also be considered intermediate habitats between forest and meadow biotopes, i.e ecotones. Ecotones are often characterized by the "edge effect", i.e. higher indices of abundance and diversity of organisms, compared to the adjacent habitats. RUSEK (1989, 1992) fully confirms this thesis for *Collembola* communities in the forest-meadow mesoecotone. Our results also show increases in the total density of springtails and the number of species, although the differences are not always significant.

In general, the effect of single trees on their environment may depend on the following factors: the tree species, the age of the tree, the season of the year and weather conditions, climate characteristics and anthropogenic impact. Most probably, it is not the species of the tree, but the group (coniferous, deciduous etc.) that is important. We suggest that oak and lime, both of which are deciduous trees, have a similar effect on *Collembola* communities. As was expected, our data show that a young tree modifies the springtail community lesser than an old one. In the definitely continental climate of Tien Shan, a single spruce (VTOROV, MARTYNOVA 1974) has been shown to harbour a specific complex of springtails which was considerably different from the *Collembola* community in a nearby meadow. In an urban environment, the role of single trees is difficult to observe. Obligatory forest *Collembola* species are absent not only from communities under crown of trees, but also from usual forest plantations. They can only be found in forest parks (KUZNETSOVA 1994). In contrast, various meadow, compost and ruderal forms are present in great numbers in the soil under trees. Such invasions are considerably greater in urban than in non-urban environments. This has already been noted for urban *Collembola* communities (SCHAEFFER 1989), and corresponds to certain theses of the theory of urban biocenoses (TREPL 1994, PISARSKI, TROJAN 1976 a,b). Occurence of typical forest springtails indicate a high liklihood of successful tree plantation.

In an urban environment *Collembola* communities become more varied compared to forest or meadow environments (STERZYŃSKA 1990). There are changes in species composition and density, but it is very difficult to show exactly how human influence the organization of *Collembola* communities. Comparative studies of the organization of springtail communities in a seminatural environment (a tree in a meadow) and an urban one (a tree in a lawn) allows us to analyze precisely the range of disturbances in the organization of *Collembola* communities caused by the stressful urban environment.

CONCLUSION

Single trees play a considerable role in the spatial organization of *Collembola* communities of open biotopes, allowing typically forest species as well as corticophilous and various hygrophilous eurytopic *Collembola* to survive outside a forest. Compared to the adjacent meadows, the Collembola communities of soil under crown of single trees were higher density and diversity. Human activity, particularly the urban environment, neutralizes the environment-forming ability of single trees to a great extent. As a result, the soil under trees in towns is inhabited by numerous springtail species that are not characteristic of forest biotopes, and the total density and diversity of *Collembola* is similar to that in lawns. The presence of typically forest springtail species may serve as a convenient indicator of how much soil conditions under tree plantations differ from those specific to forest biotopes.

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STRESZCZENIE

[Tytuł: Wpływ pojedynczego drzewa na strukturę zgrupowań glebowych *Collembola* w miejskim i pozamiejskim środowisku]

Celem badań było porównanie wpływu jaki wywiera pojedyncze drzewo na organizację zgrupownia *Collembola* w środowisku naturalnym i miejskim. Materiał do badań zebrano w latach 1991–93 na zieleńcach moskiewskich i na łąkach w bezpośrednich okolicach Moskwy. Badano *Collembola* strefy okołopiennej drzew liściastych: lipy (*Tilia cordata*) i dębu (*Quercus robur*). Przy czym, pod uwagę brano także wpływ wieku drzewa na strukturę zgrupowania *Collembola*. Porównano zgrupowania *Collembola* występujące pod koronami starych pojedynczych drzew usytuowanych na łąkach ze zgrupowaniami zasiedlającymi otwartą przestrzeń na łące i na trawniku miejskim. Analizowano również rozprzestrzenienie *Collembola* w kolejnych strefach: wokół pnia i srw odległości 1 m od pnia.

Stwierdzono, że pojedyncze drzewo w otwartych biotopach pełni istotną rolę w przestrzennej organizacji zgrupowań *Collembola*. Stanowi ono swoiste

refugium dla występowania gatunków typowo leśnych, kortykofilnych jak i różnych eurytopów wilgociolubnych. W porównaniu do otaczającej drzewo łąki zgrupowania *Collembola* w pobliżu pojedynczego drzewa charakteryzują się wyższą liczebnością i różnorodnością. W środowisku miejskim ten typ organizacji przestrzeni w strefie okołopiennej drzewa i na przestrzeni otwartej trawnika u zgrupowań *Collembola* zostaje zaburzony. W strefie pod koroną drzewa brak jest gatunków specyficznych dla biotopów leśnych a różnorodność zgrupowań *Collembola* jest podobna jak na odsłoniętym trawniku.

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