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Ecofaunistical study of bark-dwelling spiders *(Araneae)* on black pine *(Pinus nigra)* in urban and forest habitats

Horváth, Roland[1] and Szinetár, Csaba[2]

[1] Department of Evolutionary Zoology and Human Biology
Debrecen University, Debrecen, POBox 3, H-4010 Hungary
horvathr@tigris.klte.hu

[2] Department of Zoology, Berzsenyi College
Szombathely, H-9701 Hungary
szcsaba@fs2.bdtf.hu

Abstract The study of the bark-dwelling spiders on black pine was carried out from the winter of 1997 to the autumn of 1998 in two different regions of the country (Western-Hungary, Great Hungarian Plain) in six sampling sites in urban habitats and pine plantages. Five samples from each site monthly were taken by trunk-traps placed at 3 meters height. We compared the forest and urban habitats, and the areas with different geographical and climatic conditions. There was an essential difference between the urban and forest sampling sites, as well as the two different sites of the country. The similarity of the spider communities of the sampling sites also shows specific seasonal changes. That the mountain forest biotope had a characteristic species structure, which is typical only of the forests of the western borderland in Hungary, which was reinforced by the IndVal statistical method. The higher species richness of the moderately polluted urban samples in relation to the forest samples and the higher abundance values can be effected by the following factors: (i) the significantly higher prey density of towns, (ii) the warmer climate of towns, which enables Southern-European species to settle down (iii) the weaker predation in towns, which can originate partly from the lower number of predators (mainly birds), partly from the more dense foliage of pines in towns as it can offer a better hiding place for spiders.

Keywords Bark-dwelling spiders, Black pine, Town, Forest, Indicator species.

Introduction

With the accelerating development of industry and transport, special climatic conditions have been developed which allowed a lot of creatures to settle down. There are several among them which find their living conditions exclusively in or near human settlements today (Braun 1956, Beer 1978, Schäfer and Kock, 1979, Pisarski and Kukesza 1982, Salz 1992, Szinetár 1993). Among them, there are some species settled down in towns with warmer climate as well, which species are found exclusively in natural habitats in the mediterranean areas (Szinetár 1992a, Horváth and Szinetár 1998). During our study the spider fauna of a town (Szombathely) was investigated in comparison with spiders occurring in pine plantages in natural circumstances. For our studies black pine *(Pinus nigra)* was chosen which is a frequent species both in towns and pine plantages. We concentrated on the study of bark-dwelling spiders because this topic has been studied by only a few auctors both in Hungary and abroad (Albert 1976, Wunderlich, 1982, Hansen 1992, Bogya 1995, Koponen 1996, Szinetár 1996, Horváth and Szinetár 1998, Schulz and Schmidt 1998). Because the bark has special microclimatic and structural conditions, it is an exclusive habitat for many spider species (Wunderlich 1982). The ecology of spiders is relatively well-known, which allows to use them as the subjects of ecological studies (Tretzel 1952, Braun and Rabeler 1969). Our studies were carried out in three urban and three forest habitats. One of the forest habitats is situated in the Kőszeg Mountains while the other two are found in areas surrounding Debrecen. Despite spiders are mobile and relatively short lived, they are suitable for indicating abiotic and biotic environmental changes.

In the present study we carried out a comparative ecological study between the forest and urban habitats. We studied the differences in species composition, species richness and diversity of spiders between urban biotopes and pine plantages.

Material and Methods

Study area and sampling

Samples were taken with trunk-traps made of waved cardboard. Using trunk-traps, one can sample and study not only the exclusive dwellers on or under the bark of black pine, but also the foliage-dwelling spiders, because a part of the foliage-dwelling spider overwinter under the bark (Wunderlich 1982). Traps were 15 centimetres wide and placed at 3 meters above the ground on the trunk. Belts were put around the trunk, with their waved surfaces facing the trunks and covering the whole outline of the tree as if a kind of artificial bark. 30-30 trunk-traps were installed to the six sampling sites, first in October of 1997 then in April of 1998. We collected 5 trunk-traps from the six sampling sites in every month. The samples were collected at around noon or early in the afternoon in calm weather. Bogya (1995) applied similar methods in orchards in the Netherlands and in Hungary.

We sorted out the samples in the laboratory and the specimens were stored in 70% ethanol. Some juveniles were kept at 20-22°C temperature and fed with fruit-flies *(Drosophila melanogaster)* until they completely developed and we could identify them. We used Loksa (1969, 1972), Heimer and Nentwig (1991) and that of Roberts (1995) for identification and the nomenclature of Platnick (1997) was followed.

We carried out our studies at the following sampling sites:

(1) Szombathely, Gagarin avenue (G): This avenue is surrounded by family houses. There is only a small traffic road along it, therefore, the air pollution is not significant there.

(2) Szombathely, Paragvari street (P): This site is next to a main road, which leads the traffic partly to Kőszeg and partly to Gencsapáti. Because of the heavy traffic the air is heavily polluted in this part of the town.

(3) Szombathely, Csónakazó pond (Cs): This is a green belt area with two artificial ponds and an open-air swimming pool. The studied row of trees is situated along a road without heavy traffic between the two artificial ponds and the open-air pool, therefore this site is only moderately polluted.

(4) Kőszeg Mountain, Bozsok (B): This site is situated in the southern part of the mountain 200 meters above the sea level near Bozsok. We can find a quite large black pine forest here, which was planted during the second World War. This area is completely free from air pollution and from other sorts of disturbances.

(5) Debrecen, Nagyerdő forest (N): A large black pine plantation can be found here. This area is situated 200 m away from the highway No 4. Despite the heavy traffic, this area is only moderately polluted due to the filtering effect of the forest.

(6) Debrecen-Kondoros, Fancsika ponds (F): This sampling site is surrounded with ponds and is located beyond the suburbs of the town. The air pollution is not significant here, because it is far from both the highway and the industrial plants.

Data analyses

Hierarchical cluster analysis using the Matusita index of similarity was used for abundances to assess similarities in spider assemblages among the traps in the four studying periods (Tóthmérész 1993b).

To find indicator species and species assemblages characterising the sites with different air pollution the IndVal (Indicator Value) approach was used (Dufrêne and Legendre 1997). This method derives indicator species from site classification. We obtained the site classification from hierarchical cluster analysis using Matusita similarity for abundances. Based on this site classification IndVal identifies the indicator species corresponding to the various groups. Indicator species are defined as the most characteristic species of each group, found mostly in a single group of the classification and present in the majority of the sites belonging to that group. The method is robust to differences in the absolute abundances of different taxa. Furthermore, by using a Monte Carlo permutation test it is possible to assess the statistical significance of the species indicator values (Legendre and Legendre 1998, McGeoch and Chown 1998). This method has been applied successfully in studies on other arthropods (Magura *et al.* 2000).

We examined whether there were any seasonal changes in the diversity and species composition of spiders, therefore, 4 seasonal periods were distinguished: A – winter period (December, January, February); B – spring period (March, April, May); C – summer period (June, July, August); D – autumn period (September, October, November).

During our analysis the pooled samples of the 3 months representing the given seasonal period were used.

	species	genus	subfamily	family	counts	diversity
Gagarin avenue	27	9	1	2	1111	2.666
Csónakázó pond	23	12	1	2	1227	2.618
Paragvári street	16	9	1	2	613	2.217
Bozsok	18	6	0	1	311	2.167
Fancsika ponds	19	10	0	1	393	2.418
Nagyerdő forest	15	6	0	1	184	2.312

Tab. 1: Studied characteristics of the spider assemblages.

Results

During the study a total of 3839 individuals belonging to 49 species, 17 taxa, 1 subfamilia and 4 familia were trapped. Tab. 1 shows a few characteristics of the spiders in the given habitat. 18.26% of the trapped spiders (701 individuals) were mature when they were collected. 560 of them were females

(79.88%) and 141 of them were males (20.12%).

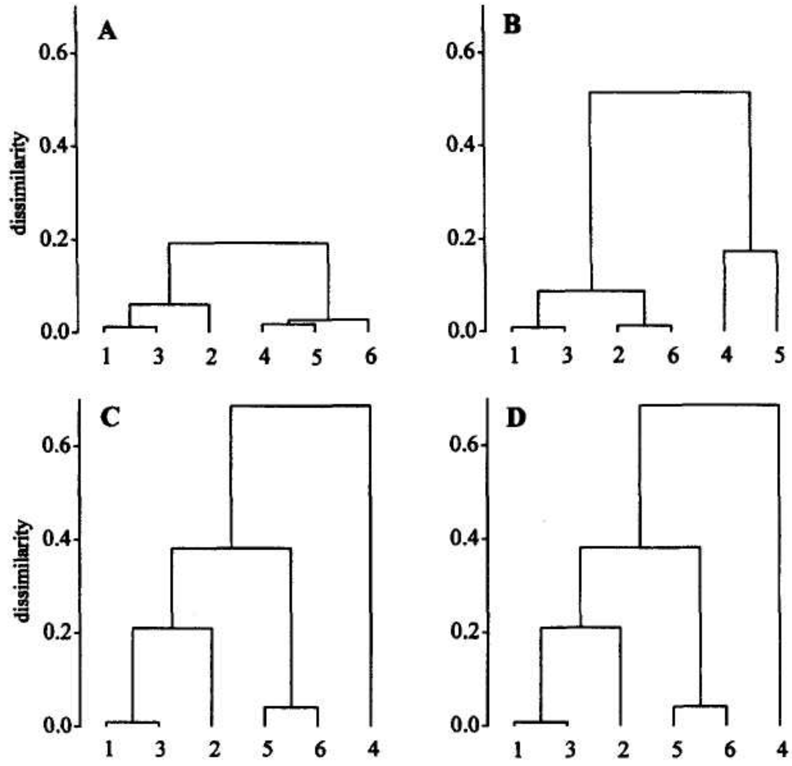

Fig. 1: Tree-diagrams of the spider assemblages during the seasons in 1998. A – winter, B – spring, C – summer, D – autumn. 1: Gagarin avenue, 2: Paragvári street, 3: Csónakázó pond, 4: Bozsok, 5: Fancsika ponds, 6: Nagyerdő forest.

The results obtained with the cluster analysis demonstrate the seasonal differences (Fig. 1 A-D). During the winter period urban and forest samples are segregated well, which can be interpreted by the special species composition characteristic of towns, although because of the many similar species (which occur in small number in the lowlands) even the largest difference does not reach 20%. In spring, because the foliage-dwelling spiders begin to move back, the species composition becomes more balanced. This explains why the polluted town area shows larger similarity to the Nagyerdő forest sampling site, and there is a relatively large difference between the mountain and plain (Fancsika ponds) areas. In summer, the sampling site of Bozsok stands out in sharp contrast to the other groups. The reason for this is the special species composition that originates from the climatic and relief

	IndVal	G	P	Cs	B	F	N
Gagarin avenue							
Steatoda bipunctata	54.6*	30/9	0/0	8/6	0/0	2/2	2/2
Anyphaena accentuata	35.3*	28/6	1/1	2/1	6/5	2/1	1/1
Lathys humilis	22.0*	13/4	2/2	2/1	0/0	1/1	0/0
Gagarin avenue and Csónakázó pond							
Clubiona pallidula	53.3*	53/9	0/0	57/7	0/0	0/0	0/0
Csónakázó pond							
Nuctenea umbratica	54.8*	4/4	3/3	37/13	3/2	11/8	4/4
Philodromus rufus	21.3*	3/2	0/0	12/4	0/0	0/0	0/0
Szombathely							
Philodromus sp.	63.2*	62/10	38/11	67/10	2/2	12/7	1/1
Theridion tinctum	62.9*	24/11	57/7	79/11	1/1	1/1	2/2
Clubiona genevensis	29.1*	49/5	49/5	26/5	2/1	0/0	16/3
Paragvári street							
Theridion mystaceum	64.2*	12/6	71/11	3/3	1/1	4/4	3/3
All sites							
Philodromus sp.	56.7ns	17/7	7/4	12/7	15/8	27/11	33/14

Tab. 2: The indicator table showing the species indicator power for the habitat clustering hierarchy for the species which were present by more than ten individuals during the first studied period.

conditions of the Kőszeg Mountains, where there are exclusive bark-dwelling spiders found only on the western borderline of Hungary. The sample from Bozsok is separated from the other sites in the autumn, as well. As a result of the wandering back of the foliage-dwelling spiders, the differences are increasing between the town and lowland areas.

The collected spider species can be divided into seven groups by characterisation of habitats by indicator species (Tab. 2-5): (1) habitat generalists that occurred numerously in all habitats *(Philodromus (margaritatus)* species group, *Scotophaeus scutulatus, Nuctenea umbratica),* (2) species occurring only in the Kőszeg Mountains (Bozsok) *(Amaurobius fenestralis, Clubiona corticalis, Harpactea hombergi, Segestria senoculata),* (3) species occurring in large numbers only in Szombathely *(Clubiona genevensis, Philodromus (aureolus)* species group, *Theridion tinctum),* (4) species that were abundant only in heavily polluted urban areas (Paragvári street) (*Theridion mystaceum, Theridion blackwalli),* (5) species that were abundant only in moderately

	IndVal	G	P	Cs	B	P	N
Szombathely							
Clubiona genevensis	61.1*	52/9	97/9	40/11	1/1	0/0	29/8
Gagarin avenue							
Steatoda bipunctata	50.8*	16/10	2/2	1/1	0/0	2/1	0/0
Gagarin avenue and Csónakázó pond							
Clubiona pallidula	22.6*	22/6	0/0	16/5	0/0	1/1	0/0
Moebelia penicillata	56.8*	14/7	3/1	44/12	0/0	0/0	1/1
Paragvári street							
Theridion mystaceum	22.2ns	5/4	13/5	5/3	0/0	8/4	7/4
Theridion tinctum	21.1*	3/3	44/4	11/5	1/1	5/4	3/2
Theridion blackwalli	32.9*	2/2	14/6	0/0	0/0	0/0	1/1
Bozsok and Fancsika ponds							
Anyphaena accentuata	25.3*	7/3	0/0	0/0	13/5	6/4	0/0

Tab. 3: The indicator table showing the species indicator power for the habitat clustering hierarchy for the species which were present by more than ten individuals during the second studied period.

	IndVal	G	P	Cs	B	F	N
All sites without Bozsok							
Scotophaeus scutulatus	45.0*	50/9	48/15	48/11	0/0	67/9	19/4
Nuctenea umbratica	45.3*	12/7	2/2	17/9	0/0	10/8	10/8
Bozsok							
Clubiona corticalis	86.7*	0/0	0/0	0/0	63/13	0/0	0/0
Amaurobius fenestralis	80.0*	0/0	0/0	0/0	33/12	0/0	0/0
Segestria senoculata	66.7*	0/0	0/0	0/0	27/10	0/0	0/0
Harpactea hombergi	46.7*	0/0	0/0	0/0	17/7	0/0	0/0

Tab. 4: The indicator table showing the species indicator power for the habitat clustering hierarchy for the species which were present by more than ten individuals during the third studied period.

polluted areas (Gagarin avenue, Csónakázó pond) *(Clubiona pallidula, Moebelia penicillata, Nigma walckenaeri),* (6) species occurring in large numbers only at the sampling site of Csónakázó pond *(Philodromus rufus),* (7) 3 species occurring in only at the sampling site of Gagarin avenue *(Steatoda bipunctata, Lathys humilis, Cheiracanthium mildei).*

	IndVal	G	P	Cs	B	F	N
Szombathely							
Theridion tinctum	45.6*	11/4	34/9	38/9	0/0	4/3	0/0
Clubiona genevensis	35.6*	22/6	4/3	13/7	0/0	0/0	0/0
Scotophaeus scutulatus	30.6*	8/5	18/5	7/5	0/0	2/2	0/0
Gagarin avenue and Csónakázó pond							
Moebelia penicillata	61.6*	18/10	0/0	35/14	0/0	0/0	0/0
Clubiona pallidula	32.8*	236/9	0/0	233/9	0/0	11/5	0/0
Philodromus sp.	40.4*	20/8	5/3	62/9	0/0	3/2	2/2
Nigma walckenaeri	31.3*	5/4	0/0	18/6	0/0	0/0	0/0
Gagarin avenue							
Cheiracanthium mildei	56.0*	56/9	0/0	4/4	0/0	0/0	0/0
Steatoda bipunctata	39.4*	23/9	7/4	3/3	0/0	1/1	1/1
Anyphaena accentuata	18.6*	23/4	2/1	6/2	2/2	0/0	0/0
Fancsika ponds							
Philodromus sp.	48.8*	7/6	1/1	6/3	0/0	91/9	7/3
All sites without Bozsok							
Nuctenea umbratica	41.3*	18/8	4/2	24/11	0/0	8/4	7/6
Bozsok							
Amaurobius fenestralis	44.9*	0/0	0/0	0/0	38/10	0/0	0/0

Tab. 5: The indicator table showing the species indicator power for the habitat clustering hierarchy for the species which were present by more than ten individuals during the fourth studied period.

Discussion

Earlier studies (Wunderlich 1982) have shown that only some bark-dwelling spiders live constantly on the bark or under the bark, while the others visit the bark only temporarily (mainly for the purpose of overwintering). For this reason, bark-dwelling spiders can be divided into two large groups: (1) the group of exclusive bark-dwelling spiders which live exclusively on bark and can be collected from there during the whole year and (2) the group of facultative bark-dwelling spiders which live also in another places besides bark and use the bark of the tree as a habitat temporarily (for example, for overwintering).

The species found during our study can be included in the above-mentioned categories in the following way: Exclusively bark-dwelling species: *Theridion mystaceum, Moebelia penicillata, Nuctenea umbratica, Amaurobius fenestralis, Amaurobius jugorum, Micana* *subopaca, Scotophaeus scutulatus, Marpissa muscosa, Pseudicius encarpatus.*

Facultative bark-dwelling species: *Segestria bavarica, Segestria senoculata, Harpactea rubicunda, Harpactea hombergi, Achaearanea riparia, Steatoda bipunctata, Theridion tinctum, Theridion blackwalli, Lathys humilis, Nigma walckenaeri, Anyphaena accentuata, Cheiracanthium mildei, Clubiona corticalis, Clubiona genevensis, Clubiona pallidula, Philodromus aureolus, Philodromus margaritatus, Philodromus praedatus, Philodromus rufus, Diaea dorsata, Diaea pictilis, Misumenops tricuspidatus, Macaroeris nidicolens, Salticus zebraneus, Dendryphantes rudis.*

The occurrence of the other species considered as occasional because of the low number of species and various habitat-selection: *Anelosimus vittatus, Dipoena tristis, Steatoda triangulosa, Erigone atra, Linyphia triangularis, Araneus diadematus, Gibbaranea bituberculata, Mangora acalypha, Agelena labyrinthica, Tegenaria ferruginea, Dictyna civica, Dictyna uncinata, Phrurolithus festivus, Clubiona comta, Clubiona terrestris, Synaema globosum.*

Further research, including studies on other tree species, are required in order to be sure which species can be regarded as facultative bark-dwellers and which are the ones that occur only accidentally.

In comparison with our earlier study (Horváth and Szinetár 1998), the following species are found:

Achaearanea riparia (Blackwall 1834): This species occurs both on ground level and in vegetation. It prepares its web and specific hiding-place in crevices (under stones or bark). Its sparse and rare occurrence is due to its hidden way of life. In Hungary, it is found mainly on the bark of platan (Szinetár 1996).

Dipoena tristis (Hahn 1833): This is an European species with sparse occurrence. In Hungary, only a few data are known (Samu and Szinetár 1999). It lives generally in low vegetation near the ground and often on low branches of Scotch fir (Heimer and Nentwig 1991).

Steatoda triangulosa (Walckenaer 1802): The species is known from central and Northern Europe, the Turkestan and North America (it does not occur in England). This is a typical synantrop species in Central-Europe. In inhabited areas it can occur accidentally outdoors, and near buildings, as well (Szinetár 1992b).

Erigone atra (Blackwall 1841): Holarctic species. Stenotopic species, photobiont, hygrobiont; it lives on damp meadows, in detritus, grass, on shrubs and on bark.

Linyphia triangularis (Clerck 1757): The species with Palearctic distribution. It lives in various biotopes, on shrubs and smaller plants. It is common in the alder carr, occurring in all above-ground layers, especially in the herb layer. Because of this, its turn-up on bark can be regarded as occasional.

Mangora acalypha (Walckenaer 1802): This species is wide spread in whole Europe, in the temperate zone of Asia, in Asia Minor, in North-Africa and in several islands. In Hungary, it is very frequent both in lowlands and in hilly areas (Loksa 1972). It is thermophilous, avoiding cool forests, so its occurrence in a stand of black pine above Bozsok can be regarded as occasional.

Agelena labyrinthica (Clerck 1757): It often makes its web in dense bushes or hedges of parks and gardens (Loksa 1969). It occurs accidentally on the bark of trees, for example at knags or at cracked parts of the bark where there are appropriate conditions for preparing its large funnel web.

Dictyna civica (Lucas 1849): It prepares its web mainly on walls of houses. It is frequent in Europe, in North-America and in a lot of atlantic islands. In Hungary, this species is wide-spread in towns and smaller habitat, so its occurrence in the sample from Paragvári street is occasional and it is due to the closeness of houses (Loksa 1969).

Dictyna uncinata Thorell 1856: An European, Eastern-Asian species. It is very frequent in Hungary, it can be found both in damp and dry areas. It prepares its web in vegetation, on tree-trunks and on the walls of buildings, so its occurrence is likely with low number of species in other areas, as well (Loksa 1969).

Amaurobius jugorum (L. Koch 1868): A Central-European, mountain species. It is common in the Mecsek, Kőszeg and Sopron Mountains. It is occurrence in the sample from Bozsok is typical (Loksa 1969).

Phrurolithus festivus (C. L. Koch 1835): The species is known from all over Europe, the Caucasus and Northern Africa. Mesic species, hemiombrophil, hemihygophil; it mostly occurs on sandbanks, in moss and pine woods. This forest species may occur at other sites, as well.

Clubiona comta C. L. Koch 1839: European species; it lives in stands, on shrubs and stalks, in moss, litter and under rind of trees. Only one individual has been found so far. It is a species living mainly on deciduous trees in Hungary.

Clubiona terrestris Westring 1862: European species. It lives among high stalks and shrubs, under rind of trees and in grass on meadows. Only one individual has been found so far, as well. It is a species living mainly in the leaf-litter layer. Its occurrence in large numbers is unlikely.

Diaea pictilis (Banks 1896): The species occurs in Nearctic and Palearctic Region too. It has been known in Europe from Switzerland, Austria, Czech Republic and Turkey (Buchar and Thaler 1984) and has also occurred in Hungary since 1996 (Szinetár 1996). It lives in oak forest on shrubs and lower branches of trees (Maurer and Hänggi 1990).

Misumenops tricuspidatus (Fabricius 1775): The species with Palearctic distribution; it occurs in masses on leafy trees and green plants in sunny sites. This foliage-dweller species may appear on the barks during the winter period.

Synaema globosum (Fabricius 1775): Palearctic species with southern distribution. Poland is considered its northern boundary. It lives on blooms and leaves of smaller plants in warm and dry biotopes. Likewise the previous species, small numbers of this species can be detected during the winter-period.

Dendryphantes rudis (Sundevall 1833): A forest species, frequent on gymnosperms, especially on Scotch pine and on spruce (Roberts 1995, Heimer and Nentwig 1991). In this country as well, it lives mainly in forests. In urbanized areas, on planted pines, *Macaroeris nidicolens* is much more common than this species (Szinetár 1995).

Salticus zebraneus (C. L. Koch 1837): European species known also from the Near East; it lives on trunk of trees. In Hungary, it is known to occur in the foliage of both spruce and black pine, for this reason, its occurrence were expected (Szinetár 1992b, 1996).

Species composition, species richness and diversity of bark-dwelling spider communities can be mainly influenced by the mass of prey, the climatic conditions, the structural heterogenity of the environment and the needle-density of the foliage. The higher species richness and diversity in towns can be interpreted by the warmer climate characteristic of towns and the much more dense foliage. In samples from forests, both the mass of prey and the density of the foliage are much lower than in towns, so this can account for the lower species richness and diversity. In the higher abundance of spiders found in towns, the lower predation may have a share, which can be a significant selective effect made by birds (Gunnarsson 1983). The number of individuals of many spiders which can be found in samples during the winter period is reduced is samples taken in spring *(Steatoda bipunctata, Lathys humilis, Clubiona pallidula, Philodromus rufus, Philodromus (aureolus)* species group, *Philodromus* *(margaritatus)* species group). One of the reasons for it is that the species using the bark only for an overwintering habitat returned to the foliage (Tab. 2). The strong reduction in the number of individuals of some species in spring and summer samples may also result from the fact that according to the favourable changes in climatic conditions they get prey running about by day, therefore they are absent in belt traps collecting in daytime. This supposition must be studied later, by using part of the day-traps. In spring samples two bark-dwelling spiders occurs *(Scotophaeus scutulatus* and *Moebelia penicillata),* which spend the winter under the deeper parts of the bark, for this reason, these species can't be trapped with the aid of belts posited on the surface of the bark in the winter period (Tab. 3). The *S. scutulatus* can be found in large numbers until the next winter when it slips back to the deeper layers of bark because of the unfavourable climatic conditions. On the contrary, the number of individuals of a *M. penicillata* decreases heavily by the summer and it turns up again with large numbers only in the autumn. The reason for it would be worth studying later. In samples which are taken during the summer the species occurring in large numbers in spring on bark disappear *(Theridion mystaceum, Theridion tinctum, Anyphaena accentuata, Clubiona genevensis, Clubiona pallidula, Steatoda bipunctata).* Hence, those six species are to move back to the foliage the latest. It is obvious from the data (Tab. 4), that in summer only the real bark-dwelling or branch-dwellers are found in large numbers in every area. However, it is also visible that the four species found in Kőszeg Mountains *(Segestria senoculata, Harpactea hombergi, Amaurobius fenestralis, Clubiona corticalis)* are exclusively found there, which can be explained by the special climatic conditions of the mountain area as well as the relationship with the natural communities of the surrounding forests. The reason for the occurrence of these species can also be that they spend the winter under the deeper layers of the bark. In autumn (Tab. 5), when there are unfavourable changes in climatic conditions, the species begin to migrate again towards the bark, therefore species living in the foliage only in summer turn up in larger numbers again (*Theridion tinctum, Clubiona genevensis, Clubiona pallidula, Anyphaena accentuata, Steatoda bipunctata).* However, in the autumn samples there are two species *(Cheiracanthium mildei, Nigma walckenaeri)* present which are absent in the previous winter sample. This may result from the fact that those are the species which begin to migrate the earliest, even in September, towards the bark. As we took out the traps only at the end of October, in 1997, by that time those two species were

having a rest. That is why we could not catch even an individual of them. Although the exclusive bark-dwellers and branch-dwellers can be found in the samples, their number of individuals decreased considerably. It shows that when the foliage-dwelling species begin to migrate, at the same time these species start to slip back to the deeper layers of the bark.

Previous studies (Luczak 1984, Bengtsson and Rundgren 1984, Clausen 1984) have shown that the species of the *Linyphiidae* and *Clubionidae* families can be sampled in large numbers from areas with air pollution. Our study has not confirmed the results mentioned above. We collected very few of the species *(Moebelia penicillata)* representing the familia *Linyphiidae* from the air polluted area (Paragvári street), but they were present in large numbers in samples from green belts. In the case of the familia *Clubionidae* we also had contradictory results. The two frequent species of the familia *(Cheiracanthium mildei, Clubiona pallidula)* occur exclusively in the moderately polluted town areas and they are absent in the Paragvári street with the biggest traffic. *Clubiona genevensis* occurring in large numbers in Paragvári street is frequent in the two other sites of the town as well, therefore, it has not supported the earlier studies. It can be considered that the two species of familia *Theridiidae* (*Theridion mystaceum, Theridion blackwalli)* occurred with the larger number of individuals in the polluted area which shows their higher tolerance to environmental pollution.

The foregoing studies verified that different species compositions are characteristic of the fauna of the bark of black pine. For this reason, bark-dwelling spiders can be suitable subjects for biological monitoring and indicative research. To find out which factors are responsible for the differences the factual measurement of environmental parameters, manipulative and non-manipulative investigations are needed.

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