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The leafhopper fauna in birch (*Betula pendula* Roth) stands

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ABSTRACT: In birch (*Betula pendula* Roth) stands of the Děčín sandstone uplands (northern Bohemia) 55 species of leafhoppers were captured using photoeclectors, ground traps and shaking down onto sheets (23,855 specimens of larvae and imagoes). The dominant representatives of the grass and herb undergrowth in birch stands are *Jassargus allobrogicus, Anoscopus flavostriatus, Neophilaenus lineatus, Hyledelphax elegantula, Diplocolenus bohemani, Streptanus brevipennis, Macustus grisescens, Planaphrodes bifasciata* and *Cercopis vulnerata.* A heavy abundance of the dominant *Oncopis flavicollis* and the less abundant *O. tristis,* weakens birch growth due to the leaf-sucking activities of the insects.

Keywords: birch (*Betula pendula* Roth); fauna of leafhoppers; photoeclectors; ground traps; shaking down; air-polluted area

The objective of long-term observations of the arachnoentomofauna of birch stands in the conditions of the forest district Sněžník (Děčín) was to evaluate the individual animal groups attracted to these forest ecosystems that were established in the disturbed site conditions. We were already engaged with spiders (KULA 1997g), bugs (KULA 1999b), ground beetles (KULA 1997e), rove beetles (KULA 1997f), weevils (KULA 1990/1991), butterflies (KULA 1997a,b,c, 1999a) and syrphids (KULA 1997h; KULA, SCHOLZ 1995; KULA, LÁSKA 1997) and now it is the turn of leafhoppers.

The most abundant numbers of leafhoppers live in fields and meadows, in steppes and in broad-leaved forests. Coniferous forests are relatively poor in leafhoppers. Monophagous species are mostly arboricolous while the oligophagous species are attracted to grasslands; some of them belong to polyphagous species. VIDANO and ARZONE (1987a,b,c) studied the ecology and ethology as well as the feeding habits of leafhoppers on *Corylaceae, Fagaceae, Betulaceae* and alder.

MATERIAL AND METHODS

Leafhoppers were studied systematically in birch stands *(Betula pendula* Roth) of the forest district Sněžník during the entire vegetation period (April–October) in 1988–1998 applying the method of shaking down, photoeclectors and ground traps.

In 14-day intervals the crown leafhoppers were shaken down onto 2 × 2 m sheets from five trees of each of the 6 birch stands.

The individual specimens abandoning the soil and, as a rule, bound to the herb layer, were controlled in 7-day intervals using photoeclectors. Before the onset of the vegetation period, seven 1 m^2 photoeclectors were placed under the birch crowns in 6 birch stands. The material that was collected in 7-day intervals from 10 ground traps in each area was included in the evaluations.

In the course of 11 years we collected 2,745 imagoes and larvae of leafhoppers from the tree crowns, 11,897 from the photoeclectors and 9,213 leafhoppers from the ground traps.

Our sincere thanks go to Dr. JIŘÍ DLABOLA, CSc., for his great willingness to help determine such a huge amount of material. However, not all the larvae species were determined, only the genus and family. In the tables these data are listed in the column “others”.

RESULTS

The collection of the leafhoppers was based on general methods used for investigations of the arachnoentomofauna. In the 11-year period of investigations (1988–1998) we obtained 23,855 ex. of imagoes and larvae, most of them from photoeclectors (11,897 ex.), ground traps (9,213 ex.) and by shaking down (2,745 ex.).

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PHOTOECLECTORS

In 1988–1998 we captured 11,897 ex. of 38 species of leafhopper adults and larvae in birch stands using 42 soil photoeclectors.

Anoscopus flavostriatus occupied an eudominant position in these birch stands (i.e. 48.8%, 5,809 ex.) accompanied by *Neophilaenus lineatus* (8.1%) and *Hyledelphax elegantula* (5.3%) as the two dominant species. *Javesella forcipata* (4.3%) occupied a sub-dominant position and seven species formed a group of receding species. We saw partial differences between the localities, but the eudominant species corresponded (Table 1).

The insects were most abundant in the Tisá locality (i.e. 41.8 specimens/m per year); in the Ostrov and Kristin Hrádek localities the situation was similar (33.2 and 28.6 specimens/m per year, respectively). On average, only 18.4 specimens/m per year and 11.9 specimens/m per year were caught in the Sněžník and Vlčák localities, respectively.

GROUND TRAPS

In 1988–1998 we captured 9,213 ex. of leafhopper imagoes and larvae from 60 ground traps in 6 birch stands. Among the eudominant species we found *Jassargus allobrogicus* (41.3%), *A. flavostriatus* (19%) and *H. elegantula* (11.9%). *Diplocolenus bohemani* (3.2%) was the dominant species and one species was classified as a receding species. The substantial part of the species spectrum was composed of sub-receding leafhoppers (28 species) (Table 2).

Most of the leafhoppers were captured in the stands of the Kristin Hrádek locality (23.1 specimens per ground trap/year); in Tisá (11.5 specimens per ground trap/year), Letadlo (13.9 specimens per ground trap/year) and Vlčák (13.2 specimens per ground trap/year) their numbers were balanced. The catch was the lowest (7.8 specimens per ground trap/year) in the Ostrov locality.

CROWN FAUNA – SHAKING DOWN

In 1988–1998, 2,745 specimens were shaken down from birch crowns; most of them were from the Kristin Hrádek locality (54.9 specimens/year), followed by Vlčák (46.2 specimens/year). In the long-range investigations the findings in Ostrov and Sněžník (42.7 specimens/year) and Tisá and Letadlo (31.6 specimens/year) were similar (Table 3).

Although we collected 26 species using the method of shaking down, 76.5% of them were the dominant *Oncopsis* species, namely *Oncopsis flavicollis* (41.2%) and *O. tristis* (25.4%). Only *Cercopis vulnerata* (8.6%) belongs to the dominant species while *Aphrophora alni* and *N. lineatus* are sub-dominant species (i.e. 4.4% and 3.7%, respectively). *Kybos virgator* was classified as a receding species (1.8%) and the remaining 20 species were sub-receding species.

There were some differences between the respective localities where the above species were captured. Most of the *Oncopsis* species were captured in the Tisá (86%) and Letadlo (87%) localities, the least in the Kristin Hrádek locality (63%). The abundance of *C. vulnerata* was balanced in all localities (2.9–5.36%) with the exception of Kristin Hrádek, where 24.2% were eudominant species. The current abundance of *A. alni* was 0.8–2.6% and was markedly different in the Ostrov and Sněžník localities (i.e. 9.8% and 10.9%, respectively). In *N. lineatus*, the greatest difference was in the Letadlo locality, i.e. 0.6% (Table 3).

DISCUSSION

The species diversity of leafhoppers colonising the investigated biotopes corresponds with the species diversity of the undergrowth of birch stands. Especially the composition of the tree-inhabiting species, permanently or only partly (especially in the imago stages) colonising forest stands with birch or only coniferous biotopes was not very diverse. To some extent it is the influence of the altitude of the biotopes. The leafhoppers as a group of phytosuccivorous insects is dependent, in the first place, on the indigenous character of the species composition of the plant cover; on the other hand, the more the biotopes are disturbed, the more the species composition of the leafhoppers is limited and changed. In forest monocultures and in agrocoenoses with cultivated arable land the community of leafhoppers is a mere torso, only a few species of great abundance.

The species composition of leafhoppers of birch stands differed from the coniferous stands: as for the eudominant species only the dominance of *J. allobrogicus* was twice as high in birch stands (41.3%). The proportion of the following species was higher in coniferous stands than in birch stands: *D. variate* (4.3 × 0.4%) and *A. flavostriatus* (25.2 × 19%) and the *Javesella* species (8.6 × 1.1%), i.e. *J. dubia* (2.1 × 0.1%), *J. obscurella* (2.3 × 0.7%), *J. discolor* (2.3 × 0.1%), *Streptanus brevipennis* (2.4 × 1.3%). The *Cicadellidae* family was more abundant in birch stands (8.3 × 4.8%) while the abundance of the *Delphacidae* was the reverse (6.4 × 11.8%). The representation of *D. bohemani* and *H. elegantula* in these two biotopes was balanced, i.e. 3.2 × 2.2% and 11.9 × 10.9%, respectively (KULA, DLABOLA 1999).

The comparisons showed a very marked difference in the abundance of leafhopper species in localities with coniferous stands and in birch stands. Birch stands host a much larger number of species than can be found in coniferous stands where their populations are sporadic. The decisive factor is the herb layer, which is more diverse in birch stands as well as the degree of coverage, both of which provide good conditions for the existence of a larger number of species.

The species spectrum of leafhoppers inhabiting the low ground vegetation is composed of the following: *A. flavostriatus, Planaphordes bifasciata, Aphrodes trifasciatus, Eupelix cuspidate, Aphrodes bicinctus, A. albiger* and *Javesella discolor.*

The species of low meadow vegetation or forest undergrowth are the following: *Neophilaenus infumatus,*

N. lineatus, N. minor, Hyledelephax elegantula, Javesella forcipata, S. brevipennis, Dikraneura variata, Jassargus allobrogicus, Javesella obscurella, Cercopis vulnerata, Streptoma affinis, Javesella discolor, Macustus grisescens, Philaenus spumarius, Javessela dubia, D. bohemani, Psammotettix helvolus, Neophilaenus exclamationis, Arocephalus languidus, Macrosteles laevis, Streptanus sordidus, Psammotettix confinis, Agalia venosa, Anaceratagallia ribauti, Arthaldeus pascuellus, Euscelis incisus, Paluda flaveola, P. parvispina, Psammotettix cephalotes, Elymana sulphurella, Doratura stylata, Athysanus argentatus, Emelyanoviana mollicula, Empoasca solana, Jassargus flori, J. obtusivalvis, Turrutus socialis, Deltocephalus pulicaris, Javesella pellucida, Eurybregma nigrolineata, Limmotettix striola.

Wagneripteryx germari (Zett.) and *Colladonus torneellus* (Zett.) are bound to conifers (KULA, DLABOLA 1999).

Conomelus anceps is a species of the wetlands with *Juncus*.

The species whose larvae overwinter on roots of grasses and whose imagoes migrate to taller plants, particularly bushes, belong to the genus *Cixius*. The species *C. cunicularius* is relatively abundant on alder and hazel (DLABOLA 1959), on birch it was captured accidentally. *C. nervosus* was abundant on goat willow and birch.

Ph. spumarius, Neophilaenus spp. and *Aphrophora* spp. belong to the species whose larvae develop on taller plants and whose adults fly over to bushes and the lower tree layers, particularly on the edge of the forest: *Ph. spumarius, Neophilaenus* spp. and *Aphrophora* spp. *A. alni* attacks willow, alder, goat willow and the larvae develop in the undergrowth on *Hieracium, Taraxacum* and *Fragaria*. The species *Ph. spumarius* is abundant in all grasslands and is the vector of viruses.

The following species prefer rather shaded wetlands and the edges of water surfaces: *H. elegantula, S. brevipennis, Stiroma affinis, Javessella* spp., *N. lineatus* and *Cicadella viridis*.

Only two species, i.e. *Dikraneura variata* and *Empoasca solani,* belong to the group whose imagoes overwinter especially in the forest undergrowth.

The *Javessella* spp. and *Eupelix cuspidata* are the species that overwinter in the forest undergrowth and in bushes as larvae.

The following species living on bushes and tall plants were captured in the investigated region: *Cixius nervosus, A. alni, Cixius stigmaticus, C. cunicularius, Aphrophora corticea, E. solani, Macropsis marginata, C. vulnerata* and *Ph. spumarius*.

O. flavicollis, K. virgator, Speudotettix subfusculus, Allygus modestus and *O. tristis* are all species feed-dependent on birch, goat willow and other willows. The *Oncopsis* spp. and *Kybos* spp. develop on the birch and their imagoes remain here. The larvae of other species live in the forest undergrowth and their imagoes fly over to bushes and broad-leaved trees.

Leafhoppers living on conifers were found only rarely in the collections from birch stands (*A. alni, A. corticea* etc.) and they were carried there by the wind. The species captured in ground traps in the spring are mostly specimens overwintering in the soil and under the tree bark.

The following species definitely rank among the dominant representatives of grass and herb undergrowth of birch stands: *J. allobrogicus, A. flavostriatus, H. elegantula, Streptanus brevipennis, Macustus grisescens* and *P. bifasciata.* We can also include *C. vulnerata* in this group.

The incidence of species abundant in the undergrowth of birch and conifer stands differs considerably when using ground traps. For example, we caught 1,755 ex. of *A. flavostriatus* in birch stands and 766 ex. in conifer stands, but the order of dominance was reverse, i.e. 19% and 25.4%, respectively. The proportion of *D. variata* was the opposite, i.e. 32 ex. (0.35%) in birch stands and 130 ex. (4.3%) in conifer stands. A thicker grass cover was more suitable for the species *D. bohemani* in birch stands, i.e. 294 ex. (3.2%), while in conifer stands it was only 2.2% (66 ex.). The shade-loving and hydrophilic *H. elegantula* was very abundant under birch trees, i.e. 1,093 ex. (11.9%), and conifers (10.9%). *J. allobrogicus*, which is introduced from the weed infested spruce stands, demonstrated twice as high a dominance in birch stands (41.3% × 21.4%) (JAVOREK 1978). *Neophilaenus lineatus*, most frequently inhabiting wet submontane meadows, as well as *M. grisescens* and *S. brevipennis* can be evaluated in the same way.

Among the species capable of weakening the birch growth as a result of sucking is the dominant *O. flavicollis* and the less abundant *O. tristis*. The accumulation of large numbers of larvae of these two species could be a threat to young stands.

O. tristis described by NUORTEVA (1951) as a species massively attacking birch (and oak) trees, is widely spread on birch trees in Finland, its incidence culminating in the second half of July; the males culminate one week earlier than the females. Copulation takes place in early August. Their natural enemies are, for example, the spider *Epeira cucurbitina* Cl. and the bug *Lygus contaminatus* Fall., which occupy a dominant position among the bug fauna of the region (KULA 1999). The adult leafhoppers suck young and old shoots and leaf stalks, while the larvae prefer the leaf stalks and young shoots. They do harm by sucking assimilates and water and can cause desiccation of leaves (JOHNSON 1934). WHEELER (1997) reported that repeated punctures of leaves generated leaf chlorosis (e.g. *Empoasca (Kybos) luda* Davidson and De Long), because they are concentrated on the mesophyll. The result is aesthetic devaluation of the trees, particularly in parks and urban green areas. In forest stands, especially in nurseries, the planting stock is severely damaged (JOHNSON, LYON 1988). All species of the genus *Oncopsis* are univoltine, the eggs overwintering on the host plant (CLARIDGE, REYNOLDS 1973). *O. flavicollis* and *O. subangulata* (Sahlb.) are feed-dependent on birch *B. pendula* and *B. pubescens* Ehrh.

The efficiency of the various methods of collection is also dependent on the type of feed on which the leafhoppers are dependent. In the photoeclectors we captured 82% of leafhoppers feed-dependent on the herb undergrowth and only

Table 1. Distribution of leafhoppers in birch stands of the Forest District Sněžník (photoeclectors, 1988–1998)

Locality	Tisá		Ostrov		Sněžník		Vlčák		Kristin Hrádek		Letadlo		Total	
Species	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)
Anoscopus flavostriatus (Donovan)	1,447	44.90	1,571	61.51	459	32.37	303	32.86	1,231	55.78	798	50.73	5,809	48.83
Aphrodes bicinctus (Schrank)	0	0.00	0	0.00	1	0.07	0	0.00	0	0.00	1	0.06	2	0.02
Aphrodes trifasciatus (Fourcroy)	0	0.00	1	0.04	0	0.00	0	0.00	7	0.32	0	0.00	8	0.07
Aphrophora alni (Fallén)	1	0.03	5	0.20	2	0.14	1	0.11	0	0.00	2	0.13	11	0.09
Aphrophora salicina (De Geer)	0	0.00	0	0.00	1	0.07	0	0.00	0	0.00	1	0.06	2	0.02
Cercopis vulnerata Illiger	5	0.16	1	0.04	2	0.14	2	0.22	34	1.54	7	0.45	51	0.43
Cicadella viridis (Linnaeus)	0	0.00	0	0.00	2	0.14	0	0.00	2	0.09	0	0.00	4	0.03
Cixius cunicularius (Linnaeus)	1	0.03	1	0.04	43	3.03	6	0.65	38	1.72	13	0.83	102	0.86
Cixius nervosus (Linnaeus)	31	0.96	47	1.84	25	1.76	53	5.75	3	0.14	28	1.78	187	1.57
Cixius stigmaticus (Germar)	2	0.06	1	0.04	3	0.21	2	0.22	0	0.00	1	0.06	9	0.08
Conomelus anceps (Germar)	0	0.00	0	0.00	0	0.00	0	0.00	1	0.05	2	0.13	3	0.03
Dikraneura variata Hardy	44	1.37	16	0.63	34	2.40	26	2.82	9	0.41	40	2.54	169	1.42
Diplocolenus bohemani (Zetterstedt)	1	0.03	1	0.04	0	0.00	0	0.00	1	0.05	3	0.19	6	0.05
Doratura stylata (Boheman)	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	0.06	1	0.01
Elymana sulphurella (Zetterstedt)	0	0.00	0	0.00	0	0.00	1	0.11	0	0.00	0	0.00	1	0.01
Emelyanoviana mollicula (Boheman)	1	0.03	0	0.00	0	0.00	1	0.11	0	0.00	0	0.00	2	0.02
Empoasca vitis (Goethe)	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Eupelix cuspidata (Fabricius)	0	0.00	0	0.00	1	0.07	0	0.00	0	0.00	5	0.32	6	0.05
Hyledelphax elegantula (Boheman)	111	3.44	147	5.76	83	5.85	95	10.30	81	3.67	112	7.12	629	5.29
Jassargus allobrogicus (Ribaut)	18	0.56	5	0.20	21	1.48	10	1.08	41	1.86	45	2.86	140	1.18
Javesella discolor (Boheman)	36	1.12	4	0.16	0	0.00	0	0.00	0	0.00	0	0.00	40	0.34
Javesella dubia (Kirchbaum)	8	0.25	12	0.47	0	0.00	0	0.00	0	0.00	0	0.00	20	0.17
Javesella forcipata (Boheman)	394	12.22	115	4.50	0	0.00	0	0.00	1	0.05	4	0.25	514	4.32
Javesella obscurella (Boheman)	67	2.08	29	1.14	1	0.07	2	0.22	13	0.59	16	1.02	128	1.08
Javesella pellucida (Fabricius)	0	0.00	0	0.00	0	0.00	0	0.00	4	0.18	1	0.06	5	0.04

Table 1 to be continued

Locality	Tisá		Ostrov		Sněžník		Vlčák		Kristin Hrádek		Letadlo		Total	
Species	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)
Macustus grisescens (Zetterstedt)	2	0.06	1	0.04	1	0.07	1	0.11	28	1.27	5	0.32	38	0.32
Neophilaenus exclamationis (Thumberg)	0	0.00	1	0.04	0	0.00	0	0.00	0	0.00	0	0.00	1	0.01
Neophilaenus infumatus (Haupt)	0	0.00	0	0.00	0	0.00	0	0.00	1	0.05	0	0.00	1	0.01
Neophilaenus lineatus (Linnaeus)	333	10.33	44	1.72	86	6.06	132	14.32	316	14.32	56	3.56	967	8.13
Neophilaenus minor (Kirchbaum)	22	0.68	20	0.78	10	0.71	20	2.17	41	1.86	7	0.45	120	1.01
Oncopsis flavicollis (Linnaeus)	2	0.06	1	0.04	4	0.28	0	0.00	4	0.18	5	0.32	16	0.13
Oncopsis tristis (Zetterstedt)	0	0.00	1	0.04	1	0.07	1	0.11	0	0.00	3	0.19	6	0.05
Paluda parvispina (Wagner)	0	0.00	1	0.04	0	0.00	0	0.00	0	0.00	0	0.00	1	0.01
Philaenus spumarius (Linnaeus)	11	0.34	4	0.16	4	0.28	0	0.00	3	0.14	0	0.00	22	0.18
Planaphrodes bifasciata (Linnaeus)	13	0.40	2	0.08	36	2.54	0	0.00	52	2.36	22	1.40	125	1.05
Psammotettix helvolus (Kirchbaum)	2	0.06	0	0.00	1	0.07	0	0.00	0	0.00	0	0.00	3	0.03
Speudotettix subfusculus (Fallén)	0	0.00	0	0.00	0	0.00	0	0.00	2	0.09	0	0.00	2	0.02
Stiroma affinis Fieber	0	0.00	44	1.72	0	0.00	0	0.00	0	0.00	2	0.13	46	0.39
Streptanus brevipennis (Kirchbaum)	28	0.87	2	0.08	7	0.49	18	1.95	58	2.63	122	7.76	235	1.98
Other	643	19.95	477	18.68	590	41.61	248	26.90	236	10.69	271	17.23	2,465	20.72
Total	3,223	100.00	2,554	100.00	1,418	100.00	922	100.00	2,207	100.00	1,573	100.00	11,897	100.00

Table 2. Distribution of leafhoppers in birch stands of the Forest District Sněžník (ground traps, 1988–1998)

Locality	Tisá		Ostrov		Sněžník		Vlčák		Kristin Hrádek		Letadlo		Total	
Species	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)
Agallia venosa (Fourcroy)	1	0.06	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	0.01
Allygus modestus (Scott)	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	2	0.13	2	0.02
Anaceratagallia ribauti (Ossiannilsson)	0	0.00	1	0.12	0	0.00	0	0.00	0	0.00	0	0.00	1	0.01
Anoscopus flavostriatus (Donovan)	268	16.83	270	31.43	377	30.23	205	14.16	375	14.76	260	17.03	1,755	19.00
Aphrodes albiger (Germar)	0	0.00	1	0.12	0	0.00	0	0.00	0	0.00	0	0.00	1	0.01
Aphrophora alni (Fallén)	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	0.07	1	0.01
Arocephalus languidus (Flor)	0	0.00	0	0.00	0	0.00	2	0.14	0	0.00	0	0.00	2	0.02
Arocephalus longiceps (Kirchbaum)	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	0.07	1	0.01
Arthaldeus pascuellus (Fallén)	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	0.07	1	0.01
Cercopis vulnerata Illiger	2	0.13	0	0.00	0	0.00	0	0.00	3	0.12	1	0.07	6	0.07
Cicadella viridis (Linnaeus)	1	0.06	0	0.00	1	0.08	1	0.07	2	0.08	0	0.00	5	0.05
Cixius cunicularius (Linnaeus)	0	0.00	0	0.00	3	0.24	0	0.00	0	0.00	0	0.00	3	0.03
Cixius nervosus (Linnaeus)	1	0.06	2	0.23	0	0.00	0	0.00	0	0.00	2	0.13	5	0.05
Conomelus anceps (Germar)	12	0.75	0	0.00	0	0.00	7	0.48	2	0.08	0	0.00	21	0.23
Deltocephalus pulicaris (Fallén)	1	0.06	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	0.01
Dikraneura variata Hardy	12	0.75	7	0.81	4	0.32	1	0.07	2	0.08	6	0.39	32	0.35
Diplocolenus abdominalis (Fabricius)	0	0.00	0	0.00	0	0.00	0	0.00	3	0.12	1	0.07	4	0.04
Diplocolenus bohemani (Zetterstedt)	52	3.27	4	0.47	10	0.80	37	2.56	137	5.39	54	3.54	294	3.19
Diplocolenus bohemani calceolatus Boheman	1	0.06	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	0.01
Doratura stylata Boheman	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	3	0.20	3	0.03
Elymana sulphurella (Zetterstedt)	7	0.44	2	0.23	1	0.08	1	0.07	1	0.04	0	0.00	12	0.13
Eupelix cuspidata (Fabricius)	0	0.00	0	0.00	1	0.08	0	0.00	0	0.00	4	0.26	5	0.05
Euscelis incisus (Kirchbaum)	1	0.06	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	0.01
Hyledelphax elegantula (Boheman)	288	18.09	211	24.56	89	7.14	171	11.81	148	5.83	186	12.18	1,093	11.86
Jassargus allobrogicus (Ribaut)	565	35.49	155	18.04	551	44.19	824	56.91	1,159	45.63	555	36.35	3,809	41.34
Javesella discolor (Boheman)	3	0.19	3	0.35	3	0.24	1	0.07	0	0.00	0	0.00	10	0.11
Javesella dubia (Kirchbaum)	3	0.19	1	0.12	0	0.00	0	0.00	1	0.04	1	0.07	6	0.07

Table 2 to be continued

Locality	Tisá		Ostrov		Sněžník		Vlčák		Kristin Hrádek		Letadlo		Total	
Species	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)
Javesella forcipata (Boheman)	5	0.31	2	0.23	1	0.08	0	0.00	1	0.04	0	0.00	9	0.10
Javesella obscurella (Boheman)	17	1.07	24	2.79	0	0.00	11	0.76	9	0.35	6	0.39	67	0.73
Javesella pellucida (Fabricius)	1	0.06	0	0.00	0	0.00	0	0.00	3	0.12	0	0.00	4	0.04
Kybos virgator (Ribaut)	2	0.13	0	0.00	0	0.00	1	0.07	1	0.04	0	0.00	4	0.04
Macrosteles laevis (Ribaut)	1	0.06	0	0.00	0	0.00	0	0.00	0	0.00	1	0.07	2	0.02
Macustus grisescens (Zetterstedt)	11	0.69	4	0.47	0	0.00	3	0.21	24	0.94	2	0.13	44	0.48
Neophilaenus exclamationis (Thumberg)	0	0.00	0	0.00	0	0.00	1	0.07	0	0.00	3	0.20	4	0.04
Neophilaenus lineatus (Linnaeus)	6	0.38	5	0.58	2	0.16	4	0.28	16	0.63	1	0.07	34	0.37
Neophilaenus minor (Kirchbaum)	0	0.00	2	0.23	1	0.08	4	0.28	4	0.16	0	0.00	11	0.12
Oncopsis flavicollis (Linnaeus)	4	0.25	0	0.00	0	0.00	2	0.14	3	0.12	3	0.20	12	0.13
Oncopsis tristis (Zetterstedt)	4	0.25	2	0.23	3	0.24	3	0.21	3	0.12	1	0.07	16	0.17
Paluda flaveola (Boheman)	0	0.00	0	0.00	0	0.00	0	0.00	1	0.04	0	0.00	1	0.01
Paluda parvispina (Wagner)	0	0.00	0	0.00	0	0.00	0	0.00	1	0.04	0	0.00	1	0.01
Philaenus spumarius (Linnaeus)	1	0.06	3	0.35	0	0.00	0	0.00	1	0.04	0	0.00	5	0.05
Planaphrodes bifasciata (Linnaeus)	1	0.06	3	0.35	20	1.60	4	0.28	3	0.12	18	1.18	49	0.53
Psammotettix cephalotes (Herrich-Schaffer)	1	0.06	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	0.01
Psammotettix confinis (Dahlbom)	0	0.00	1	0.12	1	0.08	0	0.00	0	0.00	0	0.00	2	0.02
Psammotettix helvolus (Kirchbaum)	9	0.57	2	0.23	5	0.40	3	0.21	2	0.08	43	2.82	64	0.69
Speudotettix subfusculus (Fallén)	0	0.00	0	0.00	0	0.00	1	0.07	0	0.00	2	0.13	3	0.03
Stiroma affinis Fieber	0	0.00	3	0.35	0	0.00	1	0.07	0	0.00	0	0.00	4	0.04
Streptanus brevipennis (Kirchbaum)	16	1.01	3	0.35	9	0.72	16	1.10	10	0.39	68	4.45	122	1.32
Other	295	18.53	148	17.23	165	13.23	144	9.94	625	24.61	301	19.71	1,678	18.21
Total	1,592	100	859	100	1,247	100	1,448	100	2,540	100	1,527	100	9,213	100

Table 3. Crown fauna of leafhoppers in birch stands of the Forest District Sněžník (shaking down, 1988–1998)

Locality	Tisá		Ostrov		Sněžník		Vlčák		Kristin Hrádek		Letadlo		Total	
Species	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)
Allygus modestus (Scott)	1	0.29	1	0.21	0	0	0	0	0	0	0	0	2	0.07
Anoscopus flavostriatus (Donovan)	0	0	2	0.43	5	1.07	0	0	2	0.33	1	0.29	10	0.36
Aphrodes trifasciatus (Fourcroy)	0	0	0	0	0	0	10	1.97	0	0	0	0	10	0.36
Aphrophora alni (Fallén)	4	1.15	46	9.79	51	10.9	13	2.56	5	0.83	3	0.86	122	4.44
Aphrophora salicina (De Geer)	0	0	0	0	0	0	1	0.2	0	0	1	0.29	2	0.07
Cercopis vulnerata Illiger	14	4.02	15	3.19	26	5.56	26	5.12	146	24.17	10	2.88	237	8.63
Cicadella viridis (Linnaeus)	1	0.29	0	0	3	0.64	4	0.79	1	0.17	7	2.02	16	0.58
Cixius cunicularius (Linnaeus)	0	0	0	0	1	0.21	0	0	1	0.17	0	0	2	0.07
Cixius nervosus (Linnaeus)	1	0.29	0	0	0	0	1	0.2	0	0	1	0.29	3	0.11
Cixius stigmaticus (Germar)	0	0	0	0	1	0.21	0	0	0	0	0	0	1	0.04
Dikraneura variata (Hardy)	0	0	0	0	2	0.43	0	0	0	0	0	0	2	0.07
Diplocolenus bohemani (Zetterstedt)	2	0.57	0	0	0	0	0	0	0	0	0	0	2	0.07
Elymana sulphurella (Zetterstedt)	0	0	1	0.21	0	0	0	0	0	0	0	0	1	0.04
Hyledelphax elegantula (Boheman)	0	0	0	0	0	0	1	0.2	1	0.17	1	0.29	3	0.11
Jassargus allobrogicus (Ribaut)	1	0.29	7	1.49	2	0.43	2	0.39	1	0.17	0	0	13	0.47
Kybos virgator (Ribaut)	4	1.15	13	2.77	6	1.28	3	0.59	11	1.82	12	3.46	49	1.79
Macustus grisescens (Zetterstedt)	0	0	0	0	0	0	1	0.2	3	0.5	0	0	4	0.15
Neophilaenus exclamationis (Thumberg)	0	0	1	0.21	0	0	0	0	0	0	2	0.58	3	0.11
Neophilaenus lineatus (Linnaeus)	19	5.46	19	4.04	15	3.21	21	4.13	25	4.14	2	0.58	101	3.68
Neophilaenus minor (Kirchbaum)	1	0.29	1	0.21	0	0	7	1.38	0	0	0	0	9	0.33
Oncopsis flavicollis (Linnaeus)	174	50	188	40	157	33.55	261	51.38	214	35.43	137	39.48	1,131	41.2
Oncopsis tristis (Zetterstedt)	93	26.72	157	33.4	123	26.28	103	20.28	161	26.66	59	17	696	25.36
Philaenus spumarius (Linnaeus)	0	0	4	0.85	0	0	0	0	0	0	0	0	4	0.15
Planaphrodes bifasciata (Linnaeus)	0	0	0	0	1	0.21	0	0	0	0	1	0.29	2	0.07
Psammotettix helvolus (Kirchbaum)	0	0	1	0.21	0	0	0	0	0	0	0	0	1	0.04
Streptanus brevipennis (Kirchbaum)	0	0	1	0.21	0	0	0	0	0	0	0	0	1	0.04
Other	33	9.49	13	2.76	75	16.02	54	10.63	33	5.47	110	31.7	318	11.61
Total	348	100	470	100	468	100	508	100	604	100	347	100	2,745	100

3% of exclusively tree-inhabiting species (some specimens were classed into families only and their feed dependence was not univocally specified). Based on the feed habits, 60% were bound to herbs only, 21% to wetland herbs, 0.2% to herbs and trees, 0.2% to birch trees and 2.8% to other trees.

Using the method of shaking down, we captured 83% of tree-inhabiting species and in addition also 16% of species of the herb layer. Out of the tree species 9.6% were bound both to trees and herbs, 78.6% exclusively to birch and/or goat willow trees, and 4.7% to other broad-leaved trees.

The ground traps concentrated species of the herb layer (83.8% – 67% were bound exclusively to the herb layer and 16.8% to wetland herbs); only 0.6% were tree-inhabiting species.

CONCLUSION

Using photoeclectors, ground traps, the method of shaking down and yellow trays in stands of the forest district Sněžník we captured 23,855 larvae and imagoes and 55 leafhopper species.

The ground photoeclectors confirmed the incidence of 38 species in birch stands, the most important of which were *A. flavostriatus* (48.8%), *N. lineatus* (8.1%) and *H. elegantula* (5.3%). The leafhoppers were most abundant in the Tisá locality (41.8 specimens/m per year), while in the Vlčák locality it was only 11.9 specimens/m per year.

In birch stands 33 species were captured in the ground traps, with the highest abundance of the species *J. allobrogicus* (41.3%), *A. flavostriatus* (19%) and *H. elegantula* (11.9%). The highest abundance was reported in the Kristin Hrádek locality and the lowest in stands of the Ostrov locality (23.1 and 7.8 specimens per ground trap/year, respectively).

The crown fauna consisted of 26 leafhopper species; *O. flavicollis* (41.2%) and *O. tristis* (25.4%) were eudominant species, accompanied by *C. vulnerata* (8.6%) and *A. alni* (4.4%).

By means of the applied methods of collection (photoeclectors, ground traps) the entire spectrum of leafhoppers bound to the herb undergrowth was captured and only a limited range of tree-inhabiting species that were captured using the method of shaking down.

During the period of investigations no damage or weakening of birch stands occurred due to the sucking activities of leafhoppers. Chlorosis appeared locally in the Litvínov transect during checks of defoliation.

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Fauna křísů v porostech břízy (*Betula pendula* Roth)

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ABSTRAKT: V porostech břízy (*Betula pendula* Roth) Děčínské pískovcové vrchoviny (severní Čechy) tvořilo faunu křísů 55 druhů zachycených metodou fotoeklektorů, zemních pastí, sklepáváním (23 855 ex. larev a imag). K dominantním zástupcům travních a bylinných podrostů březových porostů se řadí *Jassargus allobrogicus, Anoscopus flavostriatus, Neophilaenus lineatus, Hyledelphax elegantula, Diplocolenus bohemani, Streptanus brevipennis, Macustus grisescens, Planaphrodes bifasciata* a *Cercopis vulnerata.* Z korunové fauny může při vysoké abundanci sáním oslabit růst břízy dominantní *Oncopis flavicollis* a méně hojný *O. tristis.*

Klíčová slova: bříza; fauna křísů; fotoeklektory; zemní pasti; sklepávání; imisní oblast

Fauna křísů byla systematicky sledována metodou sklepávání, fotoeklektorů a zemních pastí v porostech břízy (*Betula pendula* Roth) LS Sněžník po celé vegetační období (IV.–X.) v letech 1988–1998.

Korunová fauna byla hodnocena v šesti porostech břízy sklepáváním na plachtu 2 × 2 m z pěti stromů každé lokality ve 14denním intervalu.

Jedinci opouštějící půdní prostředí a druhy vázané k bylinnému patru byli kontrolováni v sedmidenním intervalu pomocí fotoeklektorů instalovaných před začátkem vegetační doby pod koruny bříz. Souběžně byl odebírán materiál ze zemních pastí, kterých bylo umístěno na každé ploše deset.

Celkem bylo za 11 let zachyceno 2 745 imag a larev křísů v korunách stromů, 11 897 ks ve fotoeklektorech a 9 213 křísů v zemních pastech.

V porostech břízy (*Betula pendula* Roth) Děčínské pískovcové vrchoviny (severní Čechy) tvořilo faunu křísů 55 druhů zachycených metodou fotoeklektorů, zemních pastí, sklepáváním (23 855 ex. larev a imag). K dominantním zástupcům travních a bylinných podrostů březových porostů se řadí *Jassargus allobrogicus, Anoscopus flavostriatus, Neophilaenus lineatus, Hyledelphax elegantula, Diplocolenus bohemani, Streptanus brevipennis, Macustus grisescens, Planaphrodes bifasciata* a *Cercopis vulnerata.*

Abundance výskytu druhů nacházejících se v podrostu březových a jehličnatých porostů se významně liší při odchytu do zemních pastí. Například *A. flavostriatus* dosahoval v bříze 1 755 ex. a v jehličnanech 766 ex. s dominancí 19 % a 25,4 %; *Dikraneura variata* byla v opačném poměru – v bříze 32 ex. (0,35 %) a v jehličnatých porostech 130 ex. (4,3 %). Bohatší travní pokryv vyhovoval více druhu *Diplocolenus bohemani* v porostech bříz 294 ex. (3,2 %), zatímco v jehličnatých porostech dosáhl 2,2 % (66 ex.). Stínomilný a vlhkomilný *Hyledelphax elegantula* byl velmi hojný pod břízami 1 093 ex. (11,9 %) i jehličnany (10,9 %) a dvakrát vyšší dominanci v porostech břízy prokázal *J. allobrogicus* (41,3 % × 21,4 %), který je uváděn ze zabuřeněných ploch smrkových porostů (JAVOREK 1978). Podobně lze hodnotit druhy *Neophilaenus lineatus,* který žije nejčastěji na mokrých podhorských loukách, v rašeliništích, a *Macustus grisescens, Streptanus brevipennis.*

Z druhů, které mohou sáním oslabit růst břízy, to byl dominantní *Oncopis flavicollis* a méně hojný *O. tristis.* Tyto dva druhy při hromadném výskytu larev mohou představovat určité ohrožení mladých porostů.

Účinnost metod sběru se odvíjí i od typu potravní vazby křísů. Ve fotoeklektorech bylo zachyceno 82 % jedinců vázaných na bylinný podrost, a pouze 3 % tvořily druhy výhradně arborikolní (část jedinců byla determinována pouze do čeledi a nebyla stanovena jednoznačně potravní vazba). Pouze k bylinám bylo vázáno 60 % jedinců, k bylinám mokřadů 21 %, k bylinám a stromům 0,2 %, k bříze 0,2 % a k jiným stromům 2,8 %.

Metoda sklepávání kromě podchycených arborikolních zástupců (83 %) vykázala i 16 % druhů bylinného patra. Ze stromových druhů bylo 9,6 % současně vázáno na stromy a byliny, 78,6 % výhradně na břízu, případně vrby, a 4,7 % na jiné listnáče.

V zemních pastech se soustředily druhy bylinného patra (83,8 %, z toho 67 % jedinců bylo výhradně vázáno na bylinné patro, 16,8 % na byliny mokřadů), arborikolní zástupci tvořili pouze 0,6 %.

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