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**Neuropteran (*Planipennia* and *Raphidioptera*; *Neuropteroidea*)
communities of coniferous forests in the Kampinoska Forest and in Białoleka
Dworska near Warsaw**

[With 4 Figures and 2 Tables in the text]

Abstract. The species composition and the structure of the communities of *Neuropteroidea* were studied in tree canopies in mixed coniferous forests (*Pino-Quercetum*) and in pine forests (*Peucedano-Pinetum*) near Warsaw. A comparison was made of the parameters of neuropteran communities from natural forests (the Kampinoska Forest) and from anthropogenized forests homologous to the former (Białoleka Dworska).

INTRODUCTION

Over 60 species of *Planipennia* (= *Neuroptera* s. str.) and 7 species of *Raphidioptera* live in Poland. *Planipennia* occur commonly in various forest habitats and in other wooded ones such as parks, gardens, orchards etc. Certain species, secondarily adapted to treeless areas, inhabit agrocoenoses. *Raphidioptera*, represented by only a few species, do not form abundant populations. Most frequently, they are found in warm coniferous and deciduous forests.

The ecological role of neuropterans has been studied fairly well only in agrocoenoses; at present, under way are investigations on how to utilize *Chrysoperla carnea* in the biological control of plant pests. But knowledge of the significance of these insects in forest habitats is very poor. Neuropterans generally lead a nocturnal life and, moreover, most of them stay in tree canopies throughout their life cycle. Therefore, they are difficult of access.

In the zoocoenological studies conducted recently by the Institute of Zoology PAS, in Warsaw, Moericke's traps suspended in tree canopies were one of the

methods applied. They proved successful for sampling lacewings and camelneck-flies. On the basis of materials thus obtained the neuropteran fauna of the town green of Warsaw has been worked out (CZECHOWSKA 1982, 1985), and the neuropterans of linden-oak-hornbeam forests in the Mazovian Lowland are being worked out.

The aim of the present paper is to determine roughly the species composition and structure of the communities of *Neuropteroidea* in coniferous forests in Mazovia and to compare the communities from natural and anthropogenized habitats.

TIME AND AREA OF THE INVESTIGATIONS

Catches were carried out in 1976 and 1977 in two mixed coniferous forests (*Pino-Quercetum*), one natural and one anthropogenized and in two moist pine forests (*Peucedano-Pinetum*), one natural and one anthropogenized.

The two natural forests are situated at the edge of the north-eastern part of the Kampinos National Park (the Kampinoska Forest). The anthropogenized forests are in Białoleka Dworska which is a peripheral, northern district of Warsaw, 14 km from the city centre. The entire area of Białoleka Dworska has been strongly restructured during many years of management. Most of the area is occupied by crop fields and gardens. Areas with poorer soils have been afforested secondarily (BAŃKOWSKA, GARBARCZYK 1981).

Phytosociological characteristics of the habitats

Mixed coniferous forests (*Pino-Quercetum*)

Natural forest (the Kampinoska Forest). The habitat covers 2.5 ha; it also comprises parts of a mixed deciduous forest. The 65–75-year-old tree stand consists mainly of *Quercus robur* with a relatively small share of *Betula verrucosa* and *Pinus silvestris*. 40-year-old *Pinus silvestris* grows in the central part, in groups and separately. The undergrowth covering 80% of the area consists of *Quercus robur*, *Juniperus communis*, *Frangula alnus*, and *Betula verrucosa*. From the north and west the site is surrounded with a moist pine forest (*Peucedano-Pinetum*) and from the east and south with a young (35 years old) wet alderwood (*Carici elongatae-Alnetum*) stretching along a bog (BAŃKOWSKA, GARBARCZYK 1981).

Anthropogenized forest (Białoleka Dworska). The habitat covers 2–3 ha. It is situated at the foot of a dune embankment and it is connected with the pine forest (*Peucedano-Pinetum*) growing over the embankment. The 30-year-old tree stand consists of *Quercus robur* and *Betula verrucosa*. The undergrowth consists of *Quercus robur*, *Betula verrucosa*, and *Pinus silvestris*. Old oaks (120–150 years old) grow on the edge. The mixed coniferous forest is adjacent to a birch wood (30–35 years old) covering 0.5 ha. From three sides the birch wood is surrounded with gardens (BAŃKOWSKA, GARBARCZYK 1981, ROO-ZIELIŃSKA 1981).

Moist pine forests (*Peucedano-Pinetum*)

Natural forest (the Kampinoska Forest). The habitat covers 26 ha and in the crest part of the dunes it comprises fragments of a dry pine forest (*Cladonio-Pinetum*). *Pinus silvestris* predominates in the 70–80-year-old tree stand and the share of *Betula verrucosa* and *Quer-*

cus robur is very small. The tree cover is moderate and discontinuous at places. The undergrowth consists mainly of *Juniperus communis*, *Quercus robur*, and *Picea excelsa* growing separately and in groups (BAŃKOWSKA, GARBARCZYK 1981).

Anthropogenized forest (Białoleka Dworska). The character of the forest is transitional between *Peucedano-Pinetum* and *Cladonio-Pinetum*. The 30-year-old tree stand is highly degraded and consists of *Pinus silvestris*, *Betula verrucosa*, and *Quercus robur*. The habitat occupies a 3-km-long belt which is generally 1 km wide, and it joins a big forest complex which is diversified in respect of age and which consists mainly of *Pinus silvestris*, *Betula verrucosa*, and *Quercus robur* (BAŃKOWSKA, GARBARCZYK 1981, ROO-ZIELIŃSKA 1981).

METHODS AND MATERIAL

Neuropterans were caught by means of Moericke's traps (MOERICKE 1950). They were yellow plastic cups 18 cm in diameter, filled with a water solution of ethylene glycol with some detergent. They were suspended in the upper parts of tree canopies. At each plot, 3 trees were selected: an oak (*Quercus robur*), a birch (*Betula verrucosa*), and a pine (*Pinus silvestris*). Three cups were suspended in each tree. Catches took place from April to November. Material was collected at 5- and 10-day intervals. The present paper studies the material from 5-day samples. However, in order to check whether the qualitative composition and the abundance of neuropterans differed in the two types of samples, the 10-day samples from all the plots in 1977 were also inspected. No significant differences in the species composition were recorded. The abundance of neuropterans in terms of the number of individuals caught into 1 cup during 24 hours (abundance index) was also very similar. The differences did not exceed 3%.

The basic material consisted of 1608 individuals. Determinations were made on the basis of a monograph by H. ASPÖCK, U. ASPÖCK and HÖLZEL (1980).

CHARACTERISTICS OF THE COMMUNITIES

Structure of the communities in the mixed coniferous forests

Twenty one species of *Planipennia* and 2 species of *Raphidioptera* were caught in the natural forest. The abundance index of the community was 0.691. *Anisochrysa prasina* was the dominant species and *Chrysoperla carnea* the subdominant. Of the other species, *Coniopteryx parthenia* and *Raphidia notata* were fairly numerous.

Fourteen species of *Planipennia* and 3 species of *Raphidioptera* were recorded in the anthropogenized forest. The abundance index of the community was 0.332. *Chrysoperla carnea* was the dominant. The group of subdominants included *Anisochrysa prasina*, *Coniopteryx parthenia*, and *Hemerobius humulinus*. *Raphidia notata* was the most abundant among *Raphidioptera* (Tab. I).

Altogether 25 species of *Planipennia* and 3 species of *Raphidioptera* were recorded in tree canopies of both mixed coniferous forests. Only 12 species were

Table I. Species composition and abundance of *Neuropteroidea* in the researched habitats
(*n* – abundance index; + – abundance lower than 0.001)

No	Species	Habitat, locality	Mixed coniferous forest (<i>Pino-Quercetum</i>)				Moist pine forest (<i>Peucedano-Pinetum</i>)			
			Kampinoska Forest		Białoleka Dworska		Kampinoska Forest		Białoleka Dworska	
			<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
<i>Raphidioptera</i>										
1	<i>Raphidia ophiopsis</i> LINNAEUS		—	—	0.002	0.6	0.006	1.1	0.020	3.5
2	<i>Raphidia notata</i> FABRICIUS		0.024	3.5	0.016	4.8	0.011	2.1	—	—
3	<i>Raphidia xanthostigma</i> SCHUMMEL		0.006	0.9	0.003	0.9	0.020	3.8	0.006	1.1
4	<i>Inocellia crassicornis</i> (SCHUMMEL)		—	—	—	—	0.001	0.2	—	—
<i>Planipennia</i>										
5	<i>Aleuropteryx loewii</i> KLAPALEK		—	—	—	—	0.002	0.4	0.002	0.4
6	<i>Coniopteryx tineiformis</i> CURTIS		—	—	—	—	—	—	0.002	0.4
7	<i>Coniopteryx borealis</i> TJEDER		—	—	0.005	1.5	—	—	0.001	0.2
8	<i>Coniopteryx parthenia</i> (NAVAS et MARCET)		0.043	6.2	0.037	11.4	0.046	8.7	0.072	12.5
9	<i>Parasemidalis fuscipennis</i> (REUTER)		0.003	0.4	—	—	0.007	1.3	—	—
10	<i>Semidalis aleyrodiformis</i> (STEPHENS)		—	—	—	—	—	—	0.003	0.5
11	<i>Conventzia psociformis</i> (CURTIS)		+	+	—	—	—	—	0.003	0.5
12	<i>Conventzia pineticola</i> ENDERLEIN		0.004	0.6	—	—	0.002	0.4	0.005	0.9
13	<i>Drepanopteryx phalaenoides</i> (LINNAEUS)		+	+	—	—	—	—	—	—
14	<i>Wesmaelius concinnus</i> (STEPHENS)		0.006	0.9	0.011	3.3	0.056	10.6	0.012	2.1
15	<i>Wesmaelius nervosus</i> (FABRICIUS)		—	—	0.002	0.6	0.001	0.2	0.004	0.7
16	<i>Wesmaelius subnebulosus</i> (STEPHENS)		—	—	0.001	0.3	—	—	—	—
17	<i>Wesmaelius mortoni</i> (MCLACHLAN)		—	—	—	—	+	+	—	—
18	<i>Hemerobius humulinus</i> LINNAEUS		0.009	1.3	0.024	7.2	0.037	7.0	0.030	5.2
19	<i>Hemerobius stigma</i> STEPHENS		0.004	0.6	0.007	2.1	0.001	0.2	0.002	0.4
20	<i>Hemerobius pini</i> STEPHENS		0.002	0.3	—	—	—	—	0.002	0.4
21	<i>Hemerobius nitidulus</i> FABRICIUS		0.004	0.6	0.002	0.6	0.004	0.8	0.009	1.6
22	<i>Hemerobius micans</i> OLIVIER		0.001	0.1	0.004	1.2	0.003	0.6	0.001	0.2
23	<i>Symphorobius pygmaeus</i> (RAMBUR)		+	+	—	—	—	—	—	—

24	<i>Sympherobius elegans</i> (STEPHENS)	—	—	—	—	—	—	0.001	0.2
25	<i>Sympherobius fuscescens</i> (WALLENGREN)	—	—	0.002	0.6	—	—	0.002	0.4
26	<i>Nineta flava</i> (SCOPOLI)	0.003	0.4	0.005	1.5	0.002	0.4	0.007	1.2
27	<i>Nineta vittata</i> (WESMAEL)	0.003	0.4	—	—	—	—	—	—
28	<i>Chrysotropia ciliata</i> (WESMAEL)	0.001	0.1	—	—	+	+	—	—
29	<i>Chrysopa dorsalis</i> BURMEISTER	0.001	0.1	—	—	—	—	+	+
30	<i>Chrysopa septempunctata</i> WESMAEL	0.006	0.9	0.002	0.6	0.013	2.5	—	—
31	<i>Anisochrysa prasina</i> (BURMEISTER)	0.432	62.5	0.074	22.3	0.272	51.2	0.287	50.0
32	<i>Anisochrysa ventralis</i> (CURTIS)	0.009	1.3	—	—	+	+	+	+
33	<i>Chrysoperla carnea</i> (STEPHENS)	0.129	18.7	0.135	40.7	0.043	8.1	0.103	17.9
34	<i>Cunctochrysa albolineta</i> (KILLINGTON)	0.001	0.1	—	—	0.002	0.4	+	+
Total		0.691		0.332		0.529		0.574	

common to both sites. The degree of qualitative similarity (after Sørensen's formula) of the forests studied was fairly low — 60%.

The compared neuropteran communities differed in the number of species, the abundance and the dominance structure. The community from the natural habitat was richer both in respect of quality and quantity. However, the community was characterized by a very uneven distribution of the proportions of particular species. The disproportion between the share of the dominant and the shares of the other species was considerable. In the anthropogenized mixed coniferous forest the abundance of neuropterans was lower twice but the proportion of particular species was more even. The lower abundance of the community was first of all due to a decreased abundance of *Anisochrysa prasina*.

The unusually high abundance of *Anisochrysa prasina* in the natural mixed coniferous forest indicates that the species found its most favourable habitat conditions there. Considerably, for as much as sixfold lower abundance in the coniferous forest in Białoleka Dworska indicates that for this species the site conditions are worse. It is probably connected with greater shadiness of this habitat.

Structure of the communities in the moist pine forests

Eighteen species of *Planipennia* and 4 species of *Raphidioptera* were caught in the natural forest. The abundance index of the community was 0.529 on average. *Anisochrysa prasina* was the most numerous species. The next positions were occupied by *Wesmaelius concinnus*, *Coniopteryx parthenia*, *Chrysoperla carnea*, and *Hemerobius humulinus*. Among *Raphidioptera*, the most abundant was *Raphidia xanthostigma*.

Twenty two species of *Planipennia* and 2 species of *Raphidioptera* were recorded in the homologous anthropogenized forest. The abundance of this community was 0.574. Just as in the natural forest, *Anisochrysa prasina* constituted about 50 percent. The next positions were occupied by *Chrysoperla carnea* and *Coniopteryx parthenia*. Of the remaining species, *Hemerobius humulinus* and *Raphidia ophiopsis ophiopsis* were fairly abundant (Table I).

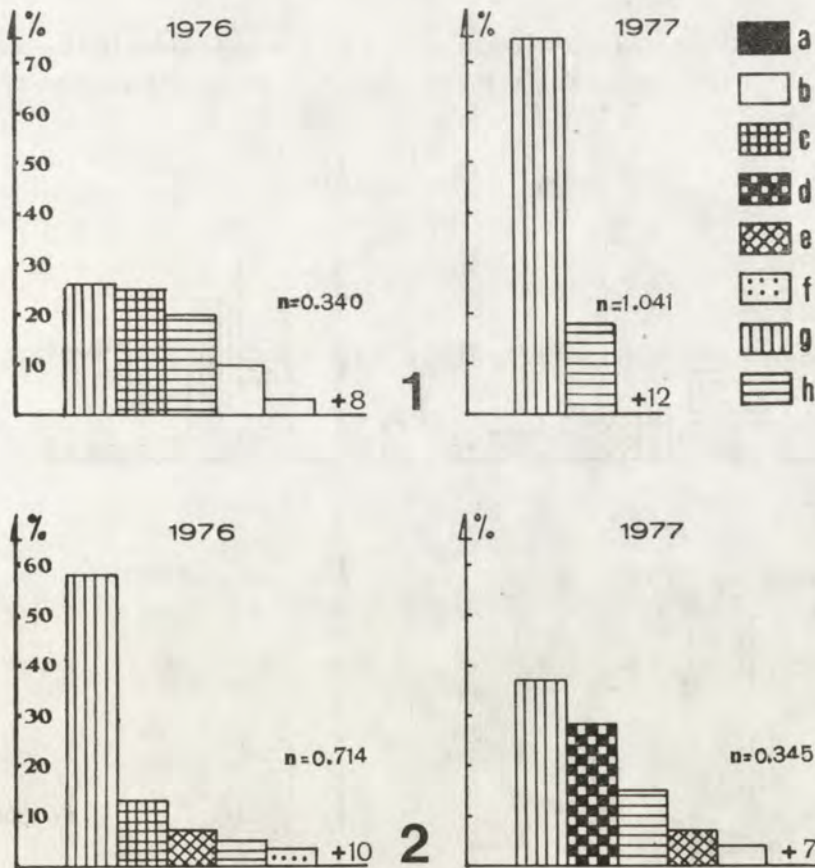
Altogether 26 species of *Planipennia* and 4 species of *Raphidioptera* were recorded in both pine forests. The index of qualitative similarity of the communities was a little higher than for the mixed coniferous forests — 69%. The compared communities differed slightly in respect of the number of species and their abundance. They were also characterized by a certain similarity of the dominance structures. Both in the Kampinoska Forest and in Białoleka Dworska, *Anisochrysa prasina* was the dominant and it constituted about a half of the total abundance of the communities. There were differences in the positions of the subdominants. In the natural forest, with respect to abundance *Wesmaelius concinnus* was the second species. In the anthropogenized forest its proportion was five times lower and chiefly at its cost the proportion of *Chrysoperla carnea* was higher.

The number of species of *Raphidioptera* recorded in the natural pine forest

exceeded by 2 the number recorded in the anthropogenized forest and it included the fairly rare *Inocellia crassicornis*. The species of *Raphidioptera* most frequently caught in the Kampinoska Forest was *Raphidia xanthostigma* and in Białołęka Dworska — *Raphidia ophiopsis ophiopsis*.

General remarks about the communities of neuropterans
in the coniferous forests

The total number of species of *Neuropteroidea* recorded in the four coniferous forests investigated was 34 and it included 30 species of *Planipennia* and 4 species of *Raphidioptera*. Ten species were common to all the plots and they were: *Raphi-*



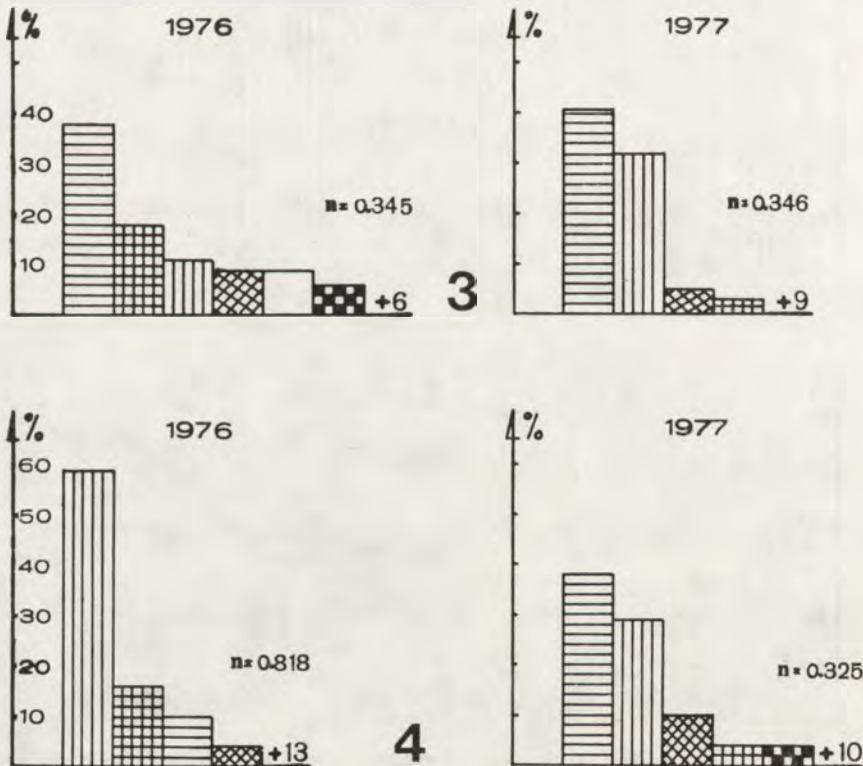
Figs 1 and 2. Differences in the dominance structures of the communities of *Neuropteroidea* in the natural coniferous forests in the Kampinoska Forest (1 — mixed coniferous forest; 2 — moist pine forest) in the successive years of investigations (1976, 1977) (a — *Raphidia ophiopsis ophiopsis*; b — *R. notata*; c — *Coniopteryx parthenia*; d — *Wesmaelius concinnus*; e — *Hemerobius humulinus*; f — *Chrysopa septempunctata*; g — *Anisochrysa prasina*; h — *Chrysoperla carnea*; + ... — number of accessory species not included in the diagram; n — abundance index of the community).

dia xanthostigma, *Coniopteryx parthenia*, *Wesmaelius concinnus*, *Hemerobius humulinus*, *H. stigma*, *H. nitidulus*, *H. micans*, *Nineta flava*, *Anisochrysa prasina*, and *Chrysoperla carnea*. Only 4 of these: *Wesmaelius concinnus*, *Hemerobius humulinus*, *Anisochrysa prasina*, and *Chrysoperla carnea* were recorded in all the 4 plots during the two years of investigations.

There were 24 species common to both types of habitats. Therefore, the similarity index of the faunas of the mixed coniferous forests and of the moist pine forests is high – 83%.

Among the species common to both types of habitats, some demonstrated a preference for one type. For instance, *Raphidia ophiopsis ophiopsis*, *R. xanthostigma*, *Wesmaelius concinnus*, and *Hemerobius humulinus* were caught more frequently in the moist pine forests while *Raphidia notata* in the mixed coniferous forests.

The mean abundance of the communities of *Neuropteroidea* in the coniferous forests studied was 0.533. The values obtained in particular seasons oscillated



Figs 3 and 4. Differences in the dominance structures of the communities of *Neuropteroidea* in the anthropogenized coniferous forests in Białoleka Dworska (3 – mixed coniferous forest; 4 – moist pine forest) in the successive years of investigations (1976, 1977) (symbols as in Figs 1 and 2).

between 0.325 and 1.041. The most convergent and the most frequently (5 times) obtained results oscillated around the value 0.350. With this value of the index, the dominance structure of the community was characterized by the most even distribution of the shares of particular species (Figs 1–4). Higher values of the index were generally due to a tremendous increase in the abundance of *Anisochrysa prasina*. Outbreaks of these insects led to considerable disproportions between the share of this species and that of the other *Neuropteroidea*. An extreme case of this occurred in 1977 in the natural mixed coniferous forest when within a very high abundance of the community (1.041) *Anisochrysa prasina* constituted 74%. As a result of the outbreak of this species and a fairly numerous occurrence of *Chrysoperla carnea* these two species constituted 92% of the community. The proportions of the other 12 species were only from 0.2 to 1.3%.

Practically all species of lacewings were characterized by fluctuations in their abundance. However, in the case of species of low or medium abundance, they sometimes were completely absent from the samples of a given season. This can be exemplified by *Coniopteryx parthenia* which in 1976 was the subdominant in the Kampinoska Forest. Its proportion in the community of the mixed coniferous forest was 25.5% and in that of the pine forest it was 12.8%. During the following season, the species was never found in the samples from these two habitats.

Ecological characteristics of the species

Half of the species of neuropterans recorded in the coniferous forests were xerophilous or photophilous insects. In these habitats, higrophilous and shado-philous species were recorded rarely. This ecological element was represented by *Chrysotropia ciliata*, *Nineta flava*, *Nineta vittata*, and *Anisochrysa ventralis*. The presence of *Chrysotropia ciliata* in the natural coniferous forests was undoubtedly incidental and connected with the fact that there was a wet alderwood nearby. The above species and *Nineta flava* constituted the core of the communities of lacewings in the linden-oak-hornbeam forests (*Tilio-Carpinetum*) of Mazovia (CZECHOWSKA, in preparation).

The connections of neuropterans with a particular habitat are also greatly influenced by their food requirements. Indirectly, through selection with regard to their prey (phytophages), *Planipennia* and also *Raphidioptera* demonstrate connections with particular plants.

The core of the communities of *Neuropteroidea* in the coniferous forests studied consisted of polyphages that could feed on phytophages of both coniferous and deciduous trees. They included, first of all, the following species: *Anisochrysa prasina*, *Chrysoperla carnea*, and *Hemerobius humulinus*. The proportion of this group of neuropterans oscillated between 68 and 87% of the abundance of the communities (Tab. II).

Species living in coniferous forests constituted the group that characterized the coniferous forests. There were 13 such species recorded and of these 7 were

closely connected with the pine. Within the group under discussion, the smallest number of species (6) was caught in the anthropogenized mixed coniferous forest and the greatest (10 in each) in both moist pine forests (natural and anthropogenized). The proportion of individuals of these species in the communities from the pine forests in the Kampinoska Forest and in Białoleka Dworska was 23.7 and 22.2%, respectively (Tab. II). In the natural forest, the most numerous were the representatives of *Wesmaelius concinnus* and *Coniopteryx parthenia*

Table II. Proportions of the particular biotic groups in the communities of *Neuropteroidea* in the investigated habitats

(N – number of species; n – abundance index; % – percentage share in the total abundance of the community)

Biotic group \ Habitat, locality	Mixed coniferous forest						Moist pine forest					
	Kampinoska Forest			Białoleka Dworska			Kampinoska Forest			Białoleka Dworska		
	N	n	%	N	n	%	N	n	%	N	n	%
Species associated with coniferous trees	8	0.067	9.7	10	0.125	23.7	6	0.061	18.6	10	0.126	22.0
Species associated with deciduous trees	10	0.021	2.9	6	0.040	7.7	5	0.019	5.7	8	0.023	4.0
Species associated with coniferous and deciduous trees	5	0.603	87.3	6	0.364	68.6	6	0.252	75.8	6	0.425	74.0
Total	23	0.691		22	0.529		17	0.332		24	0.574	

while in the anthropogenized forest mainly *Coniopteryx parthenia*. Of scarce species, there must be mentioned 1 specimen (♂) of *Wesmaelius mortoni* caught in the natural pine forest. Earlier, another specimen of the species (also ♂) had been caught by means of a light trap in 1977 in Warsaw (CZECHOWSKA, unpublished). Up till now, in Poland *Wesmaelius mortoni* has been recorded only from the Tatras (ZAĆWILICHOWSKI 1939).

In the mixed coniferous forests, the abundance of species living in coniferous trees was lower. In the natural forest, the proportion of their individuals was 9.7% and in the anthropogenized one 18.6%. In both plots, the most abundant was *Coniopteryx parthenia*.

Species living in deciduous trees had the lowest proportion. This group, though consisting of 13 species constituted 2.9% of the abundance of the communities in the natural mixed coniferous forest and 5.7% of that in the anthropogenized one. In the moist pine forests these proportions were 7.7% (natural) and 4.1% (anthropogenized) (Tab. II).

The abundance of *Neuropteroidea* obtained from trees of particular species

indicate that neuropteran imagines occurred much more numerous on deciduous trees than on pines. On average, only 19 % of all imagines caught came from pines while 36 % came from birches and 45 % from oaks. These proportions were more or less similar in all the plots. This was probably due to differences in the thermic-humidity conditions of the canopies of deciduous and coniferous trees. The majority of neuropterans caught in pines belonged to species whose diet made them closely connected to phytophages of coniferous trees. At the same time, this group of neuropterans is characterized by higher thermic and lower moisture requirements. Therefore, it is adapted to living in light canopies of pines. Imagines of species more sensitive to overdrying seek shelter in canopies of deciduous trees which provide more shade. For instance, 50 % of all caught individuals of *Anisochrysa prasina* came from oaks, 40 % from birches and only 10 % from pines. The situation was similar in the case of *Chrysoperla carnea* and *Hemerobius humulinus*¹. However, it must be pointed out that the distribution of neuropteran larvae can be entirely different, this being indicated by the results of investigations conducted in Warsaw parks (CZECHOWSKA 1985).

Coniferous forests provide very favourable living conditions for *Anisochrysa prasina*. The most numerous occurrence of this species was recorded in the natural mixed coniferous forest. In the moist pine forests *Anisochrysa prasina* was equally abundant in 70-year-old and in 30-year-old tree stands. The lowest abundance of this species was recorded in the anthropogenized mixed coniferous forest (Tab. I).

In the coniferous forests, with respect to abundance, *Chrysoperla carnea* was the second species. These lacewings, characterized by a very great ecological amplitude, inhabit all habitats. However, as the dominant they are recorded most frequently in those habitats where abundant occurrence of species of lower plasticity is impossible. *Chrysoperla carnea* is rarely the dominant in habitats providing the ecological optimum for other species. Long-term investigations carried out in natural linden-oak-hornbeam forests of Mazovia and in Warsaw (parks and the green of housing estates) have revealed that this species is generally a subdominant occupying the second or third position (CZECHOWSKA 1985). An analogous situation was recorded in the natural coniferous forests where *Chrysoperla carnea* always was the subdominant. An increase in the abundance of this species was recorded in the anthropogenized coniferous forests, especially in the mixed coniferous forest where the species was the dominant during the two seasons.

¹ Lacewings are very sensitive indicators of the microclimatic conditions of a habitat. Depending on the local microclimate, within the same association of species there arise communities with different dominance structures. For instance, in one Warsaw park, according to the degree of insolation and humidity of particular plots the dominants were *Chrysoperla carnea*, *Anisochrysa prasina* or *Nineta flava* (CZECHOWSKA 1985).

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STRESZCZENIE

[Tytuł: Zgrupowania siatkoskrzydłych (*Planipennia* i *Raphidioptera*; *Neuropteroidea*) borów w Puszczy Kampinoskiej i w Białolece Dworskiej koło Warszawy]

Zbadano skład gatunkowy i strukturę zgrupowań siatkoskrzydłych (*Neuropteroidea*) w naturalnych i zantropogenizowanych borach mieszanych (*Pino-Quercetum*) i borach sosnowych świeżych (*Peucedano-Pinetum*). Bory naturalne znajdowały się w Kampinoskim Parku Narodowym, zantropogenizowane na terenie peryferyjnej dzielnicy Warszawy – Białoleki Dworskiej. Wiek drzewostanu w borach naturalnych wynosił 70–100 lat, w zantropogenizowanych ok. 30 lat. Materiał pobierano w latach 1976 i 1977 w koronach dębów (*Quercus robur*), brzoź (*Betula verrucosa*) i sosen (*Pinus silvestris*) przy użyciu szalek Moericke'go.

Łącznie w badanych środowiskach stwierdzono 30 gatunków sieciarek (*Planipennia*) i 4 gatunki wielbłądek (*Raphidioptera*). W borach mieszanych odłowiono 28, a w borach sosnowych świeżych 30 gatunków siatkoskrzydłych. Podobieństwo faun środowisk tych typów było wysokie – 83% (wg wzoru Sörensena).

Огółем доминowały *Anisochrysa prasina* (BURM.) i *Chrysoperla carnea* (STEPH.). Доść liczny był także *Coniopteryx parthenia* (NAVAS et MARCET) i, локальнє, *Wesmaelius concinnus* (STEPH.). Wśród *Raphidioptera* przeważały: w borach mieszanych — *Raphidia notata* FABR., w borach sosnowych świeżych — *R. xanthostigma* SCHUMM. i *R. ophiopsis ophiopsis* L.

Najwyższą liczebność (wskaźnik 0,691) miało zgrupowanie w naturalnym borze mieszanym. Liczebność zgrupowań z obu borów sosnowych była również wysoka. W borze naturalnym przeciętna wartość wskaźnika wynosiła 0,529, w borze zantropogenizowanym — 0,540. Najniższą średnią liczebność (0,332) miało zgrupowanie z zantropogenizowanego boru mieszanego.

Zgrupowania siatkoskrzydłych z badanych borów sosnowych (naturalnego i zantropogenizowanego) wykazywały duże podobieństwo pod względem liczby gatunków, liczebności i struktury dominacyjnej. Natomiast zgrupowania z naturalnego i zantropogenizowanego boru mieszanego różniły się pod tymi względami znacznie. Zgrupowanie z boru naturalnego było bogatsze w gatunki, jak i bardziej liczebne.

Pod względem liczebności wśród siatkoskrzydłych borów obu typów przeważały gatunki światło- i cieplolubne oraz formy o szerokim zakresie fagizmu. Zwłaszcza *Anisochrysa prasina* znajdowała w badanych borach szczególnie korzystne warunki bytowania, stanowiąc 50–70 % liczebności zgrupowań.

Charakterystyczne dla badanych środowisk były gatunki troficznie związane z fitofagami drzew iglastych. Gatunków takich stwierdzono łącznie 13 (7 z nich to formy ściśle związane z sosną). Najliczniejszymi reprezentantami tej grupy były *Coniopteryx parthenia* i *Wesmaelius concinnus*.

РЕЗЮМЕ

[Заглавие: Сообщества сетчатокрылых (*Planipennia* и *Raphidioptera*; *Neuropteroidea*) из боров Кампиносской пуши и Бялоленки-Дворской около Варшавы]

Исследовали видовой состав и структуру сообществ сетчатокрылых (*Neuropteroidea*) в природных и находящихся под влиянием человеческой деятельности смешанных борах (*Pino-Quercetum*) и в свежих сосновых борах (*Peucedano-Pinetum*). Природные боры находились в пределах Кампиносского национального парка, находящиеся под влиянием антропогенного фактора — на территории периферического района Варшавы — Бялоленки-Дворской. Возраст лесонасаждений природных боров колебался от 70 до 100 лет; в Бялоленке-Дворской — около 30 лет. Материал для исследований был собран в 1976 и 1977 г.г., в кронах дубов (*Quercus robur*) берез (*Betula verrucosa*) и сосен (*Pinus sylvestris*), при помощи мисок Мерицкого.

Всего в исследованных биотопах констатировали 30 видов настоящих сетчатокрылых (*Planipennia*) и 4 вида верблюдок (*Raphidioptera*). В смешанных борах отловлено

28 видов, а в сосновых свежих борах — 30 видов сетчатокрылых. Сходство фаун биотопов этих типов было узкое — 83% (согласно формуле Соренсена).

Обычно доминировали *Anisochrysa prasina* (BURM.) и *Chrysoperla carnea* (STERN.). Довольно многочисленный был также *Coniopteryx parthenia* (NAVAS et MARCET) и местами *Wesmaelius concinnus* (STERN.). Среди *Raphidioptera* преобладали: в смешанных борах — *Raphidia notata* FABR., в свежих сосновых борах — *R. xanthostigma* SCHUMM. и *R. ophiopsis ophiopsis* L.

Наибольшую численность (показатель 0,691) достигало сообщество в природном смешаном боре. Численность сообщества в обоих типах сосновых боров была также высокая. В природном боре величина показателя составляла в среднем 0,529, в антропогенизированном боре Бялоленки-Дворской — 0,540. Самая низкая средняя численность сообщества наблюдалась в антропогенизированном смешаном боре.

Сообщество сетчатокрылых из исследованных сосновых боров (как природных, так и под влиянием антропогенного фактора) отличалось большим сходством с точки зрения числа видов, их численности и структуры доминации. В то время, как сообщества из природного и антропогенизированного смешаного бора значительно отличались по перечисленным показателям. Сообщество из природного бора было более богатым в виды, как и более многочисленным.

С точки зрения численности преобладали среди сетчатокрылых обоих типов бора виды свето- и теплолюбивые и с широкоми пределами фагизма. В исследованных борах особенно благоприятные условия существования находила *Anisochrysa prasina*, которая составляла 50–70% численности сообществ.

Характерными для исследованных биотопов были виды, связанные трофически с фитофагами хвойных деревьев. Таких видов было всего 13 (7 из них — это формы тесно связанные с сосной). Наиболее многочисленными представителями этой группы были *Coniopteryx parthenia* и *Wesmaelius concinnus*.