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THE ESTIMATION OF THE PRESERVATION DEGREE FOR WET BIOTOPES OF THE POLESKI NATIONAL PARK BASED ON SPECIES RICHNESS OF CHRYSOMELID (COLEOPTERA, CHRYSOMELIDAE) COMMUNITIES

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Summary. 98 chrysomelid species were collected during the studies regarded chrysomelid communities of wet biotopes of the Poleski National Park. Among these 98 species – 50 (51%) demonstrated the qualities of bioindicators for these types of habitats (hydro-, higro-, and mesohigrophilous species).The highest chrysomelid species richness was found in rushes**,** and the lowest in high-peat bog**.** The analogical results occurred during the comparison of the species diversity indexes for chrysomelid communities of these two habitats. The high preservation and natural state degrees of the studied area occurred in rushes and also in low-peat bogs and osier scrubs that are populated by the wet biotope beetles, as well as by the rare species in the whole country scale. The species richness of chrysomelid communities inhabiting wet biotopes reached the level as high as the one in the Lasy Janowskie Landscape Park and was significantly higher than the one in the Kozłowiecki Landscape Park.

Key words: leaf-beetles, Chrysomelidae, Poleski National Park, species diversity, wet biotopes

INTRODUCTION

The fauna of the Poleski National Park (PNP) is extremely poorly known. Until now only two faunistic works have been published, regarding the occurrence of 16 hydrophilous species (from *Donacia* and *Plateumaris* genera) of the subfamily Donaciinae [Pietrykowska and Staniec 1997] as well as 7 species new for that area, of the subfamilies: Cryptocephalinae, Galerucinae and Alticinae [Ścibior and Pietrykowska-Tudruj 2008]. Two following publications describing the next 117 new species for PNP are currently at the final stage of the publishing process: Ścibior and Pietrykowska-Tudruj [2010], Ścibior [2010 – in press].

Among the numerous beetle families of Polish fauna, chrysomelids play the leading role as the indicator species of the habitats in which they occur. Selected species of this family are an important source of information on ecosystem abilities, as they consistently respond to adverse ecosystem changes.

Studies regarding the estimation of the preservation degree of natural habitats using Chrysomelidae as bioindicators (on the synecological and autecological level) were conducted already 30 years ago in Germany and recently in Poland [Gräf and Koch 1981, Raj 1997, Wąsowska 2005, Ścibior and Dunus 2006].

The anthropogenic pressure causes rapid changes in chrysomelid species formation that often embrace stenotopic species, in this case: hydro-, higro- and mesohigrophilous ones (including relict) which are first eliminated from the habitat when changes – both natural and anthropogenic – take place. The aim of the research presented here was an attempt to estimate the quality of wet biotopes of the Poleski National Park, based on the chrysomelid fauna and bioindicative attributes of its representatives.

RESEARCH AREA, MATERIAL AND METHODS

The studies on the chrysomelid beetles were conducted in the years 2005–2008 at 17 research localities of PNP area and close (up to 100 m) to its borders (in the buffer zone) (Fig. 1). The samples containing leaf-beetles material were collected regularly in each full vegetative season (from the beginning of April till the end of September) with 2–3 week intervals in between.

The wet biotopes of the PNP as the chrysomelids catching area were divided in two conventional groups: 3 forest types (almond willow-osier scrubs, Central-European alder fen forest, osier scrubs) and 5 wide-open types (moist meadows, rush communities, low-, transitional-, and high peat-bogs).

In this study the phytosociological terminology has been used according to Matuszkiewicz [2005].

The studied forest communities are successively: typical form of Central-European alder fen forest – association *Ribeso nigri-Alnetum*, osier scrubs (*Salicetum pentandro-cinereae*) accumulated in the peat-bogs area and almond willow-osier scrubs (*Salicetum triandro-viminalis*). The studied moist meadows associations belonged to *Molinietalia caeruleae* order and *Molinion caeruleae*, but mostly to *Calthion palustris* alliances. The transitional/low peat-bogs were assembled together with *Caricion nigrae* alliance from the *Scheuchzerio-Caricetea nigrae* class; the transitional peat-bogs assembled also with *Magnocaricion* alliance. The rush communities contained several associations of diverse physiognomy from *Phragmitetea* class, whereas high peat-bogs were represented by two associations: *Sphagnetum magellanici* and – significantly rarer – *Ledo-Sphagnetum magellanici*.

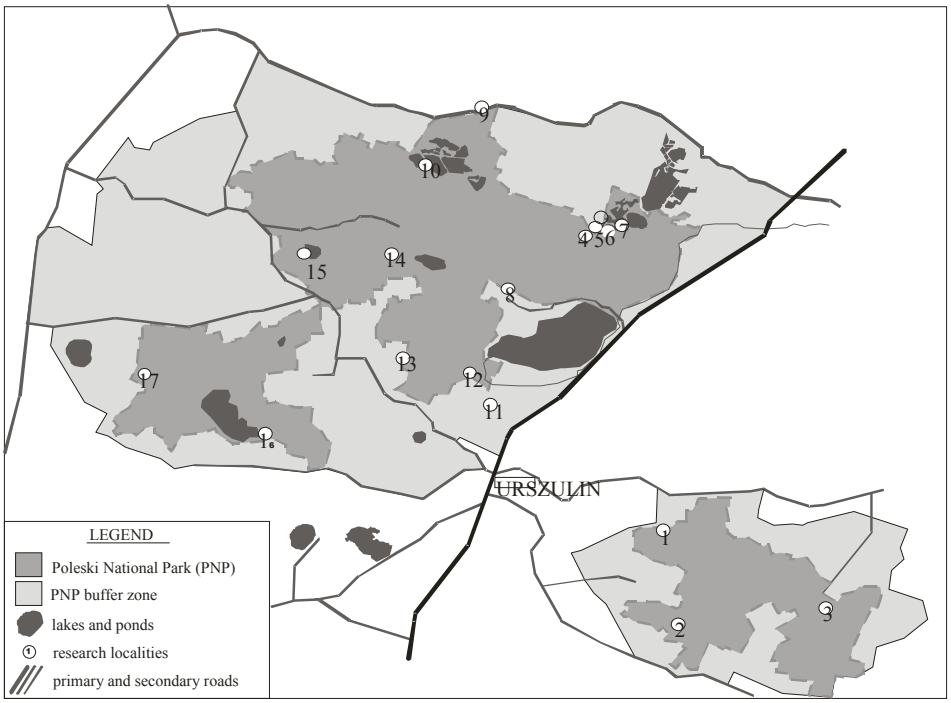

Fig. 1. Numbering of the research localities in the Poleski National Park area (and its buffer zone): peat-bog „Bubnów" at Zastawie (1), Czemiernik at Sęków (2), peat-bog „Staw" at Gatyska (3), Mietiułka at Nowiny (4), Nowiny (5), pond „Graniczny" at Nowiny (6), pond „Perkoz" at Nowiny (7), Wólka Wytycka (8), Tabakówka (9), pond „Dziki" at Pieszowola (10), lake Karaśne at Michałowska Grobelka (11), forest „Brzeziny" at Michałowska Grobelka (12), Dzikie Łąki at Olszowo (13), Mszary at Kol. Wola Wereszczyńska (14), lake Moszne at Jamniki (15), peat-bog „Spławy" at Załucze Stare (16), Blizionki at Lejno (17)

The methods of collecting the chrysomelids from the forest communities were catching them into the entomological umbrella or using the sweep-net. From other communities insects were collected using only the sweep-net.

In the analysis the species richness was specified, and the structure of dominance (D%) and Shannon-Wiener biodiversity index were calculated.

RESULTS

In total, the chrysomelid communities found in the wet biotopes of the investigated area numbered 98 species (2151 individuals), which comprised circa 21.5% of chrysomelid fauna in Poland. Four undetermined taxons (additional 64 indiv.) were excluded from the quantitative calculations. These taxons were represented by females of the genus *Altica* (40) and females of the species *Oulema melanopus/duftschmidi* (7), *Chaetocnema concinna/picipes* (10) and *Longitarsus succineus/noricus* (7) (Tab. 1). The highest value for the species

richness for the chrysomelid community was obtained in rushes – 51, similar results (29–36) were obtained for the forest communities, moist meadows and transitional/low peat-bogs. The lowest richness was determined for high peat--bogs (10) (Fig. 2).

Table 1. The full list of leaf-beetles collected in wet biotopes of the Poleski National Park and their structure of dominance. A – total abundance; biotopes: [1] – moist meadows, [2] – almond willow-osier scrubs (*Salicetum triandro-viminalis*), [3] – Middle-European alder fen forests (*Ribeso nigri-Alnetum*), [4] – osier scrubs (*Salicetum pentandro-cinereae*), [5] – rush communities, [6] – low peat-bogs, [7] – transitional peat-bogs, [8] – high peat-bogs. Names of taxa after Löbl. Smetana [2010]. The list of species is given in alphabetical order

No.	Taxa	A	Structure of dominance (%) of leaf-beetles communities in the investigated biotopes [1–8]							
			[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
1	*Agelastica alni*	40	-	2.5	0.8	2.9	5.4	1.3	-	2.2
2	*Altica brevicollis*	2	0.5	-	-	-	-	-	-	-
-	*Altica* n. det. (♀)	40	-	-	-	-	-	-	-	-
3	*Altica palustris*	2	-	-	-	-	0.9	-	-	-
4	*Altica quercetorum*	1	-	-	-	-	0.5	-	-	-
5	*Aphthona euphorbiae*	3	-	-	-	0.9	-	-	-	-
6	*Aphthona lutescens*	271	40.6	-	0.8	0.6	5.9	24.5	18.7	2.2
7	*Aphthona nonstriata*	36	0.3	-	2.5	4.9	0.5	3.2	3.1	-
8	*Neocrepidodera brevicollis*	9	2.0	-	-	-	-	0.6	-	-
9	*Neocrepidodera ferruginea*	10	-	1.2	-	0.3	0.5	-	0.3	-
10	*Neocrepidodera motschulskii*	3	-	-	-	-	-	-	1.0	-
11	*Neocrepidodera nigritula*	1	-	-	-	-	0.5	-	-	-
12	*Neocrepidodera transversa*	12	1.8	0.2	-	-	0.9	0.6	0.3	-
13	*Cassida denticollis*	1	-	-	-	-	0.5	-	-	-
14	*Cassida flaveola*	11	0.3	0.7	-	-	2.3	0.6	-	-
15	*Cassida prasina*	1	0.3	-	-	-	-	-	-	-
16	*Cassida rubiginosa*	14	-	0.2	0.8	0.9	3.2	1.3	-	-
17	*Cassida vibex*	11	0.3	-	-	0.6	3.2	0.6	-	-
18	*Cassida viridis*	28	0.5	-	1.6	-	8.1	3.9	-	-
19	*Cassida vittata*	1	-	-	-	-	-	0.6	-	-
20	*Chaetocnema aridula*	4	-	-	-	0.3	0.5	-	0.7	-
-	*Chaetocnema concinna/picipes* (♀)	10	-	-	-	-	-	-	-	-
21	*Chaetocnema hortensis*	4	-	-	-	-	0.9	-	0.3	2.2
22	*Chaetocnema mannerheimii*	5	0.5	0.2	-	-	0.9	-	-	-
23	*Chaetocnema picipes*	3	0.3	-	-	0.3	-	-	0.3	-
24	*Chaetocnema procerula*	2	0.3	-	-	-	-	-	0.3	-
25	*Chaetocnema sahlbergii*	5	1.0	-	-	-	-	0.6	-	-
26	*Chrysolina herbacea*	2	-	-	-	-	-	1.9	-	-
27	*Chrysolina polita*	20	1.8	0.2	0.8	-	2.3	1.9	1.0	-

28	*Chrysolina varians*	17	0.8	1.1	4.1	-	0.9	0.6	-	-
29	*Chrysomela cuprea*	1	-	-	0.8	-	-	-	-	-
30	*Chrysomela populi*	31	1.0	0.7	4.9	3.2	2.7	-	-	-
31	*Chrysomela saliceti*	120	-	20.1	0.8	0.3	1.4	-	-	-
32	*Chrysomela tremula*	1	-	-	-	0.3	-	-	-	-
33	*Chrysomela vigintipunctata*	29	-	4.6	-	0.3	0.9	-	-	-
34	*Clytra laeviuscula*	2	-	-	-	0.6	-	-	-	-
35	*Coptocephala rubicunda*	1	-	-	-	-	-	0.6	-	-
36	*Crepidodera aurata*	239	-	35.6	0.8	9.3	1.4	-	-	-
37	*Crepidodera fulvicornis*	86	-	6.0	1.6	9.9	6.8	0.6	-	-
38	*Cryptocephalus bilineatus*	6	0.8	-	-	-	0.5	0.6	0.3	-
39	*Cryptocephalus decemmaculatus*	30	0.5	0.2	-	-	0.5	-	7.8	6.7
40	*Cryptocephalus fulvus*	2	-	0.2	-	-	-	-	0.3	-
41	*Cryptocephalus janthinus*	44	9.8	-	-	-	0.5	1.3	0.7	-
42	*Cryptocephalus labiatus*	4	-	-	0.8	-	-	-	1.0	-
43	*Cryptocephalus ocellatus*	22	-	3.9	-	-	-	-		-
44	*Cryptocephalus octopunctatus*	1	-	-	-	0.3	-	-	-	-
45	*Cryptocephalus pusillus*	5	-	0.7	-	0.3	-	-	-	-
46	*Cryptocephalus pygmaeus*	1	-	-	-	-	0.5	-	-	-
47	*Cryptocephalus sericeus*	2	-	0.2	-	-	0.5	-	-	-
48	*Dibolia occultans*	5	0.3	-	-	-	0.5	0.6	0.7	-
49	*Donacia aquatica*	3	-	-	-	-	0.5	1.3	-	-
50	*Donacia clavipes*	8	-	-	-	-	3.6	-	-	-
51	*Donacia impressa*	1	-	-	-	-	-	-	-	2.2
52	*Epitrix pubescens*	28	-	-	8.2	3.2	-	3.2	0.7	-
53	*Galeruca tanaceti*	2	-	0.2	-	-	0.5	-	-	-
54	*Galerucella calmariensis*	31	2.5	-	-	-	5.4	1.9	1.7	2.2
55	*Galerucella grisescens*	119	-	-	29.5	3.5	13.5	26.5	-	-
56	*Galerucella lineola*	19	-	1.6	1.6	1.4	1.4	-	-	-
57	*Galerucella pusilla*	17	1.8	-	-	-	0.9	1.9	1.7	-
58	*Galerucella tenella*	70	12.6	-	-	1.2	3.2	1.9	2.0	-
59	*Gastrophysa viridula*	1	-	-	-	-	0.5	-	-	-
60	*Gonioctena quinquepunctata*	10	-	0.7	3.3	0.6	-	-	-	-
61	*Hippuriphila modeeri*	2	-	-	-	-	0.5	-	0.3	-
62	*Hypocassida subferruginea*	2	0.5	-	-	-	-	-	-	-
63	*Lochmaea cepreae*	149	0.5	0.5	0.8	0.3	0.9	-	39.5	53.3
64	*Longitarsus fulgens*	1	-	-	-	-	-	0.6	-	-
65	*Longitarsus luridus*	1	0.3	-	-	-	-	-	-	-
66	*Longitarsus melanocephalus*	1	0.3	-	-	-	-	-	-	-

67	*Longitarsus noricus*	1	-	-	-	-	-	0.6	-	-
68	*Longitarsus rubiginosus*	1	-	-	-	-	0.5	-	-	-
-	*Longitarsus succineus/noricus* (♀)	7	-	-	-	-	-	-	-	-
69	*Lythraria salicariae*	143	14.6	1.8	4.1	2.6	4.5	12.9	10.5	-
70	*Oulema duftschmidi*	1	0.3	-	-	-	-	-	-	-
71	*Oulema gallaeciana*	12	0.5	0.2	0.8	-	2.7	0.6	0.3	-
-	*Oulema melanopus/duftschmidi* (♀)	7	-	-	-	-	-	-	-	-
72	*Pachybrachis hieroglyphicus*	11	-	0.9	-	-	2.7	-	-	-
73	*Phaedon armoraciae*	2	-	-	-	-	0.9	-	-	-
74	*Phratora laticollis*	110	-	0.9	5.7	28.1	0.5	-	-	-
75	*Phratora tibialis*	67	-	8.1	3.3	4.9	-	-	-	-
76	*Phratora vitellinae*	4	0.3	0.4	-	0.3	-	-	-	-
77	*Phratora vulgatissima*	13	-	1.4	0.8	0.6	-	0.6	0.3	-
78	*Phyllobrotica quadrimaculata*	7	1.5	-	-	-	0.5	-	-	-
79	*Phyllotreta atra*	3	0.3	-	-	0.3	-	-	0.3	-
80	*Phyllotreta cruciferae*	4	-	0.4	-	-	-	0.6	-	2.2
81	*Phyllotreta nemorum*	4	-	-	-	0.3	-	-	0.3	4.4
82	*Phyllotreta nigripes*	1	-	-	-	-	-	0.6	-	-
83	*Phyllotreta ochripes*	1	-	-	-	-	-	-	0.3	-
84	*Phyllotreta striolata*	1	-	-	-	-	0.5	-	-	-
85	*Phyllotreta undulata*	1	-	-	-	-	-	-	0.3	-
86	*Phyllotreta vittula*	13	0.5	0.2	-	0.6	-	-	2.7	-
87	*Pilemostoma fastuosum*	1	-	-	-	-	0.5	-	-	-
88	*Plagiodera versicolora*	65	-	4.4	4.1	8.4	2.7	-	-	-
89	*Plagiosterna aenea*	2	-	0.5	0.8	2.3	-	-	-	-
90	*Plateumaris rustica*	2	-	-	-	-	-	-	0.7	-
91	*Plateumaris sericea*	11	-	-	-	-	-	-	0.3	22.2
92	*Prasocuris marginella*	1	-	-	0.8	-	-	-	-	-
93	*Psylliodes affinis*	20	-	-	4.1	4.1	-	-	0.3	-
94	*Psylliodes cucullatus*	1	-	-	-	1.4	-	-	0.3	-
95	*Psylliodes dulcamarae*	18	-	-	9.8	-	-	0.6	-	-
96	*Pyrrhalta viburni*	1	-	-	0.8	-	-	-	-	-
97	*Smaragdina salicina*	2	0.5	-	-	-	-		-	-
98	*Sphaeroderma testaceum*	1	-	-	-	-	0.5		-	-
	Total	2215								

The dominance structure of chrysomelids in every particular plant community (Tab. 1) was as follows: moist meadows [1] – eudominants: *Aphthona lutescens* (40.6), *Lythraria salicariae* (14.6), *Galerucella tenella* (12.6); dominants: *Cryptocephalus janthinus* (9.8); almond willow-osier scrubs [2] – eudominants: *Crepidodera aurata* (35.6), *Chrysomela saliceti*; dominants: *Phratora tibialis* (8.1), *Crepidodera fulvicornis* (6.0); Central-European alder fen forests [3] – eudominant *Galerucella grisescens* (29.5); dominants: *Psylliodes dulcamarae* (9.8), *Epitrix pubescens* (8.2), *Phratora laticollis* (5.7); osier scrubs [4] – eudomi-

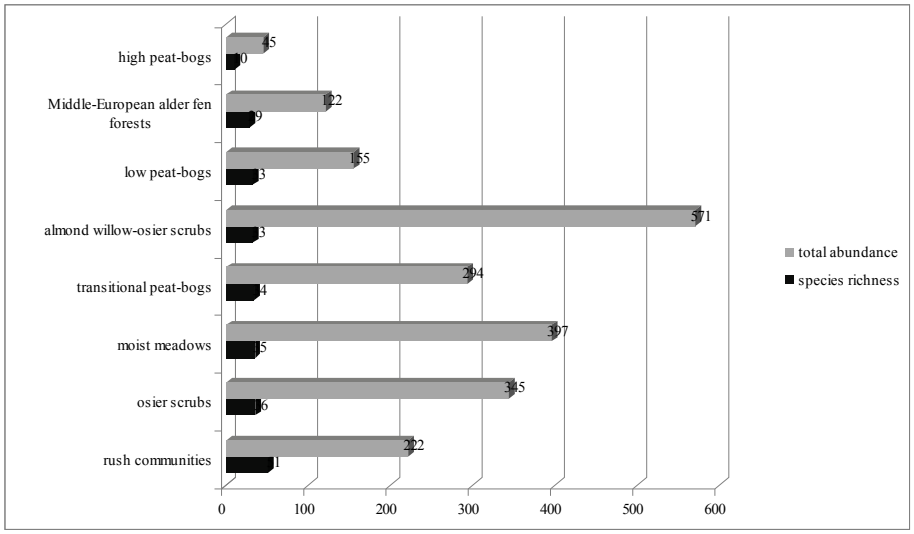

Fig. 2. Total abundance and species richness of leaf-beetles in investigated biotopes of the Poleski National Park

nant *Phratora laticollis* (28.1); dominants: *Crepidodera fulvicornis* (9.9), *C. aurata* (9.3), *Plagiodera versicolora* (8.4); rush communities [5] – eudominant *Galerucella grisescens* (13.5); dominants: *Cassida viridis* (8.1), *Crepidodera fulvicornis* (6.8), *Aphthona lutescens* (5.9), *Agelastica alni* (5.4), *Galerucella calmariensis* (5.4); low peat-bogs [6] – eudominants: *Galerucella grisescens* (26.5), *Aphthona lutescens* (24.5), *Lythraria salicariae* (12.9); dominants: none; transitional peat-bogs [7] – eudominants: *Lochmaea capreae* (39.5), *Aphthona lutescens* (18.7), *Lythraria salicariae* (10.5); dominant *Cryptocephalus decemmaculatus* (7.8); high peat-bogs [8] – eudominants: *Lochmaea capreae* (53.3), *Plateumaris sericea* (22.2); dominants: none.

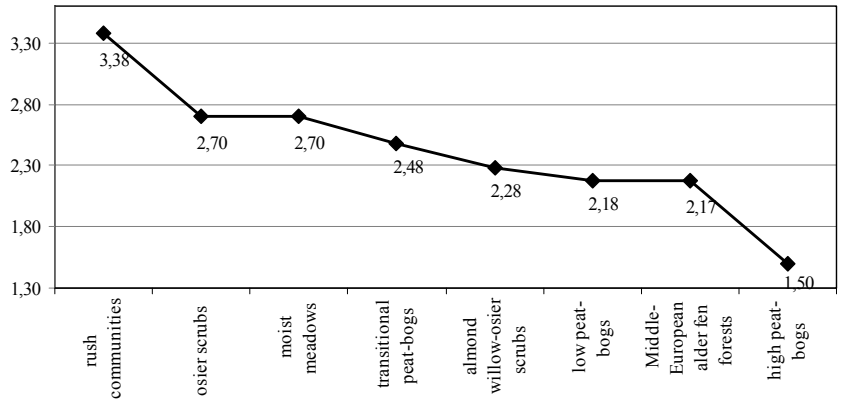

Fig. 3. Values of Shannon-Wiener diversity index of leaf-beetle communities in investigated biotopes of the Poleski National Park

The number of 10 eu- and dominant species of particular communities of the Park area were described earlier by Gräf and Koch [1981] as bioindicators for wet biotopes of Rhineland in Germany. In the PNP the species considered as the bioindicators were higro- and mesohigrophilous: *Agelastica alni*, *Cassida vibex*, *Crepidodera aurata*, *C. fulvicornis*, *Epitrix pubescens*, *Galerucella calmariensis*, *G. pusilla*, *G. tenella*, *Plagiodera versicolora*, *Plateumaris sericea*.

In the investigated wet biotopes of the Park the highest value of the species diversity index was obtained for the chrysomelid communities in rushes (3.38), stable values occurred together in the forests, moist meadows and transitional/low peat-bogs (2.17–2.7) and the lowest for the high peat-bogs (1.5) (Fig. 3).

DISCUSSION

In south-eastern Poland the preservation degree of similar wet biotopes regarding the chrysomelid beetles occurrence was carefully studied only in the landscape park areas such as Kozłowiecki and Lasy Janowskie [Ścibior 2002a; Ścibior and Dunus 2006]. Therefore, there is still a lack of comprehensive data for the particular ecological analysis.

The obtained values of the Shannon-Wiener index showed explicitly that the highest natural state degree was demonstrated by chrysomelid communities mostly in the rushes, then in the alder communities (both forest or shrub formations) and in the low peat-bogs. This is the result of the low anthropogenic pressure that occurs in this region. All these areas are simultaneously high priority biotopes and the reason for the ecological protection. The chrysomelid communities of the moist meadows and high peat-bogs attained the lowest preservation value. In the case of the meadows this value stands in proportion to the fact that the meadows are anthropogenic areas, often under agricultural use (mowing). As a result – frequent changes occur in the plant layers (the height, seldom the species formation), introducing some environmental instability, mostly for the phytophagous group. The anthropogenic pressure has also an influence on the chrysomelid domination structure, since only the three higrophilous species: *Aphthona lutescens*, *Lythraria salicariae* and *Galerucella tenella* provide almost 70% of the chrysomelid species composition. The lowest value of the Shannon-Wiener index in the case of the high peat-bogs is due to the smaller variety of host plants and lesser chrysomelid population rather than to the anthropogenic pressure.

The catch of the *Longitarsus fulgens* species in the PNP area needs to be considered as a great rarity in the Polish fauna scale. This taxon, with unclear biology and ecology, was marked only several times in Poland, for example in the Lasy Janowskie area [Ścibior 2002b]. Furthermore, *Altica palustris*, *Asiorestia brevicollis*, *A. motschulskii* and *Chaetocnema procerula* species also need to be considered as rare stenotopic species in our country. All mentioned species are in close connection with wet biotopes and they show the fidelity index regarding to all areas where they occur.

CONCLUSIONS

Several types of the PNP wet biotopes are fairly stable (showing high values of species diversity index for chrysomelid communities) and better preserved (rushes, almond willow-osier scrubs), whereas some other biotopes show lesser values of species richness than the analogous biotopes in the Lasy Janowskie Landscape Park. The majority of wet biotopes of PNP are well preserved and highly natural, resulting in a small quantitative share of ubiquistic species and a very high number of hydro-, higro-, and mesohigrophilous species of chrysomelids. In the studied PNP area rare chrysomelid species in the scale of Poland have been caught, closely related to the bogs of Fennoscandia (boreal), and those mostly occurred in the bog communities of the park. All the chrysomelid communities of every wet biotopes of PNP demonstrated significantly higher richness and diversity values than in the Kozłowiecki Landscape Park.

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OCENA STOPNIA ZACHOWANIA SIEDLISK WILGOTNYCH POLESKIEGO PARKU NARODOWEGO NA PODSTAWIE BOGACTWA GATUNKOWEGO ZGRUPOWAŃ STONKOWATYCH (COLEOPTERA, CHRYSOMELIDAE)

Streszczenie. Podczas badań nad zgrupowaniami chrząszczy stonkowatych siedlisk wilgotnych Poleskiego Parku Narodowego stwierdzono ogółem występowanie 98 gatunków. Spośród nich 50 gat. (51%) wykazywało cechy biowskaźników tych siedlisk (hydro-, higro- i mezohigrofile). Największym bogactwem gatunkowym Chrysomelidae w Parku charakteryzowały się zbiorowiska szuwarowe, natomiast najmniejszym – torfowiska wysokie. Identyczne wartości uzyskano zestawiając wskaźniki bioróżnorodności zgrupowań wymienionych dwóch siedlisk. Najwyższy stopień zachowania i naturalność stwierdzono w zgrupowaniach w szuwarach, a także na torfowiskach niskich i w olsach drzewiastych, które zasiedlane były przez gatunki wskaźnikowe dla siedlisk wilgotnych oraz rzadkie w skali całego kraju. Wartości bogactwa gatunkowego zgrupowań stonkowatych biotopów wilgotnych przypominały uzyskane w Parku Krajobrazowym Lasy Janowskie oraz były większe niż w Parku Krajobrazowym Lasy Kozłowieckie.

Słowa kluczowe: chrząszcze stonkowate, Chrysomelidae, Poleski Park Narodowy, różnorodność gatunkowa, siedliska wilgotne