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Species Composition and Numerical Force of *Heteroptera* of the Lublin Coal Basin *

Skład gatunkowy i liczebność pluskwiaków różnoskrzydłych (*Heteroptera*) Lubelskiego Zagłębia Węglowego

Видовой состав и численность настоящих полужесткокрылых (*Heteroptera*) Люблинского угольного бассейна

The aim of investigations was to determine the composition of species and quantitative structure of *Heteroptera* of the Lublin Coal Basin. The material was gathered in 1977—1980 upon 8 stands located in coastal zones of the lakes: Nadrybie, Wytyckie, Dratów and Płotycze. Two of the selected communities were transitory peat-bog associations: *Caricetum limosae* (stand I) and *Caricetum lasiocarpae* (stand I), two of them were represented by high sedge associations — *Caricetum gracile* (stand III) and *Caricetum elatae* (stand IV). The other four were hay-growing meadows included among *Poa-Festucetum rubrae* (stands V—VIII) as regards phytosociological aspect.

The insects were caught by means of quantitative method, with an entomological net, taking as one sample a series of 8×25 catches. The samples were taken at 10 days' intervals during the whole vegetation season. The collected material was analysed by means of two indices; relative density and dominance. Three classes of numerical force have been distinguished — eudominants, of a share over 10%; dominants (5.1—10%); and recedents (⩽5%). More detailed information regarding the nature of the investigated communities and methods can be found in the paper preceeding (1).

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Table 1. *Heteroptera* species and their quantity, found upon the area of the Lublin Coal Basin

No.	Name of species	Kaniwola	Wólka Wytycka	Dratów	Płotycze	Kaniwola	Wólka Wytycka	Dratów	Płotycze	Sum of specimens
		stand I	stand II	stand III	stand IV	stand V	stand VI	stand VII	stand VIII	
1	2	3	4	5	6	7	8	9	10	11
1.	Eurygaster maura /L./		1			1	1			3
2.x	E. testudinaria /Geoffr./	14	3			1	2			20
3.	Aelia acuminata /L./			1		2		2	2	7
4.	Eusarcoris aeneus /Scop./	10		3	1	6				20
5.	Holcostethus vernalis /Wff./			1			1			2
6.	Carpocoris fuscispinus /Boh./						1			1
7.	C. purpureipennis /Deg./						2			2
8.	Dolycoris baccarum /L./	3	3	2		13	4	2	3	30
9.	Eurydema oleraceum /L./		3	2		5				10
10.	Picromerus bidens /L./	3			1					4
11.	Zicrona coerulea /L./			4		2		4		10
12.x	Rhopalus maculatus Fieb.	49	7		1	1	2	2		64
13.	Rh. subrufus /Gmel./					2				2
14.	Rh. parumpunctatus /Schill./					2				2
15.	Myrmus miriformis /Fall./		28	1	3	1	4			37
16.	Nysius thymi /Wff./	1	2							3
17.	Kleidocerys resedae /Pz./	2								2
18.x	Cymus glandicolor /Hhn./	31		10		1		1		43
19.	C. claviculus /Fall./	1		1	1	3	2	1	2	11
20.	Geocoris grylloides /L./				2		2			4
21.	G. dispar /Waga/						1			1
22.x	Chilacis typhae /Perr./	1								1
23.x	Pachybrachius fracticollis /Schill./	19	3	3				1		26
24.x	P. luridus /Hhn./	7		4						11
25.x	Ligyrocoris silvestris /L./		1							1
26.x	Acompus rufipes /Wff./		1		1	22	38			62
27.	Stygnocoris rusticus /Fall./			1				3		4
28.	S. pedestris /Fall./	2				9				11
29.	Orsyus silvaticus /F./					1	1			2
30.	Scolopostethus thomsoni Reut.	1				3				4
31.x	S. pilosus /Reut./							3		3
32.	Rhyparochromus pini /L./		1			1	2			4
33.x	Peritrechus nubilus /Fall./					1				1
34.	P. geniculatus /Hhn./						1			1
35.	Megalonotus chiragra /F./					1				1
36.	Berytinus minor /H.-S./	6		1		2				9
37.	Piesma maculata /Lap./				1					1
38.x	Chartoscirta cincta /H.-S./	1								1
39.x	Saldula orthochila /Fieb./				1					1
40.x	S. opacula /Zett./		2							2
41.x	S. saltatoria /L./		7	1					1	9

Table 1 continued

1	2	3	4	5	6	7	8	9	10	11
42.	Tingis ampliata /H.-S./		1				1			2
43.	T. cardui /L./	2		1		1				4
44.x	Dictyla lupuli /H.-S./	1		2						3
45.x	Agramma ruficorne /Germ./	357		2		5				364
46.x	A. laetum /Fall./	33								33
47.	Pygolampis bidentata /Gz./					1				1
48.	Coranus subapterus /Deg./	1					2			3
49.	Stalia boops Schdte.						1		1	2
50.	Nabicula limbata /Dhlb./				1					1
51.x	N. lineata /Dhlb./	7	8		1					16
52.	Nabis ferus /L./	26	7	16	10	31	37	33	4	164
53.	N. pseudoferus Rem.	17	19	12	10	18	24	51	2	153
54.	N. punctatus Costa	3	2					2		7
55.	Anthocoris nemorum /L./	2		2	6	4		1		15
56.	Deraeocoris punctulatus /Fall./	1								1
57.	Leptopterna dolobrata /L./		1		2	2	7		3	15
58.x	Teratocoris antennatus /Boh./		1							1
59.	Stenodema calcaratum /Fall./	9	2	3	3	45	21	7	13	103
60.	S. virens /L./	4		1		2	8	3		18
61.	S. laevigatum /L./					1	1			2
62.	Notostira elongata /Geoffr./	1	4	5	2	9	149	7	3	180
63.	N. erratica /L./	3	5	27	6	13	2	45	4	105
64.	Trigonotylus ruficornis /Geoffr./							10		10
65.	T. coelestialium /Kirk./	9	2	77		141	276	176	75	756
66.x	Adelphocoris ticinensis /M.-D./	1		2	2					5
67.	Calocoris norvegicus /Gmel./							1		1
68.	Lygus pabulinus /L./					1				1
69.	L. spinolai /M.-D./					1				1
70.	L. lucorum /M.-D./		1		1	1				3
71.	Exolygus rugulipennis /Popp./	23	6	22	24	58	25	28	3	190
72.	E. pratensis /L./	10	8	12	48	19	29	10	1	137
73.	Orthops campestris /L./	1				2				3
74.	O. kalmi /L./	2			2	13				17
75.	Polymerus microphthalmus E.W.					5				5
76.	P. unifasciatus /F./	1	2	1		5				9
77.	Charagochilus gyllenhali /Fall./			1				1		2
78.	Capsus ater /L./		4	2	2	3	7	1	1	20
79.x	C. wagneri Kem.		10				3			13
80.	Capsodes gothicus /L./		3		3	3	7			16
81.	Halticus apterus /L./					11				11
82.	Orthocephalus saltator /Hhn./						2			2
83.	O. vittipennis /H.-S./							1		1
84.	Pilophorus clavatus /L./	1								1
85.	Plagiognathus chrysanthemi /Wff./	1		1	1	14	2	11		30
86.	P. arcuatorum /F./			1		8				9
87.	Chlamydatus pulicarius /Fall./	11	1	9	1	77	3	12	6	120
88.	Ch. pullus /Reut./					15				15
89.	Criocoris crassicornis /Hhn./		1							1
90.x	Tytthus pygmaeus /Zett./			1						1
91.	Amblytylus nasutus /Kb./			3	3	18			2	26
92.	Hoplomachus thunbergi /Fall./	2								2
	Sum of specimens	680	152	238	140	608	671	419	126	3034

Explanation: x — hygrophilous species.

THE ANALYSIS OF MATERIAL

During four-year investigations upon all the stands there were found 92 *Heteroptera* species which concentrated 3034 specimens (Table 1).

The differentiation of relative level of density at the particular areas fluctuated from 7.7 to 37.3 specimens/sample, the numerical force being, as a rule, greater in meadow communities fauna. The same big differences were in the number of species, since at the particular stands 17—51 taxons were caught (Table 2). Upon all the stands 10 species were included among eudominants, next 5 belonged to the class of dominants. Most of the caught specimens belonged to these 15 species (54—70%). This group was the basis for tracing domination relationships among *Heteroptera* of the investigated communities.

Table 2. Amount and density of *Heteroptera* species upon the investigated stands

Parameters	Stands							
	I	II	III	IV	V	VI	VII	VIII
Number of species	42	33	36	28	51	35	27	17
Relative density	15.8	10.1	7.7	17.5	14.5	37.3	13.5	15.7

In the fauna of boggy communties (stands I, II) the species composition of eudominants and dominants was almost completely different. Only the hygrophilous *Rhopalus maculatus* was included among the dominants upon both areas (Fig. 1). In *Caricetum limosae* association a very big share and a considerable density had the hygrophilous *Agramma ruficorne* — a species living on sedges. In *Caricetum lasiocarpae* the level of density of eudominants was much lower; the species commonly occurring in various habitats belonged to that class: phytophagous, nutritively connected with with grasses *Myrmus miriformis* and predatory *Nabis pseudoferus*. To the class of dominants upon both areas belonged mainly hygrophilous species — *Rhopalus maculatus* (stands I, II), *Capsus wagneri* and *Nabicula lineata*, as well as eurytopic *Exolygus pratensis* — stand II (Fig. 1). In the fauna of boggy communities hygrophilous species had a large share; to them, among *Caricetum limosae* fell a considerable majority of specimens and nearly 30% of the whole number of species. In the other community the share of hygrophilous species is similar, though they concentrate much less specimens (Fig. 3).

Large differences were also found among *Heteroptera* of sedge communities (stands III, IV). In *Caricetum gracile* association the eudominants were found to be trophic species connected with grasses — *Tri-*

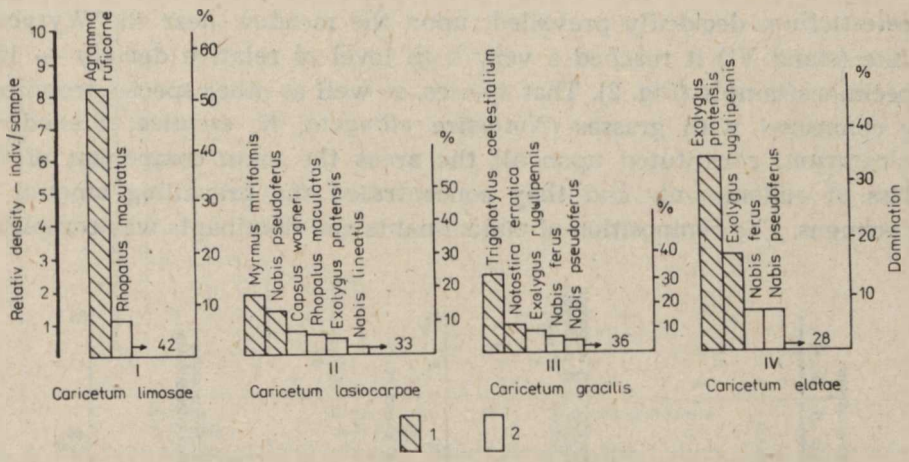

Fig. 1. Level of relative density and per cent share of *Heteroptera* among transitory peat-bog associations (stands I, II) and in high-sedge associations (stands III, IV); 1 — eudominants, 2 — dominants

gonotylus coelestialium and *Notostira erratica*, and their density level was low (Fig. 1). Differently, in *Caricetum elatae* association polyphagic phytophagous species connected mainly with bifoliate plants: *Exolygus pratensis* and *E. rugulipennis* belonged to the group of most numerous species. There was a similar composition of dominants to which on both areas zoophagic forms: *Nabis ferus* and *N. pseudoferus* belonged, as well as *Exolygus rugulipennis* — upon the area III (Fig. 1). The share of hygrophilous species, specially as regards density, was small, and they occurred only among recedents (Fig. 3).

As it results from the presented records the fauna of boggy and sedge communities was characterized by large discrepancies as regards the species composition and numerical force. *Heteroptera* within *Caricetum limosae* had the domination structure quite distinctly corresponding to physical and floristic conditions in this community — with prevalence of hygrophilous species, trophically related to sedges or to other boggy plants. In the remaining three lake associations *(Caricetum lasiocarpae, Caricetum gracile, Caricetum elatae)* the ubiquistic species constitutes the main part of *Heteroptera*. It should be stressed that investigations carried in the vicinity of Olsztyn and Lublin proved just in those associations the distinct domination of species connected with growing vegetation (sedges), mainly *Cymus glandicolor* and species from *Agramma* Steph. genus (5, 6, 7). The share of these species apart from *Caricetum limosae* association on the investigated area was slight.

Meadow communities (stands V—VIII) were characterized by similar system of insects' domination structure. Upon all the areas *Trigonotylus*

coelestialium decidedly prevailed; upon the meadow near the Wytyckie Lake (stand VI) it reached a very high level of relative density — 15.3 specimens/sample (Fig. 2). That species, as well as other species trophically connected with grasses *(Notostira elongata, N. erratica, Stenodema calcaratum)* constituted upon all the areas the main component of the class of eudominants and they concentrated the prevailing amount of specimens. The composition of eudominants and dominants was completed

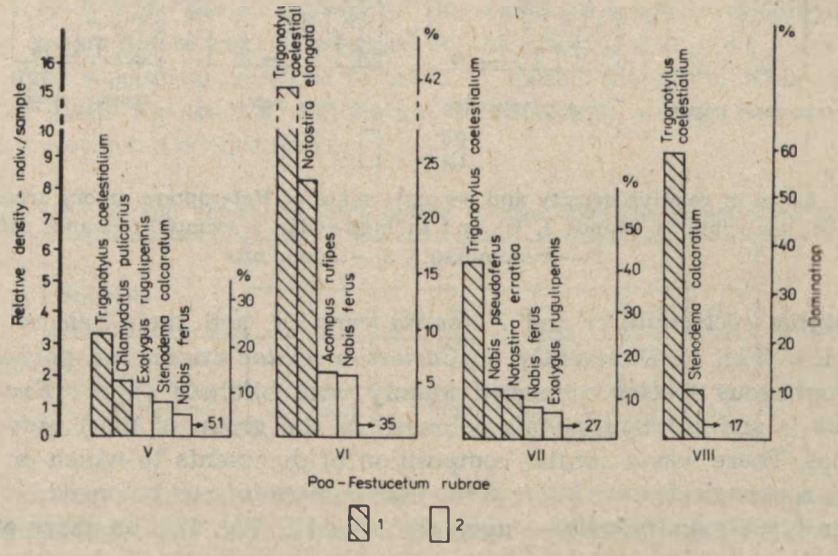

Fig. 2. Level of relative density and per cent share of *Heteroptera* among meadow communities; 1 — eudominants, 2 — dominants

by polyphagic phytophagous species *(Exolygus rugulipennis, Chlamydatus pulicarius)* and predatory species *(Nabis ferus, N. pseudoferus)* — Fig. 2. Hygrophilous forms in the investigated meadow communities were represented by single specimens, which caused that their share in the general density structure was minimum (Fig. 3).

The presented picture of groups of *Heteroptera*, in general, corresponds to the structure of vegetation upon the investigated meadow areas. It should be stressed, however, that in the investigations on the fauna of the discussed group of insects in meadow communities of *Molinio-Arrhenatheretea* there was proved, as a rule, a quantitative prevalence of species connected with dicotyledonous plants. Trophic forms dependent on grasses were the species occurring in great quantities of the following genera: *Stenodema* Lap., *Notostira* Fieb., *Leptoterna* Fieb. (2, 6—12). It seems that such a high density of *Trigonotylus coelestialium* upon the meadows of the Lublin Coal Basin is to some degree a specific feature

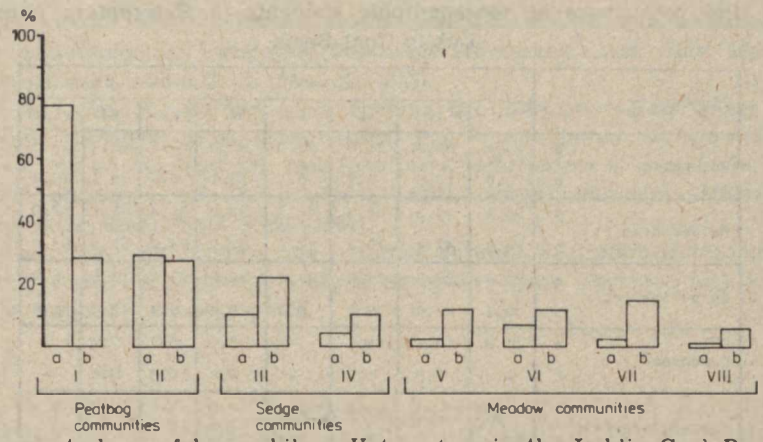

Fig. 3. Per cent share of hygrophilous *Heteroptera* in the Lublin Coal Basin communities; a — specimens' share, b — species' share

of the fauna of the Łęczna—Włodawa Lake District or of such a type of communities in the eastern part of Poland. The results of investigations carried recently upon the meadows of Podlasie and in Bystrzyca valley in the vicinity of Lublin, where the species was very numerously represented (4, 5) seem to support such a view.

The collected insects belong to 5 zoogeographic elements (Table 3). In all the habitats the palaearctic range species were most numerous. The share of holarctic and Euro-Siberian was slightly lower, while the European and Mediterranean element was represented by few forms. The share of specimens belonging to the distinguished zoogeographic elements on the major part of the areas was similar. Among sedge and meadow communities the species of palaearctic range prevailed, whereas among boggy communities the relations are different. Among the fauna of *Caricetum limosae*, as regards density, the species of sub-Mediterranean range prevail; they concentrate over 50% specimens. Among the insects settling *Caricetum lasiocarpae* association, beside palaearctic element, also Euro-Siberian species showed high density (Table 3).

FINAL REMARKS

The attained results showed that the characteristic features of *Heteroptera* fauna are: low density, distinct prevalence of eurytopic species and large differentiation of the structure of domination among boggy and sedge communities. It is to be assumed that qualitative and quantitative data included in the paper will constitute a point of reference for observation of the influence of developing industry on the insects of the

Table 3. Per cent share of zoogeographic elements in *Heteroptera* fauna of the Lublin Coal Basin

Elements		Stands							
		I	II	III	IV	V	VI	VII	VIII
Holarctic	a	23.8	30.3	25.0	25.0	30.0	25.7	25.9	35.3
	b	3.8	15.8	9.2	6.4	23.1	5.4	8.1	12.7
Palaearctic	a	38.1	33.3	33.3	40.4	32.0	31.4	48.1	52.9
	b	24.8	47.4	75.3	82.2	62.9	84.8	89.0	84.1
Euro-Siberian	a	21.4	27.3	25.0	25.0	32.0	37.1	18.5	5.9
	b	9.6	27.6	9.2	9.3	9.4	9.4	2.4	1.6
European	a	11.9	9.1	11.1	-	2.0	5.7	7.4	-
	b	4.4	9.2	4.2	-	0.8	0.5	0.5	-
Submediterranean	a	4.8	-	5.6	3.6	4.0	-	-	5.9
	b	57.4	-	2.1	2.1	3.8	-	-	1.6

Explanation: a — species, b — specimens.

Łęczna—Włodawa Lake District. This is significant because of fragmentary information about *Heteroptera* fauna which is limited to the notes on the occurrence of several species in the peat-bog associations in the northern part of the Lake District (3, 13).

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STRESZCZENIE

W niniejszej pracy przedstawiono wyniki czteroletnich badań (1977—1980), które miały na celu określenie struktury jakościowej i ilościowej fauny pluskwiaków różnoskrzydłych na terenie oddziaływania powstającego ośrodka przemysłowego (Lubelskiego Zagłębia Węglowego). Badania prowadzono w zbiorowiskach torfowiskowych — *Caricetum limosae* (stanowisko I) i *Caricetum lasiocarpae* (stanowisko II); turzycowych — *Caricetum gracile* (stanowisko III) i *Caricetum elatae* (stanowisko IV) oraz łąkowych — *Poa-Festucetum rubrae* (stanowiska V—VIII). Na wszystkich powierzchniach stwierdzono występowanie 92 gatunków wyróżnionych ze zbioru 3034 osobników (tab. 1). Liczba gatunków i poziom względnego zagęszczenia był zróżnicowany, a najwyższe wartości obu parametrów fauny stwierdzono w zbiorowiskach łąkowych (tab. 2). Najliczniej poławianymi gatunkami były: *Trigonotylus coelestialium* i *Notostira elongata* w zbiorowiskach łąkowych (stanowiska V—VIII) oraz *Agramma ruficorne* w zespole *Caricetum limosae* (stanowisko I). Pozostałe gatunki, niezależnie od pozycji w strukturze dominacji, cechowały się o wiele niższym zagęszczeniem (ryc. 1 i 2). Udział stenotopowych gatunków higrofilnych był wysoki w faunie torfowisk przejściowych (stanowiska I i II). W pozostałych zbiorowiskach formy wilgociolubne były reprezentowane w niewielkich ilościach (ryc. 3). Stwierdzone gatunki należały do 5 elementów zoogeograficznych, wśród których zdecydowanie przeważały gatunki o zasięgu palearktycznym (tab. 3).

РЕЗЮМЕ

В настоящей работе представлены результаты 4-летних исследований (1977—1980), цель которых заключалась в определении качественной и количественной структуры фауны настоящих полужесткокрылых *(Heteroptera)* на территории воздействия создаваемого промышленного центра (Люблинский угольный бассейн). Исследования проводили в сообществах: торфяных — *Caricetum limosae* (местооб. I) и *Caricetum lasiocarpae* (местооб. II), осоковых — *Caricetum gracile* (местооб. III) и *Caricetum elatae* (местооб. IV) и луговых — *Poa-Festucetum rubrae* (местооб. V—VIII). Всего выявили 92 вида из общего числа 3034 особей (табл. 1). Число видов и уровень относительной плотности были дифференцированы; самые высокие значения обоих параметров фауны отмечены в луговых сообществах (табл. 2). Среди пойманных видов наиболее многочисленными были: *Trigo-*

notylus coelestialium и *Notostira elongata* в луговых сообществах (местооб. V—VIII) и *Agramma ruficorne* в ассоциации *Caricetum limosae* (местооб. I). Остальные виды, независимо от их позиции в структуре доминантности, характеризовались значительно более низкой плотностью (рис. 1, 2). Участие стенотопных гигрофильных видов было высокое в фауне переходных торфяников (местооб. I, II). В остальных сообществах число влаголюбимых видов было незначительное (рис. 3). Обнаруженные виды принадлежат к 5 зоогеографическим элементам, среди них решительно преобладали виды палеарктического размещения (табл. 3).