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COCCINELLIDS (COLEOPTERA, COCCINELLIDAE) OF WARSAW
AND MAZOVIA

ABSTRACT

There were 58 coccinellid species recorded from Mazovia. Within administrative boundaries of Warsaw 51 species were found, and in urban green areas (parks, green areas of housing estates and of the centre of the town) 32 species. The species showing a high ecological plasticity are best adapted to urban habitats. Thus in the town, an increase was observed in the proportion of species with large geographical ranges (cosmopolitan and Palaearctic) and large environmental tolerance (eurytopic and polytopic). The bulk of the community consists of polytopic species associated with woodlands. Among the species with lower ecological plasticity only xero-thermophilous group occur in the town.

Dominant species in urban green areas are *Adalia bipunctata*, *Stethorus punctillum*, *Propylaea quatuordecimpunctata*, and *Adalia decempunctata*. *Adalia bipunctata*, a cosmopolitan eurytopic and ubiquitous species, is particularly abundant.

INTRODUCTION

The literature data on the occurrence of coccinellids in Mazovia are mainly taken from Bielawski [1, 3, 4], who found 42 species collected mostly in the surroundings of Warsaw.

Among earlier contributions, information on the *Coccinellidae* of Mazovia can be found in Tenenbaum [17—21], who set up check-lists of different beetle groups. These lists include 17 ladybird species. Moreover, some faunistic data on this group can be found in Gałęcka [8], Głowacki [9], Obarski [13, 14], Wiąckowski and Wiąckowska [23]. In sum, 47 ladybird species occurring in Mazovia have been reported in the literature available so far.

The ladybirds of Warsaw (within its administrative boundaries) were not uniformly studied. Their species composition is relatively well-known in the suburbs, 38 species being recorded there. There are no literature data, however, on coccinellids inhabiting managed urban green areas, that is, parks, green areas of housing estates, squares and streetside lawns in the centre of the town. Only 2 species have been recorded from the habitats of this type. They occur in the Botanical Garden [4].

The comprehensive zoocoenotic studies in Warsaw and surroundings, conducted at the Institute of Zoology PAS in 1974—1977, largely extended our knowledge of the coccinellid fauna in this region. Major premises, habitat characteristics, and methods are presented in separate papers [6, 11, 12, 22].

Most of the coccinellids collected in this study occurred in crowns of such trees as the horse-chestnut (*Aesculus hippocastanum*), maple (*Acer* sp.), alder (*Alnus glutinosa*), birch (*Betula* sp.), hornbeam (*Carpinus betulus*), oak (*Quercus* sp.), lime (*Tilia* sp.), silver fir (*Abies alba*), Norway spruce (*Picea excelsa*) and Scots pine (*Pinus silvestris*). Some coccinellids were collected in the layer of herbaceous plants. A total of 7000 specimens of these beetles were collected in Warsaw and non-urban habitats of Mazovia during the present study.

The objective of this paper is not only to determine species composition of the coccinellids occurring in Warsaw, but also to indicate changes in the fauna caused by man-made habitat transformations of different degree.

In addition to the literature data and the materials recently collected, also the collection of the Institute of Zoology PAS is utilized here. This collection contains materials gathered for many years and unpublished so far. They enabled us to supplement lacking data on occurrence of ladybirds in the suburbs of Warsaw and in natural habitats of Mazovia.

SPECIES COMPOSITION

In the museum materials and in those collected in this study, there are 11 species not recorded from Mazovia so far. These are *Scymnus limbatus*, *S. bipunctatus*, *Hyperaspis pseudopustulata*, *H. reppensis*, *H. campestris*, *Coccinella divaricata*, *Synharmonia impustulata*, *Calvia decemguttata*, *Neomysia oblongoguttata*, and *Vibidia duodecimguttata*.

Thus, together with the species already recorded in the literature, we have data on the occurrence of 58 coccinellid species in Mazovia (Tab. 5). They account for 86% of the total number of the species in Poland.

In non-urban habitats of Mazovia there occur 56 species (97% of the known fauna of Mazovia), in the suburbs of Warsaw 51 species (88% of the fauna of Mazovia), and in the urban green areas 32 species (55% of the fauna of Mazovia). Among urban habitats, the parks were richest in coccinellids. They were inhabited by 28 species, which accounts for 87% of the fauna of urban green areas, and 48% of the fauna of Mazovia. The coccinellid communities occurring in the green areas of housing estates and in the centre of the town were much simplified. Only 12 species (37% and 21% respectively) were caught in the green areas of housing estates, and 14 species (44% and 24% respectively) in the centre of the town.

Thus, the coccinellid communities became more and more poor along the gradient from the natural habitats of Mazovia to the most urbanized habitats. The greatest changes in the species composition of coccinellid communities were observed on transition from the suburbs to the urban green areas. The number of species dropped by about 34% as compared with that in the suburban areas. This is mostly related to a sudden drop in the habitat diversity. The suburbs include almost all types of habitats occurring in Mazovia, consequently, the differences in the species composition between this zone and non-urban habitats was small. The urban green areas, however, are mostly located on the sites of oak-hornbeam forests (in some parts also on the sites of carrs).

There are many differences between urbanized areas and physiographically corresponding natural habitats. One of the features of urban habitats is a lowered soil moisture and air humidity. Also plant cover is markedly transformed. From old tree stands only small fragments persisted in Warsaw, mainly in old parks and on the Vistula escarpment. Most of the trees have been introduced, also from other habitats or even other regions of the world. Thus the present tree stands are enriched in species, as compared with natural oak-hornbeam stands.

The largest and most diversified plant communities in the town are parks. They are also characterized by a rich habitat mosaic. Due to these features they are inhabited by the greatest number of insect species, including ladybirds, of all the urban green areas. The coccinellids occurring in crowns of trees are dominated by *Adalia bipunctata*, *Stethorus punctillum*, *Propylaea quatuordecimpunctata*, and *Adalia decempunctata*. Also *Coccinella septempunctata* and *Synharmonia conglobata* are constant elements of this community, but their numbers are much lower. Characteristic ladybird species in park tree stands are those associated with damp habitats. They include *Scymnus ferrugatus*, *S. haemorrhoidalis*, *S. rubromaculatus*, and all the three species of the genus *Calvia* Muls., particularly *C. decemguttata* and *C. quinquedecimguttata*.

An opposite microclimate is characteristic of open and insolated lawns in the parks. The regular cutting of the grass, combined with water deficiency, produce xerothermal conditions. Thus, xerophilous species are characteristic of this layer, such as *Seymnus mimulus mimulus*, *S. frontalis*, *Platynaspis luteorubra* and *Coccinula quatuordecimpustulata*.

Green areas of housing estates, in contrast to parks, never form close plant communities as they are separated by high buildings into small and large patches. They are not so densely covered with trees, and much of their areas is covered with asphalt and concrete. The species composition of the vegetation largely varies, dependings on the age of an estate and on the inventiveness of its inhabitants. Also habitat diversity of housing estates is smaller than that of parks. All these factors account for the next substantial change in the species composition of coccinellids. Only 12 species

were caught in two average housing estates of Warsaw (existing for about 20 years). In tree crowns, the dominant species were *Adalia bipunctata* and *Stethorus punctillum*. The proportion of *Propylaea quatuordecimpunctata* was relatively low, and only single specimens of *Adalia decempunctata* and *Synharmonia conglobata* were caught. In the herb layer, *Coccinella septempunctata* dominated. Among xerophilous species there were *Scymnus mimulus mimulus*, *Tythaspis sedecimpunctata*, and *Coccinula quatuordecimpustulata*.

A similar number of species occurred in the verdure of the centre of the town. The crown of trees were dominated by *Stethorus punctillum*, *Adalia bipunctata*, and *Propylaea quatuordecimpunctata*. *Stethorus punctillum* occurred in largest aggregations on streetside trees, while *P. quatuordecimpunctata* was more numerous on trees located in small, shady courtyards.

Insolated and overdried lawns of the centre of the town were colonized by *Rhyzobius litura*, *Coccidula rufa*, *Scymnus mimulus mimulus*, and *Coccinula quatuordecimpustulata*. On the herbs of courtyards such species as *Propylaea quatuordecimpunctata*, then *Coccinella septempunctata* and *Adalia bipunctata* were most often caught.

ZOOGEOGRAPHICAL ANALYSIS

Among 58 coccinellid species recorded in Mazovia, there are such geographical elements as cosmopolitan, Holarctic, Palaearctic, Euro-Siberian, south-Euro-Siberian, European, and Mediterranean (Tab. 1).

The bulk of this group consists of Palaearctic species accounting for 47% of all the coccinellids of Mazovia. Also the proportion of Euro-Siberian and European species is high. These 3 elements contributed to 83% of the coccinellids of Mazovia.

Against this background, in the urban green areas the proportion of species with large geographical ranges increased, while those with small

Tab. 1. Proportions of zoogeographical elements in coccinellids of Warsaw and non-urban habitats of Mazovia

(N — number of species)

Zoogeographical element	Warsaw											
	Mazovia		Urban green areas									
			Suburbs		Total		Parks		Housing estates		Town centre	
	N	%	N	%	N	%	N	%	N	%	N	%
Cosmopolitan	2	3.6	2	3.9	1	3.1	1	3.6	1	8.3	1	7.1*
Holarctic	2	3.6	2	3.9	1	3.1	1	3.6	1	8.3	—	—
Palaearctic	26	46.4	25	49.0	20	62.5	18	64.3	8	66.6	9	64.3
Euro-Siberian	11	19.6	8	15.7	5	15.6	4	14.3	1	8.3	2	14.3
South-Euro-Siberian	5	8.9	5	9.8	2	6.3	2	7.1	—	—	—	—
European	9	16.0	9	17.6	3	9.4	2	7.1	1	8.3	2	14.3
Mediterranean	1	1.8	—	—	—	—	—	—	—	—	—	—

ranges dropped (Tab. 1). Here also the Palaearctic species are the most important group. Their proportion increased by about 19%, on the average, in the urban green areas. Also the proportion of cosmopolitan and Holarctic elements slightly increased. The percentage of the other elements dropped. The average proportion of Euro-Siberian, south-Euro-Siberian, and European species in urban green areas were lower by 7.3%, 6.5%, and 9.5% respectively, as compared with those in non-urban habitats.

This is also reflected in the species composition of the dominant group. It mainly consists of the elements with large ranges: cosmopolitan — *Adalia bipunctata*, and Palaearctic — *Adalia decempunctata* and *Propylaea quatuordecimpunctata*. Among ladybirds with smaller ranges only *Stethorus punctillum*, an Euro-Siberian species, is more numerous.

ECOLOGICAL ANALYSIS

ECOLOGICAL AMPLITUDE AND HABITAT REQUIREMENTS

The ecological amplitude of the coccinellids of Mazovia involves all its categories from very narrow to very broad. However, the proportion of stenotopic forms requiring strictly specified physico-chemical or biotic factors, is very high. They accounted for 38% of the coccinellids known from this region. The proportion of polytopic species, thus occurring in different habitats within one category (e.g. only in wooded areas, or only in open areas), was the same. The eurytopic species contributed to 11% of all the species.

In urban green areas of Warsaw, the proportion of coccinellids with very large environmental tolerance, i.e. eurytopic, tended to increase, while the number of stenotopic species dropped. The relatively highest number of stenotopic species was recorded in parks (Tab. 2).

The family *Coccinellidae*, though represented by a relatively small number of species in Poland, has very diversified habitat requirements. They inhabit almost all types of terrestrial plant formations, all forest types, forest plantations, parks, gardens, orchards, clearings, meadows, crop fields, wetlands, xerothermal grasslands, dunes, and brackish lands.

The largest group of coccinellids, up to 60% of all the species living in Mazovia, is associated with various wooded habitats; 29% of the species inhabit only open areas, and 11% can live in most of the habitats listed (ubiquitous species).

The town is colonized by the species of all the three categories. Their proportions in urban green areas of particular types largely depend on the structure of vegetation, and in particular, on the ratio of wooded to open areas. The proportion of wooded areas usually drops in favour of open areas and lawns with increasing urbanization. These changes are followed by respective changes in the proportions of coccinellids (Tab. 2). In parks,

the species associated with trees are dominants. Their proportion reached 68% there, while it dropped to 42% in the green areas of housing estates and to 36% in the centre of the town. Instead, the percentage of the species associated with open areas and ubiquitous species, increased in the more urbanized areas (Tab. 2).

A comparison of natural habitats with urban green areas shows that in the latter habitat the percentage of species associated with open areas dropped a little, the proportion of species associated with wooded areas was maintained at the same level, and the proportion of ubiquitous species

Tab. 2. Proportions of groups with different ecological requirements in coccinellids of Warsaw and non-urban habitats of Mazovia
(N — number of species)

Group	Mazovia		Warsaw									
			Suburbs		Urban green areas							
	Total				Parks		Housing estates		Town centre			
			N	%	N	%	N	%	N	%	N	%
Eurytopic	6	10.9	6	12.2	5	15.6	5	17.9	4	33.3	4	28.6
Polytopic	21	38.2	18	36.7	14	43.8	11	39.3	4	33.3	5	35.7
Oligotopic	7	12.7	7	14.3	3	9.4	3	10.7	2	16.7	2	14.3
Stenotopic	21	38.2	18	36.7	10	31.2	9	32.1	2	16.7	3	21.4
Ubiquitous	6	10.9	6	12.2	5	15.6	5	17.9	4	33.3	4	28.6
Associated with wooded areas	33	60.0	29	59.4	19	59.4	19	67.8	5	41.7	5	35.7
Associated with open areas	16	29.1	14	28.6	8	25.0	4	14.3	3	25.0	5	35.7
Xerophilous	11	20.0	10	20.4	9	28.1	6	21.4	4	33.3	5	35.7
Mesohygrophilous	29	52.7	25	51.0	19	59.4	18	64.3	8	66.7	9	64.3
Hygrophilous	15	27.3	14	28.6	4	12.5	4	14.3	—	—	—	—

increased. The preference for non-specialized organisms in urban green areas is still more pronounced in the average values calculated for all the three habitat types. According to these values, the proportion of ubiquitous species in the town increased at the expense of the species associated with wooded areas by about 16%, as compared with this in non-urban habitats.

Among the coccinellids with a narrow range of environmental tolerance, a very large portion is represented by the species requiring specific microclimatic conditions: 28% of the *Coccinellidae* of Mazovia inhabit humid biotopes, and 20% prefer dry and warm habitats. Among the coccinellids with a narrowed ecological amplitude, mostly xerophilous forms occur in the town, and their proportion increase towards the centre (Tab. 2). An opposite situation was observed for hygrophilous forms. Their proportion was reduced by 15% in urban green areas as compared with natural habitats. Only large parks are refuges of these species. They do not occur at all in green areas of housing estates and in the centre of the town.

FOOD HABITS

Most coccinellids of Poland belong to predatory zoophages. Both larvae and adults feed on insects, sometimes on acarids. There are only two phytophagous species — *Subcoccinella vigintiquatuorpunctata* feeding on leguminous plants (*Papilionaceae*), and *Thea vigintiduopunctata* living on fungi. Partly phytophagous are the species of the genera *Calvia* Muls., *Halyzia* Muls., and *Vibidia* Muls. Their adult forms are fungivorous, while larvae are predators (aphidophages). Anyhow, the diet of these coccinellids is not sufficiently known, and the data reported by different authors are not always consistent.

The diet of predatory coccinellids is predominated by *Homoptera* such as aphids (*Aphidodea*) and scale insects (*Coccoidea*). The largest group of the *Coccinellidae* of Poland belongs to aphidophages. They are also most abundant in Mazovia; 70% of the coccinellids inhabiting this region feed on aphids over their life time, 8.6% feed on aphids as larvae; 7% prefer scale insects but can also feed on aphids; 9% feed only on scale insects. Only one species of the fauna of Mazovia (2%) and also of Poland, *Stethorus punctillum*, feeds on acarids.

Food specialization of the predatory coccinellids can cover various ranges. They include polyphages feeding on aphids associated with different plants (herbs, broad-leaved and coniferous trees and shrubs) and oligophagous species feeding on aphids associated with single plant species (e.g. *Rhizobius chrysomeloides* which is associated with pines).

Few species are polyphages with extremely wide food spectrum. Among the coccinellids occurring in Poland only *Adalia bipunctata* can be included here. Most of them are polyphages living on insects associated with the vegetation of one type. In Mazovia 33% of the coccinellid species feed on the aphids associated with broad-leaved trees and shrubs; 29% on aphids associated with herbs, and 20% on aphids associated with coniferous trees; 14% live on aphids associated with the vegetation of two types (mostly with herbs and broad-leaved trees and shrubs), and only 4% of the coccinellids feed on aphids occurring on plants of all types.

Urban green areas located on the sites originally covered with oak-hornbeam forests (in part with carrs) are dominated by tree species characteristic of these sites. The enrichment of urban biotopes with coniferous trees (spruce, pine, fir) created suitable conditions for such coccinellids as *Scymnus suturalis*, *Chilocorus bipustulatus*, *Exochomus quadripustulatus*, or *Aphidecta obliterated*. These species feed on aphids (or scale insects) associated with coniferous trees, thus they occur only locally, mostly in parks, where these trees are grown most often.

The urban fauna is dominated by coccinellids feeding on aphids. A particularly high concentration of these beetles can be observed on trees and shrubs, frequently heavily infested with aphids. As many as 97%

of the collected coccinellids occurred in this layer. Only 3% of the material was collected in the herb layer where aphids are scarce because of a simplified floristic composition of this layer as compared with natural habitats. Apart from aphidophagous coccinellids, also *Stethorus punctillum*, a species feeding on acarids, is rather numerous on trees in Warsaw, particularly on those growing along streets.

STRATIFICATION

Vertical distribution of coccinellids depends largely on food requirements of particular species. As it has already been noted, most coccinellids are associated with crowns of trees and shrubs. More than a half of the species known from this region occur there. Next, there are coccinellids inhabiting the herb layer (29%). The species of largest ecological amplitude and food spectrum, inhabiting all plant layers, form the least numerous group (18% of all the species) (Tab. 3). Nevertheless, this group, because of their high adaptability, is least reduced in urban habitats. In Warsaw the proportion of these species increased by about 4% as compared with that in non-urban habitats. The proportions of this group in particular types of urban green areas are most stable, the proportions of the two other groups being rather variable. Opposite tendencies are observed in these groups. The proportion of the species associated with tree crowns decreased, while that of the species associated with the herb layer increased with rising urban pressure. These trends are closely correlated with plant diversity in each of these layers, although microclimatic changes are also important for some stenotopic species. In parks, where the species composition of tree stands is most diversified and herbaceous plants are relatively poor, the bulk of the fauna was made up of the coccinellids associated with tree crowns. An opposite situation is observed in green areas of the centre of the town. Tree stands are much simplified there and, consequently, the proportion of the coccinellids associated with tree crowns was reduced by 25%. At the same time, the proportion of the species associated with the herb layer increased by the same percentage. The respective proportions of coccinellids in the green

Tab. 3. Proportions of groups with different vertical distribution in coccinellids of Warsaw and non-urban habitats of Mazovia
(N — number of species)

Layer	Mazovia		Warsaw									
			Suburbs		Urban green areas							
	Total				Parks		Housing estates		Town centre			
	N	%	N	%	N	%	N	%	N	%	N	%
Shrubs and tree crowns	30	53.6	25	49.0	17	53.1	17	53.1	5	41.7	5	35.7
Herbs	16	28.6	15	29.4	8	25.0	8	25.0	4	33.3	6	42.9
All layers	10	17.8	11	21.6	7	21.9	7	21.9	3	25.0	3	21.4

areas of housing estates had intermediate values, this indicating an intermediate (between parks and green areas of the town centre) character of this habitat.

FREQUENCY OF THE OCCURRENCE AND ABUNDANCE

Ladybirds belong to best known insects, due to few species common all over the country. Most species are rare. In Mazovia there occur 32 rare species, that is, more than a half (57%) of all the coccinellids living in this region. The species most frequently met accounted for only 11%. These are *Scymnus suturalis*, *Exochomus quadripustulatus*, *Adonia variegata*, *Adalia bipunctata*, *Coccinella septempunctata*, and *Propylaea quatuordecimpunctata*.

Two of these species, *Adalia bipunctata* and *Propylaea quatuordecimpunctata*, are common in the town. Moreover, *Stethorus punctillum* and *Adalia decempunctata* are relatively frequent in Mazovia and in Warsaw. These four species are dominants in urban green areas. *Adalia bipunctata* accounted for 43% of the collected material, *Stethorus punctillum* for 26%, *Propylaea quatuordecimpunctata* for 15%, and *Adalia decempunctata* for 11%. Thus, *Adalia bipunctata* shows the highest dominance. This species dominates in parks and green areas of housing estates. In the centre of the town *Stethorus punctillum* is most abundant. *Adalia bipunctata* dominates also in suburban oak-hornbeam sites, but the proportion of this species there is a little lower than in the urban green areas. It was very scarce, however, in the samples from natural oak-hornbeam forests of Mazovia (Tab. 4). Thus, these coccinellids are likely to avoid dense, shady tree stands, preferring loose, insolated stands of the type of a park.

Also the numbers of *Stethorus punctillum* and *Propylaea quatuordecimpunctata* increased in urban green areas (2.3 and 1.8 times respectively). An opposite situation was observed for *Adalia decempunctata*. This species was two times more numerous in natural oak-hornbeam forests than in the town. In the town it was relatively most abundant in parks and adjoining trees. In the green areas of housing estates and in the centre of the town it was occasionally caught.

Many coccinellids occur also in the herb layer. In the herb layer of non-urban oak-hornbeam forests most abundant species are *Coccinella septempunctata* and *Propylaea quatuordecimpunctata*, and in dry, insolated sites also *Coccinula quatuordecimpustulata*.

All these species also occur in the town but their numbers varied for particular types of urban green areas. This variability was related to the structure of the herb layer and to the habitat requirements of particular species.

The species composition of herbaceous plants is generally much simplified in urban green areas. This is particularly the case of park lawns where weeds are usually removed. As a result, these are grassy monocultures. Consequently, the coccinellids associated with the herb layer, such as

Coccinella septempunctata and *Coccinella quatuordecimpustulata*, are largely reduced. Other two species caught there, *Adalia bipunctata* and *Propylaea quatuordecimpunctata*, probably arrive from adjacent trees where they usually occur, having there rich food supply.

Tab. 4. Proportions of more abundant species with different vertical distribution in coccinellids occurring in Warsaw and in natural oak-hornbeam forest of Mazovia (n — number of specimens, + — occasional species)

Plant layer	Species	Mazovia (oak-hornbeam forest)		Warsaw									
				Suburbs (oak-hornbeam forest)		Urban green areas							
		n	%	n	%	Total		Parks		Housing estates		Town centre	
Tree crowns	<i>Stethorus punctillum</i>	28	11.1	174	22.7	1043	25.6	896	24.0	17	22.7	130	47.3
	<i>Scymnus auritus</i>	56	22.2	16	2.1	—	—	—	—	—	—	—	—
	<i>Adalia bipunctata</i>	+	+	273	35.6	1747	42.8	1605	43.0	47	62.7	95	34.5
	<i>Adalia decempunctata</i>	52	20.6	113	14.7	429	10.5	423	11.3	1	1.3	5	1.8
	<i>Propylaea quatuordecimpunctata</i>	20	8.0	76	10.0	594	14.5	557	15.0	4	5.3	33	12.0
	Others	81	38.1	115	14.9	269	6.6	251	6.7	6	8.0	12	4.4
Herbs	<i>Adalia bipunctata</i>	+	+	2	1.4	33	25.2	18	40.0	9	23.1	6	12.8
	<i>Coccinella septempunctata</i>	20	29.4	23	16.5	29	22.1	4	8.9	20	51.3	5	10.6
	<i>Coccinula quatuordecimpustulata</i>	18	26.5	31	22.3	9	6.9	1	2.2	2	5.1	6	12.8
	<i>Propylaea quatuordecimpunctata</i>	16	23.5	19	13.7	32	24.4	7	15.6	4	10.2	21	44.7
	Others	14	20.6	64	46.1	28	21.4	15	33.3	4	10.2	9	19.1

The situation looks somewhat better in housing estates and in the centre of the town. Green areas of housing estates have diversified herbaceous vegetation and are often watered, thus their microclimate is more humid. Due to this, *Coccinella septempunctata* can find suitable conditions there, their number being 5 times as high as in park lawns (Tab. 4).

Dry streetside lawns where herbaceous vegetation is also more diversified, support large amounts of *Coccinula quatuordecimpustulata*.

CONCLUSIONS

There are 58 coccinellid species recorded so far from Mazovia. Urban green areas (parks, housing estates and town centre) are inhabited by 32 species. This accounts for about 62% of all the coccinellids occurring in Mazovia.

The richest coccinellid communities occur in parks. Since these are largely diversified habitats, most of the species recorded from Warsaw live there. In more urbanized habitats, with the simplified structure and species composition of the plant cover, also coccinellid communities are poor in species. In zoocoenoses of housing estates and in the centre of the town,

the number of species is reduced by half as compared with that in parks.

Urbanization of the habitat is followed by an increase in the proportion of the species with large zoogeographical ranges (particularly Palaearctic).

The coccinellids characterized by wide ecological amplitudes most readily adapt to urban habitats, while those with narrow amplitudes are eliminated. Therefore, the proportion of the species with a large environmental tolerance, i.e. eurytopic and polytopic, increases in the town, while the percentage of stenotopic species drops.

Among the species little tolerant of microclimatic conditions, the proportion of xerophilous coccinellids is higher in the town than in non-urban habitats. The proportion of hygrophilous species is largely reduced in the town. Few of them inhabit parks.

The largest group of coccinellids living in urban biocoenoses consists of polytopic species associated with wooded areas and, in particular, with the crowns of trees and shrubs.

Most abundant coccinellid communities occur in the layer of tree crowns, this being a result of a generally high species diversity of trees in the town, as well as the abundance of food in their crowns. Food abundance is due to the outbreaks of aphids, and phytophagous acarids, frequently occurring in Warsaw. In the herb layer, where food resources are poor, floristic composition being simplified, coccinellids occur in small numbers.

SPECIES NEW TO THE FAUNA OF MAZOVIA¹

Scymnus limbatus Steph.

syn. *Scymnus testaceus* Motsch.

Known from the whole Palaearctic region. In Poland recorded from Silesia, Przemysł region, and the Bieszczady mountains.

Very rarely met. Occurs in wet habitats of the carr character [5]. Not recorded during the present study. In the collection of the Museum at the Institute of Zoology PAS there is 1 specimen caught in Warsaw.

Scymnus bipunctatus Kugel.

Palaearctic species. In Poland recorded from Masuria, Pomerania, Silesia, in the region of Częstochowa, Kraków, Przemysł, and Zamość.

Very rarely met. Occurs in different habitats on perennials and broad-leaved trees. During the present study 1 male was found on a birch (*Betula* sp.) in Warsaw-Białołęka. In the collection of the Muzeum at the Institute of Zoology PAS there are specimens collected in Grodzisk Mazowiecki, Łomianki, Kampinos Forest, and Serock.

¹ Data on the distribution of some species in Poland were kindly provided by Prof. M. Mroczkowski.

Hyperaspis pseudopustulatus Muls.

Its close range stretches from southern regions of the USSR to Central Europe. Single stands are known from Austria and Upper Bavaria. In Poland recorded from Kielce, Kraków and surroundings [15, 16].

Biology and ecology unknown. In this study not recorded. Specimens collected in Warsaw-Radość are in the Museum at the Institute of Zoology PAS.

Hyperaspis reppensis Hbst.

Distributed over the Palaearctic region and Abyssinia. In Poland recorded from Pisz Forest, Poznań surroundings, Silesia, regions of Częstochowa, Kraków, and from southwestern part of the country.

Very rarely met. Biology and ecology little known. Occurs in xerothermal habitats on grasses, perennials and fruit trees [2, 10]. Not recorded in the present study. Specimens collected in Dembe Wielkie are in the Museum at the Institute of Zoology PAS.

Hyperaspis campestris (Hbst.)

Occurs in Europe, Asia Minor and the Caucasus. In Poland recorded from Białowieża, Great Poland, Silesia, near Częstochowa, Kraków, and from south-eastern part of the country.

Rarely met. Occurs in warm biotopes on perennials and broad-leaved shrubs and trees. In this study recorded from Warsaw-Bielany Wood and Warsaw-Białoleka, in the herb layer. Specimens from Powsinek and Podkowa Leśna are in the Museum at the Institute of Zoology PAS.

Coccinella divaricata Oliv.

Known from Europe, northern part of Africa, and from Asia. In Poland recorded from Masuria, Pomerania, regions of Poznań, Toruń, Łódź, from Silesia, regions of Kraków, Zamość, and from the Bieszczady mountains.

Rather rarely met. Most frequently occurs near nests of *Formica rufa*, on pines growing in clumps or at forest edges [2, 15]. Not recorded in this study. Specimens collected in Warsaw, Warsaw-Anin, Zielonka, and Celestynów are in the Museum at the Institute of Zoology PAS.

Synharmonia impustulata L.

European species. Fürsch [7] recorded it from Upper Bavaria. In Poland recorded as *Coccinella impustulata* L. from Masuria, the whole Silesia, regions of Kraków and Zamość.

According to literature data [7], particularly frequent in carrs and raised bogs. In this study recorded from Mazovia; 30 specimens were caught in a mixed pine forest in crowns of oaks (*Quercus* sp.), birches (*Betula* sp.), and Scots pines (*Pinus silvestris*). Most of them (29 specimens) were collected from the Kampinos Forest, and one specimen was caught in Warsaw-Białoleka. In the Museum at the Institute of Zoology PAS there are specimens collected from Warsaw-Wawer, Sękocin, Piaseczno, Brwinów and Drewnica.

Sospita vigintiguttata (L.)

Known from Europe. In Poland recorded from Great Poland, Silesia, regions of Częstochowa, Kraków, Lublin, Przemyśl, and Rzeszów.

Very rarely met. Occurs in wet biotopes on herbs, willows and alders [10]. In the region of Kraków caught on pines and young oaks at forest edges [15]. In this study recorded from Mazovia; 8 specimens were caught in a carr in Radziejowice, 1 specimen was found on an oak (*Quercus* sp.) at the edge of a mixed forest in Warsaw-Białołęka. In the Museum at the Institute of Zoology PAS there are specimens collected in Zaborówek, Dembe Wielkie, Mińsk Mazowiecki, and in the Kampinos Forest.

Calvia decemguttata (L.)

Known from Europe, Asia, and Japan. In Poland recorded from Great Poland, Silesia, in the regions of Częstochowa, Kraków, Żywiec, Przemyśl, and in the Bieszczady mountains.

Associated with shrubs and trees of wet habitats. In this study 10 specimens were recorded from parks of Warsaw, Warsaw-Białołęka, Kampinos Forest, and Radziejowice. In the Museum of Institute of Zoology PAS there are specimens collected in Natolin, Małkinia, Wyszogród, and Kampinos Forest.

Neomysia oblongoguttata (L.)

Inhabits Europe and Asia. In Poland recorded from southern parts of the country.

Rather rarely met. Associated with coniferous trees such as pine and spruce. Recorded from Mazovia in this study: 4 specimens found on pines in Warsaw-Białołęka and Kampinos Forest. In the Museum of Institute of Zoology PAS there are specimens collected in Warsaw-Bielany, Podkowa Leśna, and Śródborów.

Vibidia duodecimguttata (Poda)

Known from Europe, Caucasus, Asia Minor, and Siberia. In Poland recorded from some localities of northern, western, central, southern, and southeastern parts of the country.

Rather rarely met. Occurs on perennials and trees in wet habitats. Not recorded in this study. In the Museum of Institute of Zoology PAS there are specimens collected in Grodzisk Mazowiecki, Zaborów, Dembe Wielkie, Zielonka, and Małkinia.

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Tab. 5. Check list of *Coccinellidae* species occurring in Warsaw and Mazovia

No.	Species	Mazovia	Warsaw				
			suburban areas	parks	green areas in housing estates	town centre	other sampling areas
1	2	3	4	5	6	7	8
1	<i>Subcoccinella vigintiquatuorpunctata</i> (L.)	●	●	+	-	-	+
2	<i>Coccidula scutellata</i> (Hbst.)	○	-	-	-	-	-
3	<i>Coccidula rufa</i> (Hbst.)	○	●	-	-	+	-
4	<i>Rhyzobius litura</i> (Fabr.)	○	●	-	-	+	+
5	<i>Rhyzobius chrysomeloides</i> (Hbst.)	○	○	-	-	-	-
6	<i>Stethorus punctillum</i> Ws.	●	●	+	+	+	+
7	<i>Scymnus (Pullus) ferrugatus</i> (Moll.)	○	○	+	-	-	-
8	<i>Scymnus (P.) haemorrhoidalis</i> Hbst.	●	●	+	-	-	-
9	<i>Scymnus (P.) auritus</i> Thbg.	●	●	-	-	-	-
10	<i>Scymnus (P.) limbatus</i> Steph.	-	-	-	-	-	+
11	<i>Scymnus (P.) suturalis</i> Thbg.	●	●	+	+	+	-
12	<i>Scymnus (P.) ater</i> Kugel.	○	○	○	-	-	-
13	<i>Scymnus (Scymnus) nigrinus</i> Kugel.	○	○	-	-	-	-
14	<i>Scymnus (S.) anietis</i> Payk.	○	-	-	-	-	-
15	<i>Scymnus (S.) mimulus mimulus</i> Capra et Fürsch	○	+	+	+	+	-
16	<i>Scymnus (S.) frontalis</i> (Fabr.)	●	●	+	+	+	-
17	<i>Scymnus (S.) apetzoides</i> Capra et Fürsch	○	-	-	-	-	+
18	<i>Scymnus (S.) interruptus</i> (Goeze)	○	○	-	-	-	-
19	<i>Scymnus (S.) rubromaculatus</i> (Goeze)	●	●	○	-	-	-
20	<i>Scymnus (Nephus) quadrimaculatus</i> (Hbst.)	○	●	+	-	-	-
21	<i>Scymnus (N.) bipunctatus</i> Kugel.	+	+	-	-	-	-
22	<i>Scymnus (N.) redtenbacheri</i> Muls.	●	●	-	-	-	-
23	<i>Hyperaspis pseudopustulatus</i> Muls.	-	+	-	-	-	-
24	<i>Hyperaspis reppensis</i> (Hbst.)	+	+	-	-	-	-
25	<i>Hyperaspis campestris</i> (Hbst.)	+	+	-	-	-	-
26	<i>Platynaspis luteorubra</i> (Goeze)	+	●	+	-	-	-
27	<i>Chilocorus renipustulatus</i> (Scriba)	+	●	+	-	-	-
28	<i>Chilocorus bipustulatus</i> (L.)	+	●	+	-	-	-
29	<i>Exochomus quadripustulatus</i> (L.)	+	●	+	-	-	-
30	<i>Hippodamia tredecimpunctata</i> (L.)	●	○	-	-	-	+
31	<i>Hippodamia septemmaculata</i> (Deg.)	○	+	-	-	-	●
32	<i>Adonia variegata</i> (Goeze)	○	○	-	-	-	-
33	<i>Anisosticta novemdecimpunctata</i> (L.)	●	+	-	-	-	+
34	<i>Aphidecta obliterated</i> (L.)	○	○	+	-	-	○
35	<i>Tythaspis sedecimpunctata</i> (L.)	+	●	-	+	-	+
36	<i>Adalia conglomerata</i> (L.)	○	-	-	-	-	-
37	<i>Adalia decempunctata</i> (L.)	●	●	+	+	+	○
38	<i>Adalia bipunctata</i> (L.)	●	●	+	+	+	○
39	<i>Coccinella septempunctata</i> L.	●	●	+	+	+	+
40	<i>Coccinella quinquepunctata</i> L.	●	●	+	-	-	+

1	2	3	4	5	6	7	8
41	<i>Coccinella undecimpunctata</i> L.	○	+	+	-	+	-
42	<i>Coccinella divaricata</i> Oliv.	+	+	-	-	-	+
43	<i>Coccinella hieroglyphica</i> L.	●	○	-	-	-	+
44	<i>Coccinula quatuordecimpustulata</i> L.	●	●	+	+	+	+
45	<i>Synharmonia conglobata</i> (L.)	●	●	+	+	+	+
46	<i>Synharmonia impustulata</i> L.	+	+	-	-	-	-
47	<i>Harmonia quadripunctata</i> (Pont.)	+	●	+	-	-	-
48	<i>Myrrha octodecimguttata</i> (L.)	●	●	-	-	-	+
49	<i>Sospita vigintiguttata</i> (L.)	+	+	-	-	-	-
50	<i>Calvia decemguttata</i> (L.)	+	+	+	-	-	-
51	<i>Calvia quatuordecimguttata</i> (L.)	+	●	+	+	-	+
52	<i>Calvia quinquadecimguttata</i> (Fabr.)	●	-	+	-	-	-
53	<i>Propylaea quatuordecimpunctata</i> (L.)	●	●	+	+	+	+
54	<i>Neomysia oblongoguttata</i> (L.)	+	+	-	-	-	-
55	<i>Anatis ocellata</i> (L.)	●	●	+	-	-	+
56	<i>Halyzia sedecimguttata</i> (L.)	●	+	-	-	-	+
57	<i>Vibidia duodecimguttata</i> (Poda)	+	-	-	-	-	-
58	<i>Thea vigintiduopunctata</i> (L.)	○	●	-	-	+	+

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BIEDRONKOWATE (COLEOPTERA, COCCINELLIDAE) WARSZAWY I MAZOWSZA

STRESZCZENIE

Na Mazowszu występuje 58 gatunków *Coccinellidae*. W granicach administracyjnych Warszawy stwierdzono 51 gatunków. Skład gatunkowy przedmieść Warszawy nie odbiega od stanu stwierdzonego na obszarach pozamiejskich. Natomiast fauna uprawianej zieleni miejskiej (parków, zieleni osiedli mieszkaniowych, podwórek, skwerów i trawników przyjezdniowych) jest znacznie uboższa. W środowiskach tych stwierdzono występowanie łącznie 32 gatunków biedronek. Najbogatsze zgrupowania *Coccinellidae* zamieszkują parki, w zoocenozach zieleni osiedli mieszkaniowych i centrów miejskich żyje o połowę mniej gatunków.

W miejskich zespołach *Coccinellidae* dominują gatunki o szerokich zasięgach geograficznych (kosmopolityczne i palearktyczne), oraz o dużym zakresie tolerancji względem czynników biotycznych i abiotycznych. Trzon fauny stanowią gatunki politopowe, związane ekologicznie z warstwą koron drzew i krzewów. Wśród biedronek o ograniczonej plastyczności przeważają w mieście gatunki sucholubne.

Do najliczniej występujących biedronek w środowiskach miejskich należą: *Adalia bipunctata*, *Stethorus punctillum*, *Propylaea quatuordecimpunctata* i *Adalia decempunctata*. Gatunki te stanowią około 93% zebranego w zieleni miejskiej materiału. Zdecydowanym dominantem jest *Adalia bipunctata* — gatunek kosmopolityczny, eurytopowy i ubikwistyczny.

БОЖЬИ КОРОВКИ (COLEOPTERA, COCCINELLIDAE) ВАРШАВЫ И МАЗОВИИ

РЕЗЮМЕ

В Мазовии встречается 58 видов *Coccinellidae*. В административных границах Варшавы нашли 51 вид, а на территории городских зелёных насаждений (парки, зелень жилых районов, дворов и улиц центра города) — 32 вида. К условиям городской среды

легче всего приспосабливаются виды, характеризующиеся большой степенью экологической пластичности. Таким образом, на территории города возрастает количество видов широко распространенных (космополитические и палеарктические), а также видов обладающих широким диапазоном экологической терпимости — эвритопных и политопных. Ядро сообщества составляют политопные виды, связанные экологически с древонасаждениями. Из группы видов с узкой экологической пластичностью в условиях города встречаются только ксерофильные организмы.

Видами доминирующими в благоустроенной городской зелени были: *Adalia bipunctata*, *Stethorus punctillum*, *Propylaea quatuordecimpunctata* и *Adalia decempunctata*. Особенно многочисленная была *Adalia bipunctata* — вид космополитический, эвритопный и убиквист.

LONGICORNS (COLEOPTERA, COCCINELLIDAE) OF WARSAW AND MAZOWIA

ABSTRACT

There are 119 longicorn species in the fauna of Warsaw. Within the metropolitan boundary 80 species were recorded, including 60 species in green parks and 20 species in urban green areas of other regions. Other species belonging to dry xerophiles, oligo- and monophages associated with agriculture were not very abundant on leaves of plants living in tree trunks. No agricultural references were found in the vegetation of which larvae of species feeding on bark are found, and their feeding on roots was noted. Longicorns of urban green areas consist of 76 species, among which 20 species are scarce or locally abundant in Warsaw, remaining in the region of a city that has the proportion of thermophilous species with small low-wooded and high-wooded green is higher in the town than in non-urban areas. Also, the proportion of species *Exochus dentis* occurs occasionally in the town.

INTRODUCTION

Intense coleopterological studies in Warsaw and surroundings have been conducted since the second half of the 19th century. Such distinguished collectors worked in this sphere as Haldé [19, 31], Mulsant [20], Tenenbaum [31, 55–58], Czaplewicz [3, 4], and Bartoszyński. Also at present many entomologists work in these areas. Longicorns, besides, longicorns are one of the best known families of beetles. The occurrence of this family in Mazovia consists of 76 species [1–4, 8–21, 29–31, 33–45, 47–58, 60–63]. Many unpublished materials are in the collection at the Institute of Zoology PAZ in Warsaw (collections of Tenenbaum, Czaplewicz, and Bartoszyński as well as material collected recently). To illustrate the intensity of urban green parks in Warsaw surroundings, it may be noted that 31 longicorn species are recorded from such a small area as the reserve "Dictyos word" (14.6 ha) situated within the administrative boundaries of Warsaw. They account for 40.5% of all the currently 76 species recorded from Mazovia.

There were 89 species recorded from Mazovia. However, 19 of them have not been recorded since 1920. Thus their occurrence needs confirmation.