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Winter and early spring assemblages of ladybird beetles (Coleoptera: Coccinellidae) in two forest habitats in suburban area of Warsaw, central Poland

Summary

In March and April of 2014 and 2015, overwintering and post-overwintering assemblages of ladybird beetles were investigated in deciduous (*Tilio-Carpinetum*) and mixed forest (*Quercus roboris-Pinetum*) patches in a forest complex on the north-western periphery of Warsaw. March samples were collected by sifting forest litter with an entomological sieve, while in April, ladybirds were collected from the vegetation using sweeping net and beating sheet. In both years, mean densities of ladybirds found in March in the two forest types were low, not exceeding 2 individuals/m². Seven ladybird species were found overwintering in the litter of the deciduous forest and four in that of the mixed forest. *Propylea quatuordecimpunctata* was the most abundant in both habitats in 2014, while in 2015 in the litter of the deciduous forest *Vibidia duodecimguttata* predominated. In April, 15 species were recorded in the deciduous forest and 7 in the mixed forest. *Scymnus ferrugatus* predominated in the former plant community and *P. quatuordecimpunctata* and *Coccinella septempunctata* in the latter. Several of the recorded species, such as *Clitostethus arcuatus*, *Scymnus femoralis* and *S. abietis*, have rarely been reported from Poland.

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1. Introduction

The Coccinellidae are considered an economically important beetle family because the majority of its members are predators of aphids, coccids, mites, and other soft-bodied arthropods that may be pests of cultivated plants. Due to their beneficial role, ladybirds have attracted much attention of researchers, and various aspects of their biology and ecology have been studied in detail (van Emden and Hodek 2012). However, a few topics of ladybird ecology remain rather neglected, and one of the most unappreciated seems to be community ecology of the dormant beetles (Ceryngier 2015). While relatively much is known on the assemblages of ladybirds during their active life (for review see Honěk 2012), there is very few data on dormancy assemblages of these beetles (Turnock and Wise 2004, Godeau and Ceryngier 2011, Ceryngier and Godeau 2013, Kozon *et al.* 2016). Investigations on the species composition and densities of Coccinellidae spending dormancy in various habitats might not only enrich our general knowledge on this group, but might also be important for more applied issues, such as the management of pests using predatory ladybirds and the conservation strategies of rare species. Recent studies by Godeau and Ceryngier (2011) and Ceryngier and Godeau (2013) showed that some specific habitats may serve as rich winter reservoirs of rare ladybird species.

In this study we determined the species composition and densities of Coccinellidae overwintering in the patches of two forest types: oak-linden-hornbeam forest (*Tilio-Carpinetum*) and mixed oak-pine forest (*Quercus roboris-Pinetum*). We also surveyed assemblages of ladybirds in those two forest patches in early post-overwintering period.

2. Study area and methods

The study was conducted in March and April of 2014 and 2015 in a forest complex called Park Młociński that is situated on the

north-western periphery of Warsaw, Poland (52°19'N, 20°55.5'E, UTM: DC99). Park Młociński covers an area of about 100 ha and adjoins the left bank of the river Vistula. In the central part of this complex we selected two forest patches representing different plant associations: oak-linden-hornbeam forest (*Tilio-Carpinetum*) (thereafter referred to as the deciduous forest) and mixed oak-pine forest (*Quercus roboris-Pinetum*) (thereafter referred to as the mixed forest). In each forest patch, 10 regularly distributed sampling plots of one square meter area (1 m x 1 m) were established as shown in Fig. 1. In mid-March, the whole litter layer within each plot was sifted with an entomological sieve of 10 mm x 10 mm mesh. The sifted material was sorted in the laboratory and each ladybird beetle found was noted and identified to the species level. Based on these samples, we determined the species composition and calculated densities of ladybirds hibernating in the litter of both habitats.

In addition to the litter samples, in early spring (April), when ladybirds usually leave their winter shelters, we sampled them from the vegetation in both habitats by sweep-netting through low plants and shaking down insects from tree and shrub branches on a 1 m x 1 m

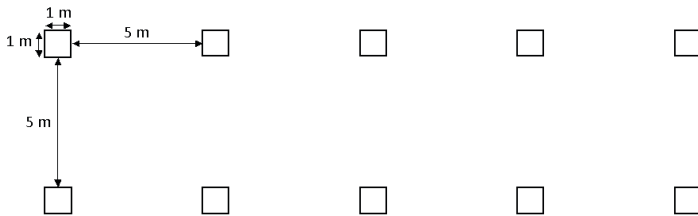


Fig. 1. Arrangement of plots for the litter samples of Coccinellidae in the deciduous and mixed forest.

beating sheet. Samples were taken at about one-week intervals and in each habitat individual sampling sessions lasted for about one hour. In

the deciduous forest beating sheet samples were collected from *Prunus padus*, *Corylus avellana*, *Carpinus betulus*, *Acer platanoides* and *Tilia cordata*, and in the mixed forest from *Pinus sylvestris*, *Quercus robur*, *Juniperus communis*, *Prunus serotina* and *Carpinus betulus*.

3. Results

3.1. March litter samples

In 2014, sifting the litter covering 10 sampling plots in the deciduous forest resulted in finding 18 ladybird individuals, which gives the average density of 1.8 individuals/m². On individual one square meter plots, the ladybird numbers ranged between 0 and 4. The average density in 2015 was the same (18 individuals, 1.8 individuals/m²) but ladybirds were distributed in more aggregative manner (six plots with no ladybirds, three plots with one ladybird on each and one plot with 15 ladybirds). The analogous sampling in the mixed forest yielded slightly lower ladybird numbers in 2014 (16 individuals in total = 1.6 individuals/m², range 1-3 individuals/m²) and much lower in 2015 (two individuals in total = 0.2 ind./m², range 0-1 individual/m²).

In the litter of the deciduous forest six ladybird species were recorded in 2014 and four in 2015 (seven species in total). The most abundant were *Propylea quatuordecimpunctata* (in 2014) and *Vibidia duodecimguttata* (in 2015) (Fig. 2A, C). The recorded assemblages of ladybirds overwintering in the litter of mixed forest contained less species: three in 2014 and two in 2015 (four for both years). In 2014 *P. quatuordecimpunctata* clearly predominated, while in the next year single individuals of *P. quatuordecimpunctata* and *Coccinella quinquepunctata* were only collected (Fig. 2B, D).

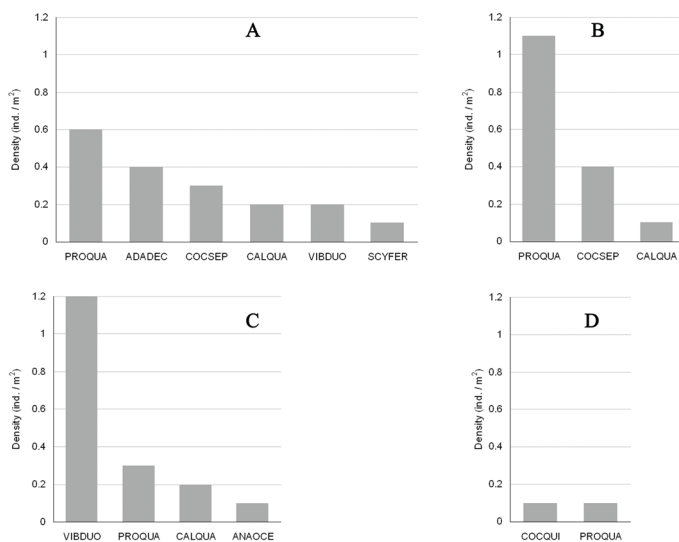


Fig. 2. Species composition of Coccinellidae sifted from the litter of the deciduous forest (A and C) and mixed forest (B and D). A-B – March 2014, C-D – March 2015. Species symbols: ADADEC – *Adalia decempunctata*, ANAOCE – *Anatis ocellata*, CALQUA – *Calvia quatuordecimguttata*, COCQUI – *Coccinella quinquepunctata*, COCSEP – *Coccinella septempunctata*, PROQUA – *Propylea quatuordecimpunctata*, SCYFER – *Scymnus ferrugatus*, VIBDUO – *Vibidia duodecimguttata*.

3.2. April vegetation samples

Sampling in April revealed more ladybird species than the earlier litter sifting (Tables 1 and 2). The tendency of the deciduous forest to be more species-rich than the mixed forest was maintained: 15 species (13 in 2014 and 10 in 2015) were recorded in the deciduous forest and 7 species (7 in 2014 and only 2 in 2015) in the mixed forest. The species most abundant in the deciduous forest was *Scymnus ferrugatus* followed by *Vibidia duodecimguttata*, *Calvia decemguttata* and *P. quatuordecimpunctata*. In the mixed forest, the only relatively frequently recorded species were *P. quatuordecimpunctata* and *Coccinella septempunctata*.

Table 1. Coccinellidae recorded in April 2014 and April 2015 in the oak-linden-hornbeam forest (*Tilio-Carpinetum*) in Park Młociński. In pairs of values separated by a slash the first value indicates number of individuals caught from low vegetation by a sweeping net and the second, those shaken down from trees and shrubs on a beating sheet.

Species	2014							2015							Total
	1 Apr.	8 Apr.	17 Apr.	24 Apr.	29 Apr.	9 Apr.	16 Apr.	21 Apr.	27 Apr.	27 Apr.	27 Apr.	27 Apr.	Total		
<i>Scymnus ferrugatus</i> (Moll)	0 / 15	0 / 8	0 / 3	1 / 1	0 / 1	0 / 4	0 / 5	0 / 26	-	-	-	-	64		
<i>Vibidia duodecimguttata</i> (Poda)	-	-	-	0 / 11	-	-	-	-	-	-	-	0 / 22	33		
<i>Calvia decemguttata</i> (L.)	0 / 2	0 / 7	1 / 4	0 / 2	-	1 / 0	0 / 2	0 / 9	0 / 1	0 / 1	0 / 1	0 / 1	29		
<i>Propylea quatuordecimpunctata</i> (L.)	-	0 / 3	0 / 2	1 / 2	1 / 0	-	-	-	0 / 8	0 / 8	0 / 8	0 / 8	17		
<i>Adalia decempunctata</i> (L.)	0 / 2	-	-	-	-	0 / 4	-	-	-	-	-	-	6		
<i>Coccinella septempunctata</i> L.	-	0 / 2	0 / 2	-	-	-	-	0 / 1	-	-	-	-	5		
<i>Halyzia sedecimguttata</i> (L.)	-	-	-	-	-	-	0 / 2	0 / 3	-	-	-	-	5		
<i>Scymnus suturalis</i> Thunberg	-	-	1 / 1	1 / 0	-	0 / 1	-	-	-	-	-	-	4		
<i>Calvia quatuordecimguttata</i> (L.)	-	0 / 1	-	-	-	0 / 1	-	-	-	-	-	-	2		
<i>Scymnus auritus</i> Thunberg	-	-	-	0 / 2	-	-	-	-	-	-	-	-	2		
<i>Clitostethus arcuatus</i> (Rossi)*	-	1 / 0	-	-	-	-	-	-	-	-	-	-	1		
<i>Exochomus quadripustulatus</i> (L.)	-	0 / 1	-	-	-	-	-	-	-	-	-	-	1		
<i>Rhyzobius chrysomeloides</i> (Herbst)	-	-	0 / 1	-	-	-	-	-	-	-	-	-	1		
<i>Scymnus abietis</i> (Paykull)*	-	-	-	-	-	-	0 / 1	-	-	-	-	-	1		
<i>Scymnus nigrinus</i> Kugelann	-	-	0 / 1	-	-	-	-	-	-	-	-	-	1		
Total	19	23	16	21	2	11	10	39	31	31	31	31	172		
No. of species	3	7	7	6	2	5	4	4	4	4	4	4	3		

* rare species treated in detail in the Discussion section

Table 2. Coccinellidae recorded in April 2014 and April 2015 in the mixed oak-pine forest (*Quercus roboris-Pinetum*) in Park Młociński. Pairs of values – as in Table 1.

Species	2014				2015				Total	
	1 Apr.	8 Apr.	17 Apr.	24 Apr.	29 Apr.	9 Apr.	16 Apr.	21 Apr.		27 Apr.
<i>Propylea quatuordecimpunctata</i> (L.)	-	1/0	0/4	0/1	-	-	-	-	1/7	13
<i>Coccinella septempunctata</i> L.	0/1	2/5	1/1	1/1	-	-	-	-	-	12
<i>Adalia decempunctata</i> (L.)	0/1	0/1	-	-	-	-	-	-	-	2
<i>Chilocorus bipustulatus</i> (L.)	0/2	-	-	-	-	-	-	-	-	2
<i>Scymnus auritus</i> Thunberg	-	-	-	0/1	-	-	-	-	0/1	2
<i>Harmonia quadripunctata</i> (Pont.)	-	-	-	0/1	-	-	-	-	-	1
<i>Scymnus femoralis</i> (Gyllenhal)*	-	-	-	-	0/1	-	-	-	-	1
Total	4	9	6	5	1	-	-	-	8	33
No. of species	3	3	2	4	1	-	-	-	2	

* as in Table 1

4. Discussion

4.1. Species composition and abundance

The assemblages of ladybird beetles recorded to overwinter in the patches of deciduous and mixed forest in Park Młociński were rather species-poor compared to those found in other studies (Godeau and Ceryngier 2011, Ceryngier and Godeau 2013, Kozon *et al.* 2016), and dominated by a ubiquitous *P. quatuordecimpunctata* (especially in 2014) with lower contributions of other relatively common species, such as *C. septempunctata*, *Adalia decempunctata*, *Calvia quatuordecimguttata* and *V. duodecimguttata*. This latter species, most abundant in the litter of the deciduous forest in 2015, until recently was considered rare in Poland, but for several years is commonly recorded both in its breeding and feeding habitats (Ceryngier *et al.* 2016a, b) and overwintering sites (Ceryngier and Godeau 2013, Kozon *et al.* 2016).

Densities of overwintering ladybirds recorded in this study were low, not exceeding two individuals per square meter. In anthropogenic habitats in the municipality of Łomianki (a few kilometers from our study area) Kozon *et al.* (2016) found average densities of overwintering Coccinellidae to be nearly 7 individuals/m². Also the species richness recorded by Kozon *et al.* (2016) was much higher (25 ladybird species) than that recorded in this study (altogether 8 species for both habitats and years). Certainly, this difference partly resulted from differences in the diversity of habitats considered in the two studies. While our investigations were conducted in two relatively uniform forest habitats, those reported by Kozon *et al.* (2016) involved many habitats in farmland, built-up areas and highway roadsides. However, accepting that the present study was limited to only two habitats, the number of recorded species is still low, especially for the mixed forest (4 species found during 2-year survey). In a syntaxonomically similar mixed forest patch in Kampinos National Park (about 7 km west of Park Młociński), Godeau and Ceryngier (2011) found much richer overwintering assemblage (12 species) dominated by rare wet habitat specialists: *Calvia quindecimguttata*, *C. decemguttata* and *Sospita vigintiguttata*. Sharp differences between the assemblages

recorded in Park Młociński and Kampinos National Park might be due to different environmental conditions within the forest sites and around them. The former site lies in a small (about 100 ha) complex of forests, mostly anthropogenically degraded. The shrub layer of this site is dominated by the invasive black cherry (*Prunus serotina*). In contrast, the better preserved site in Kampinos National Park is surrounded by vast areas of diverse forest and marshy ecosystems.

The ladybirds recorded in April on the vegetation might either previously overwinter in the same habitat as they were caught or might immigrate in early spring from adjacent habitats. Some of the species only found in April on the vegetation could be present during the winter in the same habitat but in microhabitats different than the litter (e.g. under tree bark). Indeed, several April collected species (*Chilocorus bipustulatus*, *Harmonia quadripunctata*, *Rhyzobius chrysomeloides*, *Scymnus ferrugatus*, *S. suturalis*,) are known to overwinter under loose tree bark (Bielawski 1955, 1959, 1961, 1962, Spitzer *et al.* 2010, Hodek 2012). Several other species (*Clitostethus arcuatus*, *Exochomus quadripustulatus*, *Scymnus abietis*, *S. femoralis*, *S. nigrinus*) might simply be too rare in the investigated habitats to be recovered in the litter samples. The species most abundantly collected in April in oak-linden-hornbeam forest (*S. ferrugatus*, *V. duodecimguttata* and *C. decemguttata*) are deciduous tree specialists moderately common in Poland. In an earlier survey of Coccinellidae of Mazovian oak-linden-hornbeam forests (Czechowska 1989) neither *S. ferrugatus* nor *V. duodecimguttata* was recorded, and *C. decemguttata* was found in low numbers. April sampling in mixed oak-pine forest resulted mostly in finding very common, ubiquitous species, *P. quatuordecimpunctata* and *C. septempunctata*.

4.2 Rare species

Despite the generally poor ladybird diversity and predominance of common species in the sites chosen for this study, we found there several species that are rarely recorded in Poland. Three of them,

Clitostethus arcuatus, *Scymnus abietis* and *S. femoralis*, are discussed below in detail.

Clitostethus arcuatus (Rossi, 1794)

A single specimen of this species was swept on 8 April 2014 from the layer of low vegetation in the deciduous forest. *C. arcuatus* is a specialized feeder of whiteflies (Hemiptera: Aleyrodidae) that mainly occurs in the Mediterranean region (Bathon and Pietrzik 1986) but in recent years has been reported to expand northwards and become more common in many parts of Europe, including Ukraine (Chumak and Berest 2003), the Czech Republic (Špryňar 2012), Germany (Pütz *et al.* 2000), and England (Springate and Arnold 2011, Brown and Whitehead 2012). In the nineteenth century and at the beginning of the twentieth century *C. arcuatus* was reported from present-day southern Poland: Letzner (1874) noted one specimen from Legnica (Liegnitz) and Eichler (1914) caught one specimen in the Ojców environs. As those specimens could not be found in entomological collections, Bielawski (1959, 1962) questioned the occurrence of this species in Poland. In 2005, however, Królik (2006) collected a series of specimens of *C. arcuatus* in Kluczbork (Opolian Silesia) confirming the affiliation of this ladybird with Polish fauna. Later, other specimens were collected again in Kluczbork (in 2006) and in nearby Szczedrzyk (in 2010) (Greń *et al.* 2013), as well as in Rogalin near Poznań (in 2008) (Ruta *et al.* 2009). In Mazovia *C. arcuatus* is recorded since 2013 (Ceryngier *et al.* 2016a). In 2015 it was also found in several localities in Cedyňa Landscape Park (NW Poland) (Ceryngier *et al.* 2016b). The records from Poland confirm the expansion of *C. arcuatus* in Europe and document further spread of the species to the north of the continent.

Scymnus (Parapullus) abietis (Paykull, 1798)

A specimen of this species reported here was collected on 16 April 2015 from *Prunus padus* in the deciduous forest. *Scymnus abietis* specializes in feeding on adelgids (Hemiptera: Adelgidae) occurring on spruce (*Picea*). In older entomological literature *S. abietis* was rarely reported

from the area of present-day Poland, mostly from its southern part (Burakowski *et al.* 1986). Only recently it has more frequently been reported from central and northern Poland: Greater Poland (Ruta *et al.* 2009), Mazovia (Plewa *et al.* 2014a, 2014b, Borowski 2015, Ceryngier *et al.* 2016a), Białowieża Primeval Forest (Jędryczkowski and Gutowski 2014, Plewa *et al.* 2014a), Wigry National Park (Ceryngier *et al.* 2015) and Cedyňa Landscape Park (Ceryngier *et al.* 2016b).

Scymnus (Scymnus) femoralis (Gyllenhal, 1827)

In this study one female of *S. femoralis* was caught on 29 April 2014 from *Prunus serotina* growing in the mixed forest. *Scymnus femoralis* is known to occur in several countries in central and northern Europe (Kovář 2007). In Poland it has been reported from a few localities: Wrocław (Ruta *et al.* 2009), Mokrz near Wronki (Ruta *et al.* 2009), Kampinos National Park and its vicinity (Ceryngier 1997, Marczak 2010, Kozon *et al.* 2016), Szumin near Łochów (Ruta *et al.* 2009), Biebrza National Park (Ruta *et al.* 2009), and Wigry National Park (Ceryngier *et al.* 2015).

References

- Bathon H., Pietrzik J., 1986, *Zur Nahrungsaufnahme des Bogen-Marienkäfers, Clitostethus arcuatus (Rossi) (Col., Coccinellidae), einem Vertilger der Kohlmottenlaus, Aleurodes proletella Linné (Hom., Aleurodidae)*, Journal of Applied Entomology, 102, 321-326.
- Bielawski R., 1955, *Morphological and systematical studies on Polish species of the genus Rhyzobius Stephens, 1831 (Coleoptera, Coccinellidae)*, Annales Zoologici, 16, 29-50.
- Bielawski R., 1959, *Chrzyszczce – Coleoptera, Biedronki – Coccinellidae, Klucze do oznaczania owadów Polski, cz. 19, zesz. 76*, Państwowe Wydawnictwo Naukowe, Warszawa.
- Bielawski R., 1961, *Coccinellidae (Coleoptera) w zbiorowisku roślin zielnych i młodnika sosnowego w Warszawie na Bielanach*, Fragmenta Faunistica, 8, 485-525.

- Bielawski R., 1962, *Materiały do poznania Coccinellidae Polski. I (Coleoptera)*, Polskie Pismo Entomologiczne, 32, 191-205.
- Borowski J., 2015, *Beetles (Coleoptera) of the Rogów region. Part II – ladybirds (Coccinellidae)*, International Letters of Natural Sciences, 7, 90-101.
- Brown A., Whitehead P. F., 2012, *Clitostethus arcuatus (Rossi, 1794) (Col., Coccinellidae) breeding in the Kidderminster area of Worcestershire: overwintering strategy and breeding biology*, Worcestershire Records, 33, 20-22.
- Burakowski B., Mroczkowski M., Stefańska J., 1986, *Chrząszcze – Coleoptera. Cucujoidea, część 2*, Katalog Fauny Polski, 23, 13.
- Ceryngier P., 1997, *Ekologiczne uwarunkowania występowania i liczebności Coccinella septempunctata L. (Coleoptera, Coccinellidae) w agrocenozach*, PhD thesis, Institute of Ecology, Polish Academy of Sciences, Dziekanów Leśny.
- Ceryngier P., 2015, *Ecology of dormancy in ladybird beetles (Coleoptera: Coccinellidae)*, Acta Societatis Zoologicae Bohemicae, 79, 29-44.
- Ceryngier P., Godeau J.-F., 2013, *Predominance of Vibidia duodecimguttata (Poda, 1761) in the assemblages of ladybird beetles (Coleoptera: Coccinellidae) overwintering in floodplain forests*, Baltic Journal of Coleopterology, 13, 41-50.
- Ceryngier P., Krzysztofiak A., Romanowski J., 2015, *Biedronkowate (Coleoptera: Coccinellidae) Wigierskiego Parku Narodowego*, Parki Narodowe i Rezerваты Przyrody, 34, 13-24.
- Ceryngier P., Romanowski J., Romanowski M., 2016a, *Biedronkowate (Coleoptera: Coccinellidae) Parku Skaryszewskiego w Warszawie*, in: J. Romanowski (ed.), *Park Skaryszewski w Warszawie – przyroda i użytkowanie*, Wydawnictwo Naukowe UKSW, Warszawa, 177-186.
- Ceryngier P., Romanowski J., Romanowski M., 2016b, *Biedronkowate (Coleoptera: Coccinellidae) Cedyńskiego Parku Krajobrazowego*, Wiadomości Entomologiczne, 35, 41-58.
- Chumak P. Ya., Berest Z. L., 2003, *The lady beetle, Clitostethus arcuatus Rossi (Coleoptera: Coccinellidae), a predator of celandine whitefly, Aleurodes proletella and greenhouse whitefly, Trialeurodes vaporariorum (Homoptera: Aleurodidae) in Ukraine*, The Kharkov

- Entomological Society Gazette, 10, 175-178 (in Russian, with English summary).
- Czechowska W., 1989, *Coccinellidae (Coleoptera) of linden-oak-hornbeam and thermophilous oak forests of the Mazovian Lowland*, Fragmenta Faunistica, 32, 159-182.
- Eichler W., 1914, *Przyczynek do tęgopokrywych Ojcowa*, Pamiętnik Fizyograficzny, 22, 138-149.
- Godeau J.-F., Ceryngier P., 2011, *Notes on the overwintering of marshy forest ladybirds in Poland and on the colour change in *Sospita vigintiguttata* throughout the winter*, Harmonia – Coccinelles du monde, 6, 20-24.
- Greń C., Szołtys H., Grzywocz J., Królik R., 2013, *Chrzęszcze (Coleoptera) Śląska Dolnego i Górnego – dotychczasowy stan poznania oraz nowe dane faunistyczne: biedronkowate (Coccinellidae)*, Acta entomologica silesiana, 21, 31-52.
- Hodek I., 2012, *Diapause/dormancy*, in: I. Hodek, H. F. van Emden, A. Honěk (eds) *Ecology and Behaviour of the Ladybird Beetles (Coccinellidae)*, Wiley-Blackwell, Chichester, 275-342.
- Honěk A., 2012, *Distribution and habitats*, in: I. Hodek, H. F. van Emden, A. Honěk (eds), *Ecology and Behaviour of the Ladybird Beetles (Coccinellidae)*, Wiley-Blackwell, Chichester, 110-140.
- Jędrzykowski W. B., Gutowski J. M., 2014, *Biedronkowate (Coleoptera: Coccinellidae) Puszczy Białowieskiej*, Wiadomości Entomologiczne, 33, 200-213.
- Kovář I., 2007, *Family Coccinellidae Latreille, 1807*, in: I. Löbl, A. Smetana (eds), *Catalogue of Palaearctic Coleoptera, Vol. 4*, Apollo Books, Stenstrup, 568-631.
- Kozon E., Ceryngier P., Romanowski J., 2016, *Zimowanie biedronkowatych (Coleoptera: Coccinellidae) w strefie podmiejskiej Warszawy*, Wiadomości Entomologiczne, 35, 82-90.
- Królik R., 2006, *Potwierdzenie występowania w Polsce *Clitostethus arcuatus* (P. Rossi, 1794) (Coleoptera: Coccinellidae)*, Wiadomości Entomologiczne, 25, 126.

- Letzner K., 1874, *Nachträge zu seinem Verzeichniss der Käfer Schlesiens*, Jahres-Bericht der Schlesischen Gesellschaft für Vaterländische Cultur, 51, 184-188.
- Marczak D., 2010, *Rzadkie gatunki chrząszczy (Insecta: Coleoptera) Kampinoskiego Parku Narodowego*, Parki Narodowe i Rezerваты Przyrody, 29, 81-89.
- Plewa R., Jaworski T., Hilszczański J., 2014a, *Martwe drewno a jakościowa i ilościowa struktura chrząszczy (Coleoptera) saproksylicznych w drzewostanach dębowych*, Materiały i Studia CEPL w Rogowie, 41, 279-299.
- Plewa R., Hilszczański J., Jaworski T., Sierpiński A., 2014b, *Nowe i rzadko spotykane chrząszcze (Coleoptera) saproksyliczne wschodniej Polski*, Wiadomości Entomologiczne, 33, 85-96.
- Pütz A., Klausnitzer B., Schwartz A., Gebert J., 2000, *Der Bogen-Zwergmarienkäfer Clitostethus arcuatus (Rossi, 1794) – eine mediterrane Art auf Expansionskurs (Col., Coccinellidae)*, Entomologische Nachrichten und Berichte, 44, 193-197.
- Ruta R., Jałoszyński P., Konwerski S., Majewski T., Barłożek T., 2009, *Biedronkowate (Coleoptera: Coccinellidae) Polski. Część I. Nowe dane faunistyczne*, Wiadomości Entomologiczne, 28, 91-112.
- Spitzer L., Konvička O., Tropek R., Roháčová M., Tuf I. H. & Nedvěď O., 2010, *Společenstvo členovců (Arthropoda) zimujících na jedli bělokoré (Abies alba) na Valašsku (okr. Vsetín, Česká republika)*, Časopis Slezského Zemského Muzea, Opava, série A – vědy přírodní, 59, 217-232.
- Springate S, Arnold S. E. J., 2011, *New vice-county records of Clitostethus arcuatus (Rossi) (Col.: Coccinellidae) and a new association with wild cabbage*, British Journal of Entomology and Natural History, 24, 224-225.
- Špryňar P., 2012, *Faunistic records from the Czech Republic – 332. Coleoptera: Coccinellidae: Scymninae*, Klapalekiana, 48, 157-158.
- Turnock W. J., Wise I. L., 2004, *Density and survival of lady beetles (Coccinellidae) in overwintering sites in Manitoba*, Canadian Field-Naturalist, 118, 309-317.

van Emden H. F., Hodek I., 2012, *Recent progress and possible future trends in the study of Coccinellidae*, in: I. Hodek, H. F. van Emden, A. Honěk (eds), *Ecology and Behaviour of the Ladybird Beetles (Coccinellidae)*, Wiley-Blackwell, Chichester, 520-525.

Zimowe i wczesnowiosenne zgrupowania biedronkowatych (Coleoptera: Coccinellidae) w dwóch środowiskach leśnych na przedmieściu Warszawy, centralna Polska

Streszczenie

W marcu i kwietniu, w latach 2014 i 2015 badano zgrupowania biedronek zimujących i wychodzących z miejsc zimowania w płatach lasu liściastego (*Tilio-Carpinetum*) i boru mieszanego (*Quercu roboris-pinetum*) w kompleksie leśnym na północno-zachodnim skraju Warszawy. W marcu próby pobierano poprzez przesiewanie ściółki leśnej przez sito entomologiczne, zaś w kwietniu odławiano biedronki z roślinności przy użyciu czerpaka entomologicznego i płachty do otrząsania owadów. W obu latach średnie zagęszczenia biedronek stwierdzanych w marcu w dwóch typach lasu były niskie i nie przekraczały 2 osobników/m². W ściółce lasu liściastego zarejestrowano zimowanie 7 gatunków biedronek, a w ściółce boru mieszanego – 4 gatunków. W 2014 roku najliczniejszym gatunkiem była w obu środowiskach *Propylea quatuordecimpunctata*, zaś w 2015 roku w ściółce lasu liściastego przeważała *Vibidia duodecimguttata*. Podczas odłowów kwietniowych stwierdzono 15 gatunków w lesie liściastym i 7 gatunków w borze mieszanym. W pierwszym z wymienionych środowisk dominował *Scymnus ferrugatus*, a w drugim *P. quatuordecimpunctata* i *Coccinella septempunctata*. Kilka z odnotowanych gatunków, takich jak *Clitostethus arcuatus*, *Scymnus femoralis* i *S. abietis*, to biedronki rzadko podawane z Polski.

Słowa kluczowe: Coccinellidae, zimowanie, *Clitostethus arcuatus*, *Scymnus abietis*, *Scymnus femoralis*