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Ladybird beetles (Coleoptera: Coccinellidae) of Cedynia Landscape Park

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ABSTRACT: The species richness and relative abundances of ladybird beetles (Coleoptera: Coccinellidae) were surveyed in 2014-2015 in Cedynia Landscape Park (NW Poland). In total, 50 species were found, of which the most common was the invasive *Harmonia axyridis* (PALLAS, 1773). Some of the species recorded in this study, such as *Hyperaspis concolor* (SUFFRIAN, 1843), *Clitostethus arcuatus* (ROSSI, 1794), *Nephus bipunctatus* (KUGELANN, 1794), *N. quadrimaculatus* (HERBST, 1783), *Scymnus ater* KUGELANN, 1794, *S. limbatus* STEPHENS, 1832, *Novius cruentatus* (MULSANT, 1846) and *Cynegetis impunctata* (LINNAEUS, 1767), have very rarely been reported in Poland. **KEY WORDS:** Coccinellidae, Cedynia Landscape Park, N-W Poland.

Introduction

The Cedynia Landscape Park covers the westernmost part of Poland, with an area of 30,850 ha. It lies at the junction of three geographical macroregions – the Toruńsko-Eberswaldzka Ice-marginal Valley (the mesoregion of the Freienwalde Basin), the Szczecin Shoreland (the mesoregion of the Lower Oder Valley) and the West Pomerania Lakeland (the mesoregion of the Myśliborskie Lakeland), but according to a division used by the Catalogue of Polish Fauna, it belongs entirely to the Pomeranian Lakeland. The area is a mosaic of diverse habitats such as riparian forests, peat moors and reed beds in the swampy Oder Valley, thermophilic turf and thickets on the slopes of the valley, as well as pine and mixed forests, covering morainic plateaux. The geographical location

and different habitats of the park render it a place where diverse and species-rich groupings of plants and animals occur (RĄKOWSKI i in. 2004). The degree to which the fauna of Coccinellidae of the Cedyńia Landscape Park has been known is small. The already published data refer almost entirely to the forest-steppe Bielinek Reserve, and they are included in the study by ENGEL (1938), demonstrating 14 ladybird species, as well as in the studies by ZUMPT (1931) and GRIEP (1939), both providing one species each. The only record outside the Bielinek Reserve is probably wrong, and it concerns the specimen *Hyperaspis erythrocephala* (FABRICIUS, 1787) collected in 1942 in the town Siekierki. According to HORION (1961) and BURAKOWSKI & all. (1986), the said specimen (lost during the war) might have been erroneously labeled or accidentally taken to the environs of Siekierki. *H. erythrocephala* occurs predominantly in Asia and Eastern Europe; moreover, it is recorded from few localities in Central Europe and Denmark (KOVÁŘ 2007). In Poland and its current borders, apart from the doubtful locality in Siekierki, the species was recorded only from the environs of Przemyśl (TRELLA 1923).

The aim of the following study is to recognise more fully the species richness of Coccinellidae of the Cedyńia Landscape Park and provide an evaluation of the relative abundance of particular species. A special attention has been drawn to the quantitative role of the invasive species *Harmonia axyridis* (PALLAS, 1773) in ladybird groupings in different habitats of the Park.

Material and methods

Coccinellidae were collected and observed during three visits to the Cedyńia Landscape Park on the days 16–18 June 2014, 22–25 July 2015 and 15–17 September 2015. The materials were collected from different habitats with the use of standard collecting methods: sweeping plants with a butterfly net, shaking insects off trees and shrubs onto a 1 m × 1 m canvas (a so-called entomological umbrella), and collecting spotted specimens directly. All collected specimens were recorded and the majority of them freed at the place of their capture after having been labeled. Only a few specimens were taken to serve as an evidence material (from one up to a few specimens of each of the recorded species), as well as those which required laboratory labeling. The evidence

specimens can be found in the authors' collections. The nomenclature and systematic arrangement of ladybird beetles follow KOVÁŘ (2007).

Results

During the research, the total of 2587 Coccinellidae specimens (2265 imagines, 286 larvae, and 36 pupae) belonging to 50 species were recorded (Tab. 1).

Table I. The list of Coccinellidae found in Cedynia Landscape Park during this study with the number of specimens recorded

Systematic position	Number of imagines (2) larvae (3) & pupae (4)			
	1	2	3	4
Coccidulinae, Coccidulini				
<i>Coccidula rufa</i> (HERBST, 1783)		21		
<i>Coccidula scutellata</i> (HERBST, 1783)		3		
<i>Rhyzobius chrysoloides</i> (HERBST, 1783)		102	6	
Scymninae, Hyperaspidini				
<i>Hyperaspis concolor</i> (SUFFRIAN, 1843)		8		
Scymninae, Scymnini				
<i>Clitostethus arcuatus</i> (ROSSI, 1794)		24		
<i>Nephus (Bipunctatus) bipunctatus</i> (KUGELANN, 1794)		5		
<i>Nephus (Nephus) quadrimaculatus</i> (HERBST, 1783)		1		
<i>Nephus (Nephus) redtenbacheri</i> (MULSANT, 1846)		3		
<i>Scymnus (Neopullus) ater</i> KUGELANN, 1794		1		
<i>Scymnus (Neopullus) haemorrhoidalis</i> HERBST, 1797		14		
<i>Scymnus (Neopullus) limbatus</i> STEPHENS, 1832		3		
<i>Scymnus (Parapullus) abietis</i> (PAYKULL, 1798)		5		
<i>Scymnus (Pullus) auritus</i> THUNBERG, 1795		1		
<i>Scymnus (Pullus) ferrugatus</i> (MOLL, 1785)		1		
<i>Scymnus (Pullus) suturalis</i> THUNBERG, 1795		86		
<i>Scymnus (Scymnus) frontalis</i> (FABRICIUS, 1787)		5*		
<i>Scymnus (Scymnus) nigrinus</i> KUGELANN, 1794		6		
<i>Scymnus (Scymnus) rubromaculatus</i> (GOEZE, 1777)		5		
Scymninae, Stethorini				
<i>Stethorus pusillus</i> (HERBST, 1797)		224		
Chilocorinae, Chilocorini				
<i>Chilocorus bipustulatus</i> (LINNAEUS, 1758)		10	11	3
<i>Chilocorus renipustulatus</i> (Scriba, 1791)		36	28	1
<i>Exochomus quadripustulatus</i> (LINNAEUS, 1758)		84		
Chilocorinae, Platynaspidini				
<i>Platynaspis luteorubra</i> (GOEZE, 1777)			2	

1	2	3	4
Ortaliinae, Noviini <i>Novius cruentatus</i> (MULSANT, 1846)	4		
Coccinellinae, Halyziini <i>Halyzia sedecimguttata</i> (LINNAEUS, 1758) <i>Psyllobora vigintiduopunctata</i> (LINNAEUS, 1758) <i>Vibidia duodecimguttata</i> (PODA, 1761)	27 98 60	5 20 2	2 1
Coccinellinae, Tytthaspidini <i>Anisosticta novemdecimpunctata</i> (LINNAEUS, 1758) <i>Coccinula quatuordecimpustulata</i> (LINNAEUS, 1758) <i>Tytthaspis sedecimpunctata</i> (LINNAEUS, 1761)	70 89 156	21 50	
Coccinellinae, Coccinellini <i>Adalia bipunctata</i> (LINNAEUS, 1758) <i>Adalia decempunctata</i> (LINNAEUS, 1758) <i>Anatis ocellata</i> (LINNAEUS, 1758) <i>Aphidecta oblitterata</i> (LINNAEUS, 1758) <i>Calvia decemguttata</i> (LINNAEUS, 1767) <i>Calvia quatuordecimguttata</i> (LINNAEUS, 1758) <i>Calvia quindecimguttata</i> (FABRICIUS, 1777) <i>Coccinella magnifica</i> L. REDTENBACHER, 1843 <i>Coccinella quinquepunctata</i> LINNAEUS, 1758 <i>Coccinella septempunctata</i> LINNAEUS, 1758 <i>Harmonia axyridis</i> (PALLAS, 1773) <i>Harmonia quadripunctata</i> (PONTOPPIDAN, 1763) <i>Hippodamia tredecimpunctata</i> (LINNAEUS, 1758) <i>Hippodamia variegata</i> (GOEZE, 1777) <i>Myrrha octodecimguttata</i> (LINNAEUS, 1758) <i>Myzia oblongoguttata</i> (LINNAEUS, 1758) <i>Oenopia conglobata</i> (LINNAEUS, 1758) <i>Propylea quatuordecimpunctata</i> (LINNAEUS, 1758)	14 26 13 28 61 2 298 481 34 10 22 3 4 4 75	1 1 1 18 43 28 12 11 1 1 11	1 23 2 4 2
Epilachninae, Cynegetini <i>Cynegetis impunctata</i> (LINNAEUS, 1767)	1		
Epilachninae, Epilachnini <i>Subcoccinella vigintiquatuorpunctata</i> (LINNAEUS, 1758)	26	4	

* Several related species belonging to the *Scymnus frontalis* group can be reliably connected to the species based on the male copulatory organs. Two of the five collected specimens of this group were males. After the dissection of their genitalia, both appeared to be *S. frontalis*.

The most frequently collected species was the invasive Asian lady beetle *Harmonia axyridis* (513 species = 19.8% of all collected lady beetles). Its presence in the groupings of Coccinellidae was, however, very divergent in different types of habitats. It held a dominant position only in habitats consisted of deciduous trees and shrubs (31% of the

collected lady beetles). Its presence on low vegetation (herbaceous plants and dwarf shrubs) amounted to 16% and was lower than the presence of *Coccinella septempunctata* LINNAEUS, 1758 and *Tytthaspis sedecimpunctata* (LINNAEUS, 1761), and as for *H. axyridis*, its presence on coniferous trees (pines, spruces, and junipers) amounted to only 3% of the recorded species. The most abundant were *Rhyzobius chrysomeloides* (HERBST, 1783) and *Scymnus suturalis* THUNBERG, 1795 (Fig. 1).

Three forms of multicoloured Asian lady beetle were recorded: *H. axyridis* f. *succinea* (HOPE, 1843), *H. axyridis* f. *spectabilis* (FALDERMANN, 1835) and *H. axyridis* f. *conspicua* (FALDERMANN, 1835). As for the frequency, the form *succinea* was definitely predominant (469 out of 481 collected adults of *H. axyridis* = 97.5%). The presence of the form *spectabilis* amounted to 1.7% (8 specimens), whereas the form *conspicua* amounted to 0.8% (4 specimens).

Many of the recorded ladybird beetles from the Cedynia Landscape Park belong to the species that are rarely or very rarely encountered in Poland. Below, the detailed data on the collected specimens of these species are provided, with brief information about their biology and more recent literature data published after the release of the part of the Catalogue of Polish Fauna devoted to Coccinellidae (BURAKOWSKI & all. 1986).

Hyperaspis concolor (SUFFRIAN, 1843)

- VU46 the Oder Valley below the Bielinek Reserve at the base of the Storczykowy Gorge, 23 VII 2015, 2 exx., na *Salix viminalis* L.; VU46 Barcie, 17 IX 2015, 4 exx., in the groundcover of an alder riparian forest, 1 ex., in the reed beds of an overgrowing small lake; VU45 Stary Kostrzynek, 17 IX 2015, 1 ex., on a *Reynoutria japonica* HOUTT. Near the old riverbed of the Oder River.

A rarely collected species with a poorly studied biology, probably related to humid habitats. In recent years recorded from the environs of Poznań (RUTA & all. 2009), Wrocław (GREŃ & all. 2013), Rogów (the Łódź Upland) (BOROWSKI 2015) and Warsaw (SZAWARYN & HAWRO 2015).

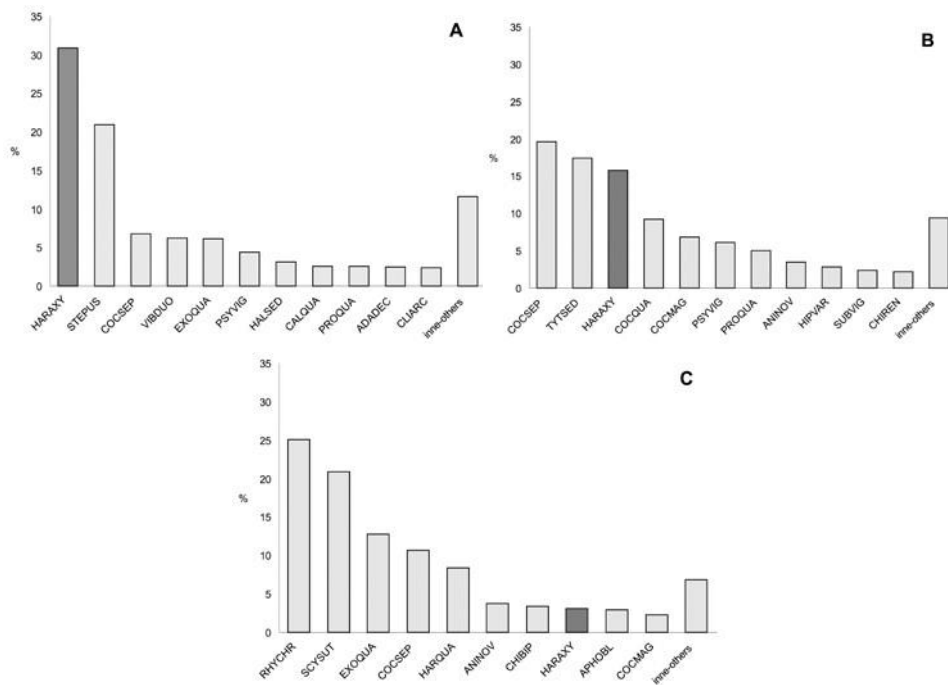


Fig. 1. Species composition of Coccinellidae recorded in Cedynia Landscape Park on deciduous trees and shrubs (A), low vegetation (B) and conifer trees (C).

Darker bars – contribution of the invasive *Harmonia axyridis*.

Species symbols:

ADADEC – *Adalia decempunctata*, ANINOV – *Anisosticta novemdecimpunctata*,
 APHOBL – *Aphidecta oblitterata*, CALQUA – *Calvia quatuordecimguttata*,
 CHIBIP – *Chilocorus bipustulatus*, CHIREN – *Chilocorus renipustulatus*, CLIARC
 – *Clitostethus arcuatus*, COCMAG – *Coccinella magnifica*,
 COCQUA – *Coccinula quatuordecimpustulata*, COCSEP – *Coccinella septempunctata*,
 EXOQUA – *Exochomus quatuordecimpustulatus*, HALSED – *Halyzia sedecimguttata*,
 HARAXY – *Harmonia axyridis*, HARQUA – *Harmonia quadripunctata*,
 HIPVAR – *Hippodamia variegata*, PROQUA – *Propylea quatuordecimpunctata*,
 PSYVIG – *Psyllobora vigintiduopunctata*, RHYCHR – *Rhyzobius chrysomeloides*,
 SCYSUT – *Scymnus suturalis*, STEPUS – *Stethorus pusillus*,
 SUBVIG – *Subcoccinella vigintiquatuorpunctata*,
 TYTSED – *Tythaspis sedecimpunctata*, VIBDUO – *Vibidia duodecimguttata*.

Clitostethus arcuatus (ROSSI, 1794)

- VU54 Gozdowice, 15 IX 2015, 1 ex., on *Hedera helix* L., 2 exx., on *Fraxinus excelsior* L., 17 IX 2015, 5 exx., on *F. excelsior*; VU54 the Słubia Valley near Stare Łysogórki, 15 IX 2015, 11 exx., on *Crataegus* sp.; VU46 Lubiechów Dolny, 15 IX 2015, 1 ex., in an alder. on *H. helix*; VU45 the Oder Valley near Osinów Dolny, 16 IX 2015, 2 exx., on

Crataegus sp.; VU45 Cedynia, 17 IX 2015, 1 ex., the town centre, on a *Fraxinus* sp.; VU56 Piasek vic., 17 IX 2015, 1 ex., in a mixed forest on a *Quercus petraea* (MATT.) LIEBL.

A southern European species, which in recent years has evinced a distinct expansion towards Northern Europe (PÜTZ & all. 2000, CHUMAK & BEREST 2003, SPRINGATE & ARNOLD 2011, BROWN & WHITEHEAD 2012, ŠPRYŇAR 2012). In the second half of the 20th century and at the beginning of the 20th century, it was recorded from Legnica (LETZNER 1874) and Ojców (EICHLER 1914), though the data were questioned by BIELAWSKI (1962) due to the lack of evidence specimens, and until recently, it was not credited to the Polish fauna. Since 2005, it has been recorded from Śląsk Opolski (KRÓLIK 2006, GREŃ & all. 2013), Rogalin near Poznań (RUTA & all. 2009), and Warsaw and its environs (CERYNGIER & all. 2016).

Nephus (Bipunctatus) bipunctatus (KUGELANN, 1794)

– VU45 „Wrzosowiska Cedyńskie” res., 24 VII 2015, 2 exx., on *Quercus robur* L., 15 IX 2015, 2 exx., on *Q. robur*; VU45 the Oder Valley near Osinów Dolny, 16 IX 2015, 1 ex., in an alder riparian forest, on a *Populus* sp.

This very rare in Poland species is encountered on deciduous trees and shrubs, as well as on herbaceous plants, usually in xerothermic habitats (BURAKOWSKI & all. 1986). Recently recorded from the Białowieża Forest (JĘDRYCKOWSKI & GUTOWSKI 2014, PLEWA & all. 2014a), the Biebrza National Park (GUTOWSKI & all. 2006), the Spalsko-Rogowskie Forests (BOROWSKI & KIESZEK 1999, BYK & all. 2013, BOROWSKI 2015), the Świętokrzyskie Mountains (BYK 2007) and Upper Silesia (GREŃ & all. 2013). The species has not been recorded earlier from the Pomeranian Lakeland.

Nephus (Nephus) quadrimaculatus (HERBST, 1783)

– VU54 Gozdowice, 15 IX 2015, 1 ex., on a *Hedera helix*.

Similarly to the previous species, *N. quadrimaculatus* inhabits deciduous trees and shrubs, as well as herbaceous plants at warm and sunny sites (BURAKOWSKI & all. 1986), and is very rare in Poland. More recent reports on having collected specimens of this species come from Wrocław (KANIA 1994), Poznań and its environs (RUTA & all. 2009), Szumina near Łochów in the east part of the Mazovian Lowland (RUTA &

all. 2009), and from the village Miedary located in Upper Sielsia (GREŃ & all. 2013). The species new to the Pomeranian Lakeland.

Nephus (Nephus) redtenbacheri (MULSANT, 1846)

– VU54 the ecological ground „Murawa Bleszyńska” ad Stary Bleszyn, 24 VII 2015, 1 ex., collected from a xerothermic turf; VU56 Krzymów vic., 17 IX 2015, 2 exx., in a blueberry groundcover (*Vaccinium myrtillus* L.) in Brzezina.

Rarely encountered in Poland, though more frequent than other representatives from the genus *Nephus*. Usually present in a layer of groundcover on wetlands. After 1986, it has been recorded in different regions, more often in the north and in the centre than in the south of the country: the Pomeranian Lakeland (GUTOWSKI & RUTA 2004, RUTA & all. 2009, BYK 2011), the Wigry National Park (CERYNGIER & all. 2016), the Biebrza National Park, (GUTOWSKI & all. 2006), the Białowieża National Park (Ruta & all. 2009), Greater Poland and Kujawy (PRZEWOŹNY 2006, RUTA 2006, RUTA & all. 2009), Mazovia (BLOCK & all. 2011, BOROWSKI 2015), the Lublin Upland (STĄCZEK & PIETRYKOWSKA 2002), Lower Silesia (RUTA & all. 2009), Upper Silesia (GREŃ & all. 2013).

Scymnus (Neopullus) ater KUGELANN, 1794

– VU45 the Oder Valley near Osinów Dolny, 16 IX 2015, 1 ex., on *Salix* sp.

The species present probably in the whole Poland, yet everywhere rarely encountered (BURAKOWSKI & all. 1986). Most frequently, it inhabits humid habitats, different deciduous trees and shrubs (BIELAWSKI 1962). In recent years recorded from the Pomeranian Lakeland (RUTA & all. 2009), Greater Poland (RUTA 2006, MOKRZYCKI & all. 2008, RUTA & all. 2009, RENNER & MESSUTAT 2013), Lower Silesia (RUTA & all. 2009, GREŃ & all. 2013), the Łódź Uplands (Rogów) (BOROWSKI 2015), Warsaw (CERYNGIER & all. 2016), the Lublin Upland (PLEWA & all. 2014a) and the Białowieża Forest (JĘDRYCKOWSKI and GUTOWSKI 2014, PLEWA & all. 2014a).

Scymnus (Neopullus) limbatus STEPHENS, 1832

– VU44 the Oder Valley between Stare Łysogórki and Siekierki, 18 VI 2014, 1 ex., on *Salix viminalis*; VU45 the Oder Valley near Osinów Dolny, 16 IX 2015, 1 ex., on *Salix alba* L., 1 ex., on *S. viminalis*.

Very rare in our country, species related to willow-poplar riparian forests and willow thickets on the banks of water bodies. Among the studies published after 1986, it was only recorded by STĄCZEK (1996) from the Janowskie Forests (the Sandomierska Lowland) RUTA & all. (2009) and from the environs of Poznań and Włocławek. The species new to the Pomeranian Lakeland.

Scymnus (Parapullus) abietis (PAYKULL, 1798)

- VU54 Stare Łysogórki, 17 VI 2014, 5 exx., on *Picea* sp. in a backyard garden.

The species trophically related to spruce gall adelges (Hemiptera: Adelgidae). In the 19th and 20th centuries in the today borders of Poland, it was rarely recorded, mainly in the south (BURAKOWSKI & all. 1986). Since recently, it has been more often recorded also from the central and northern regions of the country. In recent years recorded from Poznań and Mokrz in Greater Poland (RUTA & all. 2009), Rogów (the Łódź Uplands) (BOROWSKI 2015), the Wigry National Park (CERYNGIER & all. 2015), the Białowieża Forest (JĘDRYCKOWSKI & GUTOWSKI 2014, PLEWA & all. 2014a), in the eastern part of Mazovia (Łochów and Węgrów vic.) (PLEWA & all. 2014a, 2014b), Warsaw (CERYNGIER & all. 2016), in the environs of Puławy (PLEWA & all. 2014a) and Upper Silesia (GREŃ & all 2013). The species new to the Pomeranian Lakeland.

Scymnus (Scymnus) rubromaculatus (GOEZE, 1777)

- VU54 Stary Błeszyn vic., 17 VI 2014, 1 ex., collected from the xerothermic “Murawa Błeszyńska”, 1 ex., on a wet meadow with nettles; VU45 Stary Kostrzynek vic., 17 VI 2014, 1 ex., in a crop of nettle near the Oder River, 1 ex., on a dry meadow; VU46 Barcie, 17 IX 2015, 1 ex., in the groundcover near an overgrowing small lake.

The species recorded relatively often, although owing to its external similarity to *S. femoralis* (GYLLENHAL, 1827), not included in Bielawski’s identification key (1959), the correctness of some, especially older identifications should be verified.

Mentions about the occurrence of *S. rubromaculatus* published after 1986 concern the environs of Łódź (JADWISZCZAK 1988), the Lublin Upland (STĄCZEK 1990, PLEWA & all. 2014a), Greater Poland (RENNER & MESSUTAT 2007, RUTA & all. 2009, PLEWA & all. 2014a), the central part of the Pomeranian Lakeland (BYK 2011), the Spalsko-Rogowskie Forests (MOKRZYCKI & all. 2013, BOROWSKI 2015), Lower and Upper Silesia

(GREŃ & all. 2013), the environs of Pińczów in the Małopolska Upland (PLEWA & all. 2014a) and the environs of Łochów in the eastern part of Mazovia (PLEWA & all. 2014a). *Platynaspis luteorubra* (GOEZE, 1777)

– VU54 Stary Bleszyn vic., 24 VII 2015, 2 exx. (larvae), observed on a *Rumex acetosa* L.

A ladybird beetle not often collected, related to open and sunny habitats. It usually inhabits herbaceous plants in aphid colonies guarded by ants from the genera *Lasius* FABRICIUS, 1804, *Myrmica* LATREILLE, 1804 or *Tetramorium* MAYR, 1855. The larvae of *P. luteorubra*, which move slowly and are not attacked by ants by virtue of morphological adaptations (flattened body, long bristles, short legs) and probably its chemical camouflage (VÖLKL 1995), they are generally easier to encounter than more agile adult specimens. New faunistic data concerning this species come from many Polish regions: the Pomeranian Lakeland (RUTA & all. 2009), Greater Poland (RENNER & MESSUTAT 2007, RUTA & all. 2009), the environs of Rogów (BOROWSKI 2015), the Suwałki Region (CERYNGIER & all. 2015), the Białowieża Forest (JĘDRYCZKOWSKI & GUTOWSKI 2014), the Polesie National Park (PIETRYKOWSKA & STĄCZEK 2001), the Lublin Upland and Roztocze (RUTA & all. 2009), the Świętokrzyskie Mountains (BYK 2007), the Małopolska Upland and the environs of Ojców in the Krakowsko-Częstochowska Upland (RUTA & all. 2009), and Lower and Upper Silesia (RUTA & all. 2009, GREŃ & all. 2013).

Novius cruentatus (MULSANT, 1846)

– VU54 Stare Łysogórki, 18 VI 2014, 1 ex., on a pine at the sunny edge of a pine forest; VU44 between Stare Łysogórki and Siekierki, 25 VII 2015, 1 ex., on a pine at the sunny edge of a pine forest; VU45 Wrzosowiska Cedyńskie vic., 15 IX 2015, 1 ex., on a pine; VU46 Barcie, 17 IX 2015, 1 ex., in the grassy side of a forest road.

In Poland, the species collected very rarely, only in the northwestern part of the country. During a season, it probably inhabits the crowns of old pines, feeding on scale insects *Palaeococcus fuscipennis* (BURMEISTER, 1839) (Hemiptera: Monophlebidae) (BURAKOWSKI & all. 1986, MENDEL & all. 1998). In recent years, it was recorded only from Pszczew in Greater Poland by RENNER and MESSUTAT (2007) and from Puszczyków near Poznań and the Drawsko Forest (the Pomeranian Lakeland) by RUTA & all. (2009).

Vibidia duodecimguttata (PODA, 1761)

- VU44 between Stare Łysogórki and Siekierki, 23 VII 2015, 8 exx. (5 imagines, 2 larvae, 1 pupa) on *Crataegus* sp.; VU45 Stara Rudnica, 17 VI 2014, 1 ex., on an *Acer pseudoplatanus* L., 5 exx., on an *Acer platanoides* L.; VU45 Stary Kostrzynek, 17 VI 2014, 4 exx., on a *Crataegus* sp., 24 VII 2015, 1 ex., on a *Ulmus* sp.; VU45 Wrzosowiska Cedyńskie vic., 15 IX 2015, 1 ex., on a *Quercus robur*, 1 ex., on a *Betula pendula* ROTH; VU45 Cedynia, 17 IX 2015, 3 exx., the city centre, on a *Fraxinus* sp.; VU46 Lubiechów Dolny, 15 IX 2015, 3 exx., on an *Alnus glutinosa* (L.) GAERTN., 16 IX 2015, 1 ex., on a *A. pseudoplatanus*; VU46 „Olszyna Źródłiskowa pod Lubiechowem Dolnym” res., 16 IX 2015, 1 ex., on a *Humulus lupulus* L., 1 ex., on an *A. glutinosa*; VU46 a forest near Lubiechowo Dolne, 16 IX 2015, 1 ex., on a *Carpinus betulus* L.; VU46 the Bielinek Reserve, 23 VII 2015, 4 exx., on an *A. pseudoplatanus*, 15 IX 2015, 1 ex., on a *C. betulus*, 16 IX 2015, 1 ex., on a *Prunus spinosa* L.; VU46 Barcie, 17 IX 2015, 4 exx., on a *Prunus serotina* EHRH., 1 ex., on an *A. glutinosa*, 1 ex., on a *Q. robur*, 1 ex., from a wild apple tree (*Malus domestica* BORKH); VU54 Stare Łysogórki, 18 VI 2014, 13 exx., on an *Acer negundo* L., 15 IX 2015, 3 exx., on a *Crataegus* sp.; VU54 Stary Błeszyn vic., 24 VII 2015, 1 ex., on a *Crataegus* sp.

A ladybird beetle encountered usually on different deciduous trees, especially attacked by fungi from the order Erysiphales (Ascomycota: Erysiphales), on which it feeds. Mentions about its occurrence are scant and usually concern collections of single specimens. In more recent publications, it is recorded from Mazovia (GUTOWSKI & all. 2006, FLOREK & all. 2011, CERYNGIER & GODEAU 2013, RUTKIEWICZ & all. 2013, BOROWSKI 2015, CERYNGIER & all. 2016), Greater Poland (RUTA & all. 2009, PRZEWOŹNY 2011, RENNER & MESSUTAT 2013), the Białowieża Forest (JĘDRYCZKOWSKI & GUTOWSKI 2014) and Lower Silesia (GREŃ & all. 2013).

Calvia quindecimguttata (FABRICIUS, 1777)

- VU45 Stary Kostrzynek, 24 VII 2015, 1 ex., on a *Ulmus* sp. on top of a xerothermic hill; VU45 „Wrzosowiska Cedyńskie” res. vic., 24 VII 2015, 3 exx. (2 imagines, 1 pupa) on an *Alnus glutinosa* at the edge of an alder forest.

A rarely encountered stenotopic species associated with swampy habitats in alder forests. In more recent times, it has been recorded from

the Polesie National Park (PIETRYKOWSKA & STĄCZEK 2001), the environs of Gdańsk (BUBIENKO & CIEPIELEWSKA 2010), Mazovia (FLOREK & all. 2011, GODEAU & CERYNGIER 2011, MOKRZYCKI & all. 2013, CERYNGIER & all. 2016) and the Suwałki Region (CERYNGIER & all. 2015). The species new to the Pomeranian Lakeland.

Cynegetis impunctata (LINNAEUS, 1767)

– VU46 the Oder Valley below the Bielinek Reserve at the base of the Storzyczkowy Gorge, 23 VII 2015, 1 ex., from herbaceous plants.

This ladybird beetle that feeds on different grass species occurs in Poland rarely and locally, which is probably due to its limited dispersal abilities resulting from the reduction of a second pair of wings. Apart from a single record from Olsztyn (BUBIENKO & all. 2010), in recent years, it has been recorded only in the south of the country: in Greater Poland (RUTA 2006, RENNER & MESSUTAT 2007, RUTA & all. 2009), the environs of Oborniki Śląskie (RUTA & all. 2009), Legnica (GREŃ & all. 2013), and the East Sudetes (RUTA & all. 2009). From the environs of the Bielinek Reserve, it was recorded earlier by ENGEL (1938).

Discussion

The Cedynia Landscape Park is a region with a very abundant species richness of Coccinellidae. Short and pilot faunistic studies allowed for a registration of 50 ladybird beetle species in this area. Among the species recorded earlier from the area of the Cedynia Landscape Park, we have not managed to find two of them – *Hyperaspis erythrocephala* and *Sospita vigintiguttata* (LINNAEUS, 1758). The occurrence of the former in this part of Poland is highly doubtful (cf. Introduction), whereas GRIEP's report (1939) on the collection of *S. vigintiguttata* in the Bielinek Reserve does not raise any objections. Therefore, it can be assumed that in the Cedynia Landscape Park, the occurrence of 51 species (apx. 67% of the national representatives of the family Coccinellidae) was documented, which is the same number as the one hitherto recorded from the Polish and Belarusian parts of the Białowieża Forest combined (JĘDRYCKOWSKI & GUTOWSKI 2014) – a region that is in fact less scenically diverse than the Cedynia Landscape Park, but significantly bigger (apx 150,000 ha) and more extensively studied. Out of the published data on ladybird beetles from other Polish regions covering a comparable area (below 100,000 ha), only in one case the number of listed species was higher than in the Cedynia Landscape Park; namely, it concerns the environs of

Rogów in the southwestern part of Mazovia, where BOROWSKI (2015) recorded the occurrence of 56 species in the course of a few-year research.

The most frequently collected ladybird beetles from the studied area were common eurytopic species – *Harmonia axyridis* and *Coccinella septempunctata*. Whereas *C. septempunctata* is traditionally regarded as one of the most widely distributed European ladybird beetles (BURAKOWSKI & all. 1986, HODEK & MICHAUD 2008), *H. axyridis* has been present in Europe only since recently. In Poland, it was recorded for the first time in 2006 in Poznań (PRZEWOŹNY & all. 2007), but, perhaps, it had crossed the western boundary a bit earlier. It can be thus assumed that from the appearance of *H. axyridis* in the area of the Cedyňa Landscape Park to the studies herein discussed, 10 years have passed. This relatively short period of time sufficed to consider *H. axyridis* as an unquestionable dominant in the groupings of Coccinellidae, especially on deciduous trees and plants. In the past within habitats of this sort, *Adalia bipunctata* (CZECHOWSKA & BIELAWSKI 1981, ADRIAENS & all. 2008) usually predominated, being at the same time one of the most frequently encountered representatives of ladybird beetles in Poland (BURAKOWSKI & all. 1986). Currently in the Cedyňa Landscape Park, *A. bipunctata* constitutes barely 0.5% of the whole collected ladybird beetles and 1.3% of ladybird beetles collected from deciduous trees and plants. A comparably low presence of this species was reported recently in the Skaryszewski Park in Warsaw (CERYNGIER & all. 2016). The process of disappearing of *A. bipunctata* in Europe in the wake of the invasion of *H. axyridis* does not raise any doubts today, which was not difficult to predict (CERYNGIER 2008), considering the similarity between ecological niches of these two species, as well as the fact that the analogous process took place earlier in the North American continent (*A. bipunctata* is a Holarctic species) (HARMON & all. 2007).

Recently conducted analyses of the changes in population of different ladybird beetle species in three European countries (Belgium, the Great Britain, and Switzerland), demonstrated that after the appearance of *H. axyridis*, a significant decrease in the population of a few species occurred, but the population of *A. bipunctata* (ROY & all. 2012) decreased the most dynamically.

Harmonia axyridis is not the sole representative of the family Coccinellidae collected in the Cedyňa Landscape Park, which in recent years have distinctly gained its territorial scope and population. *Clitostethus arcuatus* can also be included in this category. It was registered in the Park only by the end of the research (in September 2015),

but instantly in significant abundances (24 specimens collected). Contrary to *H. axyridis*, the expansion of *C. arcuatus* was not initiated by the human, but rather as a result of current climate changes. Perhaps, an increase in the population of *Vibidia duodecimguttata* could be also associated with climate changes.

The majority of literature data indicate that it is a rare species in Poland, which stands in contradiction with the results from the research conducted recently in the environs of Warsaw (CERYNGIER & GODEAU 2013, CERYNGIER & all. 2016), in which it was demonstrated that in this area *V. duodecimguttata* belongs to common species. The results of the research show that it is also common in the Cedynia Landscape Park (6.2% of Coccinellidae collected from deciduous trees and plants), therefore its population increase is not limited to Mazovia by a local phenomenon.

SUMMARY

Cedynia Landscape Park covers an area of about 30,850 ha in the westernmost part of Poland. The eco-faunistic survey of the ladybird beetles (Coccinellidae) conducted there in 2014-2015 resulted in recording 2587 ladybird specimens belonging to 50 species. Of the 15 species reported from this area in the past, two (*Hyperaspis erythrocephala* and *Sospita vigintiguttata*) were not recorded in the present study. As the occurrence of *H. erythrocephala* in the western part of Poland is very little probable, the reliable list of ladybirds of Cedynia Landscape Park consists of 51 species. The species most frequently found in this study (19.8% of the recorded specimens) was the invasive *Harmonia axyridis*. It was especially abundant on deciduous trees and shrubs, where its contribution to ladybird assemblages reached 31%. In contrast, the contribution of *Adalia bipunctata*, formerly very common throughout Europe and Poland but now declining due to a severe competition from *H. axyridis*, was only 0.5% of all the collected ladybirds and 1.3% of the ladybirds collected from deciduous woody plants. Many ladybird species very rarely recorded in Poland (e.g. *Hyperaspis concolor*, *Nephus bipunctatus*, *N. quadrimaculatus*, *Scymnus ater*, *S. limbatus*, *Novius cruentatus*, *Cynegetis impunctata*) were found in Cedynia Landscape Park during this survey. The discovery in this area of quite an abundant population of *Clitostethus arcuatus* is of special interest, as it documents a further expansion of this Mediterranean species to the north of Europe.

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