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Ladybirds /Coleoptera, Coccinellidae/ on the beaches of Gdańsk

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Abstract

The phenomenon of mass appearance of ladybirds on the beaches in Gdańsk was observed in August 2008. The report on their appearance is limited only to species composi, number and domination structure and is usually concerned with a small part of the beach. Research material was collected from two sites, the Stogi Beach and the Górki Zachodnie Beach.

In the research on both sites (beaches), in total 1979 beetles of the Coccinellidae family, from 18 species, were collected. Among the collected ladybirds, in both research sites *Coccinella septempunctata* (Linnaeus, 1758) was an eudominant. *Anatis ocellata* (Linnaeus, 1758), *Harmonia axyridis* (Pallas, 1773) and *Adalia bipunctata* (Linnaeus, 1758) were included in the other dominating species. Taking into consideration a high participation share of *H. axyridis*, which is an invasive species, one may expect that in a short period of time it will become one of the most numerous ladybird species in Poland.

Introduction

Mass appearance of ladybirds (Coccinellidae) on the beaches of seas, oceans and large lakes is a well – known natural phenomenon that is documented in numerous publications (NALEPA *et al*., 1998; LEE, 1980; KLAUSNITZER,

1989; SAVOISKAYA, 1965). There are many hypotheses justifying the phenomenon of seashore ladybird aggregations. HAGEN (1962) suggested, seemingly rightly that there is a cause and effect chain related to this phenomenon (HODEK, 1973; HODEK & HONEK, 1996; MAJERUS & MAJERUS, 1996). In favourable weather conditions the number of Aphididae increases immensely. To respond to a growth in the number of aphids, Coccinellidae increase their fecundity, though larvae and pupae mortality decreases. A young generation grows up quickly as a result of which food competition grows. The increase in ladybird activity and their enhanced migration are the consequences of the lack of food. According to many authors (HODEK *et al.*, 1993; HODEK & HONEK, 1996; MAJERUS & MAJERUS, 1996) the frequency in which coleopterans move after food is decisively greater in the case of aphid – consuming ladybirds than in species feeding on other foods. Wind also plays an effective role in mass appearance of ladybirds by water reservoirs. According to ŻURAŃSKA (1962) at wind velocity 1.5 m/s, the flight of some insects accords with wind direction. Their significant part is directed to places where they can feed and procreate. Wind direction may suddenly change and reverse because of the storm and daily fluctuations. Then at such a flight a part of the insects die by being thrown onto the beaches or into the water and then on the land. Research on water movement as carried out by RUSCHMEYER & OLSON (1958) suggests that both wind direction and water movement may lead to aggregation formation. It has to be remembered that Coccinellidae aggregations, though not explained in detail, are an inseparable element of their behaviour.

The information on the mass appearance of ladybirds on the beaches of the Gulf of Gdańsk is limited to a check list of species composition, number, dominance structure and usually concerns only a small part of the beach.

Site and methods

The phenomenon of ladybird mass appearance on the beaches in Gdańsk was observed in August 2008. Research material was collected on 23 August, only once from two sites at a 6 km long distance from one another, i.e. the Stogi Beach (S – I) and the Górki Zachodnie Beach (S – II). These beaches are separated from the housing estate of Gdańsk by a 1.5 km wide forest (pine, deciduous).

The experiment was carried out on 40 m – long beach parts selected at random. On each research area entomological material was collected 5 m away from the seashore in a straight line using a 1 x 1 m frame (1 m^2). The research material was collected in 5 m long gaps, in 5 repetitions. From each m^2 delineated by hand all the ladybirds were collected and stored in 75% ethyl alcohol. In a laboratory their species were identified.

Results and discussion

Following the research results, in both sites (beaches) in total 1979 coleopterans of the Coccinellidae family, belonging to 18 species were collected (Tab. 1). The number and species composition was different in both research sites. In total in S – I, 867 specimens were collected and identified to 15 species (Tab. 1). In the second site S – II, 1112 ladybirds identified to 18 species were collected (Tab. 1). Mean number of ladybirds in 1 m^2 on the Stogi Beach amounted to 173.4 specimens, and in Górki Zachodnie – 222.4. The greatest number per 1 m^2 in S – I was 325 specimens, and the smallest – 4. In S – II, the greatest number was 502 specimens, and the smallest – 9.

Table 1. Number and species composition of Coccinellidae on two beaches of the Gdańsk Gulf

Species	S – I		S – II		Total	
	n*	D**	n	D	n	D
Coccinella septempunctata (Linnaeus, 1758)	621	71.6	810	72.8	1431	72.3
Anatis ocellata (Linnaeus, 1758)	62	7.2	73	6.6	135	6.8
Adalia bipunctata (Linnaeus, 1758)	27	3.1	55	5.0	82	4.1
Harmonia axyridis (Pallas, 1773)	51	5.8	27	2.4	78	4.0
Adalia decempunctata (Linnaeus, 1758)	30	3.5	39	3.5	69	3.5
Hippodamia variegata (Goeze, 1777)	34	4.0	32	2.8	66	3.3
Propylea quatuordecimpunctata (Linnaeus, 1758)	11	1.3	27	2.4	38	2.0
Harmonia quadripunctata (Pontoppidan, 1763)	5	0.6	10	1.0	15	0.7
Myrrha octodecimguttata (Linnaeus, 1758)	4	0.5	9	0.8	13	0.6
Coccinella quinquepunctata (Linnaeus, 1758)	9	1.0	3	0.3	12	0.6
Chilocorus renipustulatus (Scriba, 1790)	2	0.2	8	0.7	10	0.5
Coccinula quatuordecimpustulata (Linnaeus, 1758)	4	0.5	4	0.4	8	0.4
Halyzia sedecimguttata (Linnaeus, 1748)	2	0.2	5	0.5	7	0.3
Hippodamia tredecimpunctata (Linnaeus, 1758)	3	0.4	3	0.3	6	0.3
Myzia oblongoguttata (Linnaeus, 1758)	2	0.2	4	0.4	6	0.3
Tytthaspis sedecimpunctata (Linnaeus, 1761)			1	0.1	1	0.1
Calvia quatuordecimguttata (Linnaeus, 1758)			1	0.1	1	0.1
Calvia quindecimguttata (Fabricius, 1777)			1	0.1	1	0.1
Number of species	15		18		18	
Total	867	100.0	1112	100.0	1979	100.0

*n – individuals in numbers
**D – dominance index

Among the collected ladybirds, *Coccinella septempunctata* was an eudominant in both research sites, as it amounted to 72.3% i.e. 1431 specimens. (Tab. 2, Figs. 1, 2). Research by Rothschild (1971) and Schaefer *et al.* (1987), confirms the dominance of *C. semptempunctata* in the samples of seashore aggregations. The presence of this species on the beaches in such a large number seems relatively easy to explain. According to Hodek & Hodek (1996); Maje-

RUS & MAJERUS (1996) *C. septempunctata* is most prone to a sudden population growth. Its number largely depends on the number of aphids. In Europe the greatest *C. septempunctata* migration coefficient takes place in the period of aphid density decrease. CERYNGIER (2008), claims that during the next few years one of the most common ladybird species in Poland will be the Asian ladybird, *Harmonia axyridis* (Pallas, 1773). One can suppose that it will soon replace *C. septempunctata*. *H. axyridis*, as eurytopic polyphagous species may also threaten other species of the Coccinellidae family and also other aphidophagous species (FIRLEJ *et al.*, 2005; KOYAMA & MAJERUS, 2007; ROY *et al.*, 2008). *H. axyridis* for the first time was registered in Poland in 2006 (PRZEWOŹNY *et al.*, 2007). Our research shows that on the Stogi Beach, next to *Anatis ocellata, H. axyridis* is found in the class of dominants (Tab. 2). This testifies only to its fast rate of expansion. On the Górki Zachodnie Beach *Anatis ocellata* and *Adalia bipunctata* dominated (Tab. 2, Fig. 2). In this case *H. axyridis* represented the class of subdominants. One may also realize that *H. axyridis*, which is a foreign invading species on new land procreates fast and in fact quickly situates itself in an ecological niche of domestic ladybird species, and as a result it becomes a dominating species (ADRIAENS *et al.*, 2008; BROWN *et al.*, 2008). In 2009 as soon as in May, ladybird communities were again observed on the beaches of the Gdańsk Gulf.

Table 2. Structure of Coccinellidae species dominance according to KROMP & STEINBERG (1992)

Dominance group	**S – I**	**S – II**
Eudominants *(>10%)*	*C. septempunctata*	*C. septempunctata*
Dominants (5 – 10%)	*A. ocellata*	*A. ocellata*
	H. axyridis	*A. bipunctata*
Subdominants (2 – 5%)	*H. variegata*	*A. decempunctata*
	A. decempunctata	*H. variegata*
	A. bipunctata	*H. axyridis*
		P. quatuordecimpunctata
Recedents (1 – 2%)	*P. quatuordecimpunctata*	
	C.quinquepunctata	
Subrecedents (<1%)	7 species	11 species

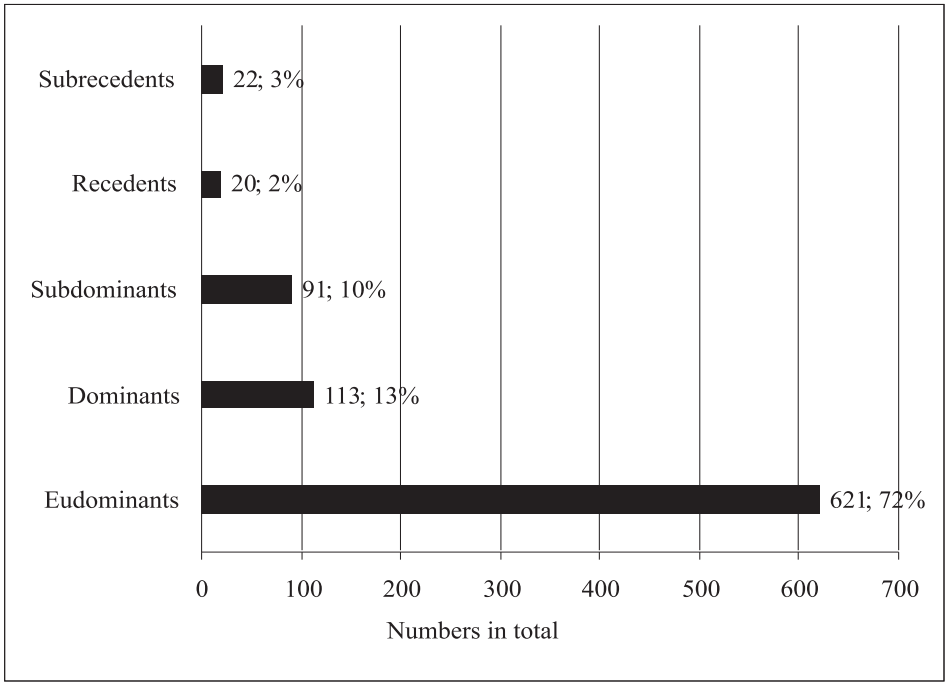

Figure 1. Coccinellidae dominance structure in S - I

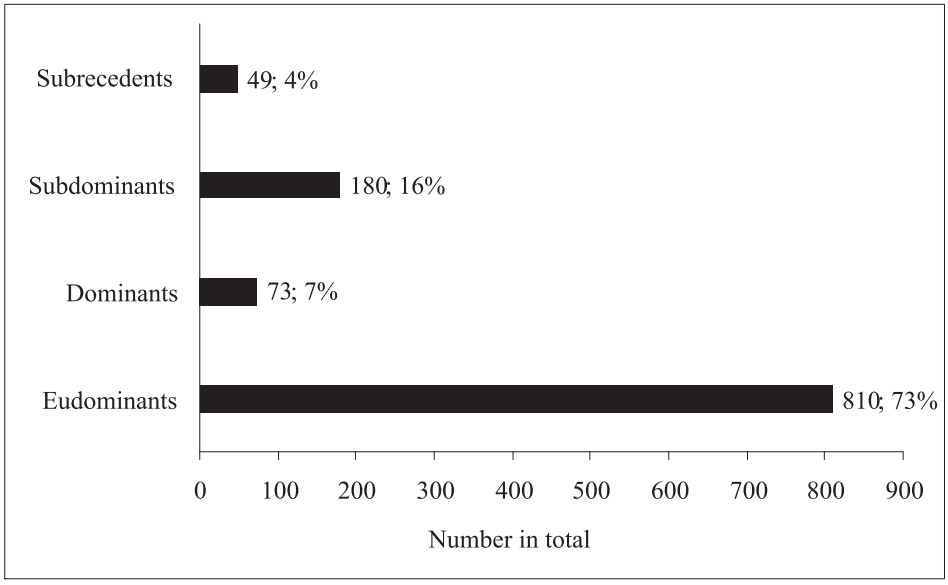

Figure 2. Coccinellidae dominance structure in S - II

Conclusions

1. *Coccinella septempunctata* was the most numerous species of the Coccinellidae in both research beaches. *Adalia bipunctata* and *Anatis ocellata* were dominating species.
2. *Harmonia axyridis*, which is considered a foreign, invading species, was also present in large quantities on the Stogi Beach.
3. It is necessary to continue the research which would define the connections between seashore communities and the Coccinellidae life cycle.

References

ADRIAENS T., SAN MARTIN Y., GOMEZ G., MAES D. 2008. Invasion history, habitat preferences and phenology of the invasive ladybird *Harmonia axyridis* in Belgium. BioControl, 53: 69-88.

BROWN P. M. J., ADRIAENS T., BATHON H., CUPPEN J., GOLDARAZENA A., HÄGG T., KENIS M., KLAUSNITZER B. E. M., KOVÁ I., LOOMANS A. J. M., MAJERUS M. E. N., NEDVED O., PEDERSEN J., RABITSCH W., ROY H. E., TERNOIS V., ZAKHAROV I. A., ROY D. B. 2008. *Harmonia axyridis* in Europe: spread and distribution of a non - native coccinellid. BioControl, 53: 5-21.

CERYNGIER P. 2008. Inwazyjna biedronka *Harmonia axyridis* (Coleoptera: Coccinellidae) w środowisku miejskim: zagrożenia dla entomofauny i człowieka. [In:] Fauna Miast, Ochronić różnorodność biotyczną w miastach. P. Indykiewicz, L. Jerzak, T. Barczak (eds.) SAR „Pomorze", Bydgoszcz: 604-610.

FIRLEJ A., BOIVIN G., LUCAS E., CODERRE D. 2005. First report of *Harmonia axyridis* Pallas being attacked by *Dinocampus coccinellae* Schrank in Canada. Biological Invasions, 7: 553 – 556.

HAGEN K. S. 1962. Biology and ecology of predaceous Coccinellidae. Annual Review of Entomology, 7: 289-326.

HODEK I. 1973. Biology of the Coccinellidae. Academia. Prague, 260p.

HODEK I. HONEK A. 1996. Ecology of Coccinellidae. Kluwer Academic Publisher, Dordrecht, 464p.

HODEK I., IPERTI G., HODKOVA M. 1993. Long distance flights in Coccinellidae (Coleoptera). European Journal of Entomology, 90: 403-414.

KLAUSNITZER B. 1989. Marienkaferansammlungen am Ostseestrand. Entomologische Nachrichten und Berichte, 33: 189-194.

KOYAMA S., MAJERUS M. E. N. 2007. Interactions between the parasitoid wasp *Dinocampus coccinellae* and two species of coccinellid from Japan and Britain. BioControl, 53: 253-264.

KROMP B., STEINBERGER K. H. 1992. Grassy field margins and arthropod diversity: a case study on ground beetles and spiders in Eastern Austria (Col.: Carabidae; Arachnida: Aranei, Opiliones). Agricultural, Ecosystems and Environment, 40: 71-93.

LEE R. E. JR. 1980. Aggregation of Lady Beetles on the Shores of Lakes (Coleoptera: Coccinellidae). The American Midland Naturalist. 104(2): 295-304.
MAJERUS M. E. N., MAJERUS T. M. O. 1996. Ladybird population explosions. British Journal of Entomology and Natural History, 9: 65-76.
NALEPA C. A., AHLSTROM K. R., NAULT B. A., WILLIAMS J. L. 1998. Mass Appearance of Lady Beetles (Coleoptera: Coccinellidae) on North Carolina Beaches. Entomological News, 109(4): 277-281.
PRZEWOŹNY M., BARŁOŻEK T., BUNALSKI M. 2007. *Harmonia axyridis* (Pallas, 1773) (Coleoptera: Coccinellidae) New species of ladybird beetle for Polish fauna. Polish Journal of Entomology, 6: 177-182.
ROTHSCHILD M. 1971. A large migration of the seven – spot ladybird (*Coccinella septempunctata* L.) at Deauville, France. Entomologist, 104: 45-46.
ROY H. E., BROWN P. M. J., ROTHERY P., WARE R. L., MAJERUS M. E. N. 2008. Interactions between the fungal pathogen Beauveria bassiana and three species of coccinellid: *Harmonia axyridis, Coccinella septempunctata* and *Adalia bipunctata*. BioControl, 53: 265-276.
RUSCHMEYER O. R., OLSON T. A. 1958. Water movements and temperatures of Western Lake Superior. School of Public Health. University of Minnesota, Minneapolis, 65p.
SAVOISKAYA G. I. 1965. Hibernation and migration in southeastern Kazakhstan. [In:] I. Hodek (ed.). Ecology of aphidophagous insects. Academia. Prague: 139-142.
SCHAEFER P. W., DYSART R. J., SPECHT H. B. 1987. North American distribution of *Coccinella septempunctata* (Coleoptera: Coccinellidae) and its mass appearance in coastal Delaware. Environmental Entomology, 16: 368-373.
ŻURAŃSKA I. 1962. Z badań nad entomofauną styku lasu z polem uprawnym. Zeszyty Naukowe Wyższej Szkoły Rolniczej w Olsztynie, 12: 33p.

Biedronki /Coleoptera, Coccinellidae/ na plaży gdańskiej

Streszczenie

Zjawisko masowego pojawiania się biedronek na plaży w Gdańsku zaobserwowano w sierpniu 2008 roku. Doniesienie ogranicza się do spisu gatunków, liczebności, struktury dominacji i dotyczy na ogół niewielkiego odcinka plaży. Materiał do badań pobierano z dwóch stanowisk – plaża Stogi i plaża Górki Zachodnie.

W badaniach, na obu stanowiskach (plażach), zebrano łącznie 1979 chrząszczy z rodziny Coccinellidae, należących do 18 gatunków. Wśród zebranych biedronek, eudominantem w obu badanych miejscowościach była *Coccinella septempunctata*. Do gatunków dominujących należały *Anatis ocellata*, *H. axyridis* oraz *Adalia bipunctata*. Biorąc pod uwagę wysoki udział biedronki azjatyckiej *Harmonia axyridis,* jako gatunku inwazyjnego, możemy spodziewać się, że w stosunkowo krótkim czasie stanie się ona jedną z najliczniej występujących biedronek w naszym kraju.