

Polish Academy of Science

Vth Division - Agricultural and Forest Sciences

**APHIDS AND OTHER  
HOMOPTEROUS INSECTS, 8**

Mszyce i inne pluskwiaki  
równoskrzydłe, 8

Publication founded by Polish  
Research Council (KBN)

University of Podlasie

Migration of the *Carabidae* from copes to crop fields

**Agnieszka Kosewska<sup>1</sup>, Mariusz Nietupski<sup>1</sup>, Dolores Ciepielewska<sup>1</sup>, Oleg Aleksandrowicz<sup>2</sup>, Wojciech Sañej<sup>1</sup>**

<sup>1</sup>*Department of Phytopathology and Entomology*

<sup>2</sup>*Department of Ecology and Environment Protection,*

*University of Warmia and Mazuria, Prawocheñskiego 17, 10-722 Olsztyn*

## **Introduction**

*Carabidae*, which are the dominant group of the epigenic entomofauna of agrocenosis, are particularly precious because of their food preferences [Gorny 1971, Sklodowski 1997]. Trophic specialisation of the *Carabidae* is often highly advanced, and is characteristic for both, predatory and herbivore species. It has been observed that different aphid species settling field crops may constitute to the diet of *Carabidae* [Chikh-Khamis and Hurej 1992].

*Harpalus rufipes* (De Geer), *Pterostichus vulgaris* (L.) and *Agonum dorsale* (Pont.) have been classified as aphidophagous species of the *Carabidae* [Sunderland 1975, Sopp and Wratten 1986, Gabrys and Sobota 1999].

The aim of this study was to follow the migration of *Coleoptera* from the *Carabidae* family in the area of copes to crop fields, as well as to find out whether this parameter is determined by pea aphids (*Acyrtosiphum pisum* (Harris)).

## **Material and methods**

The experiment was carried out at the Experimental Station of the University of Warmia and Mazuria, in Tomaszkw, near the city of Oisztyn. The object of the research were:

- I Copes and mixed forest of 45 years old comprised in 90% of pines (*Pinus* spp.) and in 10% of birch-trees (*Betula* spp.), grown on former crop-fields, located 150 m from an asphalt road and 30 m from a field path.
- II crop field (horse bean - cultivarietas Nadwislaniski) surrounded by copes.

In order to establish species composition and occurrence dynamics of the *Carabidae*, soil traps placed in five different spots of the investigated area were set up. The collected material was identified with the use of Burakowski et al. terminology [1973 and 1974]. The number of pea aphid population was specified on 50 plants chosen at random. The observations were carried out from July until mid-September in 1996 and 2000.

### Results and discussion

758 individuals of the *Carabidae* were collected altogether.

In the copes area 20 from the *Carabidae* species of 13 genera were trapped. The following were the dominating species: *Calathus micropterus* (18.65%), *Carabus hortensis* (16.06%), *Pterostichus niger* (15.54%), *Pterostichus vulgaris* (11.92%), *Cychrus caraboides* (11.40%), *Ammara brunnea* (6.74%), *Platynus assimilis* (5.18%) oraz *Harpalus rufipes* (2.59%) were less numerous. The percentage composition of other species was much smaller (Tab. 1.)

The beetles *Calathus micropterus*, *Carabus hortensis* and *Pterostichus vulgaris* have been classified by Sklodowski (1997) as dominating species in stand of trees area. But *Pterostichus vulgaris* and *Harpalus rufipes* are considered as aphid predator species (Sunderland 1975, Sunderland and Vickerman 1980, Scheller 1984). In the field neighbouring with the trees area 22 species of the *Carabidae* appeared (Tab. 2).

Pea aphid (*Acyrtosiphum pisum* (Harris)) appeared on the horse bean crops relatively late and usually forms scarce colonies which are easily washed away with rain (Sadej and Nietupski 2000). In the years of the research during its frequent and abundant appearance on horse bean crop numerous *Carabidae* species known as aphid predators such as *Harpalus rufipes* and *Pterostichus vulgaris* were collected. In the research period those species were observed both, in crops and copes (Figure 1). Wegorek and Trojanowski found similar correlation in their research (1989). A correlation between abundant appearance of *A. pisum* and *Carabidae* occurrence in copes was also found out. It has been observed that in the period of great aphid appearance on the crop the number of *Carabidae* in copes decrease. The *Carabidae*, as most aphid predators, appears in the pest-dominated fields slightly later (Fig. 2).

Following from our observation, it seems that the number of *Carabidae* in copes increased since the end of July until mid-August. However, the decreasing aphid number in crop fields causes the aphidophagous *Carabidae* to move to those areas where they find further nutrient basis, as well as a spot for overwintering. This might suggest their migration course from the copes onto the crop field where food is found easily.

### Conclusions

1. *Calathus micropterus* and *Carabus hortensis* are the dominating species in copes.
2. Aphid predator *Harpalus rufipes* is the dominating species in crops neighboring with copes.
3. The number of aphidophagous *Carabidae* depends on crop fields' short distance.

### References

- BURAKOWSKI B., MROCZKOWSKI M., STEFANSKA J. 1973. Katalog Fauny Polski, Chrzaszcze, Coleoptera: Biegaczowate - Carabidae. I; 20; 1-233.
- BURAKOWSKI B., MROCZKOWSKI M., STEFANSKA J. 1974. Katalog Fauny Polski, Chrzaszcze, Coleoptera: Biegaczowate - Carabidae. II; 22; 1-430.
- CHIKH - KHAMIS Z., HUREJ M. 1992. Occurrence of *Carabidae* in sugar beet crop and their possible role as *Aphis fabae* Scop. predators. 1992. Aphids and Other Homopterous Insects, PAS, Warsaw; 3; 89-95.
- GABRYS B., SOBOTA G. 1999. *Agonum dorsale* (Pont.) - the aphidophagous species of *Carabidae* in the winter oilseed rape crop. Aphids and Other Homopterous Insects, 7;325-331.
- GORNY M. 1971. Z badan nad biegaczowatymi (*Col.*, *Carabidae*) zadrzewienia sródpolnego i pół. Polskie Pismo Entomologiczne, XLI/2; 387-413.
- SADEJ W., NITUPSKI M. 2000. Occurrence of pea aphid (*Acyrtosiphon Pisum* Harris) on fabe bean and some biotic factors reducing its numbers. Naturae Sciences, 5; 73-81.
- SHELLER H. 1984. Z. Ang. Ent. 97:451-463.

---

SKŁODOWSKI J. 1997. Ekotonowe zgrupowania epigeicznych biegaczowatych (*Carabidae, Col.*) Sylwan 10; 51-63.

SOOP P. WRATTEN S. 1986. Entomol. Exp. Appl. 41:69-73.

SUNDERLAND K. 1975. The diet of some predatory arthropods in cereal crops. Journal of Apply Ecology, v. 12, n.2; 507-515.

SUNDERLAND K., VICKERMAN G. 1980. Aphid feeding by some polyphagous predators in relation to aphid density in cereal fields. Journal of Applid Ecology, 17; 389-396.

WEGOREK W., TROJANOWSKI H. 1989. Epigenic Entomofauna of beetles on the join of forest and field. Prace Naukowe IOR; tom XXXI, zeszyt 2, 11-47.

Table 1. Structure of the *Carabidae* population settling copes (Tomaszkowo)

Species	Time of observation					Total		
	26.07	12.08	23.08	30.08	9.09	<i>n</i>	%	
<i>Calathus micropterus</i> (Duftschmid,1812)	9	15	3	6	3	36	18,65	dominant
<i>Carabus hortensis</i> ( Linnaeus, 1758)	2	3	5	17	4	31	16,06	
<i>Pterostichus niger</i> (Schaller,1783)	10	13	1	4	2	30	15,54	
<i>Pterostichus vulgaris</i> (Linnaeus)	6	11	3	3		23	11,92	
<i>Cychrus caraboides</i> (Linnaeus, 1758)	6	13			3	22	11,40	
<i>Amara brunnea</i> (Gyllenhal, 1810)	5	8				13	6,74	
<i>Platynus assimilis</i> (Paykull,1790)	2	3	2	2	1	10	5,18	
<i>Harpalus rufipes</i> (De Geer, 1774)	3	2				5	2,59	sd
<i>Leistus rufescens</i> (Fabricius, 1775)		1	1	2		4	2,07	
<i>Epaphius secalis</i> (Paykull,1790)		2		1		3	1,55	recedent
<i>Pterostichus oblongopunctatus</i> (Fabricius)	1		1	1		3	1,55	
<i>Calathus fuscipes</i> (Goeze,1777)		2				2	1,04	
<i>Carabus nemoralis</i> ( O.F.Muller, 1764)		1		1		2	1,04	
<i>Carabus violaceus</i> ( Linnaeus, 1758 )		2				2	1,04	
<i>Notiophilus biguttatus</i> (Fabricius, 1779)				1	1	2	1,04	
<i>Badister lacertosus</i> (Sturm, 1815)	1					1	0,52	
<i>Calathus melanocephalus</i> (Linnaeus, 1758)				1		1	0,52	
<i>Carabus granulatus</i> ( Linnaeus, 1758)					1	1	0,52	
<i>Europhilus fuliginosus</i> (Panzer, 1809)					1	1	0,52	
<i>Panagaeus cruxmajor</i> (Linnaeus, 1758)		1				1	0,52	
<i>SUMA</i>	45	77	16	39	16	193	100	

sd - subdominant sr -

subrecedent

Table 2. Structure of the *Carabidae* population settling crops bordering with copes

Species	Time of observation					Total	
	26 VII	12 VIII	23 VIII	30 VIII	9 IX	n	%
<i>Harpalus rufipes</i> (De Geer, 1774)	37	25	47	40	21	170	30,36
<i>Calathus fuscipes</i> (Goeze, 1777)	10	30	38	21	47	146	26,07
<i>Amara bifrons</i> (Gyllenhal, 1810)	7	19	16	17	27	86	15,36
<i>Pterostichus vulgaris</i> (Linnaeus)	17	21	3	6	5	52	9,29
<i>Calathus melanocephalus</i> (Linnaeus, 1758)	2	3	0	9	5	19	3,39
<i>Bembidion lampros</i> (Herbst, 1784)	9	2	2	3	2	18	3,21
<i>Bembidion femoratum</i> (Sturm, 1825)	4	2	1	2	2	11	1,96
<i>Curtonotus aulicus</i> (Panzer, 1781)	1	2	1	3	3	10	1,79
<i>Anchomenus dorsalis</i> (Pontoppidan, 1763)	10	0	0	0	0	10	1,79
<i>Amara similata</i> (Gyllenhal, 1810)	5	0	0	1	2	8	1,43
<i>Harpalus</i> sp.	0	3	0	0	5	8	1,43
<i>Pterostichus niger</i> (Schaller, 1783)	0	5	0	0	0	5	0,89
<i>Amara consularis</i> (Duftschmid, 1812)	1	1	1	0	1	4	0,71
<i>Brosicus cephalotes</i> (Linnaeus, 1758)	0	1	1	0	1	3	0,54
<i>Cychrus caraboides</i> (Linnaeus, 1758)	0	0	1	2	0	3	0,54
<i>Harpalus affinis</i> (Schrank, 1781)	1	0	0	0	1	2	0,36
<i>Carabus cancellatus</i> (Illiger, 1798)	0	0	1	1	0	2	0,36
<i>Clivina fossor</i> (Linnaeus, 1758)	2	0	0	0	0	2	0,36
<i>Lorocera pilicornis</i> (Fabricius, 1775)	1	0	0	0	1	2	0,36
<i>Synuchus vivalis</i> (Illiger, 1798)	0	0	0	1	1	2	0,36
<i>Trechus quadristriatus</i> (Schrank, 1781)	0	0	1	0	0	1	0,18
<i>Epaphius secalis</i> (Paykull, 1790)	0	0	1	0	0	1	0,18
<b>Total</b>	107	114	114	106	124	565	

sd - subdominant

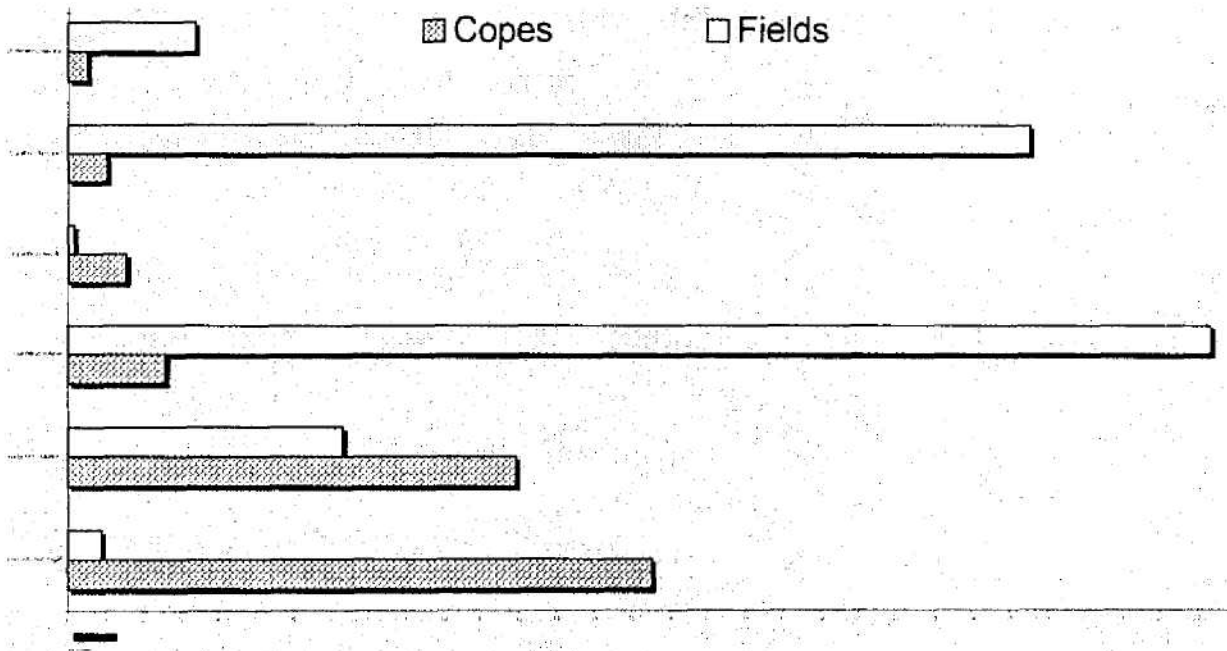


Fig. 1. Number of the *Carabidae* species migrating from copes onto crop field

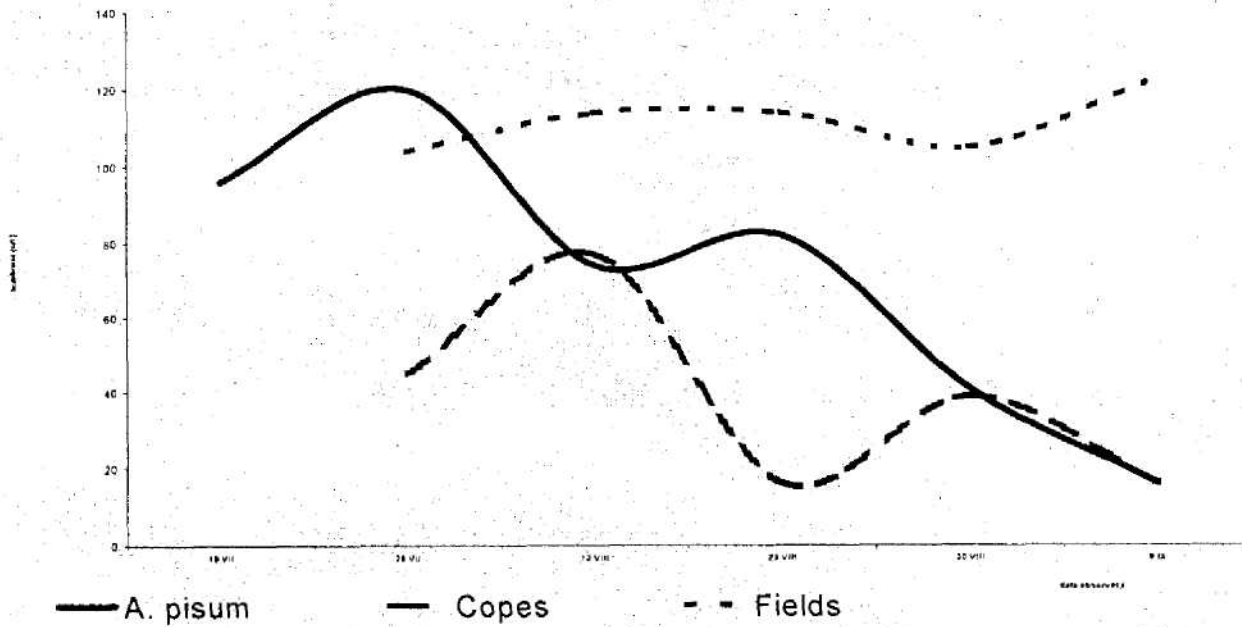


Fig. 2. Dynamics of *Acyrthosiphum pisum* on horse bean occurrence and number of *Carabidae* populations



Migracje *Carabidae* z zadrzewien sródpolnych na pola uprawne **Streszczenie**

Biegaczowate (*Carabidae*) sa dominujacym skladnikiem epigeicznej entomofauny agrocenoz - cennym, ze wzgledu na preferencje pokarmowe (drapieznictwo). Fakt ten pozwala zaliczyc te gatunki do grupy owadów o duzej przydatnosci w naturalnym regulowaniu populacji szkodników. Obserwowano, ze skladnikami diety biegaczowatych, obok innych szkodników, moga byc różne gatunki mszyc, zasiedlajace uprawy polowe. Dlatego tez biegaczowate mozna wlaczyc do grupy afidofagów. Zatem celem obserwacji bylo przesledzenie migracji gatunków z rodziny *Carabidae* pomiedzy strefa zadrzewien sródpolnych, a uprawami rolniczymi. Sklad gatunkowy oraz dynamike wystepowania chrzaszczy z rodziny biegaczowatych badano stosujac odlawianie osobników do zmodyfikowanych pulapek glebowych. Pulapki umieszczono na polu uprawnym oraz w przylegajacej do nich strefie zadrzewien sródpolnych o różnym charakterze: zadrzewienia w poblizu szosy, zadrzewienia w poblizu zabudowan i zadrzewienia typowe sródpolne. Jak stwierdzono podczas kilkuletnich, wyrwkowych obserwacji gatunkami dominujacymi w uprawach polowych byly: *Harpalus rufipes* (30,36%), *Calathus fuscipes* (25,54%), oraz *Pterostichus melonarius* (7,32%). W sasiadujacych z uprawa zadrzewieniach sródpolnych struktura populacji *Carabidae* przedstawiala sie podobnie. Najliczniej odlawiano, wymieniane w literaturze jako gatunki afidofagiczne: *Pterostichus melonarius* (13,11 %) i *Harpalus rufipes* (7,82 %).