DYNAMICS OF OCCURRENCE OF DOMINANT SPECIES *PSEUDOOPHONUS RUFIPES* (DE GEER, 1774) AT *HORDEUM SATIVUM, VAR ANNUA AND HORDEUM SATIVUM, VAR. BIENNIS*

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Abstract: *Agroecosystems represent specific biotopes compared to natural biotope, the presence of Zoocenosis individuals; especially their quantitative and qualitative composition significantly indicates the state of the environment. An important part of the agrozoocenosis is family Carabidae. Its major role is that Carabidae species act as natural enemies of harmful insect in agriculture. One of the dominant species occurring within agroecosystems is a species Pseudoophonus rufipes (De Geer, 1774), which acts as a generalist and its occurrence reaches automatic dominant representation. The study was realized at Dolná Malanta (Slovak Republic) within the polyfactorial field experiment, two growth crops: spring barley (Hordeum sativum var. Annua) and winter barley (Hordeum sativum var. Biennis) in conventional farming systems. The site is located at an altitude of 175-180m above the sea. The soil type is brown soil and territory belongs to the categories of high-producing soil. Epigeic material by the earth traps method was obtained. During the five-years period within the spring barley 4182 individuals (exemplars = ex) were obtained, belonging to the family Carabidae, it representing from the whole set 66.32% representation. Within the winter barley 4859 ex were obtained, belonging to the families Carabidae, which was 71.00% representation. Biological material was determined on the lowest systematic unit - species. From the above mentioned values was dominant species Pseudoophonus rufipes represented in spring barley 1961 ex. And within the winter barley 2568 ex. Dynamics of its occurrence was in spring barley: 1st year – 351 ex, 2nd year – 1057 ex, 3rd year – 441 ex, 4th – 0 ex, 5th – 112 ex. Maximum incidences reached in second year, which was satisfactory in terms of climatic conditions. Occurrence in winter barley was as follows: 1st year – 605 ex, 2nd year – 832 ex, 3rd year – 931 ex, 4th – 84 ex, 5th – 116 ex, with a peak incidence in the third year. Based on the above can be winter barley evaluated as crop with more satisfactory topical and trophic conditions. Dominant representation showing even species Pterostichus melanarius (Illig., 1798), which recorded in spring barley incidence 320 ex (12.58% representation) and in winter barley 146 ex (5.11% representation). Occurrence of other species was only at the level of subdominant, recendent respectively subrecendent representation, i.e. occurrence of less than 5%. Based on the calculated of species identity according to Jaccard is similarity of species composition for both monitored variants identical to 68%.*

Key words: *Carabidae, Pseudoophonus rufipes (De Geer, 1774), Hordeum sativum, var. Annua, Hordeum sativum, var. Biennis*

INTRODUCTION

Species of the family *Carabidae* serve as a model group for scientific and ecological studies and are also used for studing the environmental impacts within different agro-technical measures. They are important bioindicators of load agro-ecosystems. *Carabidae* are an important part of agrozoocenosis and play an important role by acting as natural enemies of insect pests in agriculture. Most species of *Carabidae* are insectivores that consume dead or alive species of insect and only a few stand out as phytophage (BUKEJS, BALALAIKINS, 2008; TYLER, 2008; PORHAJAŠOVÁ, 2011). HARRISON, GALLAND (2012) consider of eudominant species *Pseudoophonus rufipes* for generalist of agroecosystems and state that this most

common species consume type of weed seeds. PORHAJAŠOVÁ, ŠUSTEK (2011) state *Pseudoophonus rufipes* as clearly dominant species within the family *Carabidae* occurring in agro-ecosystems, reaching with its occurrence almost autodominant representation. As for more dominantly occurring species this are the *Poecilus cupreus, Pterostichus melanarius, Carabus scheidleri* etc. ANDERSEN (1999) states that the species *Pseudoophonus rufipes* is strongly dominant species that prefers mainly cultivated soil and is characteristic by broad ecological valence and besides other dominant species they belong to the types with a strong link to the environment. Based on the gained results many authors conclude that agro-technical interventions have positive impact. The impact of climatic factors such as rainfall, temperature and the year has not significantly affected the incidence of dominant species *Pseudoophonus rufipes*. The incidence of invasive species is not conditioned by the occurrence of other species and is not dependant on the environmental conditions. This species is able to move for long distances, especially during night flights and in the case of not suitable environment they are able to leave the place within two or free hours (KÁDÁR, SZENTKIRÁLYI, 1997; ŠUSTEK, 2007; VICIAN ET AL., 2009; VICIAN ET AL., 2011; PORHAJAŠOVÁ, 2011). The adult *Pseudoophonus rufipes* species, black, with prolonged oval body, with a body length of 1.25 to 1.6 cm and with red legs, are very moving. Overwinters as a larvea, but also as an adult. Its activity begins in May reaching the highest density the end of June. Active at night, it hides food under dead leaves of plants. Present vegetation provides him with suitable microclimate and shelter from predators (LYS, NENTWIG, 1991, ZHANG, DRUMMOND, LIEBMAN, HARTKE, 1997). Many species are omnivorous with a predominance of carnivory or even herbivorous (*Amara*, *Harpalus*) (HŮRKA, 1996). Representatives of the genus *Harpalus* utilize plant food especially during the summer, but also consume animal often feed overgrown with fungus. DEMPSTER (1968, 1973) notes that species *Pseudoophonus rufipes* is an important predators of the early life stages of larvae of the family *Pieridae*. Petřvalský, PETERKOVÁ (1996) in their research in the area of interest Nitra - Dolná Malanta found that the dominant species *Pseudoophonus rufipes* is in terms of trophic developmnt at the level of herbivore and carnivore.

JORGENSEN, TOFT (1997) found that the *Pseudoophonus rufipes* preferred weed seeds of dandelion and from insects it was mainly aphids and drosophila. PORHAJAŠOVÁ et al. (2000) characterizes the species *Pseudoophonus rufipes* as significantly eurytopic species in agro-ecosystems widespread, tends more or less to the wetter environment (impact of vegetation cover), in terms of trophic according to developmental stages at the level of herbivore and carnivore. Comply with him are sandy - loamy wetter soils, with temperature indication of favorable habitat and capable of vertical migration in soil.

The aim of this work is to determine the dynamics of the dominant species *Pseudoophonus rufipes* (DE GEER, 1774) under conventional management in two crops spring barley and winter barley, over a three year period.

MATERIAL AND METHODS

Sampling of biological material were realized at monthly intervals during the growing season, in the months from April to October, during the five-years period. Earth traps method was used, they are 1 liter bottles, which are filled to the brim fixative, 4% formaldehyde and top are protected by a roof. Epigeic material was conserved in 75% alcohol and then determined in terms of the Department of Environment and Zoology. Earth traps were exposed to the experimental base of SPU Nitra-Dolná Malanta (Slovak Republic) in two model crops *Hordeum sativum var. Annua* and *Hordeum sativum var. Biennis*. The locality is in altitude of 175-180 m about sea level. Soil type are brown soils and the area is classified as category high soil belongs to the warm and dry area (HANES, 1993). Polyfactorial field experiments were

based method of divided parts, with measuring of 2 x 7m, under conventional farming system. Family *Carabidae* in terms of abundance and dominance was evaluated and then attention has focused on the seasonal dynamics of the dominant species *Pseudoophonus rufipes* (DE GEER, 1774). For comparison of variants was calculated index of the specific identity according to Jaccard (I_J), (LOSOS, et al., 1984), was subsequently the biodiversity of monitoring populations was evaluated.

RESULTS AND DISCUSSIONS

During the five-years period, from 2002 to 2006 were obtained by the method of earth traps along 9041 individuals belonging to the family *Carabidae*. We may conclude that their occurrence in monitoring crop *Hordeum sativum var. Annua* and *Hordeum sativum var. Biennis* was almost equal. The occurrence in the crop *Hordeum sativum var. Annua* was a five-year period 4182 ex, ie in the year 2002: 512 ex (53.90% from *Coleoptera*); in the year 2003: 1378 ex (75.63% from *Coleoptera*); in the year 2004: 652 ex (61.46% from *Coleoptera*); in the year 2005: 1444 ex (83.03% from *Coleoptera*); in the year 2006: 196 ex (62.63% from *Coleoptera*). In the crop *Hordeum sativum var. Biennis* was found occurrence 4859 ex, that is in the year 2002: 662 ex (63.06% from *Coleoptera*); in the year 2003: 1016 ex (72.06% from *Coleoptera*); in the year 2004: 1181 ex (75.37% from *Coleoptera*); in the year 2005: 1816 ex (83.96% from *Coleoptera*); in the year 2006: 184 (74.19% from *Carabidae*) (Table 1). Varvara (2010) states that environmental factors influence the occurrence of environmental conditions of the family *Carabidae*. The most important and decisive considers temperature, soil type, moisture, enough food and compete against each other. Any change of environmental factors in any real ecosystem. In addition to the above basic ecological factors Gongalsky, Cividanes (2008) add that the limiting factor is the climatic conditions that affect the spatial variation in lowland Carabidae population. In relation to the method of collection, the state of agro-ecosystems and crop structure is the appearance of the family *Carabidae* species present realistic.

Table 1

Representation of the family *Carabidae* on the locality Nitra-Dolná Malanta, during the years 2002-2006, in the crops *Hordeum sativum var. Annua and Hordeum sativum var. Biennis*

Hordeum sativum var. Annua	**2002**	**% from *Coleoptera***	**2003**	**% from *Coleoptera***	**2004**	**% from *Coleoptera***	**2005**	**% from *Coleoptera***	**2006**	**% from *Coleoptera***	**Total**
Family *Carabidae*	512	53.90	1378	75.63	652	61.46	1444	83.03	196	62,63	4182
Hordeum sativum var. Biennis	**2002**	**% from *Coleoptera***	**2003**	**% from *Coleoptera***	**2004**	**% from *Coleoptera***	**2005**	**% from *Coleoptera***	**2006**	**% from *Coleoptera***	**Total**
Family *Carabidae*	662	63.06	1016	72.06	1181	75.37	1816	83.96	184	74.19	4859

Based on the analysis of the family *Carabidae* species were determined a total of 19 species. Dominant is exhibited species *Pseudoophonus rufipes* (DE GEER, 1774), which along with other kinds of distinquendus *Harpalus distinquendus, Pterostichus melanarius, Anchomenus dorsalis, Calathus fuscipes* etc. fall under Symondsona et al. (2000) between the major field types. The occurrence in the crop *Hordeum sativum var. Annua* was a five-year period 1961 ex; ie in the year 2002: 351 ex (68.56% from *Carabidae*); in the year 2003: 1057 ex (76.70% from *Carabidae*); in the year 2004: 441 ex (67.65% from *Cararbidae*); in the year 2005: the species *Pseudoophonus rufipes* has not occurred; in the year 2006: 112 ex (57.14% from *Carabidae*). In the crop *Hordeum sativum var. Biennis* was found occurrence 2568 ex, that is in the year 2002: 605 ex (91.38% from *Cararbidae*), in the year 2003: 832 ex (81.89%

from *Carabidae*), in the year 2004: 931 ex (78.83% from *Carabidae*); in the year 2005: 84 ex (4.63% from *Carabidae*); in the year 2006: 116 ex (63.04% from *Carabidae*) (Table 2).

Table 2

Representation of the species *Pseudoophonus rufipes* on the locality Nitra-Dolná Malanta, during the years 2002-2006, in the crops *Hordeum sativum var. Annua and Hordeum sativum var. Biennis*

Hordeum sativum var. Annua	**2002**	**% from *Coleoptera***	**2003**	**% from *Coleoptera***	**2004**	**% from *Coleoptera***	**2005**	**% from *Coleoptera***	**2006**	**% from *Coleoptera***	**Total**
Family *Carabidae*	351	68.56	1057	76.70	441	**67.65**	-	-	112	57.14	1961
Hordeum sativum var. Biennis	**2002**	**% from *Coleoptera***	**2003**	**% from *Coleoptera***	**2004**	**% from *Coleoptera***	**2005**	**% from *Coleoptera***	**2006**	**% from *Coleoptera***	**Total**
Family *Carabidae*	605	91.38	832	81.89	931	78.83	84	4.63	116	63.04	2568

The model type is determined as stenotophic to eurytophic, in terms of dominance is among eudominant occurring species agroecosystems. In this environment the population of the species *Pseudoophonus rufipes* is significantly large and it is assumed that topical and trophic environmental conditions are suitable, the used method of management does not act as a negative factor. The dynamics of occurrence of *Pseudoophonus rufipes* within the monitored period of five years (2002-2006) in the crop *Hordeum sativum var. Annua* and *Hordeum sativum var. Biennis* during the growing season is presented in Fig. 1 and 2.

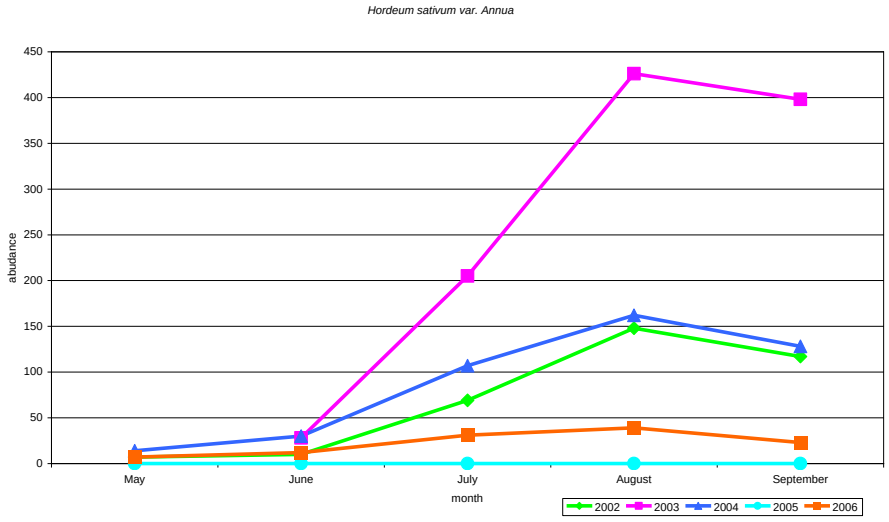

Fig. 1 The dynamics of occurrence of the species *Pseudoophonus rufipes* in the crop *Hordeum sativum var. Annua*,during the growing season (2002-2006)

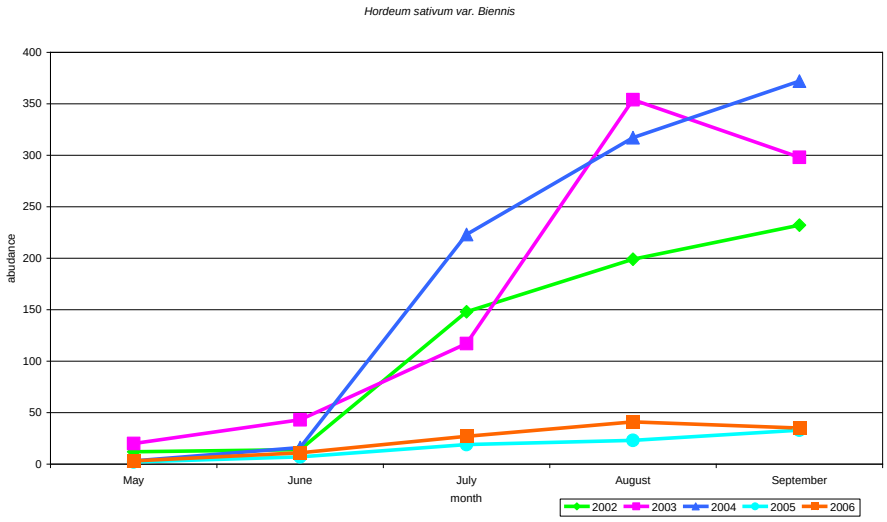

Fig. 2 The dynamics of occurrence of species *Pseudoophonus rufipes* in the crop *Hordeum sativum var. Biennis*, during the growing season (2002-2006)

We observe the increased of occurrence of the species *Pseudoophonus rufipes* collected in spring season, in May in comparison of summer and autumn season. The mentioned fact can be explained by seasonal dynamics and reproduction of this population. The prevailing majority of species *Carabidae* breeds in the spring, the larvae develop early in summer and adults of new generation develop in late summer or fall and overwinter (HŮRKA, ČEPICKÁ, 1978).

In the case of ideal conditions (particularly hot summer), this species breeds twice a year, larvae from eggs laid earlier, pupate till autumn and turn into adult individuals, which consequently overwinter. At the end of the summer next wave of propagation continues, resulting in to larvae which hibernate and dont transforme turn into adults. Larvae are predatory, some of them hibernate during even two winters. They pupate in the soil. It is interesting that while outbreaking they also extend to the wider surroundings, for example into towns and villages. They dont prefer daylight, hiding from it under the rocks and clods of soil waiting there for evening as an artificial lighting attracts them.

Based on the identified results both crops can be evaluated as satisfactory in terms of the establishment of appropriate topical and trophic conditions. The evidence of this fact is calculated index of specific identity (I_J), which reached 68%.

CONCLUSIONS

The collection of epigeic material, including the type *Pseudoophonus rufipes*, belonging to the family *Carabidae* was conducted during the five years (2002 to 2006).
Earth traps were exposed to the experimental base of SPU Nitra-Dolná Malanta (Slovak Republic) in two model crops *Hordeum sativum var. Annua* and *Hordeum sativum var. Biennis*. Alltogether there were collected 9041 ex belonging to the family *Carabidae*. Within the crop H*ordeum sativum var. Annua* was reported overall incidence of 4182 ex and within the crop *Hordeum sativum var.* Biennis was reported 4859 ex. The eudominant representation

was shown by *Pseudoophonus rufipes* species that reached in the crop *Hordeum sativum var. Annua* the incidence of 1961 ex during the five-year period *(*from 0 ex in 2005 to 1057 ex 2003). Also in the crop Hordeum sativum var. Biennis was its occurrence eudominant, reaching 2568 ex (from 84 ex in 2005 to 931 ex in 2004). The maximum occurrence of the monitored species was presented in late summer and autumn. The both above mentioned crop species provided *Pseudoophonus rufipes* species suitable conditions in terms of the occurrence. The index of specific identity (I_J) reached 68%.

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