APHIDS AT WHEAT CULTIVATED IN ORGANIC AGRICULTURE

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Abstract: The composition of aphids' species in the wheat, cultivated in organic agriculture has been researched. The influence of weed vegetation, characteristic of such a system of growing on parasites on aphids has been determined.

Key words: aphids, parasites on aphids, weeds.

INTRODUCTION

The attention to organic agriculture, as one of the ways to preserve the soil, the flora and the fauna, is a policy in a number of countries in the EU (Dimitrov, 1995). The wheat crops have a particularly great significance in organic agriculture because of their advantages – easy agrotechnics, including a comparatively successful mechanic control on weeds, control on diseases through rational crop-rotation, possibilities to maintain biologic control on the basic pests (Kitchen et. al. 2003; Leibl et.al.; 2000; Petr et. al. 2000, etc.).

In wheat cultivation in the conventional agriculture there have been observed in the crops aphids of the species *Metapolophium dirhodum, Rhopalosiphum padi, Rhopalosiphum maidis, Schizaphis graminum* and *Sitobion avenae*. It has been determined that in a low density in nature there exist the species of the family *Chrysopidae*, the predatory bug *Nabis pseudoferus Rem*., the parasites *Aphidius avenae, Ephedrus plagiator, Lysiphlebus fabarum.* They do not have a significant influence upon the density of aphids. (Grigorov, 1972,1980; Egina, Tsinovskii, 1980; USDA/ APHIS/ PPQ, 1993). Some authors recommend growing sunflower, maize, tobacco, lucerne, annual and perennial species of grass, nectar-supplying vegetation and bush vegetation in adjacent fields to wheat crops in order to raise the importance of ovum-eating parasites and other specific omnivorous predators and parasites in wheat crops. (Kaitazov et. al., 1982; Harizanov et. al., 1996). These cultures condition the additional nutrition and the receivers, on which natural enemies propagate.

It is recognized that in organic arable crop production a low weed population can be beneficial to the crop as it provides food and habitat for a range of beneficial organisms. (Patriquin et. al., 1988; Clemens et. al., 1994).

The purpose of the research is to determine the composition of species of aphids in wheat, grown in organic agriculture as well as the impact of weed vegetation, characteristic of such systems, on aphids' parasites.

MATERIALS AND METHODS

The research has been carried out during the period 2006 – 2008 in the Institute of Agriculture – Karnobat in a certified mini-field for biological agriculture, which is developed according to the jurisdiction of the Republic of Bulgaria. A two-field crop-rotation was formed in the experimental field – wheat, the variety Miriana, and pea-sunflower mix. The wheat is being grown through the application of the basic parts of the technology, which is accepted as standard in the Republic of Bulgaria, but without the usage of fertilizers and pesticides.

For the purposes of the research there has been carried out monitoring of the composition of species of aphids, the contaminated with parasites aphids, the density and the composition of weed species.

The aphids have been calculated directly on 100 wheat stalks – 10 stalks at 10 places and have been determined according to Emden (1972). The contaminated with parasites aphids have been gathered from 100 stalks – 10 stalks at 10 places.

The agrichemical characteristic of soil has been made according to the commonly accepted methodologies of determining mineral nitrogen in the Republic of Bulgaria (according to Tiurin - Kononova), of determining mobile P_20_5 (according to Egner-Reem) and of mobile K_20 (in 2 n HCl).

The weeds have been calculated according to the quantity-weight method (nb/m^2) during the months October, January, March and June.

The experiment is carried out on the soil type Leached Smolnica, whose 0 - 40 cm cultivable horizon has a heavy mechanic composition (volume density 1.10 – 1.20 g/cm^3), light acid soil reaction (pH (KCl) 6.5), average humus content (2.5 – 2.9%), weak reserve of mineral nitrogen (30-40 mg/kg soil) and mobile phosphorus (2.5 – 3.8 mg / 100 g soil) and a very good reserve of absorbable potassium (35 – 42 mg / 100g soil)

The climate in the region is transitional-continental, with an average yearly sum of rainfall 549 mm. The winter is comparatively warm, the spring is short and cool, the summer is hot and dry, the autumn is long-lasting and warm.

RESULTS AND DISCUSSION

After turning to organic growing of wheat and terminating the application of mineral nitrogen-phosphorus-potassium fertilizers for a period of 7 years, in the nutritive regimen of the soil changes occur (table. 1). There is a considerable decrease of mobile P_2O_5. There is an insignificant change in the mobile K_20. The mineral nitrogen stays relatively dynamic with a tendency of decrease. In relation to the demands of wheat to nutritive macro elements during 2006 and 2007 the soil has had a low reserve of mineral nitrogen and mobile phosphorus, while the reserve of potassium has been very good. In spite of the observed changes, the nutritive regimen of soil is still comparatively good for the development of wheat and weed vegetation.

Table 1. Agrochemical characteristics of the soil in horizon 0-40 cm.

	1998		2006		2007	
Parameters	variation*	average	variation*	average	variation*	average
Mineral N, mg/100g	40.2 – 45.9	43.6	37.6 – 39.8	37.9	30.7 – 35.0	32.9
Mobile P_2O_5, mg/100g	5.2 – 5.6	5.5	3.8 – 4.2	4.7	3.7 – 4.1	3.8
Mobile K_2O, mg/100g	40.8 – 42.9	41.0	35.7 – 39.6	36.9	35.7 – 39.1	37.1

Remark: * The minimum and maximum values of indicators have been pointed out.

During the period of research the nutritive regimen of soil does not prevent the normal development of plants, which creates good conditions for the nutrition of aphids.

In the wheat crops during 2006 there have been distinguished the species *Sitobion avenae, Schizaphis graminum* and *Metopolophium dirhodum*, in 2007 – *Sitobion avenae, Schizaphis graminum* and *Rhopalosiphum padi*, and in 2008 – only *Sitobion avenae* and *Schizaphis graminum*.

The composition of aphid species in 2006, 2007 and 2008 has been different and has depended on the climatic conditions, necessary for the development of each species. During these 3 years there have been present the species *Sitobion avenae* and *Schizaphis graminum*. *Sitobion avena* prevails, and the species reaches its highest density in 2008 – 0.3 numbers/a stalk (figure 1).

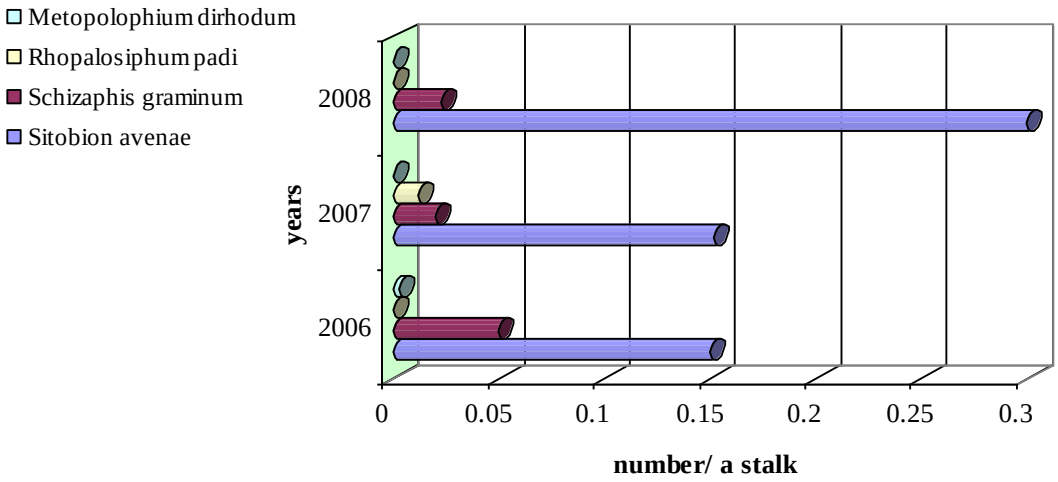

Figure. 1. Species variety and numeral dynamics of aphids in wheat

In 2006 in the wheat crops have been established a high density of weed species – 47 nb/m^2. In 2007 they decrease to 31 nb/m^2, and in 2008 they reach 23 nb/m^2 (table 2). Mainly, the decrease of density has been registered with the perennial sucker weeds – *Convolvulus arvensis* and *Cirsium arvense*, as well as the *Avena fatua*.

Table 2. Weed infestation of wheat during period 2006 – 2008 (number/m^2)

WEEDS	**nb/m^2**		
	2006	**2007**	**2008**
ANNUAL GRASS			
Avena fatua L.	11	0	0
ANNUAL BROAD – LEAF			
Anthemis spp.	1	0	3
Consolida orientalis Schroding	2	0	0
Galium tricorne With.	0	2	2
Myagrum perfoliatum L.	2	0	0
Papaver rhoeas L.	2	16	4
Ranunculus arvensis L.	1	0	1
Viola tricolor L.	0	1	2
Sinapis arvensis L.	0	2	0
Veronica hederifolia L.	0	3	2
PERENNIAL BROAD - LEAF			
Cirsium arvense (L.) Scop.	12	5	7
Convolvulus arvensis L.	16	2	2
Total:	**47**	**31**	**23**

The high density of weed species decreases the competitiveness of wheat, but on the other hand, it creates conditions for additional nutrition and multiplication of receivers, on which the natural enemies propagate.

In 2006, at the highest density of weeds, the number of contaminated with parasites, aphids reaches 0.023 nb/a stalk in comparison with the density of aphids 0.203 numbers/ a stalk. In 2007 paralleling the decrease in the density of weeds up to 31 nb/ m^2, contaminated with parasites aphids also decrease – 0.019 nb/ a stalk, with an average density of aphids – 0.184 nb/ a stalk.

Because of the favorable climatic conditions in 2008 wheat plants grow and develop well. This raises their competitiveness against weeds, reduces their density and decreases them up to 23 nb/m^2. The better-developed plants favor the nutrition of aphids, which, during this year, reach the highest density – 0.323 numbers/ a stalk, and the number of contaminated with parasites aphids decreases – 0, 010 numbers/ a stalk (figure 2).

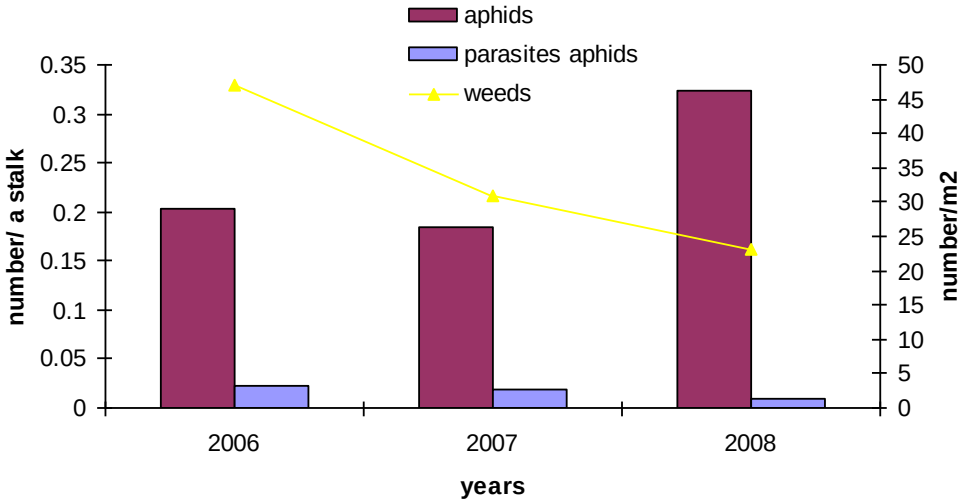

Figure. 2. Correlation between the number of weeds and the parasites aphids

There has been registered a correlation between the decrease of the number of weeds and the contaminated with parasites aphids. This is probably due to the lack of enough flourishing weed vegetation, supplying food for adult parasites.

The decrease of weed vegetation in the wheat crops also leads to a decrease of the species' variety of aphids, probably because of restriction of their receivers. During all years of monitoring research, independently from the availability of weeds and meteorological conditions there have been present the species *Sitobion avenae* and *Schizaphis graminum*.

CONCLUSION

In wheat, grown in the conditions of organic agriculture there have been observed the aphid species – *Sitobion avenae, Schizaphis graminum, Metopolophium dirhodum* and *Rhopalosiphum padi*.

The highest frequency during all three years has the species – *Sitobion avenae*.

There has been monitored a correlation between the decrease of the number of weeds and the number of contaminated with parasites aphids, which confirms Kaitazov's thesis (1982) and Harizanov's thesis et all (1996), that for the increase of the role of omnivorous predators and parasites in the wheat crops it is necessary to grow in adjacent fields flourishing nectar-supplying vegetation, annual and perennial

grass species. These cultures create the conditions for additional nutrition of receivers, on which the natural enemies propagate.

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