ВИДОВ СЪСТАВ И ЧИСЛЕНА ДИНАМИКА НА ЛИСТНИ ВЪШКИ (HOMOPTERA: APHEDIDAE) ПРИ ФУРАЖЕН И ПИВОВАРЕН ЕЧЕМИК И ВЛИЯНИЕТО ИМ ВЪРХУ ЗАРАЗЯВАНЕТО НА ЕЧЕМИКА С ВИРУСА НА ЖЪЛТОТО ЕЧЕМИЧЕНО ВДЖУДЖАВАНЕ (BYDV)

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Резюме: Изследването е проведено през 2005 – 2007 година в опитното поле на Института по земеделие – Карнобат. Определен е видовият състав и числената динамика на листните въшки (сем. Aphididae) в ечемик – Обзор и Ахелой 2, засяти в две дати на сеитба. Установени са четири вида листни въшки - *Rhopalosiphum padi, Rhopalosiphum maidis, Schizaphis graminum* и *Sitobion avenae,* като най – разпространени са *Sitobion avenae* и *Rhopalosiphum maidis.* Листните въшки преобладават в ранните дати на сеитба. За района на Карнобат основен вектор за пренасяне на BYDV е *Sitobion avenae.*
Ключови думи: въшки, ечемик**,** Barley Yellow Dwarf Virus.

SPECIES VARIETY AND NUMERAL DYNAMICS OF APHIDS (HOMOPTERA: APHEDIDAE) IN FORAGE (VARIETY AHELOY 2) AND BREWERY (VARIETY OBZOR) BARLEY AND THEIR INFLUENCE ON INFECTION WITH BARLEY YELLOW DWARF VIRUS (BYDV)

Abstract: The research was carried out during 2005 – 2007 in the experimental field in Institute of Agriculture – Karnobat, Bulgaria with time limit of sowing. Species composition and the dynamics spread of aphids from family Aphididae was defined. It was extablished that on barley variety Obzor and variety Aheloy 2 species *Rhopalosiphum padi, Rhopalosiphum maidis, Schizaphis graminum* and *Sitobion avenae.* Species *Sitobion avenae* and *Rhopalosiphum maidis* were the most widely spread. The attack in variants with early date of sowing is bigger than the late date of sowing. The main vector for carrying the BYDV is *Sitobion avenae* in the area.
Key words: aphids, barley, Barley Yellow Dwarf Virus.

SUMMARY

In years with favorable climatic conditions, plant aphids on barley increase on a large scale and damage massively the sowings. The direct damage, which they cause, consists of mechanic damage by the driving in of their stilettos and sucking out of the plant juice from the tissue, while the indirect harm consists of changes in the metabolism of the damaged organs under the effect of enzymes, toxins, hormones and viruses. Aphids cause the most serious damage through spreading virus diseases, which may fail the total crop, or may decrease the yield of grain significantly (Grigirov, 1980; Kovachevski, etc. 1999; Krasteva, Bakardjieva, 2000; Drees, Jaackman, 1999). The most widely spread and the most important from economic point of view virus disease, which plant aphids transfer to the grain crops worldwide is Barley Yellow Dwarf Virus (BYDV) (Kovachevski, etc. 1999; Krasteva, Bakardjieva, 2000).

The purpose of this research is to determine the range of species of plant aphids and the times of barley sowing, when they range in the biggest density. To find out when aphids cause the greatest damage on the yield through carrying Barley Yellow Dwarf Virus and to optimize the means for insect pest control.

MATERIALS AND METHODS

The experiment has been carried out in the experimental field of the Institute of Agriculture – Karnobat, Bulgaria during the period 2005-2007. The experiment has been founded on the block method with 2 dka size of the variants. Brewery barley Obzor variety has been planted as well as fodder barley – Aheloy 2 variety – an early one and an optimal one (Table 1).

Table 1./ Таблица 1.
Dates of sowing.
Дати на сеитба.

Sowing / Сеитба (Gramatikov et all, 2004)	Dates / Дати	
	2005/2006	**2006/2007**
Early (before 25 September)	07 Sep.2005	11 Sep.2006
Optimal (from 25 September to 30 Oktober)	19 Okt.2005	17 Okt.2006

Monitoring plant aphids has been done weekly on the four variants of the experiment through direct calculating on the plants – 10 stalks at 30 spots, and on each stalk plant aphids have been counted and their species have been determined.

The crops of both dates of barley sowing have been monitored visually for the availability of plants, contaminated with BYDV. There have been counted dwarfed plants a square meter in four replications for each variant in the phases of ear formation – full maturity. The diseased plants have been determined symptomatically. (Kovachevski, 1999)

In laboratory conditions through the weight method there have been compared dry mass of the over-ground parts and the root system of healthy and dwarfed plants.

The resistance of the plant aphids populations to various insecticides has been researched. The study has been carried out in controlled laboratory conditions in the Institute of agriculture – Karnobat in 2007. Wingless female aphids have been collected from the cereal plants in the area of the town of Karnobat and have been transferred on cereal plants put in glass cylinders and covered on top with cheese-cloth in the laboratory of entomology in the Institute. 8 insecticides from different groups have been tested with the dipping method (Rashev, 2006; Maneva, 2007) on the wingless aphids of the most spread kinds of leaf aphids on the cereal plants in the area of Karnobat: 2007 - Rhopalosiphum maidis, Sitobion avenae. The preparations - Actara 25 WG (Tiametoksam), Lannate 90 WP (Methomyl), Mospilan 20 SP (Acetamiprid), Pirimore 50 VG (Pirimicarb), Nurelle D (Cypermethrin+ Chlorpiriphosethyl), Vaztac 10 EK (Alphamethrin), Bi 58 (Dimethoate), Regent 800 VG (Fipronyl) have been used. Each preparation has been used in two concentrations – approved and doubled. The biotest included 4 repetitions on 25 adult wingless females from every kind and for every concentration.

The cereal plants have been dipped in solutions from both concentrations for the period of 10 second, after that they have been left to dry on filter paper for 2 hours. The aphids have been put on mill screen and have been dipped in the same solutions for 5 seconds after that they have been transferred on the treated cereal plants on Petri dish covered with cheese-cloth. Death-rate has been reported after 24 hours. The effectiveness of the insecticides have been calculated with the formula of Henderson – Tilten (Harizanov et all, 1998).

The given population has been accepted as resistant when doubled at the beginning recommended dose caused death – rate less than 95 %.

RESULTS AND DISCUSSION

The types of species have been researched as well as the spreading of plant aphids over barley sown on two different dates (an early and an optimal one) in autumn because this is the period when plants in the region get contaminated with BYDV.

Four types of plant aphids have been found out on the two varieties of barley – Rhopalosiphum maidis (F.), Rhopalosiphum padi (L.), Schizaphis graminum (Ron) and Sitobion avenae (F.) during the autumn vegetation period a bigger density of plant aphids on the two varieties has been monitored at the early dates of barley sowing. Rhopolasiphum maidis prevails. On the Obzor barley variety, sown on the optimal date during the year 2005/2006 Sitobion avenae prevails – 81,18 %, followed by Rhopalosiphum maidis – 13,28%, while in 2006/2007 Rhopalosiphum maidis prevail – 95, 3% On the Aheloy 2 variety during 2005/2006 there has been established a higher number of Sitobion avenae – 43, 98 %, while in 2006/2007 – of Rhopalosiphum maidis – 87,96 % (Table 2).

Table 2. / Таблица 2.

The proportion of plant aphids species according to the two dates of sowing in %.
Съотношение на листните въшки в две дати на сеитба - %.

Species Видове	2005/2006				2006/2007			
	Variety Obzor Сорт Обзор		Variety Aheloy 2 Сорт Ахелой 2		Variety Obzor / Сорт Обзор		Variety Aheloy 2 Сорт Ахелой 2	
	Early date Ранна дата	Optimal date Оптим. дата	Early date Ранна дата	Optimal date Оптим. дата	Early date Ранна дата	Optimal date Оптим. дата	Early date Ранна дата	Optimal date Оптим. дата
Sitobion avenae	23.01	81.18	24,47	43,98	10.3	4.7	21,17	12,04
Schizaphis graminum	6.33	0.19	8,17	1,4	1.76	0	3,63	0
Rhopalosiphum padi	9.06	5.35	17,1	12,79	0.17	0	3,45	0
Rhopalosiphum maidis	61.6	13.28	50,26	41,83	87.77	95.3	71,75	87,96

There has been researched the attack of the total number of plant aphids on the two varieties of barley, sown on different dates. (Table 3)

The density of the plant aphids on both varieties of barley, sown early is bigger than their density on the barley, sown on the optimal date. In the Obzor variety it reaches 27, 8 number/a stalk. Because of the more rapid development of the Aheloy 2 variety the density of the plant aphids reaches 30,43 number/a stalk. The species Rhopalosiphum maidis prevails during the autumn period. The aphids of this species settle on the central leaf of the barley plant, convoluted in a cornet. The better developed plants of the Aheloy 2 variety have become a source of better conditions and therefore, the density of the aphids in it is bigger. During the period 2006/2007 the early sown plants of both varieties developed equally and there appeared an obvious tendency in the plant aphid's preference to Obzor variety – 13,68 number/ a stalk. During that agricultural year because of drought and slower rate of development of the plants, the plant aphids had a smaller density than the previous year. At the optimal dates of sowing during both years of research, a bigger density of plant aphids has been monitored on the Obzor variety.

Table 3. / Таблица 3.

The numeral dynamics of plant aphids at the different dates of sowing.(number/ a stalk)
Числена динамика на листните въшки в различни дати на сеитба (брой/стъбло).

Date of sowing Дати на сеитба	2005/2006		2006/2007	
	Obzor Обзор	Aheloy 2 Ахелой2	Obzor Обзор	Aheloy 2 Ахелой 2
Early / Ранна	27.8	30.43	13.68	9.56
Optimal/Оптимална	1.7	0.7	0.21	0.08

The biggest percent damaged by BYDV plants have been found out on the barley sown early from all monitored variants during the two years - 100% in 2005/2006, because of the bigger density of plant aphids (the species Rhopalosiphum maidis and Sitobion avenae prevailed) and 5-7% in 2006/2007 – Rhopalosiphum maidis prevailed while the density of Sitobion avenae was insignificant. Therefore we can suggest that the main vector of transferring of the Barley Yellow Dwarf Virus in this region is Sitobion avenae. At the optimal date of barley sowing because of the smaller density of plant aphids due to the later germinating of barley and the lack of coincidence with the plant aphid's active flight, there have been found only separate plants contaminated with the virus.

From the point of view of protection of crops from contamination with BYDV, the most suitable for sowing of barley of both varieties are the optimal, the late and spring dates.

There has been made a comparison between the over-ground part and the root system of healthy and dwarfed plants in the phase of coming into ear of the early and the optimal for the region dates of sowing of the two varieties (Table 4).

Table 4. / Таблица 4.

A dry mass of healthy and contaminated with BYDV plants (%).
Суха маса на здрави и заразени с BYDV растения (%).

Variants Варианти	Dry mass / Суха маса	
	over- ground part надземна част	root system коренова система
Obzor – early sowing – healthy Обзор – ранна дата - здрави	40,06	22,83
Obzor – early sowing – with BYDV Обзор – ранна дата – заразени с BYDV	13,95	15,86
Aheloy 2 – early sowing – healthy Ахелой 2 – ранна дата - здрави	22,08	19,6
Aheloy 2 – early sowing - with BYDV Ахелой 2 – ранна дата - – заразени с BYDV	5,29	17,3
Obzor – optimal sowing – healthy Обзор – оптимална дата - здрави	33,82	30,94
Obzor – optimal sowing – with BYDV Обзор – оптимална дата - заразени с BYDV	19,01	22,02
Aheloy 2 – optimal sowing – healthy Ахелой 2 - оптимална дата - здрави	25,67	24,84
Aheloy 2 – optimal sowing - with BYDV Ахелой2-оптимална дата - заразени с BYDV	20,59	18,4

In all variants the dry mass of healthy plants is significantly bigger than the mass of dwarfed (Table 4), which confirms the thesis that contaminated with BYDV plants have an underdeveloped over- ground part and root system (Kovachevski, 1999)

The early date sown plants of the bigger Obzor variety have a better- developed over-ground part and root system in comparison with the ones, sown on the optimal date. The Aheloy 2

variety barley has a better performance at the optimal date compared to the early date of sowing.

Because of the early sowing of barley in some regions and the danger of mass attack of plant aphids there appears a necessity of carrying out a chemical pest control in order to prevent the crops' contamination with BYDV. In 2006 the plant aphids populations' resistance (Rhopalosiphum maidis, Sitobion avenae, Schizaphis graminum and Rhopalosiphum padi) to various insecticides has been tested. There has been established sensitivity to most of the researched insecticides (Maneva, 2007). Because of the bigger density of two of the plant aphids species during the agricultural year 2006/2007 a second testing has been carried out.

Table 5. / Таблица 5.

Resistance of Rhopalosiphum maydis to insecticides

Устойчивост на Rhopalosiphum maydis към инсектициди.

Insecticides Инсектициди	Actively matter Активно вещество	Dose: Approved, Doubled Доза: Одобрена Удвоена	Advance density Предварителна плътност	2007 24h After treatment 24h след третиране	
				Density Плътност	Efficiency Ефективност
Актара 25 ВГ Actara 25 WG	Тиаметоксам Tiametoksam	80 g/ha 160 g/ha	20 20	0 0	100 100
Ланат 90 ВП Lannate 90 WP	Метомил Methomyl	0.03 % 0,06 %	20 20	0 0	100 100
Моспилан20СП Mospilan 20 SP	Ацетамиприд Acetamiprid	0,0125 % 0,0250 %	20 20	0.5 0	97.5 100
Пиримор 25 ВГ Pi rimore 50 VG	Пиримикарб Pirimicarb	0.1 % 0.2 %	20 20	2 1	90 95
Нуреле – Д Nurelle D	Циперметрин+хлорпирифосетил Cypermethrin+ Chlorpiriphosethyl	0.05 % 0.1 %	20 20	0 0	100 100
Вазтак 10 ЕК Vaztac 10 EK	Алфаметрин Alphamethrin	0.02 % 0.04 %	20 20	0.5 0	97.5 100
Би 58 Bi 58	Диметоат Dimethoate	0.05% 0.1 %	20 20	0 0	100 100
Регент 800 ВГ Regent 800 VG	Фипронил Fipronyl	0.0035 % 0.007 %	20 20	0 0	100 100
Контрола, Check			20	20	-

Table 6. / Таблица 6.
Resistance of Sitobion avenae to insecticides
Устойчивост на Sitobion avenae към инсектициди.

Insecticides Инсектициди	Actively matter Активно вещество	Dose: Approved, Doubled Доза: Одобрена Удвоена	Advance density Предварителна плътност	2007 24h After treatment 24h след третиране	
				Density Плътност	Efficiency Ефективност
Актара 25 ВГ Actara 25 WG	Тиаметоксам Tiametoksam	80 g/ha 160 g/ha	20 20	0 0	100 100
Ланат 90 ВП Lannate 90 WP	Метомил Methomyl	0.03 % 0,06 %	20 20	0 0	100 100
Моспилан20СП Mospilan 20 SP	Ацетамиприд Acetamiprid	0,0125 % 0,0250 %	20 20	0.5 0	97.5 100
Пиримор 25 ВГ Pi rimore 50 VG	Пиримикарб Pirimicarb	0.1 % 0.2 %	20 20	1 0	95 100
Нуреле – Д Nurelle D	Циперметрин+хлорпирифосетил Cypermethrin+ Chlorpiriphosethyl	0.05 % 0.1 %	20 20	0 0	100 100
Вазтак 10 ЕК Vaztac 10 EK	Алфаметрин Alphamethrin	0.02 % 0.04 %	20 20	0 0	100 100
Би 58 Bi 58	Диметоат Dimethoate	0.05 % 0.1 %	20 20	0 0	100 100
Регент 800 ВГ Regent 800 VG	Фипронил Fipronyl	0.0035 % 0.007 %	20 20	0 0	100 100
Контрола, Check			20	20	-

The plant aphids - Rhopalosiphum maydis and Sitobion avenae are sensitive to all tested insecticides (Table 5,6). Most likely the sensibility of aphids is due to minimum use of the insecticides in the area.

CONCLUSION

On the early and optimal sown barley of both varieties there have been established the species Rhopalosiphum maidis, Sitobion avenae, Schizaphis graminum and Rhopalosiphum padi. The density of the plant aphids is bigger in the early dates of sowing of barley in both varieties. This is a precondition for a higher percent of contaminated plants in the earlier dates of sowing.

The plant aphids prefer the Obzor variety in conditions of equally developed plants of the varieties Aheloy 2 and Obzor.

The main vector of transferring of Barley Yellow Dwarf Virus for this region is Sitobion avenae.

For the prevention of plant aphids mass attack on barley and its contamination with Barley Yellow Dwarf Virus later dates of sowing are recommended.

The plant aphids are sensitive to all the 8 tested insecticides. If there appears a necessity of bringing out of chemical control on the prevailing species, insecticides can be applied in normal doses.

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