

Original scientific paper

## Population size of aphid (*Sitobion avenae* F.) in different varieties / breeding lines of oats (*Avena sativa* L.)

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### Abstract

The population of aphid (*Sitobion avenae* F.) on oats cultivars/lines Dunav 1, Jubilei 4, Ruse 8, Resor 1, L 615 - 3, L 621 - 1, 354 - 2, 44 - 10, CR 146 - 11 and CR 146 - 12, was studied during the period 2006 - 2007 in Karnobat, Bulgaria. Aphid population appeared on all cultivars/lines on 16 April and increased gradually up to 3 May 2007. The most resistant and most susceptible to aphid infestation varieties/breeding lines are investigated.

Key words: aphid, *Sitobion avenae*, infestation, oats, yield, cultivars.

### Introduction

Researches on aphids in cereal crops in Bulgaria have been done primary by Grigorov (1963, 1980). He reports 5 migrant and 4 not migrant species, among which the most numerous, damaging and wide spread is *Sitobion avenae* (F.). In the recent years new data concerning this group of pests in wheat and barley fields in South East Bulgaria are published (Maneva, 2007; Maneva and Koteva, 2007; Maneva and Krasteva, 2007). They specify 4 aphid species *Rhopalosiphum maidis* (F.), *Rhopalosiphum padi* (L.), *Schizaphis graminum* (Ron.) and *Sitobion avenae* (F.). Dominant in the autumn vegetation are *S. avenae* and *Rhopalosiphum maidis* (F.), and in the spring - *S. avenae*. In plant breeding researches for tolerance to pests investigations on different varieties and breeding lines reaction to aphid infestation are done (Riazuddin et al., 2004; Aslam et al., 2004). Similar studies for oats have not been conducted. The aim of the research is to determine the varieties/ breeding lines with biggest population size of *S. Avenae* and its influence on the grain yield.

### Material and methods

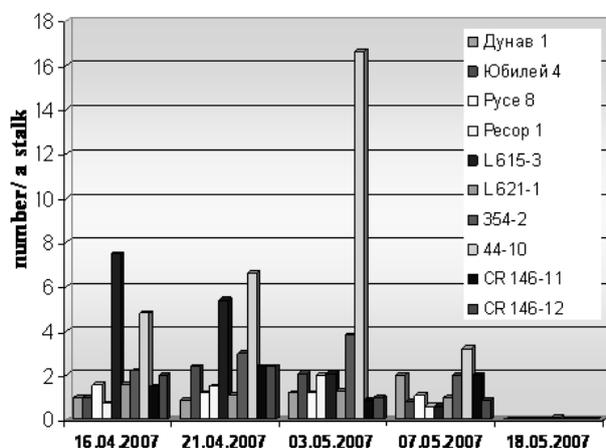
The study has been done in the Institute of agriculture – Karnobat during the period 2006-2007 in 10 varieties/ breeding lines oat - Dunav 1, Jubilei 4, Ruse 8, Resor 1, L 615 - 3, L 621 - 1, 354 - 2, 44 - 10, CR 146 - 11 and CR 146 - 12. Plots were sown at optimal autumn date. The cultural practices, not subject of this research, were according the standard technology for the region (Savova et al., 2004).

The aphid's population size is determined by direct measures on 10 oat stalks from each genotype in the spring vegetation period in every 7 - 10 days. Taxonomic analyses of the aphids are accordingly Emden (1972) и Blackman & Eastop (1989). Statistic analyses of the data have been performed by Statistica 6.

### Results and discussion

The vegetation in 2006/ 2007 in Karnobat region is characterized by dry autumn, warm winter, and poor rainfalls in the spring, hot and dry summer. Separate insects *Sitobion*

*avenae* were found in the oat fields during the autumn months. The air temperatures, higher than the average of many years values, contributed to the aphids' development but the attendant drought which lasted to the middle of May limited their population size. The lack of rainfall in April, when the formation of generative organs was executed, had a specifically negative effect on the plants' growth and development.



Graph 1. Population dynamics of *Sitobion avenae* in oat varieties/ breeding line.

Table 1. Air temperature °C – 2007

| MONTHS                         |     | III | IV   | V    | VI   |
|--------------------------------|-----|-----|------|------|------|
| Ten days                       | I   | 6,8 | 10,1 | 15,5 | 19,4 |
|                                | II  | 8,5 | 9,5  | 17,6 | 22,5 |
|                                | III | 5,8 | 12,1 | 19,4 | 25,7 |
| Monthly average temperature    |     | 7,0 | 10,6 | 17,6 | 22,5 |
| Average values for 1931 – 2006 |     | 5,2 | 10,5 | 15,5 | 19,5 |
| ± Average values               |     | 1,8 | 0,1  | 2,1  | 3,0  |

This reflected the aphids' density (Tables 1 and 2). *Sitobion avenae* was found in oat fields in the middle of April. The highest density in this period was measured in breeding line L 615 - 3 – 7.5 nb/ stalk. Lower number of insects was counted in Resor variety. In the end of the second ten-days of April the infestation was highest in breeding line 44 - 10 – 6.6 nb/ stalk and lowest in Dunav 1 variety – 0.9 nb/ stalk. The *Sitobion avenae* population size reached its maximum in line 44 - 10 -16.6 nb/ stalk in the beginning of May. In the end of the first ten days of May it marks fast decrease and in the end of the second ten days of the same month the aphids are no longer observed (Graph 1). This could be due to the abundant rainfalls in the second part of May (Table 2), which washed out large part of the insects. The concomitant high temperatures and humidity of air precipitated the plant ripening and roughness of the stalks and caused their uselessness for aphids' feed.

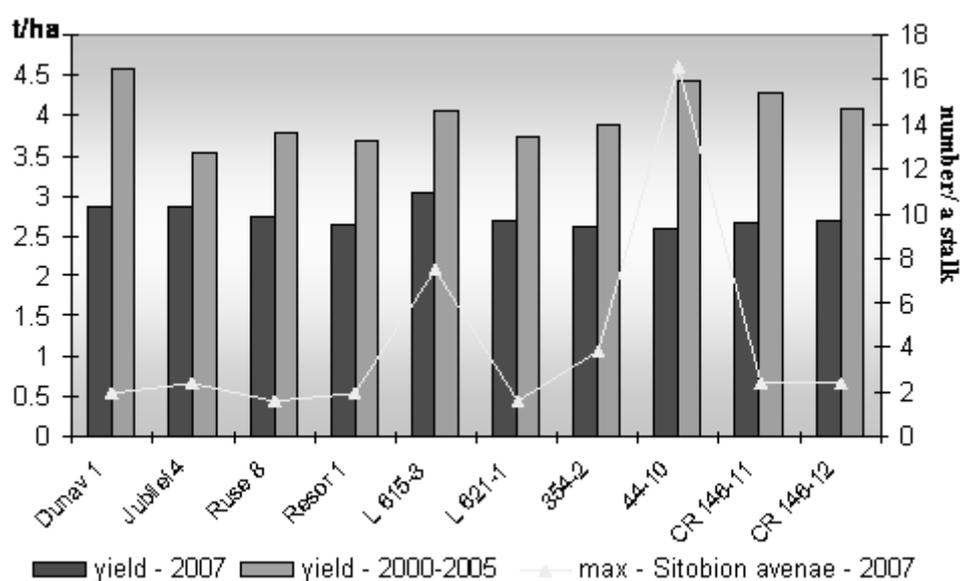
The relation between aphids' density (number per stalk) and the yield decrease has been evaluated. Correlation between those traits has been established  $r = 0.44$ ,  $p < 0.05$  (Figure 3).

Conditional separation of the genotypes can be done accordingly to the degree of aphids' infestation: weakly infested (1 - 3 nb/ stalk), medium infested (3 - 6 nb/ stalk) and strongly infested (more than 8 nb per stalk). Grouping accordingly the aphids' influence on the grain yield divides susceptible by tolerant samples.

The oat varieties/ breeding lines Dunav 1, Jubilei 4, Ruse 8, Resor 1, L 621 - 1, CR 146 - 11 and CR 146 - 12 are in the group of weakly infested. The line CR 146 - 11 is the most susceptible among them. At observation of 2.4 insects per plant the decrease of grain yield is 37.53 %. Jubilei 4 is the most tolerant cultivar in this group with yield decrease only 18.93 % at the same infestation rate.

Table 2. Rainfall in 2007, mm.

| months                           | III   | IV    | V    | VI    |      |
|----------------------------------|-------|-------|------|-------|------|
| I                                | 4,0   | 7,1   | 2,1  | 34,8  |      |
| Ten days                         | II    | 0,1   | 3,4  | 14,1  | 14,5 |
|                                  | III   | 15,6  | 1,8  | 42,2  | 8,6  |
| Monthly rainfalls                | 19,7  | 12,3  | 58,4 | 57,9  |      |
| Average rainfall for 1901 – 2006 | 34,0  | 47,7  | 57,8 | 69,0  |      |
| ± Average                        | -14,3 | -35,4 | +0,6 | -11,1 |      |

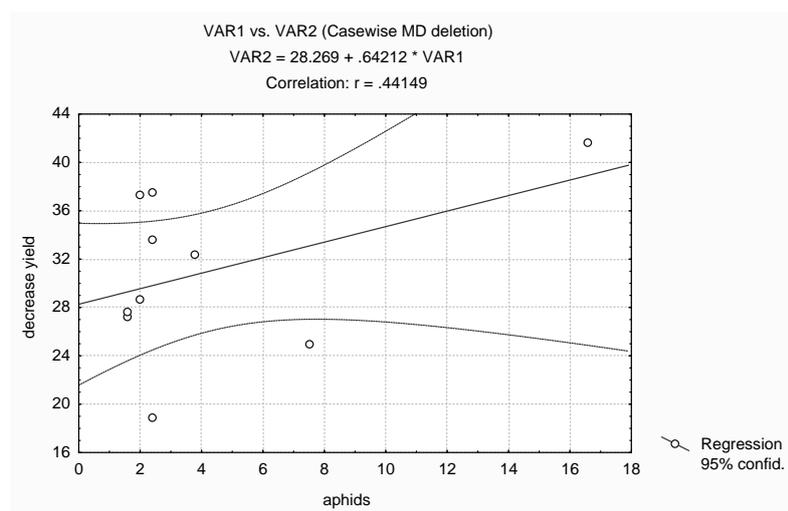


Graph 2. Maximal population size of *Sitobion avenae* and grain yield of oat varieties/ breeding lines.

The unfavorable climate conditions (drought and high temperatures) and aphids' infestation the grain yields of all oat varieties and breeding lines were below the average for the period 2000 - 2005 (Graph 2).

Medium infested are breeding lines L 615 - 3 и 354 - 2. The first is more resistible – at 7.5 number/ stalk, the yield decrease by 24.94 %. The grain yield of line 354 - 2 marks decrease by 32.39 % at 3.8 aphids per stalk.

Strongly infested is breeding line 44 - 10. At infestation rate of 16.6 insects per stalk its yield is reduced by 41.67 %.



**Graph 3. Relation between *Sitobion avenae* density and the yield decrease of oat varieties/ breeding lines in %.**

### Conclusions

Maximal population density of *Sitobion avenae* is found in breeding line 44 - 10.

Medium correlation between aphids' density and yield reduction of oat varieties/ breeding lines has been established ( $r = 0.44$ ,  $p < 0.05$ ).

Oat varieties Jubilei 4 and line L 615 – 3 are the most tolerant to aphids' infestation.

Line 44 - 10 as the most infected by *Sitobion avenae* (16.6 number/ stalk) has biggest grain yield decrease (41.67 %).

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