

## SUSCEPTIBILITY OF SOME APPLE CULTIVARS TO INFESTATION BY THE ROSY APPLE APHID (*Dysaphis plantaginea* PASS., Homoptera: Aphididae)

Vesselin Arnaoudov and Hristina Kutinkova

Fruit Growing Institute, "Ostromila" 12, 4004 Plovdiv, BULGARIA  
e-mail: instov@infotel.bg

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### A B S T R A C T

The rosy apple aphid (*Dysaphis plantaginea* Pass.) is one of the most widely spread and harmful types of leaf aphids of apple in Bulgaria. The study was carried out in the experimental apple orchard of the Fruit Growing Institute - Plovdiv, aimed at establishing the degree of susceptibility of some apple cultivars to infestation by *D. plantaginea* in the years 2000-2005. Depending on the recorded index of infestation of leaf rosettes, different cultivars were classified into 4 groups. The cultivars 'Golden Delicious', 'Jonagold' and 'Melrose' were defined as very susceptible; 'Prima', 'Gloster', 'Granny Smith', 'Charden', 'Chadel' and 'Fuji' as moderately susceptible and 'Vista Bella', 'Mollie's Delicious' and 'Aivanija' as less susceptible to infestation by *D. plantaginea*. 'Florina' and 'Liberty' were non-infested by *D. plantaginea*, apparently showing antibiosis.

**Key words:** aphids, *Dysaphis plantaginea*, infestation, susceptibility, apple cultivars

### INTRODUCTION

The rosy apple aphid (*Dysaphis plantaginea* Pass.) is one of the most harmful and widely spread leaf aphids, which infests apples in Bulgaria. In different years, its mass appearance has caused serious damage to on apple trees, including flower abscission, leaf rolling, chlorosis, leaf withering, leaf dropping, shoot twisting and strong melformation of fruits, which remain small and underdeveloped. In summer, the insect migrates to plants of the genus *Plantago*.

Control of the rosy apple aphid is difficult in principle. The difficulties arise from the high reproductive capacity of the pest. It reduces growth in plants even at low population density. It also can develop resistance to some

of the most commonly used aphicides (Hohn et al., 1995; Bourguin et al., 2000; Bylemans, 2000).

An alternative to pesticides is breeding cultivars resistant or tolerant to infestation by the rosy apple aphid, which has already met with some success various research centers (Massonie and Lespinasse, 1988; Rat-Morris, 1993; Rat-Morris, 1994; Dapena and Minarro, 2001). In the cultivar 'Florina', resistance is based on two phenomena: antibiosis and tolerance (Rat-Morris, 1993; 1994).

The aim of the present study was to determine the level of susceptibility of some apple cultivars to infestation by the rosy apple aphid.

## MATERIAL AND METHODS

The experiments were carried out from 2000 to 2005 in the experimental apple orchards of the Fruit Growing Institute in Plovdiv. The trial was conducted in a 25-year-old orchard with an area of 0.25 ha. The cultivars evaluated were: 'Golden Delicious', 'Jonagold', 'Melrose', 'Prima', 'Gloster', 'Granny Smith', 'Charden', 'Chadel', 'Fuji', 'Vista Bella', 'Mollie's Delicious', 'Aivanija', 'Florina' and 'Liberty'.

Infestation was recorded every year in the middle of May, usually fourteen days after the latest apple cultivars blossomed, and flying individuals of the aphid appeared. Throughout the study, no insecticide treatments were applied before recording infestation.

Susceptibility was assessed using the infestation index of the leaf rosettes and expressed as the mean infestation rate. 100 leaf rosettes on ten trees of each cultivar were examined. All rosettes having visible leaf aphid colonies were collected separately for each tree and cultivar in order to determine the exact number of individuals. Rosette infestation was graded on the following seven-point scale:

- 0: no leaf aphids;
- 1: 1 to 50 leaf aphids per rosette;
- 2: 51 to 200 leaf aphids per rosette;
- 3: 201 to 500 leaf aphids per rosette;
- 4: 501 to 1000 leaf aphids per rosette;
- 5: 1001 to 2000 leaf aphids per rosette; and
- 6: more than 2000 leaf aphids per rosette.

The degree of susceptibility was based on the percentage of infested leaf rosettes, applying the formula of Mc Kinney. Cultivars were categorized on the following four-point scale:

- 0: not infested;
- 1: slightly susceptible: up to 5% of rosettes infested;
- 2: moderate susceptible: from 6 to 15% of rosettes infested; and
- 3: highly susceptible: more than 15% of rosettes infested.

## RESULTS AND DISCUSSION

In early spring, the rosy apple aphid hatched from the buds when they were swelling until they opened (stage B-C). The newly hatched larvae at first sucked sap through the bud covers. After the leaves formed, they crawled on to the lower leaf surface and sucked sap from there.

The fundatrices usually completed their development at the end of April. Larvae began to hatch when most of the apple cultivars were in the tight cluster stage (stage D) or, in some cases, even at the beginning of bloom. Aphid larvae preferred to inhabit leaves of the late spurs on the trunk and skeleton branches. The aphids sucked sap from the leaves and the peduncles of the unopened flowers.

The first winged individuals usually appeared in the middle of May, when the aphids started migrating from the leaf rosettes to the tips of the developing shoots. At the end of June, when shoot growth ended, aphids migrated from the trees to their intermediate hosts of the genus *Plantago*.

The intensity of infestation varied widely from cultivar to cultivar (Tab. 1).

Table 1. Index of aphid infestation on different apple cultivars in the Plovdiv region in spring

Cultivar	Index of aphid infestation			
	average for the year			
	2001	2004	2005	2001-2005
Golden Delicious	23.6	25.9	16.3	21.9
Jonagold	19.6	22.0	13.6	18.4
Melrose	15.9	17.6	11.7	15.1
Prima	8.7	12.8	8.2	9.9
Granny Smith	7.5	10.4	6.6	8.2
Gloster	6.9	10.0	6.5	7.8
Charden	5.3	6.2	4.5	5.4
Chadel	5.5	5.8	4.6	5.3
Fuji	5.3	5.7	4.9	5.3
Vista Bella	2.8	4.2	2.5	3.2
Mollie's Delicious	0.8	1.2	0.7	0.9
Aivanija	0.7	0.9	0.6	0.7
Florina	0	0	0	0
Liberty	0	0	0	0

In 'Golden Delicious', 'Jonagold' and 'Melrose', more than 15% of the rosettes were infested, and these cultivars were categorized as highly susceptible.

In 'Prima', 'Gloster', 'Granny Smith', 'Charden', 'Chadel' and 'Fuji', between 5 and 15% of the rosettes were infested, and these cultivars were categorized as moderately susceptible.

In 'Vista Bella', 'Mollie's Delicious' and 'Aivanija', less than 5% of the rosettes were infested, and these cultivars were categorized as slightly susceptible.

In 'Florina' and 'Liberty', none of the rosettes were infested, although fundatrices were detected on them in spring.

During the growing season, the population level of aphids on 'Florina' and 'Liberty' was insignificant, in contrast to the highly susceptible cultivars 'Golden Delicious', 'Jonagold' and 'Melrose'. The rosy apple aphid failed to thrive on 'Florina' and 'Liberty' apparently because of nutritional difficulties (Rat-Morris, 1994).

On 'Florina' and 'Liberty', the aphids had a prolonged developmental cycle, and the fundatrices had a greatly reduced reproductive potential. Winged forms appeared earlier in the progeny. Migration to other plant hosts was also earlier. Altogether, these phenomena considerably reduced the population density in 'Florina' and 'Liberty', whereas in the susceptible cultivars, there was a visible and rapid rise in population density. Resistance in 'Florina' and 'Liberty' was apparently related to plant antibiosis.

The breeding program at the Fruit Growing Institute in Plovdiv has been designed around the results of this and other studies, both in Bulgaria and abroad (Angelova et al., 1997; Andreev and Kutinkova, 2004; Rat-Morris, 1993 and 1994; Rat-Morris et al., 1999; Dapena and Minarro, 2001). The main aim is to breed apple cultivars resistant or tolerant to several diseases, including apple scab (*Venturia inequalis* Aderh.) and powdery mildew (*Podosphaera leucotricha* Ellis. et Everh.), and to different aphid species, including *Aphis pomi* De Geer and, of course, the rosy apple aphid (Kutinkova and Djouvinov, 2004).

## CONCLUSIONS

- 'Golden Delicious', 'Jonagold' and 'Melrose' were highly susceptible to infestation by the rosy apple aphid.
- 'Prima', 'Gloster', 'Granny Smith', 'Charden', 'Chadel' and 'Fuji' were moderately susceptible.
- 'Vista Bella', 'Mollie's Delicious' and 'Aivanija' were slightly susceptible.
- 'Florina' and 'Liberty' were resistant to infestation by the rosy apple aphid. Resistance was apparently related to plant antibiosis.

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PODATNOŚĆ NIEKTÓRYCH ODMIAN JABŁONI NA  
ZASIEDLENIE PRZEZ MSZYCĘ JABŁONIOWO-  
BABKOWĄ (*Dysaphis plantaginea* PASS.,  
Homoptera: Aphididae)

Vesselin Arnaoudov i Hristina Kutinkova

S T R E S Z C Z E N I E

Mszycza jabłoniowo-babkowa (*Dysaphis plantaginea* Pass.) jest jedną z najbardziej rozpowszechnionych i szkodliwych mszyc żerujących na liściach jabłoni w Bułgarii. Badania prowadzono w latach 2000-2005 w doświadczalnym sadzie jabłoniowym Fruit Growing Institute w Plovdiv. Ich celem było określenie stopnia podatności niektórych odmian jabłoni na zasiedlenie ich przez *D. plantaginea*. Zależnie od wartości wskaźnika zasiedlenia rozet liściowych, badane odmiany zakwalifikowano do 4 grup. Odmiany 'Golden Delicious', 'Jonagold', 'Melrose' zostały określone jako bardzo podatne; 'Prima', 'Gloster', 'Grany Smith', 'Charden', 'Chadel' i 'Fuji' jako umiarkowanie podatne oraz 'Vista Bella', 'Mollie's Delicious' i 'Aivanija' jako mniej podatne na zasiedlenie przez *D. plantaginea*. Odmiany 'Florina' i 'Liberty' nie były zasiedlone przez *D. plantaginea*, najwidoczniej wykazując antybiozę.

**Słowa kluczowe:** mszyce, *Dysaphis plantaginea*, zasiedlenie, wrażliwość, odmiany jabłoni