

Study on some aspects of interrelations between *Malus x domestica* Borkh. and the aphids *Dysaphis plantaginea* Pass. and *Aphis pomi* de Geer.

Hristina Kutinkova, Vasilij Dzhuvinov

Fruit-Growing Institute, Plovdiv, Bulgaria

E-mail: kutinkova@abv.bg

Concent: In 2004 nineteen hybrid progenies were studied for resistance to aphids. They also manifested a resistance to scab and resistance or weak susceptibility to powdery mildew in 1998 - 2003. Golden EMLA was used as a control cultivar. Artificial infection was conducted with *Dysaphis plantaginea* Pass. and *Aphis pomi* de Geer. – under field conditions, and additionally with *Aphis pomi* on maiden trees budded on M 26 stock and grown in 4 dm³ pots. The selected hybrids of Starkrimson x Prima, Mollie's Delicious x Florina, Mollie's Delicious x Prima, Gloster x Prima, Winter Rambour x Priscilla and some hybrids of Florina (o.p.) and Liberty (o.p.) showed resistance to *Dysaphis plantaginea*. Other hybrids of Florina (o.p.), Liberty (o.p.) and Gloster x Prima proved to be resistant to *Aphis pomi*. Combined resistance to *Dysaphis plantaginea* and to *Aphis pomi* has been revealed only in one combination of Liberty (o.p.). It was confirmed that Florina is a donor of resistance to the studied aphids.

Key words: Apple hybrids, *Aphis pomi*, *Dysaphis plantaginea*, breeding resistance.

Introduction

Apple is the major fruit species of the temperate zone. It is infested by a lot of number of pests causing different damages in its particular organs. Audemard and Lepinasse (1987) reported about mites and aphids as important pests of apple. In Bulgaria, *Dysaphis plantaginea* Pass. and *Aphis pomi* de Geer. are economically important aphid species. *Dysaphis plantaginea* Pass. is a migrating species, with the species of *Plantago* genus as a secondary host. It develops from 4 to 6 generations every year. It has been spread all over the country and is one of the most harmful pests (Grigorov and Lecheva, 1989). *Aphis pomi* de Geer. is a non-migrating species. It develops from 8 to 19 generations per year, depending on weather conditions. After a widespread infestation in the nurseries, the quality of planting stock may be affected mar-

kedly. According to Höhn et al. (1996), damage caused by *Dysaphis plantaginea* Pass. and *Aphis pomi* de Geer is extremely severe in young apple orchards.

A complex of measures has been developed for protection of apple trees from diseases and pests, mainly involving the use of fungicides and insecticides. At the same time, numerous reports appeared about resistance of aphids to the aphicides, such as pirimicarb, etiofencarb and others. Use of cultivars, which are resistant to diseases and pests, may be an alternative to the chemical method and it should contribute to the reduction of harmful consequences, resulting from the application of pesticides – to humans and environment. A number of authors (Rat-Morris 1993, 1994, 2001; Rat-Morris et al., 1999; Rat-Morris and Lespinasse, 1995; Dapena and Minarro, 2001; Minarro and Dapena, 2004), reported on resistance of Prima, Florina, Fiesta and other apple cultivars to the leaf aphids *Dysaphis plantaginea* and *Dysaphis devectora*. Habekuss et al. (2000) studied 35 hybrid combinations for resistance to *Aphis pomi* and *Dysaphis plantaginea* and *Tetranychus urticae* and *Panonychus ulmi*. Gloster was used as a control susceptible cultivar. A high degree of resistance was detected in Reanda, Rebella, Resi and the breeding line Pi-AS-18,1. Combined resistance to both aphids and mites was not found. Florina was resistant not only to *Dysaphis plantaginea*, but also to *Aphis pomi*.

Introduction of the Integrated Fruit Production system requires speeding up the evaluation of new cultivars and selections, including the aspect of their susceptibility to diseases and pests. This may be achieved by applying methods of artificial infection under field and greenhouse conditions, at cultivar testing and breeding activities. The possibility of optimising and standardising the background of infection and of evaluation of large quantities of breeding stock in a short period of time are advantages of these methods. At the same time, a significant number of susceptible hybrids may be discarded at an early stage of ontogenesis, thus accelerating the breeding process.

Objective of this paper was studying the characteristics of the interrelation between *Dysaphis plantaginea*, *Aphis pomi* and *Malus x domestica*, with the aim of developing an efficient method of the earliest possible selection according to the detected resistance.

Material and methods

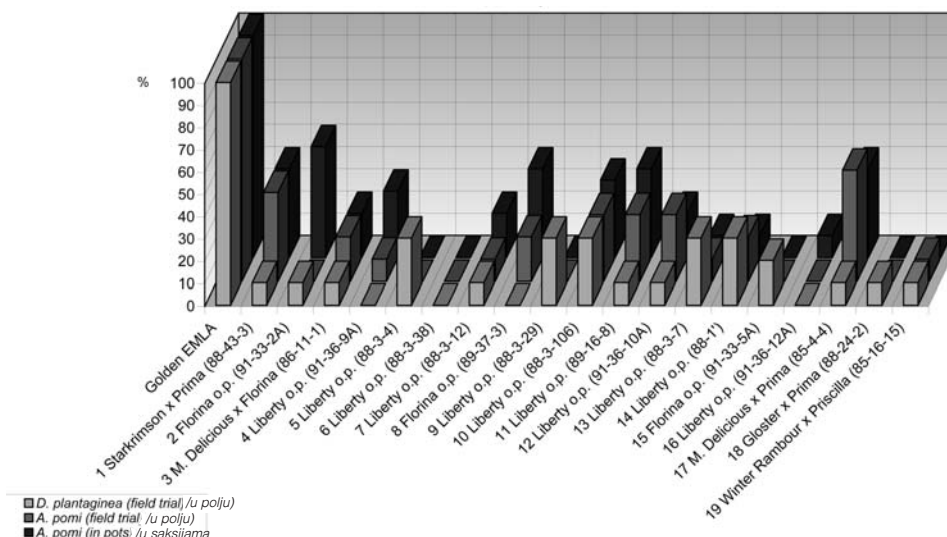
Over 1998 - 2003, 1,810 trees of different hybrid progenies were tested in preliminary field experiments. In 2004, 19 hybrids, which manifested resistance to scab, as well as resistance or low susceptibility to powdery mildew and to aphids for the period mentioned, were tested for resistance to *Dysaphis plantaginea* Pass. and *Aphis pomi* de Geer, using the method of artificial infection. Six of the studied hybrids were excluded from the experiment due to dying of some plants. Under natural field conditions, in the breeding orchard, infection was conducted with aphid colonies (naturally infested shoot tops) of *Dysaphis plantaginea* or *Aphis pomi*. Additionally, infection with *Aphis pomi* was executed on maiden trees grown in pots, under a net cover. These trees were obtained from budding with dormant buds of the tested hybrid combinations on M 26 rootstock, in August 2003. At the end of March 2004, the rootstocks with dormant buds were transplanted into the 4 dm³ (21 cm in diameter) pots. For in-

fection tests the maiden trees were used when they developed 8-12 true leaves and reached the height 40 - 60 cm. The top 1 - 2 true leaves were infected with 20 fourth instar larvae, which were brought from a natural population in the field from the breeding orchard where no chemical treatments had been applied. In order to prevent the movement of *Aphis pomi* from one plant to another, gauze bags, were used as isolators – big bags (40 × 90 cm) for branches under field conditions and smaller bags (20 × 35 cm) for plants in pots. When the pests did not cease, the infection was repeated after 24 hours.

The infestation rate was recorded at weekly intervals, applying the Rat-Morris scale (1993, 1994). Field trials were conducted in 3 replications, with single branches on two trees serving as a replication. In the pot trial originally there were 5 replications; however, in few hybrid combinations number of replications was reduced, because some plants failed for an unknown reason (not due infestation by aphids).

Results and discussion

The results of the tests are presented in graph 1, showing the infestation rate after artificial infection of the hybrid combinations with *Dysaphis plantaginea* and *Aphis pomi* under field conditions in the breeding apple orchard and in pots – for *Aphis pomi*. It was found that some of the hybrids of Liberty – o.p. and Florina – o.p. (N 4, 6, 8 and 16) manifested a resistance to *Dysaphis plantaginea*. The hybrids of Starkrimson x Prima, Mollie's Delicious x Florina, Mollie's Delicious x Prima, Gloster x



Graph 1. Rate of infestation by the aphids (*D. plantaginea* Pass. and *A. pomi* de Geer.) on the apple hybrids

Graf. 1. Stepen zaraženosti vašima (*D. plantaginea* Pass. i *A. pomi* de Geer.) na hibridima jabuke

Prima, Winter Rambour x Priscilla, Liberty – o.p. as well as Florina – o.p. (N 1, 2, 3, 7, 11, 12, 17, 18 and 19) were infested in about 10% till the second week of records, after that they died without any injuries on leaves. Other hybrid combinations of Liberty – o.p., Florina – o.p. and Gloster x Prima (N 5, 6, 9, 15, 16 and 18) appeared resistant to *Aphis pomi*. Some of the hybrids studied (Florina – o.p. and Liberty – o.p. – selections 2, 4 and 8) showed different susceptibility to the two types of infestation with *Aphis pomi*. The rest of the hybrids tested manifested almost equal degree of infestation under field conditions and in the pots. It was found that some of the hybrids of Liberty – o.p., Florina – o.p. and Starkrimson x Prima (N 1, 5, 8, 9, 11, 12, 13, 15 and 17) manifested different susceptibility to both aphid species after artificial infection. Rat-Morris and Lespinasse (1995) reported that cv Florina was resistant to scab (*Venturia inaequalis*) and to *Dysaphis plantaginea*. Habekuss et al. (2000) indicated that cv. Florina was resistant to *Aphis pomi*. Out of the 'Re' cultivars studied, Rebel-la displayed similar resistance. In our experiments a combined resistance, both to *Dysaphis plantaginea* Pass. and *Aphis pomi* de Geer, has been detected only for one of the combinations of Liberty – o.p. (N 6). These studies are being continued.

Conclusion

The hybrids from Starkrimson x Prima, Mollie's Delicious x Florina, Mollie's Delicious x Prima, Gloster x Prima, Winter Rambour x Priscilla and some of the hybrids of Florina – o.p. and Liberty – o.p. manifested resistance to *Dysaphis plantaginea*. Other hybrids of Florina – o.p. and Liberty – o.p. and Gloster x Prima proved to be resistant to *Aphis pomi*. A combined resistance, both to *Dysaphis plantaginea* Pass. and to *Aphis pomi* de Geer, was found only in one of the combinations of Liberty – o.p. It has been confirmed that Florina is a donor of resistance to the aphids under our study.

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ISPITIVANJE NEKIH ASPEKATA ODNOSA IZMEĐU *Malus x domestica* Borkh.
I JABUKINIH VAŠI *Dysaphis plantaginea* Pass. I *Aphis pomi* de Geer.

Hristina Kutinkova, Vasiliy Dzhuvinov

Institut za voćarstvo, Plovdiv, Bugarska
E-mail: kutinkova@abv.bg

Rezime

Cilj istraživanja je utvrđivanje osobnosti odnosa između jabukinih vaši *Dysaphis plantaginea*, *Aphis pomi*, s jedne, i *Malus x domestica*, s druge strane, u cilju usavšavanja metoda rane selekcije hibrida jabuke u zavisnosti od njihove već ustanovljene otpornosti prema vašima. Tokom 2004. god. ispitivano je 19 hibridnih potomstava u pogledu rezistentnosti prema vašima. U prethodnim istraživanjima tokom 1998 – 2003. godine ove selekcije su ispoljile otpornost prema čađavoj krastavosti i otpornost ili blagu osetljivost prema pepelnici. Kao kontrola korišćena je sorta EMLA.

U poljskim uslovima, veštački je izazvana infekcija vašima *Dysaphis plantaginea* Pass. i *Aphis pomi* de Geer. Pritom, zaraženost je izazvana jabukinim vašima na stablima kalemljenim na podlozi M 26, zasađenim u saksije i održavanim pod mrežom. Nivo zaraženosti utvrđivan je Rat-Morisovom skalom.

Rezultati preliminarnih ispitivanja pokazali su da su selekcionisani hibridi dobijeni ukrštanjem Starkrimson x Prima, Mollie's Delicious x Florina, Mollie's Delicious x Prima, Gloster x Prima, Winter Rambour x Priscilla i neki hibridi sorti Florina (o.p.) i Liberty (o.p.) otporni na *Dysaphis plantaginea*. Za ostale hibride sorti Florina (o.p.), Liberty (o.p.) i Gloster x Prima dokazano je da su otporni na *Aphis pomi*. Otpornost na obe jabukine vaši, *Dysaphis plantaginea* i *Aphis pomi*, ustanovljena je samo u jednoj kombinaciji sorte Liberty (o.p.). Istraživanjem je utvrđeno da je Florina donor otpornosti na jabukine vaši. Ispitivanja u tom pravcu biće nastavljena.

Ključne reči: Hibridi jabuke, *Aphis pomi*, *Dysaphis plantaginea*, selekcija na otpornost.

Author's address:
Dr Hristina Kutinkova
Fruit Growing Institute
Ostromila 12
4004 Plovdiv
Bulgaria