Bulletin of Insectology ***60*** *(2): 301-302, 2007*
ISSN 1721-8861

Malus sieboldii-based rootstocks mediate apple proliferation resistance to grafted trees

Erich SEEMÜLLER[1], Eckard MOLL[2], Bernd SCHNEIDER[1]
[1]*Federal Biological Research Center for Agriculture and Forestry, Institute for Plant Protection in Fruit Crops, Dossenheim, Germany*
[2]*Federal Biological Research Centre for Agriculture and Forestry, Central Data Processing Group, Kleinmachnow, Germany*

Abstract

Over a period of 24 years, three trials were carried out in which open pollinated apomictic seedlings were examined for apple proliferation (AP) resistance in comparison with several clonal rootstocks. The screening was performed under experimental inoculation and natural infection conditions. Criteria for the resistance rating were occurrence of AP symptoms, percentage of affected trees, incidence of the small fruit symptom and the effect of the disease on vigor. In all trials, similar results were obtained. Satisfactory resistance was only identified in trees grown on progenies of *M. sieboldii* and M. sieboldii-derived experimental rootstocks. The screening also showed that rootstocks with *M. sieboldii* parentage are often highly susceptible to latent apple viruses.

Key words: Apple proliferation, '*Candidatus* Phytoplasma mali', apple, resistance.

Introduction

Apple proliferation (AP) phytoplasma disease is difficult to control. Phytosanitary measures such as the use of healthy planting material and uprooting of diseased trees are often unsatisfactory, because infections by insect vectors are difficult to prevent. Currently, spraying against the vectors is the most promising method to reduce infection. However, sprays cannot always be applied, for example during flowering, so that insecticide treatment is often not fully efficient.

The most promising approach to control AP would be the use of resistant plants. Previous work has shown that '*Ca*. P. mali' is eliminated in the aerial parts during winter due to degeneration of phloem sieve tubes on which the pathogen is depending. Over wintering occurs in the roots where intact sieve tubes are present throughout the year. From the roots the stem may be recolonized in spring when new phloem is being formed (Schaper and Seemüller, 1982; Schaper and Seemüller, 1984; Seemüller *et al*., 1984). Due to this fluctuation in the colonization pattern many clonal rootstocks and a wide range of wild and ornamental *Malus* species were examined for AP resistance. However, most genotypes showed susceptibility for AP. Resistance was only observed in some experimental apomictic rootstock selections derived from crosses between the apomictic species *M. sieboldii* and genotypes of the nonapomictic species *M.* x *domestica* or *M. purpurea* (Kartte and Seemüller, 1991; Seemüller *et al*., 1992). To examine the *M. sieboldii*-derived resistance in more detail, long-term trials were carried out.

Materials and methods

AP resistance of open pollinated seedlings from 22 apomictic rootstock selections and the apomictic parents *M. sieboldii* and *M. sargentii* was compared with that of clonal rootstocks of the Budagovsky series B, the Polish series P and rootstocks M 9, M 11 and M 13. The rootstocks were graft-inoculated with Golden Delicious scions or were budded with healthy Golden Delicious and grown under natural infection conditions. Over a period of 24 years, three trials were carried out which where observed for 9 to 14 years.

Results and discussion

In the three trials carried out, different sets of apomictic seedling rootstocks were examined for AP resistance in comparison to various nonapomictic clonal rootstocks. The overall results obtained were similar. They showed that the rootstock-mediated resistance of grafted trees differs greatly. A high level of resistance was only induced by progenies of *M. sieboldii* in 12 out of 14 selections with *M. sieboldii* in their parentage. Thus, *M. sieboldii* appears to be the only resistance source known at present. More affected were trees on progenies of clonal stocks M9 and M11. High susceptibility showed trees on progenies of *M. sargentii*, most selections with *M. sargentii* parentage, clonal stocks of the P series, most clonal stocks of the B series and M13.

Under all resistance criteria the group of resistant *M. sieboldii*-derived stocks performed better than the clonal stocks. Of particular importance is that incidence of undersized fruits in trees grafted on resistant apomictic plants is significantly lower than the one of trees grafted on M9, the most employed commercial rootstock in Europe.

The results obtained in this study largely confirm the data of previous work in which, however, mainly other criteria including foliar symptoms, phytoplasma persistence and phytoplasma concentration were examined (Bisognin *et al*., 2007; Kartte and Seemüller, 1991; Seemüller *et al*., 1992).

The screening also showed that rootstocks with *M. sieboldii* and *M. sargentii* in their parentage are often highly susceptible to latent apple viruses including apple chlorotic leaf spot virus, apple stem grooving virus and apple stem pitting virus. Furthermore, apple trees grafted on most of the *M. sieboldii*-based progenies were more vigorous and less productive than trees on standard rootstock M9.

References

BISOGNIN C., SCHNEIDER B., SALM H., GRANDO M. S., JARAUSCH W., MOLL E., SEEMÜLLER E., 2007.- Apple proliferation resistance in apomictic rootstocks and its relationship to phytoplasma concentration and SSR genotypes.- *Phytopathology*, in press.

KARTTE S., SEEMÜLLER E., 1991.- Susceptibility of grafted *Malus* taxa and hybrids to apple proliferation disease.- *Journal of Phytopathology*, 131: 137-148.

SCHAPER U., SEEMÜLLER E., 1982.- Condition of the phloem and the persistence of mycoplasmalike organisms associated with apple proliferation and pear decline.- *Phytopathology*, 72: 736-742.

SCHAPER U., SEEMÜLLER E., 1984.- Recolonization of the stem of apple proliferation and pear decline-diseased trees by the causal organisms in spring.- *Zeitschrift für Pflanzenkrankheiten und Pflanzenschutz*, 91: 608-613.

SEEMÜLLER E., SCHAPER U., ZIMBELMANN F., 1984.- Seasonal variation in the colonization patterns of mycoplasmalike organisms associated with apple proliferation and pear decline.- *Zeitschrift für Pflanzenkrankheiten und Pflanzenschutz,* 91: 371-382.

SEEMÜLLER E., KARTTE S., KUNZE L., 1992.- Resistance in established and experimental apple rootstocks to apple proliferation disease.- *Acta Horticulturae*, 309: 245-251.

Corresponding author: Eric SEEMÜLLER (e-mail: e.seemueller@bba.de), Federal Biological Research Center for Agriculture and Forestry, Institute for Plant Protection in Fruit Crops, D-69221 Dossenheim, Germany.