INFLUENCE OF PRUNUS RING SPOT VIRUS (PRSV) ON *P R U N U S A V I U M* L./SHIROFUGEN/*P R U N U S A V I U M* L. COMBINATION

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Abstract

One-year-old *P. a v i u m* L. varieties grafted on Shirofugen/*P. a v i u m* L. were infected with Prunus ring spot virus (PRSV).

Death of Shirofugen intermediate took place in all the trees within two year's interval from infection.

The symptomatology observed in the components of the top-worked trees is discussed and compared to the symptomatology related to cases of incompatibility between rootstock and scion.

1. Introduction

The flowering cherry tree *P r u n u s s e r r u l a t a* Lindl. cv Shirofugen is well known as indicator for virus diseases in stone fruit trees due to its hypersusceptibility versus Prunus ring spot virus (PRSV) and Prune Dwarf virus (PDV) (Milbrath et al., 1945; Helton, 1960).

When indexing on Shirofugen, necrosis of the tissues of the Shirofugen contacting the grafted chip is produced. This rapid necrosis prevents the propagation of the virus in the Shirofugen.

The aim of this work has been to find out which kind of changes were produced in the union between *P. a v i u m* L. and Shirofugen, in grafted trees when the component *P. a v i u m* L. was infected. That is to say; if some kind of necrosis, such as the one developed in incompatible unions between rootstock and scion, could be produced when Shirofugen tissues contacted the virus in the union.

2. Material and methods

Some one-year-old Shirofugen grafted on *P. a v i u m* L. seedlings were budded with commercial *P r u n u s a v i u m* L. cultivars in the summer of 1981.

During the summer of 1982, top scions were allowed to grow freely as well as the sucker shoots from the rootstocks in the cases they had developed. On the other hand, shoots from the intermediate were remov-

ed. Therefore , 25 *P. avium* L./Shirofugen/*P. avium* L. double-worked trees were obtained, 11 of these trees had some suckers from the rootstock.

At the beginning of July 1983, that is, during the second growing season for the top scions, all the trees were infected by the strain Rugose Mosaic which is a strain of PRSV (Nyland et al., 1964; 1966). Infection took place in the suckers of the rootstocks in the 11 trees which had suckered. The remaining 14 trees were infected in the top scion. In figure 1., trees and place of infection are schematized.

Through the rest of 1983's summer and along 1984, trees were used periodically to examine the internal structure of the unions. Those unions were examined by sawing them by the longitudinal, radial plane which goes by the lowest point and the highest one of the union as well as by decorticating the area of the union in order to observe the external side of the xylem as well as the internal side of the phloem.

3. Results

The first external symptom of virus disease was gum formation in the intermediate (Shirofugen) below the line of union between the top scion and the intermediate. This symptom was produced 30-40 days after infection in the case of trees where the top scion was infected (fig. 1b). On the other hand, the trees where the rootstock was infected (fig. 1a), did not suffer gum formation till the following spring, at the beginning of May, when it appeared in the intermediate (Shirofugen) at the line of unions.

Internal examination of the unions showed that first necrosis of tissues were produced, in Shirofugen, in the union with *P. avium* L., being the cambium the first tissue to become necrotic. This first degeneration of the cambium spreads to all the bark tissues of the intermediate Shirofugen, so that the bark of top scion and rootstock get disconnected. As a consequence of the necrosis of the intermediate, the top scion also dies; but the rootstock remains alive.

In five of the trees where the top scion was infected (tree b, fig. 1) some suckers were produced in the rootstock after infection. These suckers were indexed after death of intermediate and top scion took place. This indexing showed positive results as to the presence of PRSV, meaning that PRSV was transmitted through the intermediate Shirofugen in spite of producing the necrosis of its tissues.

4. Discussion

One of the purposes of this work was to find out if when infecting *P. avium* L. in Shirofugen/*P. avium* L. grafted trees, a symptomatology similar to the incompatibility between rootstock and scion

could be produced. However, the symptomatology observed differs remarkably from that described for the different types of incompatibility. These differences versus localized incompatibility and translocated incompatibility are discussed below.

In the combinations with localized incompatibility, some breaks are produced within the cambium in the line of union causing small islands of parenchyma which determine the fragility of that union. At the same time, the tree continues growing without external symptoms of disease (Herrero, 1951; Mosse, 1962). In the present work, the first symptom of infection also seems to be the necrosis of the cambium of the Shirofugen in the area of the union. However, this necrosis, instead of staying localized in the line of union, spreads to the rest of the cambium and to the whole bark of the Shirofugen in a few days, thus causing the death of the tree by girdling.

Neither the symptomatology of translocated incompatibility agrees with the above mentioned symptoms. In the case of translocated incompatibility a lack of translocation is produced with the corresponding starvation of the rootstock. This lack of translocation is not produced by a girdling due to a macroscopic necrosis of the tissues (Herrero, 1951; Mosse, 1962). On the other hand, in the case of the Shirofugen, the girdling of the tree is caused by the necrosis of all the bark of the intermediate. That necrosis, being rather quick, does not produce the starvation of the rootstock while it does produce the death of the top scion.

Another aspect of the question is the different behaviour of Shirofugen when infection is developed through a one-year-old union with *P. a v i u m* L. or when grafting on it the infected chip if Shirofugen is used as indicator. In the first case, necrosis of the whole Shirofugen is produced and in the second case only the tissues of Shirofugen contacting the inoculum become necrotic.

This difference could be understood as a transmission mechanism similar to that described by Schneider (1959) for the tristeza disease in some citrus. In the trees studied in the present work, the virus would be transmitted through the sieve tubes of the union and would infect the adjacent parenchyma cells in the Shirofugen. These infected cells are described by Schneider as chromatic cells. "When chromatic cells are located adjacent to meristems (cambium, procambium, ground meristem), the chromatic condition spreads from cell to cell through the meristem" (Schneider, 1959). The virus would be translocated in the phloem of the intermediate Shirofugen, although that translocation would cause the necrosis of the cambium meristem. The destruction of the cambium would be followed by the destruction of the Shirofugen bark due to lack of replacement phloem. However, while the phloem of the intermediate was functional, the virus would reach the rootstock,

as it is shown by the indexing of the rootstock carried out in the present work.

On the contrary, when Shirofugen is used as an indicator, the virus from the chip to be indexed could not reach the Shirofugen sieve tubes, as the meristematic callus formed by the susceptible Shirofugen would become necrotic before any sieve tubes could be differentiated.

References

- Helton, A.W., 1960. Relative merits of Shirofugen and peach trees as indicators for *Prunus* ring spot in prune trees. *Phytopathology*. 50: 846-849.
- Herrero, J., 1951. Studies of compatible and incompatible graft combinations with special reference to hardy fruit trees. *J. Hort. Sci.* 26: 186-237.
- Milbrath, J.A., and Zeller, S.M., 1945. Latent viruses in stone fruits. *Science*. 101: 114-115.
- Mosse, Barbara, 1962. Graft-incompatibility in fruit trees. Technical Communication No 28. Comm. Bureau Hort. Plant. Crops. 36 pp.
- Nyland, G., and Lowe, S.K., 1964. The relation of Cherry Rugose Mosaic and Almond Calico viruses to *Prunus* ringspot virus (Abstr.) *Phytopathology*. 54: 1435.
- Nyland, G., and Lowe, S.K., 1966. Similar Yellow Leaf symptom in 'Montmorency' caused by Cherry Rugose Mosaic, recurrent Ringspot and sour cherry Yellows viruses. (Abstr.) *Phytopathology*. 56. 150.
- Schneider, H., 1959. The anatomy of tristeza-virus-infected citrus. Paper No 1104. Univ. California Citrus Exp. Sta. Riverside.

Fig. 1.

SCHEME OF THE INFECTED TREES AND PLACE OF INFECTION.

TREES WITH SUCKER SHOOTS AT THE ROOTSTOCK (a)
 WERE INFECTED IN THOSE SUCKERS. OTHER TREES (b)
 WERE INFECTED IN THE TOP SCIONS.