HISTOPATHOLOGICAL ABNORMALITIES IN THE COMPATIBLE GRAFT UNION 'CHERRY RED' (PRUNUS PERSICA (L.) BATSCH/'CONSTANTI' (P. DOMESTICA L. OR P. INSITITIA)

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Abstract

Abrupt histopathological changes on the rootstock were produced in the combination 'Cherryred' (P. persica (L.) Batsch)/'Constanti' (P. domestica L. or P. insititia (L.)) after 12 years of compatible growth.

The abnormal performance of the cambium caused important pits and pegs, easily visible when bark was peeled off, and abundant necrotic tissue filled these grooves. Consequently, development of trees was highly reduced from the third year of field growth.

Combinations of other peach varieties with the same rootstock 'Constanti' did not show any kind of abnormality, neither did 'Cherryred' grafted on the rootstock 'Brompton' (P. domestica L.).

The changes appear to be the result of hypersensitivity reaction of rootstock 'Constanti' to the pathogens provided by the peach variety 'Cherryred'. Indexing showed the presence of apple chlorotic leaf spot virus (ACLSV) in the scion but not in the rootstock. Other virus such as prunus necrotic ring spot (PNRSV), prune dwarf (PDV), apple mosaic (ApMV), plum pox (PPV), tomato ring spot (TomRSV), or different nepo-viruses were not detected. The presence of a virus-like disease is discussed.

1. Introduction

Since 1965, the Experimental Station of Aula Dei (Zaragoza) has been carrying out a selection of rootstocks among clones of 'Pollizo de Murcia' (Prunus sp.) and other plum trees, which could be adapted to calcareous and compact soils as well as suitable for a satisfactory propagation by woody cuttings. Among those clones, a common plum tree coming from 'Constanti' (Tarragona, Spain) displayed an outstanding response as a rootstock for peach and a good resistance to chlorosis and nematodes (Cambra, 1970). Due to its morphological characters, it was reported as a slow growth plum type (Prunus domestica or Prunus insititia) (Bernhard and Grasselly, 1959).

Studies made with adult trees from different peach varieties grafted on the rootstock 'Constanti' showed the good performance of this rootstock with almost all tested cultivars, except 'Cherryred', which after some years showed important abnormalities in the rootstock below the bud union. These abnormalities refer to rootstock

trunk enlargement at ground level or below, to starch distribution, and to tree. This symptomatology, however, differs from a case of translocated incompatibility (Herrero, 1951; Mose, 1962), and a hypothesis was put forward that these abnormalities could be caused by some infectious agent provided by 'Cherryred' inducing a hypersensitivity reaction in the rootstock 'Constanti'. In this paper we discuss the possible influence of some known virus on the display of those symptoms.

2. Materials and methods

Three peach cultivars, 'Cherryred', '126 AD' and 'Del Gorro', grafted on the rootstock 'Constanti' (15 trees/cultivar) were planted in 1975. Those trees were evaluated in terms of vigour, estimated by the trunk girth above and below the union. Twelve years later, trees were removed, and xylem abnormalities were examined by peeling the bark off. Radial-longitudinal sections were performed in the rootstock/scion union in order to see whether there was any parenchyma alteration, and to study the starch distribution above and below the union. All cultivars were indexed on peach seedlings of the virus indicator 'GF 305' in the greenhouse by simple grafting.

A second trial was conducted, where 'Cherryred' was grafted on the rootstocks 'Brompton EMLA' and 'Constanti'. A randomized block design with 33 repetitions of those two combinations was used in the orchard, and vigour was recorded. At the end of that trial when trees were five years old, they were removed and the rootstock abnormalities below the union and on the root system were observed. Furthermore, trees were indexed by biological methods on the peach indicator 'GF 305' in the greenhouse and by the immunoenzymatic ELISA test.

A third trial was carried out in nursery by grafting 'Cherryred' on a number of rootstocks: almond x peach hybrids 'GF 677' and 'Adafuel', peach 'GF 305', plums 'Brompton EMLA', 'Constanti', INRA 'Damas 1869', INRA 'GF 43', 'San Julian A', and the Pollizos 'Soto 101' and 'Albinia 6'. Data were taken in the three years of field growth, then trees were removed and the trunk symptoms studied. In all these combinations, the ELISA technique was used for the detection of ACLSV, PNRSV, PDV, TomRSV, ApMV and PPV. Also, the graft unions were examined by removal of the bark.

3. Results and Discussion

Except for the combination 'Cherryred'/'Constanti', all other combinations studied, i.e. of the variety 'Cherryred' grafted on the different rootstocks (Table 1), as well as of the varieties '126 AD' and 'Del Gorro' grafted on 'Constanti', displayed normal performance and neither the xylem of the variety nor the rootstock presented any abnormality.

A study of the compatibility of the combination 'Cherryred'/'Constanti' showed that in the bud union no discontinuities in the xylem or phloem were observed; only a slight involution of the xylem cylinder was present in some graftings, most of which could be

classified in the categories A and B described by Herrero (1962). On the other hand, the starch distribution was normal, corresponding to a case of translocated incompatibility (Herrero, 1951). Thus the abnormalities observed in the rootstock of the combination 'Cherryred'/'Constanti' do not correspond to those described by Herrero (1951) in the cases of translocated or localized incompatibility. The abnormalities seem to be produced by some causal agent, transmissible by grafting and provided by the variety 'Cherryred'.

Development of trees was highly reduced in the combination 'Cherryred'/'Constanti' from the third year of growth (Tables 2 and 3). Also, a strong defoliation occurred, leaves turned red, and the trees died in some cases. Below the union a bark enlargement was produced, presenting a spongy appearance with large necrotic areas and deep grooves. When peeling off the bark, strong pits and grooves together with large necrotic areas were visible in the cambium. In a transversal section of the trunk, the abnormal performance of the cambium could be observed. That abnormal performance produced important lobular-like deformations in the xylem cylinder. Many roots were easily broken at their emergence from the trunk as a result of the disorganization of the wood. Furthermore, roots are few and fragile. All these symptoms agree with those reported for prunus stem pitting (Jones, 1971; Mircetich and Fogle, 1974; Llacer, 1978).

Serological indexing by the ELISA technique showed the presence of apple chlorotic leaf spot virus (ACLSV) in the varieties 'Cherryred' and '126 AD', but in no case the presence of prunus necrotic ring spot virus (PNRSV), prune dwarf virus (PDV), apple mosaic virus (ApMV), tomato ring spot virus (TomRSV), or plum pox virus (PPV) was detected. Likewise, the indexing on the seed peach indicator 'GF 305' in the greenhouse showed symptoms of ACLSV in the same varieties as above but the presence of nepo-virus was not detected in any root/scion combination (Table 4). These results were corroborated by Desvignes (personal communication).

Although the symptomatology observed in the combination 'Cherryred'/'Constanti' is very similar to that described for peach stem pitting virus (Mircetich and Fogle, 1976), alterations were never produced in the scion or in rootstocks other than 'Constanti'. On the other side, the serological or biological tests did not show the presence of tomato ring spot virus which seems to have substantial part in the etiology of stem pitting of Prunus species (Stouffer et al., 1975).

The presence of apple chlorotic leaf spot virus was detected in 'Cherryred' and in '126 AD'. However, no symptom was produced in the rootstock 'Constanti' after grafting with '126 AD'. Likewise, this virus was not able to produce xylem alterations in the other rootstocks studied. Further work is necessary to elucidate the abnormal behaviour of the combination 'Cherryred'/'Constanti'. Although no clear virus causal agent has been detected, the fact that the disease can be transmitted together with the observed symptoms suggest that these abnormalities may be due to a virus or virus-like disease.

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Table 1 - Histopatological changes in rootstock in nursery

<u>Combination</u>	<u>Abnormalities</u>	<u>Nº Trees with N° Trees abnormalities observed</u>
'Cherryred'/'Adafuel'	NO	0/20
'Cherryred'/'INRA 'GF 677'	NO	0/10
'Cherryred'/'Brompton' EMLA	NO	0/21
'Cherryred'/'Constanti'	ABNORMAL TISSUES	20/20
'Cherryred'/'INRA 'Damas 1869'	NO	0/25
'Cherryred'/'INRA 'GF 43'	NO	0/12
'Cherryred'/'Peach seedling 'GF 305'	NO	0/9
'Cherryred'/'Pollizo 'Soto 101'	NO	0/25
'Cherryred'/'Pollizo 'Albinia 6'	NO	0/10
'Cherryred'/'San Julian A'	NO	0/25

Table 2 - Trunk girth of 12 years old trees (cm)

<u>Combination</u>	<u>Trunk girth (cm)</u>
'Cherryred'/'Constanti'	17.8 + 1.9
'126 A D'/'Constanti'	37.0 + 1.7
'Del Gorro'/'Constanti'	40.6 + 1.6

Table 3 - Growth of 'Cherryred' grafted on 'Constanti' and 'Brompton' (trunk girth (cm))

<u>Years</u>	<u>Rootstock</u>	
	<u>'Constanti'</u>	<u>'Brompton'</u>
1	8.74 + 0.19	8.35 + 0.18
2	11.85 + 0.18	13.12 + 0.23
3	11.99 + 0.17	14.55 + 0.25
5	14.10 + 0.50	29.30 + 0.70

Table 4 - Results of the serological and biological indexings

	E.L.I.S.A.					PPV	SYMPTOMS ON
	<u>CLSV</u>	<u>TomRSV</u>	<u>PRSV</u>	<u>PDV</u>	<u>ApMV</u>		
'Cherryred'/'Constanti'	+	0	0	0	0	0	'GF30S' + CLSV
'126 AD'/'Constanti'	+	0	0	0	0	0	+ CLSV
'Cherryred'/'Brompton' EMLA	+	0	0	0	0	0	+ CLSV
'Cherryred'/'GF 677'	+	0	0	0	0	0	-
'Cherryred'/'Adafuel'	+	0	0	0	0	0	-
'Cherryred'/'INRA 'Damas 1869'	+	0	0	0	0	0	-
'Cherryred'/'INRA 'GF 43'	+	0	0	0	0	0	-
'Cherryred'/'Peach seedling	+	0	0	0	0	0	-
'Cherryred'/'Pollizo 'Soto 101'	+	0	0	0	0	0	-
'Cherryred'/'Pollizo 'Albinia 6'	+	0	0	0	0	0	-
'Cherryred'/'San Julian A'	+	0	0	0	0	0	-

+ Positive result

0 Negative

- No observation