DETECTION OF VIRUS INFECTION IN IMPORTED CHERRY AND APRICOT CLONES[1]

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Abstract

Apricot and cherry clones originating in European and Asian countries were indexed on the cherry, apricot, prune and peach varieties grown commercially in British Columbia. Five unfamiliar syndromes were induced on sweet cherry varieties, and gumming reactions were given by apricot and peach. Several alternative bases are suggested for the selection of indicators to serve in the post entry indexing of stone fruits, and the relative merits of such indexing host ranges are reviewed.

Introduction

The occurrence of viruses in deciduous fruit trees and scionwood, imported to North America from other continents, has been reported by Kahn et al. (5), Milbrath (6), and Welsh and Keane (11), among others.

In 1960 and 1961 the requirements of the tree fruit breeding program at the Canada Agriculture Research Station, Summerland, justified the importation of cherry and apricot varieties originating in a number of countries in Europe and Asia. Many of these were available from the Plant Introduction Station at Chico, California. Others were imported directly from research institutions on the other continents. Some of the cherry varieties at the Chico station had been partially indexed by Milbrath (6). No information was available on the virus status of the other materials to indicate whether their introduction to Research Station plantings was a safe procedure. No established quarantine and indexing facilities existed in Canada for their reception. Accordingly, appropriate facilities were prepared at Summerland. All imported clones were established in 1961 on suitable rootstocks in an isolated location, and an indexing program was initiated to determine whether release from this isolation was justified.

Indexing procedure

The number of clones to be indexed, multiplied by the number of indicators deemed necessary for adequate indexing, yielded a total demand on time and facilities that precluded the separate indexing of individual clones. We retained the full range of indicators, but resorted to bulk indexing of groups of the imported clones. The groupings of clones were based on the regions in which they had originated, whether they had been imported directly from these regions or had been acquired through the Introduction Station at Chico (Table 1). The groupings were Austria-Germany-Netherlands; France; Iran-Pakistan-Turkey; Norway-Sweden; Poland-Russia.

The indicators chosen were the varieties of commercial stone fruits most widely planted, or most confidently recommended for planting, in British Columbia in 1961. These were 'Bing', 'Sam', 'Lambert', and 'Van' sweet cherry; 'Montmorency' sour cherry; 'Italian' prune; 'Wenatchee' and 'Tilton' apricot; 'Veteran', 'Redhaven', 'Fairhaven', 'Triogem', 'Golden Jubilee' and 'Valiant' peach. 'Myrobalan B' plum was added, specifically to detect plum pox (sarka) virus (10).

Table 1. Sources of imported cherry and apricot clones, and their groupings for bulk indexing after entry.

	Numbers of clones	
	Cherry	Apricot
Group 1: Austria-Germany-Netherlands		
Germany direct	13	1
Austria direct	3	1
Austria, Germany and Netherlands via California*	10	
Group 2: France		
France direct		4
France via California*	2	
Group 3: Iran-Pakistan-Turkey		
Iran direct		4
West Pakistan direct		2
Turkey via California*	I	
Group 4: Norway-Sweden		
Norway direct	4	
Sweden direct	2	
Group 5: Poland-Russia		
Poland direct	2	14
Poland via California*	6	
Russia via California*	2	

* U. S. D. A. Plant Introduction Garden, Chico; California.

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The indicator trees were planted in an isolated plot in 1961, and inoculated in 1962. Imported clones that had grown rapidly enough to provide sufficient inoculum budwood were indexed on all indicators. Some clones, which had produced limited terminal growth, were indexed on less extensive host ranges that gave priority to 'Bing' and 'Sam' sweet cherry, 'Montmorency' sour cherry, 'Wenatchee' apricot, and 'Veteran' peach. Two trees of each indicator variety were inoculated. Each tree received two buds from each inoculum source. Four uninoculated check trees of each indicator were included in the plot. Readings were made in the summers of 1963 and 1964.

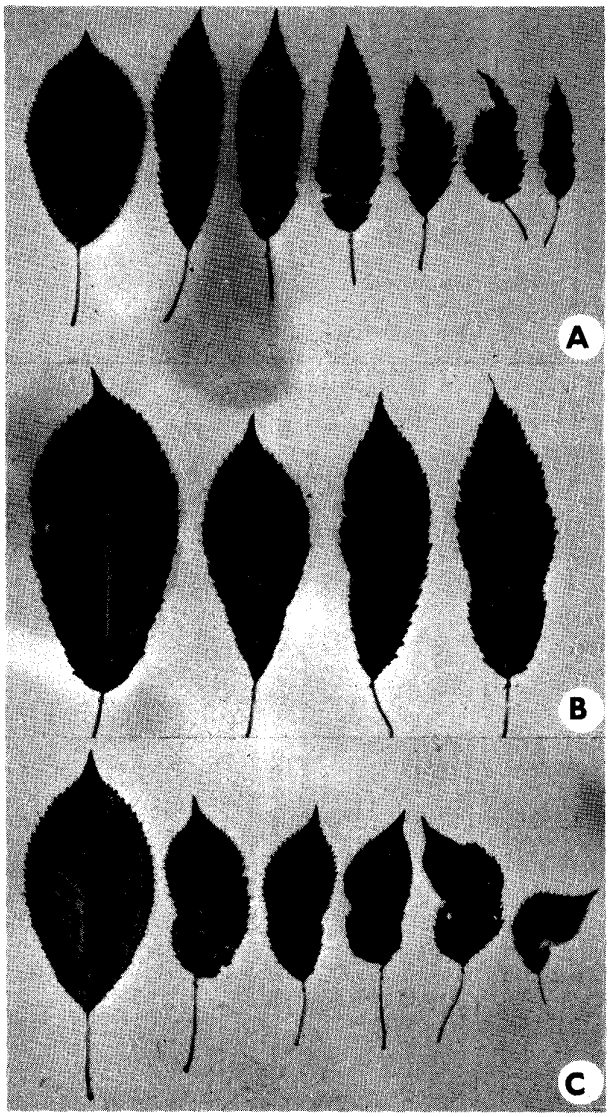

Fig .1. Symptoms on cherry test trees used for bulk indexing of cherry and apricot clones originating in France: (a) leaf narrowing and roughening symptoms on Bing; (b) similar symptoms on Sam; (c) light green areas on leaves of Bing. In each photograph the leaf at left is from an uninoculated tree.

Indexing results

Syndromes expressed in the indicators demonstrated that a number of viruses had been intercepted, including 5 that are considered especially significant because they have induced unfamiliar syndromes on commercial cherry varieties.

The indicator trees of 'Bing', 'Sam', and 'Montmorency' that indexed clones of French origin displayed symptoms in 1963 and 1964 that resembled those of Pfeffingerkrankheit (2) recently re-named rosetziekte (9). *On* 'Bing' the leaves were narrow, thickened and leathery, with shiny upper surfaces and roughened lower surfaces (Figure la). Many had feathered midribs and veins, very mild interveinal enations, and irregular serrations. The symptoms were similar but less severe on 'Sam' (Figure lb). *On* 'Montmorency' only scattered branches were affected, bearing leaves that were elongated with slightly roughened lower surfaces and feathered veins. On 'Bing' in both seasons a small proportion of leaves displayed a light green sectoring, or light-colored areas (Figure lc) resembling the "oil spots" described by Blumer (2) and Mulder (8).

In the late summer of 1963 the clones originating in Austria, Germany and the Netherlands induced moderate to severe reddening on the foliage of 'Sam' and similar but milder symptoms on 'Van'. This was accompanied by slight upcurling of the leaf margins. These are the symptoms induced in these varieties by little cherry virus. However, although these foliage symptoms recurred in 1964, the fruit symptoms of little cherry disease were not apparent in either variety.

In 1964 the 'Bing' trees indexing the Austria-Germany-Netherlands clones displayed symptoms resembling those of rosetziekte. The symptoms differed from those induced in 'Bing' by the clones originating in France only in the absence of "oil spots". However, 'Sam' and 'Lambert' indexing these sources displayed symptoms not induced by the French clones. Several limbs of each 'Sam' tree produced leaves that were small but not elongated. The serrations were irregular, the midrib and veins feathered. Affected leaves displayed mild vein-clearing, and some bore mild interveinal enations. On each of the 'Lambert' trees several limbs displayed symptoms that resembled those of cherry crinkle (Figure 2). The leaves were small with irregular serrations, feathered veins and some vein clearing. Fruiting on these branches was sparse, and the fruits were abnormally pointed. 'Montmorency' trees indexing these clones bore, on scattered branches, elongated leaves with irregular serration and feathered veins.

Clones originating in Norway and Sweden induced on 'Sam' cherry in 1963 and 1964 reactions that included interveinal leaf blotching and premature defoliation (Figure 3). In 1964 gumming blisters appeared on most terminal shoots, gradually girdling them and causing them to shrivel. A similar but milder leaf blotching was induced on 'Van' cherry.

The Norway-Sweden clones induced quite different symptoms on 'Bing' in 1963 and 1964 (Figure 4). *On* several branches of each tree the leaves developed necrotic lesions on midribs and main

veins, sometimes in areas of the leaf lamina. Puckering of the leaves resulted. Spread through the trees appeared to be slow.

In addition to these distinctive and unfamiliar syndromes, several other virus reactions were given by the indicators. Necrotic ring spot symptoms were evident in 1963 on 'Montmorency' trees indexing clones from Austria - Germany - Netherlands, France, Norway-Sweden, and Poland-Russia. Prune dwarf appeared on 'Italian prune' indexing French clones. There was profuse gumming at the sites of a number of pairs of inoculum buds of the following: Norway - Sweden indexed on 'Bing'; Austria - Germany - Netherlands, France and Norway - Sweden on one or both apricot varieties; Austria-Germany-Netherlands, France, Iran - Pakistan - Turkey, and Poland - Russia on most varieties of peach. On most trees the gumming was localized around inoculum buds in 1963 and more generally distributed in 1964 as gumming blisters at other sites on budded limbs.

Among the 'Myrobalan' test trees only one, which was indexing two apricot varieties imported from France, displayed foliage symptoms. These were minute chlorotic flecks, associated with veins, and unlike the symptoms induced by the sarka virus.

Discussion

This virus interception program has amply demonstrated the need for post entry quarantine and indexing of imported cherry and apricot clones. The necessity to resort to bulk indexing has prevented an assessment of the proportion of the imported clones that carried viruses. However, it has demonstrated that numerous virus infections occurred in these clones, and that at least 5 of these infections induce, in commercial cherry varieties, diseases that have not been observedin Canadian plantings. Re-indexing of the individual clones, now in progress, suggests that most of the more significant infections are in the imported cherry rather than the apricot clones.

Except for the gumming reactions on apricot and peach varieties, which may be merely reactions to viruses of the necrotic ring spot group, there was no evidence of viruses serious in these hosts. The viruses causing serious European diseases of peach, apricot and plum, such as l'enroulement chlorotique des feuilles **(3)** apoplexie (7) and sarka (1) were not detected in these importations.

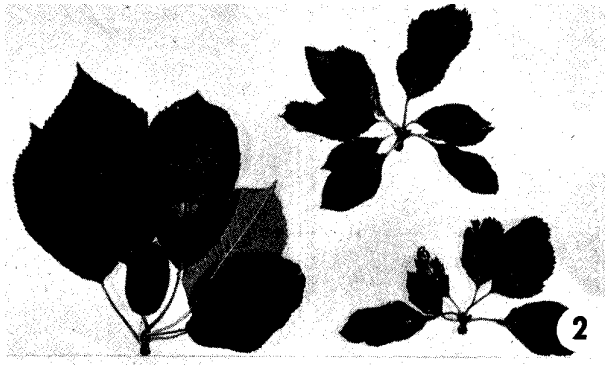

Fig.2. Leaf symptoms on Lambert cherry test trees used for bulk indexing of cherry and apricot clones originating in Austria, Germany and the Netherlands.

Fig.3. Leaf and shoot symptoms on Sam cherry test trees used for bulk indexing of cherry clones originating in Norway and Sweden.

Fig.4. Leaf symptoms on Bing cherry test trees used for bulk indexing of cherry clones originating in Norway and Sweden.

The adoption of an indicator host range that represented most of the stone fruit varieties of local importance was a means of ensuring that viruses of significance to the British Columbia tree fruit industry would be detected. The other alternatives considered were (a) the use of the standard stone fruit indicator range used by the IR-2 Tree Fruit Repository Committee (4), or (b) contriving a group of indicators selected specifically for viruses reported in stone fruits in the countries from which the imported clones originated.

Each of these selections of indicator ranges has defects. The one that was chosen would not necessarily be adequate if the imported clones were distributed from British Columbia to other fruit-growing regions on the continent where additional stone fruit varieties are grown. Indeed, already additional varieties of peach are being recommended and planted in British Columbia. The second indicator selection, which is in use for the IR-2 Repository, was devised to detect infections of the stone fruit viruses that occur already in North America; its suitability for interception of exotic viruses can be little more than fortuitous. The third alternative of adopting indicator ranges developed in source countries is applicable only if adequate research has been conducted in those countries to identify the virus infections that occur, and indicators that reveal their presence. Moreover, it might fail to detect viruses that exerted more serious effects on North American varieties than on those in the source countries,

Individual indexing of all clones on very sensitive indicators such as 'Shiro-fugen' flowering cherry, or on herbaceous indicators such as cucumber, is a logical elaboration of any indexing program. However, positive indexing on these indicators need not imply more than presence of latent viruses that are already widely distributed in domestic plantings. Therefore although such indexing provides additional useful information on the virus status of the individual clones, it does not necessarily provide justification for the rejection of importations.

Thus, full confidence cannot be placed in any of these bases for devising interception indicator ranges. The resulb of the indexing program that we are reporting suggest that one other approach to selection of indicators may usefully supplement those already considered. This is the identification of varieties that give evidence of sensitivity to unusually high proportions of the serious viruses that are introduced to them. Examples in our indexing program were 'Bing' and 'Sam' cherry, which between them gave reactions to all the potentially more serious virus infections detected through the full indicator range. It may be significant that both these varieties have been included in the IR-2 indicator range because of their sensitivity to infections of viruses known in North America.

The factors that merit being taken into consideration in devising indexing procedures for imported stone fruit materials include: (1) the major types and varieties of stone fruits grown in the regions where they will be distributed; (2) the indicators that have given evidence of unusually high sensitivity to viruses in previous indexing experience; and (3) varieties reported to be sensitive to the virus infections that are known to be common and serious in the source, countries. Only experience in interception indexing can be expected to verify that these approaches can be reconciled in a limited range of indicators

When virus incidence is as high in imported clones as it proved to be in those we have indexed, the bulk indexing of groups of clones has value only in indicating the prevalence of virus infections, and the types of symptoms that they can produce. It has not proved effective for the prompt clearance of individual virus-free clones to the importer.

Literature cited

1. Atanasoff, D. 1932. Plum pox, a new virus disease. Yearbook Univ. Sofia Fakulty Agr. 11: 49-70.
2. Blumer, S. and Goering, J. 1950. Das Kirschbaumsterben in Baselland (Pfeffingerkrankheit) Phytopathol. Z. 16: 300-335.
3. Bovey, R. 1956. L'enroulement chlorotique, une nouvelle maladie à virus du pêcher. Rev. rom. Agr. 11: 42-43.
4. Fridlund, Paul R. 1962. IR-2, a project with a "blood bank" of virus disease-free fruit trees. Wash. State Univ. Stations Circ. 401. 12 p.
5. Kahn, R.P. et al. 1963. Detection of viruses in foreign plant introductions under quarantine in the United States. Plant Disease Reptr. 47: 261-265.
6. Milbrath, J.A. 1954. The "Eckelrader" disease or "Pfeffingerkrankheit" detected in cherry importations from Europe. Plant Disease Reptr. 38: 258-259.
7. Morvan, M.G. 1957. Mise en évidence de l'action d'un virus dans le dépérissement de l'abricotier. Compt. rend. acad. agr. France 43: 613-614.
8. Mulder, D. 1951. De Eckelrader virusziekte van zoete kersen. Mededel. Dir. Tuinb. 14. 217-228.
9. Pfaeltzer, Hillegonda J. 1961. A soil-borne virus disease of cherries in the Netherlands. Tideskr. Planteavl. 65: 73-82.
10. Schuch, Kurt. 1962. Untersuchungen uber die Pockenkrankeit der Zwetsche. Z. Pflanzenkrankh. Pflanzenschutz 69: 137-142.
11. Welsh, Maurice F. and Keane, F.W.L. 1961. Introduction of a virus to McIntosh apple from an imported clone of Granny Smith. Can. Plant Disease Survey 41: 203-209.