A Relationship Between Flat Apple Disease and Cherry Rasp Leaf Disease

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ABSTRACT

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Inoculum from three sources of flat apple disease induced symptoms of rasp leaf when inoculated into sweet cherries. Similarly, cherry rasp leaf virus from three sources induced symptoms in apple identical to those associated with flat apple disease. Orchard surveys showed that the agent of flat apple disease spreads in the field in a manner that indicates a soil-borne vector. It is postulated that flat apple and cherry rasp leaf may be caused by the same virus.

Additional key words: field spread, nematodes, virus.

To find out whether any of the known stone fruit diseases might be related to known pome fruit diseases, 11 stone fruit viruses were inoculated into 16 pome fruit virus indicators and eight pome fruit viruses were inoculated into nine stone fruit virus indicators. This paper reports results which suggest that flat apple and cherry rasp leaf diseases may be caused by the same virus. These results were reported in part previously (6).

MATERIALS AND METHODS

Each cultivar or type of virus indicator tree was planted in a separate row. The cultivars used as virus indicators are listed in Table 1. The trees were handled in groups of four. The first three trees in each group in each row all were inoculated with the same virus; the fourth tree was the noninoculated check. The trees were inoculated by inserting three spurs from the virus source tree into each indicator tree. Only spurs that expressed symptoms of the disease in question were used. All of the inoculated trees were reinoculated in the same manner with the same virus in the following year. The trees were observed for symptom production for 3 yr after the last inoculation.

After the symptoms were first noticed in 1971 in the sweet cherries (*Prunus avium* L.) inoculated with flat apple, flat apple inocula from two additional sources were budded separately into sweet cherry trees to see if they also would induce rasp leaf symptoms. The flat apple inoculum in the first test in 1969 had come from an orchard near Tieton, Washington. The inocula for the second series of tests in 1971 came from two orchards, one near Yakima, Washington, and the other near Hood River, Oregon.

In 1971, rasp leaf virus from three sources also was inoculated into Red Delicious apple trees (*Malus sylvestris* Mill.). Rasp leaf virus from one source indexed negative on the Shiro-fugen flowering cherry, *Prunus serrulata* Lindl. (Shiro-negative); it was therefore assumed to be free of the sour cherry yellows - prunus ringspot virus complex. Rasp leaf virus from the other two sources indexed positive on Shiro-fugen flowering cherry (Shiro-positive).

RESULTS

In 1970, the year following the initial inoculation, no symptoms were noted (Table 2). In 1971, five out of six sweet cherry trees that had been inoculated with flat apple virus (2, 4) expressed symptoms identical to those of cherry rasp leaf disease (3, 5) (Fig. 1). The symptoms were restricted to leaves within a few centimeters of the inoculation sites. In 1972, all six cherry trees (three Bing and three Lambert) expressed rasp leaf symptoms. The location of the symptoms indicated a gradual upward movement of the virus. Cherry trees inoculated in 1971 with flat apple virus from Hood River, Oregon, expressed

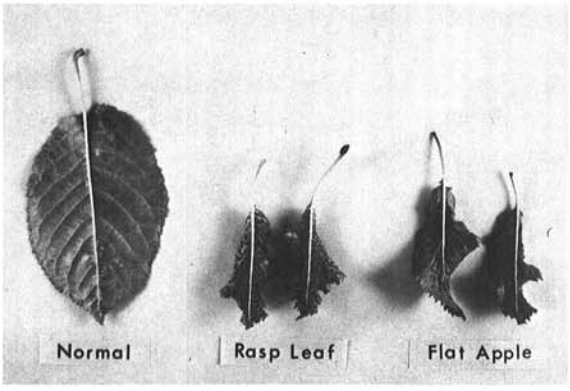

Fig. 1. Symptoms caused by cherry rasp leaf virus and "flat apple virus" inoculated into cherry: left, leaf from a normal cherry tree; center, leaves from a tree inoculated with cherry rasp leaf virus; and right, leaves from a tree inoculated with "flat apple virus."

rasp leaf symptoms in 1972, and two of the three cherry trees inoculated in 1971 with the flat apple virus from the orchard near Yakima expressed rasp leaf symptoms in 1973 (Table 2).

On the apple tree inoculated in 1971 with inoculum from the Shiro-negative source of rasp leaf, one fruit approximately 10 cm from the point of inoculation expressed symptoms of flat apple in 1973 (Fig. 2). The two Shiro-positive clones had been used for inoculation of younger trees than the Shiro-negative source; they bore only a few fruits in 1973. But one tree showed possible flat apple symptoms. In 1974, 3 yr after the inoculations, all apple trees inoculated with cherry rasp leaf virus expressed definite symptoms of flat apple disease (Table 2).

Observation in an apple orchard near Yakima, Washington, also suggested a relationship between cherry rasp leaf and flat apple diseases. This orchard previously had been planted to cherries. The trees became so heavily affected with rasp leaf that the orchard was removed and planted to apples. These subsequently developed symptoms of flat apple. No evidence was found to suggest that the virus could have been transmitted by grafting. The grower propagated his own trees. He used seedling rootstocks assumed to be virus free. His scion source tree was checked and found to be free from flat apple disease.

This orchard was mapped from 1966, and evidence of field spread of the flat apple agent was found. In 1966, 46

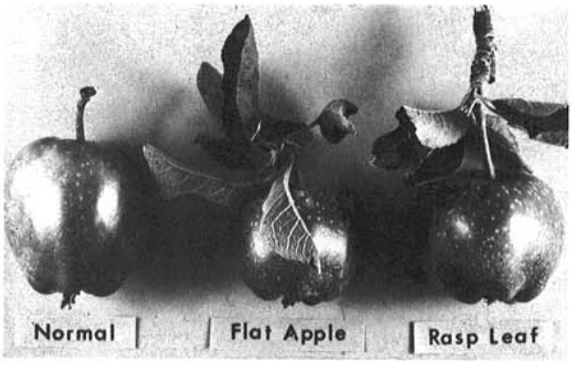

Fig. 2. Symptoms caused by cherry rasp leaf virus and "flat apple virus" inoculated into apple: left, fruit from a normal apple tree; center, fruit from a tree inoculated with "flat apple virus," and right, fruit from a tree inoculated with cherry rasp leaf virus.

TABLE 1. Stone and pome fruit trees inoculated with stone and pome fruit viruses

Stone fruit hosts	Pome fruit hosts
Prunus avium 'Bing'	*Malus sylvestris* 'Starkrimson Red Delicious'
P. avium 'Lambert'	*M. sylvestris* 'Golden Delicious'
P. serrulata 'Kwanzan flowering'	*M. sylvestris* 'Granny Smith'
P. serrulata 'Shiro-fugen flowering'	*M. sylvestris* 'Blax Stayman'
P. cerasus 'Montmorency'	*M. sylvestris* 'Red Winesap'
P. persica 'Elberta'	*M. sylvestris* 'Yellow Newtown'
P. armeniaca 'Tilton'	*M.* spp. 'Spy 227'
P. salicina 'Shiro plum'	*M.* spp. 'Russian seedling clone R. 12740-7A'
P. domestica 'Italian prune'	*M. angustifolia* 'Virginia Crab Apple'
	Malus platycarpa
	Cydonia oblonga 'Quince'
	Pyrus communis 'Bartlett'
	Pyrus communis 'Bosc'
	Pyrus communis 'Hardy'
	Pyrus communis 'Comice'
	Pyrus serrulata var. *pubescens*

TABLE 2. Cross-transmission of flat apple and cherry rasp leaf viruses and symptom development in the opposite host tree

			Appearance of symptoms		
			Year after inoculation		
Host	Inoculum source	Inoculum date	First	Second	Third
Sweet cherry	Flat apple (Tieton, WA)	1969 and 1970	...	rasp leaf	rasp leaf
Sweet cherry	Flat apple (Yakima, WA)	1971	...	rasp leaf	rasp leaf
Sweet cherry	Flat apple (Hood River, OR)	1971	rasp leaf	rasp leaf	rasp leaf
Red Delicious apple	Cherry rasp leaf (Shiro-negative)	1971	...	flat apple	flat apple
Red Delicious apple	Cherry rasp leaf (Shiro-positive)	1971	...	?	flat apple
Red Delicious apple	Cherry rasp leaf (Shiro-positive)	1971	...	?	flat apple

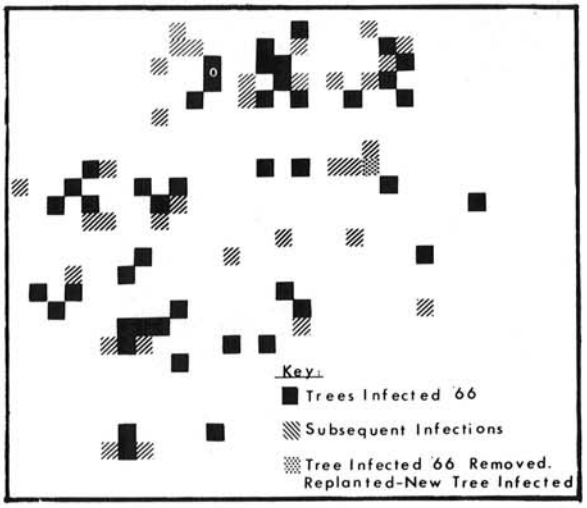

Fig. 3. Relative orchard locations of trees exhibiting symptoms of flat apple disease when the orchard was first mapped in 1966 (black squares) and subsequent field spread over the next 8 yr (squares with diagonal lines or dots).

trees expressed symptoms of flat apple. The next year (1967), 35 of the 46 infected trees were removed. Subsequently, as seen in Fig. 3, 34 additional trees expressed symptoms of flat apple. One of these trees was a replacement tree that had been planted in the site previously occupied by a flat apple-diseased tree. The manner of spread in the field suggested the possibility of a soil-borne vector and soil samples revealed the presence of *Xiphinema americanum* Cobb. Since cherry rasp leaf virus is transmitted by the nematode *Xiphinema americanum* (5), it seems logical to assume that the flat apple disease was caused by cherry rasp leaf virus transmitted by nematodes already present in the soil.

DISCUSSION

The evidence presented in this paper suggests that flat apple and cherry rasp leaf diseases are incited by the same causal agent – cherry rasp leaf virus. The possibility that the symptoms may have been caused by a mixture of cherry rasp leaf virus and a second virus responsible for the flat apple symptoms is remote, because it is unlikely that all three sources of flat apple inoculum would be contaminated with cherry rasp leaf virus, especially since they were obtained from separate geographical areas. The reciprocal experiments in which three sources of cherry rasp leaf virus induced flat apple symptoms should further rule out the likelihood of contamination.

At this point, I suggest that flat apple and cherry rasp leaf are the expressions of a single virus in apple and cherry, respectively.

Previously, it was assumed that stone fruit viruses did not appreciably affect pome fruits and vice versa. Therefore, when a cherry orchard became infected with cherry rasp leaf, replacing the cherry planting with an apple orchard frequently was recommended (1). In the light of these findings, this recommendation is no longer sound and should be changed. Cherry rasp leaf virus is soil-borne and will infect the apple trees causing flat apple disease.

LITERATURE CITED

1. ANONYMOUS. 1974. Rasp leaf disease reservoir 'found.' Page 17A *in* The Packer, 23 Mar 1974.
2. BLODGETT, E. C., M. D. AICHELE, D. L. COYIER, and J. A. MILBRATH. 1963. Flat apple disease. Plant Dis. Rep. 47:769-771.
3. BODINE, E. E., E. C. BLODGETT, and T. B. LOTT. 1951. Rasp leaf. Pages 132-134 *in* U. S. Dep. Agric. Handb. 10. U. S. Govt. Printing Office, Washington, DC 20402. 276 p.
4. CHENEY, P. W., E. L. REEVES, D. L. COYIER, and C. L. PARISH. 1967. Graft transmission of the flat apple disease. Plant Dis. Rep. 51:509-510.
5. NYLAND, G., R. F. LOWNSBERY, S. K. LOWE, and J. F. MITCHELL. 1969. The transmission of cherry rasp leaf virus by Xiphinema americanum. Phytopathology 59:1111-1112.
6. PARISH, C. L., and P. W. CHENEY. 1974. A relationship between flat apple disease and cherry rasp leaf disease. Proc. Phytopathol. Soc. 1:52 (Abstr.).