The Mechanical Transmission of the Greening Virus to Cucumber

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SOME OF THE SYMPTOMS of greening disease of citrus resemble those of stubborn disease. Because of a possible relationship between greening and stubborn, it was thought that greening virus, like stubborn, might be transmitted mechanically to herbaceous hosts (2, 3).

Material and Methods

Mechanical transmissions from sweet orange to herbaceous hosts were carried out following the method of Desjardins and Wallace (1). Soft, young leaves were triturated with a 10 per cent sucrose in pH 8.0 phosphate buffered solution, and the suspension was kept in an ice water bath until the inoculation was completed. The plants were kept in the dark 8 hours before and 4 hours after the inoculation. After inoculation, the cucumber plants were kept at temperatures of 22°C and 26°C, respectively.

The following herbaceous hosts were used for the transmission experiments: *Chenopodium quinoa, Chenopodium amaranticolor, Nicotiana tabacum* var. White Burley, *Nicotiana glutinosa,* cowpea, sesame, and cucumber var. National Pickling. Transmissions were carried out with leaf material from sweet orange seedlings infected only with greening, from seedlings and orchard trees infected with greening and tristeza viruses, and from orchard trees infected only with tristeza virus. The inocula were obtained from three localities, White River (W), Rustenburg (R), and Malelane (M), South Africa.

Experimental Results

Cucumber was the only herbaceous host to react after inoculation with greening virus. The first symptoms, which appeared about 8 days after inoculation, consisted of yellow lesions of the cotyledons. Later, the yellow areas spread and the cotyledons collapsed. About 12-15 days after transmission, the veins of the first true leaf showed yellowing and later became necrotic (Fig. 1). In most cases, the upper leaves did not develop symptoms, but the vigor of the plant was reduced. The average length of 20 infected plants was 40 cm, whereas the length of 20 healthy plants was 53 cm, 45 days after inoculation, in both cases. The results of the transmission experiments are presented in Table 1. The percentage

of positive transmissions was also higher when the leaves came from seedlings rather than orchard trees. Furthermore, the percentage was higher when the transmissions were carried out with material from Rustenburg rather than from White River. When the Rustenburg strain of greening was transmitted mechanically from cucumber back to 40 sweet orange seedlings, 2 seedlings became infected and showed the typical zinc-deficiency-like symptoms of greening, 7 weeks after inoculation. On

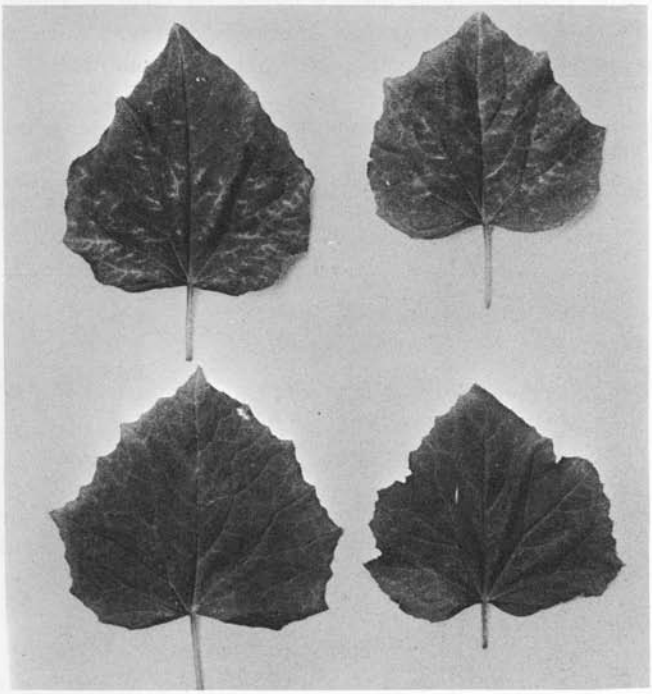

FIGURE 1. *Leaves of cucumber, var. National Pickling. Top: Greening-infected leaves. Bottom: Healthy leaves.*

the other hand, mechanical transmission from cucumber back to 60 sweet orange seedlings, with the White River strain of greening, was not successful.

Discussion

The symptoms of stubborn, observed by Storm and Streets (3) on cucumber, consisted of extreme dwarfing. This condition was frequently accompanied by an almost complete lack of internode elongation at the

top of the plant. Transmission from cucumber to citrus was attempted, but the result was negative.

There is considerable difference between the symptoms on cucumbers caused by the stubborn isolate transmitted by Storm and Streets (3), and those of greening. In addition, the high percentage of positive transmission (86 to 90 per cent) obtained with stubborn contrasts to the relatively low proportion obtained with greening. Before a final comparison can be made between greening and stubborn, the same cucumber variety should be used for the mechanical transmission of both diseases. Moreover, transmission experiments with stubborn should include isolates

TABLE 1. MECHANICAL TRANSMISSION OF GREENING VIRUS FROM SWEET ORANGE TO CUCUMBER

Inoculum sources and virus combinations		Proportion of cucumber plants infected	
		At 22°C	At 26°C
Greening virus only, sweet or. seedlings.	(W)[a]	3/40	0/60
Greening virus only, sweet or. seedlings.	(R)	36/80	2/80
Greening and tristeza, sweet or. seedlings.	(W)	9/80	
Greening and tristeza, orchard trees.	(W)	5/140	0/100
Greening and tristeza, orchard trees.	(R)	24/140	0/40
Tristeza only, orchard trees.	(M)	0/80	

a. W = White River; R = Rustenburg; and M = Malelane areas.

obtained from various areas, and finally, re-transmission of stubborn from cucumber to citrus should be attempted. The ultimate aim should be a serological comparison between stubborn and greening.

Literature Cited

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