Cytospora-Induced Changes in Stems of Prunus persica

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ABSTRACT

One-year-old Elberta peach (*Prunus persica*) seedlings infected with *Cytospora cincta* were sectioned and examined for the presence of mycelium, discoloration, gum, and starch grains. The fungus rapidly penetrated the xylem, particularly via the ray cells; gum formed in vessels and tracheids ahead of the canker margin but did not interfere with ramifying mycelia; and it was concluded that wilting due to Cytospora canker disease is associated with gum-plugging in the xylem.

Additional key words: Histology of Cytospora disease, xylem plugging, starch dissolution by *Cytospora*, fungal penetration of woody stems.

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Cytospora canker disease causes damage to stone fruit trees by killing stems distal to the canker. As the canker develops, gum exudes from the canker and adjacent tissues, wilt symptoms often develop, and the foliage turns brown or yellow and dies (2). Hampson and Sinclair (1) reported obstruction of eosin dye transport through *Cytospora leucostoma*-infected peach stems and suggested that gum may plug vessels directly or may impede the flow of xylary fluids by imparting viscosity to the fluids.

We followed the development of *C. cincta* cankers on *P. persica* via periodic examination of stem sections for the presence of gum plugs, the location of ramifying mycelium, distribution of vascular discoloration, and the disappearance of starch grains from ray cells. In May, twenty actively growing 1-year-old Elberta peach seedings in a greenhouse were inoculated with *C. cincta.* The inoculation procedure consisted of impact wounds into which uniform inoculum disks from 4-day-old malt-agar cultures (of Idaho isolate Cy-59 from Italian prune; cultured at 27 C in darkness) were pressed and the wounds bound with elastic electrician's tape. Twenty control trees were wounded and wrapped in like manner but without the inoculum. Fourteen-cm stem

TABLE 1. Location of Cytospora mycelium, vascular discoloration, vascular gumming, and starch-grain absence in infected 1-yr-old Elberta peach stems 7, 14, 21 and 28 days after artificial infection

Factor Measured	Measurement in mm[a]			
	7 days	14 days	21 days	28 days
Presence of fungus[b]				
Beyond lower canker margin	0.9	3.9	3.4	10.6
Beyond upper canker margin	1.3	2.7	2.1	16.4
Depth at inoculation point	0.3	1.1	1.1	2.8
Depth at lower canker margin	0.3	1.1	0.8	2.9
Depth at upper canker margin	0.4	0.5	1.0	2.8
Presence of discoloration[c]				
Beyond lower canker margin	6.8	23.3	27.0	29.1
Beyond upper canker margin	7.0	20.0	20.1	41.8
Depth at inoculation point	0.0	0.0	0.0	0.0
Depth at lower canker margin	0.2	0.4	1.0	1.9
Depth at upper canker margin	0.3	1.0	0.8	1.7
Presence of gum[c]				
Beyond lower canker margin	13.9	23.2	38.8	36.2
Beyond upper canker margin	0.0	19.4	20.1	41.8
Depth at inoculation point	0.0	0.0	0.0	0.0
Depth at lower canker margin	0.1	0.1	1.0	2.5
Depth at upper canker margin	0.2	0.6	1.0	1.6
Absence of starch[c]				
Beyond lower canker margin	12.2	16.2	5.7	19.8
Beyond upper canker margin	14.4	22.5	13.5	35.3
Depth at inoculation point[d]	2.8	2.4	2.4	2.7
Depth at lower canker margin[d]	2.6	2.5	1.9	2.9
Depth at upper canker margin[d]	2.6	2.4	2.0	2.9

[a] Each value represents the mean of measurements taken from five separate stems.

[b] Uninfected control stems yielded no measurements.

[c] Uninfected, but injured, control stems yielded only trace measurements for the depth-at-inoculation-point category at all intervals.

[d] Figures reflect both depth of starch grain disappearance, and the normal lack of starch grains in the interior of the xylem cylinder.

segments (inoculation or control-wound site in the center) were removed from five infected trees and five control trees at intervals of 7, 14, 21, and 28 days after inoculation (or control wounding). Each stem segment was divided into seven 2-cm subsegments and placed in formalin-alcohol-acetic acid (FAA). After at least 2 days in FAA, at least three 25-μm radial sections were cut serially from each of the 140 subsegments from both inoculated and control trees and mounted in 0.01% cotton blue in lactophenol (equal parts phenol, lactic acid, glycerine, and water).

The fungus moved into xylem vessels rapidly, but direct penetration through vessel walls was not observed. Penetration to deeper vascular tissues occurred through the ray cells. Gum was formed in advance of the canker margin (Table 1) but had no apparent effect on extension of the mycelium, either dissolving ahead of it or being easily penetrated by the hyphae. Starch grains disappeared in the xylem ray cells ahead of advancing canker margins, which confirms the observation of Willison (3). Ray cells of control stems were packed with starch grains except for a few cells directly beneath the wound. In diseased stems, the absence of starch grains generally coincided with the presence of gum in the vessels during the first 2 wk of canker development. After that time, starch grain disappearance did not keep up with gumming and discoloration. This disappearance of starch grains in outer portions of the xylem cylinder was evident throughout the study; starch grains were scarce or absent in the deeper nonfunctional portions of the wood of both infected and control stems.

In transverse sections, Hampson and Sinclair (1) observed plugging of less than 20% of the vessels and tracheids, but felt that more than 20% probably were actually occluded. Our study supports his thinking in that we found the greatest depth of occlusion in vessels and tracheids at or just beyond the canker margins, with the depth of occlusion decreasing with distance above and below the canker margins. Even at the canker margins, however, the gum plugs were not continuous, and transverse sections would not give a true indication of the extent of vascular occlusion. Since gum plugs were found at one or several points along all of the vessels and tracheids after 28 days, we have concluded that impairment of xylem

conductivity brought about by the formation of gum plugs in the xylem probably is an important factor in the development of wilt symptoms commonly associated with Cytospora canker diseases of stone fruit trees.

LITERATURE CITED

1. HAMPSON, M. C., and W. A. SINCLAIR. 1973. Xylem dysfunction in peach caused by Cytospora leucostoma. Phytopathology 63:676-681.
2. HELTON, A. W., and J. A. MOISEY. 1955. Cytospora damage in Idaho prune orchards. Plant Dis. Rep. 39:931-943.
3. WILLISON, R. S. 1932. Wound gum in peaches and grapes. Its relation to the invasion of fungus wound-parasites. Sci. Agric. 12:483-505.