Short Life of Peach Trees Induced by *Criconemella xenoplax*

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ABSTRACT

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Rooted Nemaguard peach cuttings in biodegradable pots in the greenhouse were inoculated with 5,800 *Criconemella xenoplax* and a low population of *Tylenchorhynchus claytoni* and transplanted 1 mo later into lysimeter tanks previously fumigated with methyl bromide. Within 4 yr after transplanting, nine of 10 inoculated trees died after showing cold injury symptoms typically associated with peach tree short life. Cold injury also occurred in one control tree that became infested with *C. xenoplax* during the first year after planting but not in control trees that were not infested during the 4-yr period.

Additional key words: cold injury

Many investigators have noted an association of the ring nematode *Criconemella xenoplax* (Raski) Luc & Raski with premature death of peach trees (*Prunus persica* (L.) Batsch) (2,5,6,8,10,12,13). Some experiments indicated that *C. xenoplax* predisposes peach trees to bacterial canker caused by *Pseudomonas syringae* pv. *syringae* (10,11) and to cold injury by stimulation of indole-3-acetic acid production, which interferes with dormancy (4). Bacterial canker and/or cold injury are responsible for the sudden collapse of peach trees associated with the peach-tree-short-life syndrome in the southeastern United States. Control of ring nematodes is essential for control of short life (13,14).

Although strong circumstantial evidence implicates *C. xenoplax* as a major predisposing factor in peach tree short life, proof of nematode involvement is lacking. In this paper, we report an experiment demonstrating that peach tree short life can be initiated by adding certain nematodes to peach trees near planting time.

MATERIALS AND METHODS

In 1975, peach trees were planted in lysimeter tanks (1) (microplots) 1.6 m diameter and 1.2 m deep containing Lakeland fine sand from a site previously planted with peach trees. In 1977, the trees were removed but no attempt was made to remove all roots from the soil so the microplots simulated a replant situation in which short life often appears. In March 1977, the soil in each microplot was fumigated with 1 lb (454 g) of methyl bromide under a 4-mil polyethylene tarp.

Cuttings from a Nemaguard peach tree were rooted in methyl bromide-fumigated Lakeland fine sand in 25-cm biodegradable pots and grown in a greenhouse from August 1977 to April 1978. Ten trees were then inoculated with 5,800 *C. xenoplax* collected from a peach orchard soil by Cobb's decanting method (7). Unknown to us at the time, the inoculum also contained a small number of *Tylenchorhynchus claytoni* Steiner. Ten other trees were inoculated with a nematode-free soil extract suspension from the same peach orchard soil and served as controls. In May 1978, the trees were transplanted to the microplots, one tree per plot, in a randomized design. The trees received annual applications of a balanced fertilizer (usually 10-10-10, NPK) and were watered as needed by trickle irrigation, weeded by hand, and pruned in February each year. Nematode soil samples were collected 1–15 cm deep with a trowel once a year beginning in October 1979 and were extracted by elutriation (3) followed by centrifugal-flotation (9).

RESULTS

Fumigating before planting reduced the population of plant-parasitic nematodes to undetectable levels in the microplots except in one control plot, where *C. xenoplax* was observed. In the inoculated plots, *C. xenoplax* became established and developed large populations by November 1980 (Table 1). *T. claytoni* also became established but numbers remained smaller than for *C. xenoplax*.

Tree growth during 1979 as measured by tree diameters was significantly less ($P = 0.05$) among inoculated trees (4.6 cm) than among control trees (5.4 cm). After 1979, pruning and fertilization were designed to minimize new shoot growth and no further growth measurements were made. One control tree died from waterlogging caused by defective drainage in the lysimeter tank and another died from a root disease of undetermined origin. The remaining eight control and 10 inoculated trees survived until the appearance of short life in 1981 and 1982.

Cold injury symptoms typically associated with peach tree short life (Fig. 1) were evident in two of the 10 inoculated trees in 1981 and in nine of the 10 inoculated trees in 1982. Cold injury shown by tissue discoloration was especially severe in the cambium of the trunk and usually encircled the entire trunk so that rapid collapse followed in the spring. The bark was easily removed from the xylem of affected trees (Fig. 1). The control tree infected with *C. xenoplax* also died from cold injury in

Table 1. Populations of *Criconemella xenoplax* and *Tylenchorhynchus claytoni* and the occurrence of cold injury in Nemaguard peach trees in microplots[a]

	Average no. nematodes/100 cm^3 soil[b]						No. trees dead from cold injury/no. trees
	C. xenoplax			*T. claytoni*			
	1979	1980	1981	1979	1980	1981	
Inoculated	48	662	541	13	200	64	9/10
Control	41[c]	89[c]	123[c]	0	0	0	1/8[c]

[a] Nemaguard peach trees inoculated with 5,800 *C. xenoplax* and a low population of *T. claytoni* or no nematodes (control) were planted in lysimeter tanks in May 1978.

[b] Soil samples taken during October.

[c] *C. xenoplax* in control plots was limited to one control tree. The infected control tree was killed by cold injury in 1982.

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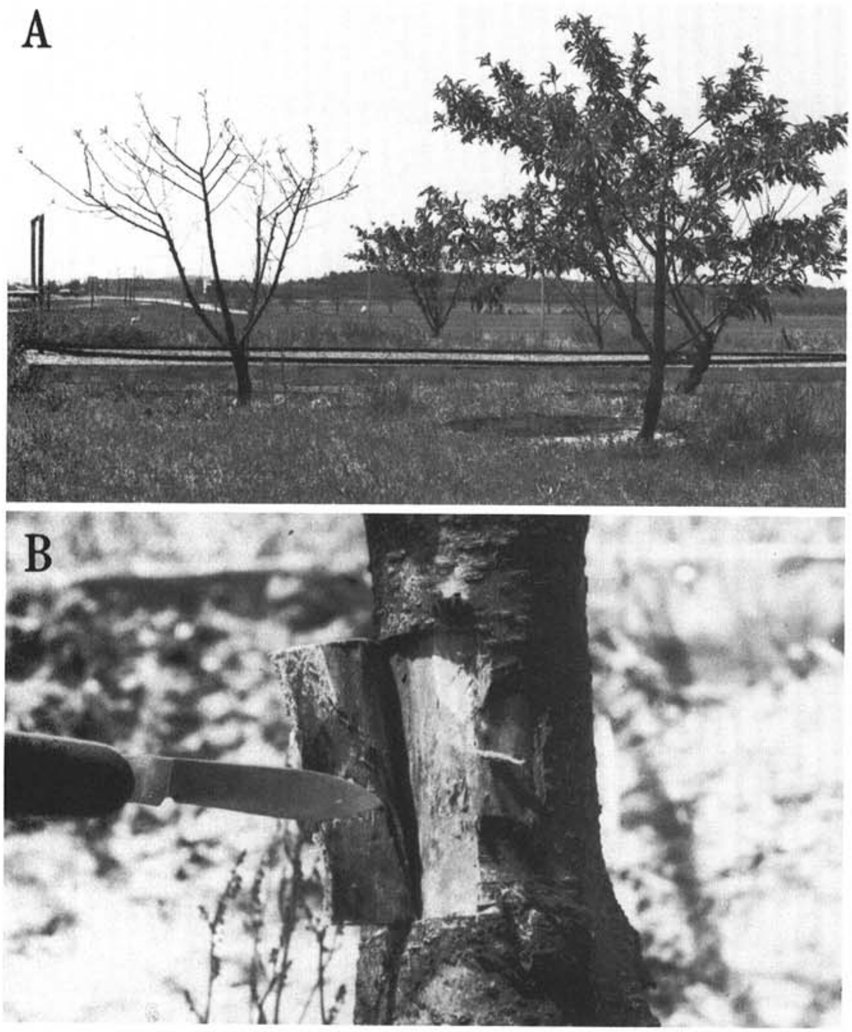

Fig. 1. Peach tree short life reproduced in microplots. **(A)** Cold injury in 4-yr-old peach tree inoculated with *Criconemella xenoplax* and *Tylenchorhynchus claytoni* (left) or not inoculated (right). **(B)** Typical cold injury in the cambium of the trunk of an inoculated tree is shown by easy separation of the bark from the xylem.

1982; the other control trees were not affected.

DISCUSSION

Symptoms and time of appearance of peach tree short life in this experiment were typical of the disease in commercial orchards. When peach trees are planted in *C. xenoplax*-infested soil, severe losses usually begin when the trees are 3–5 yr old, although they may appear in younger or older trees (13).

This experiment demonstrated that adding certain nematodes to soil just before planting may result in cold injury and eventual death of peach trees. Based on the strong circumstantial evidence associating *C. xenoplax* with peach tree short life (4–6,12–14) and the absence of such evidence for *T. claytoni*, we concluded that *C. xenoplax* was the primary agent predisposing the test trees to cold injury. Also, the single control tree that suffered cold injury was growing in soil that was infested with *C. xenoplax* but not *T. claytoni*.

The relationship of *T. claytoni* to peach trees is uncertain. Barker and Clayton (2) reported that this nematode is frequently associated with peach trees in North Carolina and it is common in South Carolina peach orchards. It is not usually associated with orchards where peach tree short life develops, however, and there is no field or experimental evidence to show that *T. claytoni* injures peach trees. Our research suggests that *T. claytoni* probably reproduces on peach, but it may have reproduced on natural vegetation that grew periodically in the microplots.

These experimental results emphasize the importance of nematode control in controlling peach tree short life. There is now no effective control for *C. xenoplax* after peach trees have been planted, and more than half of the peach acreage in South Carolina is infested with this nematode (R. W. Miller, *unpublished*). Widespread nematode infestation was probably responsible for a serious outbreak of peach tree short life in South Carolina in 1982.

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