Deciduous Fruit and Nut Trees

root-knot nematode on peach and root-lesion nematode on walnut cause serious problems for California orchardists

B. F. Lownsbery, E. F. Serr, and C. J. Hansen

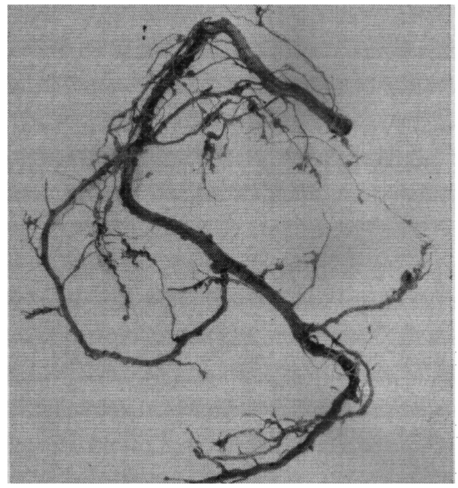
Nematodes impair the root systems of trees by releasing toxins and by introducing secondary bacteria and fungi. Sometimes root symptoms make nematode activity evident, but in many instances these symptoms do not differ from those of other root-debilitating agents.

The specific reactions of different rootstocks to the more important root-knot and root-lesion nematodes are given in the table. Other root-knot nematode species—*M. hapla* and *M. arenaria thamesi*—and other root-lesion nematode species occurring in California are not, at present, known to produce disease in fruit and nut trees.

The effects of the pin nematodes, *Paratylenchus* spp.; ring nematodes, *Criconemoides* spp.; dagger nematodes, *Xiphinema* spp.; and spiral nematodes, *Rotylenchus* spp. and related genera, on the fruit and nut trees with which they are associated are not well known. These nematodes are under suspicion because they are known to be involved in diseases of other crops. *Cacopaurus* spp. are known to parasitize walnuts in two limited areas in California.

The probability of introducing nematodes to a new area can be lessened by obtaining stock from nurseries which practice nematode control at each stage in their operation. Such nurseries obtain nematode-free propagating material, routinely treat all propagating media with heat or nematocidal chemicals, choose fields not heavily infested with plant parasitic nematodes, and treat those fields with high dosages of nematocidal fumigants before planting trees.

The probability of tree injury by nematodes already present in an area can be lowered by choosing crops or rootstocks resistant to the important nematode parasites, where such rootstocks are known. Bokhara peach from Russia and Shalil peach from India were the first rootstocks reported resistant to root knot.



Peach root galled by root-knot nematodes.

After the discovery of morphologically different root-knot nematode species, those two peaches were found resistant to the most common root-knot nematode in California—*Meloidogyne incognita acrita*—but susceptible to another California species—*M. javanica javanica*. The reaction of other peach rootstocks to these two root-knot nematodes is given in the table on the next page. Fort Valley 234-1 and Okinawa peaches are untried as rootstocks, and unavailable. They are included in the table because they are the first peach material to show a high degree of resistance to *M. javanica javanica* in California. *M. javanica javanica* does enter roots of Fort Valley 234-1 and Okinawa peaches and produce root galls, which are smaller than galls the nematode produces on other rootstocks. However, no evidence of reproduction by *M. javanica javanica* on these two rootstocks has been found in greenhouse tests.

Walnuts on Paradox hybrid rootstocks—*Juglans hindsii* × *Juglans regia*—appear to be injured somewhat less severely by the root-lesion nematode than

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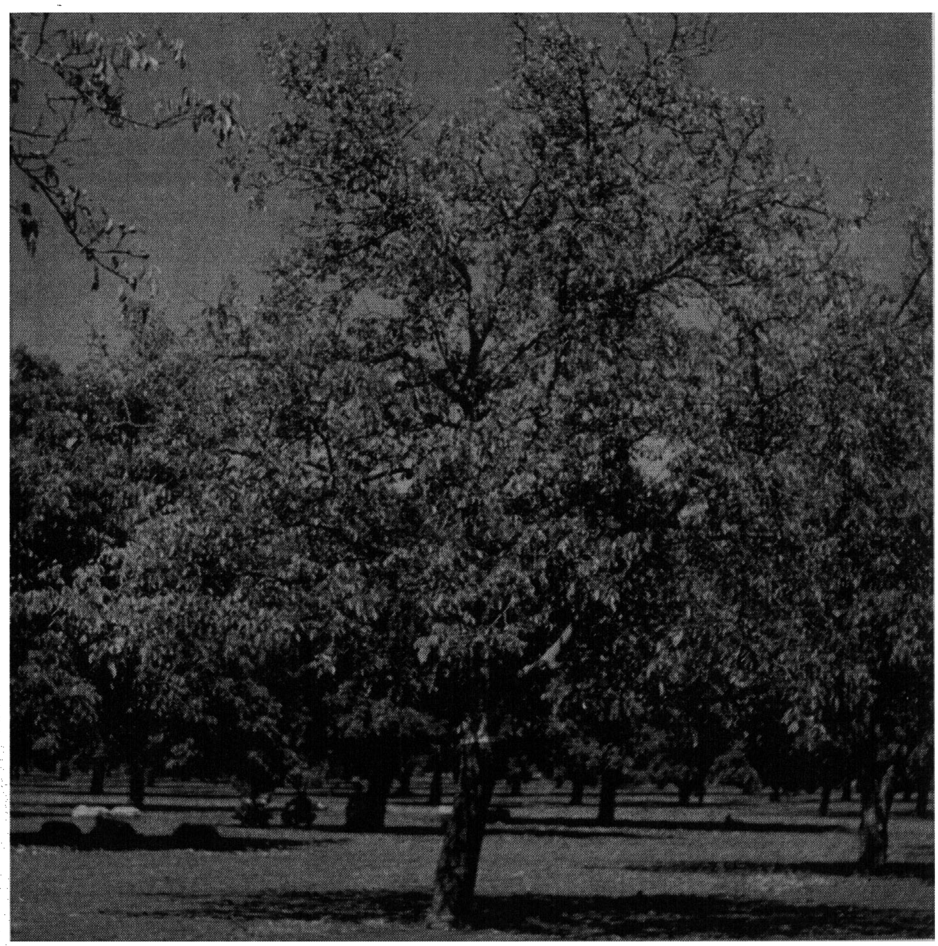
Dieback accompanying the root-lesion disease of walnuts.



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walnuts on California black walnut—*J. hindsii*—rootstocks. However, trees on Paradox rootstock frequently fail where root-lesion nematode populations are very high. Paradox clones which have shown the best growth in nematode infested soils are being propagated vegetatively by trench layering for test purposes. Progress is being made on development of techniques for propagation by cuttings.

Rootstock selection may limit the amount and kind of nematode damage, but none of the tested rootstocks are resistant to all kinds of nematodes which may be present in any field. Where plants are comparable as to age, size, and so forth, nematode damage is proportional to the number of nematodes parasitizing them. These two facts suggest the desirability of reducing nematode populations by soil fumigation before setting out trees. A good treatment will protect the grower against the drastic effects of high nematode populations on young trees with small root systems. Many more nematodes are necessary for serious injury to a large tree than are necessary for injury to a small one. Preplanting soil fumigation is not very effective in clay, peat, or muck, but is quite effective in other soils if the fumigant is applied when the soil is worked to seedbed consistency to a depth of 10″, is free of debris, moist, and at a temperature between 50°F and 80°F. Longer lasting results will be obtained with over-all treatments than with spot fumigation of planting sites only. If the new orchard follows an old one, best results will be obtained where the area is planted to annual crops for several years before fumigation and replanting of trees. This will allow time for decay of the woody roots which protect nematodes from fumigants. Dichloropropene mixture is as good a material as any available for preplanting control of the nematode parasites of trees. For a sandy loam soil, dosage rates should be 3–4 times those suggested for vegetables by the manufacturer. This rate may be lowered for sand but must be raised for clay loam. Treatments are best made in the fall, allowing two or three months for the phytotoxic fumigant to escape before planting trees.

When nematodes survive preplanting fumigation and return to high population levels, more or less injury will occur and the life of the trees will be shortened. For this reason it would be desirable to reduce nematode populations around established trees. One nematocide—dibromochloropropane—will kill nematodes in the soil around the roots of living trees without marked injury to trees, if the proper dosage—about 2.5 gallons—per acre is used as a periodically repeated supplement to preplanting soil fumigation. This treatment will not kill nematodes inside the roots, and single applications have only occasionally improved the growth of nematode infected trees which had been planted without preplanting fumigation.

Discovery of a systemic nematocide to reduce nematode populations inside roots without injuring trees represents one ultimate aim of basic research.

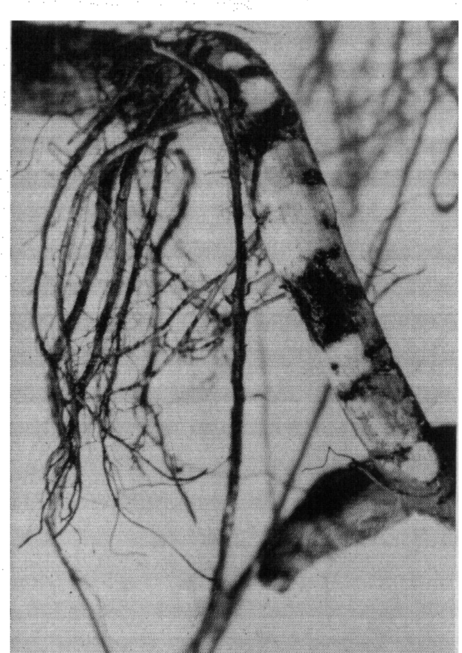
B. F. Lownsbery is Lecturer and Assistant Nematologist, University of California, Davis.

E. F. Serr is Lecturer and Pomologist, University of California, Davis.

C. J. Hansen is Professor of Pomology, University of California, Davis.

Lovell peach seedlings grown in soil infested with a logarithmic series of numbers of larvae of the root-knot nematode, *Meloidogyne incognita acrita*.

Lesion on walnut root resulting from the activity of root-lesion nematodes.



Reaction of Deciduous Fruit and Nut Trees to the Root-knot and Root-lesion Nematodes Common in California

	Root-knot nematodes		Root-lesion nematodes	
Crop or rootstock	*Meloidogyne incognita acrita*	*Meloidogyne javanica javanica*	*Pratylenchus vulnus*	*Pratylenchus penetrans*
Almond	S[1]	S	S	..
Apple	R[2]	..	R	S
Apricot	most I[3] some S	most I some S	R	..
Cherry (Mahaleb)	R	..	R	R
Cherry (Mazzard)	I	..	S	..
Cherry (Morello)	I	..	S	..
Fig	S	..	S	..
Peach (Bokhara)	some I some S	S	R	..
Peach (Fort Valley 234–1)	some I some S	R	..	..
Peach (Lovell)	S	S	S	H[4]
Peach (Okinawa)	I	R	..	..
Peach (Rancho Resistant)	I	S	..	..
Peach (S-37)	I	S	S	..
Peach (Shalil)	I	S	some R some S	R
Peach (Yunnan)	I	S	some R some S	..
Pear	R	..	R	..
Plum (Marianna 2623 and 2624)	I	I	S	..
Plum (Myrobalan 29, 29C, 29D, and 29G)	I	I	S[a]	..
Walnut (California black)	R	R	S	..
Walnut (Paradox hybrids)	R	R	some R some S	..
Chinese wingnut (walnut rootstocks)	..	..	I	..

[1] S = susceptible.
[2] R = resistant.
[3] I = immune.
[4] H = crop known to be a host; but disease not known to be important in California.
[a]—29D and 29G tested.