Nematodes on Ornamentals

root-knot, root-lesion, and more specialized or exotic forms may cause acute injuries in nursery, greenhouse, and garden

S. A. Sher

The root-knot nematodes are a limiting factor in growing ornamental plants—roses, carnations, Shasta daisies, gerbera daisies, and many others. Three species—*Meloidogyne incognita acrita*, *M. javanica javanica*, and *M. hapla*—are commonly found on ornamental plants in California. Steam sterilization of plant beds or preplanting treatments of soil with nematocides have been effective in their control.

The widespread root-lesion nematodes are probably second in importance.

Root-lesion disease of roses—caused by *Pratylenchus vulnus*—has above-ground symptoms of chlorosis, stunting, and dieback, with sparse root growth and a lack of feeder roots. The disease is seen primarily in field-grown and back-yard plantings of roses in southern California and in greenhouse roses throughout the state. Recent tests at Riverside show that the symptoms of this disease are more severe in sandy soils and at warmer temperatures.

Preplanting fumigation tests have shown that 1,3-dichloropropene-1,2-dichloropropane—D-D or Telone—is the most economical and effective means of controlling this disease. Treatment with emulsifiable 1,2-dibromo-3-chloropropane—Nemagon or Fumazone—at four gallons of actual material per acre has been effective in controlling nematodes on roses growing in 5-gallon containers.

P. scribneri is the causal organism of root-lesion disease of *Cymbidium* orchids. Symptoms are poor growth, yel-

Cymbidium plant on right infested with the root-lesion nematode—*Pratylenchus scribneri;* plant on left uninfested.

lowing of the outer leaves, and reduction in flowering. Roots show necrotic lesions or complete rotting, and the pseudobulb of the orchid often has black necrotic lesions. Recent experiments have shown that plants infested with this nematode produce only about half the growth of noninfested plants. All the above symptoms, as seen in nurseries, have been reproduced in greenhouse experiments.

Treatments of infested Cymbidium plants with available nematocidal chemicals have not been effective, probably because the habitat of the nematode is deep in the roots and pseudobulb.

Root-lesion nematodes affect many other ornamental plants, including trees, bulbs, and many flowering annuals. As with other nematode diseases, preplanting soil fumigation with nematocides is effective. *P. penetrans* is commonly found on lilies in California.

The endoparasitic root-knot and root-lesion nematodes appear at present to be the most important pests of ornamental plants. This may be true only because the importance of the large group of ectoparasitic nematodes has only recently been recognized.

The stunting disease of azaleas—caused by the ectoparasite *Tylenchorhynchus claytoni*—reduces the top growth as well as the root system. Similar symptoms, often with chlorosis, are seen in nurseries and backyard plantings infested with this nematode. Preplanting fumigation of peat moss in which diseased plants have been grown has controlled this nematode and made it possible to grow satisfactory plants. Treatment of azaleas growing in containers with emulsifiable Nemagon at the rate of four gallons of actual material per acre has also resulted in eliminating the nematode and increasing plant growth.

The ectoparasitic ring nematode—*Criconemoides xenoplax*—can cause a stunting of carnation plants and significant decline in flower production. Although roots are markedly reduced in size by the feeding of this nematode, no specific symptoms can be observed as in root-knot or root-lesion diseases.

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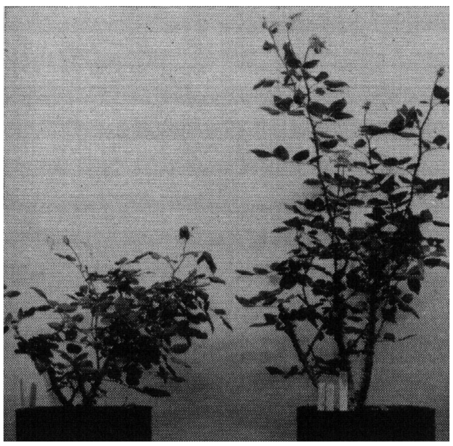
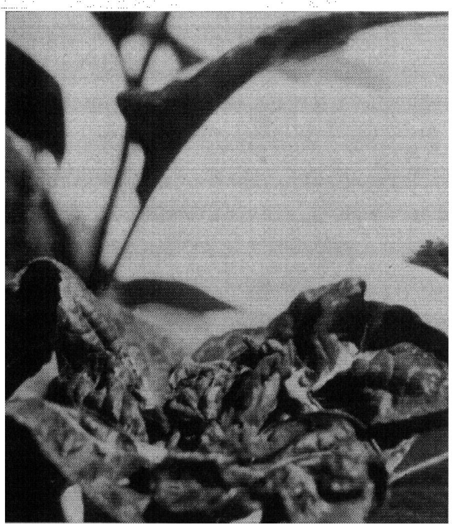
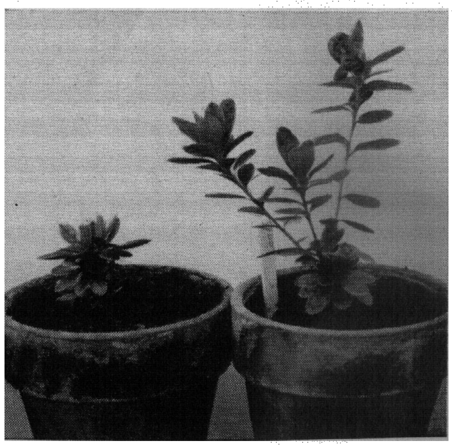
Rose plant on right treated with emulsifiable Nemagon. Plant on left untreated, infested with root-lesion nematodes.



Injury to hydrangea leaves by the bulb and stem nematode—*Ditylenchus dipsaci.*



Azalea plant at left grown in peat moss infested with the stunting nematode, *Tylenchorhynchus claytoni.* Other pot pretreated with D-D.



Biochemical Relationships

nematodes, plants, and linking soil components of complex problem of widespread, important pest of state's agriculture

D. R. Viglierchio

The problems associated with nematode diseases of plants can be visualized as one part of a system consisting usually of three components: nematodes, plants and the linking medium, most frequently soil.

This natural division can serve as the basis for separate approaches for fundamental study. For example, in an approach through the plant, the phenomenon of host preference or specificity or from another point of view the natural resistance of some plants to attack could be considered.

Scientific research normally results in the addition of small bits of information to accumulated knowledge. Occasionally one such finding observed may possess far-reaching implications. Probably, few people in 1928—at the time of the discovery with penicillium mold—would have predicted the tremendous antibiotic industry that provides a weapon against disease and gives agriculture a tool for greater production. The role of vitamins in nutrition is another example of an unsuspected consequence of what was initially just an interesting observation.

Geneticists can breed for plants of desirable character without knowing the details or the mechanism of action of the particular character, though that information would be helpful. On the other hand, chemical control of nematodes through the plant, without a knowledge of the mechanism of resistance to nematode attack, would compel reliance upon a fortuitous selection of an effective chemical agent. If, for example, the resistance of a plant were due to the presence or absence of some chemical agent or agents, it might be possible to design a substance for field application. To design such a substance, it would be necessary to know such things as the precise chemical character, sites of formation and action, ability to translocate within the plant and the concentration for activity.

The idea of chemotherapy—the application of poison which, when sprayed on a plant, is absorbed and translocated throughout the plant—has been used successfully by entomologists and plant pathologists in the control of some insect pests and fungus diseases.

A step toward chemotherapy as a control of nematodes has been taken with some grafting experiments now in progress. For example, by cross-grafts of resistant and susceptible plants it should be possible to determine whether a resistant top would confer resistance on a susceptible rootstock and whether a susceptible scion would cause a breakdown of the resistance of a rootstock on which it was grafted. The plants used in these experiments are of the genus *Beta*, domestic sugar beets which are susceptible to the sugar-beet nematode —*Heterodera schachtii*—and wild beets which are resistant to the sugar-beet nematode. The experiments are not yet completed, but the results to date with the wild beet—*Beta patellaris*—and the domestic sugar beet indicate that the rootstocks behave as the parent plant irrespective of top. The resistance and susceptibility appear to be properties of the root system of the plants. This observation agrees with the results of an English worker with the tomato-black nightshade cross-grafts and the golden nematode — *H. rostochiensis* — a close relative of the sugar-beet nematode. In

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An ectoparasitic pin nematode—*Paratylenchus* sp.—also feeds on carnation roots, but has not been found so destructive as the ring nematode in recent tests. On other crops and under other conditions it could be equally damaging.

A nematode constantly found associated with diseased camellias in California is the spiral nematode—*Helicotylenchus erythrinae*. It has been observed with its spear inserted into camellia roots, feeding. The plants not only make little or no growth but they often show dieback, and develop hairy balls on the root system—actually a proliferation of rootlets. The condition and its association with the nematode are under further investigation.

The cyst nematode—*Heterodera fici*—is interesting because it appears to have a limited host range, as do other members of its genus. It has been found only on plants of the genus *Ficus*. Ornamental rubber plants—*Ficus elastica*—throughout California often have large populations of this nematode feeding on the roots. The effect on the plant is unknown.

Two species of foliar nematodes—*Aphelenchoides fragariae* and *A. ritzemabosi*—cause damage to ornamental plants in California. *A. fragariae* is an important pest of the Croft lily causing yellowing and distortion of the foliage as well as stunting of plants. Control is by hot water treatments. This nematode also attacks a variety of other plants including birdsnest fern. It can be controlled by the use of nematode-free propagating material and nematode-free soil. *A. ritzemabosi* injures chrysanthemum, African violet, Peperomia, fibrous begonia, gloxinia and many other kinds of ornamentals. It can be controlled by the use of clean propagating material and nematode-free soil. On chrysanthemum, control has been obtained with parathion at the rate of one-fourth pound actual per 100 gallons of water applied at weekly intervals.

The stem or bulb nematode—*Ditylenchus dipsaci*—attacks and injures a wide variety of ornamental plants. In California it frequently does severe damage to narcissus causing necrosis in the bulbs as well as leaf galls that are commonly called spikkles. Control has been obtained by hot water-formalin treatment of the bulbs. The treatment consists of a presoak period of two hours in water at 75°F followed by a two-hour treatment in water at 110°F. One point of commercial formaldehyde is added per each 25 gallons of water.

Phlox, hydrangea and primula have been found infested with *D. dipsaci* in California. Control is obtained by the use of nematode-free cuttings or seed. The damage to these plants consists of swollen shortened stems and distorted leaves. Severe infestations sometimes kill young plants.

The reniform nematode—*Rotylenchulus reniformis*—and the burrowing nematode—*Radopholus similis*—are exotic parasites, found in California only in nurseries, and eradicated when found.

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