Nematodes and Bacteria on Rose

root-lesion nematode and hairy-root bacterium on important rose crop in southern California controlled by treatments

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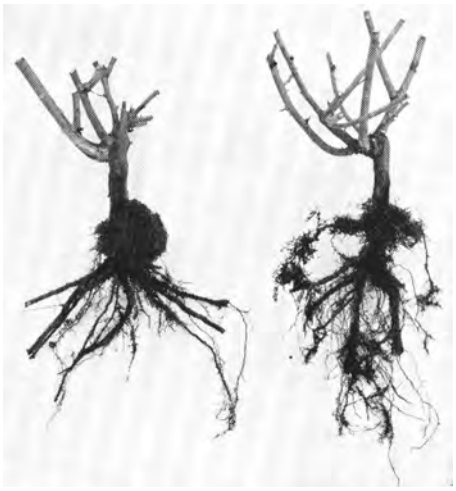
Two limiting factors in the $4 million field grown rose bush crop of southern California are root-lesion and hairy-root diseases.

Losses from these diseases in 1953 and 1954 prompted a preliminary survey in 1954 that revealed numerous nematodes, root-lesion nematode—*Pratylenchus vulnus*—and stubby-root nematode—*Trichodorus christiei*—in the soil around stunted chlorotic rose plants. Plant roots also contained root-lesion nematode in all stages and in large numbers. A bacterium, presumably *Agrobacterium tumefaciens* or *A. rhizogenes*, was isolated from plant roots exhibiting a condition symptomatic of hairy-root, or hairy-gall or both.



Left—hairy gall; right—hairy root.

Nematode Greenhouse Tests

Experiments conducted at Riverside were designed to determine the role of nematodes in the growing of rose bushes. In greenhouse tests, rose cuttings were grown in rose field soil treated by fumigation with DD, EDB, and chloropicrin and in untreated soil from the same field. In companion tests, steam sterilized soil, in which rose cuttings were growing, was infested with nematodes—*P. vulnus*, *T. christiei*, *P. vulnus* plus *T. christiei*—and a check planting left without nematodes. Cuttings in the series of fumigated soil made a striking highly significant increase of growth over the cuttings in the unfumigated series. Plants in the untreated soil series showed stunting, leaf chlorosis and small root systems that were dark and necrotic in appearance and devoid of feeder roots. Nematodes were eliminated by the soil fumigation treatments. Populations of root-lesion nematode remained high in the untreated series, but stubby-root nematode was not recovered at the termination of the test after a year. Bacteria were recovered from the EDB treatment and untreated series only, and both of these series exhibited hairy-root disease symptoms. There was no decrease in plant growth or top symptoms in the EDB treatments.

Rose plants showed disease symptoms in all replications in which root-lesion nematode was introduced. No disease symptoms were recorded in the stubby-root nematode or in the uninfested series.

Disease symptoms in the artifically infested soil test were similar to those in the fumigation soil test.

Only root-lesion nematode was recovered at the termination of the test at the end of the year in all the root-lesion nematode infested soils. Leaf analysis showed root-lesion nematode infested plants lower in iron, copper and potassium than control plant leaves.

Results of these greenhouse tests indicate that the root-lesion nematode, *P. vulnus*, can cause an important disease of rose characterized by stunting, chlorosis, and reduced root system. Elimination of this nematode controls the disease.

Bacterium Greenhouse Tests

In an attempt to identify any species of bacteria involved in the diseases a number of healthy plants were inoculated with bacteria obtained from affected rose roots. Host plants included roses—Paul Scarlet, Dr. Huey, Ragged Robin—apple, *Bryophyllum*, *Impatiens*, geranium, tomato, tobacco, *Coleus*, broad bean, bean, begonia and chrysanthemum. No conclusive results have been obtained from the inoculations, although it appears that the bacteria are closely allied to the *Agrobacterium tumefaciens–A. rhizogenes* group. Work is continuing on this aspect of the problem.

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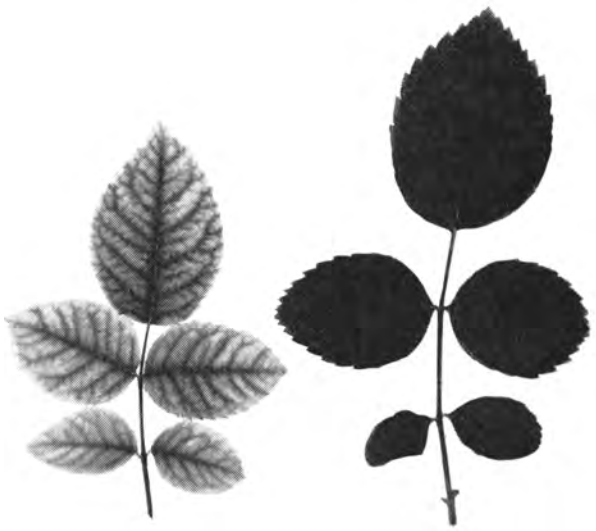
Rose plants grown in fumigated field soil—three crocks at right—and unfumigated soil—crock at left.

ROSE

Continued from preceding page

Field tests—soil fumigation and dipping of cuttings—were conducted in the fall of 1955 at Ontario with the materials, dosages of soil treatments and results shown in the table on this page. One half of the cuttings planted in each treated and untreated plot were bathed in 0.5% Purex for 20 minutes, then quickly dipped in a proprietary compound—Texas Foundation dip. The field used in the test had roses growing in it for four years and was heavily infested with root-lesion nematode—*P. vulnus*—and the hairy-root organism.

Nine months after planting the rose plants—var. Dr. Huey—in all the treatments showed a visible response over the plants in the untreated plots. The average dry weight—in grams—of the tops of 10 plants from each treatment and from the checks were: chloropicrin, 82; EDB, 71; DD, 70; Vapam injection, 59; Vapam drench, 39, and untreated, 30. Roots of plants growing in treated plots were larger and cleaner appearing than those in the checks. The increase in plant growth was correlated with a decrease in number of root-lesion nematodes in the soil. Hairy-root observations were not made.



Leaf from plant grown in root-lesion nematode infested soil on left. Leaf from plant grown in noninfested soil at right.

Percentage of Roses in Each Grade and Percentage of Hairy-root in Fumigated Plots with Dipped and Undipped Cuttings

	Chloropicrin 33 gal./acre		DD 40 gal./acre		EDB 8 gal./acre		Vapam Drench 40 gal./acre		Vapam Injected 40 gal./acre		Untreated	
	Dipped	Undipped	Dipped	Undipped	Dipped	Undipped	Dipped	Undipped	Dipped	Undipped	Dipped	Undipped
Grade 1	80.7	91.3	63.3	79.0	69.5	63.0	72.0	66.4	63.4	71.3	28.7	21.9
Grade 1½	13.0	6.4	24.6	14.6	17.9	20.1	18.5	20.7	30.0	21.7	45.5	48.5
Grade 2	6.3	2.3	12.1	6.4	12.6	16.9	9.5	12.9	6.6	7.0	25.8	29.6
Hairy-root	0.9	1.5	1.4	4.1	7.9	15.0	14.5	20.0	23.4	13.0	11.9	19.2

Test Plants Rated

The more than 13,000 plants in the test were dug in the fall of 1957 and rated for grade and hairy-root symptoms.

Soil fumigation had the most striking effect on plant growth. Number *1* grade was improved over 400% with the chloropicrin treatments, 350% with the DD treatments, and 290% with EDB. Soil fumigation also reduced hairy-root symptoms.

Dipping of cuttings had no significant effect on grade. The dipped cuttings, though, had less hairy-root in all the treatments except Vapam injected.

Although hairy-root plants often are vigorous plants at harvest, tests conducted at Los Angeles and Riverside show that most of them grow poorly or do not survive after two years.

Results of these investigations show that the two most important soil diseases of roses in southern California are root-lesion nematode and hairy-root bacterium. The two diseases are often seen together in the field but what effect the root-lesion nematode has on hairy-root bacterium—a wound parasite—is unknown. Root-lesion nematode alone can cause a disease capable of almost complete destruction of a rose crop. Soil fumigation effectively controls the disease.

Hairy-root bacterium—although not as destructive on a two-year rose crop—can produce symptoms on as many as 20% of the rose crop. Plants with hairy-root do not make good rose bushes when planted but the disease can be controlled by fumigation of soil and dipping of cuttings to be planted.

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Dave Almquist of the Armstrong Nursery cooperated in the studies reported here.

Roses grown in soil infested with root-lesion nematode—two crocks on left. Roses not infested with root-lesion nematode—two crocks on right.