Citricola Scale Control

tests find parathion a control agent of outstanding promise in commercial navel and Valencia orange groves

W. H. Ewart and H. S. Elmer

Commercial navel and Valencia orange groves in the San Joaquin Valley were used in experimental applications of parathion for citricola scale control in field tests during the period from 1947 to 1950.

Promising results were obtained with sprays containing 25% parathion wettable powder suspended in water, or with dusts composed of 1% and 2% parathion mixed with an inert diluent or with sulfur.

Three types of applications were evaluated: *1*, thorough-coverage sprays applied at the rate of 25 to 35 gallons per tree with conventional high-pressure spray equipment, using manually operated guns from the ground or—in groves with large trees—from a tower; *2*, outside coverage sprays applied with spray-duster equipment at the rate of 100 to 200 gallons per acre; and *3*, dusts applied with spray-duster equipment at the rate of 100 pounds per acre.

To conform with standard commercial practices, applications were made three times a year: *1*, from late July to late October when the hatching period was terminated and the scales were translucent and small in size; *2*, in February and early March when the scales were dark in color and slightly larger than in late summer and fall; and *3*, during the early part of the hatching period—late April to early June—when adult and newly hatched scales were present on the trees.

Summer and Fall Treatments

Late summer and fall treatments were applied from late July to late October.

With thorough-coverage sprays, excellent control was obtained with a dosage of one-quarter pound of 25% parathion wettable powder per 100 gallons of spray.

With outside-coverage sprays applied with a spray duster, good control was obtained with application of three pounds of 25% parathion wettable powder per acre and excellent control with application of six pounds per acre.

Dust treatments of 2% parathion applied at the rate of 100 pounds per acre gave good commercial control but were generally less effective than the thorough-coverage or outside-coverage sprays.

Residues of parathion recovered in the peel of ripe navel and Valencia orange fruits, based on fresh weight of peel, averaged less than 0.5 ppm—part per million—with dosages that controlled citricola scale.

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Resistance to Fumigation

studies of outbreak in southern California reveal resistance to hydrogen cyanide fumigation persists

Paul D. Gerhardt and David L. Lindgren

Citricola scale—*Coccus pseudomagnoliarum* (Kuw.)—in citrus growing areas of California is still resistant to hydrogen cyanide—HCN—fumigation.

For 15 years the population of citricola scale in southern California was so low that control treatments were rarely needed. In the summer of 1949 the scale reappeared in large numbers and it became evident that treatment would be necessary in certain groves.

Many growers and pest control operators accepted the belief that citricola scale was as resistant to HCN fumigation in 1949 as it had been prior to 1934. Within three or four years after resistance to HCN fumigation showed up in the Riverside area in 1925 it had spread to the Riverside-Highgrove and Redlands-Cucamonga areas or most of the areas where citricola scale occurred in southern California.

To ascertain the present status of the resistance of citricola scale to HCN fumigation in southern California, a series of experiments was conducted during the fall of 1949, some in groves which were fumigated by commercial operators, and others in groves in which a few trees were fumigated experimentally.

Groves used in the experiments were located in three areas in southern California—Temescal Canyon, Arlington Heights, and Redlands. Dosage schedules used were 20 cc. and 22 cc.

To compare the resistance of citricola scale to HCN fumigation in different areas, heavily infested twigs were collected from four groves in central California; two, at Ivanhoe; one, at Terra Bella; and one, at Edison. Twigs from one grove in the Highgrove area in southern California were tested also.

All twigs were brought into the laboratory, placed in small bottles of water, and fumigated in a 100 cubic foot fumigation chamber. A dosage of 6.0 cc. per 100 cubic feet was used, which is equivalent to a 20 cc. dosage field schedule.

After fumigation the twigs were held for four days in a room in which the relative humidity was 80% before the citricola scales were counted.

The results of the laboratory tests showed that the lowest mortality of citricola scale—49.9%—was obtained on scale from the Highgrove area. Higher mortality—from 87.4% to 94.7%—was obtained with the scale from central California.

Citricola scale insects from some of the areas in central California are considered resistant but they do not appear to be so resistant under laboratory conditions as do those from southern California. How-

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Citrus-Root Nematodes on Olive

pest pathologically and morphologically similar to that on orange roots infests and reproduces on olive roots

R. C. Baines

The olive is a new host of the citrus-root nematode.

Studies revealed that the citrus-root nematode, *Tylenchulus semipenetrans* Cobb, from orange roots and olive roots are similar although the olive belongs to a family—*Oleaceae*—considerably removed from the family—*Rutaceae*—which contains the other known hosts of the pest.

Greenhouse tests showed that the nematode infested and reproduced on olive roots although less readily than on sour orange roots. This checks with observations of olive roots infested naturally in the field at Riverside.

In one of the greenhouse experiments, a rooted olive cutting of the Sevillano variety and a small orange seedling of the Standard variety were planted in opposite sides of nine root-observation boxes.

One week after planting, each tree of the first three boxes received 260 nematode larvae taken from olive roots. Each tree in three other boxes was inoculated with 5,000 larvae obtained from orange roots. Three boxes were kept for controls.

Four months after inoculation the roots against the glass of the boxes were examined for female citrus-root nematodes.

A few females were found on the roots of three orange and one olive tree that were inoculated with larvae from olive roots. Numerous females were found on the three orange trees that were inoculated with larvae from orange roots, but no infestation was observed on the olive roots in the same boxes. Many of the olive roots appeared to have died, which may have affected the results.

Nine months after inoculation the roots of the trees were removed and examined for colonies of citrus-root nematodes.

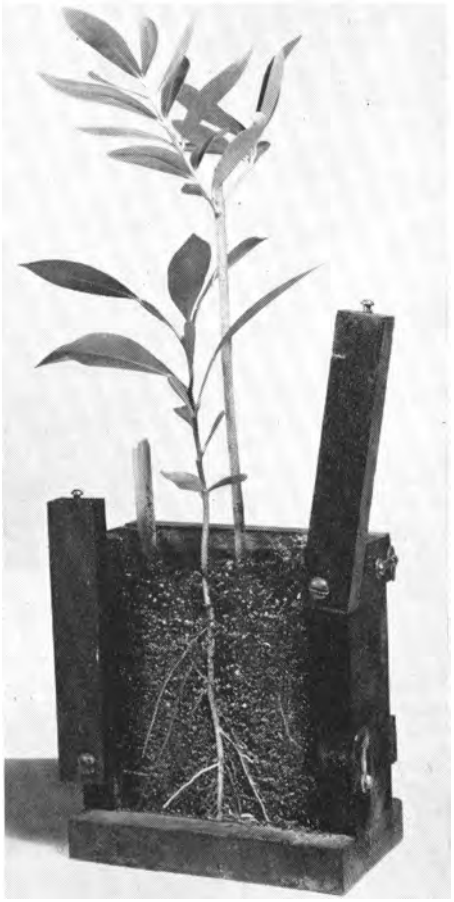
Mature females developed on the roots of all the orange and olive trees that were inoculated with larvae from olive or orange roots.

A greater number of females developed on the orange than on the olive roots of the trees inoculated, regardless of the source of the inoculum.

No infestation developed on the control trees.

A second greenhouse test studied the effect of host association on infestation.

A Mission olive and a Homosassa sweet orange seedling were planted together in



Small olive and orange trees in root-observation box used for inoculations. Side of box has been removed to show orange roots near surface. One-third actual size.

six-inch pots. Olive and orange seedlings also were planted separately in other pots. Two pots of each of the three lots were inoculated nine and 30 days after planting. Each pot received approximately 26,300 larvae obtained from sour orange roots. A similar number of trees was maintained uninoculated for controls. The trees stayed in the greenhouse for five months, then the degree of infestation on the roots was determined.

In the pot where the olive and orange trees were planted together, one gram of roots of the olive tree averaged 119 larvae, while the orange trees averaged 775 larvae.

The olive trees planted separately contained only 12 larvae on one gram of roots. The orange trees planted alone averaged 727 larvae.

No infestation developed on the roots of the control trees.

These results show that the degree of infestation was less on olive than on orange roots regardless of whether the two hosts were growing in the same pot or separately. A slightly larger number of larvae was obtained from the olive roots when grown in association with the orange than when grown individually in the pots. Such differences should be attributed largely to an increase of the nematodes on orange roots and to subsequent infestation of olive.

These cross inoculation studies and microscopic examinations revealed that the citrus-root nematodes from orange and olive roots are similar pathologically and morphologically. While orange roots are infested more readily than olive roots, the olive should not be overlooked in any control program.

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This study was done in co-operation with Gerald Thorne, Senior Nematologist, United States Department of Agriculture.

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ever, the citricola scale obtained for the laboratory studies may not have been from the most resistant groves as field observations have shown that very poor kill is obtained with HCN fumigation in these resistant areas in central California.

The following tabulation gives the results of the experiments conducted in the three localities in southern California.

Resistance of Citricola Scale to HCN Fumigation

Location of grove	Dosage schedule	Mortality		
		Pre-treatment	Post-treatment	Net mortality
Temescal	20 cc.	49.9%	77.1%	54.2%
Canyon	22 cc.	44.5	75.3	55.5
Arlington Heights	22 cc.	14.2	29.2	17.5
Redlands	20 cc	41.4	64.2	38.9
	22 cc.	52.2	65.3	27.4

The groves located in the Arlington Heights and Redlands areas had been

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ment that will leave a more effective dust control cover on the land. New plants or native plants may be developed or discovered which will produce a soil cover resistant to wind erosion. The idea of finding new plants is not too remote as foxtail and filaria—the two plants most popular with livestock men of the area—came from the Mediterranean region.

Most of the fenced areas are to be used for studies on grazing management practices which will leave a protective cover to aid dust control. This will be a complicated investigation involving economics, nutrition, palatability, season of use, and similar considerations.

During the first week of January, 1951, trial plantings were made in each of the leases. Plantings were made with a special range seeder which makes a furrow about 12" wide and from ¼" to ½" deep, and drills the seed in the middle of the furrow. By this method of seeding, the young plants get a chance to become established with less competition from native vegetation. Several rows—1,300 feet long and three feet apart—were sown with the following species: smilo, rose clover, annual rye, yellow flowered sweet clover, *Stipa cernua*, bur clover, cucamonga brome, soft chess, local rice grass, S.C.S. rice grass, harlan brome, deerweed *Lotus scoparius*, allscale *Atriplex polycarpa*, lenscale *A. lentiformis*, spinescale *A. spinifera*, wingscale *A. canescens*, and winter fat *Eurota lanata*.

About half of the species planted sprouted to a good stand but—due to the almost complete absence of rainfall—grew to about one inch in height only by March.

The clovers, rye grass, and bromes made a fine showing but none of the species lived long enough to permit any satisfactory evaluation.

Similar plots will be planted again this winter for continuing studies.

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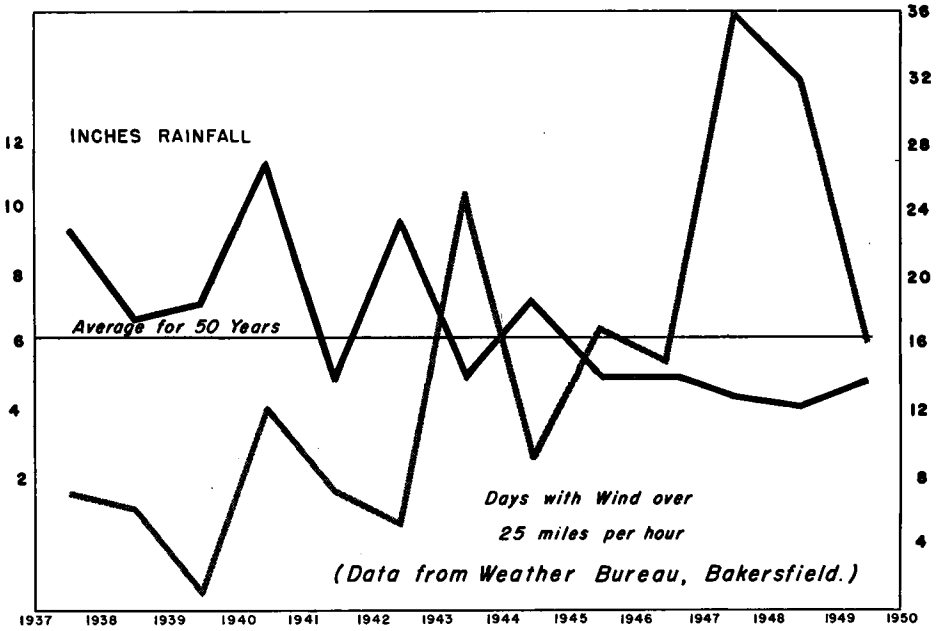
RAINFALL AND WIND STORMS — 1937 TO 1950



Experimental tract in Fresno County where tested plants grew to about one inch in height because of lack of rain. Photo taken in March 1951.

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subjected to commercial fumigation in previous years while the Temescal Canyon grove had been fumigated only every two or three years.

The net mortality in Temescal Canyon was the highest for any of the three areas tested but it was not high enough for control of the scale. With a net mortality of only 55.5%, there is no doubt that the scale in the Temescal Canyon area is resistant to HCN fumigation. The resistance in this particular grove had been maintained although the scale insects were subjected to fewer fumigations than were those in the groves in the other areas.

The scale in the Arlington Heights area had the greatest resistance to HCN fumigation. Pretreatment counts indicated a low natural mortality of only 14%, and a net mortality after fumigation of only 17%—which is very low. Apparently the scale in the Arlington Heights area is still very resistant.

It is evident that the citricola scale in the Redlands area—with a net mortality of between 27.4% and 38.9%—still possesses a high degree of resistance to HCN fumigation.

Although there is a variation in the degree of resistance of citricola scale to HCN fumigation in these three areas, it is apparent that the scale is still resistant.

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