Red Scale in Citrus

control affected by grove location and pest's post-treatment build-up

R. C. Dickson and D. L. Lindgren

The common California red scale is the most serious pest of citrus in southern California.

Apparently spreading from the original infested areas in Orange and Los Angeles counties, the red scale has reached all the citrus areas of California and Arizona. Quarantine and eradication programs have been important in limiting its spread and status as a serious pest in certain areas such as Arizona and in Ventura County, California. Climatic conditions have appeared as limiting factors in the past, and the yellow scale has outranked the red in such interior counties as Tulare and Butte. More recently, however, the red scale has been noted in the warmer sections including the Coachella Valley.

Red scale occurs over a good portion of California, being found on ornamentals where there is no citrus. In recent years this insect has shown a marked tendency to increase in the interior districts. It has become of considerable importance in the Redlands area and has appeared in commercial groves in Tulare County and in the Coachella Valley. This may indicate that natural selection is producing a strain of red scale tolerant to high temperature and low humidity.

Yellow scale is similar to red scale but can ordinarily be distinguished from it in the field by the paler color and flatter shape and by the fact that yellow scale seldom infests the wood and twigs. It is commonly found in the interior districts and at the present time is of little commercial importance except in the San Joaquin Valley.

Generations of Red Scale

Experiments were conducted for two years to determine the number of generations per year of the red scale at various locations throughout southern California. Red scale females produce young over an average period of 64 days in the summer and 154 days in the winter.

The shortest period recorded from settling to maturity was 58 days for one lot of insects at Riverside from July 7 to September 3, 1940. The longest period recorded was 262 days at Rincon Creek, Santa Barbara County, from September 11, 1940, to May 31, 1941.

In most locations it took six to seven months in the winter for a red scale to complete its development. In the summer it took a little over two months in the interior and about three months along the coast.

The number of generations per year was found to vary from 3 3/4 to Elsinore and Corona to two at Carpinteria.

A red scale population is never all in one stage of the life cycle at the same time. The nearest approach to this comes in the spring when the per cent of adults is considerably higher than at other seasons.

The long period of young production by each female creates a condition of overlapping generations and explains the presence of scale of all ages as is commonly found.

Resistance to HCN Fumigation

All reports of early HCN—hydrogen cyanide—fumigation against the red scale indicate that the results were very good. The kills obtained were so high that it was necessary to fumigate only at two- to four-year intervals. Unsatisfactory results appeared first in a limited area near Corona a few years before 1914.

Experimental work showed that the poor kills obtained in this area were due to the presence of a race of red scale that was definitely resistant to HCN fumigation.

The resistant race of red scale has become scattered throughout the citrus-growing areas of California. It is possible to find resistant red scale in any citrus-growing county and in practically any district.

Resistance to HCN fumigation in red scale is inherited so that the continued use of fumigation in a grove in which both resistant and nonresistant scale occur kills out the nonresistant race, leaving only the resistant individuals to reproduce themselves.

If a grove is infested with nonresistant scale only, repeated fumigations will not increase resistance.

The spread of resistant scale and continued fumigation have resulted in a gradual increase and extension of the resistant race so that now when red scale is introduced into a new locality there is a good chance that it will be resistant.

At the present time there is no indication that the nonresistant race is able to reestablish itself in groves which are sprayed rather than fumigated.

Control Variable

The length of time that a treatment will control the scale in a grove is determined by the density of the scale population before treatment, the per cent kill obtained, and the rapidity of the build-up following treatment.

Along the coast where the build-up is slow a comparatively poor kill will serve to hold down the scale as well as a good kill will in the interior.

Growers near the coast who practice fumigation may not be aware of the fact that they have resistant red scale in their groves since the treatment may hold the scale well anyway.

In the interior the more rapid build-up accentuates any poor kill and it soon becomes evident to the grower. This explains the rather common belief among citrus growers that resistant red scales are confined to the interior districts of California.

While resistant red scales are more common in the interior than along the coast they do occur in all areas, and now constitute an important part of our red scale population.

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to set seed on stems only two inches in height. It will probably replace or supplement much of the domestic ryegrass currently being so widely used on the range.

Prairie Brome

This strain was first grown in California at the Meloland Experiment Station of the University of California in the Imperial Valley with seed obtained from New Zealand.

Prairie brome is a strong winter grower. It has performed particularly well on coastal ranges. Elsewhere, without irrigation, its use is limited to good soils. There are indications that it is a good irrigated pasture plant. It is definitely distinct and superior to any of the "rescue grasses" of the southwestern United States.

Ryegrass 12

Ryegrass 12 is an increase from a packet of seed obtained in November, 1943, from the Plant Research Bureau, Grassland Division, New Zealand.

It is presumably a sister strain of their short rotation ryegrass. Both are selections from an artificial hybrid between annual and perennial ryegrass made in New Zealand.

Ryegrass 12 is morphologically about intermediate between the parents. It produces early fall growth, recovers more rapidly after pasturing than either bur clover or subclover, and therefore grows more rapidly than either of them in cool weather.

Ryegrass 12 is a true clover. It has no valuable burs and there is no intention of its eliminating bur clover. Rather, rose clover will supplement bur clover where it is difficult to obtain satisfactory stands or growth of the latter. It remains green one to two weeks longer than midseason subclover. It is especially useful on poor soils that are slightly acid as found in zones 1, 4, and 5.

All foundation seed of these forage plants is in the hands of capable seed growers. Under the direct supervision of the California Crop Improvement Association, the seed fields of those growers will be given every care, in order that the livestock industry may have better plants with which to relegate their ranges and irrigated pastures.

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Further information about forage plants is contained in the California Experiment Station Circular 371, "Improving California Brush Ranges," which is available without cost at the office of your local Farm Advisor or from the College of Agriculture, Berkeley 4, California.

A winter annual, the foundation seed of rose clover is derived from C. 23014. The original seed was obtained from the U.S. Department of Agriculture at Beltsville, Md.

It appears to be less sensitive to low temperatures and short daylength than either bur clover or subclover, and therefore grows more rapidly than either of them in cool weather.

Rose clover is a true clover. It has no valuable burs and there is no intention of its eliminating bur clover. Rather, rose clover will supplement bur clover where it is difficult to obtain satisfactory stands or growth of the latter. It remains green one to two weeks longer than midseason subclover. It is especially useful on poor soils that are slightly acid as found in zones 1, 4, and 5.

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 housings are required by the State Labor Housing and Sanitation Act—such as, the 25-foot distance from privies to kitchen or mess hall.

The workers' camp and individual units should be well placed with regard to compass directions. Where strong winds occur, buildings should be sheltered behind trees or hedges. Privies should be downwind from dining and sleeping quarters.

If rains usually come from a certain direction, buildings should be protected by natural land features, and placed to secure the best weather resistance.

Where summer heat is severe, bunkhouses should be shaded on the south and west by large deciduous trees.

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The University has prepared a series of leaflets on farm labor housing structures and arrangement. The structures meet the requirements of the State Labor Housing and Sanitation Act. They have been approved by the Division of Immigration and Housing.

The leaflets listed below, by number and title, may be secured without cost by addressing the College of Agriculture, Berkeley 4, California.

B-HD. Details (usually included with plans)
B-H1. A Four-Man Canvas-Roof Cabin
B-H2. A Two-Man Bunkhouse
B-H3. A Six-Man Bunkhouse
B-H4. A Two-Room Family Unit with Bath
B-H5. A Two-Room Bathhouse, Men and Women
B-H6. A Farm-Labor Mess Hall with Kitchen
B-H7. Camp and Field Privies
B-H8. Labor-Camp Equipment
B-H9. A Twelve-Man Bunkhouse
B-H10. Bunkhouse with Separate Rooms
B-H11. Arrangement of Camp Structures

The California Experiment Station Bulletin No. 472, "Adobe Construction," also is available.
TURKEYS
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hatch well, whereas washed clean eggs
hatched as well or almost as well as un-
washed eggs.

These findings emphasize the impor-
tance of producing clean eggs; keeping
them in a cool room on the farm, at the
receiving plant, and in transit; frequent
delivery to the receiving plant or hatch-
ery—two or three times a week—and
prompt shipment from the receiving plant
to the hatchery. Of course, the hatchery
operator should also set the eggs promptly
after they are received.

Turkey Feeding

Hatchability of turkey eggs is deter-
mind primarily by the hatching quality
of the egg when laid. Methods of handling
and hatching the eggs can reduce the in-
ate hatchability of the new laid egg but
cannot do much, if anything, to improve
its. This is determined by breeding and by
nutrition. In practice nutritional deficien-
cies are probably more commonly respon-
sible for hatching failures than are breeding
effects, such as those resulting from
close inbreeding.

Knowledge of the nutritional require-
ments of turkeys to ensure maximum
hatchability is still incomplete. Work
done some years ago showed the need for
riboflavin and pyridoxine and this has
been well established.

Since the needs for reproduction have
not been fully established, it would be well
to feed an adequate breeder ration start-
ing about a month before eggs are ex-
pected. If lights are used, the change to a
breeder mash might be made at the time
the lights are started. Then as an added
insurance measure fresh greens should be
fed.

The turkey nutrition work has demon-
strated that turkey poults require a
slightly higher level of the water soluble
vitamins, such as riboflavin, than chicks.
Also that the higher protein requirements
of turkey poults as compared with chicks
are reflected in higher requirements for
some of the indispensable amino acids—
the building blocks of the proteins. Too
low a level of lysine may or may not be
the cause of the wide white bar sometimes
seen on the wings of Bronze poults, but
in any case the work done on protein re-
quirements indicates that too little protein
is the commonest cause of the white bar
and the slow growth which often is
associated with it.

While much work remains undone on
the nutritional needs of young turkeys, it is
expected that work can soon be started on
the nutritional needs of breeding tur-
keys.

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