Establishment and distribution of

Wasp Parasite

of California red scale

PAUL DeBACH and JOHN LANDI

Another new species of a tiny wasp—*Aphytis*—parasitic on the California red scale of citrus, was imported to California in 1960.

The new importation—*Aphytis coheni* DeB.—is from Israel. Of several other species introduced into California in the past few years, one species—*Aphytis melinus* DeB.—seems to be permanently established in the major citrus areas of southern California.

Following its importation from India and Pakistan in 1956–57, *Aphytis melinus* was colonized in numerous plots wherever the California red scale occurred in the citrus areas of Fresno, Kern, Los Angeles, Orange, Riverside, Santa Barbara, San Bernardino, San Diego, Tulare, and Ventura counties. More than 2,300,000 mated female parasites were colonized during the initial push in 1958 and 1959. Since then, approximately another half million have been colonized in plots in additional locations. Attempts were always made to obtain plots which would not be treated with insecticides for a certain minimum time following colonization, to allow the parasites time to reproduce and disperse.

By the end of 1958, the parasites were recovered in all release plots except in San Diego County where, apparently, *Aphytis lingnanensis* Comp.—imported from China in 1947–48—is so well adapted to the local climate that it precluded the establishment of *A. melinus*. Specimens of the wasp were recovered from 31% of the colonized plots in the coastal counties, 63% in the noncoastal counties, and 90% in the San Joaquin Valley counties. However, the 1958 recoveries were made too soon after colonization to determine that the parasite was permanently established in California.

In 1960—four winters and three summers after the initial colonizations—the parasite was found, often in abundance, in all the localities of initial recovery and in many others besides.

The intensity of shading on the accompanying map indicates the degree of dominance of *Aphytis melinus* with respect to other red scale enemies.

The parasite is found in nearly all citrus areas of southern California. In the San Joaquin Valley the wasp is found most commonly in towns because the commercial groves receive red scale eradication treatments with insecticides.

In the non-coastal citrus areas of the south the parasite has dispersed from the original colonization plots. Except for groves regularly treated with insecticides, the wasp was recovered from virtually all sites sampled.

The dispersal and population increase of *Aphytis melinus* in the non-coastal areas have been greater than those of any other red scale parasite studied in California. Instances of natural dispersal within approximately two years include general establishment from Fullerton east through the Santa Ana Canyon, with the nearest colonization sites at La Sierra or at Tustin. *A. melinus* has jumped from San Fernando Valley sites across the Santa Susana Mountains to the Simi Valley, where it is established from Santa Susana to Moorpark. Also, the parasite has made the lengthy jump from either Bakersfield or Tulare to Delano.

Previous to the importation of *Aphytis melinus* from the Orient in 1956–57, long-term field studies in citrus groves indicated that *Aphytis chrysomphali* Mercet, and *Aphytis lingnanensis* Comp. were the best natural enemies of the red scale in California and were capable of controlling the scale in the absence of major insecticidal treatment, in certain favorable areas or locations. However,

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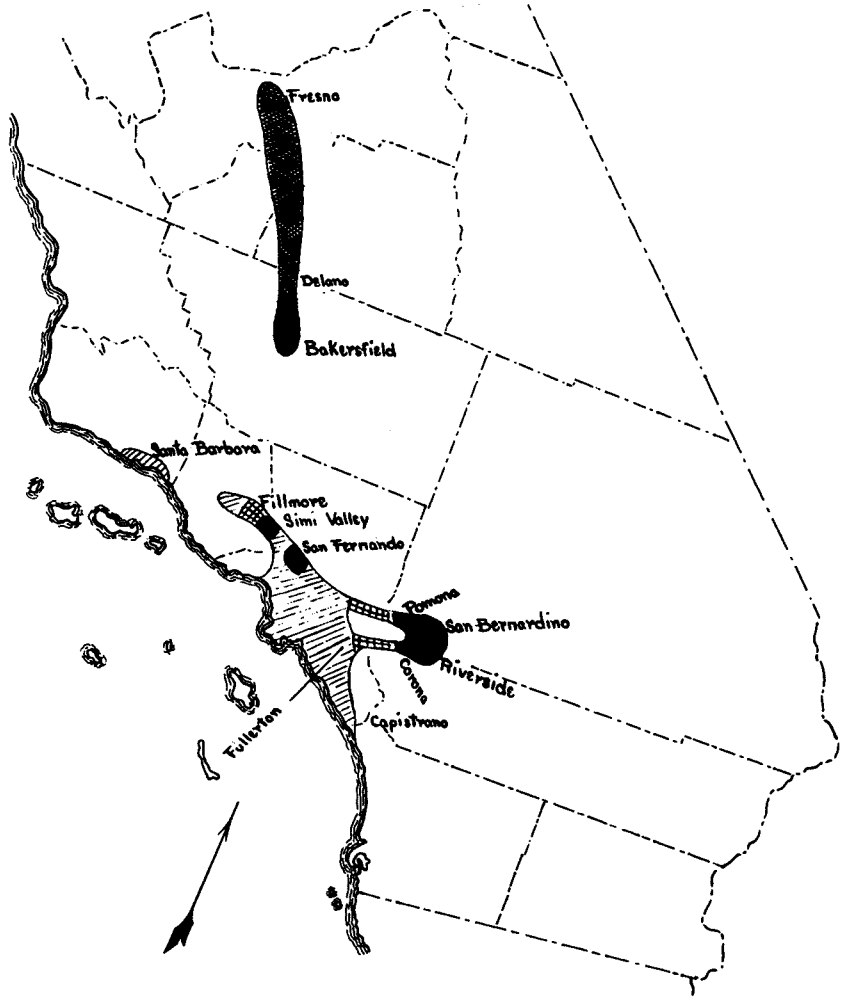

Distribution of the imported wasp—*Aphytis melinus*—parasitic on the red scale, in California citrus areas, 1960.

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WASP

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under more extreme climatic conditions, as in interior citrus areas, examples of satisfactory biological control were rare.

Although the two *Aphytis* species established in California were inherently effective parasites of the red scale, a continuing world-wide search was initiated to find other species which might be better adapted to survive California's interior area climate.

The species of *Aphytis* which attack the California red scale have similar life histories. All species of the parasitic wasp are ectoparasites and lay their eggs, usually one or two per scale, on the surface of the scale body but under the scale covering. The parasites attack when the scale body is loose from the covering. After the egg of the wasp hatches, the larva sucks out the body fluids of the scale. During the summer, a complete field life-cycle of the parasite takes about 2½–3 weeks. Hence there are about three generations of the parasite to one of the scale. When the adult wasp emerges from the pupa under the scale covering, it usually emerges by pushing its way out under the edge of the scale.

The progress of *Aphytis melinus* in non-coastal areas is encouraging; it has increased the natural enemy-caused red scale mortality and, over the years, it will make insecticidal control easier. However, the general area-wide treatment of citrus with toxic chemicals makes evaluation difficult.

Aphytis melinus appears to be a parasite that comes close to achieving biological control of the California red scale in interior climatic areas, but its complete potentialities and those of the new species from Israel remain for time to tell.

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