

Imported French

Parasite of Walnut Aphid

established in California

Imported from France in 1959, a tiny wasp—*Trioxys pallidus* Haliday—a natural parasitic enemy of the walnut aphid—*Chromaphis juglandicola* (Kaltenbach)—has become established, at least locally, in California.

The wasp was found attacking the walnut aphid in southern France and parasitized aphids were sent to California insectaries for propagation.

During the last six months of 1959 more than 12,000 parasites were reared in the insectaries and released on aphid infested English walnut trees in Contra Costa, Lake, Los Angeles, Orange, Riverside, Santa Barbara, San Benito, San Bernardino, San Diego, Tulare and Ventura counties.

Within three weeks after each parasite colonization was made, parasitized—mummified—aphids were found at most locations. The size of each colonization ranged from less than 100 up to 1,200 parasites. Relatively small numbers of parasites apparently are satisfactory for preliminary establishment. However, the wasp from France passes the cold winter

months as a larva in diapause—rest period—and permanent establishment would depend on the satisfactory emergence of the diapause individuals in the spring of 1960.

The colonizations made in 1959 were in untreated orchards or on backyard trees to avoid any detrimental effect insecticide treatments might have on the establishment of the parasitic wasp.

On April 12, 1960, adult parasites were collected—for the first time after the diapause—on trees at Rancho Santa Fe in San Diego County. Other cases of establishment were found within two weeks at Tustin, Orange County, Yucaipa, San Bernardino County, and at Kelseyville, Lake County. Therefore, the aphid parasite from France is considered established locally in southern and northern California.

Mass production of the parasite is continuing in the insectaries at Riverside and Albany. Potted English walnut seedlings, three months old, are grown in greenhouses and later infested with aphids and parasites. The seedlings, with the aphids

and the wasps, are grown in insectary cages at about 70°F using 10 hours of daylight. From June 1959 to June 1960 more than 52,000 parasites were reared and colonized in California. Releases will continue until colonizations have been completed in all major walnut-growing areas of California.

The parasite of the walnut aphid is less than 1/8" long and is closely related to *Trioxys utilis* Muesbeck, a recently imported and highly successful parasite of the spotted alfalfa aphid. The two species look so much alike that there is some question as to whether they represent a single species containing two biological races. However, the wasps attack distinctly different host aphids living in different environments. The parasite of the spotted alfalfa aphid lives near the ground in alfalfa and attacks the spotted alfalfa aphid and its relatives, while the parasite of the walnut aphid lives in trees and attacks only the walnut aphid in that environment. The parasite of the walnut aphid has been successfully reared also

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the smaller stores which must adjust prices and services to local competitive conditions.

The timeliness of price information is especially crucial to competing retail firms unless, through produce or service differentiation, they are able to make prices a secondary consideration in the minds of their customers. While timeliness is not a prime factor concerning information regarding marketing services, its acquisition and proper dissemination are vital.

Buying specialists with retailer-owned associations and wholesaler-sponsors perform most of the necessary supply functions for the affiliated retail stores. However, reliance on group action for procurement of perishable produce is less frequent than for dry groceries. This is attributable in part to the availability and wide distribution of daily terminal

and shipping point market news reports and to the effectiveness of conventional type buying services of the produce wholesalers.

Current trade estimates indicate that from \$400,000 to \$600,000—depending on the location—are required to open a supermarket capable of handling sales of \$30,000 to \$35,000 weekly. Experienced operators usually find outside capital necessary. A wider capital market is open to firms that are widely known, have established earnings records, and have their retail outlets distributed throughout a region or nationally.

The small single-unit store operator is frequently handicapped because of prospective investors' appraisals of the risk of investing in a single-unit retail grocery store that must face immediate or future competition from powerful multi-unit firms.

Cooperative and voluntary buying groups have tended to equalize the competitive buying powers of affiliated retail stores and of chains. However, a group-action solution of the buying and assembly problems has not reduced the problems incident to servicing many small, retail-store accounts. As a consequence, some cooperatives and voluntaries are setting up membership requirements that discourage small inefficient firms from joining their organizations, and in some cases the membership requirements are sufficiently rigid to cause affiliated stores to drop their memberships. Such actions by groups of independent retailers emphasize the intensity of the competitive struggle to lower merchandise costs in the retail grocery business and the difficult position of small independent stores.

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APHID

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from the black-margined aphid on pecan, in the insectary and in the field.

Colonizations of the walnut aphid parasite were made on the black-margined aphid on pecans in Riverside and Coachella, but the future degree of biological control of the aphid by the wasp is unknown.

The wasp imported from southern France is bisexual, solitary, and an internal parasite of the walnut aphid. It attacks all stages of the aphid, including the winged forms, but prefers to oviposit in the younger stages. In the insectary 10 days are required to complete a generation at 80°F, while at 70°F a generation is prolonged to 14 days. The sex ratio appears to be near 1:1, and at least 150 progeny may be produced by each female. The wasp pupates inside the aphid skin. The aphid skin is dark brown at first but as the emergence of the parasite approaches, the mummified skin of the aphid turns light brown to white. Most of the aphid mummies are found on the underside of the walnut leaves,

often near the veins in the leaves. The mummies are about $\frac{1}{16}$ " long and rather flat, for aphid parasite mummies, and are not easy to detect. Mummies containing overwintering—diapause—larvae usually remain on the leaves until autumn and then drop to the ground with the leaves. Thus the diapause population spends the winter on the ground and as soon as the adults emerge in April or May they fly up into the walnut trees and begin their search for young aphids.

Another specimen population of the French wasp was collected recently near Teheran, Iran, and sent to the quarantine laboratory in Riverside. The Iranian species appears identical to the French in California. However, stocks of the Iranian wasp population are being reared to test for environmental differences or preferences. Coming from Iran, the wasp may survive better in the warmer interior walnut areas in California than has been noted so far for the French population.

Only two species of native parasites of the walnut aphid have been reared in California. One species—*Aphelinus per pallidus* Gahan—occurs infrequently in the spring and usually close to the coast

in southern and central California. The other species—*Praon unicus* Smith—has been collected only twice and both times at Yucaipa in San Bernardino County. Probably this species rarely attacks the walnut aphid because several other aphid hosts—which it seems to prefer—are available. The two native parasites will offer little competition for the wasp from France, but some ladybird beetles, green lacewing larvae, and syrphid fly larvae have been common, at times, in conjunction with the imported wasp.

The successful establishment of the parasitic wasp from southern France offers considerable hope toward biological control of the walnut aphid in California.

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The above progress report is based on Research Project No. 1650.

Adult wasp parasites attacking walnut aphid. The round swollen aphids are dead aphid mummies.

