

A newly imported California red scale parasite from Saudi Arabia

Paul DeBach

In general, species of *Aphytis* are the most effective of California red scale parasites. Species of *Comperiella*, *Prospaltella*, *Phycus*, *Aspidiotiphagus* and *Habrolepis* are usually less effective but may act in a complementary manner. Several species of *Aphytis* are recorded to be partially to completely effective in biological control of the California red scale, *Aonidiella aurantii* (Maskell), in various citrus producing countries. *Aphytis melinus* DeBach, originally from India and Pakistan, is now established in California, Argentina, Australia, Greece, Israel, Cyprus, South Africa, and elsewhere. *Aphytis lingnanensis* Compere, originally from southeast China, is now in California, Mexico, Texas, and elsewhere. *Aphytis coheni* DeBach is important in Israel; *A. chrysomphali* (Mercet) has been of some consequence in California, Australia, Greece, Israel, and elsewhere; and *A. africanus* Quedneau is considered important in South Africa.

All of these have been tested in California; *A. melinus* and *A. lingnanensis* are well established and important causes of California red scale mortality in some areas. Other species are known to attack the California red scale in several tropical countries, but their relative effectiveness there is unknown. We have imported several of these species, but either they have failed to become established or we have been unable to culture them thus far.

Many species required

A given species may perform well in one climatic environment but poorly in another, so that more than one species is required to cover a broad climatic range. In California, *A. lingnanensis* does well in coastal zones. *A. melinus* does well in intermediate zones, is variably

effective in the interior areas of Southern California, and is established but ineffective in the San Joaquin and Imperial valleys. For some years—since the limitations of *A. melinus* became apparent—we have been endeavoring to discover and import additional species, as well as geographical races, of *Aphytis* and other California red scale parasites which might prove to be better adapted to interior and desert citrus areas.

Taxonomic studies have played a large role in this search because different biological species of *Aphytis* may be virtually indistinguishable from one another and new ones could be easily overlooked as already being established in California unless subjected to the most careful microscopic and biological studies. Such research led me to suspect that at least a geographical race—perhaps a new species—of *Aphytis* existed in the hot desert area (about 47°C maximum) of Riyadh, Saudi Arabia. Certain locations in this area also have cold winters, ranging to -6°C minimum.

The search

This story began in 1967 when I received 12 specimens of *Aphytis* for identification from H. E. Martin, FAO entomologist stationed in Riyadh. These were reared from *Aonidiella orientalis* (Newstead), the oriental scale, on citrus, near Riyadh. This scale is closely related to California red scale and its parasites may possibly attack both. For instance, *A. melinus* occurs on both scale species in India. Initial routine microscopic studies of the Riyadh specimens showed that they were virtually indistinguishable from *A. melinus* and *A. fisher* (DeBach), but did differ very slightly from them. However, they were distinct from *A. lingnanensis* and other

known California red scale parasites. The specimens were filed in our collection under *A. melinus*, but labelled thus: *Aphytis* n. sp? near *melinus*? I made a mental note that a colony of this population would be worth importing, but H.E. Martin left Saudi Arabia in 1970, and visas to enter the country reportedly were nearly impossible to obtain. Thus we marked time.

About 1973, while preparing a taxonomic monograph with Dr. David Rosen on *Aphytis* species of the world, I re-examined the Riyadh specimens and re-confirmed that each specimen had a short, black-pigmented line on the thorax which *A. melinus* lacks. Such cryptic, slight differences are often keys for species diagnosis in *Aphytis*.

It was also noted that all 12 specimens were females, which might mean that the Riyadh *Aphytis* was uniparental—females reproducing females. *A. melinus* differs in being biparental and requiring males in order to produce females. These leads, even though small, made it appear likely that the form occurring in Saudi Arabia represented a new species closely related to *A. melinus*. If true, and this species would transfer to California red scale and be more tolerant of interior and desert climates, we might have a promising new enemy of the California red scale.

Acquisition

Attempts were begun to acquire the species. In 1974 and again in 1975, I asked my colleague, Dr. Dan Gonzalez, who was going to the Middle East to explore for natural enemies of other pests, to go to Saudi Arabia and try to collect the *Aphytis* in question and send it to me. He was unable to obtain a visa, however, even with the help of the Uni-

versity of California representative in Washington and of Senator John Tunney. In January, 1976, I wrote to an Egyptian colleague who was stationed in Riyadh, Saudi Arabia, asking for shipment of *Aphytis* but nothing came of this.

Foreign exploration plans for 1977 emphasized acquisition of the Saudi Arabian *Aphytis* as well as search in the stringent climatic zones of southern Iran, Pakistan, and India. My colleague, Chuck Kennett of the Division of Biological Control, Berkeley, agreed to undertake this trip.

After finally obtaining a visa, Kennett left for Saudi Arabia in May, 1977. His first shipment of parasitized *Aonidiella orientalis* and living specimens of *Aphytis* arrived at Riverside on May 26, 1977; a second shipment arrived on May 30. Both were from Riyadh or nearby localities.

From 17 original female specimens a culture of this *Aphytis* was successfully started on the California red scale as well as on the oleander scale, *Aspidiotus nerii* Bouche, in our quarantine facility. Microscopic examination of the specimens showed them to be

identical taxonomically to the original specimens sent by H.E. Martin and to consist only of females. Thus this population is reproductively isolated from *A. melinus*, its closest relative, and is, at least functionally, a new species.

Releases

The culture was released from quarantine July 8, 1977, and was built-up as rapidly as possible for field colonization in the summer and fall, especially in interior climatic zones, and the San Joaquin and Imperial valleys. The first small releases (24 females) were made July 13, 1977 on California red scale-infested citrus trees in the San Bernardino County area of Loma Linda. Immediate interest in, and oviposition on, California red scale was observed, indicating that this scale is a preferred host for the new *Aphytis*. More releases in all areas will follow as the culture is expanded. It will be at least six months before we have any indication as to whether this parasite may become a significant addition to the complement of California red scale natural enemies in the field, but it appears to be the most hopeful prospect

imported in several years.

As a sort of bonus, the parasitized oriental scale material from Riyadh also yielded live specimens of *Habrolepis rouxii* Compere and *Aspidiotiphagus citrinus* (Crow). These parasites are currently being cultured in quarantine on California red scale. Following their release from quarantine, they will be colonized in the field. Both have been imported from other countries previously and released in California, but the new cultures might represent geographical races possessing different genetic capabilities.

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Aphid control on chrysanthemums and carnations

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Aphids commonly occur as pests on chrysanthemums and carnations as well as on many other plants grown in plastic or glass houses in California. They are usually found in colonies on plant tips, shoots of new growth, or flowers. Aphids multiply so rapidly under favorable conditions that a light infestation may increase to alarming proportions in a week. They are generally more numerous during cooler months when the most serious damage occurs. However, damage can be observed throughout the year.

Aphids injure plants by inserting their long proboscis or beak into the plant tissue and sucking out the juices. Feeding on new leaves causes the leaves to curl or crinkle, and plants become stunted or may die. Also, honeydew secretions from the aphids drop to the lower leaves form-

ing a shiny, sticky coating. These honeydew deposits attract ants and promote the growth of black smut fungus causing a black or sooty, unsightly appearance. Aphids can transmit several plant virus diseases. For example, the green peach aphid transmits carnation streak and several other viruses.

In this investigation, several insecticides were evaluated for: (a) aphid pest control on chrysanthemums and carnations grown for cut flowers, and (b) phytotoxicity. On February 29, 1972 Pompon (Hurricane variety) chrysanthemums in the tight bud stage were treated with four insecticides for the green peach aphid (*Myzus persicae*) and the leaf curl plum aphid (*Brachycaudus helichrysi*) in El Modeno, California (table 1). Separate plots were established for phytotoxicity

observations of four compounds on 19 chrysanthemum varieties. On June 1, 1972 four compounds were tested on chrysanthemums in propagating beds in Encinitas, California for leaf curl plum aphid control (table 2) and 26 varieties were sprayed with Pirimor for phytotoxicity observations. In 1974, on February 7, 11 different treatments were applied on carnations in Encinitas, California for green peach aphid control (table 3). Three insecticides were sprayed on 8 carnation varieties at the same location at 2 and 4 week intervals between April 19, 1974 and April 12, 1975 for phytotoxicity observations. A total of 15 applications were applied on each plot.

In three experiments, Pirimor and Orthene gave effective and long-lasting aphid control. No phytotoxicity was ob-