Project No. 80-F7
(Continuation of Project No. 79-F6)

Cooperator:
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Division of Biological Control
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Project: Navel Orangeworm Research
Biological Control of N.O.W. and Almond Pest Mites

Objectives: To study the effects of field released natural enemies on the control of navel orangeworm and two-spotted and European red mites in the central valley of California. To finalize the overseas search of additional natural enemy species.

Progress: The acquisition of new species of natural enemies of navel orangeworm and phytophagous mites has progressed to the field release of six parasitic wasps and the field reproduction of two species, and the culture of an Amblyseius sp. predatory mite, which shows potential for control of two-spotted and European red mites. Control of navel orangeworm was measured in the vicinity of parasite release sites at four almond orchards in the central valley and one backyard walnut planting in Riverside. Overwintering and impact data will be measured in the spring, summer and fall of 1980. Ways to integrate the effects of natural enemies with necessary orchard management practices will be studied.

Plans: Three species of parasitic wasps attacking navel orangeworm, Goniozus sp., Parasierola sp. and Diadegma sp., will continue to be released at the 1979 field study sites, and an appraisal of their role in controlling navel orangeworm will be made at the 1980 harvest, 1.5 years after initial introduction. Additional species of parasitic wasps are expected from Argentina and Uruguay this winter, and these will also be field released and evaluated.

One predatory Amblyseius sp. mite obtained from South Australia will be field tested against two-spotted and European red mites in the central valley and at Riverside. Additional strains of this species will be obtained from Loxton, Australia as the initial culture originated from a single mated female.

A study will be performed to evaluate the interference of dormant insecticidal sprays for peach twig borer on the natural enemies of navel orangeworm.

Details of the biology and ecology of introduced natural enemies will be sought.

The search in Australia for parasites and predators of phytophagous mites and carob moth will be intensified. It will be concentrated in the almond growing areas of south and western Australia where spray-free acreage is known to possess extremely low densities of phytophagous mites and carob moth (closely related to navel orangeworm). Particular emphasis will be on locating species or strains of natural enemies with winter cold and summer heat tolerances.

Almond Industry Participation $20,461

E. F. Legner

Contract #80-F7

80-F7

# BIOLOGICAL CONTROL OF NAVEL ORANGEWORM AND ALMOND-ATTACKING MITES

1980-81 Semi-annual Report
(through December 1980)

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An up-dated tabulation of the numbers of natural enemies liberated in California for biological control of navel orangeworm and phytophagous mites is shown in Table 1.

Current investigations show that two navel orangeworm parasitic wasps released in almond orchards in 1979 have successfully overwintered, persisted through the 1980 season, and have apparently reduced orangeworm populations in the immediate areas where they were released. These parasitic wasps are a Diadegma species from Loxton, Australia, and a Goniozus species from southern Uruguay and Argentina. Pentalitomastix plethoricus was also widespread in all study orchards. These parasites survived dormant sprays for mites and twig borers, but there is some evidence that dormant applications of insecticides reduced parasite numbers. In cooperation with Dr. Baldy (CSU Chico), Lonnie Hendricks (Merced), Joe Profida (Stockton), and Bill Barnett (Fresno), efforts are underway to improve the carry-over of these parasites in orchards where they are partially established. In some cases mummy almonds will be placed in containers covered with mesh which will permit the passage of the small wasps but not the navel orangeworm. The two wasps, Diadegma and Goniozus, plus a third (Chelonus mccombi Marsh) from south Texas are being released this fall and next spring in several spray-free orchards located from Fresno to Butte counties. A protozoan parasite, Mattesia sp., was also found to kill navel orangeworm larvae. These parasites are very specific and will not harm beneficial insects. They would easily disseminate through conventional spraying equipment, but no mass production scheme is known.

Navel orangeworm infestations at hull-split in August at 4 unsprayed experimental orchards were as follows: Chico (50-yr old trees) = 7.6%; Chico (15-yr old trees) = 5.8%; Chowchilla (8-yr old trees) = 3.6%; and Wasco (15-yr old trees) = 1.7%. These infestations about doubled on fruit that was left on the tree until mid-September.

Three predaceous mites, Amblyseius victoriensis and A. elinae from Australia and Phytoseiulus longipes from South Africa, were released in Kern County orchards this season. None were recovered in 1980. Releases of these and other predaceous mite species will be continued in 1981. Clover may act as a reservoir for predaceous mites particularly in the early season because it may sustain more alternate prey mites for the predators to feed on. With this in mind, work has been started to determine if it is advantageous to plant cover crops like clover.

Two foreign explorations for natural enemies in Costa Rica and southern Australia have produced some new parasitic species from Amyelois and Ectomyelois in the resepctive areas. Cultures are currently being attempted in quarantine at Riverside.

Table 1. Natural enemies released in California almond orchards for the biological control of navel orangeworm and phytophagous mites during the 1979-1980 period.

| Natural Enemy Species | Origin | Year Imported | Natural Host | TOTAL NO. LIBERATED 1979 | 1980 |
|---|---|---|---|---|---|
| *Chelonus* sp. nr. *curvimaculatus* Cameron | Addis Ababa Ethiopia | 1972 | *Pectinophora gossypiella* | 30,900 | 0 |
| *Chelonus* sp. nr. *curvimaculatus* Cameron | Ord River, NW Australia | 1975 | *Pectinophora gossypiella* | 37,700 | 0 |
| *Parasierola* sp. nr. *emigrata* (Rohwer) | Alice & Kingsville, Texas | 1978 | *Amyelois transitella* | 36,695 | 0 |
| *Bracon* sp. | Wasco, CA. | 1978 | *Amyelois transitella* | 9,500 | 0 |
| *Goniozus* sp. | South Uruguay & Argentina | 1979 | *Amyelois transitella* *Ectomyelois ceratoniae* | 18,900 | 25,250 |
| *Diadegma* sp. | Loxton, South Australia | 1979 | *Ectomyelois ceratoniae* | 9,480 | 39,840 |
| *Pentalitomastix plethoricus* Caltagirone | Brownwood, Texas | 1979 | *Amyelois transitella* | 22,000 | 0 |
| *Chelonus mccombi* Marsh | Harlingen, Texas | 1980 | *Amyelois transitella* | -- | 67,825 |
| *Amblyseius victoriensis* | South Australia | 1979 | *Tetranychus urticae* | -- | 1,600 |
| *Amblyseius elinae* | South Australia | 1979 | *Tetranychus urticae* | -- | 3,200 |
| *Phytoseiulus longipes* | South Africa | 1979 | *Tetranychus urticae* | -- | 3,200 |

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COLLEGE OF NATURAL AND
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CITRUS RESEARCH CENTER AND
AGRICULTURAL EXPERIMENT STATION
DEPARTMENT OF ENTOMOLOGY

DIVISION OF BIOLOGICAL CONTROL
RIVERSIDE, CALIFORNIA 92521

## BIOLOGICAL CONTROL

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