Oriental Fruit Moth Problem

in central California

Leslie M. Smith and Francis M. Summers

THE ORIENTAL fruit moth does its greatest damage to the peach, although other deciduous fruits, such as quince, nectarine, apricot, plum, cherry, apple, pear, and almond, are also attacked.

This pest is a moth in the adult stage. It is slate gray in color and about one quarter of an inch long.

The moths mate and lay eggs after sundown, between 6 p.m. and midnight. They rest on the foliage or bark of trees and are seldom seen during the day. In their development they pass through three distinct stages—egg, larva, and pupa—before reaching adulthood.

A single female deposits 60 to 120 eggs during her laying period of about 10 days. The eggs are cemented to the lower surfaces of the leaves and to the stems of tender shoots. They are not laid in clusters, but are distributed, several to a tree. Hatching occurs in from three to 13 days, according to prevailing temperatures. The newly hatched larva is about one sixteenth of an inch long.

Poison Deposit Not Swallowed

It is now well known that the young Oriental fruit larvae discard and do not swallow the surface tissues of the plant. This peculiar habit accounts for the failure of most stomach poisons to give satisfactory control.

Methods of Spreading

The larvae usually mature in 10 to 12 days. They then leave the plant tissues and seek suitable hiding places in which to spin their cocoons. These may be formed on the tree, in clefts of rough bark, or in the trash at the base of the tree. Larvae emerging from picked fruit are apt to form cocoons in the cracks or corners of fruit boxes and be transported in the boxes to other, noninfested areas. A new generation is started when adults emerge from the cocoons.

Damage

During spring months most of the injury is confined to the tender twigs. The young larva enters and bores downward into the core of a twig for one week or so, causing it to wilt and die. One larva may injure several twigs.

Larvae of summer generations, particularly those appearing in July or later, enter and feed within the fruit.

Experience in other states has proved that injuries to the trees are transient and minor in comparison with the losses of income due to wormy fruit.

Occurrence in California

An Oriental fruit moth survey, begun by the State Department of Agriculture in 1943, soon disclosed that the pest was established in four counties in southern California and that it already had entered the interior valleys.

By the end of the survey (1946) one or more Oriental fruit moths had been captured in each of ten counties in the San Joaquin, Sacramento, and Santa Clara valleys.

In no instance was there an indication of a thriving infestation in any of the several counties in the northern part of the state.

Localized infestations of a minor character were found in the San Joaquin Valley, at Parlier, Fresno County, and at Dinuba, Tulare County.

During the 1947 season, most of the properties in the San Joaquin, Sacramento, and Santa Clara valleys, where Oriental fruit moths were found previously by state survey crews, were reexamined.

Oriental fruit moths were trapped in two neighboring localities only, in the San Joaquin Valley, at Parlier, and at Dinuba. The small number of specimens captured indicated the presence of a very small population in each of the two places.

Seasonal History

The material included in this report covers only the life history and population studies of the moth in central California. This work was done at a field station established at Dinuba by the Division of Entomology and Parasitology.

Observations on the life history of the moth at Dinuba are relatively complete as regards insects reared under insectary conditions. Their application to actual orchard conditions is not yet fully understood because, to date, the pest has not increased to the point where continuous field observations are possible.

There are five generations per season in the insectary. All of the larvae produced in the first three generations transform to moths within the year. About one third of the fourth generation larvae and all of those of the fifth generation remain in their cocoons as overwintering forms. The first overwintering larvae appear among those which mature in the insectary during the first week of September.

Maturity Dates

Moths emerge from overwintered cocoons as early as March 20 in the insectary. They have been trapped in orchards near Parlier as early as March 19. Collections of larvae made in that locality during 1946 showed that most of the larvae of the first generation matured in the twigs on the trees during the early part of June.

Approximate peak maturity dates for later broods developing in twigs were: second generation, July 3; third generation, August 7; and fourth generation, September 5. October 11 was the final date on which larvae were taken from twigs during 1946.

The field population at Parlier was too sparse to show whether or not a substantial fifth generation of larvae occurs outside the insectary.

Influence of Summer Climate

A number of experiments were performed in the insectary at Dinuba to determine whether or not the summer climate of the San Joaquin Valley adversely affects Oriental fruit moth propagation.

The data obtained indicate that the temperature and humidity variations of the interior valley climate are not detrimental to the insect.

There are possibly other characteristics of that environment which tend to retard its season-to-season build-up. There is some evidence to the effect that continuing warm weather, in September and October, prevents the pest from entering its overwintering phase at a time when orchard conditions do not favor the growth of larvae.

It appears that many of the immature larvae, derived from late-season adults, perish for lack of fruit or succulent twigs on which to feed. The scarcity of succulent twigs or foliage after harvest also relates to the amount of water available in the soil.

Outlook

The insect is known to have been present in the interior valleys for as long as five years. During this time it has declined in many spots where first detected

until its presence cannot be demonstrated by usual methods, although at several points it has persisted in reduced numbers. We can expect very small populations for the next year or so at least.

Leslie M. Smith is Associate Professor of Entomology, and Associate Entomologist in the Experiment Station, Davis.

Francis M. Summers is Principal Laboratory Technician in the Experiment Station, Davis.

FUNGUS FLORA

Continued from page 4

some other factor, such as nematodes, pierces or weakens the root, the *Fusarium* is able to enter and cause further damage.

Even if *Fusarium* sp. 1 does not enter the citrus rootlets but grows in close association with them, getting its food material from dead root material, it is in the realm of possibility that it exerts an unfavorable influence on the plant.

When grown on plates it produces a substance which is toxic or antibiotic to other fungi.

If citrus cuttings are placed in a medium in which *Fusarium* sp. 1 has grown, the cuttings die in a short time, whereas cuttings in the same medium, which has not supported fungus growth, remain relatively healthy.

It can be stated that the growth of citrus does influence the nature of the soil fungus population. It is possible that this population directly, or more probably in combination with other factors, may exert a detrimental influence on the growth of the trees. More definite evidence in this connection is currently being sought.

J. P. Martin is Assistant Chemist in the Experiment Station, Division of Soils and Plant Nutrition, Riverside.

Harrietann Joseph is Senior Laboratory Technician, Citrus Experiment Station, Riverside.

Approximate Percentage Concentration of Certain Fungi Consistently Isolated from Old Citrus and Noncitrus Southern California Soils

Fungus species	Approximate percentage concentration	
	Old citrus soil	Noncitrus soil
Fusarium sp. 1	19	2
Fungus D1	18	not found
Pyrenochaeta sp.	12	not found
Penicillia (blue-green)	8	19
Penicillium vinaceum	5	6
Fusarium sp. 2	4	1
Penicillium restrictum	4	10
Aspergillus versicolor	2	3
Aspergillus ochraceus	2	1
Mucor sp.	1	2
Aspergillus niger	1	5
Monotospora brevis	1	<1
Aspergillus sydowi	1	2
Fungus M1	1	<1
Sclerotium sp.	1	<1
Penicillium humicola	<1	8
Trichoderma lignorum	<1	7
Penicillium nigricans	<1	3
Rhizopus nigricans	<1	1
Torula sp. 1	not found	2

PARATHION

Continued from page 3

ful consideration as was given DDT in the early applications.

It is suggested for the coming season, in order to reduce possible injury to the fruit and foliage, as well as to the operator, that only the wettable and dust formulations of Parathion be employed.

Due precautions should be taken when handling the undiluted material and from the drift of sprays and dusts.

The wettable material in the drum has a very objectionable musty odor but after dilutions in the water in the spray tank it is not so noticeable. A few days after spraying, the odor can hardly be detected in the orchard.

Excessive Dosages Not Needed

There is apparently no purpose served by employing excessive dosages of Parathion. The limits will probably be found between one fourth and 1½ pounds of a 15% wettable powder or equivalents of a 25% wettable powder.

Limited tests with 0.5% and 1% dusts have shown them to be adequate in most instances.

Compatibility

Parathion is on the acid side and is not compatible with strongly alkaline materials. It is not compatible with lime sulfur solution, bordeaux mixture, or oil emulsions.

It is, apparently, compatible with wettable sulfurs, neutral coppers, DDT, rotenone, pyrethrum, lead arsenate, and dusting sulfurs.

No Injury Noted

At the dosages and formulations thus far used in deciduous fruit orchards, Parathion has shown no injury to fruit or foliage, even under high summer temperatures, but much research is necessary before it can be considered entirely safe.

Its use with kerosene or spray oil has not been explored sufficiently on deciduous fruit. Indications are that these combinations may prove injurious.

Residue

Analytical methods for the study of spray residue deposits are known, but as yet very little technical data are available on spray residues.

Spray deposits apparently persist for a period of two to three weeks. There should be no spray residue problem on applications which are made a month prior to harvest.

No tolerance has yet been set by Federal agencies.

Availability

The availability of Parathion, in the coming season, will depend upon the speed at which the manufacturers of the technical material can get under production.

Apparently, Parathion will be available for future seasons, from most of the spray chemical companies, in formulations of wettable powders and dusts.

Arthur D. Borden, is Lecturer in Entomology, and Associate Entomologist in the Experiment Station, Berkeley.

UREA

Continued from page 10

more favorable economically, as well as providing a safe and palatable vehicle for this unpalatable substance and also favor bacterial activity in the rumen.

Use Probably Limited

In general, it would appear that urea will find a place in beef cattle feeding only when natural proteins are unavailable or when the price differential between protein and carbohydrate concentrates is very wide. To meet this possible use in the future, further tests are contemplated using pelleted materials containing urea.

H. R. Guilbert is Professor of Animal Husbandry, and Animal Husbandman in the Experiment Station, Davis.

G. H. Hart is Professor of Animal Husbandry, and Animal Husbandman in the Experiment Station, Davis.

K. A. Wagnon is Assistant in Animal Husbandry, Davis.