Leaf Miner on Deciduous Fruits

timing of spray applications important factor in control of pest on pear, apple, and cherry leaves

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An outbreak of an insect tentatively identified as the spotted tentiform leaf miner—*Lithocolletis crataegella* Clem.—occurred on the foliage of pear, apple and cherry orchards in northern California during the 1952 season.

Placer County, where most of the pear orchards were attacked, was most severely affected. It was not uncommon to find orchards with every leaf on the tree infested with 8–15 blotch type mines.

Since the outbreak, the leaf miner has been noted in almost all of the pear, apple and cherry growing districts of California.

The spotted tentiform leaf miner had never been reported in damaging numbers before last season but it has been observed on apples and pears for many years.

Miner damage is restricted to the foliage but in a high infestation over 50% of the leaf tissue is destroyed. Although the trees are not defoliated the function of the leaves is impaired. There is no evidence that this leaf damage results in weak trees or poor fruit set the following season, but continued damage over a period of two to three years may adversely affect the trees.

No native hosts of the spotted tentiform miner have been found but apple, pear, cherry and quince seem to be the favored hosts, with only a few mines found on prune, plum and peach.

Bartlett pear leaves distorted by leaf miner.

Pear leaf upper surface showing mines of leaf miner.

The Leaf Miner

The adult moth of the spotted tentiform miner is a small insect, 1/8″ in length. The forewings are golden brown in color, with silvery streaks margined with black. The wing margins have fine, long, rusty-gray hairs. When at rest, the wings are held rooflike over the body. The antennae are nearly as long as the body and are beaded. Males are usually smaller than the females, and have darker abdomens.

Eggs, when freshly laid, are opaque and faintly yellowish, becoming translucent as they mature. The egg is very small, elliptical in shape, and is normally deposited on the underside of the leaf.

The larva in the first three instars is flattened, wedge shaped, and legless; the body is white in color with a brown triangular head. In the fourth and fifth instars, the larva is cylindrical with true legs and prolegs present. The body color remains white in the fourth instar, turning yellowish in the fifth instar.

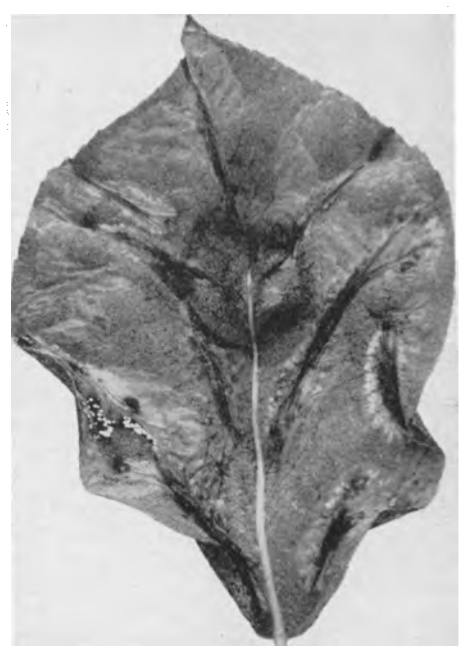
The pupa is slender, and about 1/8″ in length, enclosed in a light silken cocoon. The pupa turns dark brown as the time for the emergence of the adult draws near.

The insect overwinters as a pupa within the mines in the old leaves on the ground. Adults begin emerging from the overwintering pupae early in the spring. The first moths were seen this year on February 14. At that time, the trees were dormant.

The first eggs were found on March 10 on the young leaves of Comice and Anjou pears, which blossom and leaf out about two weeks earlier than does the Bartlett variety. Eggs were deposited on the undersurface of fully expanded leaves throughout the trees. Eggs were not deposited on young, unfolded leaves with heavy pubescence.

The adult moths rest during the day on the shady side of the tree trunks or in the cover crop. Between sundown and dark they fly into the trees where egg laying occurs. In the early morning, mating takes place, and as the sun rises the moths fly back down to the trunks of the trees and into the cover crop. In later generations, when trees are in full foliage, the adults remain in the trees during the day.

Lower surface of pear leaf showing mines.



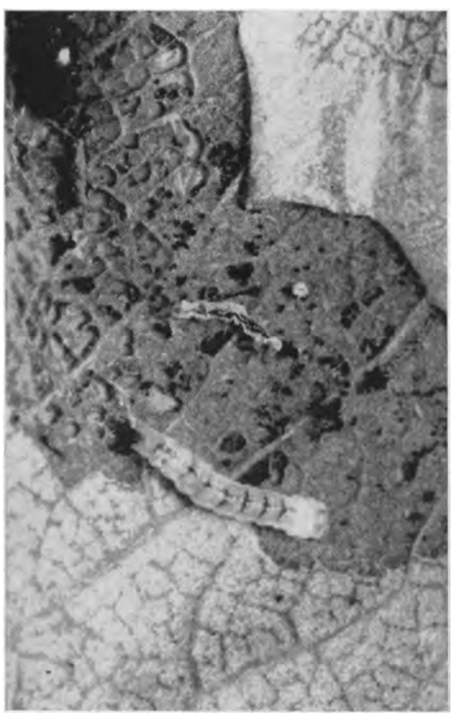
On hatching, the young larva mines through the underside of the egg directly into the leaf tissue. A linear or serpentine mine is formed in the first instar. During the succeeding two instars the feeding area is widened into a blotch type mine. The spongy tissue next to the lower epidermis is consumed, leaving a thin epidermal layer as a tent over the mine. The last two larval instars feed on the palisade cells just under the top epidermis of the leaf. They feed between the veins, and a spotted area is produced on the upper side of the leaf. During the fourth instar, the larva folds the lower epidermis covering the mine area lengthwise by means of silken threads, forming a pleated or tentiform mine.

Pupation takes place at one end of the mine within a silken cocoon. On emergence, the pupa pushes out of the lower epidermis to about one-third of its length, and the old pupa case remains in the mine after the moth emerges.

There are four generations during the season. The first generation from March to May, the second from May to July, the third from July to September, and the fourth is the overwintering generation which begins in September. Pupae of this generation are formed in October and early November, and remain within the mines on fallen leaves. Adults of this overwintering generation do not emerge until the following spring.

First generation mines are found on the small, early developed leaves, and are often hidden by later foliage growth. Succeeding generations develop in the new growth until by August the entire tree is infested. Considerable overlapping takes place by the second and third generations, adults of both generations being present at the same time. A further overlapping occurs from the pear varieties such as Anjou, Comice and Hardy, since they leaf out prior to Bartletts, and development of larvae on these varieties is about two weeks ahead of those on Bartletts.

Mine opened to show larva frass pile and feeding area.



At least three species of parasites have been collected from the larvae and pupae of the leaf miner. All are external parasites of the developing larvae and complete their life cycle within the mines. In some heavily infested orchards, natural mortality was very high toward the end of the 1952–1953 season, reaching 98% or better by October. Of this, 55% was directly attributable to parasites. The effect of existing spray programs on parasites is one factor which will be further studied this season.

Control Experiments

In the fall of 1952, a screening test was set up to find what chemicals were effective against the spotted tentiform leaf miner. In the spring of 1953, the more promising materials from the fall experiment were set up in a more extensive plot. Applications were made in late April, when the eggs of the first generation had hatched and their mines were beginning to pinch up.

Twelve tree plots, replicated twice, were used, employing conventional ground equipment with orchard guns. The materials were applied at approximately 600 gallons of dilute spray per acre. Two weeks after application, mortality counts were made by examining 100 mines per treatment, and recording living and dead larvae.

Results of April Applications

Material	Dosage per 100 gals.	% mortality
Parathion	1 lb. 25% wettable	100
Black-Leaf 253	2 lbs. 50% wettable	100
Nicotine Sulfate + light medium summer oil	¾ pint + 1½ gals.	97
Dieldrin*	½ lb. actual	97
Aldrin*	½ lb. actual	91
EPN	¾ lb. 27%	89
Heptachlor*	½ lb. actual	86
Check (grower applied DDT)	2 lbs. 50% wettable	27

*** These materials are not as yet registered for foliage treatment on deciduous fruits in California.**

Adult moth of spotted tentiform leaf miner *Lithocolletis crataegella* Clem.

Later experiments showed that parathion was effective against the eggs and pupae as well as the adults. Nicotine sulfate with summer oil was more effective against the earlier larval instars than the the later instars, and ineffective against pupae. Timing of applications would be of paramount importance in using this latter combination.

In several orchards it was noted that prebloom sprays of dieldrin, parathion or lindane, directed against the cover crops for stink bug control, completely killed the adult moths of the leaf miner. The possibility of such a treatment will be explored next season.

Timing of the treatment is very important. Control of the first generation would be the most logical approach because the overlapping of generations later in the season would make chemical control measures difficult. From the results of the 1952–1953 season's work it seems that a treatment applied after all of the first generation eggs have hatched and before any second generation moths have emerged probably would be the most feasible.

Because the 1953 season was an unusual one—with warm temperatures in February and March—the moths may not emerge from overwintering pupae as early as was recorded this spring. Timing of the applications will depend on weather conditions, which may affect the emergence of adults in the spring and the development of the first generation larvae, and may or may not coincide with the standard codling moth spray treatments.

Studies on both biology and control of the leaf miner will be continued.

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