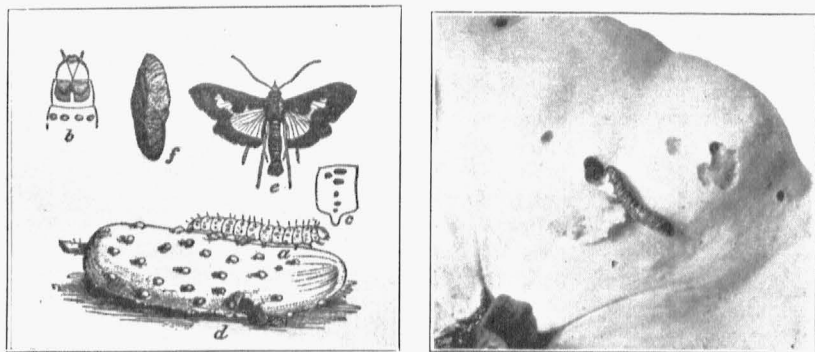


THE PICKLE WORM AND ITS CONTROL

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At left are shown: (a) larva of pickle worm, (b) head and first three segments of larva, (c) segment from side, (d) pickle showing injury, (e) moth, (f) cocoon. (After Riley). At right is shown typical injury to summer squash by full-grown larva.

During the late summer of 1923 the cantaloupe crop in Southeast Missouri was practically destroyed by the pickle worm, *Diolophania nitidolis* (Cramer). This pest attacks not only cantaloupes but also the cucumbers, squashes and muskmelons. It is reported that it will feed on the watermelon; but no serious injury has ever been caused to watermelons by this pest. As a matter of fact the pest's favorite food is squash and when this food can be obtained all other related crops escape serious injury.

The pickle worm was first reported from Missouri by C. V. Riley in 1869. The name "pickle worm" which is somewhat of a misnomer, was given to the insect at that time by Riley because he found it most abundant in cucumbers which were grown for pickling purposes. He reported the pest as causing considerable damage in the vicinity of St. Louis at that time.

The insect is sometimes called the melon worm or the melon borer, though the name "melon worm" is more commonly applied to a related species which is seldom as serious a pest as the pickle worm.

The pickle worm is common throughout the southern part of the United States including Missouri. The damage which it causes to cucurbits however varies considerably from year to year. Like many other serious pests some years very few are noted and the damage they do amounts to very little, while the following year they may appear in very large numbers and practically destroy the entire crop. There is no way of predicting an outbreak of pickle worms. It is necessary therefore to be constantly on the watch for this pest.

There is probably no cucurbit which is entirely immune from attack by the pickle worm. The cantaloupe, squash and cucumber, however, are the favorite food plants, and of these the squash is preferred. On these plants the worms feed freely in the opening bud clusters, in the blossoms, in the leaf stem, in the main stem and in the fruit. The worms are very fond of the large blossoms and the unopened buds of the summer squashes. If this type of food can be obtained the fruit is seldom bothered. Many of the worms feed upon the blossoms and the opening buds at first and then later attack the fruit. The real loss to the grower is due to the injury to the maturing fruit. The small worms may only make a shallow cavity in the rind but the larger ones usually burrow directly through and feed on the interior. It is not uncommon for one worm to make several holes in the same fruit, or to move from one fruit to another. Thus one worm may destroy several melons. A small cavity or burrow admitting air soon causes a melon to sour and rot.

LIFE CYCLE

Adult.—The adult moth of the pickle worm has a rather striking appearance, but it is seldom seen, because it flies only at night. The adult has a wing expansion of 1 to 1¼ inches. The length of the body is about ⅝ inch. The wing markings are very distinct and the moth can be readily identified by the color and markings of the wings. They are yellowish brown in general with a somewhat purplish metallic reflection. The distinguishing character however is a large irregular spot on the front wing which has a slight yellowish tinge and is semi-transparent. The adults appear about June 15 but are seldom noticed at this time, as it is the later generations which cause so much damage.

Egg.—Egg deposition takes place at night, probably after midnight as the moths are seldom on the wing before that hour. The eggs when first deposited are nearly white in color but soon take on a yellowish hue. They are elliptical in outline, flat and about one-twentieth of an inch long. The eggs are deposited in clusters of from two to seven and are placed on the buds, flowers, terminal stems and the more tender portions of the foliage. They are not firmly attached, being placed more or less loosely among the plant hairs.

Larva.—The eggs hatch in four days and the little white larvae begin to feed in the soft tissues of the bud, flower or fruit. A majority of the larvae feed on buds and flowers or other tender parts of the plant until they are about half grown and then migrate to the fruit. Some larvae however may complete their entire growth in the buds, flowers or stem of the plant. After the last molt the larva is whitish or it may take on a greenish or yellowish tinge due to the color of the food. The head is yellowish brown in color and the fully mature worm is about three-fifths of an inch long. It takes the caterpillar twelve to sixteen days to mature after hatching.

Pupa.—When the larva becomes fully mature it crawls to the fold of some wilted or dead leaf and spins a scanty cocoon in which it pupates. During the

summer the pupal stage lasts between eight and nine days. The pupae of the last generation remain over the winter. It takes from twenty-four to thirty-one days for a summer brood to complete its life cycle, that is from the egg to the adult. Ordinarily there are four generations per year in Missouri.

The first generation is usually overlooked. The numbers increase rapidly with the later generations however, and if the season is favorable for the reproduction of the insects they become so numerous as to destroy the entire crop.

DAMAGE

Ordinarily the pickle worm is not a serious pest in Missouri. A few are present every year and cucurbits may suffer to some extent. In some years, however, serious outbreaks occur and the worms of the later generations are so numerous that few squashes, cucumbers or cantaloupes escape injury. It is impossible to forecast a serious outbreak of pickle worms, and consequently, when such an outbreak does occur, entire crops of squashes, cucumbers and cantaloupes are badly damaged or totally ruined. Such was the case in Southeast Missouri in the summer of 1923 when practically the entire cantaloupe crop was ruined due to the ravages of this pest. The spring of 1923 was cold and wet. The growers did not get the seed in until late with the result that the crop did not begin to ripen until the first week in August. Normally in Southeast Missouri the cantaloupe crop is harvested during the first half of July. Thus the crop came on about three weeks later than normal and at just the right time to receive the greatest amount of injury from a heavy brood of pickle worms. If the crop had ripened at the usual time, there is no doubt that it would have escaped any great amount of injury.

During the first week in August, 1923 a survey was made of the cantaloupe fields at Holcomb and Kennett in Dunklin County, Missouri. More than nine-tenths of all cantaloupes in every field visited were injured by the pickle worms to such an extent that they could not be marketed. Each infested cantaloupe contained from one to six worms. A comparison of the yield for 1922 with that of 1923 in the Holcomb and Kennett districts is interesting.

In 1922 at Holcomb 130 acres of cantaloupes were grown which produced 30 carloads. An average net profit of \$350 per car was realized making a total net profit for the district of \$10,500. In 1923 in the same district 70 acres of cantaloupes were grown. A yield of 16 carloads was expected. Two carloads were marketed instead. The pickle worm got the other 14 cars. The loss was estimated at \$5,000.

At Kennett in 1922 about 100 acres of cantaloupes were grown which produced about 15 carloads of marketable melons. In 1923 about 30 acres were grown and less than 2 carloads were harvested. The loss suffered by the growers was approximately \$3,000.

This serious outbreak of pickle worms in Southeast Missouri was wholly unexpected. Since it was the first serious outbreak since the development of the cantaloupe industry in that section, the growers were unacquainted with the pest. Much of the loss could have been prevented could the outbreak have been foreseen. It is hoped that this report will be of value in combating future outbreaks.

CONTROL

The pickle worm has few natural enemies, and due to its feeding habits arsenical sprays are of little or no value. Control therefore depends almost

entirely on cultural methods. The larvae of the last generation in the late summer crawl into folded leaves or under some rubbish and spin flimsy cocoons in which they pupate. They pass the winter in this manner. In the fall all loose rubbish such as dead leaves, vines and weeds should be raked together and burned or plowed under. This destroys the over-wintering pupae. This phase of the control work should never be overlooked. Many serious insect pests other than the pickle worm are destroyed in this manner. Also during the summer if cantaloupes, squashes or cucumbers are badly infested it is well to plow under the entire crop immediately. This destroys hundreds of the insects and prevents further natural increase. Where only a portion of the crop is infested it should be plowed under after the uninjured melons are harvested. Early plowing is of greater value than late plowing or winter plowing as it prevents or greatly reduces later increase. Rotating the crop to other fields is of little value in fighting the pickle worm as the adults are capable of flying considerable distances.

Early planting when possible should always be practiced. The later generations of the pickle worm, those which come in late July and August, cause the greatest amount of damage. If the crop can be planted early enough so that it will mature before the insects become numerous, very little damage will be done. Late cantaloupes, cucumbers and squashes are always badly damaged during a serious outbreak while the early ones may entirely escape injury.

Probably the most effective means of protecting the cantaloupe or the cucumber crop from pickle worms is by the use of a trap crop of summer squashes. The pickle worm is partial to the squashes, and if this type of food can be obtained it will be used in preference to all others. The adult moth will deposit her eggs on squashes in preference to cucumbers or cantaloupes. When the eggs hatch the larvae will remain on the squashes, feeding in the young buds, in the blossoms or the fruit, and as long as this type of food lasts cantaloupes and cucumbers will escape serious injury.

Four rows of summer squashes equally spaced across a one-acre field of cantaloupes will afford ample protection. The first squashes should be planted about two weeks later than the cantaloupes. Additional squashes should be planted at intervals of about two weeks until the last of June or first of July. This keeps a fresh supply of squashes coming on at all times. The moths deposit their eggs on the young buds and blossoms of the squashes. When the blossoms become heavily infested with worms they should be picked off and destroyed. Careful tests have thoroughly demonstrated that a cantaloupe crop can be grown with safety where four rows of summer squashes to the acre are grown as a trap crop.

There is no danger of injuring the quality or flavor of the cantaloupe by growing squashes in the field; but it is not advisable to use the seed of such cantaloupes for the crop the following year. Seed should be secured from cantaloupes grown away from squashes.

When the following precautions are taken cantaloupes can be successfully grown without any serious injury from the pickle worm.

1. Destruction of all dead vines, weeds and rubbish by burning or by plowing under just as soon as the crop is harvested.
2. Practice late summer or early fall plowing of melon fields.
3. Use a trap crop of summer squashes. Keep a fresh supply of squash blossoms coming on during the entire season and then destroy the blossoms as soon as they become heavily infested.