

## Insect Pests of Cucurbit Crops in Indiana<sup>1</sup>

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A study of the biology and control of the striped cucumber beetle during the years 1932 to 1942 revealed the presence of many other insect pests on cucurbit crops in Indiana. While the striped cucumber beetle and the melon aphid were found to be the two most serious pests of cucumbers, cantaloupes and watermelons, and these two in addition to the squash bug and the squash borer on squash and pumpkin, 25 other insects were observed on these crops. In attempting to estimate the damage one pest does to a crop, it is necessary to know the other insects on these same plants and the extent to which their damage contributes to the total loss. In addition, it is frequently possible to direct one insecticide application at two or more insects and thereby reduce the cost of producing the crop.

In a previous publication (Gould, 1944) it was estimated that insects damage cucurbit crops in Indiana to the extent of over \$525,000 annually. Most of this loss is caused by the four insects mentioned above, although other pests have contributed substantially to this total in some years. In the following discussion the 10 major pests of cucurbits have been listed according to their economic importance, while the others are occasional pests and cannot be accurately classified as to which is the more important.

1. The striped cucumber beetle, *Diabrotica vittata* (Fabr.), is the most important pest of cucurbits in Indiana. During the past 12 seasons it has been a serious pest in fields around Lafayette every year and caused from 10 to 60 per cent loss to these crops. One canning company in northern Indiana reported a 75 per cent loss of their crop in 1943 from the beetles and bacterial wilt. Damage by this insect is caused in three different ways: the feeding of the adults on seedlings and mature plants; the feeding of the larvae on the roots; and the transmission of bacterial wilt of cucurbits. The feeding of the adults upon unprotected seedlings often necessitates the replanting of fields, as the beetles migrate in about the time the plants are coming up. An even more serious type of damage results from the feeding, which usually inoculates the plants with the organism causing bacterial wilt. In this instance plants grow long enough to bloom or even produce a few fruits before the disease kills them.

The details of the life history have been worked out by the author (1944). The life history in brief is as follows: the adult beetles hibernate under leaves and other debris on south slopes of wooded hillsides. In the spring the beetles emerge and feed on a number of early blooming flowers until the cucurbits are present. Then the beetles migrate into the fields,

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where the female lays her eggs singly in the soil around the roots. Eggs hatch in about a week and the larvae feed on the roots for about two weeks before changing into pupae in the soil. After eight to 10 days in this stage the new beetles emerge and start feeding on the foliage of cucurbits. In the vicinity of Lafayette this insect has two generations a year, with the peak of the first brood beetles present around July 15, while the second brood of beetles start emerging around August 15 and continue until frost. These beetles hibernate and come out the following spring, having a life span of 10 to 11 months.

In July of 1942, a number of striped cucumber beetles were observed on squash and cucumbers in the experimental plots near Lafayette that differed from the usual striped beetle. Even in the field this new beetle could be readily distinguished from the regular form by its broader black stripes on the elytra and the yellow abdomen in place of the normal black. A series of these beetles were sent to the taxonomic division of the U. S. Bureau of Entomology and Plant Quarantine and were reported to be a new species by H. S. Barber. Mr. Barber will describe this species in the near future.

2. The melon louse or aphid, *Aphis gossypii* Glov., is a serious pest on cucumbers, cantaloupes and watermelons, but rarely attacks squash and pumpkin. This insect was present every year during this study and frequently was the cause of the early death of the crop. The aphid population normally built up slowly during the early part of the summer, but around the first of August was usually sufficiently large to kill some plants. In some seasons aphids were held in check by parasites and predators, especially by ladybird beetles (Coccinellidae) and their larvae and by the larvae of lace-wing flies (Chrysopidae). The feeding of plant lice caused a typical curling of the leaves, which protected the insects from insecticide applications. Heavily infested areas in fields were easily detected as a black mold developed on the sweetened secretions of the aphids.

In studies on the control of the cucumber beetle it was found that plots treated with certain insecticide mixtures had a larger aphid population than untreated areas. The most serious aphid population was found on plots treated with calcium arsenate, as they appeared there first and seemed to develop in destructive numbers earliest. In a normal season the first aphid infestations were noticed about the time the plants were starting to vine and gradually increased until many plants were dying after about the second or third week of harvest. Observations over a period of years showed the following intensity of aphid damage from heaviest to lightest on plots treated with the various mixtures:

1. Calcium arsenate dust
2. Bordeaux-calcium arsenate spray
3. Cryolite dust
4. No treatment
5. Rotenone dust

Plots treated with rotenone mixtures actually had less damage from aphids than the untreated area, but since rotenone gave poor control of

the striped cucumber beetle, it was found best to use nicotine in conjunction with one of the other treatments.

3. The squash bug, *Anasa tristis* (DeG.), was found to be an exceedingly destructive enemy of squash and pumpkin and occasionally attacked cucumbers and cantaloupe. Many reports of this pest injuring cucumbers have been received, but only in the past few years has injury been seen in the experimental plots. Damage to squash and pumpkin was caused by both nymphs and adults, which eventually killed most plants either alone or in conjunction with the squash borer. Adults hibernated in debris around the garden area and in woods and fence rows nearby. In the spring the adults appeared in June when squash were about ready to bloom. The feeding of these bugs on the plants frequently caused a wilting condition of the plants known as *Anasa* wilt. The females started laying clusters of brown eggs on the foliage in early July and from them the small gray nymphs emerged and started feeding. Both nymphs and adults were gregarious and often several hundred were found on a single plant. There was one generation a year of this insect.

Squash bugs and the squash borer have made it almost impossible to grow squash and pumpkins. It was difficult to say which of the two was the more destructive, as usually both contributed to the death of the plants. Examination of several bush (Zucchini) squash dying early in the summer of 1941 with *Anasa* wilt revealed 10 to 20 adult bugs on the lower leaves of wilting plants. Since this wilting condition occurred before nymphs were present, it was concluded that only the feeding of the adults was responsible for this damage. Plants dying later in the season had both the adults and nymphs feeding on foliage and stems as well as many borers in the base of the plants.

Damage to cucumbers was caused by the overwintering squash bugs attacking small plants with only three to eight leaves. The affected plants when first noticed resembled cucurbit wilt, except that the entire plant wilted in a period of about 24 hours. An examination of wilting plants always revealed one or more adult bugs still feeding. Squash bug eggs were found on cucumbers on only one occasion, although many nymphs, migrants from nearby squash, have been collected on cucumbers. The young apparently did not cause the disease-like condition of the plants.

The damage by the adult bugs to cucumbers was checked in the laboratory by placing one bug in a cage with a cucumber plant. At the end of 24 hours the plant was wilting and died the following day. In another cage three bugs were placed on one plant and allowed to feed one hour, when the plant showed signs of wilting. The bugs were removed and the plant recovered.

4. Squash borer, *Melittia satyriniformis* Hbn., is a serious pest of squash and pumpkin but has not been found attacking cucumbers and cantaloupes. The eggs of this lepidopterous borer were laid on the stems and leaves near the base of the plant. The young larvae upon hatching entered the stems near the ground and remained there until maturity. The large base of the squash plant was well suited to this insect, for often as many as 25 to 50 borers in all stages of development were found

in one plant. Injury from this insect could be distinguished from Anasa wilt by the dying of the ends of long runners first. The wilting symptoms of an infested plant were commonly observed on hot days and resembled the symptoms of bacterial wilt in cucumbers.

5. The 12-spotted cucumber beetle, *Diabrotica 12-punctata* (F.), has been a destructive pest of cucumbers, cantaloupe, squash, pumpkins, watermelons, and gourds in practically all seasons of this study. This insect in the adult stage was a serious pest of many plants, such as beans, turnips, tomatoes, and flowering plants, while the larval stage was confined to the roots of corn. On cucurbit crops the beetle was usually less abundant than the striped beetle but was still an important factor in the spread of bacterial wilt of cucurbits.

So far as known, this insect does not hibernate in Indiana but flies north each spring. In the fall these beetles were found abundant on golden rod and wild aster in protected locations. Searches were made several times during each winter for hibernating striped cucumber beetles, and in these searches no spotted beetles were ever found. Our first record of these beetles in the spring was about May 5, although it is usually the last of May before many can be found in the fields. Eggs were laid around the roots of corn and the first adults of this brood were observed during the last 10 days of July. Beetles were exceedingly abundant during the late summer of 1943 and caused considerable damage to pods of green beans, the silks of sweet corn, and ripening tomato fruits. On August 15, 1941, large numbers of beetles were observed destroying the foliage and fruits of ornamental gourds.

On cucumbers and related crops the calcium arsenate-insoluble copper dust mixture used against the striped cucumber beetle was found to be effective against this species, although the beetles were repelled rather than killed.

6. Pale striped flea beetle, *Systema blanda* Melsh., was a serious pest on cucurbits during several seasons of this study. This pest was exceedingly abundant early in the spring in most years but occasionally persisted until the middle of July. This beetle was found on a number of wild and cultivated host plants and usually migrated to cucurbits as soon as they were up. Feeding on the small seedlings usually resulted in their death. In 1941 some hybrid cucumbers were planted around the edge of the experimental plot and were to be left untreated for records on survival from bacterial wilt. Flea beetles became so numerous on these hybrids that they had to be dusted four times in a period of about 21 days to save them for the wilt tests. The regular cucumber beetle dust gave good control of this pest.

7. Cutworms, especially the greasy cutworm, *Argrotis ypsilon* (Rott.), were destructive to cucumber plants during several seasons. Some species of cutworms were usually present in the field when the plants came up, and a single worm frequently ate several adjacent plants in a single night. Other species of cutworms were present during the summer months but seldom damaged the plants. Losses from these pests were usually negligible, although damage was frequently found in fields which had been weedy the previous year.

8. The pickleworm, *Diaphania nitidalis* (Stoll), was first observed in the field about the first of August and attacked the maturing fruits of cucumbers, cantaloupe, squash and pumpkins. Losses from this insect, which bored into and ruined the fruits, were quite severe on those maturing late in August and in September. The female moth laid her eggs on the stems and the young larvae usually fed in the blossoms until about one-third grown, when they migrated to the fruits. The worm entered the fruit and fed on the interior in such a manner that the fruit usually rotted. The opening in the fruit was plugged with green frass by the larva. Larvae frequently migrated from fruit to fruit. Damage has been reported from the southern part of Indiana, and in seasons with a late fall losses in northern Indiana are sometimes serious.

In 1937 the worms became quite abundant in cucumbers grown for pickles in northern Indiana. Since the pickles were harvested before the fruits were mature, worms were frequently found in the fruits after processing. During that winter one canning company sent in a number of specimens of preserved worms both in and out of the pickles, as well as many pickles with holes through the center. Since the presence of the worm or its feces in the finished product constituted a violation of the pure food laws, the company was greatly concerned. During the 1938 season they hired extra help on their grading machines and offered a bonus for each worm or infested cucumber found. In checking the situation on August 24, it was found that at least 90 per cent of the 480 contract growers were bringing in wormy cucumbers. In that week the graders found over 600 wormy fruits.

Growers in northern Indiana have not attempted to control the pickleworm, since outbreaks of this pest were sporadic and could not be predicted. In addition, the worms fed inside the fruits from the time they were half grown, and so any attempt at control had to be made when the young larvae were feeding in the blossoms.

9. The horned squash bug, *Anasa armigera* (Say), is similar to the true squash bug, from which it can be distinguished by the lighter color of the abdominal margins and by the sharp spine at the base of the antennae. Its type of feeding and habits were identical to the other species, except that attacks on cucumbers were more frequently made by the horned bug. This species was seldom observed a few years ago, but now it has increased in abundance to that it is frequently the predominant form found early in the season. The egg and nymphs of this species were not observed in these studies, unless they were confused with those of *A. tristis*.

10. The garden springtail, *Bourletiella hortensis* (Fitch), is a small Collembola frequently found on vegetables in early spring. It inhabits damp soils which have considerable decaying vegetation in them. Attacks from these little pests are rather sporadic, although some damage to squash, cucumbers and cantaloupes has been observed during these studies. The insect is almost microscopic in size and when disturbed jumps and quickly disappears. In some seasons they were so numerous that they covered the leaves and gave them a blackish appearance.

11. Another springtail, *Achorntes manubiralis* Tull., has been recorded in the north central states by Folsom as abundant and injurious in cold frames, where it caused serious damage to seedling cucumbers and melons. This insect was not observed during these studies, but probably occurs in Indiana.

12. The squash ladybird beetle, *Epilachna borealis* (Fabr.), is a common pest of squash and pumpkins in the southern states and occurs in those counties in Indiana bordering the Ohio River. No serious loss has been reported from this insect in this state, although the large colonies of hibernating beetles are frequently seen during the winter under the bark of trees.

13. The squash aphid, *Macrosiphum cucurbitate* (Midd.), has been observed on some occasions but never in serious numbers. This species is much larger than the melon aphid and can be distinguished from it by its longer legs, cornicles and antennae.

14. The potato flea beetle, *Epitrix cucumeris* (Harris), has been found on cucumbers, cantaloupes and squash on rare occasions. Although its specific name refers to the cucumber, this pest shows a decided preference for members of the solanaceous family.

15. The smartweed flea beetle, *Systema frontalis* (Fabr.), was observed feeding on cucumbers at Lafayette in 1941. The injury was slight. Many weeds, including smartweed, its common host, were growing around the cucumbers.

16. The melon worm, *Diaphania hyalinata* (Linn.), is a relative of the pickleworm and has been recorded in the northern states even less frequently than its relative. The only record of this insect in the Purdue collection is a specimen reared from squash at Lafayette in October, 1936. Damage by this insect is similar to that of the pickleworm.

17. The tarnished plant bug, *Lygus oblineatus* (Say), is a general feeder that attacks a number of wild and cultivated host plants. No serious infestation of this insect was observed on cucurbit crops, although many adults were seen on these plants in the fall. On cantaloupes this insect was frequently found feeding on the soft tissue where the stem was breaking from the ripe fruit.

18. The garden flea hopper, *Halticus citri* (Ashm.), is another general feeder found on a number of cultivated and wild plants. This small black bug was frequently seen on cucurbits, but no serious injury has been recorded.

19. The false chinch bug, *Nysius ericae* (Schill.), is a common insect in vegetable gardens, although it is usually found feeding on weeds. This insect was found on cucumbers in a number of years, but always in small numbers.

20. The leaf-footed plant bug, *Leptoglossus oppositus* Say, is listed as a pest of cucurbits, but no damage was observed in these studies.

21. Adults of the northern corn rootworm, *Diabrotica longicornis* (Say), was collected feeding on the foliage of cucumbers, squash and cantaloupe in the late summer. The larvae of this pest are restricted in their feeding to the roots of corn, while the beetles feed on a number of plants.

22. The garden webworm, *Loxostege similalis* (Guenee), has been observed feeding on the foliage of cucumbers and cantaloupe during August and September of most years of this study. In certain seasons this pest was present in large numbers on many weeds and cultivated plants. Damage from this pest to cucurbits was slight, even though many leaves were webbed by the webworm larvae.

23. The corn earworm, *Heliothis armigera* (Hbn.), was found in the fruits of cantaloupe and cucumbers on two occasions. These were both in the late fall when normal food plants were absent.

24. The yellow woolly-bear caterpillar, *Diacrisia virginica* (Fabr.), is frequently common in the fall and occasionally feeds on the fruits of cucumbers.

25. The common onion thrips, *Thrips tabaci* Lind., is a general pest and frequently feeds on cucurbit crops. It is frequently serious on cucumbers grown in greenhouses.

26. The common red spider, *Tetranychus telarius* Linn., is seldom found in serious numbers on cucurbits in the field, but, like the thrips, is frequently a serious pest in greenhouses.

27. Two stink bug, *Euschistus euschistoides* (Voll.) and *E. variolarius* (P. B.), were observed as common pests on several garden crops and were collected in considerable numbers on cantaloupes. These bugs preferred the ripe fruits and fed on the soft tissue exposed when the fruit broke loose from the stem. No damage was caused.

#### Literature Cited

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