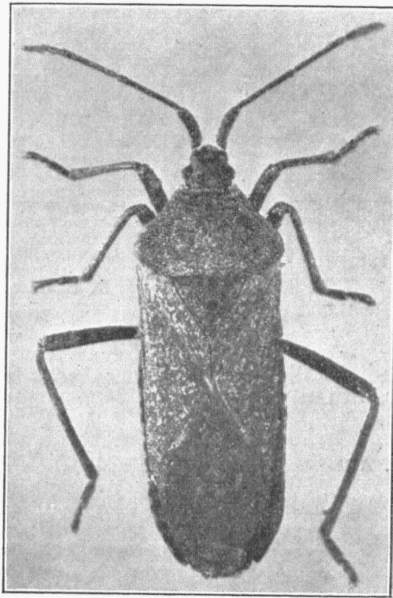


UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE
AGRICULTURAL EXPERIMENT STATION

F. B. MUMFORD, *Director*

Controlling Insect Pests of Melons, Cucumbers, and Related Crops

LEONARD HASEMAN



Squash Bug, enlarged.

COLUMBIA, MISSOURI

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Controlling Insect Pests of Melons, Cucumbers, and Related Crops

LEONARD HASEMAN

The cucurbits, including especially watermelons, cucumbers, squashes, cantaloupes and pumpkins, are important crops in Missouri. Several thousand acres of these are grown each year in the trucking centers around St. Louis, Kansas City, and other large cities, in the melon-growing area of southeast Missouri, and elsewhere along the larger rivers, and in home gardens. Net returns from these crops, when properly handled, far exceed average returns on corn and other field crops. For a number of years, the writer has been studying the insect pests and their effect on the growing of melons and related crops and, similar to the experience of successful growers, he has found that the two most important limiting factors in the successful growing of these crops in Missouri are their insect enemies and plant diseases. Overnight a promising crop may be practically ruined. This report has been prepared to assist growers in handling those insect pests which threaten the future profitable growing of these crops in this State.

MOST IMPORTANT INSECT PESTS

While melons and cucumbers are thought to have originated in Asia or, at least, in the eastern hemisphere, and pumpkins and squashes in the western hemisphere, the major insect pests of these crops in this country are, seemingly, of American origin. Of these, the striped and 12-spotted cucumber beetles, the squash bug, the melon louse, the squash vine borer, and the pickle and melon worms prove most injurious in this State. Various other insects which are general feeders may attack these crops, but these pests are the ones most closely associated with the cucurbits and require most attention.

Striped Cucumber Beetle (*Diabrotica vittata Fabricius*)

This small, yellow beetle, with three conspicuous black stripes down its back, is probably the most important single pest of the cucurbit crops. It is a native pest and occurs wherever its food plants are grown in this country, except in the far western states where a related species occurs.

Life History.—The pest lives through the winter collected in colonies of from a few beetles to two or three dozen under leaves, dry grass, or similar protection. In the spring, as a rule, by the time fruit trees are in bloom they leave winter quarters and may feed on the blossoms of fruit trees and other flowers. Then, as



Fig. 2—Striped Cucumber Beetle, enlarged.

soon as early cucumbers, squashes, or melons begin to come up, they collect in numbers on the young plants, often completely destroying them in a day or two. They tend to work in droves or packs, one hill of plants often having from 25 to 50 beetles on it, while other hills may have few or none. This tendency to attack in mass when the plants are small makes this pest a most important one.

After the beetles feed for a time they deposit their eggs around the base of the plants. These produce small, white worms with brown heads and tail plates, which bore into the base of the stems, roots, or the vines and fruits where they touch the ground. These grubs may seriously damage the plants or even kill the vines after the fruit sets. In about a month these grubs are full-fed, when they go into the ground and make a small earthen cell in which they change to the soft, white pupa. In about a week the pupa changes to the beetle, which comes out of the ground and soon begins to feed.

Under Missouri conditions, the beetles of the overwintering generation usually appear in the garden and melon field early in June, and the beetles of the second generation appear by late July

or early August. Late cucumbers, melons, or squashes are again attacked by the summer generation of beetles, some of which may mate and produce a summer generation of worms. After the plants begin to vine, the beetles may feed on and seriously damage the blossoms and young developing fruits. Late in the fall, even after killing frosts, the beetles continue to feed on the immature squashes and melons before going into hibernation.

Nature and Extent of Damage.—By far the most destructive work of this pest is done by the ravenous beetles soon after they come out of hibernation. At that time, the young plants, if not protected, may be completely destroyed in a few hours. Whole fields of watermelons in southeast Missouri may be destroyed

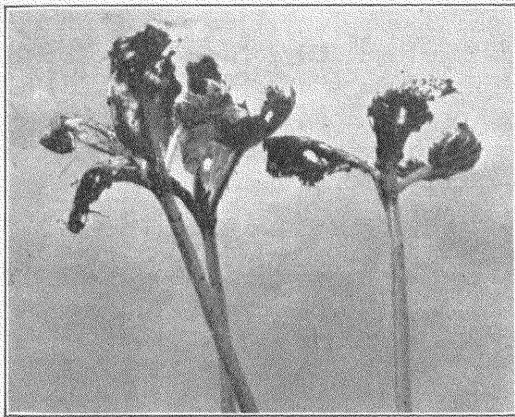


Fig. 3—Striped Cucumber Beetle Injury to Young Cucumber Plants.

in a few days, often before the grower knows that the beetles are at work. Growers speak of their sucking on the stems, but they really gnaw both the stem and the cotyledons. After the crop once begins to vine, the beetles may continue to feed but they cause most damage then by feeding in the blossoms and on the newly set fruits. The beetles, besides causing damage by feeding, may also spread bacterial wilt from plant to plant or field to field. They seem to carry the bacteria in their own bodies through the winter and inoculate the plants when they begin to feed in the summer. The beetle stage, therefore, is destructive not only by feeding on the plants but also by spreading disease.

The larvae are less destructive but their damage may prove serious. Usually the plants begin to vine and set fruits before the damage caused by the larvae shows up. Besides weakening or

even killing the vines when abundant the larvae may also do some damage to the green fruits. However, if one is careful to protect the crop for the first two or three weeks after the plants come up, neither the beetles nor the larvae are likely to do much damage later.

Control: In the control of this pest, effort first of all should be directed at preventing the beetles from appearing in the garden or field when the plants are coming up. This means that each grower in a community should apply effective control measures during the growing season and then when the crop is mature he should promptly dispose of the vines and green fruits so as to deprive the beetles of fall food, which seems to be essential for carrying large swarms of beetles through hibernation. The elimination of crop residues and the cleaning up of fence rows and other nearby attractive winter quarters will do much to reduce the number of beetles that survive the winter.

After one has done all he can to prevent the beetles from passing the winter in great numbers, he should then direct his efforts at protecting the young crop. This can be done either by spraying or dusting with an insecticide or, in case of small acreages, by using mechanical protectors over each hill of plants. When few or no beetles appear on the young plants the grower is fortunate, but he must always be on the lookout for a possible late sudden appearance of swarms of the beetles.

As mechanical protectors, some growers use strips of cheesecloth stretched over two wire wickets set one astride the other over the hill of plants and with the margins of the cloth covered with dirt. These not only keep the beetles and other insects from the hill, but in case of late frosts, they may also help protect the tender plants. This type of protector is practical for garden plantings or even for small acreages. It should be kept in mind, however, that after the plants are so large that the covers must be removed beetles may still attack them, in which case insecticides should be applied. A second type of mechanical protector is a small, fine-mesh, wire basket set down firmly over the hill of plants to keep the beetles away.

In case of large acreages, and for that matter in garden plantings, most growers depend on prompt and repeated applications of poison insecticides to protect the crop from this pest. In our investigations we have used various chemicals and combinations of chemicals and have found that a strong stomach poison which does not burn the plants, combined with some cheap powder and applied as a dust, is the most effective type of insecticide. On the

small plants dusting gives a heavier coverage than spraying. Arsenicals and the fluorine compounds have given best control though some prefer strong nicotine dusts.

Of the various arsenicals, calcium arsenate, one part, combined with powdered gypsum, 10 to 15 parts, is perhaps the cheapest and best combination. This, when applied as soon as the plants come through the ground and repeated at three- to five-day intervals for a period of three or four weeks, should protect a garden or field planting from these beetles. Paris green used in place of calcium arsenate usually does not work so well. Arsenate of lead applied full strength, or mixed one part to five parts of flour or hydrated lime, will usually protect garden plantings, but it is less effective and more expensive. With any of these arsenicals, promptness of application to prevent the beetles from gnawing the stems of the young plants, as well as the first thick leaves or cotyledons, is important. Then too, the treatment must be repeated so as to protect the new growth as it develops.

Our investigation of the fluorine compounds, in test plats and in large acreage field tests, indicates that barium fluosilicate and natural and synthetic cryolite are quite satisfactory, though more expensive than the calcium arsenate-gypsum dust. The fluorines must be repeated, the same as the arsenical dusts, in order that the new plant growth will be covered before the beetles begin to feed on it. For the control of this pest, they work better when applied as a dust.

For a number of years, nicotine sulphate combined with lime or other carrier has been used against both striped and spotted cucumber beetles. When used at the rate of 4% actual nicotine in the dust it will kill beetles which are well coated, but most of the beetles manage to escape from the hills without being covered with the powder or later recover when only lightly coated with the nicotine dust. A funnel fitted onto the end of the duster and set down over the hill as the dust is applied insures a better coating of the beetles with the dust. The use of nicotine dust for this pest is a spectacular treatment as it enables the grower to see the beetles fall down and die, while when stomach poisons are used, most beetles leave the plants before they die. However, the nicotine dust is much more expensive and must be repeated frequently, as a new supply of beetles may return to a hill as soon as the odor of the nicotine has disappeared. The addition of an arsenical to the nicotine dust adds to its effectiveness but also increases its cost. All considered, our experience leads us to conclude that a safe, cheap, highly toxic stomach poison, such as cal-

cium arsenate and gypsum, applied frequently, beginning just as soon as the plants appear above ground, is the most effective insecticide for this pest.

Twelve-Spotted Cucumber Beetle

(*Diabrotica 12-punctata* Fab.)

This yellowish-green beetle with twelve black spots on its back is the adult of the so-called southern corn root worm. It is larger and less slender than the striped beetle and is commonly found feeding with it on cucurbits.

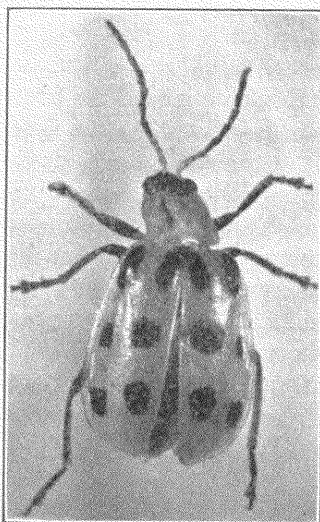


Fig. 4—Spotted Cucumber Beetle, enlarged.

Life History: As with the striped species, this beetle spends the winter in groups of from a few beetles to a few dozen, under leaves, stones, or similar shelter. In the spring they leave hibernation quarters early and feed on various plants, as well as the blossoms of hawthorn and fruit trees. They may visit fields of corn and plantings of early beans where they deposit eggs, which produce the typical corn root worms. As a rule, by the time corn begins to tassel the first brood larvae are mature and a little later beetles of the second generation appear. Very often second generation beetles are more important on the cucurbit crops than are the over-wintering beetles. In Missouri, from two to four generations of this pest may occur.

The larvae are white or yellowish-white with dark heads and tail plates and, when full-fed, about $\frac{3}{4}$ inch long. They may be

found in the roots and crowns of corn plants, or in the base of melon plants. On corn they are often a serious pest, weakening the root system and causing much of the crop to fall down about the time ears are forming.

After the larvae are full-fed they make small earthen cells, in which they transform to soft, white pupae and from which they later emerge as adults. To pass from the egg to the adult stage may require from four to six weeks under normal conditions.

Nature and Extent of Damage: It is a more ravenous feeder, quickly killing the young plants when abundant, and even after plants begin to vine it may be very destructive to the foliage, blossoms and young fruits. It, too, tends to move and feed in droves or packs. Besides cucurbits, this beetle feeds on the foliage and pods of beans, corn silks, the blossoms of dahlias and various other flowers, and, at times, may even eat into ripe apples, grapes, and other fruits. It is a very general feeder and its larvae also attack roots and crowns of various crops other than the cucurbits.

Control: The same general control measures as used against the striped beetle are effective against this species. Corn planted near fields of melons or other cucurbits may serve as a breeding place from which second generation beetles may move onto the cucurbit crops and thus do great damage after the crop has begun to vine. However, corn can be used as a trap crop if pulled up, and infested roots and crowns destroyed. Mechanical protectors and early dusting with insecticides will protect the young plants. Prompt destruction of vines and green fruits after the main crop is off, and the disposal of litter and other winter protection in and near the garden or truck patch will help to reduce the number of beetles that may safely pass the winter.

Squash Bug

(*Anasa tristis* De Geer)

Wherever cucurbits may be grown in Missouri this dirty brownish bug with a very offensive odor is sure to appear and do more or less damage. The adult is slightly over $\frac{1}{2}$ inch long, oval in shape, with color varying from almost black to brownish or even grayish. The nymphs vary from greenish to almost black.

Life History: The squash bug passes the winter as the adult hidden away in piles of wood, lumber, stones, under shingles on the roofs of houses, under dead bark on logs and stumps, in attics, under dry litter about the garden and field, and other similar protection. Late in the spring they leave these harbors and fly in search of food plants. Squashes and pumpkins are the favorite food of this pest and melons and cucumbers are usually attacked

only when their favorite food plants are not available or after they have been destroyed.

The adult bugs usually do not appear and attack the crop until after the plants have begun to vine. After feeding for a time by sucking sap they mate and the females begin depositing the large, conspicuous eggs. When first laid, the eggs are a greenish-yellow but they soon turn brown, and just before hatching they may be almost black in color. A number of eggs are laid in each cluster and they are placed on edge and cemented to the leaf. Each female is capable of depositing several clusters of eggs during her lifetime.

The eggs require about a week or 10 days to hatch in favorable weather. On hatching, the young nymphs are greenish with rosy head and appendages. All the young nymphs from a cluster of eggs remain together, feeding as a unit. The nymphs require about 5 weeks to mature. They pass through five nymphal stages before reaching the adult stage with wings. When not feeding, the older nymphs and adults may collect under the plants, under clods, or under other objects close by. In Missouri, there are normally two broods a year, though late second-brood nymphs are often caught by freezing weather before they reach the adult stage.

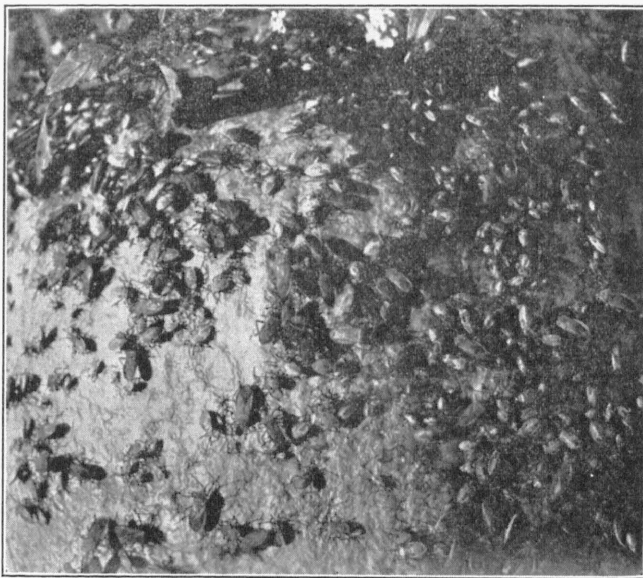


Fig. 5—Squash Bugs and Nymphs Collected on Green Squash After They Had Killed Vines.

Nature and Extent of Damage: This pest damages the crop both by extracting sap and by injecting presumably salivary secretions into the plant while sucking sap. Often a pair of the adults will kill a young vine outright and a cluster of the nymphs soon kills the part of the leaf being attacked and, in time, the whole leaf turns yellow and dies. As the summer advances and the number of bugs increases, often one's entire plantings of squash and pumpkin may be killed. Also, they may move onto and completely destroy a planting of watermelons, cantaloupes, or cucumbers from a planting of squash which they have already killed. They seem to prefer certain types of squashes, such as the Hubbard, though they may kill outright any of our ordinary squashes, even the more hardy crookneck Cashaw. After they have killed the vines, or in the late fall after frost destroys the vines, they may gather in great numbers, often completely covering the surface of the immature fruits. By feeding on the sap of these green fruits the older nymphs may mature, thus increasing the number of adult bugs to go into hibernation.

Control: The effective handling of this pest is largely one of prevention. No one has as yet found a thoroughly effective insecticide for controlling it. The prompt elimination of crop residues in the fall and the thorough disposal of favorable winter harbors will help to reduce the number of bugs to appear in the garden or field the following summer. Then, as the crop begins to develop and the adult bugs appear, hand destruction should be practiced. They tend to spend the night beneath objects under the plants, such as clods, bits of sod, chips, or the like. Early in the morning they may be gathered from beneath these and destroyed. When the conspicuous eggs are laid, crush or remove them every few days and kill any adults found laying eggs during the warm part of the day. Where clusters of eggs are allowed to hatch, remove or destroy the newly hatched colonies of nymphs. If one keeps a close watch on his crop and destroys the adults and eggs, he can largely prevent later damage. On the other hand, where one allows them to become abundant on the crop, he can still get rid of most of them by jarring them to the ground and crushing them underfoot.

Spraying or dusting with heavy concentrations of nicotine will destroy the young nymphs, but most adults and older nymphs will not be killed. We have also tried oil emulsions and the newer derris and pyrethrum dusts and sprays but without much success. While this pest is usually more destructive on garden or other

small plantings than on large acreage field plantings, it may do serious damage to field plantings.

Melon Louse

(*Aphis gossypii* Glover)

This louse or aphid attacks not only cucurbit crops but also cotton, orange, and other plants. It is commonly known as the black fly when it attacks crops in the greenhouse, and the cotton louse when found on cotton. In southeast Missouri, where cotton, watermelons, and cantaloupes are grown in adjoining fields, this aphid has an excellent opportunity to breed. In seasons favorable for development, this pest becomes one of the most destructive pests of the cucurbits.

Life History: The life history of this louse is not completely known though it seems to be unable to survive the winters in the northern states and it is believed that infestations in Missouri are due largely to the spring migration of the winged lice from more southern regions, where it is able to feed and breed throughout the winter months. It usually does not appear in this State until after the melon and cucumber plants have begun to vine.

The true sex forms and fertilized eggs, which is the stage in which other common aphids usually pass the winter, are not known to occur in this State. The winged stem-mother or female which breeds without mating flies into the field and lights on a hill of melons or other cucurbit. Here she begins to feed and to give birth to living young which may mature and in turn begin to give birth to young in 6 or 7 days. This means that in one season from 20 to 25 generations of this louse may be produced. At this rate, if it were not for the parasites, predators, and other natural checks and the work of man, this louse would soon destroy all cucurbit crops grown in any area. Some of the lice of each generation develop wings and fly to other hills of plants or to other fields. Feeding and breeding continue until frosts destroy their food plants.

Nature and Extent of Damage: This pest damages the crop by sucking sap from the leaves and tender stems of the plants. It has a sap-sucking beak and besides sapping the plant it also seems to inject a substance which further injures the plant. The infested leaves curl up, the terminal growth is checked, the plants begin to look sick, and in time may die completely. Whole fields of melons, cantaloupes, squashes, and cucumbers may be destroyed in a week or two if the grower does not take prompt steps to control them.

Control: In the fall after the crop has been matured, the pulling up of plants, as suggested in the control of the other pests of cucur-

bits, will put an end to their further breeding. In the early part of the season, keep a close watch for the first signs of this pest. When it appears on scattered plants or hills throughout the garden or field, apply control measures at once. As a rule, a nicotine spray or dust application is used. A nicotine spray of 1 ounce of 40% nicotine sulphate, combined with 3 gallons of soapsuds, will kill all lice wet by the spray. The lice feed mostly on the underside of the leaves, so an angle nozzle or a short spray rod with an upturn at the tip, is needed for best results. In case nicotine dust is to be used, the grower can prepare it as follows: Take any convenient tight container, such as a 10-pound friction top syrup pail, and put into it one pound of hydrate lime, one ounce of 40% nicotine sulphate, and four or five stones the size of a hen egg. Then put on the lid securely and shake the pail with its contents for a few minutes or until the lime and nicotine sulphate are thoroughly mixed. This can then be applied with any convenient duster so as to get as much of it as possible on the lice on the underside of the leaves. As a rule, two or three applications at about 3- to 5-day intervals should be made in order to thoroughly control the pest. Lead arsenate, or the calcium arsenate-gypsum used to control the chewing beetles, have no effect on this louse, since it is a sap feeder.

In place of using an insecticide some melon growers simply go over their field every few days and where lice are found on hills they completely cover them with a few shovelfuls of dirt. This destroys both the plants and the lice and makes sure that none escape to start infestation on other plants. Some growers pull up and remove the infested plants from the field but too often by doing so they shake off some of the lice and these crawl to other hills and start new infestations. In fighting this louse, prompt action is essential since they breed rapidly and the winged forms fly to other hills and to other nearby fields.

Squash-Vine Borer

(*Melittia satyriniformis* Hubner)

This is often a very serious pest especially of squashes, with the Hubbard squash being one of its favorites. The damage is done by the caterpillar stage tunneling out the vine just where it enters the ground. In severe infestations, it may attack the vine farther out and, at times, may work in the fruits and the stems of the leaves.

Life History: The pest survives the winter in the caterpillar stage in a cocoon an inch or two below the ground surface. Some

of the caterpillars may pupate and emerge as moths to form a partial second brood in Missouri. Pupation normally occurs the following spring and the moths emerge in the early summer after squashes begin to vine. This pest belongs to the clear-winged moths, related to the peach tree borer, and resembles a wasp. Its front wings are opaque covered with dark scales, while the hind wings are largely transparent. The abdomen is marked with red. It flies during the middle of the day. Eggs are laid on the vines near the crown early but later on they may be placed anywhere on the vines. Under favorable conditions, up to 200 eggs may be laid, and in one to two weeks they hatch and the caterpillars enter the vines.

In about a month the caterpillars are full-fed. They are then about an inch long, white, with a brownish head. They leave the vine and bore an inch or two into the soil. Here they spin a cocoon, in which they may soon pupate and emerge, or in which they remain until the following spring before pupating.

Nature and Extent of Damage.—The damage is done by the larva boring in the vine or fruits. Besides tunneling out the vine, the injury usually causes a wet, shiny decay to set in, which soon kills the plant. The borer discharges yellow granular excrement through holes in the sides of its tunnel and these collect along the vine, usually giving first evidence that the vine is infested. While the borers do enter fruits, this damage is of little importance as compared with the weakening or killing of the plants. In seasons and regions of heavy infestation one's entire planting may be attacked and destroyed.

Control.—To properly control this pest, one should do everything possible to prevent the borers from entering the vines in the first place. Insecticides generally are of little value in fighting this pest. Some have found, however, that the application of strong nicotine sprays, when the plants begin to vine or when the moths first appear on the plants, helps somewhat in reducing borer damage. Crop rotation so as to avoid planting the crop in the same or adjoining field will help. Also the destruction of the vines as soon as the crop is off may prevent some of the late borers from maturing. By disking or plowing the field in the fall or at favorable times in the winter, growers in a community may largely eliminate trouble the following summer. In the early part of the season, by planting a few hills of squashes as traps and delaying the planting of the main crop until the moths have laid most of

their eggs on the early hills, severe damage may be averted. However, when the borers are once in the vines, cutting them out with a knife, making the split lengthwise of the vine, is the only sure way to get rid of them. Where considerable damage has been done or even before it occurs, it may pay to cover one or more of the joints or nodes of the vine with a shovelful of moist dirt to encourage the vine to strike root at those points. This may enable a vine to mature its crop even when the base of the vine has been severely injured.

Pickle and Melon Worms

(*Diaphania nitidalis* Stoll and *Diaphania hyalinata* Linnaeus)

Not every year, but frequently, the acreage of squash, cantaloupes, cucumbers and, to a less extent, melons in Missouri, is attacked by these two worms. The melon worm is seldom important north of the southern counties but frequently the pickle worm destroys especially the late crops all over the State. The pickle worm confines its work largely to squash, cantaloupe, and cucumber. The adults of both these pests are beautiful moths with wing expanse of about an inch. The former has brownish wings with a semitransparent, yellowish area in the middle of the front wings, and with the basal part of the hind wings of same color. The latter species has pearly-white wings with a broad, iridescent, brown band on the front and outer margins. Both species have a brush of long scales at the end of the abdomen.

Life History: The pickle worm may have three or four generations a year, the pest requiring about a month to pass from the egg to the adult stage. The melon worm requires about the same time to mature. The small, flat, elliptical, white eggs are laid mostly on the blossoms, blossom buds, or tender tip growth. In from three to five days they hatch and the young larvae soon bore into the blossoms or buds. As a rule, they do not reach the fruits until after molting once or twice. In about two weeks the caterpillar is mature, when it spins a cocoon, pupates and, a week later, the moth emerges. Both species pass the winter in the pupa stage in a cocoon in folded leaves of the crop. The moths do not appear until rather late in the season, the pest usually not attracting much attention in Missouri until July or August. From that time on until late fall they may continue to cause damage.

Nature and Extent of Damage.—The young caterpillars of both species tend to feed on the blossoms and the tip of the vines, turning to the fruits as they become more mature. The damage to the young vines may be considerable but, as a rule, the loss is due

largely to their work in the fruits. Some years practically the entire crop of cantaloupes in the southeast part of the State is destroyed by the pickle worm. Rot usually sets in after the worm



Fig. 6—Pickle-worm Injury on Summer Squash.

bores into the fruit and infested fruits are not marketable. Squashes grown in home gardens or on a commercial scale may be so severely infested that they cannot be marketed. Cucumbers in this State are usually less severely damaged and only occasionally does either worm prove serious on watermelons.

Control.—The pickle and melon worms feed as borers largely inside the soft parts of blossoms, buds, vines, leaf petioles and fruits, so that arsenical sprays or similar insecticides are of little value. Likewise the contact chemicals, such as nicotine, are of little value in destroying the worms. Spraying with arsenate of lead will destroy some of the melon worms as they feed on the surface of the plant or fruits. Here, as with other pests of the cucurbits, preventive measures are most effective. The moths are strong fliers, so crop rotation helps but little. Destruction of infested fruits throughout the season, and the prompt destruction of the vines and immature fruits after the crop has been gathered will reduce the number of moths that may appear the next season. Deep plowing in the fall or during the winter will destroy many of the hibernating pupae. Early planted crops may escape most of the severe late summer injury. Also, squashes may be used as trap crops seeded among cantaloupes or cucumbers, since the pest seems to prefer squashes.

OTHER PESTS

Besides these major insect pests, there are a number of lesser importance, besides non-insect pests such as red spider, field mice, ground hogs, crayfish, and others.

Cutworms

There are several species of these that attack practically all growing crops and, at times, injure cucurbits severely. Some years the so-called overflow worm, which belongs in this group, is especially severe. They are most important through cutting off the young plants.

To control them, avoid planting melons on land that was in sod the previous season or which was recently flooded. When they cause trouble, sow poison bran mash over the field just before dark. Poison bran mash is made by mixing dry 25 pounds of bran and 1 pound of Paris green or powdered white arsenic, and then moistening this with about 3 gallons of water to which is added 2 quarts of molasses and the juice and cut-up rinds of 6 lemons. If available, 1 pint of sodium arsenite may be used in place of the Paris green, and in that case mix it with the water and pour over the bran while stirring. If sodium arsenite is used, handle it carefully as it is much more poisonous than the Paris green.

Grubworms

At times, grubworms are troublesome, but if land is used on which cultivated crops were grown for the last season or two, grubworm damage can be largely eliminated.

Seed-Corn Maggot

The small fly, which produces the maggots, is most troublesome in cool, wet springs. The maggots attack not only corn but also beans, peas, melons, cucumbers, and other cucurbits. When the seeds are slow in sprouting, or when they sour and fail to sprout, this pest is sure to cause trouble. To escape damage, delay seeding until the ground is warm and favorable for prompt sprouting of the seed.

Red Spider

In greenhouses and during dry seasons in the garden or melon field, the red spiders may do considerable damage. This is not a true insect but, as the name implies, it is a relative of the true spiders. It is worse in hot, dry summers and crops like cotton and raspberries are sure to suffer in such seasons. The small spiders spin silk, and feed by rasping on the lower surface of the leaves, causing the green color to turn gray and the leaves even-

tually drop off. The crop may be a complete loss in very severe cases.

To control them, dusting with sulfur is the most effective and most readily available treatment. A wettable sulfur may be used as a spray on the infested plants. In seasons when red spiders are a problem, sulfur may be added to the calcium arsenate-gypsum dust applied for the beetles or to the lime-nicotine dust used for the louse.

Field Mice

Different species of mice seem to be very fond of the seeds of cucurbits. Frequently commercial melon growers find it necessary to replant fields several times in order to get a good stand. The mice may follow down a row, digging out and eating the seeds in each hill.

Where mice have caused trouble in previous years, it is a good plan to bait the field with poison grain before the melon crop is planted. A small grain, such as wheat or a mixture of wheat and oats, may be used. To prepare it, dissolve $\frac{1}{4}$ ounce strychnine sulphate in a little hot water and add this to a gallon of water in any convenient container. Also add a cup of corn syrup as it helps to counteract the flavor of the strychnine. Soak overnight as much grain as the poison solution will cover well. Then dry the grain so that it will not mold and store in a container labeled *POISON* and out of reach of children and others not knowing that it is poisoned grain. To apply it, avoid placing it in the open where beneficial birds may get it. Old tin cans with the ends partly closed, small bottles, or similar containers which mice can get into, may be scattered about the field with about a teaspoonful of the grain in each. Some place a few grains under chips or bits of bark scattered about the field. Still others plant the poisoned grain shallow here and there about the field. If the bait is put out before the crop is seeded, most of the mice may be poisoned ahead of planting. Reseeding is naturally necessary where mice ruin the first planting.

Ground Hogs

In some melon-growing areas, ground hogs may do more or less damage to the crop, especially the ripening fruits. Neglected fence rows and hillsides afford harbors and breeding places and from such harbors the ground hogs may forage in nearby fields of melons and other crops. To eliminate this pest and prevent crop losses, one can gas them in their tunnels. Either carbon bisulphide or calcium cyanide may be used. One or two large tablespoonfuls

of calcium cyanide should be placed as deep in the tunnel as possible and the tunnel should be left otherwise undisturbed. The calcium cyanide gives off hydrocyanic acid gas which tends to fill the tunnel and one or two breaths of it is sufficient to kill the groundhog. If carbon bisulphide is used, roll up a wad of rags, pour over it about half a cup of the liquid, push the wad as deep in the hole as possible, and then close the entrance. In a few days check, and any tunnels showing live ground hogs still present should be retreated.

Crayfish

Where melons or other crops are grown in low areas close to wet, seepy crayfish land, crayfish sometimes cause trouble. This type of damage is more common in some of the more southern states. Where crayfish are a problem, they can be eliminated by going over the field and dropping a teaspoonful of calcium cyanide in each new crayfish hole.