In Order to produce high-grade, marketable vegetables, the gardener must constantly fight many insect pests, both by spraying and by special cultural methods.
CONTENTS

Insects Injurious to:

<table>
<thead>
<tr>
<th>Cabbage and Related Crops</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potatoes</td>
<td>14</td>
</tr>
<tr>
<td>Corn</td>
<td>21</td>
</tr>
<tr>
<td>Tomatoes and Eggplant</td>
<td>29</td>
</tr>
<tr>
<td>Cucumbers, Melons, and Squash</td>
<td>32</td>
</tr>
<tr>
<td>Onions</td>
<td>37</td>
</tr>
<tr>
<td>Beans and Peas</td>
<td>40</td>
</tr>
<tr>
<td>Asparagus</td>
<td>42</td>
</tr>
<tr>
<td>Celery</td>
<td>44</td>
</tr>
<tr>
<td>Horse-Radish</td>
<td>45</td>
</tr>
<tr>
<td>Index</td>
<td>46</td>
</tr>
</tbody>
</table>
Insects Feeding on Truck and Garden Crops, and How to Control Them

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In cooperation with the Department of Horticulture

Vegetable crops on the whole are very susceptible to insect attack and the problem of insect control forms one of the chief items in the cost of production. It is safe to say that insects cause an average annual loss of 20 percent to vegetable growers. In 1920 the truck crop in Illinois was valued at nearly $20,000,000, which makes the annual insect tax for the vegetable grower almost $4,000,000. The annual value of the onion set crop in Cook county is more than $1,000,000. In 1924 the onion maggot alone caused a loss of nearly one-half million dollars to this crop. Other million-dollar crops that suffer an annual loss of 10 to 50 percent by insect attack are tomato, cucumber, cabbage and sweet corn. In Illinois the ten most destructive pests of vegetables are the onion maggot, onion thrip, potato leafhopper, cabbage maggot, cabbage worm, corn-ear worm, striped cucumber beetle, asparagus beetle, flea-beetle and plant lice. These ten insects alone cause an annual loss of more than $3,500,000.

Altho the use of insecticides is essential to the maximum production of most truck and garden crops, the use of cultural methods is of great importance as a preventive means of controlling many insects. This fact is sometimes overlooked by gardeners who follow carefully arranged spraying schedules.

When a plant is attacked the grower should observe how the insects feed, as this will help materially in deciding upon the proper remedy. Injurious insects may be divided, roughly, into two classes by the nature of their feeding habits, (1) biting insects such as caterpillars and beetles, which bite and chew their food, and (2) sucking insects such as aphids and the true bugs, which suck up their food by means of their beaks. If the insect is a biting one, a stomach poison such as arsenate of lead is usually used, but if the insect is a sucking one, such poisons are of no value, because the insect inserts its beak thru the poison and reaches a safe feeding place beneath. Contact insecticides such as the nicotine sprays and dusts are more effective for sucking insects.

This circular presents both the spraying systems and cultural methods that have been found most effective for combating the more common insect pests of truck and garden crops in Illinois. Important points in the life history, together with a brief description of each insect, are given in order that the grower may apply control measures more intelligently. Each insect is considered in the order of its importance under the crop upon which it is usually most abundant and destructive.
INSECTS INJURIOUS TO CABBAGE AND RELATED CROPS

Imported Cabbage Worm Very Destructive But Easily Controlled

*Pieris rapae* Linn

The adult of the imported cabbage worm is a butterfly (Fig. 1) with a wing expanse of about 1¾ inches. The wings are nearly white, with a grayish area at the tip of each front wing. On each front wing of the male is one small, conspicuous black spot; two such spots appear on each front wing of the female. Both male and female have a small black spot near the front margin of each of the hind wings. This is the butterfly which may be seen flying low and fitfully over cabbage patches, where it alights at frequent intervals to deposit its eggs.

The eggs are pale yellow in color, about 1/25 inch in length, and are generally laid on end on the undersurface of the leaves. The eggs hatch in about a week. Small, pale, greenish yellow caterpillars emerge, which feed on the surface of the leaves and become full-grown in ten to fifteen days. They are about an inch in length, velvety green in color, and marked with a light stripe down the middle of the back, with a broken stripe on each side. When mature, the larva transforms into a pupa, or chrysalis, on the undersides of the leaves of cabbage and other plants. The chrysalis, about ¾ inch in length, and varying in color from pale green to a greenish brown, is commonly seen hanging by a silken thread from the undersurface of a leaf. The butterfly emerges in one to two weeks and then another brood is started. In Illinois there are three or four broods each year.

**Character of Injury.** Without doubt the imported cabbage worm is the most destructive pest of cabbage and related crops in Illinois. Fortunately it can be easily and cheaply controlled. The injury is caused by the larvae, or worms, which eat holes in the leaf or consume practically all of it, leaving only the larger leaf-veins. When cabbages are heading, the worms may burrow rather deep into the head, making it unfit for food.

**Control.** Cabbage worms may be controlled by spraying the plants with arsenate of lead at the rate of 2 pounds of powder, or 4 pounds of paste, in 50 gallons of water, to which has been added 3 pounds of laundry soap. Plants should be sprayed as soon as the caterpillars first appear, and the treatment repeated as the plants make...
new growth or the spray is washed off. A potato sprayer equipped with twelve nozzles to spray four rows at once, from the top and both sides, has been found satisfactory for applying the spray. There is no danger of poisoning human beings by spraying cabbage, for the head grows from within, and if the crop is thoroughly sprayed during the season of growth, it will not be necessary to spray just before the crop is cut.

Dusting with arsenate of lead, or calcium arsenate, using a hand dusting machine, will also control cabbage worms. The dust should be applied to both the upper and lower surfaces of the leaves. The formula for the dust is 1 part of arsenate of lead or calcium arsenate to 4 parts of slaked or hydrated lime.

An excellent preventive measure is the cleaning up of weeds about the farm and garden, which offer breeding grounds for this pest.

Cabbage Root Maggot Attacks Roots and Stems

*Phorbia brassicæ* Bouche

The adult or parent fly emerges in early spring (about the middle of May in the northern part of the state), and is recorded as feeding on the pollen of flowers for a time. The fly is about ½ inch in length and has the general appearance of the common house fly but is distinctly smaller, with a narrower body and proportionately larger wings. The male is dark gray in color, with three dark stripes on the thorax, or region immediately back of the head, and a wide black stripe running down the center of the abdomen. The female is lighter in color and the stripes are less distinct.

The eggs are about ¼ inch long, oval, white, with fine grooves running lengthwise. These small white eggs, which have been deposited at the base of the plants by the female, hatch in four to ten days into larvae, or maggots, which bore into the larger roots and the lower part of the stalks. The maggots become full-grown in about three weeks, and are about ⅛ inch long and shiny white in color. They taper from the hind end, which is nearly square, toward the head. When they become mature they leave the plants and work into the soil to a depth of one to three inches, where they transform into smooth, light brown, oval puparia. The time spent in the pupal stage varies from twelve days to eight weeks or a year. The majority of the flies, however, emerge in about two weeks.

**Character of Injury.** In some years the cabbage root maggot is a very destructive pest of cabbage and cauliflower and also attacks turnips, radishes, and other related crops. Upon hatching, the young maggots first attack the small roots and then burrow into the main stem. They feed by rasping out a channel in the surface of the stem. Infested plants are stunted in growth, wilt during the heat of the day, and if the infestation is severe, are killed outright. Decay sets in and the death of the plants is hastened in this way.
Control. The control measures recommended for the cabbage maggot are many and varied. The corrosive-sublimate treatment is so efficient that it is highly recommended. For this work the chemical is used at the rate of 1 ounce to 10 gallons of water. The corrosive sublimate should be dissolved in a small quantity of hot water before it is diluted. Three to five days after the plants are set in the field, a teacupful of the solution should be poured around the base of each plant. Care should be taken to wet the stem of the plant as well as the soil about the plant. This treatment should be repeated after ten days and again ten days later, making three applications in all.

The corrosive sublimate should always be dissolved in a wooden, glass, or earthenware receptacle, for this chemical will corrode all metals. A knapsack sprayer is convenient and practical for applying the solution. The sprayer should be used with a lead of hose without a nozzle. This enables the operator to stand erect and walk along the row fairly rapidly. Immediately after using, cleanse the sprayer thoroughly. If the sublimate is used on a large scale, a barrel may be placed on a wagon drawn by a horse. By using two or more leads of hose without nozzles, and a man for each lead to direct the stream on the plants, a field can be rapidly covered. No pump is needed; simply allow the solution to siphon out of the barrel.

Seed beds may be protected from the maggot with a cheesecloth covering placed over the beds or frames. The cheaper, loosely-woven grades of cheesecloth will keep the flies out if there are not less than twenty-five threads to the inch.

Cabbage Aphis Can Be Controlled by Contact Sprays

*Aphis brassicae* Linn

After the first generation, which is composed of wingless females only, both winged and wingless females are found. The wingless females are about 1/10 inch long, grayish green in color, and covered with a whitish powder which gives them a blue tint. The winged females are smaller, darker in color, and have two pairs of transparent wings. Late in the fall true wingless females and winged males are produced. The eggs are elongate, oval, smooth, black, and shiny. Forty eggs placed end-to-end would measure an inch. They are deposited on the leaves and other parts of the host plant, where they remain over winter. The young nymphs upon hatching look very much like the adult wingless female, although smaller in size. After molting four times in about two weeks, they become mature and in a few days start giving birth to living young. A new generation is produced in this manner about every two weeks throughout the summer.

Character of Injury. The cabbage aphis is frequently a destructive pest of cabbage and other related crops. This pest is a sucking insect which feeds by extracting the juices from the plant. The aphis
feeds on both the upper and lower surfaces of the leaf, which causes it to curl. The entire plant may become deformed, the head ceasing to develop, or the plant may be killed outright (Fig. 2).

**Control.** It has been found difficult to control cabbage aphids with commercial preparations. Those feeding on the undersurface of the leaf are naturally protected, while those feeding on the upper surface are protected by the curling of the leaf. The waxy scales covering the body tend to shed any spray. Since they are sucking insects, they must be controlled with a contact spray or dust. If treatments are started before the aphids have become thoroughly established, they may be killed with

40-percent nicotine used at the rate of \( \frac{1}{2} \) pint to 50 gallons of water. Three or four pounds of laundry soap should be added to the spray as a spreader and adherent.

This spray can be applied to good advantage with a power sprayer, such as is used for spraying potatoes, or with a barrel pump on a wagon. In place of fixed booms, two leads of hose 10 to 15 feet in length should be used. Extension rods 18 to 20 inches in length should be attached to the end of each lead of hose, each rod being equipped with a nozzle that will throw a fine spray. With this arrangement three men are needed, two to carry the nozzles and direct the spray and one to drive the horses. The nicotine may be added to the worm spray described on page 4.
For small amounts, use ½ tablespoonful of nicotine and a piece of soap 1 inch square in 1 gallon of water. Nicotine dust containing at least 3-percent nicotine will give fairly good control if the work is started when the aphids are first observed. Homemade nicotine dusts are cheaper than commercial preparations. They should be used fresh.

**Directions for Making Homemade Nicotine Dust**

Hydrated lime may be used as a standard base for nicotine dust prepared for use in the home garden.

For making large amounts of dust, place 48 pounds of hydrated lime in a barrel having a tight-fitting cover. Pour 2½ pounds of 40-percent nicotine sulfate over the lime, add about 30 pebbles the size of an egg, and roll the barrel back and forth over the floor, or rotate it by mounting the barrel in a frame with a rod attached to the center of the barrel. This kind of frame has a crank at one end by which it may be turned, and the barrel should be rolled, or turned, at the rate of thirty-five or forty revolutions a minute. If it is turned rapidly, the mixing is not so complete as when it is moved at the suggested rate of speed. A churn may be substituted for the barrel as a container for mixing the dust.

To make the dust in small quantities, place 6 pounds of hydrated lime in a small keg or bucket having a tight-fitting lid. Pour 5 ounces of 40-percent nicotine sulfate over the lime. Place 12 to 15 pebbles about the size of a walnut in the container, close the lid, and rotate for about ten minutes. This makes a 2-percent nicotine dust; for larger amounts follow the proportions given below.

Be careful upon opening the container not to hold the head close to the opening, as a large amount of nicotine is given off, which may cause a severe headache or nausea. It is best to mix the dust just before it is to be applied. If for any reason this is impossible, the dust should be stored in tight containers as soon as it is mixed. If allowed to stand for three or four weeks it will lose some of its strength, altho if the container is air-tight it may be held for a month or two without any great depreciation in insecticidal value.

Nicotine dust may be applied with the ordinary dust gun. In the case of insects that are rather hard to kill, it is an advantage to have a canvas hood dropped from the discharge pipe, extending outward by means of a hoop or frame and large enough to cover the plant to be dusted. By placing this hood over the plant and allowing it to remain there for a few seconds after the dust is discharged, most of the insects may be killed.

The nicotine-dust mixtures are prepared as follows:

1-percent nicotine dust

1½ pounds 40-percent nicotine sulfate
49 pounds hydrated lime
2-percent nicotine dust
   2½ pounds 40-percent nicotine sulfate
   48 pounds hydrated lime

3-percent nicotine dust
   3¾ pounds 40-percent nicotine sulfate
   47 pounds hydrated lime

4-percent nicotine dust
   5 pounds 40-percent nicotine sulfate
   45 pounds hydrated lime

Cabbage Looper a Common Cabbage Pest

*Autographa brassicae* Riley

The moth is one of the Noctuids, or night-fliers, and is closely related to the cutworms. The moth has a wing expanse of 1¼ to 1½ inches. The front wings are very dark brown marked with lighter browns and in about the center of each front wing is a silver-colored spot shaped like an imperfect “8.” The hind wings are grayish brown, shading to bronze. The eggs are white or grayish white, round, and the surfaces are ridged. It would take about fifty eggs placed side by side to measure an inch. The eggs hatch in about ten days.

The pale green larvae start feeding, both day and night, on the leaves of the host plant, eating holes in the leaves. The full-grown caterpillar is about 1¼ inch long, pale green in color, with two conspicuous longitudinal stripes on each side. The mature larva is noticeably larger at the posterior end and tapers to the head. It crawls with a peculiar looping motion similar to that of the measuring worm. The larva becomes full-grown in two to four weeks and spins a light, almost transparent cocoon consisting of two layers. The pupa within the cocoon is dark brown and about ¾ inch in length. Ten to fifteen days after pupation the moth emerges.

**Character of Injury.** The cabbage looper is a well-known pest of cabbage, kale, cauliflower, turnip, lettuce, pea, beet, celery, and tomato crops. The larva eats holes in the leaves and often bores into the cabbage head.

**Control.** The cabbage looper may be easily controlled with the same spray or dust used for the imported cabbage worm (page 4). To control this pest satisfactorily the spray must be thoroly applied, for the caterpillar shows a marked preference for unsprayed parts of the plant when feeding.

Clearing the field of old cabbage stumps and leaves and then destroying them will kill overwintering pupae.

**All Garden Plants Subject to Cutworm Depredations**

*Several species of Noctuidae*

There are many species of cutworms, but only a general description will be given in this circular. Most cutworm moths have dark
brown front wings; the hind wings are usually lighter in color. These dull-colored, heavy-bodied moths are rarely seen in the daytime, but often fly into the house at night, where they are attracted by the light. The eggs are laid, for the most part, on some garden plant, grass, or weed. Cutworms vary from 1 inch to more than 2 inches in length. They are sleek, sparsely-haired larvae that always have the appearance of being well fed. They may be streaked or mottled with various shades of yellow, gray and brown, or black. Like the adult, they are most active at night. The pupae are naked and are usually found in the soil.

**Character of Injury.** This group of insects consists of a rather large number of species of caterpillars that are destructive every year at one point or another in Illinois. Probably all garden crops are subject to attack by cutworms. The stems of growing plants may be cut off just below, at the surface, or just above the ground. The heads of cabbage, the fruit of tomato, or the ears of corn may be tunneled into and ruined. Certain species feed only on the plant foliage.

**Control.** The most practical and efficient method of cutworm control is the use of poisoned bait. The following formula has proved successful:

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Bran .................................................. 25 pounds
Molasses ............................................... 2 quarts
Water .......................................... ..... . 10 quarts
Sodium arsenite ...................................... .3½ pint
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(For small amounts)

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Bran .................................................. 5 pounds
Molasses ............................................... .¾ pint
Water .......................................... ..... . 2 quarts
Sodium arsenite ...................................... 1½ ounces
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Dissolve the sodium arsenite in water, add the molasses, and then thoroughly mix in the bran. Mixing the poison with the liquids before the bran is added insures a more even distribution, especially since sodium arsenite is a soluble poison. If sodium arsenite cannot be obtained, 2 pounds of powdered arsenate of lead may be substituted.

Another satisfactory bait is made of finely chopped vegetable leaves poisoned with sodium arsenite or Paris green, using ½ pound of poison to ten pounds of chopped leaves. Distribute the poisoned bait a few nights both before and after transplanting. Hand picking is effective in the home garden, and may be resorted to if there are not too many invaders. If shingles or boards are placed on the ground, cutworms will collect under them and they can be gathered up and destroyed. When transplanting young plants in soil that is known to be infested with cutworms, it is well to place a loose paper collar around each plant in such a way that it will extend an inch or more above the surface of the ground.
Harlequin Cabbage Bug Very Destructive in Southern Part of State

*Murgantia histrionica* Hahn

The harlequin cabbage bug, also known as the "terrapin bug," "fire bug," or "calico bug," passes the winter in the adult stage, hiding under rubbish and trash about the garden. It has a striking appearance, being gayly colored with a mixed pattern of black, yellow, and red. The adult is a little less than ½ inch in length. The eggs are about ⅛ inch long, nearly cylindrical, and flattened at both ends. They have the general appearance of small white kegs encircled with black hoops, with black spots set in the proper position for bungholes. The nymph when first hatched is pale green with black markings. After the first molt, it becomes brightly colored with black, orange or yellow, and red. Both nymphs and adults have the disagreeable odor common to stink-bugs.

**Character of Injury.** In northern Illinois this insect is not considered a pest, but from St. Louis south, severe damage is inflicted by it. Cabbage, cauliflower, eggplant, horse-radish, asparagus, potatoes, tomatoes, beans, beets, and other garden crops are attacked. Both the nymphs and adults accomplish their work of destruction by sucking the sap from the leaves and veins of the host plant. The affected plants wilt, wither, and die as if swept by fire.

**Control.** This is another of the sucking insects which is difficult to control because of its resistance to contact insecticides. A cleaning-up program is well worth following where this insect is abundant. After the crop is harvested, all remaining parts of the plant should be plowed under or collected and destroyed. Overgrown fence rows or rank weed patches should be reduced to a minimum by cutting and burning, and where possible, by plowing.

Because of the bright color and easy detection, hand picking is practical in the home garden. To be effective this must be done at the start of the season in order to capture the females before the eggs are laid.

A strong nicotine solution—1 pint of 40-percent nicotine in 25 gallons of water, in which have been dissolved 2 pounds of soap—will kill many of the nymphs but will have little effect on the adults. There is, however, some danger of burning the plants with a solution of this strength.

In carrying out the foregoing recommendations the cooperation of neighbors is necessary for the best results, regardless of the method of control employed.
Diamond-Back Moth a Minor Enemy of Cabbage and Cauliflower

Plutella maculipennis Curtis

The adult of the diamond-back moth is a gray moth distinguished by the black-marked fore wings. It is small in size with a wing expanse of about \( \frac{3}{4} \) inch. In the male the fore wings are gray, thickly covered with black spots, with an irregular, yellowish stripe along the hind margin. When at rest, the wings are folded on the back and the yellowish stripes unite to form diamond-shaped markings down the middle of the back. In the female the wings are almost uniformly gray.

The eggs are very minute; it would take about 75 placed side by side to measure an inch. They are whitish or yellowish in color and are laid singly or in small groups on the leaves. The eggs hatch in four to six days into small, active caterpillars. When full-grown, the caterpillars are about \( \frac{3}{4} \) inch in length, light green in color, and sparsely covered with small black hairs. The caterpillar is very active and when disturbed will wriggle off the leaf and hang by a silken thread. The larvae mature in ten days to four weeks. When mature, the caterpillars spin beautiful net-like cocoons which are fastened to the undersides of the leaves, and which are so frail and delicate that one can easily see thru the cocoon and observe the pupae within. The adults emerge in four to fourteen days. Apparently there are three broods annually in Illinois.

Character of Injury. The diamond-back moth is regularly one of the minor enemies of cabbage and cauliflower. Occasionally, however, it becomes sufficiently numerous to be troublesome and destructive. The caterpillars eat small holes in the undersurface of the leaves. The upper surface soon dies and the brown area drops out, leaving the leaves riddled with holes.

Control. Good results have been obtained by using the same spray or dust as recommended for the imported cabbage worm (page 4). Care should be taken to spray the undersides of the leaves as thoroughly as possible. Clean up rubbish and old refuse of cabbage and cauliflower plants at the end of the season and destroy in order to kill the hibernating insect.

Tarnished Plant Bug Common: Injury Rarely Severe

Lygus pratensis Linn

The adult of the tarnished plant bug (Fig. 3) is often overlooked by the gardener, for it is easily disturbed and flies at the slightest alarm. The bug is brown, mottled with various shades of reddish and yellowish
brown, and is about \( \frac{1}{4} \) inch in length. The adult passes the winter in rubbish, such as leaves, stone piles, and garden refuse.

The eggs are shaped like a flask, yellowish white in color, about \( \frac{1}{4} \) inch in length, and are inserted by the female in the tender tissues of the plant. They hatch in about ten days. The newly-hatched nymph is colored in various shades of green and has four black spots on the back. In older nymphs the thorax and wing pads are mottled with brown. In about twenty-five to thirty days, during which time they molt five times, they become adults. There are four or five generations each year in Illinois.

**Character of Injury.** This bug is very common in Illinois gardens, where it feeds on opening buds, flowers, new plant growth, and tender shoots of shrubs and trees. The injury caused by this insect, however, is not usually severe. Plants most often damaged are cabbage, cauliflower, celery, turnips, potatoes, and cucumbers. Most of the injury is inflicted by the adult, for most of the nymphs live on weeds. This bug injures the plant by inserting its beak into the tissues and sucking the juices. On the potato, the injury is somewhat the same as that caused by the potato leafhopper, namely, tipburn. Often the bug punctures bean pods, which stops the growth at that point and causes a deformed pod.

**Control.** This pest is very difficult to control because of the nature of its life history and feeding habits. It is a sucking insect and cannot be poisoned by applying insecticides to the plant. The adults are so active that it is difficult to hit them with a contact spray, and if hit they are so resistant that the sprays have little effect. The nymphs develop on wild plants which grow everywhere and which would be impractical to spray. It would be well to practice the cleaning up of such places as would afford shelter to the pests for the winter.

The writer has never observed serious injury to potatoes from this insect where they were regularly sprayed with Bordeaux, which acts as a repellent.
INSECTS INJURIOUS TO THE POTATO

Potato Leafhopper Causes Heavy Losses

Emoasca mali LeBaron

The adult of the potato leafhopper is a very small, pale green insect about $\frac{1}{8}$ inch long. The markings are somewhat variable in number and arrangement. The adults are very shy and will hop considerable distances when disturbed. The eggs, which are small, whitish, elongated, and slightly curved, are laid in slits in the leaf-veins, petioles, or stems of the potato plants. Upon hatching, the nymphs are scarcely visible to the naked eye. They look much like the adults, but have no wings.

Character of Injury. There is no doubt that the potato leafhopper is the most destructive pest of potatoes in Illinois. The feeding of the hopper, together with the diseased condition produced in the plant by this insect, results in a heavy loss to potato growers each year. The diseased condition, “tipburn” or “hopperburn,” is characterized by a discoloration of the leaf-tip and margins. Such leaves curl upward slightly and soon the tip and margin of the leaf become brown. Early-planted potatoes suffer most, as do early varieties of potatoes. Varieties such as Early Triumph and Early Ohio are more susceptible to leafhopper injury than the later varieties. The damage is done by both adults and nymphs puncturing the leaf surface and extracting the juices.

Control. The potato leafhopper can be successfully and economically controlled by spraying with 4-4-50 Bordeaux. Female leafhoppers are repelled by Bordeaux and avoid laying eggs on leaves sprayed with this compound. Eggs laid on leaves that have been sprayed often fail to hatch. The solution is poisonous to the nymphs, particularly in the earlier stages, and many of them die as a result of being hit by the spray or from feeding on sprayed leaves. Spraying should be begun when the vines are about six inches out of the ground or when the hoppers are first observed on the vines. The best results have been obtained where five applications were made at seven-day intervals. When a small quantity of Bordeaux is to be used, a commercial preparation is satisfactory. For spraying large areas, or fields of an acre or more, the Bordeaux is usually mixed on the farm.

Following are formula and directions for preparing 4-4-50 Bordeaux:

**Copper sulfate (blue vitriol) ...................... 4 pounds**
**Lump (stone) lime ................................. 4 pounds**
**or hydrated lime .................................... 6 pounds**
**Water ................................................ 50 gallons**

**Directions for Mixing.**¹ The required amount of copper sulfate is placed in a burlap bag and suspended in a wooden or stone vessel just

¹From Circular 277, of this Station, Directions for Spraying Fruits in Illinois. Only the highest grade of lime should be used.
at the surface of the water which has been measured into it. Do not stir until the copper sulfate has been dissolved. For convenience, use 1 gallon of water to each pound of copper sulfate. Stir the required amount of hydrated lime into enough water to make a thin paste. Four pounds of stone lime, carefully slaked, may be used in place of 6 pounds of hydrated lime.

The copper sulfate and lime are now ready for mixing. First partly fill the sprayer with water and then add the lime paste, using 6 pounds of lime to each 50 gallons of spray. Continue to fill the sprayer until it is about two-thirds full. Start the agitator and after the lime is thoroughly mixed, add 4 gallons of the copper-sulfate stock solution for each 50 gallons of spray. Then add water to make up the required volume.

**Potato Flea-Beetle Attacks Many Vegetables**

*Epitrix cucumeris* Harris

The potato flea-beetle is one of the smaller flea-beetles. It is about \( \frac{1}{16} \) inch in length, jet black in color, and has legs and antennae that are brownish yellow in color. The posterior femora, which are much enlarged, enable the beetle to jump a considerable distance when disturbed. The adults pass the winter in rubbish and trash about the garden or farm. The eggs are oval in shape, white in color, and so small that it would take one hundred placed end to end to measure an inch. They are deposited in the soil about its food plants. The full-grown larvae, which are about \( \frac{1}{2} \) inch in length and white in color with a brown head, transform within an earthen cell into whitish pupae about \( \frac{1}{2} \) inch in length.

**Character of Injury.** Altho this beetle is primarily a potato insect, capable of destroying a crop of potatoes, it is also a very serious pest of eggplant, tomatoes, beets, cabbage, turnips, radishes, melons, and sometimes celery. The larvae feed on the roots, tubers, and underground stems of the plants. The fore part of the body is often seen inserted in a potato. The tissue of the potato at the point of feeding becomes black and hardened. Sometimes the larvae cause abnormal growth, or pimples, on potatoes, which considerably reduces their market value. The adults feed on the leaves, eating out minute holes, giving the leaves a shot-hole appearance. This feeding causes the leaves, and shortly the whole plant, to dry out and die. Feeding takes place on both the upper and lower surfaces of the leaf.

**Control.** The potato flea-beetle can be held in check by spraying with 4-4-50 Bordeaux to which has been added 2 pounds of arsenate of lead powder to each 50 gallons of spray. A poison spray without the Bordeaux will not serve the purpose. Tomato plants are subject to severe attacks when first set in the field and should be kept well covered with Bordeaux. (For directions for making Bordeaux see page 14.)
For small gardens a prepared Bordeaux mixture which contains a poison may be used.

**Potato Aphid Serious About One Year in Five**  
*Macrosiphum solanifolii* Ashmead

The wingless females are rather large for plant lice, being about \( \frac{3}{4} \) inch in length. The winged viviparous female is slightly smaller. They are usually light green in color, although pink forms occur occasionally. During the growing season of potatoes, no eggs are laid, but the young are born alive. When cold weather approaches in the fall, the winged females migrate to rose plants and there produce a generation of winged males and wingless, egg-laying females. The eggs are dark, almost black, shiny, and oval in shape. They hatch early in the spring into young aphids similar in form to the adults. One or two generations are produced on the rose plant before the winged females migrate to the potato and other plants.

**Character of Injury.** When favorable weather conditions occur, the potato aphid is often a serious pest of potatoes in Illinois. Although it is present in small numbers every year, it occurs in serious numbers about one year in five. Besides potatoes, other plants such as tomatoes, eggplant, beets, spinach, and peppers, are attacked. Like all other plant lice, this aphid feeds by sucking the juices from the plant leaves. The leaves curl downward, or directly opposite to the curling caused by the potato leafhopper. The plant becomes deformed and stunted and may die. Although the plants may not be killed, the crop is often greatly reduced.

**Control.** A careful watch should be kept for the first appearance of these pests. If they are present in sufficient numbers to start the curling of the leaves, steps should be taken immediately to control them. The aphids are killed when hit with a spray containing \( \frac{1}{2} \) pint of 40-percent nicotine solution to each 50 gallons of spray. The sprayer should be equipped to spray the undersides of the leaves and should be able to maintain a pressure of 150 pounds. The spray should be applied at the rate of 100 gallons to the acre.

**Colorado Potato Beetle Is the Common “Potato Bug”**  
*Leptinotarsa decemlineata* Say

The adult of the Colorado potato beetle is about \( \frac{3}{8} \) inch in length, strongly convex above, and yellow in color. Each wing cover has five narrow black stripes running lengthwise. The eggs are oval, orange in color, \( \frac{1}{4} \) inch in length, smooth, and are laid on the potato leaf in groups of five to seventy-five. The eggs hatch in four to nine days. The larva, or grub, when full-grown is red, with two rows of distinct black spots on each side of the body. The body appears swollen and
out of proportion to the size of the head. The larva matures in ten
days to three weeks. When mature, it enters the ground and transforms
into an orange-colored pupa about \( \frac{1}{8} \) inch in length. After five or ten
days in the pupal stage, the adult emerges.

**Character of Injury.** The Colorado potato beetle may ruin a potato
crop if stringent steps are not taken to keep it in check. Most of the
injury is caused by the larvae or slugs, which eat the leaves of the
potato plant.

**Control.** Poison sprays are the standard treatment for the potato
beetle. When potatoes are being regularly sprayed with Bordeaux, the
poison may be added to this spray. Two pounds of arsenate of lead
powder to each 50 gallons of spray will give control of this pest. If
inconvenient to apply the homemade Bordeaux, use a good commercially
prepared Bordeaux which contains a poison.

For small gardens, arsenate of lead or calcium arsenate may be
dusted lightly over the plants, or the plants may be sprayed with
arsenate of lead at the rate of 4 ounces to 6 gallons of water.

**White Grubs (Adult, the June Bug or May Beetle)**

*Several Species of Scarabaeidae*

The adult or parent of the white grub is a large brown beetle
familiarly known as the June bug or May beetle (Fig. 4). The size of
the adult varies with different species, and the color varies from light to
dark brown. These beetles may be seen flying around street lights in
great numbers the latter part of May and during the month of June.
The female beetle burrows into the ground and lays the eggs singly or
in groups. They are oval, white, and about \( \frac{1}{4} \) inch in length. The larva,
or grub, is a large, soft-bodied insect with brown head and legs. Two
or three years are spent in the grub stage in the soil. When the grub is
mature it constructs a cell in the soil and transforms into a delicate,
whitish pupa. It transforms into a beetle in the fall, but remains in the
ground until spring.

**Character of Injury.** One of the most common garden pests is the
white grub or grub worm. A large variety of crops such as potatoes,
corn, sugar beets, and beets, are subject to attack. For practical
purposes, the life histories of the common species are the same. The
larvae, or grubs, are very injurious to garden crops, as they feed on
the tender roots. Corn roots may be so badly eaten that the plant is
unable to stand, while potatoes, beets, and sugar beets are often
seriously injured by the grub eating out great holes in the tubers and
roots respectively. Other root crops are injured in like manner.

**Control.** There is no insecticide that is efficient or practical for use
against the white grub. Much of the grub injury can be avoided, how-
ever, by using proper cultural methods, such as:

No insecticide can be used effectively in combating the white grub, but much injury can be avoided by using proper cultural methods.
(1) Plowing in early fall, thus exposing the grubs to the birds.
(2) Using a short rotation of crops. Land should not be left in sod for more than two years, for the female beetles prefer to lay their eggs in such places and thus the grubs will become established in the soil.
(3) Planting a legume crop on land that has been in sod for several years. Legumes are less likely to be injured.

Wireworms Necessitate Special Agricultural Methods
Several Species of Elateridae

The adult of the wireworm (Fig. 5) is familiar to nearly everyone, altho it may not be known by that name. It is the click beetle which, when placed on its back, will jump into the air as it strives to gain footing. This jumping is accompanied with a snap, or click. The female lays the eggs in the soil, preferring sod land. The larvae are elongated, cylindrical, worm-like grubs, with a hard, smooth, shiny, reddish brown, distinctly segmented surface. They vary in length from \( \frac{1}{2} \) to \( 1 \frac{1}{2} \) inches. Two to five years are spent in the soil. The pupae are very delicate, white in color, and are found in the soil.

![Fig. 5.—Larva of the Wireworm: the Full-Grown Insect Is the Common Snap Beetle](image)

The larvae burrow into many root crops and also bore into planted seeds, often necessitating replanting.

Character of Injury. Frequently wireworms cause serious injury to root crops and other vegetables. Potatoes, sugar beets, beets, cabbage, turnips, carrots, beans, corn, and other crops are attacked. The larvae bore into seeds planted in the soil and destroy them, often necessitating replanting. They also burrow into many root crops and seriously injure them. Disease and decay often set in where wireworms are working.

Control. More can be accomplished in the control of wireworms by employing special agricultural methods than in any other way. By plowing in late summer and thoroly harrowing every week or so for a month, large numbers of the pupae and newly formed adults can be killed. Rotation of crops is also beneficial.

Blister Beetles Are Sometimes Called “Long Johns”
Several Species of Meloidae

There are many species of blister beetles, all having certain characteristics which distinguish them from other garden insects. The adult
is a long-bodied, long-legged, slender beetle (Fig. 6), with a fairly soft body which when crushed on the skin may cause a blister. The beetle may be gray, black, or yellow-striped in color. In its immature stages it has a rather complicated development and does not feed on vegetables but on grasshopper eggs. It is a good example of an insect which is beneficial in one stage of development and very destructive in another.

![Image of a striped blister beetle and its stages](image)

**Fig. 6.—Striped Blister Beetle, Showing the Various Stages of the Young, Which Are Passed in the Ground Mainly as Feeders on Grasshoppers**

This insect attacks legumes used for cover crops, as well as the leaves of many vegetables.

**Character of Injury.** Blister beetles are frequently destructive to vegetables in Illinois, particularly to potatoes, tomatoes, beans, peas, melons, corn and beets. Legumes used for cover crops, such as clover and vetch, are also subject to attack. The beetles often congregate in great numbers and defoliate plants as they move across a field. A crop may be ruined in a few days unless immediate steps are taken to destroy these insects.

**Control.** Blister beetles are not easily poisoned with arsenicals. In the home garden, brushing them into pans containing kerosene is effective and, if the plants are approached carefully, this can be done rather rapidly. The operator, working with the wind, may drive the beetles from the field.

A satisfactory control may be obtained by spraying with powdered arsenate of lead at the rate of 3 pounds to 50 gallons of water. Spraying with 4-4-50 Bordeaux will serve to keep the beetles away. Unless Bordeaux is used, 3 pounds of soap should be added to each 50 gallons of solution for spraying plants which have a smooth surface. This spray should be applied as soon as the beetles are observed on the plants, for it takes some time for the poison to act.
Potato Stalk Weevil May Be Partially Controlled by Cutting Weeds and Burning Rubbish

*Trichobaris trinotata* Say

The adult is one of the snout beetles. The body is black in color, but thickly covered with bluish gray scales. In northern Illinois, the insect passes the winter in the adult stage within the burrow in the plant, while further south some of the adults leave the burrow and seek shelter in rubbish where they spend the winter. The eggs are deposited singly in the stalk or branches of the plant. They are oval, nearly white, and about ¼ inch in length. When mature the larvae are about ¼ of an inch long, legless, and dirty white in color, with a brown head. The pupae are creamy white in color and are found in the burrow.

**Character of Injury.** The potato stalk weevil is frequently injurious to potatoes and tomatoes. During the past two years it has been very injurious to eggplant in the trucking districts around Chicago. Upon hatching, the young borer burrows into the center of the stalk and as it grows the weevil hollows out the stem for a distance of three to five inches. Infested plants show a tendency to wilt in the middle of the day and later may be killed outright. Many infested eggplants show little injury but fail to produce any fruit.

**Control.** There is no very satisfactory control for this pest. It is advisable to collect all vines of the eggplant or potato, when these are known to be infested, and burn or otherwise destroy them. It is also well to keep all weeds cut down, especially those related to the potato, and to clean up all rubbish about the garden or farm.

**INSECTS INJURIOUS TO CORN**

**Corn-Ear Worm Usually More Abundant in Dry Hot Seasons**

*Heliothis obsoleta* Fabricus

The adult of the corn-ear worm is a moth (Fig. 7) with a wing expanse of about 1¾ inches. The front wings are straw colored and more or less variegated, with dark markings consisting of a dark area in the center and another at the tip. The hind wings are cream colored with a dark shaded area along the hind margin. There is a conspicuous white spot near the center of this dark area. The eggs are very small and white, nearly round, with a flattened base, and are deposited on the fresh silk of developing corn or on early tomatoes, eggplant, and other vegetables. The surface of the egg is marked with a series of ridges radiating from the tip.

The young larvae feed on the tips of ears of corn, or on the fruit of tomato or eggplant, where they mature. When mature, the caterpillar looks much like an army worm. It has a smooth-looking body which is about 1¾ inches in length. The color of the larva varies from green to various shades of brown, but is usually marked with longitudinal stripes.
When mature, the larva burrows into the ground, where it transforms into a smooth, brown pupa nearly an inch in length. The corn-ear worm is seldom, if ever, able to survive the winter in Illinois, but the moth migrates from the south each year.

**Character of Injury.** The corn-ear worm is a very destructive pest of sweet corn. During some seasons it destroys a large percentage of a crop, as in 1921. Besides sweet corn, this caterpillar attacks tomato, eggplant, pepper, pumpkin, squash, cucumber, potato, and other crops. The larvae usually feed on the silk and kernels at the tip of the ear, but when numerous will feed on the kernels on any part of the ear. The silk is eaten off and the whole ear looks uninviting. Decay often sets in or other insects gain entrance thru the burrows. The fruit of eggplant and tomato is often eaten into, decay sets in, and the fruit is worthless. The larvae are particularly injurious to late-planted corn.

**Control.** The corn-ear worm is difficult to control, because it spends the greater part of its life feeding in protected places. The adults are not usually abundant early in the season, and if the silk is dry and mature when they appear, they will look elsewhere for a place to lay their eggs. In northern Illinois, therefore, corn should be planted early, or early-maturing varieties grown. In central and southern Illinois, medium-planted corn is injured least.
Dusting the silk with calcium arsenate will kill many of the caterpillars, but this cannot be recommended for use on a large scale.

Corn-Root Aphid Control Measures Must Be Directed Against the Ant

*Aphis maidi-radicis* Forbes

The adult aphis has the general appearance characteristic of plant lice. It is bluish green in color, and is lightly covered with a fine, waxy bloom. Throughout the summer the young are born alive. Both the winged and wingless forms occur after the first generation. In the fall a wingless egg-laying generation is produced.

The eggs are laid in the soil where the lice are feeding, and are very small, dark green, and shiny. Small attendant ants, about \( \frac{1}{2} \) inch long and dark brown in color (*Lasius niger-americanus* Emery), collect these eggs and keep them in their nests over winter.

When the eggs hatch in the spring, the ants transport them, first to the roots of weeds, principally smart weed, and later to the roots of corn. In return for this attention, the aphids liberate a supply of sweet fluid which the ants feed on. The nymphs have the same general appearance as the adults.

**Character of Injury.** Altho comparatively unknown to the gardener or truck farmer, the corn-root aphis is one of the most destructive of the corn insects in Illinois. Feeding entirely underground it is easily overlooked. Like all plant lice, the corn-root aphis is a sucking insect, extracting the sap from the roots. Young corn is most liable to injury, and may be killed outright. First indications of injury are discoloration and dwarfing of the plant, especially in patches over the field. The plants lack a thrifty and vigorous appearance, and when they are older, wilting and curling of the leaves may occur.

**Control.** Since insecticides cannot be used to advantage, resort must be made to the proper cultural methods. In reality, the ant is the self-appointed owner of this aphid, and is largely responsible for its movements and distribution. The control measures, therefore, must be directed against the ant rather than directly against the aphid, and must be accomplished before the corn is planted or growing. The following steps should be taken if the ant nests are found to average more than twenty per mile of the furrow.

Plow the ground in the spring to a depth of seven inches in order to break up the ant nests. Unless the plowing is deep, the entire ant nest will not be broken up and the ants will rebuild on the old site. Following the deep plowing, the ground should be given three or four deep diskings at two- or three-day intervals in order to scatter and destroy the eggs and young of the ant and aphid.
Rotation of crops is to be recommended where aphis injury has been severe, but this method alone cannot be relied upon in truck garden districts. Keep all weeds down, especially smart weed and purslane.

**Seed treatment:** "Where land dries out slowly or the spring is so late that the corn must be planted as soon as possible after the ground is broken, ants may be kept from the corn for a time by the use of some substance which is repellent to them. These substances are best applied by mixing them with some finely ground material or fertilizer and dropping them in the hills with a fertilizer attachment on the corn planter. The best substances for this purpose are, in the order named, oil of tansy, oil of lemon, anise oil, and tincture of asafetida. The results from the use of these will not be so good as from deep cultivation."

**Seed-Corn Maggot Serious in Cold, Wet Seasons**

*Hylemyia fusciceps* Zett

The adult of the seed-corn maggot is very similar to the cabbage maggot described on page 5. The larvae or maggots are footless, cylindrical, narrowed in front, and about ¼ inch in length. Pupation takes place in the soil in a manner similar to the cabbage maggot.

**Character of Injury.** In cold, wet, backward seasons, this maggot may cause serious injury to planted corn seed and the seed of other vegetables that have been placed in the soil. Such seeds as onion, beet, bean, cabbage, pea, and others are attacked. The larvae attack the seed about the time it is germinating and, after eating the germ, feed on the soft interior of the kernel. If the seed is not destroyed, a deformed plant is produced.

**Control.** There is no satisfactory control for this pest.

**Northern Corn-Root Worm May Be Controlled by Crop Rotation**

*Diabrotica longicornis* Say

The adult beetle is about ½ inch in length, light green in color, and tapers slightly from the posterior end to the head. The legs are green nearest the body and shade to brown at the tarsi, or feet.

The eggs are laid in the soil in cornfields. They are similar to a hen’s egg in shape, dirty white in color, and very minute in size. They hatch in the spring into small, nearly white grubs. The full-grown larva is ¾ inch in length, very slender, cylindrical, and yellowish brown in color. The larva is equipped with three pairs of short, two-jointed legs. When full grown it leaves the roots and pupates in the soil. The pupa is white, and about ¾ inch in length.

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Character of Injury. The yearly loss resulting from the depredations of this insect is greater than is generally supposed. Because the measures of control are carried out unknowingly each year, an even greater loss is checked. Probably over a period of years this pest reduces the yield of corn as much as any other insect. The larvae burrow just under the surface of the corn roots. Injury is evidenced when the corn is about a foot high. Patches in the field appear to stop growing and if the plants are pulled up, the roots will be found to be short, stubby, rotten at the end, and burrowed lengthwise. If the plants are not killed, the infested hills are very likely to be barren. The infested plants are easily blown over and are unable to right themselves. Even a minor attack will affect the time of ripening and the size of the ear.

Control. The control of this insect consists of a preventive measure which is simple and effective. Since, so far as is known, corn is the only plant upon which this insect can live, rotation of crops will give excellent control. Usually it is safe to plant corn two successive years on the same piece of ground, but if corn has been injured another crop should be grown the following season.

Army Worm Is More Destructive to Field Crops

*Cirphis unipuncta* Haworth

The adult is a night-flying moth, yellowish brown in color, with a small, conspicuous white spot in the center of each fore wing. The hind wings are dull gray in color. The moth has a wing expanse of about 1¾ inches. The eggs are smooth, about ⅛ inch in diameter, and light yellow in color.

The larva has the same general appearance as the cutworm. The body is smooth and striped lengthwise with yellow to greenish brown and black stripes (Fig. 8). On the side are three distinct stripes, with the middle one dark or black. The back is generally black in color with a fine, broken, white stripe down the center; the head is brown, marked with black. Hibernation takes place when the larva is partly grown. When mature, the larva enters the ground and transforms into a dark brown pupa less than ¾ inch in length.

Character of Injury. The army worm is a general feeder, capable of causing great destruction. It is one of the best known insect pests of the farm and garden. The majority of persons, however, would not recognize any of its stages with certainty. Army worms are present every year in lowlands and meadows, where they feed singly, as do cutworms. When they become numerous and the original food supply gives out, they travel in hordes, consuming all the vegetation.
Control. Watchfulness will save much time and expense in dealing with army worms. If discovered before they have left their breeding ground, they may be surrounded by shallow trenches or furrows and destroyed by dragging a log, or drag, back and forth when they attempt to cross. If possible, the plants upon which they are feeding should be sprayed with an arsenical and the worms thus killed before they leave the breeding ground. Arsenate of lead at the rate of 2 pounds in 50 gallons of water will kill all larvae that eat it.

Poisoned bran bait is very effective in controlling army worms. Use the bait recommended for cutworms on page 10.

Fig. 8.—Full-Grown Army Worms, One Showing the Eggs of a Parasitic Fly Attached to the Back

When army worms become numerous and the original food supply gives out, they travel in hordes, consuming all the vegetation.
Grasshoppers Often Become Serious Pest of Gardens

Various Species

The adult is too well known to need description. The eggs are laid in the soil in small pockets where they remain throughout the winter. The young grasshopper resembles its parents except in size and absence of wings.

Character of Injury. From time to time grasshoppers become a serious pest to truck and garden crops, the time of attack varying from early spring to late fall. The grasshopper is a chewing insect, feeds on nearly all vegetables, and takes its food by biting chunks out of the leaves. Both the nymphs and adults are heavy feeders.

Control. Grasshoppers may be killed by spraying the plants on which they feed with arsenate of lead used at the rate of 2 pounds in 50 gallons of water.

Poisoned baits, such as are used for cutworms, may be used to advantage in combating grasshoppers (page 10).

Common Stalk Borer Very Injurious to Young Corn

Papaipema nitela Guenee

The adult, or moth, has mouse-colored fore wings marked with white. The hind wings are paler in color, with prominent vein markings. The wing expanse is about 1 1/2 inches.

The eggs are laid on various weeds and it is in this stage that the insect passes the winter. They are round, about 3/60 inch in diameter, light brown in color, and heavily ridged. The immature larvae are distinctly marked with five light, longitudinal stripes. Most conspicuous are two broad stripes, broken in the middle, that extend along the sides. This gives the larva the appearance of having been pinched or injured in the middle. When the larva becomes mature the stripes fade out, and the body varies in color from very light brown to a purplish brown. It is then about 1 1/4 inches in length.

Pupation takes place in the stalk of the host plant. The pupa is nearly an inch in length, naked, and brown in color.

Character of Injury. Occasionally the common stalk borer becomes abundant and destructive to corn, and also to such crops as potato, tomato, cabbage, cauliflower, eggplant, bean, and spinach. The larvae burrow into the stalks of corn and other plants. Young corn is most liable to injury. Infested plants wilt, break down, and die at the top. The larvae often travel from one plant to another, which increases their destructiveness.

Control. Keeping down all weeds in the vicinity of the garden or on the farm is an effective preventive measure against the common stalk borer. Little trouble from this insect is to be expected where this is done.
Southern Corn-Root Worm Feeds Both Above and Below Ground

*Diabrotica duodecimpunctata* Oliver

This insect closely resembles the northern corn-root worm in its life history, but passes the winter in the adult stage, its eggs being laid in the spring on a large number of plants.

**Character of Injury.** This pest of corn is also known as the twelve-spotted cucumber beetle. As a corn insect it is not of economic importance in northern Illinois, but farther south it is abundant and destructive. The injury inflicted by the southern corn-root worm is very similar to that caused by the northern corn-root worm described above. The larvae bore thru the center of the root instead of near the outer surface as does the northern corn-root worm. When feeding on the corn roots, the growth of the plant is retarded; the plant becomes spindling, lacks a healthy color, and may be killed outright. Infested corn which is blown over is unable to right itself. The field shows stalks uneven in height, and barren.

**Control.** Corn already infested cannot be rid of the boring larvae. Fortunately this species is not likely to cause damage to corn in the large trucking area about Chicago. Where corn is likely to suffer, special farming methods may be used to lessen the chance of injury. Keeping up the fertility of the soil, so that the plants can make a rapid growth and better withstand the attack, is recommended. Early spring plowing, followed by fallowing to keep weeds down, and late planting will aid in controlling this insect.

**European Corn Borer Attacks All Crops with Large Stems**

*Pyrausta nubilalis* Hubn

The borer is about one inch long, light, grayish brown to cream in color, and conspicuously marked with round, black spots arranged in rows on the back. The larva bores into the stalk, tassel, and ear of the corn plant. Besides corn, practically all crops which have a stem large enough to admit the borer are attacked. It is important that this insect pest be discovered as soon as possible after it enters Illinois,
and anyone finding borers that he suspects may be the European corn borer should report the case, and send specimens, if possible, to the State Entomologist, Natural History Survey, Urbana, Illinois.

Other Insects Injurious to Corn. For description and control see:

White grubs, p. 17
Cutworms, p. 9

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INSECTS INJURIOUS TO TOMATOES AND EGGPLANT

Tomato Worms the Common Insect Attacking Tomatoes

Northern Tomato Worm, *Protoparce quinquemaculata* Haw.
Southern Tomato Worm, *Protoparce sexta* Johannsen

The caterpillars of two species of moth are commonly included under the popular name of tomato worms. They are so nearly alike in all stages of their life history, habits, and general appearance that they will be taken up together. These worms, or caterpillars, are capable of inflicting serious damage, such as occurred in Illinois in 1921.
The adults of tomato worms are sphinx moths (Fig. 11). They are swift fliers, having large bodies and a wing expanse of 4 to 5 inches. The body is distinctly marked with a row of large, yellow spots on each side of a narrow, black, longitudinal line; the wings are dark gray, marked with irregular brown and black lines. The eggs are nearly round, $\frac{1}{4}$ inch in diameter, and greenish yellow in color. They are usually deposited singly on the underside of the leaf, and hatch in about a week.

These worms are capable of inflicting serious damage, such as occurred in Illinois in the summer of 1921.

The caterpillars are large, green worms, 3 to 4 inches in length when full-grown. Along the side of the northern species is a series of V-shaped white markings, while along the side of the southern species are simple, oblique, white bands. The horn on the tip of the abdomen in the northern species is black in color and straight, while in the southern species it is usually reddish in color and curved. The pupa is about 2 inches in length and brown in color, with a peculiar, handle-like projection which resembles the handle of a jug. This is the sheath, or covering, for the proboscis or mouth parts. In the northern species the handle is longer than in the southern species; otherwise the two species are nearly alike.
Character of Injury. Injury is inflicted by the caterpillars at all stages. They are capable of stripping a tomato or eggplant of all its leaves in a very short time.

Control. In small gardens, or where the worms are few and scattered, hand picking is recommended.

Where the tomato or eggplant is grown on a commercial scale and the worms are numerous, spraying with arsenate of lead at the rate of 2 pounds of powder in 50 gallons of water will give control. It is important to spray as soon as the worms appear in serious numbers, for they are capable of causing great destruction in a short time.

The tomato worms are often held in check by a parasite which feeds within the body of the caterpillar and, when full-grown, forms a small white cocoon on the outside of the body. These cocoons are often mistaken for the eggs of the worms. Caterpillars covered with these cocoons should not be destroyed, as they will do no further harm to the plants, and the parasites, upon emerging from the cocoons, may parasitize other worms.

Eggplant Flea-Beetle Much Like Potato Flea-Beetle

*Epitrix fuscula* Crotch

The eggplant flea-beetle closely resembles the potato flea-beetle described on page 15. The general appearance, the habit of jumping when disturbed, and the color are the same. The eggplant flea-beetle is slightly larger and the wing covers are slightly more hairy. This species shows a marked preference for the eggplant, but also feeds on potato, tomato, sugar beet, strawberry, and other garden crops.

Character of Injury. The injury inflicted is characteristic of all flea-beetles. The leaves are perforated with small round holes that greatly weaken, if they do not kill the plant.

Control. The eggplant flea-beetle may be successfully controlled by the same measures as are used for the control of the potato flea-beetle (see page 15).

Other Insects Injurious to Tomatoes and Eggplant. For description and control see:

- Potato flea-beetle, p. 15
- Cutworms, p. 9
- Wireworms, p. 19
- Corn-ear worm, p. 21
- Common stalk borer, p. 27

Garden Slugs Feed on Foliage and Roots of Many Crops

*Agrilomax* sp., Linn

The garden slug, which is frequently a very annoying and destructive garden pest, is a slimy, slow-moving, repulsive creature often incorrectly called a snail. It is gray in color, mottled with darker gray, and measures about 1 1/2 inches in length when extended.
Character of Injury. The slugs feed on most of the common garden crops, eating holes in the foliage and leaving a trail of slime wherever they have traveled. They also feed on the roots of many garden crops, on potato tubers, on the fruit of tomato, or on the stem of the plant near the ground, often causing disease and decay to set in.

Control. The garden slug shows a marked dislike for Bordeaux (page 14). Plants upon which the slug is feeding should be sprayed with Bordeaux to which has been added 2 pounds of powdered calcium arsenate, or arsenate of lead, to each 50 gallons of spray. In addition to spraying, poison baits should be distributed. Use either of the baits recommended for cutworms on page 10. Dusting the plants with air slaked lime will have a tendency to keep the worms away.

Caterpillars May Be Controlled by Same Methods as Tomato Worms

Several Species

Such vegetables as asparagus, beans, beets, celery, eggplant, potatoes, tomatoes, squash, rhubarb, onions, cabbage, cauliflower, radishes, and turnips are occasionally attacked by large hairy caterpillars. Their very hairy and shaggy appearance and their clumsy movements have earned for them the name of woolly bear caterpillars.

Character of Injury. When numerous these leaf-eating insects will strip plants of their foliage.

Control. Use the same methods recommended for the control of tomato worms (page 29).

INSECTS INJURIOUS TO CUCUMBERS, MELONS, AND SQUASH

Striped Cucumber Beetle the Most Destructive Pest of Melon and Cucumber

*Diabrotica vittata* Fab.

The adult is light yellow in color, with a black head and three black stripes on the wing-covers, and measures about ¼ inch in length (Fig. 12). The beetles pass the winter hiding in trash, rubbish, or in the soil. The eggs, which are about ¼ inch in length, oval, and light yellow in color, are laid in cracks and crevices in the soil about the base of the plant. In about a week they hatch into small larvae, and when full-grown the larva is close to ¼ inch in length, very slender, white, and wormlike, with a brown head, thorax, and anal plate. When mature, the larva transforms into a white pupa within an earthen cell.

Character of Injury. The striped cucumber beetle is the most destructive pest of cucumbers, melons, and squash in Illinois. Unless
growers wage a constant fight, the yield is greatly reduced, if the crop
is not lost altogether. It is a pest with which the gardener must deal
every year. The beetles are responsible for the greater part of the
injury. They feed on the leaves, stem, and fruit. When the plants first
push thru the ground they may be killed in a short time. The leaves of
older plants may be eaten to such an extent that they turn brown and
die. The stem may be girdled or eaten off entirely. The fruit may be

badly disfigured and deformed. The larvae, working underground, bore
into the stem and roots and often into the fruit where it rests on the
ground.

The adults are responsible for the spread of bacterial wilt, which
may destroy a whole crop over night. The cucumber mosaic disease is
also spread by this beetle.

**Control.** Altho these beetles are heavy feeders, they are not easily
poisoned, for they avoid poisoned plants or poisoned portions of the
plant. Therefore, any control measure attempted must be thoroly
carried out. Under Illinois conditions, a dust composed of calcium
arsenate and gypsum has been found most satisfactory.

**Preparation of calcium arsenate-gypsum dust:**

- Calcium arsenate ........................................... 1 pound
- Gypsum (burned) ........................................... 20 pounds

Gypsum or land plaster may be purchased from almost any dealer
in coal or lumber. In most cases burned gypsum will be purchased and
is preferred. Burned gypsum contains hair or fiber which can be sifted out easily by working the material thru an ordinary fly screen. After the hair has been sifted out, add the calcium arsenate and mix thoroly. It is well to run the mixed dust thru the screen twice to insure a more uniform dust.

This dust may be applied with any good hand-dusting machine. For cucumbers grown in rows, a machine that will throw a steady stream of dust is preferred, while a puff duster is better where cucumbers are grown in hills. For home gardens a simple, homemade duster may be used. To make this duster take a 2- or 4-quart pail with a tight-fitting lid and punch a number of small holes in the bottom. On two sides of the pail nail a wooden strip from 2 to 2½ feet long; the length of the strips should be made according to the height of the person who is to use the duster. Between the strips at the top, a section of a broom handle may be fitted to serve as a handle. Fill the pail half full of the mixed dust and apply by shaking over the plants.

The number of applications will depend on weather conditions, period of activity of the beetles, and thoroness of the dusting. It is important to dust all parts of the plant, and when using a dusting machine, to direct the dust upward under the leaves. Seedlings just coming thru the ground should be kept wellusted and the plants should be kept covered with the dust as long as the beetles are present.

In Wisconsin a 5- to 10-percent nicotine sulfate dust is recommended to kill the beetles. To get the best results a dust containing 8-percent nicotine sulfate and 25-percent copper sulfate with a lime carrier should be used.

Covering the plants with screen will keep the beetles off the young plants. This method may be used to advantage in the home garden.

Bordeaux mixture 4-4-50, to which has been added 2 pounds of arsenate of lead powder for each 50 gallons of spray, makes an effective spray. By rearranging the nozzles on a potato sprayer, cucumbers grown in rows may be covered rapidly. For the preparation of Bordeaux, see page 14.

Melon Aphis Most Troublesome in Hot Dry Weather

*Aphis gossypii* Glover

The life history of the melon aphis is much the same as that of most of the common aphids, or plant lice.

**Character of Injury.** This aphid, or plant louse, at times is very destructive to melons and cucumbers. It also attacks eggplant, beans, beets, spinach, tomatoes, asparagus, and cotton. Like all aphids it is a sucking insect, feeding in colonies or clusters on the undersides of the leaves. Sucking the juices from the leaves causes them to become curled
and deformed (Fig. 13). An entire plant or, when the insects are abundant, a whole crop may be destroyed. They are most troublesome in hot, dry weather, such as usually occurs rather late in the summer.

Control. Since the melon aphis is a soft-bodied, sucking insect, it must be killed with a contact dust or spray. A constant watch should be kept for the first appearance of the pest, and spray or dust applied before the aphids have curled the leaves. One-half pint of 40-percent nicotine and 3 pounds of soap in 50 gallons of water make a fairly effective spray. A 3-percent nicotine dust may be used in place of the spray and is to be preferred to the spray. The aphids must be hit with the insecticide to kill them, and it is necessary, therefore, to use an underspray nozzle, or to turn the vines over so that all the insects may be covered. The spray or dust must be driven under the leaves with as much force as possible. It should be remembered that the value of a contact insecticide lies in thoroly wetting or covering the insect. See page 7 for directions for making dust.
Squash Bug Very Destructive on Squash and Pumpkins

_Anasa tristis_ De Geer

The adult is a true bug, brownish black in color, and ¾ inch in length. It is often called the “stink-bug” because of its offensive odor. Adults hibernate in trash and rubbish. The eggs are laid in clusters on the underside of the leaf, and being comparatively large are easily detected. They are oval in shape, ½ inch in length, and when first laid are yellowish brown in color, turning to reddish brown before hatching. The nymph when first hatched is a pinkish color which later turns to black. After the first molt, it becomes gray in color.

**Character of Injury.** The squash bug is a very destructive insect to cucumbers, melons, squash, and pumpkins. It is a true bug, or sucking insect, and is most destructive on squash and pumpkins. By inserting its beak in the leaf and extracting the juice it causes the leaf to wither; later the whole plant withers and dies.

**Control.** The problem of control is difficult for two reasons: (1) a contact spray that will kill the adults will also injure the plants; (2) as the nymphs feed, for the most part, on the undersides of the leaves, they are hard to hit with a spray.

If small strips of board are placed on the ground, both before and after the crop is planted, the bugs will collect underneath during the night. Early in the morning the boards should be turned and while the bugs are still sluggish, they should be collected and killed by being dropped into a can containing kerosene.

Clean farming is highly recommended for preventing attacks by this bug. By keeping trash, rubbish, and garden refuse cleaned up, the bugs will have fewer places in which to hibernate. After the crop has been harvested, the vines should be raked into piles, and in late fall, after the bugs have collected under these piles, they should be burned.

Squash Vine Borer Grubs Work in the Vines

_Melittia satyriniformis_ Hubner

The adult is one of the clear-winged moths. The front wings are nearly black while the hind wings are transparent. The wing expanse is about 1½ inches. They are more active in the heat of the day and are often mistaken for bees or wasps. In northern Illinois there is but one full brood, while in southern Illinois there is probably a second brood. The eggs are laid on the stem of the plant and are red in color, ½ inch in length, and oval in shape. They hatch in about two weeks into small caterpillars which bore into the vines of the plants. When full-grown, the caterpillars are white with a brown head and are about one inch in length. The mature caterpillars leave the stem and enter the ground where they construct a dark brown cocoon in which they pupate.
Character of Injury. The squash vine borer is a very destructive pest in Illinois. In the southern part of Cook county it is almost impossible to grow early summer squash of the crooked-neck varieties, or pumpkin, because of injuries by this insect. This pest also attacks cucumbers and melons to some extent. The caterpillars bore into the stalk and petioles of the leaves, decay sets in, and the stem rots off at the surface of the ground or near it.

Control. Cleaning up the vines and burning them as soon as the crop is harvested will do much to reduce the numbers of this insect. Recent work by the Massachusetts Agricultural Experiment Station has shown that it is possible to stop most of the injury by spraying the squash vines four times, at weekly intervals, using 40-percent nicotine sulfate at the rate of 1 part to 100 parts of water (1.3 fluid ounces per gallon of water). The plants should be examined carefully for eggs at frequent intervals after the middle of June, and the first spray should be applied about one week after the eggs are found. This treatment, however, is rather expensive. Late planting is recommended where practical.

In the home garden the borers may be cut out of the stem with a thin-bladed knife. The borer can be located by the hole in the stem and the brown frass which the insect pushes out of the burrow. By cutting lengthwise of the stem with a very thin, sharp knife, the borers can be killed without permanent injury to the plants. Earth should then be hilled up around the plant above the wound.

INSECTS INJURIOUS TO ONIONS
Onion Maggot Can Be Controlled by Spraying

Phorbia ceparium Meigen

The adult of the onion maggot (Fig. 14) is a fly similar in appearance to the fly of the cabbage maggot described on page 5. The smooth, white, oval eggs are laid either under the leaf sheath near the ground or in cracks and crevices in the soil near the plant. The larva is a small, footless maggot, nearly white in color, and smooth, closely resembling the cabbage maggot. When mature, the maggots usually leave the onion and pupate within a brown puparium in the soil.

Character of Injury. As a crop, onions are subject to the attack of relatively few insects. The onion maggot is the most serious onion pest in Illinois (Fig. 15). The maggot bores into and thru the onion bulb, and will kill young onions in a short time. When the onions are larger, several maggots are commonly found in a single bulb. In the case of onions grown for sets, which should never get larger than an inch in diameter, the maggot will kill a plant in a short time and then move along the row infesting other onions as it goes. When the maggots are numerous many skips may be seen in the row. In infested onions,
decay sets in and hastens the death of the plant. The onions may be so thinned out that they become overgrown and too large for sets.

**Control.** Experimental work conducted over the past five years in Illinois has developed an effective control for the onion maggot. This consists in spraying the young plants as soon as they are an inch high with a Bordeaux oil emulsion. The oil emulsion is the same as that used for the control of scale insects on fruit trees, and is made by boiling together one gallon of a light grade lubricating oil having approximately 90 percent viscosity and .88 specific gravity, with two pounds of potash fish oil soap and one quart of water. This oil emulsion is added to a 4-4-50 Bordeaux mixture at the rate of 1½ gallons of the stock emulsion to 48½ gallons of Bordeaux. The spray should be

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**Fig. 14.—ONION MAGGOT; ADULT, PUPARIA AT THE RIGHT, AND FULL-GROWN LARVA BELOW**

This insect is the most serious pest of onions in Illinois, boring into and thru the onion bulb and killing young onions in a short time.
applied to the young onions with a tractor sprayer, or it can be put on by hand. Five applications should be made at weekly intervals. Results of three years' work with this material have shown practically 100 per cent control, and in some cases, the yield was increased from 44 bushels an acre to as high as 680 bushels an acre.

Onion Thrips Brown the Onion Leaves

*Thrips tabaci* Lindeman

The adult of the onion thrips is a very small, slender, yellow to yellowish brown insect, which when disturbed crawls rapidly over the surface of the plant. The wings are long and narrow, with a fringe of long hairs on the hind margin. The female is capable of laying fertile eggs without being fertilized. The eggs are white, nearly transparent, bean-shaped, and so small that it would require one hundred placed end to end to measure an inch. The egg is inserted nearly its full length into the leaf and hatches in seven to ten days. The nymph when first hatched is nearly white, with bright red eyes. It develops rapidly, becomes yellow in color, and transforms to an adult in fifteen to twenty days.

**Character of Injury.** The onion thrips ranks close to the onion maggot as a major pest of onions in Illinois. During the summer of 1921, entire fields were destroyed by ravages of this pest. It is occasionally destructive to onions grown for sets. It has been estimated that 90 percent of the set-onions grown in the United States are grown
within a radius of fifty miles of Chicago. A heavy infestation of the thrips in this area results in enormous losses to the growers. Cabbage and cauliflower are sometimes attacked by this insect. Thrips do not feed like most insects, for they scrape the surface of the leaf and then suck the juices which collect. Whitish blotches show plainly on the green leaf where they have been feeding. Later the whole plant becomes bleached, dries from the top down, and finally dies. Infested plants become weak and unable to stand upright. The injury is more marked in dry seasons.

Control. Because of their rapid reproduction and their habits of feeding and remaining protected under the leaf sheath, the thrips are difficult to control satisfactorily. Cultural methods, especially where set onions are grown, prohibit the use of heavy machinery. Relief can be obtained by spraying with 40-percent nicotine at the rate of 1 pint in 50 gallons of water, in which 4 pounds of soap has been dissolved. To get the best results use a high pressure sprayer and hold the nozzle close to the plants. Nicotine dusts have not proved so satisfactory as the spray.

It is advisable to clean up weed patches near the onion field. After the crop is harvested the tops should be raked together and burned. A common horse rake has been found useful in raking up the tops, especially where set onions are harvested.

Other Insects Injurious to Onions. For description and control see:

- Cutworms, p. 9
- Wireworm, p. 19
- Woolly bear caterpillar, p. 32

INSECTS INJURIOUS TO BEANS AND PEAS

Bean Weevil Is More Serious in the South

*Mylabris obtectus* Say

The adult of the bean weevil is light brown in color, about \( \frac{3}{8} \) inch in length, with light and dark brown spots on the back. The female gnaws a hole thru the bean pod and deposits the egg within. In shell beans the eggs are laid loose among the beans or in the holes made by the beetles when they leave the bean. The egg is white, almost transparent, nearly round, and about \( \frac{3}{40} \) inch in length. The larva, or grub, is about \( \frac{3}{8} \) inch in length, white in color, and footless. The grub transforms into a white pupa within the bean.

Character of Injury. The bean weevil is a serious pest of beans wherever they are grown, but more especially in the south. In storage, peas as well as beans are attacked. When green beans are infested, the pods are stunted and deformed, and the beans are unfit for food and will not make seed. Seed beans and peas are also attacked and are hollowed out until they are unfit for seed or food.
Control. Do not plant infested seed, for the germination will be poor and the insect will also be distributed in the field. Other than planting good seed, there is no control for the weevil in the field. To control the weevil in bean and pea seed, carbon bisulfid may be used. The beans should be placed in a tight box or bin, with the temperature about 75° F. Use the carbon bisulfid at the rate of 1 ounce to a bushel of seed, or 3 pounds to one hundred cubic feet of space. The carbon bisulfid is a liquid, and should be placed in shallow pans on top of the seed. A small amount of burlap may be placed in the pans with the liquid to hasten evaporation. The box or bin should be left tightly closed for twenty-four to thirty-six hours. Carbon bisulfid is very inflammable and should not be used near a fire or by anyone who is smoking.

If slaked lime is mixed with the seed at the rate of 1 pound to 4 pounds of seed, further spread of the weevil in the beans will be stopped. This method can be used to advantage where a small quantity of beans is stored. A small amount, one or two bushels, heated to a temperature of 135° F, for three hours will kill all stages of the beetle. This procedure will not destroy the germinating qualities of the seed.

Mexican Bean Beetle a New Pest in the Eastern U. S.  
*Epilachna corrupta* Muls.

A new and destructive insect pest may be looked for in the southern part of Illinois this year; namely, the Mexican bean beetle. All varieties of beans, as well as cowpeas and soybeans, are subject to attack. In all stages, this beetle can be distinguished readily from other insects usually found on beans. The adult is about ½ inch in length, varies from yellow to copper color and has sixteen black spots on the wing covers or back (Fig. 16). The eggs, which are laid on the undersides of the leaves, are yellowish in color, arranged in groups of fifty or less, and are laid on end. The beetle larva feeds on the underside of the leaf and becomes full-grown in two or three weeks. When full-grown, the larva is about ¼ inch in length, yellow in color, and covered with a heavy armor of spines which are branched and colored black at the tip. Pupation takes place on the underside of the leaf where the pupa may be seen hanging. The entire life cycle is completed in about a month.

Character of Injury. The beetles chew off portions of the undersides of the leaves, leaving only the skeleton. The leaf withers and dies. If you think you have found the Mexican bean beetle, send specimens or write to the State Entomologist, Natural History Survey, Urbana, Illinois.

Other Insects Injurious to Beans and Peas. For description and control see:
INSECTS INJURIOUS TO ASPARAGUS

Asparagus Beetle Always Present and Destructive

_Criocerus asparagi_ Linn

The important insects feeding on asparagus are few. The common asparagus beetle is the most important in northern Illinois, and is always present and destructive. This beetle is about \( \frac{3}{4} \) inch in length, and is beautifully colored and marked. The head, under part of the body, legs, and antennae are bluish black, usually tinted with green. The thorax, or region next to the head, is reddish, while the markings on the back vary greatly. On each wing cover is a more or less distinct inverted letter “E,” with the intervening spaces of yellow shading to orange.

The beetles pass the winter in rubbish and protected places. The eggs are oval, grayish brown, \( \frac{1}{16} \) inch in length and very conspicuous. They are laid on end, singly or in rows, on almost any part of the plant above ground. The larvae, or slugs, when full-grown are about \( \frac{3}{4} \) inch in length and are slate colored, with the head and legs shiny black. When the grubs are mature, they enter the ground and transform into pale, yellowish pupae.
Character of Injury. Injury may be inflicted by both the beetle and the grub. The beetle eats holes, or pits, in the asparagus when it is ready to cut. The grubs may defoliate leafed-out plants. This latter feeding is very injurious to young asparagus, as grown from seed, and will destroy a considerable number of the plants within a short time. As the eggs are laid on the asparagus about cutting time, the produce is objectionable to the buyer (Fig. 17).

Control. It is a common practice in asparagus-growing areas to cut the stalks every other day, or every day when the weather is warm, and thus, to a great extent, to keep one jump ahead of the beetles. However, nothing but the destruction of the beetles will keep them from depositing their unsightly eggs on the shoots. They may be killed by covering thoroughly with arsenate of lead occasional shoots which have been left to grow, in addition to keeping the crop closely cut. A solution of 3 pounds of arsenate of lead to 50 gallons of water to which has been added 3 pounds of soap, is recommended for this work.

After the cutting season is over and the plants have leafed out, the beetle can be satisfactorily controlled by spraying with arsenate of lead at the rate of 2 pounds in 50 gallons of water, to which has been added 3 pounds of soap. It has been found that this spray can be applied with an ordinary potato sprayer, using 100 gallons of spray per acre. The booms should be raised to allow the plants to pass under. Young asparagus grown from the seed should be sprayed two or three times during the summer.

Fig. 17.—Asparagus Beetle Feeding on Asparagus Tips, Showing the Eggs and Slugs on the Leaves

Injury may be inflicted by both the beetle and the grub of this insect. The beetle eats holes, or pits, in the asparagus when it is ready to cut. The grubs may defoliate leafed-out plants.
Mechanical injury to the plants by the sprayer has been negligible. Keep beds cut clean through the harvesting season.

**Other Insects Injurious to Asparagus.** For description and control see:

- Cutworms, p. 9
- Potato aphid, p. 16
- Melon aphid, p. 34
- Woolly bear caterpillar, p. 32
- Harlequin cabbage bug, p. 11
- Cabbage looper, p. 9
- Southern corn-root worm, p. 28
- Corn-ear worm, p. 21

**INSECTS INJURIOUS TO CELERY**

**Celery Looper May Make Hand Picking Necessary**

*Autographa falcifera* Kirby

The celery looper is closely related to the cabbage looper described on page 9. The larva may be distinguished from that of the cabbage looper by the conspicuous white spiracles which are ringed with black. The adult of the celery looper is about the size of the cabbage looper, but the silver spot on the fore wings does not resemble a figure “8” as in the cabbage looper. The celery looper attacks lettuce and sugar beets as well as celery and is frequently as numerous as the cabbage looper of Illinois.

**Character of Injury.** This is a leaf-eating insect which feeds by chewing holes in the leaves.

**Control.** Hand picking the larvae should be resorted to if lettuce becomes infested. This same practice may be resorted to with celery if the worms are not numerous. Young celery may be sprayed with arsenicals since the poison will wash off before the celery is bleached. Sugar beets may be treated in the same way. Use 1 pound of arsenate of lead to 50 gallons of water in which has been dissolved 3 pounds of soap.

**Tarnished Plant Bug Also Damages Celery Crop**

*Lygus pratensis* Linn

The tarnished plant bug often injures celery by sucking the juice from the plant near the joint, causing what is known as “black joint.” The celery is thus marred and the market value greatly reduced. For description and control of this insect see page 12.

**Other Insects Injurious to Celery.** For description and control see:

- Cabbage looper, p. 9
- Cutworms, p. 9
- Army worm, p. 25
- Blister beetle, p. 19
- Potato flea-beetle, p. 15
- Wireworms, p. 19
- Slugs, p. 31
INSECTS INJURIOUS TO HORSE-RADISH

Horse-Radish Flea-Beetle Is Practically Only Insect Pest of Horse-Radish

*Phyllotreta armoraciae* Koch

The adult is about \( \frac{3}{8} \) inch long, oval, strongly convex, and the body black in color. Each wing cover is yellow with a black stripe on both the outer and inner margins. The adult lives over winter in dry, sheltered places. The eggs are orange in color, smooth, oval, about \( \frac{3}{8} \) inch in length, and are laid in clusters of fifteen or twenty on the petioles of the young leaves. The eggs hatch in about a week, whereupon the larvae immediately enter the petiole, where they feed and grow. When full-grown, the larva is about \( \frac{3}{8} \) inch in length, slender, dirty white, with a dark head and thoraxic shield. When mature the larvae leave the petioles and enter the ground where they pupate within earthen cells.

**Character of Injury.** Horse-radish is comparatively free from pests with the exception of the horse-radish flea-beetle, which is capable of inflicting serious losses to the crop. Water cress is the only other crop known to be attacked. Injury is inflicted by both the adults and the larvae. The beetles are most destructive early in the season, when they gnaw small circular holes in the leaves, causing them to dry out and die. The larvae are most destructive later in the season, when they burrow into the petioles or leaf stems, killing the leaf and retarding the growth of the root.

**Control.** The horse-radish flea-beetle may be controlled by the same means as that recommended for the control of the potato flea-beetle on page 15. It is important to start spraying early, when the beetles are first noticed, in order to prevent egg-laying and subsequent larval injury. Spraying should be repeated every week or ten days until the beetles disappear. Rotation of crops will bring relief when the flea-beetle becomes numerous.
## INDEX

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ants</td>
<td>23</td>
</tr>
<tr>
<td>Army worm</td>
<td>25</td>
</tr>
<tr>
<td>Arsenate of lead</td>
<td>4, 10, 17, 26, 31, 32, 43, 44</td>
</tr>
<tr>
<td>Asparagus, insects injurious to</td>
<td>11, 32, 34, 42-44</td>
</tr>
<tr>
<td>Asparagus beetle, common</td>
<td>42</td>
</tr>
<tr>
<td>Bait, poison</td>
<td>10, 26</td>
</tr>
<tr>
<td>Beans, insects injurious to</td>
<td>11, 19, 20, 24, 27, 32, 34, 40-42</td>
</tr>
<tr>
<td>Bean beetle, Mexican</td>
<td>41</td>
</tr>
<tr>
<td>Bean weevil</td>
<td>40</td>
</tr>
<tr>
<td>Beets, insects injurious to</td>
<td>9, 11, 15, 16, 17, 19, 24, 32, 34</td>
</tr>
<tr>
<td>Blister beetle</td>
<td>19</td>
</tr>
<tr>
<td>Bordeaux mixture</td>
<td>13, 14, 15, 17, 20, 32, 34, 38</td>
</tr>
<tr>
<td>Cabbage, insects injurious to</td>
<td>4-13, 15, 19, 24, 27, 32</td>
</tr>
<tr>
<td>Cabbage aphis</td>
<td>6</td>
</tr>
<tr>
<td>Cabbage bug, harlequin</td>
<td>11</td>
</tr>
<tr>
<td>Cabbage looper</td>
<td>9</td>
</tr>
<tr>
<td>Cabbage root maggot</td>
<td>5</td>
</tr>
<tr>
<td>Cabbage worm, imported</td>
<td>4</td>
</tr>
<tr>
<td>Calcium arsenate</td>
<td>5, 23, 33</td>
</tr>
<tr>
<td>Calcium arsenate and gypsum</td>
<td>33</td>
</tr>
<tr>
<td>Carbon bisulfid</td>
<td>41</td>
</tr>
<tr>
<td>Carrots, insects injurious to</td>
<td>19</td>
</tr>
<tr>
<td>Caterpillar, woolly bear</td>
<td>32</td>
</tr>
<tr>
<td>Cauliflower, insects injurious to</td>
<td>5, 9, 11, 13, 27, 32, 40</td>
</tr>
<tr>
<td>Celery, insects injurious to</td>
<td>9, 13, 15, 32, 44</td>
</tr>
<tr>
<td>Celery looper</td>
<td>44</td>
</tr>
<tr>
<td>Corn, insects injurious to</td>
<td>10, 17, 19, 21-29</td>
</tr>
<tr>
<td>Corn borer, European</td>
<td>28</td>
</tr>
<tr>
<td>Corn ear worm</td>
<td>21</td>
</tr>
<tr>
<td>Corn root aphis</td>
<td>23</td>
</tr>
<tr>
<td>Corn root worm, Northern</td>
<td>24</td>
</tr>
<tr>
<td>Corn root worm, Southern</td>
<td>28</td>
</tr>
<tr>
<td>Corrosive sublimate</td>
<td>6</td>
</tr>
<tr>
<td>Cucumbers, insects injurious to</td>
<td>13, 22, 32-37</td>
</tr>
<tr>
<td>Cucumber beetle, striped</td>
<td>32</td>
</tr>
<tr>
<td>Cucumber beetle, twelve-spotted</td>
<td>28</td>
</tr>
<tr>
<td>Cutworms</td>
<td>9</td>
</tr>
<tr>
<td>Diamond-back moth</td>
<td>12</td>
</tr>
<tr>
<td>Eggplant, insects injurious to</td>
<td>11, 15, 16, 21, 27, 29-32, 34</td>
</tr>
<tr>
<td>Eggplant flea-beetle</td>
<td>31</td>
</tr>
<tr>
<td>Garden slugs</td>
<td>31</td>
</tr>
<tr>
<td>Grasshoppers</td>
<td>27</td>
</tr>
<tr>
<td>Horse-radish, insects injurious to</td>
<td>11, 45</td>
</tr>
<tr>
<td>Horse-radish flea-beetle</td>
<td>45</td>
</tr>
<tr>
<td>Hydrated lime</td>
<td>5, 8, 14</td>
</tr>
<tr>
<td>June bug</td>
<td>17</td>
</tr>
<tr>
<td>Kale, insects injurious to</td>
<td>9</td>
</tr>
<tr>
<td>Kerosene</td>
<td>36</td>
</tr>
<tr>
<td>Lettuce, insects injurious to</td>
<td>9</td>
</tr>
<tr>
<td>May beetle</td>
<td>17</td>
</tr>
<tr>
<td>Melons, insects injurious to</td>
<td>15, 20, 32-37</td>
</tr>
<tr>
<td>Melon aphis</td>
<td>34</td>
</tr>
<tr>
<td>Nicotine</td>
<td>7, 8, 11, 35, 40</td>
</tr>
<tr>
<td>Nicotine sulfate</td>
<td>8, 9, 34, 37</td>
</tr>
<tr>
<td>Onions, insects injurious to</td>
<td>24, 32, 37-40</td>
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<tr>
<td>Onion maggot</td>
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<td>Onion thrips</td>
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<td>Peas, insects injurious to</td>
<td>9, 20, 24, 40-42</td>
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<td>Peppers, insects injurious to</td>
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<td>Potatoes, insects injurious to</td>
<td>14-21, 27, 31, 32</td>
</tr>
<tr>
<td>Potato aphis</td>
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<td>Potato beetle, Colorado</td>
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<tr>
<td>Potato flea-beetle</td>
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<tr>
<td>Potato leafhopper</td>
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<tr>
<td>Potato stalk weevil</td>
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<td>Pumpkin, insects injurious to</td>
<td>22, 36</td>
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<tr>
<td>Radishes, insects injurious to</td>
<td>5, 15, 32</td>
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<td>Rhubarb, insects injurious to</td>
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<td>Seed-corn maggot</td>
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<td>Slugs, garden</td>
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<td>Spinach, insects injurious to</td>
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<tr>
<td>Squash, insects injurious to</td>
<td>22, 32-37</td>
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<td>Squash bug</td>
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<td>Squash vine borer</td>
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<td>Tarnished plant bug</td>
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<td>Tomato worms</td>
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<td>Water cress, insects injurious to</td>
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<td>White grubs</td>
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<td>Wireworms</td>
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