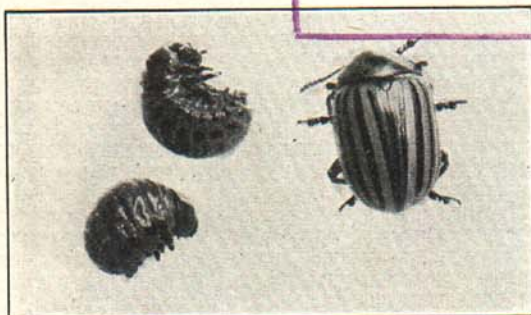


Control Methods for Insects of the Kitchen Garden

R. H. PETTIT

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Potato beetle, larvae and adult.

MICHIGAN STATE COLLEGE
Of Agriculture and Applied Science

EXTENSION DIVISION
R. J. Baldwin, Director

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CONTROL METHODS FOR INSECTS OF THE KITCHEN GARDEN

R. H. PETTIT

The owner of a small kitchen garden is confronted with conditions quite different from those encountered by the commercial grower or trucker. The owner of a small garden is obliged to contend with such insects as cut-worms, white grubs, grasshoppers, wire-worms, and all the rest, but is unable to practice crop rotations, to permit the growing of plants on fresh ground each year. In consequence, such insects as wire-worms and cut-worms are likely to accumulate and to re-establish themselves year after year in the small area under cultivation until finally the garden ceases to produce satisfactory yields.

The truck gardener provides himself with a spray rig, capable of delivering a spray of several hundred pounds pressure at the nozzle, but the owner of the small garden is forced to depend on a small hand sprayer, or perhaps an atomizer, which at best will deliver the spray under comparatively low pressure. The small garden plot is usually surrounded by weedy ground or ordinary grass sod, in which many pests thrive.

The recommendations given in this bulletin are not adapted to the growing of crops in large fields, but the treatments recommended are selected with extreme care, and it is believed that they are practical for use in a small way. The killing agents have been selected from those readily procurable from local dealers, although other materials may be superior for the use of the professional truck gardener.

In case outbreaks not considered in this bulletin occur, it is the intention of the writer to provide special leaflets when occasion arises.

In order to facilitate the finding of information in this condensed bulletin, the crops considered are arranged alphabetically.

BEANS

The insects most likely to appear on beans in the small garden are maggots, white grubs, and wire-worms.

Bean Maggot—Undoubtedly the most serious pest of beans in Michigan is the bean maggot, which works on the roots, and which in wet seasons may be troublesome. However, in the case of string beans, it is usually sufficient to observe the following precautions; use well-rotted manure rather than fresh manure; see that the soil is well-com-

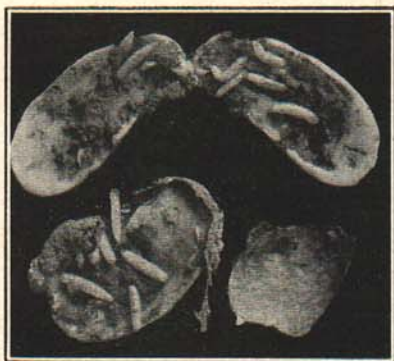


Fig. 1. Work of Bean Maggot in sprouting beans, taken from infested field, enlarged.

pacted; and, if the season is a wet one, plant the beans less than an inch deep. During dry seasons, maggots are not likely to appear and, after the beans get nicely started, the danger from the maggot is over for the season.

White Grubs sometimes eat the roots from the plants. See article on white grubs under "Corn".

Wire-worms sometimes appear in grass or sod land. Liming the soil helps very materially in that it makes the land unattractive to the snapping beetles, which lay the eggs that produce wire-worms.

Red Spider—A tiny mite, called the red spider, is liable to appear on the leaves during a prolonged dry spell. The application of plenty of water with a hose, or a spray of nicotine applied as described on page 19 is usually sufficient to control the red spider.



Fig. 2. Very young bean plants attacked by bean maggots.

Slugs are usually found in moist places. In case they appear, it is well to remove all pieces of board or objects under which they may hide themselves. Probably the best remedy is to use poisoned bran bait, such as is used for cut-worms. See page 8.

The **bean weevil** sometimes appears late in the season in beans that are to be saved for seed. It may safely be ignored when raising string beans or snap beans for the table.

BEETS

It is fortunate that garden beets are not usually preyed on by many pests, since the tops are so often used for greens. Neither the tops of beets, of Swiss Chard, or of any related plants used for greens should be sprayed or dusted with poison, owing to the danger to human life. A few caterpillars and leaf-eating pests can usually be controlled by hand-picking, and the aphid and sucking bugs may very appropriately be ignored until after the tops of the plants become too large for use as greens. After that time, plant-lice and sucking bugs can be controlled safely by 40 per cent nicotine sulphate used at the rate of one tablespoonful to a quart of hot, strong soapsuds, applied as a spray through a hand atomizer or a hand sprayer. Pyrethrum or derris dusts or sprays applied in the same way are also effective.

CABBAGE

Cabbage-maggot—Cabbage, cauliflower, and radish are all attacked by the cabbage-maggot, which does its work early in the season before the plants attain much size. The standard treatment for cabbage-maggot is to moisten the soil around the roots with a solution of bichloride of mercury, sometimes called corrosive sublimate. This solution is made by dissolving one ounce of the poison crystals in hot water, and then diluting to eight gallons with cold water. Half a teacupful of this solution should be poured about the stem of each cabbage or cauliflower at the time of setting out or within a day or two afterwards.

Corrosive sublimate is an *extremely violent poison*, dangerous to all who handle it. It has the property of combining with metals, so that neither the solution nor the crystals should be allowed to come in contact with metals at any time. The solution should be made in a wooden vessel or one of stoneware or glass. An enamel ware dipper should be used in making the application, and neither the dipper nor the container nor anything else that comes in contact with the solution should ever be used for any other purpose afterwards. Before using a solution of corrosive sublimate for any purpose, consult your local advisor for directions. *The antidote for corrosive sublimate* is to induce vomiting. Give milk or the whites of eggs immediately. *Then send for a doctor.*

Tarpaper disks, described in special bulletin 183, will control the cabbage-maggot on cabbages and cauliflower. However, they are not adapted for use on radishes.

Cut-worms are likely to appear early in the season. They can best be controlled in the case of cabbage and cauliflower by the use of poisoned bran bait. See article on page 8.

Cabbage worms are sure to appear before the season is over. Before the cabbages form heads, one can use a dust of arsenate of lead or of

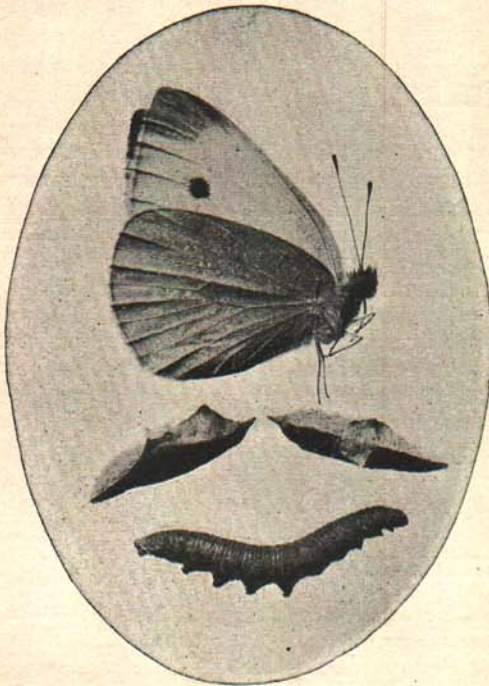


Fig. 3. Imported cabbage-worm larva, pupae and adult, slightly enlarged.

arsenate of calcium mixed with gypsum or hydrated lime. See page 19. In using poisonous dusts on any plants, be sure that none of it drifts over on to the tops of beets, lettuce, spinach, or any parts of plants likely to be used as food. After the heads have formed, however, poisonous dusts are unsafe to use, and one should then use a dust made by mixing one part of hellebore with four parts of cheap flour. Pyrethrum or derris dusts or sprays may also be used without danger to humans. See page 19. Dust this mixture on the plants through a coarse cloth from time to time as the worms appear. Any one of the pyrethrum extracts could be used according to the directions given by the maker.

Cabbage lice appear late in the season and, while they present something of an alarming appearance,

nevertheless, they are seldom very troublesome unless present in very great numbers. They can be readily killed by a spray of nicotine and soap. Use one tablespoonful of 40 per cent nicotine sulphate in one quart of hot, strong soap-suds, and apply while the liquid is still hot.

CARROTS

Carrots are not likely to be seriously injured by any insects. Aside from the large, striped yellow and black caterpillars that will appear in late summer and which may be controlled by hand-picking, no insects are very likely to cause trouble.

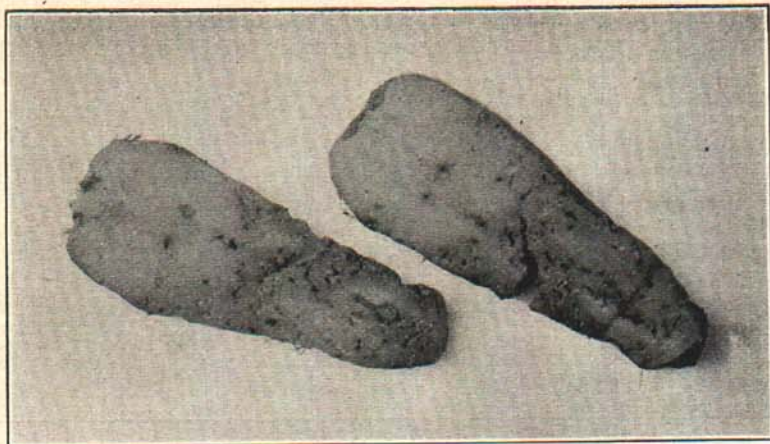


Fig. 4. Work of carrot rust-fly in carrots.

Carrot Rust-fly—Farther north the carrot rust-fly has been found, and it may appear anywhere. The injurious form is a small yellowish maggot about a third of an inch long, which tunnels in the roots, and which continues to tunnel in carrots after they have been placed in storage. If any such work is noticed, it should be reported to the entomology department at Michigan State College.

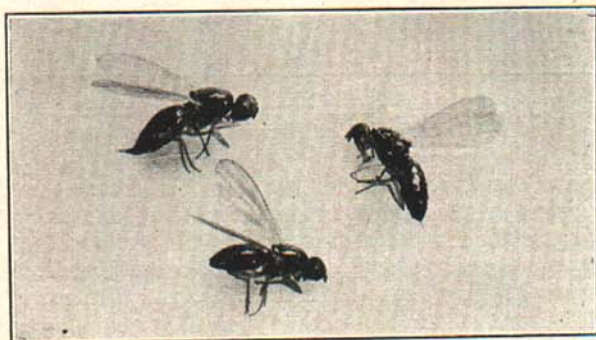


Fig. 5. Winged flies of carrot rust-fly, enlarged about three times.

SWEET CORN

White Grubs—Among the serious enemies of sweet corn are the white grubs, which are rather heavy-bodied, white larvae provided with yellow heads and legs. They work underground and eat off the roots of the plant. These grubs are not evenly distributed over the State but are more frequently found in land that has recently been in grass sod, than in other land. As a matter of fact, the best control for white grubs consists in preparing the land before the crop is planted. This prac-

tically calls for the services of an expert, because not all land is safe to treat in this way. The degree of natural acidity of the soil affects the results very profoundly. If further information is desired on this subject, write to Michigan State College, Department of Entomology, for Bulletin No. 132, which will be sent on application.

Wire-worms often attack sweet corn, especially if planted on land which lacks lime. They are the larvae of common snapping-beetles, or click beetles, which lay their eggs, by choice, in grassy places. On the farm, it is customary to maintain wire-worm infested land in clover for a period of years, in order to starve them out but, in the small garden where rotation is not practicable, about the only thing that can be done is to treat heavily with lime the soils that show an acid reaction and see that the land is well drained.

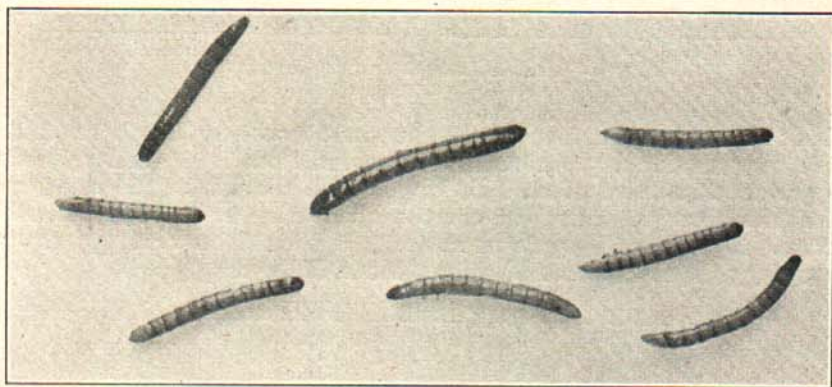


Fig. 6. Wire-worms, larvae of snapping-beetles.

Cut-worms are the larvae of moths. Most of them pass the winter partially grown in sod land. In the spring, they attack young plants. They usually cut off such plants level with the ground, and sometimes prove very troublesome. The best way to control them is by means of poison bran bait. To prepare this bait, thoroughly mix:

Bran	5 pounds
White arsenic (not arsenate of lead)	4 ounces
Molasses	1 pint
Water	Sufficient to moisten

To this mixture add one lemon or orange, skin and all, chopped fine. Scatter about the garden in the evening. Two or three treatments are usually sufficient to do away with the cut-worms. If the particles are broken up very finely, there is very little danger that birds or poultry will be injured.

European Corn Borer—The European corn borer is a moth of which the small, pink larvae, something less than an inch long, tunnel in the stalks of corn and other fleshy stemmed plants. It passes the winter in last year's cornstalks and under rubbish on the ground and is best



Fig. 7. Corn borers working in short section of cornstalk.

controlled by a thorough clean-up over large areas. It is impossible to do very much for this pest once it gets into the plant. For further information, see circular bulletin No. 70 of the Michigan State College.

Seed Corn Maggot—The seed corn maggot, which is sometimes known as the bean maggot, attacks the seed of corn in the hill sometimes just after sprouting and always before the plant attains much size. It is worse in wet seasons. It has been observed that seed planted fairly deeply escapes with less injury than that planted near the surface.

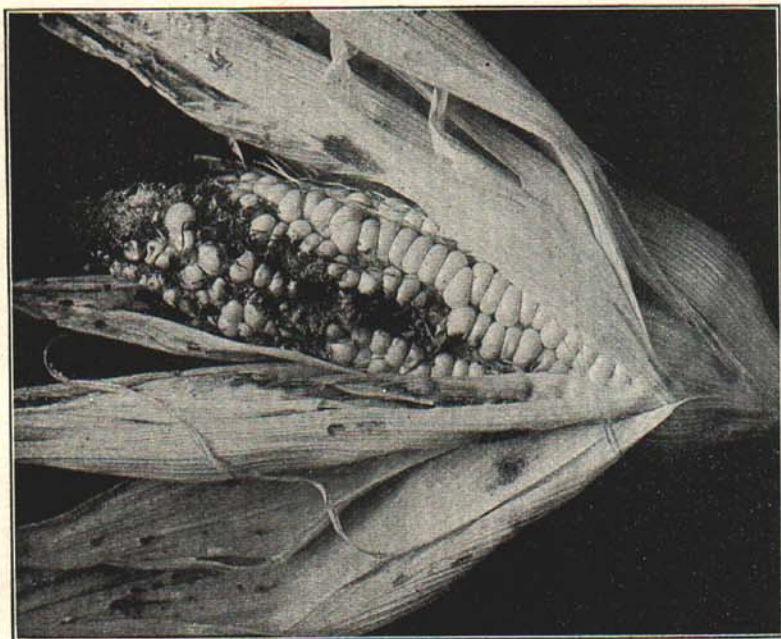


Fig. 8. Work of corn ear-worm in corn.

The use of well-rotted manure in place of fresh manure somewhat lessens the likelihood of attack.

The Corn Ear-worm—The corn ear-worm appears when the corn is in the "milk" or "dough" stage and tunnels into the ears through the silk on which the eggs are laid. It is possible to gain some measure of protection against this pest by dusting the silk, just after it is forced out of the ear, with equal parts of arsenate of lead and hydrated lime, the dusting should be repeated two or three times through a coarse cloth. The worms are commonly seen working singly in the ears, usually about the tips. The part injured usually turns black and is attacked by a fungus. If the injured part is cut off, the remainder is safe for food. In other words, in spite of the presence of the corn ear-worm in an ear of sweet corn, that part of the ear not mutilated is entirely fit for food if the injured part is cut off and discarded.

CUCUMBERS

Cucumber-beetle—By far the worst enemy of cucumber with which

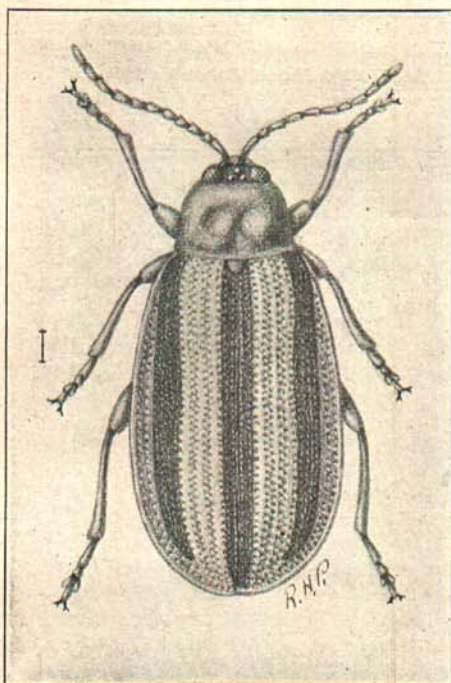


Fig. 9. The striped cucumber-beetle, greatly enlarged.

we have to deal is the small striped beetle, known as the cucumber-beetle. A glance at the figure, which is greatly enlarged, will identify the insect to anyone who has ever raised cucumbers. These tiny beetles, little more than an eighth of an inch in length, appear in large numbers and usually attack the cucumbers soon after they appear above ground. They continue to work on the young plants and often completely destroy them before they attain any size. The insects are easily controlled by dusting with 5 per cent of calcium arsenate, thoroughly mixed with 95 per cent of agricultural gypsum. Thoroughly stir five ounces of calcium arsenate into six pounds either of ordinary agricultural gypsum or the superfine gypsum specially prepared for this purpose. Dust through a piece of coarse cloth from time to time as the beetles appear and watch carefully that the beetles do not get too good a start through

neglect. They multiply almost unbelievably in a few days.

Cut-worms—Cut-worms very often cut off the young plants of cucumbers, melons, squash, and other similar plants. They may be controlled by the poison bran bait, described in the article on insects infesting corn.

White Fly—It is not unusual for the white fly, which is primarily a tomato insect, to work over on to cucumbers. The same treatment is recommended for the white fly on cucumber as that mentioned in the discussion of tomato insects.

Plant Lice—The under sides of the leaves of cucumbers are sometimes found to be badly infested by plant lice. They can be readily controlled by spraying with the nicotine mixture recommended for use on cabbage lice. It is usually necessary to turn over the vines or to arrange things in some way so that the spray may be made to hit the under surfaces of the leaves, where the plant lice are likely to congregate. Strong nicotine dust is very effective for use on cucumber lice on large plantations, but is not well adapted for garden use.

LETTUCE

It is imperative that all gardeners be warned against the use of poisons such as arsenicals or nicotine on lettuce. Nicotine sulphate leaves a residue, which may accumulate in sufficient quantity on a plant like lettuce to make it unsafe for human consumption. Plants with large leaf surfaces like lettuce, which is eaten raw, or spinach, or even beet tops, which are used for greens, should never be sprayed with arsenicals or with nicotine sulphate. Whenever it becomes absolutely necessary to spray lettuce, use some non-poisonous material like pyrethrum or derris. Both of these are vegetable products, and can be obtained, although sometimes with difficulty, from dealers. Neither one is poisonous to humans, and, if applied, the directions issued by the maker should be observed. There are a number of different brands of each of these insecticides, and each one calls for certain definite instructions when used. It is, therefore, preferable to use the directions of the maker, rather than to attempt the discussion of various brands in a condensed bulletin of this nature.



Fig. 10. Gray field-slug, enlarged.

Slugs—Slugs are soft-bodied, slimy creatures that are really snails without shells. They leave a track of slime wherever they go, and they prefer moist situations. They work at night and often hide under plants, pieces of board, or under flat stones during the daytime. If they become troublesome during a wet spell, special instructions for their control will be issued.

Cut-worms—Cut-worms frequently attack and cut off lettuce early in the season. An application of poisoned bran bait is called for in such cases. See "Corn Insects".

ONIONS

Cut-worms—Both "set" onions and seed onions which are attacked by cut-worms should be protected with the poisoned bran bait recommended for use against cut-worms in corn.

Onion-maggot—The onion-maggot is very similar in appearance and habit to the cabbage-maggot. In the case of seed onions, five treatments with bichloride of mercury or corrosive sublimate, as recommended for the cabbage-maggot on radishes, should be applied, the first treatment to be given when the onions are about an inch in height and the other four treatments at weekly or ten-day intervals there-



Fig. 11. Onion-maggot and its work in small onion, enlarged about twice.

after. In the case of "set" onions, the first treatment should be given shortly after the sets are placed in the ground, and four more should be given at intervals of one week or ten days. In case bichloride of mercury is used, it is urged that before making the application the grower consult with his local adviser.

Onion Thrips—Occasionally, onions will be attacked during a hot period by a tiny insect that blasts the tops and which is known among onion raisers as white blast. This condition is caused by tiny insects, known as thrips, which scrape the surface and cause the leaves to wilt and collapse. The best treatment is an application of nicotine, such as is advised for use against cabbage aphid. Two or three applications on alternate days are usually sufficient to check the outbreak, which ordinarily subsides on the coming of cool weather.

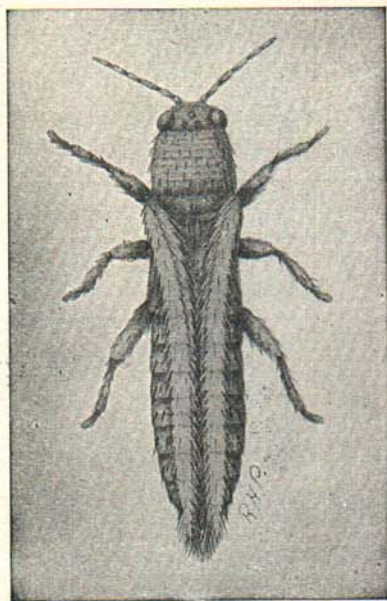


Fig. 12. Onion thrips, greatly enlarged.

PARSNIPS

The parsnip is very closely related to the carrot, and is infested by the same insects.

PEAS

Plant Lice—Peas are subject to attacks by plant lice or aphids. A spray of nicotine sulphate and soap, similar to that recommended for use in controlling cabbage lice, is usually sufficient to control the common pea aphid. Repeated applications may be necessary, and it should be remembered that each louse must be hit by the spray in order to be killed.

Most of the other insects ordinarily found on peas are very similar to those found on beans and may be controlled by the same measures.

POTATO

Potato-beetle—The potato-beetle is familiar to everyone, both the red slugs and the adult striped beetle may be controlled by a spray or

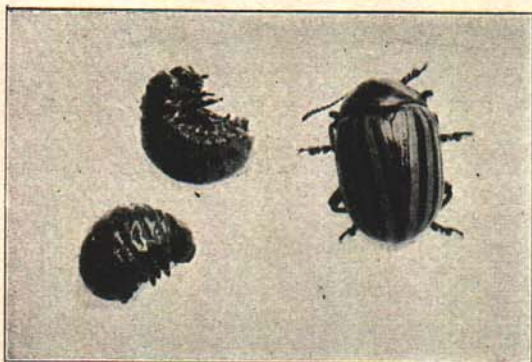


Fig. 13. Potato-beetle; adult beetle and larva, enlarged.

dust of arsenate of calcium. In case a dust is used, shake on through a coarse cloth a mixture of five parts of arsenate of calcium thoroughly mixed with 95 parts of hydrated lime. In case arsenate of calcium is difficult to obtain, then substitute for the arsenate three parts of paris-green. In case a spray is used, it should be made up at the rate of one pound of arsenate of calcium to 100 parts of water or bordeaux mixture. The formula for making bor-

deaux mixture can be obtained of your local adviser. In case paris-green is used, one-half pound of paris-green to 50 gallons of water or bordeaux mixture is the customary dose. It may be necessary to repeat this application from time to time, as the beetles or their larvae appear in sufficient numbers to make treatment necessary.



Fig. 14. Potato leaf, showing hopper-burn.

Potato Leaf-hopper—This tiny, green, jumping and flying pest usually appears, if at all, during dry spells. It causes the leaves to turn brown, curl, and finally to die. The best remedy is a spray of strong bordeaux mixture applied thoroughly so as to hit both the upper and under surfaces of the leaves.

Plant Lice—Plant lice on potatoes can be readily controlled by a spray of nicotine applied as recommended for the control of cabbage lice.

Plant Bugs and Leaf Bugs—These insects may be controlled best by a spray of nicotine such as is recommended for use against cabbage plant lice. Many of them hide under rubbish. Clean culture and the destruction of weeds in the vicinity are called for in case they make their appearance.

White Grubs and Wire-worms—These pests often attack potatoes, tunneling into the tubers very freely. See article on corn insects.

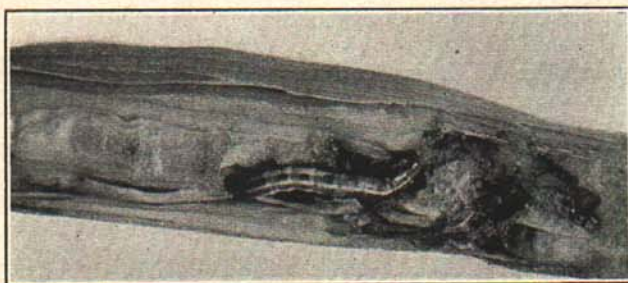


Fig. 15. *Papaipema nebris* in cornstalks, one of the stalk borers easily mistaken for the European corn borer. Slightly enlarged.

Common Stalk Borer—This insect is a slender, naked caterpillar which sometimes attains a length of a little more than an inch and which is of a cream color striped longitudinally with narrow stripes of chocolate brown. The middle of the body is also colored brown. It is the larva of a moth or miller and tunnels in the stalks of all fleshy-stemmed plants. As the insect is always inside of a tunnel in the plant itself when discovered, there is no way to deal with it once it is established. Furthermore, no spray or treatment is known that will prevent these borers from attacking fleshy-stemmed plants. It happens that their favorite food is ragweed and that the larvae work in other weeds as well. The destruction of ragweed over large districts would undoubtedly cut down the numbers of stalk borers, if it were possible to bring this about. Unfortunately, there is no practical and really effective method known to control the common stalk borer.

RADISHES

Cabbage-maggot—About the only pest that attacks radishes in gardens is the cabbage-maggot. A large proportion of the radishes grown in the kitchen garden are likely to show the work of maggots, the root often being channeled and pierced by blackened tunnels by the tiny headless and footless maggots which measure about an eighth of an inch in length. The treatment for the cabbage-maggot in radishes is the same as that for the same insect in cabbage. The soil should be moistened several times with a solution of corrosive sublimate, according to the directions given for controlling cabbage insects.

Consult your adviser before applying corrosive sublimate solution. Wash or peel radishes before use.

SQUASH

Cucumber-beetles—This insect infests squash and melons along with cucumber. For control measures, see article on cucumber insects.

The Squash Bug—A dark gray or nearly black bug, about three-fourths inch in length, often sucks the sap from squash vines, leaves and stems. This bug may be readily recognized by the suffocating odor which is given off when one is crushed. No satisfactory sprays or dusts are known for its control. During periods when the weather is fairly cool at night and when the sun shines in the daytime, the bugs come out from their winter quarters under rubbish and will seek shelter under pieces of board placed near the squash vines for that purpose. Early in the morning, before the air has become warm, these bits of boards may be picked up and turned over and the bugs killed. A very convenient way to kill them is to jar them into



Fig. 16.
Squash Bug.

a can containing water with a small amount of kerosene floating on the surface.

Squash Vine Borer—The larvae of a moth sometimes tunnels inside the vine just above or just below the ground level, hollows out the vine and causes it to die, or mutilates the plant so that it is unable to bear fruit. A shovelful of soil placed over the vine where it comes in contact with the ground, especially at a joint, will cause the vine to take root at these covered joints, so that the mutilation just described may be somewhat compensated. Vines that are induced to take root here and there along their course often bear squash quite satisfactorily under such conditions.

TOMATO

Cut-worms—It is very disappointing to set out a patch of tomatoes and on the following morning to find half of them cut off at the ground level by cut-worms. This may be prevented by enclosing each plant in a paper collar. In other words, erect a stiff paper barrier around each plant, as shown in the illustration. This barrier is merely a round

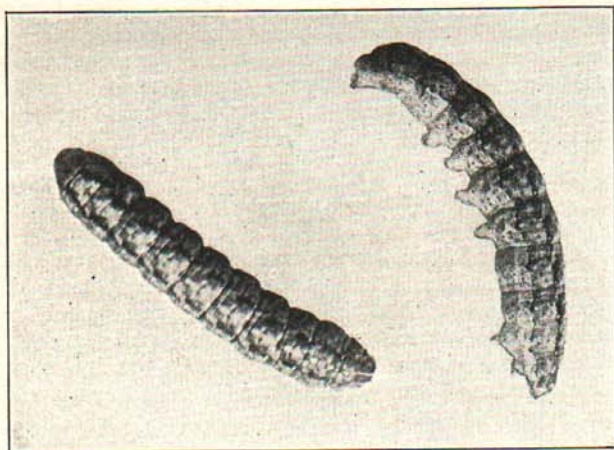


Fig. 17. Climbing cut-worms, *Lampra alternata*, slightly enlarged.

roll of stiff paper, perhaps two or three inches in diameter, placed about the plant and held in position by throwing a little soil around the base of the roll. A glance at the illustration will make the operation of such a protecting collar perfectly clear and understandable. Most cut-worms, with the exception of the climbing forms, do not find it possible to climb up the smooth surface of the paper. If after placing these collars about the plants at the time they are set out, one finds here and there a plant cut off, it will be always possible to find the cut-worm inside the collar on digging into the soil. In such a case, destroy the worm, replace the plant, and apply a new collar, after which the danger from cut-worms will pass. The use of poisoned bait, as described in the article on corn insects, may very properly be practiced along with the paper collars in protecting tomatoes.



Fig. 18. Tomato plant with collar of stiff paper for cut-worms.

Tomato Worm—A large green worm, known as the tomato or potato worm, having a curved horn projecting backwards at the tail, is often found devouring the leaves of the plants late in the season. These worms are best removed by hand when tomatoes are grown under garden conditions.

White Fly—Another insect that is very likely to appear when tomatoes are started in greenhouses is the white fly, a minute sucking insect, which appears in swarms and which remains with the plant all summer. A few individuals often come on plants that are started under glass. The insects are unable to survive our winters out-of-doors but thrive during the warm summer and sometimes become very annoying. Perhaps the best remedy is a spray of nicotine, the same as that recommended for cabbage lice, applied from time to time as the presence of these swarms of insects seems to demand. It is hopeless to attempt to get rid of them completely but their numbers may be greatly reduced by the application of nicotine.

TURNIPS

The turnip belongs to the same botanical family as cabbage, cauliflower, and radish and is attacked by the same pests. The cabbage worm feeds on the leaves, and the cabbage-maggot works on the roots. Unless these insects become more than ordinarily troublesome, they may be safely ignored, since the turnip usually produces enough leaves so that the destruction of a few of them does not seriously injure the plant. The injured portion of the root may be pared off when preparing the turnip for the table, so that any attempt to control the work of the cabbage-maggot in turnips is usually not worth while.

ANTS

Ants occur almost everywhere, in the kitchen garden, in the flower garden, in the lawn, and often in the dwelling. Ants may be divided into two classes, those that feed on grease and those that prefer sweets. The latter predominate very greatly over the former, and the sweet-loving species may readily be controlled by the use of paris-green and brown sugar. Thoroughly mix one ounce of dusting paris-green or, in the absence of the dusting grade, common paris-green in one pound of brown sugar. Do not use granulated sugar. Sprinkle this mixture wherever the ants are working, being sure that no lumps are there to attract birds, children, or anything other than ants themselves. If the poison is stirred in evenly enough with the sugar, the ants will take some of this home and feed it to their young or else the mature ants will be killed off which will leave their young to die from neglect. This treatment will have to be repeated from time to time after each rain or sprinkling of the lawn or garden but, after a few applications, the ants will usually disappear. It is imperative when using this mixture to observe precautions that will prevent accidents and possibly fatalities. Keep the reserve supply of poisoned sugar in a tightly closed fruit jar well-labeled and inaccessible to children or to anybody who is not familiar with its use and the danger attendant upon its

misuse. Break the particles up finely and scatter it very thinly where the ants can find it and lock up your reserve supply in an inaccessible place where it is safe.

Arsenate of Lime (Arsenate of Calcium)—Is usually used as a dust in gardens. It is mixed at the rate of five parts of the arsenate to 95 parts of fresh hydrated lime or gypsum. After the two have been thoroughly stirred, they may be applied with a patent duster or shaken through a coarse cloth on to the plant. It is a violent poison and should be handled with care.

Bordeaux Mixture—This is used as a repellent for certain insects, notably for potato leaf-hoppers. It is prepared by stirring together four pounds of copper sulphate dissolved in 25 gallons of water, with six pounds of hydrated lime also stirred into 25 gallons of water. The two batches are mixed separately and stirred together, to produce the bordeaux, which should be of a clear robin's egg blue color.

Derrisol—An extract made from a tree that grows in India. It is a preparation which kills practically all insects on contact but which is non-poisonous to warm-blooded animals, which, of course, includes man. It is used at the rate of one pint in 100 gallons of water, with two or three pounds of ivory soap. It works slowly, and time must be allowed for the death of the insects, sometimes as much as 48 hours after the application if the weather is cool.

Hellebore—The ground root of a plant which contains a poisonous alkaloid. It is therefore a vegetable product and breaks down or decomposes on exposure to the weather, usually in a week or ten days. It is far safer to use than an arsenical on cabbages and some fruits.

Nicotine—A violent poison, most effective when in the volatile condition. It is ordinarily sold as a 40 per cent sulphate of nicotine which for optimum results requires an activator to transform the more stable sulphate into its volatile form. The activator in most common use at the present time is cheap laundry soap. Mix in the following proportions and apply immediately, as it will not keep well after being mixed:

1 quart strong soap suds.

1 tablespoonful 40 per cent nicotine sulphate.

A cheap grade of soap serves the purpose much better than a more refined grade, due to the presence of free alkali in the cheaper soap.

Paris-green—Paris-green, otherwise known as arsenite of copper, is a violent poison. It is usually used in combination with bordeaux mixture or with hydrated lime, which partially overcomes its tendency to burn the foliage of plants on which it is sprayed. The standard strength used for general purposes is at the rate of four ounces to 50 gallons of water or bordeaux mixture.

Pyrethrum—The powdered stems, leaves, flowers, or buds of a special kind of daisy, most of which is produced abroad. This is a non-poisonous insecticide which kills insects by contact. It is used both in the form of a dry powder and as an extract.

Derris—The powdered roots of certain tropical plants. This material is non-poisonous to higher animals. It is also available as an extract.

