Insect Control IN THE *Victory Garden*

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ASSOCIATE CURATOR OF INSECTS AND SPIDERS

SCIENCE GUIDE No. 117 — THE AMERICAN MUSEUM OF NATURAL HISTORY

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IN THE

Victory Garden

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The Healthy Garden

The victory gardener, whether amateur or seasoned veteran, is certain to be worried by insect pests. Some of these are capable of causing serious losses, but it is comforting to know that, with regular examination of plants and the use of simple control methods, the ordinary small garden will come through the season with little or no loss. The victory gardener has a big advantage over the commercial grower because he can keep a keen watch on almost every individual plant. Hand picking of most pests is all that will be necessary. There are only a few kinds of garden insects that will require chemical treatment, and this does not call for extensive equipment or a large variety of insecticides.

Before discussing the various insects and insecticides, we may consider the value of certain cultural practices in controlling some kinds of insects, and the effect of environment on the garden and on the insect problem in general. The position of the garden in relation to other gardens is important, because if gardens are contiguous and the same crops are grown in all, the danger of insect damage is much greater. At the same time, control measures may be more economically carried out if a number of gardeners cooperate in buying equipment and in mixing insecticides for all the gardens at one time.

It is generally agreed that clean culture reduces insect damage. However, the small gardener cannot always practice clean culture. Adjacent yards may contain numerous weeds and debris, and insects may flourish in these. To cut the weeds after they have grown does not help the isolated gardener; it makes matters worse, because some kinds of insects infesting the weeds will migrate to garden plants.

Gardens adjacent to waste land and weed patches are very frequently subject to damage by cutworms and other migratory caterpillars. In order to guard against these it is frequently advisable to carry out cutworm control before setting out garden plants.

The general cleanup of adjacent waste land should occur in the fall in order to remove overwintering protection for insects, or in the very early spring. Late spring or summer cleanup will cause tarnished plant bugs and other pests to move to the garden. It is often better to leave lush growing weed patches alone at this time, because the pests will find plenty of food there.

No attempt has been made to include all the insects found in the vegetable garden, and some crops that are not suitable to the victory garden are not mentioned. The more common pests are discussed and control measures given for these. Other insects with similar habits may be controlled by the same treatment.

Insecticides

Two types of insecticides are used in insect control—stomach poisons for chewing insects and contact poisons for sucking insects.

Stomach Poisons

Stomach poisons are used in the control of chewing insects. They may be applied either as a spray or a dust, but the average victory gardener will find spraying more satisfactory and less expensive.

Arsenate of Lead

This is the best known of the arsenical poisons. It is a white powder and is used at the rate of 1 to 2 pounds to 50 gallons of water. It is a rather slow killer but is safe to use because it does not burn the foliage. To prepare dust, mix 1 pound of powder with 6 to 8 pounds of hydrated lime or 9 pounds of dusting sulphur.

Arsenate of Lime

This is a fine white powder with fast killing properties but apt to burn the foliage. It is used at the rate of ¾ pound to 50 gallons of water, 2 pounds of hydrated lime being added to prevent burning. It does not adhere as well as arsenate of lead but is the cheapest of the arsenicals. For dusting, mix 1 pound with 10 pounds of hydrated lime.

Paris Green

This is the oldest of the arsenical insecticides and is still used for the potato beetle and in poison baits. Other arsenicals are as good for potato beetles. With half a pound of Paris green in 50 gallons of water, add 2 or 3 pounds of hydrated lime to prevent burning. For dusting, mix one pound of Paris green with 20 pounds of hydrated lime.

Magnesium Arsenate

This is a white powder, chiefly used in the control of Mexican bean beetles. It is mixed at the rate of 1 pound to 50 gallons of water. When used as a dust, 1 pound of the powder is mixed with 10 pounds of hydrated lime.

Sodium Fluosilicate

Normally a white powder, this chemical contains a green dye when used for household insects. It is used in the control of the Mexican bean beetle. Mix about 1½ pounds per 50 gallons of water. As a dust, dilute at the rate of 1 pound to 8 or 9 pounds of hydrated lime.

These are used in the control of sucking insects and kill by direct contact.

Nicotine Sulphate

This is the most commonly used contact insecticide and it is the one that will be chiefly used during the war. The standard for nicotine sulphate is 40% nicotine, and dilutions are based on this content. Six ounces make 50 gallons of spray. The addition of 2 pounds of soap to this amount increases the efficiency of the spray. For use as a dust, mix 5 pounds with 100 pounds of hydrated lime.

Pyrethrum and Rotenone

Rotenone is not available at the present time, but a limited amount of pyrethrum is available in packages of 1 pound or less. This powder is applied as a dust. It is used chiefly for the control of the cabbage butterfly and the Mexican bean beetle and must be applied every 10 days to 2 weeks to be effective.

Soap

Soap has been pretty generally replaced as an insecticide by the other contact sprays, but it can be used in the control of aphids. Three pounds of laundry soap will make 5 gallons of spray. The soap is cut into thin strips and dissolved in hot water. The solution is then diluted to the final amount.

The chief use of soap is as a spreader in sprays, and it is then used at the rate of 2 pounds dissolved in a small amount of water to 50 gallons of spray.

Nicotine Spray

The smoker of cigars and cigarettes may make a spray that will prove satisfactory in the small garden. Cigar and cigarette butts may be saved, thrown into a bucket of water, and allowed to soak. In order to determine whether the liquid is strong enough, it can be tested on aphids, of which there are certain to be many in or near the garden. It is advisable to remove the charred ends of the cigarettes, otherwise the liquid will be very dark and the odor unpleasant. The liquid may be strained through a cloth in order to remove particles that would clog the sprayer.

Tobacco Dust

This usually comes diluted and ready to apply. It is useful for aphids and flea beetles and also serves to some extent as a soil insecticide.

Bordeaux Mixture

This is a combination of bluestone (copper sulphate) and lime. It is prepared by dissolving 3 pounds of bluestone in water, mixing 3 pounds of hydrated lime separately in water, and combining the two. This is diluted to 50 gallons. When using the commercial dust to make a spray, follow the table on page 6. If Bordeaux powder is to be made at home, finely

AMOUNTS

Amounts of concentrated insecticides to produce convenient amounts of spray or dust

SPRAYS	For a small garden, mix any of these with 1 gal. of water	For a medium size garden, mix any of these with 6 gals. of water	For a large garden, mix any of these with 25 gals. of water
Arsenate of lead	3 teasp.	2 oz.	8 oz.
Arsenate of lime	2½ teasp.	1 oz.	6 oz.
Hydrated lime	2½ teasp.	1 oz.	6 oz.
Paris green	1½ teasp.	¾ oz.	4 oz.
Hydrated lime	1 oz.	4 oz.	1 lb.
Nicotine sulphate (40% Nicotine)	1½ teasp.	8 teasp.	4 oz.
Soap	1 oz.	4 oz.	1 lb.
Bordeaux mixture powder	2¾ oz.	1 lb.	4 lbs.

DUSTS	For a small garden, mix any of these with 5 lbs. of hydrated lime	For a medium size garden, mix any of these with 10 lbs. of hydrated lime	For a large garden, mix any of these with 50 lbs. of hydrated lime
Arsenate of lead	10 oz.	1¼ lbs.	6¼ lbs.
Arsenate of lime	7¼ oz.	14½ oz.	4½ lbs.
Paris green	5 oz.	10 oz.	3⅛ lbs.
Nicotine dust (For a 3% mixture)	6 oz.	12 ozs.	3¾ lbs.
Nicotine dust (For a 5% mixture)	9½ oz.	1¼ lbs.	6½ lbs.

ground bluestone must be used. The dust contains 1 part of bluestone to 8 to 10 parts of hydrated lime.

Corrosive Sublimate

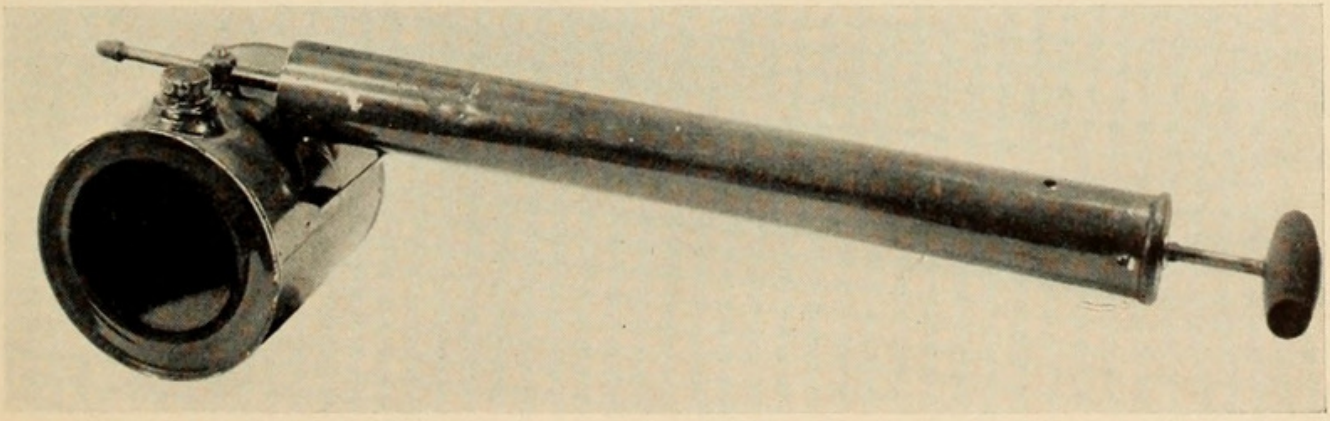
This is a special insecticide used in the control of root maggots. It is a heavy white powder, which is dissolved in water at the rate of 1 ounce to 12 gallons. It is extremely poisonous and must be handled with care, but, as used in the vegetable garden, it is perfectly safe.

The solution destroys metal containers, so the powder must be dissolved in a wooden, glass, or earthenware container. A stock solution may be made by dissolving an ounce of powder in warm water and diluting to 1 gallon. This stock may be stored in quart jars, 1 quart being added to 3 or 4 gallons of water when ready to apply.

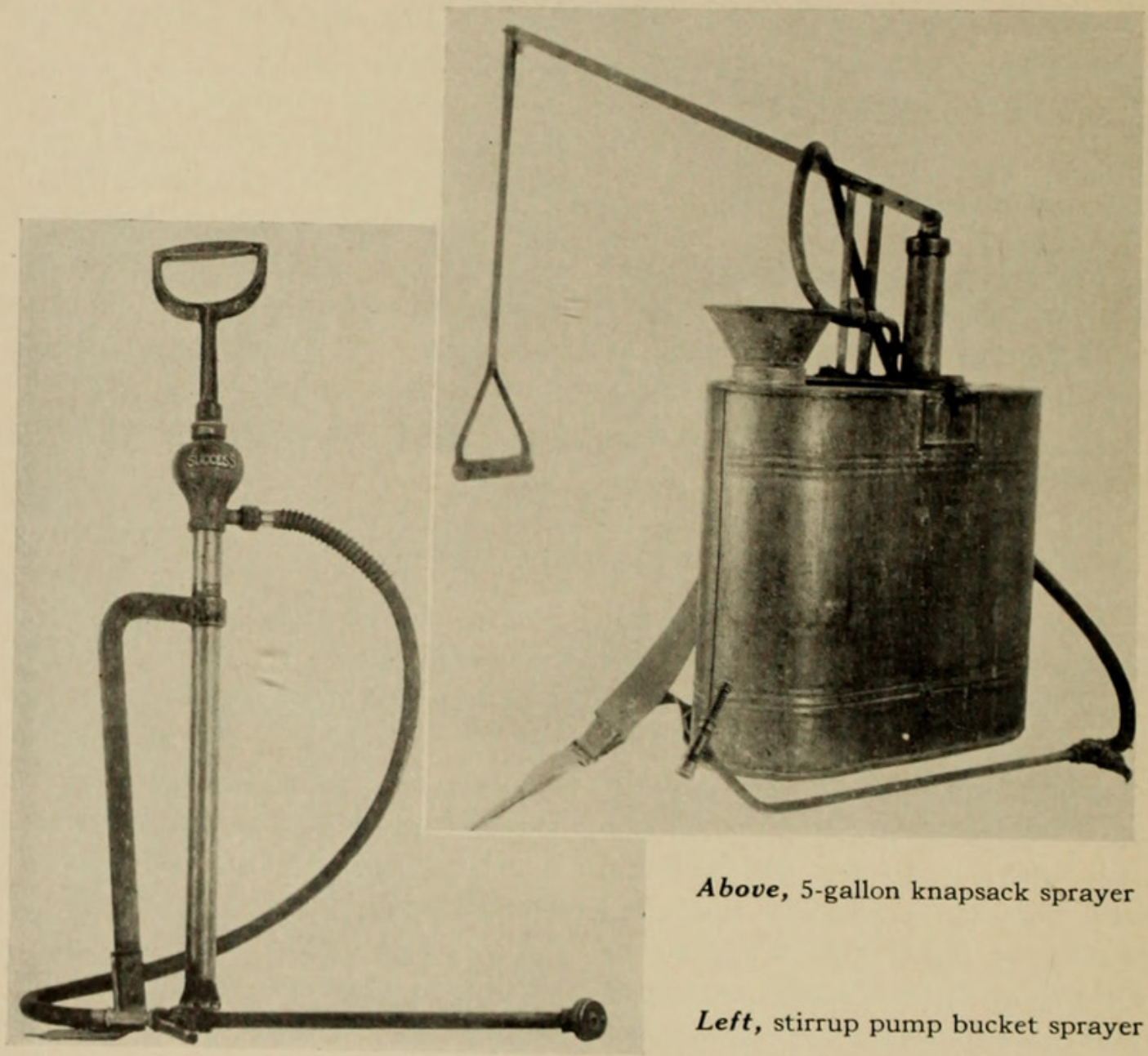
Danger of Arsenical Poisoning

Many people fear being poisoned as a result of eating vegetables that have been sprayed by poisonous substances, particularly arsenicals. Although arsenicals have been used for spraying for about 75 years, it was only after the last war that attention was focused on arsenical poisoning. This came about through the British Government's limiting the amount of lead arsenate residue to be allowed on imported apples. The British were not so much concerned about the arsenic as about the lead, which remains in the body and may cause lead poisoning.

It is perfectly safe to use arsenicals on all vegetables, and their use is recommended by the Canadian Government. If applied according to directions and if the vegetables are well washed before cooking, there is absolutely no danger of poisoning. As an added precaution, do not use the cooking water from plants recently sprayed with arsenicals for making soup. To escape any possible danger of lead poisoning, use calcium arsenate.

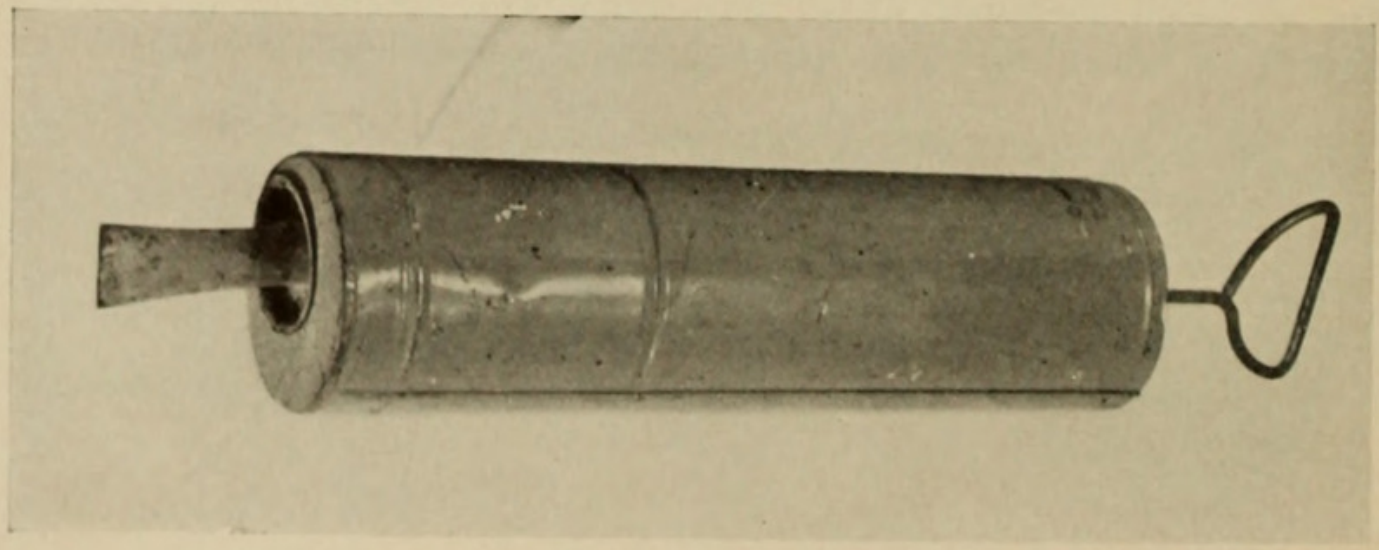


Small type hand sprayer



Above, 5-gallon knapsack sprayer

Left, stirrup pump bucket sprayer



Small type of hand duster

Applying the Insecticides

Spraying

To protect plants properly, spraying must be thorough, and the beginner may have difficulty in determining this. If spray drops from about one-fourth of the leaves, and almost all show signs of spray dots above, and it is felt that most of the leaves have been sprayed below, then the job is satisfactory. The novice is likely to use more spray than necessary, but it is better to use too much than not enough. Only experience will provide a proper balance. When plants are small, the garden may need only a quart of spray, but when they become large several gallons may be required.

Some insects feed on the under side of the leaves, and some on the upper side, while others may chew the whole leaf. A good policy in spraying is to spray the under sides of the leaves to such an extent that the drifting spray will be sufficiently heavy to allow about 50% of the upper surface to glisten. Begin on one side of the row at one end and work backward until that side is finished. Repeat on the other side, also taking in that side of the next row. When treating the lower leaves of beans, cabbages, and other low-growing plants, keep the spray gun well away from the plants and as close to the ground as possible. If you have a sprayer with an up-turned nozzle the task will be greatly simplified.

In using contact sprays, the task is often simplified. Some of the insects to be killed feed on fully exposed surfaces of the plants, so it is possible to hit them with a direct spray from several angles. However, some insects curl the leaves of the plants, and unless the culprit is actually hit the spraying will be ineffective. Contact sprays must be much more thoroughly applied than stomach poisons if satisfactory results are to be obtained.

Spraying Equipment

The spraying equipment will depend upon the size of the garden or gardens it is to cover. It must be remembered that only certain of the vegetables will need spraying. In the average garden of less than 10,000 square feet no special spraying equipment is necessary, providing the gardener has a good spray gun. If the garden is not more than 2,000 or 3,000 square feet the ordinary, small household "flit" gun will prove ample. In larger gardens a large "flit"-type gun will do the work. In gardens of over 10,000 square feet one of the small knapsack spraying machines of about 5 gallons capacity is advisable.

Time to Spray

It is not necessary in a small garden to apply preventive sprays where daily inspections will reveal insect damage as soon as it starts. However, the week-end gardener may find it advisable to, especially if there are extensive gardens close by from which pests might migrate. Cabbages, cauliflowers, and tomatoes may be given preventive sprays to advantage, and it is often advisable to spray the lower surfaces of the leaves of beans to protect the plants against the attack of the Mexican bean beetle.

Spraying may be done at any time during the day, but the spray should not be applied while the leaves are wet as the result of rain or heavy dew. The spray must dry on the plants and once it has dried it usually adheres for several weeks. If washed off by heavy rains, it must be renewed if there is further evidence of insect damage. The new growth, after spraying, is not protected, and this may necessitate further applications. The need for a second or third application can only be determined by the abundance of the pest and a knowledge of its habits.

Never spray more often than necessary, and spray only if it is obvious that control cannot be obtained by hand picking. Remember that insecticides are limited in quantity during the war and that the use of any alternative control measure is a direct contribution to our war effort.

When properly timed, one application should prove sufficient. A second should not be made unless absolutely necessary. Spray only when you feel sure that the increase in yield will much more than pay for the cost of materials. All of the insecticides recommended at the present time can be kept for years without deterioration. Some of the ingredients in insecticides are essential to war industries but they have been made available in order that you may aid in maintaining our food production.

Combination Sprays

It is possible to use all three types of spray—contact, stomach poisons, and Bordeaux mixture—in a single application, and this is often done, though it is wasteful of materials. The best practice is to apply arsenicals and Bordeaux together, since these two give control of all biting insects, as well as of fungus diseases. Contact sprays should be applied separately, and only where needed.

If you desire 6 gallons of spray, use 6 gallons of water but mix in the full amount of the arsenical and Bordeaux just as if you were making 6 gallons of each. For example: 1 oz. arsenate of lime, 1 lb. Bordeaux mixture, 6 gals. water. If the regular amount of water for each insecticide separately were used, the spray would be so dilute as to be ineffective.

Spray Injury

Spray injury results from applying a mixture too strong for tender foliage.

It is usually first apparent on the tips and edges of leaves, where drops of spray have collected and dried. The edges of the leaves dry out, wilt, and turn brown. If the injury is severe, the plant may become defoliated. Damage is most likely to occur when arsenicals or oils are used. Arsenical injury may be prevented by the addition of hydrated lime. The amounts specified in the table are more than adequate.

Dusting

Many insecticides are now applied in the form of a dust. The dusts consist of the various kinds of insecticides diluted with a number of different materials, most of which have some insecticidal value in their own right. The dusts must be applied with a dusting machine, and while in peace-time a number of types are available, few are apt to be procurable during the war. However, some victory gardeners may already own dusters and may prefer dusting to spraying.

Dusting has some advantages, especially in the commercial growing of crops, but the only advantage it offers the small gardener is that it is cleaner. In the long run it is much more expensive, since the materials cost more and more applications are needed. The recognized disadvantages of dusting are that the distribution of materials on the plants is uneven and the dusts wash off more readily than sprays. These disadvantages are more than offset when treatment is on a large scale, particularly where airplane dusting is possible.

Dust must be applied when there is little or no wind. When arsenicals are used alone, the dusting should be done in the morning or evening when there is dew on the plants. Dusting with contact insecticides gives best results during the hottest part of the day, and only when the temperature is above 70° F. However, it may be economical to apply two or more dusts in the same operation.

In general, the same rules must be followed as for spraying, and every effort must be made to get the dust on the under side of the leaves. This is sometimes difficult with low-growing plants.

Suds, Dishwater, and Soap

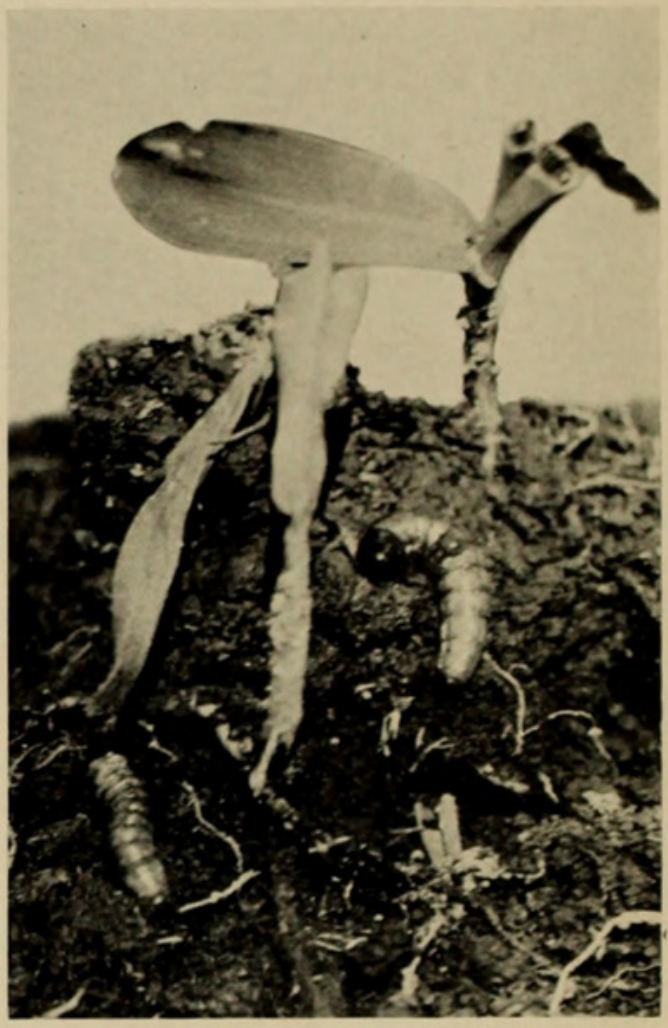
The use of suds and dishwater for the control of some garden insects, particularly aphids, is often recommended. These materials are of little, if any, value as insecticides. A soap solution, to have satisfactory insecticidal properties, must contain at least 4 pounds of strong soap for each 10 gallons of water, and even at this concentration it is inferior to other

contact sprays or dusts. The amount of soap in dishwater is so small as to be unworthy of consideration.

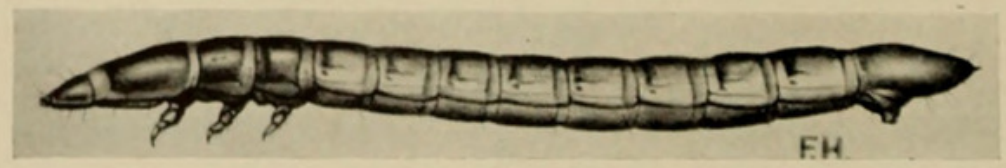
Dishwater usually contains free grease, and this may prove harmful to plants if applied frequently. Those who have lived in the country may recall that the area where dishwater was continually thrown out eventually became bare of grass and only supported the toughest of weeds.

It may be unsanitary to use suds from the washing of clothing. They may contain pathogenic bacteria if some member of the family is suffering from an intestinal ailment.

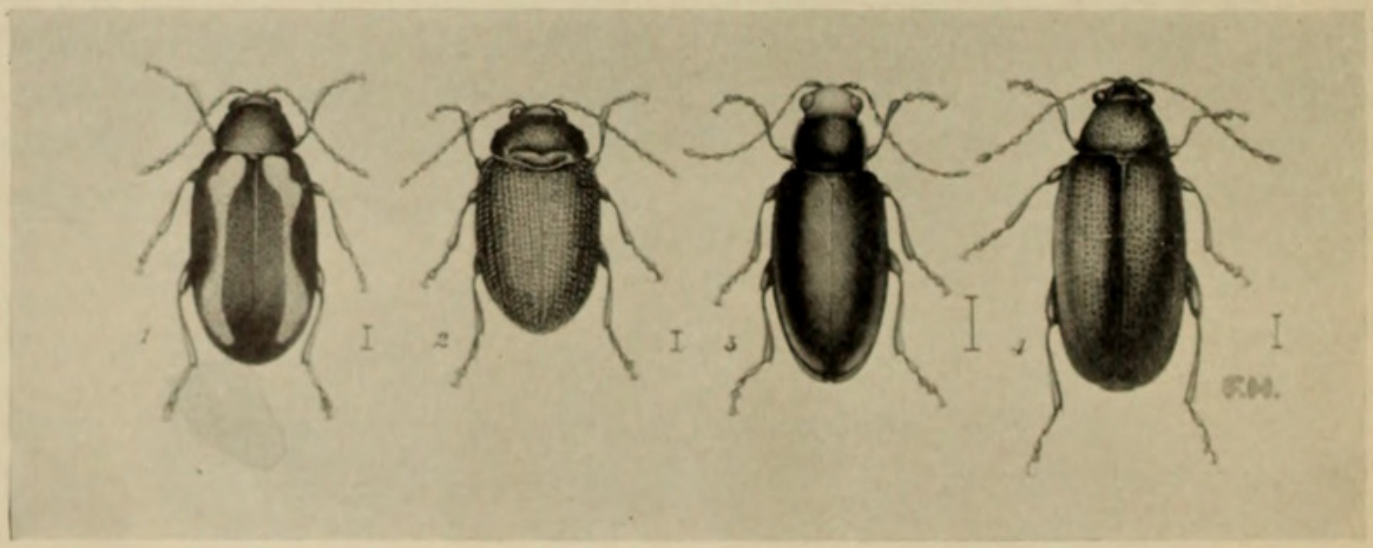
For these reasons we do not recommend the application of suds and dishwater to plants.



Above, cutworms at base of "cut" plant (life size)



Left, a wireworm (enlarged 3 ×)



1. Striped flea beetle. 2. Potato flea beetle. 3. Red-headed flea beetle. 4. Cabbage flea beetle. (All enlarged; see lines for life size)

General Feeders

Many insects feed upon a great variety of plants, and it is therefore necessary to protect almost every garden from them. Then there are insects, like aphids and flea beetles, which chiefly attack only certain kinds of related plants or groups of related plants, the control in all cases being the same. We treat the control of these under general feeders.

Aphids

These are the true plant lice. There are numerous kinds of them, and few plants are immune to their attacks. Since they are sucking insects, they must be controlled by contact sprays or dusts.

Spray or dust the affected plants with nicotine sulphate at the strength recommended under this insecticide (see table, page 6). Homemade nicotine spray (from cigarette and cigar refuse) may be used. Apply during the hottest part of the day (early afternoon).

Flea Beetles

There are many kinds of flea beetles, each limited to certain plants or groups of plants. They eat small holes in the leaves. All can be controlled in the same way. They may be recognized because they hop like fleas.

Apply Bordeaux mixture, which acts as a repellent. At the same time, it repels many other kinds of insects and is an excellent fungicide.

Cutworms

There are very many kinds of cutworms, which are the larvae of noctuid moths, and their habits are varied. The two that interest us most are the true cutworms, which cut off plants just above the surface of the ground, and the climbing cutworms. These insects bury themselves an inch or less in the soil during the day and come out at night to feed. Fortunately they like some other things more than they do vegetable plants, so it is possible to control them.

The following poisoned bait is very effective when properly applied:

Bran	5 pounds
Paris green	1½ ounces
Molasses	6 ounces
Water	2 quarts

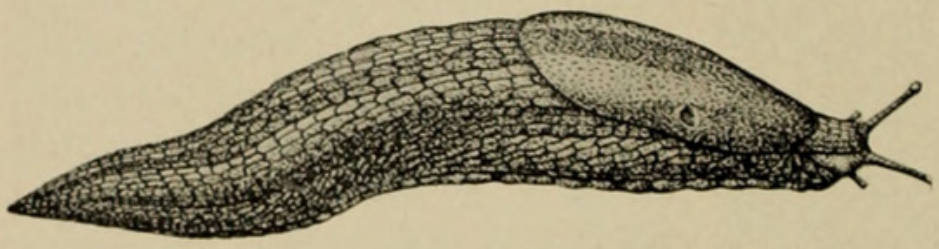
Scatter the Paris green over the top of the bran and stir with a stick or mix with the hand until thoroughly mixed. Dilute the molasses in the water. Pour some of the liquid into the bran and mix well. Continue until the mixture forms a loose, spongy mass when squeezed in the hand but does not all stick together when lifted in the open hand.

Take a handful of the mixture and spread it by a side-arm swinging

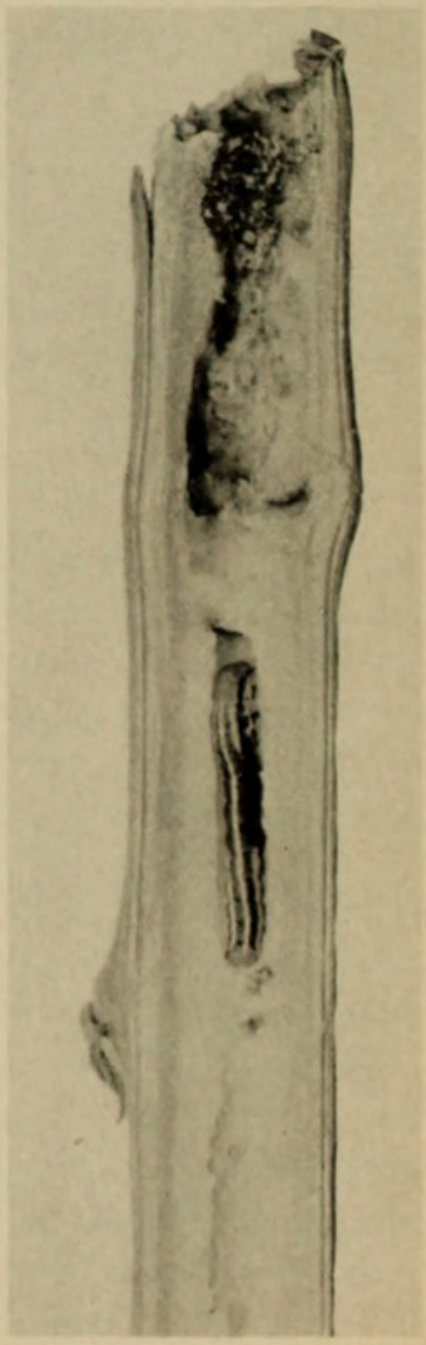
motion, allowing it to flow through the fingers. It is to be broadcast over the garden and in weed patches and hedgerows at least six feet beyond the garden limits. Application must be made at night, and the bait may be reactivated the second evening by a light sprinkling of water. The poison may be washed into the soil by a heavy watering. Keep chickens out of the garden for at least 48 hours, or until the poison has been washed away. If there is a heavy rain the first night, the application must be repeated.

Garden Slugs

These are not insects, but they often cause serious damage in the garden. They are most numerous in damp and shaded gardens. Under commercial conditions spraying may be necessary, but in the garden they may be controlled by placing pieces of board between the rows and destroying the



Above, a common garden slug (enlarged 2 ×)



Right, burdock borer in stem (life size)

Japanese beetle and its work (life size)

slugs found under them in the daytime. Some kinds of slugs are cultivated in Europe as food and are considered a great delicacy.

Wireworms

The larvae of the click beetles are common pests when grasslands have been dug over for the first time. They will attack cereals readily and, in the absence of these, garden plants. They are shiny, reddish-brown, wormlike creatures with hard shells. If many of them are found in digging the garden, control measures should be taken.

They may be trapped by burying pieces of potato about 2 inches under the surface and 10 feet apart. These pieces are dug up about once a week for a month and the wireworms destroyed. The same pieces of potato may be used 2 to 4 times. If shriveled or rotted, they should be replaced. If wireworms are not found after the second application, the procedure may be discontinued.

White Grubs

These are the larvae of June beetles and are readily recognized because they are curved so that the head and tail are close together. They are whitish in color, with a dark digestive tract visible in the middle line.

A usually satisfactory way of controlling them is to pick them at the time of digging and preparing the garden. Chickens and other birds thrive on them and will dig them out of loose soil. Starlings are particularly fond of them, both in autumn and spring. Since, in the absence of cereals, they will attack almost all roots, as many as possible should be destroyed while digging and cultivating. Potato tubers may be destroyed by them.

Grasshoppers

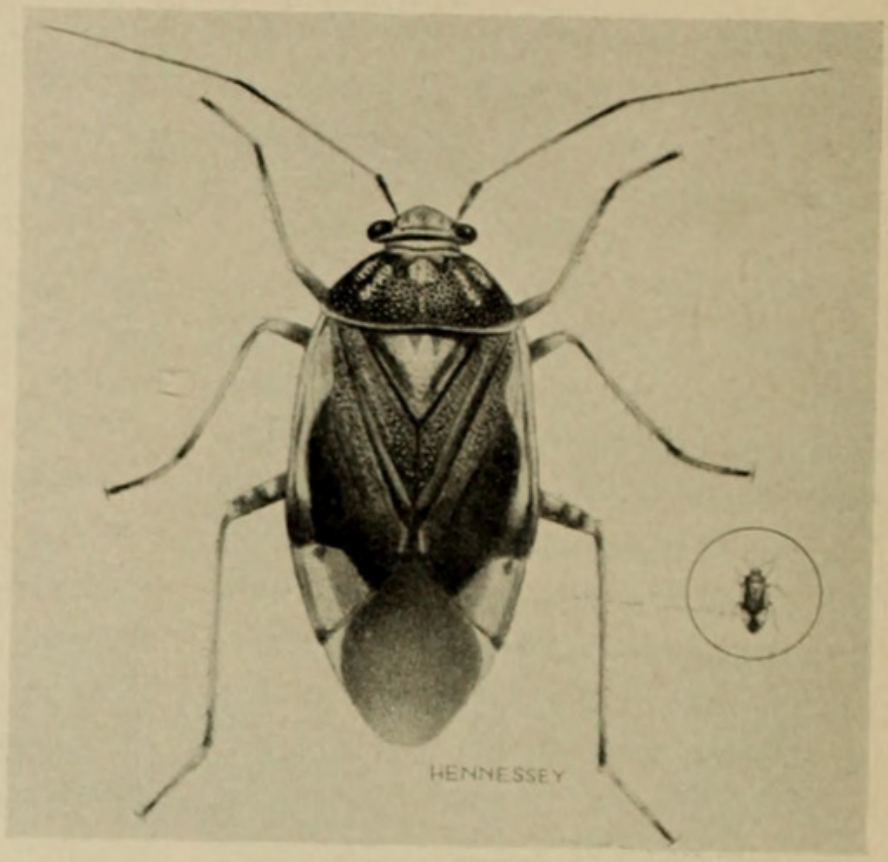
Grasshoppers are not normally a garden pest, but at times they may become so. They may be controlled by use of a bait similar to that employed for cutworms. The difference is that the molasses is replaced by 1½ ounces of salt and another pint of water is added, the bait being quite moist when applied.

Burdock and Potato Stalk Borers

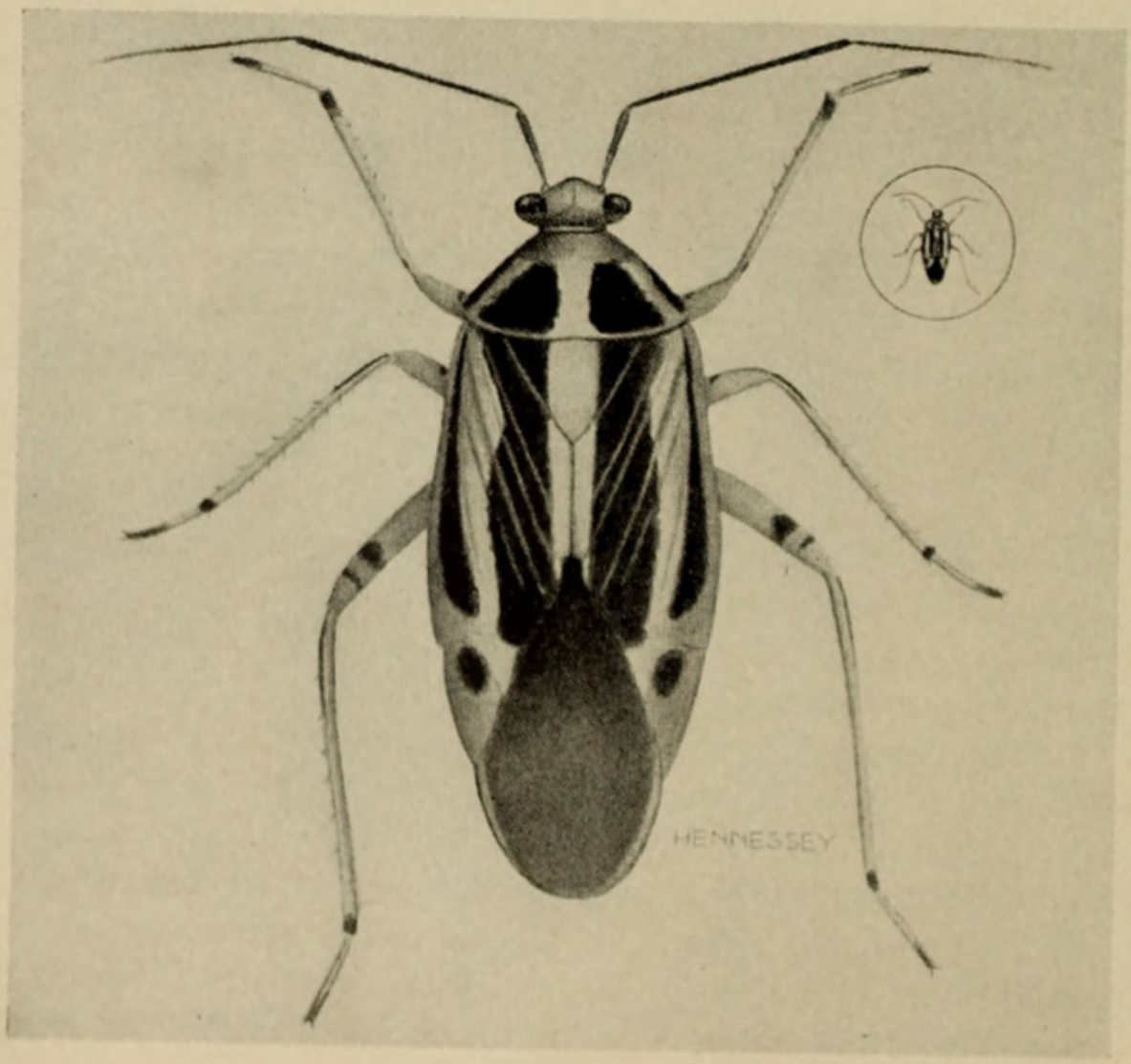
These insects attack a great variety of plants, including many flowers with large stems. In the garden, corn and tomatoes are the most frequently attacked. The tops of the plants wither and die. A single caterpillar may in the course of its migrations cause the death of several plants or branches.

There is no very good control for these borers. The larvae usually migrate from weed patches, and the first evidence of their presence is the withering tips of plants. As soon as these withering tips are noticed the plant should be cut open. The culprit can usually be located at once and destroyed. The destruction of large

Right, the tarnished plant bug (insert is life size)



Below, the four-lined plant bug (insert is life size)



weeds and discarded stems of vegetable plants by allowing them to decay in the compost heap or by burning them in the autumn will greatly aid in control.

Tarnished Plant Bug

There is no satisfactory control for this small shiny bug (*Lygus pratensis*). It feeds on numerous kinds of plants; both adults and nymphs suck the juices. Weeds in and near the garden should be kept down all season. However, if weeds outside the garden are allowed to grow to any extent, they should not be cut, since they will attract the bugs from more valuable plants. Persistent spraying with nicotine might give control but the expense is too great in proportion to the damage that usually results.

Four-lined Plant Bug

This insect (*Poecilocapsus lineatus*) also attacks various kinds of plants in the garden, and it is sometimes a much more serious pest than the tarnished plant bug. It can be controlled by persistent spraying with a contact insecticide.

Other Plant Bugs

There are numerous kinds of plant bugs which vary in size and feeding habits. As a general rule they do not compare in the amount of damage caused with the two mentioned above. However, if present in large numbers they will cause some damage. Some of the smaller kinds are temporarily repelled by Bordeaux mixture, and contact sprays will aid in keeping their numbers down.

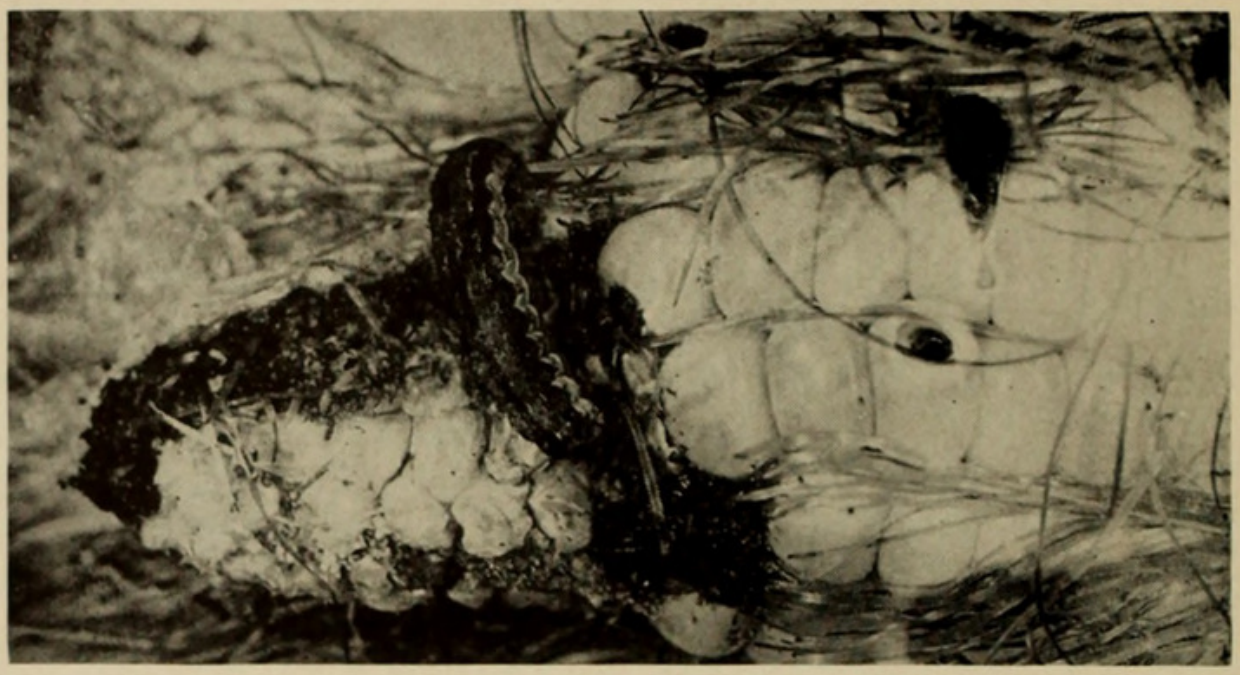
Japanese Beetle

The ravages of the adults of this insect are so well known that no further mention is needed. The beetles prefer certain kinds of crops (and even individual plants of these crops), so only those vegetables that attract many beetles need be sprayed. Hand picking will aid greatly but this may not be sufficient to prevent damage. Weeds around the edges of gardens will attract many beetles, which may then be gathered and killed.

Beetle traps aid in destroying the adults, but they should never be placed in the garden. If used, traps should be placed as far as possible from the garden. Otherwise those not caught in the trap will feed on garden plants. To be fully effective, traps must be used on a community scale.

Some Japanese beetle repellents have been developed but, never having used them, we cannot comment on their actual value.

The feeding of Japanese beetles may be greatly reduced by spraying with arsenicals. When these are used, the spray should contain lime at the rate of 4 pounds to 50 gallons of water since the additional white color has some repellent qualities. To secure best results spray the foliage of all plants in and near the garden upon which the beetles are observed feeding.



The corn ear worm at work (life size)

Work of the carrot rust fly maggot

Potato stem borer at work

Specific Feeders

Corn Insects

Corn has no place in the small victory garden, because it produces so little in proportion to the space required. However, it has its place in large gardens.

Corn is attacked by a goodly number of pests, and there is no completely satisfactory control for any of them. Japanese beetles are particularly attracted to the silk, and when this is gone they are apt to overflow onto other crops.

European Corn Borer

This is undoubtedly our worst pest. The caterpillars of this insect bore into all parts of the corn plant. Control is achieved by the complete destruction of old corn stalks and roots by approximately the middle of May.

Corn Ear Worm

This is the caterpillar of a southern moth that flies north each year and lays eggs on a number of different kinds of plants. On corn the worm usually works near the top of the ear, eating the kernels to the base. We have heard that this insect and the Japanese beetle can be kept from the ears of corn by placing a mothball at the top of the ear, within the leaves, while the silk is still green. It occurs to us that a pinch of tobacco dust (or rotenone dust, if available) might work. Both of these have some repellent qualities.

Carrot, Parsnip, and Celery Insects

There is only one serious pest of these crops. The others may be controlled by hand picking. This is the carrot rust fly. It attacks the roots of carrots in much the same way as the cabbage maggot attacks radishes and turnips. If there are wilted plants at the time of thinning, it is a sign that this insect is at work. Damage is often very serious. The carrot roots show rust-colored, irregular tunnels, caused by the burrowing larvae.

The control is the same as for the radish maggot (page 23).

The greenhouse leaf tier and the swallowtail caterpillar can be controlled in the small garden by hand picking. The former makes silken nets in the leaves of celery and other plants, while the latter is a rather large, green, black-banded caterpillar, the black bands enclosing yellow spots. The adult butterfly is quite beautiful.

Bean Insects

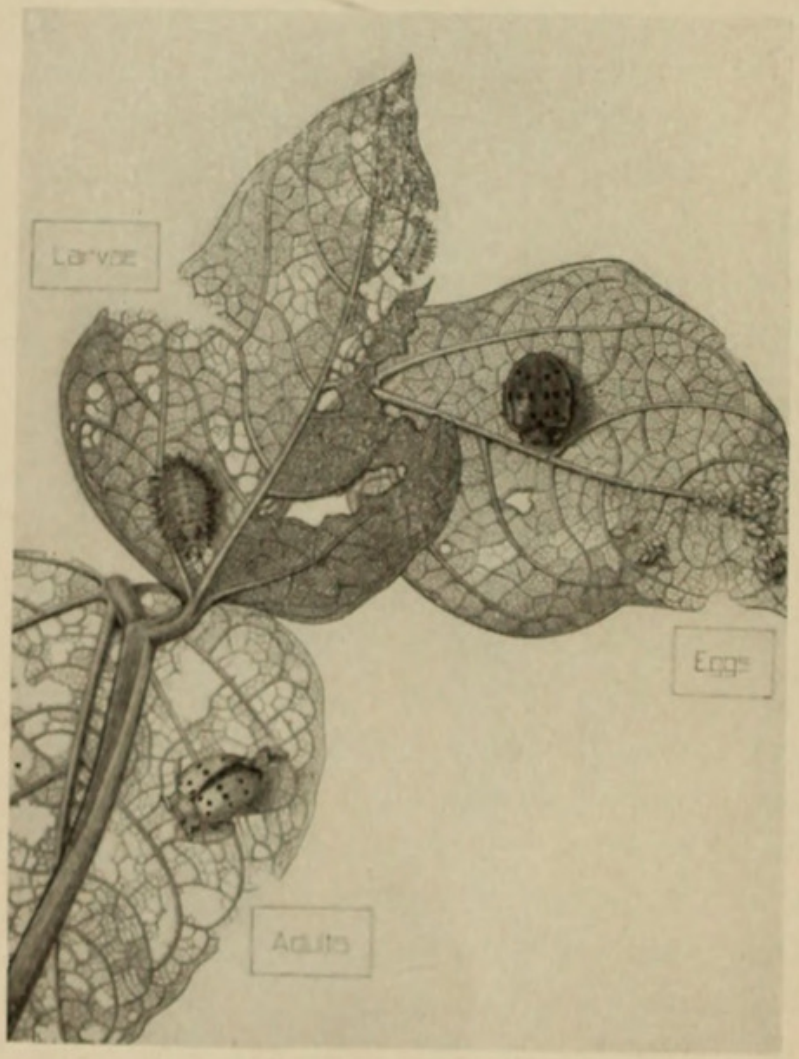
Beans are attacked by a number of different insects, the most serious pest being the Mexican bean beetle.

Damage by this insect is inclined to be spotty in the neighborhood of New York. Some patches may be very severely attacked, while others may be wholly free of the pest. It feeds chiefly on the under side of the leaves and may be well established before discovered.

The yellow eggs are laid on the under side of the leaves in clusters. But the presence of yellowish eggs does not prove the presence of the bean beetle, since other lady beetles lay similar groups of eggs, and their larvae are beneficial, since they feed upon aphids. Damage to the leaves is a sure indication.

Hand picking may be sufficient if the attack is light. If severe, either magnesium arsenate or sodium silica fluoride should be applied. Pyrethrum powder is also effective.

The banded flea beetle and the bean aphid are controlled by the sprays for flea beetles and aphids. (See page 13).



Mexican bean beetle at work (life size)

Cabbage maggots on root (life size)

All of these plants are attacked by the same insects, and control measures are practically the same for each. However, the flowers should never be sprayed with arsenicals. Once the cauliflower head forms, there should be no spraying until the leaves have been tied. In the small garden, hand picking will take care of the caterpillars on cauliflowers and cabbages. Rotenone and pyrethrum dusts give satisfactory control of the insects on these plants, but rotenone is not available at present. Many commercial growers use arsenicals in preference to the non-poisonous dusts. Since cabbages are never sprayed after reaching three-foruths of their growth and since the outer leaves containing spray are removed, there is no danger of poisoning. For the peace of mind of the user, the cabbages may be washed in a large pot of water or in running water. Poisons do not adhere well to these plants.

Cabbage Maggot

This is the worst pest during early stages of growth. The treatment consists of pouring a half cup of corrosive sublimate solution around each plant just after it is set out. This is repeated in about a week. When the plants become fully established and the roots harden, they are able to withstand attacks by one or two maggots. See description of the cabbage maggot under *Radish Care* (page 23).

Cabbage Butterflies

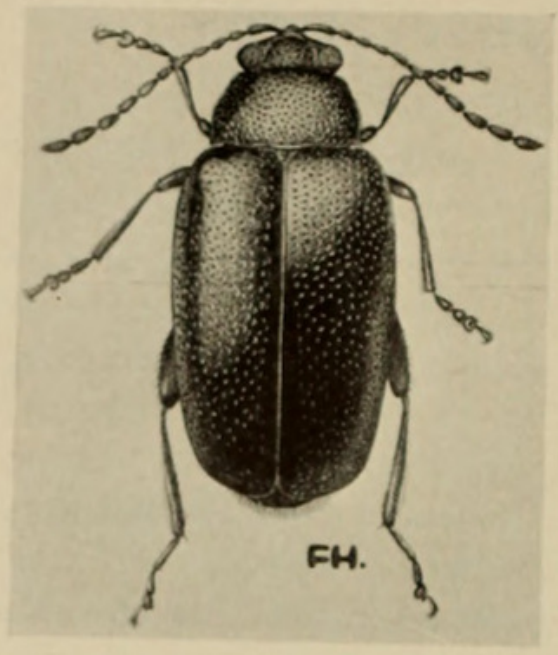
These insects, the imported and southern cabbage butterflies, attack a wide variety of plants and are the cause of serious damage to cabbages and cauliflowers. The larvae eat holes in the leaves and often bore into the heads of cabbages, frequently ruining them. The green leaves of cauliflowers are sometimes completely destroyed and the heads damaged from staining.

The caterpillars are of a soft, velvety-green color and grow to a length of 1¾ inches.

When only a few plants have been set out daily examination and hand picking should prove sufficient. The larvae live on the under side of leaves or hide between them. The presence of holes in the leaves usually indicates the presence of a caterpillar, and it should be searched for until found. Old holes will have a brownish rim and can be ignored. If there are too many plants to care for in this way, sprays or dusts should be applied to the under side of the leaves. A soap sticker must be added to the spray. Arsenicals may be used until about 3 weeks before the crop is harvested. Pyrethrum powder may be dusted on the plants every 10 days to 2 weeks.

Cabbage Looper

This insect causes injury of the same type as the cabbage butterfly, and treatment is the same. A large number of garden plants are attacked,



Cabbage flea beetle (enlarged 13 ×)

Young zebra caterpillars (life size) →

Larvae of the cabbage butterfly at work (life size)

including lettuce, beets, celery, and all crucifers. The caterpillars have white lines down the sides and back and move with a clumsy looping motion.

Zebra Caterpillar

Though not an annual pest, this insect when present does enormous damage. It may appear during the spring or in the autumn. The moth lays clusters of yellow eggs on the under side of the leaves, and the young larvae are gregarious. During this time they may be destroyed by removing the leaf on which they are feeding. When they grow older they separate and some of them find their way to other crops and flowers.

Control is the same as for the cabbage butterfly (page 21).

Diamondback Moth

This is a very small moth, with small, green caterpillars. They feed on the under side of the leaves, eating small holes through the epidermis. These show as small, brownish patches.

Control is the same as for the cabbage butterfly (page 21).

Striped Flea Beetle and Cabbage Flea Beetle

The striped flea beetle is small and black, with two wavy yellow lines down the back. The cabbage flea beetle is bright metallic green and is also quite small. All flea beetles hop when disturbed and can be recognized by this characteristic.

Apply Bordeaux mixture, which acts as a repellent.

Turnip Aphid and Cabbage Aphid

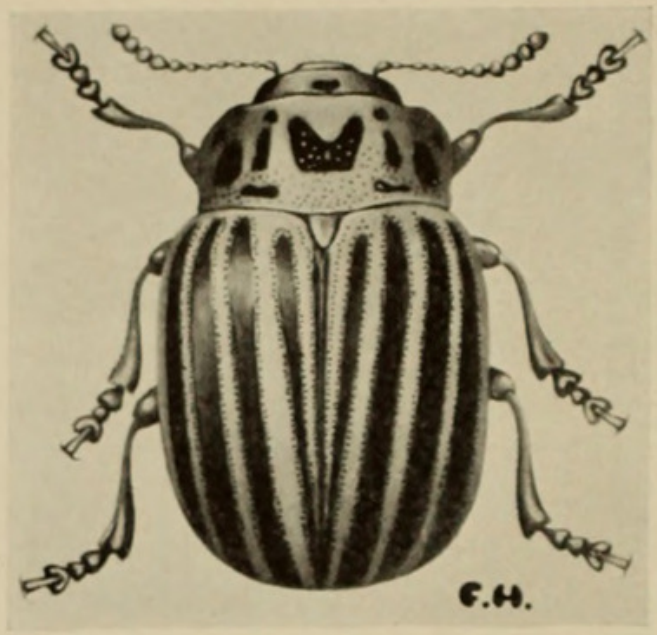
These are frequently serious pests of cabbage and cauliflower. The control is the same as is explained under *Aphid Control* (page 13). These insects also attack Brussels sprouts.

Radish Care

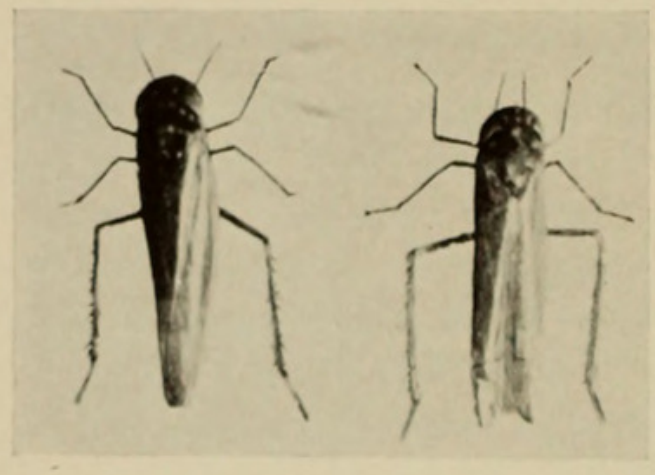
Most of the insects attacking cabbages attack radishes, but control measures are seldom necessary, with one exception—the cabbage maggot.

This is the most serious pest of the radish. The adult fly is markedly smaller than the housefly, but only a specialist could identify it. The eggs are laid either on the plants below the surface of the soil or in the soil close to the plants. They hatch in from 5 to 10 days. The maggots feed on the rootlets and later on the taproots, making winding, brownish tunnels and causing the root to become woody and unfit for use. Many of the young plants may be killed.

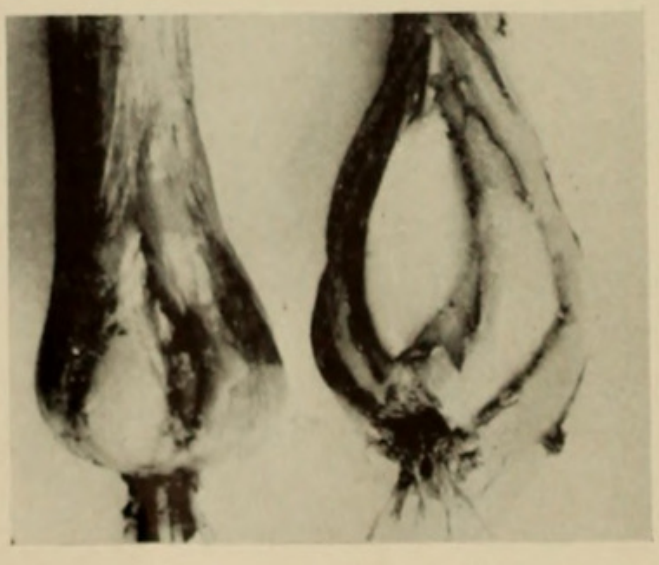
Control can be exercised when the plants are a few days old by watering with corrosive sublimate solution—about 1 cupful per foot. A large teapot or a small watering can (with the spout plugged enough to control the flow) may be used in applying. Repeat in about a week. If a metal container is used, it must be very thoroughly washed immediately after using; and do not use the teapot unless



Colorado potato beetle (enlarged 3½ ×)



Adult potato leaf hopper (enlarged 8 ×)



Onion maggots and work (life size)

it has been washed in a copious amount of hot water. Do not make any treatment after the roots begin to swell.

Turnip Care

One of the chief turnip pests is the cabbage maggot. Treatment is the same as described for this insect under radishes (page 23).

Almost all of the pests that attack cabbages attack turnips. The treatment is the same.

The turnip aphid and the cabbage aphid are frequently serious pests of the turnip, and the control is the same as is explained under *Aphid Control* (page 13).

Potato, Tomato, and Eggplant Insects

Potato Beetle

The Colorado potato beetle attacks other plants too, but it is chiefly a pest of potatoes. Potatoes are not a profitable crop for the small garden, but many week-end gardeners may have space for them. Almost as soon as the potato plants appear they are subject to attack, the foliage being eaten by both the adults and larvae, chiefly the latter. The clusters of orange eggs are usually laid on the under side of the leaves.

Hand picking of adults, larvae, and eggs will serve where the patch is small. In larger patches spray with arsenicals.

Potato Flea Beetle

This insect is often a serious pest of potatoes and tomatoes. The beetles eat small holes in the leaves. They are small and black, with brownish legs.

To control, spray or dust with Bordeaux mixture. Treatment with Bordeaux is an excellent practice, since the material is a fungicide and prevents the development of fungus diseases. It is to be particularly recommended where a garden is shaded and does not receive a good quota of sunlight.

Corn Ear Worm

This is a southern insect and cannot survive the winter in the northern states. But each year millions of the moths move northward; and since each female lays from 500 to 2,500 eggs, it is sometimes a serious pest. It frequently attacks tomatoes, boring into the fruits after they become half grown.

There is no known control, but infested tomatoes should be destroyed when the injury is discovered. The caterpillars will migrate from one fruit to another, and a single caterpillar may destroy several fruits in a bunch.

Tobacco or Tomato Worm

This insect attacks tobacco and is often a serious pest of tomatoes, feeding upon the foliage. It is, when fully grown, a very large, hairless caterpillar with a horn at the tail end. The color is green, with light V-shaped markings pointing toward the head end.

Control by hand picking. In larger patches use arsenicals.

Potato Leaf Hopper

These small, green, tapering, jumping bugs are frequently a serious pest of potatoes, tomatoes, and many other crops. The toxin they inject into the plant causes the leaves to curl and wither, this condition being known as "hopperburn."

Use Bordeaux mixture for control of this insect.

Pea Insects

Pea Moth

This is sometimes a serious pest in Eastern United States and Canada, especially where peas are grown year after year, but it is not likely to attack victory gardens unless close to commercial pea acreages. The eggs are laid at the base of the pea pod. The young larva bores its way in. Once inside, it feeds on the developing peas, sometimes attacking all of those in a pod, and usually causing a mildewy appearance.

Early varieties suffer little damage. The vines should be pulled and destroyed as soon as the crop has been harvested. By picking table peas cleanly when ripe the larvae are destroyed before they reach maturity. If they are a severe pest, peas should not be grown during the following year.

Pea Aphid

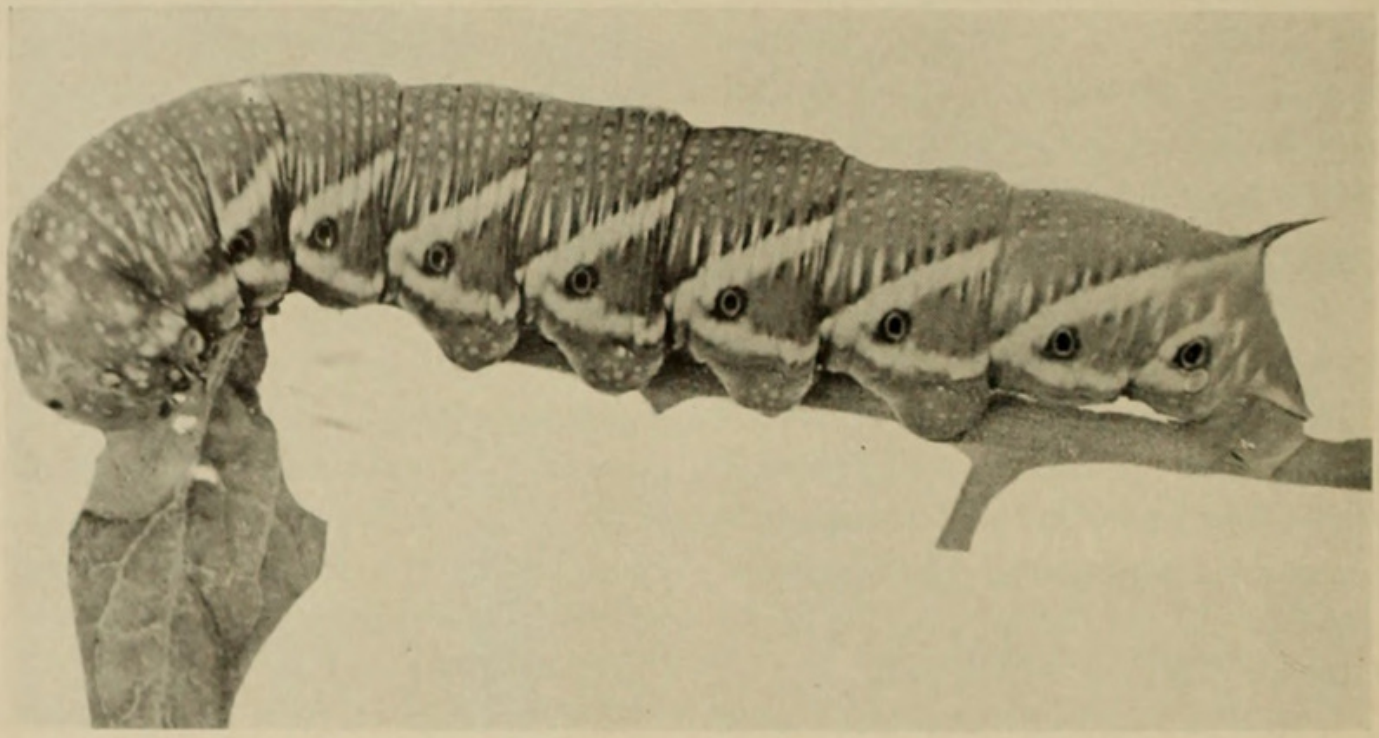
The pea aphid is often a very serious pest, especially if there is much clover in the vicinity. When very abundant,

this insect may kill the plants before the crop matures.

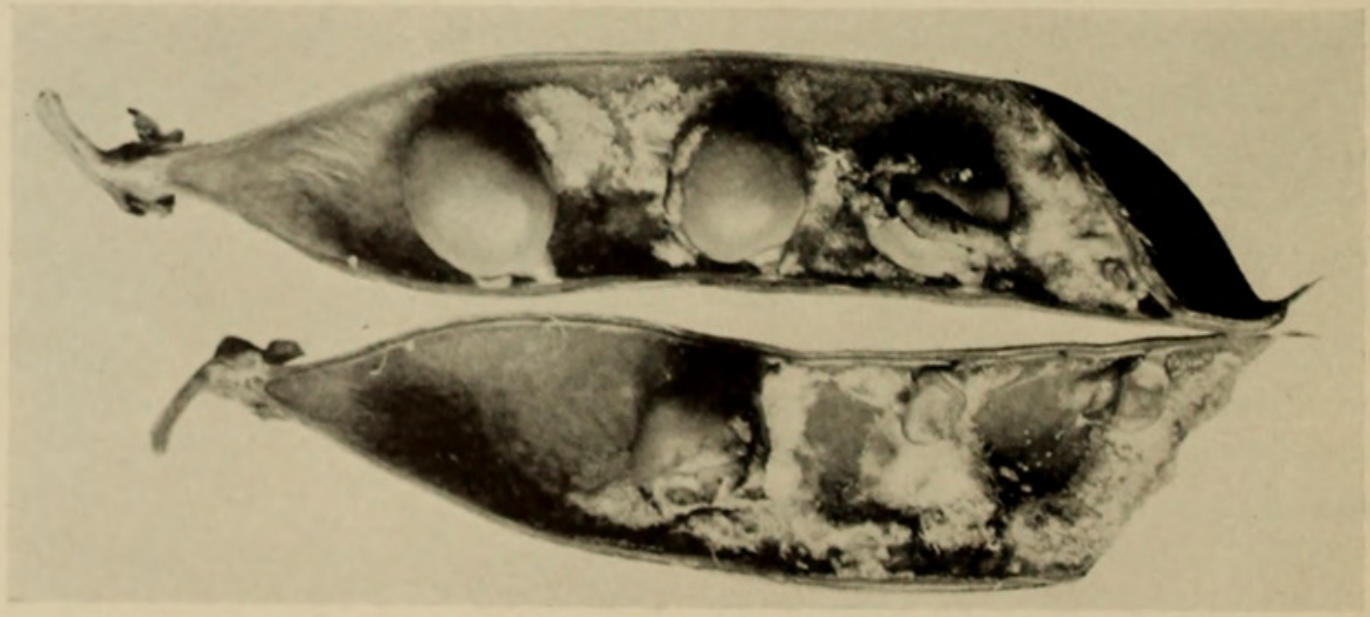
Spraying or dusting with nicotine sulphate is recommended for control of the pea aphid.

Pea Weevil

The larvae of this beetle feed within the peas and are not likely to be noticed. They are spread by sowing infested pea seed. Unless sown close to pea acreages the pest is not likely to be troublesome. The use of certified seed is an excellent safeguard and is the only precaution a small gardener can take.



The tobacco worm on a tomato plant (life size)



Larva of pea moth and injured peas

Onion Insects

Onion Maggot

This insect is related to the cabbage maggot, and the two look so much alike in all stages that only an expert can tell them apart. The eggs are laid on the onion stems below the surface of the soil, or in the soil, and the hatching maggots bore into the plants. When abundant they may destroy almost the entire crop. The first attack occurs about the time apple trees come into bloom, and they may continue throughout the summer. The young onion plants suffer most severely, older ones being able to withstand mild attacks, although suffering damage.

The treatment is the same as for the radish maggot (page 23).

Onion Thrips

This is an extremely small, feather-winged insect. The damage is caused by the feeding of the nymphs and adults. Silvery streaks on the onion leaves are a sign of this pest. In cool, wet summers the damage is seldom serious, but hot, dry seasons may result in extreme losses.

To control, spray with ½ pint of nicotine sulphate to 50 gallons of water, using 4 pounds of laundry soap as a spreader. The plants must be well soaked. Repeat if the thrips again become numerous.

When onion sets decay or onions rot they may be infested with various kinds of maggots and beetles. These are not to be considered as pests, but it is advisable to remove and destroy such onions to prevent the attraction of injurious species.

Cucumber, Melon, and Squash Insects

All of these plants are attacked by the cucumber beetle, but this insect is usually unimportant except on cucumbers.

Cucumber Beetle

Both the adults and larvae of this beetle feed on the leaves of cucumbers, and when numerous they may reduce them to mere skeletons. The orange or yellow eggs are laid in clusters on the leaves.

Control by hand picking in the small garden. Dust or spray with arsenate of lime in a large garden.

Squash Bug

This is mainly a pest of pumpkins and squash. The bugs live on the under side of the leaves. Both the adults and nymphs feed there. Since they are sucking insects, no holes are produced, but there are numerous light spots and eventually the whole leaf dies.

Since a large number of eggs are laid on one leaf and the bugs are more or less gregarious while young, the first sign of damage should be followed by an examination of the under side of all the leaves. If one finds eggs (laid in somewhat regular rows) or young

nymphs, the part of the leaf on which they occur should be destroyed. The adults and large nymphs may be picked off by hand. There is no other satisfactory control.

Melon Aphid

The melon aphid is very often a serious pest of melons.

For control, see *Aphid Control* (page 13).

Spinach Insects

A number of insects attack spinach, but few of them are important in the eastern United States.

Spinach Leaf Miner

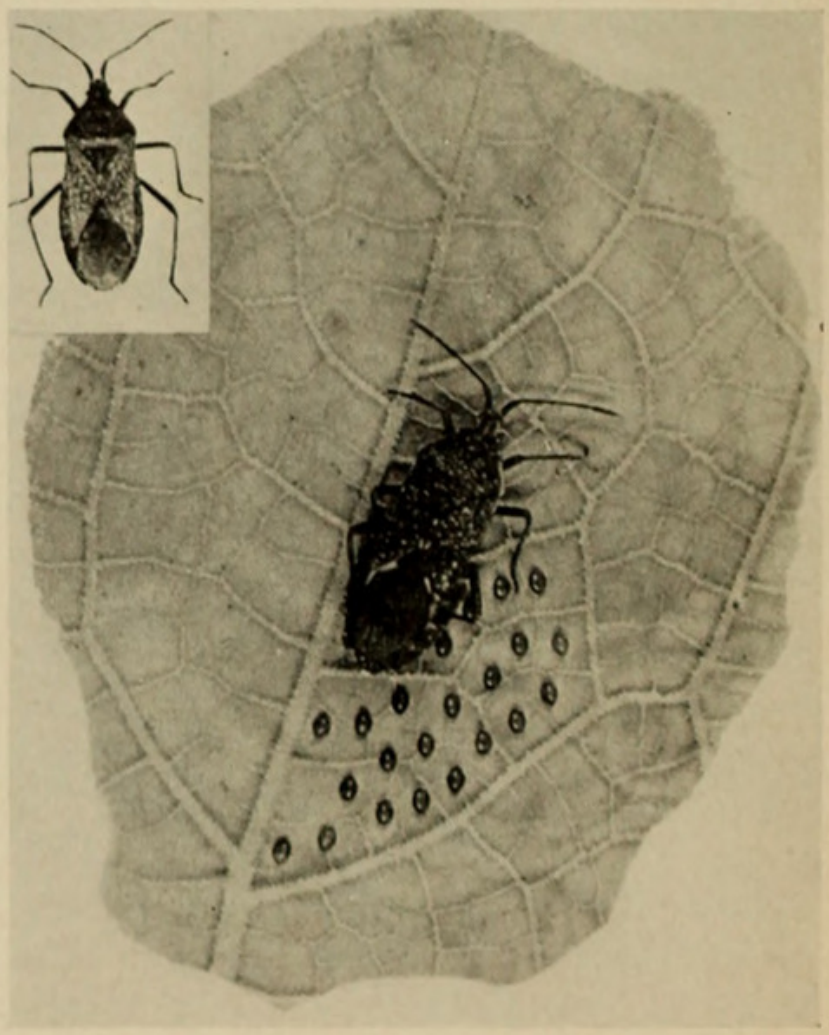
The larvae of a fly mine within the leaves and frequently cause extensive damage. Although eating the larvae will cause no ill effect, most people discard damaged leaves.

To control, destroy all weeds, particularly docks and lamb's-quarters (pigweed). Pick and destroy all spinach leaves as soon as mines are noticed.

Aphids

Aphids and other insects also attack spinach. Aphid control may be advisable (page 13).

Right, squash bug (life size) and female laying eggs (enlarged 1¼ ×)



Adult striped cucumber beetle (enlarged 5 ×)

Control of Ants

Ants are often quite a pest in gardens and their control is not always easy. As a class, ants will eat almost every kind of animal and vegetable matter but they have their preferences. Some like starches, others fats or oils, and others prefer sugars. Because of the great divergence of their preferences, it is difficult to prepare a mixture that will control all the ants in the garden.

The damage caused to plants is varied. Many plants may be destroyed by the building of nests close to them, and portions of the plants may be eaten. Then, some ants carry plant lice to the roots of plants, or from one part of a plant to another. They do this because they like the sweet juices excreted by the aphids. Damage is also caused by the building of large ant hills.

Control measures must be varied. For those ants that like sugar a sweetened bait must be used. A teaspoonful of arsenical or sodium fluoride should be added to a cup of syrup. The poisoned syrup may be poured on the soil near ant nests or placed in containers which may be mostly buried, with holes punched in the top in order to allow the ants to enter.

For control of other ants thoroughly mix a heaping teaspoonful of arsenical or sodium fluoride with 6 to 8 ounces of peanut butter. If there are no children or animals around, place small gobs of the mixture near the ant hills; otherwise place it in containers as above.

To destroy large ant hills, poke three or four deep holes in the hill and drop a tablespoon of calcium cyanide in each, then pack the top of the hill. This should be done in the evening when the ants are all in the nest.

All of these insecticides are poisonous and must be handled with great care.

There are many ant pastes and poisons on the market ready for use. Directions are contained on the packages. Whether they will prove effective in destroying the particular kinds of ants found in your garden can only be determined by trying them.

Beneficial Insects

Only a small percentage of insects are serious pests, and very many of the insects observed in the garden will be helpful in controlling those doing damage. In nature insects are chiefly controlled by other insects, and all pests have parasites. Sometimes these are sufficiently numerous to control the injurious kinds, but as a rule they are just one step behind the pests, and

only occasionally do they become sufficiently numerous to wipe out the insects causing damage.

Some of the most common beneficial insects in the garden are lady beetles and flower flies. The lady beetles feed on plant lice, both as adults and larvae, devouring enormous numbers of them. The flower fly larvae also feed on plant lice and meally bugs and often destroy whole colonies of them. The adult flies resemble wasps. Wasps are very valuable, since they catch other insects with which to feed their young. Bees, flies, and some moths—in fact, any insects that visit flowers—help to pollinate the flowers and thus are instrumental in producing crops. Ground beetles are almost all beneficial, feeding upon other insects; but since they are mostly nocturnal, they will not be seen very often.

We are unable, here, to devote much space to beneficial insects but we think that the gardener will soon learn to distinguish between the good and bad ones if they are abundant. If doubtful about an insect's habits, observe its actions. If it is a pest it will soon demonstrate the fact. Proper action can then be taken.

Control of Fungus Diseases

Although fungus diseases are beyond the scope of insect control, we include them here because the same spray, Bordeaux mixture, is used. In addition to this, there may be times when fungus will cause more trouble than insects.

Bordeaux mixture has long been used as a fungicide. Unfortunately Bordeaux will clog sprayers that do not have an agitator; but if a small hand sprayer is shaken frequently, little trouble will be experienced.

Prolonged periods of dampness are ideal for the development of fungus diseases. The use of Bordeaux will often prevent the loss of crops through fungus diseases and insect-carried viruses. It is because of this that its use is recommended along with arsenical sprays and dusts.

Mildews on plants may be prevented or controlled by dusting with sulphur. Sulphur used for dusting is of a fine quality; coarser sulphur should not be used.

Fungus diseases are spread in many ways, but the spores are carried chiefly by wind, by insects, and in manure.

Several commerical preparations are available for treating seeds to destroy fungus spores and for treating the soil against "damping off"—a germ disease of seed beds, which may destroy a fine looking crop of seedlings in a few hours. Directions for use of these materials are contained on the packages, which may be obtained from your seed dealer. Your State Botanist may be able to furnish additional information. on the subject.

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