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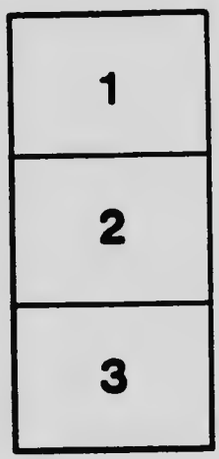

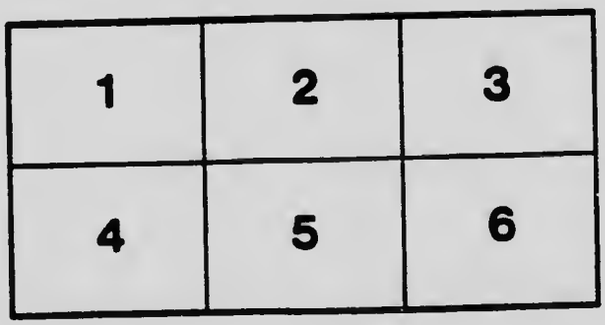

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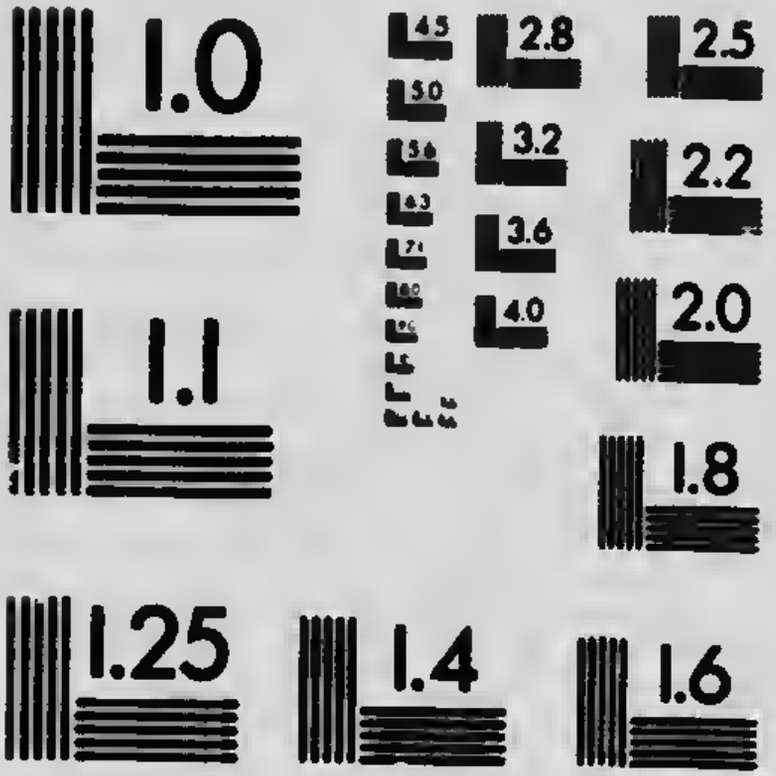

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Entomological Circular

DOMINION OF CANADA

DEPARTMENT OF AGRICULTURE

ENTOMOLOGICAL BRANCH

C. GORDON HEWITT, DOMINION ENTOMOLOGIST

COMMON GARDEN INSECTS

AND

THEIR CONTROL

BY

ARTHUR GIBSON

Chief Assistant Entomologist

CIRCULAR No. 9

Published by direction of the Hon. Martin Burrell, Minister of Agriculture
Ottawa, Ont.

OTTAWA
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1917

1885b—1

WE SHALL BE PLEASED to hear from any one whose crops may be troubled with insects not described in this circular and to advise them specially. No postage is required on such letters of inquiry when addressed:

DOMINION ENTOMOLOGIST,
Department of Agriculture,
OTTAWA, ONT.

Such enquiries should be accompanied in all cases where it is possible by specimens of the insects. The insects should be sent packed with their food plant in a strong wooden or tin box to prevent loss in transit. Packages up to 12 ounces in weight may be mailed free and every package should bear or contain the sender's name and address and be accompanied by a letter.

OTTAWA, April 10, 1917.

To the Honourable,
The Minister of Agriculture,
Ottawa.

SIR,—I have the honour to submit for your approval Entomological Circular No. 9 entitled "Common Garden Insects and their Control," which has been prepared at my request by Mr. Arthur Gibson, Chief Assistant Entomologist, who has immediate charge of this branch of our work.

This circular has been written specially for the use of the owners of small gardens and the cultivators of vacant lots who, in their endeavours to respond to the call for increased food production by maintaining gardens and raising their own vegetables and other garden produce, are certain to encounter difficulties resulting from the inevitable attacks of insect pests which are liable to cause an appreciable or even serious reduction in the amount of the crop produced unless remedial measures are undertaken.

No attempt has been made to describe fully the common pests; most of them are well known. Our idea has been to give in a few words the simplest remedial measures possible and those which we have either devised ourselves or found to be satisfactory as a result of experiment. In controlling insect attack, preventive measures are the most important; secure a vigorous plant growth in the spring, keep down weeds and cultivate as frequently as possible.

I have the honour to be, Sir,
Your obedient servant,

C. GORDON HEWITT,
Dominion Entomologist.

18955—2

Common Garden Insects and Their Control

By ARTHUR GIBSON, Chief Assistant Entomologist

INTRODUCTORY.

Garden plants are liable to attack by many different kinds of destructive insects. Some of these destroy the foliage, others the flowers, while others again bore into the stems and even into the roots.

The more the gardener knows about the insects which may attack his crops the better prepared will he be to cope with them when injury is detected. Every gardener, for example, should observe how the insects feed, as such fact will help materially in deciding upon the proper remedy to apply Injurious insects may be divided, roughly, into two classes, by the nature of their mouth parts, namely, (1) biting insects which bite and chew their food, such as cutworms and other caterpillars, grasshoppers, leaf-feeding beetles, etc., and (2) sucking insects which suck up their food by means of their beaks, such as the aphids, the true bugs, the scale insects, etc. If the insect is a biting one a stomach poison, such as Paris green, or arsenate of lead, is usually applicable, but if the species is a sucking one, such poisons would be useless because the insect would insert its beak through the poison and reach a safe feeding place beneath. For sucking insects, therefore, contact insecticides are usually recommended, those commonly used being kerosene emulsion, whale oil soap and preparations containing tobacco (see pages 7 and 8).

There are some insects such as the borers, which cannot be reached by outside applications of spray material. Injury to plants by these insects which work inside the stems and roots, is often of a serious nature and should be met with preventive measures. Very often the only thing to do is to cut out the infested part if this is possible, or destroy the whole plant so as to reduce the numbers of the insect.

PREDACIOUS AND PARASITIC INSECTS.

All the insects which occur in gardens are not injurious. There are many predacious and parasitic species which are continually assisting the gardener in destroying those destructive forms which do harm. Foremost amongst the beneficial insects are the different kinds of lady-bird beetles which, both in their larval and adult stages, feed almost exclusively upon plant lice and scale insects. The lace-wing flies, also, have similar habits. The Fiery Ground Beetle, *Calosoma calidum* Fab. and its grub, known as the Cutworm Lion, devour large numbers of cutworms. Of late years the Soldier Bug, *Perillus bioculatus* Fab. has been decidedly useful in assisting in the control of the Colorado Potato Beetle in certain parts of Eastern Canada. Other well-known beneficial insects belong to the parasitic Hymenoptera, (four-winged flies) and to the Diptera (two-winged flies.) The females of many of these latter parasites deposit their eggs upon or in the bodies of caterpillars and when the eggs hatch the young larvæ feed upon their living hosts.

CULTURAL PRACTICES FOR THE CONTROL OF INSECTS.

Vigorous plants more resistant to insect attack.—Garden soil, of course, should be well prepared and such fertilizer as is advisable applied. Good seed only should be used so that vigorous plants will be produced. Cultivation of

the soil, particularly in the early part of the season, will assist materially in retaining moisture, so necessary to produce strong, healthy plants. Everything possible should be done to induce vigorous growth from the beginning in order that the plants may be better able to withstand insect attack.

Insects exposed by cultivation.—When gardens are being dug or ploughed in spring, white grubs, wireworms, etc., are very often turned up. In small areas it is advisable to remove the same by hand when cultivating. Such would not be practicable in large gardens. Land near cities or towns to be used for gardens in which white grubs are present may be cleared of such insects by turning in some hogs if the same are available.

Clean culture.—Weeds of all kinds should be kept down throughout the entire growing season. The flea-beetles in the larval state feed upon the roots of common weeds such as the nightshades, lamb's quarters, pigweed, ragweed, etc. Weeds attract cutworm moths for the purpose of egg-laying. Remnants of garden crops and other refuse should be removed regularly, otherwise such refuse will serve as breeding places and hibernating quarters for many insects. All refuse should be either buried deeply or carefully gathered up in piles and burned.

INSECTICIDES AND THEIR APPLICATION.

Insecticides for controlling outbreaks of injurious insects are applied either in a dry form or in solution. For the application of the former, dusters, sold by seedsmen, are useful, or the powders may be dusted over the plants from bags made of cheesecloth. For applying insecticides in solution, a spraying pump is desirable. There are many kinds of hand sprayers on the market suitable for garden use. An important consideration is that the nozzle should distribute the liquid evenly and as a fine spray.

Formulæ.

For biting insects.

Paris Green:

Liquid application.—Use in the strength of 4 ounces to 40 gallons of water, with about half a pound of fresh lime added. Where only a few plants are being treated one teaspoonful, with the same quantity of lime, to a pail of water is sufficient.

Dry application.—1 pound of Paris green mixed with 20 pounds of land plaster, slaked lime or other perfectly dry powder. Should be used early in the morning when the plants are wet with dew.

Sticker.—When spraying cabbages or other plants, the leaves of which are covered with a waxy secretion, with a Paris green mixture the same will adhere better if a "sticker" is added. Such can be made by boiling together for about an hour, 2 pounds of resin and 1 pound of sal soda (crystals) in a gallon of water. This is sufficient for 40 gallons.

Arsenate of Lead:

Preferred by many growers owing to the fact that it does not burn the leaves and remains much longer on the foliage than Paris green, not being washed off to the same extent by rains. The powdered arsenate of lead is used in the strength of two pounds to 40 gallons of water, the paste form in the strength of 4 pounds to 40 gallons. For use in small quantities one tablespoonful of the paste arsenate of lead is sufficient for one gallon of water.

Poisoned Bordeaux Mixture:

Bordeaux mixture is made as follows:

Copper sulphate (bluestone)	4 lbs.
Unslaked lime	4 lbs.
Water (1 barrel)	40 gallons.

Dissolve the copper sulphate (by suspending it in a wooden or earthen vessel containing 4 or 5 or more gallons of water). It will dissolve more quickly in warm water than in cold. Slake the lime in another vessel. If the lime, when slaked, is lumpy or granular, it should be strained through coarse sacking or a fine sieve. Pour the copper sulphate solution into a barrel, or it may be dissolved in this in the first place; half fill the barrel with water; dilute the slaked lime to half a barrel of water, and pour into the diluted copper sulphate solution then stir thoroughly. It is then ready for use. (Never mix concentrated milk of lime and copper solution.)

A stock solution of copper sulphate and milk of lime may be prepared and kept in separate covered barrels throughout the spraying season. The quantities of copper sulphate, lime and water should be carefully noted. Bordeaux mixture deteriorates with age and should be used as soon as made.

To test Bordeaux mixture, let a drop of ferrocyanide of potassium solution fall into the mixture when ready. If the mixture turns reddish-brown, add more milk of lime until no change takes place.

For poisoning the mixture when using it for the potato beetle use 6 lbs. of copper sulphate, 8 ounces or more of Paris green, or 4 lbs. of paste arsenate of lead; or preferably 8 ounces of Paris green and 1½ pounds powdered arsenate of lead to 40 gallons of water.

POISONED BRAN MIXTURE. (For Cutworms and Locusts.)

Bran	20 lbs.	Paris green	½ lb.
Molasses	1 quart.	Water	2 to 3 gallons

Mix the bran and Paris green thoroughly in a wash tub, while dry. Dissolve the molasses in the water and wet the bran and poison with the same, stirring well so as to dampen the bran thoroughly.

For cutworms a simple formula for small gardens is one quart of bran, one teaspoonful of Paris green and one tablespoonful of molasses, with sufficient water to moisten the bran.

Shorts or middlings in place of bran are also useful for cutworm control. For locusts excellent results have been obtained with sawdust used as the carrier for the poison.

FOR BITING INSECTS.

KEROSENE EMULSION:

Kerosene (coal oil)	2 gallons.
Rain water	1 gallon.
Soap	½ pound.

Heat the water, cut the soap into fine shavings and add them to the water stirring till all is dissolved, then pour this into the kerosene and churn the whole violently with a syringe or force pump for about five minutes or until a thick creamy emulsion is produced. This makes the stock solution which as it cools thickens into a jelly-like mass. When required for use dilute with nine times its measure of warm water. The stock solution when properly made will keep for months if kept from the air.

When only a small quantity of kerosene emulsion is required for immediate use, the following mixture is recommended.

Kerosene	1 quart.
Flour	8 ounces.
Water	2 gallons.

Stir together the flour and kerosene, then add the water and churn briskly for five minutes. Should be used at once.

WHALE OIL OR FISH OIL SOAP:

Has been used extensively for aphids, etc. Its unpleasant odour is objectionable to many lovers of ornamental plants. For brown or black aphids it should be used in the strength of one pound to 4 gallons of warm water; for green aphids or thrips in the strength of one pound to 6 gallons of water.

TOBACCO EXTRACTS:

Trade preparations of nicotine are sold by nearly all seedsmen. Two of these which are widely used for sucking insects are "Nickoteen" and "Black Leaf 40". It is desirable to add soap to the diluted spray at the rate of about two pounds to 40 gallons of mixture.

SULPHUR-SOAP MIXTURE. (For Red Spider):

Flowers of sulphur	1 ounce.
Laundry soap	2 ounces.
Water	1 gallon.

Dissolve the soap in the water then add the sulphur and spray the mixture in such a way as to reach the undersides of the leaves where the mites are. A short rod with elbow at nozzle end is advisable.

INSECTS OF THE VEGETABLE GARDEN.

GENERAL FEEDERS.

CUTWORMS.

These well-known smooth, cylindrical caterpillars feed, under normal conditions, at night, hiding in the soil during the day. The surface-feeding cutworms cut off plants near the ground, or a little below it. Some climb up the stems of succulent plants and feed upon the leaves, etc. Others feed entirely below the surface of the ground attacking the roots of corn and other plants. A female cutworm moth lays several hundreds of eggs, usually on the leaves of weeds, grasses, shrubs, etc. The moths of the chief injurious species appear in June, July and August. Cutworm injury, as a rule, ceases before the end of June. The more regularly-occurring species are the Red-backed Cutworm, *Euxoa ochrogaster* Gn., the Dark-sided Cutworm, *Euxoa messoria* Harris, and the Greasy Cutworm, *Agrotis ypsilon* Rott. Of recent years the Striped Cutworm *Euxoa tessellata* Harris, has been an important garden pest.

Cutworms are general feeders, attacking all kinds of garden plants, particularly when these are young and succulent. Cabbages, cauliflowers, beets, carrots, beans, etc., are readily attacked as well as flowering plants such as asters, gladioli, etc.

Remedies.—The poisoned bran mixture described on page 7 is the remedy which is now used most extensively. In gardens containing rows of vegetables the mixture should be scattered thinly along the rows on either side, as soon as cutworm injury is noticed. Flowering plants may be protected by placing a small quantity of the poisoned bran around, but not touching, each plant. It is important that the poisoned bran be scattered after sundown so that it will be in the very best condition to attract the cutworms when they come out to feed at night.

In small gardens as soon as cutworm injury is noticed the culprits can as a rule be easily located in the soil, about an inch or so beneath the surface, and within a radius of a few inches of the plant, and destroyed by hand.

PLANT LICE.

There are few kinds of plants which are free from injury by the various species of plant lice, which are also known as "Aphis" and "Green Fly." Cabbage, turnip, potato and other vegetable crops are injured seriously as well

as many plants in flower gardens. Some aphids, like the Pea Aphis, appear suddenly in enormous numbers and completely destroy garden peas as well as sweet peas. The foliage of ornamental bushes such as the snowball, etc., is often rendered unsightly by the curling and deforming of the leaves caused by the plant lice. Bush fruits too, such as the currant, are subject to injury by these insects, the foliage becoming blistered and much distorted. There are a great many different kinds of plant lice, or aphids, in Canada; some are green, others dark coloured and some even red; a common red species is the one which occurs on Golden Glow. All are sucking insects and live solely on the juice which they extract from their host plants. Some kinds feed on the underside of the foliage, others cluster on the stems of plants and others again are found attacking the roots.

Remedies.—As the plant lice appear in early spring, garden plants should be examined at frequent intervals for their presence. The undersides of leaves and the upper portions of stems are the chief feeding places and when the insects are first noticed the plants should be sprayed with a contact insecticide such as kerosene emulsion, whale oil soap, or a tobacco preparation, (see pages 7 and 8). Whichever insecticide is used it must be applied so as to reach the places where the insects are clustered. Only the plant lice which are actually hit by the spray will be killed. Some kinds of plant lice, as for instance the Cabbage Aphis, are not noticed in destructive numbers until late in the season. Much can be done to prevent the spread of these insects if the earlier colonies are destroyed.

FLEA BEETLES.

The small dark coloured " flea beetles " so called from their habit of leaping or jumping, eat holes into the leaves of turnips, radishes, potatoes, tomatoes and other vegetables and feed freely on the leaves of such flowering plants as Rose of Sharon, mallow, weigelia, forget-me-not, etc. In size they range from about one-twentieth to one-quarter of an inch in length. They are most injurious in spring at which time young seed leaves are often visited by large numbers of the insects and quickly destroyed. The Potato Flea Beetle, *Epitrix cucumeris* Harr., is one of the most destructive species feeding upon the foliage of potato, tomato, cabbage, cucumber, bean, tobacco, squash, etc. The Turnip Flea Beetle, *Phyllotreta vittata* Fab., is another regularly occurring species both in the vegetable and flower garden. The Red-headed Flea Beetle, *Systena frontalis* Fab., is some years very destructive in Eastern Canada to potatoes and beans as well as to flowering plants such as marsh mallows, rose mallows and Japanese honeysuckles.

Remedies.—Spray the infested plants with an arsenical mixture containing either Paris green or arsenate of lead, (page 6) or with the Bordeaux mixture alone (page 6), which acts as a deterrent. Paris green may be used dry with a powder (page 6).

LOCUSTS.

In years of abundance these insects, particularly the Lesser Migratory Locust, *Melanoplus atlanis* Rilcy, the Red-legged Locust, *Melanoplus femurrubrum* DeG., the Pellucid Locust, *Camnula pellucida* Scudd. and the Two-striped Locust, *Melanoplus bivittatus* Say, very often migrate to gardens and vegetable plots near cities and towns and cause serious damage by devouring the foliage of potato, corn, celery, etc.

Remedy.—The poisoned bran mixture (page 7, with the addition of the juice and peel of 3 oranges or 3 lemons) is a valuable means of destroying large numbers of these insects. The bait should be broadcasted lightly early in the morning to attract the locusts when they are hungry after their night's rest. Four pounds of the mixture is sufficient to treat one acre.

BLISTER BEETLES.

There are a few kinds of blister beetles which almost every year cause considerable anxiety to farmers and gardeners from their habit of appearing suddenly, in large numbers, and feeding on potatoes, beans, beets, carrots, corn, tomatoes and other vegetables, and ornamental plants, such as asters, clematis, zinnia, chrysanthemum, etc. In Eastern Canada the Black Blister Beetle, *Epicauta pennsylvanica* DeG., the Ash-gray Blister Beetle, *Macrobasis unicolor* Kirby, and the Gray Blister Beetle *Epicauta cinerea* Forst, are the better-known species. All are soft-bodied insects; in shape they are slender and cylindrical, and about one-half an inch in length. In the prairie provinces the Western Blister Beetle, *Cantharis nuttalli* Say, is decidedly destructive, and in British Columbia, the Spotted Blister Beetle, *Epicauta maculata* Say, is the one most frequently complained of.

Remedies.—Paris green or arsenate of lead as recommended for the potato beetle (page 13) will control blister beetles, but in some outbreaks it may be necessary to repeat the application as the beetles which are killed are soon replaced by others. In gardens many of the insects may be destroyed by beating them from the plants into a pan containing water with a little coal oil on the surface. As blister beetles are easily disturbed a remedy which has been successfully employed is for two or three boys, or more if necessary, to walk through an infested plot or field and wave from side to side boughs of spruce, or other branches. Such an operation will drive the beetles ahead of them and when the insects come to the edge of the crop they will disperse and seldom return.

RED SPIDER.

Several kinds of small mites, which, of course, are not insects, known collectively as Red Spider, are commonly found on a great variety of garden plants, particularly during hot dry seasons. The presence of these small creatures on the plants is indicated by the leaves losing their colour, having a whitish, bleached appearance and becoming stunted, resulting from the juice having been sucked out.

Remedies.—One of the best remedies for these mites is to spray the plants with a sulphur-soap mixture (page 8). As the mites feed chiefly on the undersides of the leaves the spray should be forced well up among the foliage. The free use of water alone as a spray is also useful. Remnants of crops or flowering plants should be promptly removed and burned so as to prevent the spread of the mites.

SNAILS AND SLUGS.

Very often these soft-bodied molluscs are decidedly destructive in vegetable and flower gardens attacking many different kinds of plants. They are often complained of by tomato growers. They are nocturnal in habit, hiding during the day beneath stones, clods of earth, etc.

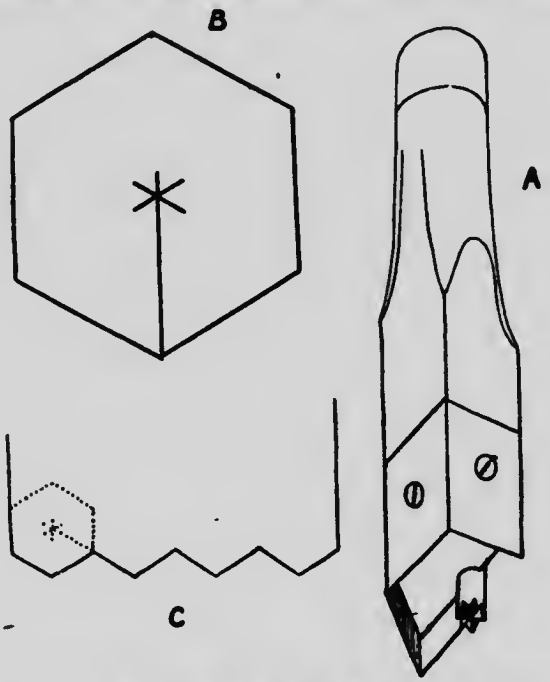
Remedies.—As they come out to feed in the evening an excellent remedy is to broadcast lightly over the soil, before nightfall, freshly slaked lime. This adheres to their bodies and soon kills them. Three applications on consecutive evenings are advisable. Shingles placed here and there throughout an infested garden and under low growing plants will attract many slugs, forming as they do suitable shelters for these creatures. If the shingles are turned over in the morning the slugs there hiding may be easily destroyed by scraping them off and crushing them with the foot.

ATTACKING CABBAGES, CAULIFLOWERS, TURNIPS AND RADISHES.

CUTWORMS (see page 8).

THE CABBAGE ROOT MAGGOT, *Phorbia brassicae* Bouché.

The Cabbage Maggot Fly, a serious pest of the above crops resembles the common house fly but is rather smaller and more slender. About the time cabbages and cauliflowers are set out, or when radishes and turnips appear above the ground, the flies may be seen flying close to the ground and depositing small, white, elongated, eggs on the stems of the plants or adjacent thereto. The eggs hatch in a few days and the small white maggots at once burrow into and destroy the roots. Injury may continue from May until autumn.



(A), Tool used for cutting tarred felt paper discs, one-third size; (B) disc about one-half size; (C) showing how the tool is used, the dotted line indicates the position of the edge of the tool. (After Goff.)

Remedies.—Cabbages and cauliflowers may be protected from injury by placing around the stems at the time they are planted out, a disc made of one-ply tarred felt paper. The implement for making the discs is shown in the accompanying figure at A. Some growers use a square disc. Such a tool as is here illustrated can be made by any expert blacksmith. The blades are made of steel bent in the form of a half hexagon and then taking an acute angle reach nearly to the centre. The part making the star-shaped cut is formed from a separate piece of steel so attached to the handle as to make a close joint with the blade. The dotted lines shown at C indicate how the tool is used. The edge of the tarred felt paper should first be cut by using one edge of the tool. By thus placing the tool where the dotted lines are shown and striking the handle with a hammer, or wooden mallet, a complete hexagonal disc is cut out similar to that shown at B. One yard of tarred felt paper is sufficient to make

about 200 discs. In small gardens where only a few discs would be required, the grower by following the diagram closely, could cut with a sharp knife a sufficient number of discs for his purpose. It is important that the discs be placed around the stems of cabbages and cauliflowers immediately they are set out. In placing the disc one side is raised sufficiently to allow the parts of the star at the end of the slit to point upwards and thus fit close to the stem. The whole disc is then pressed down firmly so that it will rest evenly on the ground.

Radishes may be largely protected by watering them, using an ordinary watering can with a small spout, once a week until they are ready for the table, with a decoction of fresh pyrethrum insect powder, or white hellebore, 2 ounces to each gallon of water. Frames covered with cheese cloth are useful for protecting plants from root maggots. At Ottawa we have used with success a frame 8 by 2 by 2 ft. covered with cheese cloth, placed over plants when they are set out, or under which to grow radishes and garden turnips.

FLEA BEETLES (see page 9).

THE CABBAGE BUTTERFLY, *Pieris rapae* L.

The green caterpillar of the White Cabbage Butterfly generally called the cabbage worm, destroys large numbers of cabbages every year. The butterflies are very common in gardens where they may be seen depositing their eggs on the leaves of cauliflowers and turnips in addition to cabbages as well as, frequently, on the foliage of nasturtium and mignonette.

Remedies.—Dusting the infested plants with fresh pyrethrum insect powder, and cheap flour, one part of the former in four of the latter, is a useful remedy. The powder and flour after thoroughly mixing together should be kept in a tight vessel for 24 hours before using. The mixture may be applied from a duster, sold by seedsmen, or from a cheese cloth bag tied on the end of a short stick, the operator holding the bag over the plants and tapping the stick with a cane held in the other hand as he walks along the rows.

Paris green ¼ of a pound to 40 gallons of water, or dry arsenate of lead 2 pounds to 40 gallons, may be safely used as a spray for cabbages *until the heads are half formed.* If either is used add the " sticker " mentioned on page 6.

THE RED TURNIP BEETLE, *Entomocelis adonidis* Fab.

In the prairie provinces of western Canada, the Red Turnip Beetle, is every year, more or less destructive to cabbages, radishes and turnips, particularly the latter, as well as to other plants of the Cabbage or Mustard Family. The beetle is a handsome one, being of a bright reddish colour with three black stripes down its back. It is about two-thirds the size of the Potato Beetle. It feeds on the foliage of cruciferous plants both in the larval and adult stages.

Remedy.—Spray with Paris green or arsenate of lead as recommended for the Cabbage Butterfly.

THE DIAMOND-BACK MOTH, *Plutella maculipennis* Curt.

The small green caterpillars of this moth are in some years decidedly destructive to the leaves of cabbages, turnips, etc. The caterpillars are very active and when disturbed wriggle backwards. When full grown, at which time they are about three-eighths of an inch in length, they spin open network cocoons on the lower sides of the leaves, and then change to the pupal state.

Remedies.—In gardens spraying the infested plants with kerosene emulsion (page 7) will destroy the caterpillars if applied, as an under spray, to come into contact with them. The remedies mentioned for the Cabbage Butterfly are also useful if the mixtures are forced up among the leaves.

THE CABBAGE APHIS, *Aphis brassicae* L. (see Plant Lice page 8).

THE ZEBRA CATERPILLAR, *Ceramica picta* Harr.

Occurs, intermittently, in eastern Canada in numbers sufficient to cause considerable anxiety to growers of turnips and cabbages. Fortunately, however, such outbreaks have generally occurred late in the season, consequently the injury has not been so important as would otherwise have been the case. The caterpillar is about two inches long when full grown, of a velvety black colour with two conspicuous yellow stripes on each side of the body which are connected by narrow lines of the same colour.

Remedies.—Same as those recommended for Cabbage Butterfly. In small gardens their numbers may usually be kept down by hand picking.

ATTACKING POTATOES AND TOMATOES.

CUTWORMS (see page 8).

THE COLORADO POTATO BEETLE, *Leptinotarsa decemlineata* Say.

Towards the end of May and early in June the over-wintered female potato beetles lay clusters of bright, orange coloured eggs on the undersides of the leaves which soon hatch into the well known dark-coloured grubs. There are several generations of the insect during the season, and both the grubs and the beetles continue to feed from spring to autumn.

Remedies.—It is important to destroy the beetles early in the season, and as soon as they are seen to be present the vines should be sprayed with either Paris green or arsenate of lead, (page 6). Some of the larger growers in Eastern Canada prefer to use paste arsenate of lead in the proportion of 4 pounds to 40 gallons of water. At the Experimental Farm, Ottawa, the following formula has given satisfaction: 8 ounces of Paris green and 1½ pounds of powdered arsenate of lead to 40 gallons of water. Both Paris green and arsenate of lead may be used in Bordeaux mixture and if such is done the above proportions are suitable for 40 gallons of the mixture. Such a poisoned Bordeaux mixture (page 6) not only destroys potato beetles and grubs but also protects the plants from blight and rot. Applications should be made in the beginning of June, when the beetles are seen, then early in July and about August 1, 15 and 31.

BLISTER BEETLES (see page 10).

WHITE GRUBS, *Phyllophaga* spp.

The well known White Grubs, the larvæ of the common May beetles, or June bugs, are responsible for much injury to the roots of garden plants particularly to the tubers of potatoes. They live naturally in land down to grass, feeding on the roots of the grasses, so when pasture, meadow land or a lawn is turned into a vegetable garden the grubs being deprived of their usual food, attack such plants as corn and potatoes, or strawberries if these are grown on the land. The chief destructive species require three years to complete their life-cycles.

Remedies.—When the garden is being prepared all white grubs detected should be removed by hand and destroyed. Unfortunately we know of no remedy which can be applied under acre conditions when the grubs are found to be destroying the tubers of potatoes. Early fall ploughing which brings many grubs to the surface and exposes them to adverse weather conditions, is useful in years when the grubs are changing to beetles. Birds such as crows,

gulls and domestic fowls feed readily on the upturned grubs. If hogs are available these should be turned into an infested area either in spring before ploughing or in autumn when the crop has been removed. They are fond of white grubs and will root them out and devour them.

WIREWORMS, *Elateridae*.

The slender tough yellowish, or reddish-brown grubs, known commonly as wireworms are also very often destructive to the tubers of potatoes as well as to the roots of many other plants. The life-history of these insects is extended into several years like the white grubs and their natural food plants are similar to those of the latter insects.

Remedies.—The removal of the grubs which are observed when digging or cultivating the garden, as mentioned under White Grubs is, of course, advisable. In small gardens it is claimed they may be trapped by placing under boards bunches of clover poisoned with Paris green.

FLEA BEETLES (see page 9).

THE POTATO APHIS (see Plant Lice, page 8).

THE TOMATO WORM, *Protoparce quinquemaculata* Haw.

The Tomato Worm, in some seasons, is the cause of conspicuous injury not only to the foliage of tomato but also occasionally to that of potato as well as tobacco. It has been chiefly complained of in the province of Ontario particularly in the south-western portions. In colour the caterpillar is dark green with somewhat V-shaped white markings on the sides and when full grown is from three to four inches long; at the posterior end there is a conspicuous horn.

Remedies.—In gardens in districts where the insect may occur in numbers to attract attention, hand picking will doubtless prove the simplest remedy. In large plots or under acre conditions spraying with Paris green or arsenate of lead as recommended on page 6 would destroy the caterpillars.

SNAILS AND SLUGS (see page 10).

ATTACKING ONIONS.

THE IMPORTED ONION MAGGOT, *Hylemyia antiqua* Mg.

The Imported Onion Maggot is a regularly occurring pest in every province from Nova Scotia to British Columbia. The appearance of this insect in general is similar to the Cabbage Root Maggot. Under natural conditions so far as we know, it only attacks onion plants. The various varieties are liable to infestation at any time during the growing season, but in most years it is the young plants in June which are largely destroyed.

Remedies.—The fact that there is a period of 10 to 14 days from the time the female flies emerge until they lay their eggs upon the plants, has proved of value in demonstrating the use of a poisoned bait to kill them. The following has been successfully used under acre conditions: 5 grams of commercial sodium arsenite dissolved in a gallon of boiling water, with one pint of cheap molasses added. The mixture is applied *as a coarse spray of large drops* once a week in strips across the plot or field throughout the summer. In small gardens decoctions of fresh pyrethrum insect powder or white hellebore as recommended for the Cabbage Root Maggot (page 12) are useful.

CUTWORMS (see page 8).

THE ONION THRIPS, *Thrips tabaci* Lind.

The Onion Thrips is a very small insect about one-twenty-fifth of an inch long and of a pale yellowish colour. In addition to the onion the insect feeds on the leaves of cabbage, cucumber, tomato, etc.

Remedies.—Any of the contact insecticides mentioned on pages 7 and 8 are useful in controlling this insect. Tobacco preparations are preferred by many growers.

ATTACKING CARROTS, PARSNIPS, PARSLEY AND CELERY.

THE CARROT RUST FLY, *Psila rosae* Fab.

In Eastern Canada, the Carrot Rust Fly is an important enemy of carrots and parsnips, particularly the former. Occasionally celery is also attacked. The maggots which work in the roots in a somewhat similar way to the root maggots, are of a yellowish-colour and when mature about one-quarter of an inch in length. Very often whole plantings of carrots are destroyed before the roots are two inches in length.

Remedies.—Spraying the plants with kerosene emulsion (page 7) has been successfully used to control the insect. The first application should be made when the young carrots are large enough to thin out and further applications once a week throughout the latter part of June and into July. Late sowing has been found of advantage in escaping injury and in districts where the insect occurs regularly it is a good practice to make several sowings of carrots a week apart. Very often the maggots will be found in carrots stored in sand for winter use. When such happens the sand should be carefully removed in spring and buried in a deep hole or thrown into water as it will doubtless contain many of the insects which have entered it to pupate.

THE CELERY CATERPILLAR, *Papilio polyxenes* Fab.

This insect is often found in sufficient numbers on the leaves of celery, carrots and parsnips to attract attention. The caterpillar is a beautiful one, green in colour, with conspicuous velvety black transverse bands, and when mature it is about two inches in length. If disturbed it has the habit of extruding near the head a pair of soft retractile organs.

Remedies.—Under garden conditions owing to the conspicuous colouring of the caterpillar, hand picking is a usual remedy, or they may be knocked off the plants and crushed with the foot. Should they become very abundant spraying with either Paris green or arsenate of lead (page 6) would soon destroy them.

ATTACKING PEAS AND BEANS.

THE PEA WEEVIL, *Bruchus pisorum* L.

The Pea Weevil, often called the pea bug, has caused enormous losses to field peas in the province of Ontario. In years of abundance it is also present in garden peas. The grub feeds on the forming peas in the pod and when mature there changes to the well-known small, brownish-gray beetle about one-fifth of an inch long. The Pea Weevil has recently been found in garden peas in British Columbia.

Remedies.—When garden peas are seen to be infested they should not be allowed to ripen but the vines should be carefully gathered and piled so that the unused pods containing the insects may be burned. If the seed is allowed to ripen it should be fumigated with bisulphide of carbon after harvesting. Farmers very often treat small quantities of seed in an ordinary coal oil barrel which holds about 5 bushels. For such a quantity 3 ounces of bisulphide of carbon is sufficient and may be poured right onto the seed. The barrel should have a tight fitting cover, or sacks slightly dampened or blankets may be placed over the top and covered with boards. The seed should be exposed to the bisulphide for 48 hours.

THE PEA APHIS (see Plant Lice, page 8).

THE BEAN WEEVIL, *Bruchus obtectus* Say.

This insect is about half the size of the Pea Weevil but many of its habits are similar. Unlike the Pea Weevil, however, the Bean Weevil works in the dry seeds as well as when the same are forming in the pods, and several may enter a single bean.

Remedy.—Fumigate infested seed with bisulphide of carbon as recommended for the Pea Weevil.

BLISTER BEETLES (see page 10).

THE PEA MOTH, *Laspeyresia nigricana* Steph.

In Eastern Canada the small, whitish caterpillars of the Pea Moth, which when mature are about half an inch in length, are frequently responsible for considerable injury. The caterpillars feed upon the forming peas in the pod, eating into them and thus causing irregular cavities.

Remedies.—When garden peas are gathered for the table all pods containing caterpillars should be destroyed and in badly infested gardens it would be advisable to remove all the vines and burn the same before the insects leave the pods. We have observed that the earliest maturing and the latest varieties of peas are least subject to attack.

THE SEED-CORN MAGGOT, *Phorbia fusciceps* Zett.

This insect has in some seasons caused considerable damage in eastern Canada to the seed of beans, peas and corn. The maggot is similar to the Cabbage Root Maggot but it is smaller in size.

Remedy.—The eggs of this insect are no doubt laid on the soil where the seeds are planted and as it is not a regularly occurring pest, the gardener cannot anticipate its presence in his land. The important preventives we think would be to sow such seeds as the above not deeper than one or two inches, in good season and in well prepared soil. When seed is planted during a period of cold and damp weather, decay to the seeds, of course, is liable to set in and the conditions possibly rendered more attractive to the adult flies for egg-deposition.

ATTACKING CORN AND RHUBARB.

THE CORN-EAR WORM, *Heliothis obsoleta* Fab.

Fortunately there are few insects which attack the ears of garden or sweet corn. The Corn-ear Worm, is the only one of importance. Some years the caterpillars cause locally rather important injury by feeding on the kernels. The caterpillar varies in colour from a light green to dark brown with rather indistinct stripes; when full grown it is about 1½ inches long.

Remedy.—Recent experiments conducted in certain parts of the United States where the insect is a very serious pest indicate the importance of dusting the corn silks several times at short intervals with powdered arsenate of lead and sulphur, 75 per cent of the former and 25 per cent of the latter.

THE SEED-CORN MAGGOT (see page 16).

THE POTATO-STEM BORER, *Gortyna micacea* Esp.

In the Maritime Provinces the insect known in England as the Potato-stem Borer has of recent years been complained of as a pest of corn, rhubarb, garden peas and potatoes. The most complaints have probably referred to the caterpillar boring in the stalks of corn and in the stem and crown of rhubarb. When full grown the larva is about one and a quarter inches in length, and is of a creamy colour with a pinkish tinge.

Remedy.—All weakened stems which indicate the presence of the insect should be cut out and burned. In Nova Scotia, Professor W. H. Brittain has found that the eggs of the insect are deposited on couch grass, and it is possible other weeds may also attract the moths for egg-laying. This is one of many instances where it is advisable to keep down all weeds.

ATTACKING LETTUCE, BEETS AND SPINACH.

CUTWORMS (see page 8).

THE BEET-LEAF MINER, *Pegomyia vicina* Lint.

The Beet Leaf-miner works in the leaves of beets and spinach, causing conspicuous discoloured blotches. The maggot which is responsible for the injury is white in colour and of rather small size. The female flies lay their whitish eggs on the undersides of the leaves and on hatching the young maggots at once enter the foliage and begin their mining operations.

Remedy.—In gardens where the leaves are used for greens all blotched leaves, should be removed by hand and burned. This should be done before the maggot leaves the foliage to pupate in the soil. Spraying is of no avail in controlling this insect.

THE BEET WEBWORM, *Loxostege sticticalis* L.

This insect which occurs intermittently in enormous numbers in the prairie provinces of Western Canada is an important enemy of sugar beets. When an outbreak occurs the caterpillars assume the marching habit and enter gardens destroying beets, lettuce, spinach and other vegetables. It is nearly an inch in length, greenish in colour with yellow stripes on the back and sides.

Remedy.—Garden plants used for greens could not of course be treated with a poisoned spray to kill the caterpillars. In years when the insect is abundant plants could undoubtedly be protected from the ravages of the caterpillars by digging a trench around the garden. The trench should be about 10 inches deep and the side nearest the garden made straight to prevent the caterpillars climbing up. Post holes dug in the trench, 1 or 2 feet deep, would doubtless trap large numbers and they could easily be killed by crushing them with the blunt end of a post. The holes should be about 15 feet apart.

ATTACKING MELONS, CUCUMBERS, SQUASHES AND PUMPKINS.

THE STRIPED CUCUMBER BEETLE, *Diabrotica vittata* Fab.

When young cucumber, melon and other cucurbits appear above the soil they are often destroyed by the over-wintered black and yellow-striped beetles, about two-fifths of an inch in length, known commonly as the Striped Cucumber Beetle. The beetles are also present later in the season and some years much injury is effected to the leaves and other portions of the plants.

Remedies.—In gardens during the early part of the season the plants may be protected if grown beneath cheese cloth screens, the frame supporting which may be made of barrel hoops cut in two, crossed, and the ends stuck into the ground. Later when the vines are too large to be thus protected the beetle may be largely controlled by spraying with poisoned Bordeaux mixture (page 6) using arsenate of lead which adheres to the foliage longer than does Paris green.

PLANT LICE (see page 8).

THE SQUASH BUG, *Anasa tristis* DeG.

In the province of Ontario, the Squash Bug is an important pest of squashes, cucumbers, melons and pumpkins. This insect is dark brown in colour and about three-quarters of an inch long. The females deposit their eggs on the undersides of the leaves and the young soon appear and feed with the mature bugs.

Remedies.—Early in the season many of the bugs may be removed from the plants by the hand. All egg clusters seen should also be destroyed. When the insects are young they may be killed by spraying with kerosene emulsion or whale-oil soap (pages 7 and 8). The mature bugs may be trapped by placing shingles or pieces of boards in the garden under which they will hide at night. Such traps, should be examined early in the morning and the bugs collected and destroyed.

ATTACKING ASPARAGUS.

THE ASPARAGUS BEETLES.

The two kinds of asparagus beetles, namely, the Common Asparagus Beetle, *Crioceris asparagi* L. and the Twelve-spotted Asparagus Beetle, *Crioceris 12-punctata* L. are well known pests in the province of Ontario. Both beetles are about one-quarter of an inch in length, the former being of a steel-blue colour marked with six pale yellow blotches on the back and having a red thorax and a margin of paler red to the wing-covers, while the latter is yellow in colour with 12 black spots on the back, the head and thorax being red.

Remedies.—A useful remedy is to dust the plants with air-slaked lime in the morning when they are wet with dew. This adheres to the bodies of the grubs and destroys them. Spraying with powdered arsenate of lead two pounds to forty gallons of water is recommended. Such a spray may be applied as soon as cutting is over and repeated when necessary at intervals of a week or 10 days.

INSECTS OF THE FLOWER GARDEN.

ATTACKING THE ROSE.

ROSE-SLUGS.

There are three different kinds of rose-slugs which destroy the foliage of the rose in eastern Canada, namely, the American Rose-slug, or Rose sawfly, *Endelomyia aethiops* Fab., which is green in colour and feeds on the upper side of a leaf, hiding during the day on the under surface; the Bristly Rose-worm, *Cladius pectinicornis* Fourcr., which is of a dirty yellowish-green to a glaucous green colour with a darker green line down the back and with stiff hairs giving it a bristly appearance, and which works very much in the same way as the Rose-slug, skeletonizing the leaves and leaving whitish blotches, as well as eating out

irregular holes all over the foliage; and the Curled Rose-worm, *Emphytus cinctipes* Nort, green above with the sides and legs grayish-white but which may be easily distinguished from the other two kinds in having a yellowish-brown head marked with a broad brownish-black spot. The last species eats the entire substance of the leaf, feeding along the edges, with the body curled up beneath it. The three rose-slugs, or false caterpillars, vary in size from one-third of an inch to two-thirds of an inch in length.

Remedy.—These rose-slugs are easily controlled by spraying with a weak solution of Paris green, one ounce in fifteen gallons of water.

APHIDS OR PLANT LICE (see page 8).

SCALE INSECTS.

Two common scale insects are frequently found on the shoots of rose, namely the Rose Scale, *Aulacaspis rosae* Bouché and the Oyster-shell Scale, *Lepidosaphes ulmi* L. The former is roundish in outline and being white in colour is conspicuous on the greenish or reddish shoots. The latter, a well-known apple tree pest, is shaped like an oyster-shell.

Remedy.—Both of these scale insects may be controlled by spraying with commercial lime-sulphur, one gallon diluted to 10 gallons with water. The mixture should be applied before the buds burst. Heavily infested canes should be cut off.

RED SPIDER (see page 10).

THE ROSE LEAF-HOPPER, *Typhlocyba rosae* L.

This common leaf-hopper occurs in most places where roses are grown, feeding on the undersides of the leaves. These insects, which are very small, are pale greenish-white in colour. Throughout the summer they may be found on the leaves in various stages of development and are frequently extremely destructive. Their injury is particularly noticeable in the middle of June.

Remedy.—Any of the contact insecticides for sucking insects are useful in controlling the leaf-hopper (pages 7 and 8). Applications should be made early in the season before the insects attain their wings and whichever insecticide is used should be applied as an under spray.

THE ROSE BEETLE, *Macrodactylus subspinosus* Fab.

This well-known pest of the fruit grower is also, as its popular name would indicate, very destructive to the flowers of rose bushes as well as to the bloom of many other kinds of flowering plants. This insect occurs particularly in the Niagara district of the province of Ontario, The beetle is about one-third of an inch long, of a light brownish colour, with long spiny legs.

Remedy.—In flower gardens the beetles may be beaten from the plants, early in the morning when they are sluggish, into an inverted umbrella after which they may be dropped into a vessel containing water with coal oil on the surface.

ATTACKING DAHLIA, ZINNIA, CHRYSANTHEMUM, ASTER, ETC.

CUTWORMS (see page 8).

THE TARNISHED PLANT BUG, *Lygus pratensis* L

This common plant bug is troublesome in flower gardens almost every season, destroying the buds of dahlia, zinnia, etc. It also sucks the juice from the leaves, causing the same to become distorted. The bug is about one-quarter of an inch long, of a brown colour with black and yellowish markings. It hibernates in the adult stage under stones, rubbish, etc.

Remedy.—Unfortunately there is no satisfactory remedy known for this insect. In gardens particularly early in the morning when the bugs are sluggish they may be beaten from the plants as recommended for the Rose Beetle. Areas which are kept clean of weeds, rubbish, etc., will not attract the insects as will plots and gardens which are allowed to become dirty.

THE FOUR-LINED LEAF BUG, *Poecilocapsis lineatus* Fab.

This is another plant bug which is very destructive at times to dahlia, zinnia, weigelia, snap-dragon, etc. It is of a bright greenish-yellow colour, one-quarter of an inch long, with two black spots on the thorax and four stripes of the same colour down the back.

Remedies.—A spray of strong kerosene emulsion (1 to 6) will destroy the nymphs, but the perfect insects are more difficult to kill. Many of these latter may be beaten from the plants as recommended for the Tarnished Plant Bug.

ATTACKING THE VIRGINIA CREEPER.

THE GRAPE LEAF-HOPPER, *Typhlocyba comes* Say.

Virginia Creepers are every year attacked and made unsightly by the destructive work of the Grape Leaf-hopper. The insects work on the under-sides of the leaves sucking out the juice and causing them to turn whitish and drop prematurely. These small active hopping insects which are often called "thrips" are of a translucent white colour marked with red and dark brown lines.

Remedy.—Spray the vines thoroughly with a contact insecticide (pages 7 and 8). The spray should be forced well up from beneath as it must actually hit the insects to be effective. Around verandahs many prefer to use a tobacco preparation such as the proprietary mixtures "Nikoteen" or "Black Leaf 40," sold by all seedsmen.