INSECTS OF THE FLOWER GARDEN AND THEIR CONTROL

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INSECTS OF THE FLOWER GARDEN AND THEIR CONTROL

By Arthur Gibson, *Dominion Entomologist*

INTRODUCTION

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 knowledge will help materially in deciding the proper remedy to apply. Injurious insects may be divided, roughly, into two classes, by the nature of their mouthparts, namely, (1) biting insects which bite and chew their food, such as cutworms and other caterpillars, leaf-eating 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 one with biting mouthparts a stomach poison, such as Paris green, or arsenate of lead, is usually applicable; but if the species has sucking mouthparts, 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 page 7).

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 by 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 insects.

BENEFICIAL INSECTS

All insects which occur in gardens are not injurious. There are beneficial ones as well, which continually do good by destroying those species which are harmful. These beneficial kinds should be known to the gardener. Foremost amongst them are the different kinds of ladybird beetles (figs 1 and 2), which, both in their larval and adult stages, feed almost exclusively upon plant-lice and scale insects.

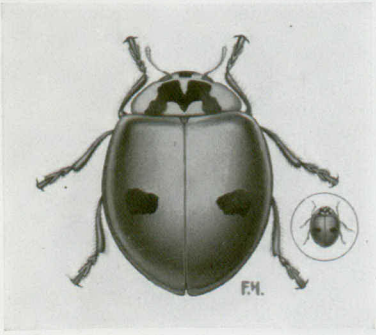

Fig. 1—The two-spotted ladybird beetle, *Adalia bipunctata* L.; enlarged and natural size (after Gibson and Twinn).

Fig. 2—Larva of ladybird beetle, enlarged about 3 times (after Ross).

Another kind of beetle, the fiery ground beetle, *Calosoma calidum* Fab., is a particularly useful insect. This beetle, and its voracious black grub, which is called the cutworm lion, destroys enormous numbers of cutworms. The beetle, shown in the figure, is brownish-black, with the wing-cases spotted with coppery red. The large harpalus, *Harpalus caliginosus* Fab., also destroys cutworms. The appearance and habits of these good friends should be known to everyone (fig. 3).

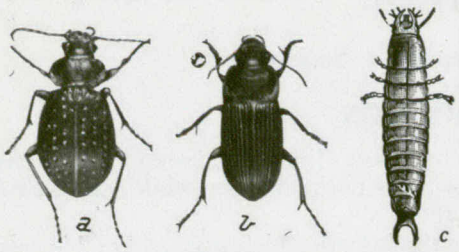

Fig. 3—Predaceous enemies of cutworms; *a*, fiery ground beetle; *b*, large harpalus; *c*, cutworm lion; (*a* and *b*, author's illustrations; *c*, after Riley).

Other well-known beneficial insects belong to the parasitic hymenoptera (four-winged flies), and to the diptera (two-winged flies). Among the latter are the maggots of the syrphid flies which feed on plant lice (fig. 4).

Many of the four-winged and two-winged parasitic flies deposit their eggs upon or in the bodies of cutworms and other injurious caterpillars. These eggs soon hatch and the young larvæ therefrom at once begin to feed upon the living caterpillar, which of course soon dies.

Fig. 4—Syrphid larva feeding on plant lice (after Gibson and Ross).

The different kinds of lace-wing flies (*Chrysopa* species) are also good friends of the gardener; their larvæ feed particularly on plant lice, for which reason

they are known as aphis-lions. The adult flies are beautiful creatures, green in colour, the wings finely veined and transparent.

Predaceous mites, small oval-bodied eight-legged creatures, are important in controlling the common spider mite. Spiders by preying on injurious flies and other insects are also valuable.

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.

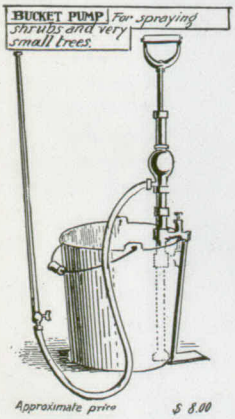

Fig. 5—Bucket spray pump (after de Gryse).

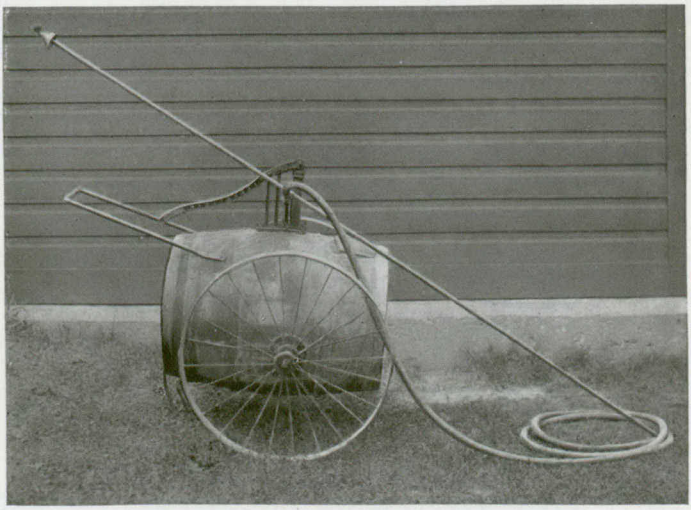

Fig. 6—Barrel sprayer suitable for use in small gardens (after Dustan).

Insects exposed by cultivation.—When gardens are being dug in spring, white grubs, wireworms, etc., are very often turned up. It is advisable to remove and destroy the same by hand whenever possible.

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,

Fig. 7—Small type of hand duster (after Dustan).

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 the manufacturers or their agents, usually seedsmen, are employed. 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. For the application of dusts, various types of dusters are sold by seedsmen and other dealers. The smaller or plunger type of dust gun is cheap and useful for ordinary sized gardens.

Fig. 8—Rotary duster discharging nicotine dust (after Glendenning).

Formulae

STOMACH POISONS 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 hydrated lime added. Where only a few plants are being treated, one teaspoonful, with double this quantity of lime, to a pail of water is sufficient.

Dry application.—1 pound of Paris green mixed with 15-20 pounds of hydrated lime. Should be used early in the morning when the plants are wet with dew.

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. It is used in the strength of 2 pounds to 40 gallons of water. For use in small quantities 4 ounces is sufficient for 5 gallons of water.

Dry application.—1 pound of arsenate of lead mixed with 4-6 pounds of hydrated lime or land plaster.

COMBINATION DUST MIXTURES:

In addition to dry applications of Paris green or arsenate of lead, many growers prefer a combination dust mixture such as either one of the following: (1) dusting sulphur, 9 pounds, arsenate of lead, one pound; (2) dehydrated copper sulphate (bluestone) 1½ pounds, arsenate of lime, one pound, hydrated lime, 10 pounds. Both of these mixtures are of value in controlling fungous diseases, as well as biting insects.

Dust mixtures are best applied when the air is still, in late evening or early morning.

POISONED BRAN MIXTURE (for cutworms and grasshoppers):

Bran	20 pounds	Paris green	½ pound
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 1 quart of bran, 1 teaspoonfull of Paris green and 1 tablespoonful of molasses, with sufficient water to moisten the bran.

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

CONTACT INSECTICIDES FOR SUCKING 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 can be preserved 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	½ pound
Water	2 gallons

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

NICOTINE SULPHATE:

Commonly used against sucking insects. Trade preparations containing 40 per cent of nicotine are sold by nearly all seedsmen. Directions regarding the strength at which the material should be used are given on the containers. When only a small number of plants are to be treated, nicotine sulphate may be used at the strength of 1 to 1¼ teaspoonfuls to 1 gallon of water. It is usual to add common laundry soap to the diluted spray at the rate of ½ pound to 10 gallons of mixture.

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SOAPS:

Washes containing soap have been used extensively for aphids, etc. Common laundry soap, 1 pound, dissolved in 4 or 5 gallons of water, is a useful contact insecticide. Commercial soaps, such as whale oil or fish oil soap, have also been widely recommended. Their unpleasant odour, however, is objected to by many lovers of ornamental plants. For brown or black aphids, fish oil soap should be used in the strength of 1 pound to 4 gallons of warm water; for green aphids in the strength of 1 pound to 6 gallons of water.

NICOTINE DUSTS:

(*See* page 31.)

LIME SULPHUR:

Commercial lime-sulphur may be obtained at seed stores. It is a useful mixture for scale insects, and may be used in the strength of 1 gallon to 7 gallons of water when the shrubs or bushes are in a dormant state.

BORDEAUX MIXTURE:

(*See* page 31.)

OTHER INSECTICIDES:

In addition to the above there are other insecticides—pyrethrum extracts, etc.— sold by seedsmen and others which on the whole will be found of value. The directions attached should be followed carefully.

LEAF-EATING INSECTS

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. A female cutworm moth lays several hundreds of eggs, usually on the leaves of weeds, grasses and shrubs; eggs are also laid on the soil. 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. Other species,

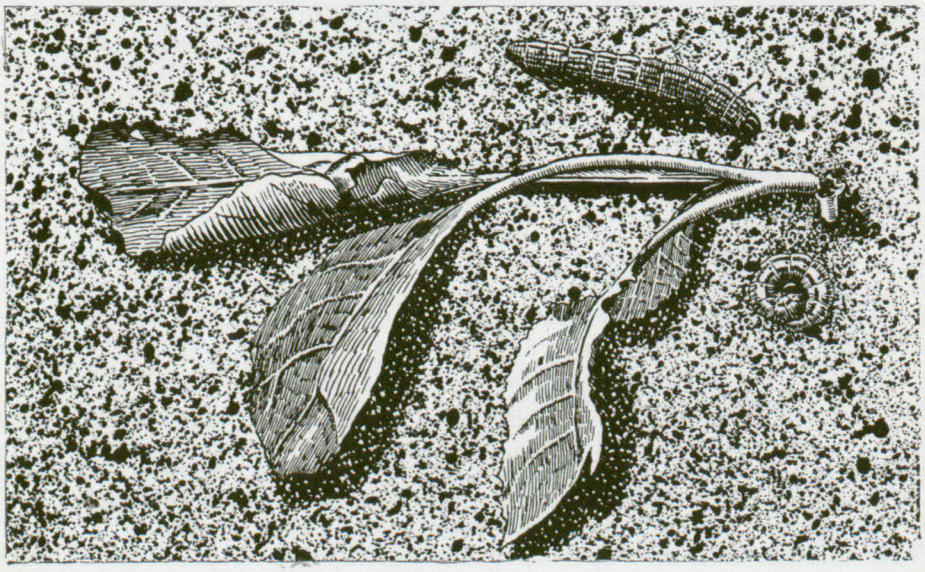

Fig. 9—Characteristic habit of cutworms (author's illustration).

especially the variegated cutworm, *Lycophotia margaritosa* Haw.; the spined rustic, *Barathra curialis* Sm., and its close ally, *B. configurata* Wlk.; the white cutworm, *Euxoa scandens* Riley, and the spotted cutworm, *Agrotis c-nigrum* L., have some years caused appreciable injury to flowering plants. Cutworms are general feeders, attacking all kinds of garden plants, particularly when these are young and succulent.

Control.— The poisoned bran mixture described on page 7 is the remedy which is now used most extensively. In gardens containing rows of plants the mixture should be scattered thinly along the rows on either side, as soon as cutworm injury is noticed. Individual flowering plants may be protected by placing a small quantity of the poisoned bran around, but not touching, each plant. The best results will be secured if the poisoned bran is spread during warm weather, after sundown, and when the soil is moist. Valuable plants may be protected from cutworms by placing a band of tin, or wrapping a piece of paper, around the stems; as shown in fig. 10.

Fig. 10—Method of protecting young plants from cutworms by means of small tin cylinders (author's illustration).

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.

The Imported Cabbage Worm, *Pieris rapae* L.

This common pest, the caterpillar of the butterfly known as the white cabbage butterfly, is prevalent in gardens where it can be seen depositing eggs on

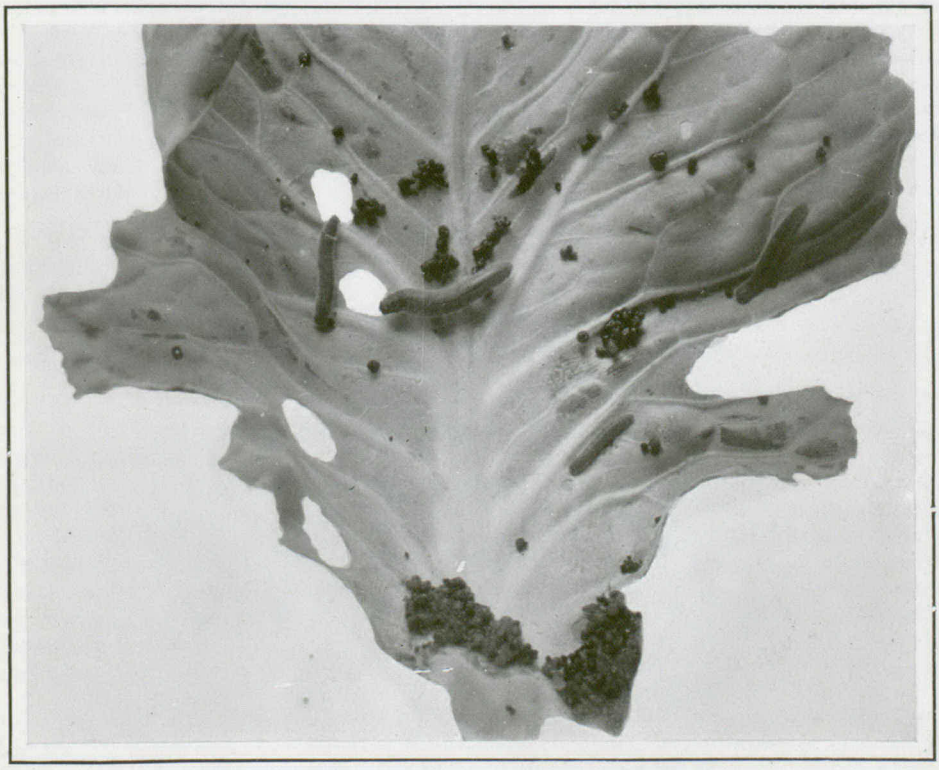

Fig. 11—The imported cabbage worm and its work (author's illustration).

the leaves of cabbage, cauliflower, turnip, and also on the foliage of nasturtium, mignonette and alyssum. The caterpillar is velvety green in colour, and when mature is about an inch in length. It has a yellow line along each side and an unbroken one down the middle of the back. The caterpillar as soon as it hatches from the egg, begins to feed upon the foliage and soon renders this unsightly. It is particularly destructive to mignonette, some seasons it being almost impossible to grow good plants.

Control.—Dusting the infested plants with fresh pyrethrum insect powder and cheap flour, 1 part of the former to 4 of the latter, is a useful remedy. The powder and flour after being thoroughly mixed together should be kept in a tight vessel for 24 hours before using. The mixture may be applied from a duster, 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.

A dust mixture made of 1 part of arsenate of lead and 5 parts of hydrated lime is commonly used to destroy the cabbage worm.

Paris green, $\frac{1}{4}$ of a pound to 40 gallons of water, or arsenate of lead, 2 pounds to 40 gallons, may be used. For use in small quantities one teaspoonful of Paris green, with the same quantity of lime, to a pail of water, is sufficient, or 1 teaspoonful of arsenate of lead to 1 gallon of water.

The Cabbage Looper, *Autographa brassicæ* Riley

Occasionally in Eastern Canada the cabbage looper is abundant enough to attract attention. When full grown the caterpillar is about one and one-quarter inches long, pale green in colour, with whitish stripes. It loops its body

Fig. 12—The cabbage looper feeding on leaf (after Gibson and Ross).

when walking. Flowering plants attacked include, mignonette, carnation, geranium, and chrysanthemum.

Control.—Spray or dust with arsenate of lead as for the alfalfa looper.

The Alfalfa Looper, *Autographa californica* Speyer

This insect, which is widespread in distribution in Western Canada, when in outbreak form attacks many kinds of plants in gardens. In British Columbia it has injured rhododendron, laurel, holly and rose. Other flowering plants attacked are chrysanthemum, carnation, mignonette and geranium. The caterpillar when mature is one and one-quarter inches in length, dark green in colour, with pale longitudinal stripes. Having only three pairs of abdominal legs, it loops when walking. When abundant it assumes a marching habit and plants attacked may be entirely stripped of foliage.

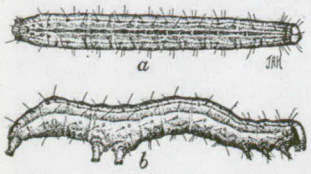

Fig. 13—The alfalfa looper, *a*, dorsal aspect; *b*, lateral aspect. Slightly enlarged (after Hyslop).

Control.—Spray or dust with arsenate of lead (see p. 6). Mechanical means of protection possibly would be found of advantage, such as the ploughing of furrows or the digging of trenches ahead of the line of march of the caterpillars. These means of protecting crops from the ravages of migrating hordes of caterpillars have been fully discussed in bulletins 9 and 13 of the Dominion Entomological Branch.

The Rose Budworm, *Pyrrhia umbra* Hbn.

The caterpillar of this moth causes damage to roses in Eastern Canada, by eating into the buds. The moth is known as the bordered sallow. Other flowering plants, such as delphinium, snapdragon and columbine, are also attacked. The caterpillar is of two distinct forms, one being green in colour spotted with black tubercles and having conspicuous dark longitudinal stripes, and the other milk-white in colour, with cross-shaped orange blotches down the centre of the back.

Control.—Infested buds whenever seen should be removed by hand and the caterpillars destroyed. If they are very numerous, spray the bushes with arsenate of lead in the strength of 8 ounces to 10 gallons of water.

The Honeysuckle Budworm, *Homohadena badistriga* Grt.

In Eastern Canada the caterpillars of this noctuid moth have been noticeably abundant in ornamental gardens on several kinds of climbing honeysuckles. In May they have been observed in numbers particularly on yellow-flowered varieties. The young caterpillars feed on the buds and foliage of the new shoots of the plant, hiding in the day time inside the two clasping leaves which surround the cluster of flower buds at the tip. As they mature they crawl down to the shady side of the old wood of the plant upon which they rest when not feeding. When mature, at which time they are about one and one-quarter inches long, the ground colour of the caterpillar is remarkably like that of the stem, or twig, upon which it rests.

Control.—In areas where this pest is more or less abundant every year, the plants should be examined early in the season and, as soon as the very small caterpillars are noticed, sprayed or dusted with arsenate of lead (see p. 6).

THE YELLOW WOOLLY BEAR, *Diacrisia virginica* Fab.

This well known woolly bear caterpillar is occasionally found in destructive numbers in flower gardens feeding on the foliage of sunflower, dahlia, verbena, hydrangea, etc. When mature it is about one and a half inches in length and as the name "woolly bear" would indicate is clothed with dense clusters of stiff hairs, not always of a yellow colour, however, as in many specimens these are of a dark rusty or reddish-brown colour, or even nearly white. In the paler specimens a more or less broken lateral stripe is present, as well as bands of the same colour across the back.

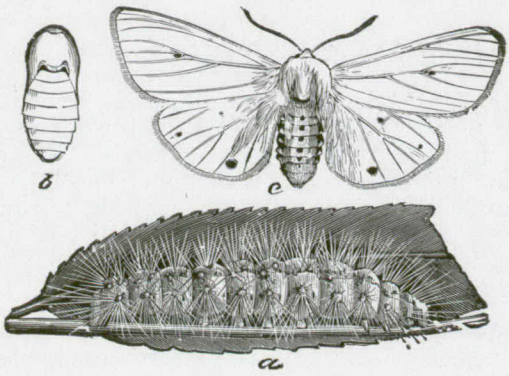

Fig. 14—Yellow woolly bear, pupa and moth (after Riley).

Control.—As the caterpillars are so conspicuous, they may easily be removed from the plants by hand. If abundant, spraying with arsenate of lead will destroy them (see p. 6).

THE SALT-MARSH CATERPILLAR, *Estigmene acraea* Drury

This woolly bear caterpillar is larger than the yellow woolly bear, being two and a half inches long when full grown, and differs in having a yellow body and yellow markings along the sides. Injury is most noticed when the caterpillars are in their younger stages during which time they feed together. As they grow older and reach maturity they separate and wander off by themselves. They attack a wide range of garden plants.

Control.—Same as for the yellow woolly bear.

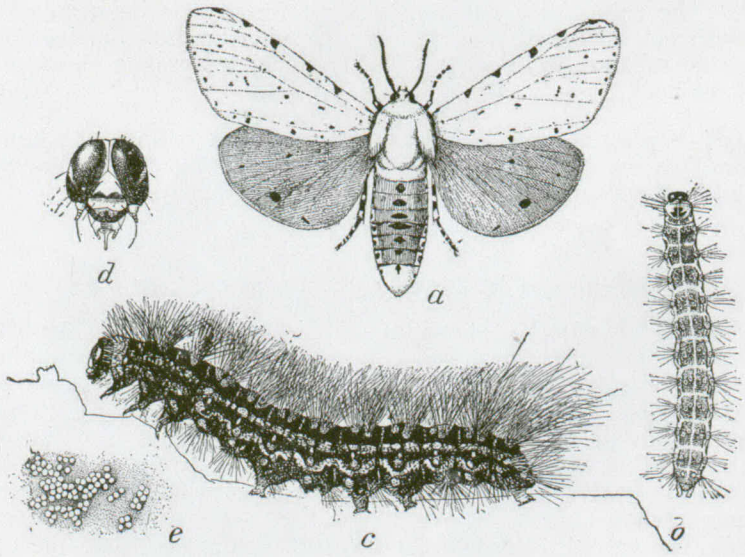

Fig. 15—Salt-marsh caterpillar and moth (after Chittenden).

THE ZEBRA CATERPILLAR, *Ceramica picta* Harr.

This well known enemy of turnips, cabbages and other cultivated crops occurs, intermittently, in Eastern Canada in numbers sufficient to cause con-

Fig. 16—Young zebra caterpillars feeding on cabbage leaf (after Dustan).

siderable anxiety, and when such outbreaks occur, flowering plants, such as sweet peas, lilies, gladioli, etc., are liable to attack. Fortunately, however, the outbreaks occur 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.

Control.—Same as that recommended for the cabbage worm (see p. 10). In small gardens its numbers, usually, may be kept down by hand picking.

Fig. 17—The greenhouse leaf-tyer and its work (author's illustration).

THE GREENHOUSE LEAF-TYER, *Phlyctaenia rubigalis* Gn.

This well known greenhouse insect some years causes important injury to plants in the open particularly in gardens adjacent to greenhouses. During 1927, the foliage of peony, English daisy and a number of other flowering plants were seen to be much injured. In the United States, too, the leaves of wall-flower, dahlia, begonia, rose, nasturtium, geranium and other plants grown outside are attacked. The caterpillar has the habit of drawing together portions of a leaf or of two leaves that happen to be contiguous, and tying them with fine threads of silk. When full grown it is three-quarters of an inch in length, of a semi-translucent green colour darker on the back which bears longitudinal stripes.

Control.—The remedy recommended for the oblique-banded leaf-roller is suggested, if the leaf-tyer is found to be present in flower gardens (see p. 20).

THE FALL WEBWORM, *Hyphantria cunea* Drury

Shade trees of various kinds are commonly attacked by this insect which forms unsightly webs on the branches. When such trees are near flower gardens, the caterpillars frequently become dislodged from the trees or migrate therefrom and enter the gardens attacking such plants as rose, honeysuckle, geranium, etc. The caterpillar when mature is about one and one-half inches long and is conspicuously clothed with pale coloured hairs.

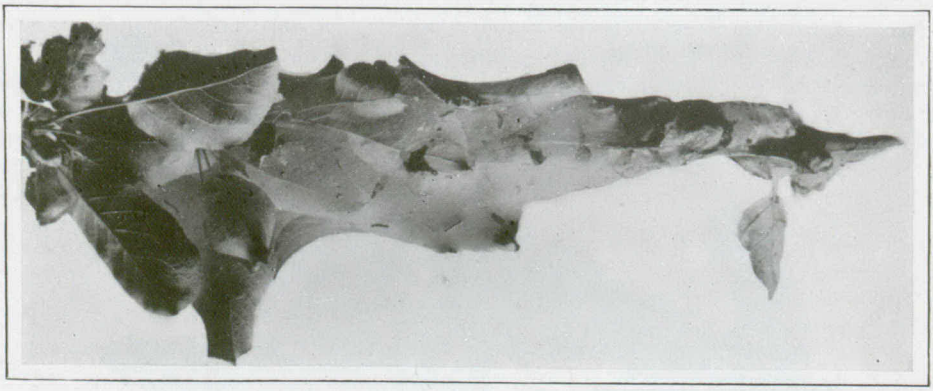

Fig. 18—Fall webworm and web; reduced (author's illustration).

Control.—All webs seen on nearby trees should be removed by hand and the caterpillars destroyed by crushing or burning. Flowering plants may be protected by spraying with arsenate of lead as recommended for other leaf-eating insects (see p. 6).

THE WHITE-MARKED TUSSOCK MOTH, *Hemerocampa leucostigma* S. & A.

This well known pest of shade trees, in years of abundance, not infrequently migrates to flower gardens causing appreciable injury to the foliage of rose, geranium and other plants. When mature the caterpillar is about one and one-quarter inches in length. It is "beautifully marked, with a coral red head, a yellow band along each side, and a row of four conspicuous brush-like tufts of white or yellow hairs along the back." Three long pencils of black hair are also present, two at the front of the caterpillar and one at the rear.

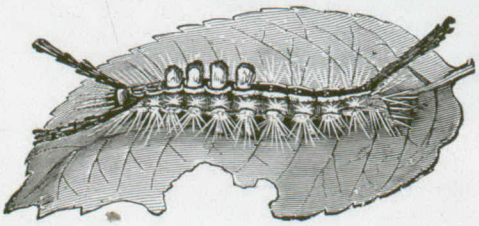

Fig. 19—The caterpillar of the white-marked tussock moth (after Riley).

Control.—Spray with powdered arsenate of lead, one-quarter of a pound in 5 gallons of water, as soon as the caterpillars are noticed. Destroy the conspicuous whitish egg masses, on the trunks and lower limbs, by painting them with creosote.

Fig. 20—Egg mass of white-marked tussock moth (original).

THE RUSTY TUSSOCK MOTH, *Notolophus antiqua* L.

This common tussock moth differs from the white-marked tussock moth in being less brightly coloured and in having a pencil of black hairs on either side of the fourth segment behind the head. In some years it is abundant in ornamental gardens and may be found upon almost any kind of tree, shrub or herbaceous plant. It has been observed causing important injury to the foliage of geranium, sweet pea, gladiolus, rose, philadelphus, and other garden plants.

Control.—Same as for the white-marked tussock moth.

Fig. 21—Work of caterpillars of rusty tussock moth, on spruce hedge bordering flower garden (author's illustration).

Tent Caterpillars

The eastern tent caterpillar, *Malacosoma americana* Fab., and the forest tent-caterpillar, *Malacosoma disstria* Hbn., during years of abundance migrate from their favourite food plants (apple, cherry, plum, maple, poplar, etc.), enter gardens and attack rose and other plants. These caterpillars when mature are about two inches long and of a bluish-grey colour, the former species having a white band down the middle of the back and the latter, a row of elongate whitish spots in place of the band.

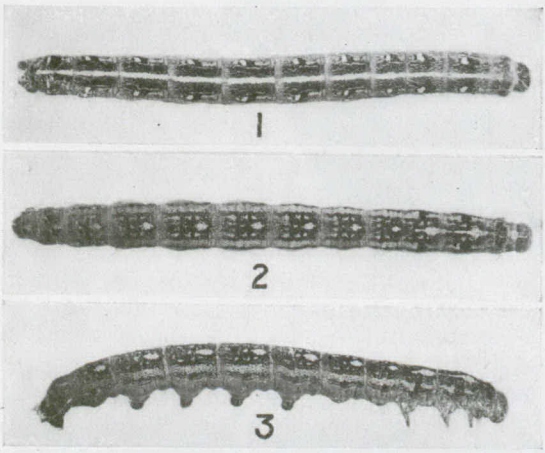

Fig. 22—1, eastern tent caterpillar; 2 and 3, forest tent caterpillar (after Swaine).

Control.—Trees near gardens should be kept as free as possible of tent caterpillars. The eastern tent caterpillar makes a conspicuous silken "tent" in which it lives when at rest. Such tents with the contained caterpillars should be removed from the trees as soon as noticed and destroyed. The forest tent caterpillar does not make a tent but congregates in masses on the trunks of trees and at such times may be destroyed by crushing with a stiff brush attached to a long pole. Spraying the trees with arsenate of lead, 2 pounds to 40 gallons of water, should, of course, be practised if at all possible.

The Eight-spotted Forester, *Alypia octomaculata* Fab.

The caterpillar of this beautiful moth in some years is noticeably destructive to the foliage of grape. In years of abundance the leaves of Virginia creeper are not infrequently attacked. The caterpillar is cutworm-like in shape, noticeably smaller at the head end, and in colour pale bluish. It is marked, conspicuously with black, transverse lines. An orange band also crosses each segment. In its early stages, the caterpillar is paler in colour and the markings are less distinct.

Control.—Ordinarily, hand picking the caterpillars and crushing them should answer as a remedy. If numerous, spray with arsenate of lead mixture (see p. 6).

Hawk Moth Caterpillars

Occasionally, hawk moth caterpillars are found on the foliage of garden plants. These caterpillars are usually large and conspicuous. Most of the species are of some shade of green and some are ornamented with coloured stripes on their sides. At the end of the body most of them have a spine-like organ known as the caudal horn. The caterpillar of the waved sphinx, *Ceratomia undulosa* Wlk., feeds on the foliage of privet; the hermit sphinx, *Sphinx eremitus* Hbn., on bergamot, spearmint and sage; the

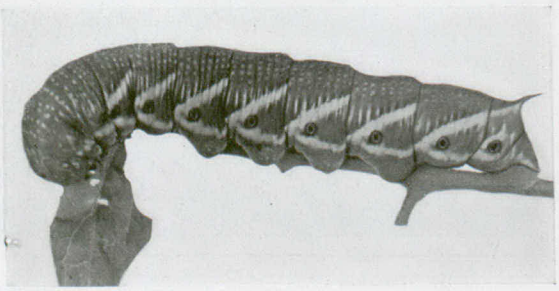

Fig. 23—Hawk moth caterpillar (after Dustan).

chersis sphinx, *Sphinx chersis* Hbn., on privet and lilac; the laurel sphinx, *Sphinx kalmiae* A. & S. on lilac, laurel and fringe tree; the snowberry sphinx, *Sphinx vashti* Stkr.; the blind-eyed sphinx, *Paonias excaecata* A. & S., on wistaria and spirea; the humming-bird clearwing, *Haemorrhagia thysbe* Fab., on snowball and certain other flowering shrubs; the snowberry clearwing, *Haemorrhagia diffinis* Bdv., on honeysuckle and snowberry; the satellite sphinx, *Pholus satellitia pandorus* Hbn., on ampelopsis; the achemon sphinx, *Pholus achemon* Dru., on ampelopsis; the hog sphinx, *Ampeloeca myron* Cram., on ampelopsis; the nessus sphinx, *Amphion nessus* Cram., on ampelopsis.

Control.—Remove the caterpillars by hand as soon as the foliage is seen to have been attacked, and destroy them by crushing.

THE VARIEGATED FRITILLARY, *Euptoieta claudia* Cram.

The caterpillar of this butterfly in some years is sufficiently abundant to cause important injury to the foliage of portulaca, pansy and violet, infestations having occurred in the provinces of Ontario, Manitoba and Saskatchewan. When full grown it is about one and one-quarter inches long, the body being, in general, of an orange-red colour although some individuals are dull brownish. Conspicuous, whitish, longitudinal bands are present on the body, also spine-bearing tubercles which are prominent and black, two specially large ones being present just behind the head.

Control.—Same as for the cabbage worm (see p. 10).

THE BIRCH LEAF SKELETONIZER, *Bucculatrix canadensisella* Chamb.

Birch trees grown on lawns adjacent to flower gardens are some years seriously attacked by the Birch Leaf Skeletonizer, a small yellowish-green

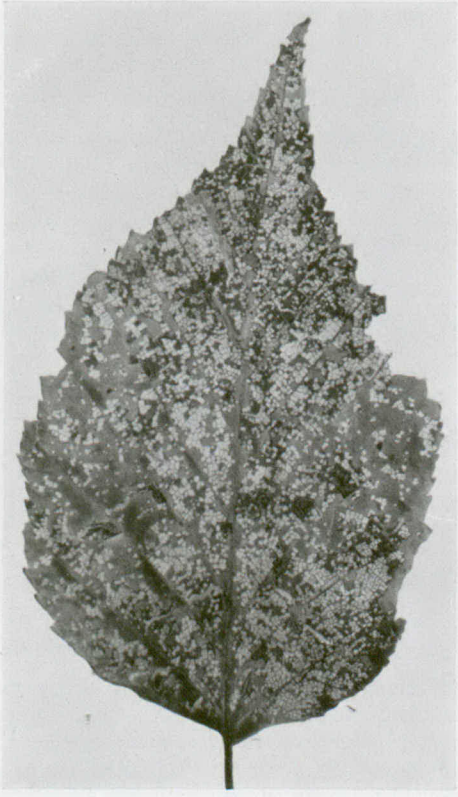

Fig. 24—Birch leaf destroyed by birch leaf skeletonizer (original).

Fig. 25—The corn ear worm (photo by W. G. P. Garlick).

caterpillar, about one-quarter of an inch in length. The injury is apparent particularly in late summer, when the foliage is seen to be skeletonized from the feeding of the caterpillars, resulting in more or less defoliation.

Control.—Cultivated birch trees, if not too high, may be readily protected from the ravages of this insect by spraying with arsenate of lead (see p. 6). The application should be made as soon as the first injury is noticed.

The Corn Ear Worm, *Heliothis obsoleta* Fab.

Some years this insect, a well known pest of corn, also causes injury to flowering plants. 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. It usually appears in the latter part of the summer. Dahlia, rose, gladiolus, phlox, sweet pea, and other flowering plants have been attacked.

Control.—Dust with arsenate of lead mixture (see p. 7).

The Diamond-back Moth, *Plutella maculipennis* Curt.

The small green caterpillars of this moth are, some years, decidedly destructive to the leaves of wallflowers, stocks, etc., particularly during July and August. They are light green in colour, 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.

Control.—Kerosene emulsion applied to infested plants (see p. 7) will destroy the caterpillars if applied as an under spray to come into contact with them. A better remedy is to spray or dust with an arsenical mixture, as recommended for the cabbage worm (see p. 10).

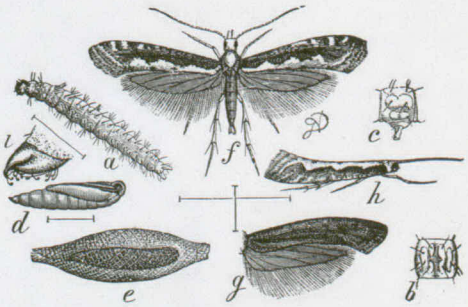

Fig. 26—The diamond-back moth; *a*, caterpillar; *d*, pupa; *c*, cocoon; *f*, moth enlarged (after Riley).

The Aster Shark, *Cucullia convexipennis* G. & R.

The caterpillars of this noctuid moth are in some years fairly abundant in Eastern Canada, feeding chiefly on the flowers of China asters. As a rule not more than one or two specimens have been found on the same plant. The caterpillar measures rather more than an inch and a half in length. It has a wide reddish band down the centre of the back on either side of which are four or five dark brown irregular lines, the colour between being white. The sides

are white with transverse bands of brown. When present on a plant, the caterpillar is generally seen lying among the florets and as a rule is quite conspicuous.

Control.—Remove the caterpillars by hand and destroy them.

THE BEET WEBWORM, *Loxostege sticticalis* L.

In the Prairie Provinces this insect occurs intermittently in enormous numbers. When an outbreak occurs, the caterpillars assume the marching habit and enter flower gardens, destroying such plants as peony, pansy, stocks, pinks, candytuft and tobacco. When mature the caterpillar is about an inch in length, greenish in colour with yellow stripes on the back and sides.

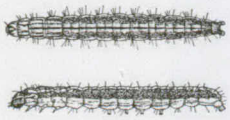

Fig. 27—Beet webworm—natural size (original).

Control.—During 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 in it a cheap poisoned bait such as freshly pulled weeds (lamb's quarters, etc.) poisoned with Paris green should be scattered. The weeds should be moistened thoroughly and the Paris green dusted thereon, turning the weeds constantly with a fork so that the poison may be evenly distributed. 1 pound of Paris green is sufficient to poison 50 pounds of weeds. Fresh applications may be necessary from time to time.

THE SOD WEBWORMS, *Crambus* spp.

In southwestern Ontario, during recent years, the small pale-coloured caterpillars, about three-quarters of an inch when mature, known commonly as sod worms, have effected serious damage to lawns. Injury, though not so apparent, has also been caused in Manitoba. In Ontario, *Crambus trisectus* Walk., *C. teterrellus* Zinc. and *C. leachellus* Zinc. have been the dominant species present, and in Manitoba, *C. dorsipunctellus* Kft. Mr. G. M. Stirrett, of the Dominion Entomological Branch, who has had these insects under study, reported that all kinds of grasses were readily eaten in 1931, "the smaller softer grasses such as the bents, blue grasses and red top, were injured before the taller and harsher fescue grasses." These caterpillars live in silken tunnels formed in the maze of dead grass blades and the crowns of the grass plants just above the surface of the ground.

Control.—Observations made on golf greens by Mr. Stirrett, indicated that the spraying of valuable greens or lawns with arsenate of lead, 2½ to 3 pounds per 1,000 square feet, gave fairly satisfactory control. Noble* recently stated that a modified kerosene emulsion gave excellent results in destroying sod webworms. He

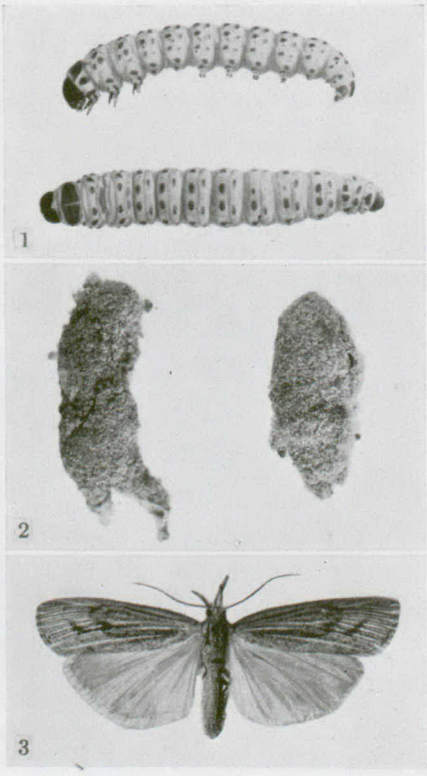

Fig. 28—Sod webworm, *Crambus trisectus* Walk.; 1, larva; 2, earthen cells containing pupae; 3, adult; all about twice natural size (original).

* Circular 248, November, 1932, U.S. Dept. of Agric.

recommends a stock emulsion prepared as follows: dissolve 1 pound of laundry soap in 1 gallon of boiling water; add one-half gallon of kerosene; stir rapidly until a creamy emulsion is obtained with no drops of free oil visible. For use in webworm control, 1 part of this stock emulsion should be thoroughly mixed with 50 parts of water and the resulting mixture then applied to the infested turf at the rate of about 1 gallon to each square yard of surface. The mixture may be applied by means of an ordinary watering can.

Fig. 29—Sod webworm injury to lawn (photo by G. M. Stirrett).

THE OBLIQUE-BANDED LEAF-ROLLER, *Cacoecia rosaceana* Harr.

This caterpillar, also called the rose leaf-tyer, has a wide distribution and is known to attack rose, carnation, aster, honeysuckle, and other plants. It feeds upon the foliage and flower buds, concealing itself by rolling a leaf, fastening the same with silken threads. Sometimes several of the terminal leaves may be tied together which interferes with the growth of the plants. When mature it is about three-quarters of an inch in length, the colour of the back being dark green, the under portion lighter green.

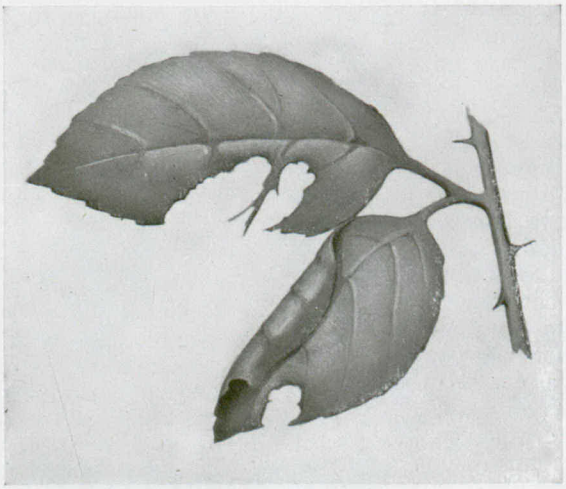

Fig. 30—The work of a leaf-roller (author's illustration).

Control.—Infested leaves—those which are seen to have been rolled over — should, wherever noticed, be gathered by hand and burned. If the caterpillars are abundant, spraying with arsenate of lead should be resorted to (see p. 6)

THE RED-BANDED LEAF-ROLLER, *Eulia velutinana* Walk.

Another leaf-roller with feeding and other habits similar to those of the oblique-banded leaf-roller, is the red-banded leaf-roller, so-called on account of the red-coloured bands present on the upper wings of the moths. This caterpillar is, also, greenish in colour and when mature is of the same size as the oblique-banded leaf-roller.

Control.—Same as for the last-named species.

The European Leaf-roller, *Cacoecia rosana* L.

The caterpillar of this tortricid moth has during recent years appeared in conspicuous numbers particularly in the Maritime Provinces and British Columbia. It is of a dull green colour without any markings and when mature is rather more than half an inch in length. It has a wide range of food plants among which are laurel, lilac and rose. The female moth lays her eggs in a mass which resembles a small greyish patch. These patches, from one-quarter to one-third of an inch in length, are laid on the stems of rose bushes, the trunks and lower limbs of shrubs and even on pergolas, fences and other objects near the food plants.

Control.—In British Columbia where this insect is particularly abundant, the control consists of spraying the egg masses in February or early March with miscible oil at a strength of 1 part to 12 parts of water. The summer control consists of spraying the affected plants with nicotine sulphate (40%) 1 ounce, whale oil soap 4 ounces, lead arsenate powder 3 ounces, water 3 gallons, the spray to be applied as soon as the young larvae are noticed, and directed so as to reach the buds and curled leaves in order to come into contact with the caterpillars. It may be necessary to repeat the spraying.

Pettit's Leaf-roller, *Sparganothis pettitana* Rob.

The caterpillar of this moth occurs in June. In Eastern Canada, maple is a favourite food plant. Some years, however, it causes important injury to the foliage and buds of peonies. Fig. 31 shows injury to buds. The caterpillar, one of the leaf rollers, is yellowish-green in colour, with a brownish head, and when found causing noticeable injury is about half an inch in length.

Control.—Same as for the oblique-banded leaf-roller (see p. 20).

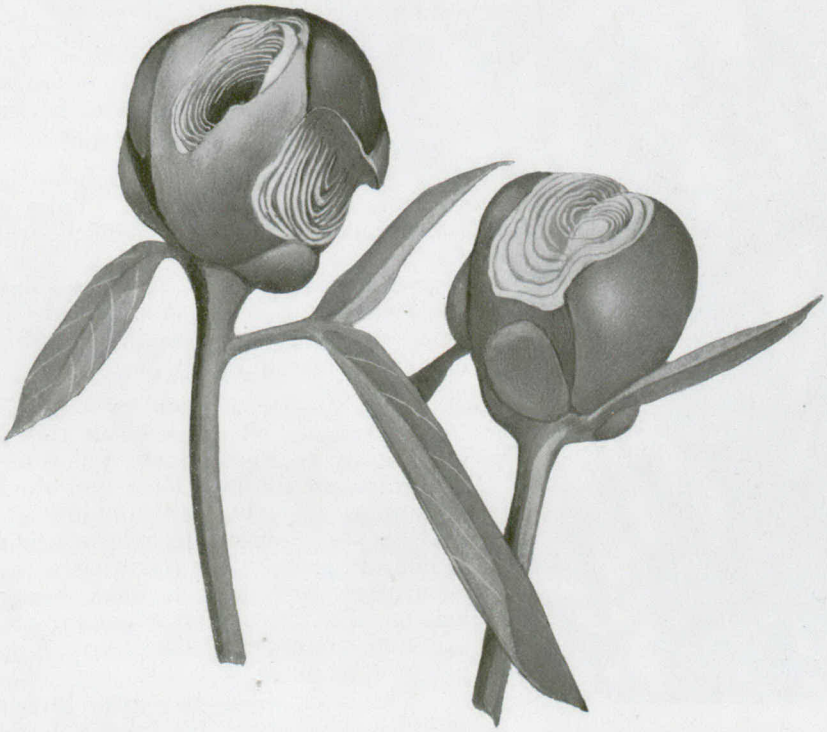

Fig. 31—Injury to peony buds, by Pettit's leaf-roller (author's illustration).

The Orange Tortrix, *Tortrix citrana* Fern.

This insect, a common pest in California, has recently caused important injury to asparagus ferns and certain other plants grown under glass in British Columbia. In view of its establishment in greenhouses in Canada and the habit of feeding on flowering plants grown out-of-doors in the United States, it may at sometime be found injuring flowering plants growing in the open in the warmer sections of British Columbia. It is known to attack rose, geranium, begonia, and other flowering plants.

The caterpillar is very active and spins a considerable amount of silk. When mature it is about half an inch long and varies in colour from greenish-white to dark gray.

Control.—In British Columbia excellent control has been obtained by spraying with arsenate of lead (see p. 6), at intervals of two weeks.

The Spirea Leaf-tyer, *Evora hemidesma* Zell.

This insect has occasionally caused injury to spireas in eastern Ontario. The caterpillar has the habit of drawing the leaves at the tips of the branches together, fastening the same with silk. Within such enclosure it feeds. When the caterpillars are abundant, their feeding places may be easily detected. The caterpillar is about half an inch in length, of a dark velvety green colour, with conspicuous rows of white tubercles on the body.

Control.—We have had no opportunity of testing any control for this insect but doubtless spraying with arsenate of lead (see p. 6) would be of advantage, particularly in the early stage of the injury.

Fig. 32—Scotch pine injured by European pine shoot moth (original).

The European Pine Shoot Moth, *Rhyacionia buoliana* Schiff.

This destructive pest has gained a firm foothold in Eastern Canada. Pines grown for ornamental purposes should be watched for the presence of this insect. The small brown caterpillar, with a black head, destroys the buds and young shoots, the chief injury being to the leading terminal, resulting in crooked or arrested growth.

Control.—Mr. J. J. deGryse, Division of Forest Insects, who has given this insect much study, recommends the following: cut off and burn infested buds and shoots in autumn or spring before the middle of June. Do not plant pines which have originated in infested areas. The following spray has been used with fair success: water, 10 gallons; arsenate of lead, 1 pound; nicotine sulphate, 4 ounces; whale oil soap, ½ pound; penetrol, 6 ounces.

This spray should be applied three times at intervals of about two weeks, beginning June 25.

The Verbena Bud Moth, *Argyroploce hebesana* Wlk.

The caterpillar of this moth is about one-third of an inch in length. It is of a dull copper colour with a black head and has a wide range of food plants, being known to cause injury to verbena, iris, snapdragon, gentian, etc.

In Ontario, the larvae have been found causing important injury to the seed capsules of iris. The insect is widespread in distribution, occurring both in Eastern and Western Canada.

Control.—In districts where this insect has effected injury, plants should be watched carefully in spring and when the attack is first noticed, the flowering buds and young stalks should be sprayed with arsenate of lead (see p. 6). A second spraying a week later may be advisable.

The Holly Budmoth, *Rhopobota naevana ilicifoliana* Hbn.

The caterpillar of this small moth, which when mature measures less than half an inch in length, is of a dull grey-green colour with a black head. It has the habit of feeding on the terminal shoots and tying the young leaves together.

Control.—This insect like the holly leaf-miner is difficult to control, but in British Columbia where the insect occurs, some success has been obtained by spraying, with force, the opening buds about the middle of May with nicotine sulphate (40%) 1 ounce, whale oil soap 4 ounces, lead arsenate 3 ounces, water 3 gallons. A second spray may be necessary a week later. As the majority of the small caterpillars pupate among the rubbish beneath the bushes, all such debris should be gathered up and burned early in July before the moths emerge.

Fig. 33—Holly buds deformed as a result of holly budmoth infestation (photo by W. Downes).

Other Leaf-rolling Caterpillars

The caterpillars of other eucosmid or tortricid moths are occasionally found attacking the foliage of flowering plants in gardens, usually during the month of June. *Hedia ochroleucana* Hbn. (*nimbatana* Clem.) is known to feed on rose; *H. separatana* Kearf. on rose; *H. cyanana* Murt. on rose; *Argyroploce albiciliana* Fern. on spirea; *Sparganothis flavibasana* Fern. on honeysuckle; *Argyrotoxa albicomana* Clem. on rose; *A. semipurpurana* Kearf. on rose; *Pandemis limitata* Rob. on rose; *Cacoecia purpurana* Clem. on violet and geranium, and *C fractivittana* Clem. on lilac.

All of these insects may be controlled by spraying with arsenate of lead (see p. 6).

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The Hoary Plume Moth, *Oidoematophorus monodactylus* L.

Occasionally in Eastern Canada and also in Manitoba, complaints are received of injury to the minor convolvulus by the caterpillars of this moth. At Ottawa, one year, the caterpillars were found to be eating the flower buds and leaves at the tips. The caterpillar, less than one-half inch long when mature, is green, marked with pale pinkish and yellowish longitudinal stripes.

Control.—Same as for the cabbage worm (see p. 10).

The Arbor-vitae Leaf Miner, *Argyresthia thuiella* Pack.

The leaves of white cedar or arbor-vitae, are some years noticeably injured by this insect known as the arbor-vitae leaf miner. This is a small, yellowish caterpillar about one-eighth of an inch in length which tunnels into the leaf tissue, as a result of which it has been given the common name of leaf miner. Some years ornamental cedars are seriously disfigured by this insect.

Control.—The important remedy is preventive in nature, namely, the cutting off and burning of the injured tips in autumn or early spring so as to destroy the contained insects. It has been suggested that a nicotine sulphate-soap solution (see p. 7), applied in July would reach the larvae and destroy them.

The Lilac Leaf Miner, *Gracilaria syringella* Fabr.

During recent years this insect has become very abundant and has rendered lilac and privet bushes very unsightly. The caterpillar which is of a yellowish colour and when mature about one-third of an inch long, feeds within the leaves causing conspicuous blotch-like areas.

Control.—Infested leaves should be picked as soon as they are noticed and burned. Nicotine sulphate (40%) in the strength of $1\frac{1}{2}$ tablespoonfuls to 1 gallon of water is recommended, the first application being made early in June, and a second application of 2 tablespoonfuls of nicotine sulphate to 1 gallon of water should be made two weeks later. Both sides of the foliage should be covered with the spray.

The Privet Leaf Miner, *Gracilaria cuculipenellum* Hbn.

This European insect has not, as yet, developed into a serious pest in Canada. It has, however, occurred in destructive numbers in eastern Ontario, especially in the district of Ottawa, where one year it caused noticeable damage. The mines in the foliage, resulting from the work of the caterpillar, are blotch-like in appearance, similar in general to those made by the lilac leaf miner. The small caterpillar, about seven-eighths of an inch long when mature is whitish in colour. When young it feeds within the mine, but soon leaves this. It then rolls the edges of the leaf, feeding externally on the tissue.

Control.—Same as for the lilac leaf miner.

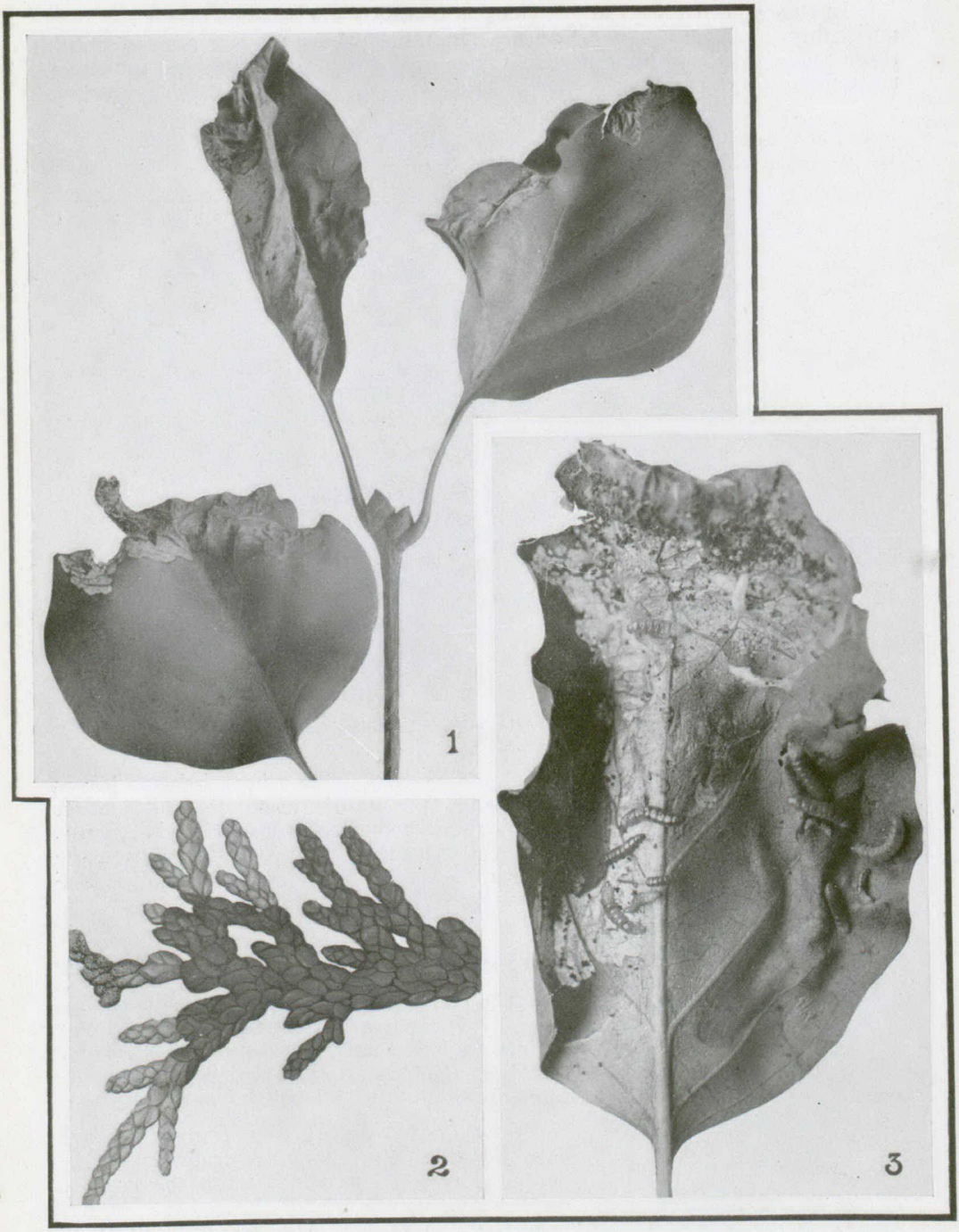

Fig. 34—1, Lilac foliage destroyed by the lilac leaf miner; 3, lilac leaf opened to show larvae; 2, white cedar injured by arbor-vitae leaf-miner (author's illustration).

THE LARKSPUR LEAF MINER, *Phytomyza delphiniae* Frost.

In Quebec province, the foliage of larkspur and monkshood plants has been noticeably damaged by this species. The mines of the maggot are not unlike those made by the columbine leaf miner, and when the larvae are numerous these mines often coalesce to form blotches.

Fig. 35—The work of the larkspur leaf miner (original).

Fig. 36—The work of the holly leaf miner (original).

Control.—Remove and burn infested leaves and canes preferably when injury is most conspicuous which usually occurs in mid-August. This will prevent or reduce the infestation the following season. Spraying with nicotine sulphate (see p. 7) is also of value.

THE HOLLY LEAF MINER, *Phytomyza ilicis* Curtis

The pale yellow or whitish maggots of this small fly, which live between the upper and lower surfaces of the holly leaves, form unsightly blotches. In Canada, the insect is only troublesome in the province of British Columbia.

Control.—No satisfactory control has yet been devised as the holly is very sensitive to the action of insecticides which might be used to destroy the larvae within the leaves. It has been found, however, that the adult flies may be destroyed in considerable numbers by applications of a 2 per cent nicotine-lime dust, the first applied towards the middle of May and two or three others a week apart.

THE COLUMBINE LEAF MINER, *Phytomyza aquilegiae* Hardy

The leaves of columbine are rendered unsightly by the work of this fly, the maggot of which makes conspicuous white serpentine mines in the leaves. Several of the small pale coloured maggots may be present in a single leaf. The adult fly which deposits its eggs in the leaves is also small and of a dark brownish colour.

Control.—Hand pick the infested leaves and destroy these by burning. When the first mines appear spray with nicotine sulphate-soap solution (see p. 7).

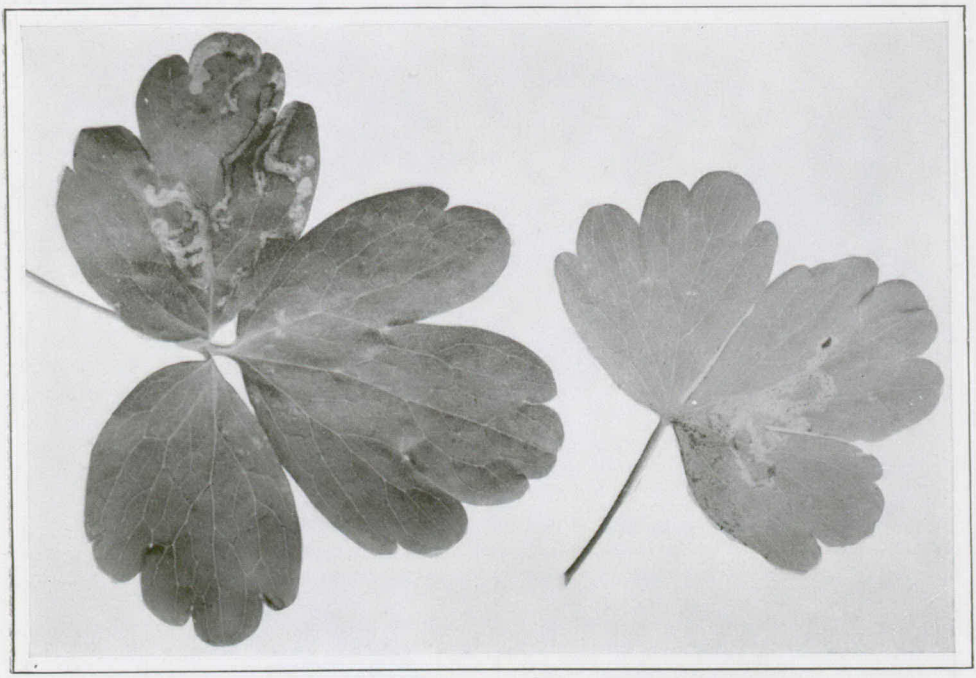

Fig. 37—Columbine leaves showing work of columbine leaf miner (author's illustration).

THE HONEYSUCKLE LEAF MINER, *Lithocolletis fragilella* F. & B.

The caterpillars of this beautiful little moth have not infrequently been found in Eastern Canada, mining the leaves of cultivated honeysuckle. In the district of Ottawa it was observed that the larva makes a conspicuous blotch-like mine in the leaves, and on some foliage examined, there were two or three mines in the same leaf.

Control.—Same as for the columbine leaf miner.

THE CONVOLVULUS LEAF MINER, *Bedellia somnulenta* Zell.

Some years ago the writer found this insect fairly abundant at Ottawa on the minor convolvulus. Since, it has been reported from Manitoba as causing injury to the same plant. The small pale coloured caterpillars make irregular mines in the leaves. The mines at first are narrow, but later they develop into wider feeding areas, blister-like in appearance.

Control.—Same as for the columbine leaf miner.

THE EUROPEAN ROSE SLUG, *Caliroa aethiops* Fab.

This false caterpillar is often responsible for injury to the foliage of roses. It skeletonizes the leaves by feeding on the tissues of the upper surface, leaving the veins and the tissues of the under surface intact. It is green in colour and has the habit of hiding during the day on the under surface of a leaf. When mature it is about one-half inch long.

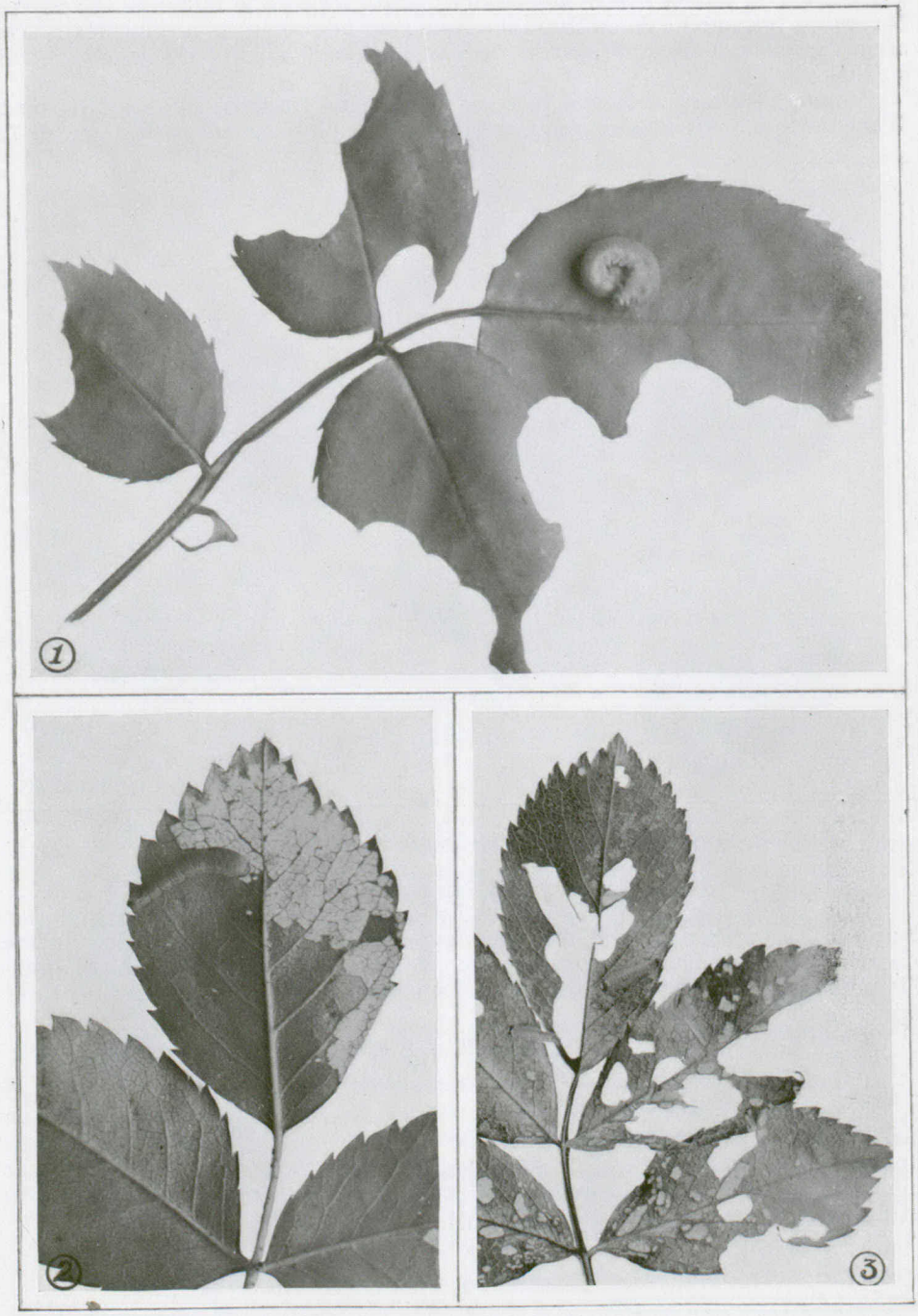

Fig. 38.—The work of rose slugs (author's illustration).

Control.—This rose slug is easily controlled by spraying the infested plants with a weak solution of Paris green or arsenate of lead (see p. 6).

The Bristly Rose Slug, *Cladius isomerus* Nort.

The larva of this insect is of a dirty yellowish-green to a glaucous-green colour with a darker green line down the back. The body bears stiff hairs which give to the larva a bristly appearance. This slug works very much in the same way as the European rose slug, skeletonizing the leaves from the underside, and later as it increases in size, devouring all the leaf tissues except the largest veins. When full grown it is about one-half inch in length.

Control.—Same as for the European rose slug.

The Coiled Rose Worm, *Allantus cinctipes* Nort.

The coiled rose worm is green above with the sides and legs grayish-white. It may be easily distinguished from the European rose slug and the bristly rose slug in having a yellowish-brown head, marked with a broad brownish-black spot. It eats the entire surface of the leaf, feeding along the edges with the body coiled up beneath it. When mature it is about one-half inch long.

Control.—Same as for the European rose slug.

The European Rose Sawfly, *Allantus cinctus* Linn.

This insect was reported some years ago as attacking rose bushes in the vicinity of Boston. During 1926 the species was found in the district of Montreal in the stems of field-grown roses, particularly of the multi-flora group. Specimens of the adults were reared at Ottawa. It is also present under greenhouse conditions in the province of New Brunswick. The larva, Fig. 38 (1), feeds on the foliage of the rose much the same as other sawfly larvæ, and when mature enters the old wood to pupate. So far only one complaint of the presence of the insect under outside conditions has been received.

Control.—Control may be effected by spraying with an arsenical mixture (see p. 6). If the larvæ are found entering the old wood of rose bushes to pupate, such wood should be removed from the bushes and destroyed by burning.

The Violet Sawfly, *Emphytus canadensis* Kby.

Pansies and violets, always favourites in gardens, are some years seriously attacked by the false caterpillars of this sawfly. These larvæ, which are smooth and bluish-black in colour, are about one-half an inch in length when mature. In their younger stages they have the habit of eating little holes in the leaves but as they reach maturity they feed mostly along the edge of a leaf. As a rule they feed during the night.

Control.—Same as for the cabbage worm (see p. 10).

The Honeysuckle Sawfly, *Abia inflata* Nort.

The yellow, black-spotted, partially orange-banded, larvæ of this species which ranges in distribution throughout Eastern Canada, have in some years, caused noticeable injury to honeysuckle, in June. When full grown the larvæ are about one inch in length.

Control.—Spray with lead arsenate (see p. 6) as soon as noticed, and preferably while the larvæ are only partly grown.

Flea Beetles

The several kinds of flea beetles which are destructive in Canada vary considerably in size and colour. In general, they may be described as either yellowish, brownish, bluish, greyish, purplish or black, shining beetles of an oval-elongate shape. The upper joint of each hind leg is well developed enabling them to leap suddenly. Owing to this jumping habit they have been given the popular name of flea beetles. In size they range from about one-twentieth to one-quarter of an inch in length.

The flea beetles are most injurious in spring, at which time the young seed leaves are visited by large numbers of the adult insects and are quickly destroyed. Numerous small holes, in some of the larger leaves as many as several hundred, are eaten into and through the leaves; in fact large portions of the foliage are often completely eaten, the larger veins only remaining. Two species particularly are found in flower gardens, namely, the striped flea beetle, *Phyllotreta vittata* Fab., and the red-headed flea beetle, *Systena frontalis* Fab. The former, which is about one-eighth of an inch long, black, with yellowish markings on

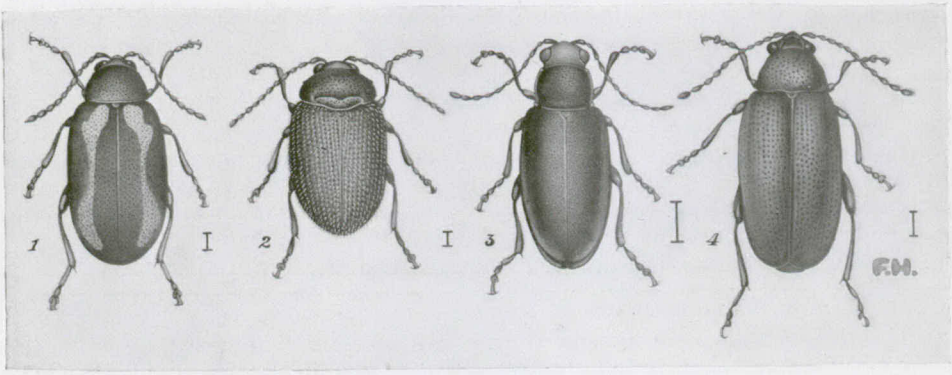

Fig. 39—Striped flea beetle; 2, potato flea beetle; 3, red-headed flea beetle; 4, cabbage flea beetle; hair lines indicate natural size (author's illustration).

the wings, has attacked, freely, the white flowers of the alpine rock cress, a favourite border and rockery plant. The red-headed flea beetle, which is about one-fourth of an inch long with a red patch on the head is destructive to the foliage of marsh mallow, rose mallow, honeysuckle, asters, chrysanthemum, etc. The potato flea beetle, *Epitrix cucumeris* Harr., a very small species, black, with pale reddish legs, has been found on petunia. In British Columbia, the cabbage flea beetle, *Phyllotreta albionica* Lec., metallic-green in colour and one-eighth of an inch long, attacks garden nasturtium, candytuft, sweet alyssum and rock cress. The larvæ of the grape flea beetle, *Haltica chalybea* Ill., dirty yellowish brown grubs with black shining bristle-bearing tubercles, often cause injury to the foliage of Virginia creeper. In Manitoba the rose flea beetle, *Haltica canadensis* Gent., originally confined to wild rose bushes, has during recent years caused injury to cultivated varieties.

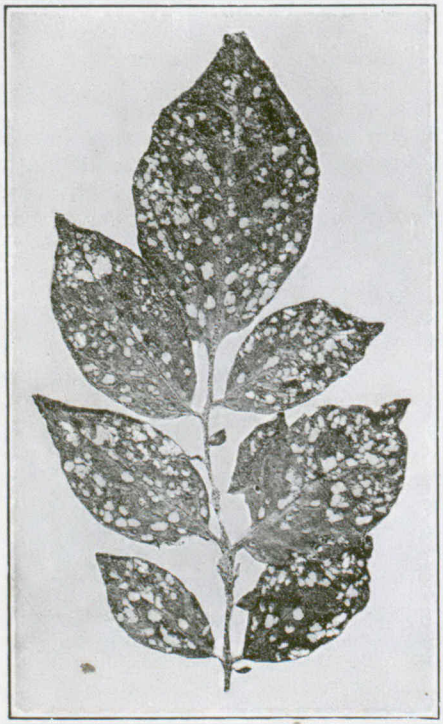

Fig. 40—Characteristic work of flea beetle (author's illustration).

Control.—The usual remedy for these insects is either to spray or dust the infested plants with arsenate of lead (see p. 7) or spray with Bordeaux mixture (see p. 31). For the cabbage flea beetle a three per cent nicotine dust is recommended. In pamphlet No. 80, new series, Dominion Department of Agriculture, Mr. R. Glendenning says: "To prepare fifty pounds of three per cent dust, three and three-quarter pounds or

2·4 imperial pints (three U.S. pints) of forty per cent nicotine sulphate should be added to fifty pounds of hydrated lime. For smaller quantities it is convenient to mix five fluid ounces of nicotine sulphate with each five pounds of lime. The dusting should be performed on a sunny day when the temperature in the shade is 70° F. or over. The number of applications necessary varies greatly under different circumstances, but probably three applications in the spring and one or two in August will keep the beetles down to negligible numbers. For small garden plots the plunger type of dust gun, costing about $1, is sufficiently large and does good work. These guns hold about one-half of a pound of dust. One row should be dusted at a time, the gun being held about two feet above the plants and care being taken not to unnecessarily disturb the beetles before discharging the dust. The row should be approached facing the sun so that it is possible to envelope the beetles in the cloud of dust before they become frightened and leap off. As many beetles as possible should be hit by the dust which sticks to them, death being caused by the liberated fumes."

The method of making Bordeaux mixture, which acts as a deterrent to flea beetles, is as follows:—

Copper sulphate (bluestone)	4 pounds
Unslaked lime	4 pounds
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.

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. It occurs particularly in the Niagara district, Ontario. The beetle is about one-third of an inch long, of a yellowish brown colour, with long spiny legs.

Control.—This insect breeds only in light, sandy soil, chiefly in neglected or poorly cultivated land, where the larvæ feed on the roots of grasses and weeds, passing the winter in the soil at depths ranging from 6 to 18 inches. The control of the insect is a rather difficult matter, owing to its omnivorous habits, its great numbers, and its resistance to the action of stomach poisons. Good results, however, have been secured by spraying with arsenate of lead used at the rate of three-quarters of a pound to 10 gallons of water. Another method often used is to hand pick the beetles from the blossoms, dropping them into water coated with a film of kerosene. The most satisfactory means of control in districts severely affected by the rose beetle is to bring waste sandy lands under cultivation, a measure which demands community action.

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Fig. 41—The rose beetle and its work (author's illustration).

THE ROSE WEEVIL, *Pantomorus fulleri* Horn.

This insect, known also as Fuller's rose beetle, which is occasionally troublesome in greenhouses, is recorded in the United States as a garden pest of canna, azalea, rose, and other flowering plants. We have no record of it causing such injury out-of-doors in Canada but it may require attention any year. The larvæ attack the roots and the beetles the foliage, buds and flowers. The former are thick, white, legless grubs one-fourth of an inch long when mature. The beetle is a brown weevil about the same length as the grub; it has a short snout and long slender feelers bent abruptly in the middle; on each wing cover a whitish stripe is present.

Control.—If infested plants are jarred, the beetles may be collected and destroyed as recommended for the tarnished plant bug.

THE BLACK VINE WEEVIL, *Brachyrrhinus sulcatus* Fab.

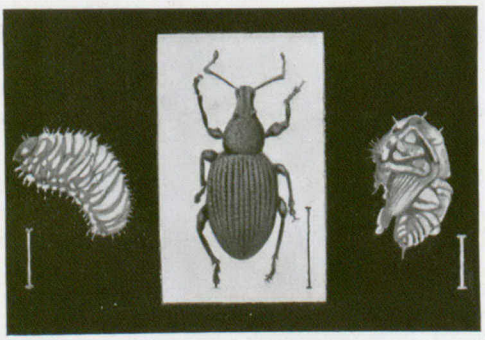

Fig. 42—Black vine weevil; grub at left; adult beetle in centre; pupa at right; hair line indicates natural size (after Gibson and Ross).

In British Columbia this insect has in some years, caused important injury, to primrose and wallflower. In Ontario, the larvæ have been found feeding on the roots of English ivy, in mid-April. In the United States several other garden plants are attacked. The grubs which live in the soil and feed upon the roots of the plants are about three-eighths of an inch long when mature, and of a yellowish-white colour. The adult insect, one of the snout beetles, is black in colour with patches of yellow hairs on the wing covers which show up as spots. In length it is about three-eighths of an inch.

Control.—Same as for the rose weevil.

Blister Beetles

There are a few kinds of blister beetles which almost every year cause anxiety from their habit of appearing suddenly, in large numbers, and feeding on 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 caragana beetle, *Lytta nuttalli* Say, is decidedly destructive to caragana. Other prairie species which some years are destructive to flowering plant are *Macrobasis subglabra* Fall and *Lytta sphæricollis* Say. Blister beetles are always more numerous in years of grasshopper abundance because the larvæ of a number of the species feed upon the eggs of the grasshoppers.

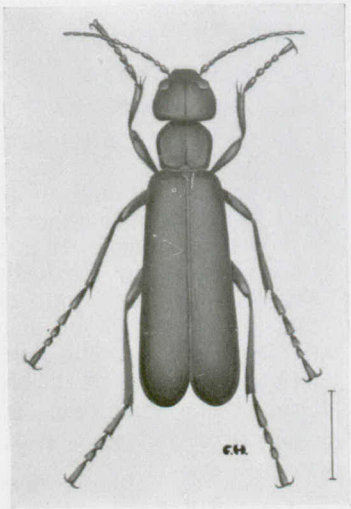

Fig. 43—Black blister beetle; hair line indicates natural size (author's illustration).

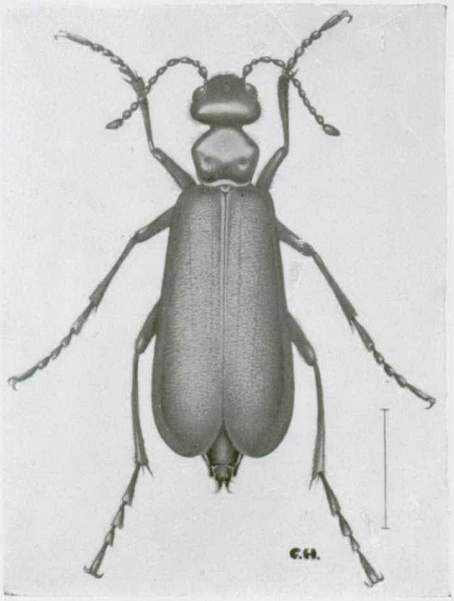

Fig. 44—Western blister beetle; hair line indicates natural size (author's illustration.)

Control.—Dust mixtures containing Paris green or arsenate of lead (p. 7) are recommended for 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.

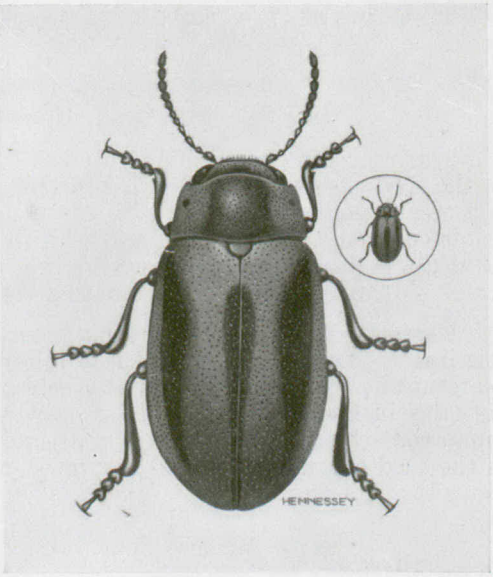

Fig. 45—The red turnip beetle, enlarged and natural size (after Dustan).

THE RED TURNIP BEETLE, *Entomoscelis adonidis* Pall.

In the Prairie Provinces, this beetle is destructive to cabbages, radishes, turnips, as well as to other plants of the mustard family. Among ornamental plants, alyssum has been noticeably attacked. 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 well known Colorado potato beetle. It feeds on the foliage of plants of the above family both in the larval and the adult stages.

Control.—Dust infested plants with arsenate of lead and hydrated lime (see p. 7).

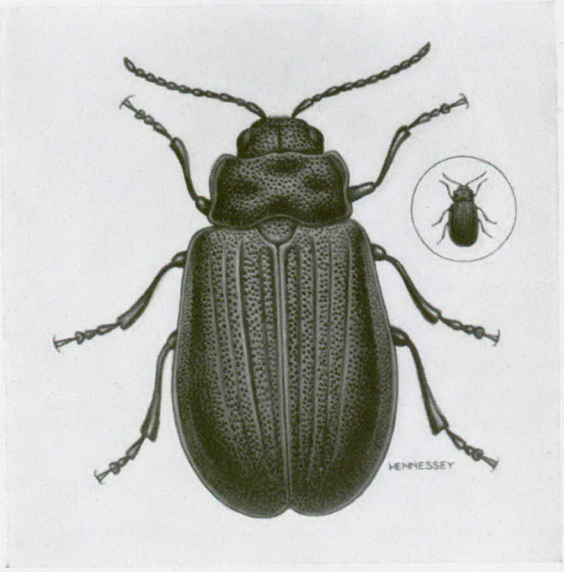

Fig. 46—The pepper grass beetle, enlarged and natural size (after Dustan).

THE PEPPER GRASS BEETLE, *Galeruca externa* Say

In districts in the Prairie Provinces where this insect is abundant, the common food plants are pepper grass and tumbling mustard. It is not unusual, however, for the dull, blackish beetles, about one-quarter of an inch in length, to visit flower gardens, and do damage to plants of the same family—the cruciferae—such as alyssum and rock cress.

Control.—Dust infested plants with arsenate of lead and hydrated lime (see p. 7). Pepper grass and tumbling mustard growing in the vicinity of gardens should be kept down.

IRIS SNOUT BEETLE, *Mononychus vulpeculus* Fab.

During recent years this insect has been responsible for important damage to the seed pods of cultivated iris in the province of Ontario. The adult beetle is a small species about one-fifth of an inch long, black above, with the body below covered with yellowish and whitish scales. The beetle, in feeding, punctures the pods, such injury resulting in the formation of rough, corky, irregular scars. Japanese, European and native varieties of iris are attacked.

Control.—We have had no opportunity to test control measures against this insect. In the case of a closely related snout beetle—the cabbage curculio—arsenical poisoning has been suggested (see p. 6). One grower of valuable varieties in Ontario, used glass vials which were inverted over the pods and supported by wire stakes, small vials being used at first, and larger ones later as the seed capsules increased in size. On the whole this method of protection proved satisfactory although it entailed considerable labour.

THE BUMBLE FLOWER-BEETLE, *Euphoria inda* L.

This rather common beetle, which occurs in Eastern Canada, is abundant some years in June and again in September. When present in numbers it

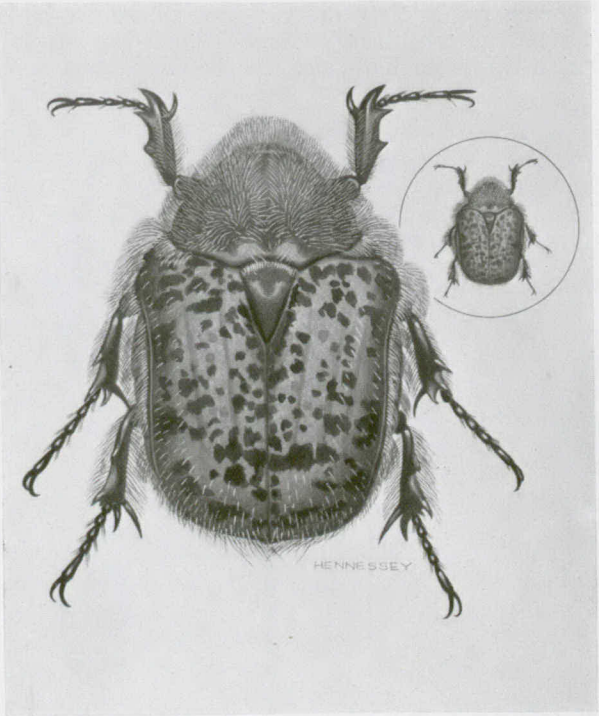

Fig. 47—The bumble flower beetle, enlarged and natural size (original).

causes appreciable injury to roses and other flowering plants, not only by eating the pollen but also by sucking the juices from buds and adjacent succulent stems. The buds of roses have been injured to an important extent. The beetle is about half an inch in length, of a golden brown colour with streaks and dots of black. The thorax, head and underparts are covered thickly with short whitish hairs.

Control.—Owing to the size of these beetles they are readily seen and may be removed from the plants by hand.

The Rose Curculio, *Rhynchites bicolor* Fab.

The rose curculio, frequently referred to as the black-snouted rose beetle, is an important pest of roses in the Prairie Provinces. The beetle is about one-quarter of an inch in length, bright red above, the snout and under portions of the body being black. It injures roses by puncturing the buds, frequently eating numerous holes in the same bud, with the result that the blooms fail to develop. It lays its eggs in the hips (fruit), and the larvæ hatching therefrom after developing, drop to the ground and there change to the beetle state. The beetles emerge during the following spring and reinfest the bushes. It will thus be seen that in gardens where control is not practised the grower may expect injury year after year.

Control.—If the beetles are not too abundant, control may be secured by hand-picking or by shaking them into an inverted umbrella and then destroying them. When numerous, spraying with arsenate of lead as recommended for the rose beetle (see p. 31), should be practised. Officers attached to the Dominion

Entomological laboratory, at Treesbank, Man., advise the picking and burning of all hips soon after the beetles fall. As wild roses are also infested, the fruits of these growing in the immediate vicinity should be destroyed before the end of August.

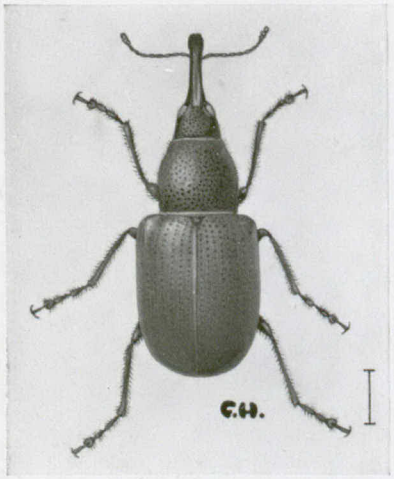

Fig. 48—Rose curculio; hair line indicates natural size (author's illustration).

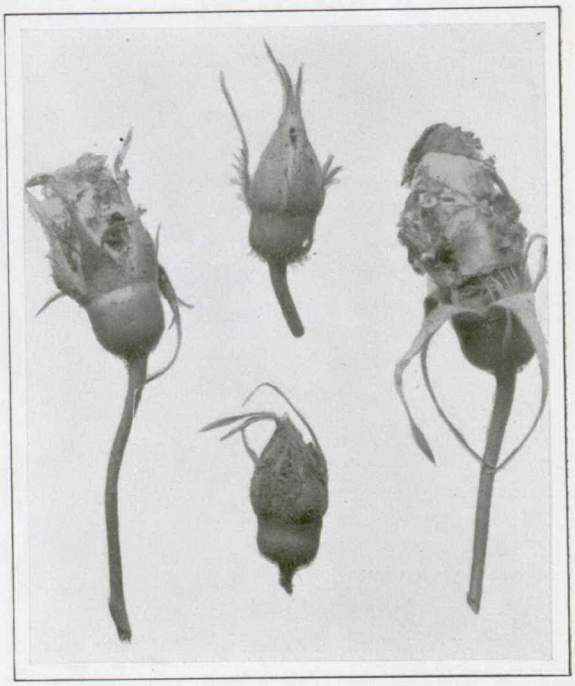

Fig. 49—Rose buds injured by the rose curculio (author's illustration).

The Green Rose Chafer, *Dichelonyx backi* Kirby

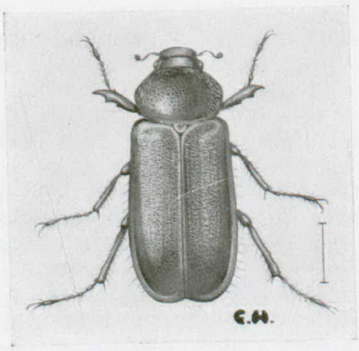

Fig. 50—The green rose chafer; hair line indicates natural size (author's illustration).

This scarabæid beetle is some years sufficiently abundant in the Prairie Provinces to cause important injury to the foliage of cultivated roses. It occurs all through Western Canada, but is apparently uncommon in the East. The feeding habits of this insect are similar to those of the rose beetle. The wing-covers of the beetle are of a metallic green colour, the head is black and the legs dark brown or blackish. The beetle is one-quarter of an inch in length, some specimens being larger.

Control.—Spray with arsenate of lead three-quarters of a pound to 10 gallons of water.

The Three-lined Leaf-beetle, *Lema trilineata* Oliv.

Occasional damage by this well known insect is caused to the foliage of such flowering plants as tickseed, ground cherry, chinese lantern, and other herbaceous plants. The beetle is a rather conspicuous one, about one-quarter of an inch in

length, of a pale yellow colour marked with three black stripes on its back. The grub is about half an inch in length, covered with a sticky secretion to which is attached its own excrement.

Control.—Same as for the Colorado potato beetle.

The Sunflower Beetle, *Zygogramma exclamationis* Fab.

This yellow beetle with conspicuous brownish stripes down the back, is not uncommon in the three Prairie Provinces. In years of abundance, it is quite injurious to garden sunflowers. It is about a quarter of an inch in length, and, in general, might easily be mistaken for a small specimen of the Colorado potato beetle.

Control.—Same as for Colorado potato beetle.

The Godetia Weevil, *Tyloderma nigra* Csy.

This insect is a small, shiny-black weevil about one-eighth of an inch long. It feeds upon the foliage of Godetia, Clarkia and evening primrose. Reports of injury have been received only from Manitoba. Most of the damage, however, is done by the larvæ. They seriously injure the roots and not infrequently kill the plants outright. The insects hibernate in the adult state and in autumn and early spring may be found rather commonly on and around the foliage of the wild evening primrose.

Control.—Dusting the infested plants with arsenate of lead and hydrated lime (see p. 7) is the only remedy we can suggest.

The Colorado Potato Beetle, *Leptinotarsa decemlineata* Say

This well-known beetle often migrates to gardens and attacks plants of the tobacco family grown for ornamental purposes because of their large foliage and showy flowers. In September particularly, large numbers of beetles have been found on such plants and much injury has been caused to them.

Control.—As soon as the beetles are noticed, the plants should be sprayed or dusted either with Paris green or arsenate of lead mixture (see p. 6).

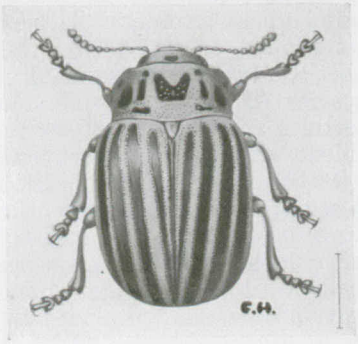

Fig. 51—Colorado potato beetle; hair line indicates natural size (author's illustration).

The Milkweed Labioderma, *Labioderma clivicollis* Kirby

In eastern Ontario this beetle is very abundant on the common milkweed, *Asclepias syriaca* L. Owing to its beauty, the pleurisy-root, *Asclepias tuberosa* L. is grown as an ornamental plant. At Ottawa we have noticed in some years that these plants have been freely infested with the beetle, the infestation being noticeable during the month of August. The beetle is of a dark blackish-blue colour, the wing covers being orange-yellow with conspicuous blackish markings. It ranges in size from about one-third to nearly one-half an inch in length.

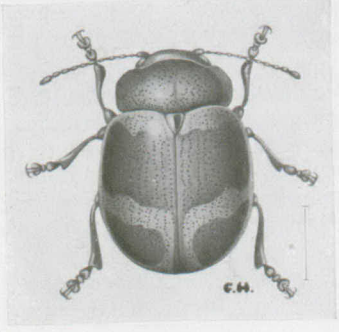

Fig. 52—Milkweed labioderma; hair line indicates natural size (author's illustration).

Control.—As soon as the beetles are noticed, the plants should be sprayed or dusted either with a Paris green or arsenate of lead mixture (see p. 6).

The Tickseed Leaf-beetle, *Calligrapha elegans* Oliv.

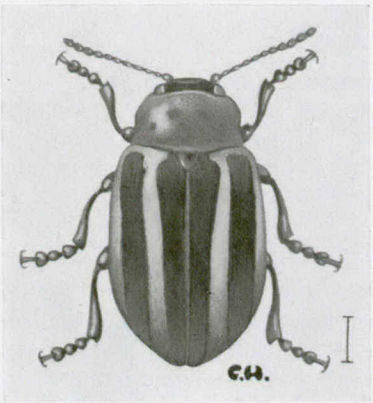

Fig. 53—Tickseed leaf-beetle; hair line indicates natural size (author's illustration).

Occasionally this pretty little leaf beetle has been found in Western Canada, particularly in Manitoba, causing noticeable injury to the foliage of cultivated tickseed (*Coreopsis* sp.), usually referred to in the trade under the name *Calliopsis*. This insect which occurs rather widely in Canada, feeds normally on wild plants of the composite family, to which tickseed belongs, such as bur, marigold, boneset and solidago. In size the beetle is about three-eighths of an inch in length and black in colour. On each wing-cover near the inner edge there is a wide yellowish band and also a marginal band of the same colour, to which the former is joined.

Control.—Same as recommended for the Colorado potato beetle.

Tortoise Beetles

There are several species of tortoise beetles which some years occur in numbers in gardens. Those which have been commonly observed are the golden tortoise beetle, *Metriona bicolor* Fab., a beautiful little species of a bright gold colour; the mottled tortoise beetle, *Chirida guttata* Oliv., varying in colour, some being almost black, others mottled with black and gold; and the milkweed tortoise beetle, *Chelymorpha cassidea* Fab., a larger species of a dull yellowish-red colour, spotted with black. All of these species have been found feeding on the foliage of morning glory and certain other garden plants.

Control.—If the beetles are too numerous to remove by hand, infested plants may be sprayed with arsenate of lead (see p. 6).

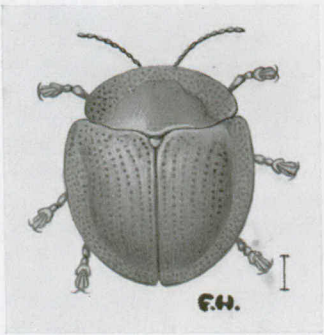

Fig. 54—Golden tortoise beetle; hair line indicates natural size (author's illustration).

Grasshoppers

In years of abundance these insects very often migrate to gardens and cause serious injury to flowering plants. The chief destructive species are as follows:—

The lesser migratory grasshopper, *Melanoplus mexicanus* (Saussure). This species is the most regularly-occurring destructive grasshopper in Canada. It is found commonly from British Columbia to Nova Scotia. It is shown natural size in figure 55.

The red-legged grasshopper, *Melanoplus femur-rubrum* DeG., is very similar in size and general colour and markings to the lesser migratory grasshopper. It, also, has a wide distribution in Canada.

The clear-winged grasshopper, *Camnula pellucida* Scud., occurs very often with the lesser migratory grasshopper. The females are larger than those of the latter species, but the males are of about the same size. It has conspicuous blackish spots on the wing-covers and near the upper edge of each wing-cover is a pale-coloured longitudinal stripe.

The two-striped grasshopper, *Melanoplus bivittatus* Say, is of a yellowish-green colour, varying to dull brown, with two distinct longitudinal stripes (one on either side) from the head to the end of the wing-covers. The females are large and heavy-bodied.

The Carolina grasshopper, *Dissosteira carolina* L. is a large species, the adults having black underwings with a wide yellow border. It frequently does much damage by devouring seedling plants of various kinds. It is very inconspicuous when young and for this reason is often overlooked.

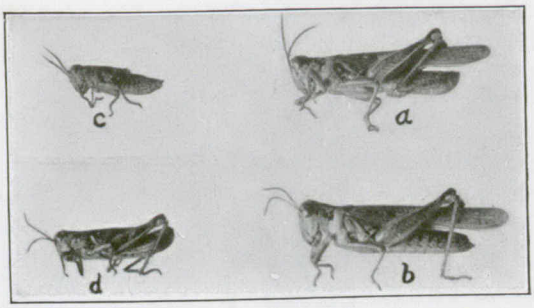

Fig. 55—The lesser migratory grasshopper: *a*, adult male; *b*, adult female; *c*, *d*, young hoppers (author's illustration).

Control.—The poisoned bran mixture (see p. 7) is a valuable means of destroying large numbers of these insects. The bait should be broadcast lightly on bright, hot days when the grasshoppers are active. Do not spread the bait on dull, cloudy days.

Leaf-cutter Bees

Fig. 56—Leaf-cutter bee and its work (redrawn after Comstock).

Complaints are occasionally received of injury to the foliage of rose plants by the insects known as the leaf-cutter bees. Writing of these insects Comstock[1] says: "The bees of the genus *Megachile* have a curious habit of making cells for their young out of neatly cut pieces of leaves. These cells are packed away in such secure places that one does not often find them; but it is a very easy thing to find fragments of leaves from which the pieces have been cut by bees. The leaves of various plants are used for this purpose, but rose leaves are used more frequently than any other kind." The nests made by these bees have been found[2] in the stems of large pithed plants such as dahlias.

Control.—In districts where important injury is caused to the foliage of rose plants, it is recommended to remove any nests of the bees which are found and destroy these by burning.

The European Earwig, *Forficula auricularia* Linn.

During recent years this insect has caused important damage in gardens in British Columbia, particularly in coastal areas. The earwig is about five-eighths of an inch in length, of a dark reddish-brown colour, the legs, the feelers and the small wing-covers being yellowish-brown. At the end of the body are a pair of so-called pincers or forceps. Those of the female are nearly straight, while those of the male are larger and distinctly curved. Dahlias, roses, carnations, asters, and other flowering plants have been noticeably injured.

[1] An Introduction to Entomology.
[2] United States Department of Agriculture, Farmers Bulletin 1495.

Control.—The following mixture is recommended: sodium fluoride 12 ounces, molasses 2 quarts, wheat bran 12 pounds, water 6 quarts. Dissolve the sodium fluoride and the molasses in the water, the latter after the first, and then wet the bran with such poisoned mixture, stirring the while. If more liquid is required add more water, but not enough to make a sloppy mash. In gardens the mixture should be spread among the plants to be protected, the applications to b made during warm evenings in late May or early June. If this bait is used in or around houses, care should be taken in its use to see that it is spread thinly, not in lumps, and not left about where children or domestic animals may have access to it. Applications of the mixture should be made at intervals when the insect is noticed to be increasing in numbers.

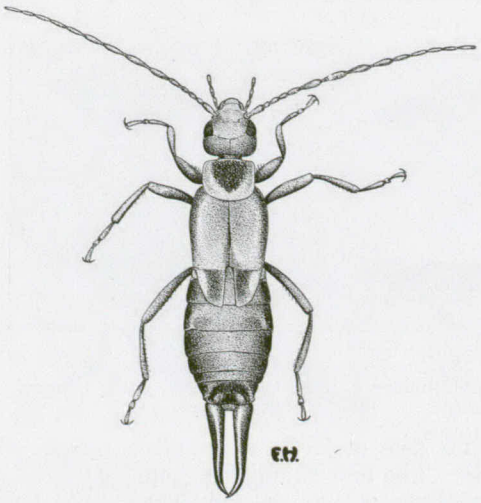

Fig. 57—The European earwig; enlarged four times (author's illustration).

Ants

Enquiries are frequently made for information concerning ants which infest garden plants of many kinds. It is believed that these insects do harm to plants, but this, in general, is usually not the case. In most instances, if close observation is made, it will be found that plant lice are present and are the real cause of the injury. The relations of ants to plant lice are very interesting. It is well known that ants are protectors of plant lice; they are very fond of the sweet honeydew which is emitted by the aphids and certain kinds even actually colonize them on plants growing near their nests.

Control.—When they are seen to be running about on plants, a search should be made for their nest which, in all probability, will be located in the earth close by. When this is found a tablespoonful of bisulphide of carbon should be poured into it and the opening immediately closed up by stepping on it. The fumes of this liquid will penetrate quickly into all parts of the nest, and not only kill the adults but the larvæ as well. This material is very inflammable and care must be taken not to expose it to any form of fire. Another remedy is to pour scalding water into the nests.

SUCKING INSECTS

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." Plant lice are small, delicate, soft-bodied insects; they breed in numbers very rapidly and are capable of causing serious damage unless effectually checked. Some aphids, like the pea aphid, appear suddenly in enormous numbers and completely destroy sweet peas as well as garden 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 plant lice. There are many different kinds of plant lice 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. They secrete a sweet liquid known as honeydew which attracts ants and causes the growth of a sooty fungus which greatly disfigures the plants.

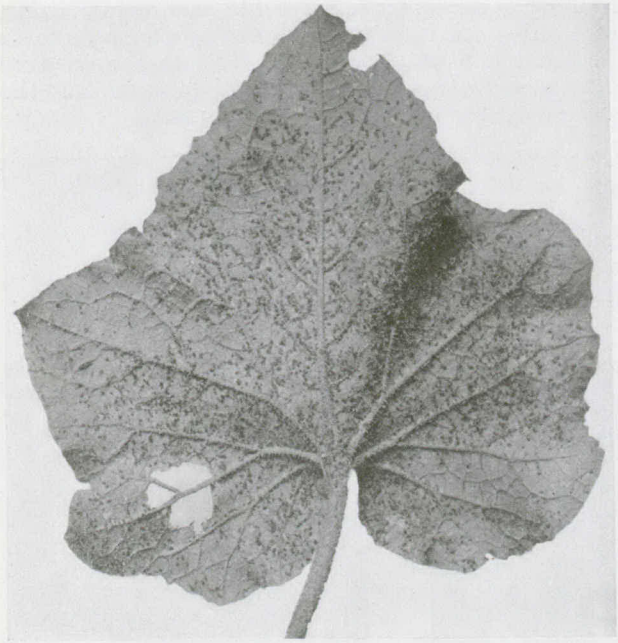

Fig. 58—Aphids clustered on underside of leaf (after Dustan).

Control.—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 nicotine sulphate-soap wash, or kerosene emulsion. Nicotine dusts are also useful (see p. 31). Whichever insecticide is used, 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 or dust will be killed. For those kinds which are found attacking the roots of garden plants, such as asters, it is recommended to loosen the earth around portions of the roots and apply, freely, nicotine sulphate solution, in the strength of one teaspoonful to one gallon of soapy water.

The Spruce Gall-aphid, *Adelges abietis* Kalt.

Ornamental spruce trees are not infrequently attacked to a serious extent by this common gall-aphid. The injury results in the formation of pine-apple-like galls on the branches, which greatly disfigure the trees.

Fig. 59—Spruce gall-aphid injury (after Swaine and Hutchings).

Control.—Early spring applications of lime-sulphur (1-8), or miscible oil (1-20) have been found of value. When only a few trees require attention, as many of the galls as possible should be cut off and destroyed by burning before midsummer.

The Greenhouse White Fly, *Trialeurodes vaporariorum* Westw.

In some years this well known greenhouse pest is decidedly destructive in flower gardens, attacking the foliage of such plants as fuschia, nasturtium, aster, lilac, etc. It is a sucking insect and, both in the nymph and adult stages feeds greedily on plant juices. The adult is a small four-winged moth-like creature about one-sixteenth of an inch long, the wings being pure white in colour and the body yellowish. The insect lives on the undersides of the leaves.

Control.—Spray the infested plants with nicotine sulphate-soap solution, or whale oil or fish oil soap, $1\frac{1}{2}$ ounces to 1 gallon of water. The spray should be applied to reach the undersides of the leaves. Several applications a week or so apart may be necessary.

Fig. 60—Whitefly; adults and nymphs; enlarged four times (after Gibson and Ross).

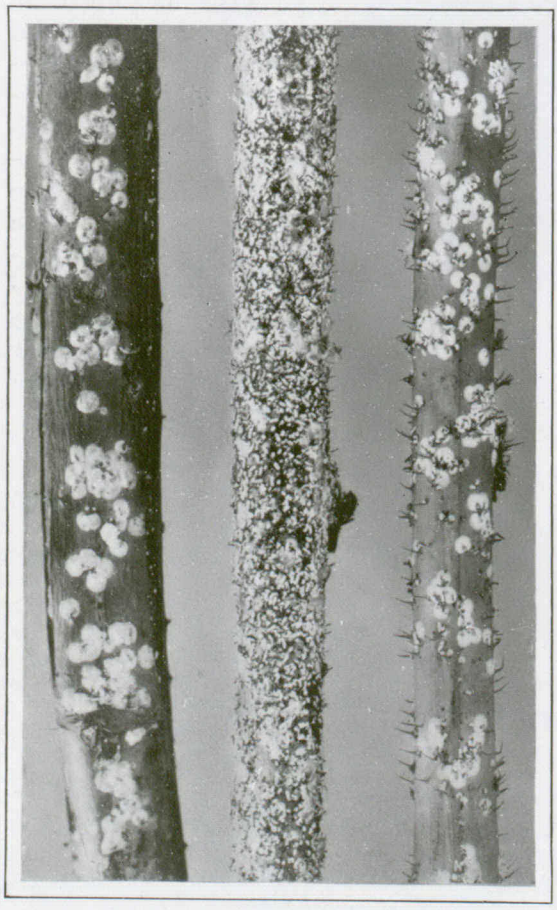

Fig. 61—Rose scale; middle cane densely infested with male scales (author's illustration).

The Rose Scale, *Aulacaspis rosae* Bouché

This scale insect is not infrequently sufficiently abundant on rose plants to give the shoots a decidedly whitish appearance. The scale is thin, flat, and snowy-white and when abundant may entirely cover much of the shoots. The female scales are almost round in shape and in width about one-twelfth of an inch. The male scales are much smaller and of a different shape, being long and narrow. These insects in addition to being unsightly, injure the shoots by sucking the plant juices from them.

Control.—Spray the infested shoots with commercial lime-sulphur mixture (1 gallon to 7 gallons of water), a commercial oil spray, or with a strong whale oil, or fish oil, soap solution (1 pound in 1 gallon of water) in early spring before the buds burst.

The Oyster-shell Scale, *Lepidosaphes ulmi* L.

The oyster-shell scale is a very common scale insect throughout Canada. It is so called owing to its shape which resembles a miniature oyster shell. The scale or covering of the female is about one-eighth inch long; that of the male is smaller. In colour the scale is dark brown. It occurs on many kinds of plants, including lilac and rose, and when abundant seriously affects the health of the plants.

Fig. 62—Oyster-shell scale on apple (after Ross).

Control.—Same as for the rose scale, or the plants may be sprayed at the time the young scale insects hatch out (usually shortly after apple blossoms fall) with the following mixture: lime-sulphur 1 gallon, nicotine sulphate $\frac{3}{8}$ pint, water 40 gallons.

The European Fruit Lecanium, *Eulecanium corni* Bouché

Another scale insect which in some years is commonly found on certain flowering plants is the European fruit lecanium. This scale insect is round in shape, and in colour varies from yellowish-brown to a deep red-brown. The immature scales are paler in colour and marked with conspicuous transverse black bands. The larger specimens vary in diameter

Fig. 63—European fruit lecanium (author's illustration).

from about one-sixteenth to almost one-quarter of an inch. They are sucking insects and occur on the stems of rose, cornus, osage-orange, and other plants.

Control.—Same as for the rose scale (see p. 42).

The Grape Leafhopper, *Erythroneura comes ziczac* Walsh

Virginia creepers are attacked every year and made unsightly by the destructive work of the grape leafhopper. The insects work on the undersides of the leaves sucking out the juice and causing them to turn whitish and drop prematurely. These small, active, hopping insects are of a translucent white colour marked with red and dark brown lines.

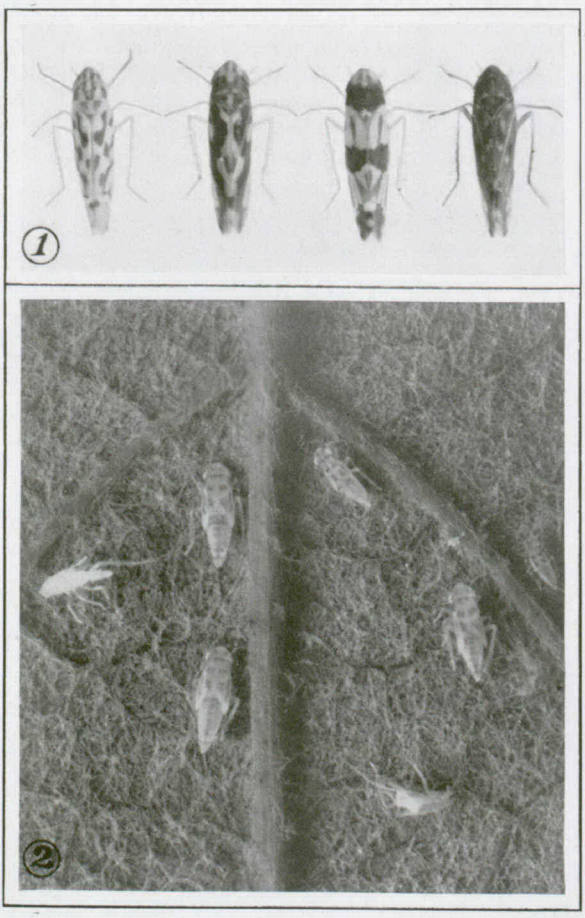

Fig. 64—1, Grape leafhopper; adults, x 10; 2, nymphs on leaf, x 5 (author's illustration).

Control.—Spray the vines thoroughly with a contact insecticide such as nicotine sulphate, one teaspoonful to one gallon of water, when most of the hoppers are in the nymph or wingless stage. The spray should be forced well up from beneath as it must actually hit the insects to be effective. These leafhoppers pass the winter hidden away amongst fallen leaves and other rubbish. The ground, therefore, should be raked and kept clean during autumn so as to reduce as much as possible the opportunities of these insects wintering near the vines.

The Rose Leafhopper, *Typhlocyba rosae* L.

This common leafhopper occurs in most places where roses are grown, feeding on the undersides of the leaves. It is a small insect, pale greenish-white in colour, and when mature is about one-eighth of an inch long. It attacks, chiefly, the rose and apple, but also feeds upon certain other trees and shrubs. It causes injury to roses by sucking the plant juices from the foliage, resulting in a mottling of the leaves. This weakening of the leaves in severe infestations, causes them to fall prematurely. Throughout the summer, the insects may be found on the leaves in various stages of development. The injury is particularly noticeable in the middle of June.

Control.—Any of the contact insecticides for sucking insects are useful in controlling the rose leafhopper (see p. 7). Applications should be made early in the season before the insects attain their wings. Whichever insecticide is used, should be applied as an under spray. In British Columbia, a nicotine dust, such as that recommended for the cabbage flea-beetle (see p. 31), has been found of value.

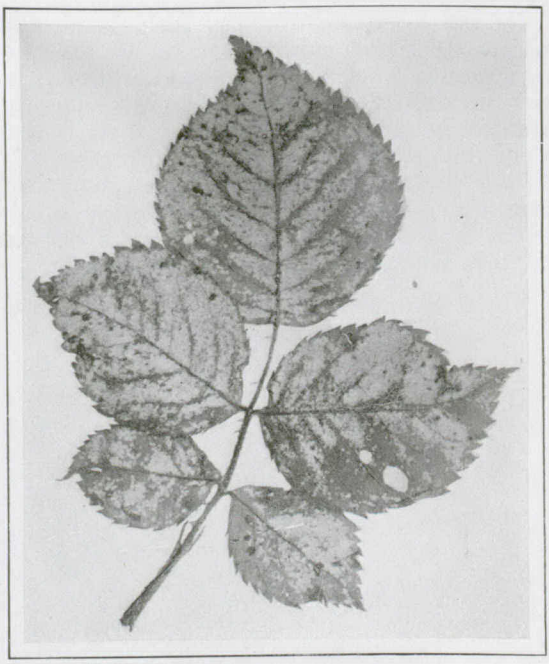

Fig. 65—Rose leaves injured by rose leafhopper (author's illustration).

The Apple Leafhopper, *Empoasca fabae* Harr.

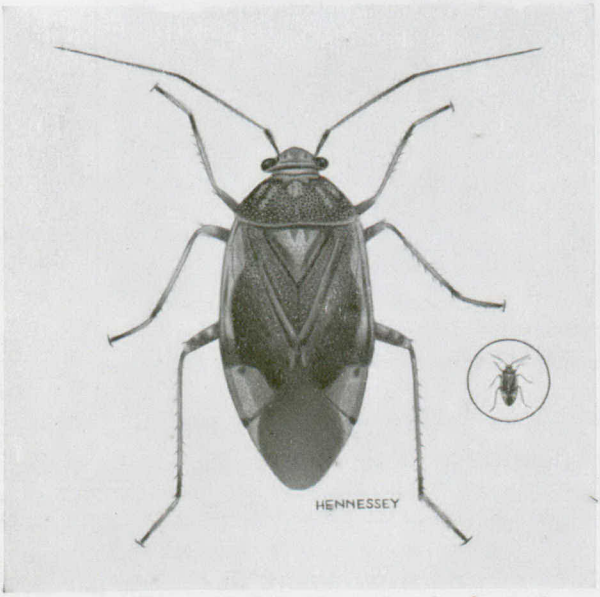

Fig. 66—The tarnished plant bug, enlarged and natural size (after Dustan).

This small leafhopper, with habits similar to those of the grape leafhopper, in some seasons is very abundant in Eastern Canada, where it feeds on a variety of plants. In Ontario it has been observed in flower gardens where noticeable injury has been caused to the leaves of dahlia plants. The insect is pale yellowish-green in colour, and in length about one-eighth of an inch.

Control.—Same as for the grape leafhopper (see p. 44).

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 light brown colour with black and yellowish markings. It is most active during the heat of the day. It hibernates in the adult stage under stones, rubbish, etc.

Control.—Unfortunately, there is no satisfactory remedy known for this insect. 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. Applications of dust mixtures, such as hydrated lime alone, or lime containing 5 per cent nicotine sulphate, are of value in repelling the tarnished plant bug. A dust made of 2 pounds of copper sulphate, 2 pounds of sulphur, 3 pounds of lime and 3 pounds of tobacco dust, has also been recommended. Gardens which are kept clean will not attract these insects as will plots in which weeds, rubbish, etc., are allowed to accumulate.

Fig. 67—Flower buds destroyed by tarnished plant bug (author's illustration).

THE FOUR-LINED PLANT BUG *Poecilocapsis lineatus* Fab.

This plant bug is very destructive at times to dahlia, zinnia, weigelia, snapdragon, 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.

Control.—A spray of strong kerosene emulsion (1 to 6; see p. 7) will destroy the nymphs, but the mature insects are more difficult to kill. Many of

these latter may be beaten from the plants as recommended for the tarnished plant bug. Applications of a dust mixture, as suggested for the latter insect, are worthy of a trial. The eggs of the four-lined plant bug are white and are laid in the autumn on the terminal twigs of currant and other bushes. Once they are known, it does not take very long to look over a bush and clip off and burn such shoots as contain the eggs.

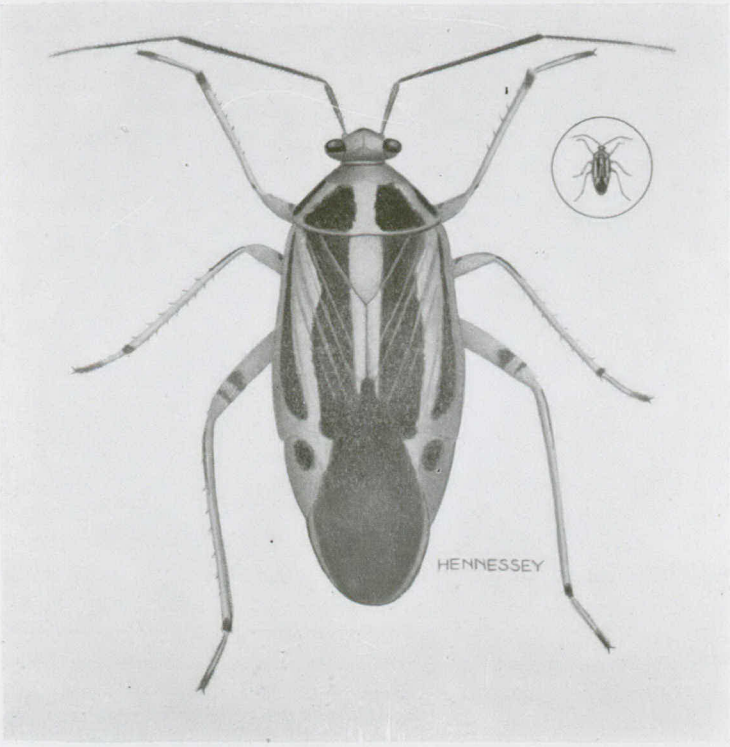

Fig. 68—The four-lined plant bug, enlarged and natural size (after Dustan).

The Caragana Leaf Bug, *Lopidea dakota* Knight

This leaf bug occurs throughout Western Canada where it attacks caragana and other leguminous plants and also hollyhock and dahlia. It is about one-quarter of an inch in length, bright red in colour except the head, antennae, legs and wing tips, which are blackish. The feeding punctures of this insect causes the foliage to turn yellow and wilt.

Control.—We have not had an opportunity to carry out experiments on the control of this insect, but would suggest spraying with nicotine sulphate (see p. 7).

The Garden Fleahopper, *Halticus bracteatus* Say

In Eastern Canada this small fleahopper has occasionally been reported as causing injury to zinnia and other garden plants by feeding on and discolouring the upper surfaces of the leaves. It has not as yet appeared generally, as a pest of importance. In size, it is about one-sixteenth of an inch and in colour black, with the lower part of the legs yellowish. The name fleahopper has been given to this insect owing to its ability to leap like a flea.

Control.—In the event of infestations developing we would suggest spraying with nicotine sulphate (see p. 7).

Fig. 69—Four-lined plant bug injury to leaves of weigelia (author's illustration).

Spittle-insects

These insects, known also as froghoppers, in some years are found, commonly, on the stems and leaves of flowering plants. The small, immature, brownish insect lives within a mass of white froth which is quite conspicuous on the plants. There are a number of different species all belonging to the family Cercopidæ. They are all sucking insects, living on the sap which they obtain from the plants.

Control.—If these insects are present in numbers sufficient to cause injury, spraying the plants with nicotine sulphate-soap solution would be of value (see p. 7).

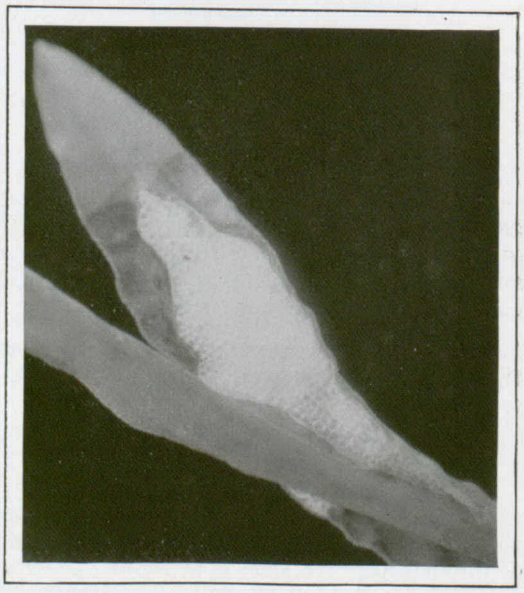

Fig. 70—Froth on leaf, caused by spittle-insect (author's illustration).

The Pentatomids or Stink Bugs

These insects, known popularly as stink bugs, owing to the fact that many of them have a disagreeable odor, are not uncommon in gardens. They are all animal or vegetable feeders, those of the latter habit puncturing the plants with their beaks for the purpose of obtaining the sap. One species particularly, namely *Cosmopepla bimaculata* Thom., in some seasons is very common in gardens, and has been found in numbers on such plants as columbine, snapdragon, beard-tongue, etc. It is a pretty little species, one-third of an inch long, of a shining black colour, spotted with red and orange.

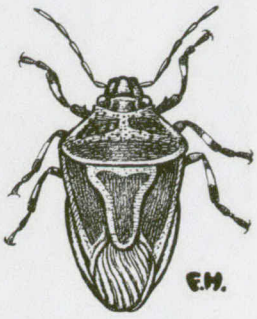

Fig. 71—A pentatomid bug—enlarged (author's illustration).

Control.—Owing to the fact that these bugs have caused comparatively little injury in gardens, no experimental control work has been attempted. For closely related insects it is recommended to spray infested plants with kerosene emulsion or whale oil soap (see p. 7). Doubtless many could be destroyed by knocking them from the plant into a pail containing water with a surface film of coal oil.

The Rhododendron Lace-bug, *Leptobyrsa rhododendri* Horv.

In British Columbia this lace-bug is sufficiently numerous in some years to cause important injury to the foliage of rhododendron and mountain laurel. It feeds on the undersides of the leaves causing them to become mottled and later to assume a brownish unhealthy appearance. The adult lace-bug is less than one-sixth of an inch in length. The wings "are transparent and without markings except a small clouded area near the base."

Control.—Spray the undersides of the leaves with a contact spray insecticide such as nicotine sulphate solution (see p. 7).

Thrips

There are several species of thrips which cause important injury to flowering plants in gardens. All are minute, elongate insects, in colour yellowish, yellowish-brown, brown or black. They attack the foliage and flowers, and by rasping the tissues and extracting the sap and colouring matter, produce a speckled silvery effect. The onion thrips, *Thrips tabaci* Lind., and the greenhouse thrips, *Heliothrips haemorrhoidalis* Bouché, are common species. Another species which has recently caused widespread damage to gladioli, is the gladiolus thrips, *Taeniothrips gladioli* M. and S.

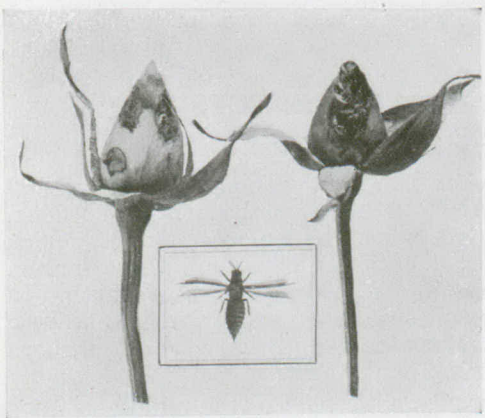

Fig. 72—Rose buds destroyed by thrips; adult thrips below, much enlarged (after Gibson and Ross).

Control.—These insects are difficult to control. If the infestation is not too heavy, fair success may be had by spraying with a mixture composed of 2 tablespoonfuls of Paris green, 2 pounds of brown sugar, and 3 gallons of water. Spraying with nicotine sulphate-soap mixture is also recommended (see p. 7).

Fig. 73—Leaves of gladiolus destroyed by the gladiolus thrips (original).

For the gladiolus thrips, an entirely different treatment is advised. Mr. Alan G. Dustan, of the federal entomological service, who has given this insect much study recommends the following:—

A month or so before planting, free the corms of thrips by fumigating them with naphthalene flakes, 1 ounce to 100 corms. The corms should be placed in paper bags, the correct amount of naphthalene sprinkled over them and, after being closed, stored away at room temperature for a period of between 3 and 4 weeks. Fumigation should not be attempted in tin or other tight containers as this would result in sweating and sprouting of the corms. When the correct time has elapsed, the naphthalene still remaining around the corms should be removed and the containers well aired. Care must be taken to guard treated corms against reinfestation.

For field control, spray infested plants with the Paris green-brown sugar mixture (see p. 49). Applications should be made weekly, commencing when the plants are 5-6 inches in height and continuing until just before blossoming.

BORING OR ROOT-INFESTING INSECTS

The Burdock Borer, *Papaipema cataphracta* Grt.

This borer is frequently complained of as a garden pest. It is a general feeder and although found commonly in Eastern Canada in the stems of burdock, it by no means confines its attention to that plant. Larkspur, sunflower, golden glow, dahlia, hollyhock, rose, iris, and other flowering plants are also attacked. The caterpillar when mature is about one and a quarter inches in length. In general, it is a smooth, cylindrical, pale brownish caterpillar with a whitish stripe down the middle of the back and a lateral band of the same colour, both continuous, the latter about twice the width of the former.

Control.—Injury by this borer is usually noticeable in the middle of June but in some years its work is not detected until July, during which month, as well as in early August, the withered tops of infested plants may be seen. All injured stems should be removed from the plants as soon as noticed and destroyed by burning. Keep areas adjacent to gardens as free from weeds as possible. In autumn gather and burn all old stems and other plant remains to destroy any eggs that may be present.

Fig. 74—Burdock borer and its work (author's illustration).

The Potato Stem Borer, *Gortyna micacea* Esp.

This insect which has been complained of chiefly in the Maritime Provinces as a result of injury to potatoes, corn, rhubarb, and certain other vegetables, has also caused damage to flowering plants such as dahlia, rose, peony, iris, lily, and gladiolus. The caterpillar is a typical borer, working within the stems. When full grown it is about one and one-quarter inches in length and of a creamy colour with a pinkish tinge.

Control.—All weakened stems which indicate the presence of the borer should be cut out and burned. It is known that the female moths lay their eggs on couch grass and other weeds. All weeds in and adjacent to gardens, should, therefore, be destroyed during late summer when the moths are active.

The Stalk Borer, *Papaipema nebris nitela* Gn.

In southwestern Ontario where this insect frequently infests corn and other vegetable plants, the stems of flowering plants are also entered and important injury effected. The stalk borer when mature is about one and a half inches in length. It is, in general, very similar to the burdock borer.

Control.—Same as for the burdock borer.

The Columbine Borer, *Papaipema purpurifascia* G. & R.

In some years this borer is very destructive to columbines. The caterpillar bores inside the stems of the plants and generally works its way down into the roots which are large and tuberous. Here it consumes the inner part and reaches maturity. When full grown, the borer is an inch and a half in length, the back being of a salmon colour, some specimens more brightly coloured than others. Down the middle of the back there is a pale stripe.

Control.—Remove all parts of infested plants as early as possible after the first injury takes place. Recent experiments indicate that the caterpillars may be destroyed by injecting carbon bisulphide into the soil close to the roots, in the strenth of one ounce to each plant.

Fig. 75—Young corn plants destroyed by the potato stem borer (author's illustration).

The Iris Borer, *Macronoctua onusta* Grt.

Another borer which some years causes important losses in gardens is the one known as the iris borer which attacks iris plants, some varieties more than others. This borer like other similar species is smooth and cylindrical in shape and when mature measures about one and a half inches in length. In general appearance it is a flesh-coloured, cutworm-like caterpillar with a more pronounced pinkish tinge on the back. As with the columbine borer the early injury is to the stems of the plant after which the borer migrates downward to the lower portions.

Control.—Same as for the columbine borer.

The European Corn Borer, *Pyrausta nubilalis* Hbn.

This insect which has become established in the provinces of Ontario and Quebec, and to a lesser extent in the Maritime Provinces, is a serious pest of sweet and field corn. It also attacks celery, bean, beet, spinach, potato, tomato, rhubarb, etc. The stems of flowering plants such as dahlia, gladiolus, etc., grown near corn plantations are liable to become infested. The borer when mature is

about one inch long. It is of a light brownish or flesh colour. The head is dark brown, the neck or thoracic shield paler brown, as are also the warts or tubercles on the body. The caterpillar hibernates within the plant.

Control.—As recommended for the burdock borer, all injured stems should be removed from the plants as soon as noticed and destroyed by burning.

Fig. 76—Columbine borer and its work (author's illustration)

Fig. 77—Iris borer and its work (author's illustration).

The Lilac Borer, *Podosesia syringae* Harr.

The whitish or pale yellowish caterpillars of this clear-winged moth, are not infrequently found causing important injury to lilac. The injury often takes the form of ugly scars, punctured with exit holes. The stems are girdled and killed where several larvæ work together.

Control.—Valuable lilacs should be examined during the early summer and any borers in the stems removed with a sharp knife or killed by injecting carbon bisulphide into the tunnels, retaining the fumes for a few hours with a plug of putty or clay. The holes should later be coated with tar or creosote and filled with putty. Dying and unthrifty stems should be cut out and burned as soon as they are discovered.*

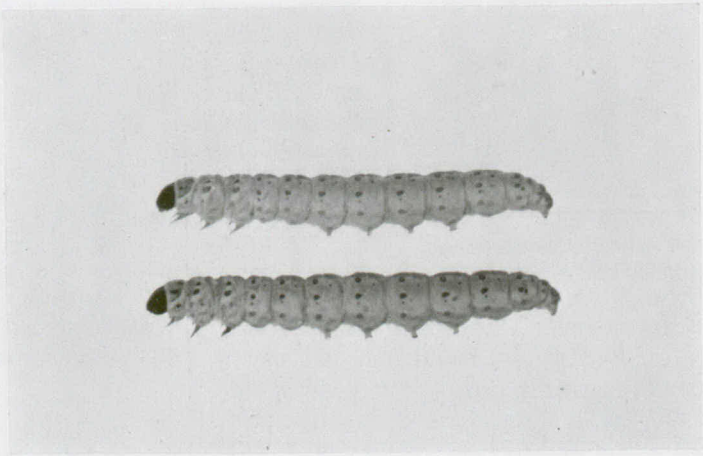

Fig. 78—European corn borer, twice natural size (original).

A new mixture for destroying borers in apple trees was recently devised by Mr. C. E. Petch, in charge of the Dominion Entomological Laboratory at Hemmingford, Que. It has also been used with success to control borers in willow, maple and poplar. The mixture is prepared by combining powdered calcium cyanide with raw linseed oil until a thick paste is formed. A liberal coating of the mixture is applied over the wounds by means of a small paint brush. We have had no opportunity to test this mixture for the lilac borer, but in view of its value in destroying other borers, it is certainly worthy of a trial. In using the mixture it would be advisable not to cut and remove the old bark around the wounds.

*Entomological Branch Bulletin No. 28.

Fig. 79—The work of the raspberry cane-borer (author's illustration).

The Raspberry Cane-borer, *Oberea bimaculata* Oliv.

This well known raspberry pest, during recent years has been found attacking the shoots of roses, particularly where grown near raspberry plantations. The female beetle, slender in shape with black wing-covers and a yellow thorax, flies to a young shoot and with her mandibles cuts two rings of punctures around it. Between these rings, which are an inch or less apart, she lays an egg, and the whitish grub hatching therefrom at once begins to consume the pith. The resultant injury causes the shoot to fade and ultimately die.

Control.—As soon as faded shoots are noticed, they should be cut off well below the injury and destroyed by burning.

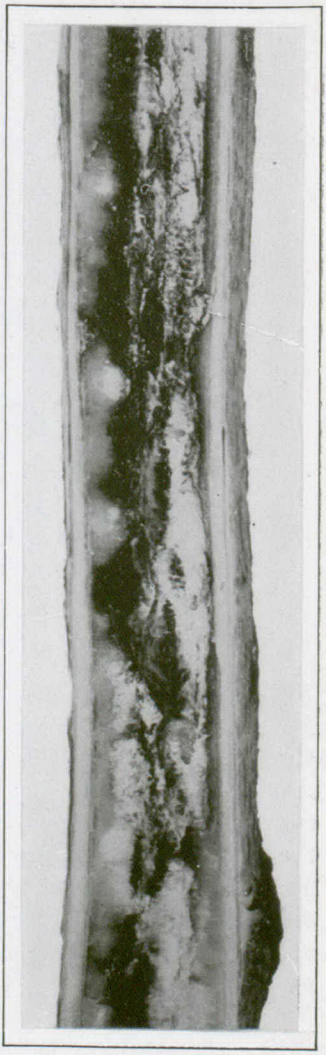

Fig. 80—Portion of sunflower stalk cut open to show work of sunflower maggot (author's illustration).

The Sunflower Maggot, *Straussia longipennis* Weid.

The maggots of this fly infest the stems of the cultivated sunflower, *Helianthus annuus* L., particularly in Eastern Canada. The maggot is cream-coloured and about one-third of an inch long when mature. In some years, the stems are seriously weakened as a result of the feeding of the maggot, in fact to such an extent as to cause some of them to break down.

Control.—Like other insects which feed internally, all stems known to be infested should be gathered and burned. The adult fly, known as the peacock fly, is yellowish in colour with markings on the wings which gave it this popular name. It has been suggested that spraying with arsenate of lead (see p. 6) might destroy the fly, as it has similar feeding habits to the cherry fruit flies.

The Rose Stem-girdler, *Agrilus viridis fagi* Ratz.

This European insect which has become established in several of the eastern states of the United States, was discovered in a private garden in southwestern Ontario in 1931, the infestation supposedly arising from roses imported some

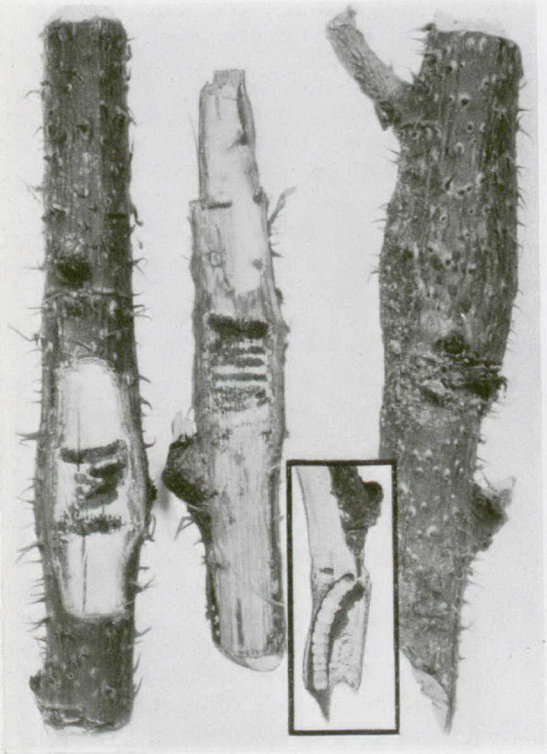

Fig. 81—The rose stem-girdler and its work (photo by F. J. Hudson).

matures. When full-grown it is about one-twelfth of an inch long.

Control.—We have had no opportunity of conducting control experiments under outside conditions. Shoots or buds observed to be attacked by the maggot should be removed by hand and burned.

Mulching rose beds in spring with tobacco dust or refuse should be of value. Cultivate the bed, make the surface as smooth as possible with a rake and then apply a coat of tobacco dust or other tobacco refuse. Leave the mulch undisturbed for two weeks or so and then cultivate as usual.

The Chrysanthemum Midge, *Diarthronomyia hypogaea* H. Lw.

This well-known greenhouse pest was first found in Canada in 1915. In that year, in British Columbia, chrysanthemums growing outside as well as under glass, were attacked. The occurrence of the insect under outside garden

Fig. 82—Rose shoots destroyed by rose midge (author's illustration).

years previously from Europe. Since 1931, further infestation has been found in Ontario. The beetle is a small one, about one-fifth of an inch in length, and of a bronze-green colour. It lays its eggs on the bark, the young grubs on hatching enter the wood, their feeding resulting in the formation of spiral or longitudinal tunnels, over which a swelling develops.

Control.—It is recommended to cut off and burn infested rose shoots just as soon as they are noticed.

The Rose Midge, *Dasyneura rhodophaga* Coq.

The rose midge, which has caused serious damage in greenhouses, has, in Ontario, been found to attack hybrid tea and hybrid perpetual varieties grown outside. The occurrence in gardens, however, is apparently unusual. Shoots infested with the maggot of the midge are deformed and, as a rule wither and die. Injury to rose is shown in figure 82. The maggot in its early stages is whitish in colour, becoming tinged with red as it

Fig. 83—Galls on leaves of chrysanthemum resulting from the attack of the chrysanthemum midge (author's illustration).

conditions in Canada, however, is unusual. The figure, herewith, shows the galls resulting from the work of the small yellowish maggot which when mature, is about 1 mm. long. The adult insect is a small two-winged fly with an orange-coloured body and yellowish legs.

Control.—Remove infested material from the plants and destroy the same by burning.

Rose Galls

Galls, or swellings, resulting from the work of certain small species of insects, are sometimes found on roses. The most common forms are the mossy rose gall, *Rhodites rosae* L., and the rose root gall, *Rhodites radicum* O. S. The former consists of a conspicuous globular mass of greenish and reddish filaments, or fibres, clustered about a woody centre formed by several hard cells around the infested stem. The root gall which often occurs at the roots of cultivated roses, is also large and conspicuous, measuring from one and one-half to two inches in diameter.

Control.—Cut off and burn all the infested galls or swellings noticed. This will destroy any insects present.

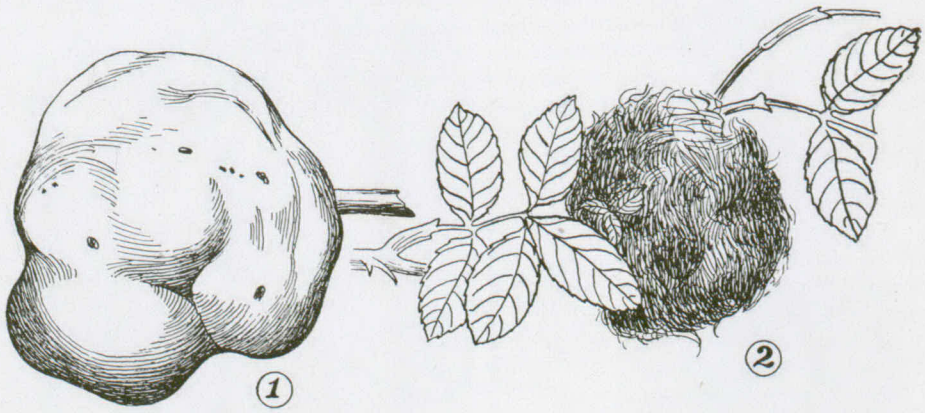

Fig. 84—Rose galls; 1, rose root gall; 2, mossy rose gall (redrawn from Beutenmuller).

White Grubs, *Phyllophaga* spp.

The roots of many kinds of flowering plants—aster, gladiolus, rose, geranium, etc.—are often eaten by the larvæ of May beetles, or June bugs. These larvæ known

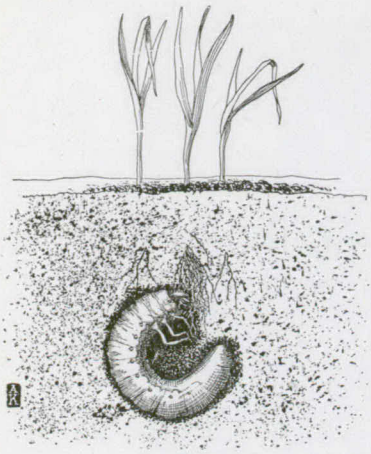

Fig. 85—White grub feeding on roots of grasses (author's illustration).

as white grubs usually occur in land which has been in sod for several years, their natural food being the roots of grasses. When such land is used for a garden, the grubs, being deprived of their usual food, attack such plants as those mentioned, which may be upon the land. The chief destructive species require three years to complete their life cycle.

Control.—When the land is being prepared all white grubs detected should be removed by hand and destroyed. Fall cultivation, too, brings many of the insects to the surface and exposes them to adverse weather conditions. When the cultivation is in progress, if it is possible to allow domestic fowls the run of the garden, this should be done, as these animals are very fond of the grubs.

Wireworms, *Elateridae*

The slender, tough, yellowish, or reddish-brown larvæ, about an inch or so in length, known commonly as wireworms are also very often destructive to the roots of many plants. The life-history of these insects is extended over several years like the white grubs and their natural food plants are similar to those of the latter insects.

Control.—The removal of the wireworms 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.

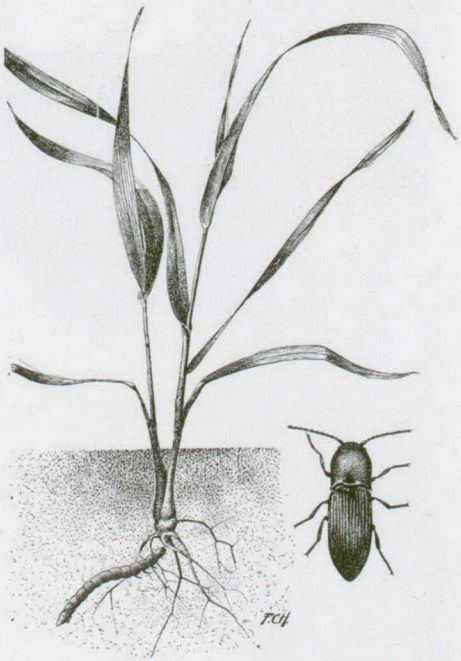

Fig. 86—Wheat wireworm and adult (after Hudson).

Narcissus Bulb Flies

There are three species of bulb flies in Canada, the maggots of which are found in narcissus, hyacinth and other bulbs grown in the open. These species are known as the narcissus bulb fly, *Merodon equestris* Fab. and the lesser bulb flies, *Eumerus tuberculatus* Rond. and *E. strigatus* Fln. Under field conditions in British Columbia, one florist lost 50,000 narcissus and daffodil bulbs in one year, from infestation by the first named species. The *Eumerus* species have been found in bulbs growing outside in the provinces of Ontario, Manitoba, and British Columbia. The maggot of *Merodon* is whitish or yellowish in colour, and when full grown is from one-half to three-quarters of an inch in length. That of *Eumerus* is usually of a greyish colour, distinctly wrinkled, and about one-half an inch long when mature.

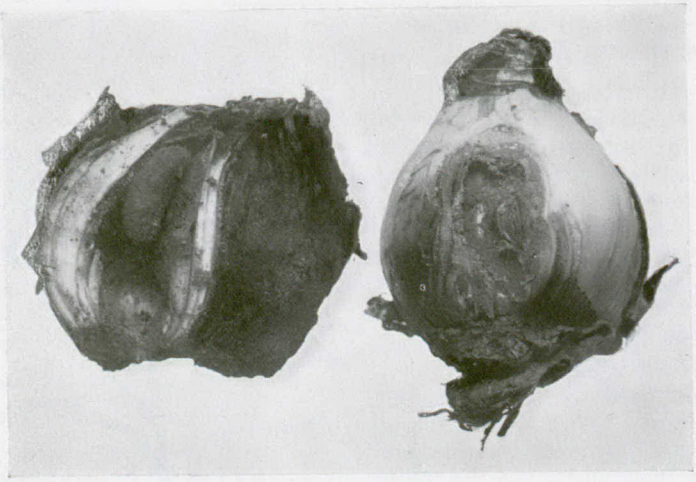

Fig. 87—Narcissus bulbs infested with larvae of narcissus bulb fly. Bulb at left opened to show larva and its work (after Gibson and Ross).

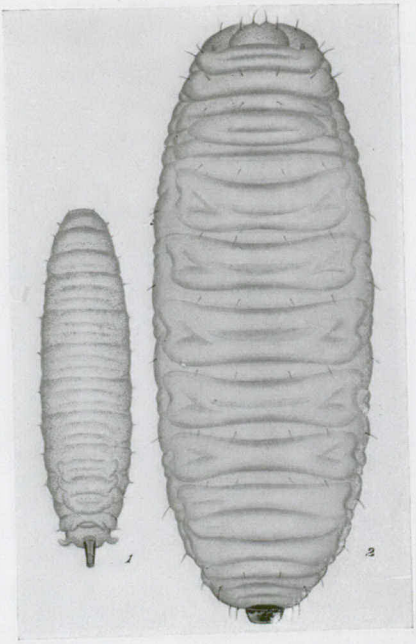

Fig. 88—1, Maggot of *Eumerus:* 2, maggot of *Merodon* (author's illustration).

Control.—Only bulbs which are absolutely firm should be planted. The maggots may be destroyed by fumigating the bulbs with paradichlorobenzine as recommended for the bulb mite (see p. 64).

Stem-nesting Wasps and Bees

There are several kinds of small wasps and bees which make their nests in injured or old stems of roses and other plants. The illustration herewith shows the work of one of the solitary wasps. The female, after choosing a suitable location, tunnels into the pith and at the bottom of the excavation lays an egg. She deposits close to it some soft-bodied insects which she has stung and which remain in the burrow as food for the young grub when it hatches. Eventually, a series of compartments is completed as seen in the figure. The eggs hatch in due course and in time the adult insects emerge.

Control.—Few complaints have been received of the work of these insects. Infested parts of plants should be removed and destroyed by burning.

Fig. 89—Rose stem infested with one of the solitary wasps (author's illustration).

ANIMAL PESTS OTHER THAN INSECTS

Sow Bugs

Sow bugs, or wood lice so-called, are not insects but crustaceans. They are found, commonly, in gardens. When full grown they are about half an inch in length, dark gray in colour and of an oval, flattened shape. They attack the roots and young growth of carnations, sweet peas and other flowering plants. As a rule they prefer dark situations where decay is taking place.

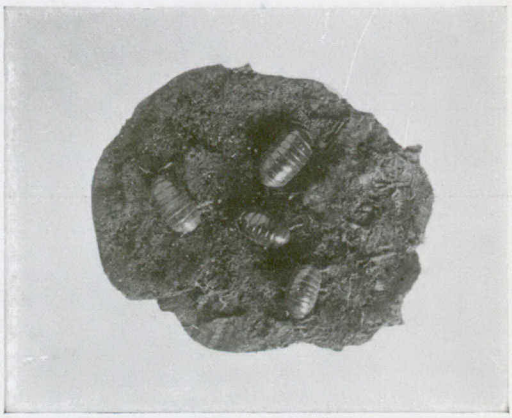

Fig. 90—Sow bugs feeding on manure (after Gibson and Ross).

Control.—A poisoned bait made of 2 parts of white flour, 2 parts of sugar and 1 part of Paris green (all by weight) will attract sow bugs and kill them. Systematic trapping by means of inverted flower pots containing damp hay will materially reduce the pests. The traps should be examined in the morning and the sow bugs destroyed.

Millipedes

Several species of millipedes or "thousand legged worms," creatures related to insects, occur in flower gardens. In general they may be described as brown, rather slender, worm-like, cylindrical creatures with a hard surface. Although millipedes are known to injure seedlings and to attack the roots of plants, their natural food is decaying vegetable matter.

Fig. 91—A common millipede (after Gibson and Ross).

Control.—The placing as traps, of slices of potatoes, which have been dipped in a Paris green solution, or dusted with dry Paris green, near the infestation, is recommended. Lumps of dough sweetened with molasses, may also be used as traps, collecting them at frequent intervals and destroying the millipedes attracted thereto.

Snails and Slugs

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

Control.—As they come out to feed in the evening an excellent remedy is to broadcast air-slaked or dehydrated lime over the soil, before nightfall. 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 hiding there may be easily destroyed by scraping them off and crushing them with the foot.

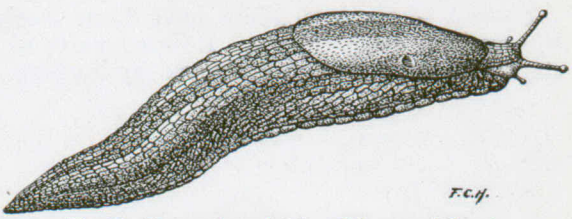

Fig. 92—Slug, enlarged (after Gibson and Ross).

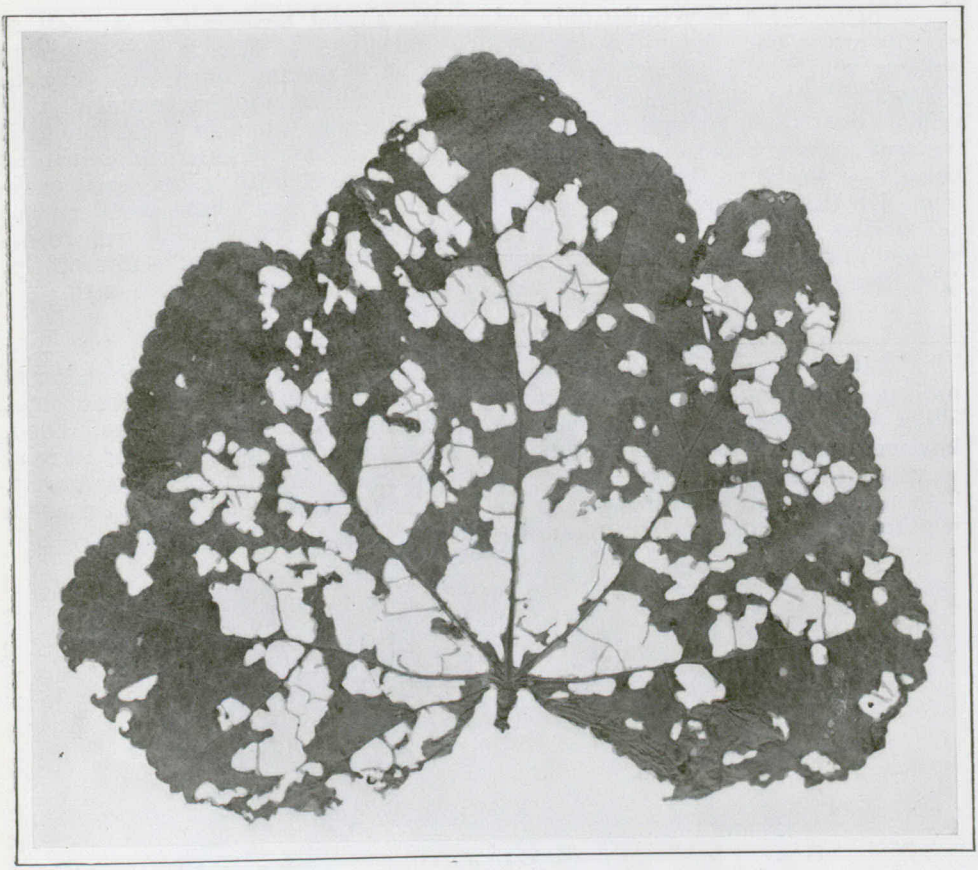

Fig. 93—Injury to hollyhock leaf by slugs (author's illustration).

The Bulb Mite, *Rhizoglyphus echinopus* Fum. and Robin

Shipments of bulbs arriving in Canada from Europe are not infrequently infested with the bulb mite. The mite is very small and can hardly be seen without the aid of a good lens. It is whitish in colour, frequently with a pinkish tinge. It may be present on the bulb in all stages—egg, larva, nymph, etc. Important signs of infestation are: the checking of the growth of the plants; the leaves turning yellowish; failure of the plants to produce flowers; and the presence of reddish brown spots on the scales of the bulb indicating the feeding places of the mites. There has been a good deal of discussion as to whether this mite is the cause of primary injury to the bulbs or not.

Recently Hudson* has stated that "the mite is not a primary parasite of the narcissus but at the same time it cannot be dismissed as being of no importance to this plant. On the contrary, it is often responsible for a very serious loss of bulbs. Bulbs, for instance, that are slightly cut or bruised in lifting and handling will often make a good recovery if they are kept free from mites. If, on the other hand, numbers of mites are able to invade the injured portions of the bulbs, they will very soon become firmly established there, the injured areas will tend to extend rather than diminish, and the bulbs are likely eventually to succumb."

*Bull. No. 51, Narcissus Pests, Ministry of Agriculture and Fisheries, London, 1932.

Control.—Healthy bulbs only, of course, should be planted. All soft or partly rotten ones should be destroyed by burning. If there is any reason to believe that bulbs are infested with mites, it is recommended that they be fumigated with paradichlorobenzine. Hodson[1] and Stenton[2] recommend that this be done in an air-tight box or container, and that 4 ounces of the fumigant be used for every foot of space in the container. A layer of paradichlorobenzine should be placed on the bottom of the box and covered with rather coarse sacking. On this place a single layer of bulbs and cover down with another piece of sacking. Further lots of bulbs may be placed in successive layers, so arranged that there is a layer of the fumigant and a layer of the bulbs alternately. The fumigation should last for at least 48 hours, preferably for three days.

The Common Spider Mite, *Tetranychus telarius* Linn.

This small creature, commonly known as "red spider" occurs abundantly on a great variety of plants, developing especially under warm, dry conditions. When the mite is young it is of a pale pinkish colour and has six legs. Soon, however, it develops the normal number of legs, namely eight. The adult mite is very variable in colour—green, yellow, orange, carmine, black or brown. The mites feed on the undersides of the leaves, which after an attack assume a whitish or bleached appearance.

Fig. 94—Foliage of sweet pea injured by common spider mite. Adult of spider mite below, much enlarged (after Gibson and Ross).

Control.—Spray the undersides of the leaves with nicotine sulphate (see p. 7) or with a soap-sulphur mixture made as follows: dissolve 10 ounces of laundry soap in 5 gallons of water, and then add 5 ounces of flowers of sulphur. A short angle nozzle will be found of value in forcing the spray well up into

[1]Bull. No. 51—Ministry of Agriculture and Fisheries, England, 1932.
[2]Jour. Min. Agric. XXXII, No. 2, Feb., 1926.

the foliage. Several sprayings at intervals of a week may be necessary. Forcible and frequent spraying with water alone will do much to hold this pest under control. In the Niagara district, Mr. W. A. Ross, Dominion Entomological Laboratory, Vineland Station, Ont., recommends a 1 per cent summer oil spray, plus 1 ounce of common laundry soap to each gallon of mixture.

Fig. 95—Roots showing swellings, or galls, resulting from nematode infestation (after Gibson and Ross).

Nematodes

These creatures which are not insects, belong to a group of animals commonly known as eel worms. They abound in the soil as immature, colourless, thread-like worms. Some of the species are known to enter the roots of plants where they cause important injury. In Eastern Canada, for instance, peony, phlox, etc., have been attacked.

Control.—Unfortunately, little is known regarding the control of eel worms under garden conditions. All plants showing knotty, unhealthy roots, should be pulled up and destroyed.

Regarding the Treatment of Narcissus Bulbs with Hot Water.—In *The Gardeners' Chronicle* of October 31, 1933, Mr. R. J. Hastings, Dominion Laboratory of Plant Pathology, Saanichton, B.C., published an article describing certain experiments which he carried on to destroy nematodes. In the tests conducted

large numbers of nematodes were used. They were gathered from the basal plates of diseased bulbs in the form of large clusters of dormant, coiled nematodes. Based on the results of the hot water treatments of the investigation carried on by Mr. Hastings, it is stated that a minimum immersion period of three hours at 110°-112° F. appears to be required.

Earthworms

Earthworms feed on organic matter obtained from the earth that is passed through the body, and, generally speaking, are decidedly beneficial. Their burrowing and feeding habits break up and mix the soil, making it more accessible to conditions favourable to the growth of plants. Occasionally, in flower beds, they may become so numerous as to adversely affect the delicate root systems of the plants, necessitating control action. In lawns, too, they are frequently a decided nuisance.

Control.—Experiments have indicated the value of light dressings of hydrated lime, washing in the same immediately. Watering the infested places with lime water made by adding 2 cupfuls of unslaked lime placed in 2 gallons of water is recommended by Weigel and Middleton of the United States Bureau of Entomology. The mixture should be thoroughly agitated and allowed to settle, after which the clear liquid should be used.

In the treatment of lawns, we would advise sprinkling them with corrosive sublimate, 1 ounce in 10 gallons of water, after which they should be well washed. The corrosive sublimate should be dissolved in a small quantity of water and then diluted to the required amount. As this chemical is a deadly poison it should not be placed where children and domestic animals would have access to it. Furthermore, as it corrodes metal containers the mixture should be prepared in a wooden, glass, or earthenware vessel, which should be thoroughly cleaned immediately after use.

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